CATARINA WALL GAGO

BETWEEN HOUSING CONSERVATION AND COMFORT

RENOVATING THE BUILT HERITAGE

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CATARINA WALL GAGO

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To my parents

Revolução

Como casa limpa
Como chão varrido
Como porta aberta

Como puro início
Como tempo novo
Sem mancha nem vício

Como a voz do mar
Interior de um povo

Como página em branco
Onde o poema emerge

Como arquitectura
Do homem que ergue
Sua habitação

27 Abril 1974
Sophia de Mello Breyner (1977)

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PART 6 / CASE STUDIES – COMFORT AND RENOVATION TECHNIQUES

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Objectives and Research issues

This research[1] studies contemporary renovations of housing built in the cities of Lisbon and Oporto, in Portugal, and Geneva, in Switzerland, between the end of the 18th century and the beginning of the 20th century[2]. The aim is to identify and examine renovation strategies that address current living needs and comfort expectations with respect for original layout and building features.
The research presented in this book largely pertains to our PhD thesis Contemporary renovation of 19th century housing (EPFL 2015). Some sections were extended to fit in with the new format.
The research interests underpinning this work arise from the observation of the state of degradation of the historical built environment in several European cities with large 19th century areas. A major aim is, therefore, to contribute to future renovations. The study is specifically directed at contemporary interventions on 19th century housing with the objective of identifying renovation strategies that can assist future projects. The focus is on changes in domestic space layout and on renovation techniques for thermal and sound insulation.

Preliminary issues. First, it is important to identify the features that make up the urban character of the sets of houses as well as the areas of urban expansion at the time of study. Therefore, the preliminary questions are:
– Which are the main areas of late 19th century urban expansion in Lisbon, Oporto and Geneva ?
– What are the main features of the urban expansion in relation to the proportion, shape, dimension and repetitiveness of blocks, buildings and courtyards ?

Leading issues. Secondly, it is essential to have a correct understanding of the original characteristics of these houses by identifying:
– Which are the main types of original domestic space organisation ?
– What are the original building systems and materials ?
With regard to the domestic space several questions have been identified, corresponding to different parameters of analysis:
– What are the dimensions of the plots and buildings (width, depth and number of floors) ?
– How many rooms are there and which functions are allocated to each space of the house ?

– What is the relative position of rooms ?
– How are rooms connected or distanced from each other and to the outside ?
Contemporary renovations of 19th century housing have to take into account not only their original features at the time of building but other elements that may have been added, adapted or subtracted from the buildings. For this research, it is also important to understand:
– What are the most frequent changes that have been carried out in the layout and building systems of the houses throughout time ?

Core issues. The main focus of the research is the analysis of contemporary renovations, in order to identify strategies for future projects on how to renovate these buildings today, by adapting them to current domestic living needs and comfort expectations while preserving their main original features. The case studies of renovation were examined in detail according to the chosen parameters of analysis (domestic space layout and building features) and also by looking at diverse contexts of intervention:
– What are the main changes to the domestic space layout ? How do changes make use of original layout features ?
– Which are the main changes to original building features addressing current comfort needs ? How do they impact on original features ?
– How do the main actors in the process of renovation perceive the projects ?
– What does housing renovation carried out in different cities and national settings tell us about the variety of renovation strategies and processes ? How does it help us to better define renovation for future projects ?

Thematic relevance

The renovation of residential buildings has been a main focus of our research interests, leading to a master's dissertation entitled *Habitação na Baixa Pombalina: Análise de tipos e estudo de intervenções* (Wall Gago 2007) in which we examined housing in Lisbon*'s Baixa Pombalina*, where regular blocks of flats were built after the 1755 earthquake. The work analysed the layout of first storeys and studied a few renovations. During the research for this thesis, we also took part in the project *Assainissement de fenêtres dans les immeubles 1850-1920* (Ortelli 2012), identifying original types of windows in mid 19th to early 20th century buildings, and evaluated the impact of several interventions on original features and their thermal performance.
In the aforementioned studies, the aim was to understand how the houses and their elements could be renovated in keeping with their unique characteristics – as examples of how to build and live at a given time – and simultaneously be adapted to current living needs and expectations. Through the observation of historical housing, we understood that the degradation of these buildings is often due to negligence or damaging interventions. Therefore, we find it crucial to determine how to preserve and take advantage of these houses' original features and adapt them for people to

live in comfortably today. Their innate qualities, such as spatial adaptability, allow for the richness and complexity of living in such homes. The balance between their repetitiveness and a few variable features allow for the identification of different types of housing. Replicable solutions for ordinary residential buildings can play a fundamental role in preserving and developing a city's identity, of which the houses' domestic habitat is an essential feature, thereby improving daily life and social dynamics. Moreover, this patrimony has yet to be systematically studied from this perspective.
The comparison of renovations in Lisbon, Oporto and Geneva is an original approach to this subject that could introduce a new point of view to housing in both countries. By examining qualified renovations and making this analysis available, this work hopes to impact on the quality of future renovation projects, contribute to the renovation of these cities' ordinary heritage and improve the quality of life of their residents. The stability of certain original layout and building features in the cities examined, lead us to imagine that some results of this research could be applicable, with due adaptations, to other examples of 19th century residential buildings in Europe. However, we believe that it is mainly the methodology adopted in this study that could be carried out in other cities where planned areas and types of housing can be identified.

Implementation and Methods

The investigation was structured along the following main lines:
– Examining the urban morphology of 19th century housing and looking in detail at the main original features of the houses. First, by analysing the types of domestic space layout in order to understand room distribution and functions; secondly, by looking at a selection of original building systems and materials in order to carry out the thermal and acoustic analyses.
– Analysing renovation strategies based on case studies of recent renovations of 19th century houses in Lisbon, Oporto and Geneva. The aim is to show how to modify historical residential buildings with respect for urban identity, the changes in domestic life, current comfort demands and the characteristic original features of the buildings. More specifically, the research examines changes in house layout and those related to thermal and sound insulation. Furthermore, it seeks to determine how architects and residents perceive the changes and their effectiveness.
– Understanding the legal framework on the renovation of historical housing, namely concerning heritage protection, measures to promote renovation and housing, and technical regulations on thermal and sound insulation.
– Collecting and comparing data on renovation strategies from cities in two different countries – Portugal and Switzerland – with the objective of enriching the scope of strategies examined.
The methods of the research project were structured according to five main topics: urban morphology, types of housing, renovation strategies, legal framework, and international comparison. These topics collectively contribute to the main objective of this work: identifying and examining renovation strategies and techniques that

make use of original layout or building features to address changes in domestic life or current comfort demands.

Urban morphology ☞ Research concerning the urban development first aimed to identify the main expansion areas of the cities of Lisbon, Oporto and Geneva from late 18th to early 20th century. The research was conducted through a literature review on "Urban morphology and types of housing" ☞, which was complemented by comparing historical and recent cartography. In Lisbon, we could mention the expansion areas of the *Baixa Pombalina*[3] and *São Paulo,* the *Chiado* area built for the 1758 Plan and afterwards, and the 19th century expansion in the *Lapa*, *Cotovia*, *Santa Isabel* and the *Amoreiras* areas. The expansion of Oporto was defined by the *Almadina* intervention inside the defensive walls (including the *Rua de S. João*) and, outside, by radial expansion streets (such as *Rua de Santo António* and *Rua dos Clérigos*, *Rua do Almada* or *Rua de Santa Catarina*). In mid to late 19th century, the expansion continued into new neighbourhoods such as *Bonfim* and *Cedofeita*.
Secondly, the research aimed to select city areas for fieldwork with a quite homogeneous urban morphology, revealing some stability in the block or plot dimensions, and mainly comprising residential buildings. In Lisbon, we chose housing in the *Baixa Pombalina* area, planned in late 18th century, which would be compared to housing in Oporto dating from approximately the same time, in the expansion streets from the planned *Almadina* expansion. In Geneva, we chose to further analyse the expansion perimeter of the *ceinture fazyste*, built since mid 19th century. The aim was, in the following steps, to examine the main original features of housing in the selected areas, and to select examples of renovations located in these areas or in other identified 19th century expansion areas.

Types of housing

LISBON AND OPORTO ☞

From the publications examined in the literature review, we concluded that there were quite detailed studies depicting 19th century housing layout in Lisbon and Oporto. In Lisbon, several authors[4] published and analysed floor plans, several looking at buildings located in the *Baixa Pombalina* area. In Oporto[5], several studies had examined late 19th and early 20th century housing in detail, while only one – the doctoral dissertation by Francisco Barata Fernandes (1999) – analysed the housing types from the 17th to early 20th century, even though in less detail. From this analysis, we identified possible topics for further studies, such as better understanding the differences between the layout of different floors, in Lisbon, or distinguishing between housing features in specific streets, in Oporto, particularly relating to late 18th and early 19th century buildings. Houses dating from this building time in Oporto are, in fact, the ones for which there is less available data. The requirement to present floor plans of new houses in licence applications for building at the city hall was only established after mid to late 19th century. Before then, mainly elevation drawings were presented and there were rarely floor plans. Moreover, there are not many systematically

collected and published floor plans, with the exception of a few prepared by Barata Fernandes. To further detail the analysis of houses in Oporto, we collected a large number of floor plans located in late 18th and early 19th expansion streets at the *Arquivo do Departamento de Construção*[6] of Oporto's architecture faculty and at the *Arquivo do Licenciamento das Aguas do Porto*[7]. A preliminary observation of these drawings led us to conclude that this examination could draw some specificities of housing layout in given streets, but would probably not vary considerably from the features that had already been pinpointed by Barata Fernades. We chose, therefore, to not pursue a detailed examination of floor plans in Oporto, but rather to explore the comparison between late 18th and early 19th century housing features in Lisbon and in Oporto. The comparison between Lisbon and Oporto 19th century urban development and housing had sometimes been mentioned in key publications (França 1981; Mandroux-França 1986; Fernandes 1999), but usually not from an equal standpoint: studies concerning Oporto mention Lisbon in passing, and vice versa. For our work, it was this detailed comparison that needed to be further examined. The research aimed to better understand original house layout and domestic life, namely concerning room functions, their relative positions and distribution. We also identified some main changes to house layout that took place since the time of building.

The analysis that we carried out for the chapter "A typology of housing: Lisbon and Oporto" ☞ was based on the comparison of the conclusions of secondary sources focusing on each city, and on floor plans collected in published work and in city archives. In the case of the *Baixa Pombalina,* in Lisbon, we relied on the main conclusions of a study we carried out in 2007, examining the floor plans of 240 buildings, pertaining to Jorge Mascarenhas' metric survey of 304 buildings (Mascarenhas 1996; Wall Gago 2007). The drawings of late 18th and early 19th century houses in Oporto are less numerous, and we do not know of systematic published metric surveys. We examined floor plans of three houses dating from this time included in Francisco Barata Fernandes's doctoral thesis, *Transformação e Permanência na Habitação Portuense*, a reference work in the analysis of Oporto's domestic architecture from the 17th century to early 20th century[8] (Fernandes 1999). The location of these three buildings is not mentioned, and their floor plans seem to constitute the sum of the houses' features collected by the author. We assumed that these examples were representative of housing at the time. We also examined the floor plans of six houses, which we collected at the *Arquivo do Licenciamento das Aguas do Porto*[9] and through architects carrying out renovation work, and floor plans of a house built later that, according to the Barata Fernandes, follows the same principles as the previous examples. All the selected drawings were redrawn at the same scale to facilitate their comparison.

The analysis of the houses was carried out using the same parameters for housing located in Lisbon and in Oporto: general building dimensions, staircase location and, concerning house layout, room function and location, as well as room distribution. The results of the analysis conducted for this chapter were used in the chapter "Case studies: Changes to domestic space" to compare original housing layout and the changes carried out in the case studies of recent renovations.

GENEVA ☞

The literature review concerning the city of Geneva showed that several studies depicted the urban development, or the work of specific architects. As far as we could determine, only one study systematically examined 19th century housing, relating to one specific neighbourhood (Pfändler 1974). Nevertheless, as far as we could determine, no studies had systematically compared floor plans of 19th century houses at a larger scale.

Based on the previous background and cartographical analysis[10] of Geneva's 19th century development, the area of the *Ceinture Fazyste* was chosen for a more in-depth study of residential blocks and buildings ☞, going on to focus on the types of internal layout. This work was carried out through a detailed analysis of domestic spaces based on building permission and on metric survey floor plans (done before renovations) where the original layout could be identified[11]. We chose to systematically collect, through bibliographical and archive research[12], floor plans of residential buildings within this perimeter or just next to it that still exist (even if partially transformed) and where the collected data could be verified if necessary.

Out of around 500[13] buildings in the entire *Ceinture Fazyste,* we collected and analysed the floor plans of 176 buildings, including 324 housing units. Each housing unit corresponds to a flat or to a single-family house. Generally, if a building had two flats per main floor, which were replicated on other floors without significant or documented differences, only these two flats were included in the analysis. However, when flats on another floor were significantly different from main floor flats, they were also analysed as separate housing units whenever floor plans were available. This is most commonly the case of (larger) ground floor flats and, sometimes, of (smaller) flats on top floors.

The analysis was carried out statistically using an Excel table where data on all buildings and selected flats was placed[14]. General information on the buildings was included, such as archive identification marks and, whenever possible, the name of the architect and owner, as well as the project date. The data was then distributed according to two main groups of variables. A first group focused on the buildings' urban context (city area[15], urban expansion, location, number of floors, etc.) and on their internal features such as floor functions, staircase position and number of housing units. The second group included variables related to housing unit layout according to four main topics: distribution (entrances and distribution spaces), room function, room location within the housing unit, and the communication between rooms. This data was then cross-referenced in order to identify different building and housing unit characteristics that were most common or more exceptional, leading to the identification of main types of housing.

We compared several variables to determine changes in living standards within the different areas of the perimeter. We started by analysing the distribution by urban and housing types. Then, we focused our attention on variables relating to the layout of housing units. First, we compared the number of rooms[16] per housing unit, specifically focusing on city areas where there are smaller or larger flats. Secondly, we looked into the composition of the smallest flats to determine which room functions

were present in 4 or 5-room homes. Finally, we carried out the opposite procedure, that is, to examine the room functions and features which were less common in the standard house, such as small living rooms[17], smoking rooms, library rooms, certain outside spaces, as well as the presence of fireplaces in more than 3 types of rooms, so as to pinpoint the city areas and types of housing where they were present.
We also analysed the examples to understand if there was a tendency to improve health and hygiene in *Ceinture Fazyste* buildings throughout time and, if that was the case, whether these changes were related to the legislation. We also aimed to determine if hygiene was related to housing type and, therefore, to socioeconomic[18] status. Trends in health and hygiene were analysed by pinpointing, according to the date and housing type, the number of bathrooms, as well as the presence of alcoves and small inner rooms or that gave onto light wells.
Finally, we looked into the location of main service spaces (kitchens and maids' bedrooms) within the houses and in relation to the public space. This examination allowed us to consider the visibility of service areas in relation to other household functions and to the public eye, as well as to study their lighting and ventilation.

Legal conditions for renovation ☞ The main objective of this part of the research work was to identify and examine key protection measures, restrictions on changes to housing, measures promoting renovation, and thermal and sound insulation standards for building renovation that apply to 19th century housing in the cities of Geneva, Lisbon and Oporto.
Legal research was carried out by examining the key pieces of legislation on each topic. In Geneva, these are, for heritage protection, the law applying the federal land-use planning law (*Loi d'application de la loi sur l'aménagement du territoire* [LaLA]), the law on the protection of monuments, nature and sites (*Loi sur la protection des monuments, de la nature et des sites* [LPMNS]) and the law concerning building and diverse installations (*Loi sur la construction et les installations diverses* [LCI]). The two main pieces of legislation that define energy demands in Geneva are the energy law (*Loi sur l'énergie* [LEn]) and the *Règlement d'application de la loi sur l'énergie* (REn), which defines rules for the application of the LEn. We also analysed the main piece of legislation regarding sound insulation, the ordinance on noise protection (*Ordonnance sur la protection contre le bruit* [OPB]), which has a federal basis. The LEn, the REn and the OPB then refer to regulations by the Swiss society of engineers and architects[19] (SIA) on more specific topics. Of these regulations, we focused our attention mainly on the SIA 380/1 concerning thermal energy in buildings (*L'énergie thermique dans le bâtiment*) and on the SIA 181: 2006 concerning noise protection in buildings (*Protection contre le bruit dans le bâtiment*).
In Portugal, the legal framework concerning heritage protection is defined by *Lei nº107/2001*, which establishes the regime of protection and valorisation of cultural heritage, and by ordinance *Decreto-Lei nº309/2009* that details the listing procedures, the regime of protection areas and the preparation of the detailed conservation plan. At a municipal level, we looked into the additional protection regimes defined in Lisbon and in Oporto by the municipal land-use plans (*plano director*

municipal [PDM]). During the last decade, specific instruments were created to promote renovation at a larger and faster pace, of which we analysed the latest revision of the legal regime of urban renovation (*Regime jurídico de reabilitação urbana* [RJRU]), included in *Lei nº32/2012*, and the temporary regime established by *Decreto-Lei nº53/2014*, which exempts the renovation of residential building from several technical regulations.
In Portugal, specifications on thermal and sound insulation are enforced at a national level. Regarding thermal insulation, we examined *Decreto-Lei nº118/2013*, approving the system of energetic certification of buildings, and the *Portaria nº349-B/2013*, which defines the requirements for the conception of new buildings and interventions (*Requisitos de conceção para edifícios novos e intervenções*) as far as residential buildings are concerned. With regard to noise protection, we examined the general noise regulations (*Regulamento geral do ruído [RGR]*), included in the *Decreto-Lei nº9/2007*, and the regulations on the acoustic requirements of buildings (*Regulamento dos requisitos acústicos dos edifícios [RRAE]*), updated by the *Decreto-Lei nº96/2008*.

Contemporary renovation strategies. The main aim of this work was to identify renovation strategies that took advantage of original layout and building features to respond to new comfort ☞ and usage needs ☞. The research was essentially based on examining case studies of recent renovations of 19th century housing in Lisbon, Oporto and Geneva.

CRITERIA FOR CHOOSING CASE STUDIES

We defined several criteria for the selection of case studies based on their time of building and original features, state of conservation and future function, as well as the balance between the original elements and new features.

TIME OF BUILDING AND ORIGINAL FEATURES

We targeted examples of housing preferably dating from a period where certain original layout and constructive features remained quite stable in each city so that renovation strategies could be more easily compared. In Lisbon and Oporto, we established the beginning of this period in late 18th century, after Lisbon's 1758 rebuilding plan ☒ and of Oporto's expansion plans by the *Junta de Obras Públicas* ☒. At approximately the same time, in Geneva, the first steps were also taken toward building localized planned homogenous urban areas that would set the basis for the *genevois* block of flats[20]. However, the most significant moment leading to the stabilization of Geneva's types of housing was, in mid-19th century, the 1849 definitive decision to demolish the fortifications ☒ and significantly expand the city. As such, most of the chosen case studies in Geneva were built since that time. We chose to focus on the renovation of ordinary rather than exceptional housing in each city. The analysis period corresponds mainly to the stabilization of the block containing one or two flats per floor, in Lisbon, and of the narrow contiguous single-family house in Oporto. It is nevertheless important to mention the presence of other housing types in each city, sometimes associated

with specific areas. In Lisbon, this is the case of the *Bairro das Águas Livres*, a planned regular area[21], only partially completed, with contiguous small single-family houses for textile manufacturers of the silk factory (Rossa 1998). We could also mention the upper-class *palacetes* ("small palaces") noble single-family houses dating from mid to late 19th century that were mixed with the more ordinary yet comfortable buildings containing one flat per floor in the *Principe Real* or *São Francisco* areas (Tostões 1994: 90; Leal 2006: 871). In Oporto, one of the less usual housing types was the single-family house standing isolated with four independent façades, the palaces of the higher bourgeoisie (Mota 2010: 103). With all due spatial and chronological differences, the most common 19th century housing type in Geneva was, as in Lisbon, the block of flats, that had one, two or three flats per floor in this city. The less frequent type was, in this case, the repeated terraced house that was built in the upmarket city areas of the *Tranchées* and the *Bastions* ☒ (Pfändler 1974).

The main structural elements of houses at the time were stone masonry walls and wooden floor supporting beams, even though there are important local specificities. In Lisbon's *Baixa Pombalina*, these same materials were used to constitute the *gaiola* (literally "cage")[22], in which the wooden floor beams worked together with interior structural walls made of crisscrossed wooden elements filled with masonry. This type of structure had the objective of increasing earthquake resistance. It was used in other city areas, with successive adaptations. In Geneva's buildings from the second half of the 19th century, structural drawings sometimes show the presence of localized metallic elements, such as beams, associated to a majority of wooden ones[23].

In the three cities, the end of our defined time frame was marked by changes in layout that roughly[24] correspond to the introduction of new legislation on health and hygiene conditions in Geneva, in 1899 (Conseil d'État 1899), and in Portugal, in 1903 (Ministerio das obras publicas 1903). In Geneva, the 1899 regulations specify that inner rooms should be sufficiently ventilated. From the building plans approved after this legislation, it seems that "sufficiently ventilated alcoves" needed to be open towards an adjoining room. Moreover, light wells serving bedrooms should be at least 4m wide, and the ones between different buildings should not have a width inferior to a third of the highest building's height. Light wells that served kitchens or corridors should have at least 12m square (Conseil d'État 1899: Art.75). The Portuguese 1903 regulations also specify minimal dimensions for light wells according to room type: a minimum of 9m square for the ones serving kitchens, and 4m square if they served vestibules, antechambers or stairs, that is, a bit smaller than Geneva's[25]. Most importantly, they also specify that bedrooms "should always have a window putting them in contact with the outside air"[26] (Ministerio das obras publicas 1903: Art. 13). This article could explain why housing floor plans dating from early 20th century in Lisbon, when compared to floor plans from the 1860s and 1870s, often had light wells inside flats, and not just courtyards between buildings as was mostly the case before. Almost consequently, they also show the replacement of alcoves for rooms onto small courtyards around this time. However, in some published floor plans of houses in Oporto dating from a few years after the application of the 1903 regulations, there are still alcoves present inside the houses, marked as bedrooms,

offices or storage rooms. There are other examples where a small passage was left on one side of the buildings, so that all rooms could have windows[27]. In Lisbon, the corridor continued its extension to access most rooms in each housing unit, as was already the case in Oporto, due to its particular single-family house layout, as well as in mid 19th century Geneva.
At the end of the 19th century, a large number of houses in all three cities had running water available[28]. However, the connection to public sewage was less frequent, and many houses were not connected to a cesspit until the 1930s. Toilets were included in some houses starting in mid 19th century and occasionally bathrooms were present in houses destined for a wealthier clientele. Nevertheless, it was the legal framework put in place in 1899, in Geneva (Conseil d'État 1899), and in 1903, in Portugal (Ministerio das obras publicas 1903), which imposed and thus generalized the presence of latrines in more ordinary housing.
The above-mentioned legislative changes led to significant differences in floor plan layout, mostly in Lisbon and in Geneva's blocks of flats. Even though it is out of the scope of our work, it is also significant to mention that, legally, alcove and light well near interdiction were enforced in Lisbon in 1930[29] and in Geneva in 1929[30].
It is necessary to stress that throughout this century-long time frame – from late 18th century to early 20th century – there were housing layout variances between buildings located in different new city areas, and that domestic features also slowly evolved throughout time. Moreover, the greater availability of case studies of flats in Geneva dating from the later end of our study period, and of earlier ones in Lisbon, somewhat exacerbated differences in floor plan layout between the two cities. We considered that, just as domestic life did not completely change overnight, renovation case studies could benefit from these variations as long as they did not impair reasonable coherence and comparability. Some of the observed layout features, such as the enfilade or alcoves, were more frequent in slightly earlier housing, and others, such as overall distributing corridors or occasional bathrooms, most often existed in later housing.

STATE OF CONSERVATION AND FUTURE HOUSING FUNCTION

Case studies of housing renovations in each city were also chosen based on the characteristics of the renovations themselves. We purposely chose to analyse renovated buildings destined for present-day housing. The objective was, again, to increase comparability between the renovations as well as between renovations and the original housing floor plans, to better identify the changes that were carried out. Moreover, housing is a key function to introduce a more permanent occupation of city centres. Keeping the housing function has generally tended to induce less frequent destruction of original elements than adaptations to offices or hotels, for instance. In fact, today we can find buildings whose substance has been extensively modified by unrestricted interventions, mainly during the second half of the 20th century. Even though today several offices coexist peacefully within historic buildings where other floors may even have a housing function[31], a large number of interventions for this purpose were probably based on the idea that offices could not coexist with the original structure, partitions, woodwork or plasterwork.

Renovating or rebuilding historical buildings that have been substantially damaged is a non-negligible issue that sometimes has to be addressed by architects and engineers alike. Even though this type of intervention was not the focus of our work, it is important to mention that, today, there are successful projects that deal as well as can be expected with these difficult situations. Their aim is both to salvage the few remaining interior original elements and to rethink the layout logic to fit with the original, the transformed and the new. We could mention, for instance, the project for the renovation of the building on *Rua dos Douradores* 2-14, in Lisbon, by architects *Appleton & Domingos*. The flats in better condition on one side of the building would be renovated by keeping existing partitions and by restoring the remaining decorations; most of the new infrastructure, including the lift, would be placed on the more damaged side requiring a partial reconstruction. The new structural walls on this side would be aligned with the existing structural walls in wood and masonry (*frontais*) and built using the same simplified system.

BALANCE BETWEEN ORIGINAL ELEMENTS AND NEW FEATURES

A large majority of historical ordinary housing buildings have gone through one or more small interventions during their life span, such as the introduction of bathrooms and kitchen worktops, of heating installations, the addition of a partition to divide flats, or the removal of one or two nonstructural walls. These changes have usually left most of the original features intact, even if they may have been partially hidden by carpeting or fake ceilings. The final choice of case studies focused on examples of recent interventions where a large part of the original substance was still present, most importantly the original structure, and where most of these elements were not subsequently eliminated in the case studies examined. The main objective was to determine how the renovation work addressed the balance between original characteristics, previous small changes to the houses and present-day family life and comfort demands.

Our research was carried out from a positive angle. The case studies that were analysed in this work show diverse possibilities for balanced renovations of housing. However, it is important to point out that recent very damaging changes still take place, ignorantly or willingly altering buildings in a permanent way. These are, for instance, interventions that have gone out of their way to (re)move original partitions by 20 cm because going into a bedroom from the living room was not considered acceptable. Let alone the ones that have chosen to demolish the inside of buildings or blocks to completely rebuild the inside as a new next-door two-bedroom flat. All intervening actors have a responsibility in this aspect, from the owner, tenant, architect, engineer, to the authorities overseeing the projects as well as the ones legislating on technical requirements, protection instruments and support mechanisms for renovations. The legal framework is also important as it can often avoid immediate demolition and help protect essential original elements. Furthermore, legislation also enforces comfort living standards when renovating. In this context, it is essential for architects and engineers to think up solutions for compromise that will address the comfort needs of the users while preserving the houses' original features, but also for

the technical regulations to be flexible enough to accept variations that come with each project's specificity.

COLLECTING INFORMATION ON CASE STUDIES

A preliminary list of examples of recent renovations was built up based on the enumerated criteria, 23 in Lisbon, 27 in Oporto and 12 in Geneva[32]. Further analysis then led to the final selection of 24 recent renovation case studies, 9 in Lisbon, 9 in Oporto and 6 in Geneva[33]. Examples were sought out in secondary sources, such as dissertations, books, or magazines, through presentations held at conferences, or by consulting data on renovation prizes or candidacies[34]. Another fundamental research method was to ask actors involved in the first renovations examined to identify other examples. Whenever possible, we also got in touch with city hall personnel in charge of renovations of municipal patrimony.

Fieldwork on contemporary renovations was carried out through visits, interviews and collection of graphic material. We conducted visits to renovated buildings, to buildings where renovation was to take place or by following renovation work on site. Whenever possible, we also conducted semi-directed interviews to architects and residents. The interviews allowed us to better identify the motivations behind the renovations, and to get feedback on the results. Two interview guides were prepared for the interviews with architects and residents. Depending on the available elements, collected graphic material included original or floor plan archive drawings, general and detail floor plan drawings, photographs before, during and after renovation, as well as technical drawings of available specialties. Graphic material was collected through the architects, the residents or at archives in each city. The consulted archives were, in Lisbon, the *Arquivo Intermédio da Câmara Municipal de Lisboa,* in Oporto, the *Arquivo Histórico Municipal do Porto*[35] and the *Arquivo do Licenciamento das Aguas do Porto* and, in Geneva, the *Département des constructions et de l'aménagement* archives and the *Archives d'État de Genève.* We prepared record sheets for each case study including project data, photographs showing the renovation work and, mainly, comparable technical drawings adapted to the same scale and design.

The final choice of case studies was based on the main objective of the work, that is, to identify and examine renovation strategies that make use of original layout or building features to respond to new comfort or usage demands. A preliminary analysis allowed us to determine six main renovation strategies and select the examples that more clearly illustrated them. We also aimed to show a variety of strategies and to depict each one in as much detail as possible. As such, some examples were eliminated if they were very similar to others. This choice was also based on the number and type of elements that we were able to collect, as it was important that the number of collected drawings allowed for an accurate analysis of the renovations. Examples with no collected drawings or very few available elements were eliminated.

ANALYSIS OF RENOVATION STRATEGIES

Two chapters of the thesis describe our analysis of the renovation strategies that are used in the selected case studies. In the chapter "Case studies – Changes to

domestic space" ☞, we carried out a comparative analysis of changes to domestic layout in the renovations. We specifically looked at modifications of housing unit number and size within a building, and of room function, distribution and of connections between spaces within the housing units. The analysis was carried out according to six main renovation strategies:
– Re-using alcoves for new functions;
– Dealing with privacy issues while taking advantage of the *enfilade*;
– Addressing the kitchen's role in domestic sociability;
– Creating additional housing units through division;
– Attic reconversion;
– Promoting accessibility through the introduction of lifts.
Chapter VI, entitled "Comfort and renovation techniques" ☞, focused on comfort demands that are frequently addressed in contemporary renovations. We specifically examined how the adaptation of some frequently renovated building components – roofs, walls and windows – to energy regulations, and of windows and timber floors to acoustic regulations, affects historical elements. Moreover, the aim was also to identify some design solutions for compromise between heritage and comfort aspects, as well as possible conflicts between the protection and thermal or acoustic insulation of these elements.
The research was first carried out by examining the original building systems and materials of specific elements – windows, walls, and timber floors – and by analysing the strategies that are put in place in recent renovations.

International comparison: Lisbon and Oporto – Geneva. In the initial project for this thesis, we planned to examine the cities of Lisbon and Oporto, in Portugal, and carry out a comparison with one or two other European cities. The work was, from the start, planned in collaboration with the IST and the EPFL, and later included in the framework of the *IST-EPFL Joint Doctoral Initiative*. The aim was to confront and enrich the examination of renovation strategies by widening the number and the diversity of the examples. In this way, we hoped to contribute to the project's main objective: to identify and examine renovation strategies for 19th century housing that make use of original layout or building features to address changes in domestic life or current comfort demands and, therefore, inform future projects.
As previously mentioned, a fundamental point of the work was to compare Lisbon and Oporto's urban morphology and types of housing from an equal standpoint, identifying the shared aspects of their late 18th and 19th century urban development, with large areas that were planned almost simultaneously, and using the same legal framework. It was also important to note the similarities in house layout, relating to the way of life of the time, and the specificities of the domestic spaces in each city, evidently translated into Oporto's terraced houses and Lisbon's blocks of flats.
We based our choice of a Swiss city to examine along with the examples of Lisbon and Oporto on some main criteria. The first was that the size of the city or, at least, of its 19th century expansion area, be comparable to the Portuguese examples, so that replicable housing traits could be examined. Secondly, as in Lisbon and Oporto,

we aimed to select and examine a city area where urban and building features remained quite stable. This was more likely in a planned urban setting. Thirdly, for comparative purposes, we aimed to examine one or two cities with blocks of flats, as in Lisbon, and single-family terraced houses, as in Oporto. It was also preferable that building materials remained similar, which, given the time of building and the European context, was quite likely in any of the possible cities. Finally, it was essential to have easy access and a sufficient selection of examples of recent renovations.

We based the choice of the city examined mainly on two groups of publications: the *Inventaire Suisse d'Architecture* (INSA) and the *Monuments d'Art et d'Histoire* volumes. These collective studies allow for a well-documented global view concerning the urban development of the majority of Swiss cities. Quite early on, we decided to choose a city in a French-speaking context. Based on a study by Othmar Birkner (1981), housing in the city of Bâle seemed to present an interesting example, but the study was unfeasible due to the impossibility of examining literature almost exclusively in German. In French-speaking Switzerland, a few examples had significant late 18th or 19th century urban developments and, moreover, also had planned areas with a more regular morphology and homogeneous character: La Chaux-de-Fonds, Carouge, Neuchâtel and Geneva. One of the initial explored options was the simultaneous analysis of the smaller cities of La Chaux-de-Fonds and Carouge, where we could respectively observe blocks of flats and single-family artisan's houses. La Chaux-de-Fonds is a city rebuilt after a fire, in 1794, based on successive early 19th century plans (Gubler 1982). The plans defined a regular matrix of slab blocks, each corresponding to one block of flats. Carouge was mainly established between 1772 and 1783 based on five successive regulating plans, which partially defined some regular blocks and main axis (Baertschi 1989: 8). However, a more detailed examination concerning housing in the city revealed, on the one hand, that the layout of the two-floored artisan's house was less comparable to the Oporto terraced houses, and that, throughout the 19th and 20th century, a large number of these houses had been rebuilt. The third considered option, the city of Neuchâtel, has a mid 19th century planned neighbourhood, from 1874 to 1876 – the *quartier des Beaux-Arts* – based on the slab block and on the block with a central courtyard, as well as large single-family terraced houses and blocks of flats (Piguet 2000). Nevertheless, this area was too small both for a typological analysis and for a sufficient selection of renovation examples. Finally, the city of Geneva not only had a sufficient size for a single-city analysis – similar to the city of Oporto – but also had a large planned expansion area dating from the 19th century, the so-called *ring* or *Ceinture Fazyste*. As in Neuchâtel, the urban morphology is based on the slab block and block with a central courtyard. Moreover, besides the most common type of housing – the block of flats – there were also several slab blocks composed of single-family terraced houses.

Structure of the book

The following book is divided into six sections. We start by contextualising the topic of bourgeois housing in 19th century Europe ☞. Based on secondary sources, we respectively examine two representative examples where blocks of flats and terraced housing prevailed: Haussmannian Paris and Georgian Bath.
We then conduct a review of the main secondary sources ☞ concerning 19th century urban development and types of housing in the cities examined. The literature review first looks at the studies on the cities of Lisbon and Oporto, which are examined together and, secondly, at the studies on the city of Geneva.
In Part III, we explore data in the secondary sources as well as data collected in archives, to further analyse 19th century types of housing. The chapter is divided in two sections. The first section is a comparison of early 19th century housing layout in Lisbon and Oporto ☞, comparing data from secondary sources and, in the case of Oporto, adding some new archive data. The second section suggests a typology of housing in Geneva ☞, based on the comparison of newly collected archive data.
In Part IV ☞, we examine a selection of legal diplomas applicable to the renovation of historical residential buildings. The analysis includes the following topics: built heritage protection measures, measures promoting renovation in Portugal, restrictions on housing transformations in Geneva, and technical requirements for renovation. The chapter contributes to illustrating the renovation context in both countries, and provides useful data for the examination of the case studies.
Two main sections examine strategies for the renovation of 19th century housing, based on case studies of recent renovations. Part V looks into the main changes in the layout of the houses ☞ that were carried out in the renovation projects. We mainly examine how changes in domestic space layout take advantage of original features to produce different room functions or distribution principles.
In Part VI ☞, we start by conducting an examination of selected handbooks concerning the improvement of thermal and acoustic performance. The chapter then focuses on renovation techniques that aim to improve thermal or acoustic comfort, using data from the case studies and, occasionally, by adding other examples from relevant publications. Lastly, the conclusions draw together and discuss the main findings of our research.

[1] A printed version of this work was published in French by MētisPresses.
[2] To simplify the following descriptions, we will hereafter designate our time of study as the 19th century, even though some of the examples examined date from late 18th or early 20th century.
[3] For further details concerning the building of the *Baixa Pombalina*, see the bibliographical revision, and the chapter examining types of housing in Lisbon and Oporto.
[4] Vítor Lopes dos Santos (1994) conducted a detailed metric survey of eight floor plans in the *Baixa Pombalina* for his Doctoral dissertation and Maria Helena Ribeiro dos Santos (2005) carried out a detailed survey of all the floors of a single building in Rua da Madalena. In 1996, Jorge Masca-

renhas (1996) presented a less detailed but very extensive metric survey of the first storeys of 304 *Baixa* buildings in his Doctoral dissertation. More recently, articles by Maria Helena Barreiros concerning the *Baixa* revealed original floor plans for two buildings and surveys of three more (2004), five more belonging to the Santa Casa da Misericórdia (2010), and transformation floor plans of buildings near the Praça do Comércio (2012). Joana Alegria (2008) conducted an analysis of buildings in the *Rua da Madalena*, publishing a metric survey for one of them. So far, two pieces of work were found showing drawings of ordinary housing at the time of study outside the *Baixa Pombalina*. The first one is Isabel Maria Rodrigues (2000) Master's thesis on the housing ofavenues of *Ressano Garcia* influence, starting in 1889. Two floor plans of late 19th century buildings from the city hall archives are included in this work. The second is Joana Cunha Leal's (2005) Doctoral dissertation, collecting material from several archives on housing since late 18th century. It is also worth mentioning that Raquel Henriques da Silva's (1985) Master's dissertation, which also includes floor plans but only relating to housing built after 1903.

[5] The studies by Ernesto Veiga de Oliveira and Francisco Galhano (1994) and by Joaquim Teixeira (2004) mainly depict the general layout and the building systems of Oporto housing. Analysis of the domestic spaces including floor plan drawings has been carried out by a few authors since Francisco Barata Fernandes (1999). His Doctoral dissertation includes technical drawings of 15 buildings (floor plans, elevations and sections) from the *Arquivo Histórico* and several drawings by the author depicting type variations (without a location). Thereafter, Master's studies on specific areas of the city were carried out, analysing the houses' technical drawings from the *Arquivo Histórico* for the *Rua Álvares Cabral* (Pires 2000) and for the *Praça Marquês de Pombal* (Vasconcelos 2008). Recentely, a Master's dissertation by Nelson Mota (2006) analysed and presented technical drawings of houses dating from 1897 to 1900, which were collected at the *Arquivo Histórico Municipal do Porto.*

[6] We carried out an essential part of the research in Oporto at the *Arquivo do Departamento de Construção da Faculdade de Arquitectura da Universidade do Porto.* 2nd year architecture students' work in the subjects of building technology is stored in this archive. Their work for one of these subjects is to do metric surveys of ordinary 19th century housing in Oporto. We consulted and collected photographically the elements for 116 survey files (floor plans, sections, elevations and photographs) of houses in *Oporto* built during the 18th and 19th centuries. The quality and detail of the surveys varies.

[7] The *Arquivo do Licenciamento das Aguas do Porto* collects project demands concerning changes in the water supply system, sewage system or in sanitary installations in the city of Oporto. The observed changes were often carried out during the 1930s, after the 1929 legislation making sewage connections mandatory (Trevisan 2002). We collected drawings of houses located in the following streets: *Rua do Almada, Rua dos Clérigos, Rua de São João, Rua Trinta e Um de Janeiro, Rua Formosa, Rua de Santa Catarina, Rua da Alegria* (partial), *Rua da Picaria, Rua do Pinheiro, Rua de Cedofeita, Rua da Torrinha, Rua Miguel Bombarda, Rua do Rosário, Praça da República, Rua da Boavista*.

[8] In this work, Francisco Barata Fernandes examines the plots, elevations and house layouts, coming to the identification of three main types of housing in Oporto associated with three building times: mercantilist, illuminist, and liberal. In the chapter, we examine houses that the author would include in the illuminist type.

[9] Most of the collected floor plans pertain to houses that were examined as case studies and, in two cases, of houses that were visited but not examined further as case studies.

[10] Fort further details see the literature review on Geneva's urban morphology during the 19th century.

[11] Floor plan analysis was carried out individually using original drawings whenever possible, or survey floor plans if these were understandable. The latter were eliminated whenever this was not possible. However, as the analysis is based almost exclusively on the floor plans, it is important to mention that some original designs might have changed when built, and that surveys could have occasionally been drawn without all the original elements.

[12] The archive sources used to find housing floor plans in Geneva are included in the sources and bibliography.

[13] In a recent city map we counted 494 buildings within the perimeter including housing and office buildings, schools, churches etc. This number is approximate due to some changes that have undoubtedly taken place since the time of building.

[14] A list of the variables and separate tables ☞ with the main cross-referenced results are included at the end of the chapter.

[15] Limits of city areas were defined as shown on most original separate plot sale plans, which roughly correspond to city areas we can identify today. We decided to include the area near the *conservatoire* in the adjacent *Hollande* area and the area near the *Cornavin* train station in the *Chantepoulet* area, so that they could each account for a larger number of buildings.

[16] The comparison of housing unit areas would give further information on this aspect, but the range of such an analysis would be beyond the scope of this investigation.

[17] Large flats or single-family houses generally had a small living room (*petit salon*), which was an additional social space, complementary to the living room and dining room.

[18] An in-depth analysis of the socioeconomic status of the residents was beyond the scope of this work. A complete examination of this topic would require research into the inventory of residents and their professional occupations by year.

[19] The SIA is a "professional association for building, technology and environment specialists. [...] It develops, updates and publishes numerous standards, regulations, guidelines, recommendations and documentation [...] for the Swiss building industry" (SIA 2014).

[20] We could mention the blocks on *Rue Beauregard 6-8*, built in 1774 (Corbière 2010: 58-59; Blondel 1960: 53), the one on *Rue de la Corraterie,* built as from 1827-1828 (Corbière 2010: 78-79), and the larger area of the *Quai des Bergues,* built as from 1839-1841 (Broillet 1997: 117-119).

[21] According to Walter Rossa, apart from the *Baixa,* this was in fact the only publicly planned area that was put into practice in the period following the 1755 earthquake (Rossa 1998: 118).

[22] For further details on the *gaiola* structure see, for instance, Jorge Mascarenhas' (1996: Appendix 3, 52) analysis and drawings and, more recently, articles by Stephen Tobriner (2004), and by Mário Lopes, Rita Bento and Rafaela Cardoso (2004) included in the *Monumentos 21* magazine.

[23] In Geneva's archives, only a few original building projects depict constructive systems in detail. This is the case of some projects by architect Léon Fulpius, kept at the *Centre d'Iconographie Genevoise* (*Fonds Vieux Genève*, not catalogued). The presence of metallic beams was observed, for instance, in the drawings for buildings on *Rue du Stand* 54, designed in 1872, *Boulevard Georges-Favon* 4-6, in 1893-94, and *Rue de l'Arquebuse* 13-15, in 1897.

[24] These legislative changes on health and hygiene conditions were not always strictly followed in the years after their promulgation. We chose to use them as approximate time limits because they express specific concerns relating to the domestic space that gradually become present and that were increasingly applied since the beginning of the 20th century.

[25] The 1903 Portuguese regulations distinguish between light wells and courtyards; we chose to depict light well dimensions, which are smaller. However, regulations also specify that courtyards between buildings should have at least 30m square with a minimum width of 5m for buildings that are less than 18m high, and at least 40m square and the same width for buildings that are higher than 18m (Ministerio das obras publicas 1903: Art. 19).

[26] "Os quartos de dormir [...] terão sempre uma janella que os ponha em contacto com o ar exterior" (Ministerio das obras publicas 1903: Art. 13).

[27] Alcoves are present in the 1906 floor plans of houses included in Franciso Barata Fernandes' work (Fernandes 1999: 184, 185, 191, 192), as well as in the 1910 original floor plans we collected of several houses on *Rua Duque de Palmela,* of which one was renovated by the Pedra Líquida offices. The book by Maria do Carmo Marques Pires on the *Rua Alvares Cabral* presents an example with a passage along side a house, thus ensuring windows onto all rooms. This is also the case of our case study on *Rua António Granjo* 108, built in 1918.

[28] In Lisbon water distribution and sewage connection (when available) was in principle required for new buildings and additions by the 1864 regulations (Leal 2005: 687). In Oporto, a more general water distribution was put in place between 1882 and 1887, but did not reach all neighbourhoods (Trevisan 2002: 32). Sewage distribution began in this city as from 1903, but the houses' connection was only mandatory as from 1929. In Geneva, the 1899 regulations made this connection, compulsory whenever there was a public sewer.

[29] In the 1930 *Regulamento geral da construcao urbana para a cidade de Lisboa*, article 119 stated that "housing compartments should have at least one window or door giving onto the exterior,

receiving ventilation and light. [...] Exceptionally, [...] in each house one compartment that does not completely respect this article may be allowed, as long as that compartment receives enough light via the continuous rooms" (Câmara Municipal de Lisboa 1944: Art. 119). Article 172 stated that "Light wells will not be permitted, with the exception of the following cases: a) To provide light and ventilate pantries, corridors, bathrooms, toilets, vestibules and stairs, and one should then be able to fit in it a circle with a minimal diameter of at least 1/6 of the highest wall, and never inferior to two meters. b) To provide light and ventilate kitchens and one room per housing, for storage, and in this case the diameter of the circle should be, at least, ¼ of the highest wall and never inferior to two and a half meters" (Câmara Municipal de Lisboa 1944: Art. 172). For further details on this issue see the analysis of the development of light wells in Lisbon in the doctoral thesis by Nuno Reis *O saguão na habitação urbana* (Reis 2009).

30 Articles 37 and 38 of Geneva's 1929 *Loi sur les constructions et les installations diverses* states that: "All rooms destined for housing and all kitchens [...] should be aired and receive light via a window opening directly to the exterior"; "Alcoves, meaning a depression in a room to house a bed, should be entirely open onto the bedroom, without a door or any other device to separate them" (Conseil d'État 1929: Art. 37-38). Courtyard dimensions were defined by area according to the free distance in front of the windows, and are much more demanding than before. In area 1, for instance, the minimum courtyard area is 30m square for a free distance of 4-5m in front of a window (Conseil d'État 1929: Art. 26).

31 We could name, for instance, João Maria Trindade's architecture office on the 2nd floor of *Rua da Madalena* 139, a renovation example we examined in our Master's thesis (Wall Gago 2007). Several of the renovation case studies in Oporto used the single-family houses' lower floor(s) for offices and the upper ones for housing. See, for instance, the example of the Pedra Líquida offices on *Rua Alvares Cabral* 44.

32 The difference in the initial number of located examples in Lisbon and Oporto in relation to Geneva can be explained through the analysed topics in each country. In Lisbon and Oporto, the original 19th century housing types have been analysed by several authors, giving us a good work basis. In these two cities, we focused mainly on finding a variety of renovation examples. This led to the near saturation of renovation strategies examined, as they are quite similar between several examples, then allowing for a more incisive selection. In Geneva, a large part of the research was spent establishing a typological basis, which was inexistent. We then also proceeded to find the same number of case studies, without aiming for a saturation of the analysis pool.

33 Other visited examples are also sometimes mentioned in the text.

34 We examined all the Minutes and existing candidacy files for the *João de Almada* prize at the *Departamento Municipal de Museus e Património Cultural* located at *Casa Tait*, in Oporto,. It is a prize awarded to building renovations since 1989, which was also awarded in 1990 and since then every two years. The Minutes include a list of the awarded prizes (the *Prémio João de Almada* and the commendations) and of the other candidates. By examining the files, we were able to select the examples of ordinary late 18th to early 20th century housing where the main original structure was still present and, afterwards, select the ones that were renovated for purposes of housing.

35 There are two indexes at the *Arquivo Histórico da Câmara Municipal do Porto* pertaining to building requests, which can be used to identify documents in the *Plantas de Casas* books. The first refers to requests dating from 1771 to 1908, and the second to requests dating from 1893 to 1943. Some of the records kept in this archive are still fairly disorganised, and it is frequently not possible to accurately identify the street name and number for each project, as houses were sometimes originally listed under a nearby street (when the new street did not have a name yet) and door numbers have sometimes changed. Subsequently, at the *Departamento Municipal de Museus e Património Cultural* located at *Casa Tait*, we examined the *Inventário do Património Arquitectónico do Porto* with the help of Orquídea Felix and Filomena Moura. This work is a vast set of folders divided by street name that includes floor plan and elevation drawings for each street, as well as verified licence numbers for each building (at the *Arquivo Histórico Municipal do Porto* and at the *Arquivo Geral*), including all the successive building work done to each plot and, thus, making further archive work faster. Unfortunately, this work only covers part of the city and is in paper format. It would be very important to make this information more widely available, as well as using it to update the archive records by address.

BOURGEOIS HOUSING IN EUROPEAN CITIES

Part 1

Housing dating from late 18th century to early 20th century is important both due to its size and to its architectural value. The renovation of ordinary blocks of flats and terraced houses in urban areas dating from this time is thus essential to preserve the lasting image of the cities themselves. At the time, demographic and societal changes pressed for more housing, and were accompanied by the development of urban planning. In several cities, large urban areas were planned and constructed, often in public and private cooperation.

Regarding bourgeois housing, the typological features varied between cities where blocks of flats prevailed, such as Paris or Lisbon, or those with a majority of single-family terraced houses, such as London or Brussels. Occasionally, there were cities where the two types of property coexisted, such as Geneva ☞. Several domestic features remained the same in most contexts, whether in modest blocks of several flats per floor or in the more up-market terraced houses. These features were based on living arrangements of the time – we could mention the presence of reception rooms next to the main façade or the usual shunning of kitchens to less visible locations. It is also worth mentioning the stability of building materials such as bearing masonry walls, wooden beams and wooden roof structures. These were naturally enriched by regional specificities. This is the case even in small details such as the type of window used. Although windows were systematically wooden and single glazed, the opening system varied: from sash-windows in England to the casement window in France or the double window often used in colder climates such as Switzerland. Building systems could also be site-specific, such as Lisbon's *gaiola Pombalina* which was specifically developed to increase earthquake resistance following the 1755 earthquake.

In this chapter, we will briefly examine how two European cities each became models for specific housing types: the block of flats used in the transformation of Paris under Baron Haussmann, and the terraced house that shaped the extension of Georgian Bath ☞.

Blocks of flats: Haussmannian Paris

While[1] it is characteristic of the 19th Century European city, the block of flats is an architectural type developed from the 18th century on. Also called the "rental property", it was intended to house several families and to enable private investment where a comfortable income was guaranteed. The block of flats takes on different

characteristics according to the urban culture within which it was produced. In several cities, its development often accompanied the building of large planned city areas, following a lack of housing or the rebuilding of an urban area after a tragic event such as an earthquake or a fire[2].

The investment property in 19th century: Haussmannian Paris. In Paris, the block of flats is the prerequisite for the success of the city's beautification and modernisation as undertaken by Baron Haussmann. At the beginning of the 19th century, the city of Paris that emerges from previous periods of revolution and reform is still largely made up of a dense urban fabric inherited from the middle ages. Nevertheless, some preliminary experiences paved the way for a much larger building endeavour. Already during the First French Empire in early 19th century we could mention the regular *rue de Rivoli*, an impressively straight cut through the city, which was extended in mid 19th century (Des Cars and Pinon 1991: 40). Later, and under previous prefects, it was the case of a few first cuts through the old city, such as *rues Rambuteau*, *d'Arcole* and *de Constantine*. The most frequent, however, was the opening of new streets in private building developments (Des Cars and Pinon 1991: 21). However, the nascent question of an integrated vision for urban sanitation and modernisation was as yet unresolved. According to the in-depth description by Jean des Cars and Pierre Pinon of the urban operations during this period, the broader operations required in the old neighbourhoods implied more destruction and expropriation than the municipality was as yet willing to undertake.

Seduced by the reconstructed City of London after the fire of 1666, Napoleon III instigated the renewal of Paris and gave the task of carrying it out to Georges Eugène Haussmann, Prefect of the Seine from 1853 to 1870, later appointed "Baron Haussmann". Napoleon III himself sketched out his project for Paris on a map. This project ⊠ comprised a network of arteries to facilitate traversing the capital with ease, and a series of train stations around Paris.

As is widely known, Baron Haussmann had a crucial role in implementing Napoleon III's large plans that would forever transform the city. The later wanted to transform Paris into a prestigious capital through urban transformation. Haussmann put this ambitious plan into practice, and in doing so, "transformed a brutal project into a daily practice that was adapted to the location and circumstances" (Des Cars and Pinon 1991: 13). This was carried out in collaboration with actors such as the duc de Persigny, minister for the Interior, who devised the financial system, and Eugène Deschamps, responsible for the *Service du Plan de Paris*, who drew up the precise cuts through the city ⊠ (Des Cars and Pinon 1991: 16).

Even if conducted in an autonomous way, each intervention was carried out according to the same criteria of regulation and beautification. The rules of the urban landscape were put into place as follows: the infrastructure was built by the public authorities, and the buildings by investors of the private sector. These interventions on the morphology of the public street-space were accompanied by sanitation measures and the construction of the underground infrastructure still operational today ⊠. The drinking-water and drainage networks would later be completed by

the gas and electricity networks serving every building. The private investor became the actor shaping the image of public space.
The different cutting and regulatory interventions to the urban space caused significant plot modifications – some of which were more important than others. The geometry of the plots which was derived solely from these interventions and was never regular, resulted in a series of geometric strategies which normalize the flat floor plans. Plots were sold by the city administration or by companies, buildings became a source of profit and investment and the private city mansion was superseded by the investment property.
Piece by piece, a background of homogenous public space was constructed, composed of different façades but responding to the same rules of rhythm. The façades were in cut stone, which often came from urban underground quarries. The hierarchy of floors was translated through ornaments such as mouldings and corniches and through the window and balcony definition.
The block of flats ☒ faces the street with a cut stone façade often extending to five or six floors comprising: a ground floor with commercial use, a modest mezzanine floor without a balcony with a reduced height which provides accommodation for the artisan or retailer on the ground floor; a second floor, the noble floor, with a high ceiling where the largest and most expensive flats are located, defined by a long balcony which often reappears on the fifth floor; the third to the fourth floor, generally with the same ceiling heights; a "crown" creating the attic-space where the servant's quarters were located. Instead of a balcony, the other floors often have windows with a low sill and railing. The building is no longer the image of an individual house, an autonomous object, but a continuous ordering element which defines the block and the street.
Architects were therefore confronted with continuous order on the street-front, but the plots varied and were often either too deep or not deep enough. They therefore invented an adaptable type. The plots were of course not completely built out, but the buildings were articulated by a series of courtyards ☒ of different sizes which brought light and ventilation into the block's interior. This produced certain irregular situations, but more importantly created a type with an extraordinary degree of flexibility. The aristocratic city of the 18th century makes way for the bourgeois city, a new way of living, inherited and developing from the typical 18th century private city mansion. The hierarchy of this previous building type was organised vertically floor to floor. But in the more luxurious examples of the block of flats, this hierarchy is transposed horizontally in three parts ☒.
First, reception, representation and social spaces, that is, a row of regular, connecting rooms along the street-front with a dining room usually facing the courtyard. Secondly, private spaces for the tenants, a series of private rooms including powder and dressing rooms, the master bedroom facing the street in the row of connecting lounges, with other rooms extending to the courtyard further back. Finally, service spaces for the domestic staff, including the kitchen and other service rooms that needed to be as far away as possible from the reception areas. The spatial hierarchy was clearly defined but allowed a certain flexibility in the sequences, absorbing the oddly-shaped geometries resulting from the configuration of the plot.

The architects developed a series of strategies in order to "straighten" the main reception rooms. As described by Monique Eleb and Anne Debarre, the architects developed a way of "revalorizing" small residual spaces ⊠. Triangles containing services such as toilets or offices often appeared in the non-orthogonal rooms to resolve the geometry (Eleb 1989: 101).
In the book *L'architecture privée sous Napoléon III*, 19th century architect César Daly describes the different areas and rules to follow when designing a home:

> Domestic life is well divided in two distinct parts: one part is completely dedicated to intimacy, affection and family duties and it demands an organization of the plan that guarantees freedom of movement and protects the secrets of private life; the other part is mixed with the exterior world through our business and pleasure relations and this second, more public side of life contains more luxury and splendour than the first. (Daly 1864: 15) [3]

Surrounded by servants, the way of life practised by this bourgeois society demanded an organisation and spatial arrangement within which the activities of the household staff could be as discreet as possible. We can therefore read a hierarchy of circulation in the floor-plans. First, the circulation of service, both horizontal, behind the row of connecting rooms, and vertical, through a service stair leading from the kitchen to the servant's rooms in the attic. Secondly, the circulation for the tenants and their guests, carried out horizontally through a peripheral circulation system through the connecting rooms along the façade, and vertically through the building's main stair. The latter served only the floors of the apartment proper and did not give access to the attic.
The *Haussmannian* building had little social diversity, apart from the strictly controlled mix of tenants and domestic staff. Instead, social diversity was found in the different city quarters; those close to the centre and in the west were more luxurious, whereas those in the north and the east were most modest. The influential 19th century architect and writer César Daly classifies them into three categories according to their wealth, from the luxurious 1st class to the more modest 3rd class. Apart from the size, the difference in these classes depended on the number of rooms, therefore the 1st class flats had a row of rooms to the street with double horizontal and vertical circulation, whereas a 3rd class flat may not have had a lounge or double circulation.
The 19th century also marks the separation of working and living spaces for the emerging bourgeoisie. The rise in comfort levels reinforced the intimate character of the flats – the notion of the "domestic" is used to define the living sphere. The distinction between the public and private spaces is clearly evident in the organisation of the plan; the public perceives that the rooms looking onto the street and the rooms on the courtyard are protected by double circulation.
Up to a certain extent, the investment property contributed to democratising a way of living. Comfort became a priority and the flats were furnished and serviced accordingly – a tendency that has continued to develop steadily until today. This also led to increased autonomy regarding the use of public space – water, gas and soon electricity were present in all the floors of the buildings, and a sewage system was established. Many services were relocated underground, therefore the relationship to public space had transformed.

BIBLIOGRAPHIE 🕮

Terraced housing: Georgian Bath

Terraced houses – called row houses, town houses or simply terraces – usually refer to narrow similar or identical single-family houses built in a row. Houses share one or more party walls with neighbouring houses, and generally have a rectangular floor plan with a street façade, as well as a courtyard or garden façade. Starting in late 17th century, the terraced house developed in several European cities went on to take various regional specificities. Several well-known examples were destined for wealthier urban classes, especially during the Georgian era. Nevertheless, following the demographic pressure of the Industrial Revolution, the type was often used in more modest higher density settings, such as back-to-back housing without rear yards.

Georgian Bath. In the Georgian era – that is, during the 18th century and early 19th century – the city of Bath was planned and promoted as an elegant holiday resort, focusing on the Roman baths that used water from the adjoining natural hot springs. The development of Bath made use of contiguity and homogeneity as its main strengths. The rows of houses follow the landscape to make up the urban fabric. Unlike rationalistic options, which are based on an ideal orientation and on a distance between blocks, in Bath the block in a slab formation can be adapted ☒ to the existing morphology and underline it.
Joseph Gilmore's map ☒ portrays late 17th century Bath as a city still mostly enclosed in its medieval city walls. At the time, it was a very small town, with nearly only the rest of the Roman establishment and a few building extensions outside the old walls. To the west is the land where the first large building developments would take place, starting with Queen Square ☒, the first major development by architect John Wood the Elder in Bath: "At Queen Square Wood created not just a building, but an entire space within the city". It was "his own Palladian palace: a row of terraced town houses united by a single façade" (Spence 2005: 78).
The city as we know it today is chiefly the product of the collaborative endeavour of two men, entrepreneur Ralph Allen and architect John Wood the Elder, who was later succeeded by his son, John Wood the younger. In the book *John Wood and the Creation of Georgian Bath*, historian Cathryn Spence describes the crucial collaboration between the Ralph Allen and John Wood:

> Both men were entrepreneurs, prosperous businessmen whose shared vision and mutual furtherance ensured their individual success and the birth of a fashionable city. [...] Through their respective interests, Wood and Allen capitalised on the ownership of stone production, the means and control of its distribution, and the provision of a market. Only the combination of both men, in Bath at the same time, could have resulted in this celebrated city of architecture in stone. (Spence 2005: 21)

John Wood the Elder was the main instigator, developer and architect of the fundamental development of Bath at this time. Ralph Allen, on the other hand, was an extremely wealthy entrepreneur who bought up the Bath freestone quarries. Most of the houses designed by John Wood in Bath were built using the stone from the quarries Allen owned in Combe Down. In this way, the homogeneity of the town is

not only connected to the device of contiguous houses but also to the same material and, even, to the repetition of identical windows. Sash windows, or sliding windows with a counter-balancing mechanism, were a technical advance dating from the late 17th century onwards. They helped improve ventilation and were popular for centuries in British and Dutch homes (Louw 1983).

The development of Bath was also lucrative. Wood leased the land and then subleaseed the house or plot to the individual builders who had to conform to the elevations he designed. While the street façade gives onto the public space and had to abide by a plan of alignments, there was a greater de-regulation concerning the most private side of the houses. This aspect is clearly visible in the Circus ☒, a paradigmatic circular building also designed by John Wood the Elder. It was built between 1754 and 1768 and completed by his son. Here, behind a strictly controlled homogeneity on the street side, each house has a somewhat similar but different back façade, and varying layouts. The bow windows on the garden side are the defining element of each house, extending the domestic space into the gardens.

The same reasoning applies to the interior of the houses: several elements often give them the greatest architectural homogeneity – the same entrance door, the same access system – but, inside, each house has a slightly different environment. The gardens usually have the same width as the built plots, unfolding in depth.

The town is made up of three to four floor-houses with a public façade facing the street and another on the garden side. In 1948, Walter Ison published the book *The Georgian buildings of Bath from 1700 to 1830*. It has since become the most important reference concerning its domestic architecture. In describing the typical features of the terraced house ☒, he says:

> The standard type of terrace house, to which the majority of the Bath examples belong, usually has a street frontage varying from 20 to 25 feet in width, and a building depth of 35 to 50 feet, with a garden or yard at the rear according to the site conditions. Accommodation is arranged in a basement containing the domestic offices and kitchen; ground- and first-floors each with a large and a small reception-room; and bedrooms on the second- and third-floors, this last usually an attic storey. The staircase well is placed at one side of the smaller room, rising either towards the front or rear of the house in order to allow the principal drawing-room, occupying the full width of the building plot, to be placed overlooking the best available prospect. (Ison 1948: 109)

There are usually two layers of rooms between the street and garden façades. To go into the houses, one crosses a small bridge that passes over the light well. The latter was located below street level, allowing for coal delivery and giving natural light to service areas. According to Ison, Georgian houses in Bath were built according to the best standards of the time. Larger houses had external and internal stone walls, combined with worked ashlar or ashlar dressings depending on the importance of the façade. In latter examples, stone would have only been used for structural walls with partitions built in lath and plaster (Ison 1948: 114). Throughout the years, the success of the city of Bath was so big that narrower houses were built, with fewer floors and less decorative elements.

These principles continued to be applied by the next generation of architects, namely John Wood's son who completed the Circus. Between 1767 and 1774, John Wood

the younger designed another of Bath's most emblematic buildings – the Royal Crescent ☒. Historian Sigfried Giedion eloquently described how the private houses contributed to public richness:

> There's only a broad lawn which slopes gently toward the town, and the countryside beyond lies at the front. [...] Thirty small standardized houses have fused into a single unit to produce the Crescent, and its monumental impressiveness derives from the fact that these standardized units are added together without any separations. (Gideon 2008: 149)

The Royal Crescent defines a large green space that was – at the time – reserved for its residents. Even though it was destined for private use, this green space contributed to shaping the public space. Beyond the major episodes of the Royal Crescent and of the Circus, their urban model was repeated in other areas with some formal variations, with rounder or rectilinear shapes. This capacity of adapting the blocks in a slab formation, to the variations of the terrain, produces a city with an incredibly rich morphology, and large green spaces. In the end, it is a city made up of sequences of contiguous and homogenous double-facing unities.

Today, large terraced houses such as the ones in Bath or in other European cities, have proved to be quite adaptable to different living needs. While some are still inhabited by one family, others have been divided in horizontal layers. The type is quite flexible since the position of the common staircase allows, precisely, for the distribution of different flats.

In the conclusion to the book *John Wood and the creation of Georgian Bath,* the authors say:

> Heralded by many as the most perfect example of town planning in England, Bath became the model for towns and cities built of squares, circles and crescents. Not long after the younger Wood completed the Crescent in Bath, John Carr would build his own crescent at Buxton in Derbyshire, whilst visitors to Edinburgh cannot fail to recognise the resemblance of the streets of the New Town to those of Bath. (Spencer 2005: 108)

[1] Some sections of the following text were adapted from the script developed by the author, Luca Ortelli, Simon Berger and Nancy Couling at the *Laboratoire de Construction et Conservation* (EPFL) for the MOOC *Housing and Cities* (EdX) ⍰.

[2] It was the case of the Swiss city of *La Chaux-de-Fonds. rebuilt after a fire in 1794. The successive early 19th century plans* defined a regular matrix of slab blocks, each corresponding to one block of flats (Gubler 1982).

[3] "Cette existence [domestique] se divise en deux parts bien distinctes: l'une est tout entière consacrée à l'intimité, aux devoir et aux affections de la famille, et elle réclame des dispositions architecturales qui garantissent la liberté et le secret de la vie privée; l'autre est mêlée au monde extérieur par nos relations, soit d'affaires soit de plaisir, et ce second côté, pour ainsi dire public, de notre existence, comporte plus de luxe et d'éclat que le premier."

LITTERATURE REVIEW URBAN MORPHOLOGY AND TYPES OF HOUSING

Part 2

The following literature review concerns urban morphology and housing types between the end of the 18th century and the beginning of the 20th century. It was divided according to the cities examined: Lisbon and Oporto, in Portugal, and Geneva, in Switzerland. Extensive work relating to urban morphology has been carried out mainly by historians and also, occasionally, by architects and engineers. Literature on ordinary domestic spaces focuses both on their physical characteristics and on domestic life at the time. The publications on this topic have, therefore, quite a broad spectrum of authors such as architects, historians or sociologists. The following analysis includes a selection of publications that have been considered essential contributions to the development of this subject and to further analogous work. These comprise some earlier studies dating from late 18th or 19th century, which could be considered primary sources and, mostly, secondary sources dating from mid 20th century to this day.

The publications that are examined in this topic, together with recent and historical cartography, later contributed to the selection of the areas in each city where housing types were analysed, in the chapters concerning "housing typology". The objective was to map the areas where it was possible to identify some regularity in the plot dimensions and house layout. We were also able to determine the wider areas of late 18th to early 20th century urban development in each city, where examples of contemporary housing renovations were selected as case studies.

The literature review was carried out chronologically, according to the date of original publication of the selected studies. This approach was occasionally changed to allow us to cover some thematic sequences.

Observations at the end of the 18th century

Some documents dating from the end of the 18th century describe the urban transformations in Lisbon at that time. The first, *Lisboa em 1758: Memórias paroquiais de Lisboa* (Matos 1974), even though it was only published in 1974, gathers documents from the *Torre do Tombo* archive, relating to several Lisbon parishes which were part of the survey sent in 1758 to all parish priests of the Patriarchate by priest Luís Cardoso, under Sebastião José de Carvalho e Melo (who later became Marquês de Pombal), with data collected between 1758 and 1760. In most cases, the parish priests present a brief physical and human description of their parish, including the number of homesteads and residents before and after the 1755 earthquake, and then reply more specifically to the following question: "Has [that land] suffered any ruin from the 1755 earthquake, in what way, and has it been repaired ?"[1] (Matos 1974: 23).

Although the detail in these descriptions is variable, it is possible to understand the state of the built environment (damaged, destroyed and already rebuilt) of a considerable part of the city of Lisbon after the earthquake, thus constituting a working base to understand the reconstruction of the city centre, the *Baixa*, and the formation of new neighbourhoods. The descriptions of the *São Nicolau* and *Santa Justa* parishes, both in the *Baixa*, are enlightening in that respect. In the first one it is said that "the earthquake and the subsequent fire devoured my parish's whole district leaving its deserted territory inhabitable, and mountains of ruins"[2] (Matos 1974: 209), while in the second the reconstruction work that would completely transform that area is described: "This whole church burnt down, having escaped the big commotion [earthquake] that ruined others on the 1st of November 1755. Then we established an accommodation inside it that is now being removed to open up one of the straight spacious streets that cut across the burnt city, although it does not yet reach what escaped from the fire"[3] (Matos 1974: 136-137).

The second piece of work, *Lisboa na 2ª metade do séc. XVIII (plantas e descrições das suas freguesias)*, is also a series of documents kept in the *Torre do Tombo* archive that were collected, in this case, by Francisco Santana in 1976. It gathers the information from a book written for the 1770 parish remodelling, including a list of Lisbon's parishes before the 1755 earthquake, as well as descriptions of 40 parishes and the plans for 37 of these. The information relates to the existing and planned built environment without distinguishing between them, and its analysis

draws on the data included in the plan for the division and translocation of the parishes a decade later, in 1780, also included in this work. As an example, one could again mention the *Santa Justa* parish. While its description and 1770 plan foresee the building of regular blocks of housing, identical to the ones in the rest of the *Baixa*'s mesh in the space to the east of the *Praça do Rossio*, in the 1780 description the "*Praça das Hervas, ou da Figueira*" (Santana 1976: 139) is already mentioned.

As regards Oporto, in late 18th century there is the *Descrição topográfica e histórica da cidade do Porto*, a 1788 publication by the priest Agostinho Rebêlo da Costa (1945). The objective of this work was to document the urban, social and commercial development of the city of Oporto since its origins and, mainly, at the time it was written. In chapters 2, "About its extension, situation, streets, squares, buildings, fountains and goodness of the climate"[4], and 3, "About the parishes and residents that it has got; its character, genius and habits; number of main temples and chapels, convents of religious men and women"[5], the author divides the city into five main neighbourhoods in which he includes the ten main city parishes, also mentioning its main streets and approximate number of residents. However, it is difficult to identify the extension and location of the urban development in the decades that preceded its publication, with the exceptions of a few examples, as is the case of the brief description of "*rua nova de S. João* opened in the year 1765" underneath which passes the "river called *da Vila*"[6] (Costa 1945: 54-55). However, it is possible to infer that significant changes had taken place in Oporto on the basis of two facts mentioned by the author: a fast and considerable population increase due to the displacement of families from Lisbon in the post-earthquake period and the increase in commercial exchanges; the author's criticism of the continual multiplication of the number of streets by the "economical government" with "obvious damage to the public safe"[7] (Costa 1945: 78-79) in the context of a stabilization of population growth after 1785. During the decades before this publication, João de Almada e Melo was the *Governador das Armas do Porto e do seu Partido*, a fact which is only mentioned by Rebêlo da Costa when listing the governors of the city throughout time. It is not mentioned that, as president of the *Junta de Obras Públicas*, he was the main instigator of public building, accomplished with the support of the legislation promulgated by the Marquês de Pombal. The second edition, dated 1945, includes a 1789 letter to the *Jornal Encyclopedico* by Tomaz de Modessan about this work, and a preface by Artur de Magalhães Basto. In the preface, Magalhães Basto explains that the included letter by Modessan completes the book by "giving valuable information on the remarkable reformative action of João de Almada e Melo [...]. This author [Rebêlo da Costa] seems to have started the conspiracy of silence that was plotted against the outstanding governor"[8] (Basto 1945: IX). Tomaz Modessan's criticism is directed precisely at the omission of João de Almada e Melo's work as Oporto's governor between 1758 and 1786, during which urban reform led to "an unspeakable number of streets and public and private buildings, that [...] have extended this same city through old and new gates"[9] (Modessan 1945: 431).

Documental analyses at the end of the 19th century and during the first half of the 20th century

One of the important sources of information on Oporto's 19th century life are Alberto Pimentel's writings, such as the recently republished *O Porto há trinta anos* (Pimentel 2011). The book constitutes a key portrait of societal life during the thirty years before its writing, in 1893, including its author's memoirs on current events (fairs, theatres, processions, etc.), main personalities, professions and daily habits. In the first chapter, Pimentel briefly describes the recent urban changes that had been taking place in Oporto, mentioning in a metaphoric way how "the city, feeling asphyxiated, tried to free itself from the walls' domination and waved its arms about in despair both to the east and to the west"[10] (Pimentel 2011: 18). The author goes on to specifically mention some of the new neighbourhoods – *Cedofeita, Aguardente*[11] and *Bonfim* – established by municipal initiative during the 19th century. In the second chapter, the author describes what he believes was the typical mid-19th century resident of Oporto, coloured by a brief yet insightful portrait of the city's *bourgeois* domestic spaces. Even though it is not specifically mentioned, it is clear from the description that these were single-family houses:

> It was at home that the resident of Oporto was at ease; in the street, he felt like a fish out of water. This was not because the interior of *bourgeois* houses of the time captivated by its luxury or its commodities. [...] The furniture was simple, modest: couch and wicker chairs, mahogany tables with silver candlesticks; in front of the couch, a narrow carpet laid out on the floor; on the wall, over the couch, the portrait of the house owner [...]. In some houses, there was the addition of a manichord or a harpsichord, a rectangular block, wrapped in green baize. [...] The resident of Oporto loved his house for the patriarchal charm he could enjoy, for the simplicity of his own habits, which allowed him to live at ease, without constraints and without witnesses. He lived there, like a snail in its shell. (Pimentel 2011: 27) [12]

During the first half of the 20th century, historiography about Oporto is linked to the municipal archives, a fact which, among other factors, is due to the initiative of three successive directors of the *Gabinete de História da Cidade,* beginning with its establishment in 1936: Artur de Magalhães Basto (the historian who wrote the previous note to the second edition of Rêbelo da Costa's book), António Cruz and João Pinto Ferreira, who undertook and promoted the publishing and analysis of important written and drawn documents from the previous centuries (Homem 1991). They later cooperated with other authors in the work of synthesis *História da cidade do Porto* (Cruz 1964-1965). Among the documents published by the *Gabinete de História da Cidade*, it is important to mention the 1941 publication of the *Apontamentos para a história do govêrno militar do Pôrto até ao século XX*, written in 1867 by Henrique Sousa Reis, who then worked at the *Biblioteca Municipal do Porto*. Even though these notes do not specifically address the urban development of this city, they document how João de Almada e Melo took office of the "*Govêrno das Armas dêste Partido* [of Oporto] at the beginning of 1757 in the days after the uprising against the *Companhia*"[13] *Geral da Agricultura das Vinhas do Alto-Douro* (Reis 1941: 13), as well as the fact that the military tax, namely on wine, was used for undertaking the city's public construction work.

Artur de Magalhães Basto was also the author of a 1932 publication entitled *O Pôrto do Romantismo*, one of the first about the social, commercial and family habits of the 19th century bourgeoisie in the city of Oporto, relating them to the main political events of the time, in particular to the period going from the French invasions to the liberal wars. It is important to emphasize the author's description of Oporto's urban development in 1850 (Basto 1932: 37-54), where he explains how the city's radial expansion started at the end of the 18th century from the *Fernandina* city walls and was then consolidated and extended into new neighbourhoods: "Since the end of the 18th century the city has started its expansion in the direction of *Cedofeita*, *Aguardente* and *Bonfim*; lately, all those places have become part of the urban circuit, forming the eccentric zone"[14] (Basto 1932: 38). The description of this expansion is not exhaustive or supported by any graphic elements, focusing rather on details relating to buildings, shops or the residents of a given street or place, thereby accomplishing the main goal of this work, to illustrate life in Oporto in the mid-century before it was written. Furthermore, the author describes what he believes to be a radical change in lifestyle during this period, from a "quiet and authentically provincial life" to a society led by liberal ideals, a stronger bourgeoisie and foreign influences, that "makes an effort to shadow the capital city in luxury and animation"[15] (Basto 1932: 3). One of the most important chapters is the one on the "Bourgeois family"[16], illustrating family life and roles, the characteristics of the home and the social life. The description is based on literature and periodicals of the time, such as Alberto Pimentel's books, and on manuscripts from the city hall archives. Magalhães Basto's description of bourgeois domestic features is detailed and extremely vivid:

> The home was a sacred place, and strangers were only admitted into its intimacy after serious hardship, because the Father watched carefully, but not always effectively, his daughters' relationships. The family was still very united. [...] Oporto's typical houses [...] were four or five storeys high, *room to the front, room to the back*, interior staircase illuminated by a skylight [...]. Each family lived in their own building -, like an independent kingdom where the neighbourhood buzz did not enter. In the first storey facing the street was the *visiting room*, in the last the *dinning*. [...] The *visiting room* deserves a special reference, and it was in many bourgeois homes the stage for the first great romantic passions. Some preserved examples of those rooms still exist today. The chairs, the sofas, and the mahogany side tables were generally placed along the walls [...]. A beautiful carpet with vegetal motifs was usually placed along these pieces of furniture, marking the dance floor. A chandelier hung from the ceiling. The irreplaceable piano – a *Collard pianoforte* –, covered with a spread, was put away in one of the corners"[17] (Basto 1932: 98-99).

During João Pinto Ferreira's direction of the *Gabinete de História da Cidade*, his initiative lead to the *Exposição de Plantas da Cidade do Porto, dos Séculos XVIII e XIX* (Gabinete de História da Cidade 1949), an exhibition that promoted the extensive publicizing of fundamental and disregarded elements of the history of Oporto. These elements included plans of the city that document its expansion from the 1813 "Planta Redonda" by George Balck ☒ to the "Planta da Cidade do Porto referida ao ano de 1903", as well as many drawings by the architects of the *Junta de Obras Públicas* ☒. At the same time, three conferences were promoted and later

transcribed to the magazine *Civitas*, in particular the one by Ezequiel Campos[18] (1949), "A Urbanização da Cidade do Porto nos Séculos XVIII[e] XIX". The brief analysis that we carried out leads us to believe that these documents were fundamental to subsequent studies on this topic. In his speech, the author acknowledges his previous ignorance regarding the existence of this sequence of plans at the archives, and then goes on to describe the urban development of Oporto that they document. These changes are already related to the arrival of João de Almada e Melo in Oporto following the mutiny that took place after the founding of the *Companhia Geral da Agricultura das Vinhas do Alto-Douro* and changes to the wine trade, and his later action as president of the *Junta de Obras Públicas* to reform the city inside (*Rua de S. João*) and outside the defensive wall (*Rua do Almada*, *Praça da República*, etc.). His son, Francisco de Almada e Mendonça, is mentioned to have continued this work as the next president of the *Junta* after his father's death in 1786. As we shall see, Almada e Mendonça is referred to in this way in several publications up to the doctoral thesis by Joaquim Ferreira Alves, who minimises his role in the city's urban transformations (Alves 1988). Although with less detail regarding the connection which is established between urban development and the city's public management, Ezequiel Campos also mentions the interlude in the city's expansion caused by the French invasions and then goes on to briefly identify the plans of the following period and to illustrate the city's progressive extension in all directions:

> The condensed settlement which started at the bank of the *Rio Douro*, from the *Porta Nova* to the *Guindais*, until the *Praça Nova*, was greatly extended to the northwest - from the *Palácio de Cristal* to the *Largo do Priorado de Cedofeita*; and to the north, along the *Campo da Regeneração* until the *Largo da Arca de Água* and the *Praça do Marquês de Pombal*; and also to the east, from the *Jardim de S. Lázaro* to the *Igreja do Bonfim*, along the *Rua do Heroísmo* towards the *Pinheiro* (*Campanhã*) train station. (Campos 1949: 129)[19]

Meanwhile, during an approximately identical period, several authors developed studies on the successive transformations of the city of Lisbon. It is important to mention the work of Júlio de Castilho, among which we point out the *Lisboa Antiga* volumes, four about the *Bairro Alto* and twelve about the *Bairros Orientais*, with a first edition in 1884-1890, and a second extended edition which was started in 1935. Although the main period analysed in this work is not the same as the one we look into, this work is an important reference for following studies on the history of Lisbon. We examined the volumes on the *Bairros Orientais*, in which the author describes the origins and the development of the city in the *Castelo* hill, and the characteristics of the built environment in the city's *Baixa* and the *Pedreira* hill (currently *Chiado/Carmo*) before the 1755 earthquake. Occasionally, it is also possible to gather some information on the built environment at the time the work was written, through the comparisons that are carried out with what existed before the earthquake. This comparison is clearer in the plans that are annexed to this work, that illustrate overlapping fragments of city areas before and after the earthquake. Among the sources that the author drew on are the 1758 parish memoirs that we mentioned at the beginning of this revision, and the previous ones, dated 1751, which were both kept at the *Torre do Tombo* archives.

In a study by Gustavo de Matos Sequeira, written between 1916 and 1934, *Depois do Terramoto: Subsídios para a História dos Bairros ocidentais de Lisboa*, the author's cooperation in the second edition of Júlio de Castilho's work is underlined. As mentioned in the "Forward by the history and archaeology section"[20] of the Academia das Ciências, this study complemented the one by Castilho (whom he considers as his master) through the analysis of the history of Lisbon's western neighbourhoods throughout time. These were first named generally as "*Campolide*" and, meanwhile, "unfolded into so many new neighbourhoods, such as *Estrela, Lapa, Rato, Campo de Ourique* and *Campolide* as such"[21] (Sequeira 1967: VII). In the four volumes of this work the political, social, commercial, religious history is analysed, as well as some curious facts about specific buildings and residents. The history of the shaping and building development of these neighbourhoods is often mixed with these facts and divided into streets. Although these details often make it harder to have a complete vision of the whole, this is probably the first study to analyse the history of these neighbourhoods in detail, looking at unexplored archive sources, such as the *Livros das Superintendências da Décima*[22] as well as several parish records, such as the manuscripts gathered by priest Luís Cardoso on the 1751, 1758 and 1780 inquiries. The author dates the origins of the old *Campolide* area to the 17th century, going on to describe how it was mostly occupied mainly by farmland before the earthquake, and later on by less qualified housing, the *barracas* (shacks). This occupation was subsequently consolidated through the allotment and flat building between the end of the 18th century and mid 19th century. The chapters on the factories built by the Marquês of Pombal should also be mentioned, starting with the *Fábrica das Sedas* and the adjoining *Aguas Livres* neighbourhood. Years later, in 1990, Walter Rossa (Rossa 1998) conducted an in-depth analysis of this neighbourhood in his master's thesis *Além da Baixa: indícios de planeamento urbano na Lisboa setecentista*.

Texts by Raul Lino on southern domestic architecture

In regards to Lisbon's housing, we would like to start with two relatively small pieces of work by the architect Raul Lino. In 1937, Lino wrote a brief article entitled "Essai sur l'évolution de l'architecture domestique au Portugal", in which he described housing in Portugal throughout time, with a certain emphasis on decorative aspects. It seems to be based mainly on Lino's direct observations and no bibliography is mentioned. Regarding the time of study, the author mentions the progressive replacement of wooden ceilings for detailed stucco decorative ceilings, and the multiplication of frescoes. The most important section of this text are two paragraphs where the 1755 earthquake is mentioned, originating, according to the author, a plain and very practical type of domestic architecture:

> But it must not be forgotten that the famous 1755 earthquake that destroyed Lisbon imposed in this city very practical architectural conceptions, as uniform as possible, thereby also influencing the south of the country. Be as it may, it is at this time that the average type of Portuguese house is defined in its most widespread aspects, and that, with minimal variations, continues

existing up to today. The floor plan always presents little interest: the rooms are drawn inside a rectangle with more or less regularity, and some do not receive direct light. As for the exterior, it always maintains a great sobriety. However, it is the interior ornamentation that the greatest charm of our residences. The moulded stuccos, the glazed tiles and the frescoes are the three main elements of these interesting decorations, and their style ranges from the *rocaille* to Louis XVI, to the Empire and the romantic. (Lino 1937: 19)[23]

In a 1943 article about 17th century urban housing, "O estilo da casa portuguesa do século XVIII", published in Lisbon's *Revista Municipal*, Lino refers to the wide spreading of an urban housing type at this time, which would last up to mid 19th century: "In Lisbon there are still many examples of this sober and dignified architecture that distinguishes itself in quality from the insipidness of housing starting in mid 19th century and the subsequent disarray that, at last, is apparently trying to be stopped"[24] (Lino 1943: 5). It is an opinion that was also expressed in the previous document, where Lino criticises the lack of artistic education of builders and the imported foreign fashions at the end of the 19th century. In the 1943 article, the author goes on to briefly describe one of the 17th century examples, located in the *Bairro Alto*, which included a "facade with shops, a good noble floor and a second floor of little headroom that contrasts with the main one by the small size of its windows"[25] (Lino 1943: 5).

Studies on Oporto's domestic spaces from the 1960s

Between 1957 and 1959, Ernesto Veiga de Oliveira and Fernando Galhano published three articles describing Oporto's housing in slightly different ways, exploring a comparison with Brazil's Recife houses, analysing the roofs or describing the main characteristics of domestic life and of house building in the city. These articles were later published in a book by both authors on traditional building systems in several areas of Portugal, *Arquitectura tradicional portuguesa* (Oliveira 2003). In the article entitled "Casas do Porto", the authors depict the narrow tall house built in Oporto until the beginning of the 20th century, describing it as a relatively common type in the North of Portugal and in Europe for popular and bourgeois population. Its "urban residence and commercial establishment simultaneously referred to the same family" that kept "the shops, storage or workshops [...] on the ground floor, next to the street, and lived on the upper floors"[26] (Oliveira 2003: 312). Their description is more detailed (and associated with the building systems) but quite similar to the one by Magalhães Basto. The location of the kitchen is now also mentioned as well as the location of the servants" quarters:

[...] rooms to the front, rooms to the back, the dining room and the kitchen on the top floor, because of possible fires and smells, the attics for the servants' lodgings and storage and, centred with the staircase, skylights; and, on the ground-floor, next to the street, the commercial establishment -, and if normally the decoration is sparing, in the rigidity of the visiting room and the office, a bit stiff, with its standard mahogany furniture, it also presents shapes that transcend the ordinary, becoming similar to elements of the noble palaces, and that, in due

proportions and in a modest scale, can, as the very class which inhabits it, be similar to the same type of housing of those *bourgeois* cities in Northern Europe. (Oliveira 2003: 329)[27]

The portrayal of the outside of the houses is also a bit more specific in this article when compared to previous work. The authors refer to the houses as being of variable height, stating that 16th, 17th, and 19th century housing have mainly two or three floors above the ground-floor, excluding any additions, with two or three windows to the front. However, the observation of 18th century housing with four or even six or seven floors is mentioned, particularly in *Rua de S. João*. Late 19th century housing is not as well characterised, but an important observation is made when mentioning the generalisation of housing at this time with only the residential function.

Several studies on Oporto's domestic spaces continue to be connected to the *Gabinete de História da Cidade*, in 1961, with a small publication during João Pinto Ferreira's direction, *Casas do Porto (século XIV ao século XX)*. Its importance is of a strategic nature. By then, the city's urban development during the *Almadino* period had already started being analysed and publicised. However, the characteristics of ordinary houses, that played a crucial role in that urban character of the city (before, during and after that period), were apparently still a fairly disregarded topic. This brief publication does not carry out a detailed analysis of the houses, but rather introduces it in a city hall publication. The article by Veiga de Oliveira and Galhano might not have been known by its authors, as it is not mentioned in the bibliography. This publication consists of a collection of five articles and photos of houses organised chronologically until the 19th century. Robert Smith introduces the book and mentions, as from 1700, "rare displays of Spanish influence but, generally, in the beautiful "functional" style of the *Pombalina* rebuilding of Lisbon sponsored by Governor João de Almada e Melo. "Just like in the capital city, big blocks of sober harmonious lines appeared, full of windows that, as observed by Rebelo da Costa in 1788, filled the interiors with light"[28] (Smith 1961: 7). The most relevant article to this topic is the one by Pinto Ferreira himself, focusing specifically on Oporto's 19th century houses. The author mentions a great increase in population during the second half of the 19th century, which would also increase the building of bourgeois housing but also of the *ilhas*, conglomerates of very small working-class housing. The *ilhas* were sometimes built in the former backyard of houses located next to the street. Then, a few paragraphs provide a general description of the main observed features of ordinary 19th century housing:

The main facade of Oporto houses in the 19th century, and quite often the other outside walls as well, are covered with polychrome tiles, mainly in dark red, several shades of green, brown, faun, several shades of blue and purple. The houses' interior is spacious, with great cubage, thick walls and considerable headroom. All the house's compartments have plaster ceilings with symbolic motifs according to their purpose [...]. The lighting of the house, after the second half of the century, is done with gas, with artistic chandeliers suspended from the ceilings, or serpentines fixed to the walls [...]. The house usually has two to six floors, with a garden and almost always with a large backyard. (Ferreira 1961: 41)[29]

José-Augusto França's work

Amongst the extensive work carried out by historian José-Augusto França, it is important to mention the studies on Lisbon's urban history. The author's 1962 doctoral thesis, *Une ville des lumières: la Lisbonne de Pombal*[30] (França 1977), is a detailed analysis on the process of rebuilding of Lisbon's *Baixa Pombalina*. As antecedents, we find in Matos Sequeira's previously mentioned work a brief review of the events that took place during the earthquake (which were much publicized according to the author) and a general description of Manuel da Maia's "Dissertações" and of the plans to rebuild the *Baixa*. The author points to the existence of a "valuable folder where the originals of the *Pombalino* projects for the rebuilding of Lisbon are kept, all signed by Pombal and by Eugénio dos Santos Carvalho" (Sequeira 1967: 184), documents which we imagine to be the elevations from the *Cartulário Pombalino* ⊠, which were only published in 1999 (Viegas 1999). Norberto de Araújo (Araújo 1992), in the *Peregrinações em Lisboa* volume dedicated to the *Baixa*, published in 1938, also briefly describes the rebuilt buildings, even though the author's main aim was to describe what existed in that area before rather than the process of rebuilding or the characteristics of the buildings. José-Augusto França's work is, therefore, pioneering in its focus on the planned rebuilding of the *Baixa* with regular blocks of blocks of flats and planned elevations, making up an orthogonal mesh of hierarchized streets. The head engineer Manuel da Maia's "Dissertações" are studied in detail, as well as the six projects for the rebuilding and the sets of elevations for the final plan ⊠. França also briefly analysed the building system of the blocks – the wooden *gaiola* (França 1977: 167) – planned to withstand future earthquakes, and the prefabrication used to make different elements. Quoting J.B.F. Carrère, the author presented a first description of the floor distribution of the blocks of flats of the *Baixa Pombalina*: "The flats (according to justified criticism of a French traveller at the end of the century) are 'badly laid out', made up of 'large rooms, one after the other, without toilettes or small storage rooms, and without an independent communication between rooms' [...]. A lot of rooms have no windows, and 'most of the kitchens are dark'"[31] (França 1977: 167).

Regarding the urban morphology of the *Baixa,* José-Augusto França also refers to the descriptions and drawings from the previously mentioned parish memoirs, and studies the project for the urbanisation of the western part of the city (Santos, Mardel, Poppe, with Andreas and J. D. Poppe) (França 1977: 149), already examined by Matos Sequeira, as well as the project for the eastern part of the city, which were both later discarded. As for the other neighbourhoods of the city, the author only mentions that, "with the exception of the *Baixa*, the rebuilding of Lisbon was an empirical phenomenon – and the small occasional clusters of urbanisation that we can point out, do no more than reinforce this conclusion, which we also gather by observing how the work progressed. And, yet, the building of the *Baixa*, the urban process that it accomplishes, was echoed outside Lisbon, in the South, as well as in Oporto, Brazil and India"[32] (França 1977: 152).

In the course of the research, only occasionally does the author look into the urban development of Oporto, and mainly to point out the repercussions of the Marquês

de Pombal's work on this city: "In Oporto, a governor, a cousin of Pombal, João de Almada, sent there after the rebellion against the wine legislation, set up, in 1758, a *Junta de Obras Públicas* with the objective of promoting the city's improvement – and was asked by the minister to implement, in 1769, Lisbon's legislation of the 12th of May 1758"[33] (França 1977: 152-153). It was this legislation that allowed for plot redistribution that transformed the old urban structure into the new regular urban structure in the name of the "common good that should prevail over private interests"[34] (Alvará de 12 de Maio 1758 cit. in Mandroux-França 1986: 10). In the third updated edition of this work, dating from 1983, Marie-Thèrese Mandroux-França's recent research is mentioned (presented in a 1972 symposium).

A few years later, in the 1966 *A Arte em Portugal no século XIX* (França 1981), França summarizes in a few chapters the issue of the urban development of Oporto at the end of the 18th century and during the 19th century. Drawing on studies by João Pinto Ferreira, and the *Exposição de Plantas da Cidade do Porto dos séculos XVIII e XIX* (Gabinete de História da Cidade 1949) and the respective conferences, he synthesizes the conclusions of those publications. In relation to 19th century Oporto, the author mentions a slower urban expansion due to the French invasions and the prolonged siege during the civil war (or liberal wars), and the housing development that would then follow "to the northwest, to the north, to the northeast, and in density"[35] (França 1981: 161). In relation to Lisbon, beyond the wars, the previous political situation of the *viradeira* is mentioned, the transition from D. José I to D. Maria I's reign (including the removal of the *Marquês of Pombal*), and the author also acknowledges a stagnation of the public building work in this city. According to França, the rest of the building work slowed down as from 1807, thereby implying only a brief reference to the "first signals of a new urbanisation"[36] (França 1981: 31) in the *Rua Nova da Palma,* the embankment in the 1860s, and the building of neighbourhoods to the west: "if the *Alegria* was a favoured place in the 40-50s, as well as *Estrela* and *Buenos Aires*, that was only to fill in previous programs"[37] (França 1981: 310). In this way, the author introduces the urban developments that would follow, from the promotion of gardens to the demolishing of the *Passeio Público* to open the *Avenida da Liberdade*.

Contributions to the history of the urban development of Oporto in the 1980s

Between 1985 and 1988, three fundamental studies were published which contributed to the understanding of Oporto's urban development between the end of the 18th century and the beginning of the 19th century, that is, before and during the time when the *Junta de Obras Públicas* was operational. As previously mentioned, following the leads that were indicated by other authors, Marie-Thèrese Mandroux-França (1986) presented in a 1972 symposium the preliminary results of a more thorough research on the urbanisation of Porto in the 18th century entitled "Quatro Fases da Urbanização do Porto no Século XVIII", which were published in 1986. In this document, the author discloses the conclusions of research carried out at the *Junta de Obras Públicas* archive (situated at the *Arquivo Histórico Municipal*), at

the *Companhia Geral da Agricultura das Vinhas do Alto-Douro* archive, and in other non-mentioned sources. The main aim was to analyse the urban development of Oporto since the beginning of the 18th century. Research findings show that the radial-concentric expansion at the end of the century was connected to the need for expansion that existed previously and which led to the opening of the *Rua do Anjo das Hortas* (later extended to form the *Rua do Almada*) and the *Praça Nova* (now the *Praça da Liberdade*). Subsequently, the commercial importance of the foundation of the *Companhia Geral da Agricultura das Vinhas do Alto-Douro* by the Marquês de Pombal in 1756 is mentioned, as well as his delegation on João de Almada e Melo to Oporto to solve the mutiny. According to Mandroux-França, it is João de Almada e Melo who creates the *Junta de Obras Públicas,* which was "in charge of enforcing the programs and the urban embellishments, that the economic growth and the "awareness" of a modern city, aroused by the *Junta*'s action, would render necessary"[38] (Mandroux-França 1986: 9). The author emphasises the importance that the enforcement of the legislation created for Lisbon's *Baixa* had in the transformations of the city of Oporto, where the buildings had not endured the consequences of the 1755 earthquake. The different moments of planning and opening of the new streets by the *Junta* during João de Almada e Melo's presidency are identified: the first plans, referring to the *Bairro do Laranjal* (including the *Rua do Almada*) and, subsequently, the transformations inside the defensive wall and, later, the integration of these first projects "in a wider system" which started with the opening of *Ruas de Santa Catarina, Direita de Santo Ildefonso* and *Cedofeita*, and which were readdressed in the *Junta*'s 1784 "Plano de melhoramentos" (Mandroux-França 1986: 15). The author identifies the transformations that took place at the time as a real overall plan for the expansion of the city that was, however, adapted throughout time according to what was necessary. The expansion of the city and the development of new neighbourhoods that followed this plan would, according to Mandroux-França, connect these new streets transversally, thus creating the new clusters of urbanisation mentioned by Magalhães Basto and Ezequiel Campos.

Oporto's urban development was later examined by architect Bernardo José Ferrão in his 1985 dissertation for his Professorship Examinations at the *Escola Superior de Belas Artes do Porto*, entitled *Projecto e transformação urbana do Porto na época dos Almadas (1758-1813)*. This study, which was later published as a book, documents the urban transformations that were carried out in the transition between the 18th and the 19th centuries by the *Junta de Obras Públicas*, relating them to the national context of regular urban interventions that took place under the influence of the Marquês de Pombal and to the origins of the agglomerate, which became the city of Oporto. The author's conclusions on urban morphology are quite similar to the ones by Mandroux-França, although they are more detailed and linked to a few graphic elements. A more thorough identification of the periods and expansion streets after 1780 is carried out, in the period between the governments of João de Almada e Melo, Francisco de Almada e Mendonça and Pedro de Melo Breyner, as is the case, for example, of the initial section of the *Rua da Boavista* (to the west), *Rua Formosa* and *Rua da Alegria* (to the East) and, later, *Rua de Santo António* and *Rua dos Clérigos* that connect the two hills to the *Praça Nova*.

Even though Bernardo Ferrão's main objective was to describe the urban development of the city, the author also carries out a brief study of housing configurations, connecting them to the different times of expansion of the city. The description begins with some 15th century examples of housing, with only a ground floor made of crude granite and the rest of planking, and continues until the early 19th century housing in areas of urban development planned by the *Junta de Obras Públicas*. This last description, which interests us the most, states that Oporto's types of ordinary housing during the 18th century were fairly maintained during the subsequent period. This included its internal division of commercial establishments on the ground floor and single-family housing above. The author distinguishes single-family housing in Oporto from housing in Lisbon, where the block of flats was greatly developed at this time. The characteristics of Oporto houses of the *Almadino* period are, according to the author, similar to the ones described to the previous period. The characteristics that are maintained are depicted in the following way:

> The house with a narrow front, [...] a straight facade and windows opening to balconies. [...] Now it is totally built in stone, with two, three or, more rarely, four levels, [...] generally covered with hipped roofs, in narrow and extended plots, one next to the other along the streets [...]. The street facade, [...], individually identified, generally has one long balcony per floor. [...] The ground floor usually has three openings and is systematically destined for shops or storage. One of the side doors is to access straight run stairs to the upper floors; on the inside, the house is organised to the front and to the back of the central staircase (illuminated by skylight and articulated with the straight run stairs) with two interior alcoves, illuminated from the staircase, and two more spacious rooms, illuminated directly from the street or courtyard. (Ferrão 1989: 155-156)[39]

Adding to those features, the author refers an increase in the height of the residential buildings as well as higher headroom on the floors and an increasing number of windows, changing the general look of the elevations.
In 1987, another historian, Joaquim Ferreira Alves, also studied this thematic, this time in a doctoral thesis, *O Porto na época dos Almadas (1757-1804)*. In this case, the fact that it was a more extended research allowed the author to detail, with clear references to the sources, the planning and accomplishment dates for public building works in Oporto, and its way of acquiring funds through the successively renovated tax over 10 year periods. The author refers to the parish memories of 1758 (which we mentioned in relation to Lisbon) about Oporto to describe the city as it would have been observed by João de Almada e Melo upon his arrival the previous year. His positions and dates of their occupation are also identified: *Governador das Armas do Porto e do seu Partido*, and also *Governador das Justiças da Relação e Casa do Porto* and president of the *Junta de Obras Públicas*. According to the author, it is important to clarify a misapprehension by some authors as to the role of Francisco de Almada e Mendonça in the city's transformations. These were continued by the successive presidents of the *Junta*, a position which Francisco de Almada e Mendonça occupied for less than a year, between 1798 and 1799, and it would be during the presidency of Manuel Francisco da Silva e Veiga Magro de Moura and Pedro de Melo Breiner that, for example, the work on the *Rua de Santo António* (nowadays *31 de Janeiro*) and *Rua dos Clérigos* would continue.

Also during the year of 1987, Luís Berrance undertook an undergraduate architecture thesis entitled *Evolução do desenho das fachadas das habitações correntes Almadinas: 1774-1844* (Berrance 1992). It describes the elevations during the *Almadino* ☒ period in a broad sense, that is, during the time of action of the *Junta de Obras Públicas* (during and after João de Almada's administration). It was published as a book in 1993 by the *Arquivo Histórico da Câmara Municipal do Porto*, where a great part of the research was carried out. In this work, the housing elevations are clearly considered as part of the urban character of the city and analysed as such. First, the project of the elevations, designed by *Junta de Obras Públicas* architects, are compared to the existing buildings, briefly indicating what was not built according to the project, what was and, in this case, what was added. The author goes on to choosing a set of parameters and studying buildings elevations in several streets. The trends in the elevation features according to the time of building is also briefly analysed.

Although it is a study published a decade after the above-mentioned research, the similarity of the thematic and, also, its importance, leads us to include in this sequence Anni Günther Nonell's (Nonell 2002) doctoral thesis in architecture: *Porto, 1763/1852: a construção da cidade entre despotismo e liberalismo*. Starting at the date of establishment of the *Junta de Obras Públicas*, 1763, the author summarizes the analysis of the *Junta*'s and João de Almada e Melo's action, framing it historically and clarifying it through an analysis in which the planned and accomplished interventions are distinguished. However, the main novelty of this work is its more detailed analysis of the planned and accomplished interventions during the first half of the 19th century, a period which was not studied by Ferreira Alves and that was until then less examined. For example, it describes some of the *Junta*'s discarded projects (such as the renovation of *Largo de São Domingos*), as well as "the first considerable projects of private initiative that affect the urbanisation outside the existing street network"[40] (Nonell 2002: 28), such as the *Cedofeita* area ☒ or the transformations that took place in *S. Lázaro* (*Bonfim*).

Regarding Oporto's domestic spaces – and going back to our chronological sequence –, the 1988 doctoral thesis by Manuel C. Teixeira (1988), *Habitação popular na cidade oitocentista: as ilhas do Porto*, is an innovative work focusing on describing and locating the *ilhas,* small working class residential conglomerates. According to the author, the *ilhas* started being built in Oporto during the second half of the 19th century, and can be located either inside the courtyards of consolidated bourgeois housing or in leftover land from the previous expansion of the city. Although the main object of the present review is ordinary mostly bourgeois rather than working class housing, this study is nevertheless of interest because of its accurate and meticulous contextualisation and mainly because, besides showing elevation drawings from the *Arquivo Histórico*, it also presents original ground floor plans of housing next to the *ilhas*. The author includes this information to depict how the original access system to the houses and shops was adapted to fit in with the need to access the *ilhas* at the back.

New research on the rebuilding of Lisbon's *Baixa*

In the late 1990s, several studies were published on the late 18th and 19th century rebuilding of Lisbon. Omitting for the moment Walter Rossa's important research on Lisbon's *Aguas Livres* neighbourhood, we would like to focus on two doctoral theses in architecture, which constitute quite complete researches on the urban and constructive features of the *Baixa Pombalina*: the thesis by Vítor Lopes dos Santos (1994), entitled *O Sistema Construtivo Pombalino em Lisbon em edifícios urbanos agrupados de habitação colectiva*, and the one by Jorge Mascarenhas (1996), entitled *A Study of the Design and Construction of Buildings in the Pombaline Quarter of Lisbon*. The latter is more acknowledged since it was published as a book in 2001. In both cases, the authors contextualise and analyse the different projects for the *Baixa*, which we mentioned in the description of José-Augusto França's *Lisboa Pombalina e o Iluminismo*. Both authors analyse in detail the *gaiola* building system and the elevation drawings and its variations. Vítor Lopes dos Santos carries out an analysis of the existing cartography to determine the connections between what was successively planned and built, as well as the metric relations between the different blocks and between the different streets. The author also examines some types of flat based on a detailed metric survey that is cross-referenced to a chapter on social and family life at the time. Jorge Mascarenhas does a more detailed analysis of the buildings' building system, distinguishing, for instance, between the commercial ground floor, usually built with stone arches or vaults, and the masonry and wooden *gaiola* structure on the upper, exclusively residential, floors. In summary, the latter are described in the following way:

> The interior arrangement of the flats is very basic. The most important rooms [...] always face the street, so they are well lit and airy. [...] The kitchens, on the other hand are very simple without decoration, and always have windows facing the interior space of the block [...]. There were no separate toilets, a small basin used for the purpose being situated in one of the kitchen corners. [...] The kitchens are always dominated by an enormous fireplace [...]. Between the front rooms and the kitchens, there are always numerous inner rooms without direct light or ventilation, positioned in a rigidly modulated way. These compartments have [rare] no independent access via corridors. Instead there are numerous interconnecting doors. (Mascarenhas 1996: 96-99)

Mascarenhas' analysis is supported by a less detailed but fundamental metric survey, due to its impressive extension. The noble first storeys of 304 buildings were surveyed and their development linked to the location of the staircase. In the master's thesis presented in 2007, entitled *Habitação na Baixa Pombalina: análise de tipos e estudo de intervenções* 🔍, we carried out a statistic analysis of the floor plans of the main floors ⊠ (first storeys) of 240 buildings (Wall Gago 2007) based on the metric survey by Jorge Mascarenhas.
In the same year as Jorge Mascarenhas thesis, an important master's thesis by Maria Helena Ribeiro dos Santos (2005) was also completed: *A Baixa Pombalina, Passado e Futuro*. The main original contribution of this study is a meticulous metric survey and the analysis of a building in the *Rua da Madalena,* a street in the *Baixa*

Pombalina. Recently, the author co-advised Joana Alegria's (Alegria 2008) master's thesis *A Arquitectura Pombalina na Rua da Madalena*. It is a systematic analysis of building features in the same street, including the metric survey floor plans for one more complete building.

Contributions to the history of Lisbon's western neighbourhoods

Even though previous studies concerning the city of Lisbon had already pointed to some important elements of the history of the city's western neighbourhoods before and after the 1755 earthquake, until the 1990s a great part of this history had not been analysed. We have selected four main studies on this topic. The first one, architect Walter Rossa's (Rossa 1998) master's thesis in art history, *Além da Baixa: indícios de planeamento urbano na Lisboa setecentista,* mainly concerns the development of the *Cotovia-Amoreiras* axis, and particularly focuses on the *Águas Livres* neighbourhood. Although this work does not analyse the rest of the western neighbourhoods (and maybe because of this) it is very precise in its bibliographical, documental and cartographical sources. Starting with the progressive expansion of the city since the 16th century inward and to the west, through successive allotments of convent or farm land, this research places the beginning of a real attraction to the western area of the city (the *Campolide* area that Matos Sequeira referred to) in the 17th century, quoting as examples the *Linha de Fortificação* and the initial early 18th century plans to locate the Patriarchal in the *Buenos Ayres* area (only resumed after the earthquake), where a new urban focus could be established (Rossa 1998: 25). After the earthquake, the author acknowledges Manuel da Maia's concerns with the area's anarchical occupation and analyses the two plans that were ordered by him for this area, that would never be applied (as was also the case of the royal palace in *Campo de Ourique*). Besides this important contextualisation, the author focuses his attention on the plan and building of the *Águas Livres* neighbourhood, which he considers to be "out of all the plans outside the *Baixa* the only one with a previous urban content beyond the simple rational occupation of land in the spaces between its built mesh. The urban connection of the *Baixa* to this area was also reinforced"[41] (Rossa 1998: 50), through the *Cotovia* area.

As implied by Walter Rossa at the beginning of his master's thesis, it would also be important, for the history of Lisbon's western neighbourhoods, to study the privately-promoted built environment of the end of the 18th century or of the 19th century. The in-depth analysis of this history started, curiously, with a publication by historian José Sarmento de Matos on the origins of headquarters of the *Fundação Luso-Americana*, a building located in the *Lapa* neighbourhood. The research was entitled *Uma casa na Lapa* (Matos 1994). To frame this analysis, the author examined the initial development of the neighbourhood and its cartography, starting with the allotment of land belonging to the *Trinas do Mocambo* nuns' convent after the earthquake, a decision taken against official instructions.

We would like to complete this thematic sequence with two doctoral theses in art history that played an important role in documenting the history Lisbon' western

neighbourhoods, both presented to the *Faculdade de Ciências Sociais e Humanas* of the *Universidade Nova de Lisboa*. The first is Raquel Henriques da Silva's (Silva 1997) *Lisboa Romântica: Urbanismo e Arquitectura, 1777-1874*, a fundamental urban research with a broad focus, based on an approach presenting a global vision of the city and a vision of each neighbourhood, and reinforced by inquiries into unpublished manuscripts and varied cartography. According to the author, the accentuated expansion of the city to the west starting at the end of the 18th century, which is frequently interpreted as a consequence of post-earthquake panic, should however be interpreted as the continuation of the city's expansion before the earthquake, already signalled in the "outline of alternative nucleoli"[42] (Silva 1997: 44), as mentioned by Walter Rossa (1998). During the 19th century, alternative nucleoli to the *Baixa* would become consolidated "in the north of the *Lapa*, in *Santa Isabel*, at the burnt Patriarchal (now the *Príncipe Real* square), in the *Ajuda*, far away in *Campo Grande* and, mainly, in the *Chiado* where, at the time, the heart of romantic *Lisbon* was being outlined"[43] (Silva 1997: 539). The *Chiado* area (in a broad sense) would, according to the author, be extended throughout the 19th century, along with undertakings in other city areas: the continual urban development of *Santa Isabel* linked to the establishment of the *Jardim da Estrela* and, near the river, the "*Aterro da Boavista* and opening of the *Rua 24 de Julho*, including the allotments next to the *Largo de Santos*, next to the *Janelas Verdes* and *S. Bento*"[44] (Silva 1997: 543). The broad lines of Raquel Henriques da Silva's master's and doctoral theses[45], ranging from the rebuilding of the *Baixa* until the outlining of the *Avenidas Novas* at the beginning of the 20th century, were recently systematised in an article entitled "Lisboa reconstruída e ampliada (1758-1903)". The latter is included in a coherent set of articles produced by several authors for the exhibition catalogue *Lisboa 1758: o plano da Baixa hoje,* celebrating the passing of 250 years since the law passed for the *Baixa*'s reconstruction. The exhibition and its catalogue were curated by Walter Rossa and Ana Tostões (2008) and present new analyses focused on plan modernity and *avant-garde*. The catalogue proposes, on the one hand, an urban vision of the reconstruction plan ☒ and of the mechanisms allowing for land redistribution and, on the other hand, looks into the changes to urban identity that took place during the 20th century. The adjoining CD includes an important collection of graphic information, such as various historic plans and photographs.

The second doctoral thesis we would like to mention within this sequence is historian Joana Cunha Leal's (2005) *Arquitectura privada, política e factos urbanos em Lisboa: da cidade Pombalina à cidade liberal*. This is an extensive work on Lisbon's urbanism since the *Baixa*'s rebuilding in late 18th century to late 19th century. Its first chapters focus on urbanism in the *Baixa* and in the western areas of *Santa Isabel*, *Pombal*, *Cotovia* and *Lapa*. The author namely explores the (reduced) public control of urbanism in several less regular western areas, mostly originating from allotments of private initiative, with the exception of the *Aguas Livres* neighbourhood, which, as we have seen, was examined by Walter Rossa.

In regards to housing typology, the main original research of Joana Cunha Leal's work refers to the collection and analysis of a large number of archive drawings of mid to late 19th century houses, as well as the study of the legal and political context

concerning those buildings. These are drawings included in the *Colecção de Alçados* (collection of elevations) at the *Arquivo Municipal do Arco do Cego*, of which the original catalogue, the *Livro de Prospectos,* "contained the registry of all construction work submitted by private undertakers to Lisbon's city hall between October 1845 (date in which the archiving of drawings was made mandatory) and 1874/1875 (date in which it was reorganised)"[46] (Leal 2005: X). As from the December 1864 building decree[47], this collection included housing plans, of which a large number are presented in the thesis annexes relating to chapter "8.3 The residential structures and the city"[48]. Joana Cunha Leal focuses her analysis on higher end housing: the *palacetes*, larger buildings following a single-family house schema (even if there could be two overlapping residences with separate entrances), and one flat per floor buildings. The latter are particularly interesting to our study, since they show slowly evolving transformations of the domestic spaces, with strong remaining features that can already be observed in the *Pombalino* flats[49]. In most examples, the staircase was placed within the central sequence of rooms, and flats generally had multiple entrances, most often with at least one to a front-side room and another to a central corridor. Changes are evident in the increasingly clearer corridor, and in the "introduction of a series of sanitation and comfort devices [...] in more qualified interiors: the presence of a small space latrine space and the moving of the wastewater sink from the interior of the kitchen to the outside"[50] (Leal 2005: 704).

Recent perspectives concerning Lisbon's *Baixa*

Several studies were recently published concerning Lisbon's *Baixa Pombalina*, making important new developments. The first is the 21st volume of the *Monumentos* magazine published in 2004 by the *Direcção Geral dos Edifícios e Monumentos Nacionais* (Costa 2004). This publication gathers several articles by researchers on topics related to the *Baixa Pombalina*. In this review, we would like to mention two articles, one focusing on building chronology, the other on domestic spaces. The first is entitled "A Décima da Cidade: contributo para a datação do edificado da Baixa" (Reis 2004), and depicts a significant research at the *Arquivo Histórico do Tribunal de Contas* on the *Décima da cidade de Lisboa e seu Termo*[51], allowing for quite an accurate dating of buildings. The building dates of the majority of the *Baixa*'s buildings were determined (as they were originally, as some were replaced later), and a map with this information was produced. As described by Raquel Henriques da Silva in the introduction to the article, this chronological data on buildings is extremely useful to understand the building paces, and this type of research should be extended to other areas of the city. The second article, by historian Maria Helena Barreiros, "Casas em cima de casas" (Barreiros 2004), is a fundamental original contribution to the description of the *Pombalino* house layout including rare drawings from the time of building and new metric surveys:

> There can be one or two flats per floor, and both solutions can coexist in the same plot. The last disposition [two flats per floor] will become the "classic" schema right flat/left flat, common in Lisbon during the 19th century and a large part of the 20th century [...] (Barreiros 2004: 90) [52]

As an identifiable layout principle, there is a double sequence of rooms, a first composed by the front sitting rooms and chambers, communicating directly through a series of doors en enfilade, and a second, doubling the previous one, composed by the alcoves without a window – in principle, housing the beds for sleeping -, which open onto the front rooms. (Barreiros 2004: 92)[53]

In preparation of her doctoral thesis, Maria Helena Barreiros has written several articles (2010, 2011, 2012) contextualizing and describing *Baixa*'s domestic spaces. As far as could be established, they constitute the most recent updated work on this topic. The article examining the blocks of flats belonging to the *Santa Casa da Misericórdia* charity is of particular interest to understand the general transformations of domestic spaces from early 18th century to late 19th century, corresponding to the examples' different building dates. In this article, the author also republishes[54] a rare original late 18th century *Pombalino* floor plan ☒ of two buildings, one of which is a typical four window one-flat floor. It has the particularity of having indicated room functions:

The room giving onto the stairs is destined for reception; the following one, for sitting and reception; one draws from the latter into the alcoves (chambers) to sleep; dinning takes place at the back, in the room next to the kitchen. Over a hundred years later, the functional program of Lisbon's bourgeois block of flats will be organised in the same way, only with the increase of the distance – physical, social and living – between the "visitors" rooms and the kitchen, through the introduction of an element that starts structuring the house, the longitudinal corridor. (Barreiros 2010: 29-30)[55]

As mentioned earlier, several articles presented new or restructured analyses on the 1758 plan for the *Baixa Pombalina* in the 2008 exhibition catalogue *Lisboa 1758: O plano da Baixa hoje* (Tostões 2008). Among these articles, we would also like to mention the one by jurist Cláudio Monteiro, who looked up new data on the legislation that allowed for the plan to be carried out and for the compensation of previous property owners. The complete results of this research were recently published in the 2010 book *Escrever direito por linhas rectas: Legislação e planeamento urbanístico na Baixa de Lisboa (1755-1833)* (Monteiro 2008).

Family trajectories and housing – developments in the 1990s

The scope of this review could not include a complete study of literature concerning the trends in 19th century family life in the cities examined. Nonetheless, it is essential to mention the contribution of family history and sociology to the understanding of the city and home dynamics.

In regards to 19th century Oporto, one particularly important work is Gaspar Martins Pereira's (1995) doctoral thesis in modern and contemporary history *Famílias portuenses na viragem do século (1880-1910)*. The author gives a portrait of different socioeconomic family structures and trajectories in the neighbourhood of *Cedofeita*[56] between 1890 and 1910. The portrait of Oporto's families pertaining to different socioeconomic and professional categories is of particular interest since, as we shall see in the next analysed study, these correspond to different housing types:

Among the Oporto elites, domestic intimacy is increasingly valued [in late 19th century]. Houses are closed behind fenced gardens, the home is protected from the public eye with muslin curtains, blinds or shutters, in the elegant and less dense areas of the Foz, Campo Alegre, Boavista etc. However, this movement, which reflects new attitudes, only represents the surface of Oporto's society. Even in sectors of the high bourgeoisie, this movement is far from general. In the small and medium bourgeoisie of workshop managers and shop keepers, many will still reside in the narrow homes of the urban centre, on the floors above their shop or workshop, sometimes housing the apprentice or assistant, as we observed in the *Rua do Almada*.
For most Oporto residents, who live in the numerous *ilhas* [...], in the "hives" of the old city, or in the popular alleys [...], public and private spaces have imprecise limits, [...], a door open to the street, where residents are almost like at home, where children play and where, occasionally, residents also work. (Pereira 1995: 47)[57]

Research into housing in Oporto was further developed in a doctoral thesis in architecture by Francisco Barata Fernandes, *Transformação e permanência na habitação portuense: As formas da casa na forma da cidade* (1999), which has since become the work of reference on the study of domestic architecture in Oporto built between the 17th and early 20th centuries. The author analyses the plot dimensions, elevations, internal layout and building systems. The information is systematised by identifying three main types of housing according to three main times: mercantilist, illuminist and liberal. The author undertook a detailed *in situ* research, as well as an analysis of building licences at the *Arquivo Histórico*. General technical drawings depict the types of housing ☞, unfortunately without referencing many of the analysed examples.
In summary, Francisco Barata Fernandes describes the houses of late 18th and of the first half of the 19th century (the *illuminist* type), generally, as narrow 3 to 5 floor-houses with a commercial ground floor and with upper floors occupied by one family, often with a separate entrance. Inside, the transverse central staircase separated street and courtyard side rooms that, depending on the plot depth, could be associated with alcoves placed next to the staircase. The street-side room on the first storey would be prepared for visitors. As in Lisbon, it was placed far from the service areas: the kitchen was usually located on the top floor on the courtyard side, away from the public eye (Fernandes 1999: 143-144). As was also indicated by Martins Pereira, whose thesis is not mentioned by Barata Fernandes, these features partially changed during the second half of the 19th century in higher-end buildings, which had an exclusively housing function. Francisco Barata Fernandes names this housing type the *liberal* type, with features commonly associated with the Flemish or British terraced house. They were contiguous narrow houses with 3 or 4 floors, nearly always associated with a garden to the back. The ground floor, used for residential purposes, was elevated and distanced from the street. It was, hence, the ground floor room next to the street that was used for receiving visitors, while the rest of the house could remain undisclosed. The kitchen was, most likely, located on the ground floor next to the courtyard façade. It was also possible for the kitchen to be placed in the room below, on the basement floor, if this room was on the same level as the garden (Fernandes 1999: 171-173). Small toilets were usually placed on the courtyard side next to the balconies on each floor, but bathrooms were rare and only present in some examples since the beginning of the 20th century.

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Master's studies on specific locations in Oporto

Several years apart, three master's theses presented to the *Faculdade de Letras da Universidade do Porto* each analyse a specific place of the city of Oporto. The first, *A Rua Alvares Cabral (1895-1940): Formas de habitar,* is a thesis in art history by Maria do Carmo Pires (2000), which depicts the urban development, housing types and successive owners of houses in the *Rua Álvares Cabral* between 1895 and 1940. The research was carried out by cross-referencing manuscripts and drawings from several archives. Although this work analyses a very specific location, it gives us crucial information on the characteristics of late 19th century housing and on the urban development of the area around it, *Cedofeita*. In fact, the grounds where *Rua Álvares Cabral* is now located were still a farm during most of the 19th century, that had already been reduced during the *Almadino* period to open the *Rua da Boavista* and to extend the *Campo de Santo Ovídio* (nowadays *Praça da República*). According to the author, the division of the rest of the farm into plots to open this street was carried out between 1897 and 1905, at a time of great demographic growth when areas with narrow single-family houses, in keeping with Oporto's tradition, were being built exclusively for housing, targeting a high-standard bourgeoisie, mostly corresponding to the *liberal* housing type identified by Barata Fernandes. The thesis presents detailed charts for housing at the analysed location in their original versions, including copies of the original archive drawings.

Jorge Ricardo Pinto's master's thesis, *O Porto oriental no final do século XIX* (Pinto 2007), refers to the urban and social history of the oriental areas of Oporto. It is a thesis in geography analysing the urban development of the area based on successive collected archive plans, and characterizing its population as well as its industrial and commercial development. The author characterizes the area in 1750, when it was mainly made up of large farms, and goes through the first main developments with an impact on this area, as also previously identified by Nonell: at the very end of the 18th century, the opening of the *Rua de Santo António* (*31 de Janeiro*) ☒ connecting the *Santo Ildefonso* and *Bonjardim* neighbourhoods, and alignment work on *Rua de Santo Ildefonso* (Pinto 2007: 35); since 1805, the urbanisation of the Fraga farm, with the opening of the southeast section of the *Rua de São Vitor* (Pinto 2007: 46); in 1834, the opening of the city's first public garden in *São Lázaro*. The main original work focuses on a particularly important time for the urban development of the area, between the opening of the *Campanhã* train station, in 1875, and the *São Bento* train station in 1896. During this time, the urbanization of two large farms took place, first the Fragoeiro farm, an operation concluded in the 1880s and leading to the opening of the *Rua Alexandre Herculado* and the *Rua do Duque de Loulé*, and secondly the *Quinta do Reimão*. According to the author, the latter was an innovative plan composed of set of converging streets, such as the *Rua de Ferreira Cardoso, Rua do Conde Ferreira* and *Rua Joaquim António de Aguiar.* Ricardo Pinto also looks into the actions carried out in the framework of Oporto's 1881 *Plano de melhoramentos*[58], such as the *Rua do Padre António Vieira* and the *Rua de Pinto Bessa*, which aimed to improve the connections between the centre and the *Campanhã* train station (Pinto 2007: 81).

A third master's thesis focusing on a specific area was carried out a few years later by architect Domingas Vasconcelos (2008): *A Praça Marquês de Pombal na Cidade do Porto: Das suas origens até à construção da Igreja da Senhora da Conceição.* Like the thesis portraying the *Rua Alvares Cabral,* it is a thesis in art history, with a similar methodology. The author depicts the *Praça Marquês de Pombal*, located at the northern end of *Rua de Santa Catarina*, from the origins of the square to mid-20th century, analysing its urban development and buildings, residential and otherwise. According to the author, the place for the square, previously entitled *Largo da Aguardente*, is already mentioned in 1784 as the predicted end for the planned *Rua de Santa Catarina*. After several projects for the square's regularization, it would take its present shape during the second half of the 19th century. Although with less detail as the previous work, the opening of streets around it is also described chronologically. The author also describes the houses around the square, and the process of transformation from single to multifamily housing. The work presents floor plans for four early 20th century houses, and photographic charts with building and demolition dates for buildings around the square.

Recent studies concerning housing in Oporto

During the 2000-decade, that is, roughly during the same period as the previously analysed studies, two pieces of work provided new data on Oporto's ordinary housing. The first is Joaquim Teixeira's[59] (2004) Professorship dissertation, the *Provas de aptidão pedagógica e capacidade científica* at the Oporto Architecture Faculty. The study focused on the building system of the bourgeoisie houses in Porto between the 17th and the 19th centuries, which had not yet been systematically analysed:

> The main structure is composed of: (i) party walls, usually made of granite rubble stone masonry […]; (ii) the floor structure and (iii) the roof structure, both composed of round section beams, usually in chestnut wood, national pine wood or, in wealthier examples, in Nordic pine. The secondary structure is made up of: (i) façade walls, that can be built in stone masonry (granite), mainly with dressed stones in the shape of kerb stones (which corresponded to the doorposts, lintels and thresholds of the openings and decorative elements) or, when there were added floors, in simple or resistant wooden frame walls, (ii) interior division walls and staircase walls, in simple wooden frame or reinforced simple wooden frame; (iii) staircase structure; (iv) skylight structure and the (v) attic structure and that of all small roof elements. (Teixeira 2004: 45)[60]

The text is accompanied by the author's students' constructive metric survey drawings of Oporto houses.
Nelson Mota (2010) recently published a master's thesis in architecture entitled *A arquitectura do quotidiano: público e privado no espaço doméstico da burguesia portuense nos finais do século XIX*. In this work, the author analyses and presents a large selection of *bourgeois* housing floor plans dating from a very precise short period, from 1897 to 1900, collected at the *Arquivo Histórico Municipal do Porto.* The examples are divided in two large groups, the isolated houses of the high-end bourgeoisie (with or without direct access to the street), and the contiguous terraced

houses, which, as we have seen, were a more common type defining the image of the city. The terraced housing examples are then distributed according to several categories: houses without direct access to the street, houses with three façades, houses with an elevated ground floor (and an exclusive housing function) or the ones where the ground floor had a direct access to the street (mostly related to commercial functions). According to Mota, the two last categories were the most common, corresponding respectively to 29 % and 31 % of the analysed examples (Mota 2010: 103-111). The key original work is the detailed and well-referenced comparative analysis of the domestic spaces. The author describes, for instance, the reception rooms, intimate spaces, the introduction of rooms dedicated to hygiene, or the relation of the staff quarters with the rest of the house. The annex volume, which was not included in the book version, shows the author's exemplary methodology by presenting a collection of all the examined floor plans and references pertaining to the houses, sometimes including additional axonometries.

Observations during the 19th century and early 20th century

We would like to begin this review with three studies concerning the history of Geneva written from mid 19th century to early 20th century, thus mentioning events both in the authors' distant and recent past. The first, *Genève depuis la constitution de cette ville en république jusqu'à nos jours (1532-1856),* is a book published in 1856 regarding the history of Geneva from 1532 until the time it was written. In the preface, we learn that the author is Eusèbe-Henri Gaullieur, a history professor at the *Académie de Genève* who wrote several books on the history of particular regions or Swiss literature. Moreover, he was a contributor for two pro-radical journals, and later worked as secretary general for the *Institut National Genevois*, founded by James Fazy (Maggetti s.d.). Even though the book focuses on the political history of Geneva from the 16th to the 19th century, some fundamental urban developments are mentioned, without any graphic elements. In the final section, concerning the 19th century, the author describes the period of Geneva's annexation to France, from 1798 to 1814, the restoration of its independence and, in 1815, the setting up of Geneva as a new Swiss canton. During the 1830s, Gaullieur refers to the simultaneous building of a new monument to Jean-Jacques Rousseau and of "a new bridge, that of the *Bergues* [...], to link the city's new embankments to the new neighbourhoods built in the *Saint-Gervais* area"[61] (Gaullieur 1856: 407). No further reference is made to *the Bergues* building operation in *Saint-Gervais*.
Throughout the following chapters, Gaullieur introduces the 1841 and 1846 revolutions by describing the opposition movements and their publications. According to the author, the revolutions led to the repeated revision of Geneva's constitution and to the institution of a representative democracy based on the adoption of the universal suffrage as the basis for the electoral system. Little reference is made to urban development, with the exception of the political debates surrounding the demolition of the city's fortifications. The author distinguishes between a more conservative approach of those who wanted to keep the city walls, and the position of the radical party, which the author supported, whose members sought "to demolish the ramparts that surrounded Geneva both ideologically and geographically"[62] (Gaullieur 1856: 457) The cantonal government of radical majority led by James Fazy, elected after the 1846 revolution, promulgated the final decision for demolition in 1849[63]:

> One of the essential results of Geneva's 1846 revolution was the demolition of the fortifications, which started in 1849. Numerous watchmaking and industrial workers, unemployed due to the economic crisis that followed the 1848 revolutions, were first charged with levelling out the

land. [...] They cleared a vast building land, in very good locations, all around the old city on both banks of the *Léman* Lake and of the *Rhône* [river]. Magnificent banks were created on both sides of the river, extending those that were created around twenty years ago. Remarkable buildings, both public and private, are built with incessant speed and activity. An entirely new city is thus born besides the old Geneva. Rail works are being actively carried out to connect Lyon to Geneva. [...] Another railway-line will also connect Geneva to Bern, Basel and all of Switzerland. (Gaullieur 1856: 500-501)[64]

The second work we would like to mention, *Genève à travers les siècles* (Fatio 1994), was completed just under half a century later by Guillaume Fatio. The author completed several studies aiming to make the history of Geneva accessible to the public, even though it was not his main professional occupation, leading to the attribution of a *honoris causa* doctorate from Geneva university (Fatio 1994). According to the biography written by Oliver Fatio for the *Dictionnaire historique de la Suisse*, "he fought, together with his brother, architect Edmond Fatio[65], for patrimonial protection, urbanism, public health and social aide"[66] (Fatio 1994). Unlike the previous work, this book mainly describes urban issues or relevant buildings. The text is illustrated by a few general urban plans and, mainly, by photographs taken by Frédéric Boissonnas[67], a well-known photographer based in Geneva. The chapter regarding the 19th century is divided in two parts, before and after the demolition of the fortifications. In the first part, the author mentions key buildings or events, giving a more detailed description of two early 19th century building operations that had an important urban impact. The first was an operation promoted by public authorities in the *Corraterie* area:

New streets were planned, as well as bridges over the Rhône River, and fountains inside the city. The land in the *Corraterie*, freed by the extension of the fortifications, was sold in auction in 1827; the houses were built according to a uniform plan imposed by the State. It is one of the rare examples that exist in Geneva of mandatory architecture; the fifth and the eighth house have a pediment, giving the appearance of three large series of buildings, which are both simple and elegant. (Fatio 1994: 139)[68]

The second building operation that was mentioned by the author was the *quartier des Bergues,* of private initiative, which had been briefly mentioned by Gaullieur. Fatio does not go into detail concerning the building features, but describes the process and the involved actors. While Gaullieur's book focuses on James Fazy's political endeavours – without mentioning his participation in the *Bergues* operation – Fatio starts by highlighting Fazy's role as a building entrepreneur in this large enterprise with a significant urban impact:

In 1827 appears for the first time an important figure to Geneva's 19th century transformations. He [James Fazy] conceived the project of creating a new neighbourhood in the location of the *Bergues* factory, on land that belonged to his family and that was located next to the *Rhône*, in front of the *Rousseau* Island. [...] Fazy gained the support of several influential men for his enterprise; [...] an anonymous society [...] was formed under the name "Société des Bergues". It was the first society established in Geneva with the aim of developing and embellishing the city. (Fatio 1994: 141-142)[69]

In the section concerning the second half of the 19th century, the author depicts the urban changes carried out since the 1846 revolution. The first operations that are

briefly mentioned are the new *Eaux-Vives* and *Léman* riverbanks and the *Mont-Blanc* and *Coulouvrenière* bridges. The author also notes the inauguration of the railway line from Lyon to Geneva in 1858, whose building had been mentioned by Gaullieur. In this section, Fatio mainly describes how the area that was previously occupied by the fortifications was the target of a complete urban plan with clear building regulations, following the definitive decision to demolish the fortifications after the establishment of an administration of radical majority. Without going into many details, the author describes how the operation was financially profitable to the State through the sale of plots of land, going on to praise the new areas which, according to him, were "models of what a city should be, following a masterplan that was adopted in advance and followed scrupulously"[70] (Fatio 1994: 154). The paragraph in which the new areas of the perimeter are described is particularly interesting, specifying that each one had its own particular character:

> The *Tranchées*, place of opulence, are the continuation of the old aristocratic neighbourhood, said to be "up high". After passing a viaduct, to stride across the previous casemates, we are in the middle of the *faubourg Saint Germain* [in Paris]. The neighbourhood of the stock exchange became, to Geneva, what the City is to London, a work place to see clients, or make money, but where living should be avoided. The same thing happened to other parts of the new city, around the old one, where natural groups were soon formed. (Fatio 1994: 155)[71]

The author then compares these areas with the ones that had been built since, which he believed to completely lack in urban planning, since the State had chosen to only divide its own plots, leaving the rest to private endeavours.
In 1908, Guillaume Fatio wrote the preface to a short book by Charles Rimond entitled *Récits et souvenirs sur Genéve de 1840 à 1860*. In the preface, we learn that the Rimond lived through the events that took place in Geneva from during the 1840 to 1860, a 20-year period which, according to Fatio, constituted one of the most eventful periods of history (Rimond 1908: Préface). In this work, Rimond recalls the political events that took place during this time, namely describing the revolutions from an insider point of view. The author mentions the importance of the demolition of the fortifications, but gives more emphasis to describing the fortifications before they were demolished than to the subsequent expansion of the city. For instance, James Fazy's house on the new *Mont-Blanc* embankment [the *Square du Mont-Blanc*] is only mentioned in passing, when the author supports opposition deputy Théodore de Saussure on his criticism of the use of that location as a gambling house (Rimond 1908: 51).

Publications by the *Société Suisse des Ingénieurs et Architectes*

The *Société Suisse des Ingénieurs et Architectes,* founded in 1837 under the name *Gesellschaft Schweizerischer Ingenieure und Architekten*, started publishing magazines in 1874 for the promotion of its activities or of recent architecture and engineering projects. This was the case of the *Schweizerische Bauzeitung* and of the *Bulletin technique de la société vaudoise des ingénieurs et des architectes*. However,

most late 19th or early 20th articles referring to Geneva concern technical issues such as water or gas distribution, or reparation work to a bridge or riverbank. In 1907, the Geneva section of the *Société Suisse des Ingénieurs et Architectes* did a commemorative volume of a general assembly – an *Album de fête* – concerning the recent work of some architects in the city, accompanied by floor plans of each building. The articles referred to some emblematic buildings, as was the case of the *Musée d'Art et d'Histoire*, designed by Marc Camoletti (1907), but there were also two articles concerning housing buildings by architect Jean-Louis Cayla: a block of flats built in the previous location of two possibly 15th century houses (Cayla 1907), with three flats per floor, and a large single-family house in the up-market *Tranchées* area, the *hôtel Micheli* (Cayla 1907). It is particularly interesting to note the architect's description of the house's layout, one of the largest single-family terraced houses in the area:

> The basement, partially lit by air shafts, has the caretaker's flat, the kitchen, the pantry, storage, central heating and other service areas. The ground floor was completely occupied by reception areas (living rooms, dining room, billiard room, etc.) and the two upper floors by private dwellings and the servants' rooms. [...] The two upper floors are connected by a secondary staircase in oak, which does not overlap the one from the ground-floor.[72]

While even the largest flat in the blocks of flats only had a toilet and one maid's bedroom, single-family houses could have bathrooms, central heating, a caretaker's flat and a top floor dedicated to maids' dwellings.

In 1910, the collection *La maison bourgeoise en Suisse* (The bourgeois house in Switzerland) started being published by the *Société Suisse des Ingénieurs et Architectes*. It was an innovative publication specifically focusing on emblematic housing examples, including original documental research and surveys. Each volume analysed houses in a different canton. The second volume, *La maison bourgeoise en Suisse: Canton de Genève*, was first published in 1912 and referred to housing in the city and canton of Geneva. Architect Edmond Fatio, whom we mentioned earlier, carried out the documental research, the drawings and the photographs. The text was written by architect Camille Martin. In 1919, just a year before becoming director of the *Bureau du plan d'extension*, Martin wrote an article in the *Schweizerische Bauzeitung* historically contextualizing Geneva's urbanism to focus on specific problems and improvements considered necessary to the future urban development: "La ville de Genève: sa formation et son développement futur" (Martin 1919). The paragraphs depicting the changes in housing since the Middle Ages are of particular interest to our work:

> The development of housing is influenced by historical facts. In the Middle Ages, in the city and its outskirts, the contiguous housing type, with one floor above the ground floor, and a narrow and long garden, is virtually the only existing type. [...] It is in the 17th century, and mainly in the 18th century, that we see houses with several floors built all at once, with larger façades. [...] During the 19th century, the tradition of the 5 or 6 floor house remains frequent and is intensified. Nevertheless, over the location of the previous fortifications, regulations are adopted to limit the number of floors to three, two or even one over the ground floor, depending on the neighbourhoods. This rule was not applied to private land. The territory of the outskirts

and even of certain regions of the countryside was invaded by disparate buildings, without order. (Martin 1919: 164)[73]

The volume of the *Maison bourgeoise* collection concerning Geneva was republished in 1940, in a revised edition coordinated by architect Edmond Fatio. This time, Fatio was assisted by architect and cantonal archaeologist Louis Blondel. A few years later, in 1946, Blondel published *Le développement urbain de Genève à travers les siècles* (Blondel 1946), which would become a work of reference concerning the urban development of the city since prehistoric times. The book compiles a series of articles published by the journal *La Suisse* between 1930 and 1932, comprising descriptions and schematic maps depicting the city's development throughout time. The chapter concerning the 19th century is divided in three sections: from the restoration to the demolition of the fortifications (1815-1850); the main extension of the city over previous fortification land (1850-1888); from the establishment of a tram network to the development of the outskirts and of main access roads (1888-1914). The author mentions that the city does not increase during the first period, but that some important operations were carried out, such as the construction of new embankments (*Grand-Quai, Bergues, Seujet*), the building of the *Bergues* Bridge and of the *Corraterie* housing set[74]. Blondel emphasises the role of cantonal engineer colonel Guillaume-Henri Dufour in these operations, especially as far the *Corraterie* is concerned:

It is interesting to note that [the *Corraterie*] is due to State initiative, who imposed very detailed building regulations concerning roof, cornice and floor height. The main aspects of the project were defined by colonel Dufour, but the plans are signed Vaucher-Delisle. Building started in 1827. This long line of houses is designed according to a uniform plan, as if the ground was horizontal. Only the progressive heights of shop arcades, with or without a small mezzanine level, make up for the difference. (Blondel 1946: 88-89)[75]

The description of the following period, from 1850 to 1888, follows the main aspects that were identified by other authors: the overthrow of the conservative government and establishment of a radical one directed by James Fazy; the decision to demolish the fortifications and the changes brought about by new neighbourhoods; the creation of a railway line (Blondel 1946: 92). Again, Blondel praises Dufour's work, noting that, before the definitive decision for demolition, Dufour had already obtained permission to fill in some ditches to reduce the number of counter guards. The author then describes the general urban features of the new neighbourhoods:

The principle was of streets which intersect at a right angle, thus forming neighbourhoods with regular rectilinear plans. There are also rectangular squares, circular star shaped ones, such as the *Rond-Point de Plainpalais*, and square ones with cut angles, as the *Cours de Rive*. The most frequent system is of lined up buildings, with or without a terrace, giving onto two streets, such as the *Cours des Bastions*, or the *rue Sénebier*, but for more important plots, there are also blocks with central gardens [*squares*]. Thanks to height constraints and to agreements between owners, several streets have blocks of flats or single-family houses that form a set where the roofs and the cornices are at the same level. (Blondel 1946: 94)[76]

Regarding the forthcoming period, Blondel focuses on the extension and building of Geneva's outskirts, mentioning – just like Guillaume Fatio – the lack of general plans and regulations until the beginning of the 20th century. The author lists the multiple partial plans that were conducted for several areas after 1900 (Blondel 1946: 101). Another important aspect was the restructuring of some areas of the old city centre by enlarging some streets or opening new ones[77]. According to Blondel, one of the largest restructuring and rebuilding operations was done on the *Île,* an island-like area between the two riverbanks[78] (Blondel 1946: 102).

Rolf Pfändler's work concerning the *Tranchées* and *Bastions* area

Rolf Pfändler's *mémoire de licence* (1974), entitled *Histoire du quartier des Tranchées et des Bastions*, was the first in-depth work looking into the urban development of a *Ceinture Fazyste* neighbourhood – the *Tranchées* and *Bastions* – and, most importantly, carrying out an in-depth analysis of its housing. The work follows the urbanisation of the area since prehistoric times, leading to its present configuration that was defined after the demolition of the fortifications in mid 19th century. According to Pfändler, the new up-market residential neighbourhood was, at the time, "considered as a place of urban residence by its residents who, for the most part, already possessed country houses"[79] (Pfändler 1974: 8). The final plan, established by engineer Blotnitzki in 1855 and approved in 1868, defined an exclusively orthogonal matrix of streets for this area (Pfändler 1974: 29). It was subsequently adapted to fit in with the low density, gardens, hygiene and health patterns that Geneva's bourgeoisie aspired to (Pfändler 1974: 32).
Pfändler describes the features of the houses by examining several examples in detail. The descriptions are paired, in the annexes, with a collection of several urban plans, photos and floor plans of 16 buildings. The author describes several types of buildings, starting with the ones used for rental, mostly with two flats per floor and five levels for flats. According to Pfändler, the blocks of flats often followed the model of the next-door *Rue Beauregard* 2-8, four contiguous blocks of flats built in 1774, with two or three façades per building, and where all rooms could be accessed by a central hall (Pfändler 1974: 100). In the *Tranchées* neighbourhood, other more luxurious housing solutions existed, such buildings one flat per floor where owners might rent one or more flats above their more comfortable one on ground-floor (Pfändler 1974: 78). The floor plans are divided into four groups according to the number and position of the façades: two façades at a right angle, two parallel façades, three or four façades (Pfändler 1974: 100). The single-family houses are also described in detail. They usually had "only four levels, that are each attributed to a household function: kitchens and service areas, reception rooms, main rooms, secondary rooms"[80] (Pfändler 1974: 92). According to the author, the kitchen was usually placed in the basement, next to the street, in order to leave all available space on the ground floor for reception rooms. The main bedrooms would be located above, on the first floor, and other bedrooms, ateliers and servants' rooms on the second floor (Pfändler 1974: 99).

The work has a particularly interesting description of some original health and hygiene conditions of the buildings, and of the subsequent changes[81]. According to the author, sanitary arrangements and service rooms contributed to this development. In the original floor plans of houses designed by architect Emile Reverdin, for instance, all single-family houses have a very small bathroom, paired with a toilet cabinet and a toilet on each floor. In the architect's set of floor plans, no flat had a bathroom, only a toilet and a toilet cabinet (Pfändler 1974: 109). According to Pfändler, the first blocks of flats to be designed with a bathroom in that area date from 1897 and 1904. The first main change that the author documented, carried out during the 20th century, was the introduction of bathrooms, often placed in the toilet cabinets. The second was moving the kitchen in single-family houses from the basement to the ground floor, near the dining room, a change that was possibly due to the reduction of household staff (Pfändler 1974: 111).
Following his *mémoire de licence*, Pfändler wrote some articles based on the conclusions of this study, two focusing on the history of the area (Pfändler 1976, 1979), and another analysing the project portfolio of architect Emile Reverdin (Pfändler 1985). We will examine this article in the section concerning studies that have looked into the work of specific architects.

Studies examining 19th century building regulations

The repetition of certain traits in Geneva's 19th century areas stems not only by the building traditions of the time, but also from predefined urban plans and building regulations. As we have seen, this was the case of the series of early 19th century buildings in the *Corraterie* and, since mid-19th century, of the areas built over previous fortification land, often designated by *ring* or *Ceinture Fazyste*.
In the work concerning the *Tranchées* and *Bastions*, Pfändler analyses the building regulations applicable to these two areas of the *Ceinture Fazyste*. The first general building regulations are examined, established in 1850 for the entire previous fortification land, "but which were, in the *Tranchées* and the *Bastions,* changed and enriched by clauses specific to each plot"[82] (Pfändler 1974: 39). According to Pfändler, the regulations had the aim of insuring good neighbourly relations between owners of different plots, and avoiding aesthetic or practical incidents. They did not however try to ensure health and hygiene conditions for the users of the buildings: "This is why the issues regarding interior dispositions are neglected compared to those that have an impact on the whole neighbourhood, concerning property limits or the outside appearance of buildings"[83] (Pfändler 1974: 39). As such, there were rules concerning chimneys, water disposal or building quality and, mainly, relating to urban issues such as projecting elements, building height and depth. In the *Tranchées* and the Bastions areas, the depth was, according to *Pfändler*, usually around 16 or 17 m; heights were usually limited by a minimum and maximum value and number of floors. In most cases, "buildings are allowed one to three floors over the ground floor, 10 to 16 m up to the cornice, and 20 m to the ridge"[84] (Pfändler 1974: 42).

In 1977, lawyer Gabriel Aubert wrote an article concerning the development of heritage protection measures in Geneva[85] until that date, entitled *La protection du patrimoine architecturale en droit genevois* (Aubert 1977). A decade later, in 1981, Aubert picked up the analysis of the measures allowing for the protection of 19th century homogenous areas, and also examined the original building regulations that contributed to their quite homogeneous character. The article was entitled *Création et protection des ensembles architecturaux en droit genevois: Carouge et les quartiers du XIXe siècle* (Aubert 1981). It aims to establish a justifying basis for current protection measures in the original historic building regulations that contributed to defining the urban identity of the areas.
The analysis first focuses on Carouge[86], a city just south of Geneva where a regular urban plan, dating from 1813, was partially enforced. The plan established a regular grid that intersects older routes, forming some rectangular large blocks. Secondly, Aubert looks into the original building regulations managing 19th century areas in the city of Geneva, including the set of buildings in the *Corraterie* and, mainly, the perimeter of buildings overlapping previous fortification land:

> A copy of building regulations concerning the buildings located in previous fortification land accompanied every act of sale. From 1850 to 1879, the *Conseil d'État* successively adopted four general building regulations, containing detailed dispositions concerning the alignments, the height and the materials of future buildings. Each neighbourhood was the object of a particular plan, and the buyers had to build within a predetermined delay. (Aubert 1981: 14)[87]

The work compares how the four successive general building regulations stipulate maximum building heights for the new areas. According to Aubert, the volumes respond to a constant search for harmony, which is present in the regulations (Aubert 1981: 15). The first regulations, in 1850, defined a cornice height of 17,55 m for the left riverbank, and of 20m for the right riverbank. Regarding the left riverbank, these were successively adapted to 18,25 m in 1851, and 20 m in 1852. According to the author, in 1852 and 1853 special decrees were enforced for the *square du Mont-Blanc*, allowing for a maximum cornice height of 22,45 m, as long as the ridge height remained the same. The general building regulations approved in 1854 kept the cornice height at 20 m. When exceptions were allowed, the height of the building should be applied to the block. In 1859, new adjustments were made: the maximum cornice height was increased from 20 to 22 m, but the number of floors was limited to five above the ground floor. Finally, in 1879 the 20 m limit was reinstated, "but the shape of the roof changed to allow for the placing of an additional floor in the attic"[88] (Aubert 1981: 15).
In relation to this topic, it is important to mention two additional studies. The first – *Répertoire de cartes et plans de Genève: 1798-1975,* by historian Armand Brulhart (1982) – is one of the publications[89] by the *Centre de Recherche sur la Rénovation urbaine* (CRR). The CRR was a research centre funded in 1976 at Geneva's architecture faculty by professors Italo Insolera and André Corboz, to examine processes of urban renovation (Brulhart 2007). For the most part, this study publishes an important comprehensive list of plans of Geneva between 1798-1975. Its final section is of particular interest, since it includes a chronologically organised list of a very

large number of plot sales in previous fortification land. Each sale is associated to its address, which was not included in the original documents, and to the names of the notaries and buyers. This information was collected in the yearly registry of the *Département des Travaux Publiques.*

The second study we would like to mention is an urban and legal analysis of the neighbourhoods built over fortification land. The work was carried out by Marie-Paul Mayor during her architecture studies at Geneva University, supervised by professors Georges Descombes and Alain Leveillé. The latter was also part of the CRR, as was Mayor following her studies. As far as the legal analysis is concerned, the author's conclusions are similar to those of Gabriel Aubert. The analysis goes into further detail regarding the exemptions to the general building regulations. According to Mayor, following the 1854 regulations, building height could be exceptionally exceeded, and that demand should be done before the sale; the height could also be exceptionally reduced, if specified by additional decrees. These dispositions would explain, as signalled by Rolf Pfändler, the particularly low density of the *Tranchées* and *Bastions* area, and the morphological differences between neighbourhoods (Mayor 1983: 48). Mayor also gives further information as to the changes to roof shape that were introduced in the 1879 building regulations. Before this date the height of the roof was limited to a 45° established from the cornices; after 1879, the height was limited by a half-circle with a maximum radius of 8m. As noted by Aubert, this allowed for an extra (possibly residential) floor, built under the roof shape. Mayor adds that, "if the radius cannot exceed 8 meters, the depth of the plot cannot scarcely be higher than 2 x 8 m = 16 m"[90] (Mayor 1983: 49).

Studies from the 1980s on Geneva's 19th century urbanism and housing

A large number of studies were published in the 1980s concerning Geneva's urban development and architecture, often focusing on important areas and on residential buildings. The growing interest in this type of heritage stems from numerous heritage protection debates take took place at the time, namely in opposition to demolitions in *Carouge*, *l'Île*, *Pâquis* and in the *Grottes* neighbourhood (Brulhart 2007: 5). This movement led to legislative changes that allowed for a more effective protection of building areas or sites. In the new *Loi sur la protection des monuments, de la nature et des sites* (Law concerning the protection of monuments, nature and sites), in 1976, "classification is completed by two additional measures: the inclusion in the registry of buildings to protect, and the site plan, an instrument applicable to built and natural sites" (Nemec-Piguet 2007: 50)[91]. In another piece of legislation, the *Loi sur les constructions et les installations diverses* (Law concerning building and diverse installations), "conservation areas were extended, between 1973 and 1983, to part of the *fazyste* neighbourhoods built on previous fortification land, and to 19th century and early 20th century urban areas" (Nemec-Piguet 2007: 45)[92]. "This legal disposition was long called "Blondel law", named after its author, Denis Blondel"[93] (Nemec-Piguet 2007: 48). Blondel was at the time deputy at the *Grand Conseil* and president of the *Société d'Art Public*.

Inventaire Suisse d'Architecture 1850-1920 – INSA. The *Société d'histoire de l'art en Suisse* (SHAS) has long promoted research and publication of studies looking into urban and architecture history. Two collections are particularly important due to their reach and exhaustiveness: the *Monuments d'Art et d'Histoire* (History and Art Monuments) series, and the *Inventaire Suisse d'Architecture 1850-1920* (Swiss Architecture Inventory). Both have volumes concerning urban development and architecture in the city of Geneva. The first includes three books, which were published since 1997 and that we will examine further on. Also published by the SHAS, we will examine the particularly important architecture guide entitled *Arts et Monuments: Ville et canton de Genève*, included in the collection *Guides régionaux et cantonaux.*

The *Inventaire Suisse d'Architecture 1850-1920* (INSA) series is a fundamental collection of books describing the urban expansion and chosen architecture work of 40 Swiss cities, during a key period of their development, from 1850 to 1920. Each volume is based on the cross-referencing of several secondary sources, as well as new original fieldwork and archive research by several authors. The INSA analysis of the city of Geneva was published in 1982, as a collaboration between Gilles Barbey[94], Armand Brulhart, Georg Germann and Jacques Gubler (Barbey 1982). The work is divided in four chapters: historical survey, urban development, topographical inventory, and annexes. The latter include a building inventory mainly focusing on the intensive urbanisation period between 1896 and 1900, and on the *Plainpalais* and *Grottes* areas, including available project shelf number in the respective archives.

The second chapter, concerning Geneva's urban development, starts by describing the decision process that led to the demolition of the latest fortifications, which had been built only a century earlier. According to the authors, the demolition of the fortifications had already been discussed under the Restoration regime, and cantonal engineer Guillaume-Henri Dufour had been in charge of levelling out certain areas. This decision would be confirmed in 1849 by the new government of the radical party, led by James Fazy, "providing an adequate administrative, economic and cultural platform for the study and first specific operations of the 'new Geneva'"[95] (Barbey 1982: 276). The INSA work then chronologically follows the demolition of the fortifications and the building of new homogenous areas, starting with the *Rive* area, on the south riverbank, and the *Square du Mont-Blanc,* on the north riverbank. According to the authors, the final plan, submitted by cantonal engineer Blotnitzki, was rectified by the *Conseil d'État* in 1858 and, as previously mentioned, was then paired with detailed building regulations. The authors note that it would be convenient to analyse the influence of the Parisian model supported by Napoleon III in the ways of financing the operation, the height limits, the roads and urban furniture (Barbey 1982: 282). The work then examines the urban development of the peripheral municipalities, that had "administrative prerogatives more like the Restoration than the radical regime"[96] (Barbey 1982: 287).

The chapter concerning Geneva's urban development includes a section focusing on housing. The analysis of housing features in the 19th century *Ceinture Fazyste* builds on Rolf Pfändler's work on the *Tranchées* neighbourhood that was, up until then, one of the only publications focusing on the topic. The authors mention the

presence of two new housing types in Geneva after 1860, the narrow single-family house (*hôtel familial*) and the block of flats (*immeuble à appartements*), which were distinct from the previously "traditional" houses types: the private mansions (*hôtel particulier*) and the country villas (Barbey 1982: 292). To illustrate the two new housing types, the example of the *Tranchées* neighbourhood is mentioned, going on to a more general description of 19th century housing in Geneva:

> The contiguous single-family houses [in the *Tranchées*], placed between a courtyard and a garden, have several levels like the English houses, while flats occupy the area of a floor in the blocks of flats. […] To the advantages of the superposition of housing spaces on different levels, we can oppose the horizontal distribution of rooms according to the *enfilade* or symmetrical arrangements. Throughout the 19th century, bourgeois housing tends to join the formula of the contiguous building with flats giving onto two opposing façades, one onto the street, and another to the courtyard. Usually, reception rooms give onto the front, while the bedrooms and the kitchen give onto the back. The common residential production in Geneva during the last decade of the 19th century leads to the elaboration of certain stereotypes that are almost only distinguishable by their degree of sanitary and household comfort. (Barbey 1982: 292)[97]

The authors then describe the increasing need for social or modest housing during late 19th century and the beginning of the 20th century, which was, like in many European cities, paired with movements promoting better health and hygiene conditions (Barbey 1982: 293). This topic was further developed, in 1983, by Roderick Lawrence, in *Espace privé – espace collectif – espace public: l'exemple du logement populaire en Suisse Romande: 1860-1960* (Lawrence 1983) and, in 1994, by Bernard Lescaze, David Hiler and Anita Frei, in the book *La Société Coopérative d'Habitation Genève & l'Histoire du logement social à Genève (XIXe & XXe siècles)* (Lescaze 1994).

Guides focusing on history of architecture in Geneva. In 1984, two years after the publication of the INSA, Leïla El-Wakil[98] and Sabine Piguet published a comprehensive article focusing on the Plainpalais roundabout and its surroundings: *Le Rond-Point de Plainpalais à Genève et ses abords: développement urbain et architectural* (El-Wakil 1984). The study examines the development of this area – the University quarter – during the 19th century, after the demolition of the fortifications, and its importance at the time as a transition area between the Geneva and *Plainpalais* municipalities. The authors compare the urban plans for the new square since 1854 looking, for instance, at how block design was adapted to increase courtyard size, according to new hygienist concerns at the end of the 19th century. Moreover, applicable building regulations were analysed, namely regarding building height and roof shape. Research was carried out concerning the buildings around the square, dating them and identifying architects and building owners. Even though flat layout is not the focus of the work, schematic floor plans are presented for three buildings.
The following year, two guides were published concerning Geneva's urban development and chosen buildings. It is important to note that, for the first time, a large number of the examined buildings are not only monuments but also more ordinary architecture that was considered particularly representative of its time.

The first guide we would like to mention – *Art et monuments: Ville et canton de Genève* – was published, like the INSA, by the *Société d'histoire de l'art en Suisse,* this time in the collection *Guides régionaux et cantonaux.* It is a study carried out by historians Armand Brulhart, whom we mentioned earlier, and Erica Deuber-Pauli. The study is organised by city areas, starting with the *ville ancienne*, the old city centre, and moving on to 19th and 20th century expansion areas. It has a large chronological focus and aims for a historical and social contextualisation of the buildings. For each examined area, there is a historical introduction, and a description of selected buildings. The selection includes some important housing sets.

In the same year, Brulhart, Deuber-Pauli and El-Wakil participated in the publication of another city guide to Geneva, this time focusing only on 19th century architecture, *Le grand siècle de l'architecture genevoise 1800-1914: un guide en douze promenades* (Beerli 1985). The guide was the result of a larger collaboration between ten historians: Beerli, Bory-Barschall, Brulhart, Candauy, Deuber-Pauli, El-Wakil, Hermanés, Neuenschwander, Pfändler, Roth-Lochner. Several of the authors have since continued to conduct research on the topic. The book was published by the *Société d'Art Public,* presided at the time by Denis Blondel whom, as previously noted, was the driving force behind the introduction of heritage protection for 19th and early 20th century areas. The work describes the historical background of a large number of selected buildings, which are quite often residential. Original research was carried out to date them and identify the architects and other important actors.

The guide by Brulhart and Deuber-Pauli, which did not follow a strict chronological limit, mentions, in the *ville haute*, the four "luxurious" blocks of flats built between 1774 and 1778 on *Rue Beauregard* 2-8. These houses had been mentioned by Pfändler as a model for flats in the *Tranchées,* built almost a century later. According to Brulhart and Deuber-Pauli, "as in the *Rue des Granges*[99]*,* the [*Beauregard*] operation was started by the authorities of the Republic and submitted to a unitary conception, even in defining the position of the terraces, which were created over the southern ramparts"[100] (Brulhart 1985: 71). Also in the older part of the city, both guides mention two other publicly promoted housing and commercial buildings, which were also described in other studies: the *Rue de la Corraterie* 10-26, built in the late 1820s according to a design by Samuel Vaucher under the wing of cantonal engineer Dufour; the *Quai des Bergues* 23-31, built in the 1830s, possibly by the same architect (Beerli 1985: 13, 15).

Brulhart and Deuber-Pauli describe the perimeter of new neighbourhoods built during the second half of the 19th century, after the demolition of the fortifications. The analysis is divided between the north riverbank and, in the southern riverbank, in several smaller areas: *Rive*, *Tranchées*, *Bastions*, *Rond-point de Plainpalais et quartier de l'Université*, *Quartier de la place Neuve*, *Boulevard Georges-Favon et quartier de Hollande*. "With its vast warehouse and market on the one hand, and its *Hôtel de la Métropole* and residences on the other hand, *Rive* widens the field of traditional activities of the lower riverside streets of commercial and hotel facilities"[101] (Brulhart 1985: 120). The *Tranchées*, on its southern

side, is described as an "exceptional quarter" (*quartier d'exception*), with a lower density and many single-family houses (Brulhart 1985: 124-125). According to the authors, the area of the *place Neuve* had been, before the demolition of the fortifications, a symbolic area for the Restoration government, with monumental buildings, such as the Rath museum and the theatre. This representative aspect would live on, with the replacement of the theatre with the *Grand-Théâtre*, and the building of the music conservatory (Brulhart 1985: 136-137). The adjoining neighbourhood, bordering the *Plainpalais* municipality, would be designed as a scientific and cultural area that extended that of the *place Neuve*, and which included the University buildings (Brulhart 1985: 133). Still on the south riverbank, the authors mention that the *Hollande* area was chosen for the extension of the new postal building, in 1865 (Brulhart 1985: 140). In the other examined architecture guide, *Le grand siècle de l'architecture genevoise,* it was designated by *quartier des Banques*, the bank quarter, due to the large number of banks and service buildings[102] (Beerli 1985: 60).

On the opposite riverbank, Brulhart and Deuber-Pauli emphasise that the *Ceinture Fazyste* neighbourhoods were defined by two key elements. The first was the *square du Mont-Blanc*, the only block that was already depicted in the 1850 plan. "The *square*'s exceptional dimensions [...] would end up defining, after several possibilities, the composition rules for the whole neighbourhood"[103] (Brulhart 1985: 144). The other defining element would be the location of the railway station in *Cornavin*, chosen in 1855, "with the station in the axis of the *square du Mont-Blanc* and the rails perpendicular to it"[104] (Brulhart 1985: 144).

In this sequence, it is also important to mention another study by Armand Brulhart, *Guillaume Henri Dufour: Génie civil et urbanisme à Genève au XIX^e siècle,* a thorough chronologically organised research into the work of cantonal engineer Guillaume Henri Dufour. The aim was to ascertain Dufour's influence in the urban changes that took place in Geneva during the 19th century (Brulhart 1987). Brulhart highlights the repeated collaboration between engineer Dufour and architect Samuel Vaucher in several projects, such as Geneva's prison (1822-1825), the Rath museum (1824-1826) or the above-mentioned *Corraterie* operation, with nine contiguous buildings (1827-1833). In these projects, "urban theories attempting to reduce all that could seem arbitrary in the city were slowly confirmed, giving it a structured organisation"[105] (Brulhart 1987: 50-51). The *Bergues* operation to build a new riverside residential area is described and documented in detail.

As mentioned, the operation took place in land belonging to the Fazy family. According to Brulhart, the conception of the operation can be attributed to James Fazy adding, however, that the initiative was then left to the main shareholders of the *Société des Bergues*, "the first anonymous society and large association formed for building purposes in Geneva"[106] (Brulhart 1987: 66). According to the author, Dufour was one of the shareholders and would become the main strategist of the operation. He took part in the commission for the elaboration of the development plan, and his and Vaucher's plan was chosen as the final option (Brulhart 1987: 69). Furthermore, the author adds that the urban model of the *Bergues* area certainly influenced the new neighbourhoods built over the previous fortifications

land, excluding its main faults: "an exaggerated density, questionable hygiene conditions, an arguable circulation"[107] (Brulhart 1987: 71). The typological basis is described as revolutionary:

> The idea of placing the staircase at the centre of each block of flats, lit from above by a skylight, allowed for an simpler distribution of the flats in relation to both sides of the road: we could call it a revolutionary typology since the solution solved the problem of buildings with two façades giving directly onto the street. Even tough the sanitary conditions, with as a toilet and running water, obviously provided an added comfort, only the buildings giving onto the riverbank could claim to have all the advantages of what contemporaries already designated by the term *modern hygiene*. (Brulhart 1987: 70)[108]

Inventories of buildings in Geneva

The Geneva municipality promoted, since 1978, a project called *Recensement du domaine bâti,* the systematic data collection concerning buildings in the city with the aim of building up an inventory. It focused "mainly, but not exclusively, on the still less inventoried sector of urban housing of the *fazyste* and post-*fazyste* period"[109] (Bernasconi 1985-c 1991: 1), but intended, one day, to extend this analysis to the entire city, refusing to select only more representative examples. The team collected historic and building information such as original floor plans or changes that were carried out throughout time, aiming to propose a diagnostic in case of renovation. Five volumes of charts – entitled *Recensement genevois d'architecture* – were published from 1985 to 1991 based on the collected information (Bernasconi 1985-1991). The volumes included one chart per building, each with a general description, documented changes, relevant bibliography, photos and floor plans with an indicated scale. The presence of floor plans is particularly important, since this type of information was usually not included in many previous studies, with the exception of Pfändler's *mémoire de licence*. Depending on the information that was available in the archives, the floor plans are either original or based on metric surveys carried out for renovation work.

As previously mentioned, Geneva's *Grand Conseil* passed a law in 1983 "aiming for the protection of areas dating from the 19th century and early 20th century. […] Articles 89 to 93 of the *Loi sur les constructions et installations diverses* (LCI) of the 14th of April 1988 define the dispositions applicable to 19th century and early 20th century areas0 located outside the protected areas of the *Vieille-Ville* and the southern sector of the old fortifications, as well as the *Vieux-Carouge*"[110] (Service des Monuments et Sites 1991: 1). In 1991, Geneva's cantonal heritage protection department, the *Service des monuments et des sites*, published an inventory of the protected 19th and early 20th century areas or sets of buildings (located outside other protected areas), the *Répertoire des ensembles du XIXe siècle et du début du XXe siècle*. The work has one page per set with a short description, project number, architect name, date of building, and several photos. Occasionally, there are also small floor plans, without a specific scale.

Articles concerning specific city areas or buildings

The reports carried out by historians working for the C*onservation du patrimoine architectural* unit (Heritage conservation unit) of the Geneva municipality can be particularly useful sources, which are not publicly published. Historical reports are usually produced by request, often of municipal services, whenever changes are planned on a specific building or city area. They usually include a description of the building or area throughout time, and a collection of maps and plans available in the archives. Regarding buildings or areas of our time of study, we could mention, for example: Anastazja Winiger-Labuda's (1990) study concerning the late 18th century *Rue de Beauregard 8: L'ancienne maison Thellusson;* the research by Véronique Palfi (1996) regarding the *Ensemble Promenade du Pin* 1-5, in the *Ceinture Fazyste*'s *Tranchées* area; the study by David Ripoll (1999) examining the *Place Dorcière, place des Alpes,* next to the *square du Mont-Blanc*; Nathalie Chollet's (2009) analysis of *La place de la Synagogue,* in the *Ceinture Fazyste*'s *Hollande* area.
A similar type of historical study was conducted by Leïla El-Wakil for the Baur fondation concerning the transformation of a 19th century single-family house built in the *Tranchées* into an art museum: *Transformer un hôtel particulier en musée d'art: un siècle d'histoire d'un bâtiment genevois* (El-Wakil 1998). The author traces the history and examines the layout of the houses on numbers 4, 6, and 8 on *rue Munier Romilly*, designed simultaneously by architects Charles Gampert and Jean-Louis Cayla. The recent changes concern the largest house, on number 8, *hôtel Micheli-Ador,* which, we recall, was presented by Cayla in an article in 1907 (Cayla 1907).
We would also like to mention some studies of a different nature, which focus on specific building elements: the *mémoire de licence* by historian Catherine Reymond (directed by El-Wakil) depicting the entrance halls of Geneva's buildings dating from 1880 to 1930, *Les vestibules peints à Genève: 1880-1930* (Reymond 1994); a recent publication by several authors, including Reymond, concerning the staircases of residential buildings in French-speaking Switzerland, including some examples in Geneva, *Escaliers: décors et architecture des cages d'escalier des immeubles d'habitation de Suisse romande, 1890-1915* (Hoffman 2006); finally, a *mémoire de licence* by Wally de Marco Pfister looking at wrought ironwork in buildings late 19th or early 20th century in the neighbouring city of Lausanne, *La ferronnerie lausannoise au tournant des XIXe et XXe siècles: entre art et industrie* (Pfister 2010).

Monuments d'art et d'histoire *volumes: the Rade and Saint-Gervais*. The *Monuments d'art et d'histoire* collection has been published since 1927 by the *Société d'histoire de l'art en Suisse* (SHAS). Each volume is the result of new research work concerning built heritage in a specific canton or city. There are currently three volumes relative to the city of Geneva, each focusing on a specific area or topic, successively published in 1997, 2001 and 2010.
The first volume, *La Genève sur l'eau* (Broillet 1997), looks into the urbanisation of the riverside areas in Geneva. The sections that interest us the most concern the urban transformations throughout the 19th and 20th century, *La métamorphose de la*

Rade aux XIX^e^ et XX^e^ siècles, written by Leïla El-Wakil and Bénédit Frommel (1997), and a section describing selected residential buildings. El-Wakil and Frommel's article starts by emphasising Guillaume-Henri Dufour's work in the development of projects for the riverside areas, namely the *Bergues* bridge and the north riverbank (Broillet 1997: 114), going on to describe the main changes to both riversides. The authors describe the early 19th century *Bergues* building operation. The main new material in relation to these buildings is presented by El-Wakil in the section concerning residential buildings. Individual building dates and architects are identified for the area of the *Société des Bergues,* and for its extension in the direction of *Saint-Gervais*. The original ground floor and flat floor plan are included for two buildings, representative of the new layout type:

> Revilliod-Faesch and Recordon-Ducommun asked the Vaucher-Ferrier et Cie company to design two almost identical buildings. Over a ground floor and a mezzanine floor for shops and storage, are two beautiful flats per floor, each with four rooms each, including a living room and a dining room in *enfilade* on the riverside, and a kitchen and a bedroom giving onto the *rue des Étuves*. (El-Wakil 1997: 339)[111]

As far as the new neighbourhoods built over fortification land are concerned, the authors first detail the *square du Mont-Blanc* operation:

> The *Société immobilière genevoise,* formed in 1853 [...] carried out the building of almost all of the *square du Mont-Blanc*. The society took on engineer Charles Goetz and architect François Gindroz (1822-1872) to built beautiful buildings corresponding to a mixed program of housing and commercial archways [...], and even a hotel. (El-Wakil 1997: 131)[112]

Secondly, the authors depict the *Rive* area on the south riverbank, which was also built in the early days of the *Ceinture Fazyste.* It comprised three rectangular blocks on the present *quai Général-Guisan*, and a system of blocks with large courtyards around the *Rive* square (El-Wakil 1997: 132).
The author details the building of one of the *quai Général-Guisan* blocks, built according to the 1852 regulations for the *Ceinture Fazyste* perimeter, which imposed a maximum cornice height of 20 m and a roof at a 45° angle (El-Wakil 1997: 342). Floor plans are included for one of the blocks of flats, the *maison Calame*, which is described as follows:

> The *maison Calame* still has its two beautiful flats per floor, laid out around a central block made up of a staircase with a square floor plan and open central stairwell with a skylight, and an airshaft with sectioned edges that also illuminated the kitchen and toilets of the two flats, which were built against each other. The living rooms with corner chimneys, giving onto *rue Pierre-Fatio*, had connecting doors to the dining rooms. The bedrooms were then placed on either side of the reception rooms. (El-Wakil 1997: 343)[113]

Metric survey floor plans are also included for two other buildings in the same area, *rue Pierre Fatio* 3 and 5, located in the riverside *square des Eaux-vives*, also on previous fortification land. Similar research work was carried out for the urban development of some late 19th and 20th century riverside areas, such as the *Pâquis* on the north riverbank, the *Eaux-Vives* on the south riverbank, and the competition and changes done on the *Île* area.

The second publication by the SHAS concerning Geneva focused on a specific area of the north riverbank, *Saint-Gervais*. The book was entitled *Genève, Saint-Gervais: Du bourg au quartier* (Winiger-Labuda 2001). The section that is most relevant to the present revision deals with the urban development of the area after the demolition of the fortifications, and was written by Bénédict Frommel (2001). In the section concerning residential buildings, there are also some particularly important 19th century examples, which were depicted by Frommel, David Ripoll and Isabelle Brunier. In the first section, Frommel describes the successive projects and discussion for the left riverbank following the demolition of the fortifications, the adoption of final plan signed by cantonal engineer Blotnitzki, and the progression of the construction work throughout the 19th century. The projects for the *Cornavin* train station, and the changes and openings to the older central area of *Saint-Gervais* are also described in detail (Frommel 2001: 69-76). Among those changes, it is worth mentioning the publication of original urban and flat floor plans of the *rue Lissignol* and *square Paul-Bouchet* social housing operation, carried out in late 19th century (Frommel 2001: 75; Brunier 2001).
In the section of the book concerning selected housing, three examples appertaining to the *Ceinture Fazyste* are described in detail and complemented by the respective floor plans. Frommel looks into the history of *Rue Ami-Lévrier* 1-15, the rectangular block behind the *square du Mont-Blanc,* with six buildings dating from 1854 to 1862. The author includes a floor plan of the block based on collected original floor plans and metric surveys. These floor plans allow for the identification of the main layout features of the flats:

> Three of the five older buildings have a central staircase with one flight and two quarters of a circle, that opens onto an interior courtyard with a rectangular floor plan. Each level has two large flats giving onto both streets, or otherwise onto a corner, for the buildings at the end of the block. The reception areas give onto *rue Lévrier*, and the bedrooms onto *rue Pécolat*, while service areas are gathered around the courtyards. Of a slightly different conception, numbers 3 and 9 are organised around a side courtyard. In the building with numbers 5-7, two semi-circular stairs, placed on either side of a rectangular courtyard, lead off to two flats per floor. The service rooms, located in the centre of the building, are illuminated by two lateral airshafts. (Frommel 2001: 366)[114]

The other two examples examined were built at the end of the 19th century on the north riverbank along the *Boulevard James-Fazy*, on the opposite end of the *Ceinture Fazyste*'s perimeter. The building of the i*mmeuble des Tourelles* on number 2, depicted by David Ripoll, was authorised in 1888. Its location contributes to the articulation of the riverbank's two levels, with commercial spaces on the lower floors and flats above. The flats were already accessible through a lift at the time of building. According to Ripoll, the flats were aimed at a high-end clientele. There were six rooms with a large number of chimneys, maids' bedrooms, and the living and dining room were placed in *enfilade* (Ripoll 2001: 368). Frommel analyses the two buildings on numbers 8 and 10 of the same avenue, designed simultaneously by architect Léon Bovy in 1897. Each building had two large flats per floor distributed by a central staircase, each giving onto two opposite façades:

In accordance with the building's *bourgeois* character, the living room, small living room and dining room, in *enfilade*, are placed next to the main façade, while the kitchen and the bedrooms give onto *rue Necker*. The service rooms, such as the maid's room, small rooms, storage and bathroom are gathered around the airshaft and the staircase. (Frommel 2001: 370)[115]

The third and latest volume of the *Monuments d'art et d'histoire* collection – *Genève, ville forte* (Corbière 2010) – goes back through Geneva's history and urban development inside the perimeter of its three successively larger city walls. The conducted research is important to understand the subsequent new 19th century urban development. The changes to the urban fabric are documented with maps where the new or rebuilt buildings are shown. In the map documenting the period from 1690 to 1798, for instance, the *Rue des Granges* and the *Rue Beauregard* sets of buildings are indicated; in the following map, concerning the 1814-1846 restoration period, the *Rath* museum and the *Corraterie* block are signalled; an additional map documents the massive changes that took place during the 19th and 20th century to the lower part of the medieval city centre, on the south riverbank.

Studies concerning the work of specific architects or developers

Several authors have examined the life and work of specific architects who designed buildings in Geneva during the 19th century and who, in some cases, largely contributed to shaping the city's urban development of the time. As previously mentioned, Rolf Pfändler published an article in 1985 examining the career history and some of Emile Reverdin's projects, which are kept in a portfolio at the municipal archives[116]: *Aperçu de l'architecture bourgeoise à Genève à la fin du XIXe siècle: Le portefeuille de projets d'Émile Reverdin* (Pfändler 1985). In the article, we learn that Émile Reverdin (1845-1901) took over his father Adolphe Revedin's office in 1872. His main activity was housing, from the urban single-family houses and the block of flats, to the suburban villa (Pfändler 1985: 32). Pfändler resumed the examination of Reverdin's continuous terraced houses in the *Tranchées* (Rue Bellot 8, 10, 12 and Rue Émilie Gourd 4, 6, 8), of which he published and examined the original floor plans: service spaces in the basement including the kitchen, ground floor with a terrace and reception rooms, first floor and attic for bedrooms (Pfändler 1985: 33). The author conducts a sparser examination of floor plans, only comparing the terraced houses with an up-market flat on the *cour des Bastions* 6: "Three reception rooms in *enfilade* and the main bedroom give onto a small French-like *parterre*. On the other side of the central gallery, the bedrooms give onto the street, as does a serving room where a staircase leads off to the kitchen in the basement"[117] (Pfändler 1985: 33). The rest of the article is dedicated to the analysis of Reverdin's villas.

Years later, in 1996, Leïla El-Wakil wrote an article concerning the life and work of architect Léon Bovy: *Regard sur Léon Bovy (1863-1950), architecte*. A list of the architect's known work is included at the end of the article. According to El-Wakil, Léon Bovy was a very active architect in Geneva during late 19th century and the beginning of the 20th century, designing around ten buildings per year. One of the

moments that would kick-start his career was going into Émile Reverdin's office in 1879, at the age of sixteen (El-Wakil 1996: 132), going on to start his own office in the early 1890s. According to El-Wakil, most of the architect's work was the design of more than 150 blocks of flats and of around 20 private houses: "For Bovy, the block of flats is the occasion to experiment an extremely vast morphological and typological range [...]. According to the purpose, the budget, the neighbourhood, [...] Bovy reinterprets floor plans and façades"[118] (El-Wakil 1996: 135). The floor plans of several of the buildings designed by Bovy are included in the article. One of them is the block of flats he builds in 1894-5 on *Rue du Jura* 10, in which he designed two four-bedroom flats per floor; on the first floor, Bovy designed a more comfortable five-bedroom flat for his family: "The five rooms comprise a living room with a corner chimney, which communicates with the dining room, and then with a large bedroom paired with a bathroom; the kitchen and another bedroom give onto the courtyard. An alcove serves as a small bedroom, while a minuscular maid's bedroom, facing the kitchen next to the entrance, receives light from the staircase landing"[119] (El-Wakil 1996: 136). According to the author, Bovy adapted the typological model throughout his career. Later, in 1914, he designed three three-bedroom flats per floor in the *rue Verte*, which no longer had alcoves or maids' bedrooms, but where there was one bathroom per flat (El-Wakil 1996: 136).

The following year, the *Institut National Genevois* (Zinnow 1997), the very same that was founded by James Fazy in 1852, published three articles relative to Geneva's 19th and early 20th century urban development, based on recent *mémoires de licence.* The one by Olivier Perroux – *La Société Immobilière Genevoise, un acteur dans le développement urbain de Genève* – examines in detail the role and history of a specific promoter, the *Société Immobilière Genevoise* (SIG), during its first 50 years of activity, from 1853 to 1903. The history and actors of the SIG's main operations are examined in detail; nevertheless, the examination does not comprise the floor plans or layout. According to Perroux, the *sociétés immobilières* were very important actors[120] in the city's urban development of the time, starting with the *Société des Bergues* in early 19th century. According to Perroux, the action of these societies in the *Ceinture Fazyste* was wanted and legally encouraged by the authorities through tax reductions. The societies were often formed by a group of owners, specifically to build and manage a set of buildings or, like the SIG, to buy, resell or manage several buildings over a number of years (Perroux 1997: 131). The SIG first focused its activities on the area of the *Ceinture Fazyste*, but rapidly became interested in land outside this area, as long as investments remained profitable – such as land in proximity of the *Cornavin* train station or in riverside areas. It is particularly interesting to note the first operation of the SIG, which was none other than the purchase of several plots of the *square du Mont-Blanc*. Several buildings were rapidly built according to a design by architect Francis Gindroz (Perroux 1997: 133), and sold whenever a good occasion presented itself. In relation to the flats, Perroux only mentions that, according to SIG documents, the rent of flats had to be lowered, since there was, at the time, a large number of flats for the "middle class" on the market, with 6-7 rooms.

The action of the *Société Immobilière Genevoise* was re-examined in 2010 in an article by Frédéric Python[121] (2010), *La société immobilière genevoise et ses architects.* In relation to Perroux's article, Python adds information concerning some of the actors involved in the SIG's operations, namely architect Francis Gindroz and engineer Philippe Ami Goetz, who were employees of the SIG and designed most of its buildings between 1853 and 1889 (Python 2010: 192).

Architect Anita Frei has conducted two comprehensive studies concerning the work of architects who largely contributed to Geneva's 19th century urban development. The first, *Samuel Darier, architecte à Genève (1808-1884)* follows the life and work of architect Samuel Darier. The author starts by describing the early years of his professional training, highlighting in particular the internship in Samuel Vaucher's office whom, as we have seen, designed several projects under the wing of general Guillaume-Henri Dufour (Frei 1999: 19). Anita Frei then goes through Darier's first public and private realisations, such as two residential buildings for his family in the *Saint-Gervais* area (Frei 1999: 29). The architect is best known for the urban plans designed for the competition for the extension of Geneva, put in place by cantonal authorities in 1848 (Frei 1999: 48). Darier won the competition by proposing a greater connection of the city to the lake, the need for a profound intervention in the old city centre, and by defining several principles for the extension of the city itself. Frei emphasises that, even though the adopted project for the *Ceinture Fazyste* went in a different direction – namely with a complete demolition of the fortifications – several of Darier's ideas were put in place (Frei 1999: 60). It is the case of the composition rules between the square du Mont-Blanc and the *Cornavin* station. Darier would then be hired by the municipality to examine changes to be carried out in the medieval area of *Saint-Gervais*, where he proposes a new square and *rue Grenus*, built from 1852 to 1862 (Frei 1999: 61). In the new neighbourhoods of the fortification perimeter, Darier was in charge of the construction sites and of detailing projects by Parisian architect Jean-Baptiste-Cicéron Lesueur, namely the music conservatory (Frei 1999: 98). Of Darier's own design, it is important to mention the large entrepot in the *Rive* area, an administrative building in the *Hollande* area in 1860, and three examples of up-market residential architecture in the *Tranchées*: a single-family house for Pierre Raisin in 1859; two one flat per floor buildings for bankers Paccard et Ador in 1862 on the *Rue de l'Athenée*; two twinned single-family houses on the *Cour des Bastions* 12-14. The author emphasises that while the buildings on *Athenée* had a more modern layout with one eight-bedroom flat per floor nearly corresponding to the area of a single-family house, the buildings on *Bastions* had a more traditional layout of a terraced house, with reception rooms on the ground floor, service areas in the basement, bedrooms on the first floor and servants' bedrooms on the second (Frei 1999: 132). Only one floor plan is included of these buildings, a survey conducted for transformation purposes in 1927 of the *Cours des Bastions* 12 (Frei 1999: 131).

More recently, Anita Frei conducted an important research[122] concerning the work of three successive generations of architects within the Fulpius family: *Jaques, Léon et Frantz Fulpius, un siècle d'architecture à Genève*. It was mainly Léon Fulpius who

was active during our time of study. Nevertheless, it is important to note the participation of Jaques Fulpius (1812-1870) in one key example of residential architecture in the *Tranchées*, by supervising the construction of *Promenade du Pin* 1-3, designed between 1861-1863 by architect Louis Brocher (Frei 2004: 6).
Léon Fulpius designed numerous residential buildings in Geneva during the second half of the 19th century, a large number of which were built in the *Ceinture Fazyste* perimeter:

> It is not surprising to find Léon Fulpius [...] working all over the new [part of the] city. His name appears on the *boulevard Helvétique*, the *cours de Rive*, the *rue Lefort*, the *rue Bautte*. Sometimes, as in number 12 *rue de Malatrex*, he acquires the plot, builds, and then resells it. The buildings can sometimes be modest, as they are certainly on the north riverbank, on the *rue de Lyon*, or the *rue de Charmilles*, or clearly more opulent, such as on the *rue de Candolle*. (Frei 2004: 18)[123]

Anita Frei chronologically lists and describes many of Léon Fulpius' projects, such as the blocks of flats on *rue Petitot* 2,4, 6, built in 1872-1873 and 1879 next to the synagogue, or the work in the perimeter of *boulevard Georges-Favon* and *rues du Stand, Synagogue* and *Arquebuse* in the 1890s (Frei 2004: 12-13). The building on *rue de l'Arquebuse* 15 is described in further detail. According to Frei, it was bought in the name of Léon Fulpius in 1894, who then founded the *société anonyme du boulevard de la synagogue*. Frei considers its layout to be "very typical" of buildings in Geneva: "It has eight levels: a basement with storage spaces, a ground floor with two flats placed slightly underneath pavement level, five floors each with a three-bedroom flat and a four-bedroom flat, and the attic with rooms for storage and to hang washing out to dry"[124] (Frei 2004: 14). The author also mentions the available installations serving the building, such as a reservoir in the attic distributing water to the flats, gas lighting, a furnace for heating in the hall of the four-bedroom flats, furnaces in the bedrooms and a chimney in the living room (Frei 2004: 15). It is also important to mention the two twinned blocks of flats located in the *Tranchées* on *rue Sturm* 20, each with two flats per floor. They were designed at the very end of the 19th century and already bare the signature of Léon and Frantz Fulpius, since the latter joined his father's office in 1898 (Frei 2004: 19).
Also in 2004, Anne Gueissaz carried out a *mémoire de licence* directed by Leïla El-Wakil, concerning another architect belonging to a family of architects, Marc Camoletti. The study – entitled *Le logement: un aspect de l'œuvre de Marc Camoletti (1857-1940)* – follows the architect's work starting with his collaboration since 1875 with his brother John Camoletti (1847-1894), who had opened an office in 1872, up until Marc Camoletti's retirement in 1926, when he already carried out projects with his son Jean Camoletti (1891-1972) (Gueissaz 2004: 2, 5). Gueissaz goes through the vast scope of projects Marc Camoletti participated in, and then focuses on the residential buildings. Among the non-residential designs, it is important to mention the new building for the *post du Mont-Blanc*, built by the brothers between 1890 and 1892, or the *Musée d'Art et d'Histoire*, designed by Marc and inaugurated in 1910.
Among Marc Camoletti's residential buildings, Gueissaz identifies one up-market one-flat per floor building, built in the *Bastions* area in 1905: "The flats are divided in

two areas, joining the main rooms in the corner of the building (*rue Imbert-Galloix*), with the small living room and dining room on the garden side, the living room on the street side, while the intimate areas (five bedrooms and bathroom) and service spaces (kitchen, service room, service entrance) were placed next to the party wall"[125] (Gueissaz 2004: 51). According to the author, most of the architect's other residential buildings in the city of Geneva were either blocks of flats or buildings with commercial and residential areas, in keeping with the secular mixed-function tradition of the medieval part of town. In 1879, this was the case of *rue Diday* 10-12, a plot bought by Marc and John to build a bank headquarters on the ground floor, and housing above (Gueissaz 2004: 19, 55). It was located in the new bank quarter of the *Ceinture Fazyste,* where the brothers built extensively. In keeping with the watchmaking tradition of the *Saint-Gervais* area, the Camoletti office also designed, in 1878, four blocks of flats with workshops in the attic, on the corner of the *boulevard James-Fazy* and the *place des XXII-Cantons* (Gueissaz 2004: 16).

One of the sections of the study by Gueissaz specifically examines the interior layout of the residential buildings. The author notes that, within *bourgeois* housing, the division of rooms in three areas – family, reception, service – were kept from the single-family house to the flat; in more modest houses, there would be only two areas, without a space reserved for servants. The number and size of circulation areas defined the status of the house (Gueissaz 2004: 93-94). There could be several reception areas in houses for the high bourgeoisie, while in more modest housing the dining room was the only reception room, and in popular housing it is merged with the kitchen (Gueissaz 2004: 100). In relation to intimate spaces, Gueissaz observes that "between 1880 and 1914, the bedrooms are progressively placed together, forming the intimate area of the flat [...]. Nevertheless, the presence of bedrooms in the reception area is not abandoned. Even if it becomes more intimate, the usage of receiving people in the bedroom is kept"[126] (Gueissaz 2004: 101). Alcoves were very frequent in small flats and, even if rarer, were still present in *bourgeois* housing. In the latter, they were either used as an additional resting space for the family or, more frequently, as a maid's bedroom, usually placed next to the kitchen (Gueissaz 2004: 103). The author mentions that, in spite of regulations issued in 1899 to improve hygiene and health conditions, the maids generally continued to have similar accommodations (Gueissaz 2004: 106). The author also looks into the issue of the changing vertical hierarchy of flats, the importance of the corner buildings at the beginning of the 20th century (Gueissaz 2004: 59), or the beginning of the introduction of lifts in some of Marc Camoletti's buildings at the very end of the 19th century.

In 2009 David Ripoll wrote an article – *Plans de carrière: Charles Boissonnas et Antoine Feltmann (Genève, 2e moitié du XIXe siècle)* (Ripoll 2009) – comparing the careers of two men who practised architecture in Geneva during the second half of the 19th century: Charles Boissonnas (1832-1912), who was quite successful, and Antoine Feltmann (1828-1880), who met with several professional problems. Ripoll looks into their professional training, network, strategies, and identifies their main built work. In the latter we could include, for both architects, several residential buildings in the perimeter of the *Ceinture Fazyste* and adjoining areas. The author does not go into details concerning the domestic spaces, choosing mainly to place

the works in the context of their time and of the architects' career. Nevertheless, all shelf numbers at the archives are mentioned for future reference.

Research concerning technical installations

We would like to conclude this bibliographical revision with a book by Gérard Duc, Anita Frei and Olivier Perroux, *Eau, gaz, électricité: Histoire des énergies à Genève du XVIII^e siècle à nos jours* (Duc 2008). The authors carried out a comprehensive study concerning the development of water, gas and electrical distribution in Geneva since the 18th century. The research is of particular interest to our work, since it relates the history of technical installations to their impact on domestic spaces. Frei and Perroux's previous research interests, which we mentioned earlier, certainly played a role in the analysis of this topic. The book is organised chronologically and according to the type of network, starting with water distribution. According to the authors, in early 18th century, hydraulic machines pumped enough water from the *Rhône* River to serve 24 public fountains and 19 private fountains. The latter were destined for the aristocratic up-town houses (Duc 2008: 19). In 1843, the newly installed hydraulic machine would have sufficient power to start distributing water directly to the houses through rising mains:

> For the first time, the households can envisage abandoning the water chore, that involves fetching it from the public fountains and bringing it up to the house. This precious water is kept in a basin or, even better, in a "*pierre à eau*", a thick stone basin with a capacity for around fifty litres, which is built in the wall over the sink and fitted with a tap. (Duc 2008: 31)[127]

The rising mains would start being installed in buildings around 1850. In the beginning, this water supply would be managed by storing the water in a reservoir, usually placed in the attic, and only later would houses have access to a better supply, controlled with a meter (Duc 2008: 32). According to the authors, sewage distribution was already in place in late 18th century, but the system was far from ideal:

> In the houses, the sewage system is also a delicate issue. The domestic latrines – there is on average one for every two dwellings at the end of the 18th century – are equipped with a drainpipe in earthenware or in lead leading to a rock recipient. This container is supposed to separate the liquids, that go to public ducts, or faecal mater, that should be emptied at regular intervals. (Duc 2008: 34)[128]

The threat of a typhoid fever epidemic in 1884 contributes to the installation of a main sewer [*tout-à-l'égout*] in Geneva. The authors mention that the 3 m high collectors that received the entire urban drainage system were completed in 1889 (Duc 2008: 37). Starting in mid-19th century, the hygiene of houses becomes a major concern. The authors mention an exceptional example of social housing built in 1866 – the "Maison des petits ménages" by architect Sachaeck-Jaquet – where there was already one latrine per flat, and running water in the kitchen, from a reservoir kept in the attic (Duc 2008: 38). The following step was the generalisation of the water closet, made possible by the existence of sewage network, rising mains in buildings and an abundant water supply in late 19th century Geneva.

As far as the lighting system is concerned, gas would be used for generalised public lighting since 1844 (Duc 2008: 46). Nevertheless, it was petrol oil or kerosene that were most used inside houses, at least until the First World War, when the lack of these substances boosted domestic electric lighting (Duc 2008: 54, 69). Nevertheless, gas distribution was most used inside the home to obtain water heater, which is related to the increasing presence of bathrooms.

[1] "Se padeceu [essa terra] alguma ruína no terramoto de 1755, e em que, e se está reparado ?".
[2] "o perterito teramoto, e fogo a elle subsequente devorou todo o destrito da minha parochia deixando todo seu teritorio dezerto inhabitavel, e montanhas de ruinas."
[3] "Ardeo esta Igreja toda, havendo escapado da grande comoção, que arruinou a outras no dia 1 de Novembro de 1755. Depois fizemos huma accomodação dentro que agora se tira para correr direita hũa das espacozas ruas, que cortão a cidade queymada e ainda nam chegão ao que escapou do incendio."
[4] "Da sua extensão, situação, ruas, praças, edifícios, fontes e bondade do clima."
[5] "Das freguesias e moradores que tem; o seu carácter, génio e costumes; número dos principais templos e capelas, conventos de religiosos e religiosas."
[6] "rua nova de S. João aberta no ano de 1765" sob a qual passa o "rio chamado da Vila."
[7] "governo económico" com o "manifesto prejuízo do cofre público."
[8] "dar informações valiosas sobre a notável acção reformadora de João de Almada e Melo [...]. Êste autor parece ter iniciado a conspiração do silêncio que se urdiu contra o ilustre governador das Justiças."
[9] "um indizível número de ruas e de edifícios públicos e particulares, que [...] vêm a fazer continuada a mesma cidade por portas antigas e modernas."
[10] "A cidade, sentindo-se asfixiada, procurava desembargar-se do jugo das muralhas, bracejava com desespero tanto para o oriente como para o ocidente."
[11] The previous *Largo da Aguardente* is today the*Praça do Marquês de Pombal*.
[12] "Em casa era que o portuense estava à vontade; na rua, fazia lembrar o peixe fora de água. E não era porque o interior das casas burguesas daquele tempo cativasse pelo luxo ou atraísse pelas comodidades. [...] A mobília era simples, modesta: canapé e cadeiras de palhinha, mesas de mogno encimadas por castiçais de prata; diante do canapé, um tapete estreito entendido no chão; na parede, sobre o canapé, o retrato do dono da casa [...]. Em algumas casas havia o apenso de um manicórdio ou de um cravo, um estafermo rectangular, embrulhado numa baeta verde. [...] Mas o portuense amava a sua casa pelo encanto patriarcal que nela respirava, pela singeleza dos seus próprios hábitos, que o deixavam viver à vontade, sem constrangimentos e sem testemunhas. Vivia ali, como um caracol dentro da casca."
[13] "do Govêrno das Armas dêste Partido [do Porto] nos princípios do ano de 1757 e dias depois do motim contra a Companhia" Geral da Agricultura das Vinhas do Alto-Douro.
[14] "Desde os fins do século XVIII, a cidade começara a alargar-se para os lados de Cedofeita, Aguardente e Bonfim; ultimamente já todos esses lugares pertenciam ao circuito urbano, formando a zona excêntrica."
[15] "uma vida pacata e autenticamente provinciana"; "esforçava-se até por ombrear a Capital em luxo e animação."
[16] "Família burguesa."
[17] "O lar constituía um lugar sagrado, a cuja intimidade os estranhos só vencidas sérias dificuldades eram admitidos, porque o Pai vigilava ciosamente, mas nem sempre com eficácia, as relações das suas filhas. A família conservava-se ainda muito unida. [...] A habitação tipicamente portuense [...] era de quatro ou cinco andares, sala para a frente, sala para trás, escada interior iluminada

por uma clarabóia [...]. Cada família habitava no seu prédio – "como num reino independente onde não chegava o rumor da vizinhança". No primeiro andar para a rua ficava a sala de visitas, no último a de jantar. [...] Merece uma referência especial a sala de visitas, que em muitos lares burgueses foi o teatro em que se representaram as primeiras cenas de grandes paixões românticas. Ainda hoje se conservam alguns curiosos exemplos desses interiores. As cadeiras, os sofás, as consolas de magnífico mogno, estavam geralmente dispostas junto das paredes [...]. Ao longo destes móveis, pelo chão, em geral, corria um belo tapete de ramagens, espécie de sobrado para a dança. Um lustre de muitas velas pendia do tecto. O indispensável piano – um piano forte de Collard – coberto por uma colcha, ficava arrumado a um dos cantos."

[18] Ezequiel de Campos was also the author of the *Prólogo ao Plano da Cidade do Porto* (Campos 1932), in which he defended the improvement of living conditions in Oporto through the complete demolition of the oldest part of town since, according to the author, it was not adapted to the demands of modern life.

[19] "O povoamento condensado que ia da margem do rio Douro, da Porta Nobre aos Guindais, até à Praça Nova, estendeu-se muito para Noroeste – do Palácio de Cristal ao Largo do Priorado de Cedofeita; e para o Norte, pelo Campo da Regeneração até ao Largo da Arca de Água e à Praça do Marquês de Pombal; bem como para o Nascente, pelo Jardim de S. Lázaro até à Igreja do Bonfim, e pela Rua do Heroísmo para a Estação do Pinheiro (Campanhã)."

[20] "Parecer da secção de história e arqueologia."

[21] "desdobrado em tantos novos bairros, como o da Estrela, o da Lapa, o do Rato, o de Campo de Ourique e o de Campolide propriamente dito."

[22] The *Livros das Superintendências da Décima* are the annual registry of the tax paid property and several incomes since 1762, which includes property owners, tenants, their occupations and rent value, allowing for quite an accurate dating of buildings. They are archived at the *Conselho Superior de Administração Financeira do Estado*.

[23] "Mais il ne faut pas oublier non plus que le fameux tremblement de terre de 1755 qui ravagea Lisbonne imposa dans cette ville, et sous son influence dans tout le sud du pays, des conceptions architectoniques aussi pratiques, et par conséquent aussi uniformes que possible. Quoi qu'il soit, c'est à cette époque que se fixa le type moyen de la maison portugaise dans son aspect le plus répandu, et qui, avec quelque minimes variations, s'est maintenu jusqu'à nos jours. Le plan présenta toujours fort peu d'intérêt: à l'intérieur d'un rectangle, sont tracées les pièces avec plus ou moins de régularité, certaines d'entre elles ne recevant pas directement de lumière. Quant à l'extérieur, il conserve toujours une grande sobriété de lignes. Mais c'est dans l'ornementation intérieure que réside le plus souvent l'enchantement de nos résidences. Les stucs moulés, les *azulejos* et les fresques sont les trois éléments principaux de ces intéressantes décorations dont le goût évolue de la rocaille au Louis XVI, à l'Empire et au romantique."

[24] "Em Lisboa existem ainda inúmeros exemplos desta arquitectura sóbria e digna que se distingue com muita vantagem da insipidez das casas a partir de meados do século XIX e da subsequente barafunda a que, por fim, nos tempos correntes parece se está diligenciando pôr cobro."

[25] "fachada com lojas, bom andar nobre e segundo andar de pequeno pé-direito, que contrasta com o principal pelo reduzido tamanho das suas janelas."

[26] "residência urbana e estabelecimento comercial ao mesmo tempo, referidos à mesma família [...] que tinha [...] as suas lojas, armazéns ou oficinas no rés-do-chão, junto à rua, [...] e habitava os andares superiores."

[27] "salas para a frente, salas para as traseiras, a sala de jantar e a cozinha no último andar, por causa dos incêndios e dos cheiros, os sótãos para o alojamento dos criados e arrumações, e a meio a escada, iluminada por óculos ou clarabóias; e, no rés-do-chão, sobre a rua, o estabelecimento -, e se normalmente a sua decoração é mesquinha, na rigidez da sala de visitas e do escritório, um pouco hirtos, com o seu mobiliário de mogno de tipo padrão, ela apresenta também formas que transcendem o tipo comum, assemelhando-se por vezes, em muitos dos seus elementos, aos palácios nobres, e que, nas devidas proporções e em mais modesta escala, se pode, como a própria classe que a habita, aproximar do mesmo tipo dessas cidades burguesas do Norte da Europa."

[28] "Apareceram, como na capital, grandes blocos de edifícios de sóbrias linhas harmoniosas, cheios de janelas que, como notou Rebelo da Costa em 1788, encheram os interiores de luz."

[29] "A fachada principal das casas do Porto, no séc. XIX, e em muitos casos as restantes paredes exteriores são revestidas com azulejos policromados, predominando as cores vermelho-escuro, vários tons de verde, o castanho, o amarelo-torrado, o azul de vários cambiantes e o roxo. O interior das casas é espaçoso, com divisões de grande cubagem, paredes espessas e salas de grande pé direito. Todos os compartimentos da casa têm tectos de gesso com motivos simbólicos, conforme a sua utilização [...]. A iluminação da casa, depois da segunda metade do século, passa a ser feita a gás, com artísticos lustres de cristal suspensos nos tectos, ou serpentinas fixas nas paredes [...]. A casa tem geralmente dois a seis pavimentos, possuindo jardim e quase todas um grande quintal."

[30] The thesis was originally written in French and presented at the Sorbonne in 1962, under the direction of Pierre Francastel. It was first published as a book in 1965, including an edition in French and another in Portuguese, entitled *Lisboa Pombalina e o Iluminismo*.

[31] "Os apartamentos (seguimos críticas justas de um viajante francês no fim do século) são 'mal distribuídos', formados por 'grandes divisões, que se continuam em fila, sem retretes, sem pequenas casas de arrumações, sem comunicações independentes de umas para as outras' [...]. Muitos quartos são sem janela, e 'a maior parte das cozinhas escuras'."

[32] "Exceptuando a Baixa, a reconstrução de Lisboa foi um fenómeno empírico – e os pequenos focos de urbanização que podemos apontar, ocasionais, não fazem mais do que reforçar esta conclusão à qual se chega também observando como os trabalhos progrediram. E, no entanto, a obra da Baixa, o processo urbanístico que ela concretiza, teve ecos fora, no Sul do País, tal como no Porto e assim como no Brasil e na Índia."

[33] "No Porto, um governador, primo de Pombal, João de Almada, enviado após as revoltas contra a legislação vinícola, criou, em 1758, uma Junta de Obras Públicas com o fim de promover o melhoramento da cidade - à qual o ministro aplicou, em 1769, a legislação lisboeta de 12 de Maio de 1758."

[34] "bem comum que deve prevalecer ao particular."

[35] "para noroeste, para norte, para nascente, e em densidade."

[36] "primeiros indícios de nova urbanização."

[37] "se a Alegria era sítio favorecido nos anos 40-50, tal como a Estrela e Buenos Aires, isso limitava-se a preencher programas anteriores."

[38] "encarregada de pôr de pé os programas e os embelezamentos urbanos, que o crescimento económico e a 'consciência' de uma cidade moderna, suscitados pela acção da Companhia, iam tornar necessários."

[39] "a casa da frente estreita, [...] de fachada lisa e com vãos abrindo para varandas. [...] Agora totalmente edificada em pedra, com dois, três ou, mais raramente, quatro níveis, [...] geralmente coberta por telhados de quatro águas, inserindo-se em lote de terreno estreito e fundo, associando-se em banda ao longo dos arruamentos [...]. A fachada para a rua, [...] individualmente identificada, dispõe geralmente de uma varanda corrida por piso, para onde abrem portas envidraçadas [...]. O rés-do-chão que dispõe, em geral, de três aberturas é sistematicamente destinado a loja ou armazém, servindo uma das portas laterais, de acesso, por escada de tiro, aos níveis superiores; interiormente, a habitação organiza-se na frente e traseiras de caixa de escadas central (iluminada por clarabóia e articulada com aquela escada de tiro) possuindo casa piso duas alcovas interiores, iluminadas a partir do vão de escadas, e duas salas, mais espaçosas, iluminadas directamente pela rua e logradouro."

[40] "primeiros grandes projectos de iniciativa privada que afectam a urbanização à margem da rede viária existente."

[41] "Foi sem dúvida de todos os planos exteriores à Baixa o único com prévio conteúdo urbano para além da simples ocupação racional do terreno em descontinuidade da sua malha edificada. Houve ainda a preocupação de reforçar a ligação urbana da Baixa a toda esta zona."

[42] "delineamento de núcleos alternativos."

[43] "no norte da Lapa, a Santa Isabel, na Patriarcal Queimada, na Ajuda, nas lonjuras do Campo Grande e, sobretudo, ao Chiado que então se delineia como o coração da Lisboa Romântica."

[44] "o Aterro da Boavista e abertura da Rua 24 de Julho, incluindo os loteamentos adjacentes ao Largo de Santos, articulados com as Janelas Verdes e S. Bento [...]."

[45] At the same time as the first in-depth studies on the urban developments in Oporto, Raquel Henriques da Silva conducted a fundamental analysis of Lisbon's urban expansion between 1900 and 1930 in a master's thesis entitled *As Avenidas Novas de Lisboa: 1900-1930*. A few years later, in 1989, she directed and wrote the main article for the exhibition catalogue on city hall engineer Frederico Ressano Garcia's role in the *Avenidas Novas* plan and concretion. This article, "Lisboa de Frederico Ressano Garcia: 1874-1909", homonym of the exhibition, analyses Lisbon's development immediately before, during and after the engineer's action. In the article on Ressano Garcia, Raquel Henriques da Silva mentions the engineer's intervention in the *Avenida da Liberdade* project, and how he regarded it for the first time as an opportunity to organise a planned expansion of the city towards the North: "the city hall's engineer not only corrected the project [for the *Avenida da Liberdade*] (integrating the *Passeio Público* as the first part of the avenue and enlarging significantly the circulation lanes) but immediately linked it to a broader reflection on the need to extend the city to the North of which the desired avenue was only 'the first part'". The author goes on to describe the development of late 19th century new neighbourhoods next to the new avenue, the *Bairro Barata Salgueiro* and *Bairro Camões* as well as the projects for the multiple avenues that would be built from the *Rotunda do Marquês de Pombal* since the beginning of the 20th century.

[46] "continha o registo de todas as obras submetidas por particulares a licenciamento na Câmara Municipal de Lisboa entre Outubro de 1845 (data em que o arquivo dos desenhos se tornou obrigatório) e 1874/1875 (data em que o mesmo arquivo foi reorganizado)."

[47] The 31st December 1864 decree indicated that city improvement plans (*plano geral dos melhoramentos*) should be prepared for the cities of Lisbon and Oporto, indicating several building conditions that should be fulfilled for new neighbourhoods or building conversions. In Oporto, these conditions and the improvement plan were only imposed several years later. In Lisbon, according to Cunha Leal, even though the decree mainly specified that new projects respect essential conditions of lighting, ventilation and water distribution, the municipal authorities used this regulation to demand plan submissions for all new buildings or floor additions, so that sanitary conditions could be verified (Leal 2005: 687).

[48] "8.3 As estruturas residenciais e a cidade."

[49] In the conclusions of the thesis, Cunha Leal states that the "continual expansion and densification of the Lisbon's housing during the 19th century shows that the *Pombalina* typology of the block of flats impregnated the city, either as a structure ready to be (re)interpreted and worked on, or as a pattern of regularity that framed the condemning and overcoming of vernacular ways which remained in areas outside the rebuilding plan" (Leal 2005: 861-862).

[50] "a introdução de um conjunto de dispositivos de saneamento e conforto que [...] vinham a ser divulgados nos interiores prediais mais qualificados: a presença de um pequeno espaço votado à existência de latrinas e deslocação da pia geral de despejos domésticos do interior da cozinha para o exterior."

[51] As we have seen, this is the annual registry of the tax paid property and several incomes since 1762, which includes property owners, tenants, their occupations and rent value.

[52] "podem ocorrer um ou dois fogos por andar, podendo coexistir ambas as soluções num mesmo lote. A última disposição tornar-se-á no esquema "clássico" andar esquerdo/direito, comum em Lisboa durante o século XIX e boa parte do século XX [...]."

[53] "Como princípio de distribuição identificável temos uma dupla sequência de aposentos, a primeira constituída pelas salas e câmaras da frente, comunicando directamente através da série de portas en enfilade, e uma segunda, dobrando a anterior, composta pelas alcovas destituídas de janela – em princípio, albergando as camas de dormir –, abertas para os aposentos da frente."

[54] As mentioned by Barreiros, this floor plan was already included in Raquel Henriques da Silva's doctoral thesis (Silva 1997: 64) and identified as a *pombalino* flat, and in a publication Ayres de Carvalho, who first catalogued it, even though incorrectly (Ayres de Carvalho 1977: 106).

[55] "Na sala aberta às escadas recebe-se; na seguinte, está-se e também se recebe; recolhe-se a partir desta última sala às alcovas (câmaras) para dormir; janta-se nas traseiras, no compartimento anexo à cozinha. Mais de cem anos depois, o programa funcional do prédio burguês de Lisboa organizar-se-á da mesma forma, aumentando apenas drasticamente a distância – física, social e vivencial – entre as salas ('de visitas') e a cozinha, através da introdução de um elemento que passa a ter valor estruturante na habitação, o corredor longitudinal."

[56] The *Cedofeita* area was part of Oporto's new urban developments that we have been examining in this revision. Its houses were mostly built between late 18th century and mid 19th century. The author believes that this neighbourhood is fairly representative of the city's main urban areas of the time, with the exception of the older riverside city centre and the areas of rural transition on the outskirts.

[57] "Entre as elites portuenses, valoriza-se, cada vez mais, a intimidade doméstica, Fecham-se as casas dentro de jardins cercados por grades e sebes, veda-se o lar a olhos alheios com cortinados de cassa, estores ou persianas, nas zonas elegantes e menos densas da Foz, do Campo Alegre, da Boavista, etc. Mas este movimento, que reflecte novas atitudes, apenas toca à tona a sociedade *tripeira*. Mesmo em sectores da alta burguesia, o movimento está longe de ser geral. Na pequena e média burguesia dos mestres de ofício ou comerciantes, muitos continuarão a residir nas casas esguias do centro urbano, nos andares cimeiros sobre a loja ou oficina, dando por vezes "cama, mesa e roupa lavada" ao aprendiz ou ao caixeiro, como observamos na Rua do Almada. Para a maioria dos portuenses, que vivem nas inúmeras "ilhas" [...], ou nas "colmeias" do velho burgo, ou ainda nas vielas populares [...], os espaços públicos e privados têm limites imprecisos [...], a porta aberta para a rua, onde se está quase tanto como em casa, onde as crianças brincam, onde, por vezes, se trabalha."

[58] Literally meaning "improvement plan", which comprised changes or the extension of streets, or the design of new streets.

[59] Joaquim Teixeira very recently completed a doctoral thesis (defended march 2014), which we have not yet been able to have access to. It was entitled *Salvaguarda e valorização do edificado habitacional da cidade histórica. Metodologia de intervenção no sistema construtivo da casa burguesa do Porto* (Conservation and valorisation of residential buildings in the historical city. Methodology of intervention on the building system of Oporto's *bourgeois* house).

[60] "A estrutura principal da casa é constituída por: (i) paredes de meação, normalmente constituídas em alvenaria de pedra de granito, de aparelho irregular [...]; (ii) estrutura dos sobrados e (iii) estrutura da cobertura, ambas compostas por vigas em forma de paus rolados, normalmente em madeira de castanho, pinho da terra ou, nos exemplos mais endinheirados, em pinho nórdico. A estrutura secundária é constituída por: (i) paredes das fachadas, que podem ser construídas em alvenaria de pedra (granito), maioritariamente composta de pedras de cantaria em forma de lancis (correspondentes às ombreiras, vergas e parapeitos das aberturas e elementos decorativos) ou, quando se trata de pisos acrescentados, em tabique misto ou tabique simples, (ii) paredes interiores de compartimentação e da caixa de escadas, em tabique simples ou tabique simples reforçado; (iii) estrutura das escadas; (iv) estrutura da clarabóia e pelas (v) estruturas das águas furtadas ou de outros elementos de pequena dimensão que pontuam as coberturas."

[61] "un nouveau pont, celui des Bergues [...], pour faire communiquer les nouveaux quais de la ville avec les nouveaux quartiers bâtis dans le faubourg de Saint-Gervais."

[62] "renverser les remparts qui circonvenaient Genève aussi bien dans le domains des idées que sur le terrain géographique."

[63] The 1849 *Loi sur les fortifications et les limites de la ville de Genève* starts in the following way: "Art.1. The fortifications of the City of Geneva will be successively demolished, as the State finds use for the land they occupy. Art.2. The land is disposed of by the State to serve the establishment of new neighbourhoods and walkways or to build public buildings. Art.3. The State Council is authorized to put up for sale the land that will make up the new neighbourhoods by public adjudication" (Conseil d'État 1850: 442).

[64] "Un des résultats essentiels de la révolution genevoise de 1846, a été la démolition des fortifications, commencée en 1849. Les nombreux ouvriers de la fabrique d'horlogerie et des autres industries, demeurés sans ouvrage par l'effet de la crise commerciale qui suivit les révolutions de 1848, furent d'abord occupés aux travaux de nivellement des terrains. [...] Ils ont rendu disponibles de vastes terrains à bâtir, des emplacements admirablement situés, sur les deux rives du lac Léman et du Rhône, tout autour de l'ancienne ville. De magnifiques quais ont été érigés des deux côtés du fleuve, comme prolongement de ceux qui avaient été créés il a y une vingtaine d'années. Des constructions remarquables, tant publiques que particulières, s'élèvent avec une rapidité et une activité incessantes. C'est une ville entièrement nouvelle qui naît ainsi à côté de l'ancienne Genève. Les travaux

d'un chemin de fer sont en pleine activité pour joindre Lyon à Genève. [...] Une autre voie ferrée reliera aussi Genève à Berne, Bâle et toute la Suisse."

65 Architect Edmond Fatio participated in the publication *La maison bourgeoise en Suisse*, in 1912, together with architects Louis Blondel and Camille Martin.

66 "Il milite, avec son frère l'architecte Edmond Fatio, pour la protection du patrimoine, l'urbanisme, la salubrité publique et l'entraide sociale."

67 In 2011, the Geneva municipality acquired Frédéric Boissonnas' photography repertoire, which is now kept at the *Centre d'Iconographie Genevoise*. Many photographs were scanned and are already available online.

68 "On projetait en outre la création de nouvelles rues, de ponts sur le Rhône, de fontaines dans l'intérieur de la ville. La vente des terrains de la Corraterie, gagnés par l'agrandissement des fortifications, se fit aux enchères en 1827; ces maisons y furent construites, sur un plan uniforme, imposé par l'État. C'est un des rares exemple que nous ayons à Genève d'architecture obligatoire; la cinquième et la huitième maison ont un fronton, ce qui donne à l'alignement l'apparence de trois grands corps de bâtiments, à la fois simples et élégants."

69 "C'est en 1827 que nous voyons apparaître, pour la première fois, une figure importante dans l'histoire des transformations qui subit Genève au 19e siècle. Il conçut le projet de créer un nouveau quartier sur l'emplacement de la manufacture des Bergues, sur des terrains qui appartenaient à sa famille et qui étaient situés au bord du Rhône, en face de l'île Rousseau. [...] Fazy obtint pour cette entreprise l'appui efficace de plusieurs hommes influents; [...] une société anonyme, [...] fut constituée sous le nom de 'Société des Bergues'. Ce fut la première Société formée à Genève pour le développement et l'embellissement de la ville."

70 "modèles de ce que doit être une ville construite d'après un plan d'ensemble, adopté à l'avance et suivi scrupuleusement."

71 "Les Tranchées, séjour de l'opulence, sont la continuation de l'ancien quartier aristocratique, dit 'du haut'. Un viaduc à passer, pour enjamber les anciennes casemates, et l'on se trouve en plein faubourg Saint-Germain. Le quartier de la Bourse est devenu, pour Genève, ce qu'est la City pour Londres, savoir un lieu de travail où l'on reçoit des clients, où l'on gagne de l'argent, mais où l'on se garde d'habiter. Il en a été de même des autres parties de cette ville nouvelle, entourant l'ancienne, où des groupement naturels n'ont tardé à se former."

72 "Le sous-sol, éclairé en partie par des courettes anglaises, contient la loge du concierge, la cuisine, un office, la cave, le chauffage central et divers autres locaux de service. Le rez-de-chaussée est entièrement occupé par les pièces de réception (Salons, Salle à manger, Billard, etc.) et les deux étages supérieurs par les appartements privés et les chambres de domestiques. [...] Les deux étages supérieurs sont réunis par un escalier secondaire en chêne, non superposé à celui du rez-de-chaussée."

73 "L'évolution de l'habitation s'est effectuée sous l'influence des faits historiques. Au moyen âge, dans la ville et dans les faubourgs, le type de la maison contiguë, à un étage sur rez-de-chaussée, avec jardin étroit et profond, est pour ainsi dire seul représenté. [...] C'est au 17e siècle seulement, et surtout au 18e, que l'on voit apparaître des maisons construites d'un seul jet à plusieurs étages avec des façades plus développées en largeur. [...] Au 19e siècle, la tradition de la maison à 5 ou 6 étages se maintient et se fortifie. Cependant, sur l'emplacement des anciennes fortifications, une règlementation est adoptée pour limiter le nombre des étages à trois, deux ou même un sur rez-de-chaussée, selon les quartiers. Cette norme ne fut pas appliquée aux terrains privés. Aussi tout le territoire de la banlieue et même certaines régions de la campagne furent-ils envahis par des constructions disparates, disposées sans ordre."

74 The *Corraterie* building operation is described in further detail in 1976 by Eugène-Louis Dumont, in an article written for the *Revue du Vieux Genève* (Dumont 1976).

75 "Il est intéressant de constater qu'il est dû à l'initiative de l'État, qui a imposé aux constructeurs un cahier des charges très détaillé concernant les hauteurs de toits, les corniches et les étages. Les grandes lignes du projet sont dues au colonel Dufour, mais les plans sont signés par Vaucher-Delisle. La construction débuta en 1827. Cette longue lignée de maisons est conçue selon un plan uniforme, comme si le terrain était horizontal. Seules les hauteurs progressives des arcades de magasins, surmontées ou non d'un petit entresol, compensent la coupure."

76 "Le principe adopté est celui de rues se coupant à angle droit, donc de quartiers à plan régulier rectiligne. On a aussi prévu des places rectangulaires, d'autres circulaires en étoile, comme le

Rond-Point de Plainpalais, d'autres encore, carrées, avec les angles rabattus, comme le Cours de Rive. Le système des immeubles en ligne avec ou sans terrasse donnant sur deux rues, comme le Cours des Bastions, la rue Sénebier est le plus fréquent, mais pour des lots plus important on a aussi exécuté des blocs avec des squares. [...] Grâce à des servitudes de hauteur, mais aussi grâce à l'entente entre le propriétaires, plusieurs rues présentent des immeubles ou de petits hôtels qui forment des ensembles où les toits et les corniches sont au même niveau."

77 This aspect, which was not examined in the present revision, was studied in detail by André Conrad Beerli in the book *Rues basses et Molard: Genève du XIII^ème^ au XX^ème^ siècle* (Beerli 1983).

78 The competition that was put in place for this area was briefly examined in an article by Catherine Courtiau, *Pré-voir Genève vers 1900* (Courtiau 1990).

79 "considéré comme un lieu de résidence urbaine par ses habitants qui pour la plupart possèdent déjà des maisons de champagne."

80 "Les hôtels genevois relativement bas comportent quatre niveaux seulement, qui sont chacun le lien d'une des différentes fonctions de la maison: les cuisines et dépendances, les pièces de réception, les chambres principales, les chambres secondaires."

81 Some of the changes in the layout of domestic spaces in Geneva's collective housing are also documented by Bruno Marchand in the doctoral thesis *Typologie des logements collectifs à Genève: Proposition de classement selon des contextes différenciés*. The work concerns mostly collective housing types in Geneva throughout the 20th century, during the period following the First World War. The changes are documented by the comparison of some late 19th century examples and the ones from the forthcoming period. The author mentions for, example, the secluded position of the kitchen in 19th century housing, mostly giving onto a courtyard or airshaft, often associated to maid's bedrooms in more bourgeois housing; the main rooms would be generally placed next to the street. According to Marchand, this situation would change in the 1930s, with a new relation between the living room and kitchen, and the creation of a dining area in the latter (Marchand 1992: 179-180).

82 "mais modifié et enrichi de clauses particulières à chaque parcelle dans le cas des Tranchées et des Bastions."

83 "C'est pourquoi les questions ayant trait à l'aménagement intérieur sont négligées au profit de celles qui ont une incidence sur l'ensemble du quartier, qui concernent les limites de propriété ou l'aspect extérieur des bâtiments."

84 "Ainsi, dans la plupart des cas, les immeubles sont autorisés à avoir de un à trois étages sur rez-de-chaussée, ainsi que 10 à 16 m sous corniche et 20 m au faîte du toit."

85 This issue was also examined by Armand Brulhart and Erica Deuber-Pauli (Brulhart 2007), and by Sabine Nemec-Piguet (Nemec-Piguet 2007).

86 For more details concerning the development of Carouge see the study by André Corboz, *Carouge: 1772-1792* (Corboz 1968).

87 "À tout acte de vente des parcelles situées sur l'emplacement des anciennes fortifications se trouvait joint un exemplaire du cahier des charges régissant les constructions à édifier. De 1850 à 1879, le Conseil d'État adopta successivement quatre cahiers généraux des charges, contenant des dispositions fort détaillées sur les alignements, les gabarits et les matériaux des futurs bâtiments. Chaque quartier faisait l'objet d'un plan particulier, les acquéreurs s'engageant à construire dans un délai déterminé."

88 "mais la forme des toitures est modifiée, de manière à permettre l'aménagement d'un étage dans les combles."

89 Other publications by the CRR include the *Bibliographie critique de l'urbanisme et de l'architecture à Genève* (Brulhart 1978-1982), and the *Atlas du territoire genevois: permanences et modifications cadastrales aux XIX^e^ et XX^e^ siècles* (Centre de recherche sur la rénovation urbaine 1993-1999).

90 "si le rayon ne peut excéder 8 mètres, la profondeur de la parcelle ne doit guère être supérieure à 2 x 8 m = 16 m."

91 "le classement est complété par deux mesures supplémentaires: l'inscription à l'inventaire des immeubles dignes d'être protégées et le plan de site, instrument applicable aux sites bâtis et naturels."

92 "Les zones protégées seront étendues, entre 1973 et 1983, à une partie des quartiers fazystes édifiés à l'emplacement des anciennes fortifications et aux ensembles urbains du 19^e^ et du début du 20^e^ siècle."

[93] "Cette disposition légale a longtemps été appelée 'loi Blondel', du nom de son auteur, Denis Blondel."

[94] Architect Gilles Barbey wrote several publications concerning the evolving features of domestic spaces. In relation to Geneva, it important to mention the article entitled *Maisons d'habitation et culture domestique en Suisse occidentale* (1850-1980), in which Barbey sums up the changes in urban housing in western Switzerland, including Geneva, mainly by comparing research results of other studies conducted until that time (Barbey 1992).

[95] "assure(nt) la plate-forme administrative, économique et culturelle adéquate à l'étude et aux premières réalisations ponctuelles de la 'nouvelle Genève'."

[96] "où le morcellement foncier et les prérogatives administratives se rapportent davantage à la Restauration qu'au régime radical."

[97] "L'hôtel familial construit en ordre contigu entre cour et jardin, déployé sur plusieurs niveaux comme les maisons anglaises, se distingue de l'immeuble à appartements, dont chacun occupe toute la surface d'un étage. [...] Aux avantages procurés par la superposition des espaces d'une même habitation à des niveaux distincts, on peut opposer la distribution horizontale des pièces sur les modes de l'enfilade et de la symétrie. Au cours du 19e siècle, l'habitation bourgeoise tend à se rallier à la formule de l'immeuble en contiguïté avec son plan 'traversant' qui donne à la fois sur rue et sur cour. Ordinairement, les pièces de réception, salon et salle à manger s'ouvrent sur le devant, tandis que les chambres à coucher et la cuisine sont situées à l'arrière. La production courante de logements de ce type à Genève durant la dernière décennie du 19e siècle conduit à l'élaboration de quelques stéréotypes qui ne se différencient plus guère que par le nombre de pièces par appartement et le degré du confort sanitaire et ménager. L'appartement d'angle est souvent préféré à la distribution 'traversante' dans la mesure où il permet le dégagement des pièces sur deux rues et la relégation des espaces de service sur cour. La disposition angulaire du salon assure son éclairage bilatéral, avantage fréquemment rehaussé par la présence d'un oriel ou véranda constituant une pièce supplémentaire."

[98] It is important to mention that just two years earlier, Leïla El-Wakil had written an article concerning architect Jean-Daniel Blavignac (El-Wakil 1982). One of the examined projects was the *maison Rillet*, located on the *rond-point de Plainpalais*.

[99] The *Rue des Granges* was "the first private real-estate operation in which the [Geneva State] government was completely involved, by defining the plot plan and the general conditions for its completion. The project, mentioned in 1715, was launched the following year" (Corbière 2010: 55).

[100] "Comme à la Rue des Granges, l'opération fut lancée par les autorités de la République et soumise à une conception unitaire, jusqu'à la disposition des terrasses à créer sur les remparts sud de la ville."

[101] "Avec son vaste entrepôt et son marché d'une part, on grand hôtel de la Métropole et ses résidences de l'autre, Rive élargit le champ des deux activités traditionnelles des Rue-Basses de commerce et d'accueil hôtelier."

[102] For further details concerning the socioeconomic features of the medieval centre and of the *Ceinture Fazyste* neighbourhoods, see also the *mémoire de licence* in economic and social sciences by Tania Ljubisavjevic and Thierry Lopez, *Évolution spatiale de la Ville de Genève au XIXe siècle et ses conséquences sur la division sociale et fonctionelle* (Ljubisavljevic 2000).

[103] "Les dimensions exceptionnelles du square [...] finirent par fixer après plusieurs variantes les règles de composition de tout le quartier."

[104] "avec une gare dans l'axe du square du Mont-Blanc et des rails perpendiculaires à cet axe."

[105] "se vérifiaient peu à peu les premières théories urbaines qui cherchaient à faire reculer tout ce qui pouvait apparaître arbitraire dans la ville, pour lui donner une organisation 'raisonnée'."

[106] "Ce fut, à Genève, la première société anonyme et grande association qui se forma pour des constructions."

[107] "une densité exagérée, un hygiénisme douteux, une circulation discutable."

[108] "L'idée de placer au centre de chaque immeuble locatif une cage d'escalier, éclairée zénithalement par une verrière sur la toiture, facilitait la distribution des appartements sur les deux côtés de la rue: on peut parler de typologie révolutionnaire dans le sens où la solution parvenait à régler le problème des immeubles à doubles façades donnant directement sur rue. Si les conditions sanitaires, telles que W.-C. et eau courante, apportaient un confort évident, seuls les immeubles

donnant sur le quai pouvaient prétendre disposer de tous les avantages de ce que les contemporains désignaient déjà par le terme d'hygiène *moderne."*

109 "principalement, mais non exclusivement, sur ce secteur encore peu touché par l'inventorisation qu'est le logement urbain de la période fazyste et post-fazyste."

110 "ayant pour but la protection des ensembles du 19e siècle et du début du 20e siècle."

111 "Revilliod-Faesch et Recordon-Ducommun demandèrent à l'entreprise Vaucher-Ferrier et Cie de leur dessiner deux immeubles quasi identiques. Au-dessus du rez-de-chaussée avec entresol dévolu aux magasins et arrière-magasins, deux beaux appartements par étage, de quatre pièces chacun, comprenant salon, salle à manger en enfilade du côté du quai, cuisine et chambre à coucher sur la rue des Etuves."

112 "La Société immobilière genevoise, constituée en 1853 [...] entreprit la construction de la quasi-totalité du square du Mont-Blanc. Elle s'entoura des conseils de l'ingénieur Charles Goetz et de l'architecte François Gindroz (1822-1872) pour lui bâtir de beaux immeubles répondant à un programme mixte de logements et arcades commerciales [...], et même un hôtel."

113 "la maison Calame a gardé ses deux beaux appartements par étage, disposés autour d'un bloc central constitué d'une cage escalier de plan carré à noyau vide, éclairée zénithalement, et d'une courette à pans coupés qui donnait aussi des jours à la cuisine et aux toilettes des deux appartements adossés. Les salons avec cheminée aux angles, du côté de la rue Pierre-Fatio, communiquaient avec les salles à manger. Venaient ensuite les chambres de part et d'autre des pièces de réception."

114 "Trois des cinq immeubles les plus anciens présentent un escalier central à une volée et deux quartiers tournants, qui s'ouvre sur une cour intérieure de plan rectangulaire. Chaque niveau comporte deux grands appartements traversants, ou d'angle, pour les bâtiments de tête. Les pièces de réception donnent sur la rue Lévrier, les chambres sur la rue Pécolat tandis que les locaux de service sont groupés autour des cours. D'une conception légèrement différente, les nos 3 et 9 sont organisés à partir d'une cour latérale.
Dans l'immeuble nos 5-7, deux montées semi-circulaires, disposées de part et d'autre d'une cour centrale rectangulaire, desservent deux appartements par niveau, distribués en façade. Les locaux de service, placés au milieu de l'édifice, prennent jour sur deux courettes d'aération latérales."

115 "Conformément au caractère bourgeois de l'édifice, on trouve du côté de la façade principale salon, petit salon et salle à manger, disposés en enfilade, tandis que du côté de la rue Necker se concentrent la cuisine et les chambres. Les locaux de service tels que chambre de bonne, chambrettes, réduits et bains sont groupés autour de la courette d'aération et de la cage d'escalier."

116 The portfolio is currently kept at the *Centre d'Iconographie Genevoise.*

117 "Trois pièces de réception en enfilade et la chambre principale ouvrent sur un petit parterre à la française. De l'autre côté de la galerie centrale les chambres donnent sur la rue, de même qu'une office d'où un escalier mène aux cuisine situés au sous-sol."

118 "Pour Bovy, l'immeuble est l'occasion d'exploiter une gamme morphologique et typologique extrêmement vaste [...]. Selon la destination, le budget, le quartier, héritier en cela d'un sens de la convenance [...] Bovy réinterprète plans et façades."

119 "Les cinq pièces qui le constituent sont distribuées en un salon avec cheminée d'angle communicant avec la sale à manger puis une grande chambre avec sale de bains; la cuisine et une autre chambre donnent sur la cour. Une alcôve tient lieu de chambrette, tandis qu'une chambre de bonne minuscule, en face de la cuisine près de l'entrée, prend son jour sur le palier de l'escalier."

120 In relation purchase conditions and buyers of plots in the *Ceinture Fazyste*, see also the doctoral thesis in economic and social sciences, *L'évolution du paysage urbain à Genève au XIXe siècle* (Eggimann 1989). Eggimann examines the role of real-estate societies, commercial societies and also of architects as developers. However, according to Perroux, Eggimann possibly underestimated the role of real-estate societies, since they were often formed after plot purchases.

121 In his *mémoire de licence,* Frédéric Python examined the villas designed by architect Edmond Fatio in Geneva between 1871 and 1959 (Python 2007). He is now preparing his doctoral thesis on the analysis of Fatio's career and body of work.

122 The document produced by Anita Frei as a result of her research for the architects' family, is available at Geneva's *Centre d'Iconographie Genevoise* under the shelf mark EC FULP 1. Several project drawings by Léon Fulpius are also kept in the same archive, and listed by street name.

[123] "Il n'est pas étonnant de trouver Léon Fulpius [...] à l'œuvre aux quatre coins de la ville nouvelle. Son nom apparait au boulevard Helvétique, au cours de Rive, à la rue Lefort, à la rue Bautte. Parfois, comme au 12 rue de Malatrex, il acquiert la parcelle, construit, puis revend. Les bâtiments peuvent être modestes, comme ils le sont certainement sur la rive droite, à la rue de Lyon, à la rue des Charmilles, ou nettement plus opulents, comme à la rue de Candolle."

[124] "Il comporte huit niveaux: un sous-sol, affecté aux caves, un rez-de-chaussée avec deux appartements situés légèrement en-dessous du niveau du trottoir, cinq étages avec chacun un appartement de trois pièces et un autre de quatre pièces, et les combles abritant les greniers et un étendage".

[125] "Les appartement sont divisés en deux parties, regroupant les belles pièces en tête de bâtiment (rue Imbert-Galloix), petit salon et salle à manger – côté jardin -, grand salon – côté rue – et les pièces privées (cinq chambres et salle de bains) ainsi que les espaces de service (cuisine, office, entrée de service) côté mitoyen."

[126] "Entre 1880 et 1914, les chambres sont progressivement regroupées, formant la partie privée de l'appartement [...]. Cependant, la présence de chambres dans l'espace de réception n'est pas abandonnée. Si elle devient plus strictement intime, la coutume de l'ouvrir aux invites lors de la réception est également maintenue."

[127] "Pour la première fois, les ménages peuvent envisager de renoncer à la corvée de l'eau, qu'il faut aller chercher aux fontaines publiques et monter jusqu'au logement. Cette eau précieuse est conservée dans une cuvette ou, mieux encore, dans une 'pierre à eau', épais bassin en pierre d'une contenance d'une cinquantaine de litres encastré dans le mur au-dessus de l'évier et muni d'un robinet."

[128] "Au niveau des habitations, le système de vidange est aussi un sujet délicat. Les latrines domestique – on en compte en moyenne une pour deux logements à la fin du 18e siècle – sont équipées d'une colonne de chute en terre cuite ou en plomb aboutissant à un sac en roche. Ce contenant est suppose séparer les liquides, qui se déversent dans les conduits publics, et les matières fécales, qui doivent être vidangées à intervalle régulier."

A TYPOLOGY OF HOUSING

Part 3

Since mid 18th century, profound urban changes occurred in the cities of Lisbon and Oporto. After the terrible 1755 earthquake, the centre of Lisbon – the *Baixa* – was rebuilt according to a regular plan ⊠ where most blocks followed an orthogonal grid between two squares. The expansion and urban restructuring of Oporto had a radio-concentric development ⊠, which included both changes in the medieval city centre and new street alignments outside city walls. In both cases, there was a "recently acquired notion of public space as a space whose valorisation is the responsibility of public administration (that is, the State), who has the duty of assuring that, over the desires of any private clientele, prevails public interest"[1] (Nonell 2002: 161).
The building of the *Baixa Pombalina*[2] was submitted to specific legislation implemented by the *Marquês de Pombal,* "mostly juridical clauses destined to reduce individual property rights in relation to the urban enterprises of central authorities, in addition to which there were also considerations on the buildings"[3] (Mandroux-França 1986: 11). The legislation allowed for property redistribution leading to the formation of new more regular plots. Meanwhile, in Oporto, João de Almada e Melo "founded the *Junta das Obras Públicas do Porto* [...], under the aegis of the *Marquês de Pombal*, [...] an organism in charge of putting into practice the new urban programs"[4] (Ferrão 1989: 188), that he presided for twenty years. The *Junta* functioned between 1763 and 1833, after the instauration of the liberal regime (Nonell 2002: 95). The difficulties in implementing the *Junta*'s programs to an urban structure consolidated in its medieval matrix lead the *Marquês de Pombal*, in 1769, to apply to Oporto the same legislation that had been created for Lisbon's rebuilding, thus enabling an urban action that profoundly changed the city (Mandroux-França 1986).
Public space image was essential to *Pombalino* and *Almadino* urban planning, as well as to urban coherency having as unit the block, in the *Baixa Pombalina* case, and the street, in the case of Oporto. The spatial unity was defined by the façades drawn *a priori* ⊠ at the *Casa do Risco* and, in some cases, at the *Junta de Obras Públicas* ⊠, according to a logic of regularity and element repetition. Nevertheless, there was a clear distinction between an urban plan designed for the centre of a capital after an earthquake, and the partial successive plans for Oporto ⊠ (Nonell 2002). In the latter, the definition of street alignments and not of regular blocks originated a greater variation in plot depth, with some repetition in building depth but a great variability of courtyard depth, which could be patios or gardens (Fernandes 1999: 144). On the contrary, "the action based on the block has to [...] control the building plus the courtyard, so that it can insure block dimensions and grid patterns"[5] (Fernandes 1999: 144).

The present chapter[6] carries out a comparative analysis of housing built in the cities of Lisbon and Oporto during late 18th and early 19th century, that is, during the first part of the period[7] chosen for this thesis. The study focuses on common residential buildings most likely destined for the small to high *bourgeoisie*. We examined two types of housing with different urban characteristics: the block of flats located in the compact blocks built after the 1755 earthquake in Lisbon's *Baixa Pombalina,* and the narrow single-family houses located in Oporto's expansion streets approximately during the period of action of the *Junta de Obras Públicas* (1763-1833).

Bourgeois housing

There is least one clear difference between late 18th and 19th century *bourgeois* housing in Oporto and in Lisbon. While in Lisbon's *Baixa Pombalina* the block of flats for rental was being tested and stabilized at a large scale, in late 18th century Oporto the existing tradition of the narrow single-family house was maintained. Nevertheless, both Lisbon's blocks of flats and Oporto's single-family houses were usually multifunctional[8] at this time. In most cases, the ground floor was occupied by commercial establishments or warehouses, and the rest with housing with its own independent access.

We consider the definition of the block of flats in the *Baixa Pombalina* as described by José-Augusto França (1977) in the seminal research *Une ville des lumières: la Lisbonne de Pombal*:

> The houses would have to satisfy economic demands, making their income interesting for local owners, who had to submit to a[n urban] plan that took away all their freedom and opinion on this aspect. [...] Developed for the *Baixa*, [the *pombalino* block of flats] was repeated many times, wherever urban developments emerged. [...] Even though the notion of "*pombalino* building" is, in any case, an abstraction, since there are not buildings, but [urban] blocks, sets of blocks of buildings [...]. (França 1977: 163-164)[9]

The number of floors of the blocks of flats was pre-established at four floors plus one residential floor ☒ below the roof. This number was defined in the façade designs completed by city senate architect Eugénio dos Santos between 1758 and 1759 (França 1977). Nevertheless, the blocks often have one or two more floors, either due to an increase in flexibility during the time of building[10] or later, when posterior additions were allowed[11].

In approximately two thirds of housing units, one staircase served two flats per floor ☞, although there were also frequent examples of narrower buildings where one staircase served one flat per floor ☞ (Wall Gago 2007: 30). These housing units were meant for rental and their layout was most often replicated between floors, making these buildings the precursors of the modern block of flats (Barreiros 2004: 90). Nevertheless, according to a vertical social hierarchy between floors, there could also be fewer, larger flats on the lower more noble floors, which could be divided into more flats above (Barreiros 2012: 149).

At the same time, the functions of single-family houses in Oporto ☞ were distributed by three, four or five floors (Fernandes 1999: 144). According to Francisco

Barata Fernandes, the Oporto *bourgeoisie* chose to keep a tradition that favoured "access independence, privacy and a connection to the ground"[12] (Fernandes 1999: 143). The author mentions that a block of flats implied "a larger initial capital investment, a more complex building management and administration, and less flexibility in the sale and rental decisions" (Fernandes 1999: 180-181). In the single-family house model, it would be possible to build one house at a time to sell or to rent.

Domestic spaces

There are several original drawings dating from the time of building relating to urban space and to the adjoining building elements such as the façades or, in the *Baixa Pombalina*, the wastewater drainage system ⊠. However, it is rare to find original drawings depicting the house's interior, as mentioned by Maria Helena Barreiros in the article *Casas em cima de casas* (2004):

> If in fact we dispose of numerous series of "prospects" [elevations] and at least one street section [...], the presence of plans of *pombalino* interiors is almost unknown. With one or two exceptions ⊠ – often of later building, referring to plots at the edge of the *Baixa* or on its surrounding hills. (Barreiros 2004: 90)[13]

In Lisbon, the requirement to submit plans to municipal authorities for new buildings or when carrying out changes to existing ones was enforced in 1864[14]. In Oporto, from what we were able to ascertain from the books of plans at the *Arquivo Histórico Municipal do Porto,* referring to "building permissions for particular construction work, including projects of building, rebuilding, reconstruction, extension etc., of housing, factory, commercial, religious, or funerary buildings, among others"[15] (AHMP 2010) between 1771 and 1943[16], there are only original elevations and urban plans relating to buildings dating from late 18th and early 19th century. Floor plans mainly refer to projects submitted after 1899, when it became mandatory to submit floor plans for new buildings distanced up to 5m from the street (Matias 2002: 22). The ones that refer to earlier buildings were usually submitted for interior conversion purposes, such as the addition of bathrooms ☞ or floors.
The regularity that, even so, we can observe in the layout of Lisbon and Oporto houses is probably due to the stability of building systems throughout the time of study, of ways of life associated to certain domestic spaces and, when applicable, to the metric of the previously drawn façades:

> Until the 40s [of the 20th century in Oporto], an image of cohesion ⊠ [...] remained beyond the small metrical differences in the plot fronts, in the number of building floors, in their floor height, window size and even in its decoration. It is a way of building that remains when exogenous or extra-disciplinary factors, or the introduction of new materials or technologies, do not call into question a consolidated experience. (Fernandes 1999: 81)[17]

In the *Baixa Pombalina* blocks, it is essential to mention the use of the *gaiola* building system ⊠ that aimed for an increased seismic resistance[18].

Housing entrance. The entrance to Oporto's late 18th and early 19th century single-family houses was usually independent from the entrance to commercial areas on the ground-floor ☞ (Fernandes 1999: 144). Nevertheless, several authors (Oliveira 2003; Pereira 1995) suggest that the buildings were often used for the housing of the owner of the commercial space:

> The narrow tall house [...] is, in its form and original sense, a hybrid functional type of urban dwelling and commercial establishment, simultaneously pertaining to the same family, strictly utilitarian, in accordance with the professional needs and the mentality of people who had their shops, warehouses or workshops on the ground floor, next to the street, open to the public, and lived [...] on the upper floors [...]; it is, in other words, the popular and *bourgeois* house, narrow to save land and facilitate maintenance, whose hybrid character is attested by the presence of at least two doors: one, for the residence, another, for the shop. (Oliveira 2003: 298)[19]

In several plans examined, even though there were two separate entrances, there was also a direct passage ☒ between the commercial space and the hall leading to the residential area (*Rua do Rosário* 223 ☞, *Rua do Doutor Alves da Veiga* 114 ☞, *Rua da Picaria* 80-84 ☞, *Rua do Pinheiro* 71-75 ☞, *Rua da Alegria* 97 ☞). In example 4 ☞, which was built later according to similar principles, the room functions that are mentioned in the plans show that the house was used by the owners of the commercial space.

From the observation of the plans, we can also note that there are some exceptions to the two separate entrances rule. In one example, the access to the residential floors took place via the store or warehouse on the ground floor (Example 2 ☞). In two other examples, there was only one entrance door to the ground floor, suggesting that the room or rooms with windows onto the street were occupied by housing quarters (Example 3 ☞ and *Rua do Breyner* ☞[20]).

In Lisbon's *Baixa Pombalina*, the access to commercial spaces and to housing was done independently, even though there were examples of commercial posterior occupations of large ground floor lobbies (Barreiros 2004: 90). The situation is different from the one in Oporto, since, in Lisbon, the lobby was a common access to several housing units. Nevertheless, data from Nuno Luís Madureira's work confirms that the people who ran commercial spaces often lived in a flat of the same or of a nearby building (Madureira 1992: 44).

Inside the blocks of flats, it is the number and type of entrances to the flats that seems to have been the target of experimentation. A closer observation of metric survey plans shows that the main issue was how to reach the reception and service spaces as independently as possible. In most cases, this issue was translated into two entrances per flat ☒, mainly when there was only one flat per floor. When there were two flats per floor, only one entrance per floor was nearly as common as two (Wall Gago 2007: 34). A single entrance to a flat usually gave onto a short passage – a half-corridor – that was roughly located in the centre of the house, next to an intermediate line of inner rooms. This passage allowed for a first access separation between the social areas, generally giving onto the street, and the service ones, which were usually placed near the courtyard. When there were two entrances to the flats, one usually also gave access to this passage. The other entrance was, in

most cases, to a room located in the intercommunicating series of rooms giving onto the street, generally associated with social functions. Sometimes this room was the main living room, identifiable due to its larger dimensions. However, in most cases, it was a smaller room, that had a "relation with the rest of the house invariably subject to elevated levels of control", and to which it was connected "via the social areas, or via a *hall* or corridor"[21] (Leal 2005: 163). This type of connection allowed for the use of this room for other activities without disturbing the rest of the house. Some authors mention that this room was probably used for professional or commercial activities[22] (Santos 2005; Barreiros 2004). Nevertheless, the comparison with examples in Oporto, in which the way visitors were received was a fundamental element of domestic life at the time and the fact that, sometimes, this second entrance in the *Baixa* gave directly onto the living room, leads us to consider the possibility that these spaces were initially planned and used as reception rooms. In a recent article, Maria Helena Barreiros also notes this usage when describing a late 18th century typical 4-window flat, depicted in a rare original plan where room functions were shown (Barreiros 2010: 29).

Occasionally, when cost and space permitted, the access to social and service areas of flats in the *Baixa Pombalina* was completely separated ☒. This separation was carried out by adding a small flight of stairs on each floor ☒, giving access to the service areas at the back, while the main landing led to the reception rooms. If we compare this situation with housing in Oporto, there was only a separate access to service areas later, during the second half of the 19th century, in the houses that Barata Fernandes associates with the "liberal" type. In these cases, the author mentions the occasional presence of a second staircase, used for service access and placed next to the kitchen, as well as a possible lateral ground-floor access to the courtyard.

Staircase location. The characteristics of the original staircase in Lisbon's *Baixa Pombalina* blocks of flats were examined in detail by Jorge Mascarenhas (1996). As we can note in the survey plans included in this work, the staircase was usually placed within a central axis when it served two flats per floor ☒, which was more economical and allowed for greater structural stability. When there was only one flat per floor, it was rather placed against a party wall ☒. The author identifies three main staircase positions in relation to the buildings' façades – staircases next to the street façade, next to the courtyard façade or placed in the centre of the building[23] –, in which he includes several types of access. Staircases were most often placed either against the courtyard façade, where they could receive light through a window, or in the centre of the building, where natural light came from a skylight and stairwell. It was less frequent that staircases be placed next to the street façade, since they would take up space destined for the largest most important rooms. As previously mentioned, in a few cases there was an additional flight of stairs ☒ to access service spaces independently.

According to Barata Fernandes (1999), in the Oporto houses dating from late 18th and early 19th century the staircases ☒ usually had a central position ☞, perpendicular

to the length of the plot, and were frequently located against a party wall. This was the case in all the examples examined. The staircases usually had skylights ☒, which were sometimes associated with windows to provide light to the inner rooms ☒. As far as we know, in the multifamily buildings of the *Baixa Pombalina*, there were no situations where rooms had windows onto the staircase, since there was a clear separation between the flats and the common access spaces. In Lisbon, inner rooms in the flats received light exclusively through adjoining rooms, and there were often fanlights over the doors ☒, a solution that was also frequent in Oporto.
In most of the examples examined in Oporto, the entrance from the street to the residential spaces gave onto a long hall ☒ leading to the U-shaped stairs in the centre of the building. In these cases, the commercial areas were probably reduced to the room giving onto the street on that side of the staircase. However, both one of the collected metric surveys (*Rua da Picaria* 80-84) and example number 4, built later as a continuation of the same layout type, had two staircases. The first was a straight-run staircase ☒ to access the first residential floor directly; the second were typical U-shaped stairs ☒ with two parallel flights and intermediate landings to access the remaining floors. This solution made it easier for the entire ground floor to be used for commercial purposes. The presence of these two types of stairs is already depicted in the examples Barata Fernandes uses to characterise the "mercantilist" houses, built between the 15th and the 17th centuries. As such, it is likely that this solution was also applied in more examples of late 18th and 19th century houses.

Building dimensions. Oporto's late 18th and early 19th single-family houses were invariably narrow, approximately between 5 and 7 m wide with two or three windows per façade. The building depth was close to 12 or 22 meters (Fernandes 1999: 144). There were considerable gross floor areas that, according to these dimensions, varied between 60-84 m square and 110-154 m square *per floor*, without including the courtyard. On the contrary, the buildings included in the *Baixa Pombalina* blocks had variable widths, in general greater than the ones in Oporto, an average of three to five windows per flat and a minimum of two. The depth of the flats was dependent on the block in which it was included. Most were blocks with a main North-South orientation in the *Baixa*'s central area, with a depth of approximately 11 to 13 m. In the blocks located further south, this value increased to 14 to 16 m and, in the blocks located further north, to 18 and 22 m. We did not calculate the total areas per flat in the *Baixa Pombalina*. Nevertheless, a preliminary observation suggests that the complete areas of houses in Oporto were considerably greater than Lisbon's flats, even though the area of the latter tended to "duplicate in relation to previous vernacular solutions"[24] (Leal 2005: 159). From the work of Barata Fernandes and Gaspar Martins Pereira, we know that houses in Oporto often comprised extended families, servants and commercial apprentices but that, whenever it became necessary, they were divided and adapted to multifamily housing, frequently with one flat per floor (Pereira 1995; Fernandes 1999: 228-229). In Lisbon, it is the social analysis of the *Baixa*'s *São Nicolau* parish by Nuno Luís Madureira that gives us further information on the topic. A chiefly commercial and crafts industry area, almost 42 % of its

occupants in 1780 were artisans, and only 13,8 % were businesspersons, service or administrative workers. According to the author, the repartition of the flats was dependent on the means. As such, a more modest artisan could, for instance, rent a smaller flat or part of the attic, while families of greater means might occupy two consecutive floors, or a top floor and attic (Madureira 1992: 39, 44, 48), where servants could have been housed.

Room function and location. Domestic life in late 18th and early 19th century houses in Lisbon and Oporto was defined by a "sense of progression from public to private, from the representative to the functional"[25] (Fernandes 1999: 146). This progression was translated into house layouts organised according to floor depth, in both cities and, in Oporto, according to a vertical differentiation between floors.

Most flats in Lisbon's *Baixa Pombalina* had three lines of rooms ☒ parallel to the façades, even though they could sometimes be as little as two and as much as five. The rooms closest to the street façade – often in *enfilade* ☒ – are usually considered the main social areas of the house. There was often a larger room, possibly the main living room (Leal 2005: 150) and, as previously mentioned, a room with a separate entrance from the staircase landing, which could have been used as a reception room for visitors. This series of rooms next to the façade was usually followed by one or more central lines of alcoves ☒, that is, of inner, smaller rooms that received light only through the adjoining spaces. According to Maria Helena Barreiros, alcoves in these flats were, "in principle", used as "sleeping chambers", but could have also have multiple functions, such as "dressing rooms, children's rooms, or all that simultaneously"[26] (Barreiros 2004: 92, 96). The possible advantage of using them as sleeping chambers – meaning where the bed was placed and not much else – was to be able to use the adjoining rooms next to the façade for social functions whenever necessary, keeping the beds hidden away.

The kitchen ☒ – easily identifiable by the position of the chimney – was usually placed next to the courtyard façade, and could be paired with other service rooms or with a dining area[27]. The kitchen was, therefore, as far away as possible from the houses' most public areas, and not visible from the street. It is also important to note that, according to Jorge Mascarenhas, the houses originally did not have toilets but only a wastewater sink in the kitchen (Mascarenhas 1996: 97). During late 19th century and, mainly, the beginning of the 20th century, toilets or bathrooms were frequently added next to the kitchen or the courtyard façade[28], and included in new buildings (Leal 2005: 704).

In the plans examined of houses in Oporto, we note that in buildings that are less deep, there are three to four lines of rooms ☞ parallel to the façades per floor and, in the deepest building, five to six lines of rooms ☞ (counting the staircase). In these cases, there were, respectively, none to one inner room per floor, and two to three inner rooms per floor[29]. As previously mentioned, the inner rooms or alcoves were placed next to the staircase and could have small windows giving onto the stairs ☒.

According to Barata Fernandes, most of the rooms in Oporto's houses probably did not have a specific function, serving as living rooms or bedrooms according to the residents' preference (Fernandes 1999: 145). Nevertheless, the author frequently designates inner rooms as bedrooms, suggesting that they could have a similar use as flats in Lisbon or, at least, that beds were placed in that location when necessary. Later, in original plans presented for building permissions towards the end of the 19th century, alcoves were not designated as bedrooms but as *toilette*, dressing rooms, offices or storage[30], possibly indicating that their function was variable, especially considering increasing health and hygiene concerns towards the end of the century.

There were two rooms in Oporto's single-family houses that generally had a specific function, the kitchen and the reception room. As in Lisbon, the location of these two spaces abided by the domestic ways of life at the time: reception rooms were generally located close to the entrance and next to street – in the houses' most public area – while the service spaces were as distant as possible from the latter. Even though it cannot be established from the examination of plans, several authors place the reception room on the first floor ☞ next to the street façade (Basto 1932: 98; Oliveira 2003: 300; Fernandes 1999: 143). In most of the examined plans[31] of houses in Oporto, the location of the kitchen was identifiable by the presence of the chimney ☒. According to a functional differentiation in height and depth, it was located on the top floor ☞, next to the back façade, distant from the street and keeping the rest of the house away from possible fires and odours (Oliveira 2003: 300). There was usually one toilet per floor, which was generally also placed next to the courtyard. It was thus usual to have to pass through other rooms to get to them. The addition of toilets ☞ next to the back façade was very frequent during the second half of the 19th century, as confirmed by archive sources[32]. However, most of them were only connected to the sewage system after 1929, when this connection became mandatory (Trevisan 2002: 32).

Type of distribution. In the *Baixa Pombalina* flats ☒, the communication between most rooms took place directly, without mediating spaces. There were rarely any corridors. In most cases, one of the entrances to the flats gave onto a short central passage, which made it possible to then access social or service areas separately. Nevertheless, it was also quite frequent for the entrance to lead directly to a room of the same size as the others (Wall Gago 2007: 36).

In the plans examined of houses in Oporto, we did not notice the same type of experimentation in relation to accessing social and service areas. The entrance from the street usually gave onto a hall or corridor and, on the inside, almost the entire circulation was done via mediating spaces. The access to most rooms took place via the staircases and the adjoining passages on either end of the staircase landings. Sometimes, a room next to one of the façades was divided in two, in which case one of the rooms was either accessed via the other, or had two entrances. Alcoves also often had a double access, one from the adjoining room and another from the passage next to the landing. Finally, it is also interesting to note that in

three of the houses examined in Oporto (*Rua do Pinheiro* 71-75 ☒, *Rua do Doutor Alves da Veiga* 114 ☞, *Rua da Alegria* 97 ☞), the staircase design allowed for a low, narrow passage from the front to the back rooms below the intermediate landings. This passage served as an alternate circulation to the main staircase landing, and it could have made it easier to divide the houses into several flats. This type of passage was also noted by Barata Fernandes, but mentioned in relation to late 19th century examples (Fernandes 1999: 173).

[1] "recém-adquirida noção de espaço público como espaço cuja valorização é da responsabilidade da administração pública (isto é, do Estado), a quem compete assegurar que, sobre os desejos de quaisquer clientelas particulares, prevaleça o interesse público."

[2] Lisbon's *Baixa* is generally called *Pombalina* due to the deciding role played by State secretary for the Kingdom Sebastião José de Carvalho e Melo – the *Marquês de Pombal* – in the rebuilding of the city during the reign of king D. José I.

[3] "proposições, de ordem sobretudo jurídica, destinadas a diminuir os direitos da propriedade individual, em face dos empreendimentos urbanos do poder central, às quais se somam considerações sobre as construções que se devem erguer."

[4] "fundava [...], sob a égide do Marquês de Pombal, [...] a Junta das Obras Públicas do Porto, organismo encarregado de pôr em prática os novos programas urbanísticos."

[5] "a acção com base no quarteirão não pode prescindir [...] de controlar a edificação mais o logradouro, para assim poder assegurar medidas de quarteirão e padrões de malha."

[6] Written work for this chapter was started with the article written for the *Cultura Arquitectónica* subject at the IST PhD program, entitled "Configuração espacial de habitações em Lisboa e Porto: o espaço doméstico burguês no século XVIII-XIX". We would like to thank professor João Vieira Caldas for his useful input at that time.

[7] In the chapter "Changes to domestic space", we added to this analysis by examining how some original features of houses in both cities changed during thesecond half of the 19th century.

[8] As mentioned in the bibliographical revision, in several areas of Oporto's mid to late 19th century urban development, there were houses with an exclusive residential function. For further details see work by Francisco Barata Fernandes (1999), Maria do Carmo Pires (2000) and, mainly, the recent study by Nelson Mota (2010).

[9] "Tais casas teriam que satisfazer exigências económicas, tornando o seu rendimento interessante para os proprietários locais, obrigados a submeter-se a um plano que lhes tirava toda a liberdade e toda a opinião na matéria. [...] Estudado para a Baixa, [o prédio de rendimento pombalino] foi várias vezes repetido, por todo o lado onde focos de urbanismo apareceram. [...] Ainda que o "prédio pombalino" seja, de qualquer maneira, uma abstracção, pois não existem prédios, mas blocos, conjuntos de quarteirões de prédios [...]."

[10] Buildings with one or two more floors were mostly allowed after the transition from D. José I to D. Maria I's reign, and the removal of the Marquês de Pombal as State Secretary.

[11] In the annexes to her doctoral thesis, Joana Cunha Leal (2005) includes several mid to late 19th century plans for floor additions in the *Baixa Pombalina.*

[12] "independência de acessos, privacidade e ligação à terra."

[13] "Se de facto dispomos de infindáveis séries de "prospectos" e de pelo menos um corte de rua [...] é quase desconhecida a ocorrência de plantas dos interiores pombalinos. Com uma ou duas excepções – estas tendencialmente mais tardias, referentes a lotes situados nas bordas da Baixa ou nas colinas que a encerram."

[14] According to Joana Cunha Leal, this requirement was enforced by municipal authorities following the 31st December building decree, which mainly concerned health and hygiene conditions for

buildings. This situation was examined in further detail in the bibliographical revision of Joana Cunha Leal's doctoral thesis, *Arquitectura privada, política e factos urbanos em Lisboa: da cidade Pombalina à cidade liberal* (Leal 2005).

15 "processos de licenciamento para obras particulares, que incluem projectos de construção, reconstrução, ampliação etc., para edifícios habitacionais, fabris, comerciais, religiosos, funerários, entre outros".

16 There are two indexes at the *Arquivo Histórico da Câmara Municipal do Porto* concerning building requests, which can be used to identify documents in the *Plantas de Casas* books. The first refers to requests dating from 1771 to 1908, and the second to requests dating from 1893 to 1943.

17 "Até aos anos 40 [do século XX], uma imagem de coesão [...] terá prevalecido para além das pequenas diferenças métricas existentes nas frentes dos lotes, no número de pisos dos edifícios, no seu pé-direito, na dimensão dos vãos e até no seu ornato. É um modo de construir que permanece quando factores exógenos ou extra disciplinares, ou a introdução de novos materiais e tecnologias, não põem em causa uma experiência consolidada."

18 As mentioned in the Introduction, several studies have examined the *gaiola* building system. See, for instance, the work by Jorge Mascarenhas (1996: Appendix 3, 52) or, more recently, articles by Stephen Tobriner (2004) and by Mário Lopes, Rita Bento and Rafaela Cardoso (2004), included in the *Monumento*s magazine.

19 "A casa estreita e alta [...] constitui, na sua forma e sentido originários, um tipo híbrido funcional de residência urbana e estabelecimento comercial, simultaneamente, referidos à mesma família, estritamente utilitário, de acordo com as necessidades profissionais e a mentalidade da gente de que é própria, que tinha as suas lojas, armazéns ou oficinas [...], no rés-do-chão, junto à rua, abertas ao público, e habitava [...] os andares superiores [...]; ela é, por outras palavras, a casa popular e burguesa, estreita por economia de terreno e de manutenção, cujo carácter híbrido é atestado pela existência, sem excepção, de pelo menos duas portas sempre: uma, da residência, e outra, da loja."

20 The house on *Rua do Breyner* 143 was probably destined for a family or greater means, which could justify the use of the ground floor for residential quarters. The plot was slightly larger than average and there were two steps between the street and entrance levels.

21 "estabelece com elas [remanescentes áreas da habitação] uma relação invariavelmente sujeita a elevados níveis de controle", "ligados à casa por vias de acesso às áreas de sociabilidade ou a um *hall* ou corredor."

22 In plans submitted to the Oporto and Lisbon municipality in late 19th century and early 20th century, these rooms are sometimes designated as "saletas" (small living room) or as "gabinetes" (offices or practices), which suggests that their use varied throughout time (Leal 2005: Annexes to chapter 8.3.2). In Oporto, Nelson Mota mentions late 19th and early 20th century examples where offices are close to or communicate with reception rooms (Mota 2010: 197).

23 Jorge Mascarenhas also suggests the hypothesis of a chronological development of staircase types (Mascarenhas 1996: 152-177). Firstly, the staircase would be placed next to the street façade, similar to medieval buildings in the city; secondly, the staircase would be placed at the back, allowing for its natural lighting without taking up valuable space next to the street façade; finally, the staircase would be located in the centre, a solution which became common with the generalization of skylights. However, the author could not confirm these trends chronologically. Several factors could explain the prevalence of certain types of staircases throughout time, such as the preferences of certain architects or residents.

24 "em relação à maioria das soluções vernaculares anteriores."

25 "um sentido de progressão do público para o privado, do representativo para o funcional."

26 "em princípio, albergando as camas de dormir", "quartos de vestir, quartos de criança, ou tudo isso simultaneamente."

27 The presence of a dining area next to the kitchen was noted by Maria Helena Barreiros when describing the previously mentioned late 18th century original plan. Even though the presence of a dining room next to the courtyard was common in late 19th and early 20th century, according to Madureira this activity often took place in the social areas, next to the street, in earlier examples (Madureira 1992: 135).

[28] As mentioned in the Introduction, water distribution and sewage connection (when available), was in principle required by the 1864 regulations for new buildings and additions (Leal 2005: 687).

[29] This correspondence between building depth and number of interior rooms seems quite logical, but it would be necessary to examine more examples to better understand the variability of the number of lines of rooms parallel to the façades on each floor.

[30] See, for instance, the plans published in: Fernandes 1999; Pires 2000; Mota 2010.

[31] This kitchen was located on the top floor in all the plans examined with the exception of the house on *Rua da Alegria* 97. In the plans depicting the house in 1936 the kitchen was located on the basement floor, at courtyard level (*Arquivo do Licenciamento das Aguas do Porto* – nº2889, 1936).

[32] There are many requests for the addition of sanitary installations mentioned in the indexes for building work requests, referring to the documents included in the *Plantas de Casas* books at the *Arquivo Histórico da Câmara Municipal do Porto*. In late 19th century, they are already frequently included in original building plans.

FLOOR PLANS OF HOUSES IN LISBON AND OPORTO

LISBON | BAIXA POMBALINA
1st floor plans | by Jorge Mascarenhas (1996), redrawn

OPORTO | LATE 18th – EARLY 19th CENTURY EXPANSION
Floor plans | by Francisco B. Fernandes (1996), redrawn
Rua da Alegria 97
Rua do Doutor Alves da Veiga 104 – (120)
Rua do Breiner 143
Rua da Picaria 80 – 84
Rua do Pinheiro 71 – 75
Rua do Rosário 223

COMPARATIVE CHART OF HOUSES IN LISBON AND OPORTO

LISBON

BAIXA POMBALINA

Fist floor plans of blocks of flats

Drawings

MASCARENHAS, 1996;

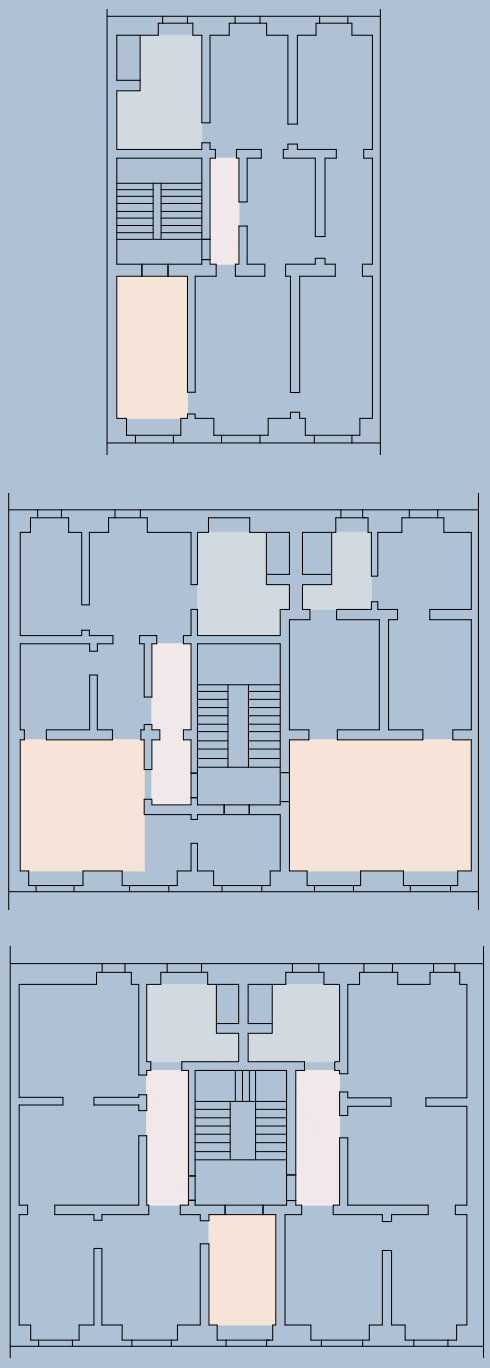
WALL GAGO, 2007;

Development of the Baixa plan, 1756-1758

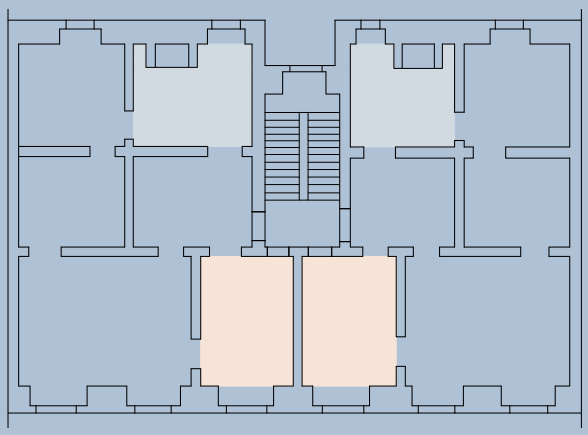
(IGP-0354 | TOSTÕES, ROSSA, 2009: CD)

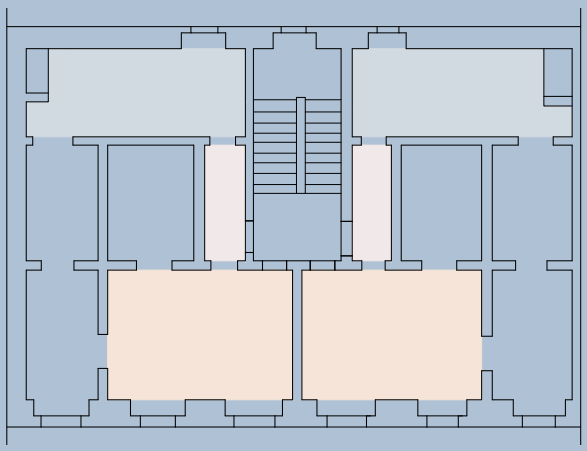
Elevation for the Baixa, 1756-1758

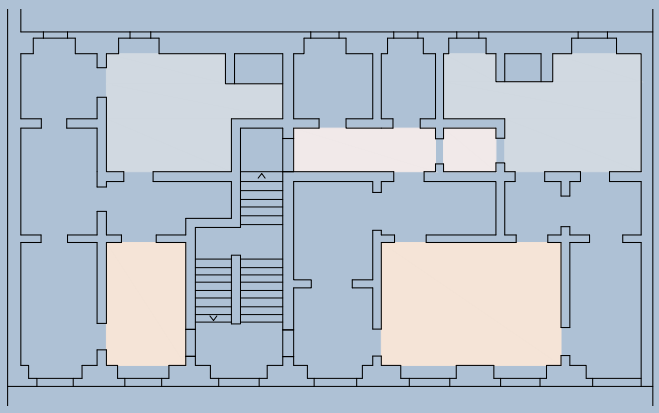
(TOSTÕES, ROSSA, 2009: CD)



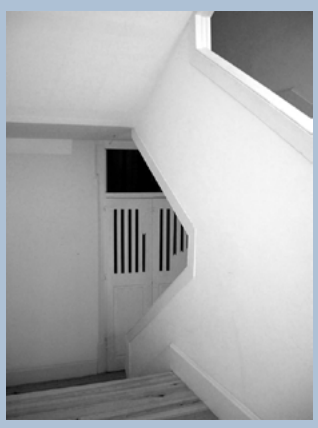
First floor plans 1:200







Praça D. Pedro V
(AFP | TOSTÕES, ROSSA, 2009: CD)



Staircase in Cç. Correio Velho 1-3
(photo | Maria Helena Barreiros)

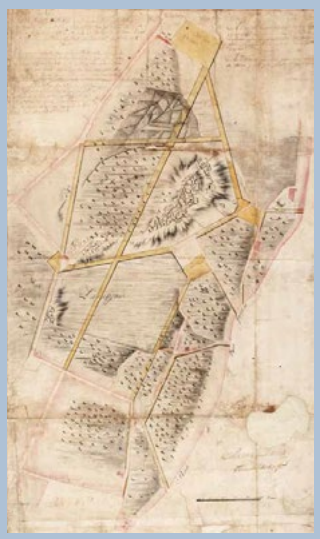
OPORTO

LATE 18TH - EARLY 19TH CENTURY EXPANSION STREETS

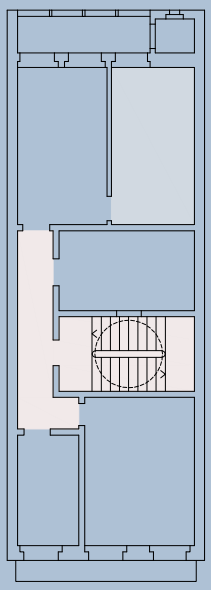
Single-family terraced houses, usually with a commercial area on the ground floor

Drawings

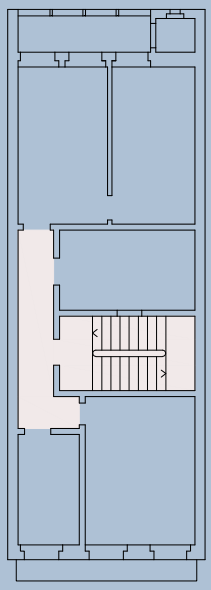
FERNANDES, 1996: 156-157;



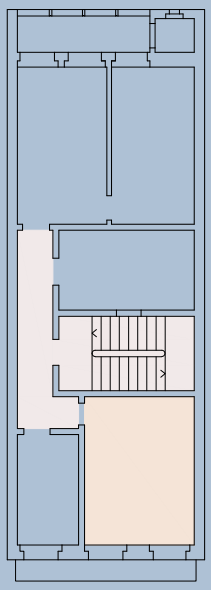
Planta do sitio dos laranjaes, 1794
(Miranda | AHMP)



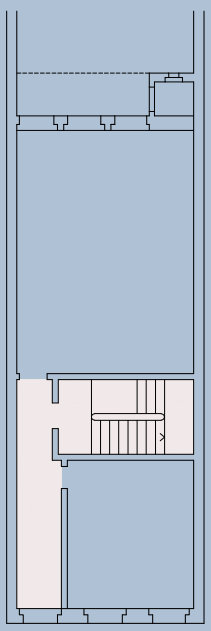
3rd floor 1:200



2nd floor

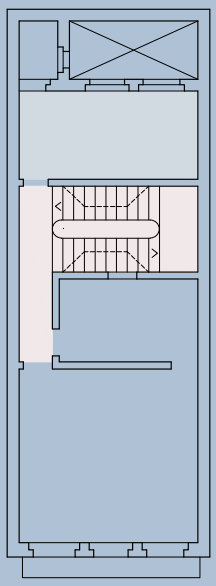


1st floor

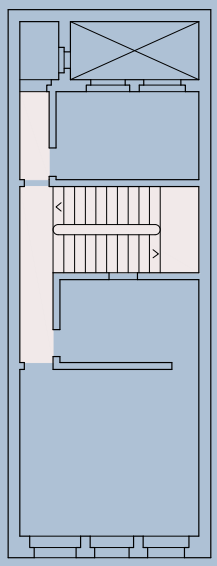


Ground floor

Service areas
Social areas
Circulation areas

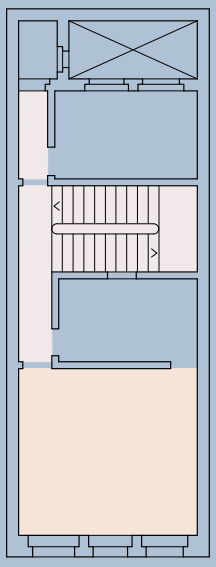


3rd floor 1:200

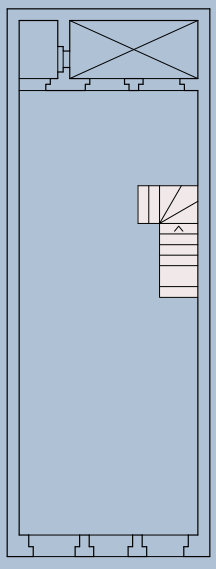


2nd floor

Rua de Cedofeita, 1961
(photo | Teófilo Rego)
(AHMP | FP CMP 10 257 77)



1st floor



Ground floor

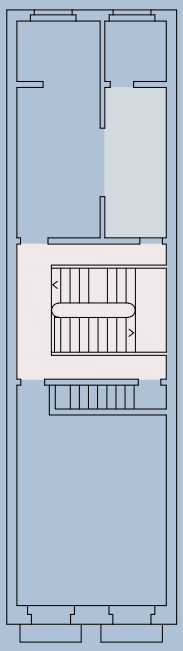
Rua dos Clérigos, 1958
(photo | Teófilo Rego)
(AHMP | FP CMP 12 75 36)

LATE 18TH - EARLY 19TH CENTURY EXPANSION STREETS

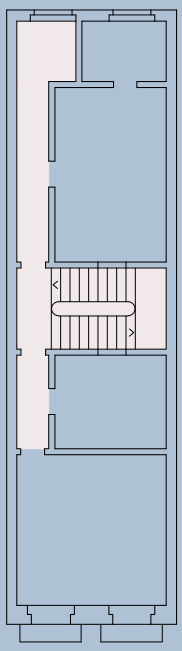
Single-family terraced houses, usually with a commercial area on the ground floor

Drawings

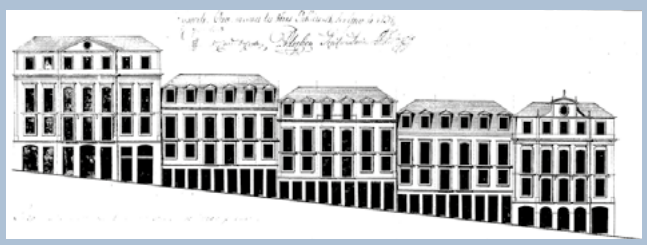
FERNANDES, 1996: 158; 185;



2nd floor 1:200

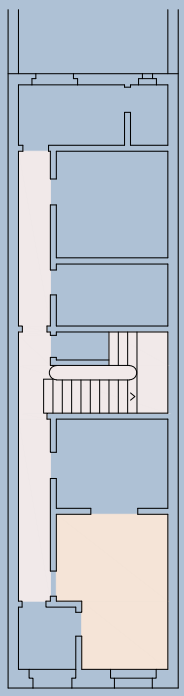


1st floor



Prospecto da Rua nova de S. Antonio, 1794

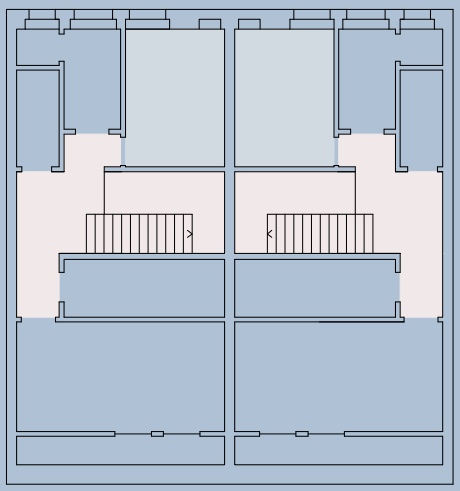
(Miranda | AHMP)



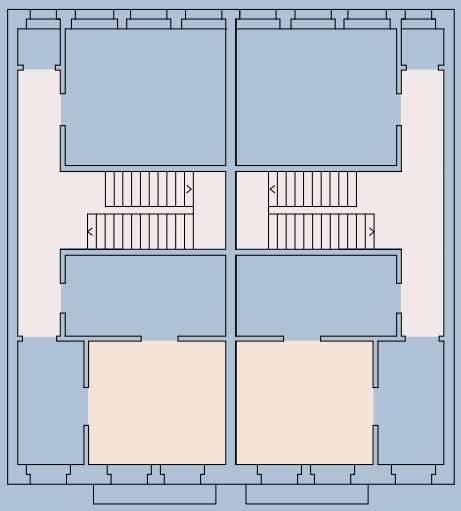
Ground floor

Service areas
Social areas
Circulation areas

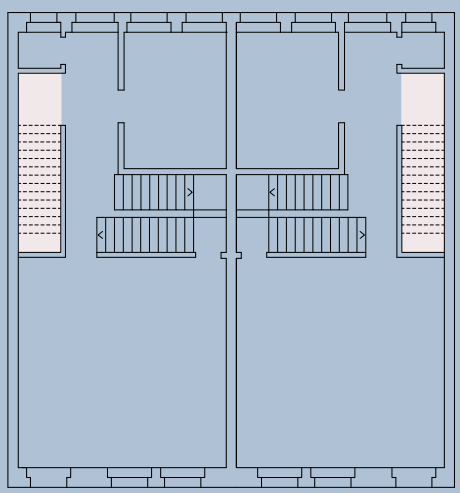
0 1 5



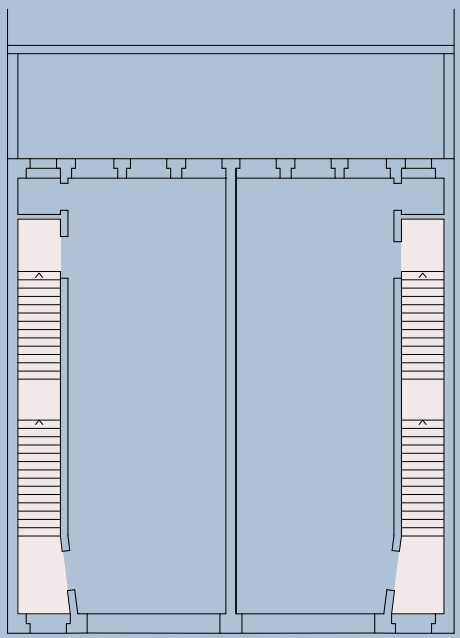
3rd floor 1:200



2nd floor



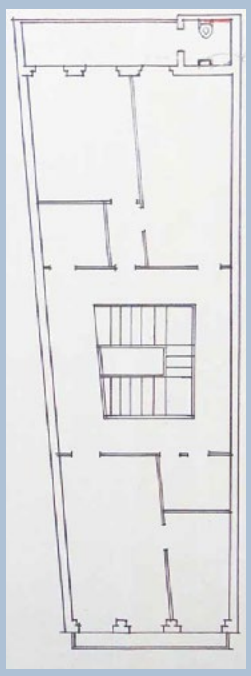
1st floor



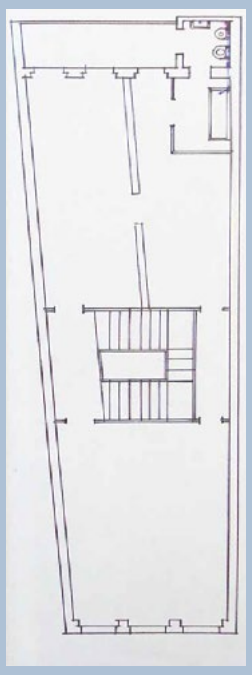
Ground floor

RUA DA ALEGRIA 97
Single-family terraced house
Commercial area on ground floor

Drawings
Arquivo do Licenciamento das
Aguas do Porto:
n° 2889 – 1936

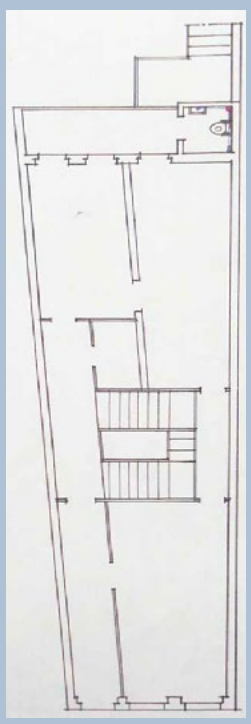


2nd floor 1:200

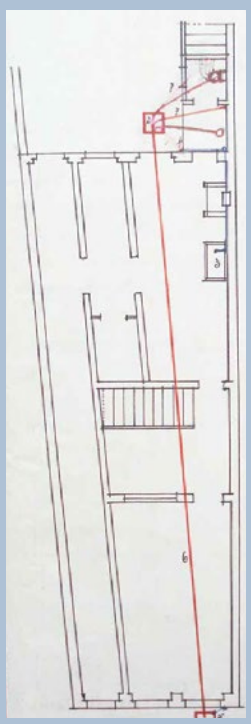


1st floor

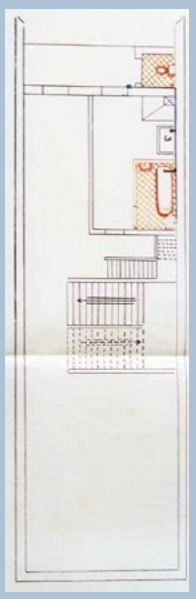
Rua da Alegria 97
(photos | Catarina Wall Gago)
(renovation project | arch. João Moura)



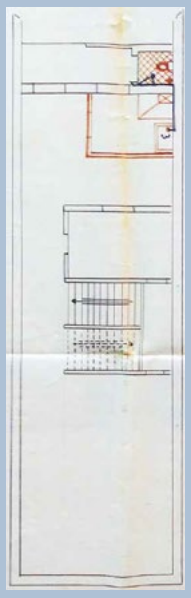
Ground floor



Lower ground floor



2nd floor 1:200

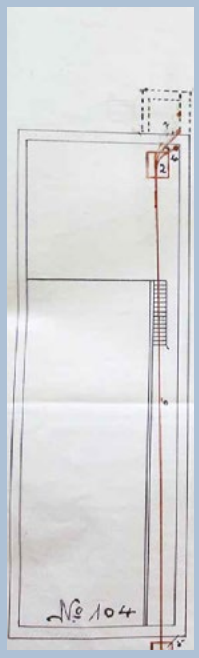


1st floor

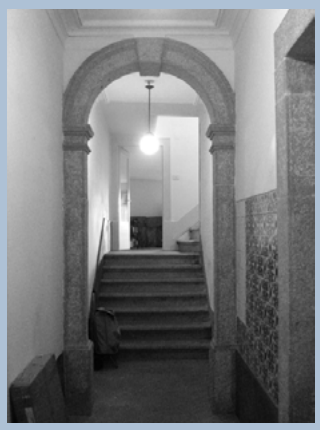
RUA DO DOUTOR ALVES DA VEIGA 104-(120)
Single-family terraced house

Drawings
Arquivo do Licenciamento das Aguas do Porto:
n° 3004 – 1936

Ground floor



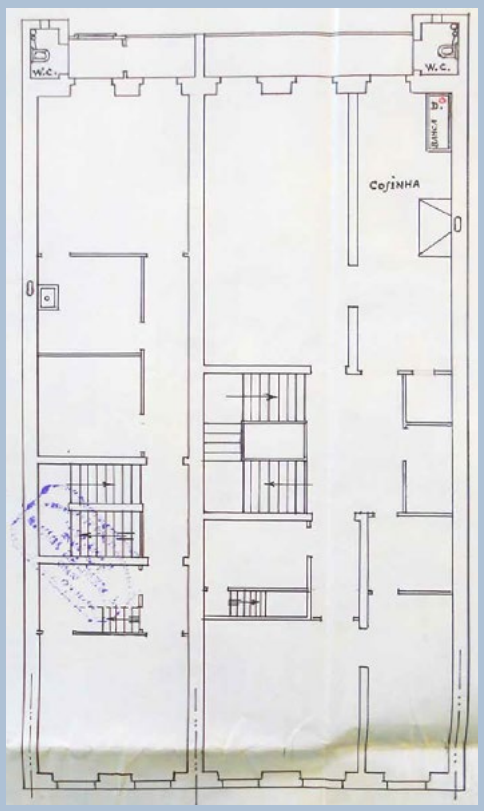
Lower ground floor



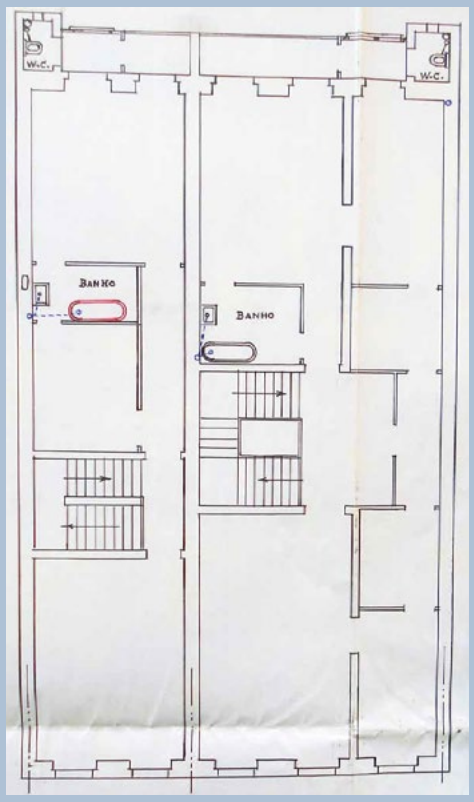
Rua Doutor Alves da Veiga 114
(photos | Catarina Wall Gago)
(renovation | arch. Laurent Scanga)

RUA DO BREINER 143 [73-75]
Single-family terraced house

Drawings
Arquivo do Licenciamento das
Aguas do Porto:
n° 1493 – 1936

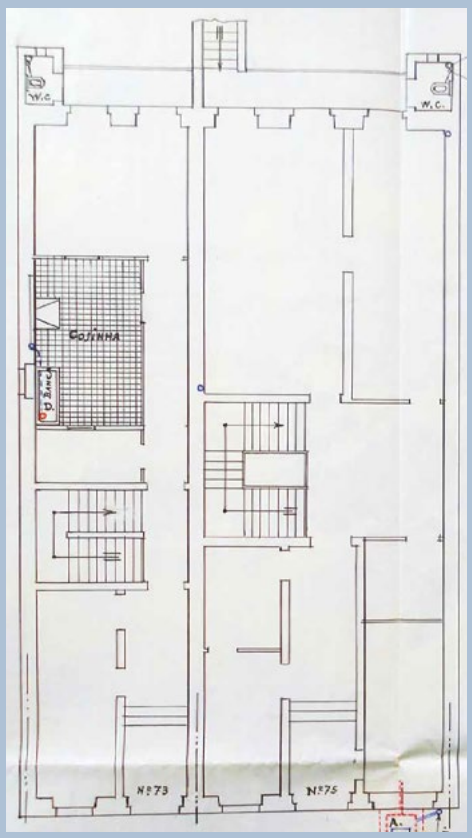


2nd floor 1:200

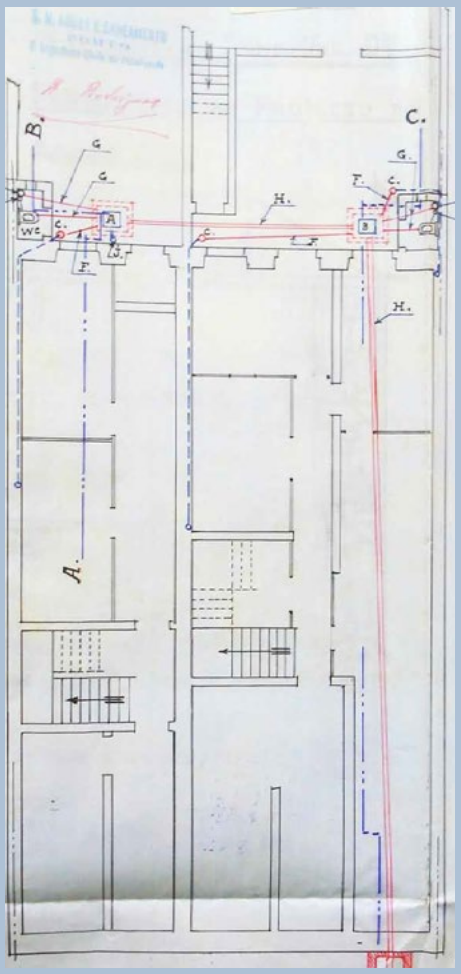


1st floor

0 1 5



Ground floor

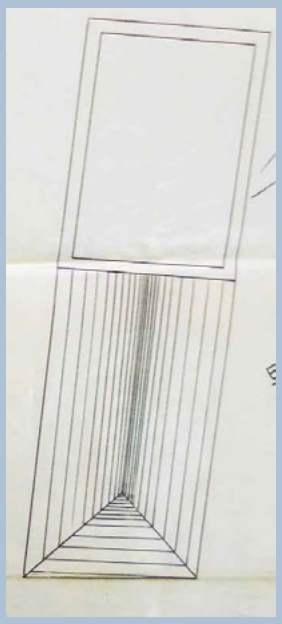


Lower ground floor

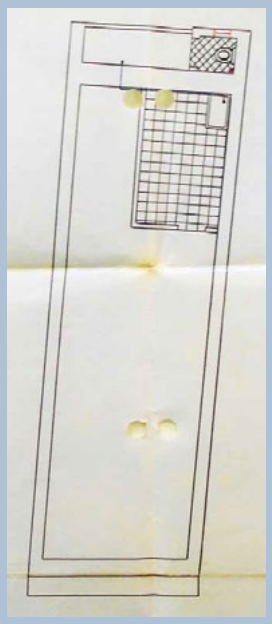
RUA DA PICARIA 80-84
Single-family terraced house
Commercial area on ground floor

Drawings
Arquivo do Licenciamento das
Aguas do Porto:
n° 3257 – 1936

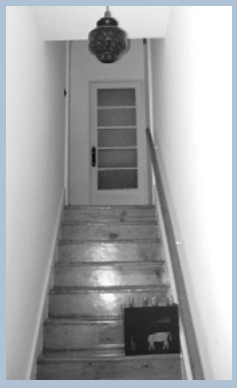
Rua da Picaria 80-84
(photos | Catarina Wall Gago)
(renovation | arch. Cristiano Bartolini)

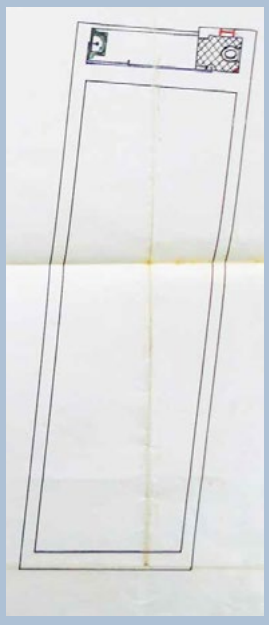


Attic 1:200

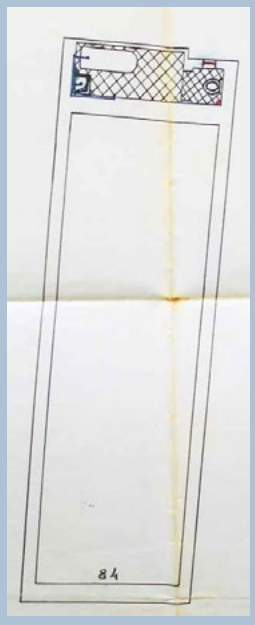


2nd floor 1:200

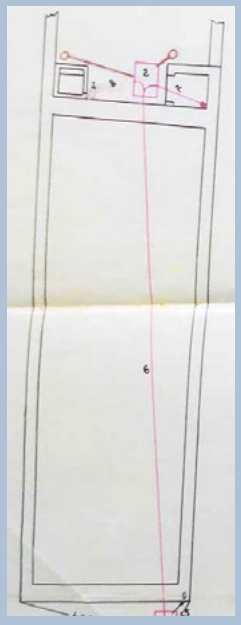




1st floor



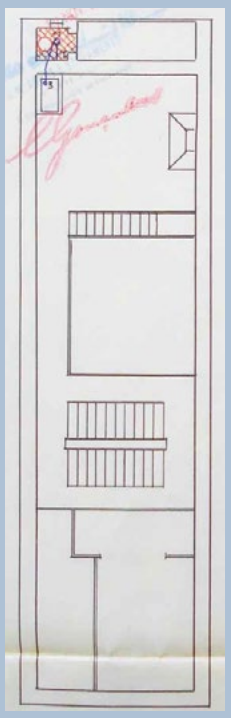
Ground floor



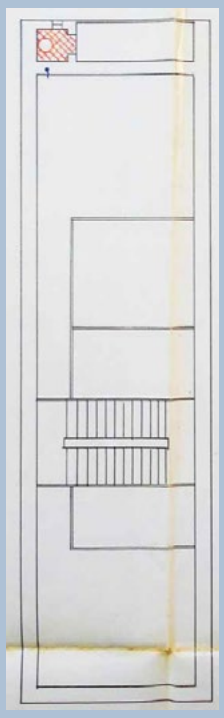
Lower ground floor

0 1 5

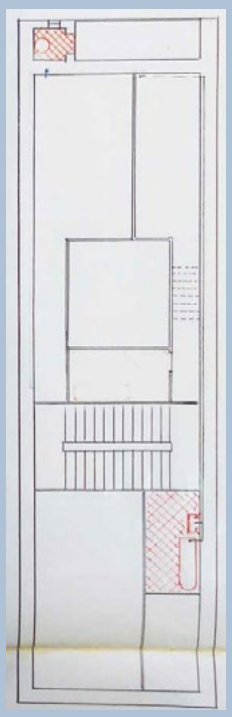
Attic 1:200

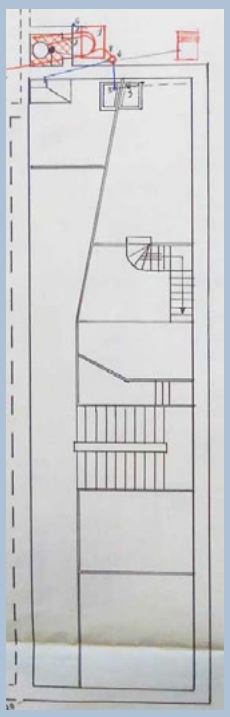


3rd floor



2nd floor

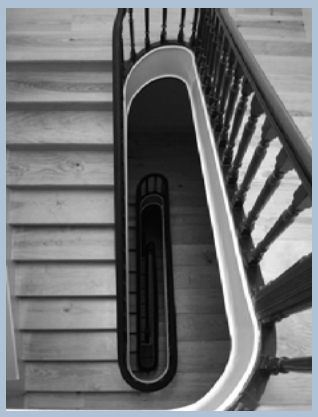




1st floor
Ground floor

RUA DO PINHEIRO 71-75
Single-family terraced house
Commercial area on ground floor

Drawings
Arquivo do Licenciamento das Aguas do Porto:
n° 4001 – 1936

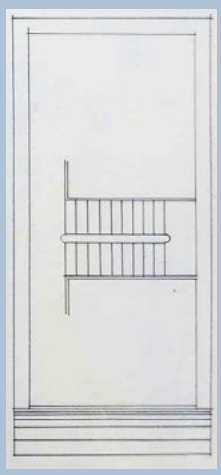


Rua do Pinheiro 71-75
(photos | Catarina Wall Gago)
(renovation | arch. Bernardo Amaral)

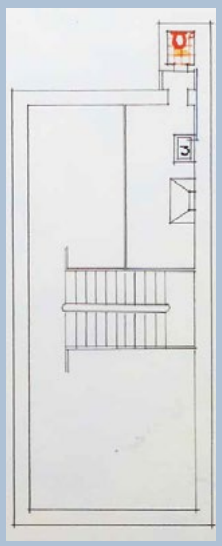
RUA DO ROSARIO 223
Single-family terraced house
Commercial area on ground floor

Drawings
Arquivo do Licenciamento das
Aguas do Porto:
n° 3598 – 1936

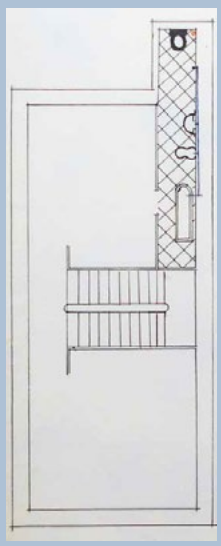
Rua do Rosário 223
(photo façade | Paula Ribas)
(photo chimney | Catarina Wall Gago)



3rd floor 1:200



2nd floor



1st floor

Ground floor

0 1 5

COMPARATIVE CHART OF HOUSES IN LISBON AND IN OPORTO

PARAMETERS	OPORTO	LISBON
Function	Commercial/storage on ground floor and single-family housing on the upper floors	Commercial on ground floor and multifamily housing on the upper floors
Number of floors	3, 4 or 5 floors	4, 5 or 6 floors plus a residential attic floor
Flat width	5 to 7 m, with 2 to 3 windows per plot	Average of 3 to 5 windows per flat; minimum of 2 windows per flat
Building and plot depth	Approximately building depth of 12 or 22 m; variable courtyard depth	According to the type of block: blocks of NS direction aprx. 11 to 13 m; blocks of EW direction aprx. 14 to 16 m; blocks located near the *Rossio* and *Praça da Figueira* aprx. 18 to 22 m
Number of lines of rooms parallel to the façades	In the examined plans: 4 lines of rooms in buildings that are less deep; 5 or 6 in deeper buildings (reception room next to street on the first floor, kitchen next to courtyard on the top floor)	Usually 3 lines of rooms parallel to the façades (social, intermediate/alcoves and service); there could be as little as 2 to and as many as 5 lines of rooms
Staircase location	Central transverse staircase with a skylight	Next to the back façade or in a central position; less often located next to the street façade
Number of entrances per flat	1 entrance, usually independent from commercial spaces	Usually 2 entrances, but 1 entrance was also quite frequent; occasionally there were 3 or 4 entrances
Entrance space	Hall or corridor	Usually a hall and a reception room, or just hall when there is 1 entrance per flat
Internal distribution	Generally via mediating spaces/corridors, with the exception of the toilet (necessary to pass through other rooms to access it)	Generally small entrance passage, and then most rooms were intercommunicating
Number of rooms	In the examined plans between 6 and 19 rooms	Average of 6 to 7 rooms but there could be 8, 9, or more
Kitchen location	On top floor next to courtyard façade	Next to courtyard façade
Toilet location	Systematic addition of toilets next to the courtyard façade on all floors	Wastewater sink in the kitchen; frequent addition of toilets next to the courtyard façade
Bedroom location	Inner rooms next to the staircase, others not specified	Inner rooms in the centre of the flats, others not specified
Location of reception room or living room(s)	Reception room next to the street façade on the first floor	Reception room (or office) with independent access next to street façade; Larger living room also next to the street façade

Geneva's Vauban-like fortifications ☒ were demolished following the 1849 decree ☒ (Conseil d'État 1850), leading to the building of a large city expansion area on both riverbanks around the old centre, the so-called *Ring* or *Ceinture Fazyste* ☒. Building lasted for over half a century. Regulations were precise as to building elements concerning public space as well as to construction quality, yet flexible regarding façade style and plan layout. General building regulations[1] specified plot sale conditions, building quality standards and, mainly, public space directives, such as the implementation of general maximum height values. Furthermore, individual plot sale ☒ regulations often enforced different maximum and minimum height values that differentiated between city areas or favoured certain types of urban spaces such as important squares or riverside buildings vs. inner neighbourhoods. These regulations contributed to the formation of a perimeter of homogenous appearance with some variations.

Within the *Ceinture Fazyste,* housing accounted for the vast majority of buildings. Location within this expansion perimeter was, in some cases, an important factor in determining whether this function was exclusive or combined with shops or offices within the same building, as well as building features determined by socioeconomic status (for instance, the number and type of rooms, and the presence of library and smoking rooms, fireplaces, and outside spaces). Time of building was also an essential factor, as it reflects changing habits and building regulations regarding hygiene, airing and natural light.

In the following chapter we analyse the original characteristics of 176 buildings allocated to housing within or right next to the *Ceinture Fazyste* perimeter using variables relating to urban context, building organisation and above all to housing unit layout. We suggest a typological classification based on the number of housing units per building, distinguishing between 3 building types: blocks of flats ☞ with 2 to 4 flats per floor, buildings with 1 flat per floor[2] ☞, or single-family houses ☞. We also identified 2 sub-types based on the building's functional use: 1 flat per floor buildings with a terrace orientation ☞, and buildings with a functional separation between housing and offices ☞.

The analysis of housing plans was carried out under four main headings – distribution, function, location, and communication between rooms – including several variables for each ☞. The aim was to contribute to a better understanding of a fundamental part of Geneva's current patrimony and of its domestic life, thus providing essential material for future renovation projects. Moreover, this study also

contributes to a more grounded analysis of the changes to domestic space in the renovation projects that will be examined in the forthcoming chapters.

Building chronology of urban and housing types

The planned *Ceinture Fazyste* building perimeter ☒ extends to Geneva's two riverbanks around the medieval city centre. The largest built-up area is on the south riverbank, where most analysed buildings are also located (80,68 %). We collected a large number of house plans ranging from as early as 1853, and up to 1912. Nevertheless, most of the collected plans refer to housing built at two particular times, around 1870-1879 and 1890-1899, which correspond respectively to 32,39 % and 32,39 % of all analysed buildings. According to historian David Ripoll's cross-analysis table ☒ of dates and number of building permissions[3] in this area, these are, in fact, approximately the two main building periods within this perimeter. As the parcels were generally put up for sale by public tender, worse financial circumstances (purchasing power) possibly influenced the pace of construction. Moreover, several houses in the perimeter were built and waiting to be purchased or rented, which would account for a reduction of the building pace (Gueissaz 2004: 48; Perroux 2009: 198; Eggimann 1989: 196). Nevertheless, it should be noted that the presentation of floor plans when applying for building permission only became mandatory in 1895 (Conseil d'État 1895), which probably contributed to there being a significant number of floor plans from this time in the archives.

Within the *Ceinture Fazyste* perimeter, we identified four main urban types that, generally, allowed for a decreasing density: blocks with a central courtyard[4] ☒, blocks that were open on one side ☒, blocks in a slab formation ☒ and isolated buildings ☒. Most analysed buildings were part of blocks with a central courtyard (46,59 %), which allowed for a higher density, or were otherwise included in slab blocks (39,20 %). There were also those that formed blocks with a courtyard open on one side (12,50 %) and, very rarely, buildings that were isolated[5] (1,70 %).

We have identified three main types of residential buildings based on the number of flats per floor and two sub-types that reflect specific functional differences. The first type, the block of flats ☞ – with 2 to 4 flats per floor – existed in all city areas and was by far the most common (57,39 % of all analysed buildings). There was also a significant number of buildings belonging to the second type, with one flat per floor ☞ (30,68 %) and, finally, some included in the third type, single family houses ☞ (11,93 %). As far as we can tell from the 11 examples examined (only 6,25 % of collected building plans) dating from the first building decade (1850-1859), blocks of flats may represent most of the building investment in the *Ceinture Fazyste* at this time. Most of the identified blocks with the highest number of floors were built during this period (mostly 6 floors, but also 7). As we observed during the examination of plot sale decrees, sales during this first period were mainly directed at the most representative places for city image (river banks ☞ and main squares), where buildings were allowed to exceed the general cornice height and, in some cases, also the number of floors[6].

Even though the percentage of blocks of flats was still significant during the following period (1860 to 1869), most of the buildings were those containing one flat per floor (65,22 %). 68,52 % of all analysed buildings of this type were built before 1879 (the second major building phase, from 1890-1899, only accounted for 15,79 % of all buildings of this type). During the first main building phase, from 1870-1879, blocks of flats were again the main housing type (47,37 %), only to decrease again as the construction pace slowed between 1880-1889 (40 % 1 flat per floor, 33,33 % blocks of flats, 26,67 % single family houses). As building picked up again during the 1890s, blocks of flats seem again to have taken over the market (71,93 %). The interpretation of these conclusions, which are based on the analysis of 176 buildings, should be carefully addressed. Two explanations seem possible. The first, that during years of less favourable economic circumstances, building for the wealthy did not slow down as much as more ordinary housing such as blocks of flats, thus accounting for a larger proportion of the total housing stock. The second could be linked to our research method. As the requirement to submit housing plans to the authorities only became mandatory in 1895 (Conseil d'État 1895), the submission of plans for blocks of flats during periods of less construction activity might have diminished, without this necessarily having implications for the actual building situation.

Urban types: *de l'îlot à la barre*[7]

Buildings in blocks with a central courtyard ⊠ were the most representative of housing within this perimeter. These buildings had a main street façade and another secondary courtyard façade (92,68 % of buildings in blocks). In rare cases, a terrace was also present (4 examples, 4,88 % of buildings in blocks), such as the 3-building *Plainpalais* set on *Rue Saint-Ours* 2, 4, 6 ⊠. In this one-of-a-kind example, the elevated ground floor flats (1st floor in one case) had terraces that gave onto the closed courtyard.

Buildings in blocks with a central courtyard were mostly blocks of flats (76,83 %) or otherwise of 1 flat per floor (23,17 %), but never single-family houses. This corresponded to buildings with generally mixed functions, with shops on the ground floor and housing on the others (51,52 % of buildings in blocks). In some cases, elevated housing also occupied the ground floor (23,17 %). The number of floors ranged from 3 to 7 but, most commonly, it was 5 (59,76 %) or 6 (24,39 %), following the maximum limits imposed by building regulations for most areas[8].

Blocks in a slab formation ⊠ were the most far ranging and adaptable urban type as far as location, housing type and number of floors are concerned, even though they allowed for a lower density than other urban types. In fact, density issues could explain the predominance of the block with a central courtyard type throughout the perimeter and why slab blocks were often used, allowing for a somewhat public/private circulation between them. Nevertheless, or buildings in slab blocks were almost as common as the ones in blocks with a central courtyard (39,20 %). Even though the main housing type within slab blocks was still

the block of flats (39,13 %), mostly giving onto a street and a side street, there were also quite a few buildings with one flat per floor (33,33 %) and single-family houses (27,54 %). The latter, and part of the one flat per floor buildings, account for the high number of buildings with terraces that was part of this urban type (42,03 %). Ground floors were mainly residential (56,52 %), or were otherwise occupied with shops (24,64 %). This adaptability to several housing types also explains the high range in number of floors, from 2 to 7. There was almost an equal number of buildings in slab blocks with 3 (24,64 %), 4 or 5 floors (26,09 % both) due to the decreasing number of floors from the block of flats (mainly 5-6 floors), to buildings with 1 flat per floor (mainly 4-5 floors) and to single-family houses (mainly 2-3 floors). It is also important to note that even though single-family houses represented only 27,54 % of buildings included in slab blocks, this number accounts for nearly all (90,48 %) of the analysed single-family houses. Hence, it is the single-family house that was, in fact, quite stable in its presentation, as we shall see below.

The open block ☒ represents only 12,50 % of all analysed buildings. It existed in 4 city areas (*Tranchées, Saint-Gervais, Rive and Plainpalais*) and was not a dominant urban type in any of them (respectively, 33,33 %, 20 %, 4,00 % and 4,35 % of all buildings in each of these areas). Both in morphology and in relation to the housing type, location and height variables, it was generally in between the block with a central courtyard and the block in a slab formation. As such, most buildings in open blocks were blocks of flats (50 %) and had a street-courtyard orientation (86,36 %), but some had terraces (13,64 %) unlike buildings within blocks, and there was even one single-family house[9]. Buildings with 1 flat per floor were also more frequent than in other urban types (45,45 %). Most buildings were exclusively residential (63,64 % with ground floor housing, 22.73 % with shops). The main number of floors was around 4 (54,55 %) or 5 (31,82 %), that is, slightly lower than in blocks. However, unlike in slab blocks, it was never lower than this number. The open block reveals, therefore, some adaptability to several housing types and a variety of external spaces, which can be courtyards such as the ones in blocks or become private or semi-private gardens for ground-floor use.

Isolated buildings ☒ were very rare within this perimeter, and always had a terrace or garden and an exclusive housing function. We analysed 3 examples[10], 2 buildings with one flat per floor and one single-family house ☒, which were all 3 floors high. If we look at a map of the entire *Ceinture Fazyste* ☒, we can see that isolated buildings only existed in the *Bastions* and *Tranchées* areas ☒.

19th century domestic spaces

Building within the *Ceinture Fazyste* perimeter probably implied a considerable investment in plot purchase ☒ in addition to construction work. Therefore, flats were built to a higher standard, possibly to account for the necessary and expected return on this investment. As we can see, all analysed flats included a kitchen and a toilet

per housing unit (and not a shared toilet on the landing) and there was always a living room (97,22 %), and very often a dining room (84,88 %). Top living standards were set by the rich bourgeois contiguous single-family houses or ground-floor flats with private terraces which, however comfortable they might be, would never equal the large 18th century *hôtels particuliers* in the old city centre, such as the ones in the *Rue des Granges*[11] ⊠. In most cases, the standard within the perimeter was housing for a medium-income bourgeoisie, who had a maid but no bathroom. Exceptionally, smaller flats with 4 or 5 rooms also existed, with plans that were similar to social housing built by housing societies in late 19th century, even though actual living conditions also depended on the actual number of residents[12].
The depiction of French bourgeois 19th century domestic life in *L'architecture de la vie privée* (Eleb-Vidal 1989: 89) through the comparison of architects' treatises (César Daly, Daniel Ramée, Eugène Viollet-le-Duc) is in many ways applicable to the Geneva-based plans. In this work, Monique Eleb-Vidal and Anne Debarre-Blanchard describe the architects' insistence on the separation of private and public areas and, above all, of service rooms, as in the previous century. This portrayal is also similar to Didier Challand's depiction of Lausanne's late 19th century *villas urbaines*[13]:

> Unsurprisingly, the floor plan [...] is organised according to the three poles of bourgeois life, [...] widespread at the end of the 19th century: intimate spaces (bedrooms), of social life (reception areas) and dedicated to service (kitchen and maids' bedrooms). Their separation calls for more or less articulated typological devices according to social standing and available floor area. In modest housing, limits tend to diminish: the maid's bedroom is closer to the family's bedrooms, and when it is no longer present, it is the very distinction between intimate and representation spaces that completely disappears. (Challand 2009: 153)[14]

Eleb-Vidal and Debarre-Blanchard's description emphasises the fact that even though housing is described in treatises first and foremost as a place for the family, "this position [...] remains ambiguous as, in discourse as in plans, it is the house's role of reception that is nevertheless underlined and that guides choices"[15] (Eleb-Vidal 1989: 89). This statement is also applicable to Geneva's *Ceinture Fazyste* housing plans, in which the defining layout element was, generally, the placing of reception areas next to the main façade and within easy access from the hall or antechamber while being (at least) visually distant from service areas. The central social space was usually the living room with a fireplace, which was directly connected in *enfilade* to the dining room ⊠ (73,15 % of all housing units have such a connection), where the stove[16] was most likely located. The living room was usually placed near the façade where social life took place, which could be the street or the terrace façade, according to the type of building. The dining room was most often also placed near the street façade (72,84 % of all housing units)[17], regardless of building date[18]. The importance of the living room was reinforced by placing it in the corner of the buildings ⊠ (77,06 % of housing units): "The angular disposition of the living room ensures its bilateral natural lighting, an advantage that is frequently emphasised by the presence of a bow-window or veranda that constitutes an additional room"[19] (Barbey 1982: 292). This was apparently unlike examples in Lausanne, where the dining-room most often occupied this privileged position (Challand 2009: 153).

In all the houses, intermediate spaces such as a corridor, hall or anteroom gave access to most rooms. Apart from this distribution, half the houses also presented a direct *enfilade* connection between at least 3 rooms (54,32 %), usually in the houses' social area. This was logically more frequent in upper-class housing, and slightly less in blocks of flats (42,92 %, 80,52 % and 80,95 % of housing units in blocks of flats, of 1 flat per floor or single-family houses). In single-family houses and 1 flat per floor buildings, the living-room/dining-room connection was most often combined with an *enfilade* between the living room and a small living room ⊠ (52,38 % of single-family houses and 32,47 % in 1 flat per floor housing units) or between the dining-room and a service room (66,67 % of single-family houses, 23,38 % of 1 flat per floor housing units). In the latter, it was also sometimes possible for a living room (or, less often, a dining-room) to be connected to a bedroom (16,88 % for living rooms and 10,39 % for dining rooms) that, naturally, also had its own independent access, or for there to be a 3-room connection between the dining room, the service room and the kitchen[20]. In the more ordinary housing units pertaining to blocks of flats, the living room – dining room connection was sometimes complemented with an alcove off the living room ⊠ (29,65 % of housing units in blocks of flats). Otherwise, this set could be connected to a bedroom, a small living room or a room having no particular function in the plans.

Alcoves ⊠ were quite frequent within the analysed housing units pertaining to blocks of flats (52,21 % without including the ones marked as maids' bedrooms). They also existed in 31,17 % of housing units included in 1 flat per floor buildings and 23,81 % of single-family houses. The main space alcoves were connected to depended on the housing type. In housing units that were part of blocks of flats, they generally gave onto living rooms ⊠, (29,65 %), onto bedrooms (15,93 %) and, rarely, onto dining rooms (7,96 %). In 1 flat per floor buildings and in single-family houses, where lack of space was less of a problem, they nearly always gave onto bedrooms ⊠ (existing respectively in 15,58 % and 23,81 % of housing units). The frequent use of alcoves giving onto living rooms in medium-sized flats was apparently frequent in late 19th century Lyon, as well as in other southern and eastern French cities (Bertin 2008: 321). According to Dominique Bertin and Nathalie Mathian's study of housing in Lyon, they constituted small private spaces where the bed was placed, thus allowing the adjacent room to be used for other functions while the sleeping area stayed hidden. This was especially true in blocks of flats, where the living room with a bed hidden in the alcove could be used as a bedroom at night time, thus making up for the lack of space.

There was usually at least one bedroom[21] ⊠ per housing unit but, quite often, more than one (63,27 %). The most important bedrooms also generally included fireplaces. Bedrooms almost always gave onto the building façades, whether it was the main street and a secondary one (58,95 % onto the street, 48,46 % onto a courtyard or side street), or the street and the terrace façade in buildings where this space was present. In single-family houses, there was a clear separation between the reception areas, on the ground floor, and the private areas with bedrooms ⊠, that were placed on the first floor (and, in 13 out of 21 cases, also on the second floor ⊠). The possibility of managing this separation generally decreased with the flat's size

and standing. While service and reception rooms clearly defined two separate areas in which all rooms in each one were kept together, bedrooms could be separated within the same flat.

Type 1 – The block of flats ☞ The block of flats was the most common type of housing (57,39 %) in most urban types (blocks with a central courtyard, open blocks, slab blocks) with the exception of isolated buildings, and in most *Ceinture Fazyste* areas except for the *Tranchées* and *Bastions*. In broad terms, we might define it as a building that was part of a block with a central courtyard ☒ (62,38 % of blocks of flats), with a main street façade and a secondary courtyard façade or, otherwise, as a building that was part of a block in a slab formation ☒ (26,73 % of blocks of flats) giving onto two streets. In this case, there could also be a main façade and a secondary one. According to the maximum height most often imposed by regulations, buildings went up to 5 floors (53,47 %), or otherwise 6 (28,71 %), and rarely had less than 4 floors (out of all analysed blocks of flats, only one example had 3 floors), thus maximising building investment. This was also the only housing type that occasionally went up to 7 floors, which was sometimes possible by placing atelier or mansard floors above the cornice[22] ☞. Nearly all blocks of flats had 2 flats per floor ☞ (85,15 %), and rarely more than 3[23] ☞.
The use of the ground floor was variable, most often with shops at street level (58,42 %), or housing placed a few steps above (23,76 %). It is difficult to say if it was a common feature since, in many cases, no detailed plans were available, but caretakers' flats were occasionally shown on ground floor and basement plans (15 ground-floor and 5 basement plans, out of 101 buildings). The use of mansard floors and of attics was also quite difficult to determine due to lack of plans. In the analysed blocks of flats, there was a tendency for mansard floors to be used also as housing flats ☒. Whenever floor plans could be found, mansard floors generally replicate the floors below (with the exception of *Rue de l'Arquebuse* 13-15 and *Rue de l'Athénée* 4 ☒), even if they were possibly still considered less 'noble' due to lower floor height and harder access. Attic plans were even rarer (we found only 9 plans out of 101 buildings, equivalent to 8.91 %). Within these 9 plans, the functions represented were small storage rooms for the flats, drying areas for clothes, and small bedrooms (possibly for maids), or small flats.
Blocks of flats usually had a single staircase (91,09 %) located in the centre of the building (57,43 %) or otherwise near the secondary façade (33,66 %), that is, on the courtyard side or onto the street of lesser importance. Staircase lighting was important: when it was placed near a façade, it was lit through windows; if not, it had glass and metal skylights ☒ that we can see across the Geneva's rooftops. There was quite often only one common entrance to the building for residents (41,58 %)[24], as well as only one entrance to the flats (98,23 %).
In the flats, the number of rooms was usually less than 12 (96,02 %) but was most often around 6 and 9 (79,65 %). The most frequent combination of rooms was: kitchen, living and dining room, one or two bedrooms, a toilet[25], and a maid's bedroom (often placed near the kitchen). These rooms were combined, in approximately half

the examples, with one or two alcoves that gave onto a bedroom, a living room or a dining room[26].
The separation between social and service areas was done by placing, whenever possible, living rooms and dining rooms next to the main street ☒ (in respectively 95,13 % and 78,32 % of housing units in blocks of flats), while kitchens were located next to the courtyard side (53,10 %), and sometimes next to a secondary street in the slab blocks (11,95 %). This layout feature was previously described in Geneva's *Inventaire Suisse d'Architecture 1850-1920*:

> Throughout the 19th century, bourgeois housing tends to join in to the contiguous block of flats with its plans onto two opposing façades, onto the street and the courtyard. Ordinarily, the reception rooms, living and dining room, give onto the front, and the bedrooms and the kitchen onto the back. The current production of housing of this type in Geneva throughout the last decade of the 19th century lead to the production of some stereotypes that differ only in number of rooms and sanitary comfort and household equipment. (Barbey 1982: 292)[27]

However, when flat layout did not allow for it (corner flat, 3 flats per floor, etc.) the kitchen gave onto the main street side ☒ (17,70 %). Unlike housing units in other housing types, some kitchens also gave onto an interior courtyard (27 housing units in blocks of flats, 11,95 %, and only one in 1 flat per floor buildings). As we shall see, even though kitchens giving onto light wells ☒ were not predominant at any building time, they were most representative of flats from the first two building decades (1850-1869). Within the analysed examples, and contrary to the general observation made by Barbey, bedrooms gave onto one side or the other, either onto the courtyard or side street (51,33 %) or onto the street (53,10 %).
There were often no bathrooms within housing units that were part of blocks of flats (22,12 %), and only started to appear from 1891 on[28], when running water and gas distribution were more widespread. After this date, slightly over half these flats still did not have bathrooms, but quite a significant number already did (42,86 % from 1890-1899 and 44,00 % from 1900-1912). It is also interesting to note that many flats had a maid's bedroom or alcove and did not have a bathroom ☒ (56,00 % of flats with a maid's bedroom did not have a bathroom), but that hardly any flats were found where a bathroom existed without an identifiable maid's bedroom[29]. We can deduce from this data that having a bathroom within the flats was less of a priority or considered a greater expense than other types of rooms, at least until the 1890s. Consequently, they existed mainly in homes of the wealthiest families (52,38 % of single-family houses), or in more ordinary housing built at the end of the century.

Type 2 – The block of 1 flat per floor ☞ Observed quite often on the south bank, and not at all on the north, buildings with one flat per floor represent nearly a third of all analysed buildings (30,68 %), and existed in all kinds of block. They were a bit lower than the average for blocks of flats, generally presenting 4 (44,44 %) or 5 floors (37,04 %).
Even though the ground floor sometimes had shops (22,22 %), in most cases it was a flat (55,56 %) elevated in relation to the street ☒. Ground floor flats could

sometimes be particularly important and present a similar configuration to the comfort and functional separation of single-family homes. This was obtained by placing the social areas and bedrooms on the ground floor and the service areas (coal and wood storage, and the kitchen) in the basement ☞ (25,93 %, 14 out of 54 buildings), connecting them by means of a separate service staircase[30]. In the few other basement plans we were able to analyse, first basements with small windows onto the street included storage areas, laundry rooms, and sometimes a small caretaker's flat[31] ☒.

Available mansard and, especially, attic floor plans are, again, very sparse. As in blocks of flats, there was a non-confirmed tendency for mansard floors to be residential flats (33,33 %, 18 buildings). Other mansard floor functions mentioned in plans of only 3 buildings are the same as the ones we observed in the 10 attic floor plans we were able to analyse: a combination of storage, clothes' drying rooms, and maids' bedrooms.

One flat per floor buildings gave mainly onto a main street and a courtyard (51,85 %), but also onto a main street and a secondary one (20,37 %), or onto a street and a terrace (25,92 %). When the buildings gave onto a street and a courtyard or onto a secondary street, the flats' general functional scheme was the same as in the blocks of flats. The social rooms were most often placed next to the main street façade (62,34 % of living rooms and 59,74 % of dining rooms) and, whenever possible, the kitchen and the staircase on the opposite side (42,86 % onto the courtyard, 12,99 % onto a side street).

Unlike blocks of flats, about half the housing units in one flat per floor buildings had more than one entrance (48,05 % have 1; 35,06 % have 2; and 14,29 % have 3). Whenever a second entrance was built, the aim was usually to allow for a less visible service access. This was achieved through a second door from the main staircase landing (23,38 %), providing more direct access to the service areas or, occasionally, from the service staircase landing or from common basement in the case of ground floor flats (9,09 %, 7 housing units)[32]. Often there were no service staircases to all floors in *Ceinture Fazyste* buildings. They were only observed in 1 flat per floor buildings ☒ (10 out of 54 buildings, 18,52 %).

Even though some flats had around the same number of rooms as blocks of flats (20,78 % with 6 to 9 rooms), most of them had more, that is, around 10 to 17 rooms (66,23 %). There were also some extraordinary examples, such as a flat with 21 rooms (*Promenade du Pin* 1 ☒) and two with more than 26 (*Rue de l'Athénée* 6-8). In the more common 10 to 17 room flats ☒, key rooms that existed in blocks of flats were kept: kitchen, toilet, living room, dining room, and a maid's bedroom generally placed near the kitchen[33]. However, there were usually some more bedrooms (between 3 and 5), and slightly less than half the flats presented a small living room (41,56 %) or a service room for meal preparation (44,16 %). These rooms could then be combined with an alcove (31,17 %), a small inner room or a small room next to a light well (27,27 %) (that could serve as an extra maid's bedroom, for instance), a toilet cabinet (19,48 %) or a bathroom (16,88 %).

For most flats, distribution was achieved in two ways: with a corridor and a social enfilade of at least 3 rooms (72,73 %). As in blocks of flats, the living–dining room

connection was generally present (71,43 %) and, logically, could then be additionally connected to two other quite common spaces: from the living room to a small living room (32,47 %), or from the dining room to the service room for meal preparation (23,38 %). That is not to say that other room connections were not also possible, such as from the living or dining room to a bedroom (16,88 %, 10,39 %) (that, naturally, kept an independent access), from the dining room to the small living room (12,99 %), and the kitchen to the service room (16,88 %). A direct connection from the kitchen to a maid's bedroom sometimes existed, but much less often than in blocks of flats[34]. Even though the maid's bedrooms were, just like in the latter, usually located in the service area next to the kitchen, the fact that there was more space possibly allowed for independent access to both rooms through a corridor.
As with blocks of flats, housing units of 1 flat per floor buildings often had no bathrooms (16,88 % of those identifiable). However, unlike in the first case, there were a few examples with bathrooms as early as 1870 (3 housing units from 1870-1879 and 2 more from 1880 to 1889 ☒)[35]. Just as in blocks of flats, there were several flats with a maid's bedroom that did not have a bathroom (out of the housing units with maid's bedrooms, 54,10 % did not have bathrooms, 33 examples out of 61, and 19,67 % did), and only one example where there was a bathroom without an identifiable maid's bedroom.

Subtype 1 – 1 flat per floor terraced housing ☞ In some one flat per floor buildings (14 examples[36], 25,93 %) the ground floor flat had a terrace for its own private use ☒ on one side. The other façades gave onto the street and, occasionally, also onto a courtyard. Whenever the buildings gave onto a terrace, the layout of flats above was also reversed in relation to the street-courtyard orientation, and the main façade became the one onto the terrace ☒ or garden, where the living room was almost invariably located (13 out of the 14 examples). In these examples, the dining room location then varied between the terrace and the street. This particular organisation rarely existed in blocks of flats[37].
Six ground-floor flats[38] fulfil both criteria that give them a particular status: service areas in the basement and a terrace on one side. In these cases, if not earlier, the ground floor flat certainly became the so-called *étage noble*, usually with a higher ceiling than other floors, a status generally attributed to the first floor in other blocks of flats. However, we cannot establish a direct correlation between the existence of a terrace and basement service areas for ground floor flats[39].

Living standards within the perimeter

The location within the expansion perimeter of urban types – block, open block, slab block, isolated building – and, mainly, of housing types – block of flats, block of 1 flat per floor, and single-family houses – is evidence of the different living standards in the primarily residential upper class areas of the *Trachées* and the *Bastions* ☒. In fact, the urban plan and the building analysis of these two contiguous areas reveal

the most obvious socioeconomic differences from the rest of the *Ceinture Fazyste* perimeter. This was not a chance event. In the city hall's *Département des travaux publics'* (1854) report addressed to Geneva's *Conseil d'État,* in which a commission analysed the successive *Ceinture Fazyste* plans and gave further suggestions, it is said that "it would be very convenient to create a special neighbourhood on the *Tranchées* plateau", "that seems mainly destined for well-off families"[40] (DÉPARTEMENT DES TRAVAUX PUBLICS 1854: 9, 14). Building regulations contributed to this distinction by enforcing different public space morphology, lower height limits and even the creation of private outside spaces[41] ☒.

As historian Rolf Pfändler also observed in his *mémoire de licence* on the *Histoire du quartier des Tranchées et des Bastions* (PFÄNDLER 1974), it was in the *Bastions* and *Tranchées* areas that blocks with closed courtyards were practically non-existent, even though they were the most common urban type in all other neighbourhoods[42]. Buildings in these two areas had primarily one façade onto the street and another onto a garden or a terrace (47,92 % of *Tranchées* buildings and 69,23 % of *Bastions* buildings), usually belonging to the ground-floor flat(s) or to single-family house(s), even though a small but significant number also gave onto two streets or onto an open courtyard (in the *Tranchées* area case). It was also only here that single family houses were observed, and quite frequently (representing 35,42 % of *Tranchées* buildings and 30,77 % of *Bastions* buildings). These houses were often contiguous ☒ and perpetuated the tradition of the so-called *hotels particuliers*[43] on a smaller scale, so much so that, in Geneva's INSA volume, Gilles Barbey defined this type as the *hôtel familial* (BARBEY 1982: 292). They coexisted with the most common type of housing in these two areas, residential buildings with one flat per floor ☞ (47,92 % of *Tranchées* buildings and 46,15 % of *Bastions* buildings), that allowed for a denser urban fabric than single-family homes while keeping comfortable living areas of upper-class standards. Buildings in these areas were also generally lower than the 5-floor majority (42,05 % of buildings in all areas), with mainly 3 or 4 floors and never more than 5, as enforced by building regulations. It was also only here that four buildings with only 2 floors were observed. Naturally, these were single-family houses. Outside and semi-outside spaces such as terraces, conservatories ☒ and bow windows were, quite logically, a predominant feature of homes in these two areas (69,23 % of buildings in the *Bastions* and 64,58 % in the *Tranchées*)[44].

Housing units with 12 or more rooms were fairly representative of the *Tranchées* and *Bastions* neighbourhoods (respectively 66,18 % and 63,16 % of housing units in each area), and those with more than 17 rooms only existed in these two areas (21 in the first, 30,88 %, and 6 in the second, 31,58 %). Some housing units with 12 or more rooms also existed – without being representative – in the *Mont-Blanc, Plainpalais, Hollande* and *Rive* areas. In all other areas besides the *Bastions* and the *Tranchées*, buildings generally had between 6 and 11 rooms (mostly 8-10 in the *Mont-Blanc* case and 6-9 in the *Plainpalais* case).

The location of buildings with one flat per floor within the rest of the perimeter is, at first glance, indicative of some difference between the two riverbanks, even if we exclude the *Tranchées* and *Bastions* areas from the analysis, where they

represent respectively 47,92 % and 46,15 % of buildings. In fact, while 24 % to 39,39 % of buildings in other areas of the south riverbank had one flat per floor, all analysed buildings in the north riverbank were blocks of flats[45]. If we consider the number of rooms per housing unit as well, only the *Mont-Blanc* area in the north riverbank had one flat with 12 rooms (the 7 other analysed flats in this *square* ☞ had 8, 10 and 11 rooms). Considering the high-end clientele of this block (Broillet 1997: 130) it would not be surprising to find that these flats had a quite high living standard for their time, since they were amongst the first to be built in this perimeter.

Specific exclusive room functions such as libraries ☒ and smoking rooms were not common in any area and were only observed in some south bank areas (*Bastions*, *Tranchées, Hollande* and, in the smoking-room case, also Plainpalais). Small living rooms were more frequent (18,52 % of all housing units) and existed in a high percentage of housing units in the *Tranchées* (47,06 %) and Bastions (36,84 %) areas. They are also somewhat representative in the *Plainpalais* (18,18 %) and *Hollande* (10,17 %) areas. This is also the case as far as the existence of fireplaces in 3 or more room types is concerned, with a visible presence in *Tranchées* (57,35 %) and Bastions (36,84 %) areas, while also existing in the *Hollande* (18,64 %) *Plainpalais* (12,73 %) areas. In fact, the earliest available drawings[46] depicting central hot air heating systems are of two single-family houses by architect Jacques Elisée Goss in the *Tranchées* area: *Rue Rodolphe Toëpffer 4*, built in 1870, and *Boulevard Helvétique 14bis* ☒, in 1873. The plan drawings show that the stove was placed in the basement. It had a channel for air extraction from the outside, and a chimney taking out the contaminated air. A separate network composed of several air-ducts took the hot air to each room. Nevertheless, the existence of such a system did not imply a reduction of the number of fireplaces, which were still present in most rooms.

Housing units with the least number of rooms, that is, 4 or 5, were generally not frequent (4.01 % of all housing units, 13 examples) and were always included in blocks of flats[47] ☞. They only existed in 4 city areas (*Saint-Gervais, Plainpalais, Entrepôt, Hollande*) without being the majority in any of them. However, even though available data is not extensive on the *Saint-Gervais* area, on the north bank, it could be indicative of some slight differences. Although the majority of housing units were within the 6-11 room average (35 out of 42, 83.33 %), they never went beyond this number, and there were 7 flats with 4-5 rooms (16.67 % of all housing units). Interestingly enough, even though most housing units within the *Plainpalais* area had between 6-9 rooms, there were also, as we have seen, some housing units with more than 12 rooms (5 housing units, 9.09 %), and some with very few (4 housing units, 7.27 %). Flats with only 4 or 5 rooms all had a kitchen and a toilet. When there were only 4 rooms per flat, the two remaining rooms could be assigned to a sleeping area and a living room (or to an unspecified purpose), or otherwise both to sleeping areas. Naturally, there were no specifically maids' bedrooms inside these small homes[48]. In the case of 5 rooms per flat, there was nearly always a living room and one bedroom, while the last room could either serve as an alcove, a maid's bedroom or have an undefined function.

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Type 3 – The single-family house ☞ The 21 analysed single-family houses were all located in the high-end *Tranchées* and *Bastions* ☒ neighbourhoods. They were spacious and mostly contiguous terraced houses located in blocks in a slab formation[49] (90,48 %) that gave, on one side, onto the street and, on the other, onto a private garden or terrace (100 %).
The houses comprised many more rooms than housing units in blocks of flats or in 1 flat per floor buildings. Even though not all floor plans are always available (the top and the basement(s) floor plan are sometimes missing), all houses had at least 14 rooms and, most commonly, over 26 (71,43 %). Whenever all floor plans were available ☞ (11 buildings), we counted between 26 and 33 rooms including all service areas and floors (and the always exceptional example on *Boulevard Helvétique 14bis [drawings of building],* which has more).
Since space was much less limited than in other housing types, single-family houses could keep to a stricter "ideal" separation of service, reception and private areas ☞ that were respectively placed at basement, ground floor and 1st floor level according to a vertical functional distribution scheme. The rooms were distributed over 3 floors (76,19 %) or, otherwise, 2 floors (19,05 %), combined with 1 or 2 basements.
According to Rolf Pfändler[50], contiguous single-family terraced houses with a similar functional distribution had already been tested in early 19th century in the *Rue De-Beaumont* ☞ operation[51]:

> Starting in 1854, the Contamines square, on the even-numbered side of the rue Beaumont, by initiative of Dr. Senn, is planned according to the English model. It constitutes the perfect prototype of what could be built in the Tranchées. Small contiguous single-family houses in continuous bands are separated from the street by a small garden and, on the other side, a garden gives onto the common square. (Pfändler 1974: 32)[52]

Furthermore, the construction of the *Beaux-Arts* neighbourhood[53] ☒ in Neuchâtel, at a slightly later date than the start of the *Ceinture Fazyste* operation, also mixed blocks of flats and contiguous terraced single-family houses. The only floor plans ☒ we were able to find, in an article by Gilles Barbey (1983: 43), generally follows the functional distribution that we shall now describe for the analysed examples in Geneva, even though, unlike in our examples, a service staircase served all floors.
The service areas of *Ceinture Fazyste*'s single-family houses were for the most part hidden away in the basement ☒ (85,71 %, 18/21 houses, the other 3 are not identifiable), usually including the kitchen ☒ as well as coal and wood storage and other storage rooms. In one of the examples there was also a small flat represented in the basement plan, possibly for a caretaker ☒. In only 3 examples were the storage rooms located, as usual, in the basement, but the kitchen placed on the ground floor (*Rue Rodolphe-Toepffer* 4, *Rue Mont-de-Sion* 12, *Boulevard Helvétique* 14bis[54]). The separation of service areas from the other household spaces was also achieved by having, apart from the main staircase, a second access to the kitchen (90,48 %), either directly from the street to the basement or through a passage from the hall, just after the main street entrance. There was also a second staircase for service

purposes ☒ between the basement and the ground floor in some examples (9 out of 21 houses, 42,86 %). Just over half the houses also had a direct access from the street to the terrace.

The main reception areas of the single-family houses were located on the elevated ground floor ☒. From the street entrance, a few steps lead visitors to a central hall next to the main staircase, generally placed centrally next to the party wall[55]. The living room was always straight ahead, on the terrace side, sometimes connected to the dining room or to a small living room[56], which could be placed on either side. A service room for meal preparation before serving was either placed next to the dining room, next to the kitchen in the basement, or even in both places (it existed in 18 examples, 85,71 %). Libraries, smoking rooms and offices were also occasionally included in the social area of the most spacious houses.

There was quite a strict separation between the reception and private areas of the houses, and bedrooms or alcoves[57] were never located on the ground floor. Private life rather took place above, on the first floor ☒, with bedrooms giving onto both façades and, in slightly over half the cases, with a bathroom (11 examples, 52,38 %) or a toilet cabinet. Moreover, in over half the examples a bathroom or a toilet cabinet was accessible both through the corridor and through a bedroom (12 examples, 57,14 %). A quite exceptional example – *Rue Munier-Romilly* 8 – had three bathrooms on the first floor ☒ giving onto bedrooms and corridors.

However, in these single-family houses, some rooms more commonly associated with social functions could occasionally be placed on the 1st floor next to the bedrooms, probably either for family use or to create another privacy layer to which guests were admitted according to their degree of proximity to the family (5 observed examples), as in the case of the *petit salon* (small living room) placed next to the bedrooms in *Boulevard Helvétique* 14bis ☒ or *Rue Jean-Senebier* 10. Quite an interesting trio of connecting rooms could be found on *Rue Bellot* 8's 1st floor ☒ next to the terrace façade: in the centre, *chambre de Monsieur*; to one side, the smoking room; to the other, *chambre de Madame*. The connection between two bedrooms was also quite common in all single-family house examples (18 examples, 85,71 %).

The 2nd floor ☒ – with a mansard or, otherwise, a pitched attic roof – was generally the place where maids' rooms and a few extra bedrooms were placed (11 out of 12 existing plans). In 4 examples, there is also the indication of a small side room for linen storage. In Leila El-Wakil's article on the *Rue Munier-Romilly 8* house ☒, this floor is described as such: "The mansard floor housed other bedrooms partially intended for the staff, partially intended for passing guests"[58] (El-Wakil 1998: 34). Access to this floor was either via the main staircase or, sometimes, via a separate smaller one between the 1st and the 2nd floors (7 examples).

Location and building function

Location within the perimeter was also an important factor as to building function. Within the perimeter, the buildings we have analysed were exclusively residential,

or else this function was combined with shops (on the ground floor) or offices (on one or more floors). Exclusive housing function on all floors was predominant in the central areas of the south river bank, the *Tranchées* (91,67 %), *Bastions* (76,92 %) ⊠ and *Plainpalais* (60,87 %) areas[59] ⊠. Housing privacy vis-à-vis the public space was important, and flats on the ground floor were always elevated in relation to the street. In rare cases (4,55 %, 8 buildings[60]), there were also flats at basement level (designated as a lower ground floor, with small windows onto the street). This solution allowed for a few more flats per building while keeping the maximum permitted building height. In the western area of the north riverbank, *Saint-Gervais*, housing on the ground floor also played a role (20 % of buildings in this area, while 65 % are dedicated to shops). In riverside areas of the south bank (*Rive*, *Hollande*) and in all areas of the north bank, most buildings analysed were of mixed use, with shops on the ground floor and housing on the top floors.
The riverside *Hollande* area ⊠, on the west side of the south riverbank ⊠, seems to have quite a specific character. Even though the ground floor was mostly dedicated to shops (51,52 %), there were also a few buildings with offices (7 buildings with offices, 21,21 %, and 2 with shops and offices, 6,06 %). As we shall see, even though we only examined plans of 9 buildings in this situation, these are significant on account of the complete lack of observed similar examples in other areas.

Subtype 2 – Office-residential buildings ☞ There was a particular kind of *Ceinture Fazyste* building that differed from the rest because of a functional bipartition between offices and housing. We identified only 9 buildings in this situation, 5 with 1 flat per floor ☞ and 4 that were blocks of flats[61] ☞. These examples are nevertheless interesting to observe, as they are all located in the *Hollande* ⊠ area. This area has been described by some authors as being specifically allocated to the office function, especially in banking (Beerli 1985: 60). In these 3 to 5-floor examples, offices occupied the ground and the 1st floor or just the ground floor. Housing floors above had 1 or 2 flats per floor with 8 to 13 rooms, a number that was within the average for flats in this perimeter. In these examples, the proportion of housing floors was usually higher, but 2 three-floor buildings (*Jean-Petitot* 12 and *Hollande* 10 ☞) only had one housing floor.
Access to both the office and residential floors was often through the same entrance from the street and using the same staircase. However, accesses could be separate, as in the building on Rue *Bovy Lysberg* 5 ☞, which had 2 separate entrances and staircases for the offices and housing floors. On the first floor, residents changed to a third staircase placed centrally, which gave access to two flats per floor.

Domestic spaces throughout time: changing habits and building regulations

Important changes took place in hygiene, ventilation and airing standards throughout the time the *Ceinture Fazyste* buildings were under construction. Some of these changes can be identified in the legislation, even though the four successive

building regulations for the *Ceinture Fazyste* perimeter did not specify detailed health standards for internal areas. Sometimes they prescribed minimal floor heights or limited the number of floors in line with specified buildings heights. They did however guarantee a right to daylight on all free façades as foreseen by the urban plan, that is, that a future building would not be allowed to cover another's windows. Hygiene requirements concerned only ducts for wastewater and rainwater, demanding that they be placed in all buildings and specifying their minimal dimensions[62]. No rules were made as to running water, toilets or bathrooms. The chronological development of regulations gives us an idea of the history of the municipal sewage network in the perimeter. Regulations start out very high in 1850, requiring the connection of all buildings to the municipal sewage system (Conseil d'État 1851: Art.8) and, in 1852, that drainpipes be connected to a rock recipient before the main sewer (Conseil d'État 1853: Art.9). Before the installation of a more efficient sewage systemt[63], a rock recipient was used to separate the liquids, which could go into public sewers, from fecal maters that should be regularly emptied (Duc 2008: 34). However, it is clear that the pace of building work overtook distribution of the network in the *Ceinture Fazyste* perimeter. In fact, the 1854 regulations state that wastewater should be connected to odourless cesspits, which *could be* replaced by a connection to the public sewage system, when this connection existed (Conseil d'État 1854: Art.22). Finally, the 1879 regulations state that odourless cesspits *had to be* connected to the public sewer if, and when, there was one (Conseil d'État 1879: Art.23).

In 1895, the *Loi générale sur les Routes, la Voirie, les Constructions, les Cours d'eau, les Mines et l'Expropriation* (Conseil d'État 1895) decreed new building regulations for the entire canton. It brought in a fundamental change, by making it compulsory to submit an application for permission to the *Département des Travaux Publics* in case of construction or conversion work. This application included not only 1:50 façade drawings but also plans on the same scale, "indicating the conditions for building and distribution of flats, courtyards and stairs, as well as the placement of water basins, reservoirs, smoke and airing channels, and of the wastewater drainage system"[64] (Conseil d'État 1895: Art.78). This law also stipulated that regulations as to specific topics would be issued later, namely on health and hygiene, and on distances to be observed with regard to health and safety. These regulations were only issued in 1899. At this time, most buildings in our perimeter were already completed, even though some were only built at the beginning of the 20th century. However, the regulations not only apply more demanding rules to new buildings, but also impose minimal hygiene conditions on existing ones.

In relation to drainpipes, the 1899 regulations required the mandatory connection of all existing buildings to the public sewer within 2 years of its issuing (Conseil d'État 1899: Art.81), and gave specific instructions as to cesspit placement if the streets were not yet connected to the sewer. Additionally, running water was to be distributed to every kitchen. Only when this connection was not possible were buildings to receive water from a well no further than 10 m away (Conseil d'État 1899:

Art.90,92). Articles that concern toilets stipulate at least 1 toilet (*latrine*) per floor for all buildings, and 2 WCs with running water for buildings of 3 floors or more (Conseil d'État 1899: Art.78). In the examples of *Ceinture Fazyste* houses analysed, there was always one toilet per housing unit, even though it is usually not clear from the plans whether running water was already available. The toilet was a small room, most often ventilated by means of a light well or airshaft of variable size ☒, or giving onto the common staircase ☒ (79,94 % of housing units have one of these 3 types of ventilation).

Water mains started being installed in buildings since 1850, and widespread by the end of the century (Duc 2008: 32). In the few cases where more detailed drawings exist, a water reservoir is sometimes depicted in the attic[65] ☒. This probably indicates the presence of a public water distribution named *à la jauge,* before the introduction of meters, in which each building received a subscribed daily amount of water that was stored in a reservoir placed above the kitchen or toilet (Chatzis 2010: 214). The 1899 regulations mention this system and specify its minimal running conditions (Conseil d'État 1899: Art.91). As far as the number of toilets is concerned, these regulations' demands seem to equal what was already in place within the perimeter, thus reinforcing the idea that living standards in this area were quite good for the time[66].

There were bathrooms ☒ in the *Ceinture Fazyste* homes analysed, but they were not very common (22,84 % of all housing units). However, this figure does not account for two key elements: time of building and socioeconomic status. Within the housing units analysed there are no bathrooms (or they are not identifiable in the plans) until the 1870-1879 building period (6,52 % of housing units during this period, 6 out of 57) and, even then, only in three *Tranchées* single-family houses ☞ and in two 1 flat per floor buildings, one in the *Tranchées*, the other in the *Hollande* area[67]. If we compare housing types, the single-family house is the only one where the percentage of housing units with bathrooms is greater than the percentage of those without:

> At the end of the 19th century, only the more luxurious buildings had bathrooms; the middle-income bourgeoisie of big cities ordered a mobile bath service [...]. Smaller-income bourgeoisie and the numerous subtenants use the public bath establishments or those belonging to private companies. (Fröhlich 1992: 240)[68]

In the *Inventaire Suisse d'Architecture 1850-1920*, Gilles Barbey comes to similar conclusions:

> Sanitary comfort and household equipment vary according to housing categories. While single-family houses built in the *Tranchées* around 1860 already had toilet cabinets, the first rooms with a bathtub do not appear until the end of the 19th century, and in upper-class housing only. It is only after the 1914-1918 war that the usage of bathrooms is generalised. (Barbey 1982: 293)[69]

Within the buildings examined, better access to running water and to simple methods of heating bathwater probably explain the increasing presence of bathrooms over time. According to Duc, Frei and Perroux, heating bathwater inside the home made

simpler with the coal or wood powered water heaters since mid 19th century and, mainly, with the presence of a gas distribution and mains (Duc 2008: 41, 55). The percentage of housing units with bathrooms within each period increased steadily during the building period covered (6,52 % from 1870-1879, 17,24 % from 1880-1889, 44,86 % from 1890-1899, 51,72 % from 1900-1911). From 1890 onwards, they represent around half of all analysed housing units and also start to be found in a fair number of those located in blocks of flats ☒ (42,86 % from 1890-1899 and 44,00 % from 1900-1912).

The 1899 building regulations brought in new requirements concerning lighting and ventilation, which would have a significant impact on house layout. The regulations stated that courtyards next to bedrooms should be at least 4m wide, and that those between different buildings should not be less wide than a third of the highest building's height. Light wells that gave onto kitchens or corridors were to have at least 12 m square. For alcoves, the regulations were much less strict, requiring only that they should be sufficiently ventilated (Conseil d'État 1899: Art.75). Until 1889, between 60,87 % and 85,71 % (according to 9-year span building periods) of all analysed housing units presented alcoves or small interior/light well rooms; after 1890, this number went down to approximately half (46,73 % from 1890 to 1899, 50 out of 107 units). After the 1899 regulations, these rooms existed ☒ in about a third of the fewer examples analysed (31,03 %, 9 out of 29 housing units). These 9 flats were part of 3 contiguous blocks on *Rue De-Candolle 32, 34* and *36* ☞. In nearly all of them alcoves were open enough to become a part of the contiguous room, which would provide sufficient ventilation as far as the regulations were concerned. However, as in the case of maids' bedrooms, even as late as 1901 one flat in the *Rue De-Candolle 36* ☒ building had a more closed off alcove, and another had a small bedroom giving only onto a small airshaft (a bed is represented in this room, so it was probably considered a maid's bedroom).

Keeping service away from the public eye: kitchens and maids' bedrooms

Domestic spaces of all *Ceinture Fazyste* housing types always included a kitchen ☒, which was placed as often as possible within visual distance of social areas, as was the case in 19th century houses across several European countries. In Geneva, this result was most often achieved by placing these spaces on opposite façades ☒, for instance, with the living room on the street side and the kitchen on the courtyard side, or the living room on the terrace side and the kitchen on the street side. For ground-floor flats in 1 flat per floor buildings or for single-family houses, these spaces were often placed on different floors, with the kitchen in the basement ☞. Furthermore, this distance could be reinforced by creating a separate service entrance or access[70].

Kitchens giving onto light wells ☒, thus completely hidden from the public eye, were not a main feature of the *Ceinture Fazyste* buildings (28 housing units, 8,64 % of all

housing units), and neither were bedrooms that gave onto this space (11 housing units, 3,40 %). Nevertheless, kitchens onto light wells do represent a high percentage (even if not the majority) of buildings during the first decade of construction (33,33 % of housing units from 1859-59, and 28,26 % from 1860-1869). Bedrooms onto light wells were a minority at all times[71]. Nevertheless, most housing units where the kitchen or some bedrooms gave onto a light well were built up to 1869 (20/28, 71,43 % of kitchens and 9/11, 81,81 % of bedrooms), until they became a residual feature. None are found in the few examples in our survey (29 housing units) built after 1899, the year the regulations defining these light wells' dimensions at 12m square or more were issued.

Maids' bedrooms or maids' alcoves inside housing units were a very common feature of in the perimeter and building period analysed (51,72 % to 87,85 % of all housing units per 9-year building period[72]). According to studies on buildings dating from late 19th century and the beginning of the 20th century in Lausanne and Zürich, the general percentage of maids' bedrooms inside homes was around 22 to 25 % (Lüthi 2009). If this was also the case in Geneva, our data on this topic would confirm that the *Ceinture Fazyste* was not an area of social or popular housing, but rather aimed at a lower, medium and higher-income bourgeoisie.

Maids' bedrooms were usually placed away from the public eye. With the exception of single-family houses, where they were generally located on the top floor[73], they were most commonly part of the service area near the kitchens (respectively 71,05 % and 70,67 % of housing units in blocks of flats and in 1 flat per floor buildings), as was also the case in the Lausanne-based examples:

> The service spaces have an important role in the typological articulation of Lausanne's *villa locative*. Close to the kitchen, which rarely had a service room, the presence of a maid's room testifies to the generalised usage of household personnel, even in average to modest housing. (Challand 2009: 154)[74]

In our Geneva-based examples, they were even occasionally directly connected to the kitchens ☒ (37,16 % of maids' rooms near kitchens have this connection).

Based on the data collected, it would seem that maids' bedrooms were the most neglected domestic space in these homes, which were otherwise fairly comfortable. They sometimes had windows onto one of the buildings' façades, but their access to light and air was most often achieved through other solutions inside the building such as a window onto a light well ☒ (24,69 %) or, occasionally, the building's staircase ☒ (8,64 %). They were also quite often interior rooms (21,30 %), which could have a window or door to another room such the kitchen.

The 1899 regulations partially contributed to improving the living conditions of maids' bedrooms by requiring continuous lower ventilation of all courtyards and light wells, the need for "sufficient" ventilation of alcoves (without specifying how this should be achieved), and minimal dimensions for courtyards between buildings. They also defined a minimum width of 4 m for courtyards providing light to residential rooms, even though it is not clear whether maids' rooms were included in this category.

After the enforcement of the 1899 regulations, we would expect to see a reduction of maid's bedrooms on the inside or giving onto light wells. In general, we do see a

continued tendency to reduce the number of interior rooms, alcoves or rooms next to light wells (not marked as maids' rooms) over time. As far as maids' bedrooms are concerned, during the 1900-1912 period the main change is the existence of flats without them (31,03 %, 9 out of 29 housing units), which was very unusual during earlier years. Nevertheless, there are also some examples dating from 1900 to 1912 of maids' bedrooms that still gave only onto to the kitchen (or onto a kitchen and a light well), one with only a window onto the stairs and another, inner one[75]. In a study examining residential buildings by architect Marc Camoletti, Anne Gueissaz also comes to the conclusion that, "in practice, maids' dwellings are still in the same spaces as before"[76], even though they started responding to stricter regulations (Gueissaz 2004: 106).

A particularly interesting example of this is the 1902 building on *Rue François-Versonnex 17* ☞, included in the analysis but located just outside the *Ceinture Fazyste*. A first request for project approval was accepted on the condition that the maids' bedrooms – exclusively lit and aired by a 1,5 m-wide courtyard – be changed in accordance with article 62 of the 1899 regulations (Conseil d'État 1899: Art.62). This article enforced a minimal width of 4 m for courtyards onto housing rooms, and of a third of the buildings' height for courtyards between buildings. However, rather than lose space by increasing the size of the light well, the new project turned the maids' rooms into alcoves opening onto the living room and, in one of the flats, added an alcove (possibly used as a maid's bedroom) that opened onto the kitchen.

Changes throughout the 20th century

Throughout the 20th century most 19th century housing buildings – namely the block of flats and the building of 1 flat per floor – were in great part usable as such and easily adaptable to new comfort demands. Furthermore, they also allowed for the creation of more housing units by transforming attic storage space into housing or by dividing large flats. Within the examples examined, there were divisions of 1-floor flats into 2 and of blocks with 2 flats per floor into 3. Naturally, one of the most common changes in the beginning of the 20th century was the addition of bathrooms to the flats, which, as we have seen, were originally not very common. Bathrooms were most often placed in the alcoves, which were hence connected to the corridor instead of a main room, or in small interior rooms or that gave onto a light well, as they were increasingly less used. Furthermore, existing bathrooms and kitchens often went through renovation work to add new appliances and work-tops. Thus, in recent renovations, it is quite common to find only partially original features in the kitchens, such as the chimney or the *garde-manger,* a food-keeping closet with a hole in the wall to the outside for ventilation. Occasionally, lifts have and continue to be introduced, mainly when the internal staircase space is large enough.

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[1] Four general building regulations for this perimeter were introduced by Geneva's *Conseil d'État* in 1850 (amended in 1851), 1852, 1854 (amended in 1859) and 1879 (CONSEIL D'ÉTAT 1851, 1852, 1853, 1854, 1879). These were applicable to all buildings unless stated otherwise in plot sale decrees.

[2] Buildings on *Promenade du Pin* 1 and 3 ☒ could function both as 1 flat per floor or as duplexes that occupied 2 floors. They were considered to be flats of one flat per floor to facilitate the statistical analysis.

[3] The table was presented by David Ripoll at the conference "Protéger, conserver, transformer le patrimoine. Habiter en ville aux 19e et 20e siècles" (18.04.2013, organised by Geneva's *Office du patrimoine et des sites*). The author suggested there was a correlation between the number of buildings and changes in the economic situation.

[4] Slab blocks that form block-like units with a central courtyard were included in the "Block" urban type.

[5] Two of the isolated buildings we analysed are buildings with 1 flat per floor, and the other a single-family house. None are blocks of flats.

[6] Even though we analysed only 11 buildings from this time (thus not enough to draw any definitive conclusions), these were in fact located in key riverside areas and squares: the Mont-Blanc square (page with pictures of Square) and adjacent slab block, a block next to the *Rond-Point de Plainpalais*, the riverside in the *Rive* area, and in front of the *Cornavin* square in the *Chantepoulet* area. The *Square du Mont-Blanc* was granted successive permissions in height and number of floors, and its particular situation was examined previously ☞. The idea that height concessions could be made for riverside locations continued to exist in the 1899 regulations (CONSEIL D'ÉTAT 1899: Art. 54).

[7] The expression refers to the book *Formes urbaines: de l'îlot à la barre* (CASTEX 1980), translated into English as *Urban forms: the death and life of the urban block*, and its analysis of urban morphology, from the 19th century block with a central courtyard to the favouring of slab blocks during the 20th century.

[8] Lower floors above cornice, mansard and *entresol* floors (low commercial or office floors over the ground-floor) were counted as floors in the analysis, but not attics under pitched roofs. Cornice height limits in general building regulations ranged from 17,55 m to 22 m, depending on date and city area. With the exception of the 1854-1859 period, general building regulations also include a minimum floor height (2,80 or 2,60m, not counting the *ateliers* above the cornice) or a maximum number of floors. More specific regulations were very often included in the plot sale decrees.

[9] This 1873 house on *Boulevard Helvétique* 14bis (drawings of building) by architect Jacques-Elysée Goss has quite a detailed set of drawings kept at Geneva's *Archives d'État*.

[10] Two identical buildings of 1 flat per floor on *Rue de l'Athénée* 6 and 8, and the single-family house on *Rue de l'Athénée 7* ☒.

[11] The *Rue des Granges* was "the first private real-estate operation in which the (Geneva State) government was completely involved, by defining the plot plan and the general conditions for its completion. The project, mentioned in 1715, was launched the following year" (CORBIÈRE 2010: 55). *Hôtels particuliers* with numbers 2-6 were built simultaneously and have almost identical plans with typical entrance courtyards and back gardens, drawn by architect Jean-Jacques Dufour. For more information see the books *Genève, Ville forte* (CORBIÈRE 2010) and *La maison bourgeoise en Suisse: Le canton de Genève* (BLONDEL 1960). Some plans can be found at the *Centre d'Iconographie Genevoise* (CIG).

[12] According to several authors (LAWRENCE 1983; LESCAZE 1994), the first social housing experiences in Geneva started during the second half of the 19th century and, more frequently, from the 1890s onwards, in operations where speculative or philanthropic housing associations responded to the increasing number of industrial workers and to poor living conditions in the old city centre. Small contiguous houses were sometimes built further in city outskirts. Closer to the centre, social housing blocks of flats such as the ones built by the *Société genevoise des logements hygiéniques*

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(*Rue du Jura* in 1893-4 or *Rue Caroline* in 1898-1900) aimed to improve health and hygiene. These flats included one or two bedrooms, a kitchen with running water, and a WC per flat (LESCAZE 1994: 239-240), and were similar to the ones built by municipal authorities in the *Rue Louis-Favre (Grottes)* in early 20th century (LESCAZE 1994: 256). According to Roderick Lawrence (LAWRENCE 1983: 85), these buildings differed from earlier ones where flats were less individualised and shared a corridor and a WC on the landing.

13 Unlike Geneva, Lausanne's 19th-century housing was based on less strict urban plans and regulations that allowed for (and somewhat encouraged) the construction of successive isolated blocks of flats, the so-called *villas locatives*.

14 "Sans surprise, le plan d'étage de la villa locative s'organise selon les trois pôles de la vie bourgeoise, [...]: espaces de la vie intime (chambres), de la vie sociale (pièces de réception) et de service (cuisine et chambres de domestiques). Leur séparation appelle des dispositifs typologiques plus ou moins articulés, en fonction du *standing* et de la surface disponible. Dans les logements plus modestes, les limites tendent à s'estomper: la chambre de bonne côtoie celles de la famille, et lorsqu'elle disparaît du programme, c'est la distinction même entre espaces intimes et espaces de représentation qui s'efface complètement" (CHALLAND 2009: 153).

15 "[...] cette position [...] reste ambiguë car, dans les discours et sur les plans, le rôle de réception de l'habitation est malgré tout souligné et guide les choix" (ELEB-VIDAL 1989: 89).

16 Earlier ones were usually masonry stoves, while later ones often made in cast iron. They often had a compartment where food could be heated.

17 When one façade gives onto a terrace half the buildings have housing units with a dining room that gives onto that space (15 out of 32 buildings, which correspond to 20 analysed housing units).

18 Eleb-Vidal and Debarre-Blanchard observe that an increasing importance is given to the dining room in the French examples throughout time: near the courtyard in earlier ones, near the street façade in later ones (ELEB-VIDAL 1989: 97). In Geneva it is the living room that takes precedent both in the analysed examples, which date from the second half of the 19th century, and in the earlier example of *Rue Beauregard* 8 (BLONDEL 1960: 53), where the living room is placed in the corner and the dining room right next to it. The dining-room is only placed in the corner in 16,51 % of all analysed examples.

19 "La disposition angulaire du salon assure son éclairage bilatéral, avantage fréquemment rehaussé par la présence d'un oriel ou véranda constituant une pièce supplémentaire" (BARBEY 1982: 292).

20 As kitchens in single-family houses or ground-floor flats of 1-flat per floor buildings were generally located in the basement, there was also a connection between the kitchen, service room and dining room ⊠ but it was made through the service staircase and corridor.

21 We considered as bedrooms rooms indicated as bedrooms on the plan or where a bed was drawn, and which had a window onto one of the building's exterior façades. There were also rare occasions where indicated bedrooms gave onto light wells: *Ami-Lévrier* 5 and 7 ☞, *Chantepoulet* 8, *James-Fazy* 2, *Rodolphe-Toepffer* 21. Otherwise, small rooms giving onto these spaces or without windows where considered as "small rooms" in the analysis.

22 This was the case of buildings on *Rue François-Bonivard* 6,8,10 [page with drawings of building] that benefited from the special height provisions in the *Square du Mont-Blanc* (see, for instance, the 31.01.1854 decree allowing for a maximum roof height of 22,45 m, including 1 or 2 atelier floors above the main cornice). It was also the case of the building on *Rue Pradier* 11, which profited from the fact that there was no limit to the number of floors or to floor height between 1854 and 1859 to create a low floor above the ground floor. The building on the *Boulevard des Philosophes* 9 had a maximum cornice height of 19,50 m, in which 6 floors were built, and another mansard floor was added within the circle with an 8m radius that defined maximum roof height (as stated in the 1879 building regulations). Finally, the specific sale decree for building on *Boulevard des Philosophes* 18 (04.01.1901) limited its roof height to 23,50 m, comfortably allowing for 7 floors. Naturally, the fact that we have found only a few buildings with 7 floors means that maximum building occupancy was not always sought after.

23 Only one example with 4 flats per floor was analysed – *Boulevard des Philosophes* 2 – located just outside the *Ceinture Fazyste*.

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[24] In many cases (41,58 %) it was not possible to determine the number of common entrances to the building. In the same number of cases we found that there was only one entrance, and in 16,83 % of cases there were 2 entrances (never more).

[25] The toilet could either be a latrine or a water closet (WC), when there was running water.

[26] The specific percentages of these room functions within the flats are: kitchen (100 %), living room (96,02 %), dining room (80,53 %), 1 bedroom (34,07 %), 2 bedrooms (36,73 %), toilet (100 %), maid's bedroom inside the housing units (77,43 %), 1 alcove (32,30 %), 2 alcoves (16,37 %). Within the maids' bedrooms percentage, we counted bedrooms that were specifically marked as such as well as small rooms, alcoves or bedrooms that were part of the service area, either very close or connected to the kitchen (they have been marked separately in the Excel table so that these values could be individually read).

[27] "Au cours du 19e siècle, l'habitation bourgeoise tend à se rallier à la formule de l'immeuble en contiguïté avec son plan 'traversant' qui donne à la fois sur rue et sur cour. Ordinairement, les pièces de réception, salon et salle à manger s'ouvrent sur le devant, tandis que les chambres à coucher et la cuisine sont situées à l'arrière. La production courante de logements de ce type à Genève durant la dernière décennie du 19e siècle conduit à l'élaboration de quelques stéréotypes qui ne se différencient plus guère que par le nombre de pièces par appartement et le degré du confort sanitaire et ménager" (Barbey 1982: 292).

[28] The first example of housing units in blocks of flats with bathrooms – that is, a room shown as a bathroom or where a bathtub is depicted – is the building on *Boulevard Helvétique* 17, built in 1891. The rest of the examples were built as from 1895. The second example – *Général Dufour* 12 – had a maid's bedroom in both flats and a bathroom only in one.

[29] In 2 housing units on *Boulevard des Philosophes* 17 and in 1 of the flats on *Terreaux du Temple* 3-7-9 a maid's bedroom could not be identified. In the latter, the small room with a window onto the staircase could possibly be used as a maid's bedroom, even though there is no indication as to its function.

[30] These are the buildings on *Rue Abraham-Constantin* 4 and 6 ☞, *Cours des Bastions* 6, *Rue De-Candolle* 18 and 26 ☞, *Rue François-Bellot* 1, 4 and 6, *Promenade du Pin* 1, 3 and 5, *Rue Rodolphe-Toepffer* 11, *Rue Saint-Victor* 8 and 10. In Lausanne's *villas locatives* the kitchen was no longer placed at this level. However, there are documented examples in which the ground floor flat also occupied the 1st floor, and a second private staircase between these floors was added (Challand 2009: 159).

[31] According to the existing basement and ground-floor plans we were able to analyse, small caretakers' flats existed in half the 1 flat per floor buildings (27 out of 54 examples, 8 on the ground floor and 19 in the basement. These 19 examples include 5 where the basement was also used for the ground floor flat's service areas).

[32] The third entrance in the 11 housing units in 1 flat per floor buildings that have 3 entrances were either to the terrace in ground floor flats (5 examples), to a bedroom corridor (3 examples), a second entrance to an intermediate space (2 examples), or a second service entrance (1 example).

[33] 79,22 % of housing units in 1 flat per floor buildings had a maid's bedroom inside the housing space, and 71,43 % of had a maid's bedroom near the kitchen (only 6 housing units with maids' bedrooms did not have one near the kitchen).

[34] The maid's bedroom-kitchen connection existed in 12,99 % of housing units in 1 flat per floor buildings, which represented 18,18 % of maids' bedrooms near the kitchen in these buildings. In housing units that were part of blocks of flats, this connection existed in 30,53 % of housing units, which represented 42,86 % of maids' bedrooms near the kitchen.

[35] These correspond to buildings on *Rue de Hollande* 13, *Rue Saint-Victor* 10, and *Rue De-Candolle* 18 and 26 ☒.

[36] These are the buildings on *Rue Abraham-Constantin* 4 and 6 [images of this building], *Rue de l'Athénée* 6 and 8, *Cours des Bastions* 6 and 15, *Rue Charles-Bonnet* 10, *Rue Emilie-Gourd* 6, *Rue Firmin-Massot* 4, *Rue François Le-Fort* 2 ☞, *Rue Jean-Sénebier* 4 and 20, and *Rue Saint-Victor* 8 and 10.

[37] This was only the case of one particularly large ground floor housing unit in each of the blocks of flats on *Rue Rodolphe-Toepffer* 11bis and 17.

[38] *Rue Abraham-Constantin* 4, 6 ☞, *Cours des Bastions* 6, *Rue Saint-Victor* 8, 10, *Rue Firmin-Massot* 4.

[39] This correlation was suggested by Rolf Pfändler (PFÄNDLER 1974: 81). Even though this combination was, as the author suggests, the most favoured, we found some plans of ground floor flats with a direct connection to exclusive service areas in the basement that did not have a terrace (*Rue De-Candolle 18* and *26* (images of this building), *François-Bellot* 1,4,6, *Promenade du Pin* 1,3,5, *Rue Rodolphe-Toepffer* 11) and vice-versa (*Rue Charles-Bonnet* 10, *Rue Emilie-Gourd* 6, *Rue François Le-Fort* 2 ☞, *Rue Jean-Senebier* 4 and 20).

[40] "Il y aurait toute convenance à créer un quartier spécial sur le plateau des Tranchées", "qui paraît principalement destiné à des habitations de familles aisées" (DÉPARTEMENT DES TRAVAUX PUBLICS 1854: 9, 14).

[41] It is the case of the plots included in the slab block indicated as group 17 on *Rue Charles-Bonnet*. The plot sale decrees made it mandatory to have a terrace at least 3 m wide (see plot sale decrees dating from 19.03.1872, 08.11.1872-Titre I and 08.01.1872).

[42] The *Entrepôt* area behind the *Square du Mont-Blanc* was also composed of slab blocks. However, most flats in these 6-floor blocks ☞ had a street-light well orientation, which is not evident in a building analysis alone.

[43] In French architectural tradition, a *hôtel particulier* is a large 16th-17th century mansion owned by one family. The most commonly known are those with a patio entrance towards the city, and an interior garden on the opposite side (see, for instance, ELEB-VIDAL 1989). During the 18th and 19th centuries single-family houses would continue to be mentioned by the same name and replicate some of their distribution principles on a much smaller scale.

[44] These percentages correspond to 9 out of 13 buildings in the *Bastions* area, and 31 out of 48 in the *Tranchées* area. They also existed in 3 buildings in the *Plainpalais* area, and only in 1 building in the *Hollande* area.

[45] Naturally, a more detailed analysis could draw more definitive conclusions by comparing housing unit areas in all three housing types.

[46] There are other detailed drawings depicting the same type of heating system for buildings on *Rue de Hollande 10*, built in 1877-1878, a one flat per floor building by architect Émile Reverdin, and the single-family house by Jacques Élisée Goss on *Rue François-Bellot 14-16*, dating from 1880.

[47] 1861 building on *Rue Ami-Lévrier* 5-7 ☞ is a rare example of a project where plans of mansard floor flats are available. While 2 flats per floor existed up to the 4th floor, the mansard had 4 much smaller flats per floor. *Rue de Candolle* 32-34 ☞ were two almost identical buildings from 1900 with 4 to 6 room flats. As in the previous example, alcoves seem to have be sleeping areas off the rooms where the bed was placed, leaving the rest of room space available for daily activities. Finally, *Rue Bautte* 16 ☞ was rather an exceptional example of social diversity. Here, the plans show 3 flats designed for increasing living standards: a 4-room flat with no living room, a typical flat with living, dining room and (maid's) alcove off the kitchen and, finally, a flat with living and dining room, 2 bedrooms, (a maid's) small bedroom, and even a bathroom.

[48] Maids' bedrooms were very common within the perimeter, and we can only confirm that they did not exist (meaning a different function was indicated for all rooms in the plans) in 7 housing units. Although these are very few to draw any definitive conclusions, we can observe that they were flats with 4 or 6 rooms located in the *Saint-Gervais* (1 example) and in the *Plainpalais* areas (6 examples).

[49] Out of the 21 analysed single-family houses, only one was an isolated building (*Rue de l'Athénée 7* ☒) and another was included in an open block (*Boulevard Helvétique* 14bis).

[50] As we have previously mentioned, historian Rolf Pfändler's undergraduate thesis (PFÄNDLER 1974) describes the history of the *Tranchées* and *Bastions* neighbourhoods and analyses most of the single-family houses we describe here. For the most part, our conclusions in relation to housing layout are the same.

[51] Even though we could not find original floor plans of the houses, the collection of surveys of *Rue De-Beaumont* numbers 6, 8 and 12 ☞ done for conversion purposes gives us a general idea of the house layout: separate basement and main entrances, the living, dining room and, possibly, the kitchen on the ground floor, bedrooms and (also possibly) a bathroom above.

[52] "Dès 1854, le square de Contamines, sur le côté pair de la rue Beaumont, dû à l'initiative du Dr. Senn, est conçu selon le modèle anglais. Il constitue le prototype parfait de ce qui pourraît être construit aux Tranchées. De petits hôtels mitoyens en bandes continues y son séparés de la rue par un premier jardinet, alors que de l'autre côté, un second jardinet donne sur un square commun" (PFÄNDLER 1974: 32),

[53] The *Beaux-Arts* neighbourhood was a building operation based on the *square* and slab block urban types planned as from 1873 and started in 1880. Publications describing this operation and, especially, the housing that was a part of it, are, to the best of our knowledge, not extensive (BARBEY 1983; PIGUET 2000). There is also an unpublished text by Dave Lüthi (University of Lausanne) that we have not been able to consult.

[54] In this example, there was also a flat at first basement level in relation to *Rue Rodolphe-Toepffer* (1st floor level in relation to *Boulevard Helvétique*). It could have been used for a caretaker's flat but had more rooms than usual for this kind of accommodation, or otherwise for other family members or to rent.

[55] There are 4 exceptions to this typical staircase position. In houses on *Cours des Bastions* 12-14 the staircase was slightly further forward in relation to the party wall in order to place a service room between the dining room and the service area and staircase. It was placed centrally next to the street façade in the *Rodolphe-Toepffer* 14, that is a narrow corner building, and *Athénée 7*, an isolated building where, as all other façades had windows onto main rooms, the street façade became the less important one.

[56] There was a three-room *enfilade* in nearly all the single-family houses analysed (17 examples, 80,95 %). In 13 examples the dining room was placed on the street side, and in 7 on the terrace side. It was connected to the living room in 13 examples (61,90 %). A small living room existed in 16 houses (76,19 %) and was connected to the living room in 11 of them.

[57] In these single-family houses' alcoves were only present in 5 examples and were always connected to bedrooms on the 1st floor.

[58] "L'étage mansardé abritait d'autres chambres destinées en partie au personnel, en partie aux hôtes de passage" (EL-WAKIL 1998: 34).

[59] This percentage is probably higher, but we cannot be sure of the main high ground floor function (housing or offices) in 26,09 % of buildings in this area due to lack of ground-floor plans.

[60] *Rue Saint-Léger* 2bis, *Rue Charles-Sturm* 20, *Rue Rodolphe-Toepffer* 3 and 5, *Rue du Général Dufour* 12, *Rue Bautte* 16 ☞, *Rue de l'Arquebuse* 13 and 15.

[61] These are, respectively, *Bourse 5*, *Hollande 10* ☞, *12, 13, Synagogue 6,* and *Bovy-Lysberg 5* ☞, *Jean-Petitot 12, Général Dufour 5* and *7.* We did not find a ground-floor plan for *Rue de Hollande 13*, but the office/housing function is mentioned in *Le grand siècle de l'architecture genevoise 1800-1914* (BEERLI 1985: 70). The *Général-Dufour* 5 and 7 buildings could have had a shop or office function on the ground and 1st floor according to the original floor plans, but shortly after building they were used as the *Journal de Genève* headquarters.

[62] These were the ducts that connected the buildings' rainwater and wastewater network to the public sewer in the centre of the street. In 1850 and in 1854 the ducts' minimal diameter was 0,5 m high by 0,4 m wide for wastewater, and 0,3 m high and 0,25 wide for rainwater. These dimensions were not specified in the 1879 regulations.

[63] According to the study by Duc, Frei and Perroux, the installation of 3 m high collectors, that could receive all the sewage from the network, was completed in 1889 (DUC 2008: 37).

[64] "indiquant les conditions d'établissement et de distribution des étages des cours et escaliers, l'emplacement des cuvettes, celui des réservoirs, les canaux de fumée et d'aération, et l'écoulement des eaux résiduaires jusqu'à l'égout public."

[65] The reservoir in the attic is depicted as early as 1869 in the plans for a one flat per floor building on *Rue François-Bellot* 2 ☒, designed by Adolphe Reverdin. It is also depicted in plans for buildings such as: *Rue du Stand* 54, built in 1872, *Rue Jean-Petitot* 5, in 1873-74, *Rue Abraham-Constantin* 6, in 1875, *Rue François-Bellot* 8, 10, 12, in 1879, *Rue François-Bellot* 14-16, in 1880, *Quai Gustave-Ador* 14, 16, 18, in 1884, *Rue de l'Arquebuse* 13,15, in 1897, and *Rue Rodolphe-Toepffer* 21, in 1899.

[66] Later, in the 1929 *Loi sur les constructions et les installations diverses* it was obligatory to have at

least one WC per rental contract and, whenever the means are available, these had to be equipped with a flush and a siphon (Conseil d'État 1929: Art.41).

[67] These are the single-family houses on *Rue François-Bellot 10* and *12* ☞, designed in 1879, and on *Boulevard Helvétique 14bis*, dating from 1873. The 1 flat per floor buildings are on *Rue Hollande 13* and *Rue Saint-Victor 10* ☞ (we did not find any original drawings for this last example, but architect Bernard Vial, in charge of the renovation project, confirmed that there was an original bathroom).

[68] "Vers la fin du 19e siècle, seuls les immeubles les plus luxueux sont équipés de salles de bains; les bourgeois moyens des grandes villes font venir un service de bain mobile. [...] La petite bourgeoisie et les nombreux sous-locataires utilisent les établissements de bains publics ou ceux d'entreprises privées."

[69] "Le confort sanitaire et l'appareillage ménager varient selon les catégories d'habitation. Alors que les hôtels construits aux Trachées vers 1860 sont déjà munis de cabinets d'aisance, les premières salles d'eau avec baignoire ne feront leur apparition qu'à la fin du 19e siècle et dans les classes luxueuses d'habitation seulement. Il faudra attendre l'après-guerre de 1914-1918 pour voir se généraliser l'usage des salles de bains."

[70] This service access existed in most single-family houses (90,48 %), was quite common in housing units in 1 flat per floor buildings (44,16 %) and was practically non-existent in the ones in blocks of flats (0,88 %).

[71] The percentage is higher for the 1860-1869 period, being found in 19,57 % of housing units. However, even during this period most housing units had bedrooms giving onto an outside space (56,52 %).

[72] We can certainly confirm the existence of maids' bedrooms within 48,46 % of housing units (without counting those in attics). In 28,7 % of housing units there was an alcove of a bedroom just off the kitchen that, without being described as a maid's room, most likely fulfilled this function. The following percentages mentioned in the text consider these rooms as maids' bedrooms.

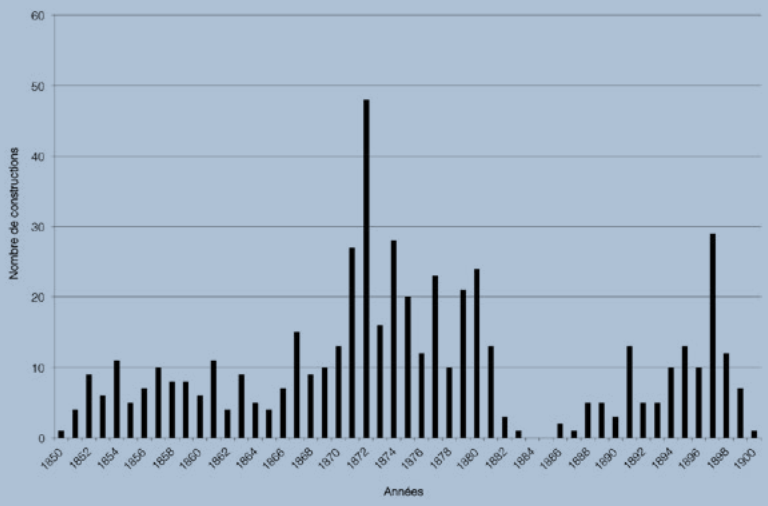
[73] Bedrooms (possibly maids' ones) are indicated in the attic plans of 5 blocks of flats (*Rue Rodolphe-Toepffer* 21, *Rue Charles-Sturm* 20, *Boulevard Georges-Favon* 14, 4 and 6) and in 7 buildings of one flat per floor (*Abraham-Constantin* 6 ☞ and *Rue Jean-Senebier* 20, where they are marked as maids' bedrooms, and *Rue François-Le-Fort* 2 ☞, *Rue Saint-Victor* 10, *Rue Jean-Petitot* 5, *Rue du Stand* 54 *and Rue François-Bellot* 2). However, due to the lack of attic plans of most buildings it is impossible to draw any further conclusions. In an article by on the topic of maids' bedroom in Lausanne buildings from 1890 to 1940, Dave Lüthi (2009) also mentions the existence of some maids' bedrooms in attics and the lack of plans that could help determine how often. However, Lüthi also refers to written documents that would attest to the general usage in Switzerland of having maids inside the flats rather than in the attic, as opposed to François Loyer's (1987) observation that these were frequent in 19th century Paris.

[74] "Les espaces de la domesticité jouent un rôle important dans l'articulation typologique de la villa locative lausannoise. À proximité de la cuisine, rarement augmentée d'un office, la présence d'une 'chambre de bonne' ou de 'demoiselles' témoigne du recours généralisé à du personnel de maison, et ce même dans les logements de standing moyen à modeste" (Challand 2009: 154).

[75] In *Rue Bautte* 16-Flat on the right ☞, *Rue François-Versonnex* 17-Flat on the right ☞ and 19-Flat in front the maids' bedrooms gave only onto the kitchen; *Boulevard des Philosophes* 18-Flat on the left only had a window onto the staircase landing; in *Rue Emilie-Gourd* 6-Ground floor and flats above they are interior.

[76] "Dans les faits, les domestiques sont logés dans les mêmes espaces qu'auparavant" (Gueissaz 2004: 106).

FLOOR PLANS OF HOUSES IN GENEVA



Buildings completed in the ceinture fazyste

David Ripoll (2013)
Table presented at the conference "Habiter en ville aux XIXe et XXe siècles", 18.04.2013, unpublished

CHRONOLOGY OF ANALYSED EXAMPLES

Building date	% of analysed buildings	N° of analysed buildings
1850 - 1859	6.25 %	11
1860 - 1869	13.07 %	23
1870 - 1879	32.39 %	57
1880 - 1889	8.52 %	15
1890 - 1899	32.39 %	57
1900 - 1912	7.39 %	13
Total	100.00 %	176

	Housing type		
Building date	**Block of flats**	**1 flat / floor buildings**	**Single-family houses**
1850 - 1859	100.00 %	0.00 %	0.00 %
1860 - 1869	30.43 %	65.22 %	4.35 %
1870 - 1879	47.37 %	38.60 %	14.04 %
1880 - 1889	33.33 %	40.00 %	26.67 %
1890 - 1899	71.93 %	15.79 %	12.28 %
1900 - 1912	76.92 %	15.38 %	7.69 %
Total	57.39 %	30.68 %	11.93 %

BLOCK WITH A CENTRAL COURTYARD

Housing type	Block of flats	1 flat / floor buildings		Single-family houses		
	76.83 %	23.17 %		0.00 %		
Height	**2**	**3**	**4**	**5**	**6**	**7**
(n° floors)	0.00 %	2.44 %	7.32 %	59.76 %	24.39 %	6.10 %
Ground floor	**Housing**	**Housing or offices**	**Shops**	**Shops & housing**	**Offices**	**Shops & offices**
	23.17 %	12.20 %	51.22 %	3.66 %	7.32 %	2.44 %

Quai du Mont-Blanc
CIG · VG P 2024

BAR

Housing type	Block of flats	1 flat / floor buildings		Single-family houses		
	39.13 %	33.33 %		27.54 %		
Height	**2**	**3**	**4**	**5**	**6**	**7**
(n° floors)	5.80 %	24.64 %	26.09 %	26.09 %	15.94 %	1.45 %
Ground floor	**Housing**	**Housing or offices**	**Shops**	**Shops & linked housing**	**Offices**	**School**
	56.52 %	7.25 %	24.64 %	2.90 %	1.45 %	1.45 %

Rue de l'Athénée n° 4, 1912
(photo | J. Jullien) | CIG · 69824

OPEN BLOCK

Housing type	Block of flats	1 flat / floor buildings		Single-family houses		
	50.00 %	45.45 %		4.55 %		
Height	**2**	**3**	**4**	**5**	**6**	**7**
(n° floors)	0.00 %	0.00 %	54.55 %	31.82 %	13.64 %	0.00 %
Ground floor	**Housing**	**Housing or offices**	**Shops**			
	63.64 %	9.09 %	22.73 %			

École des Beaux-Arts & Musée du pont de St Antoine
Boulevard Jaques-Dalcroze, 1901
CIG · VG 853

ISOLATED BUILDING

Housing type	Block of flats	1 flat / floor buildings	Single-family houses
	-	2 examples	1 example
Height	**2**	**3**	
(n° floors)	-	3 examples	
Ground floor	**Housing**		
	3 examples		

Rue Charles-Bonnet n° 14, 1926
(photo | J. Jullien) | CIG · 6523A

	Housing type		
City area	Block of flats	1 flat / floor buildings	Single-family houses
Bastions	23.08 % (3)	46.15 % (6)	30.77 % (4)
Chantepoulet	100.00 % (3)	0.00 %	0.00 %
Entrepôt	100.00 % (7)	0.00 %	0.00 %
Hollande	60.61 % (20)	39.39 % (13)	0.00 %
Mont-Blanc	100.00 % (4)	0.00 %	0.00 %
Plainpalais	73.91 % (17)	26.09 % (6)	0.00 %
Rive	76.00 % (19)	24.00 % (6)	0.00 %
Saint-Gervais	100.00 % (20)	0.00 %	0.00 %
Tranchées	16.67 % (8)	47.92 % (23)	35.42 % (17)
Total	57.39 % (101)	30.68 % (54)	11.93 % (21)

Height	Housing type			
(n° floors)	Block of flats	1 flat / floor buildings	Single-family houses	Total
2	0.00 %	0.00 %	19.05 % (4)	2.27 % (4)
3	0.99 % (1)	9.26 % (5)	76.19 % (16)	12.50 % (22)
4	10.89 % (11)	44.44 % (24)	4.76 % (1)	20.45 % (36)
5	53.47 % (54)	37.04 % (20)	0.00 %	42.05 % (74)
6	28.71 % (29)	9.26 % (5)	0.00 %	19.32 % (34)
7	5.94 % (6)	0.00 %	0.00 %	3.41 % (6)

Rue Toepffer 17, Bedroom
Foyer du travail féminin
(photo | Jullien)
BGE-CIG | 11765

Rue Toepffer 17, Living room
Foyer du travail féminin
(photo | Jullien)
BGE·CIG | 12281

	Distribution spaces	
Housing type	**Enfilade (and corridor)**	**Just corridor**
Block of flats	42.92 % (97)	57.08 % (129)
1 flat / floor buildings	83.12 % (64)	16.88 % (13)
Single-family houses	80.95 % (17)	19.05 % (4)
Total	54.94 % (178)	45.06 % (146)

	Living room - dining room connection	
Housing type	**Exists**	**Does not exist**
Block of flats	74.78 % (169)	25.22 % (57)
1 flat / floor buildings	71.43 % (55)	28.57 % (22)
Single-family houses	61.90 % (13)	38.10 % (8)
Total	73.15 % (237)	26.85 % (87)

	Living room	
Housing type	**Exists**	**Does not exist**
Block of flats	96.02 % (217)	3.98 % (9)
1 flat / floor buildings	100 % (77)	0 %
Single-family houses	100 % (21)	0 %
Total	97.22 % (315)	2.78 % (9)

	Dining room	
Housing type	**Exists**	**Does not exist**
Block of flats	80.53 % (182)	19.47 % (44)
1 flat / floor buildings	93.51 % (72)	6.49 % (5)
Single-family houses	100 % (21)	0 %
Total	84.88 % (275)	15.12 % (49)

	Bathroom	
Housing type	**Exists**	**Does not exist**
Block of flats	22.12 % (50)	54.87 % (124)
1 flat / floor buildings	15.58 % (12)	51.95 % (40)
Single-family houses	52.38 % (11)	14.29 % (3)
Total	22.53 % (73)	51.54 % (167)

Bathrooms		
Building date	**Exist**	**Do not exist**
1850 - 1859	0.00 %	52.38 % (11)
1860 - 1869	0.00 %	57.78 % (26)
1870 - 1879	6.52 % (6)	54.35 % (50)
1880 - 1889	13.79 % (4)	48.28 % (14)
1890 - 1899	44.44 % (48)	48.15 % (52)
1900 - 1912	51.72 % (15)	48.28 % (14)
Total	22.53 % (73)	51.54 % (167)

BLOCKS OF FLATS		**Bathrooms**
Building date	**Exist**	**Do not exist**
1850 - 1859	0.00 %	52.38 % (11)
1860 - 1869	0.00 %	75.00 % (18)
1870 - 1879	0.00 %	56.36 % (31)
1880 - 1889	0.00 %	20.00 % (2)
1890 - 1899	42.86 % (39)	52.75 % (48)
1900 - 1912	44.00 % (11)	56.00 % (14)
Total	22.12 % (50)	54.87 % (124)

1 FLAT / FLOOR BUILDINGS		**Bathrooms**
Building date	**Exist**	**Do not exist**
1850 - 1859	-	-
1860 - 1869	0.00 %	40.00 % (8)
1870 - 1879	10.34 % (3)	62.07 % (18)
1880 - 1889	13.33 % (2)	66.67 % (10)
1890 - 1899	40.00 % (4)	40.00 % (4)
1900 - 1912	100.00 % (3)	0.00 %
Total	15.58 % (12)	51.95 % (40)

SINGLE-FAMILY HOUSES		**Bathrooms**
Building date	**Exist**	**Do not exist**
1850 - 1859	-	-
1860 - 1869	0.00 %	0.00 %
1870 - 1879	37.50 % (3)	12.50 % (1)
1880 - 1889	50.00 % (2)	50.00 % (2)
1890 - 1899	71.43 % (5)	0.00 %
1900 - 1912	100.00 % (1)	0.00 %
Total	52.38 % (11)	14.29 % (3)

BLOCK OF FLATS	Bathroom	
Maid's bedroom	Exists	Does not exist
Exists	26.86 % (47)	56 % (98)
Does not exist	0.00 %	100 % (9)
Total	22.12 % (50)	54.87 % (124)

1 FLAT/FLOOR	Bathroom	
Maid's bedroom	Exists	Does not exist
Exists	19.67 % (12)	54.10 % (33)
Does not exist	-	-
Total	16.88 % (13)	51.95 % (40)

SINGLE-FAMILY	Bathroom	
Maid's bedroom	Exists	Does not exist
Exists	50.00 % (7)	21.43 % (3)
Does not exist	-	-
Total	52.38 % (11)	14.29 % (3)

Rue Toepffer 17, Bathroom
Foyer du travail féminin
(photo | Jullien)
BGE-CIG | 11767

EARLIER EXAMPLES

RUE DES GRANGES 2-6

ca. 1716 - 1723
Architect Jean-Jacques Dufour

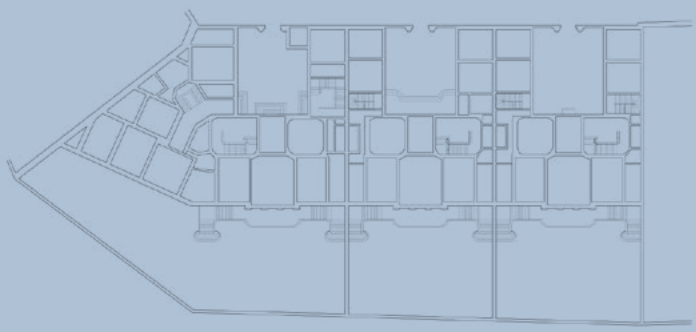
Drawings
Centre d'Iconographie Genevoise:
Vieux Genève [organised by street]

Selected bibliography
CORBIÈRE, 2010
BLONDEL, 1960 [1912]

View of the ensemble
BGE-CIG | VG P 1260

Terrace side elevation
Ground floor plan, redrawn 1:1000

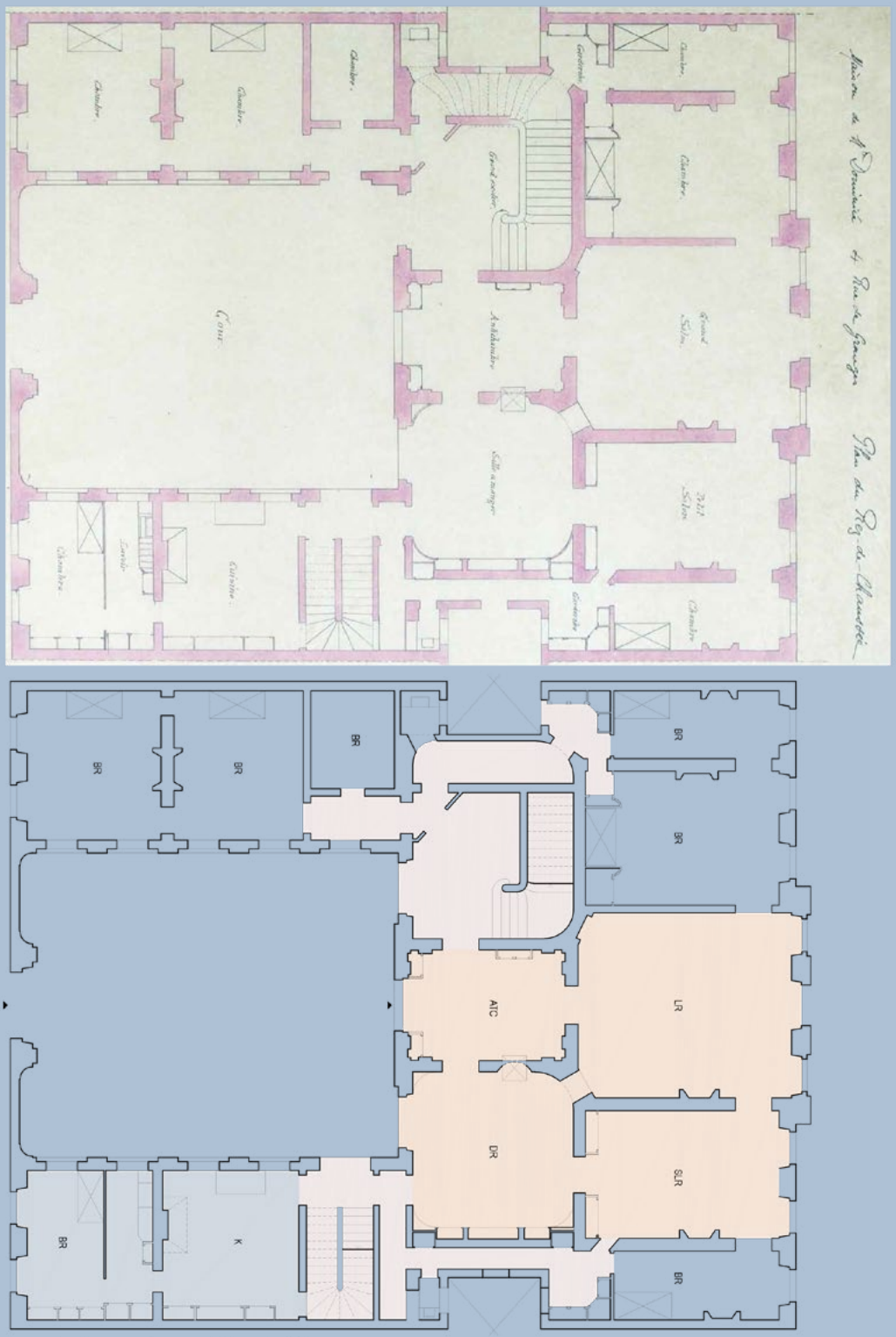
Rue des Granges 2
(photos | Atelier Boissonnas)
BGE-CIG | FBB P GE 03-02 01 and 06



Types of rooms

BR Bedroom
LR Living room
SLR Small living room
DR Dining room
K Kitchen
ATC Antichamber

Service areas
Social areas
Circulation areas



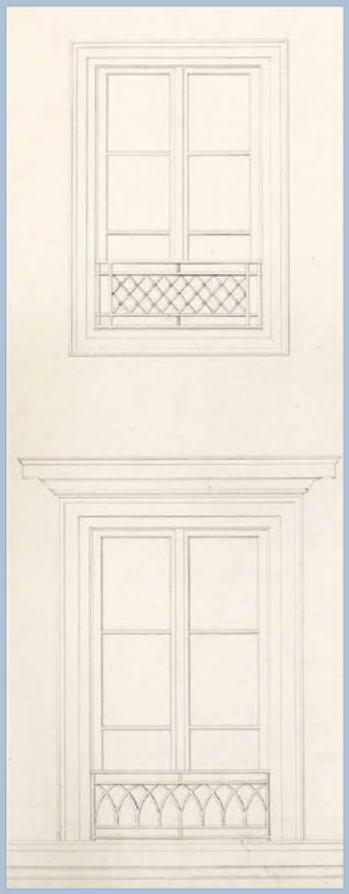
Rue des Granges 4, ground floor 1:200

RUE DE LA CORRATERIE
ca. 1827
Architect Samuel Vaucher
[cantonal enginneer Guillaume-Henri Dufour]

Drawings
Département des constructions et de l'aménagement · Ville de Genève:
Original drawings in large folders;
Cité 43-P · 1920 [number 14-16];
Cité 130/E · 1936 [number 10];

Selected bibliography
DUMONT, 1976
BRULHART, 1985

Rue de la Corraterie, 1880
(photo | Atelier Boissonnas)
BGE-CIG | FBB P GE 03-16 09



Rue de la Corraterie 10, windows
Rue de la Corraterie 12, elevation
[signed Samuel Vaucher, 1833]

RUE BEAUREGARD 2-6

ca. 1774 - 1777

Architect Pierre-David Matthey and others

Drawings

Département des constructions et de l'aménagement - Ville de Genève:

DD 96231 [number 6];

DD 81539 [number 8];

Selected bibliography

WINIGER-LABUDA, 1990

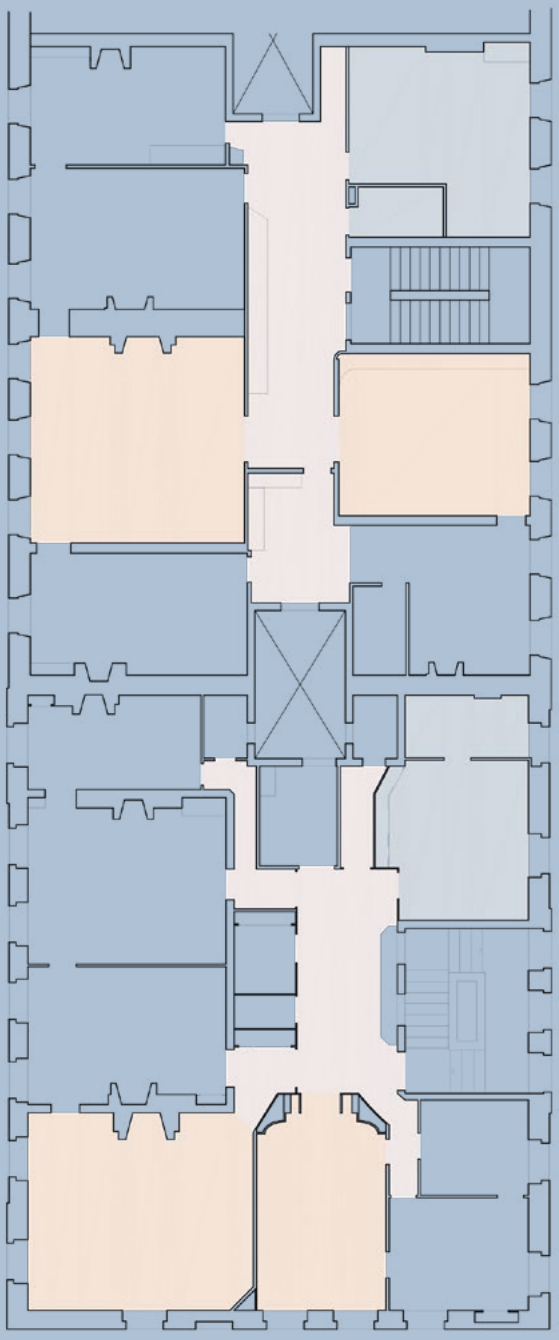
BLONDEL, 1960 [1912]

View of the ensemble

BGE-CIG | VG 13432

Rue Beauregard 8

BGE-CIG



Rue Beauregard 6 and 8 Floor plan 1:200

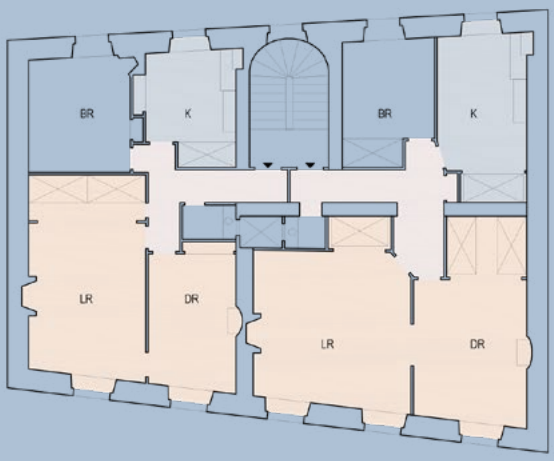
QUAI DES BERGUES

ca. 1827 - 1841
attributed to Samuel Vaucher

Drawings
BROILLET, 1997: 336-341
(from the Archives d'État de Genève)

Selected bibliography
BRULHART, 1987
BROILLET, 1997

Quai, pont des Bergues
(photo | Atelier Boissonnas)
BGE-CIG | FBB P GE 06-02 25



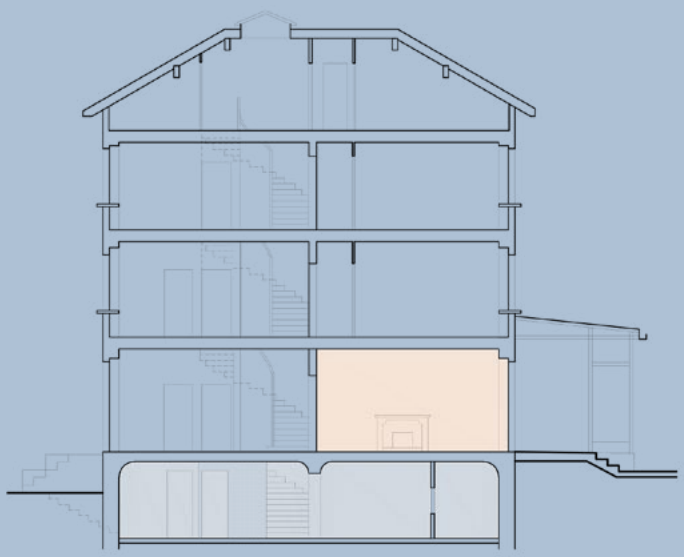
Maison Revilliod au quai des Etuves
[quai des Bergues 11] 1:200

Types of rooms

BR Bedroom
LR Living room
DR Dining room
K Kitchen

Service areas
Social areas
Circulation areas

0 1 5



RUE DE BEAUMONT 6-12

ca. 1854

Architect Samuel Vaucher

[cantonal enginneer Guillaume-Henri Dufour]

Drawings

Département des constructions et de l'aménagement - Ville de Genève:

1935/15/R [number 8];

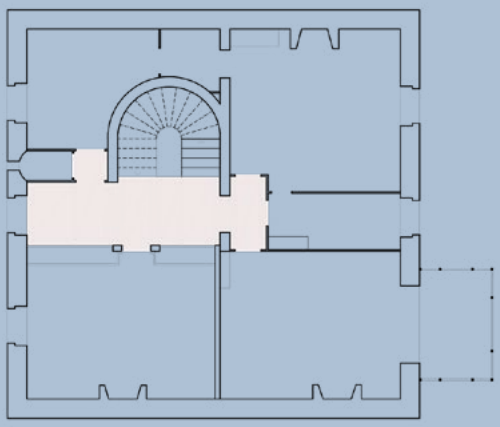
DD 68419 - 1976 [number 12];

DD 84509 - 1986 [number 8];

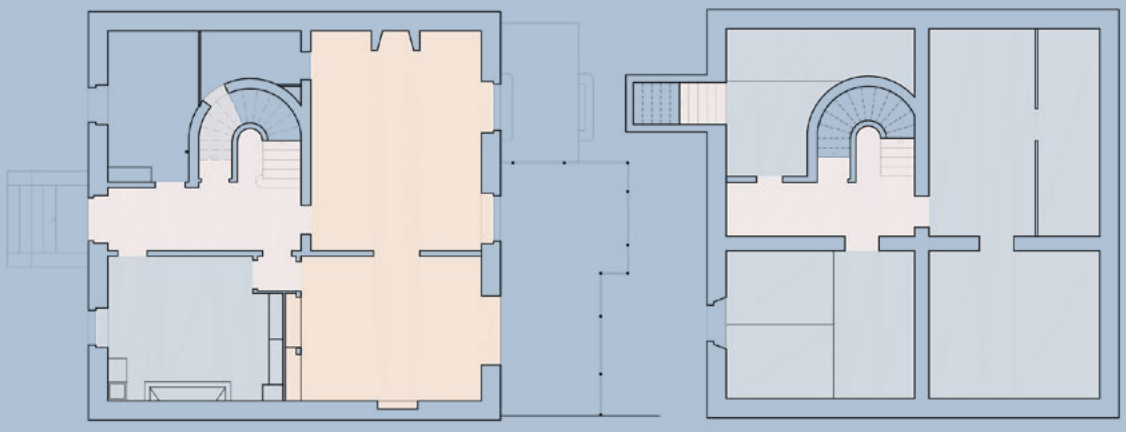
DD 88563 - 1993 [number 6]

Selected bibliography

PFÄNDLER, 1974



Rue de Beaumont 6-8, 1st floor 1:200



Ground floor

Basement

TYPE 1 - THE BLOCK OF FLATS

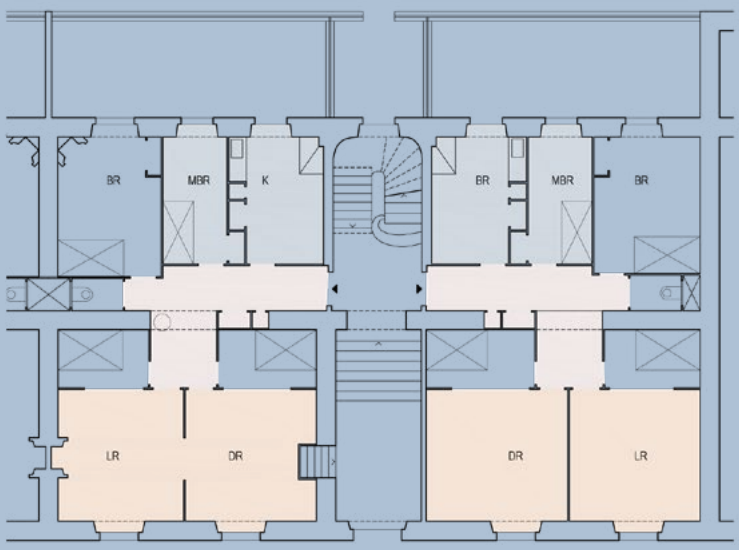
RUE SAINT-OURS 2-4-6

ca. 1898
Architect Alexandre Bordigoni

Drawings
Département des constructions et de l'aménagement - Ville de Genève:
Cité 437 - 1898;

Selected bibliography
BEERLI et al., 1985: 56

Plan of the block
DCA | Cité 437 - 1898



Types of rooms

BR Bedroom
MBR Maid's bedroom
LR Living room
DR Dining room
K Kitchen

Service areas
Social areas
Circulation areas

0 1 5

Rue Saint-Ours 4, floor plan and section 1:200

View of the Square du Mont-Blanc
BGE-CIG | 13178

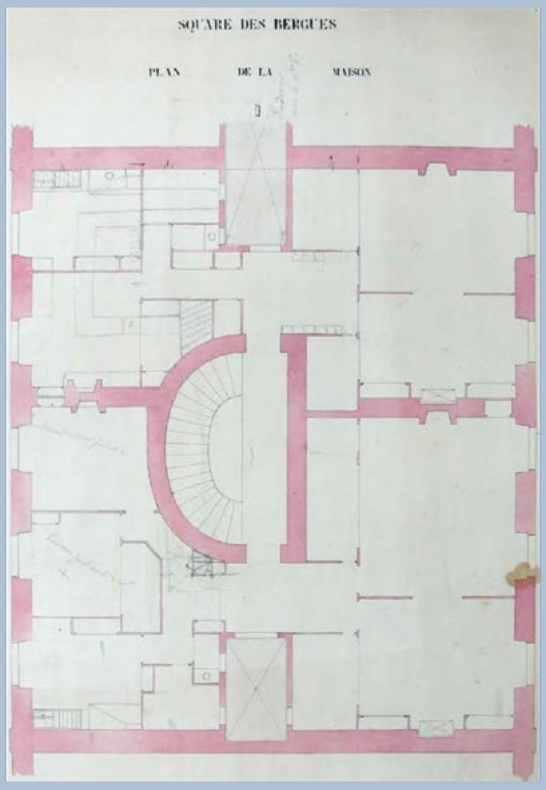
RUE FRANÇOIS-BONIVARD 10

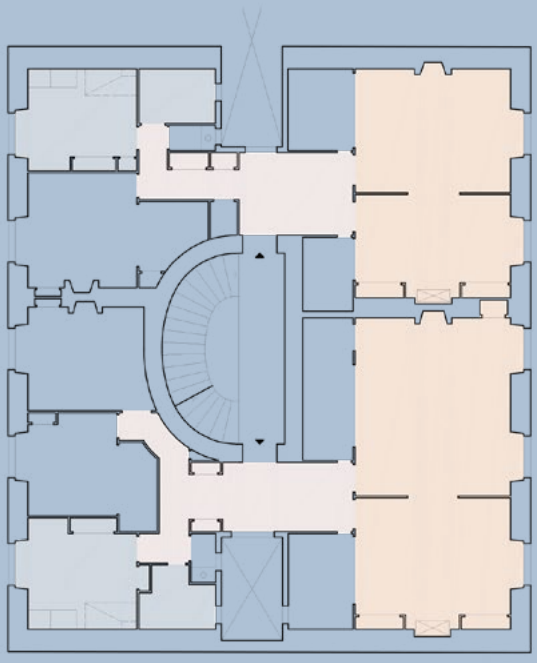
SQUARE DU MONT-BLANC
ca. 1857-1858

Architect François Gindroz
for Société Immobilière Genevoise

Drawing
Centre d'Iconographie Genevoise:
Vieux Genève [organised by street]

Selected bibliography
BRULHART, DEUBER-PAULI, 1985: 145





Floor plan 1:200
[original signed F. Gindroz]

Service areas
Social areas
Circulation areas

0 1 5

RUE AMI-LÉVRIER 5-7

ca. 1861-1862

attributed to architect Jean-Marie Gignoux, for the Société anonyme du Théâtre des variétés

Drawings

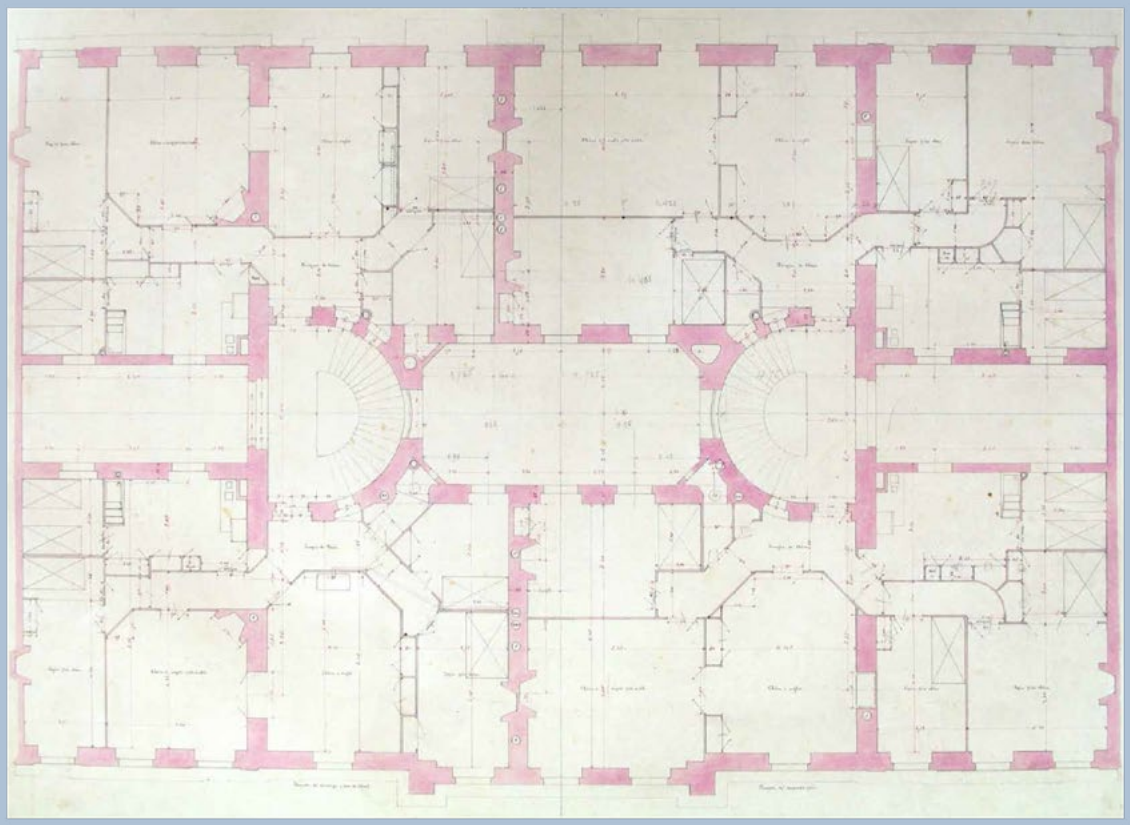
Centre d'Iconographie Genevoise:
Vieux Genève [organised by street]

Département des constructions et de l'aménagement - Ville de Genève:
1944 / 16911

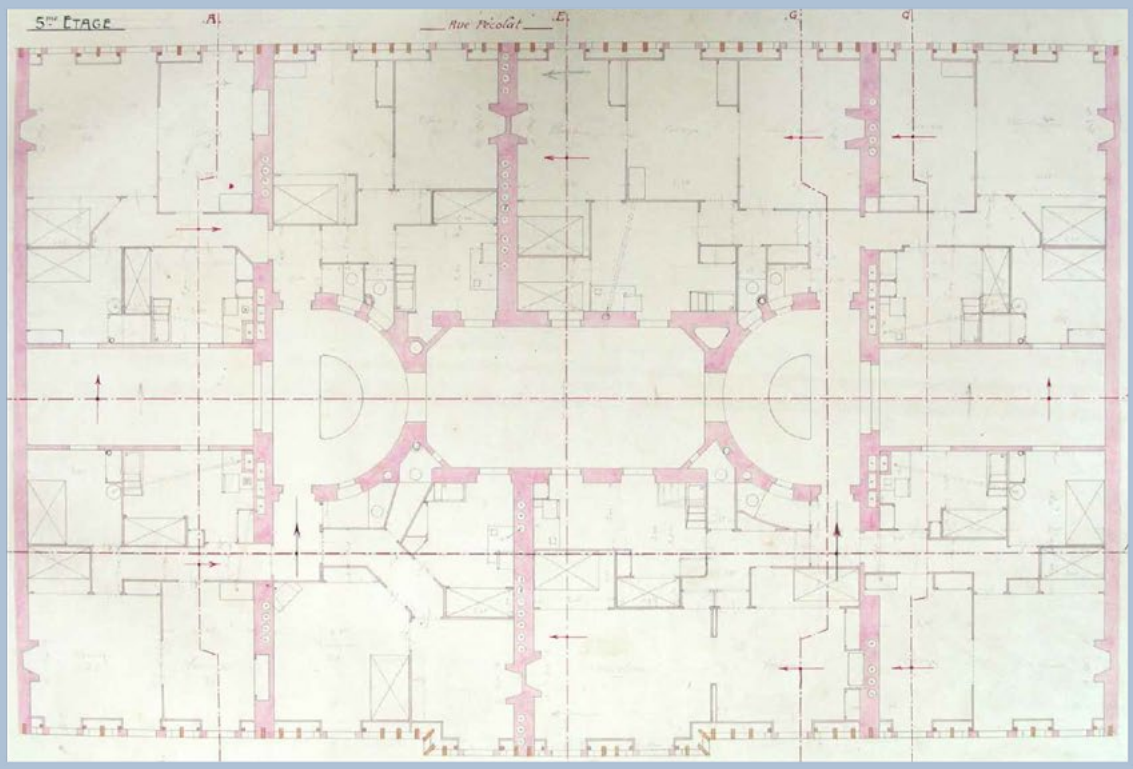
Selected bibliography

WINIGER-LABUDA, 2001: 363

Rue Ami-Lévrier
(photo | E. Pricam)
BGE-CIG | VG 4485 01



2nd floor plan | scaled to aprx. 1:200



5th floor plan – mansards

RUE BAUTTE 16

ca. 1904

Architect Théodore Cosson

for the Société Immobilière de la rue de Malatrex

Drawings

Archives d'État de Genève:

TP 1904 - 268

Département des constructions et de l'aménagement - Ville de Genève:

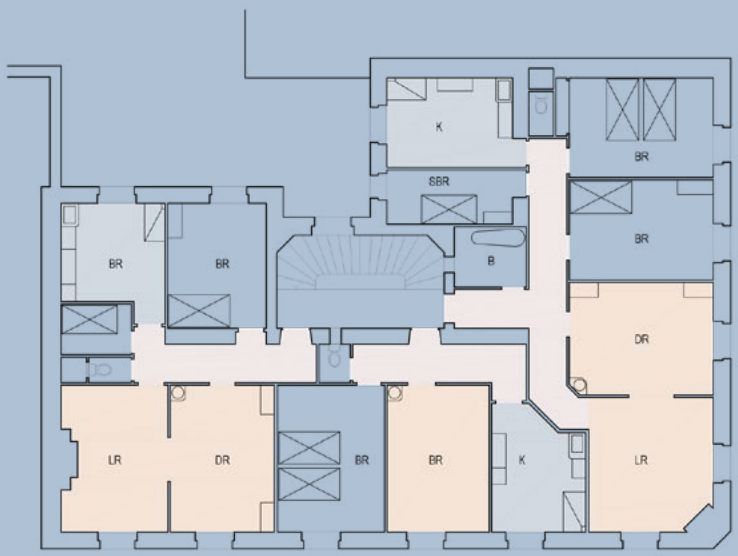
Cité 1904 - 671

Selected bibliography

COURTIAU, 2011

Rue Bautte 16, 1991

COURTIAU, 2011: 15



Floor plan 1:200

Types of rooms

BR Bedroom
SBR Small bedroom
LR Living room
DR Dining room
K Kitchen
B Bathroom

Service areas
Social areas
Circulation areas

0 1 5

RUE FRANÇOIS-VERSONNEX 17

ca. 1902

Architects Antoine Leclerc & Gaston Lecerf for the Société Immobilière de la Place Versonnex

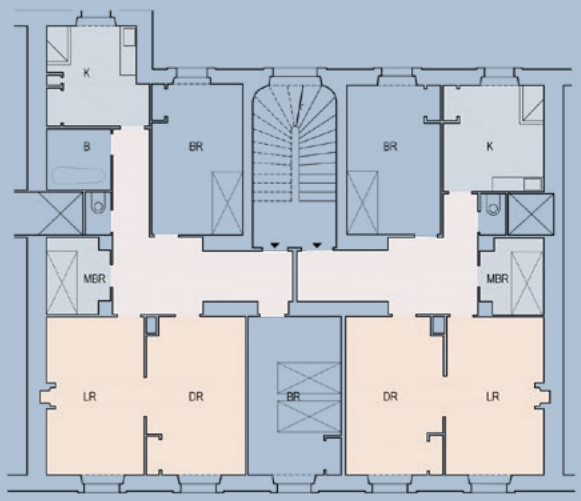
Drawings

Archives d'État de Genève:

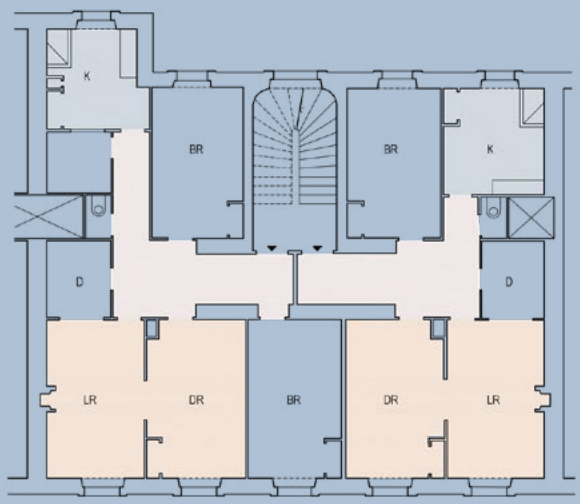
TP 1902 - 152

Selected bliography

BEERLI, BARSCHALL, BRULHART et al., 1985: 84



First option, with a closed maid's bedroom



Second option, with an alcove open towards the living room

RUE DE-CANDOLLE (32)-34-36

ca. 1900-1901

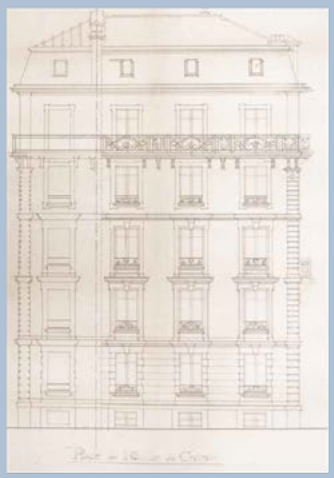
Architects Grosset & Golay

Drawings

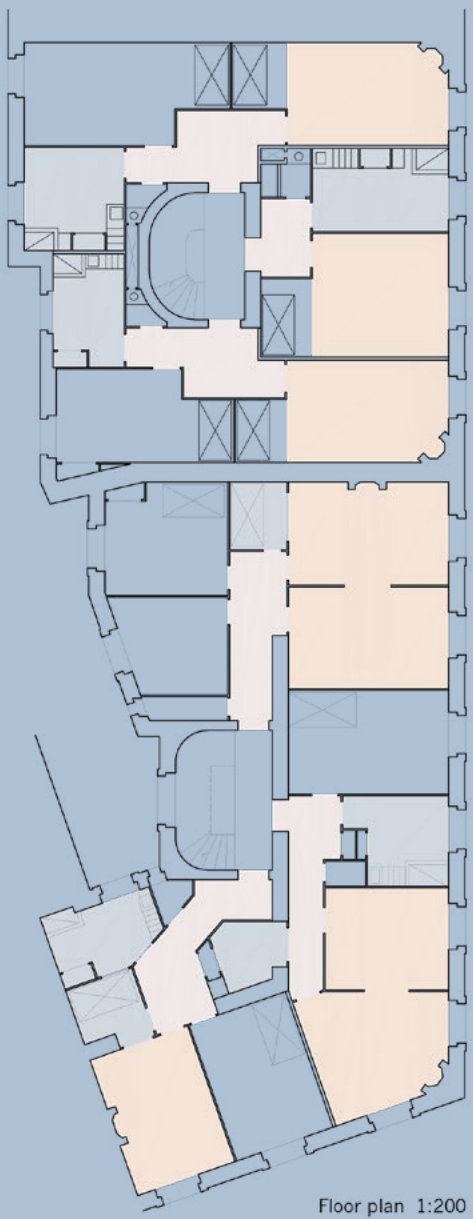
Département des constructions et de l'aménagement - Ville de Genève:

1900 - 537 - Cité [numbers 32-34];

1901 - 565 Cité [number 36];



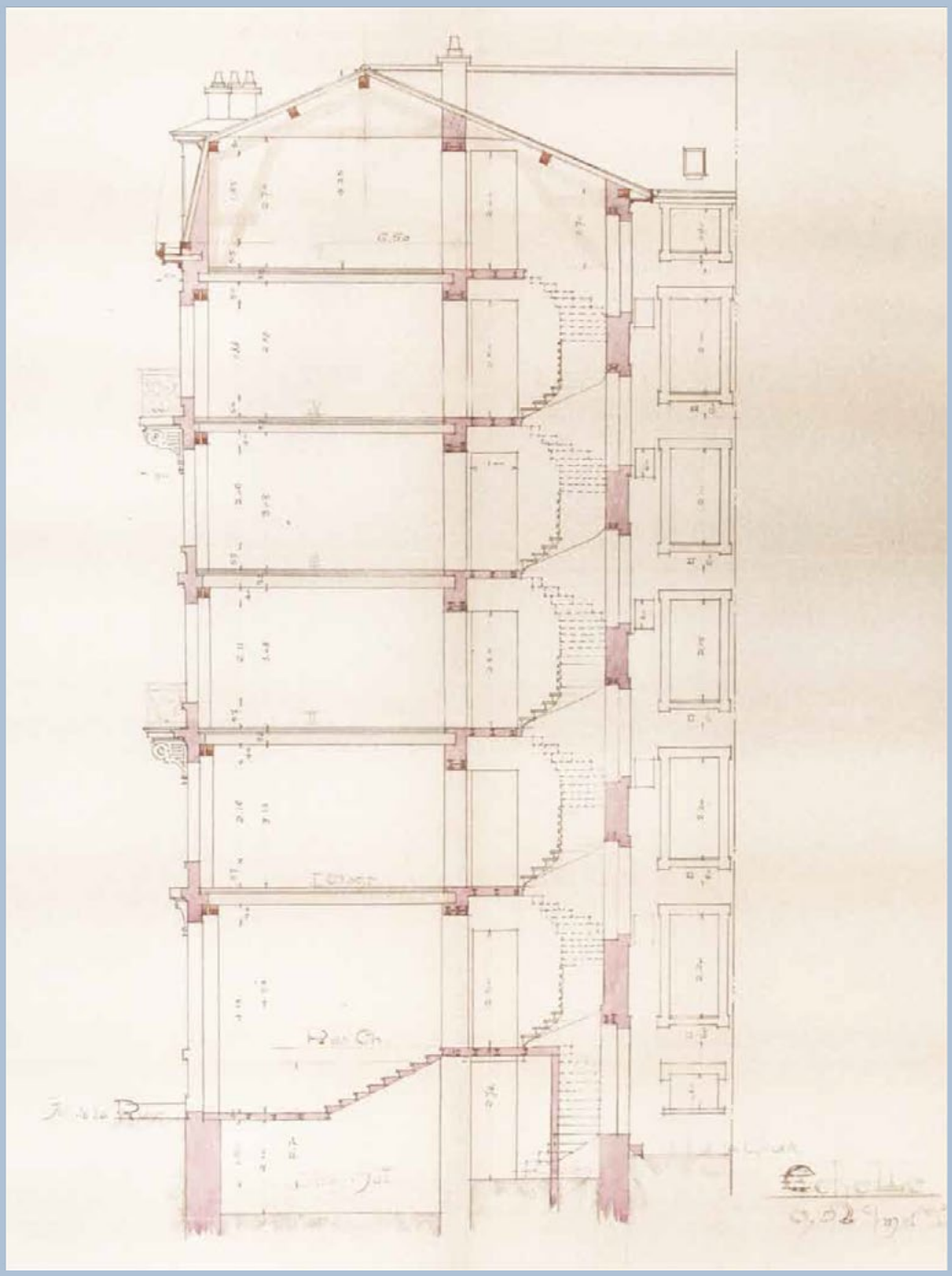
Rue de-Candolle 36, elevation



Floor plan 1:200

Service areas
Social areas
Circulation areas

0 1 5



Rue de-Candolle 36, section
scaled to aprx. 1:200

TYPE 2 · 1 FLAT PER FLOOR BLOCK

RUE DE HOLLANDE 13

1879

(Date mentioned in Armand Brulhart's inventory at Geneva's *Archives d'État*)

Architects John et Marc Camoletti for M. Binet and M. Scherer (GUEISSAZ, 2004: Annexe 1)

Drawings

Archives d'État de Genève:

AP 194/G/40 · T3/24-2-5

[dated 13th December 1894 with the indication "Immeuble de M. Binet"]

Plot sale TP 1877/221

Selected bibliography

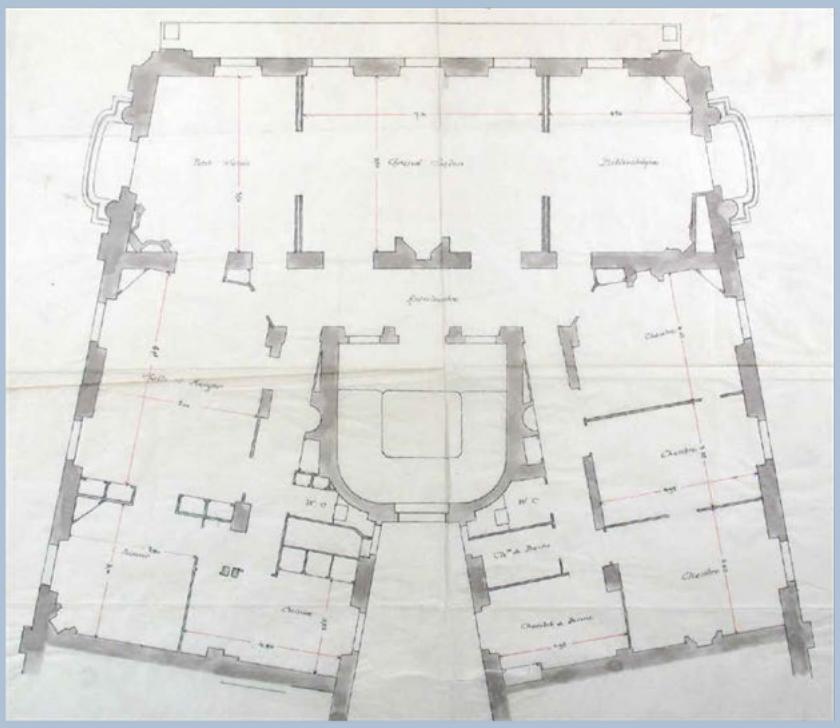
BEERLI et al., 1985: 70;

BARBEY (1982): 349;

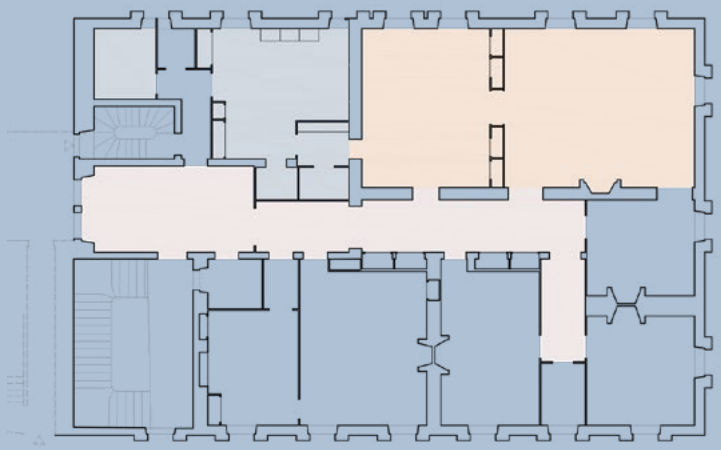
GUEISSAZ (2004): Fiche 12 and Annexe 1

View of the Hollande neighbourhood

BGE-CIG | VG N24X30 410 [taken before the construction of Hollande 13]



Floor plan | scaled to aprx. 1:200



RUE CHARLES-BONNET 10

ca. 1861-62

Architects Charles-Gabriel Diodati and Charles Schaeck for the Compagnie des Immeubles des Tranchées

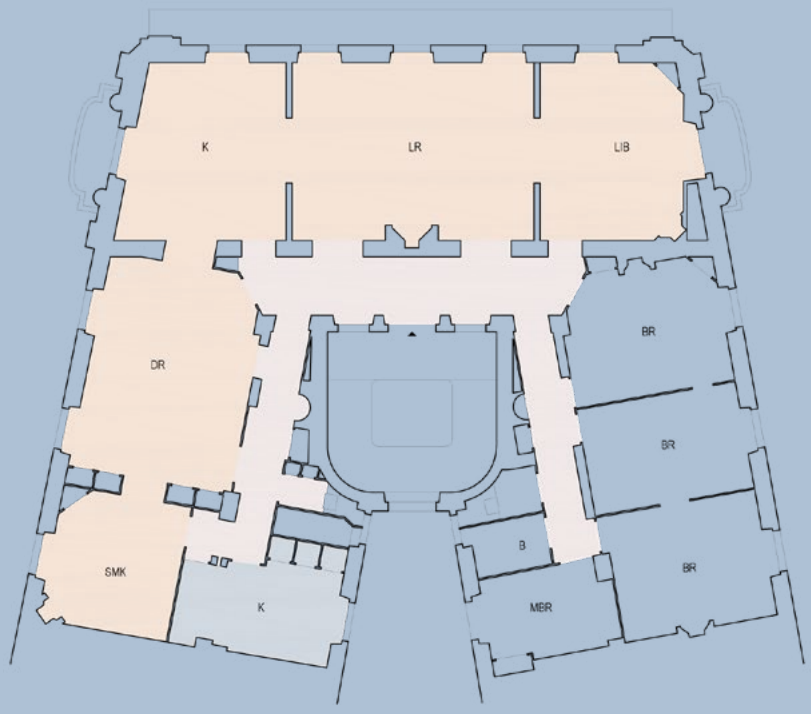
Drawings

Département des constructions et de l'aménagement - Ville de Genève:
1942 / 15012

Selected bliography

BEERLI et al., 1985: 41
BRULHART, 1985: 128

Flat floor plan, showing ground floor entrance to service staircase



Types of rooms

BR Bedroom
MBR Maid's bedroom
LR Living room
DR Dining room
LIB Library
SMK Smoking room
K Kitchen
B Bathroom

Service areas
Social areas
Circulation areas

0 1 5

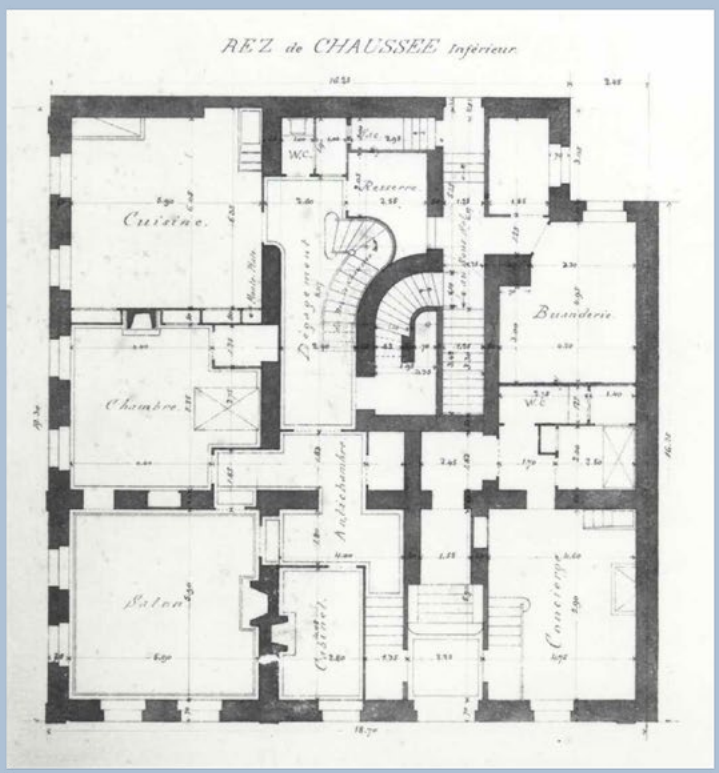
RUE DE CANDOLLE 26

ca. 1880
Architect Léon Fulpius

Drawings
Centre d'Iconographie Genevoise:
Vieux Genève [organised by street]

Selected bibliography
BEERLI et al., 1985: 54;
FREI, 2004: 89;

Rue de Candolle 26, 1895
BGE-CIG

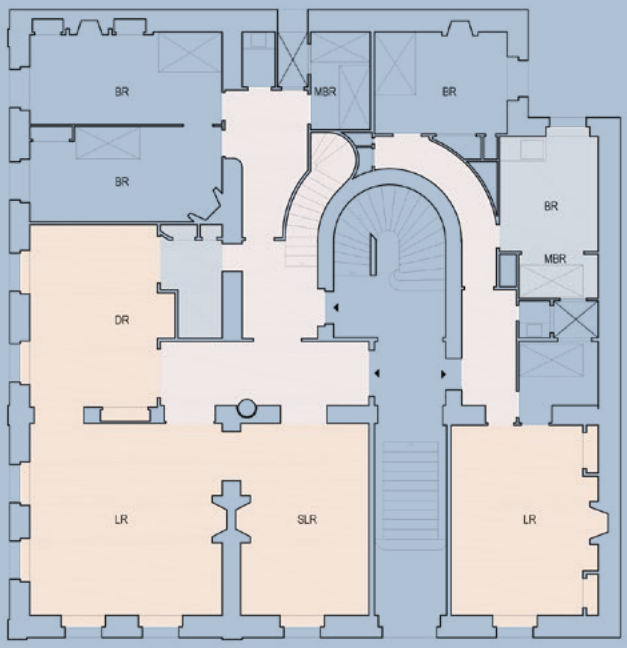


Types of rooms

BR Bedroom
MBR Maid's bedroom
SBR Small bedroom
LR Living room
SLR Small living room
DR Dining room
CAB *Cabinet* (possibly office)
K Kitchen
L Laundry room
CRT Caretaker's flat

Service areas
Social areas
Circulation areas

0 1 5



Ground floor 1:200

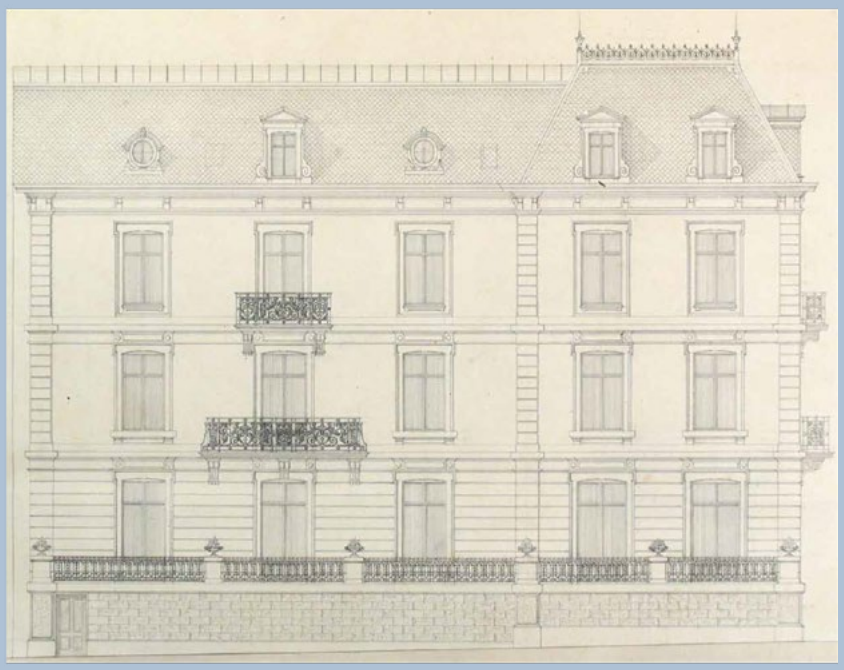
Lower ground floor, including the kitchen of one of the upstairs flats

SUBTYPE 1 – 1 FLAT PER FLOOR
TERRACED HOUSING

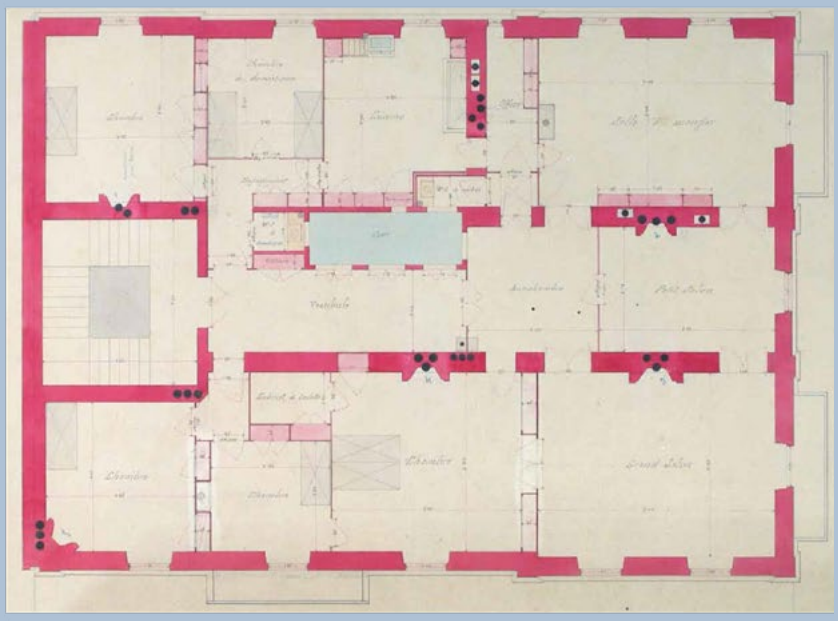
RUE ABRAHAM-CONSTANTIN 6

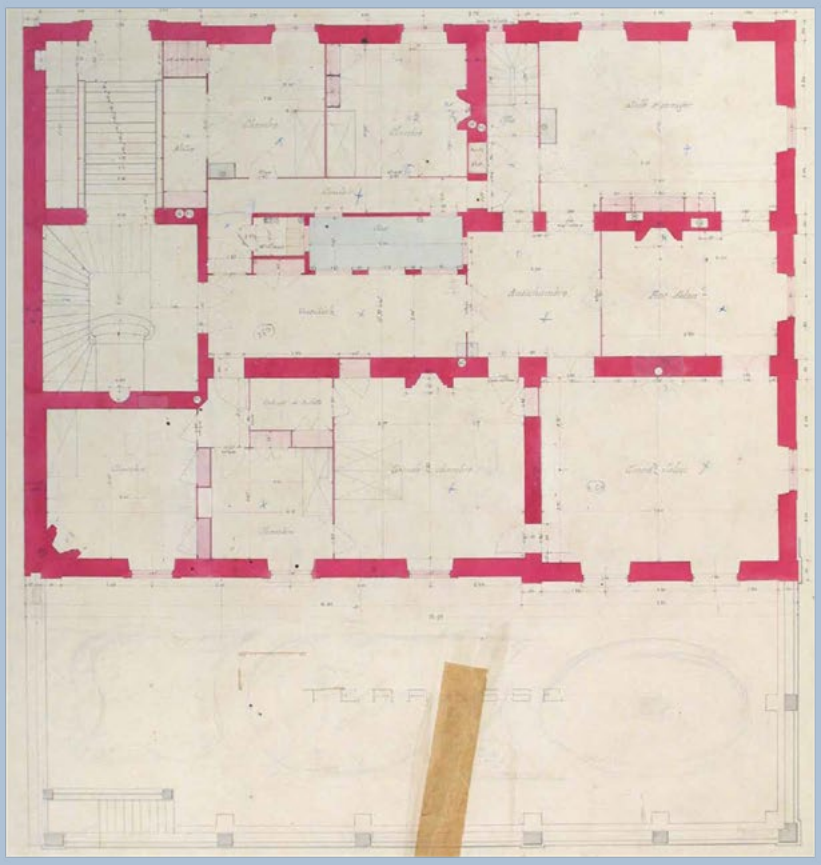
ca. 1880
Architect Jacques-Elisée Goss
for M. Viesseux

Drawings
Archives d'État de Genève:
AP 194/E/79 - TE/13-2

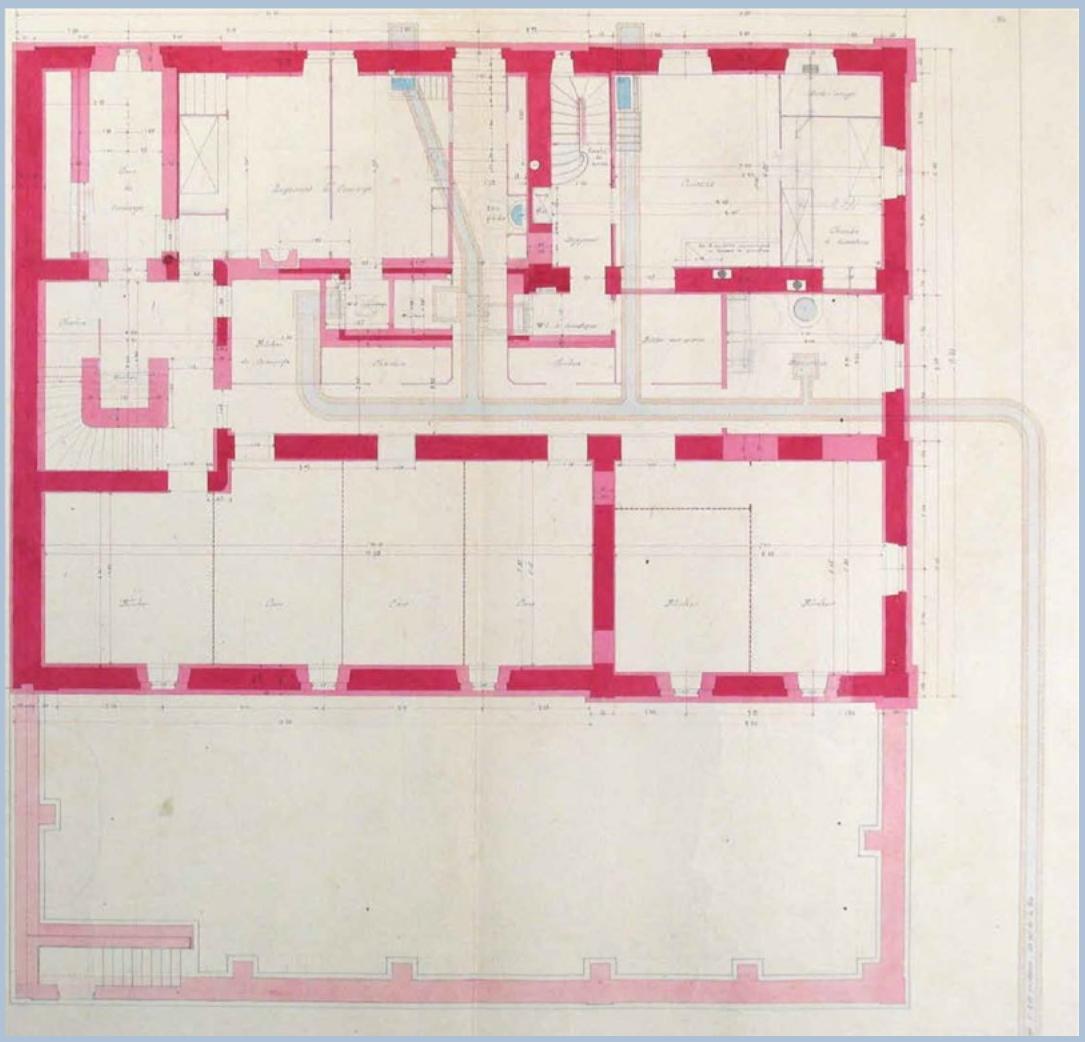


Terrace-side elevation

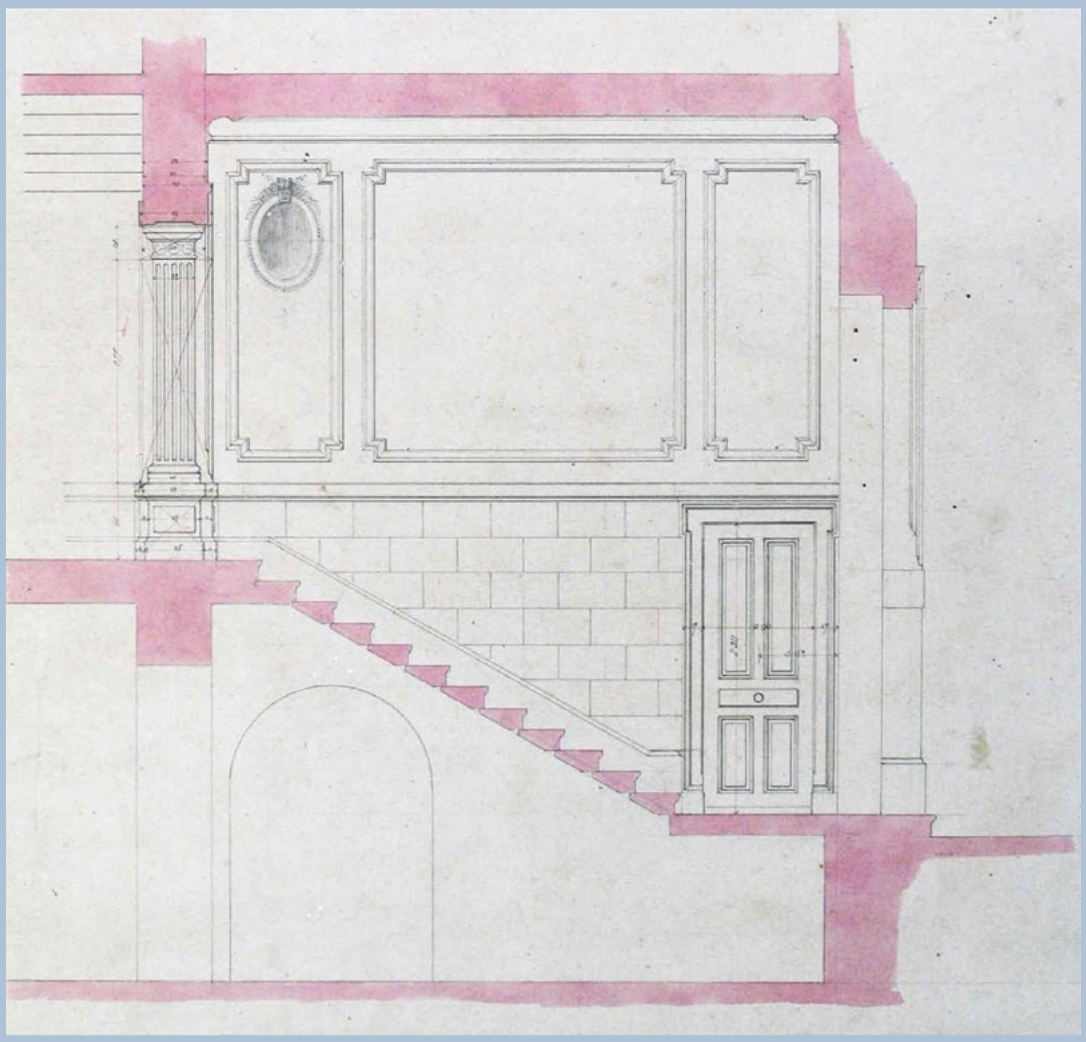




Ground floor and 1st floor | scaled aprx. to 1:200



Basement, with service areas for ground floor flat, and a small caretaker's flat
scaled to aprx. 1:200

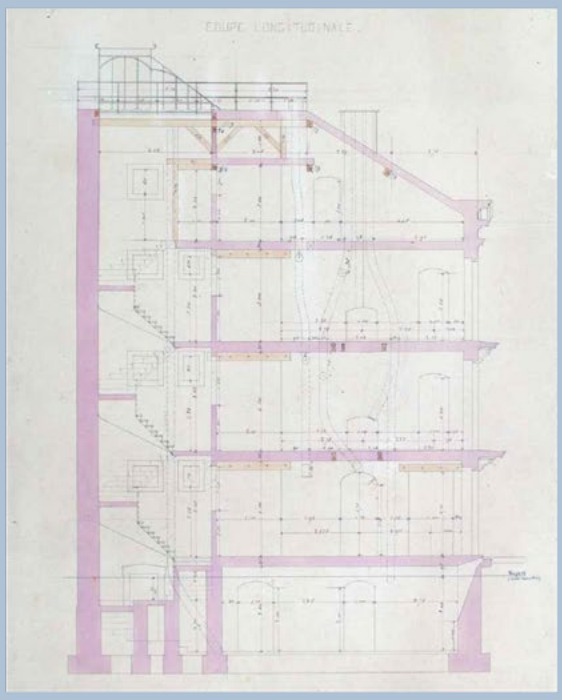


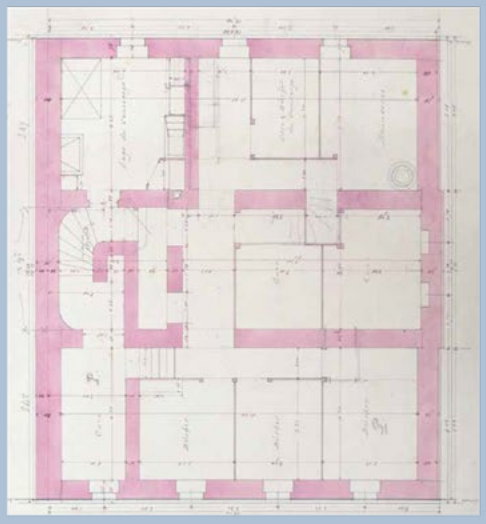
Entrance hall detail | scaled to aprx. 1:50

RUE FRANÇOIS LE-FORT 2
ca. 1872
Architect Léon Fulpius

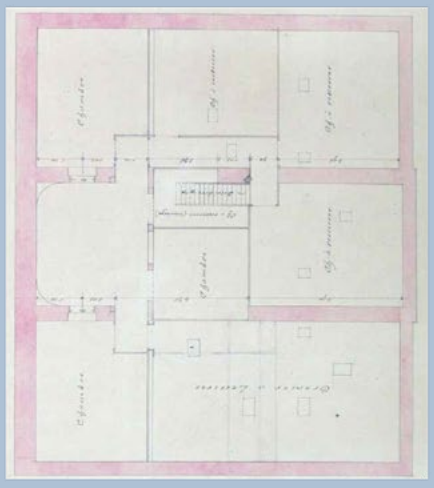
Drawings
Centre d'Iconographie Genevoise:
Vieux Genève [organised by street]

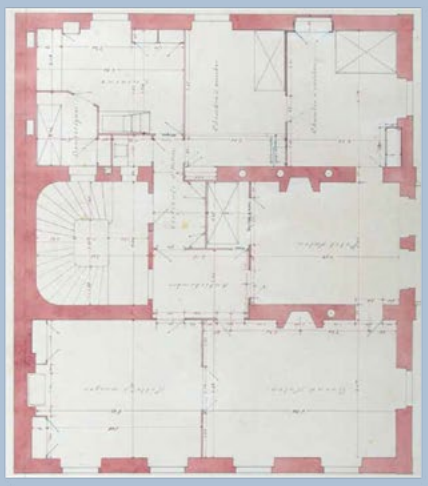
Selected bibliography
PFÄNDLER (1974): LXXXIII;

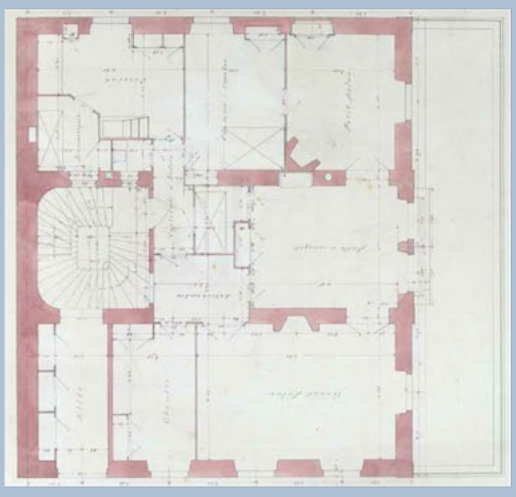




Common basement, with a small caretaker's flat
scaled to aprx. 1:200







Attic | 1st floor | Ground floor

TYPE 3 – THE SINGLE-FAMILY HOUSE

RUE FRANÇOIS-BELLOT 8-10-12

ca. 1880-1882 [number 8]
ca. 1879-1881 [numbers 10-12]

Architect Émile Reverdin
for M. Seigneux [number 8],
for himself [numbers 10-12]

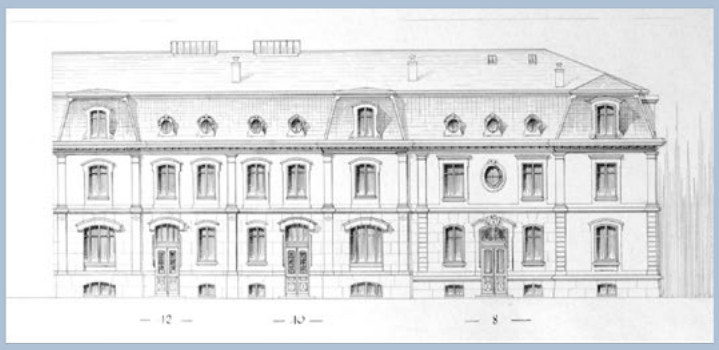
Drawings

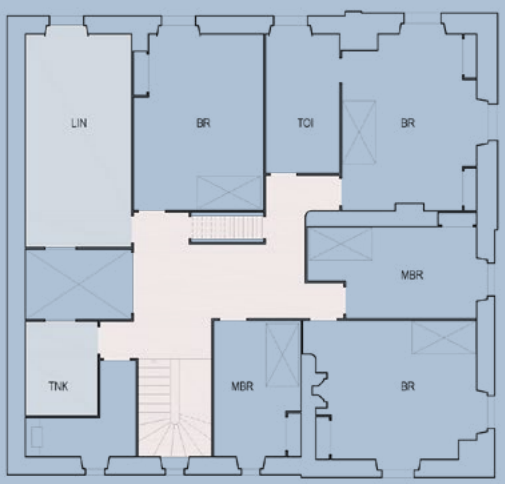
Centre d'Iconographie Genevoise:
Collection of projects by
Émile Reverdin, n°s 25, 26, 27, 31 and 32

Archives d'État de Genève:
AP 194/C/70 - TE/8-8 [section]

Selected bibliography

BEERLI et al., 1985: 30;
BRULHARD, 1985: 127;
PFÄNDLER, 1974, 73;
PFÄNDLER, 1985: 32;





Rue François-Bellot 8, 2nd floor 1:200

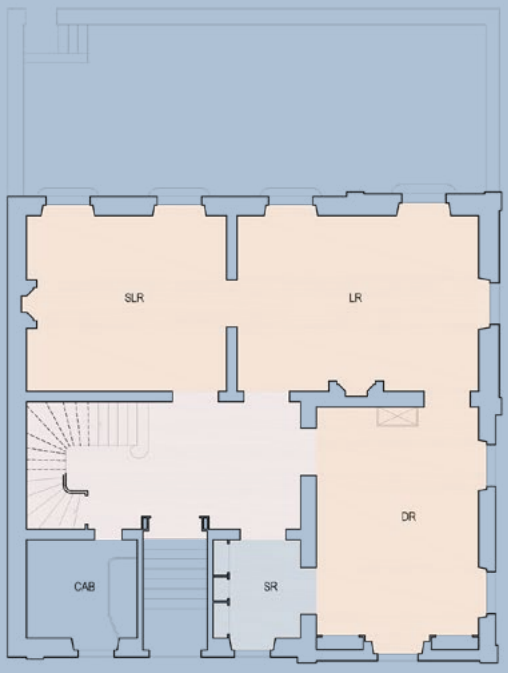
Types of rooms

BR Bedroom
SMK Smoking room
B Bathroom
TOI Toilet cabinet
MBR Maid's bedroom
LR Living room
SLR Small living room
DR Dining room
SR Service room
CAB *Cabinet* (possibly storage)
K Kitchen
L Laundry room
ST Storage (wood, coal, pantry)
TNK Water tank

Service areas
Social areas
Circulation areas

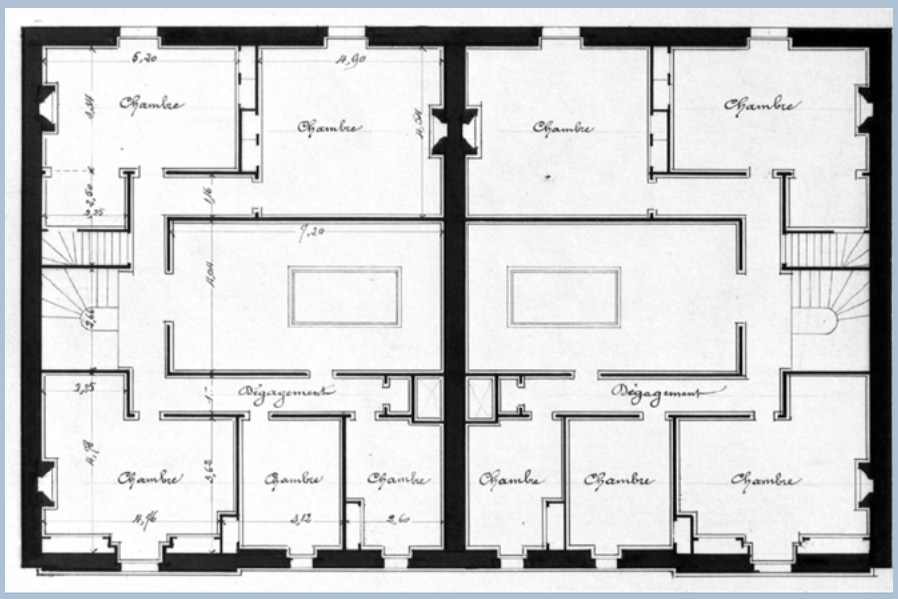
0 1 5

1st floor, with a bathroom and toilet cabinet

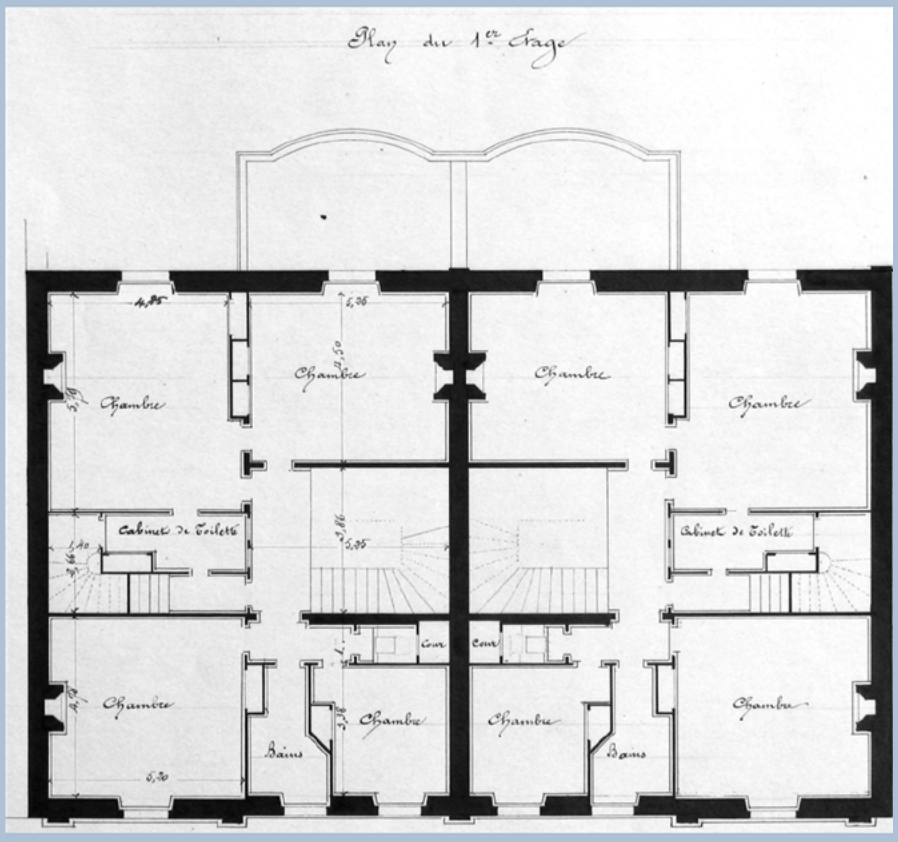


Ground floor

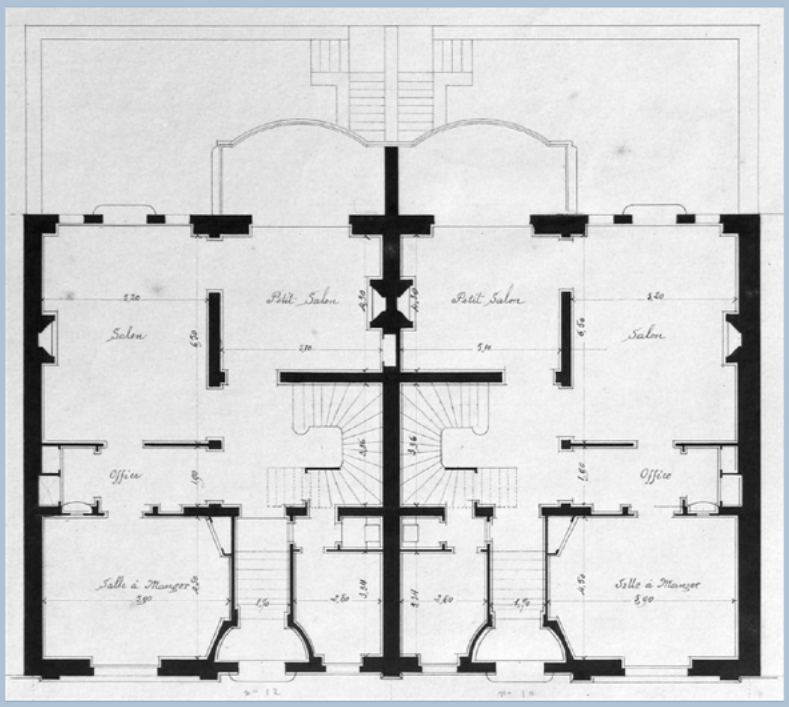
Basement



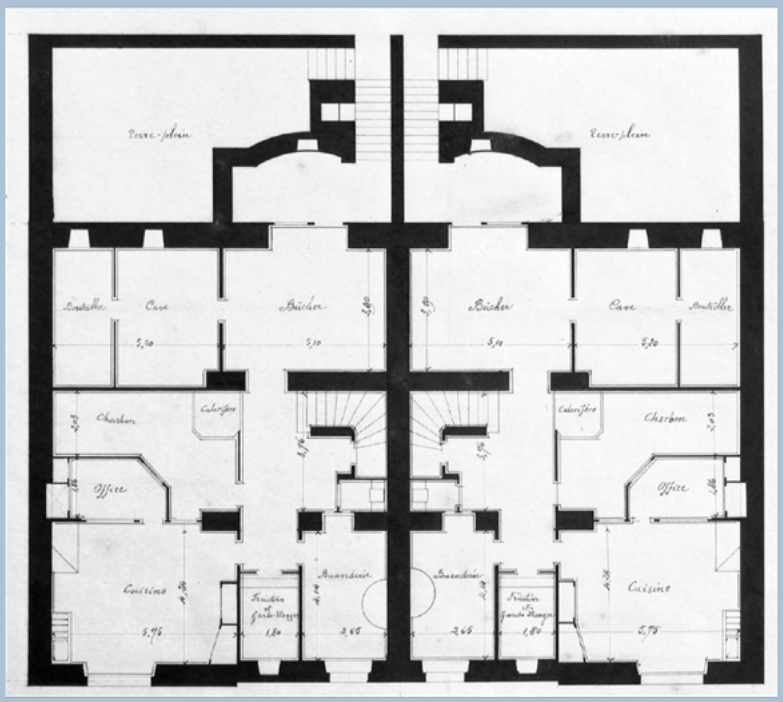
Rue François-Bellot 10-12, 2nd floor 1:200



1st floor, with a bathroom and toilet cabinet



Ground floor



Basement

RUE MUNIER-ROMILLY 4-6-8

ca. 1897
Architects Gamper & Cayla
for Mme Micheli Ador

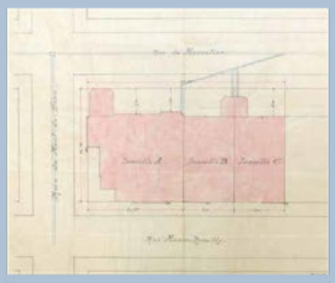
Drawings
SIA, 1907: 67-68;

Département des constructions et de l'aménagement · Ville de Genève:
1897 · 398 · Cité [numbers 4-6-8]

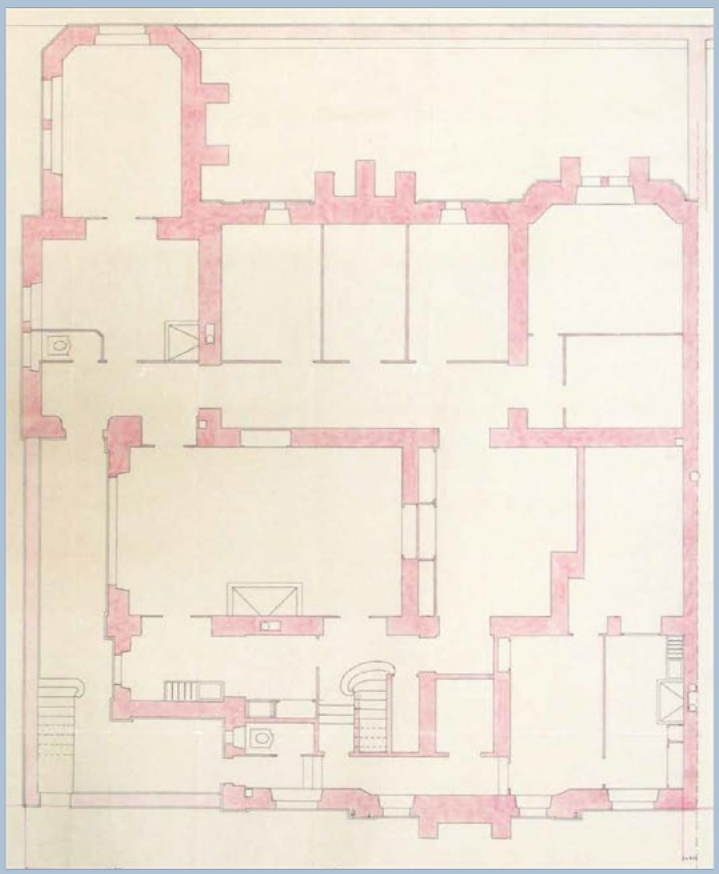
Archives d'État de Genève:
TP 1917/1 [number 6]

Selected bibliography
SIA, 1907: 67-68
EL-WAKIL, 1998:13;
BARBEY, 1982: 364
PFANDLER, 1974: LXX;

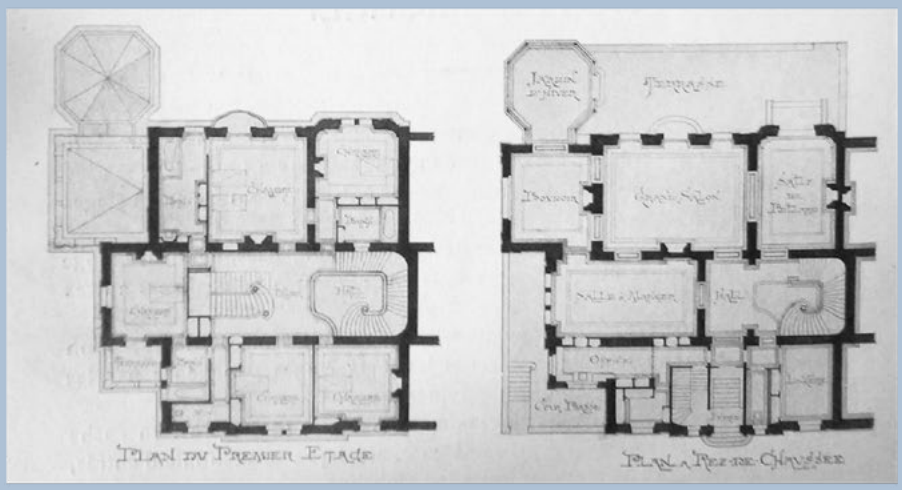
Rue Munier-Romilly 8
BGE-CIG | 84571



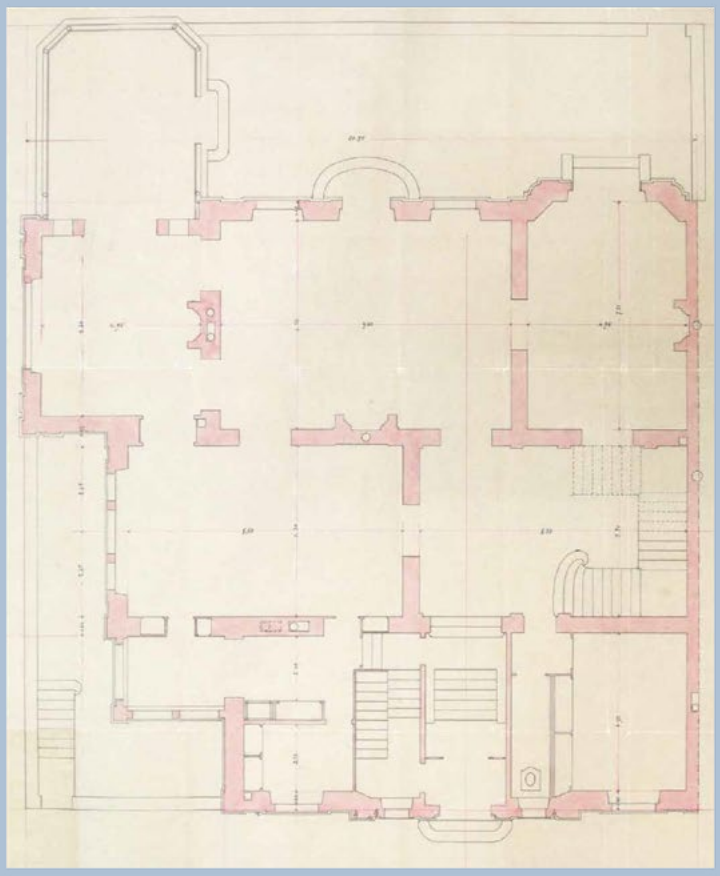
Library
BGE-CIG | VG P 2502



Rue Munier-Romilly 8, Ground floor 1:200

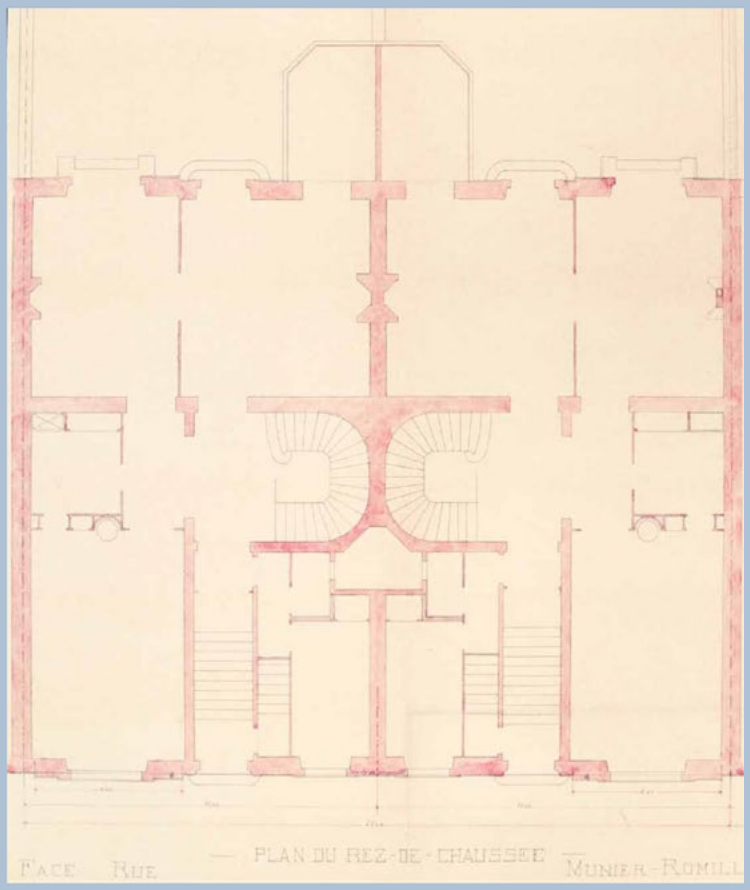


First floor and ground floor plans (SIA, 1907: 68)



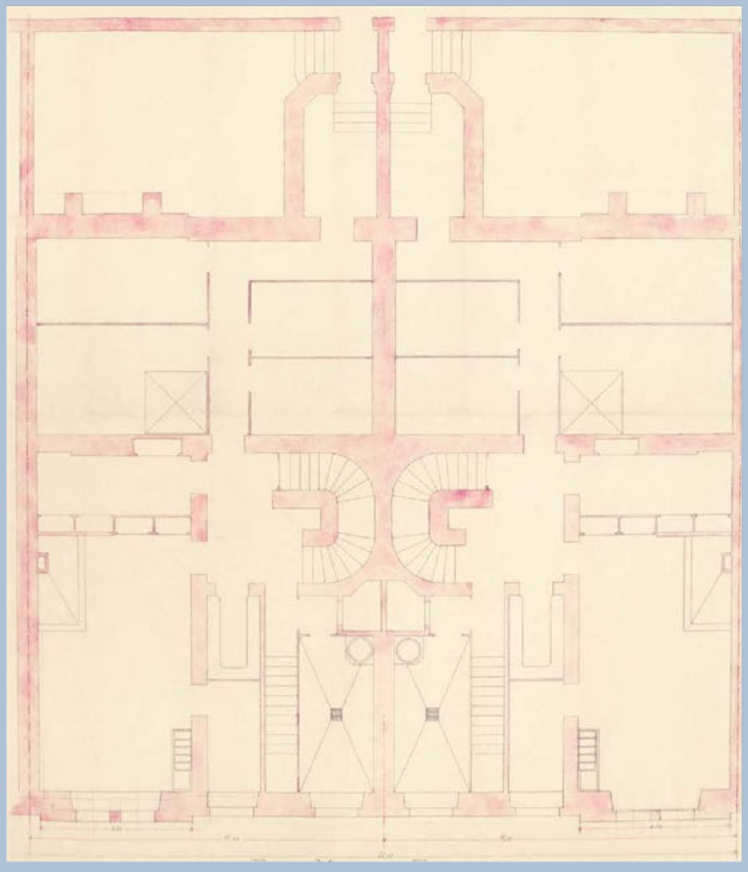
Basement

Rue Munier Romilly 4, 1915
(photo | Jullien)
BGE-CIG | 78752



Rue Munier-Romilly 4, Ground floor | scaled to aprx. 1:200

Rue Munier Romilly 4, 1915
(photo | Jullien)
BGE-CIG | 78754A



Basement

SUBTYPE 2 – OFFICE-RESIDENTIAL BUILDINGS

RUE BOVY-LYSBERG 5

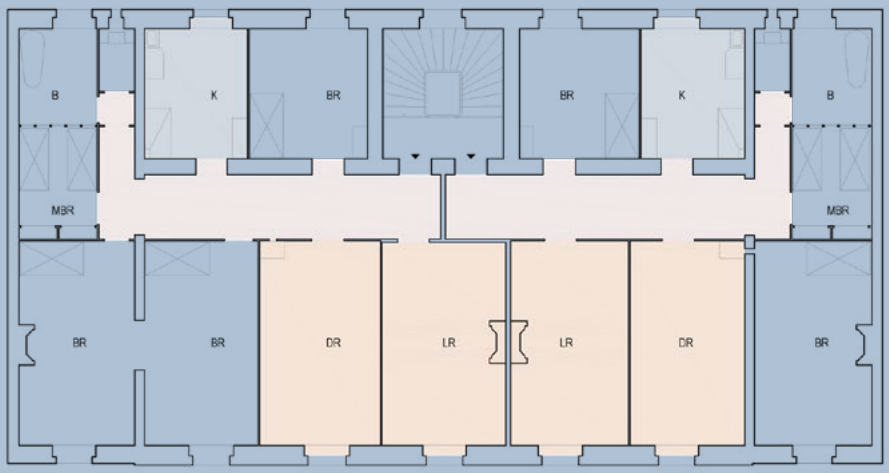
ca. 1896
Architect Marc Camoletti
for the Cercle Maçonnique

Drawings

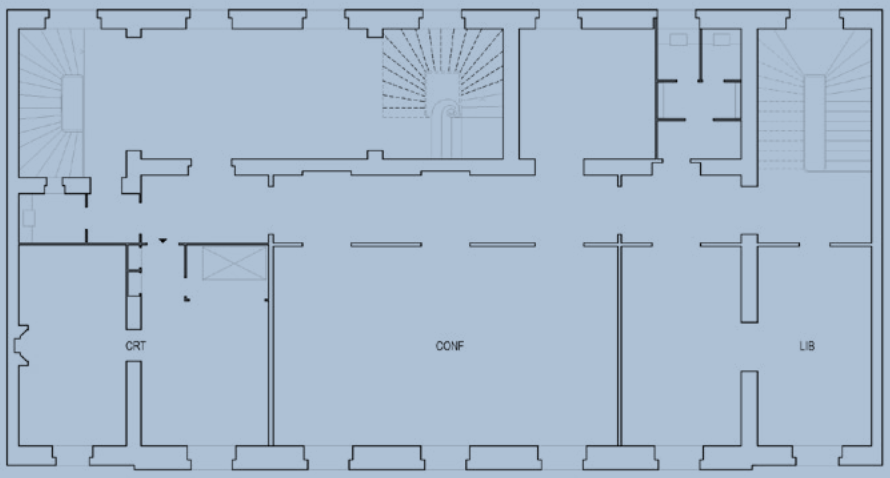
Département des constructions et de l'aménagement - Ville de Genève:
1896 - 361 - Cité

Selected bibliography

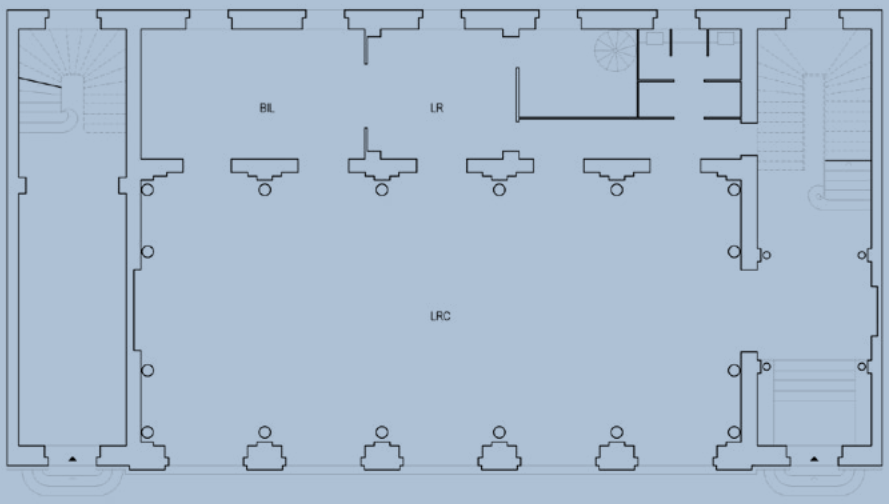
BARBEY, 1982: 323



Flat floor plan
scaled to aprx. 1:200



1st floor [residents change staircase]



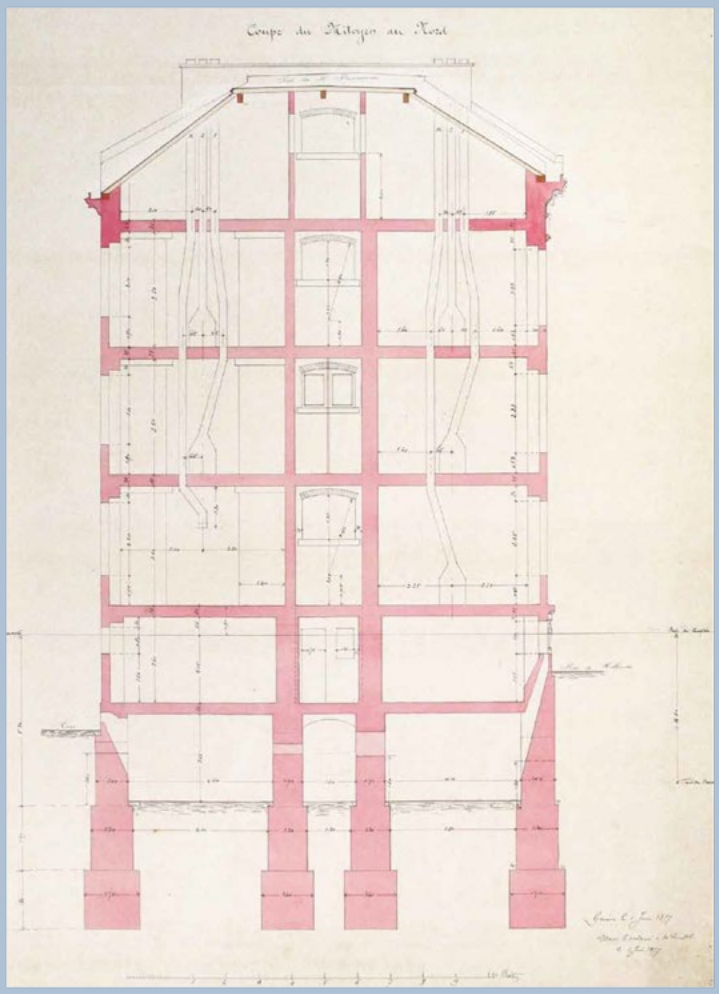
Ground floor, with two separate entrances

RUE DE HOLLANDE 10
ca. 1877-1878
Architect Émile Reverdin
for La Genevoise

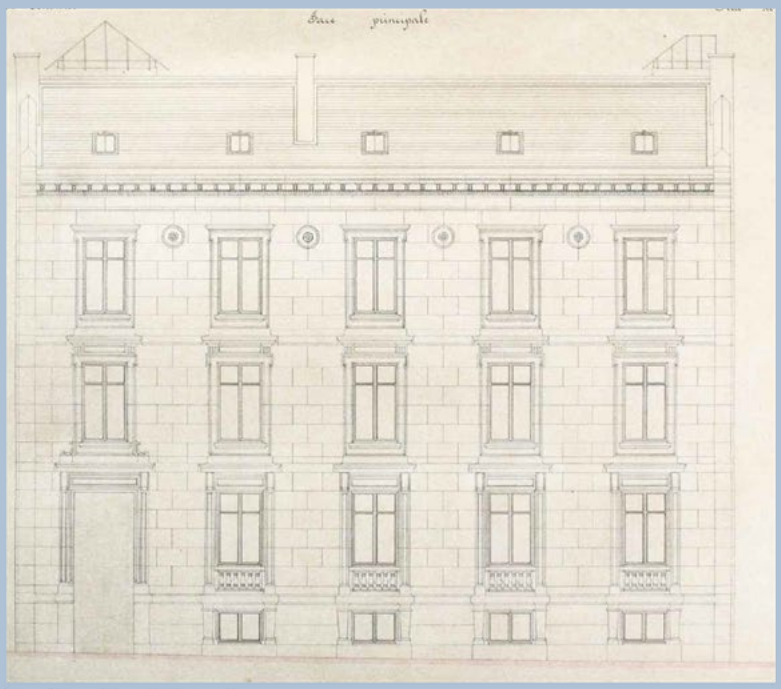
Drawings
Archives d'État de Genève:
AP 194/B/84 - TE/5-42

Centre d'Iconographie Genevoise:
Collection of projects by
Émile Reverdin, n°12

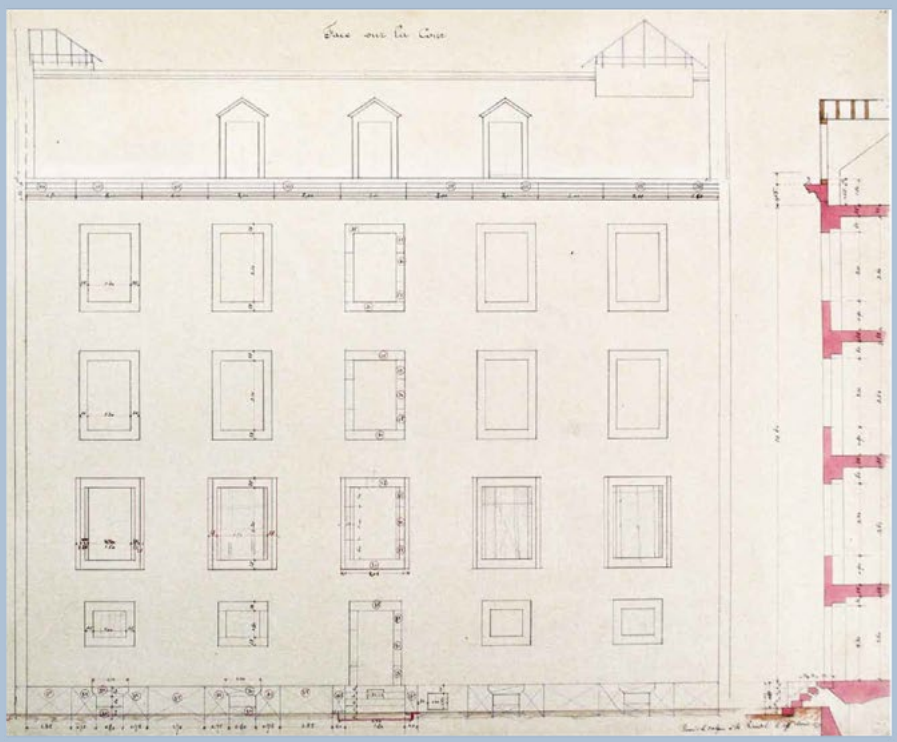
Selected bibliography
BEERLI, 1985: 71



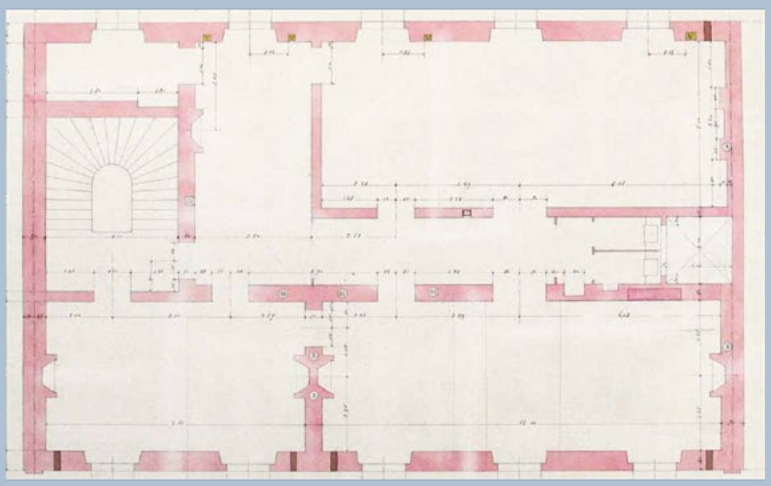
Transverse section, with a view of the chimneys
scaled to aprx. 1:200

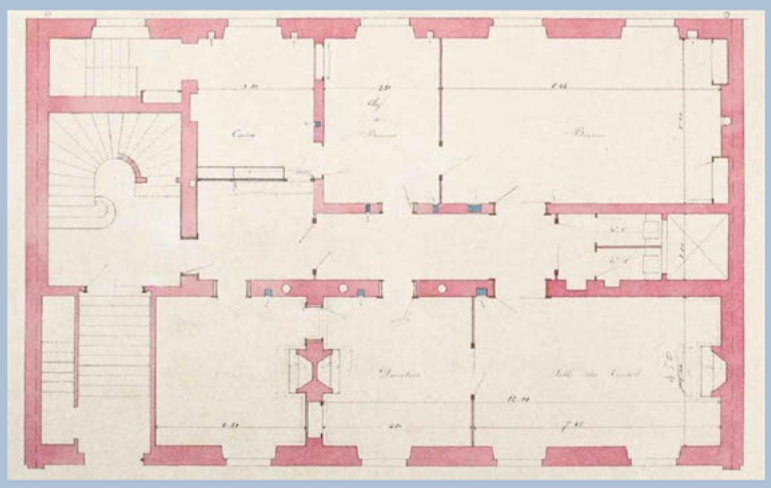


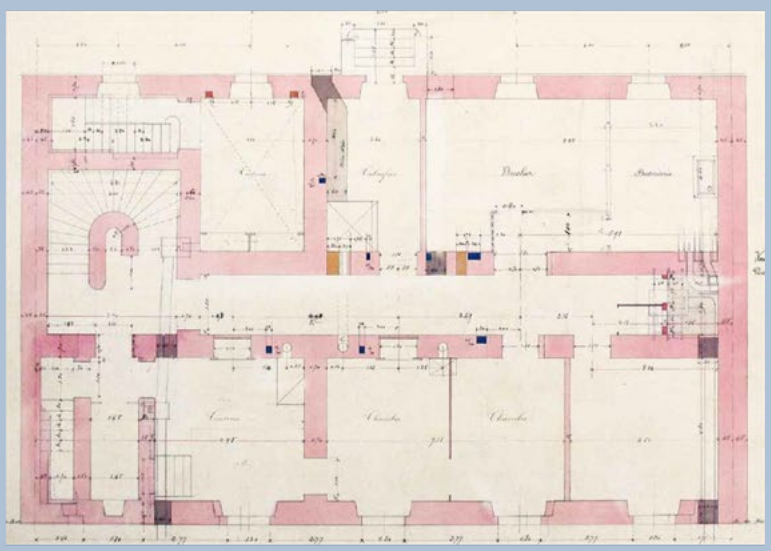
Elevation – Rue de Hollande



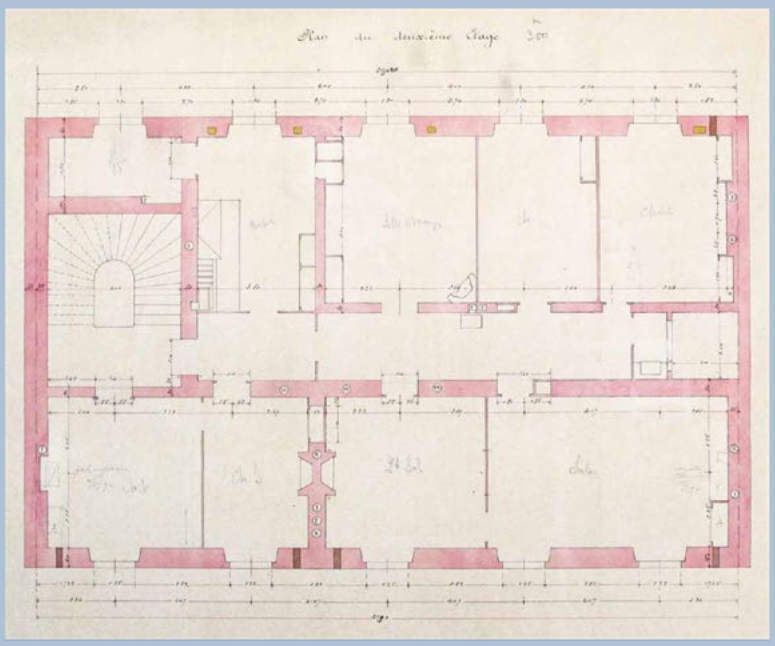
Courtyard side elevation



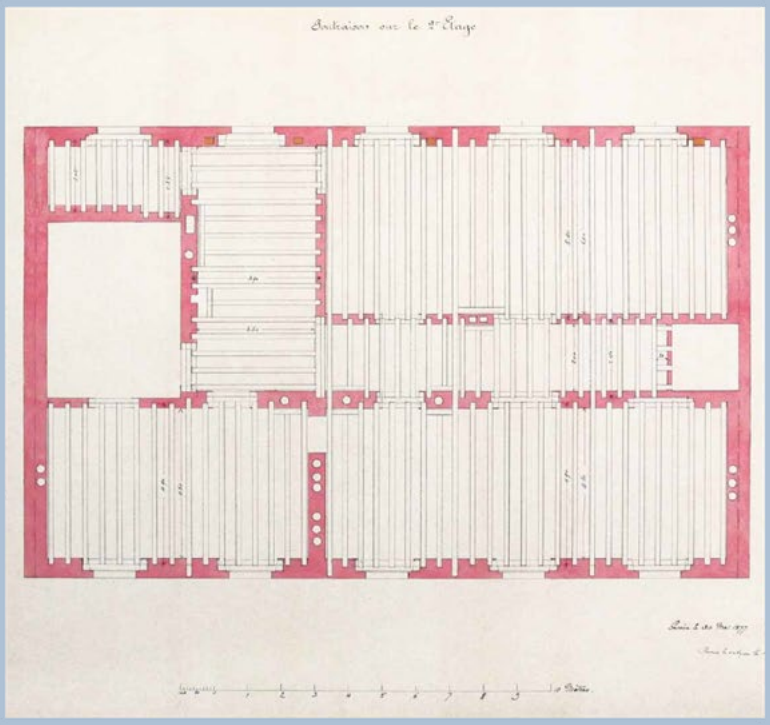




1st floor | GF – Offices
Basement
scaled aprx. to 1:200



2nd floor flat



Plan of the timber joists on the 2nd floor

LEGAL CONDITIONS FOR RENOVATION

Part 4

This chapter[1] examines the legislation that concerns 19th century residential buildings in the cities of Geneva, Lisbon and Oporto, focusing on the topics of built heritage protection, restrictions on housing transformations, measures promoting renovation[2], and technical regulations regarding thermal and sound insulation. Measuring the practical impact of these pieces of legislation was beyond the scope of this work. Nevertheless, their effects are partially covered by this legal analysis, as well as by the chapters concerning renovations to improve thermal and sound insulation.

Historical residential buildings are affected by issues such as the present-day housing market, the importance that is socially attributed to historic sites and the evolution of family life and their comfort expectations. The current and changing legal context is one of the aspects that frame this reality. Legally, these issues can be translated into town and country plans and strategies, patrimonial protection of buildings or sites, and comfort or safety regulations on buildings.

Legislation and plans for built heritage protection in Switzerland are essentially of cantonal responsibility, based on some common principles delineated by a federal legal basis, the *Loi fédérale sur l'aménagement du territoire* (LAT) and the *Loi fédérale sur la protection de la nature et du paysage* (LPN). In addition, a federal inventory of sites of national importance (ISOS) serves as encouragement to the protection of significant sites, even though it does not enforce building regulations (Assemblée Fédérale 2012: Art.5, Conseil Fédéral 2012). This regional specificity means, in turn, that protection and comfort demands might vary significantly between Swiss cantons. The city of Geneva's 19th century areas are an example of coherent large-scale developments where blocks of flats play a fundamental role. This is especially true in the so-called *Ceinture Fazyste* ⊠, a planned area built around the medieval city centre through the demolishing of the old fortification walls in mid 19th-century. At a federal level, the city was included in the ISOS inventory. At a cantonal level, there is highly demanding legislation regarding energy standards, with a particular focus on the promotion of a sustainable low-energy consumption society. However, heritage protection in the canton of Geneva is also quite exceptional, since it promotes the conservation of both individual and ordinary 19th and early 20th century buildings, reinforcing their value as whole. Sound insulation demands have a federal legal basis (OPB). As we shall see, while regulations on this issue are also quite demanding, exemptions are clearly taken into account depending on the impact on existing buildings.

Legislation for the protection of built heritage in Portugal has a clear national basis, law nº107/2001, establishing the regime of protection and valorisation of cultural heritage, and ordinance nº309/2009, detailing the listing procedures, the regime of protection areas around monuments and the preparation of the detailed conservation plan. It is important to note that the listing procedure in Portugal can be applied not only to individual monuments but also to particularly important sites or homogenous urban areas. However, there can be important differences between cities in the application of the listing status to sites. Each municipality can also define additional protection instruments through the urban municipal plan (*plano director municipal*). Technical regulations concerning the improvement of thermal performance are, in principle, applicable to large renovations. However, both regulations regarding thermal and acoustic performance have recently been the target of exemption regimes with the aim of encouraging the completion of a larger number of renovations at a lower cost.

In both countries, the measures that can most directly affect ownership rights and reinforce public powers are directed at pressing issues affecting the population and the built environment. In Geneva, the extreme lack of available housing has motivated the enforcement of specific legislation (LDTR) that limits changes to buildings that would to result in rent increase or in the reduction of the number of rooms per flat. In Portugal, the serious degradation of a large number of buildings in several cities has led to the issuing of a special renovation regime (RJRU) that aims to promote and enforce building renovation in selected areas using, under certain conditions, mechanisms such as forced sale, expropriation, etc.

Protection measures in Switzerland

Switzerland is a federal state where cantons have a large autonomy. On matters where the constitution states that the federation will legislate or issue principles, federal laws are generally drawn up by the Federal assembly (*Assemblée fédérale*) and ordinances on those laws by the Federal council (*Conseil fédéral*). The ordinances then specify the rules that are applicable to the legislation. In most cases, more detailed cantonal legislation is drawn up, either according to competences that derive from federal legislation or directly from the constitution.

Two sections of the constitution relating to competences are applicable to our study: "*Environment et aménagement du territoire*" (Titre 3, Chapter 2, Section 4) and "*Logement, travail, sécurité sociale et santé*" (Titre 3, Chapitre 2, Section 8). According to Section 4, the confederation defines the principles of town and country planning, which is then of cantonal responsibility (Confédération suisse 2012: Art.75). The protection of nature and patrimony is entrusted to the cantons: "The protection of nature and of heritage is of cantonal responsibility"[3] (Confédération suisse 2012: Art.78). However, the confederation considers their protection when accomplishing its tasks, and preserves the integrity of important locations if public interest demands it.

Two federal legal instruments include the main measures that constitute the basis for heritage protection of homogenous urban areas in Switzerland (*ensembles*), the federal law on land-use planning (*Loi fédérale sur l'aménagement du territoire* [LAT]) and the federal law on the protection of nature and of the landscape (*Loi fédérale sur la protection de la nature et du paysage* [LPN])[4].

The LAT states the confederation's main principles for town and country planning, such as the creation and upkeep of a built environment that is harmoniously planned (Assemblée Fédérale 2012: Art. 1b), and defines federal and cantonal responsibilities in the matter. There are two main planning measures[5] at a cantonal level: cantonal master plans (*plans directeurs des cantons*), which define the main cantonal planning strategies, and land-use plans (*plans d'affectation*), that specify different land uses. As stated in article 6b, in order to define their master plans, the cantons establish their main planning lines, identifying, among others, "the areas of the territory that [...] stand out by their beauty or value, have particular importance for leisure activities or have an outstanding ecological role"[6] (Assemblée Fédérale 2012: Art.6b). The master plans are then approved by the *conseil fédéral*. The land-use plans of each canton go even deeper into the subject of patrimonial protection, as they

must at least define building, agricultural and protected areas (*zones à protéger*) (Assemblée Fédérale 2012: Art.14). Cantonal authorities approve the land-use plans. Article 17 of the LAT specifies the characteristics of protected areas, which might be of natural importance (rivers, animal biotopes, specific plants, etc.), or regarding the cultural and built environment, such as valuable cultural heritage, typical and historical places and monuments. Further on, in article 29, the LAT states that the Confederation can grant compensations for the protection measures defined in article 17, when these are of particular importance.

The second main piece of legislation, the LPN, aims to promote the protection of valuable natural and built sites, and support cantons, organisations and research in accomplishing this goal. The articles that interest us concern the responsibilities of state institutions (federal and cantonal) in this respect, the distinction between object importance, and the financial support that may be granted to conservation programs. State responsibility is enforced by considering this matter when caring for its own patrimony and by imposing conditions or refusing permissions and grants (Assemblée Fédérale 2012: Art.3). It is particularly interesting to note that the LPN protection measures also specifically engage owners, constituting public law restrictions to ownership (Assemblée Fédérale 2012: Art.13).

In article 4, the LPN distinguishes between patrimonial objects based on their national, regional or local importance. Objects of national importance are inventoried by the *conseil fédéral*, and particular protection measures defined for their conservation. A federal inventory of sites of national importance to be protected in Switzerland was drawn up in accordance with article 5 of the LPN. It is regulated by the *Ordonnance concernant l'Inventaire fédéral des sites contruits à protéger en Suisse* (Conseil Fédéral 2012). This inventory does not enforce building requirements or limitations, but is rather a reference and an encouragement to their protection, as these sites are to be considered by cantons when establishing their master plans (Assemblée Fédérale 2012: Art.6). Financial support may be granted by the confederation to conservation programs for the protection of natural or historical monuments, depending on the national, regional or local importance of the objects. The city of Geneva is one of the listed sites of national importance that are mentioned[7] and thus taken into account by the canton when drawing up its master plan and protection measures.

The LAT and the LPN define a common federal basis for heritage protection in Switzerland. While having these common principles, more specific legislation and plans are then drawn up by each canton. This regional specificity means in turn that patrimonial protection and comfort demands can vary significantly between Swiss cantons, especially when we consider the case of historical ordinary buildings rather than individual monuments. As we have previously argued, the key value of ordinary housing – which might sometimes be disregarded – often lies in the repetition of proportion, layout and detail, forming homogenous sets that contribute to the definition of urban identity in many cities. In many cases, these buildings are identified as having a local importance, as noted in the LPN, which usually gives them a general protection in case of transformation work, or do not benefit from any legal protection. Even in the first case, several changes could be considered as

everyday maintenance work (for example, window replacement) and not be considered subject to approval by heritage protection services.

Protection measures in Geneva. Built heritage protection in the canton of Geneva promotes the conservation of both individual monuments and more common 19th century buildings, reinforcing their value as a whole. While monument protection is generally enforced through listing (*classement*), protection of more ordinary buildings takes place by individual addition to the register (*inventaire*) or, most often, by inclusion in protected perimeters: conservation areas (*zones protégées*), site plans (*plans de site*), and special regulations (*réglements spéciaux*)[8].
Protected perimeters ⊠ are one of the main strengths of heritage protection in the canton, as they are enforced through the instruments of urban planning. As such, their basis is defined in the piece of legislation on land-use planning, the LAT, which defines the procedure for the elaboration of the land-use plans (*plans d'affectation*). The most general of these land-use plans is the zoning plan (*plan de zones*), which maybe of 3 different types: ordinary areas (*zones ordinaires*), development areas (*zones de développement*) and conservation areas (*zones protégées*). The conservation areas "form delimited perimeters [...] and have the objective of protecting the organisation and the architectural character of those neighbourhoods and places"[9] (Grand Conseil 2013: Art.12-5).
Most buildings of our time of study are in areas considered building areas (*zones à bâtir*), included in the ordinary areas, which define "the general function of the land they comprise" (Grand Conseil 2013: Art.12). Part of these areas overlap protected perimeters, such as the conservation areas or the site plans, and some buildings in these areas are included in the register or are listed. However, there is also a large number of buildings that fall outside these protection measures, making it important to understand how they are affected by the general regulations in force.
The building regulations that affect different types of areas are further defined in the LCI, including the conservation areas. In an article concerning the chronological evolution of protection measures in Geneva[10] Sabine Nemec-Piguet (2007), current head of the Geneva heritage protection department (*Office du patrimoine et des sites*), underlines how this measure shifted part of the perspective on built heritage protection from the individual to the urban character of each place. Amongst the conservation areas, two are of particular interest to our study: the *Vieille Ville et secteur sud des anciennes fortifications* and the *Ensembles du XIXe siècle et du début du XXe siècle*. The first area is the most protected, and includes the medieval city centre and a large part of the 19th century planned building area on previous fortification land, both located in the southern riverbank. Protection of this area aims foremost to preserve its urban layout and architectural character. According to the LCI, existing buildings ought to be kept in place and, in case of changes, their structure and characteristic elements should be kept. All architecture ought to match neighbourhood character in volume, scale, materials and colour, and street alignment and building height must match the existing built fabric. Furthermore, all permissions are submitted to the *commision des monuments, de la nature et des sites* for evaluation.

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The *Ensembles du XIX^e siècle et du début du XX^e siècle* are not a single area as such but rather allow for the protection of groups of buildings that define a set outside protected perimeters. This measure is still often referred to as "loi Blondel", as it was proposed by Denis Blondel, son of Louis Blondel[11] and, at the time, president of the *Société d'art public* (Nemec-Piguet 2007: Art.48). It is a mechanism that is particularly interesting as it is based on the specificity of ordinary 19th century buildings: their value as a set with repeated elements that contribute to urban identity. Historians Armand Brulhart and Erica Deuber-Ziegler called this measure "a giant step towards the recognition of the quality of homogenous urban areas"[12] (Brulhart 2007: 70) in an article concerning the slow yet steady evolution of the social and legal acknowledgement of patrimonial values in Geneva.

The *Ensembles du XIX^e siècle et du début du XX^e siècle* measure allows for the protection of buildings which might not form a very large city area but that are nevertheless important to the neighbourhood or street they integrate (Grand Conseil 2013: Art.89). The measures of protection that are applicable are similar to the *Vielle Ville et secteur sud des anciennes fortifications* area. The legislation mentions that the architectural and urban unity of these areas should be preserved, and that the areas where this unity is complete should be kept in place. As in the previous area, in case of renovation or transformation, their structure and elements that are worthy of protection ought to be preserved. All permissions are also submitted to the *commission des monuments, de la nature et des* sites. The difference that nevertheless seems to exist between the protection measures in these two areas is that while the first one clearly mentions the mandatory preservation of the buildings, in the second keeping buildings in place depends on buildings' role in an area if their unity is complete. This is also evident when we consider the fact that conditions for reconstruction are only mentioned in the second case. Nevertheless, if permission to rebuild is granted, building height and number of floors should be kept, in order to maintain a homogeneous architecture (concessions might be made if justified by the aesthetic of the set). Therefore, there is no clear gain in building area when rebuilding, which reflects a legislative preference for keeping these buildings in place. This instrument is also evoked within the regulations of the site plans for buildings that are obligatorily maintained. An indicative list of characteristic elements of the *Ensembles du XIX^e et début du XX^e siècle* that are worthy of protection (Grand Conseil 2013: Art.90) is presented in the *service des monuments et des sites'* website (SMS 2013). This list shows the extensive possibilities of patrimonial protection that are put in practice in Geneva. It is divided based on four main topics – entrance hall and staircase, apartments, façades and roof, and windows – and includes most of the main building and decorative elements (staircase, doorways, parquets, stonework, woodwork, ironwork, chimneys, elements in plaster of Paris, etc.), and even plan typology.

The LPMNS aims to preserve Geneva's monuments as well as important natural and built sites and buildings. Three main protection measures are in force: listing, registration, and the inclusion in a site plan. Listing is less applicable to our study since it focuses on individual monuments. The register includes both monuments as well as

individual buildings that are worthy of interest. Buildings that are registered should be kept and their characteristic elements preserved, using as reference the list of elements in place for the *Ensembles du XIX^e et début du XX^e siècle*. The site plan is a specific type of land-use plan that is detailed in the LPMNS. It is a fundamental measure, since it also allows for the protection of important areas, including some from 19th century. Site plans and the special regulations[13] where there are ordinary 19th century buildings focus mainly on areas that are particularly important to mark the image of the city: riverbanks and key squares. These are the buildings that frame the southern and northern riverbanks, and the two main squares of the southern riverbank[14]. Most of them include a map and specific regulations with the aim of preserving the urban identity of the area. Three main types of buildings are usually identified. The first ones should be maintained in place, as well as their main architectural elements. The second type includes buildings that have some interesting elements, and their transformation or demolition is appraised on a case-by-case basis. Other buildings can be transformed or rebuilt depending on site integration and to an established height limitation. If specific regulations are not drawn up, the LCI's protection of characteristic elements is also applicable to buildings that should be maintained according to the plan.

According to the LPMNS, cantonal authorities can have a financial participation in the upkeep of important built heritage. These contributions are either from the cantonal fund for monuments, nature and sites (*Fonds cantonal des monuments, de la nature et des sites*)[15] (Grand Conseil 2012: Arts.22 and 42) or from the subvention to building restauration (*Subvention à la restauration de bâtiments*)[16] (Grand Conseil 2012: Arts.42A-42H). In principle, a financial participation for renovation is assigned mainly to residential buildings that are listed, included in the registry or in a conservation area, or that should be maintained according to a land-use plan, such as a site plan. The respect for built heritage aspects during the interventions is a binding condition for their allocation. For owners, the protection of a building incurs in limitations to possible changes, but might thus also entail an incentive to conduct work that takes into account patrimonial aspects due to these financial contributions. In practice, if the renovation work has already been approved and if the building is the object of some sort of protection, the owners can fill out a subvention demand from the *Office du patrimoine et des sites*[17].

Main protection measures in the Geneva canton			
Protection measures		Legislation	Heritage protection effets
Listing		LPMNS	Buildings cannot be demolished, be subject to important transformations or change of purpose (without permission from the Conseil d'État); Upkeep work is subject to permission from the DU and the CMNS; the area around the monument can be subject to constraints;

Registration		LPMNS	Existing buildings should be kept; in general, their structural and important characteristic elements must be preserved (reference list);
Conservation areas	*Vieille Ville et secteur sud des anciennes fortifications*	LaLAT, LCI	Existing buildings should be kept; in general, their structural and important characteristic elements must be preserved; architecture should match neighbourhood character in volume, scale, materials, colour; street alignment and building height ought to match the existing fabric (special permissions might be granted for aesthetic reasons); all permissions are submitted to the CMNS;
	Ensembles du XIX^e siècle et du début du XX^e siècle	LaLAT, LCI	Homogenous areas where unity is complete should be kept, as well as their structural and important elements (reference list); if rebuilt, building height and number of floors are maintained (special permissions might be granted for aesthetic reasons); all permissions submitted to CMNS;
Site plans		LaLAT, LPMNS	3 types of buildings are usually mentioned: the ones that should be kept as well as their important elements (reference list); buildings with some interesting elements (transformation/demolition decided on a case-by-case basis); others that ought to be transformed based on site integration;
Règlement spéciaux		LaLAT, LCI	Defines the degree of land occupation, dimensions, architectural character, as well as the buildings that should be preserved (usually based on the same types as the Plans de site); if they overlap protected areas, transformations are submitted to the CMNS;

Protection measures in Portugal

In Portugal, the main piece of legislation concerning heritage protection is *Lei nº107/2001*, which "establishes the bases of the politics and of the regime of protection and valorisation of cultural heritage"[18] (Assembleia da República 2001: Art.1), whether it is movable or immovable. Immovable heritage, including buildings[19], can be protected through listing (*classificação*) according to the categories of monument, group of buildings or site, respectively bearing national, public or municipal interest. Therefore, this type of protection can not only be applied to individual monuments, but also to larger building sets or city areas of particular importance. Specific aspects of *Lei nº107/2001* are detailed in ordinance *Decreto-Lei nº140/2009* and, mainly, in *Decreto-Lei nº309/2009*. The latter defines "the listing procedure of immovable cultural heritage, the regime of protection areas and the establishment

of rules for the elaboration of the detailed conservation plan"[20] (Ministério da cultura 2009: 7976).

According to *Lei nº107/2001*, heritage is of national interest "when its respective protection and valorisation represents a significant national cultural value"[21], and of public interest when it is of national importance, but its protection measures are considered disproportionate (Assembleia da República 2001: Art.15). Another form of protection is registration (*inventariação*). It partially overlaps listing, since it includes all listed buildings, those for which the listing procedure has been initiated, and those for which it was initiated but later dismissed. It can also include other public or private buildings that are important from a heritage standpoint. Un-listed private buildings cannot, however, be included in the registry without the owners' previous agreement (Assembleia da República 2001: Art.19).

Heritage protection measures are aimed at public authorities, who define, implement and verify them, and at the building owners. Measures have an impact on the changes that the latter may want to carry out on their property. If necessary, they allow the authorities to require that essential conservation work be carried out. According to the legislation, it is the duty of the owner of listed or registered buildings to preserve and protect them, avoiding any loss, destruction or deterioration. (Assembleia da República 2001: Art.21). Owners of listed buildings have access to special support, incentives or financing that are put in place[22] (Assembleia da República 2001: Art.60).

In case of intervention, the heritage protection measures referring to particular building elements are generally not specified in the legislation, as is often the Swiss case. According to the examined pieces of legislation, protection usually first takes place by stopping all permissions and making them go through a heritage protection authority. Secondly, it orders the implementation of a detail conservation plan (*plano de pormenor de salvaguarda*) by municipal authorities, in coordination with the central authority managing built heritage, the *Direcção-Geral do Património Cultural* (DGPC)[23], and the regional cultural direction (*direcção regional de cultura*) (Ministério da Cultura 2009: Art.67). It is the detail conservation plan that specifies the conditions under which building permissions may be approved. In the case of a protected area or site, it distinguishes between the protection measures applicable to different types of buildings.

Whenever the listing procedure is initiated (*em vias de classificação*), the buildings are subject to a special protection regime. Any demands for plot division, urbanisation, building, demolition etc., are suspended, including permits that may have already been granted. These conditions affect buildings to be listed and buildings located in their protection areas, with the exception of those of municipal interest. Owners can be entitled to compensation for the suspension (Assembleia da República 2001: Art.42). According to *Decreto-Lei nº309/2009*, owners can also require that the procedure be examined by the DGPC to see if and under which conditions it may proceed (Ministério da cultura 2009: Art. 17).

A general protection area (*zona geral de protecção*) of 50 m is automatically established around buildings when the listing procedure has begun. When it has been completed, the listed buildings benefit from a special protection area (*zona especial*

de protecção), which is individually defined and can include non-building areas (Assembleia da República 2001: Art.43). The *Decreto-Lei nº309/2009* brought in the possibility of establishing a provisional special protection area (*zona especial de protecção provisória*) when it is necessary to define a larger protection area around a building where the listing procedure has begun (Ministério da cultura 2009: Art.38). For buildings located in protection areas, permission is always required from the DGPC for any building work with the exception of the one done to the interior of buildings without archaeological impact, or to work that may be mentioned in the specifications of the protection area, until a detail conservation plan is put in place (Assembleia da República 2001: Art.43; Ministério da cultura 2009: Art.51).

Listed buildings can be expropriated when in serious conservation risk, and buildings located in the protection area can also be expropriated if they prove damaging to the latter or to its surroundings. (Assembleia da República 2001: Art.51). Interventions on listed buildings are subject to restrictions referring to their value as heritage. These are enforced through a mandatory permission from the DGCP until a detail conservation plan is put in place. Before then, any partial or complete demolition work requires permission, as well as any work to their exterior or interior (Assembleia da República 2001: Art.49,51).

The elaboration of a detail conservation plan is required for any listed monuments, areas or sites (*plano de pormenor de salvaguarda*) (Assembleia da República 2001: Art.53). The detail conservation plans should "specify the restrictions and the effects established by the listing of the building(s) and by its special protection area"[24] (Ministério da cultura 2009: Art.64). According to *Decreto-Lei nº309/2009*, they should include: the occupation and priority uses; the areas to renovate; the intervention criteria in built and natural elements; the building rules, including the regulation of volumes, alignments and heights, the colour and exterior finishes of buildings; the rules that construction, reconstruction, extension, change, conservation and demolition work should follow; etc. (Ministério da cultura 2009: Art.66). When a conservation plan has been approved, municipal authorities may approve work in accordance to them, while only giving notice to the DGCP (Assembleia da República 2001: Art.54).

According to *Decreto-Lei nº390/2009*, listed areas or sites abide by similar principles than special protection areas. For each one, the DGCP specifies (in collaboration with the regional direction and municipal authorities): the graduation of the restrictions, namely on the volume, morphology, alignments and height, colour and exterior finish of buildings; non-building areas; areas of archaeological sensitivity; buildings that should be completely preserved, that can be changed, that should be preserved, that can exceptionally be demolished; if special follow-up is required for interventions (DL 140/2009); conditions and frequency of conservation work, etc. In individually listed buildings, and in chosen buildings located in listed areas or sites, whenever an intervention is carried out, an initial report concerning the importance, artistic or historical evaluation of the intervention is required, as well as a final report describing the intervention that was carried out. *Decreto-Lei nº140/2009* describes the detailed procedure to draw up the reports, as well as the inspection that may be required before and during the work.

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The protection regime of buildings in the registry that are not listed is not as clear or as detailed. Legislation specifies that registered buildings benefit from protection "in order to avoid their decay or deterioration, to support its conservation and to promote their existence"[25] (Assembleia da República 2001: Art.61). As previously mentioned, owners are required to preserve and protect them, avoiding any loss, destruction or deterioration.

Main protection measures in Portugal

Protection measures		Legislation	Patrimonial protection effets
Listing (*Classificação*)	Monument of national, public or municipal interest	Lei n.° 107/2001, Decreto-Lei n.° 309/2009	Until a detail conservation plan is put in place, buildings cannot be partially or completely demolished, or transformed in any way, without permission from the DGPC. Any building permissions are suspended until the end of the listing process, with the exception of listed heritage of municipal interest (the owner can require that the procedure be examined by the DGPC to see under which conditions it may proceed). Listed buildings can be expropriated when in serious conservation risk. The area around the monument is subject to general and special protection (see Protection areas). The detail conservation plan should detail the restrictions and effects to the listed building and to its protection area (see Detail conservation plan).
	Group of buildings or site of national, public or municipal interest	Lei n.° 107/2001, Decreto-Lei n.° 309/2009	Until a detail conservation plan is put in place, buildings cannot be partially or completely demolished, or transformed in any way, without permission from the DGPC. Any building permissions are suspended until the end of the listing process, with the exception of listed heritage of municipal interest (the owner can require that the procedure be examined by the DGPC to see under which conditions it may proceed). Listed buildings can be expropriated when in serious conservation risk. When the listing procedure begins, the area around the site is subject to general protection. Special protection areas can be applied when necessary (see Protection areas). For each listed site, the DGPC specifies, among other conditions: specific restrictions to volume, morphology, alignments, height, colour and exterior finishing of buildings; areas of archaeological importance; buildings or groups of buildings that can be changed, should be preserved, or can exceptionally be demolished.
Registration (*Inventariação*)		Lei n.° 107/2001	Owners of registered buildings have the duty of preserving and protecting them, avoiding any loss, destruction or deterioration. If they are not listed, they benefit from a general protection (unspecified), to avoid their deterioration and promote their conservation.

Protection areas (applicable to areas next to listed or to be listed heritage)	General protection area *(Zona geral de protecção)*	Lei n.º 107/2001, Decreto-Lei n.º 309/2009	Automatic protection area of 50m established around heritage where a listing procedure has been initiated. Any building permissions are suspended until the end of the listing process (the owner can require that the procedure be examined by DGPC to see under which conditions it may proceed).
	Special protection area *(Zona especial de protecção)*	Lei n.º 107/2001, Decreto-Lei n.º 309/2009	Special protection areas are individually defined according to the specificities of listed heritage, or where a listing procedure has been initiated (provisional special protection area). They can include: non-building areas; areas of archaeological importance; buildings or groups of buildings that can be changed, should be preserved, or can exceptionally be demolished. All building permissions are subject to approval by DGPC, except for changes to the interior of buildings, without archaeological impact. Buildings located in the protection areas can also be expropriated if they prove damaging to the latter or to its surroundings.
	Provisional special protection area *(Zona especial de protecção provisória)*		
Detail conservation plan *(Plano de pormenor de salvaguarda)* (applicable to listed heritage)		Lei n.º 107/2001, Decreto-Lei n.º 309/2009	Details the restrictions and consequences of listing and of a protection area. After a conservation plan is defined, municipal authorities can approve construction work (DGPC approval is required for individually listed buildings). Detail conservation plans include: the occupation and priority uses; the renovation areas; the intervention criteria in built and natural elements; building rules, including volumes, alignments, heights, colour and the exterior finishing of buildings; the rules for building, rebuilding, extension, changing, conservation and demolition.
Detail renovation plan *(Plano de pormenor de salvaguarda)*		Decreto-Lei n.º 309/2009; Lei n.º 32/2012	If they overlap or contain the same area as detail conservation plans, they should also include their respective content. In this case, detail conservation plans are not considered necessary.

Protection measures in Lisbon and in Oporto. According to *Lei nº107/2001* and *Decreto-Lei nº309/2009*, in the two cities examined there are individual buildings or built areas that are listed, with a varying degree of patrimonial importance. Most of the information regarding the perimeter and type of protection applicable to each area or building is currently available online[26].

For example, if we look at areas of late 18th and 19th century expansion in Lisbon, the *Baixa Pombalina* area ⊠ is listed as a site of public importance (*conjunto de interesse público*) and, since 2011, has a detail conservation plan (*plano de pormenor de salvaguarda*) (MUNICIPIO DE LISBOA 2011). Another example is the late 19th and early

20th century *Avenida de Liberdade*, which is also a site of public importance. The impact of general or special protection areas (*zona geral ou especial de protecção*) to individual monuments should also not be disregarded, since large areas can have a protection measure due to the joint effect of several individual protection areas to monuments. In Oporto, the examination of the heritage protection map shows us that there are less protected areas throughout the city than in Lisbon. The main largest one is the historical center (*Centro histórico do Porto*), which has the highest possible importance attributed, as an area of national importance (*conjunto – monumento nacional*). A large part of two streets included in the city's 19th century and early 20th century expansion were also considered areas sites of public importance, the *Rua de Cedofeita* and *Rua Alvares Cabral* (Presidencia do conselho de ministros 1993; Igespar 2012):

> The areas of urban and architectonical importance, identified in the land-use planning plan – heritage map, comprise significant areas for the history of the city that, from an urban and architectural standpoint, are representative, and contribute to the valorisation of the urban identity. They should, therefore, be protected and promoted. [...] Any urban operation in these areas should preserve the urban and architectural quality of the whole, and be subject to authorization from applicable services. (Municipio do Porto 2012: Art.44)[27]

City areas whose urban identity aims to be preserved can also be protected by land-use planning mechanisms, through the municipal master plans (*planos directores municipais* [PDM]). The measures usually refer to large city areas, each with specific urban features. Lisbon's most recent version of the PDM, for instance, established four main types of areas "that include central and residential spaces where, due to the singularity of their respective design and features of urban occupation, their morphological, environmental and landscape features, as well as most significant elements, should be preserved"[28] (CML 2012: Art.40). The first two types – A and B – mainly refer to areas with buildings that are older or dating from our time of study. The limitations to building work, building extension or change aim to preserve the urban character of the area. In general terms, building heights should be in keeping with the ones of adjoining buildings, as well as the alignment of windows and floors. In the areas of type A, the use of the attic for housing purposes is allowed, as long as it is contained within a 45° angle to the façades and in accordance with the maximum height. In areas of type B, it is also possible to use the attic for housing, or add an extra floor set back from the street, as long as it is common in that urban front, contained within a 45° angle to the façades and does not go over 3,5 m above the maximum admitted façade height (CML 2012: Art.42). The PDM does not specifically protect the interior elements of existing buildings, but several measures discourage their partial or complete demolition or deterioration in areas that have no other applicable protection measure. Demolition work of existing buildings is only admitted in very specific situations. In areas A and B, if the buildings are in pending ruin or its renovation justifiably unfeasible, it is, in principle, mandatory to keep the volume of the pre-existing building and of the main façade. Full or partial reconstruction of the existing building can be demanded when the owner's conservation duty was seriously or willingly not respected (CML 2012: Art.45).

Several pieces of legislation have addressed the degradation of a large number of buildings, which can namely be observed in Lisbon and Oporto's city centres – where it is the case of historic buildings – but also in other city areas, where buildings that are more recent call for important renovations. The degradation of 19th century buildings can have multiple causes, such as the often-drawn-out approval procedures of renovation work, the long-term blockage of rent progression[29], the high building sale prices in historic areas compared to the possible income, the availability of cheaper housing in new city areas, or the perceived cost of renovation work.
The following analysis will first focus on the legal regime of urban renovation (*Regime Jurídico de Reabilitação Urbana* [RJRU]), implemented by the *Decreto-Lei nº307/2009*, and later changed by the *Lei nº32/2012*. We will then look into the temporary exemption regime for the renovation of residential buildings[30], established by the *Decreto-Lei* nº53/2014.

RJRU – Measures to enforce building renovation

The RJRU gathers several instruments destined to make the renovation of buildings and of their surrounding areas faster and more systematic. It is mainly aimed at the owners of buildings and at municipal authorities. According to the law, building owners have "the duty of insuring their renovation, namely by conducting all work that is necessary to their maintenance, hygiene and aesthetical repair"[31] and "cannot, deceitfully or negligently, give rise to or aggravate [...] their deterioration"[32] (Ministério do ambiente 2012: Art.6). Municipal authorities have the duty of promoting urban renovation, which can be carried out through the demarcation of "urban renovation areas" (*áreas de reabilitação urbana*), where interventions comprising an "operation of urban renovation" (*operação de reabilitação urbana*) take place. Urban renovation areas are those where a particularly important degradation calls for integrated interventions. Their demarcation can be carried out through a specific instrument or through a "detailed urban renovation plan"[33] (*plano de pormenor de reabilitação urbana*) (Ministério do ambiente 2012: Art.7). They can either be managed directly by municipal authorities, or delegated to a company of the local business sector, entitled "urban renovation society"[34] (*sociedade de reabilitação urbana* [SRU]) when it only manages operations of urban renovation[35]. In these areas, owners have access to municipal tax benefits (IMI, IMT) that are obligatorily established for the area, and to any other support systems or fiscal incentives to urban renovation (Ministério do ambiente 2012: Art.14).

The operations of urban renovation are considered "simple" when directed mainly at building renovation, or "systematic", when directed at buildings, infrastructure, equipment, infrastructure, green and urban spaces, and associated with a public investment program (Ministério do ambiente 2012: Art.8). A "strategy" or a "strategic program" is established, depending on whether the operation is simple or systematic. The strategic program of a systematic operation can optionally include individual areas – execution units (*unidades de execução*) – where specific goals are pursued (Ministério do ambiente 2012: Art.33). The type of urban operation is fundamental to understand the mechanisms that the managing authority can use. When the municipality does not directly manage the operation, the latter can specify which powers are delegated (Ministério do ambiente 2012: Art.30, 33). When operations of urban renovation are simple, building renovations "should preferably be carried out by the respective owners"[36] (Ministério do ambiente 2012: Art.29). In systematic operations, the owners have the duty of promoting urban renovation, but the "operations [...] should be actively promoted by the respective managing authorities"[37] (Ministério do ambiente 2012: Art.31).

According to the RJRU, the authority managing the operations of urban renovation can have the following powers, as specified by the municipality: licensing of building operations (*licenciamento*) or communication of building operations (*comunicação prévia*); inspections; adoption of supervision measures of urban legality; tax collection; reception of due cessions and compensations (Ministério do ambiente 2012: Art.44). Furthermore, it can use quite important instruments of urban policy when carrying out the operations: requirement to renovate and coercive work; a single construction contract [for the renovation of several buildings]; building demolition; pre-emptive rights [when it believes the building should be renovated according to the operation]; forced rental" (Ministério do ambiente 2012: Art.54). Each of these instruments is detailed in the RJRU. In summary, when a building in an urban renovation area is considered degraded (defined as conservation level 1 or 2), the managing authority can order the owner to renovate it in a given amount of time. If this requirement is not respected, the managing authority can take over the building to begin the renovation work at the owner's expense (Ministério do ambiente 2012: Art.55; Ministério do ambiente 2014: Art.107-108). It can order the demolition of a building when its renovation is considered technically or economically unfeasible, and when the building does not present essential security and hygiene requisites. It is worth noting that a listed or to be listed building cannot be demolished without permission from the respective authority managing heritage protection (Ministério do ambiente 2012: Art.57). The instrument of forced rental allows the managing authority – after undertaking forced renovation work – to rent the building if the owner does not reimburse the renovation expenses or does not rent the building for a minimum of five years, affecting the profit to the compensation of those expenses (Ministério do ambiente 2012: Art.59). When the operation of urban renovation is considered "systematic", the managing authority can use additional (even more drastic) instruments: expropriation, forced sale or property restructuring. Buildings can be expropriated when this is considered strictly necessary to promote the operation, or when the respective owners do not fulfil the duty of promoting their renovation after being notified (expropriation

deemed of public utility) (Ministério do ambiente 2012: Art.61). When the expropriation has the aim of renovating the buildings to place them on the market, the owners have right of preference in the sale. In this type of operations, when the owner does not proceed with the renovation, the managing authority can also use the "forced sale" instrument in alternative to expropriation. In this case, the building or building fraction can be put up for sale in a public auction to those offering the best value and disposed to carry out the renovation, in which case the owner can make a counterproposal of sale (Ministério do ambiente 2012: Art.62). The new owner should start renovating in the six months following the sale, if not the building should be expropriated or resold. Finally, the managing authority can, under certain conditions, restructure the property of one or more buildings. This is, for instance, the case of urban buildings to be rebuilt or remodelled due to their "small dimensions, position out of the alignment, or bad hygiene, security or aesthetical conditions, when the owner does not, with due cause, comply with the notification [to renovate] within 12 months"[38] (Ministério do ambiente 2012: Art.64). If we consider the particularly small dimensions that plots can have in historical centres, it is important to note the considerable impact that this measure can have on urban character of a city area, especially when buildings are not protected.

Even in a simple operation of urban renovation, this RJRU is designed to give a great deal of power to the managing authority – the municipality or a company with delegated powers – over building owners that do not carry out renovation work in due course. In systematic operations, this is even more the case: the same authority can, under certain conditions, expropriate the building (thus becoming its owner), order the renovation project and approve it. Furthermore, it can celebrate contracts with public or private entities to elaborate, coordinate and execute renovation projects, that can also entail the transfer of the rights to commercialise, collect profit and acquire property rights over the buildings (Ministério do ambiente 2012: Art.43).

Exemptions to technical regulations when renovating

In the context of this work, it is also important to mention article 51 of the RJRU, entitled "protection of the existing". It is not – as could first be considered – a mechanism of heritage or historic building protection *per se*, but rather establishes an additional flexibility for building renovations in urban renovation areas to technical demands adopted after they were built (Ministério do ambiente 2012: Art.51). These exemptions are applicable to interventions that: "do not entail or aggravate the unconformity with current regulations; improve the security and hygiene conditions of the buildings; observe building options that are adequate to the buildings' structural and seismic security"[39] (ministério do ambiente 2012: Art.51). The legislation takes this principle even further since extension work and buildings replacing previously existing ones can also be exempted from regulations in place, when their application is disproportionate, and if the work improves the functional, structural and constructive conditions of the building, and observes adequate structural and seismic security options.

The "Special regime of urban renovation" (*Regime especial da reabilitação urbana*) is an important section of the RJRU that was added in its latest version, in 2012. It regulates "the urban renovation of buildings or fractions, even if located outside areas of urban renovation, which were built at least 30 years ago and where a renovation adding to their security and performance is justified"[40] (Assembleia da Republica 2012: Art.1). These renovations are subject to a simplified procedure of control (*procedimento simplificado de controlo prévio*) (Ministério do ambiente 2012: Art.77-B). They should comply with several cumulative conditions: "preserve the main façades, [...] with the possibility of new openings on the ground floor [...]; keep the architectural and structural elements of patrimonial value [...]; keep the number of floors above the ground and underground, as well as the roof configuration, with the possibility of using the rooftop space as liveable area, and of introducing new openings [...]; do not reduce the structural resistance of the building, namely seismic, and observe adequate structural and seismic security options"[41] (Ministério do ambiente 2012: Art.77-A). The simplified regime is not applicable to individually listed or to be listed buildings. It is applicable to buildings in protection areas that are not individually listed or to be listed, if no new openings are planned (art.77A). The simplified procedure, which is described in articles 53º-A to 53º-G, does not require the previous consultation or authorisation of any external entity, with the exception of the demolition of listed or to be listed heritage, and building work also benefits from the possibility of not following all applicable technical regulations, as was the case of buildings located in urban renovation areas (Ministério do ambiente 2012: Art.51, 53-D). Temporary legislation was issued in 2014[42], the *Decreto-Lei* nº53/2014, exempting the renovation of residential buildings that are at least 30 years old or located in renovation areas from complying with some of the existing technical regulations for a period of seven years. This decree "adopts exceptional and temporary measures of administrative simplification, that reinforce the objective of effectively boosting the administrative processes of urban renovation"[43] (Ministério do ambiente 2014: 2338). The renovation of buildings used mostly as housing (at least 50 %) can thus not abide by certain dispositions of the *Regulamento Geral das Edificações Urbanas* (Ministério das obras públicas 2008), namely on the inclusion of lifts, and on the minimal dimension of rooms or stairs, as well the technical dispositions on accessibility of the Decreto-Lei nº163/2006, on acoustic performance of the *Regulamento dos Requisitos Acústicos dos Edifícios*, and on energy efficiency, defined by the *Decreto-Lei* nº118/2013. The houses are also exempted from installing the gas network, as well as part of the telecommunications network. It is nevertheless mentioned that "the interventions cannot reduce the security and health and hygiene conditions of the buildings, nor their structural and seismic safety" (Ministério do ambiente 2014: Art.9).

Application of the RJRU in Lisbon and in Oporto

An urban renovation area was set up in Oporto in 1985, mostly corresponding to the historical medieval centre (Ministerio do equipamento social 1985). It was successively

increased to also include most of the 18th and 19th century expansion areas around the centre (Ministerio do planeamento e da administraçao do territorio 1994; Ministerio do ambiente e do ordenamento do territorio 2000). According to legislation at the time, it was designated as *area crítica de recuperação e reconversão urbanística* (ACRRU); a first slightly smaller area of priority intervention was then established (*zona de intervenção prioritária* [ZIP]). Municipal authorities have delegated the management of the operation of urban renovation to a "society of urban renovation" (*sociedade de reabilitação urbana* [SRU]) named Porto Vivo, constituted exclusively of public capital[44](Porto Vivo 2014). Following the promulgation of a new RJRU version in 2009 (updated again in 2012), Porto Vivo converted the part of the ZIP corresponding to Oporto's historical centre into an urban renovation area (*área de reabilitação urbana* [ARU]) with a systematic operation, and also plans to convert six others[45] ☒, which correspond to the previous ZIP, to fit in with the new legislation (Porto Vivo 2014). As previously mentioned, the new ARU with systematic operations correspond, in this case, to the delegation of powers to the respective SRU, such as project approval, enforcement of renovation work, forced sale, property restructuring and expropriation in case of refusal to renovate (Porto Vivo 2012: 140). Some of these mechanisms were already in place and have already been used according to previous legislation (Conselho de Ministros 2004: Art.18-23).

The actions of the societies of urban renovation are carried out in specific groups of buildings or blocks, the intervention units (*unidades de intervenção*), each comprising a document depicting the state of conservation of the buildings and the strategies that will be put in place for their renovation. Most of Porto Vivo's intervention units have been located in the medieval historical centre, even though some are also located elsewhere in the ZIP perimeter (Porto Vivo 2014). The actions are usually carried out partially by the owners, or in agreement with the owners, or by expropriating or forcing the sale of some plots, sometimes with property restructuring and/or in collaboration with private entities. This type of action has been actively debated, and several actors[46] have criticised the use of the legal instrument allowing to join several of Oporto's historically long narrow plots at a heritage protection level (Fernandes 2011; Icomos-Portugal 2013; Amendoeira 2013).

In Lisbon, there were three active societies of urban renovation around a decade ago, the *SRU Baixa Pombalina*, *SRU Lisboa Oriental* and *SRU Lisboa Ocidental*. According to a municipal document detailing past and future urban renovation strategies, the first two societies are now extinct[47] due to financial reasons and lack of practical effects on the built environment (CML 2011: 43) The *SRU Baixa Pombalina*, created in 2004 and extinct in 2008 for financial reasons, aimed to promote urban renovation in the *Baixa Pombalina, São Paulo* and *Alfama* areas through the elaboration of strategic documents. It also planned to renovate four buildings[48] that had come into its property by one of its shareholders, the *Empresa pública de urbanização de Lisboa* (EPUL).

In 2012, Lisbon municipal authorities established an urban renovation area ☒ around nearly all of the city's consolidated urban area, with the exception of new urbanisations, large equipment and cemeteries (IHRU 2014). This area included fourteen previously existing ACRRU, updated in relation to the new RJRU (CML 2011:

22). The area of urban renovation created was associated with a simple operation of urban renovation (*operação de reabilitação urbana*), that is, mainly directed at the renovation of the buildings. It is managed directly by municipal authorities (website cml, and 32/2012). (Aviso nº5876/2012). Nevertheless, there are some smaller identified areas[49] were systematic operations of urban renovation are envisaged (CML 2011: 23). Several instruments are planned to encourage renovation, such as facilitating project approval in renovations where façades, number of floors, and structural heritage elements are kept (CML 2011: 29,34), and a program of settled renovation work with the owner (*obras convencionadas*), otherwise, by using the RJRU forced sale mechanism (CML 2011: 38). Coercive renovation work was considered financially "ineffective" (CML 2011: 11,29). Several specific programs and financial incentives to renovation (such as tax reduction) are currently in force both in Oporto and Lisbon's urban renovation areas[50].

In some populated Swiss regions, such as areas around the cities of Zürich, Geneva, Basel or Lausanne[51], there are few available houses for rent of for sale, which puts this market under extreme pressure. Housing is often rare and expensive. As we have seen, the housing shortage and expensiveness is addressed in the Swiss constitution by stating federal support to house building and cost reduction (Confédération Suisse 2012: Art.108-109). In accordance with these principles, laws where drawn up at a federal level to encourage access to housing ownership and house building at a reasonable cost, and the moderation of leases. However, most of these federal measures are no longer in force. The first one was the *Loi fédérale encourageant la construction et l'accession à la propriété de lodgements* (Assemblée Fédérale 2009), which is no longer applicable to new financial encouragements since 2001. In 2003, new legislation was approved to encourage housing with moderate rents and purchase prices, the *Loi fédérale encourageant le logement à loyer ou à prix modérés* (Assemblée Fédérale 2006). As stated in the *Office fédéral du logement* website (OFL 2012), indirect support is still enforced (such as cautions for the *Centrale d'émission pour la construction de logement d'utilité publique*), but direct federal loans to owners are no longer granted. One of the few encouragement elements of the LOG that affects housing renovation ant that is still in force are loans to management funds of organisations to built or renovate *logement d'utilité publique* (LUP). LUP housing is either publicly owned or owned by associations with an agreement with the State. These loans mostly function as a public credit system facilitating the creation of social housing by public powers, such as cantons and c*ommunes*.
According to the *Office Fédéral de la Statistique,* out of all Swiss cantons, in 2012 Geneva had the lowest rate of available housing[52] for rent or sale (OFS 2012: 4). The lack of housing is a main focus of the project chart on housing policy of the cantonal master plan (*plan directeur cantonal*) "Genève 2015", emphasising the need for new house building and for the protection and renovation of existing qualified housing corresponding to main population needs (République et Canton de Genève 2013). Several measures are being put in place by public authorities to address this situation, namely by promoting and creating new building areas with housing as a major element. A main example is the *Praille, Acacias, Vernets* area. This mainly industrial area occupies 230 acres and is 82 % in public ownership, today on leasehold. During the next few decades the development project aims to decommission 135,5 acres, increase density and promote mixed functions (République et Canton de Genève 2013). Specific legal instruments have also been enforced to address the lack of housing. The *Loi sur les demolitions, transformations et renovations de maisons d'habitation*

(Grand conseil 2012) is a legal measure that aims to keep as many residential buildings for rent on the market by restricting demolitions as well as the reduction of the number of houses. It is applicable to all main building areas where there is housing, excluding areas outside the city where single-family houses are predominant[53] (Grand conseil 2012: Art.2). Several main requirements are applicable unless special permissions are granted, out of which we have chosen to highlight the ones that most affect buildings of our time of study and their renovation.

According to the LDTR, it is generally not permitted to demolish or change the use of part or all of a residential building. In case of a change of use (for instance, for offices or commercial purposes), it is necessary to compensate it by affecting another equivalent area to housing. Heightening a building is not considered an applicable compensation (Grand conseil 2012: Chapitre II, III). Other important measures that affect residential buildings – especially the ones in need of renovation – are the restrictions on changes (excluding normal upkeep). Changes for purposes of renovation are allowed, but permission is granted based on the number of rooms in a flat, to avoid its reduction, on the possible repercussion of the transformation on rent value and on heritage protection. In most cases, the department can specify the maximum rent value after the renovation work for a period of three to five years in case of pre-existing buildings[54] (Grand conseil 2012: Art.10). However, the maximum value of rents (that correspond to average population needs) can be exceeded if heritage protection entails special costs, or if measures to reduce the building's energy consumption are enforced. In this last case, this maximum can only increase of the estimated consumption value that will be saved by the tenant, plus an energetic contribution that cannot exceed 10 chf per bedroom per month (Grand conseil 2012: Art.9)[55].

To encourage the upkeep of residential buildings, the urban planning department (*département de l'urbanisme*) can make legal exemptions (unspecified) if these are likely to make renovation work too expensive, and give financial incentives to the renovation of housing. These can be allocated to housing with controlled rents (*habitation d'utilité publique*)[56], but also to other owners of residential buildings in very bad condition with low rents that have requested permission for renovation in cases where the LDTR is applicable (*bonus conjunturel à la rénovation*[57]). These incentives can go up to 15 % of the building work, and cannot be considered for rent increase. The department can also grant a cantonal tax exemption once and intercede in favour of the owner for the reduction or exemption from cantonal taxes during renovation. The objective is to contribute to the renovation of inexpensive housing in bad condition and to allow for major renovation work that would otherwise lead to an excessive rent increase (Grand conseil 2012: Art.19-22).

So long as there is a shortage of housing, that is, less than 2 % vacancy, the LDTR also generally forbids vacant housing for rent[58] for more than 3 months. When this vacancy occurs without any of the legitimate justifications, the State of Geneva can relieve an owner of his usage right and rent it out (previously encouraging the owner to do so) (Grand conseil 2012: Art.26-38). If a housing building is in such lack of upkeep as to compromise its structural stability or housing function, the urban planning department can order the execution of the renovation work or have it carried out at the owners' expense (Grand conseil 2012: Art.42A).

Regulations for the application of the LDTR where drawn up by the *Conseil d'État* in the *Règlement d'application de la loi sur les démolitions, transformations et rénovations de maisons d'habitation* (RDTR) (Conseil d'État 2012). These regulations further detail the procedures and definitions that are identified in the legislation, namely the elements that should be included in a renovation demand. Detailed elements of energetic analysis are required alongside the list of all transformation work (Conseil d'État 2012: Art.5). Changes giving special importance to elements of energetic analysis[59] where made in 2010, as shown in the RDTR historical table. These documents should describe the energetic performance of the building envelope and of the building's technical installations before renovation, as well as the foreseen drop in energetic consumption. The transformation costs that are related to energetic performance and those that are not must be distinguished. Energetic costs per household and rental evaluation documents are also required.

The LCI and, most specifically, its *Règlement d'application de la loi sur les constructions et les installations diverses* (RCI) (Conseil d'État 2013) describe the requirements and procedures that must be followed when addressing a new building or a transformation demand to the urban planning department (*département de l'urbanisme*). Furthermore, whenever applicable, the RCI also identifies the technical regulations that were drawn up by external institutions and that are in force in the canton.
In the LCI, there are three main sections that have an impact on our study: common dispositions to first four building areas, referred in the *Titre II* [60]; the *Titre III,* that refers to energy saving measures concerning new and existing buildings; the *Titre IV*, that specifies building and installation security conditions. *Titre IV: Sécurité des constructions et installations* of the LCI, that is then further detailed in *Chapitre V* of the RCI, identifies security rules are applicable in all areas, disregarding date of building. This means that the urban planning department can require that a building be adapted to follow these regulations if health, hygiene and security conditions require it (Grand conseil 2013: Art.120-128; Conseil d'État 2013: Art.46-132). These include fire protection measures, regulations on water, gas and electricity distribution, conditions for lift installation, as well as demands on housing conditions. However, one of the first general dispositions of the LCI also states that exceptions may be allowed in the case of old buildings (previous to 1961) "if the strict application of the legal prescriptions does not allow for an improvement of a building's hygiene and security"[61] (Grand conseil 2013: Art.12). These dispositions give the urban planning department a great deal of leeway to specify or concede exceptions on existing buildings as pleased.
We have focused our analysis on the legal dispositions of the LCI and the RCI that most affect renovations of residential buildings, according to the topics of housing conditions, thermal insulation and acoustic performance. We have chosen to go into further detail into the topics of thermal insulation and acoustic performance by analysing additional cantonal legislation, and SIA technical regulations that are in force.

Housing conditions

Dispositions concerning the location and dimensions of rooms, and those regarding natural lighting requirements are particularly important to understand which rooms may be used or can be adapted to fit different functions. A given room might, for

instance, have been previously used as a bedroom, kitchen or attic, and require a change of function, or need additional windows to fulfil current living needs. House living conditions that are applicable to all building areas, regardless of their date of construction are defined in *Titre IV* of the LCI and in *Chapitre V* of the RCI. In addition, some important dispositions are also made on residential spaces in the first four building areas (including the *première, deuxième*, and *troisième zones*) in *Chapitre V* of the LCI.

The legislation specifies the conditions that need to be filled so that rooms may be used for housing purposes, and spaces that cannot be used for that purpose. As such, bedrooms cannot give onto closed courtyards[62], and any room used for housing[63] must have at least 15 m^3 of air volume and a window to the outside of at least tenth of its surface, and no less 1 m^2. Exceptions to this rule can be made to build bow windows or verandas (Conseil d'État 2013: Art.125). In the first four building areas, any room for a house's day or night-time use, including kitchens (but not kitchenettes), should have direct openings to the outside and a certain field of vision[64] (Grand conseil 2013: Art.48). Their areas ought to be 9 m square, but in any case no less than 6m square. Each housing unit must be equipped with at least one bathroom including a toilet (Grand conseil 2013: Art.53). Residential buildings should also have sufficient laundry and clothes drying installations (Grand conseil 2013: Art.57). In addition, closed-off alcoves or flats that are below ground cannot be used for housing purposes. The urban planning department may request the suppression of flats below ground (Grand conseil 2013: Art.127). This suppression is, in fact, mandatory for any change that allows for the creation of a new flat (Conseil d'État 2013: Art.123).

Regulations concerning ceiling heights are also given particular importance (Conseil d'État 2013: Art.115; Grand conseil 2013: Art.49). The ceiling heights should not be less than 3m on the ground floor and 2.60m on all other floors. However, this height can be reduced for storage rooms and bathrooms (Conseil d'État 2013: Art.115). Whenever the ceiling follows roof inclination, the house surface counts as complete whenever the floor height is above 2,60 m, and as half whenever it is between 1,80 m and 2,60 m. However, existing rooms with less than 2,20 m on half or more of its surface cannot be used for housing. Unless the buildings are distant from the street, ground floor flats cannot be used for housing unless they are elevated by at least 1m. In those cases, floor height cannot be less than 2,50 m (Grand conseil 2013: Art.49). Nevertheless, a ceiling height of 2,40 m might be allowed "when there is a clear gain for the building"[65] (Grand conseil 2013: Art.49) or so that attics of buildings dating from before 1961 can be used for housing purposes (Grand conseil 2013: Art.12). In these buildings, concessions can also be made regarding the field of vision specifications. Conditions are also specified for the addition of attic openings to the outside, or dormer windows. The base of the opening cannot be at more than 1,50 m from the ground, and the top at less than 1,80 m. Like windows in other rooms, its surface cannot be less than one tenth of the room surface, and no less than 1 m square. In the first four building areas, dormer windows are allowed for attics, and their length cannot be more than 1/3 of the façade. Dormer windows can be joined if this intervention is approved by the architecture commission (*commission d'architecture*) and

the commission for heritage protection (*commision des monuments, de la nature et des sites*) (Conseil d'État 2013: Art.130).

Thermal insulation requirements

Switzerland. The main pieces of legislation that specify energy requirements for buildings in the Geneva canton are the Energy law (*Loi sur l'énergie*) (LEn) and its specifications, the *Règlement d'application de la loi sur l'énergie* (REn). Both often refer to more specific SIA regulations. The REn considers that whenever existing buildings are submitted to renovation work, the modified elements or building areas are required to respect the minimal energy demands on several topics: thermal insulation and summer thermal protection; hot water supply; ventilation; lighting; heating and air conditioning; index of energy consumption (Grand conseil 2013: Art.14). Renovation work occurs "whenever the buildings or the building elements are affected by work that changes the energy performance of the building"[66] (Conseil d'État 2013: Art.12D). Demands regarding thermal insulation follow SIA 180 *Isolation thermique et protection contre l'humidité dans les bâtiments* and SIA 380/1 *L'énergie thermique dans le bâtiment* regulations.

SOLAR PANELS

Technical installations on the roof should be placed within the roof size. Exceptions can be made for lift machinery, ventilation channels (if contained within 35° inclination), or to facilitate the placement of solar panels (Conseil d'État 2013: Art.27). The placing of solar panels is now a topic of particular importance as, according to the LEn, it is mandatory to place solar panels that cover at least 30 % of the building's hot water supply when roofs are renovated. Exceptions can be made because of the building's features, as in the case of a roof that is poorly orientated (Grand conseil 2013: Art.15). The *Assemblée fédérale* has recently suggested changes to the LAT, aiming for a better protection of natural and agricultural land and a densification of built areas[67]. Even though it is not the main object of these modifications, a change was made to article 18a concerning solar installations, stating that a permission is no longer required to place solar panels on roofs of buildings in building areas (*zones à bâtir*) or agricultural areas (*zones agricoles*). Permission is still required for buildings that are in protected areas.

SIA PRESCRIPTIONS CONCERNING ENERGY PERFORMANCE

The SIA 380/1 regulation is the main defining element for prescriptions regarding the energy performance of buildings, as well as the most demanding. Its aim is the "rational and economic energy use for heating and sanitary hot water production in buildings"[68] (Lenzlinger 2009: 4). In 2009, SIA requirements for thermal insulation in winter became stricter, following a new model defined by cantonal energy services (ENDK 2008). Global requirements regarding renovation now roughly correspond to the ones that previously existed for new buildings (Lenzlinger 2009: 4). In general terms, whenever a building is transformed including interventions that improve its energy performance, it should comply with the regulation's minimal energy

requirements. If opaque building elements are completely replaced, standards for new buildings apply; if not, renovations must follow standards concerning transformed buildings, which are a bit less demanding. Two procedures can be followed to justify a building's compliance with the regulations: localised performances (*performances ponctuelles requises*) or global performances (*performances globales requises*). In the case of localised performances, the coefficients of heat transmission – *U* values[69] – that should be respected for each element of a building's thermal envelope are defined (walls, roofs, windows, doors, etc). When the global performances procedure is applied, the thermal quality of the envelope is compared with the buildings' yearly heating requirements, Qh in MJ/m² (Lenzlinger 2009: 11). In this case, localised performances should comply with the section of the SIA 180 regulation on *U* values, which is far less demanding (Lenzlinger 2009: 7).

The method of localised performances is mostly applied to smaller renovations whenever only a few building elements are transformed. It does not require the calculation of global heating needs, but demands a very good performance of every transformed element. In buildings with extensive external and interior decorations, this method allows for their protection because only the renovated elements are required to attain certain values. In this case, the intervention might choose, for instance, not to insulate the walls and focus only on window renovation. The global performances method is generally applied to more significant renovations of entire buildings or of part of a building (for example, an attic conversion). Even though it requires further calculations, it allows for more flexibility when choosing which elements should be more or less insulated, since each individual element follows SIA 180 regulations. This aspect can be used to apply a less demanding solution to some important elements if other insulated building components can make up the difference.

According to the SIA 380/1, built heritage protection does not immediately ensure fewer requirements as far energy demands are concerned, unless exemptions are granted: "whenever following the requirements implies technical feasibility problems, unsustainable economical investments or goes against heritage

***U* LIMIT VALUES for the SIA 380/1 localised performances method for changed building elements considering an interior temperature of 20°c, and for the SIA 180 (simplified)**

		SIA 380/1: Limit values U_{li} (W/m² K)		SIA 180: U_{max} (W/m² K)		
Building element against		The outside or less than 2m underground	Non heated places or more than 2m underground	The outside or less than 2m underground	Non heated places	More than 2m underground
Opaque elements	Roof	0.25	0.28	0.4	0.5	0.6
	Floor	0.25	0.30	0.4	0.6	0.6
	Walls	0.25	0.30	0.4	0.6	0.6
Windows	-	1.3	1.6	2.4	2.4	-

protection demands, disparities should be justified"[70] (Lenzlinger 2009: 2.1.3). This means that, in principle, any necessary deviations might be authorised on a case-by-case basis, depending on the dialogue between different building actors, the Heritage protection office (*Office du patrimoine et des sites*) and the Energy office (*Office cantonal de l'énergie*).
Over the last decade, the SIA 380/1 standards have changed, becoming increasingly more demanding[71]. This can have a considerable impact on non-protected buildings, especially in cantons where heritage protection mostly applies to individual monuments.
Financial incentives that encourage energy saving measures – the *Bonus conjoncturel à l'énergie* – can be granted to owners of residential buildings that renovated within the framework of the LDTR[72], in order to cover the part of these measures that cannot have an effect on the rent value (Grand conseil 2013: Art.15A; Conseil d'état 2013: Art.13L). Other measures of encouragement can be envisaged in collaboration with the municipalities to favour rational energy usage and from renewable sources. These could be granted in the form of financial incentive, tax relief or loans.

Portugal. The main piece of legislation concerning the thermal performance of buildings in Portugal is the *Decreto-Lei* n°118/2013, which approves the system of energetic certification of buildings. This system includes regulations relating to the energetic performance of residential buildings, and regulations regarding the energetic performance of commercial and service buildings[73]. Even without considering the temporary exemptions of abiding by several technical regulations, put in place for renovations of residential buildings by the *Decreto-Lei* n°53/2014, the energetic certification of buildings is more flexible than in the Swiss case. It is only mandatory for new buildings and for those subject to large interventions, that is, when the cost of the work done to exterior elements or to existing technical installations exceeds 25% of the building's value (Ministério da economia e do emprego 2013: Art.2, gg). Listed or to be listed buildings, or those included in listed, to be listed built sets or in protected areas, do not have to abide by the regulations. As in the Swiss case, the author of the thermal project can apply for an exemption from with regulations, with due justification, should there be an incompatibility of the necessary measures with technical and functional issues or with the building's architectural value.
The conditions concerning thermal performance that are applicable to large interventions – without considering the temporary exemption regime – are the maximum value for the heating and cooling needs of each building unit, as well as for the global annual needs of primary energy[74]. In addition, there are defined maximum values for the coefficient of heat transmission (*U* value) for the set of opaque exterior buildings elements, such as walls or roofs (Ministério da economia e do emprego 2013: Art.28). Even though maximum heat transmission values for windows are defined for new buildings, this is not the case in renovations. The legislation privileges the protection from overheating, possibly as an adaptation to the Portuguese climate. It demands that transformed windows abide by a maximum solar factor, which "translates the maximum relation between the solar energy that passes to the interior through the windows and the solar energy that falls on those windows"[75] (Camelo 2006: 45).

_U_ LIMIT VALUES for transformed opaque building elements, according to the REH annex, *Requisitos de conceção para edifícios novos e intervenções*

		REH: Limit values U_{max} (W/m² K)					
Building element against		The outside or non liveable spaces with btr > 0.7			Adjacent buildings or non liveable spaces with btr ≤ 0.7		
Climatic area (Winter)		I1	I2	I3	I4	I5	I6
Opaque elements	Horizontal elements (ex. roofs, floors)	1.25	1.00	0.90	1.65	1.30	1.20
-	Vertical elements (ex. walls)	1.75	1.60	1.45	2.00	2.00	1.90

Notes: btr – coefficient of loss reduction, values of 0,8 and 0,6 can be used, respectively for all non-liveable spaces or for adjacent buildings (*Despacho* nº15793-E/2013); Lisbon is in climatic area I1, Oporto in I2.

Maximum solar factors gTmax for transformed glazed openings, according to the REH annex, *Requisitos de conceção para edifícios novos e intervenções*

		REH: Maximum solar factor values gT_{max}		
Climatic area (Summer)		V1	V2	V3
Class of inertia	Weak	0.15	0.10	0.10
-	Average	0.56	0.56	0.50
-	Strong	0.56	0.56	0.50

Notes: the class of thermal inertia of the interior can be determined according to the detailed method described in Annex VII of the RCCTE, or the simplified table included in *Despacho* nº15793-E/2013. Lisbon is in climatic area V2, Oporto in V1.

The specific values of the buildings' heating needs and heat transmission values of opaque elements are then defined by specific ordinances. The one relating to residential buildings is the *Portaria nº349-B/2013*, *Requisitos de conceção para edifícios novos e intervenções* (Governo-SEE 2013). Both the coefficient of heat transmission

and solar factor have different maximum values depending on the division of the country in three climatic areas (see the opposite tables).

Sound insulation requirements

Switzerland. In Switzerland, the main legal diploma managing the protection against noise is the *Ordonnance sur la protection contre le bruit (OPB)* (Conseil Fédéral 2012), that defines the requirements for the principles expressed by the *Loi sur la protection de l'environnement* (LPE) (Assemblée Fédérale 2010). The aim of the OPB is to "protect against damaging or irritating noise"[76] (Conseil Fédéral 2012: Art. 1, 1). It manages several issues, namely the insulation against exterior and interior noise in new buildings with rooms sensible to noise, and the insulation against exterior noise of existing buildings with rooms sensitive to noise (Conseil Fédéral 2012: Art. 1, 2 d.,e.). In residential buildings, rooms that are sensitive to noise are "all rooms inside housing units, with the exception of kitchens without a liveable area, sanitary locations and storage rooms"[77] (Conseil Fédéral 2012: Art.2:6a). The OPB refers to more specific regulations concerning both exterior and interior sound insulation, elaborated by the *Société suisse des ingénieurs et des architectes,* the SIA 181: 2006 entitled *Protection contre le bruit dans le bâtiment* (Emrich 2006). As such, most of the specific requirements on acoustic demands are made at a federal level, and cantonal legislation[78] mentions how they should be enforced locally.
The SIA 181:2006 regulations are applicable not only to new buildings but also to the exterior of existing buildings, separation elements, staircases or equipment whenever they are transformed, replaced or newly fitted (Conseil Fédéral 2012: Art. 32, 3). The regulations give specific examples as to what those changes might be:

> Replacement of windows or glazing; replacement of elastic flooring (carpeting) for hard flooring (parquet, laminate, ceramic, stone); replacement of technical equipment or of the building's fixed technical installations; replacement of sanitary installations. (Emrich 2006: 0.1.8)[79]

This means that, in most cases, the compliance with the regulations is mandatory only when a building element is transformed. However, according to the OPB, when new or transformed fixed public or franchise holder's installations producing noise (such as roads, railroads, airfields etc.) cannot exceptionally abide[80] by certain maximum values, the windows of exposed buildings with rooms in the sensitive noise category should be acoustically insulated[81] (Conseil Fédéral 2012: Art.10, 15). The required values are defined in the OPB (Conseil Fédéral 2012: Annexe 3), and depend on the main uses of the city area, which correspond to a degree of sensitivity to noise (I to IV) included in cantonal or communal land-use plans (*plans d'affectation*) (Conseil Fédéral 2012: 43-44).
The SIA 181:2006 specifies minimal and increased demands for the protection from several types of noise, depending on whether its source is exterior airborne noise or interior airborne, impact or noise from technical equipment and fixed installations[82]. We will concentrate our analysis on airborne noise coming from the outside, and airborne and impact noise coming from the inside, since it is the protection against

those types of noise that most affects historic elements. In the case of building renovations, the minimal demanded values usually apply, with the exception of impact noise, where an increased flexibility of 2 dB is granted. Increased demands apply to terraced houses, and to new buildings with ownership by floor (EMRICH 2006: 2.2.2).

EXTERIOR AIRBORNE NOISE

For exterior airborne noise, the SIA 181:2006 regulations specify the minimal values of the normalised sound insulation of the envelope (*isolement acoustique normalisé pour l'enveloppe*), $D_{e,d} = D_{e,tot} - K_P = D_{nT,w} + C_{tr} - C_v - K_P \geq D_e$ (dB). The required De value should be determined for the all the elements giving onto the outside of each liveable room in a dwelling. It depends on the daytime or night-time noise emission levels (Lr, *niveau d'évaluation du degré de nuisance du bruit extérieur*), obtained by on-site measurements that are usually available by canton on noise maps (*cadastre du bruit*)[83]. The demands also vary according to the rooms' sensitivity to noise (low for bathrooms, corridors and non-liveable kitchens, medium for bedrooms, living rooms and liveable kitchens).

INTERIOR AIRBORNE AND IMPACT NOISE

The SIA 181:2006 interior acoustic demands on airborne and impact noise are applicable between different adjoining units, that is, between different flats and not within the same flat. For interior airborne noises the regulation specifies minimum values for weighted standardized sound insulation (*isolation acoustique normalisée pondérée*, $D_{i,tot} = D_{nT,w} + C - C_v$ [dB]). These demands increase

Minimum requirements for the protection against exterior airborne noise, according to the SIA 181 (EMRICH 2006: 21)

Degree of noise pollution	**Pollution due to outside noise**			
-	Low to moderate		Important to very high	
Position of the receiver	Away from communication routes, without disturbing locations		Close to communication routes or next to disturbing locations	
Evaluation period	Daytime	Night time	Daytime	Night time
Evaluation level dB(A)	Lr ≤ 60	Lr ≤ 52	Lr ≤ 60	Lr ≤ 52
Sensitivity to noise	**Minimum D_e values**			
Low [bathroom, toilet, corridor, etc.]	22 dB	22 dB	Lr-38 dB	Lr-30 dB
Medium [living room, bedroom, etc.]	27 dB	27 dB	Lr-33 dB	Lr-25 dB
High [hospital rooms, etc.]	32 dB	32 dB	Lr-28 dB	Lr-20 dB

Notes: It is necessary to verify that $D_{e,d} = D_{e,tot} - K_P = D_{nT,w} + C_{tr} - C_v - K_P \geq D_e$ (dB).

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depending on the degree of noise pollution (for instance, moderate for rooms in housing units, staircases, offices, shops without a sound system, or high for parking, technical rooms, kindergartens, shops with a sound system) and on the rooms' sensitivity to noise, as specified earlier. For impact sound, the regulation defines maximum values of the weighted standardized sound pressure level for impact noise (*niveau de pression pondéré du bruit de choc standardisé*, $L'_{tot} = L'_{nTw} + C_i + C_v$ [db]). The maximum values decrease (become more demanding) with the degree of noise pollution and the rooms' sensitivity to noise. In the particular case of impact noise, the SIA regulations mention an increased flexibility of 2 dB for building transformations.

EXEMPTIONS TO THE REGULATIONS

Both the OPB and the SIA 181:2006 specifically mention that exemptions allowing for increased flexibility can be granted if respecting the legal demands is disproportionate in existing buildings. This is both the case of required transformations on windows specified by the OPB, or in the case of changes to building elements

Minimum requirements for the protection against interior airborne noise, according to the SIA 181 (EMRICH 2006: 23)

Degree of noise pollution	**Low**	**Moderate**	**High**	**Very high**
Examples of type and use of place of emission	Quiet use: reading or waiting room, hospital room, archive	Normal use: living room, bedroom, kitchen, bathroom, toilet, corridor, elevator shaft, office, conference room, laboratory, shop without a sound system	Noisy use: leisure activities, meeting room, classroom, crèche, kindergarten, heating, underground car park, technical location, restaurant without sound system, shop with sound system and adjoining rooms	Very noisy use: artisan workplace, workshop, rehearsal room, gymnastics room, restaurant with sound system and adjoining rooms
Sensitivity to noise	**Required [minimum] D_i values**			
Low [bathroom, toilet, corridor, etc.]	42 dB	47 dB	52 dB	57 dB
Medium [living room, bedroom, etc.]	47 dB	52 dB	57 dB	62 dB
High [hospital rooms, etc.]	52 dB	57 dB	62 dB	67 dB

Notes: It is necessary to verify that $D_{i,d} = D_{i,tot} - K_P = D_{nT,w} + C_{tr} - C_v - K_P \geq D_i$ (dB).

Minimum requirements for the protection against impact noise, according to the SIA 181 (EMRICH 2006: 24)				
Degree of noise pollution	**Low**	**Moderate**	**High**	**Very high**
Examples of type and use of place of emission	Archive, reading or waiting room	Living room, bedroom, kitchen, bathroom, toilet, office, heating and ventilation room, corridor, staircase, passageway, terrace, underground car park	Restaurant, room, classroom, crèche, kindergarten, gymnastics room, workshop, rehearsal room, and adjoining rooms	Uses marked as "high" if they take place between 19.00h and 07.00h
Sensitivity to noise	**Required [maximum] L' values**			
Low [bathroom, toilet, corridor, etc.]	63 dB	58 dB [+ 2 dB for renovation]	53 dB	48 dB
Medium [living room, bedroom, etc.]	58 dB	53 dB [+ 2 dB for renovation]	48 dB	43 dB
High [hospital rooms, etc.]	53 dB	48 dB [+ 2 dB for renovation]	43 dB	38 dB

Notes: It is necessary to verify that $L'_d = L'_{tot} + K_P = L'_{nT,w} + C_I + C_V + K_P \leq L'$ [dB].

within the framework of the SIA 181:2006. The SIA regulations mention that "the issue of proportionality of acoustic demands, that can arise in building transformations (static, monument protection, technical feasibility or use constraints, and acceptable cost), should be managed on a case-by-case basis between the interested parties and, if necessary, with the executing authority"[84] (EMRICH 2006: 0.1.1). However, the regulations also specify that even when exemptions are granted to old buildings, the changes should at least not deteriorate the buildings' acoustic performance before transformation (EMRICH 2006: 0.1.8).

Portugal. In Portugal, noise protection concerning buildings is framed by two main regulations, the *Regulamento Geral do Ruído (RGR),* general noise regulations defined by the *Decreto-Lei nº9/2007*[85], and the *Regulamento dos Requisitos Acústicos dos Edifícios (RRAE),* the regulations on the acoustic requirements of buildings, which have been most recently updated by the *Decreto-Lei nº96/2008*.
The RGR "establishes the regime of prevention and control of noise pollution, aiming for the preservation of human health and for the well-being of populations"[86] (MINISTÉRIO DO AMBIENTE 2007: Art.1). These are regulations concerning a variety of topics, such as the production of noise maps by municipal authorities[87], and the limits to noise production in different types of areas depending on the activities that

take place there. In relation to buildings, the RGR mentions that "the use or change of use to buildings and their fractions is subject to the verification of the compliance of the acoustic project"[88] (Ministério do ambiente 2007: Art.12:5) with the regulations, defined by the RRAE. As was also the case with the Swiss OPB, particular measures can be applied to the sensitive receivers (meaning to the buildings) in exceptional situations where the emission values of outside noise cannot comply with regulations in spite of applied measures, to a limit of 5 dB (A) above the emission values (Lden, Ln) defined in the RGR (Ministério do ambiente 2007: Art.11:1). The RGR specifies that, in this case, the measures applied to buildings should guarantee that the index of sound insulation to airborne sounds (D2m,n,w) exceeds the values defined in the RRAE by 3 dB (Ministério do ambiente 2007: Art.19:4). The legislation does not specify which building element should be changed.
The last revision of the regulations regarding acoustic requirements of buildings (RRAE), defined by the *Decreto-Lei n°96/2008*, updates it by taking into account the latest legal diplomas on noise, namely the RGR. According to the introduction to the RRAE, the sound insulation values were adapted in relation to previous versions, and new requirements were created for some types of buildings, such hotels or cinemas. However, it is interesting to note that the diploma specifically mentions building renovation in historical areas, by introducing "a reduction of the requirements concerning sound insulation of interior spaces when renovating buildings located in historic areas, so that it is feasible to adopt building solutions adapted to a patrimonial and historic identity"[89] (Ministério do ambiente 2008: Introduction).

EXTERIOR AIRBORNE NOISE

The RRAE establishes different values of sound insulation to exterior airborne noise according to the use of the building (residential or mixed-use buildings, and hotels; commercial and service buildings; schools and research buildings) and to the type of area in which it is located (Ministério do ambiente 2008: Art.5). Sensitive areas are defined in the RGR as those "mainly destined for residential use, or schools, hospitals or similar functions, or including leisure areas, which can also include small commercial units"[90] (Ministério do ambiente 2007: Art.3). Mixed areas are defined as those allocated mainly to other functions. The RGR stipulates a higher tolerance in the emission values of outside noise in mixed areas or sensitive areas next to important transport infrastructure than in (normal) sensitive areas (Ministério do ambiente 2007: Art.11). The correction term difference C or Ctr (for noise in particular low frequency bands) should be applied when the glazed area represents more than 60 % of a façade element. This particular aspect is different from the Swiss SIA 181 legislation, in which the Ctr correction term is always be applied to the calculations.

INTERIOR AIRBORNE AND IMPACT NOISE

The RRAE specifies minimum values of interior airborne for bedrooms or living areas in residential buildings, depending on the type of room where the source of the noise comes from. Increasingly more demanding values are required for rooms in adjoining flats, the buildings' common areas or commercial, industrial or service areas located in

Minimum requirements for the protection against exterior airborne noise in residential buildings, according to the RRAE (adapted to chart to facilitate the comparison)				
Position of the receiver	**Sensitive areas [without important transport infrastructures]**		**Mixed or sensitive areas [next to important transport infrastructures]**	
Evaluation period	Daytime	Night time	Daytime	Night time
Evaluation level dB(A)	Ld ≤ 55	Ln ≤ 45	Ld ≤ 65 or 60	Ln ≤ 55 or 50
Sensitivity to noise	**Required [minimum] $D_{2m,nT,w}$ values ≥**			
Housing [bedrooms, living areas]	28 dB		33 dB	

Notes: Add 3 dB when maximum outside noise values cannot exceptionally be respected, for new buildings in consolidated urban areas. Add correction terms C or Ctr when the glazed area is higher than 60 % of the façade element.

the buildings, which are considered to produce more noise (Ministério do ambiente 2008: Art.5:b,c,d). Additionally, a maximum value is given for impact sound level received in bedrooms or living areas of residential buildings, coming either from rooms in other dwellings or from common circulation areas (Ministério do ambiente 2008: Art.5:e). There is a tolerance of 3dB for interior airborne and impact sound requirements in the renovations of buildings located in historic areas (Ministério do ambiente 2008: Art.5:8).

Minimum requirements for the protection against interior airborne and impact noise in residential buildings (RRAE)			
Examples of type and use of place of emission	Rooms belonging to a dwelling	Common circulation areas of the building	Commercial, industry, service or entertainment areas in the building
Airborne noise	**Required [minimum] $D_{nT,w}$ values ≥**		
Housing [bedrooms, living areas]	50 dB (-3 for renovations)	48 dB 40 dB (vertical circulation area in building with lifts) 50 dB (garage used as car park) (-3 for renovations)	58 dB (-3 for renovations)
Impact noise	**Required [maximum] $L'_{nT,w}$ values ≤**		
Housing [bedrooms, living areas]	60 dB (+3 for renovations)		-

Notes: Add 3 dB when maximum outside noise values cannot exceptionally be respected, for new buildings in consolidated urban areas. Add correction terms C or Ctr when the glazed area is higher than 60 % of the façade element.

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EXEMPTIONS TO THE REGULATIONS

As mentioned, legislation has very recently been issued in Portugal, exempting renovations of residential buildings from several technical regulations for a period of seven years, as long as the existing situation is not worsened[91]. These exemptions include acoustic and thermal insulation requirements (MINISTÉRIO DO AMBIENTE 2014). Furthermore, the RJRU, the legal regime of urban renovation, also specified more flexible conditions regarding technical requirements in the renovation of buildings located in urban renovation areas. Moreover, the latest version of the RJRU applied the same flexibility to residential buildings dating from over 30 years ago that are located outside urban renovation areas. These exemptions are included in a simplified regime of building work approval, which implies certain conditions such as keeping the building façade, its structural and important historic elements, etc. (ASSEMBLEIA DA REPUBLICA 2012).

[1] Legislation pertaining to renovation is frequently changed. Since the time of writing we are aware that several instruments have since been adapted in both countries.

[2] Fiscal incentives are among the measures promoting building renovation. Even though some incentives are mentioned in this chapter, we choose not to examine this topic in detail, since fiscal incentives to renovation are frequently changed and adapted.

[3] "La protection de la nature et du patrimoine est du ressort des cantons."

[4] As defined in the Swiss constitution, the confederation defines town and country planning principles, which are then of cantonal responsibility, and can also legislate on house building and leases (CONFEDERATION SUISSE 2012: Art.75,108-109). These dispositions are then translated into specific legislation on town and country planning, the *Loi fédérale sur l'aménagement du territoire* (LAT) and the *Ordonnance sur l'aménagement du territoire* (OAT). Regarding the protection of nature and patrimony, article 78 of the constitution states that the confederation may preserve valuable historical sites if public interest demands it, protect objects of national importance, and support efforts to protect patrimony (even though this remains mainly a cantonal responsibility). These federal duties are included in the *Loi fédérale sur la protection de la nature et du paysage* (LPN) and the *Ordonnance sur la protection de la nature et du paysage* (OPN).

[5] Planning measures for territorial organisation are also defined, namely sectorial plans, which are of federal responsibility.

[6] "les parties du territoire qui [...] se distinguent par leur beauté ou leur valeur, ont une importance pour le délassement ou exercent une fonction écologique marquante".

[7] A collection of volumes was published describing each of the sites included in the *Inventaire des sites construits à protéger en Suisse*. The one on Geneva was the first to be published (HEUSSER-KELLER 1983-1984).

[8] As described by the Heritage protection office (*Office du patrimoine et des sites*), when the localised master plans (*plan directeurs localisés*) are in conservation areas (*zones protégées*), they may also be considered protection measures. Cartographical information is also available.

[9] "Les zones protégées constituent périmètres délimités [...] qui ont pour but la protection de l'aménagement et du caractère architectural des quartiers et localités considérés."

[10] Another important reference regarding this issue is the work of lawyer Gabriel Aubert on the legal measures of built heritage protection at a crucial stage of their development. His findings are described in the article *La protection du patrimoine architectural en droit genevois* (AUBERT 1977).

[11] Louis Blondel was Geneva's first cantonal archaeologist and secretary for the *commission des monuments et sites*; one of his most important contributions on the history of the city is the book *Le développement de Genève à travers les siècles* (Blondel 1946).

[12] "C'était un pas de géant dans la reconnaissance de la qualité des ensembles urbains."

[13] The main exception are regulations applicable to riverside buildings of *quai Gustave-Ador*, which focus on maintaining building height and number of floors. These buildings are also included in the *plan de site de la rade*.

[14] *Plan de site de la rade,* the *règlement special Mont-Blanc – Cornavin* and the *Gabarit des façades du quai Gustave Ador et rue Pierre-Fatio, de la place des Marroniers à la rue Versonnex, plan de site de Coutance; règlement special du Rond-Point de Rive* and *Plan de site du Rond-Point de Plainpalais*.

[15] The funds for the *Fonds cantonal des monuments, de la nature et des sites* come from several sources, namely the Geneva State budget, federal contributions to patrimonial protection, and the product of fines or other contributions that derive from the LPMNS.

[16] The budget that is available for the *Subvention à la restauration de bâtiments* is of 20 000 000 chf, divided annually since 2003.

[17] The form and the instructions for the demand are available on internet.

[18] "estabelece as bases da política e do regime de protecção e valorização do património cultural."

[19] Since buildings are the type of immovable heritage that our work refers to, we will hereafter simply use the designation "building(s)", even though other types of immovable assets are also specified in the legislation.

[20] "o procedimento de classificação de bens culturais imóveis, o regime das zonas de protecção e o estabelecimento das regras para a elaboração do plano de pormenor de salvaguarda."

[21] "Um bem considera-se de interesse nacional quando a respectiva protecção e valorização, no todo ou em parte, represente um valor cultural de significado para a Nação."

[22] The main financial instrument is the Conservation fund (*Fundo de Salvaguarda*), whose legal bases were defined by the *Decreto-Lei nº138/2009*. It finances the protection of assets in the world heritage list, as well as listed and to be listed assets in risk of destruction. The fund is to be used in emergencies affecting listed or to be listed assets, to fund the renovation of publicly owned classified buildings, to fund possible acquisitions of the latter, and to financially support interventions ordered by the Public Administration on these assets. An additional program was also created in 2009 by the *Resolução do Conselho de Ministros nº70/2009*, the program for the conservation of listed heritage, in cooperation with construction companies, but was later suspended (*Programa de recuperação do património classificado* – PRPC).

[23] Since 2012, the *Direcção-Geral do Património Cultural* (DGPC) has taken on most of the responsibilities of the previous IGESPAR, according to the *Decreto-Lei nº115/2012* (Conselho de ministros 2012). As such, we have replaced the designation present in older legislation by the one that is currently applicable. "The DGPC's mission is to ensure the management, safeguarding, enhancing, conserving and restoring of assets integrating the country's immovable, movable and intangible cultural heritage, as well as to develop and implement the national museum policy" (DGPC 2014).

[24] "desenvolvendo as restrições e os efeitos estabelecidos pela classificação do bem imóvel e pela zona especial de protecção."

[25] "Os bens inventariados gozam de protecção com vista a evitar o seu perecimento ou degradação, a apoiar a sua conservação e a divulgar a respectiva existência."

[26] See, in Lisbon, the heritage topic (*património*) on the website (accessed on 21.10.2014), and, in Oporto, the map under the topic *carta do património*.

[27] "As áreas com interesse urbanístico e arquitetónico, identificadas na planta de ordenamento – carta de património, abrangem zonas significativas para a história da cidade que, sob o ponto de vista do urbanismo e da arquitetura, são representativas, contribuindo para a valorização da imagem urbana, pelo que devem ser protegidas e promovidas. [...] Qualquer operação urbanística a levar a efeito nestas áreas deve salvaguardar a qualidade urbanística e arquitetónica do conjunto, colhendo parecer prévio dos serviços competentes."

[28] "compreendem espaços centrais e residenciais onde, pela singularidade dos respetivos traçados e características de ocupação urbana, devem ser preservadas as características morfológicas, ambientais e paisagísticas e elementos mais relevantes."

[29] In Portugal, many contracts dating from before 1990 had a blocked rent progression, a situation that could entail a lack of income for the owner and, consequently, the degradation of buildings due to poor upkeep. Measures to specify rent progression were implemented in 2006 and, more recently, in 2012, in the revision of urban rental legislation (ASSEMBLEIA DA REPUBLICA 2012). Even without a detailed examination of the legal diplomas, it is safe to say that both rent blockage and rent updating can give rise to serious issues both from a heritage preservation and human point of view, which need to be carefully addressed. For more information concerning this topic, see (accessed on 01.10.2014).

[30] Since this text was written, these exemptions have since been changed and new legislation introduced.

[31] "têm o dever de assegurar a sua reabilitação, nomeadamente realizando todas as obras necessárias à manutenção ou reposição da sua segurança, salubridade e arranjo estético."

[32] "não podem, dolosa ou negligentemente, provocar ou agravar [...] a sua deterioração."

[33] When a detailed urban renovation plan is put in place in areas that coincide with listed heritage or where the listing procedure has been initiated, the detailed urban renovation plan should include and pursue the objectives of the detail conservation plan (*plano de pormenor de salvaguarda*), hence not requiring the elaboration of the latter (MINISTÉRIO DO AMBIENTE 2012: Art.21). As such, when the detailed urban renovation plan has been prepared and agreed on with the authority managing protected heritage, its individual permission is no longer required (MINISTÉRIO DO AMBIENTE 2012: Art.28). Nevertheless, partial or complete demolition of listed or to be listed heritage cannot be executed without its explicit permission.

[34] The *sociedades de reabilitação urbana* were first mentioned in the *Decreto-Lei nº104/2004.*

[35] The companies can have state capital in cases of obvious public interest (MINISTÉRIO DO AMBIENTE 2012: Art.37).

[36] "devem ser realizadas preferencialmente pelos respectivos proprietários."

[37] "devem ser activamente promovidas pelas respectivas entidades gestoras."

[38] "pequenas dimensões, posição fora do alinhamento ou más condições de salubridade, segurança ou estética, quando o proprietário não der cumprimento, sem motivo legítimo, no prazo de 12 meses, à notificação que, para esse fim, lhe seja feita."

[39] "não originem ou agravem a desconformidade com as normas em vigor ou tenham como resultado a melhoria das condições de segurança e de salubridade da edificação."

[40] "Regulando a reabilitação urbana de edifícios ou fracções, ainda que localizados fora de áreas de reabilitação urbana, cuja construção tenha sido concluída há pelo menos 30 anos e em que se justifique uma intervenção de reabilitação destinada a conferir-lhe adequadas características de desempenho e segurança."

[41] "Preservar as fachadas principais, [...] com possibilidade de novas aberturas de vãos ou modificação de vãos existentes ao nível do piso térreo [...]; manter os elementos arquitectónicos e estruturais de valor patrimonial do edifício [...]; manter o número de pisos acima do solo e no subsolo, bem como a configuração da cobertura, sendo admitido o aproveitamento do vão da cobertura como área útil, com possibilidade de abertura de vãos para comunicação com o exterior [...]; não reduzir a resistência estrutural do edifício, designadamente ao nível sísmico, e observar as opções de construção adequadas à segurança estrutural e sísmica do edifício."

[42] Since this text was written, these exemptions have since been changed and new legislation introduced.

[43] "medidas excecionais e temporárias de simplificação administrativa, que reforçam o objetivo de dinamização, de forma efetiva, dos processos administrativos de reabilitação urbana."

[44] 60 % of the capital comes from the *Instituto da habitação e da reabilitação urbana* (IHRU) and 40 % from the Oporto municipality (PORTO VIVO 2014).

[45] Since this text was written, the urban renovation area of "Campanhã-Estação" has also been added to the set.

[46] Following the election of a new municipal administration Oporto, architect Manuel Correia Fernandes, who publicly criticised some of the Porto Vivo operations, became town councillor for urbanism.

[47] For further details concerning the history of the successive programs aiming to promote urban renovation, see the document "Estratégia de reabilitação urbana de Lisboa 2011/2024" (CML 2011).

[48] According to former board member Margarida Lancinha Pereira (Interview carried out on 21.07.2011), only one of the buildings was actually renovated by the SRU Baixa Pombalina, our case study on *Rua Nova do Carvalho,* with an architecture project by Appleton & Domingos. The three others, one in the Rua de São Paulo and two in the Rua do Arsenal, were sold with an approved renovation.

[49] So far, the only one that has been created is the ARU Santa Clara.

[50] The incentives, such as tax reduction for building materials, are mentioned in the city hall websites: ⓐ, ⓐ (accessed on 20.09.2014).

[51] According to OFS data in 2012 (OFS 2012) the cantons that have the lowest percentage of vacant housing are Geneva, Basel (BL and BS), Zoug, Zürich and Vaud.

[52] While the average in Switzerland is around 0,94 %, Geneva has a rate of 0,33 % (OFS 2012: 4).

[53] These are mainly the construction areas noted in the *Loi d'application de la loi fédérale sur l'aménagement du territoire* (Grand conseil 2013: Art.19), meaning areas 1, 2, 3 and 4 of the *Plan de zones d'affectation.* The LDTR (Grand conseil 2012: Art.2) excludes single-family houses and villas in area 5 from this rule.

[54] Sale values are also limited by the urban planning department (*département de l'urbanisme*) if ownership is already by floors or according to a similar system.

[55] Rent values might not be limited to a value corresponding to average population needs in the case of luxury housing or when it already previously exceeded this value by two and a half times.

[56] Further details concerning this type of housing can be found in the *Loi générale sur le logement et la protection des locataires* (Grand conseil 2013).

[57] The application form can be found on internet.

[58] This interdiction is applicable to housing which is allocated to rental purposes and that corresponds to average population needs in terms of rental value and area (Grand conseil 2012: Art.6).

[59] These changes also include the possibility of demanding energetic subventions – the *Bonus conjoncturel à l'énergie* (Conseil d'état 2012: Art.10A), which is further detailed in the *Loi sur l'énergie* (Grand conseil 2013).

[60] The *Titre II* also limits building height and distance between buildings for new constructions (Grand conseil 2013: Art.19,23,27). In the *deuxième* and *troisième zones* heightening is allowed when urban harmony is not compromised. In the *deuxième zone* and in part of the *troisième* the *commision des monuments, de la nature et des sites* is consulted in the elaboration of the indicative plans for building heightening. Some indicative plans (with no proper juridical value) of buildings that might be subject to heightening are available on internet. As far as we can tell, these do not include any 19th century buildings.

[61] "si l'application stricte des prescriptions légales ne permet pas d'améliorer l'hygiène et la sécurité d'une construction."

[62] Glass roofing over courtyards should also be removed in case of transformation (Conseil d'état 2013: Art.53).

[63] Legislation refers to all rooms that can serve residential purposes, which, in Geneva, means all rooms of a house excluding kitchens, bathrooms, laundry and storage rooms.

[64] Open field of vision that is measured perpendicularly to the opening for at least 4 m (Grand conseil 2013: Art.48).

[65] "lorsqu'il en résulte un avantage prépondérant pour la construction."

[66] "lorsque des constructions ou des éléments de constructions sont touchés par des travaux qui modifient la performance énergétique du bâtiment."

[67] The *Assemblée fédéral*'s 15th June 2012 proposal for the modification of the LAT is a partial revision that was suggested as a counter-proposal to the initiative "De l'espace pour l'homme et la nature". Since this chapter was written, these changes were approved in a public referendum on 3 March 2013.

[68] "une utilisation rationnelle et économique de l'énergie pour le chauffage et la production d'eau chaude sanitaire dans le bâtiment."

[69] The coefficient of heat transmission or *U* value ($W/m^2 K$) is used to evaluate the thermal conductivity of given elements. It is the inverse of heat resistance *R* ($m^2 K/W$), meaning that the lower the *U* value, the better thermal insulation is. The SIA 380/1 defines it as the "quotient of the thermal

flow by unity of surface of a building element, in a stationary regime, by the temperature difference between the surroundings that are contiguous to this element" (LENZLINGER 2009: 12).

[70] "Dans le cas où le respect des exigences se heurte à des problèmes de faisabilité technique, d'investissements économiquement non supportable ou d'exigences de la protection du patrimoine bâti, les écarts doivent être justifiés."

[71] See, for instance, the table included in the article "L'assainissement énergétique de bâtiments historiques" (BACHINGER 2011). Since 1988, *U* values for windows, for instance, have changed from 2,60 W/m²K, to 1.70, 1,50 and, finally, 1,30 (for transformations).

[72] The LDTR is applicable to residential buildings with rents that correspond to average population needs.

[73] "Sistema de Certificação Energética dos Edifícios", "Regulamento de Desempenho Energético dos Edifícios de Habitação", "Regulamento de Desempenho Energético dos Edifícios de Comércio e Serviços".

[74] The publication by INETI concerning the application of the RCCTE, *Manual de apoio à aplicação do RCCTE* (CAMELO 2006), for instance, can be particularly useful in applying the calculation methods to each building.

[75] "traduz a relação entre a energia solar transmitida para o interior através do vão envidraçado e a radiação solar incidente na direcção normal a esse vão."

[76] "protéger contre le bruit nuisible ou incommodant."

[77] "les pièces des habitations, à l'exclusion des cuisines sans partie habitable, des locaux sanitaires et des réduits."

[78] In Geneva, the *Loi d'application de la loi fédérale sur la protection de l'environnement* (LaLPE) and the *Règlement sur la protection contre le bruit et les vibrations* (RPBV).

[79] "remplacement des fenêtres ou des vitrages; – remplacement de revêtements de sol élastique (tapis) par des revêtements durs (parquet, stratifié, céramique, pierre); – remplacement des équipements techniques ou des installations fixes du bâtiment; – remplacement des installations sanitaires".

[80] In principle, the installations should primarily be planned or adapted to comply with the legislation requirements in each area without the need to intervene on the buildings, for instance, through road resurfacing or by installing antinoise panels.

[81] According to article 15 of the OPB, this requirement also applies whenever "alarm" noise values of existing fixed installations are not respected.

[82] The external and internal *bruit solidien rayonné* are also mentioned, stating that further evaluation will be done according to the future *Ordonnance fédérale sur la protection contre les vibrations.*

[83] For Geneva, the *cadastre du bruit* is available online on the *Système d'Information du Territoire – SITG* map.

[84] La question de la proportionnalité des exigences acoustiques, qui peut se poser lors de transformations de bâtiments (statique, protection des monuments, faisabilité technique et contraintes d'exploitation, ainsi que coût supportable), est à régler au cas par cas entre les intéressés et, si nécessaire, avec l'autorité d'exécution".

[85] Small changes were specified in the Declaração de Rectificação nº18/2007, de 16 de Março and in the Decreto-Lei nº278/2007, de 1 de Agosto.

[86] "estabelece o regime de prevenção e controlo da poluição sonora, visando a salvaguarda e o bem-estar das populações."

[87] The production of noise maps is also addressed in the Decreto-Lei nº146/2006, which transposes to Portuguese law the Directive nº2002/49/CE of the European Parliament and Council.

[88] "a utilização ou alteração da utilização de edifícios e suas fracções está sujeita à verificação do cumprimento do projecto acústico."

[89] "Introduz-se um desagravamento dos requisites exigíveis em termos de isolamento sonoro dos espaços interiores em edifícios em processo de reabilitação situados em zonas históricas, de modo a tornar exequível a adopção de soluções construtivas que confiram identidade patrimonial e histórica."

[90] "vocacionada para uso habitacional, ou para escolas, hospitais ou similares, ou espaços de lazer, existentes ou previstos, podendo conter pequenas unidades de comércio e de serviços."

[91] Since this text was written, these exemptions have since been changed and new legislation introduced.

CASE STUDIES – CHANGES TO DOMESTIC SPACE

Part 5

In the following chapter, we carried out a comparative analysis of changes to domestic layout in contemporary renovations of late 18th and 19th century housing in Lisbon, Oporto and Geneva. This analysis led to the identification of recent typological changes, both in relation to the original layout and taking into account the interventions since the time of building. The aim was to pinpoint the solutions that most took advantage of original layout features to respond to new comfort and usage demands. We specifically looked at modifications of housing unit number and size within a building, and of room function, distribution and of connections between spaces within the housing units. This analysis was carried out according to six main renovation strategies:

– Re-using alcoves for new functions ☞;
– Dealing with privacy issues while taking advantage of the *enfilade* ☞;
– Addressing the kitchen's role in domestic sociability ☞;
– Creating additional housing units through division ☞;
– Attic reconversion ☞;
– Promoting accessibility through the introduction of lifts ☞.

Renovation of historical housing is necessary to avoid the loss of cultural values, to address changes in family life and comfort demands, and to ensure building safety. Contemporary interventions have the potential to contribute to richer domestic spaces by valuing original qualities such as ceiling height, room dimension, and plaster or woodwork, while simultaneously responding to these new concerns.

There are recurring issues that renovation projects frequently need to address. One of them is the addition of new domestic functions, such as the placing of one or more bathrooms, as well as the privacy of bathrooms and bedrooms. Nowadays, the almost systematic placing of bedrooms in rooms with windows next to the building façades often calls for room function reorganisation. Moreover, the reduction or elimination of household staff, associated to the new role of the kitchen in the house's social life, have led architects to rethink the previously hidden service spaces in relation to the rest of the house. An additional issue is the creation of more housing units, often brought about for economic reasons and by the demand for more diversified housing in the city centre. This subject is addressed either through the division of larger housing units or by attic reconversion. Nowadays, upper floor flats are valued for their views and privacy from the bustling street, in opposition to the original situation, in which they were often the most disadvantaged. Attics that were previously used for storage are also sometimes used to increase the flats below through duplexes. Another strategy that is often important is the promotion of

greater accessibility to all floors through the introduction of lifts. This introduction changes the buildings' vertical variation of social standing at the time of building by allowing access equality to all floors.

When renovating, it is both a challenge and an opportunity to find design solutions that make use of the houses' original layout features to address present-day housing programs. As we shall see, far from the possible and visible losses this patrimony has experienced, some interventions are coherent examples of how to achieve solutions for compromise[1] maintaining the buildings' character.

Original use of alcoves

Alcoves ☒ were amongst the smallest rooms of late 18th and 19th century houses, perhaps with the sole exception of toilet compartments. They were inner rooms, most often described as sleeping chambers, which usually gave onto bigger rooms that, in turn, gave onto a street or courtyard façade. These bigger rooms would indirectly provide light and air to the alcoves through a door-size or bigger opening, often complemented by a fanlight. They could either be accessed only through this bigger room or have a secondary access through another room or mediating space.

The final section of Monique Eleb and Anne Debarre-Blanchard's *Architecture de la vie privée* (1989: 291) presents the description of housing room functions as included in some French architecture encyclopaedias or dictionaries since the 18th century. Two descriptions show the importance of alcoves at the beginning of our analysis period, in late 18th century, and their lesser significance one century later. While in 1765 D'Alembert and Diderot (D'Alembert 1765: 291) described the alcove as a usual part of the bedroom where the bed was placed, sometimes including some chairs, in 1877 Bosc (Bosc 1877: 291) depicted it as no longer being an essential part of the home, but rather a device which could be useful in defining apartment layout.

Alcoves existed almost invariably in Lisbon's blocks of flats, and quite often in Oporto's terraced houses and in Geneva's blocks of flats and houses. This can easily be noted by going through the general metric survey ☞ of Lisbon's *Baixa Pombalina* flats done by Jorge Mascarenhas (1996) for his PhD thesis *A study of the design and construction of buildings in the Pombaline quarter of Lisbon,* and in the research into Oporto's terraced houses by Francisco Barata Fernandes (1999) for his PhD thesis *Transformações e permanência na habitação portuense: as formas da casa na forma da cidade* ☞ and, for Geneva, the typological analysis ☞ we carried out of 19th century housing in the *Ceinture Fazyste* expansion area, included in the chapter "A typology of housing – Geneva" ☞.

Alcoves in Lisbon's blocks of flats. In 2004, Maria Helena Barreiros described the function of alcoves in Lisbon's ☒ late 18th and early 19th century *Baixa Pombalina* flats, "in principle", as "sleeping chambers" or, otherwise, as "dressing rooms, children's rooms, or all that simultaneously"[2] (Barreiros 2004: 92,96).

Joana Cunha Leal's PhD thesis *Arquitectura privada, política e factos urbanos em Lisboa: da cidade pombalina à cidade liberal* (Leal 2005) includes the analysis of several floor plans of comfortable one flat per floor blocks of flats in Lisbon dating from mid to late 19th century, since the application of the 1864 decree[3]. Even in these later neighbourhoods, alcoves still seem to be an essential part of the houses. The main differences to earlier floor plans ⊠ were the presence of a corridor instead of the previous passageway and, in larger flats, the inclusion of a toilet or latrine[4].

Alcoves in Oporto's single-family terraced houses. In Oporto, the late 18th and 19th century narrow single-family houses usually had 3 to 5 floors, which were distributed by a transverse central staircase. This staircase separated rooms giving onto the street or onto the courtyard side, often combined with alcoves ☞ (Fernandes 1999: 144). The existence of alcoves depended on plot depth. As previously described in the chapter concerning types of housing in Lisbon and Oporto ☞, these inner rooms most often existed in longer plots ☞, while shorter ones could have only one room on each side of the staircase. Alcoves could then receive light from openings onto these main rooms or from windows receiving indirect light from the staircase skylight ⊠. In Oporto, floor plans only started being included in building permissions since the 1899 municipal regulations[5]. As shown in the floor plans submitted since this date, alcoves towards the end of the 19th century were used not only as sleeping chambers, but also as *toilette*, dressing, offices or storage rooms ⊠.

Alcoves in Geneva's houses. We can only draw more definitive conclusions as to the presence of alcoves in Geneva ⊠ starting in mid-19th century, based on our systematic analysis of floor plans of houses located in the *Ceinture Fazyste* expansion area ⊠. The published floor plans dating from an earlier date of two 1839 buildings in the *Quai des Bergues* ☞ show two flats per floor where most rooms (living room, dining room, bedrooms and kitchen) had adjoining alcoves with beds depicted inside (Broillet 1997: 338). This was also the case in the oldest collected original floor plan of a *Ceinture Fazyste* block of flats: the building on *Rue François-Bonivard* 10 ⊠, built in 1857-58 in the *Quai du Mont-Blanc*[6] ☞.
In Geneva's 19th century blocks of flats located in the *Ceinture Fazyste,* alcoves or small rooms giving onto light wells ⊠ were quite frequent until the 1890s, after which their presence was significantly reduced. In housing units that were part of blocks of two or three flats per floor, alcoves generally gave onto living rooms ⊠, onto bedrooms and, rarely, onto dining rooms. In blocks of one flat per floor and in single-family houses, where lack of space was less of a problem, they nearly always gave onto bedrooms ⊠. The floor plans for Geneva's *Ceinture Fayzste* houses were often quite detailed, indicating the foreseen use of each room and, sometimes, the expected placement of the beds. Alcoves were sometimes depicted as sleeping areas where the bed was placed. However, even in smaller flats, the room next to it or other rooms in the house could be clearly designated as bedrooms. In this situation, the presence of alcoves allowed for multiple usages, since the room next to it could

either be used as a bedroom or as part of the house's social area, while the bed was hidden away ☒:

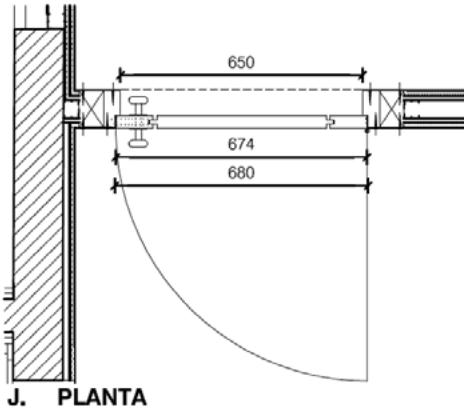
> These main [reception] rooms frequently have wooden panelling, and it is not rare that an alcove, deep enough for a large bed to fit, occupy the far end of some of them, at the same time living rooms and bedrooms. (Vouga 1984: 59)[7]

Bathrooms, libraries and storage spaces

Rua da Alfândega 108, 4th floor, Lisbon – Atelier do Bugio | João Favila ☞ The adaptation of previous alcove spaces to present-day housing programmes is illustrated by the renovation of the top floor of a late 18th century block of flats in Lisbon's *Rua da Alfândega.* It is a building located in a quadrangular block on the eastern edge of the *Baixa Pombalina* ☒, near the *Praça do Comércio,* the *Baixa*'s large riverside square. The original floor plan ☒ was determined through 1925 archive floor plans[8] for the transformation of the 1st floor ☒ and through the metric survey done before the recent renovation. The flat comprised two intercommunicating square rooms next to the street façade, possibly dedicated to social functions. A central passageway linked these rooms to two others next to the courtyard façade, including the kitchen, which had its own separate entrance from the staircase. In addition, two parallel sequences of smaller alcove spaces gave onto these bigger rooms. The existence of two chimneys could possibly be explained by one being originally dedicated to the kitchen and another to a dining area; in alternative, the flat could have been divided in two at some time.

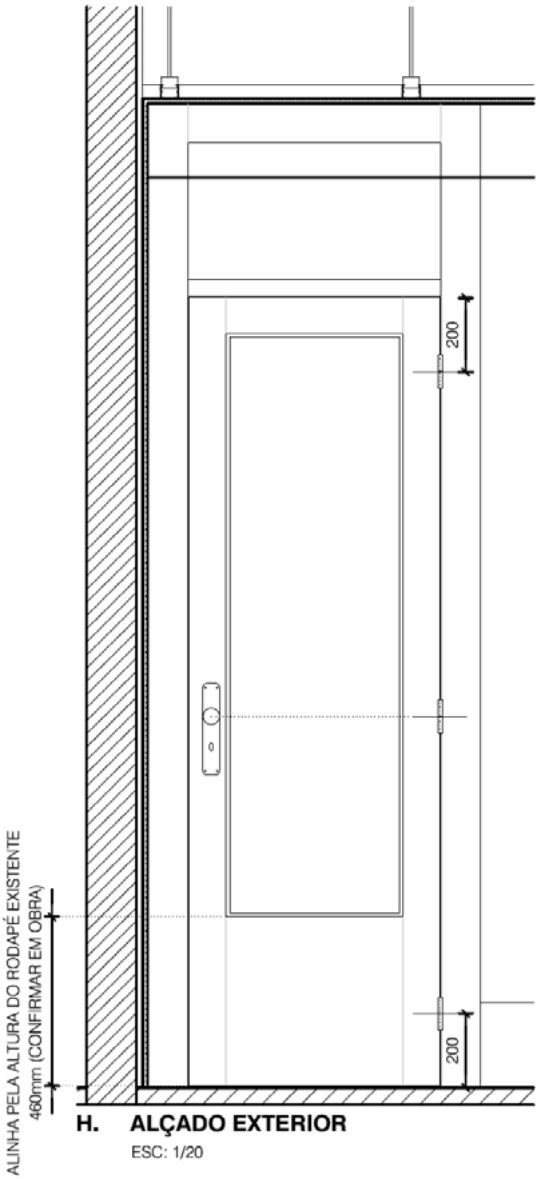
The recent renovation by architects *Atelier do Bugio* made use of the attic to increase the housing space ☒: most bedrooms were placed above, keeping the social areas downstairs. On this lower floor, the transformation was mostly concentrated on the central alcove spaces ☒, where additional housing functions were placed. According to architect and resident João Favila, this strategy kept the original fundamental geometry of the rooms next to the façade, and used the alcoves to complement these spaces.

Housing in Lisbon's *Baixa Pombalina* is documented not to have originally had toilets, but only a sink for wastewater in the kitchen (Mascarenhas 1996: 97). In several of the houses that are nowadays renovated we find that, throughout the 20th century, small WCs were often added just outside the kitchen onto the small courtyard next to the sewage drainpipe, or that improvised bathrooms were placed inside the kitchen or just next to it. In the *Rua da Alfândega* flat, a bathroom had been placed inside the kitchen, going to the length of dividing an existing window. In the recent intervention, the kitchen ☒ was kept in the same location, now including the eating area. The new downstairs bathrooms were included in part of the previous alcove spaces. The main one has a more private entrance by giving onto the existing passage. In order to pass the sewer distribution it was necessary to create a step from the corridor to the bathrooms. The sewage piping then passed between and parallel to the existing floor beams. It was then connected to the drainpipe located on the courtyard side. Water and



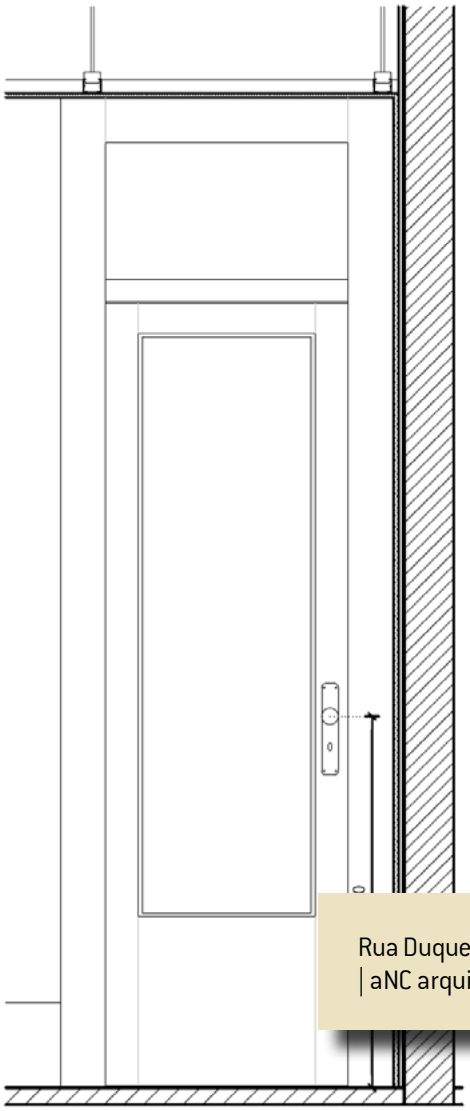
J. PLANTA

ESC: 1/20



H. ALÇADO EXTERIOR

ESC: 1/20



Rua Duque de Saldanha 600, Oporto, vertical sections – doors (Drawings | aNC arquitectos).

Adding new alcove-like bathrooms to bedrooms

Rua do Rosário 223, Oporto – architect Paula Ribas ☞ The renovation of a typical early 19th century single-family house ☒ in Oporto by architect Paula Ribas is an example of how to include one bathroom per bedroom when original alcove spaces do not exist. The project introduced new alcove-like bathrooms ☒ within each bedroom while keeping main room proportion and detailing, attesting to the increased importance of hygiene and privacy in domestic life.

The house is located on *Rua do Rosário,* a street that was part of the 1805 project by the *Junta de Obras Públicas* for the formation of a new neighbourhood to the west of the city in the *Cedofeita* area[14] (Nonell 2002: 286). Even though no original floor plans were available at the Oporto's building archives, it was possible to determine the main original layout features from the 1936 plans ☞ requesting its connection to the public sewage system[15], as well as from the metric survey done by the architect before the recent renovation work. The survey depicts a house with a basement, three main floors that constitute the street façade, and a top floor receded in relation to both façades. The ground floor is located at the same level as the street and the garden, and a back patio provides light to the basement floor. On the street side, the stone doorframe shows that originally there were probably two doors, one possibly giving access to a commercial space, another to the house. Sometime before the last renovation, the door with a commercial access was turned into a window. The interior layout follows Francisco Barata Fernandes's (1999) description of the single-family house type dating from late 18th or early 19th century:

> Two façades; central staircase; ground floor with independent access and destined for commerce, workshop, warehouse or complementary storage for the house. [...] the staircase now receives light through a skylight. In the case of deeper buildings, that have alcoves, these can receive light from the stairwell through windows opened on the interior walls. [...] From a functional point of view, one should mention that the first floor room giving onto the street is usually organised as a room ready to receive a visitor. The rest of the rooms probably followed the tradition of non-specialisation, with the exception of the kitchen, that is always located at the back on the top floor, by the roof. [...] There is a sense of progression from public to private, from the representative to the functional, as one goes up from floor to floor. (Fernandes 1999: 144-145)[16]

We cannot be sure of how many inner rooms originally ☒ existed next to the central transverse staircase. Given that the house's depth was on the lower range of the spectrum, just under 14 m, it is likely that most floors did not present any alcoves, possibly having just a main room on each side of the staircase. The metric survey done before renovation shows only one inner room located on the top floor and illuminated indirectly by the staircase skylight through a small window. Another one could have originally existed on the opposite side of the staircase on the same floor, where an identical small window also exists.

The only complete bathroom that existed before the intervention was located on the second floor. In the 1936 sewage connection request ☞ we can see that, just like the house on *Rua Duque de Saldanha* 600, this was a very long bathroom introduced by increasing the size of a small exterior toilet towards the inside of the house.

The aim of the recent renovation ☒ by architect Paula Ribas and designer Luís Mendonça, also the house's new residents, was to use it as a single-family house and office. As in the original design, there is a gradual ascending increase in privacy. The office was placed on the basement floor, using the front part of the ground floor as a buffer access area; the house's social areas were placed on the first floor, while the bedrooms ☒ were located on the floors above. The kitchen ☒ was moved down from the second to the first floor next to the street, and the living room ☒ was located on the garden side – thus constituting a common social area on the first floor. The intervention on this floor was completed by a larger balcony ☒ next to the living room, which was connected to the garden through a new metal staircase. A smaller balcony was also introduced on the ground floor.

The house's most private areas, the bedrooms, were placed on each side of the second and third floor. The residents found it necessary to add more bathrooms ☒, so that they would only be accessible to one or two bedrooms and be closer to each one. Two small bathrooms on the second floor, one per bedroom, and one on the third floor, serving both bedrooms, replaced the only existing bathroom. On the top third floor, the new bathroom was located in the existing inner room next to the staircase. On the second floor, a bathroom was introduced in each bedroom, including a lavatory, a toilet and a shower. They were placed next to the staircase to occupy the place of new "alcoves". Moreover, they were planned as pieces of furniture that do not go up to the ceiling, visually maintaining the size of each bedroom. The bathrooms' free standing walls were made of a metallic structure that was covered in plywood on the bedroom side and tiled on the inside.

Original and changing flat distribution

In the 1832 *Dictionnaire historique d'architecture,* Quatremère de Quincy presents descriptions of building features that are quite revealing of domestic space use and development. These descriptions mostly refer to 19th century urban France, but are also fairly representative of domestic spaces in several European cities that, naturally, also presented local specificities. The author describes "distribution" as "the division, the order and arrangement of rooms that form the interior of a building", adding that "distributing a building, is to combine in the best possible order, [...] all the bedrooms, living rooms, galleries, apartments, that compose a given interior"[17] (Quatremère de Quincy 1832: 530-531).

Room distribution inside the home is one of the layout features that changed the most during our analysis period, that is, from late 18th century to early 20th century. These changes took place gradually throughout a relatively long period. The most significant transformations were an increase in room specification and in mediating spaces giving access to a room without passing directly through another. As remarked by Monique Eleb-Vidal, privacy is the leading motivation for these changes:

> The first developments that significantly transformed the house: the corridor, the double circulations, the specification of room function and of its adjoining areas… are all connected both to the need of dissociating activities and to the choice of being alone or with others. (Eleb-Vidal 1985: 219)[18]

Three mechanisms are particularly significant to understand house distribution at this time: the *enfilade,* the antechamber and the corridor. The *enfilade* ⊠ is a term used to describe a sequence of two or more of intercommunicating rooms, generally (but not necessarily exclusively) placed next to a building's façade:

> Traditionally, the gathering of intercommunicating rooms forms a *suite* and gives the necessary status to social appearances. The *enfilade* device favours the reception rooms, usually placed next to the houses main façade [...]. The reception ritual stipulates that the visitor is received in a first room, and then guests go into the dining room, followed by a transition to a new sitting room, for the evening. [...] The communication doors between the rooms are placed axially to reveal a unique perspective of the room sequence. [...] However, when the doors are open, the largest part of the rooms is still not shown to the beholder. This spatial prodigality, associated to the *bourgeois* social rituals, allows the host to display his prosperous condition to his hosts. (Barbey 1980: 72)[19]

Flat layout during the 19th century shows a progressive reduction of the use of the *enfilade* and a greater use of mediating spaces, which allowed for an independent access to the houses' private, social or service areas. Depending on the residents' status and on available space, these were either distributing-reception rooms themselves – the antechambers – or narrower access passageways, that were at the origin of the corridor. According to Quatremère de Quincy, the antechamber could also be used as a dining area in smaller flats (Quatremère de Quincy 1832: 44). The corridor was already defined in the author's 1832 dictionary "as a kind of long path that leads to several rooms inside a building", necessary when there was a "long sequence of rooms, because one is not obliged to cross them to access the stairs". However, the definition also shows that this work dates from early 19th century, since the author considers that the corridor was "only used in communities or teaching facilities"[20] (Quatremère de Quincy 1832: 463). Smaller secondary access passages – the *dégagements* – were prescribed as being suited to domestic spaces.
Flats pertaining to late 18th century and early 19th century buildings in Lisbon usually present intercommunicating rooms ⊠ and small passageways, and hardly any corridors. In Geneva, there was usually an *enfilade* between the living room and dining room ⊠, which could be connected to one or two more rooms in larger flats ⊠. However, since most of the flats examined in Geneva date from mid to late 19th century, all rooms were generally also accessible through a corridor or antechamber[21]. Oporto's single-family houses presented a different configuration. Even in the earlier examples, part of the functional division could take place by floor, with the central staircase and its landings ⊠ acting as main distributing spaces.

The enfilade and the corridor in Lisbon's flat layout. The general original flat layout ⊠ of Lisbon's *Baixa Pombalina* flats, of which we undertook a partial statistic analysis[22] (Wall Gago 2007) ⊙, can summarily be described as follows. Reception rooms intended for public display faced the street, generally in *enfilade*. Emphasis was placed on their separation from the kitchen, usually placed next to the courtyard. Access separation between reception and service areas was most often done through a small distributing passage from the entrance, which was usually reinforced by creating two entrances from the staircase landing, especially when there was one flat per floor. While one of these entrances most often gave access to the distributing passage or, less often, to the service area, the other usually led to a first room next to the street façade, possibly a reception room for visitors, who might then be led to the rest of the houses' front living-rooms. When there were two flats per floor, one or two entrances per flat were nearly as common. With the exception of the passageway from the entrance, the distribution within the flat was most often done directly between rooms without mediating spaces. Corridors existed only occasionally. A single or double layer of inner rooms parallel to the façade – usually termed alcoves, and mostly associated to sleeping areas – completed the set.
The following analysis focuses on renovations in Lisbon *Baixa Pombalina* flats, where most of our earlier case studies are located. We looked into how three recent

flat renovations in this area addressed new privacy issues while making use of the existing *enfilades.*

The privacy of bedrooms and bathrooms

Calçada do Correio Velho 1-3, 1st floor, Lisbon – architect Pedro Reis 2nd floor – architects João Felino and Tiago Mota ☞ The one flat per floor building ⊠ on the corner of the *Calçada do Correio Velho* and of the *Rua de Santo António da Sé*, in Lisbon, dates from late 18th century and is probably one of the first of our case studies to be built. The recent renovation ⊠ by architects Pedro Reis, João Felino and Tiago Mota illustrates how localized interventions can have a significant impact on circulation and privacy, addressing both the residents' present-day comfort needs and the preservation of the house's identifying historical features. The building is located in a block on the eastern edge of Lisbon's *Baixa Pombalina* ⊠ built in the aftermath of the 1755 earthquake. The block's trapezoidal shape is adapted to the slope and to its location in an area of intersection between the regular rectangular blocks of the *Baixa's* central area and the pre-existing more organic ones of the *Alfama* and *Mouraria.* The building's particular history was successively documented by several authors, starting with a quite detailed study of unfortunately unknown authorship entitled *As casas do Marquês de Pombal na Rua nova da Sé* (Anonymous 1998). This work was followed in 2004 by the article "'Casas em cima de casas': Apontamentos sobre o espaço doméstico da Baixa Pombalina", in which Maria Helena Barreiros (2004) examines the block's flat layout in the context of the *Baixa*'s domestic architecture. The conclusions of the first work, also confirmed by Barreiros, were that this was one of the properties owned by Sebastião José de Carvalho e Melo, Oeiras Count and future *Marquês de Pombal*, in the period immediately following the earthquake. Attesting to that are the original floor plans ⊠ and elevations depicting the entire block dating from between 1759 and 1769 (Anonymous 1998), which constitute rare elements preserved up to this day[23]. According to the same work, 1777 is the first documented year in which the *Marquês* collected rents from flats in this building. Maria Helena Barreiros' analysis of the original floor plans reveals that even though they correspond only partially to what was built, the main layout principles remained the same:

> A closer analysis reveals the observance of the principle of access separation: private (occasionally, social), more directly linked to the "front" rooms; and service, connected to the kitchen and pantry area, the first easily identifiable by the large chimney. [...] It is worth mentioning the particularity that the direct access to the kitchen [...] is done from the staircase landing below the one that gives access to the house: the differentiation of the two entrances to the house is such that they do not even share the same landing.[24] [...] As a distribution principle that is identifiable in all the houses, we have a double sequence of rooms, the first composed of the front rooms and chambers, communicating directly through a series of doors *en enfilade*, and a second, doubling the first, composed of the alcoves without windows – in principle, housing the beds to sleep in –, open to the front rooms. (Barreiros 2004: 91-92)[25]

In the house's final built floor plan ☒, a set of three central connecting passages served as a partial corridor allowing for a double access to some of the rooms. Other more private rooms remained further away from both the possibly service corridor and the more social *enfilade* ☒.

Archive floor plans[26] dating from 2000 demanding the property's ownership by floor give us an idea of the transformations that were carried out since the time of building ☒. As was often the case, one of the main changes was the introduction of bathrooms in an inner room next to the kitchen and, on the first floor, a small toilet compartment inside the kitchen. On the second floor ☒, a nonstructural wall making up one of the passageways had been removed to form a bigger central inner space. Even though the structural walls had been kept in place, most of the decorations had been removed on this floor.

The renovation of the entire building took place in 2004. Architects João Felino and Tiago Mota planned the renovation of the 2nd floor for the first to live in, and architect Pedro Reis carried out the renovation of the remaining floors, including his own house on the first floor. The focus of the renovation was the reorganisation of the circulation and alcove spaces. The changes were localized in the flats' central area, which comprised several inner rooms. The renovation defined mediating spaces ☒ that provide a secondary private access to bedrooms and bathrooms while keeping the existing room *enfilade* next to the façade.

At the time of renovation, the first-floor flat was in quite good condition and most of the interior woodwork and plasterwork still existed. Pedro Reis kept most of the flat's original layout and founding principles. In the renovation, the living rooms ☒ were placed near the "social" entrance; the existing *enfilade* was used to establish a gradual progression from social to more private spaces: reception room, living room, library, children's bedroom, couple's bedroom. Nevertheless, the large existing kitchen was assumed as a social dining-room ☒ space that is connected to the living areas through the pre-existing passageways.

The key interventions in the central inner rooms aimed to place additional functions – two bathrooms ☒ and a closet ☒ for the master bedroom – and to introduce an alternative circulation to access spaces that are more private, the bedrooms and the bathrooms. One bedroom was located near the entrance, and two bedrooms were placed at the end of the enfilade circulation. The couple's bedroom ☒ is paired with a closet room, and located at the more private end of the circulation; the children's bedroom is between the latter and the library. The placing of an extra dividing wall in one of the previous alcove spaces allowed for an alternative access to the bathrooms and to the bedrooms. The access to one of the previous kitchen pantries was reversed so that this space could be used to increase the main bathroom. Pedro Reis praises the house's versatility, which will allow for small changes when it proves necessary. One of those changes could be to use the dual access to the middle room, to turn it into two separate bedrooms when the children are older and need more privacy.

João Felino and Tiago Mota applied a similar strategy on the second floor ☞. The existing *enfilade* is now also used as a progression of spaces ☒, from the most public, the office-reception room, to the most private, the bedrooms and family

bathroom. Two bathrooms ⊠ were also introduced: as before, a more social one was placed in an inner room near the kitchen ⊠; another one was located in the alcove next to the bedrooms. However, the repartition of mediating corridor spaces was also planned differently. The inner central space was divided by a long cupboard ⊠ that forms a three-part corridor with multiple degrees of privacy. The first part serves mainly the social area, connecting the front living rooms to the kitchen – dining room; the second is a backstage cupboard area for the master bedroom ⊠; the third is a shared access to the family bathroom for both rooms. Unlike the first floor, several of the original second flat's original woodwork had been removed or damaged. The architects designed the new doors and doorframes as a reinterpretation of the original ones, keeping the same dimensions but simplifying the details.

Rua de São Mamede 31, Lisbon – Appleton & Domingos arquitectos João Appleton and Isabel Domingos ☞ *Rua de São Mamede* 31 is an example of a late 18th or early 19th century one flat per floor building ⊠ in Lisbon's *Baixa Pombalina* ⊠ eastern area. Its recent renovation illustrates the reorganization of part of the distribution of a typical flat placed in the centre rather than the corner of a block. The changes are concentrated in the house's central area, where alcoves were originally located, introducing additional mediating spaces that give access to bathrooms and bedrooms.

The original flat layout ⊠ presented four lines of rooms parallel to the façades. A sequence of three intercommunicating rooms gave onto the street façade and was probably originally dedicated to social functions. One of these rooms had an independent entrance from the staircase landing, where guests could have been received without going into the rest of the house. Another entrance gave onto a passageway distributing the rooms on the street side and on the courtyard side, where the kitchen was located. The latter communicated directly with another large room, which could have served as a dining area or additional service room. In the centre of the flat, there were two lines of small alcoves giving onto the main rooms on each side. The entrance passageway and another passage between street and courtyard side rooms provided a secondary access to the alcoves. Throughout the 20th century, small changes had been made to the flats, such as the introduction of bathrooms in the kitchens. The main transformation took place in 1962[27], with the introduction of a lift ⊠ giving onto the staircase landing, placed in the room that previously had an independent entrance.

The renovation project by architects *Appleton & Domingos* used several of the strategies described in this chapter, such as updating of the existing lift, or moving the kitchen to the visitors' room next to the street façade. Moreover, the kitchen now makes uses of the reopening of the separate entrance from the staircase. The key transformation we will focus on is the reorganisation of part of the alcoves and passages in the centre of the flats. The aim was to introduce new functions – bathrooms and storage spaces – and additional mediating spaces that provide more privacy to bedrooms and bathrooms.

The flat layout is now structured around the entrance hall ☒, which functions as an antechamber to the rest of the house. The hall corresponds to the alcove that was previously located next to the entrance passage, where a nonstructural wall was eliminated. It gives access both to the social room enfilade on the street side, and to the three passages serving the houses' more private areas. The central alcoves were used to place the bathrooms ☒: one serving the main bedroom, a smaller social bathroom, and a bathroom serving the two bedrooms. An additional passage from the hall was introduced so that, whenever necessary, the three bedrooms and bathrooms could each be accessed independently through a mediating space. The use of these passageways placed in the centre of the flats was essential to keep the original proportions and the *enfilade* distribution of the rooms next to the courtyard. The *enfilade* was even extended to the new third bedroom. The passageways avoided the introduction of longer corridors that would fit in less with this house's original character. For the residents, the dual access has the advantage of allowing for a greater flexibility. The bedrooms can be closed off or intercommunicating according to their needs, and the two smaller bedrooms can be used separately or as one.

Rua das Pedras Negras 5, 3rd floor, Lisbon – architect Pedro Pacheco ☞ This one flat per floor corner building ☒ is located in a trapezoidal block on the eastern edge of Lisbon's *Baixa Pombalina* ☒ built in the aftermath of the 1755 earthquake, just like the previously block of flats examined.

In 1884, the owner requested permission to heighten the pre-existing building. This request ☒ still exists at Lisbon's municipal archives[28] and includes two elevations, a section and a floor plan. In the elevations, we can see three floors belonging to the original building and three new ones, including a mansard floor. The floor plan most likely shows the lower pre-existing floors. From the entrance, a very small hallway gave access to the back kitchen, to an alcove and, possibly, to a front visitors' room. This room was then connected in *enfilade* to several others giving onto the street façade. An additional inner central room was also connected to these rooms. An important aspect of this floor plan was the existence of a back corridor allowing for an independent access between the kitchen and the front rooms, an aspect that was not very common at the time of building.

The main difference between the late 18th century layout of the lower floors and the late 19th century layout of the floors above ☒ was the increasing importance of the corridor. The original floor plan of the upper floors was determined through the metric survey carried out before the recent renovation. The small entrance hallway gave access to a corridor that distributed rooms on both sides of the house. Most rooms were thus accessible through one or two other rooms in *enfilade* and through this central mediating space. While the corridor of lower floors was mainly a device allowing for a hidden service circulation, the corridor on the upper floors was a main visible distributing element that allowed for independent accesses to rooms. The kitchen and the possible visitors' room were placed as before, directly accessible from the entrance. A series of rooms in *enfilade* lined the street façade, possibly dedicated to social functions. The dining room followed the visitors' room and had

the most decorated ceiling. On the opposite side, there were three inner intercommunicating rooms, which most likely served as sleeping chambers. The kitchen was the only room giving onto the light well. The new floors probably had a wastewater sink or a toilet placed next to the drainpipe, located just outside the kitchen, where the sewage drainpipe is still located.

In 2010, architect and resident Pedro Pacheco carried out the renovation of the 3rd floor ☒, precisely one of the floors that were added in 1884. At the time of renovation, the flat was quite intact. The main exception was the kitchen ☒, which had been divided in two to include a toilet, possibly at the beginning of the 20th century. One of the main objectives of the intervention was to recover the size of the original kitchen ☒ as well as introducing a fully equipped bathroom ☒. It also aimed to increase the size of the corner living room and improve thermal and acoustic comfort. Most rooms within the house originally had a double or triple access, both through the central corridor and through the adjoining rooms. The intervention made use of the corridor and *enfilade* to introduce small changes in distribution and in room function that added a new privacy layer to the bedrooms and bathroom, while social areas were brought together. These social areas now occupy the flat's corner area: the dining room was kept in the original location, while the living room ☒ was placed in the two small adjoining rooms by eliminating a nonstructural wall. The structural condition of the remaining building was unknown, as is often the case in interventions on only one flat. As such, two metallic L-shaped beams were added on either side of the wall's top wooden beam to help contain any unknown charges.

The bedrooms are now the ones at the beginning or at the end of the circulation, before or after the social spaces. The couple's room ☒ was placed in the alcove next to the library, while the original reception room was turned into a child's bedroom. The new bathroom ☒ was placed in the inner room next to the kitchen, allowing for a direct connection to the existing drainpipe next to the back-courtyard wall. Two significant changes were introduced in the distribution to increase the bathroom and the main bedroom's privacy. The inner room between the bathroom and bedroom became an antechamber mediating and giving access to both. The communication between the new bathroom and the corridor was blocked so that the bathroom has only one entrance, precisely through this closet-antechamber. The bedroom kept its double access, but the adjoining room on the social size also became an antechamber: it is a library and music room ☒ that mediates accesses and view between the social and private areas. Just like its original purpose in the 19th century house, this room with an alcove can double as part of the bedroom or living room according to the residents' needs.

Original and changing service spaces

Floor plans of late 18th and early 19th century houses in several European cities show that, whenever possible, the kitchen and its staff were placed away from the public eye. Service spaces were often distanced not only from the main street, but also from the rooms where a guest might be received.
The trends in service spaces in the French homes was mapped by Monique Eleb-Vidal and Anne Debarre-Blanchard by comparing floor plans and descriptions in architecture treatises dating from the 17th to the 19th century. According to the authors, the increasing distance of service areas and staff from the rest of the houses is already noticeable in 18th century floor plans:

> Material barriers become necessary to replace the previous moral barriers [between hosts and staff] [...]. The service rooms (kitchens and its annexes) are isolated from the houses' main areas, so as to keep noise, views and smells distant from the hosts. (Eleb-Vidal 1989: 253)[29]

There could be more or less complex circulation devices to separate staff and hosts, such as multiple entrances, service corridors or secondary staircases. Kitchen location and the devices used to promote an access separation depended on the available space, which was usually associated to the householder's means and status. These prerogatives are expressed in Quatremère de Quincy's 1832 description of the kitchen:

> Kitchen: Room where meals are prepared. It is located, according to the size of the houses of the householders' means, either in the basement, on the ground floor, or in upper floors. The kitchen is usually kept away from the apartments, because of the smell. It should be vaulted, for fire protection. It should be complemented by some other rooms, such as a laundry, pantry etc. (Quatremère de Quincy 1832: 491)[30]

The kitchen in Lisbon's flats. The kitchen is one of the few spaces in late 18th century flats, such as the ones in Lisbon's *Baixa Pombalina,* whose function can usually be assertively determined due to the presence of the original chimney ☒. Service spaces were kept within distance of the reception areas and of the public eye – the street. As such, the kitchen gave almost invariably onto the courtyard façade. Its position in Lisbon's flats remained quite stable throughout the 19th and early 20th century (Leal 2005). Accesses ☒ were generally separated by the flats' mediating spaces from the entrance, which constituted a small passageway in earlier flats and

a longer corridor in later ones. There could also be multiple entrances to the flats. Whenever there were two separate entrances to the flats, the most common system was for them to be placed on the same landing: one to a room giving onto the street façade, another giving access to the distributing passageway (Wall Gago 2007: 34). In the *Baixa Pombalina*, we also observed flats with two separate entrances from different landings ☒, one leading to social spaces and another to the kitchen – as in the *Calçada do Correio Velho* case study. This was, naturally, a more elaborate system that was probably used when cost was less of an issue.

The kitchen in Oporto's single-family terraced houses. In late 18th century Oporto, the most common type of housing was the single-family terraced house ☒ rather than the block of flats. This distinction inevitably led to fundamental differences from houses in Lisbon, such as the use of functional repartition not only between street and courtyard but also by floor ☞. Nevertheless, there were common principles to domestic life of the time that induced layout similarities. One of those features was the location of the visitor's reception room and the kitchen. As in Lisbon's flats, these two rooms were as distant as possible from one another. While the reception room was usually placed on the first floor giving onto the street, above the commercial ground-floor area, the kitchen was located on the top floor ☒, against the courtyard façade ☒ (Fernandes 1999: 145). Both Francisco Barata (1999: 173) and Nelson Mota (2010: 217-223) describe how this situation changed in late 19th century houses. Since the houses were often exclusively residential, the reception room could be placed on the elevated ground floor, giving onto the street. The kitchen, however, should be as invisible as possible but within proximity of the dining room. The latter was generally located on the ground floor, next to the courtyard façade ☒. As such, the kitchen could be placed either in the basement at courtyard level, just below the dining room, or otherwise be located in a courtyard side annex at ground floor level. According to Nelson Mota (2010: 223), the larger isolated high-end houses often displayed more elaborate circulation methods separating staff and householders, such as a secondary service staircase serving all floors.

Service spaces in Geneva. The position of service spaces in Geneva's mid to late 19th century blocks of flats and single-family terraced houses mostly follows the same logic as Lisbon and Oporto's domestic spaces of the time[31]. In the flats ☒, the kitchen and, very often, an adjoining maid's bedroom, were distanced from social spaces, which most often comprised a living and dining room. While the latter usually gave onto the main façade, the kitchen faced the opposite direction ☒. In most cases, the buildings had a street-courtyard orientation, which meant that the social spaces usually faced the street, while the kitchen gave onto the courtyard. However, placing the kitchen away from the street was a preference ☒ rather than social requirement in Geneva. This was a fundamental difference from houses in Lisbon or in Oporto. In Geneva, when there were three flats per floor, one flat could give only onto the street, including the kitchen. A different situation occurred when the buildings gave onto a back terrace or garden that was used by ground floor flats. In

these cases, the terrace façade became the main one, where the living room on all floors was usually placed. The kitchen could then be placed in the basement – in ground floor flats –, but gave onto the street on other floors. It was apparently more important to distance service spaces from the houses' social areas than it was to make them less visible from the street.
Single-family houses in Geneva usually had a back terrace or garden, placed on the opposite side of the street entrance. Just like blocks of flats with a street-terrace orientation, the main social spaces generally gave onto the garden side. Since the kitchen ought to remain hidden but within serving proximity, it was placed in the basement ☒, and quite often disposed of a service staircase providing a secluded staff access to the ground floor. However, unlike houses in Oporto, the basement was not usually at courtyard level, since the back terrace was most likely exclusively used by the residents rather than for service activities. As such, the kitchen was generally placed against the basement street façade, so that it could receive light through the small windows produced by the ground floor elevation.

The kitchen come dining come living room

One of the topics that is frequently addressed in recent renovations is the original distance between service areas – namely the kitchen – and social areas. The aim was usually to bring the kitchen closer to the dining room and, sometimes, to living room areas. The fact that the kitchen can now be part of or accessible through the dining and/or living room attests to less embarrassment and to the greater participation of activities that take place in the kitchen, such as food preparation, in social life. They also attest to the reduction of permanent household staff. According to Christian Moley, this reasoning was developed in social housing design during the 20th century, but the separation between social and service areas was still used in houses dating from the 1960s to distinguish between a more economic and a private higher end housing production:

> A first specificity is the distance that the flat of private production has, or continued to have, between the kitchen and the living room. When we see, around 1960, studies and reflections on what the social housing design should be like, one of the *leitmotiv* is that of the functionalism proximity between the kitchen and the place where meals are taken (living, dining room or smaller eating area according to the cases): facilitate service, reduce the service distances, place a service-hatch between the two rooms. [...] Even to confirm the social connotation of a flat clearly separating the kitchen and living room through an entrance hall, the Logéco are inversely most often characterised by a direct relation between the two rooms. (Moley 1999: 194-195)[32]

The practicality of having the kitchen closer or in the same space as the eating area, as well as its social function often characterises the way residents perceive the kitchen in the renovations examined. According to each house's original features, several strategies were put in place. In the case studies on *Calçada do Correio Velho* ☒, in Lisbon, or *Rue Rousseau*[33] ☒, in Geneva, the kitchen was large enough to house the dining room, thus becoming the houses' main social area. Likewise,

in the *Rua da Alfândega* ☒ example, the dividing wall between the kitchen and its next-door room had been removed before the intervention. The residents chose to keep this new-found kitchen size and join food preparation to the eating area. The living room remained in the rooms giving onto the street. We will now examine examples that took this reasoning one step further either by moving the living or dining room next to the kitchen or vice versa, or where they were brought together in a more consequent way.

Rua de São Mamede 15, 3rd floor, Lisbon – Souza Oliveira Arquitectura e urbanismo | Alberto de Souza Oliveira ☞ The one flat per floor building ☒ on *Rua de São Mamede* 15 is located in a block on the eastern limit of the *Baixa Pombalina* as it joins the pre-existing neighbourhoods uphill. Just like the buildings we examined on *Rua das Pedras Negras* and *Calçada do Correio Velho*, this block was probably built after the 1755 earthquake at the end of the 18th century or, at the latest, at the beginning of the 19th century. The late 18th map of the entire city of Lisbon ☒ indicating the newly planned neighbourhoods and the ones that were preserved after the earthquake clearly shows the block's future more regular design overlapping the previous winding streets. A map referring to 1807 (Fava 1831) already distinguishes between the slab blocks against the *Rua de São Mamede*, and its South-facing gardens. This feature – quite unlike the ones in the centre of the *Baixa* – is particularly to its advantage. Not only does the ground floor flat have a large terraced garden but the top flats have balconies, receive substantial natural light and have an uninterrupted view of the city.

The recent renovation of the entire building was carried out simultaneously by several architects: the ground floor by architects Aires Mateus Associados, the first floor by architect Pedro Espírito Santo, the second by architect João Botelho, the third by architect Alberto de Souza Oliveira and the fourth by architect Horta[34].

The renovation of the third floor ☒ flat by architect Alberto de Souza Oliveira addresses the kitchen's new role in domestic sociability in a particularly significant way. In spite of this being a large flat occupying the entire floor with a privileged situation, its original layout followed most of the main layout features of the time. The flat had multiple entrances ☒ from the same staircase landing: one led to a distributing passage, another to the three rooms next to the street façade connected in *enfilade*. The kitchen was originally placed next to the courtyard, as were also two other rooms. In between, two parallel lines of alcoves gave onto the rooms on either side.

This building had the specificity of having the kitchen on the privileged south side. One of the main transformations was to place the living and dining room areas on this side next to the kitchen ☒, thus placing two bedrooms and a more private living area towards the street. In order to constitute this food preparation-eating-living area a nonstructural dividing wall was removed. The inner rooms next to the kitchen serve as pantry and dish washing area. As in the *Rua da Alfândega* example ☞, the other pre-existing alcoves are used as bathrooms and, in this case, also as dressing rooms for the bedrooms.

Moving the living room closer to the kitchen

Rua da Lapa 89, Lisbon – José Adrião Arquitecto ☞ The recent renovation of a one flat per floor building ☒ dating from 1890 in Lisbon's *Lapa* neighbourhood is an example where new larger social areas were placed next to the kitchen, to the south.

The urban development of the *Lapa* neighbourhood, located to the west of Lisbon's historical centre, took place during late 18th century, at around the same time as the rebuilding of the *Baixa Pombalina.* The history of this area's urban development, and of how it conflicted with state regulations forbidding it, was documented by José Sarmento de Matos in the book *Uma casa na Lapa* (Matos 1994). According to the author, while the *Baixa's* regular urban plan was implemented by public initiative, *Lapa's* allotment was of private nature, promoted by the *Trinas* nuns in the land pertaining to their convent. The streets were opened defining quite regular blocks, even though not as regular as the ones in the *Baixa*, as shown in a street plan dating from 1770 (Santana 1976).

The present-day block on *Rua da Lapa* 89 was built in 1890 in a pre-existing quite narrow plot, probably dating from the neighbourhood's formation. The comparison of the 1856-58 survey directed by Filipe Folque (1856-1858) ☒ and the one dating from 1904-1910 by Júlio Vieira da Silva Pinto (1904-1911) ☒, shows that the pre-existing building was replaced by a slightly longer one with the same width. In both maps, the courtyard was divided into narrow garden strips corresponding to plot division.

The original floor plans of all floors[35] ☒ as well as both façades and a section are available at Lisbon city archives. As shown in the longitudinal section, the building comprised three floors and an attic above street level, and an additional lower floor at courtyard level. The entire building was probably intended for housing use, since flat layout was replicated on all floors with very few differences, including the attic. The use of each room was not shown in the drawings. Nevertheless, it can be extrapolated from similar floor plans dating from the second half of the 19th century, included in Joana Cunha Leal PhD thesis annexes (Leal 2005: images referring to pages 824-825, 827-830, 838).

In the original flat layout ☒, the staircase was placed longitudinally next to one of the party walls, leaving space next to the façade for a room with an independent entrance. Originally, this room was probably used as an antechamber or reception room where visitors could be received. If the residents so wished, visitors could then be admitted into the adjoining living room, with which it communicated directly in *enfilade*. As we have seen, the double entrance device ☒, one to a reception room and another to a mediating space, was already common in the late 18th century *Baixa Pombalina* flats. However, a century later, the mediating space was no longer a small passageway but a longer corridor that gave access to all rooms in the house. As before, the kitchen was placed on the more secluded courtyard side. The room next to it could have been used as a dining room. Each main room giving onto the façade – the possible living and dining rooms – were connected to an alcove, which generally served as sleeping chambers. The block was built with an additional inner

room between these two alcoves, differently to the original floor plans. Two more inner rooms were placed between the staircase and the kitchen, instead the single one that is depicted.
In the original floor plans, the wastewater sink was located outside the kitchen, complying with the legislation in place since 1864 (Ministério das obras publicas 1864). However, toilets were not included. Even though they already existed in some upper-class flats dating from mid-19th century, their presence was only mandatory since the application of the 1903 legislation concerning health and hygiene conditions (Ministerio das obras publicas 1903). A floor plan dating from 1949[36] ☒ shows that, in the meantime, the sink compartment had been transformed into a toilet, and that a bathroom had been placed in the small inner room next to the kitchen.
As in the example on *Rua de São Mamede* 15 ☞, the kitchens were originally located on the house's southern side, including balconies. Additionally, the room next to the kitchen was possibly used as a dining room since the time of building. However, the living room was probably located on the street side, which would explain the dining room's small size. The recent renovation ☒ project by architect José Adrião addressed this issue and brought all sociability functions next to the kitchen ☒. This type of intervention eliminated an interior structural wall, and was envisaged due to the poor structural stability of this side of the building. It was possible since all flats were renovated simultaneously and could, as such, be accompanied by a structural analysis of the entire building. The wooden beams in bad condition below the kitchen and below the adjoining inner rooms were replaced by identical ones, while the rest of the timber floor was kept. A metallic beam and two pillars were placed below the wooden joists instead of the eliminated wall.
The flat layout is now composed of a social area to the south ☒, including the dining-living room and the kitchen. The latter can be opened or closed off from the remaining spaces according to the residents' needs. The living room is complemented by the existing alcove, which can function as a library space. The two existing rooms on the other side of the house, to the north, now comprise the bedrooms. The largest bedroom has a privileged access to a new bathroom, placed in the remaining alcove.

Rua do Breiner 143 [previously 75], Oporto A. Portugal & Manuel M. Reis, arquitectos | António Portugal ☞ The renovation of a single-family terraced house ☒ on *Rua do Breiner* is an example where the original kitchen location was kept on the top floor, and was used to constitute the house's social area. The owner's atelier and office were placed on the ground floor and basement.
Just like the *Rua do Rosário*, the *Breiner* street is part of the *Cedofeita* neighbourhood, a planned expansion area to the west of Oporto during the first half of the 19th century (Nonell 2002). The expansion was based on an 1805 plan drawn ☒ up by Luís Inácio de Barros Lima for the *Junta de Obras* Públicas (Lima 1805). It is quite difficult the place the house's exact date of construction without going into further research into possible ownership or rental records[37]. According to the 1813 map by

George Balck ☒, the *Rua do Breiner* was already open at that time, even though no buildings were depicted on that side of the street. A map dating from before 1824 (Paiva 1813-1824) depicts some houses at that approximate location, and the 1839 and 1844 maps (Lima 1839; Vidal 1844) show that the western half of the block was already built. However, due to their imprecision we cannot tell if the house was included in this area. Finally, the house is clearly visible in the detailed cartographical survey by Telles Ferreira ☒ dating from 1892 (Ferreira 1892).
The floor layout ☒ and some of the house's features would point to it dating from the first half of the 19th century, or built according to some principles dating back to that time. The window frames of the street façade were lower and less detailed than those usually present in late 19th century examples; furthermore, there were also sash windows with glazing divided into small partitions. The house comprised four floors, three in relation to the street. On the inside, a central transverse staircase ☒ gave access to rooms on either side, which were often paired with alcoves. As in the previously noted in the *Rua do Rosário* example, the kitchen was located on the top floor giving onto the courtyard façade. The ground floor was, however, elevated by three steps in relation to the street, a feature most commonly present in houses dating from a later time.
This house and the next-door house on number 137 (previously number 73) were probably built at the same time. First, their heights and detailing such as windows, window framing, or balcony balustrades are identical. Secondly, the 1936 floor plans ☞ demanding the connection to the municipal sewage system[38] were submitted simultaneously and show that their owner was the same at that time. Nevertheless, our case study is wider than the house next-door, respectively with three windows instead of two per floor onto each façade. We could suggest the possibility of the houses having been built by the same owner, the smaller one to rent and the larger one for him to live in, as was sometimes the case in Oporto's contiguous houses.
The renovation project by architect António Portugal for a family of four placed the owner's workshop on the basement floor, at the same level as the courtyard. The ground floor serves as an antechamber to the house, where the owner's offices and meeting rooms are located. The family's quarters occupy the first and second floors. One of the main specificities of the renovation is that the kitchen was kept on the top second floor. Its original features, such as the large chimney ☒, the stone water reservoir[39] and the stone sink still existed at the time of renovation. They were preserved and became defining features of the kitchen ☒, complemented by a new worktop. All the social areas ☒ were placed on this floor, next to the pre-existing kitchen. The family's main living space became the intercommunicating set of kitchen and dining-living room with a continuous balcony giving onto the garden. A smaller living room was located on the opposite side, next to the street façade, coupled with a visitor's bedroom and bathroom. The family's bedrooms were placed on the first floor. As we have seen in other examples, the alcoves were used to house additional functions connected to the bedrooms, such as bathrooms ☒ and closets.

Bringing the kitchen closer to the living-room

Rue de la Servette 36, Geneva MVT Architectes and Théodore Necker Architecte ☞ The block of two flats per floor ⊠ on number 36 was part of a two-building operation included in the 1910 extension plan of the *Servette* neighbourhood. The initial renovation project ⊠ by MVT Architectes followed a different strategy to the previous examples. The kitchen's role in domestic sociability would be addressed by placing it in the original social spaces, while the quieter rooms next to the courtyard ⊠ would be exclusively occupied with bedrooms.

The history of this building is well documented in the report by Pierre Monnoyeur (2003) for the Geneva municipality, who now owns the building and rents the flats as part of its social housing program. While Geneva's previous fortification perimeter was being rebuilt during mid 19th century, the *Rue de la Servette* was an exit route out of the city next to the new Cornavin train station[40] where housing developments made up of spread-out villas and small buildings started being carried out. The arrival of the tramway to this area in 1894 accelerated the building pace and its importance: "From that moment on, without inconvenient and without much expense, the *bourgeoisie* could reasonably invest in the close periphery of Geneva"[41] (Monnoyeur 2003: 4). In 1910, architects J.-A. Maurette & A. Henchoz requested permission[42] ⊠ to build two blocks of flats with six floors above street level, including an elevated ground-floor. Both buildings also had a basement with storage compartments and a small caretaker's flat. Since the building on number 34 was demolished after a fire in 1979 (Monnoyeur 2003: 13), our case study now stands half-isolated from its adjoining buildings, which are set back from the street.

The façade details are described by Monnoyeur as heading towards *Art Déco* simplifications of the time. However, if we exclusively consider the floor plan, this building still exhibits many of the traits we identified in the late 19th century *Ceinture Fazyste* blocks of flats. There is a central staircase giving access to two identical flats. Inside the flats, a hall – corridor distributed all rooms. The intercommunicating living – dining room gave onto the main, more decorated, street façade. Each was paired with its own alcove, which had wide openings onto their adjoining rooms, as specified by the 1899 regulations (Conseil d'État 1899). The kitchen, the bedroom and the maid's bedroom with a small window were placed on the more hidden courtyard side. The main difference in relation to flats of this size dating from the previous decades was the presence of a bathroom next to the toilet, both located in the centre of the flats next to an airshaft. The bathroom was not only connected to the corridor but also to the bedroom, a device that up until then we only observed in the up-class single-family houses in the *Trachées* neighbourhood[43].

The project for the future renovation ⊠ of the *Rue de la Servette* 36 by MVT Architectes plans to improve the building's energy performance, to update the technical installations of kitchens and bathrooms, and to increase the number of flats by placing two in the existing attic. According to the architects, one of the most important initially planned changes was to move the kitchen ⊠ to the existing dining room space giving onto the street. The existing kitchen would have been transformed into a bedroom:

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At first sight, it might seem obvious that keeping the present-day disposition of rooms has the advantage of being the most economical solution. However, after careful consideration, another option, consisting in transforming the present dining rooms into the kitchen – eating room, and the present kitchens into bedrooms, can add to the flats' quality of life. This new layout allows for two individual rooms to be placed on the garden side (calm area) and for the collective ones to be located on the street side (area of intense noise). [...] The two options can be envisaged without the existing partitions having to be eliminated or modified, because the apartments' features enable both layouts. These features are, namely, the generous room dimensions, particularly those on the street side, and the distribution hall – the presence of the alcoves allows for more flexibility in usages. These small spaces can be used for activities that do not require a lot of space (extra bed, office space) or for storage. (MVT ARCHITECTES SA & NECKER ARCHITECTES 2009: 11)[44]

The option of moving the kitchen to the dining room was designed at an initial stage in project development but was finally not chosen by the client due to budgetary issues. Consequently, it is not possible to evaluate the impact that the change in kitchen location could have had on the dining room's original characteristic elements. It would have been up to both the architects and to the engineers in charge of the project to come up with solutions where infrastructure and heritage protection could work together. The renovation – which is planned to take place during the next few years – will keep the kitchen in the existing location, and place a bedroom in the existing dining room. Nevertheless, on the reconverted attic floor the architects were able to take advantage of a different location of the kitchens in the project for two new flats. Their layout is very similar to the lower floors, including most of dividing walls, the entrance hall, as well as placing the bathroom and the toilet in the centre. The main difference in relation to the original lower floor plans is the placing of all the bedrooms on the calmer courtyard side (two bigger bedrooms and a smaller one) and of all social areas, including the kitchen, on the street side. In this social area, there would also be no alcoves. The hallway would communicate directly with the kitchen–dining room, that would then give onto a smaller living area, which could double as visitors' room if necessary.

Rua António Granjo 108, Oporto architects António Portugal and Anne Wermeille

☞ This single-family terraced house ⊠ was built in 1918 on *Rua António Granjo*, a street located in the limit of the *Bonfim* neighbourhood. Its renovation by architects António Portugal and Anne Wermeille joined all social functions on one floor by moving the kitchen from a less visible service floor to a room near the living room.

The *Bonfim* is an area to the west of Oporto's historical centre that is part of the city's 19th and early 20th century expansion. In 1892, date of the map by Telles Ferreira (FERREIRA 1892), *Rua António Granjo* and the next-door *Avenida Camilo* had yet to be opened, even though building had just started in several new streets around them. The original project ⊠ shows that the building was one of two identical houses built right after the opening of the "new private street" in 1916[45], which would later become *Rua António Granjo*. The building demand dating from 1918[46] is signed by the owner of the factory *Acabamentos da Vitória Lda*, requesting that the houses be built on

its the grounds. Adding to this point is the fact that the house had a direct staircase and door from the garden to the factory grounds. This connection is included in the original building project. It is still visible today but has been closed off.

Even though this is the case study that was possibly built the latest, its features show the continuation of a building expertise as well as a way of life from the previous decades in Oporto. The floor plans are deep and narrow, with approximately 6,30 m by 18,50 m. Additionally, there is a garden towards the back ☒. Nevertheless, there is a particular feature that attests to the building time: the existence of two direct passages to the garden between the houses, one for each of them, that allowed for all rooms (except for the basement storage) to have a window onto the outside. The original 1918 plans depict a house with two floors: a basement at garden level and a ground floor that was elevated by a half-floor in relation to the street. The entrance hall distributed two straight-run stairs. A larger one led to the ground floor where the living room faced the street, and the bedrooms gave onto the side and courtyard façades. A small door to the right of the entrance led to the narrow staircase giving access to the basement. As was often the case in Oporto houses from late 19th and early 20th century, the kitchen was located on this lower floor, next to the courtyard façade, with the storage rooms behind. In this case, the dining room was placed next to the kitchen, which was not very common at the time[47].

In 1933, the same owner requested the addition of one floor ☒ to the house[48]. In this project, the new staircase took up a transversal position in one of the inner rooms, typical of Oporto's 19th century houses. On this new floor, there was also a clear sign attesting to its building time, a bathroom, which was placed next to the toilet against the courtyard façade. The windows of rooms giving onto the passage between the two houses were no longer depicted, possibly indicating that another house had already been built in this space. It was certainly the case a few years later, as shown in a 1937 map of Oporto (Serviços Técnicos da Câmara Municipal do Porto 1937). This ironically produced one inner room on each of the top floors ☒, just like the ones in typical 19th century houses.

Architects António Portugal and Anne Wermeille renovated the house to use as their office and home. The new functional repartition of domestic functions followed the reasoning of the 19th century domestic house, paired with the introduction of some new dynamics in family life. Like the late 19th century houses, the functional distribution was done by floor, according to a vertical progression from public to private: the office on the basement floor, the social areas ☒ on the elevated ground floor and, finally, the bedrooms ☒ on the top floor. According to this logic, the main change was to move the kitchen ☒ from the lower level to the same floor as the living room, which remained in the same location. Nowadays, the kitchen is completely included in the house's social area. The kitchen and dining room became one space, placed next to the courtyard façade by the elimination of one nonbearing wall. Instead, a glass wall that does not go up to the ceiling partially separates the kitchen worktop from the eating area. This space then gives onto the balcony. An additional project, which was planned but not accomplished while the architects lived in the house, was to directly connect the kitchen-dining room to the garden. The plan was to use the previous toilet space as a passageway with a door towards a new metallic flight

of stairs. As we have seen, a similar proposal was carried out in the project by Paula Ribas and Luís Mendonça for the house on *Rua do Rosário,* by adding a large balcony on the first floor ⊠, which is connected to the garden.

Original and changing division of housing units

Lisbon's late 18th century and 19th century blocks of flats usually had one or two flats per floor ☒ (Mascarenhas 1996; Leal 2005; Barreiros 2010). According to Maria Helena Barreiros (2012: 149), in the *Baixa Pombalina* ☒ area it was sometimes possible for there to be fewer larger flats on the lower, nobler floors, that were divided into more flats above. This was also the case in some of Geneva's *Ceinture Fazyste* ☒ blocks of flats, where main floors generally had one, two or three flats ☞. A vertical hierarchy could be established between the ground floor, which could dispose of a terrace and a private basement floor ☒, and the upper floors. In other cases, there was a clear distinction ☒ between the general floor plan with, for instance, two flats, and the top floor plan, with four. The fact that this division could be done just by closing a few openings or partitions using the same structure and a very similar layout attests to the buildings' flexibility.

The importance of separating service areas from the reception spaces in late 18th and 19th century housing often resulted in the presence of multiple entrances, especially in larger flats ☒, which presumably housed wealthier residents with a more numerous staff. Consequently, a large number of flats in Lisbon and Geneva had two entrances (occasionally three), one closer to the service rooms, and another one usually giving access to the social area of the house. One of the strategies used to divide upper floor flats was to take advantage of the multiple entrances to constitute different flat entrances. As we can notice in archive plans depicting changes throughout the 20th century, this method was also often used later to divide larger flats in both cities.

The Oporto single-family houses also had layouts that proved to be quite flexible throughout time, allowing for a multifamily occupation whenever space or means became scarce. According to Francisco Barata Fernandes (1999: 228-229), both the earlier houses as well as the late 18th and 19th century house types often went through a process of adaptation to accommodate different uses. The most common was to divide houses into small flats per floor, in which case the houses staircase would become public or semi-public spaces (if, for instance, a flat had rooms across the same floor in a house with a central staircase).

Nowadays, whether it is to maximise a renovation investment or to provide a more varied offer in terms of flat size and sale or rental price, some of the projects examined divide existing larger flats, sometimes from an original one to two flats per floor, or from two to three flats per floor. In recent renovation projects, we identified

three types of strategies that employ existing distribution features to establish the new housing unit divisions: using previous multiple entrances to the flats from the staircase landing as new flat entrances; transforming the existing interior corridors or passages into flat distribution spaces; using the central single-family house staircase to distribute multiple flats. These strategies try to minimise the impact of flat division on the staircase landing by keeping the original accesses and entrance doors intact while using them in a different way.

When the single-family home staircase becomes public

Rua de São Miguel 41-43, Oporto architects João Pereira Moura and Paulo Rui da Eira Frutuoso ☞ The recent renovation by architects João Moura and Paulo Frutuoso had the objective of dividing the house into several small flats or studios. The house has features typical of a late 18th century single-family house ☒, even though it is most likely located in a pre-existing very narrow plot dating from the street's foundation. The *Rua de São Miguel* is part of the previous *Rua da Judiaria Nova do Olival*, a late 14th century street opened during the urbanisation of Oporto's *Olival* hill. The new city area was planned and subdivided into plots for the foundation of a Jewish quarter inside the city walls, as ordered by king D. João I (Afonso 2012: 50). Nowadays, it is included in Oporto's historical centre.

The house is around 22 m deep and 4,5 m wide, only allowing for two windows per floor on either side. It has four floors above street level, and another floor below, at the same level as the back garden. As most Oporto houses of the time, the central staircase distributed ☒ a room giving onto the street and another giving onto the courtyard side. Each main room was probably combined with an alcove next to the staircase, as is the case of the second floor, which still had most of its original features. These inner rooms were lit through sash windows ☒ giving onto the main rooms. The original kitchen was probably located on the top third floor, in the room giving onto the courtyard, as shown by the presence of a large kitchen chimney before renovation. The 1936 plans[49] to introduce water distribution and sewage drainpipes show that a bathroom was placed on this floor in the inner room next to the staircase.

In the renovation, the architects chose to optimise the division strategy that was informally used throughout the 20th century so that more than one family could occupy the house: "Its multiple compartments had been rented out without having ever been adapted for that purpose. They did not have a kitchen, and the bathrooms (that existed only in the courtyard side flats) were only equipped with a toilet and a lavatory. The tenants carried out several adaptations throughout the years, adding rooms and improvising kitchens"[50] (Moura 2010: 2). The renovation turned the existing single-family house staircase ☒ distributing several rooms into a staircase distributing one small flat on either side ☒. As such, most of the original elements could be kept. The alcoves ☒ were used to place the necessary rooms with water distribution – bathrooms and kitchens – as well as their infrastructure.

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One studio was placed on the lower garden level, and another on the ground floor. There are then two studios per floor on the first and second floors, one on either side of the staircase. Whenever possible, the bathroom was placed inside the existing inner rooms, while the kitchen counter was located on the opposite side, against the wall giving onto the living-sleeping area. The top floor now houses one larger flat by making use of the staircase space as a distributing area for the flat. One bedroom was located on the street side, and the living room (with the existing balcony), was placed on the southern courtyard side ⊠. There is an additional room in the existing small attic.

Duplex staircases in new alcove spaces

Rua do Pinheiro 71-75, Oporto – architect Bernardo Amaral ☞ The renovation project by architect and resident Bernardo Amaral transformed a single-family house on Oporto's *Rua do Pinheiro* ⊠ into a multifamily house with duplex flats. The aim was to keep the house's most characteristic elements intact by placing the new distribution and infrastructure in the existing alcoves.

The house was built during the city expansion promoted by the *Junta de Obras Públicas* when it was run by João de Almada e Melo at the end of the 18th century: "This small and narrow road was opened after the division of the Pinheiro farmhouse, a property that is mentioned in writing since 1503 and that gave its name to the street"[51] (Amaral 2012: 1). George Balck's 1813 map ⊠ clearly shows that there were already buildings on both sides of the street in early 19th century (Balck 1813)[52].

As we have seen in the case studies on *Rua do Rosário* or *Rua do Breiner*, the house layout follows the general features Francisco Barata Fernandes identified as the *illuminist* type (Fernandes 1999: 128-146). Its original plan – which we can observe in the sewage connection plans ☞ dating from 1936 and in the recent metric survey ⊠ – shows a typically deep narrow house of 6 by 21 meters with four floors above street level and three windows per floor on either side. Since the house is deeper than the one next-door, there is a window in a courtyard side room that would not usually have one. Additionally, the house has a small attic and long back garden. As in many Oporto houses dating from this time, the ground floor is at street level and not elevated, so that rooms facing the street could have a commercial function and a separate entrance from the house ⊠. The original kitchen was located on the top third floor on the courtyard side, and the small toilets were placed on each floor against the courtyard façade ⊠. The transverse staircase is located in the centre of the house next to one of the party walls, and gives access to rooms towards the street or courtyard façades, coupled with one or two inner rooms.

The objective of architect Bernardo Amaral's renovation project was to divide the building in several housing units ⊠ of different sizes, some for the owners' housing and others to rent, while preserving the main defining elements as much as possible, such as the structure, the central staircase and the features of the front rooms on both sides. Since the aim was to have two to three-bedroom flats, the division could not use the existing rooms on either side to create small studios, as

the intervention on *Rua de São Miguel* ☞. The architect also preferred not to use the existing passageways behind the staircase, since they were very narrow and only 1,50-1,75 m high. Consequently, the division strategy was to transform the inner rooms next to the staircase, where connecting staircases ☒ were placed to constitute two duplexes on the garden side, and a duplex and a studio on the street side. The interior spaces also included the kitchen infrastructure and, most often, also the bathrooms. The kitchen areas were designed with floor to ceiling folding doors so that they could be opened or closed off from the dining and/or living spaces. As described by Bernardo Amaral, the social areas and the sleeping areas in the duplexes were placed on separate floors: the bedrooms and bathrooms on one floor; the kitchen, dining and living room on the other:

> The choice was to duplicate the interior vertical distribution and create two duplex flats [on the first and second floors], placing the stairs in the place of the original antechambers and so that they could pass between the original round wooden beams. This solution allows for different spaces and it is possible to have a 120 m square two-bedroom flat and an 80 m square one bedroom flat, all with natural lighting, taking advantage of the windows giving onto the staircase. On the northern side, a small 35 m square studio is introduced on the top floor and on the southern side is the flat with the mansard, also a duplex. It is the one that was most changed because it was almost in ruins. [...] The bathrooms and kitchens were also newly designed. We chose to place the rooms with water distribution near the staircase, in small closets with the approximate dimension of the antechambers. With this solution, it was possible to place the drainpipes in a technical wall behind the staircase landing. The column of toilets paired with balconies on the southern side is also kept. [...] All floors were acoustically insulated with rock wool and with an acoustic floor underlayment. Four new kitchens and eight new bathrooms (four service ones and four new ones) were installed. There is also a new electric and hydraulic distribution, as well as a connection to the [municipal] sewage in the street. (Amaral 2012: 1)[53]

Multiple flat entrances and corridors as new flat entrances

Rua dos Fanqueiros 73-85, Lisbon – José Adrião Arquitecto ☞ The renovation of a block of flats ☒ by architect José Adrião is an example attesting to the use multiple entrances and corridors as new distributing spaces. The building is located in the heart of Lisbon's *Baixa* ☒, on the corner of *Rua dos Fanqueiros* and *Rua da Conceição*. It is included in one of the repeated rectangular blocks that form the urban units of this area. According to a historical study conducted by José Sarmento de Matos and Jorge Ferreira Paulo (2009) for next-door building on the corner of *Rua dos Douradores*, our case study is located on a plot bought in 1781 by the owner who, in 1784, completed the present building[54]. His own house would have been located on the first and second floors.

Throughout the 20th century, the flats were quite transformed. Nevertheless, most of the original structure was still present and a large part of the layout was identifiable: one line of bigger interconnecting rooms parallel to the street façades, the kitchens towards the courtyard façade, and a few alcoves and passageways in between. According to the earliest archive plans[55] ☒ for transformation purposes, the first

floor originally housed one flat with three entrances, while the upper floors were divided in two just by closing a passage between rooms. One of these upper floor flats had one entrance; the other had two from the same landing, one closer to the kitchen, and the other closer to social areas near the street.
The intervention ☒ divided the floors into three separate flats. One of the flats uses one of the original entrances ☒; the other original entrance gives access to a previously existing passageway or small corridor. This space distributes ☒ the two remaining flats. The entrance hall to the new lift makes use of the third original entrance from the staircase landing. Even though they are smaller, the new flats also address the issues we looked at in the previous examples. Some of the bathrooms were placed in previous inner rooms. The kitchens ☒ were brought next to the street façade so that they are directly connected to the living rooms. Moreover, they attest to the surpassing of a prerogative at the time of building, that is, that access to the kitchen be possible without being visible from the reception areas. On the contrary, in these flats the kitchens are only accessible through the living rooms.

Original and changing top floors

The top floors of late 18th or 19th century buildings were originally the ones with the most difficult access, and also less visible from the street or any passers-by. Moreover, they had lower ceilings and were much more exposed to the elements. They did not benefit from the thermal protection of the floors above, and the walls were usually thinner. Rooms in direct contact with the roof were the most exposed, since the latter was not insulated ☒. The tiles were usually placed ☒ directly over a layer of wooden banners, which then rested on the rafters that, in turn, rested on the roof trusses. On the inside, there could also have been a layer of battens and plaster placed against the rafters. At the time, these characteristics were more important than others that might be valued today, such as better views or the distance from the increasingly bustling street.
Depending on the roof shape and windows, the buildings' highest usable floor could be the space below a pitched roof ☒, or the upper area of a mansard roof. This area might have been high enough to house a space that could be accessed and used ☒, even if just for storage. In this section, we will refer to the floors placed directly under the roof structure that were not originally used for housing.

Attics in Lisbon's blocks of flats. According to Jorge Mascarenhas, Lisbon's *Baixa Pombalina* blocks of flats had mansard roofs when the buildings were located on main streets, and mostly presented hipped roofs ☒ on other streets (Mascarenhas 1996: 86). Both the mansard floors, and the floors underneath pitched roofs, were probably used as housing floors, as attests the presence of original chimneys. These flats necessarily had worse living conditions than the ones below: "On the upper levels the ceilings become lower, with finishings of poor quality, taking on a rustic style especially in the attics" (Mascarenhas 1996: 100).
Since many buildings had pitched roofs, top floor renovation ☒ in Lisbon often addresses spaces that were already originally used for housing. Storage was probably comprised in the houses central rooms without direct light, since it was not usual for attic spaces to be used for common storage. Nevertheless, mansard roofs have an additional smaller upper area that, depending on its floor height, could originally provide some insulation for the floor below or be used for that flat's storage (since there was no access though the main staircase). This was the case of the previously depicted renovation by Atelier do Bugio architects, located on the top floor of a late 18th century block of flats on *Rua da Alfândega* ☞.

In this case, the attic space above the mansard floor was originally accessible through narrow stairs and used for this flat's storage. Since the renovation, this space is used as a sleeping area, where new windows were added for sufficient lighting.

Attics in Geneva's blocks of flats. Geneva's 19th century *Ceinture Fazyste* blocks of flats had either pitched or mansard roofs ☒. There are very few available plans depicting the original use of these top floors. According to our analysis of existing plans in the chapter "A typology of housing – Geneva" ☞, the mansard floors were usually used for housing, either replicating the layout of lower floors or with smaller flats. Whenever the roof was pitched ☒, or when the space above this mansard floor was high enough, there was also an attic area. Available plans show that this area could have been originally used to place small storage rooms for the flats, clothes drying areas and small staff bedrooms ☒. Occasionally, main mansard floors could have also served the same purpose as the attics.

Nowadays, the canton of Geneva has one of the lowest rates of available housing in Switzerland[56]. Since many of the city's 19th century buildings had attics and basements used for storage, an intervention that is very often carried out is the adaptation of the attics to introduce new flats or to increase the housing space of top floor flats. Most of the examples of examined renovations proposing new flats or flat extensions in attics are of blocks of flats in Geneva. Technically, this type of intervention can profit from the existing drainpipes and network distribution. However, it does usually require reinforcing thermal insulation ☞, which is often inexistent, as well as acoustic insulation ☞from the floors below. The use of these flats is also legally limited in floor height.

Attics in Geneva and Oporto's single-family houses. Single-family houses during our time of study often established a functional separation between the street and courtyard façades, and between floors. As we have seen, in Oporto's late 18th century and early 19th century single-family houses, service spaces were usually located away from the public eye, on the courtyard side of the top liveable floor ☞. Above, there was usually an attic formed by the roof pitch. Even when the attic space was very low, it could have been accessible for maintenance or storage through a narrow secondary staircase[57]. Nowadays, some of these attics have one additional room that sticks out from the roof ☒ shape like a dormer window[58]. This space could be original but could have also been added throughout the 20th century.

Single-family housing examples in Geneva ☞ and in Oporto dating from the second half of the 19th century have similar features regarding the use of top floors. The kitchen was placed either on the basement floor or on the ground floor. In both cities, the top floor often housed storage spaces, small servants' bedrooms or supplementary bedrooms. There are examples in which the top floor was accessed through the main staircase, but others where a secondary staircase also existed, reinforcing its separation from lower floors. This description is put quite precisely by Nelson Mota:

Mansard or attic floors are, in many cases, occupied by the servants' sleeping area but can also house other service compartments and, if spatial organisation allows for it, also bedrooms for the family. [...] Therefore, depending on the place where the main connection between the interior and exterior is located, the layout division determines the location of service areas to the most secluded spaces, the basement or the attic. In the private areas, the distance from the public space is privileged, while the common areas are located in the rooms that most communicate with the outside. (Mota 2010: 136-138)[59]

Introducing new flats in existing attics

Rue Rousseau 7, Geneva – Atelier MARCH ☞ The building on *Rue Rousseau 7* ⊠ is the oldest of the ten case studies examined in Geneva. Its history is documented in an article by Anastezja Winiger-Labuda in the *Monuments d'art et d'histoire* volume concerning the *Saint-Gervais* area. According to the author, the house was built in 1786 on a pre-existing plot:

Four housing floors were built over the ground-floor, where the storage rooms were located. [...] At the time, the floors were divided in two flats, with the exception of the second where [the owner] Duchêne lived. [...] We do not know when the two half-timbered floors were built, destined for watchmakers' workshops, as well as a small wooden atelier above the staircase. In 1821, a document signals the presence of the workshops in the attic without indicating if they had one or two floors. The first one was turned into housing in 1874. (Winiger-Labuda 2001: 342)[60]

The author goes on to describe access to the flats and their layout:

The back façade, against which the staircase tour is placed, originally had wooden galleries that were ill-advisedly replaced by concrete ones. [...] The interior layout is very simple: two flats per floor with a kitchen [and an inner room] on the courtyard side and a room with an alcove on the street side. This situation is almost surely the original one, with the exception of the second floor where there was only one flat. We can notice that this layout reproduces the medieval housing typology, characteristic of the long plots. (Winiger-Labuda 2001: 342)[61]

The layout of this house is significantly different from other ones examined dating from mid 19th century to early 20th century in Geneva, and this aspect could have led us to discard this intervention. We decided not to do so due to the similar typological issues that are addressed: the re-use of inner rooms and the conversion of attic floors into housing flats. Furthermore, the renovation deals with additional technical issues, such as the complete replacement of the infrastructure and interior insulation, which were examined in the following chapter.
The renovation by Atelier MARCH ⊠ took place in 2012. At the time, the building was already under municipal ownership and used for subsidized housing. As described by Winiger-Labuda, four floors originally housed two long narrow flats per floor with the same layout ⊠: the kitchen on the courtyard side, an inner room next to it, and a main room with an alcove on the street side. Probably sometime during the 20th century, a bathroom was placed in the inner room next to the kitchen. The fifth and sixth floors – originally housing workshops – had already been successively

transformed since their addition to the building during the 19th century. The fifth floor had one flat giving onto the street and a studio-atelier giving onto the courtyard. Another studio was placed on the sixth floor, as well as the laundry room and some storage spaces.
The recent renovation of the residential floors up to the fourth did not change their layout. On the contrary, the fifth and sixth floors ⊠ were partially reconstructed. On these two top floors, the existing interior walls – many times transformed – were demolished; the existing roof and floor structure were kept and reinforced whenever necessary. In spite of the substantial intervention, the conversion of the top floors interests our study, since the new top floor layout is rethought by making use of the lower floor layout. These two floors were changed to introduce two bigger duplex flats ⊠ that can house larger families, thus addressing the present-day needs of the residents.
The wall between the two new flats overlaps the existing wall dividing the floors below. The plan then has a significantly similar layout that allows the infrastructure (ventilation ducts, sewage drainpipes, water distribution etc.) to follow the same vertical alignment. As on the lower floors, the entrance to the flats takes place via the kitchen, located on the fifth floor; the bathroom is also placed in the inner room next to it. The fundamental layout difference is that the alcove on lower floors was used to place the duplexes' interior staircases ⊠. On the sixth floor, the partitions were also replicated, this time with a bedroom on the courtyard side and a living room on the street side.

Increasing top floor flats into the attic

Rue de l'Athénée 4, Geneva – AFM Architectes ☞ The renovation of the top fourth floor and attic of this 1862 building ⊠ is an example of flat increase into a pre-existing attic, and of flat division by using an existing corridor. This block of two flats per floor was built in Geneva's up-market *Bastions* ⊠ neighbourhood, part of the *Ceinture Fazyste* ⊠ area. The building's history was documented by Bénédict Frommel (ca 2002) in a brochure written for the present-day owners. According to the author, plot owner William Turrettini[62] and his daughter Sophie ordered the project ⊠ from architect Louis Brocher. The building was to house a religious school and chapel, as well as flats for the teaching staff and to rent.
The outside façades ⊠ show the original vertical differentiation of floors. The school occupied the elevated ground floor. Its chapel, with a double-height ceiling, occupied half of the first and second basement floor plans. Above the ground floor, there were four housing floors with two flats each, distributed by a central staircase placed against the back wall. The second floor ⊠ was the *bel étage*, including a balcony and higher ceilings. The first and the fourth mansard floor ⊠ had lower ceilings and, according to Frommel, were destined to house the teaching staff. Additionally, there were storage spaces in the three basement levels and in the attic.
Some of the original plan drawings still exist in a private fund[63] in Geneva's *Archives d'État*, including building façades, sections and plans of the basements, ground floor,

second floor, fourth floor and attic. Through the architects in charge of the recent renovation project, we were also able to collect a floor plan of the first floor dating from 1927. The first and the second floors had similar floor plans, while the fourth – which is now being transformed – shows some differences.

The flats have some of the typical layout features of Geneva's 19th century housing. In the original second floor plan ⊠, we can see that the living room and the dining room had the most privileged position in the corners of the building. A corridor distributed all rooms, but several also had a direct connection between them. The main *enfilade* was between the dining room and the living room. The latter was then connected to another room with a chimney, possibly serving as a small living room or a bedroom. The kitchen and its adjoining toilet and pantry were located near the entrance to each flat, distanced from the social spaces. On the fourth floor ⊠, the main layout difference was the position of the dining and living room. Instead of these spaces, the corners of the building were probably occupied with bedrooms, three in one flat, two and an alcove in the other one. The dining room with its stove was placed next to the kitchen, even though there was not a direct connection between these two rooms. The living room was most likely located in the room with a chimney just across the corridor from the dining room, as shown by the aligned doorways.

The fourth floor flat has undergone some changes since the time of building. In both flats, a third window has been added to the corner façade, which previously only had two. Parts of the original corridor and alcoves have also been eliminated to form a larger entrance hall. On the left-hand side flat, the previous small toilet next to the kitchen was increased to place a bathroom, and a direct opening was introduced between the kitchen and the dining room, attesting to a greater participation of the kitchen in social life. For privacy reasons, the *enfilade* connections between the bedrooms and the living room were provisionally closed off.

The recent project ⊠ by AFM Architectes connects and partially redistributes the mansard floor and the attic. The aim was to have three duplex flats instead of the two existing one-level flats. The left-hand side flat was divided in two and connected to the attic to create two smaller duplexes, while the right-hand side flat was only extended into the attic, thus constituting a much larger flat.

The division of the flats on the right-hand side makes use of one of the main original features, the corridor ⊠. This space, which had been partially eliminated, is now the common entrance that distributes both flats. Its final section was then used to house two bathrooms, one for each flat. The wastewater piping for the new bathrooms had to be connected to the existing wastewater vertical pipes, located on the inside of the street façade, where the original toilets had been located. So as not to touch the flat below, part of the entrance corridor was elevated by two steps. After passing the corridor floor, the pipes go through the false wall behind the duplex stairs.

In these smaller flats, the entrance leads directly into the kitchen-dining room ⊠. The *enfilade* was then reintroduced from this room as a way to access the more private spaces – the bedrooms – in one flat, and a bedroom and the living room in the other. The left-hand side flat was extended into the attic ⊠ to increase the

living space of a flat destined for a family of five. The aim was to place the children's playroom and bedrooms upstairs ⊠, leaving the parents' bedroom and the social areas on the lower floor. The living room now occupies the corner room, as was also the case in the flats located on the lower floors.
In all the renovated flats, the stair ⊠ to the upper floors were placed in the mediating or collective spaces. In the largest flat, the owners chose to keep the larger hall without reintroducing the corridor. This corridor is visible further along through the alignment of the new stairs, placed next to the dining room. In the smaller flats, the stairs were located in the opposite direction: in one case, they are placed in the kitchen-dining room; in the other, in the living room.
According to Geneva's *Loi sur les constructions et les installations diverses,* housing rooms should have a minimum of 6 m square (Grand conseil 2013: Art. 52). Additionally, if the ceiling follows roof inclination, the room area counts as half if the ceiling height is between 1,80 m and 2,60 m (Grand conseil 2013: Art. 49). In this case, the attic was just within the legal limits for room ceiling height. However, the window area and height that were authorised by the *Service des monuments et des sites* did not fulfil the lighting conditions required by this legislation[64]. The small windows (*lucarnes*) were replaced by a small model of velux windows, and new long skylights (*verrières*) ⊠ were placed on the upper horizontal part of the roof. Even so, the rooms on this floor were not considered liveable, meaning that they cannot be considered for housing purposes, should the flats be rented or sold. This issue had implications on the bathrooms that were planned on this floor, which were not authorised in the building permission. The owners still hope that they might be placed at a later stage.

Transforming the attic's connection to lower floors

Rua do Doutor Alves da Veiga 213, Oporto – Edite Rosa & Joaquim Almeida Arquitectos ☞ This typical 19th century single-family house ⊠ in Oporto was renovated by a couple of architects for their home and office. The intervention looked into the necessary changes to the infrastructure, of which the focus was the introduction of a new alcove-like block including a new staircase to the attic and bathrooms for the upstairs rooms.
The present-day *Rua do Doutor Alves da Veiga* is based on regularization of a winding lane that existed at the beginning of the 19th century. This lane was named *Caminho para malmerendas* in an 1807 project for the intersection of nearby streets by Luis Ignacio de Barros Lima (Lima 1807). At Oporto's municipal archives, there are several projects for the alignment and extension of streets in this area dating from the 1840s and 1850s[65]. The most definitive plan ⊠ depicting the *Malmerendas* street's final design dates from 1858 and is entitled "Plan for the continuation of the *Rua de Malmerendas* to the *Rua Formoza,* and the *Rua Firmeza*"[66] (Brito 1858). Our case study could have been built around this time or at a slightly earlier date, since it is located in the section of the street that roughly maintains the existing alignment.

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The house's original layout ☞ has several of the features common to most 19th century houses in Oporto, as depicted in the metric survey floor plan done before renovation. It has a narrow three-window street façade and is approximately 16-meter-deep with a back patio. There are three floors above street level and a basement at the same level as the patio. Originally, the basement was probably used for storage, since it was only accessible via a passage and narrow stairs placed behind the main staircase. As in most of Oporto's 19th century houses, the main staircase was placed transversally at the centre of the house, serving rooms that give onto either side. The courtyard-side room on the first floor, and the street-side room on the second, are both complemented by an inner room placed next to the staircase. At the time of renovation, the attic comprised a room on the courtyard side with a ceiling height higher than the rest of this floor. This top area could have been original or added sometime after construction. It had already been built in 1936[67], when the owner requested the connection of the house to the public sewage system. It was not accessible via the main staircase, but by quite steep straight-run stairs placed by the entrance of the courtyard side room on the top floor.

The renovation carried out by architects Edite Rosa and Joaquim Almeida for their office and home established a progression from public to private from the lowest to the highest floor. Their office was placed on the ground floor, at street level. The kitchen could have originally been located on this floor, as depicted in the 1936 floor plans, which would explain the differentiated passageways between the front and back rooms. In the renovation, the kitchen ☒ was moved to the first-floor room on the courtyard side, while the living room ☒ remained on the street side. This change defined the floor destined for social functions. The bedrooms were placed above, on the second floor, one next to each façade.

The main changes were operated on the courtyard side room on the second floor. The objective was to combine the introduction of two overlapping bathrooms, one serving the downstairs bedrooms and another on the top floor, with a new, more comfortable staircase leading to the room in the attic. This room could then serve as an office or be used as an extra bedroom. The new staircase ☒ and bathrooms were designed as an alcove-like block almost symmetrical to the one on the opposite side of the main staircase, allowing for the upkeep of the original doors on the second floor. A small social bathroom was introduced in the existing inner room on the first floor, and a closet serving the street-side bedroom ☒ was placed in the one on the second floor.

Original and changing access to the floors

Up until the generalization of the lift in early 20th century, the access to all floors in a majority of buildings was done only through staircases. This was usually the case even in late 19th century blocks of flats with five or six floors. None of our case studies originally had a lift and, in our systematic analysis of building floor plans in Geneva's *Ceinture Fazyste*, the first building to originally have a lift[68] ☒ was designed in 1906. During the 19th century, top floor flats were less valued due to access difficulty, paired with a greater exposure to the elements and lower ceiling heights. In Lisbon and in Geneva[69], this distinction sometimes implied a greater number of flats per floor on the highest floors, and less on the *bel étage* or on all lower floors. During the 20th century, the increasing introduction of the lift changed the vertical hierarchy of floors, leading to a valorisation of the top floor, which had better lighting:

> Cleaner air "at high altitude", light and sunshine are acclaimed in studies on hygiene. The hydraulic lift, presented at the Universal Exhibition in 1867, is greatly developed since 1870. The first lifts with compressed air are built around 1890, and the electrical lift, perfected in 1895, is generalized in 1905 [...]. Living on a higher floor is no longer socially frowned upon, and architect Léon Chesnay designs a block of flats in 1907 in which he occupies the last two floors. (Eleb 1995: 404-405)[70]

In renovation projects, the original staircase features were fundamental to the future location of a lift. This is especially true when there are several flats per floor, since the staircase is quite often the only common space on housing floors. Whenever there is only one flat per floor, paired with common access spaces on the ground floor, architects also consider locations that are less dependent on the staircase.
As mentioned earlier, in the chapter concerning the types of houses in Lisbon and in Oporto, the characteristics of the original staircase in Lisbon's *Baixa Pombalina* blocks of flats were examined in detail by Jorge Mascarenhas (1996: 155). As we can observe in the survey floor plans included in this work, the staircase was usually originally located within a central axis when it served two flats per floor ☒, which was more economical and allowed for greater structural stability. When there was only one flat per floor ☒, it was rather placed against a party wall. The author identifies three main staircase positions in relation to the buildings' façades – staircases next to the street façade, next to the courtyard façade or placed in the centre of the building –, in which he includes several types of access. Staircases were

most often located either against the courtyard façade, where they could receive light through a window, or in the centre of the building, where natural light came from a skylight and stairwell. It was less frequent that staircases be placed next to the street façade, since they would take up space destined for the largest most privileged rooms (Mascarenhas 1996: 174). A less frequent staircase design was the presence of an extra flight at the back of stairs ☒. This situation was significant since it allowed for a separate access to reception rooms, next to the street façade, and to the kitchen, next to the courtyard.

In Geneva's 19th century blocks of two or three flats per floor, the staircase position in relation to the façades was similar to the one in Lisbon's blocks of flats. In Geneva, staircases were most often located in the centre of the building ☒, with a skylight ☒, or otherwise placed next to a secondary façade ☒, that is, either next to the courtyard or to a secondary street. However, staircase design was different in both cities. In Lisbon, the staircase usually had a rectangular shape, with two flights with an intermediate landing, while in Geneva it was more common for the staircase to have a half circle or curved shape, which included one continuous flight of stairs between floor landings.

In building renovations, there is a limited area where the lift can be placed, should it give access to the common staircase landing at the same level as the flats. In these cases, the introduction of a lift is often confronted with the possible replacing of a flat entrance with the lift. This is naturally possible – or even easier – in the examples where at least one of the flats had more than one entrance, or when an additional entrance can be introduced, as we shall see in the renovation of a building on *Geneva's Quai de l'Île* ☞.

Some staircase features can facilitate the introduction of lifts. If the stairwell is large enough, a lift can be placed inside it with minimal modifications to the staircase. This was, in fact, a common location for the lifts originally located in early 20th century houses, such as the 1906 example we mentioned in Geneva ☒, or the one mentioned by Monique Eleb, built in 1907-1908 in Paris (Eleb 1995: 405). As we can observe in our case studies on *Rue Saint-Victor* ☞, original staircase design in Geneva's 19th century buildings quite suits this type of intervention. The reduction of the available light can be minimized with a glazed lift shaft. In Lisbon, in the examples where there was an additional flight of stairs for separate service access, there was also usually a small inner compartment next to the stairs on all floors. This feature allows for the introduction of a lift without changing the flats' layout or the staircase design. Architects Pedro Reis and João Felino, also residents of the case study on *Calçada do Correio Velho* ☞, plan for the future introduction of a lift in this compartment whenever this proves necessary[71].

Whenever flat layout has an inner room next to the landing, it is also possible to use that compartment as a common hallway for the lift – so long as the circulation within the flat can be assured. This was the case of the previously depicted example on *Rua de São Mamede* 15 ☞, in Lisbon. Lift introduction is more limited if access to the staircase from the building entrance is done via an extra direct flight, that then leads the way to a back staircase with two flights. Since the lift cannot be located over the entrance flight, there are less available compartments giving

access to the staircase landing. This is not always possible without damaging these rooms' characteristic elements. Therefore, architects sometimes look for alternative solutions to this issue, as we shall see in the example on *Rua Cecílio de Sousa* ☞.

Adding a lift and balconies to the courtyard façade

Rua Cecílio de Sousa 52, Lisbon – Aires Mateus e Associados | Manuel Aires Mateus ☞ The one flat per floor building ☒ is located in the southern area of Lisbon's *Cotovia* neighbourhood, near the *Principe Real* Square, to the west of the *Baixa Pombalina*. The intervention by Manuel Aires Mateus put great emphasis on renovating the existing courtyard space ☒. Since the introduction of a lift in an interior space would damage either the staircase ☒ or important characteristic elements, the lift was linked to the larger renovation of the courtyard by being placed against the back façade ☒.

The building is located in a large city area that belonged to the *Real Colégio dos Nobres* during the 18th century. After the 1755 earthquake, this institution proceeded to dividing the land into building plots (Matos 2010: 3). According to a study by José Sarmento de Matos and Jorge Ferreira Paulo on the history of this building, it originally dates from 1774. The authors concluded that the present building, with five floors above street level, was the result of several additions done during late 18th century. In 1779 "it comprised only three floors: a ground floor with two shops, a housing floor and an attic floor" (Matos 2010: 5). Its sale to a new owner with greater means led to the building of a new floor, possibly in 1792, with a large decorated living room ☒, and of an additional floor topped by an attic after 1796. The heightening also led to the introduction of half-turn stairs giving onto the courtyard in order to access top floors. The authors suggest that, at the time, the owner possibly lived on the top two floors and rented out the first, even though this is apparently not clear from the building records (Matos 2010: 7).

In spite of the successive building stages, the floor plans ☒ are consistent with the main domestic features of the time. The metric survey floor plans show that the kitchens were originally placed against the courtyard façade: the oldest on the 1st floor and, on the 3rd floor, the kitchen of the owner's house at the end of the 18th century. A kitchen was also placed later in the same location on the main second floor. The largest rooms gave onto the street in *enfilade.* There were two rooms of equal size on the first floor, while the second floor comprised a large decorated living room and a smaller living room. On the third floor, the room overlapping the living room was probably the dining room at the end of the 18th century, connected to the kitchen via a direct passageway (Matos 2010: 11). In between the rooms that were placed against each façade, there was a parallel line of inner smaller rooms, which could have been alcoves for sleeping, antechambers, storage etc.

At the end of the 19th century and during the 20th century, the building underwent small changes, such as the replacement of the dormer windows and the addition of a few nonstructural walls. Small precarious constructions with bathrooms were

added on the outside of the kitchens, on the courtyard side[72], corresponding to a one flat per floor occupation.

The renovation in 2011 ⊠ by architect Manuel Aires Mateus placed one flat per floor on the first to the fourth floors, complemented by a garage and technical areas on the ground floor. At the time of renovation, the top floor was the one in worse condition due to water infiltration that damaged the timberwork. This entailed the rebuilding of the roof's structure to which new dormer windows were added, aligned with the existing windows on lower floors. On the first and second floors, most of the original decorative and layout elements could be preserved and restored. The strategy was to restore most of the original layout by removing the nonstructural walls that had been added during the 20th century, and to place the necessary bathrooms in the existing inner or smaller rooms, with corresponding new infrastructure.

A fundamental part of the intervention was to promote accessibility to all floors through the introduction of a lift. Its location was decided so that the existing characteristic elements would be preserved, such as the rooms with decorations ⊠ and the stairs ⊠. The latter consists of a straight-run stair between the ground and the first floor, and of half-turn stairs placed against the courtyard wall between the first and third floors. According to the architects, "on one [the courtyard] side it would be impossible to access the building's common spaces through a lift; on the other [side], that would entail patrimonial destruction" (Mateus 2009: 1). The decision was thus to place the lift ⊠ on the courtyard side against the kitchen wall, demolishing the precarious bathroom structures.

The introduction of the lift participated in the larger renovation of the original back courtyard. The common entrance to the lift was located on the ground floor across from the garage. The concrete block for the lift was then paired with a metallic outside platform ⊠ on each floor that gives access to the kitchen's entrance door and that can simultaneously be used as a balcony. At the further end of these platforms are stairs giving access to the rest of the courtyard. The latter has a garden just above the first-floor level and, at the back, a swimming pool, placed just above the second-floor level.

Placing the lift in the stairwell

Rue Saint-Victor 8, Geneva – MVT Architectes ☞ Plot A of group 17 was bought on 28th January 1873 by Charles Court, who was represented by architects Camoletti & Delesvaux[73] in the sale (Département des travaux publics 1873: 14-15). The building request by the same architects was later approved on 9th April 1873 (Département des travaux publics 1873: 87-88). The one flat per floor building ⊠ is located in the corner of a slab block in Geneva's *Tranchées* ⊠ area, thus comprising three façades. The vertical repartition of functions and flat layout followed some of the same principles as the next-door building on number 10, which we examined earlier. As in the latter, the elevated ground floor was clearly the most privileged. It was more easily accessible from the street – via only a half flight of stairs – and enjoyed a south-facing

terrace 3m wide ☒. The recent metric survey floor plans ☒ show that this flat also had a service staircase ☒ giving access to a separate service area in the first basement, which probably included the original kitchen and staff quarters. The remaining spaces on this basement floor seem to have housed a caretaker's flat, the laundry room and service (bed)rooms for the remaining flats. The flats' individual storage areas were placed in the attic.

The original main staircase ☒ giving access to upper floors was located in the innermost position of the plot, so that housing functions could be placed next to the façades. It is a spiral staircase with a large central stairwell topped with a skylight. As was often the case in one flat per floor terraced buildings, the street façade where the entrance was located was secondary to the terrace façade. On the upper floors ☒, a bedroom, the kitchen, and an adjoining small inner room[74] were located on the street side. The corner façade was also particularly important, since it allowed for rooms with a double orientation. The living room ☒ occupied the most privileged position in the corner of the terrace and façade, and its two windows ☒ each had a balcony on the first and second floor flats. As was almost invariably the case in Geneva's 19th century housing, the living room communicated directly with the dining room, which was located in the building's other corner. This was done through large double doors. On the terrace side, the sequence of intercommunicating rooms continued, this time through single doors. The living room gave onto a room ☒ that could double as a drawing room or bedroom, which was followed by a bedroom that concluded the *enfilade*.

The project ☒ for the building's future renovation by MVT Architectes focuses on a variety of building aspects ☒, such as the restoration of the facades' stone and brickwork, the improvement of thermal performance[75], and the updating of most infrastructures. One of the main interventions would be to improve accessibility to the flats by placing a lift ☒ giving access to all floors in the existing stairwell. The existing staircase can be preserved without substantial changes because the circular stairwell is large enough to fit a small lift. The placing of a lift elsewhere would have a much greater impact either on the façade or on flat layout. In the renovation project, the electro-mechanic lift's machinery was placed in the basement. Its shaft is glazed to keep the existing skylight and to minimize the impact on the staircase's natural lighting.

The introduction of a lift would change the relative importance of the floors that existed at the time of building. Even though the ground floor flat has a terrace and two additional rooms on the first basement floor, it is also the closest to street traffic and noise. If the project were carried out, the third floor would acquire a new importance by being more accessible and by using an extra room in the adapted attic floor. Furthermore, it also has, as before, the best view of the surroundings and added privacy in relation to the street. This fact could explain why a few more modifications are planned for the top floor and attic, where the owner plans to live. The attic would be insulated ☒ and transformed to place an extra room belonging to the third floor. This intervention would be complemented by placing a second bathroom[76] ☒ in one of this flat's existing bedrooms.

The placing of the lift shaft in the existing stairwell requires a few careful adaptations ☒ of the stairs' first steps and of the original balustrade. The latter would be interrupted on all floors so that it would be possible to go into the lift. On lower floors, these changes are due to the increasing diameter of the stairwell from the lower to the top floors. In fact, the existing diameter from the attic to the first floor allows for the placing of the lift without further changes. From the ground floor landing to the first basement landing the balusters would be shortened so as to be attached to the steps' treads rather than to the outside of the risers while maintaining the height of the handrail. Part of the balusters' lower detailing would be reattached after shortening. On the ground floor, the staircase's two first steps as well as one step on the lower landing, which were wider than the others, would also need to be shortened so that the elevator shaft could pass.

The lift as a second entrance from the landing

Quai de l'île 15, Geneva – SRA – Studio de réalisation architecturale ☞ *L'Île* is the largest of Geneva's islands ☒, located mid-river and closely connected by bridges to both riverbanks. The discussion and the process leading to the transformation of this area were described by Leila El-Wakil in an article concerning the development of Geneva's riverside during the 19th and 20th centuries. During the second half of the 19th century, at the time of demolition of the fortifications and expansion of the city, "a lively debate began on the aspect and morphology of the north-eastern part of the *Île*" (El-Wakil 1997: 153). At the time, this area still kept its 16th century morphology ☒ and contrasted with recent changes that had taken place in its immediate vicinity. In the 1880s, a large part of the buildings was demolished due to its poor condition. In 1888, geometer Aubin carried out the site's cadastral survey and, shortly after, suggested a project for its transformation (El-Wakil 1997: 156). According to the El-Wakil, this project was only partially completed through the infrastructure and the new definition of the riverbanks. Geneva's municipal authorities launched an international competition in 1890, then adopting architect Adrien Peyrot's design of a six-building block with a central courtyard. Three plots were sold in this block and the buildings completed before 1898. Out of the three, only the *Quai de l'Île* 15 ☒ still exists today. The remaining corner of the block was only completed nearly a century later (El-Wakil 1997: 158).
We reconstructed the history of the building through a few archive elements and with the help of historian Rolf Pfändler, the present-day building owner. According to Pfändler, it was his great grandfather, Jean-Étienne-Émile Rivoire (1850-1944), a notary, who bought the plot and carried out the building enterprise on the *Quai de l'Île* 15 ☒, designed by architect Adrien Peyrot. Above the basement, the building originally comprised a commercial ground floor with arches and several office floors above: two floors with two offices each, and a third floor where Peyrot's office was located. The two upper floors were allocated to housing, the fourth with two flats per floor and the fifth floor with one flat, including painter Ravel's[77] studio.

Even though the original floor plans ☒ could not be found at city or cantonal archives, a recent metric survey gives us quite a good idea of the original flat layout. The ground floor had mostly a commercial function, with shops giving onto both sides. As was the case in many blocks of flats in Geneva, there was also a small caretaker's flat with a separate entrance from inside the staircase hall, where a common toilet was also located. The first and second floors underwent a few changes throughout the years. They each had two offices per floor and, according to the survey, possibly with one double door in the centre of the landing and a single door on the side, located to the right on the first floor, and to the left on the second. The third floor housed one office with one double entrance door. The fourth floor had a two flat per floor plan, which was quite typical for Geneva's blocks of flats at the time. The staircase ☒ was located on the courtyard side. The kitchens also gave onto the courtyard, as did the small toilet and one of the bedrooms. Next to each kitchen, there was a small room with only a small window onto the staircase. Even though it was used as a bathroom during the 20th century, it was most likely originally a maid's bedroom. On the street side, the smaller flat had two intercommunicating rooms, possibly the larger living room with a chimney and the living room. In the other flat, these two rooms were connected to another one, also with a chimney, which was probably used as a bedroom or small living room.

The oldest available floor plans ☒ of the fifth floor date from 1937[78] and refer to the flat's division in two. The original layout for this large flat followed the same principles as the ones below. The intercommunicating reception rooms ☒ at the centre gave onto the street side. In two of these rooms there was an alcove paired with cupboards that covered the descending beams from the roof structure. On either side of these three central rooms, there was one more room, possibly a bedroom. As on the lower floors, the kitchen gave onto the courtyard, and was possibly paired with the inner maid's bedroom. However, the two other rooms on this side reveal the original use of the flat as an artist's studio. They both originally had large windows ☒, possibly adapted throughout the years. The smaller one near the kitchen ☒ is marked as a library in the transformation floor plans; the other one is a large atelier with considerable natural lighting and a separate side entrance from the staircase. The flat's division lead to a few changes in one of the front and inner rooms to add another kitchen and a bathroom. In the flat including the existing kitchen, the bathroom was also added at this time, in what was probably a maid's bedroom until then.

The recent renovation ☒ project by SRA architects focused on two fundamental aspects: the connection of the fifth-floor flats to the attics, including their thermal insulation, and adding a lift to improve accessibility from the basement to the fourth floor. Its location makes use of the variability in the location and number of openings per landing: sometimes there was one door and two windows, two doors and one window, or two doors and two windows. The entrance doors to the flats could have been changed between them throughout the years. This was the case of the fifth floor, where an additional entrance had been added using one of the flats' single doors. In the recent renovation, this flexibility was used to place the lift entrance ☒ as if it were another door, placed on one side of the staircase landing. Inside the flats, the lift was located in the small inner room that was probably a maid's room for the

flats, and a storage space for the offices. The lift does not go up to the fifth floor so as not to damage the unique painter's studio. Some of the existing doors were moved to optimise flat layout. The doors that existed before the intervention on the fifth floor were moved to the second floor, to account for the missing entrance. A single door was placed on the fifth floor, which now has one flat, as was originally the case. The double doors on the second floor were used to introduce a second door in the ground floor hall. On the ground floor, the new location of the lift corresponds to the original entrance to the small caretaker's flat, which is now being used for storage.

[1] The word compromise is used in a positive sense to refer to critical design solutions that achieve a non-conflicting balance between equally important issues.

[2] "em princípio, albergando as camas de dormir", "quartos de vestir, quartos de criança, ou tudo isso simultaneamente."

[3] According to Cunha Leal, even though the decree dating from 31st December 1864 "only" specified that projects respect essential conditions of lighting, ventilation and water distribution, Lisbon's municipal authorities used these regulations to demand floor plan submissions for all new buildings or floor additions, so that sanitary conditions could be verified (Leal 2005: 687). According to Isabel Matias, municipal authorities in Oporto did not choose to use this decree to demand floor plan submissions for approval (Matias 2002: 10).

[4] As previously mentioned, it is in the later flats dating from the beginning of the 20th century that layout changed more significantly. Flats became deeper and were structured around long corridors; alcoves were replaced by rooms giving onto light wells with minimum dimensions predefined in the 1903 legislation (Ministerio das obras publicas 1903). Even though further studies would be necessary to draw definite conclusions, it seems that the application of the 1903 regulations in Oporto did not have a significant impact on the presence of alcoves inside the houses.

[5] According to Isabel Matias (Matias 2002: 22), Oporto's 1899 *Código de Posturas do Município* demands that building demands be accompanied by floor plans for buildings distanced up to 5 m from the street.

[6] *Centre d'Iconographie Genevoise – Fonds Vieux Genève* [catalogued by address].

[7] "Ces pièces principales [d'apparat] sont fréquemment lambrissées, et il n'est pas rare qu'une alcôve, assez profonde pour abriter un grand lit, occupe le fond de certaines d'entre elles, à la fois salles de séjour et chambres à coucher."

[8] *Arquivo Municipal de Lisboa* – Obra 154; Processo 7081/SEC/PG/1925.

[9] *Arquivo Histórico Municipal do Porto* – D-CMP-07-125-049, 050, 051, 052.

[10] The kitchen is placed on the basement floor next to the courtyard in the 1936 floor plans (*Arquivo do Licenciamento das Aguas do Porto* – nº5059, 1936) depicting the house's connection to the municipal sewage distribution.

[11] "A fossa será fixa visto não existirem canos d'esgoto" (*Arquivo Histórico Municipal do Porto* – D-CMP-07-125-049, 050, 051).

[12] *Arquivo Histórico Municipal do Porto* – D-CMP-09-449-281, 282, 283, 284.

[13] Three bedrooms were designed in the initial project, in which one communicated directly with another, and where a folding door could be placed in the arch between them. This folding door was abandoned in the final design. Eventually, the older child started using the bedroom on the basement floor giving onto the courtyard, while the two others remained on the first floor.

[14] This extension included the present-day *Rua do Rosário, Rua Miguel Bombarda (previously Rua do Principe), Rua do Breiner, Rua da Boa-nova and Rua Adolfo Casais Monteiro (previously Rua de Pombal). In the 1813 Oporto plan by Georges Balck (1813), we can clearly see that not only had*

the Rua do Rosário already been opened, but also that it is where building was carried out at a faster pace. Even though specific door numbers were not marked on the plan, it seems to show that our case study and other houses along side it had already been built at the time.

[15] *Arquivo do Licenciamento das Aguas do Porto* – nº3598, 1936.

[16] "duas frentes; caixa de escadas central; piso térreo com acesso independente e destinado a comércio, oficina, armazém ou arrumos complementares da habitação. [...] a caixa de escadas passa a dispor de iluminação superior através de clarabóia. No caso das construções mais profundas, que dispõem de alcovas, estas podem receber luz da caixa de escadas através de janelas abertas nas paredes interiores. [...] Do ponto de vista funcional, deve salientar-se que a divisão do primeiro piso voltada à rua é normalmente organizada como sala pronta a receber um visitante. As restantes dependências deveriam seguir ainda a tradição de uma não especialização, exceptuando a cozinha, que será sempre situada nas traseiras do último piso, junto à cobertura. [...] Existe um sentido de progressão do público para o privado, do representativo para o funcional, na medida em que se sobre de piso."

[17] "C'est la division, l'ordre et l'arrangement des pièces qui forment l'intérieur d'un édifice"; "Distribuer un édifice, c'est combiner dans le meilleur ordre possible, [...] toutes les chambres, salles, galeries, appartemens, dont se forme l'ensemble d'un intérieur quelconque".

[18] "Les premières évolutions de l'habitation qui l'ont réellement transformée: couloir, doublement de circulations, spécification de la chambre et de ses dépendances... sont toutes liées à la fois à la nécessité de dissocier des pratiques et de choisir d'être seul ou en compagnie."

[19] "Traditionnellement, la réunion des salons connexes forme une suite et procure l'ampleur spatiale nécessaire au 'paraître' social. Le dispositif de l'enfilade privilégie les pièces dites 'de réception', habituellement situées sur la façade principale de la maison [...]. Le rituel de la mondanité prescrit l'accueil du visiteur dans un premier salon, puis le déplacement des convives vers la salle à manger, suivi enfin d'une transition vers un nouveau salon, pour la veillée. [...] Les portes de communication entre pièces sont situées axialement de façon à révéler en une perspective unique l'enchaînement des salons. Toutefois, lorsque les portes restent ouvertes, la majeure partie des salles continue à se dérober au regard des observateurs. Cette manière de prodigalité d'espace, assortie des rituels du paraître bourgeois, permet au maître de maison de représenter l'aisance de sa condition à l'intention de ses hôtes."

[20] "Espèce de longue allée qui, dans l'intérieur d'un bâtiment, conduit à plusieurs chambres. [...] Le corridor est en général un moyen de dégagement indispensable dans les bâtiments qui ont besoin d'une longue suite de chambres, car on n'est point obligé de les traverser pour arriver à l'escalier [...] on n'en pratique guère que dans les communautés ou les établissemens d'éducations publique."

[21] For further examples, it is also worth looking at the case study on Geneva's *Rue de l'Athénée* 4, examined in the attic renovation examples. In this renovation, the enfilade next to the façade was used for the internal flat distribution when the existing corridor was used to divide a flat in two.

[22] Few original *Baixa Pombalina* floor plans have made it to this day. We examined the collection of metric survey floor plans included in Jorge Mascarenhas PhD thesis *A study of the design and construction of buildings in the Pombaline quarter of Lisbon* (Mascarenhas 1996).

[23] According to Maria Helena Barreiros (2004: 90) the originals of these drawings are preserved at the *Arquivo Histórico do Ministério das Obras Públicas* (no particular reference number given). They were published in Barreiros's aforementioned article.

[24] Maria Helena Barreiros makes this particular observation about the double access in relation to the floor plan of another house in the same block. This was not an access separation in the original floor plans of our case study but was introduced in the final building.

[25] "Uma análise mais atenta releva a observância do princípio de separação de acessos: privado (ocasionalmente, social), mais directamente articulado com as salas 'da frente'; e de serviço, relacionado com a zona da cozinha e despensa, a primeira facilmente identificável pela presença da ampla chaminé. [...] Vale a pena salientar a particularidade do acesso directo à cozinha [...] ser praticado a partir do patim das escadas inferior ao do acesso à casa: a diferenciação dos dois acessos à habitação é de tal ordem, que eles não partilham sequer o mesmo patamar. [...] Como princípio de distribuição identificável em todas as habitações temos uma dupla sequência de

aposentos, a primeira constituída pelas salas e câmaras da frente, comunicando directamente através da série de portas *en enfilade*, e uma segunda, dobrando a anterior, composta pelas alcovas destituídas de janela – em princípio, albergando as camas de dormir –, abertas para os aposentos da frente."

[26] *Arquivo Municipal de Lisboa* – Obra 30376; Processo 46/DCEOD/PH/2000.

[27] *Arquivo Municipal de Lisboa* – Obra 39490; Processo 7126/DAG/PG/1962.

[28] *Arquivo Municipal de Lisboa* – Obra 36639; Processo 254/DAG/PG/1884.

[29] "Des barrières matérielles deviennent nécessaires pour remplacer les anciennes barrières morales [entre maîtres et domestiques] [...]. Les pièces de service (cuisines et dépendances) sont mises à l'écart du corps principal de logis, afin d'éloigner bruit, vue et odeurs, des maîtres de la maison."

[30] "Pièce où l'on apprête le manger. Elle est située, selon la grandeur des maisons ou la richesse des particuliers, soit dans l'étage souterrain, soit au rez-de-chaussée, soit dans les étages supérieurs. On éloigne ordinairement la cuisine des appartemens, à cause de l'odeur. Il convient qu'elle soit voûtée, de crainte du feu. Elle doit être accompagnée de quelques autres pièces, comme lavoir, garde-manger, etc."

[31] As in previous instances, our statements were based on our analysis of Geneva's mid 19th early 20th century housing located within the *Ceinture Fazyste* expansion perimeter.

[32] "Une première spécificité tient à la distance que l'appartement privé met, ou continue à mettre, entre cuisine et séjour. Quand on lit, vers 1960, des études et réflexions sur ce que doit être le plan du logement social, un des *leitmotive* est celui de la proximité fonctionnaliste entre la cuisine et le lieu de prise du repas (séjour, salle à manger ou coin-repas selon les cas): faciliter le service, limiter les pas de la ménagère, prévoir un meuble passe-plats entre ces deux pièces. [...] Comme pour confirmer la connotation sociale de l'appartement disjoignant nettement cuisine et séjour par l'entremise d'un hall d'entrée, les Logéco sont à l'inverse le plus souvent caractérisés par la relation directe entre ces deux pièces."

[33] Included in this chapter's section on attic reconversion.

[34] The floor plans we included in the case study charts pertain to the interventions on the ground, second and third floors.

[35] *Arquivo Municipal de Lisboa* – Obra 22709; Processo 81/1ªREP/PG/1890.

[36] *Arquivo Municipal de Lisboa* – Obra 22709; Processo 39794/DAG/PG/1949.

[37] This house would be worth a more detailed historical analysis that was out of the scope of this work. One of its most particular features is a second large entrance door from the street, which is directly connected to the basement by means of an interior ramp. Moreover, the central staircase is almost square and presents a large light well.

[38] *Arquivo do Licenciamento das Aguas do Porto* – nº1493, 1936. At this time, the owner was António Martins Gonçalves d'Azevedo. His belated wife is mentioned as the previous owner, D. Carolina Alina Dias de Bessa Ribas Gonçalves d'Azevedo.

[39] A stone reservoir with a tap above the sink was a system used to store water before running water was available.

[40] The inauguration of Geneva's Cornavin train station took place in 1858 (Brulhart 1985: 12).

[41] "Désormais, sans encombre et à moindre frais, la bourgeoisie peut investir raisonnablement dans la proche périphérie de Genève."

[42] *Département des constructions et de l'aménagement* archives – Cité 11/E, 1910.

[43] See, for instance, architects Gampert & Cayla's design for the Micheli Ador large single-family house (Cayla 1907).

[44] "À première vue, il peut sembler évident que le maintien de la disposition actuelle des pièces a l'avantage d'être la solution la plus économique, mais à la réflexion, une variante, consistant à transformer les actuelles salles à manger en cuisine – coin à manger et les actuelles cuisines en chambre, peut apporter une meilleure qualité de vie – cette nouvelle disposition permet d'avoir deux chambres individuelles donnant côté jardin (zone tranquille) et les espaces collectifs côté rue (zone de bruit intense). [...] Les deux variantes mentionnées peuvent être envisagées, sans que des cloisons doivent être supprimés ou modifiées, car les qualités des appartements rendent possible ces deux aménagements. Ces qualités se retrouvent au niveau des dimensions généreuses des pièces, en particulier celles côté rue, et du hall de distribution – la présence des alcôves permet une souplesse

d'utilisation de l'espace. Elles permettent de bénéficier de petits espaces pour des activités nécessitant peu de place (lit d'appoint, coin bureau) ou pour des surfaces de rangement."

[45] The project for the street opening dates from 1916 and is kept at Oporto's municipal archives (*Arquivo Municipal do Porto* – D-CMP/3(310)).

[46] *Arquivo Histórico Municipal do Porto* – L0-1918-0625-120, 121, 122, 123.

[47] In examples dating from early 20th century, the kitchen was, for instance, located in the basement next to the courtyard, while the dining room was placed directly above, or located next to the dining room but in a courtyard side annex. When these two rooms were placed on different floors, there could even be a plate lifter to facilitate service.

[48] *Arquivo Histórico Municipal do Porto* – D-CMP-09-680-001, 002, 003.

[49] *Arquivo do Licenciamento das Aguas do Porto* – nº3643, 1936.

[50] "Os seus vários compartimentos tinham vindo a ser arrendados sem alguma vez terem sido adaptados a esse fim. Não tinham cozinha, e os quartos de banho (que existiam apenas nos fogos das traseiras) eram equipados apenas com sanita e lavatório. Os arrendatários foram fazendo várias alterações e adaptações, acrescentando divisões e improvisando cozinhas."

[51] "Esta pequena e estreita rua terá sido criada após a alienação do lugar ou casal do Pinheiro, propriedade de que há registo escrito desde 1503 e que terá dado o nome à rua."

[52] The street is also marked in a map prepared by Anni Günther Nonell indicating the *Junta de Obras Públicas's* projects between 1788 and 1820 (Nonell 2002: 335).

[53] "A opção foi duplicar os acessos verticais interiores e criar 2 apartamentos dúplex, colocando escadas no local das antigas antecâmaras e de forma a correr entre os barrotes de pau rolado. Através desta solução, experimenta-se uma maior diferenciação espacial e consegue-se ter um T2 de 120 m^2 e um T1 de 80 m^2, todos com espaços iluminados por luz natural, tirando partido de janelas que dão para a caixa de escadas. A Norte, no último andar cria-se um pequeno estúdio de 35 m^2 e a Sul o apartamento com a mansarda, também dúplex, que sofreu mais modificações, pois estava praticamente em ruína. [...] As instalações sanitárias e cozinhas também tiveram de ser projectadas de novo. Optou-se por localizar as zonas de águas junto á caixa de escadas, dentro de pequenos armários, com a dimensão aproximada das antigas antecâmaras. Com esta solução, consegue-se localizar as tubagens de escoamento numa parede técnica atrás do patamar da caixa de escadas e mantém-se a coluna das varandas a Sul com sanitários de serviço. [...] Isolaram-se acusticamente todos os pisos a lã de rocha e com manta acústica entre soalho e barrotes. Instalaram-se 4 cozinhas e 8 casas de banho (4 de serviço e 4 novas), instalações eléctricas e hidráulicas novas e abriu-se o saneamento para a rua."

[54] The owner of both plots was at the time Dionísio Chevalier, who only a few years later lost them due to financial difficulties. The next-door building on *Rua dos Douradores* 2-14, that had only been partially built, was rebuilt in 1805 (Matos 2009: 12, 13).

[55] *Arquivo Municipal de Lisboa* – Obra 1590; Processo 3556/DAG/PG/1907.

[56] Based on data from the Swiss *Office fédéral du logement,* the cantons with the lowest percentage of vacant housing in 2013 were Bâle-Ville (0,33 %), Zoug (0,35 %), Geneva (0,36 %), Bâle-Campagne (0,37 %), Zürich (0,60 %) and Vaud (0,61 %) (Enzler 2014).

[57] It is the case of visited buildings on *Rua da Alegria* 97, *Rua do Breiner* 143, and *Rua do Doutor Alves da Veiga* 114.

[58] It is the case of visited buildings on *Rua do Pinheiro* 71-75, *Rua da Picaria* 143 and *Rua do Doutor Alves da Veiga* 213.

[59] "A ocupação das mansardas, ou piso das águas furtadas faz-se, em grande parte dos casos, com a zona de dormir dos criados mas pode também albergar alguns compartimentos de serviço ou ainda, se a caracterização espacial o permitir, quartos para a família. [...] Assim, e em função do ponto onde se localiza a principal ligação entre o interior e o exterior, a partição da compartimentação determina um afastamento das áreas de serviço para os extremos, a cave ou as águas-furtadas, enquanto que para as áreas íntimas se privilegia o afastamento em relação ao espaço público, ao contrário das áreas comuns, às quais se atribuem os espaços que de forma mais intensa comunicam com o exterior."

[60] "Au-dessus d'un rez-de-chaussée, abritant les 'caves' et les remises, furent élevés quatre étages d'habitation. [...] À cette époque, les étages étaient divisés en deux appartements, à l'exception

du deuxième où habitait Duchêne. [...] Nous ignorons à quelle date furent construits les deux étages en colombage, affectés aux 'cabinotiers', ainsi que le petit atelier en bois au sommet de la cage d'escalier. En 1821, un document signale la présence des 'cabinets' en attique, sans préciser toutefois s'ils occupaient un ou deux niveaux. Quoi qu'il en soit, le premier fut transformé en habitation en 1874."

[61] La façade arrière, contre laquelle est accolée la tour d'escalier, comportait à l'origine des galeries en bois malencontreusement remplacées par des coursives en béton. [...] La disposition intérieure est très simple: deux appartement par étage avec une cuisine sur cour et une chambre à alcôve sur rue. Cette situation correspond sans doute à l'état d'origine, excepté le deuxième étage où il n'y avait qu'un seul logement. On peut remarquer que ce schéma reprend la typologie de l'habitat médiéval, caractéristique des parcelles en longue lanière."

[62] "Lawyer (1833), official (1837) and deputy at the *Conseil représentatif* (1837). Public prosecutor (1848), [...] re-elected public prosecutor (1864-1876). Conservative deputy at the *Grand Conseil* (1846-1847 and 1854-1856)" (FROMMEL s.d.).

[63] The drawings are included in architect Edmond Fatio's fund at the *Archives d'État de Genève.* There are original drawings, including floor plans, elevations and sections, sometimes referring specifically to the "Maison Turretini". The second floor plan is dated 5 April 1861 and signed LB, probably architect Louis Brocher. There are also other drawings dated 1905 and identifying the owner as M. Perrot (husband to Turretini's daughter Sophie), which could have been done by architect Edmond Fatio for transformation purposes, even though none are in evidence: *Archives d'État de Genève* – Archives Privées 194/C/86 – T E/9-2.

[64] Based on this legislation, windows should not be higher than 1,50 m from the ground, and lower than 1,80 m. The vertical projection of the windows cannot be lower than a tenth of the room's surface, and should total at least 1 m square (GRAND CONSEIL 2013: Art. 130).

[65] Some of the projects for the development of this area were examined by Anni Günther Nonell (NONELL 2002: 364-365).

[66] "Plano da continuação da Rua de Malmerendas à Rua Formoza, e Rua Firmeza."

[67] *Arquivo do Licenciamento das Aguas do Porto* – nº3630, 1936.

[68] Among the examples of housing we examined in Geneva's *Ceinture Fazyste*, the first to have a lift was the block of flats on *Rue François-Versonnex* 19 ☒, dating from 1906. The lift was placed in the stairwell (*Archives d'État de Genève* – TP 1906/262). The floor plans for the next-door building on number 17 ☞, dating from 1902, did not have a lift (*Archives d'État de Genève* – TP 1902/152).

[69] No lifts were introduced in our case studies of renovations in Oporto and, as such, we shall focus on the features of Lisbon and Geneva's blocks of flats. Oporto is the only city examined where several case studies remained single-family houses. In cases where houses where divided into flats, lift introduction would be possible but would prove harder than in other examples. If it was placed on the courtyard side (in the small latrine compartment, for instance), it would possibly serve only half the flats. Its location in one of the alcoves by moving a flat entrance door would be possible in a duplex flat situation such as the case study on *Rua do Pinheiro*. However, this would imply a larger structural intervention, and would take up a large part of the space that, in this case, was used for kitchens and bathrooms.

[70] "L'air plus pur en 'altitude', la lumière et l'ensoleillement sont exaltés par les travaux sur l'hygiène. L'ascenseur hydraulique, présenté lors de l'Exposition universelle de 1867, connaît un grand développement à partir des années 1870. Les premiers ascenseurs à air comprimé sont réalisés vers 1890, et l'ascenseur électrique, mis au point en 1895, se généralisera vers 1905 [...]. Habiter un étage élevé n'est plus dévalorisé socialement, et l'architecte Léon Chesnay conçoit en 1907 une maison de rapport dans laquelle il occupe les deux derniers niveaux."

[71] We also identified two more renovation projects in Lisbon where this solution was designed at a project stage, on *Rua das Flores* 41-45, by Bastir architects, and on *Rua de São Paulo* 49, by Arquitraço architects, which were not examined further as case studies since, at the time, it was not sure if the renovation work would take place.

[72] Some of these changes are documented with building requests: in 1943 on the 2nd floor (*Arquivo Intermédio da Câmara Municipal de Lisboa – Obra 30777 – nº26666/43)* and in 1956 on the 4th floor (*Arquivo Intermédio da Câmara Municipal de Lisboa – Obra 30777 – nº60990/56).*

[73] Several authors (Beerli 1985: 39; Brulhart 1985: 128) have noted that this building is the work of architect John Camoletti, who founded his architecture office in 1872, joined by his brother Marc Camoletti in 1884 (Courtiau s.d.). In a study by Anne Gueissaz, we learn that John Camoletti opened his architecture office in collaboration with Etienne Delesvaux, probably in 1872; a collaboration that did not last long since, according to the author, Delesvaux already had his own office in 1873 (Gueissaz 2004: 7).

[74] Today this small interior room houses the flats' only bathroom, which is complemented by a toilet located next to the staircase. Originally, it could have been used, for instance, as a food serving room or a maid's room. There may have originally been bathroom, but it is unlikely, considering how rare their presence was at the time of building, even in this city area.

[75] The interventions addressing thermal insulation issues are described in detail in the following chapter.

[76] The conversion of one of the bedrooms into a second bathroom is only possible in the owner's flat because this would reduce the number of rooms (*pièces*) in the houses. This change is not allowed based on the *Loi sur les démolitions, transformations et rénovations de maisons d'habitation* (LDTR) (Grand conseil 1996) protecting tenants due to the extreme lack of housing in the canton.

[77] Probably Swiss painter Edouard Ravel (1847-1920) (Boissonnas s.d.).

[78] *Département des constructions et de l'aménagement* archives – Cité 1937/47, 10496.

CASE STUDY DRAWINGS

LISBON

1 – Calçada do Correio Velho 1-3 | Pedro Reis Arquitecto, 1st floor | architects João Felino and Tiago Mota, 2nd floor

2 – Rua de São Mamede 15 | Souza Oliveira arquitectura e urbanismo, 3rd floor | João Botelho, 2nd floor | Aires Mateus e Associados, GF

3 – Rua da Alfândega, 3rd floor | Atelier do Bugio

4 – Rua da Lapa 89 | José Adrião Arquitecto

5 – Rua dos Fanqueiros 73-85 | José Adrião Arquitecto

6 – Rua das Pedras Negras 5 | architect Pedro Pacheco

7 – Rua Cecílio de Sousa 52-56 | Aires Mateus e Associados

8 – Rua Nova do Carvalho 43-51 | Appleton & Domingos Arquitectos

9 – Rua de São Mamede 31 | Appleton & Domingos Arquitectos

OPORTO

10 – Rua Duque de Saldanha 600 | aNC Arquitectos

11 – Rua do Pinheiro 71-75| architect Bernardo Amaral

12 – Rua do Doutor Alves da Veiga 213 | Edite Rosa & Joaquim Almeida Arquitectos

13 – Rua de São Miguel 41-43 | architects João Moura and Paulo Frutuoso

14 – Rua de Diu 82-86 | architects Nuno Valentim and Joana Sarmento

15 – Rua da Picaria 80-84 | architect Cristiano Bartolini

16 – Rua do Breiner 143 | A. Portugal & Manuel M. Reis arquitectos e associados

17 – Rua António Granjo 108 | architects António Portugal and Anne Wermeille

18 – Rua do Rosário 223 | architect Paula Ribas

GENEVA

19 – Rue de Saint-Victor 8 | MVT Architectes

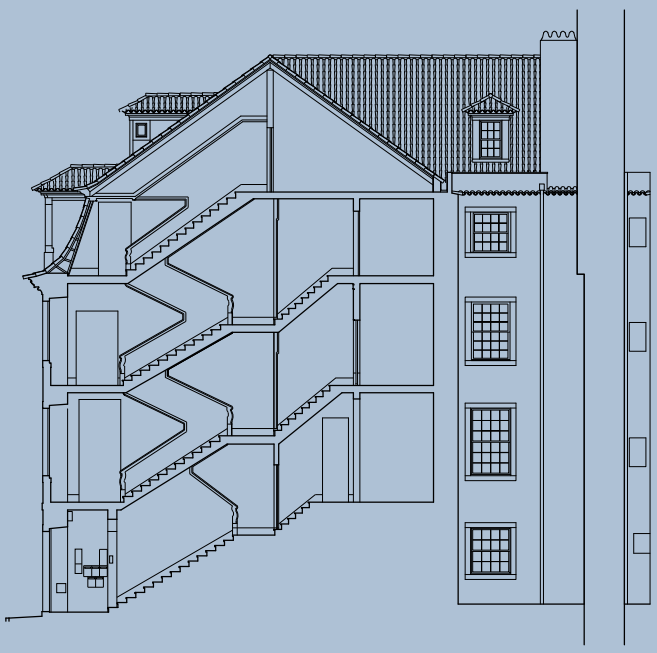
20 – Rue de Saint-Victor 10 | MVT Architectes

21 – Rue de la Servette 36 | MVT Architectes and Théodore Necker Architecte

22 – Quai de l'Île 15 | SRA - Studio de réalisation architecturale

23 – Rue Rousseau 7 | Atelier MARCH

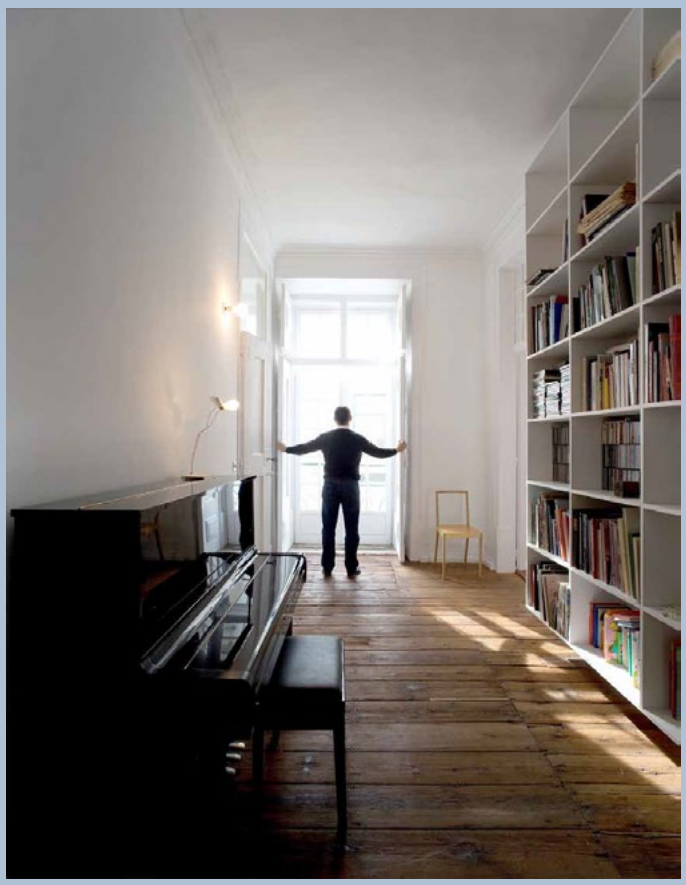
24 – Rue de l'Athénée | AFM Architectes



Street façade
Section through staircase 1:200
(drawings | Pedro Reis)

1 | LISBON

CALÇADA DO CORREIO VELHO 1-3, 1st floor
Lower GF, GF, 3rd, 4th floors

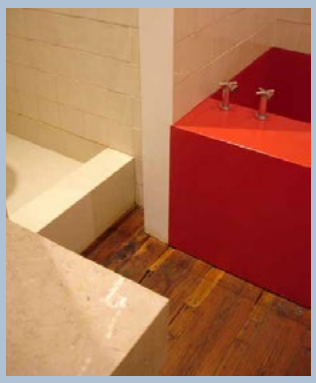


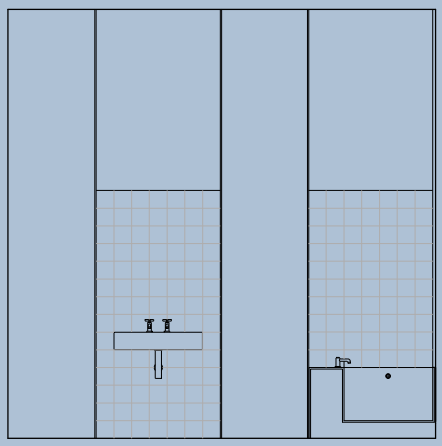
Library
(FG+SG – Fotografia de Arquitectura)

Architectural design Pedro Reis Arquitecto
Structural design ARA – Alves Rodrigues & Associados, Lda.
Plumbing design Lídia Lopes

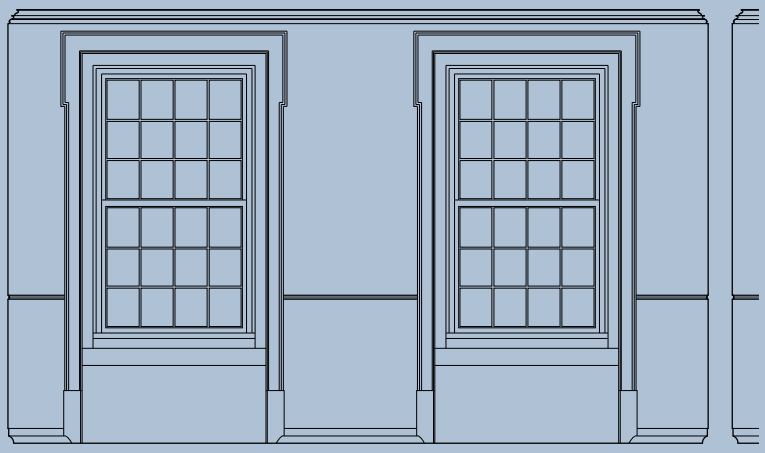
–

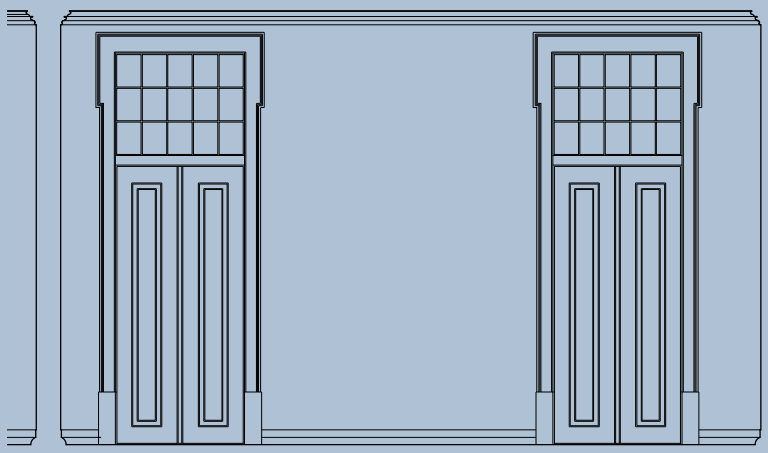
Contractor X·LOG – Construção, Lda.
Carpentry Móveis Durão, Lda.
Bathtub CORIAN_TAMPCOR, Transformação e Criatividade, Lda.
Ceramics AZURAMBIENTE
Taps DORNBRACHT



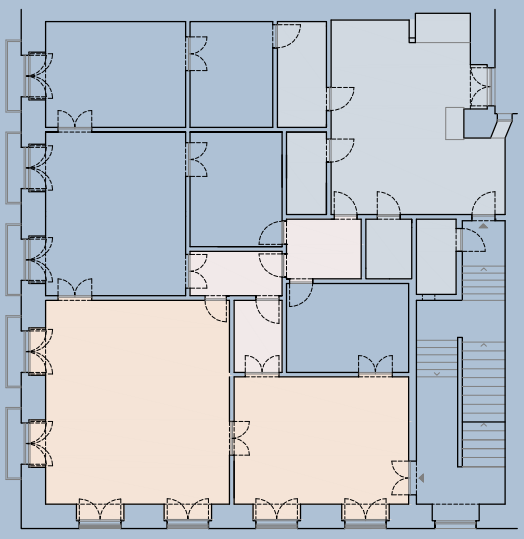


Bathroom
Living room elevations 1:50
(photo and drawings | Pedro Reis)

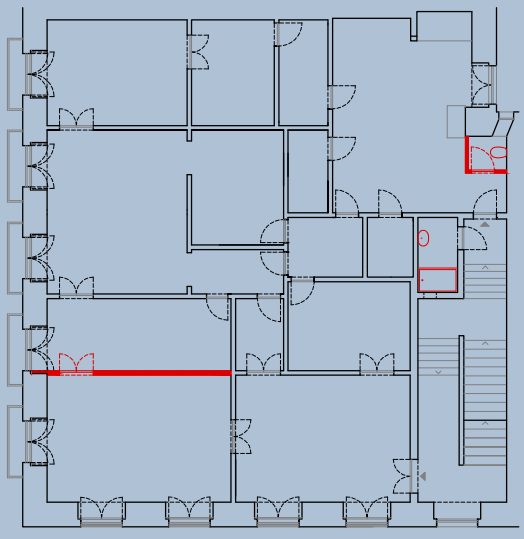




Kitchen
Living room
(FG+SG – Fotografia de Arquitectura)



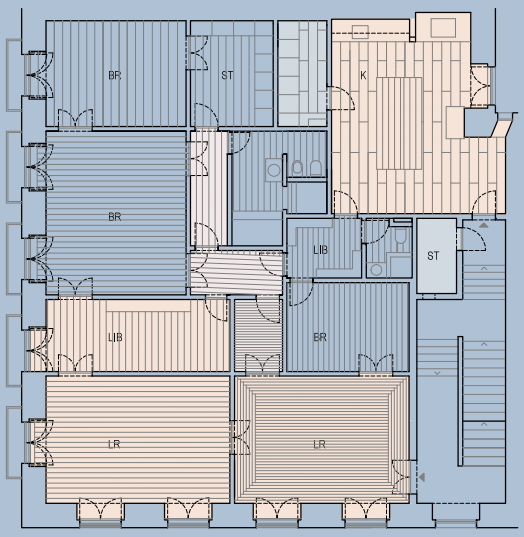
1st floor 1:200
Reconstituted original plan



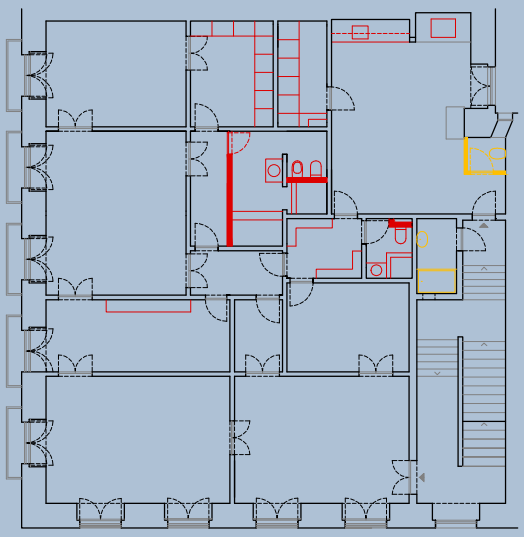
1st floor
Changes introduced to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

0 1 5



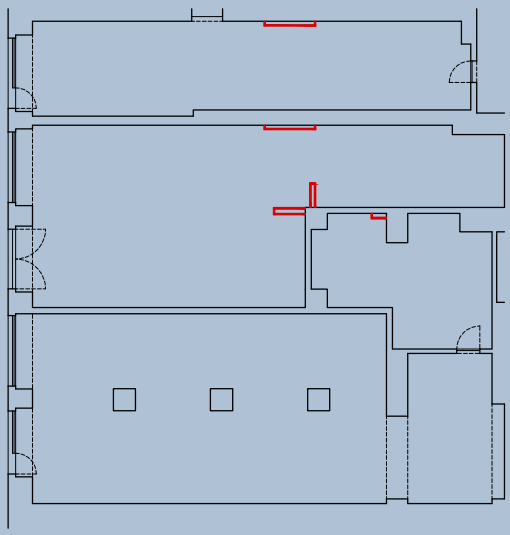
1st floor
Final plan after renovation



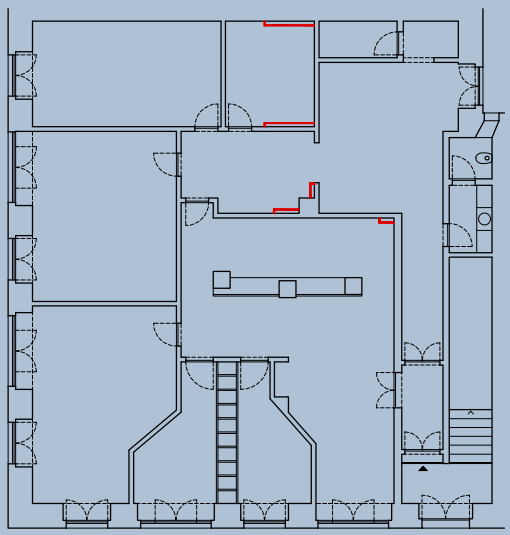
1st floor
Changes introduced by the renovation project

Types of rooms

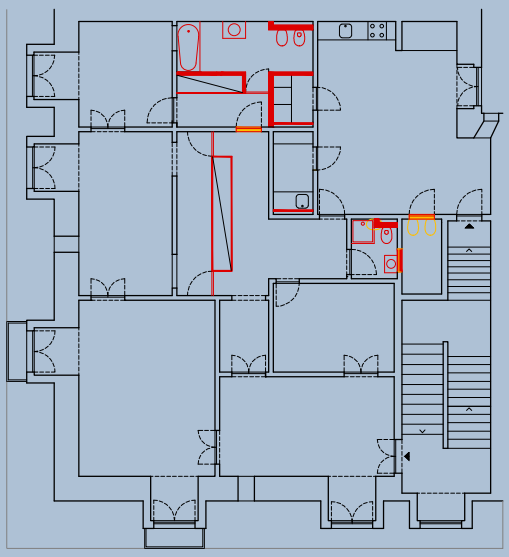
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



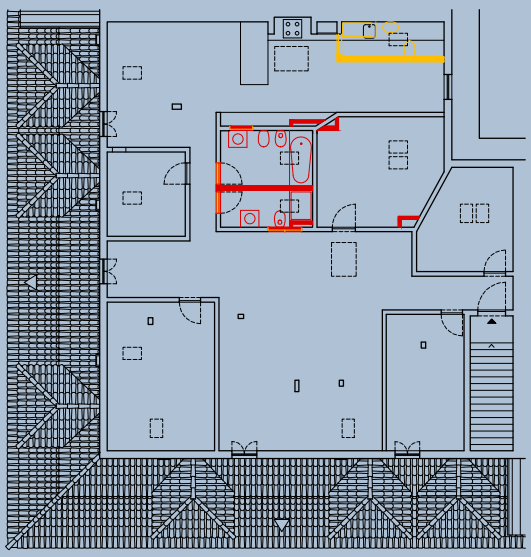
Lower ground floor 1:200
Changes introduced by the renovation project



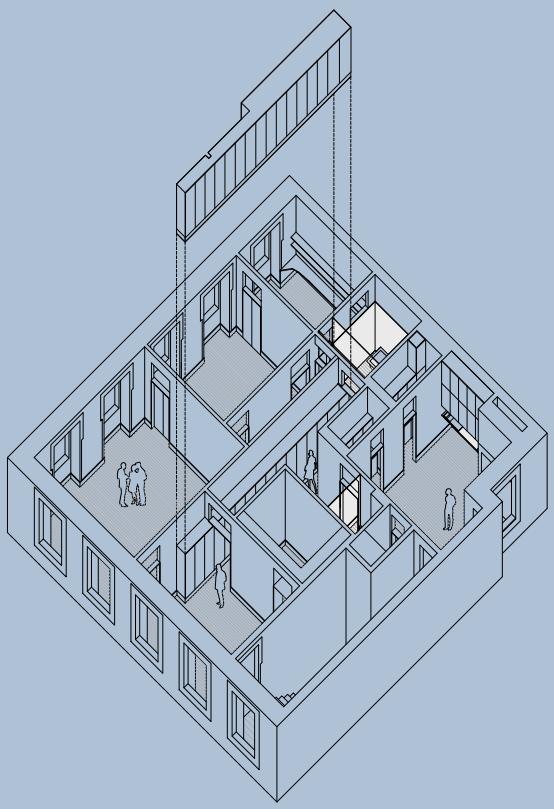
Ground floor
Changes introduced by the renovation project



3rd floor
Changes introduced by the renovation project



4th floor
Changes introduced by the renovation project



Axonometry
(drawings | João Felino)

Original construction 1770s
Renovation work 2005 · 2006
Initial and current functional type 1 flat per floor block of flats

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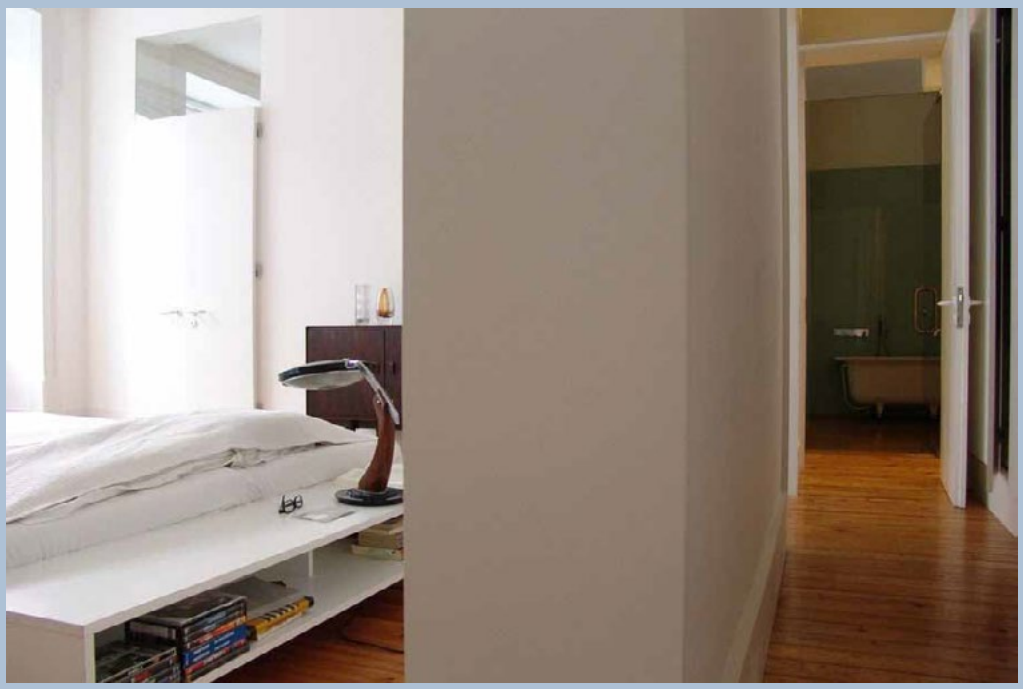
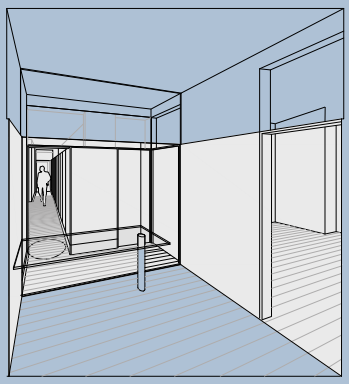
Archive information Arquivo Histórico do Ministério das Obras Públicas [Original plans]
Arquivo Intermédio CML (Obra 30376) [Plan drawings]

1 | LISBON

CALÇADA DO CORREIO VELHO 1-3, 2nd floor



Bedroom and dressing room
Axonometry
(photo and drawing | João Felino)



Architectural design João Felino and Tiago Mota
Structural design ARA – Alves Rodrigues & Associados, Lda.
Plumbing design Lídia Lopes

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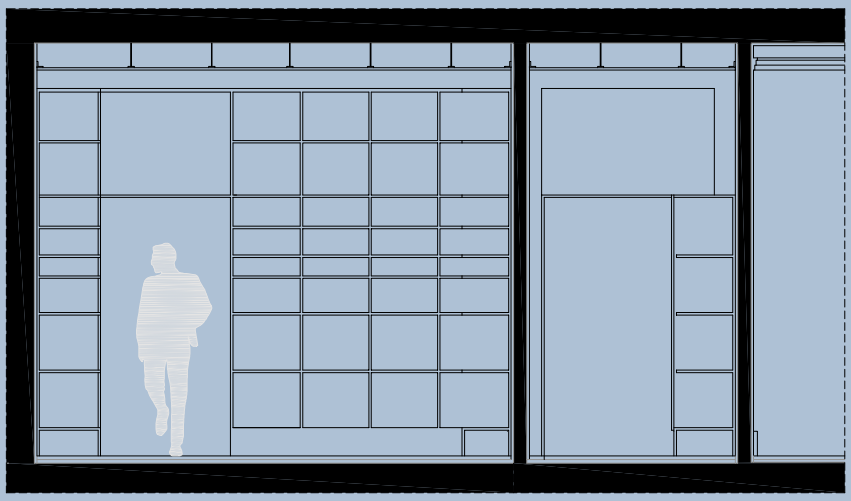
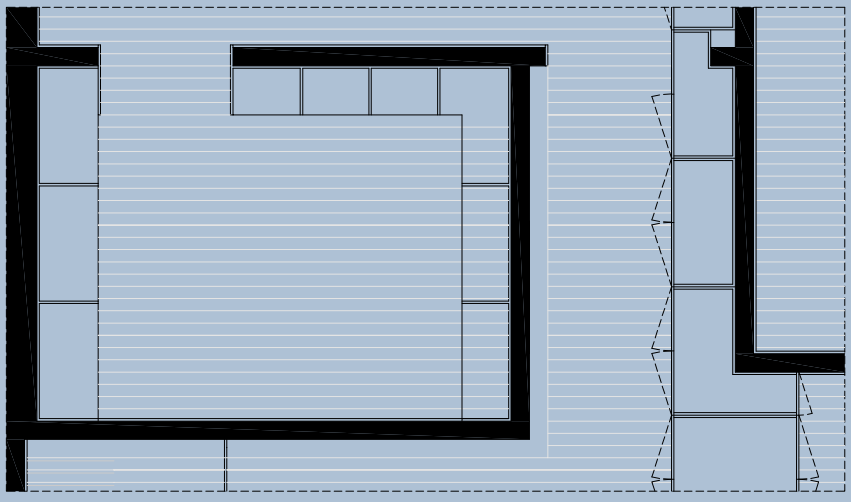
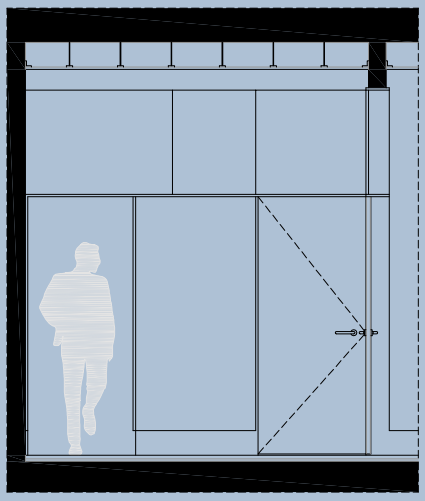
Contractor X-LOG – Construção Lda.
Electrical installation Carlo Pereira
Carpentry Carlos Durão
Glass and metalwork José Guerra
Paintwork Henrique Santos



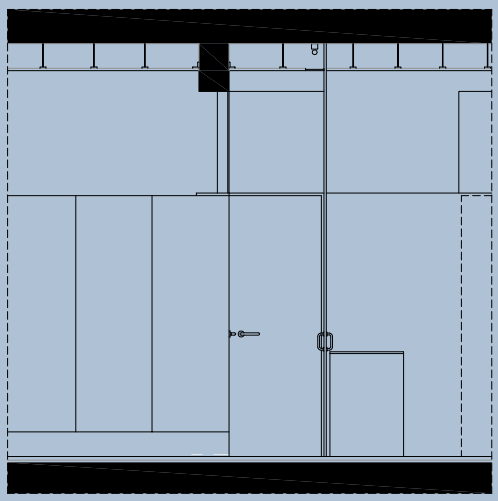
02



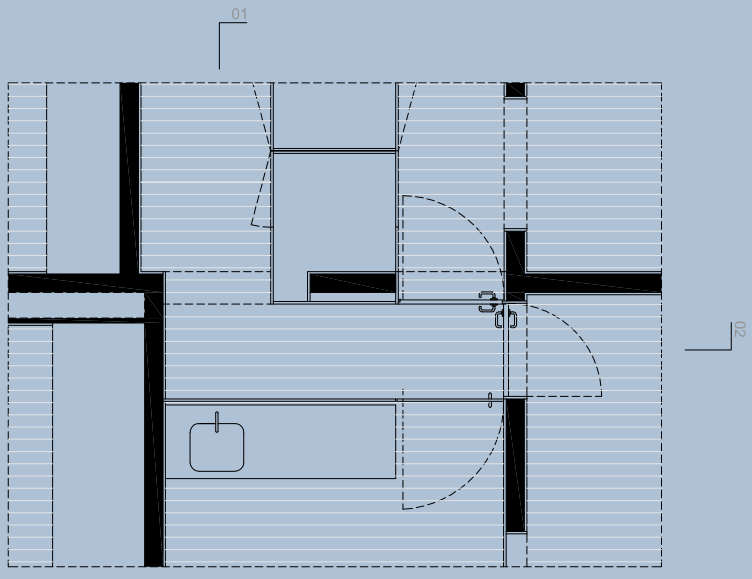
02



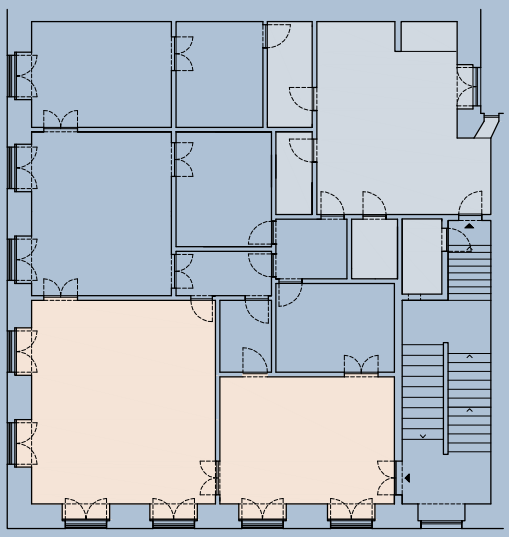
02



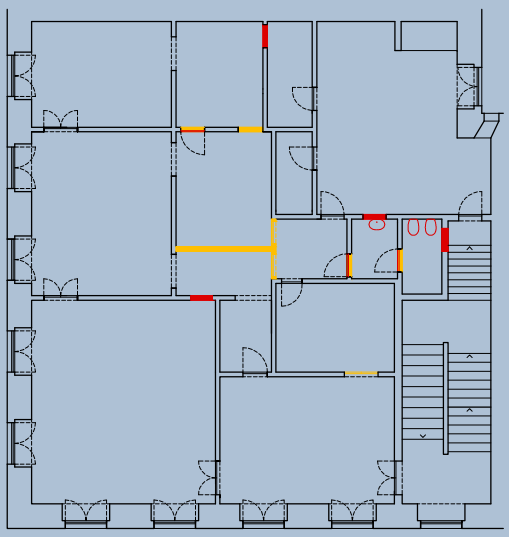
01



Library
Closet_Bedroom hall 1:50
(Plans and sections | João Felino)



2nd floor 1:200
Reconstituted original plan



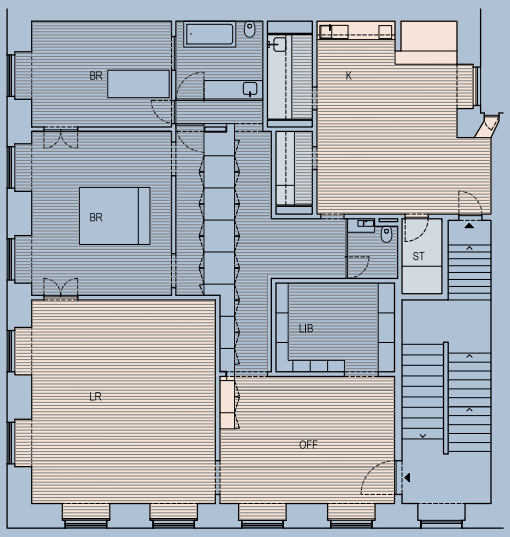
Service areas
Social areas
Circulation areas

0 1 5

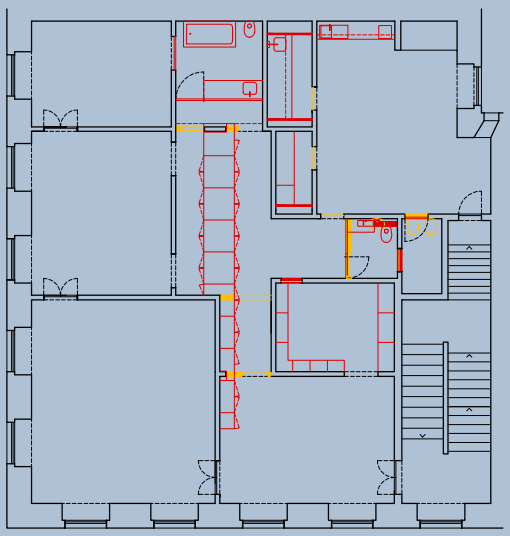
2nd floor
Changes introduced to the original plan throughout the 20th century

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office

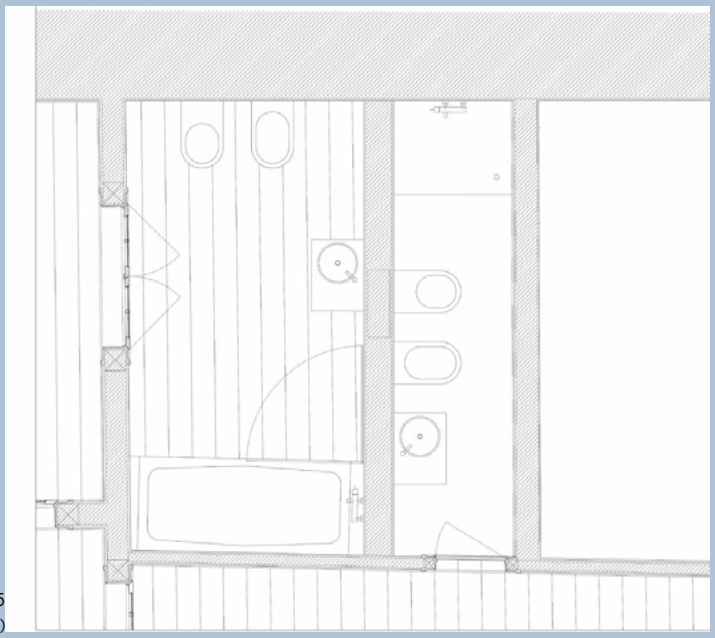


2nd floor
Final plan after renovation



2nd floor
Changes introduced by the renovation project

Bathroom
Kitchen – living room
(photos | Alberto de Souza Oliveira)



Bathroom plan 1:25
(drawing | Alberto de Souza Oliveira)

Original construction Late 18th century · Early 19th century
Renovation work 2003 · 2006
Initial and current functional type 1 flat per floor block of flats

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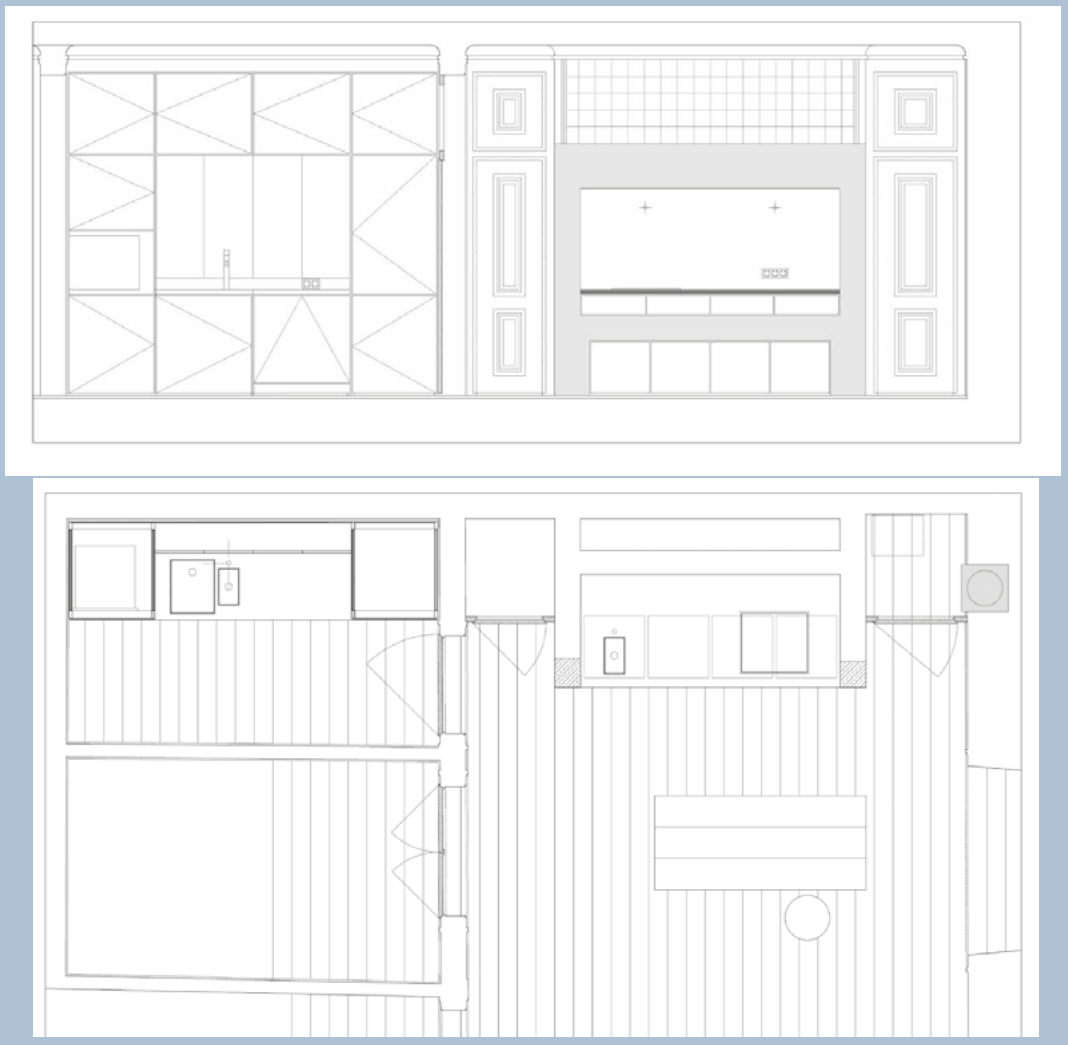
Archive information Arquivo Intermédio CML (Obra 13676) [Plan drawings]

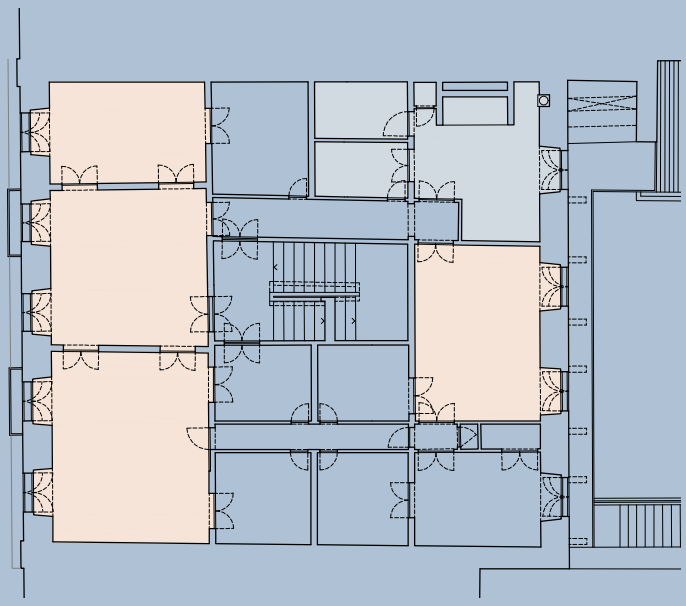
2 | LISBON

RUA DE SÃO MAMEDE 15

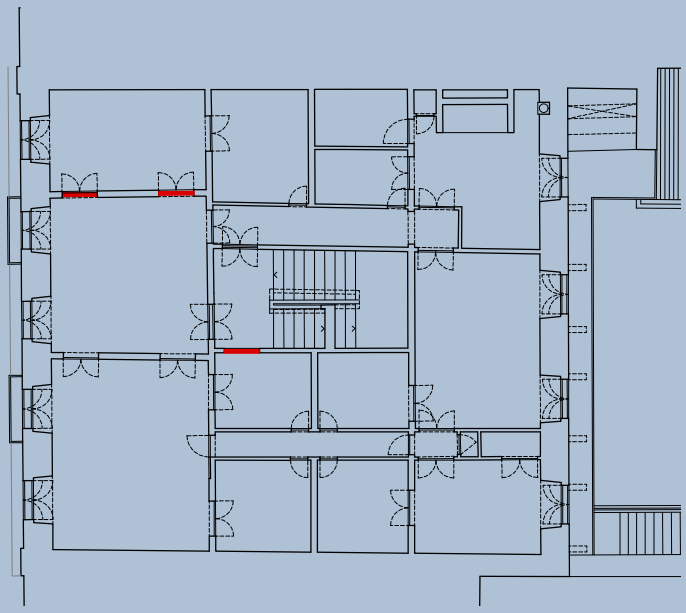


Kitchen – Plan and section 1:25
(drawings | Alberto de Souza Oliveira)

Architectural design 3rd floor | Alberto de Souza Oliveira | **Architectural team** João Botelho, Filipa Mourão
2nd floor | João Botelho
GF | Aires Mateus Associados – Manuel Aires Mateus | **Project manager** Bruno Anes
Architectural team Valentino Capelo Sousa, Maria Rebelo Pinto, Ana Rita Rosa
Structural design BETAR – Estudos e Projectos de Estabilidade, Lda.
Plumbing design GR Estudos, Projectos e Consultoria, Lda.



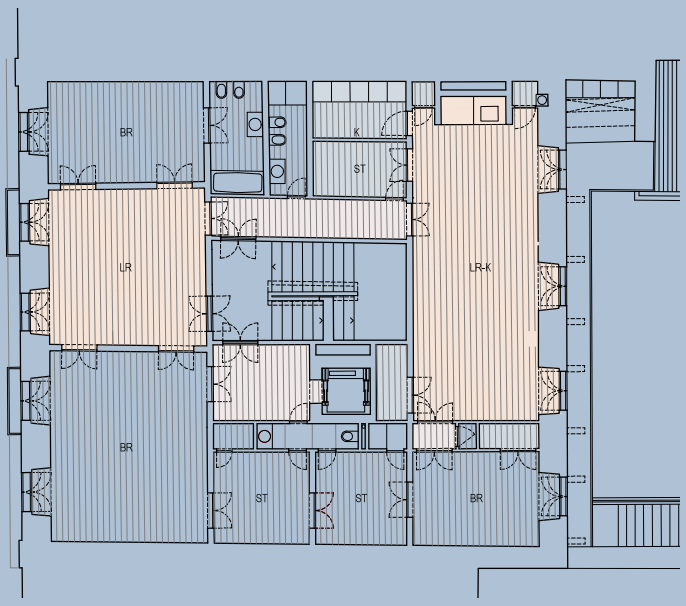
3rd floor 1:200
Reconstituted original plan



3rd floor
Changes introduced to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

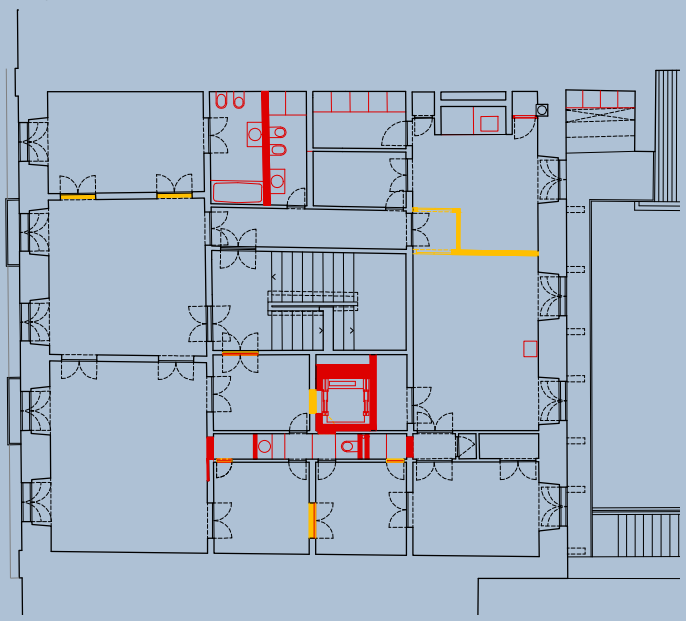
0 1 5



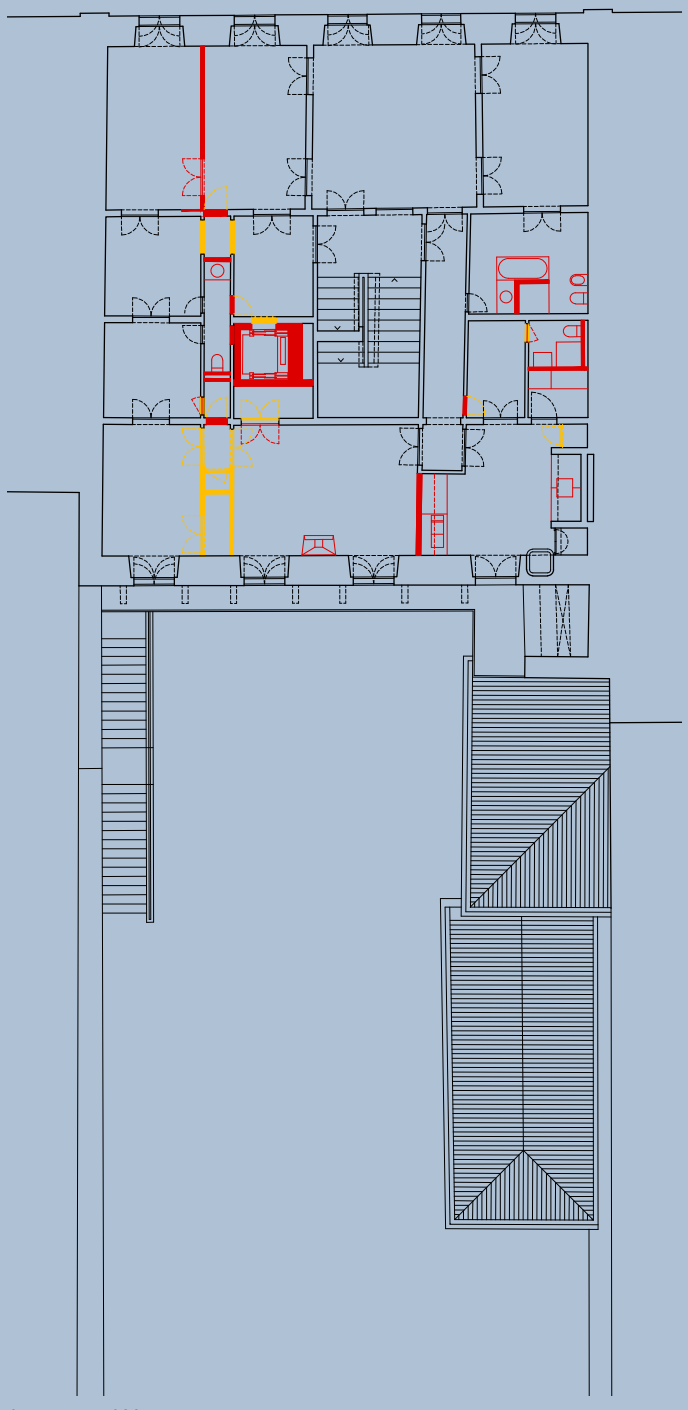
3rd floor
Final plan after renovation

Types of rooms

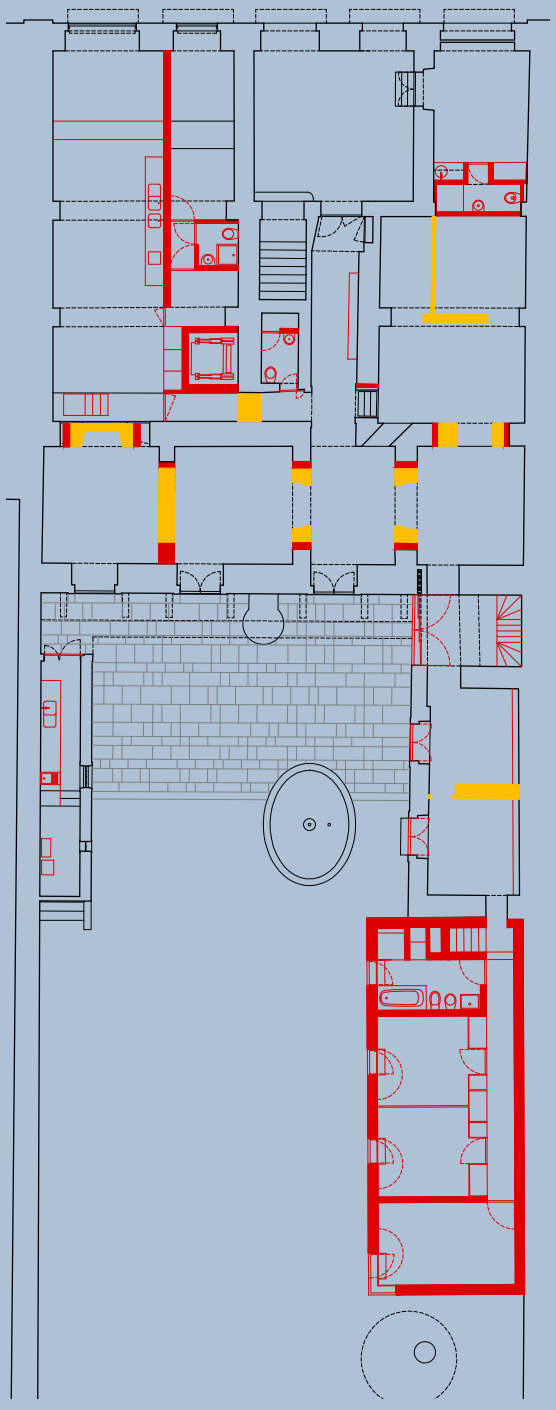
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



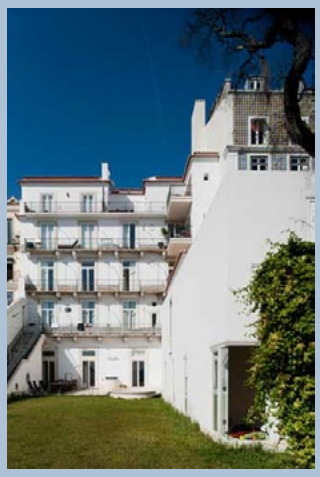
3rd floor
Changes introduced by the renovation project



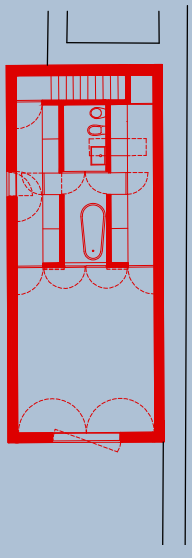
2nd floor 1:200
Changes introduced by the renovation project

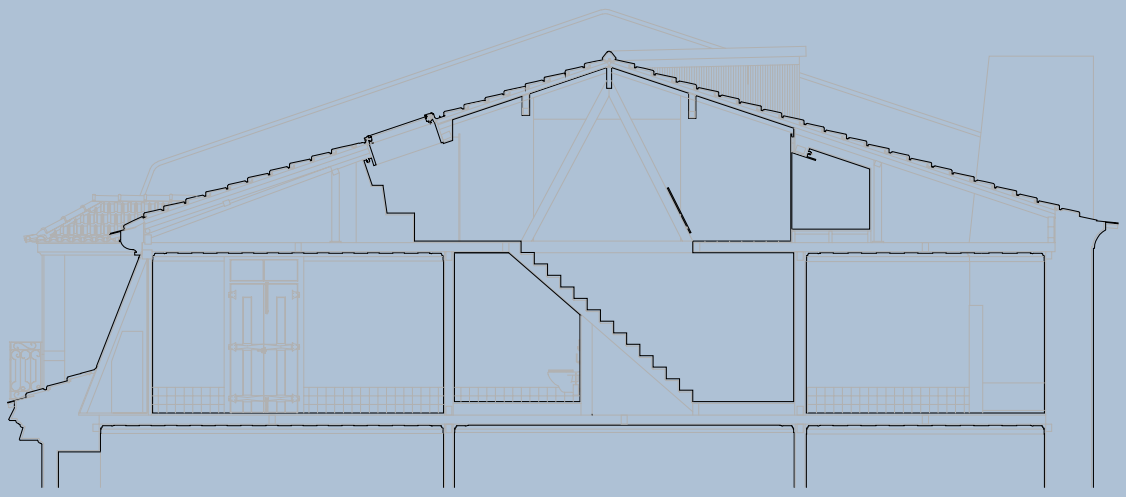


Ground floor
Changes introduced by the renovation project



Courtyard façade
(FG+SG – Fotografia de Arquitectura)





Section 1:100
(drawing | Atelier do Bugio)

Bedrooms in the attic
(photo | Leonardo Finotti)

Original construction Late 18th century
Renovation work 2005 · 2006
Initial and current functional type 2 flats per floor block of flats

–

Archive information Arquivo Intermédio CML (Obra 154) [Plan drawings]

3 | LISBON

RUA DA ALFÂNDEGA 108, 3rd floor

Library and office
(photo | Leonardo Finotti)

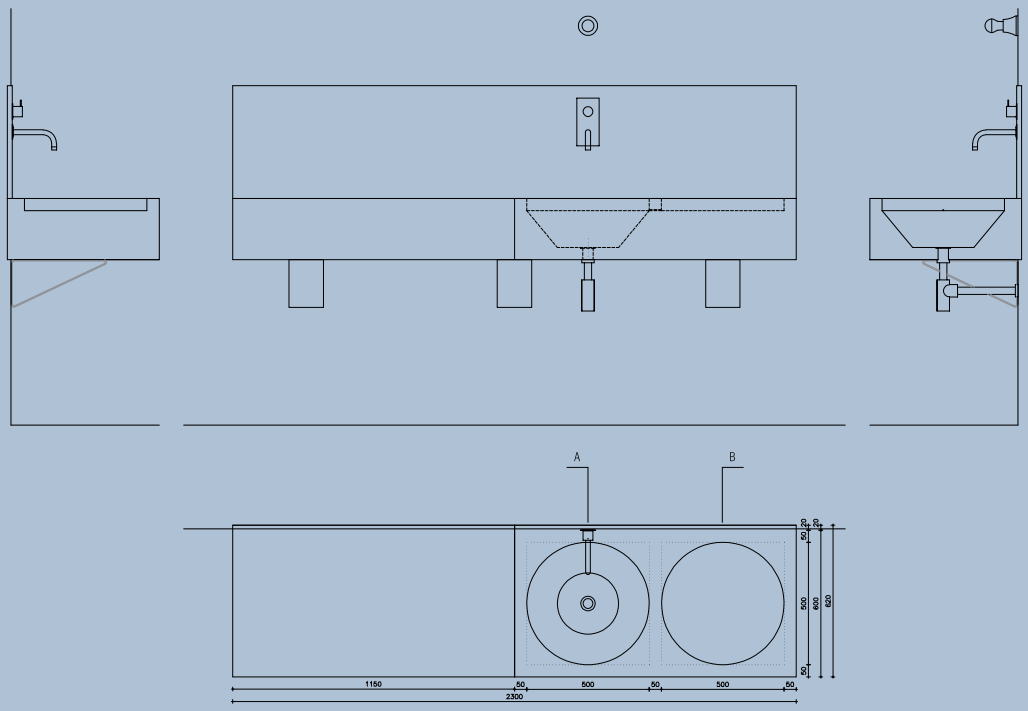
Architectural design Atelier do Bugio – João Favila

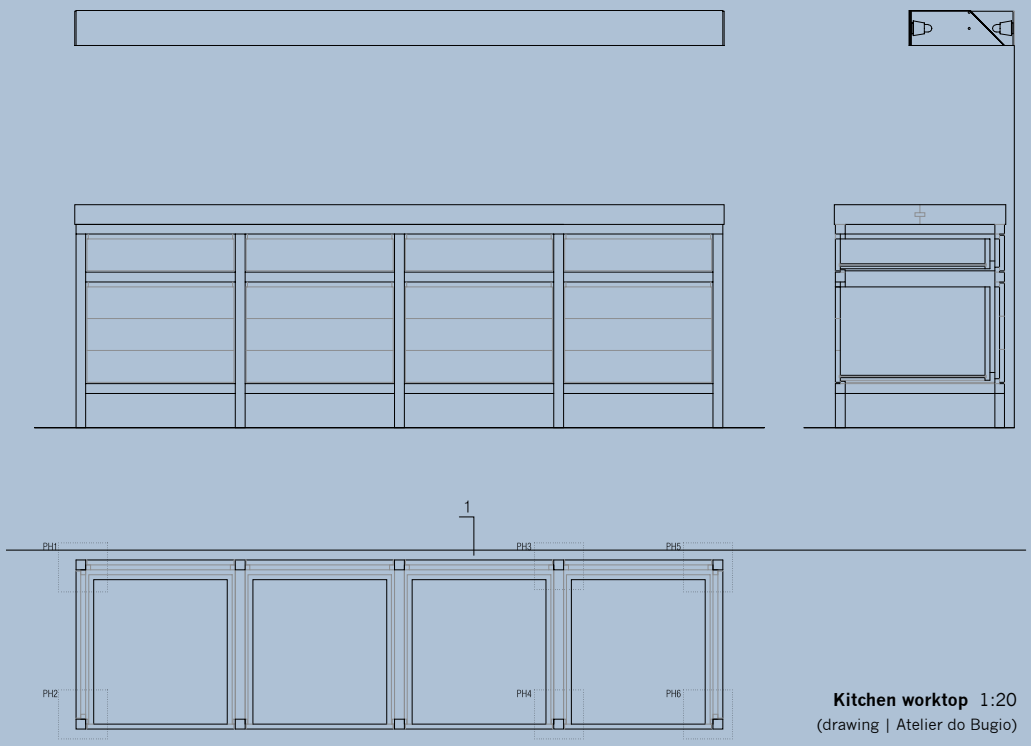
–

Contractor Afonso e Oliveira Construções, Lda.
Site supervision Nuno Pereira da Silva
Plumbing and heating installation Pedro Pacheco e Paula Rosa, Lda.

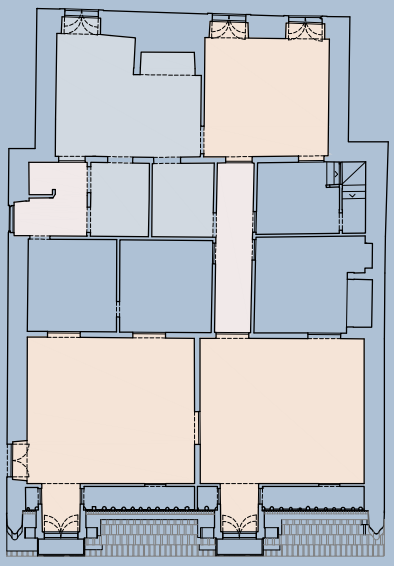
Kitchen
(photo | Leonardo Finotti)

Kitchen sink 1:25
(drawing | Atelier do Bugio)

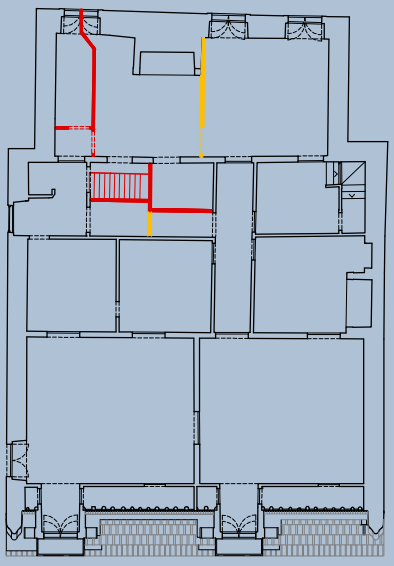




Kitchen worktop 1:20
(drawing | Atelier do Bugio)



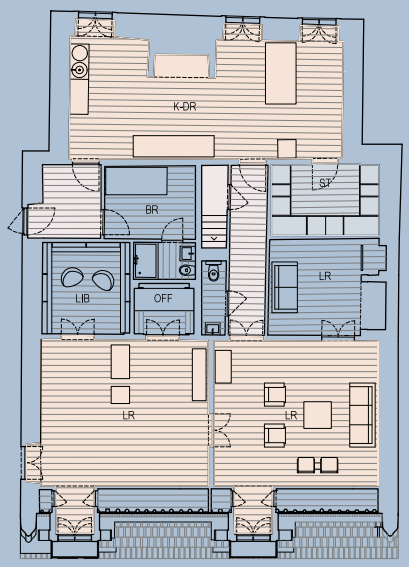
3rd floor 1:200
Reconstituted original plan

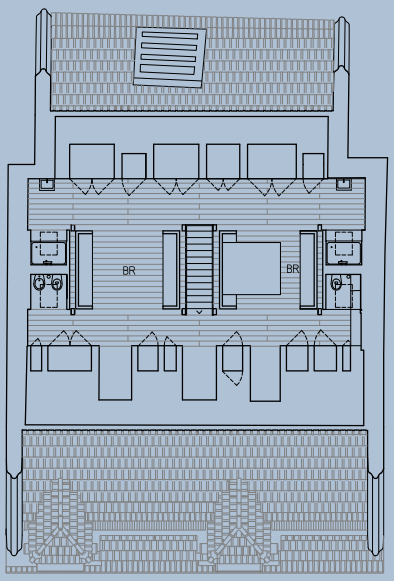


3rd floor
Changes introduced to the original plan throughout the 20th century

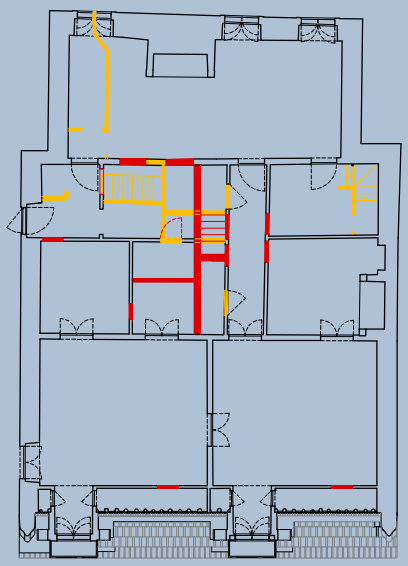
Service areas
Social areas
Circulation areas

0 1 5





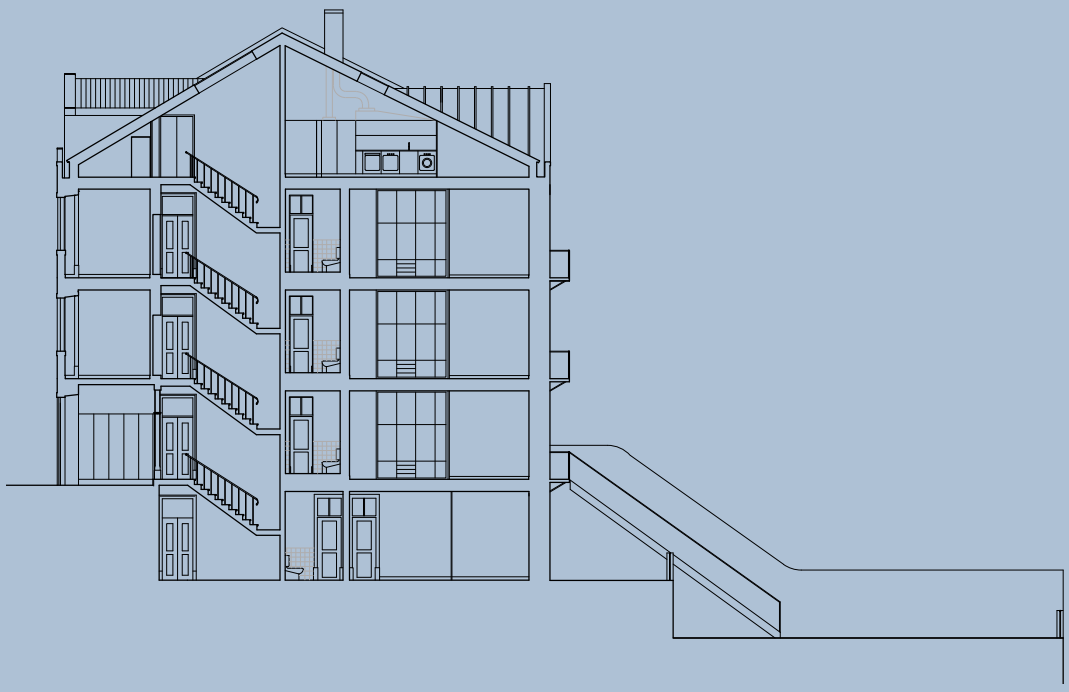
3rd floor | Attic
Final plan after renovation



3rd floor
Changes introduced by the renovation project

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



Section after renovation 1:200
(drawing | José Adrião Arquitecto)

Original construction ca. 1890
Renovation work 2003 · 2006
Initial and current functional type 1 flat per floor block of flats

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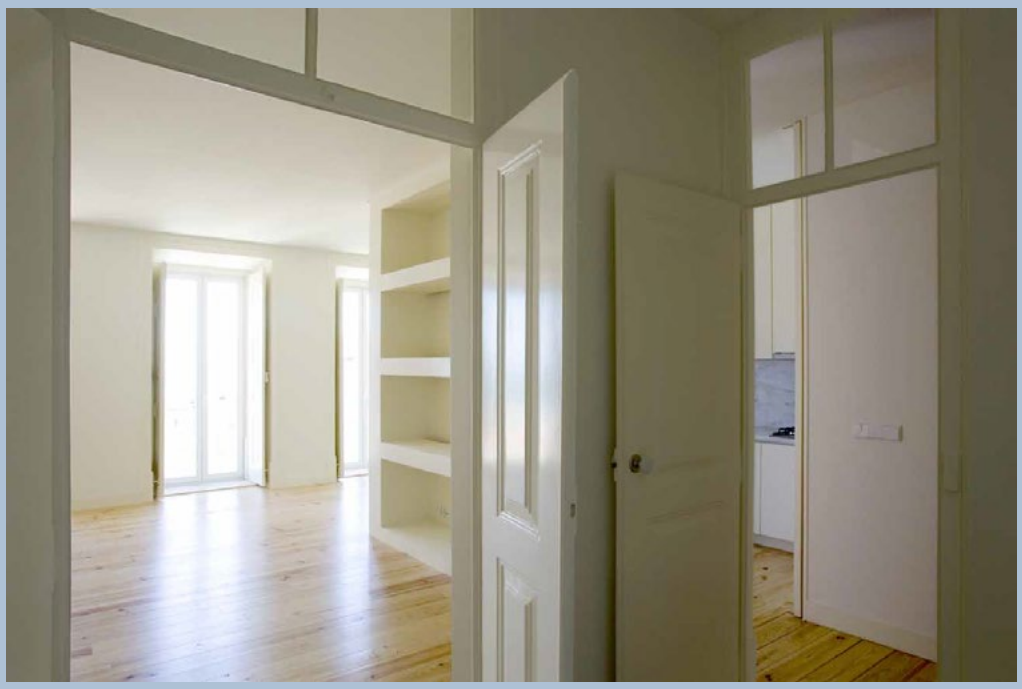
Archive information Arquivo Intermédio CML (Obra 22709) [Original and plan drawings]

4 | LISBON

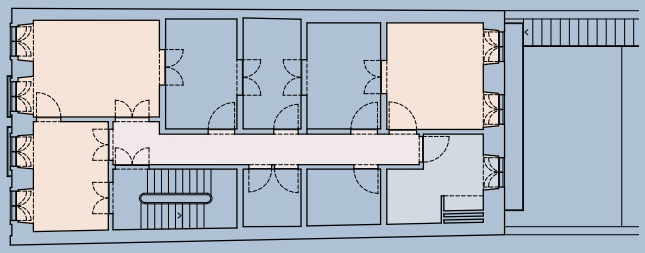
RUA DA LAPA 89



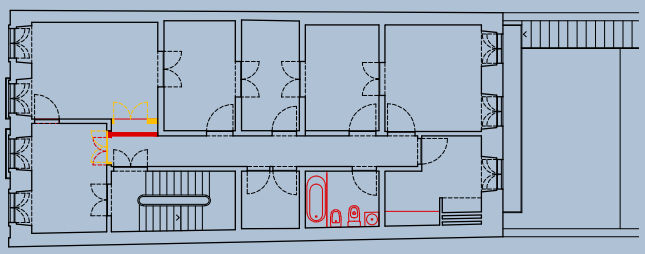
Living room and kitchen
(photo | Enric Vives-Rubio)

Architectural design José Adrião Arquitecto
Project manager Carla Gonçalves
Architectural team Luís Valente, Rui Didier, Tatiana Mourisca, Tiago Mota
Structural design ARA – Alves Rodrigues & Associados, Lda.
Systems engineering acribia – Projectos e Desenho técnico, Lda.
Heating and ventilation design | Site inspection Perfectus – Consultoria e Fiscalização de Obra, Lda.

–
Contractor Paviana construções, Lda.



1st floor 1:200
Reconstituted original plan

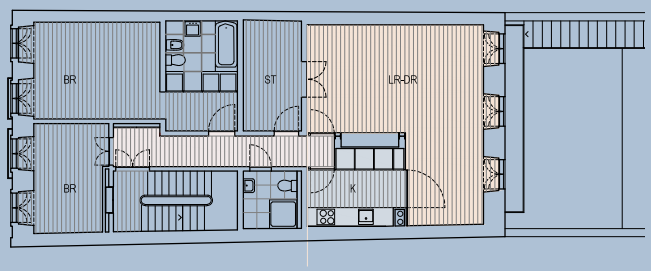


1st floor
Changes introduced to the original plan throughout the 20th century

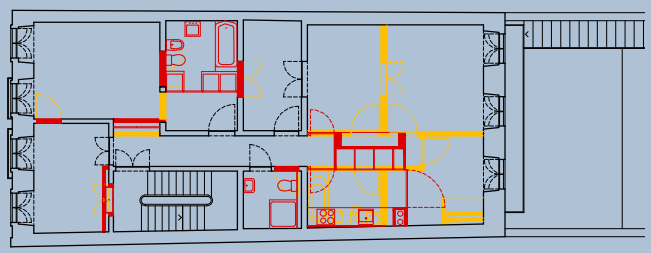
Service areas
Social areas
Circulation areas

Types of rooms

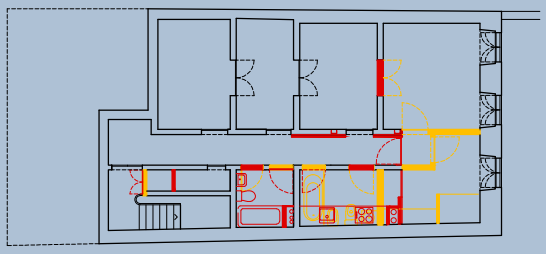
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



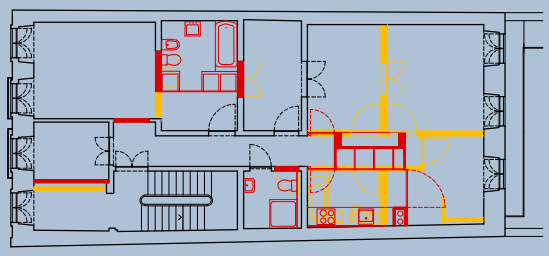
1st floor
Final plan after renovation



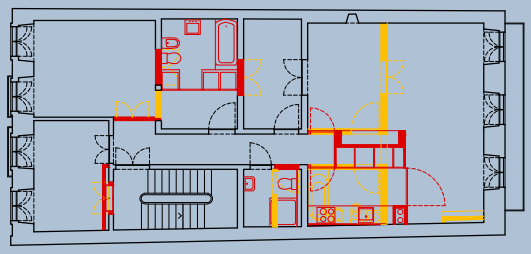
1st floor
Changes introduced by the renovation project



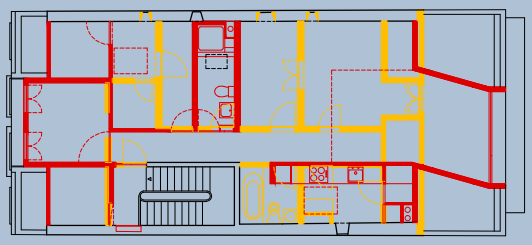
Lower ground floor 1:200
Changes introduced by the renovation project



Ground floor
Changes introduced by the renovation project

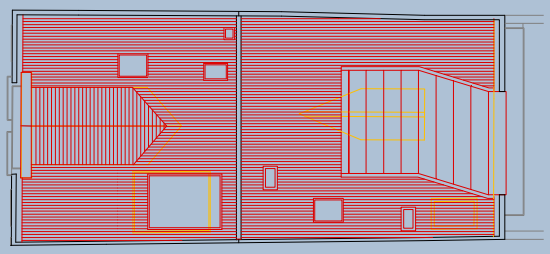


2nd floor
Changes introduced by the renovation project

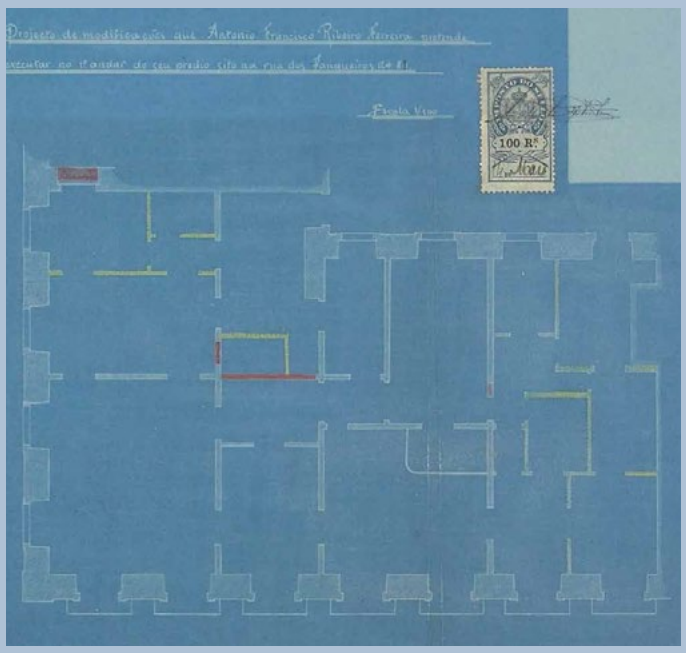


3rd floor
Changes introduced by the renovation project

Street and courtyard façade
(photos | Enric Vives-Rubio)



Roof
Changes introduced by the renovation project



Changes to 1st floor, 1907
scaled to aprx. 1:200
(AML – Obra 1590; Processo 3556)

Original construction ca. 1784
Renovation work 2007 · 2011
Initial functional type 1 or 2 flats per floor block of flats
Current functional type 3 flats per floor block of flats

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Archive information Arquivo Intermédio CML (Obra 1590) [Plan drawings]

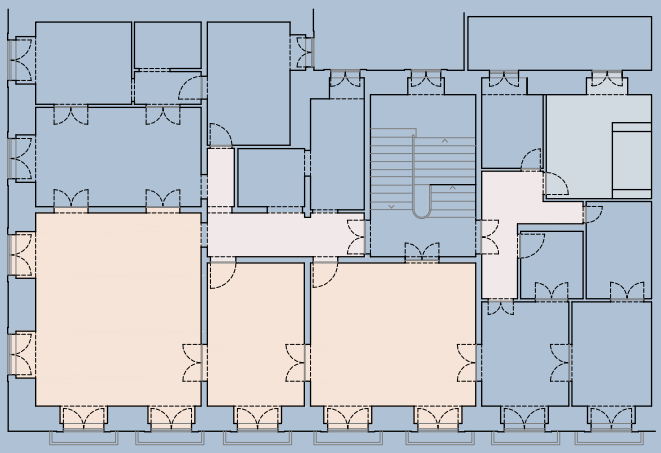
5 | LISBON

RUA DOS FANQUEIROS 73-85

Corridor and bathroom
(FG+SG – Fotografia de Arquitectura)

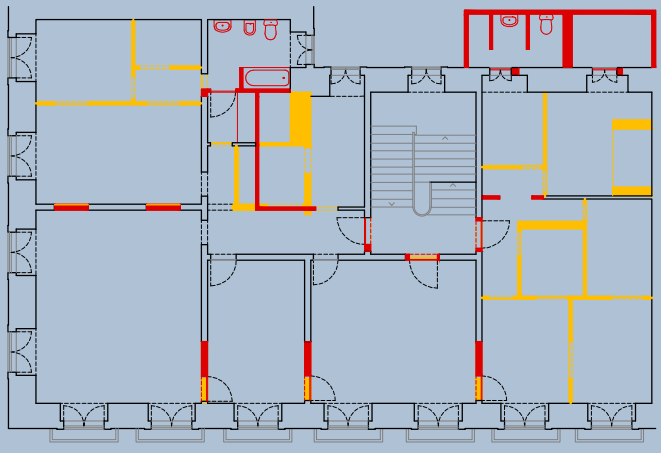
Architectural design José Adrião Arquitecto
Project manager Tiago Mota (Stage 1), Carla Gonçalves (Stage 2)
Architectural team Luís Valente, Rui Didier, Margarida Lameiro (Stage 1)
Margarida Lameiro, Ricardo Inglez, Rute Ribeiro, Sara Jardim, João Matos (Stage 2)
Structural design ARA – Alves Rodrigues & Associados, Lda.
Systems engineering acribia – Projectos e Desenho técnico, Lda.
Site inspection Grese – Estudos, Projectos e Gestão de obras; Interseta – Arquitectura, Design e Gestão de Obra
–
Contractor Paviana construções, Lda.
Decoration Ugo-Juan de Mayoralgo & Javier Carrasco

Management Baixa House | Lalola Unipessoal Lda.



1st floor 1:200
Reconstituted original plan

Street façade
(FG+SG – Fotografia de Arquitectura)



1st floor
Changes identified to the original plan throughout the 20th century

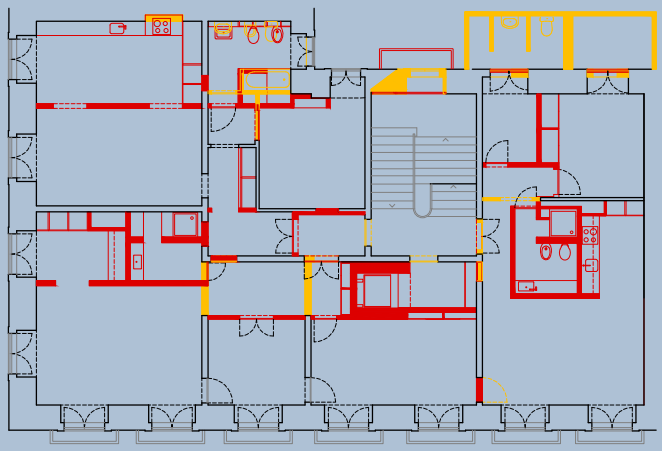
Service areas
Social areas
Circulation areas

0 1 5

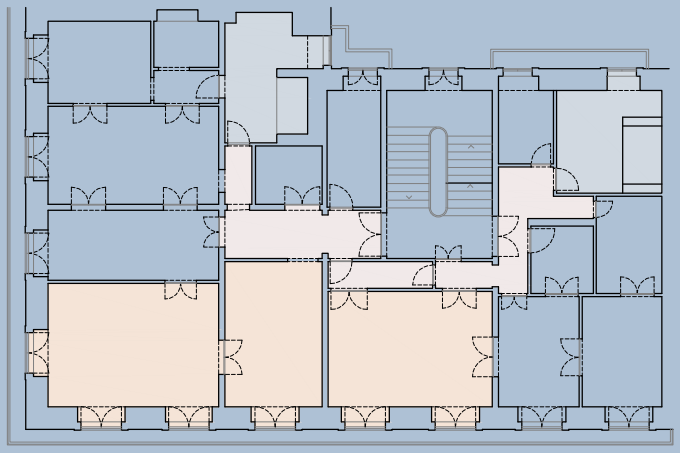
Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office

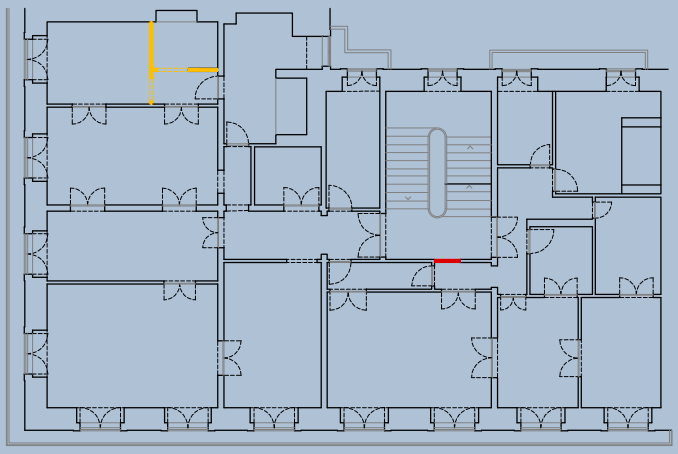
1st floor
Final plan after renovation



1st floor
Changes introduced by the renovation project



4th floor 1:200
Reconstituted original plan



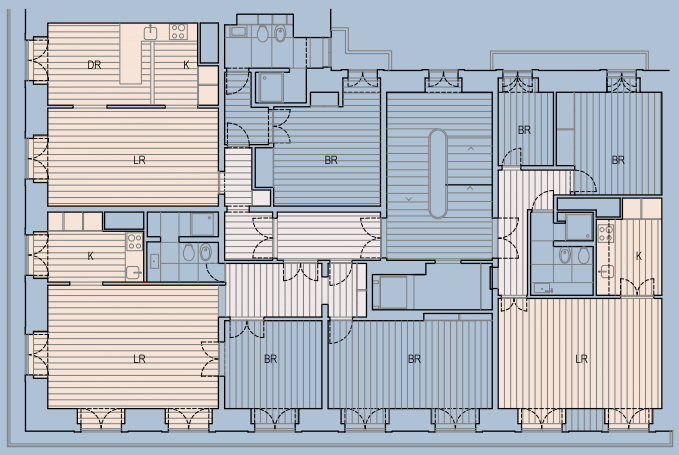
4th floor
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

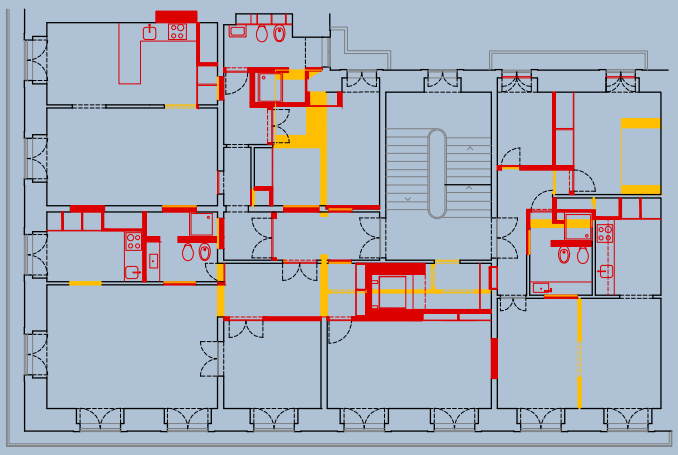
0 1 5

Types of rooms

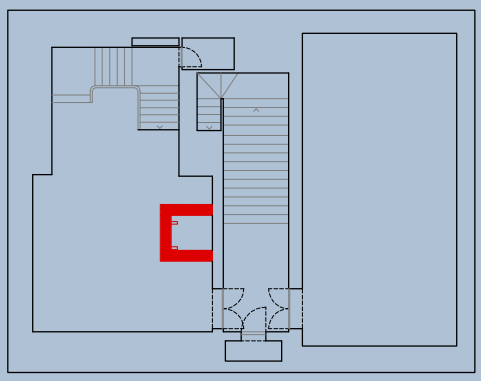
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



4th floor
Final plan after renovation

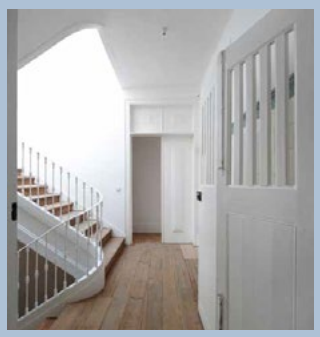


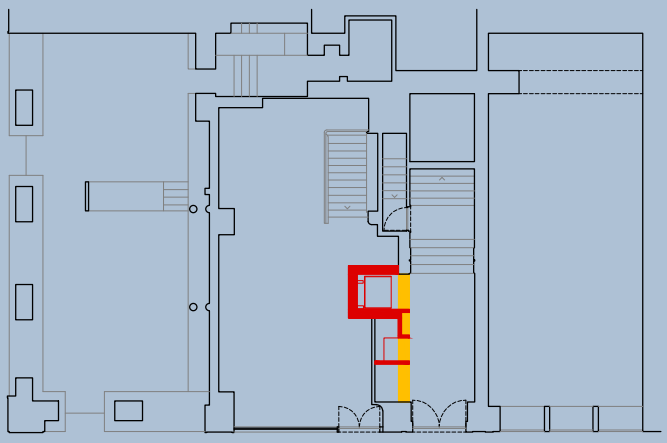
4th floor
Changes introduced by the renovation project



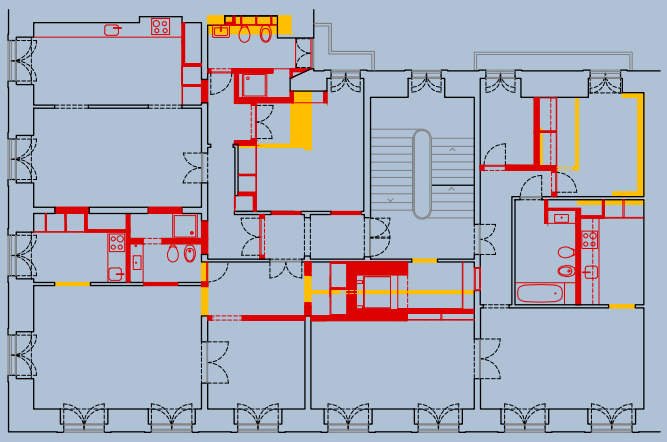
Basement 1:200

Living room and kitchen
Staircase
(FG+SG – Fotografia de Arquitectura)

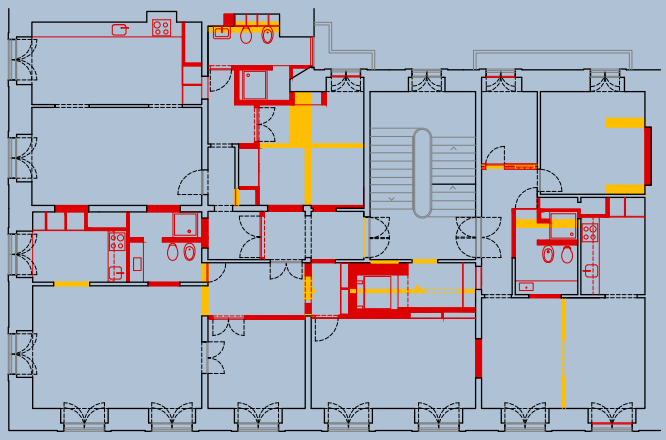




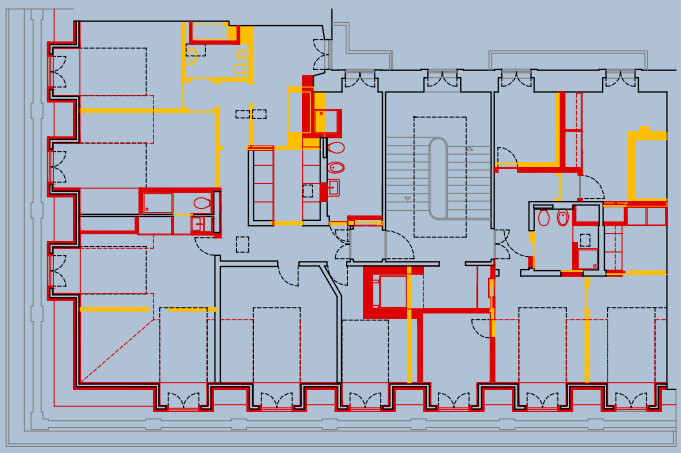
Ground floor



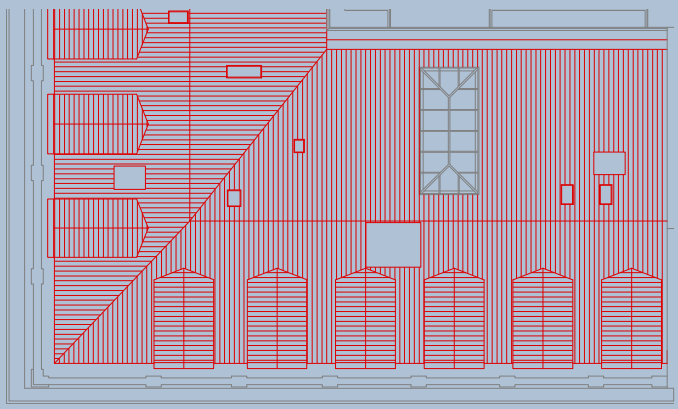
2nd floor
Changes introduced by the renovation project



3rd floor

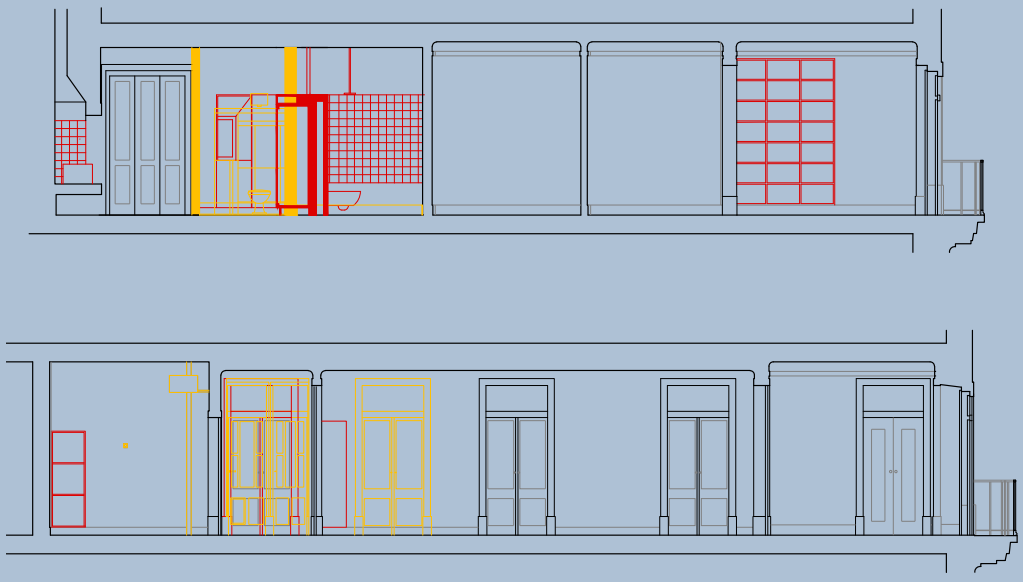


5th floor

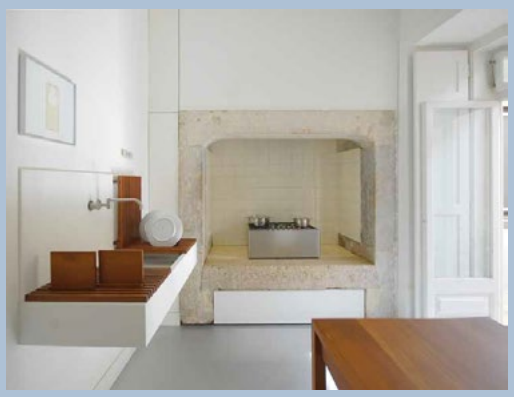


Roof

Changes introduced by the renovation project



Sections 1:100
(drawings and photos | Pedro Pacheco)



Original construction Late 18th century (lower floors) | ca. 1884 (3rd-5th floors)
Renovation work 2010
Initial and current functional type 1 flat per floor block of flats

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Archive information Arquivo Intermédio CML (Obra 36639) [Original and Plan drawings]

6 | LISBON

RUA DAS PEDRAS NEGRAS 5, 3rd floor

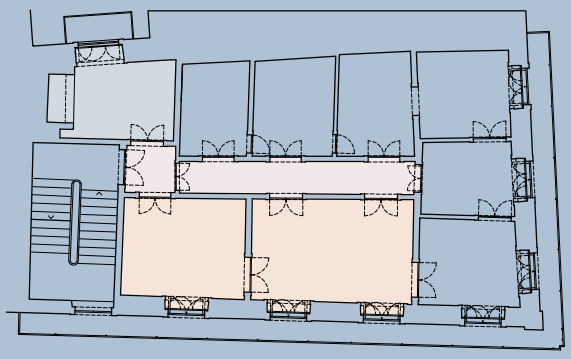
Bedroom and library
(photo | Pedro Pacheco)

Architectural design Pedro Pacheco
Architectural team Leonor Pereira, Joana Morim
Structural design Fernando Rodrigues
Plumbing design João Guimarães
Gas design Paulo Alexandre | **Installation** C.A.C Fernandes
Electrical design EPOCH | **Installation** Carlos Pereira

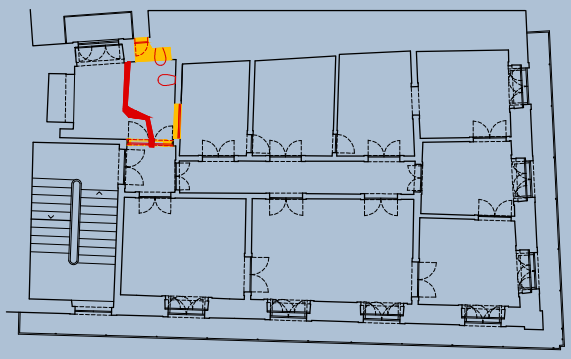
–

Contractor Nuno Rodrigues
Carpentry Móveis Durão, Lda.
Aluminium flooring for kitchen Lasindustria, Certos Aluminio
Window joints PLANET
Bathtub and sink CORIAN_TAMPCOR, Transformação e Criatividade, Lda.
Electrical switches and sockets Berker Glass and 1930 series

Street view
(photo | Pedro Pacheco)



3rd floor 1:200
Reconstituted original plan



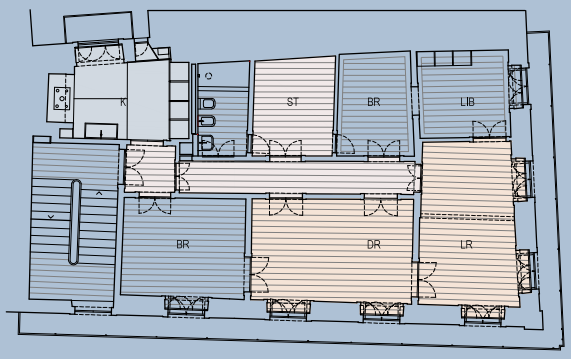
3rd floor
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

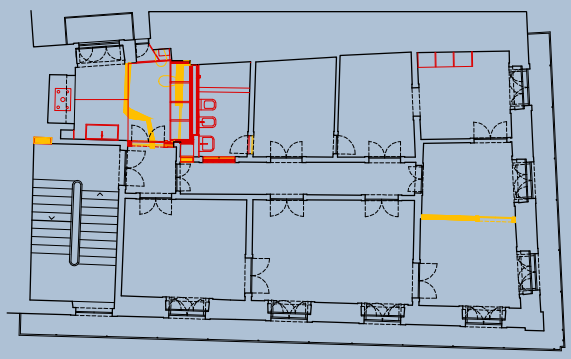
0 1 5

Types of rooms

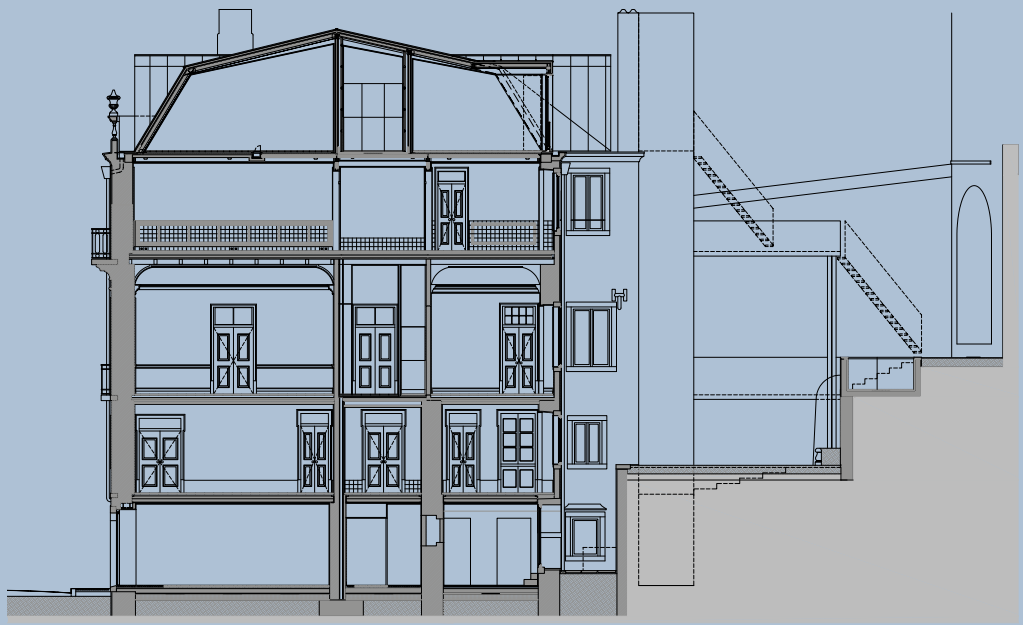
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



3rd floor
Final plan after renovation



3rd floor
Changes introduced by the renovation project



Section after renovation 1:200
(drawing | Aires Mateus e Associados)

Courtyard façade and lift
(photo | Catarina Wall Gago)

Original construction ca. 1774 (GF, 1st) | 1792 (2nd) | 1796 (3rd, 4th)
Renovation work 2012 · 2015
Initial and current functional type 1 flat per floor block of flats

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Archive information Arquivo Intermédio CML (Obra 30777) [Plan drawings]

7 | LISBON

RUA CECILIO DE SOUSA 52-56

Living room, 2nd floor
(photo | Catarina Wall Gago)

Architectural design Aires Mateus e Associados – Manuel Aires Mateus
Project manager Inês Cordevil
Structural design and systems engineering afaconsult
Metallic roof structural design FUTURENG – Projectos de construção civil, Lda.

–

Contractor Carvalho e Gomes Figueiredo, S.A.
Tile restoration work Susana do Rosário
Paintwork restoration Lara Aladina Carvalho

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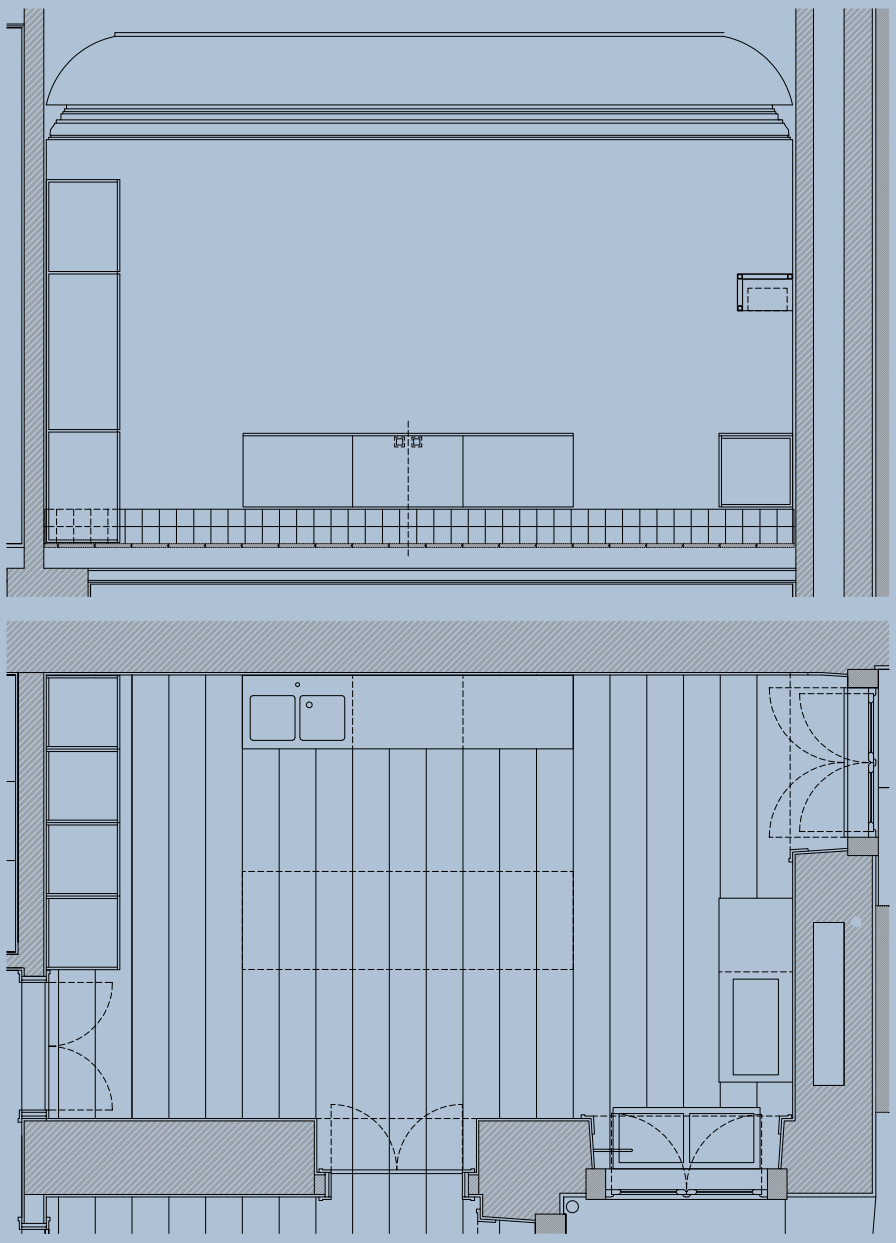
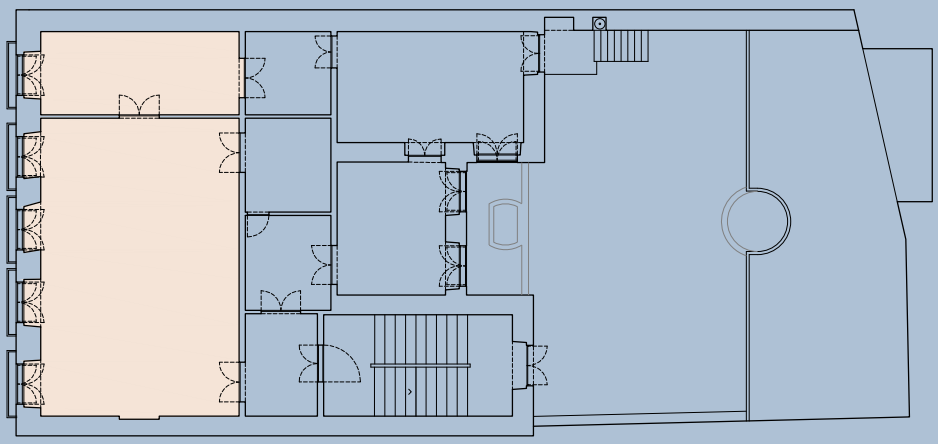
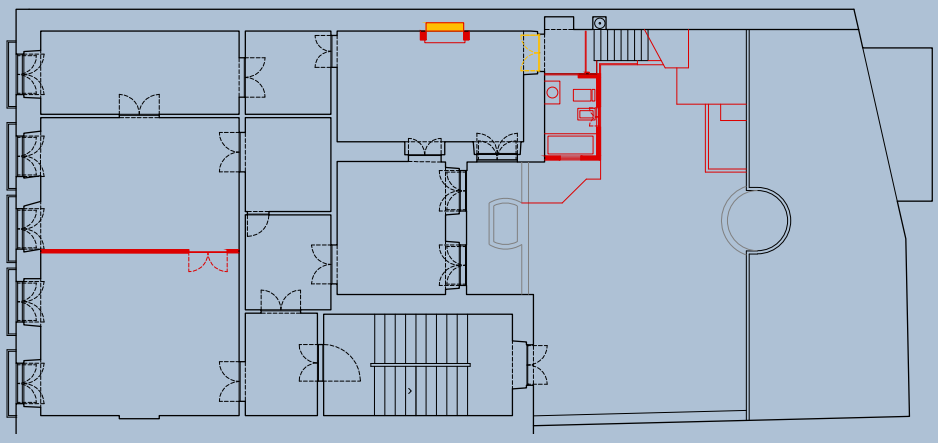
Historical study José Sarmento de Matos and Jorge Ferreira Paulo, 2010

Bathroom
Kitchen, 2nd floor 1:50
(plans and sections | Aires Mateus e Associados)





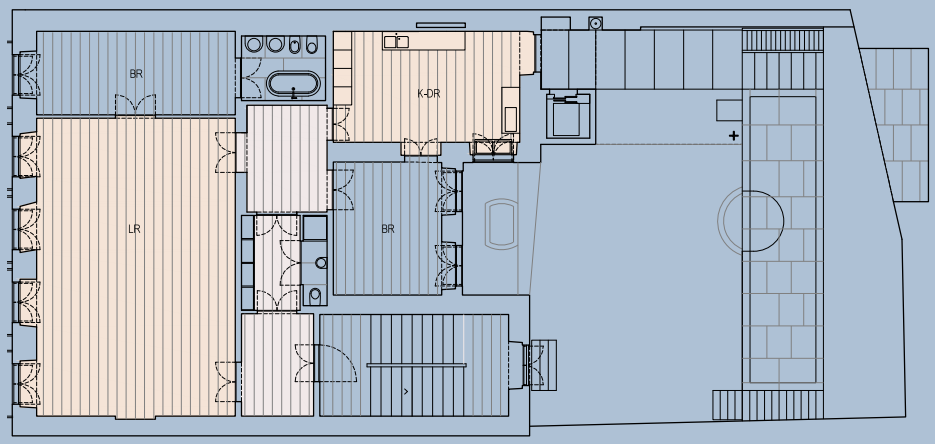
2nd floor 1:200
Reconstituted original plan



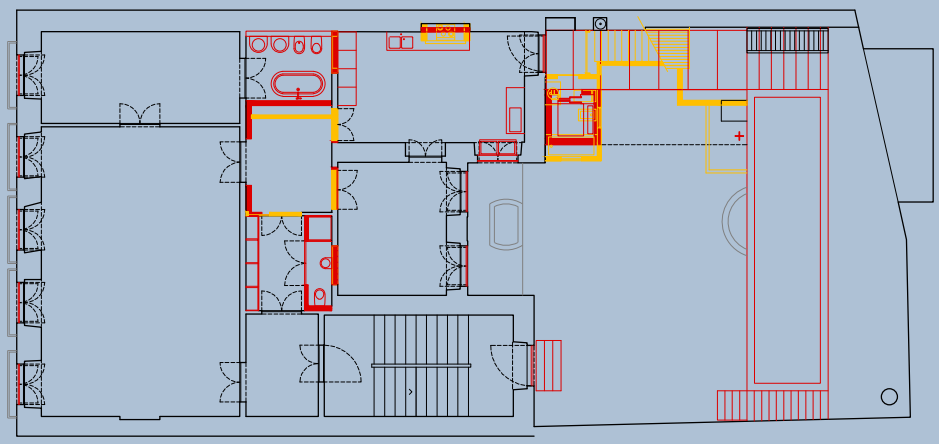
2nd floor
Changes introduced to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

0 1 5



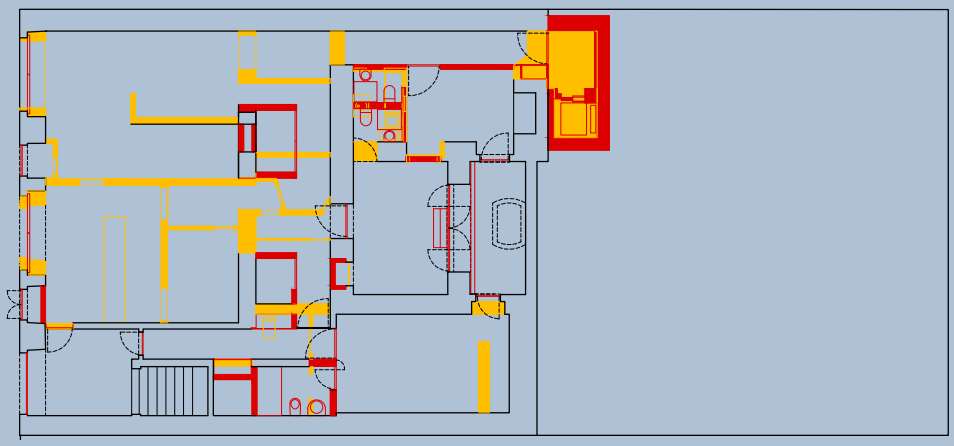
2nd floor
Final plan after renovation



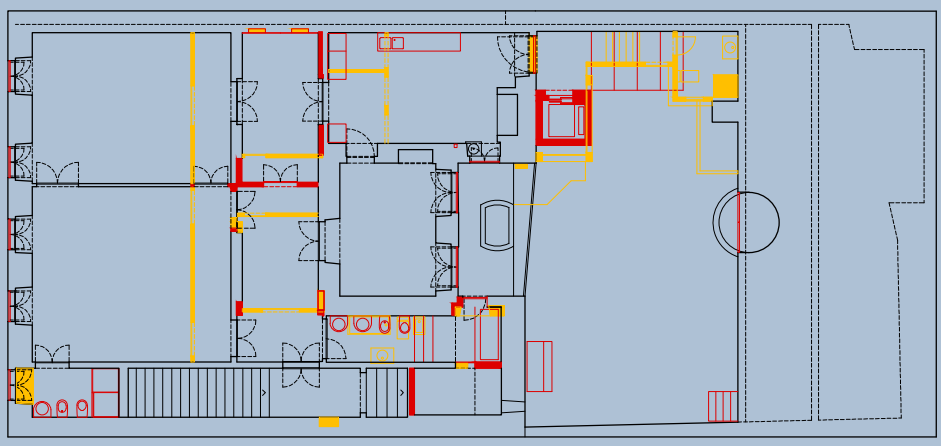
2nd floor
Changes introduced by the renovation project

Types of rooms

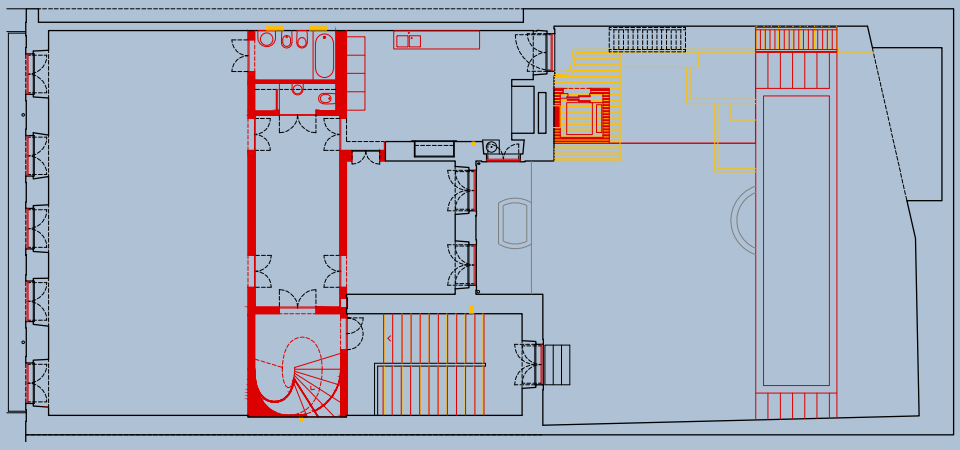
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



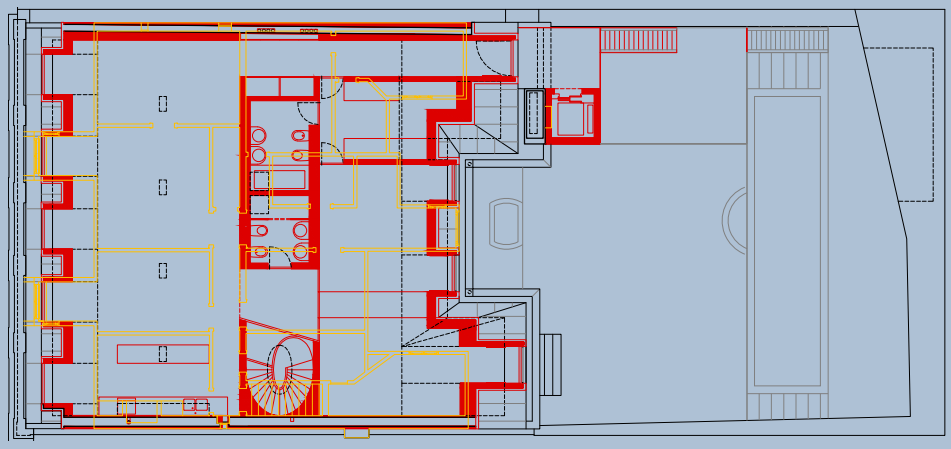
Ground floor 1:200
Changes introduced by the renovation project



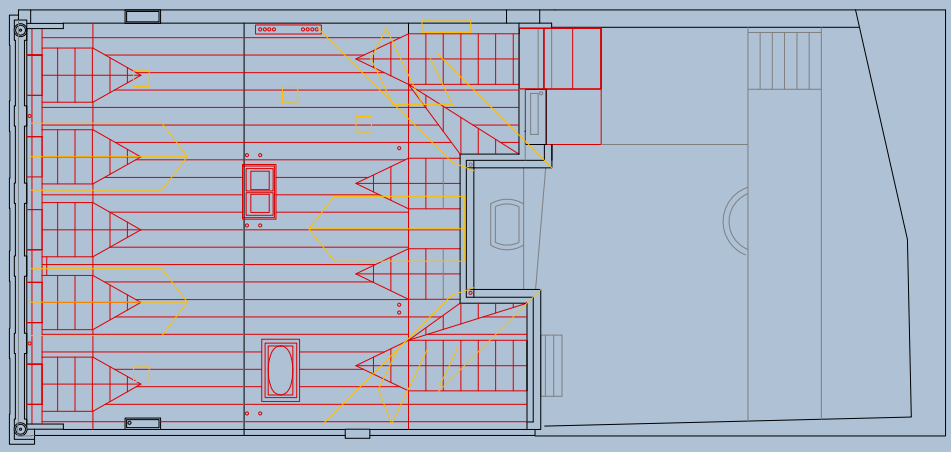
1st floor
Changes introduced by the renovation project



3rd floor



4th floor



Roof

Changes introduced by the renovation project

Street elevation 1:200
(drawings | Appleton & Domingos)

Original construction Late 18th century
Renovation work 2006 - 2007
Initial functional type 1 flat per floor block of flats
Current functional type 2 flats per floor block of flats

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Archive information Arquivo Intermédio CML (Obra 4152) [Plan drawings]

8 | LISBON

RUA NOVA DO CARVALHO 43-51

Living room with double windows
(FG+SG – Fotografia de Arquitectura)

Architectural design Appleton & Domingos arquitectos, Lda. – João Appleton and Isabel Domingos
Architecture team Christophe Tilliet and Inês Blanc de Sousa
Structural design A2P Consult – Estudos e Projectos, Lda. – João and Vasco Appleton, with João Fonseca
Plumbing design Termifrio – Serafin Graña
Electrical and telecommunications design Quanti – Luís Alegra
Acoustic consultant Acústica e Ambiente – Pedro Martins da Silva

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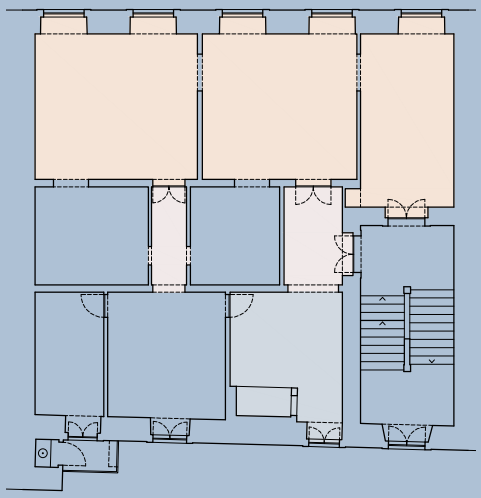
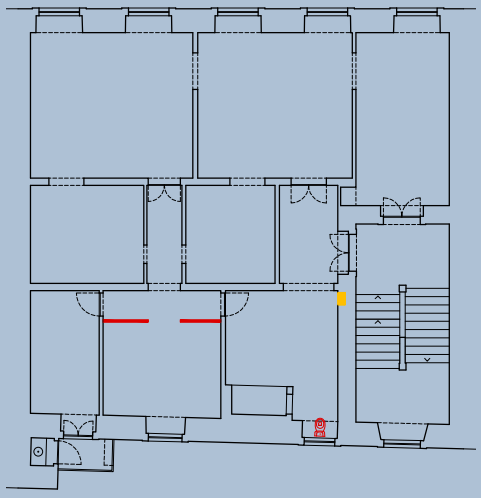
Contractor Comporto
Site inspection Tecnoplano

Street façade
Entrance corridor
(FG+SG – Fotografia de Arquitectura)



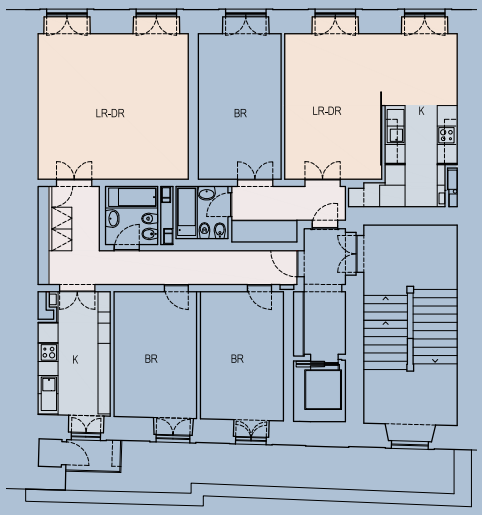
3rd floor 1:200
Reconstituted original plan



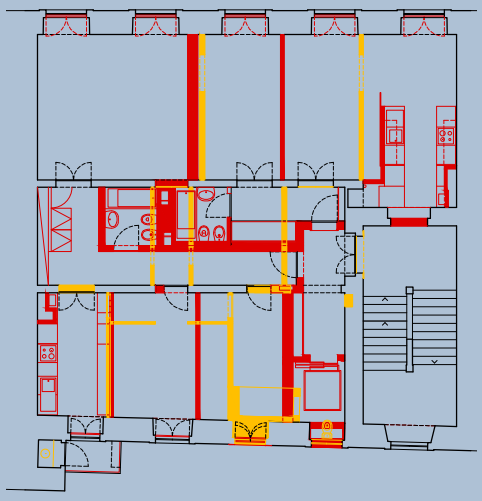
3rd floor
Changes introduced to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

0 1 5



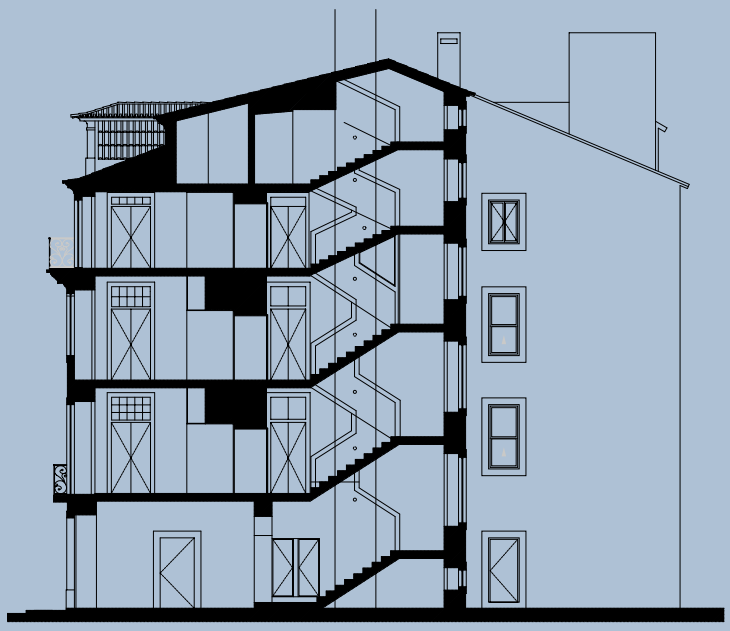
3rd floor
Final plan after renovation



3rd floor
Changes introduced by the renovation project

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



Street façade
Section 1:200
(drawings | Appleton & Domingos)

Original construction Late 18th century
Renovation work 2008 · 2009
Initial and current functional type 1 flat per floor block of flats

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Archive information Arquivo Intermédio CML (Obra 39490) [Plan drawings]

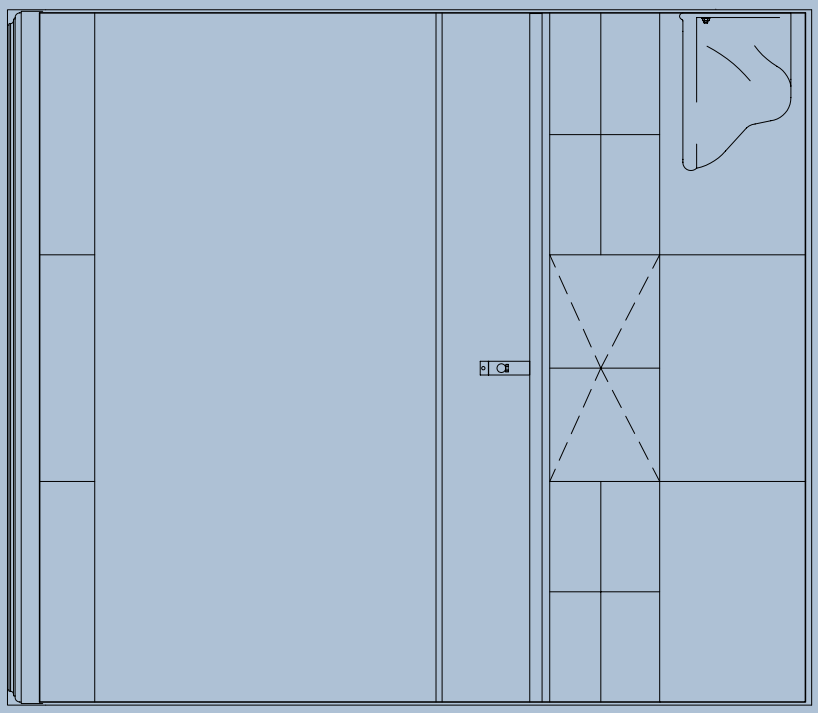
9 | LISBON

RUA DE SÃO MAMEDE 31

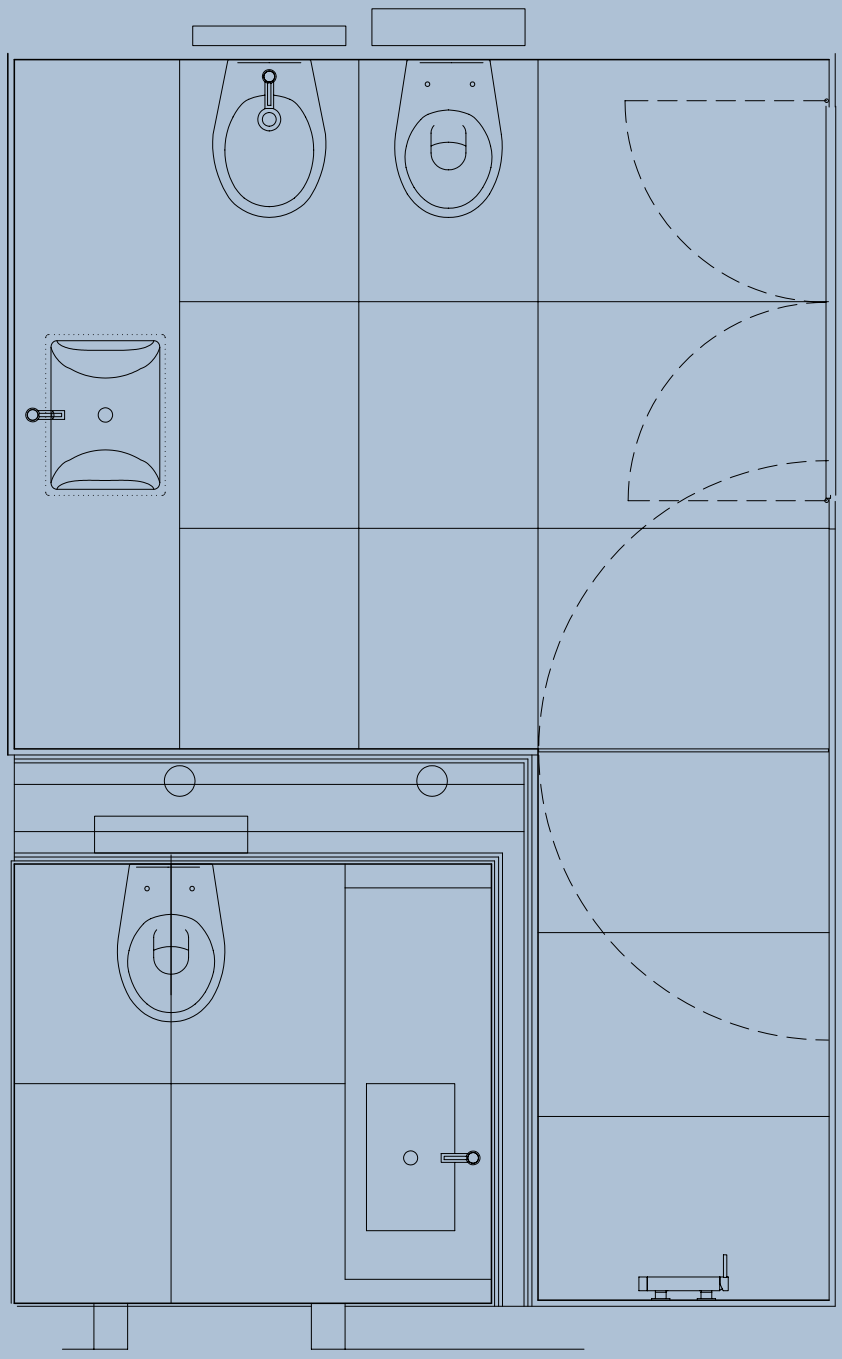
Balcony
(photo | Catarina Wall Gago)

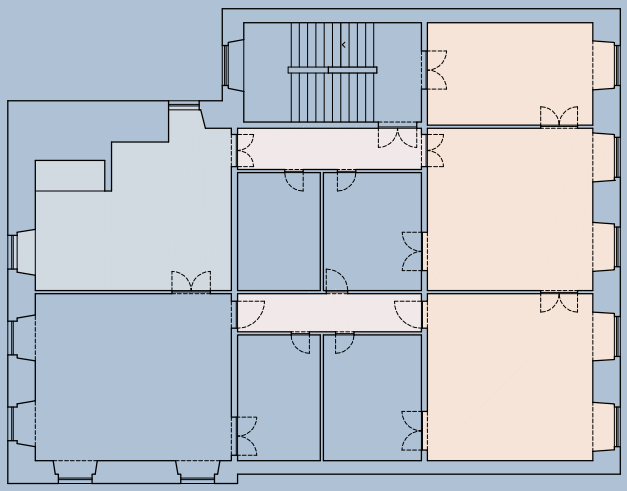
Architectural design Appleton & Domingos arquitectos, Lda. – João Appleton and Isabel Domingos
Structural design A2P Consult – Estudos e Projectos, Lda.
Plumbing and gas design Termifrio
Electrical and telecommunications design Quanti – Luís Alegra

–
Carpentry Guarnição

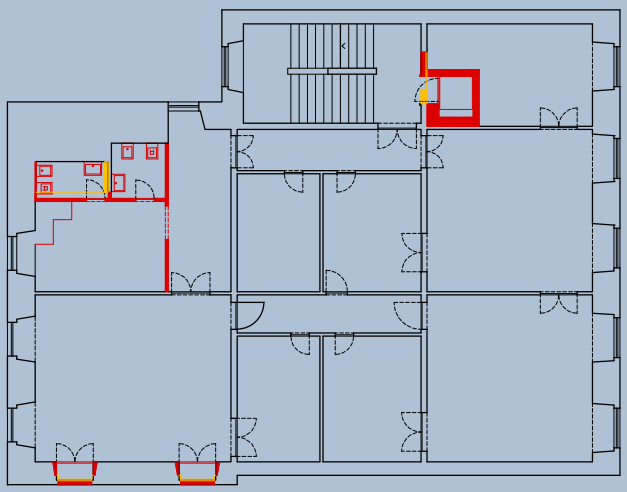


Bathroom, 3rd floor 1:20
(plan and section | Appleton & Domingos)





1st floor 1:200
Reconstituted original plan



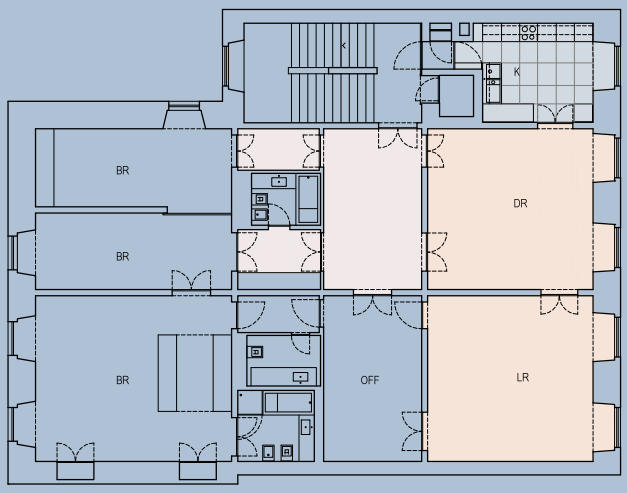
Service areas
Social areas
Circulation areas

0 1 5

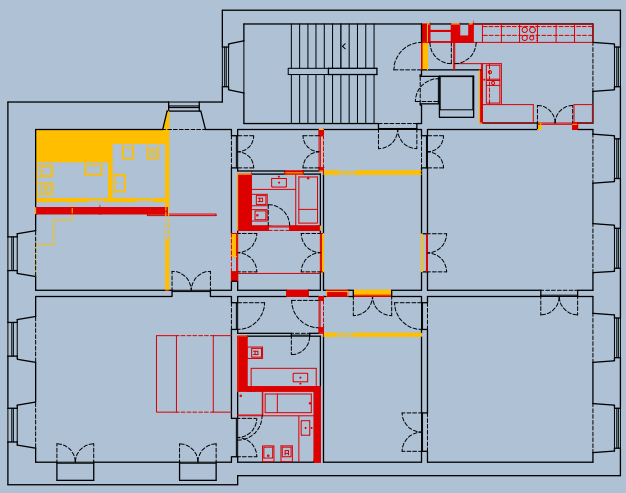
1st floor
Changes identified to the original plan throughout the 20th century

Types of rooms

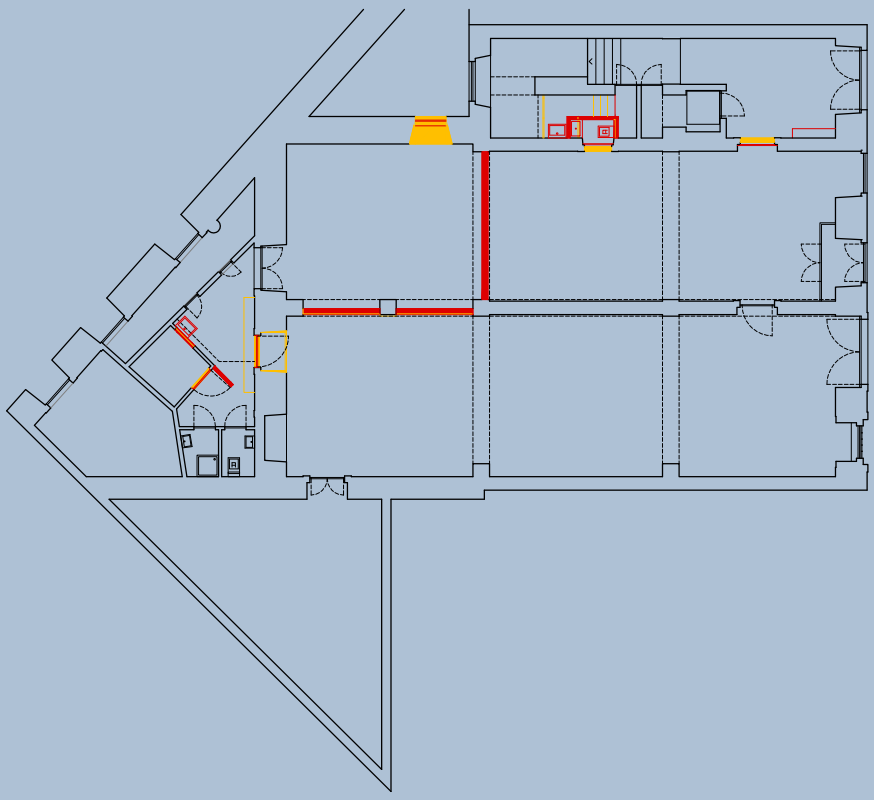
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



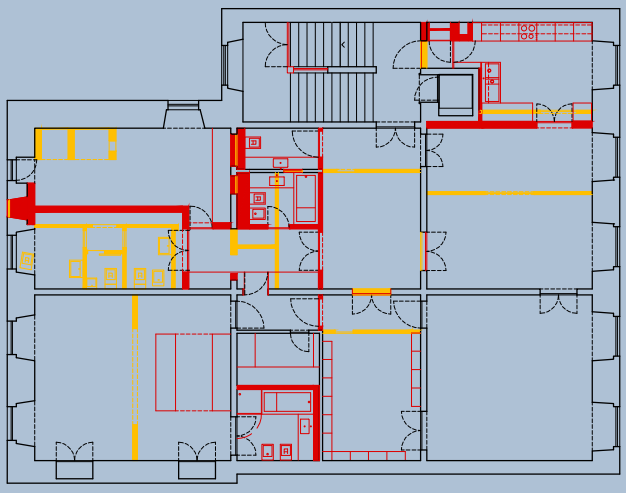
1st floor
Final plan after renovation



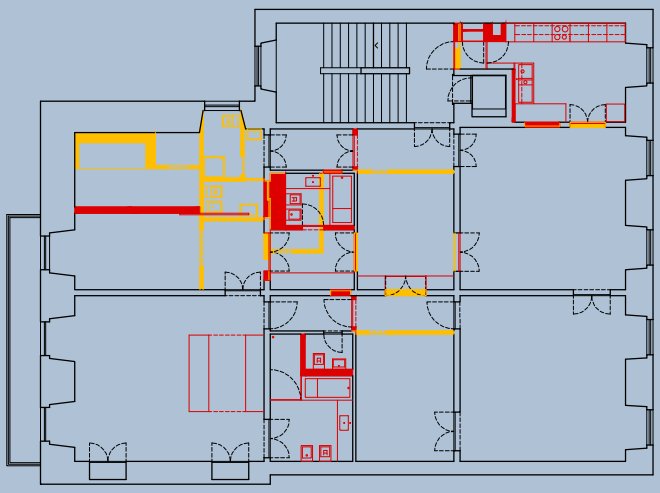
1st floor
Changes introduced by the renovation project



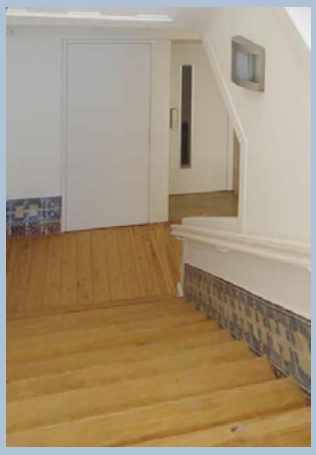
Ground floor
Changes introduced by the renovation project



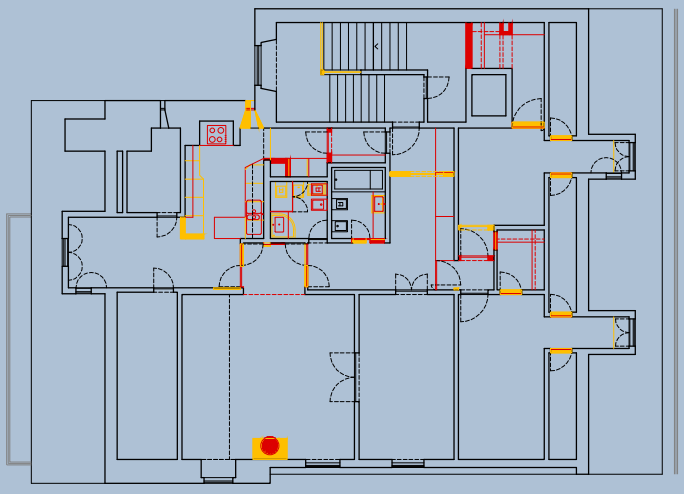
2nd floor
Changes introduced by the renovation project



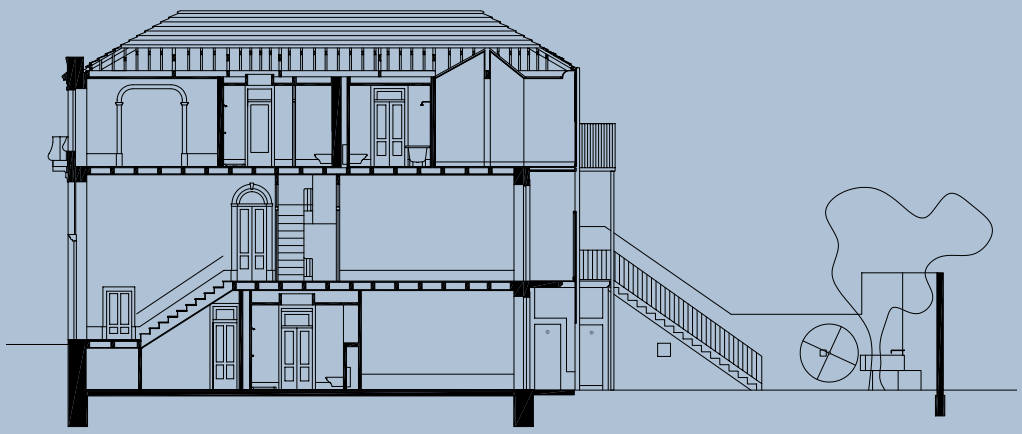
3rd floor
Changes introduced by the renovation project



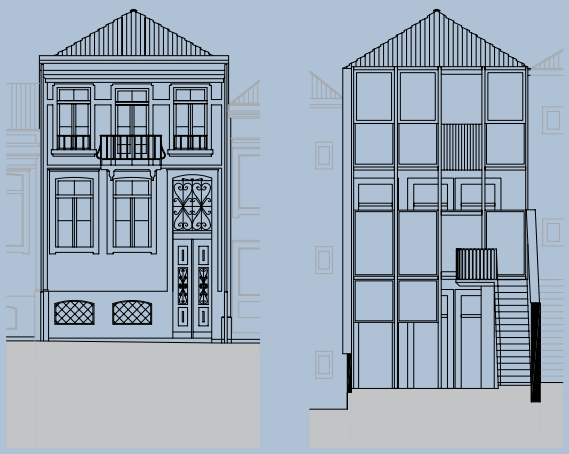
Staircase and lift
Living room
(photos | Catarina Wall Gago)



4th floor
Changes introduced by the renovation project



Section 1:200
Street and courtyard elevations
(drawings | aNC arquitectos)



Original construction ca. 1893 | 1925 (top floor)
Renovation work 2004 - 2005
Initial and current functional type Single-family terraced house

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Archive information Arquivo Histórico Municipal do Porto (D-CMP-07-125-049 to 052) [Original drawings]
(D-CMP-09-449-281 to 284) [Original drawings for top floor]
Arquivo do Licenciamento das Aguas do Porto (n° 3598, 1936) [Connection to sewage network]

10 | OPORTO

RUA DUQUE DE SALDANHA 600

Bathroom and dressing room
(photo | João Ferrand)

Architectural design aNC arquitectos – Teresa Novais and Jorge Carvalho
Project manager Teresa Novais
Architectural team Olivier Arndt, Nuno Silva, Rafael Sousa, Jorge Toscano, Tiago Branco (Project)
Maria Luísa Meneses, Jorge Toscano (Construction site)
Structural design AFA associados – Guilhermina Barreto
Electrical design Gpic, Projectos, Instalações e Consultoria, Lda. – Fernando Aires
Heating and ventilation design EnesCoord, Coordenação e Gestão de projectos e Obras, Lda. – Nuno Enes
Plumbing design EnesCoord, Coordenação e Gestão de projectos e Obras, Lda. – Rui Enes

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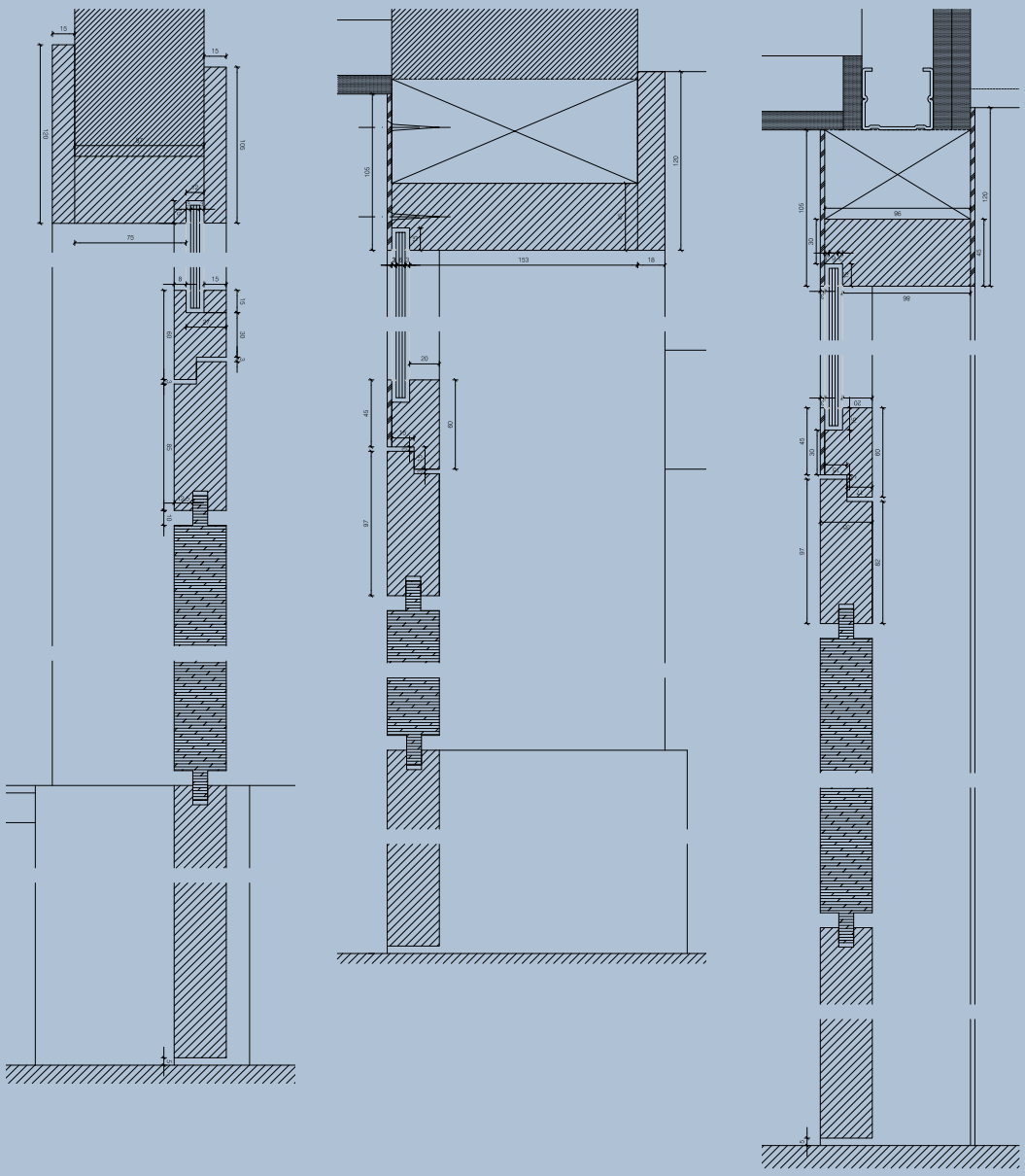
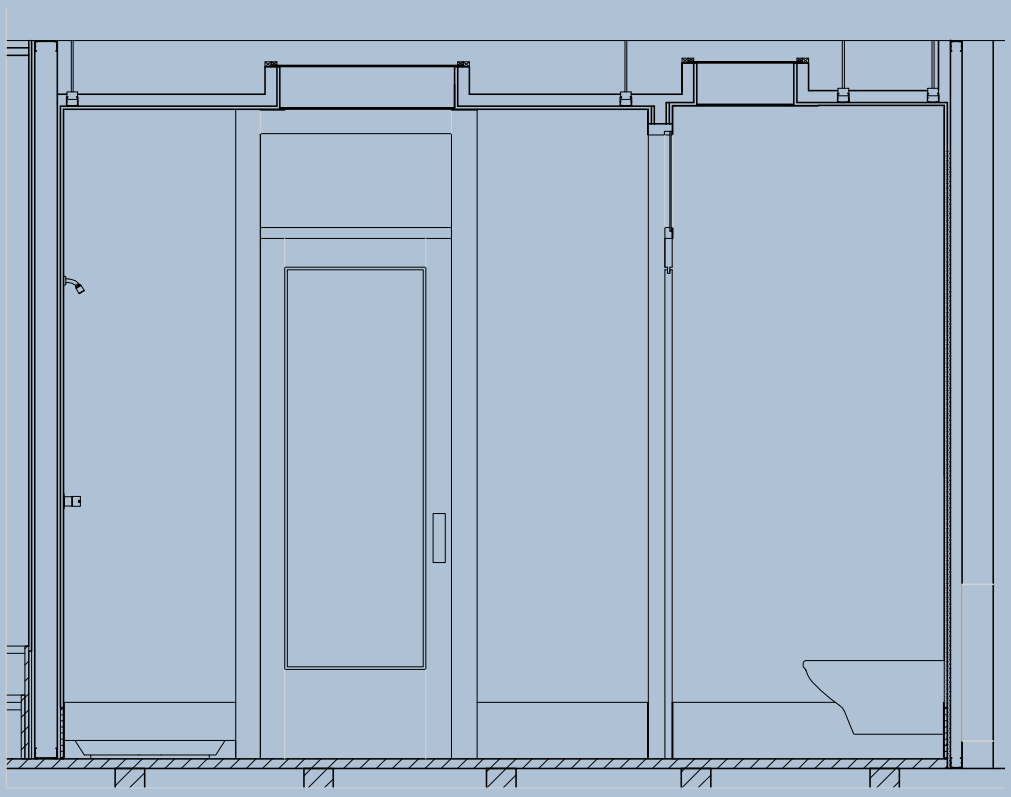
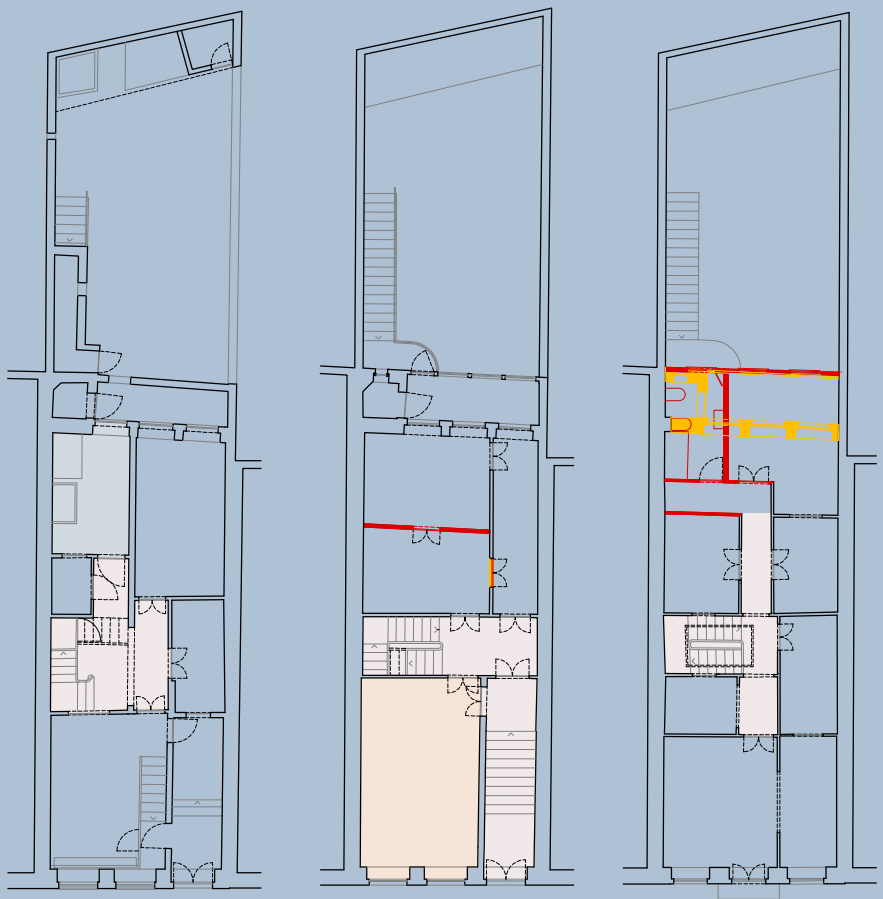
Contractor Secular, reabilitação de edifícios antigos – Alexandra Grande



Vertical sections – Doors
(drawings | aNC Arquitectos)



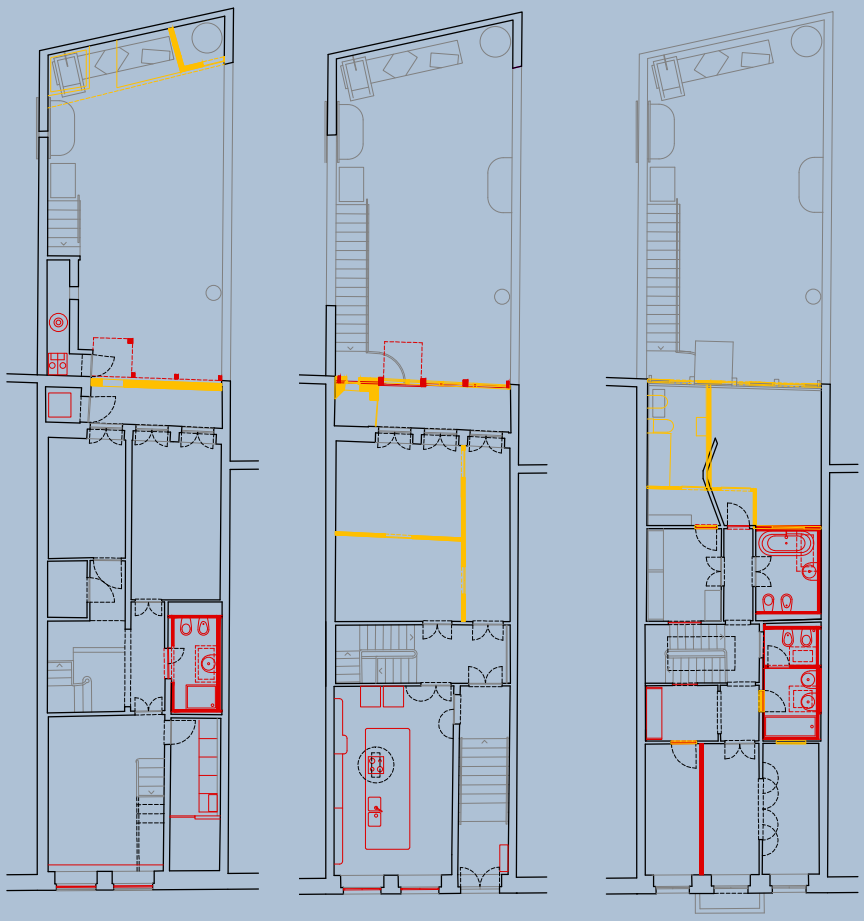
Bathroom, 2nd floor 1:25
(section | aNC Arquitectos)



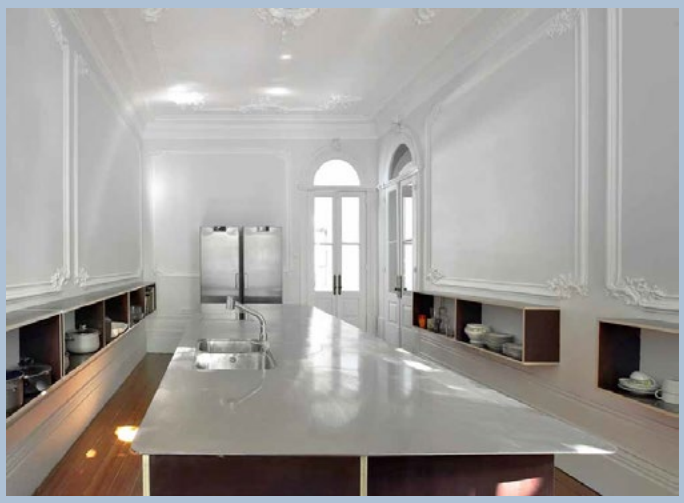
Service areas
Social areas
Circulation areas

0 1 5

Lower ground floor | Ground floor | 1st floor
Changes identified to the original plan throughout the 20th century

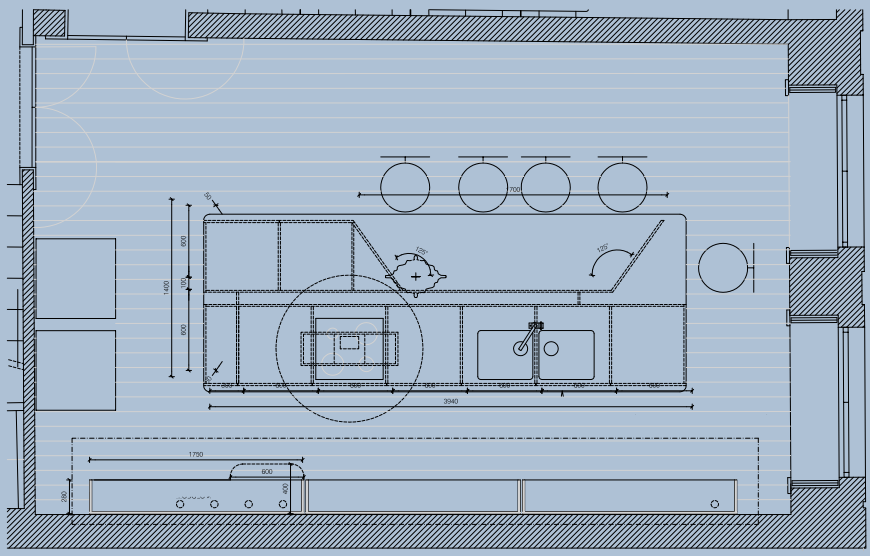


Lower ground floor | Ground floor | 1st floor 1:200
Changes introduced by the renovation project



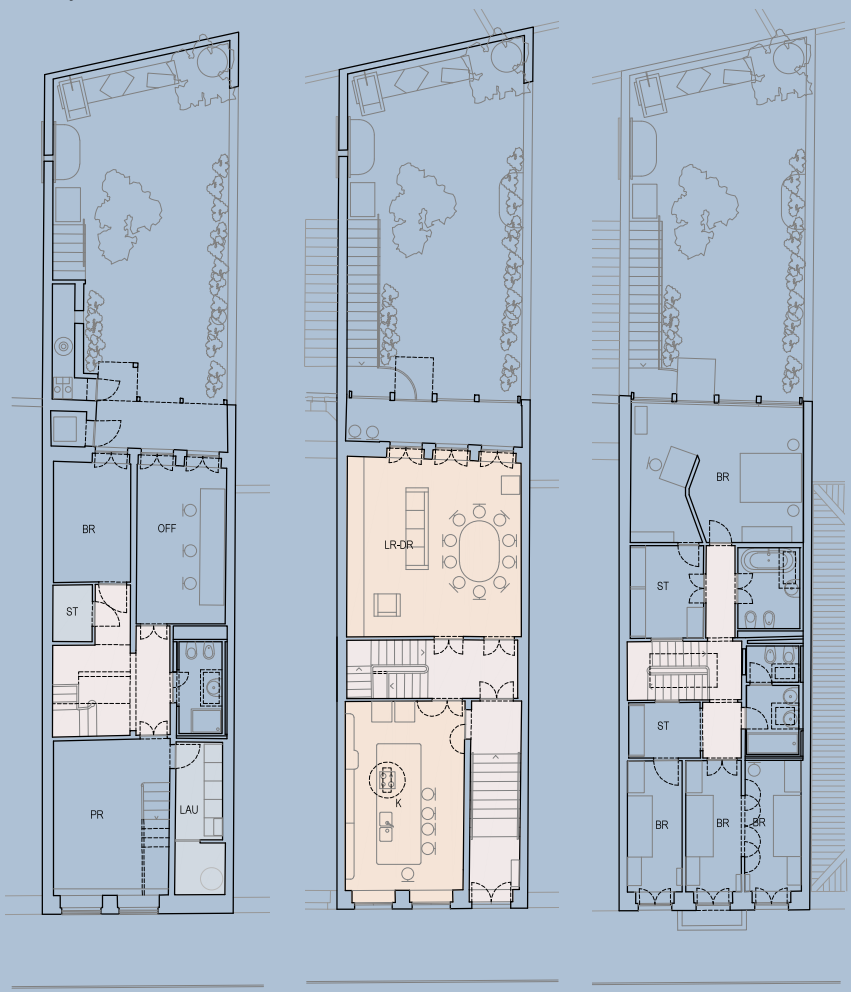
Kitchen, Ground floor
(photo | João Ferrand)

Plan 1:50
(drawing | aNC Arquitectos)



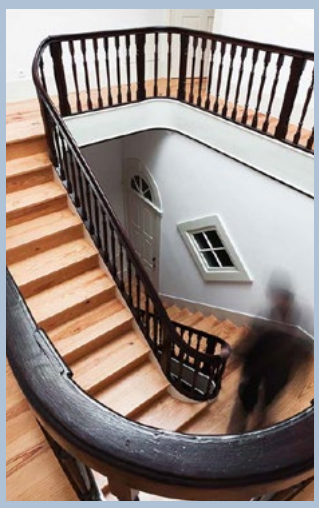
Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office
LAU Laundry room
PR Play room

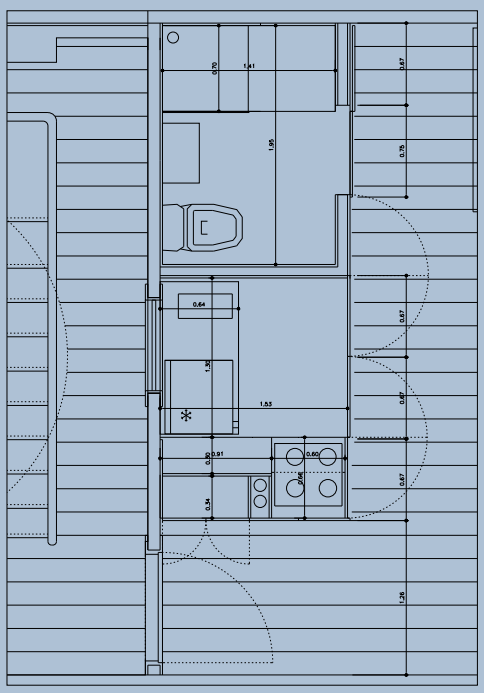


Lower ground floor | Ground floor | 1st floor 1:200
Final plan after renovation

0 1 5



Staircase
(photo | attilio fiumarella)



Kitchen – bathroom, 3rd floor 1:50
(plan | Bernardo Amaral)

Original construction Late 18th century
Renovation work 2011
Initial functional type Single-family terraced house
Current functional type Block of flats with duplexes

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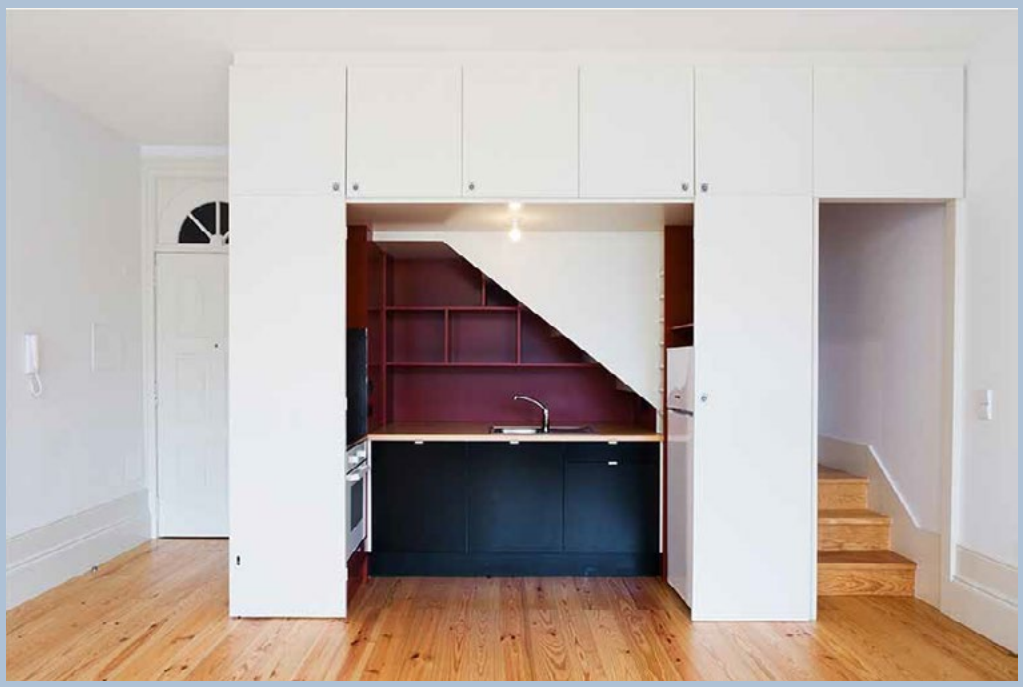
Archive information Arquivo do Licenciamento das Aguas do Porto (n° 4001, 1936) [Connection to sewage network]

11 | OPORTO

RUA DO PINHEIRO 71-75



Kitchen and staircase
(photo | attilio fiumarella)

Architectural design Bernardo Amaral
Project manager | Site inspection Bernardo Amaral
Metric survey José Alvares and Bernardo Amaral
Structural design Luís André Branco
Plumbing design João Diogo Alpendurada

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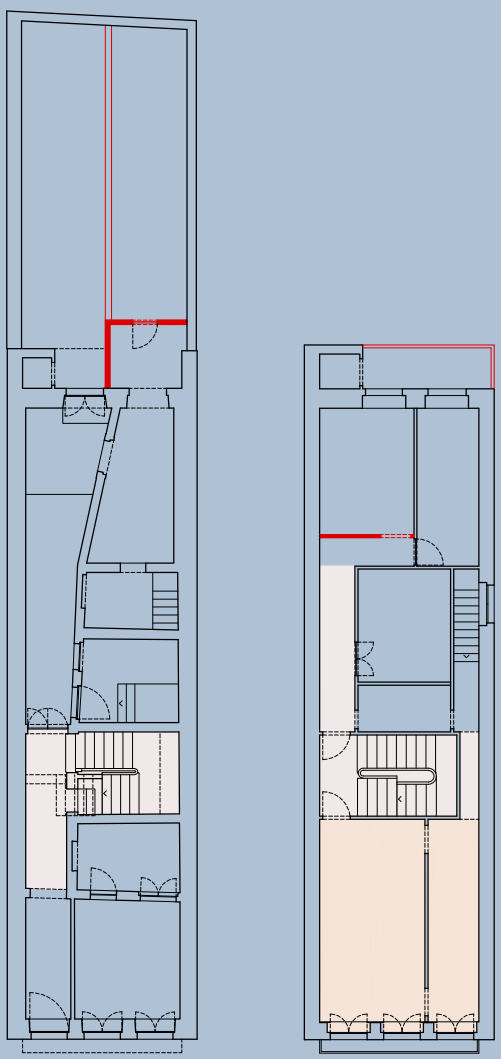
Contractor Manuel Sousa Costa
Window frames Gercima
Solar panels and heat pump Multicalor
Artistic intervention João Bonito
Outdoor spaces Noemie Pons-Robardt

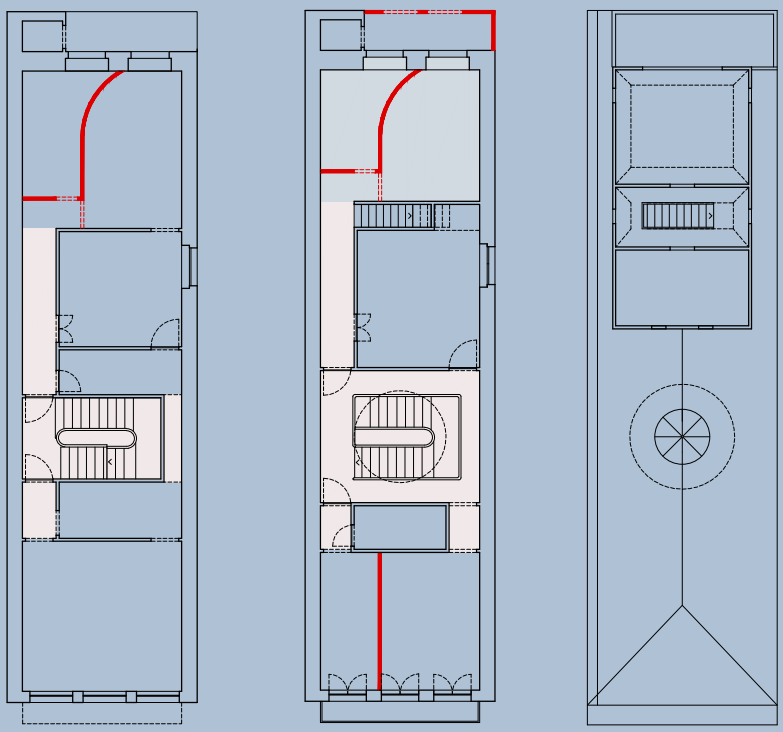
Street façade
Courtyard façade
(photos | attilio fiumarella)



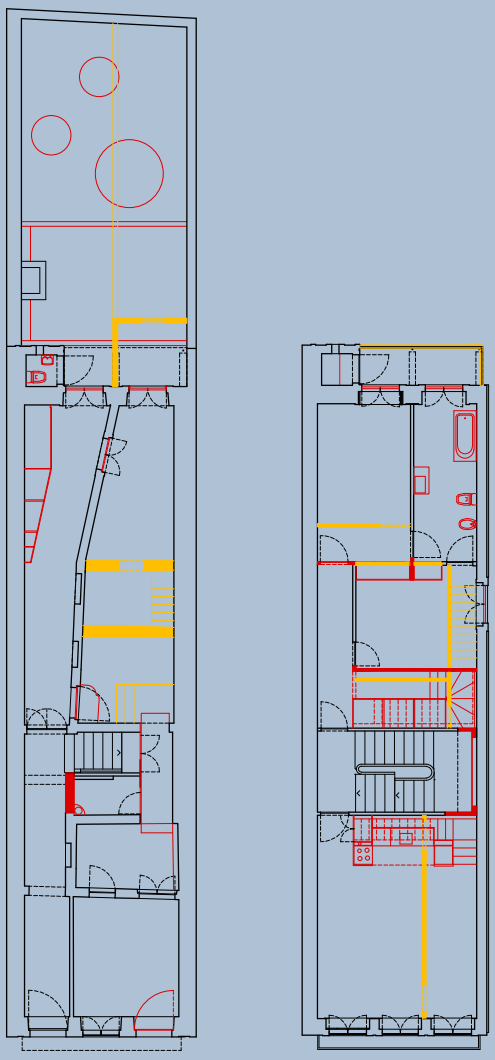
Ground floor | First floor 1:200
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

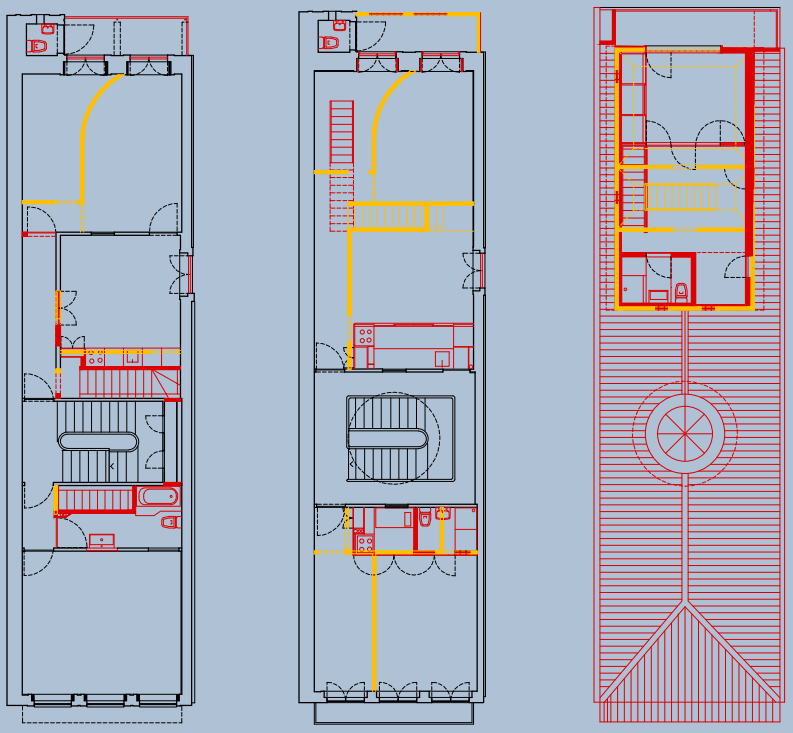
0 1 5



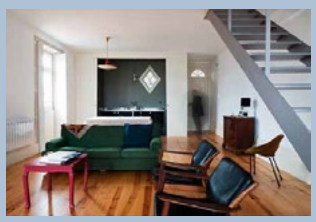
2nd floor | 3rd floor | Attic
Changes identified to the original plan throughout the 20th century



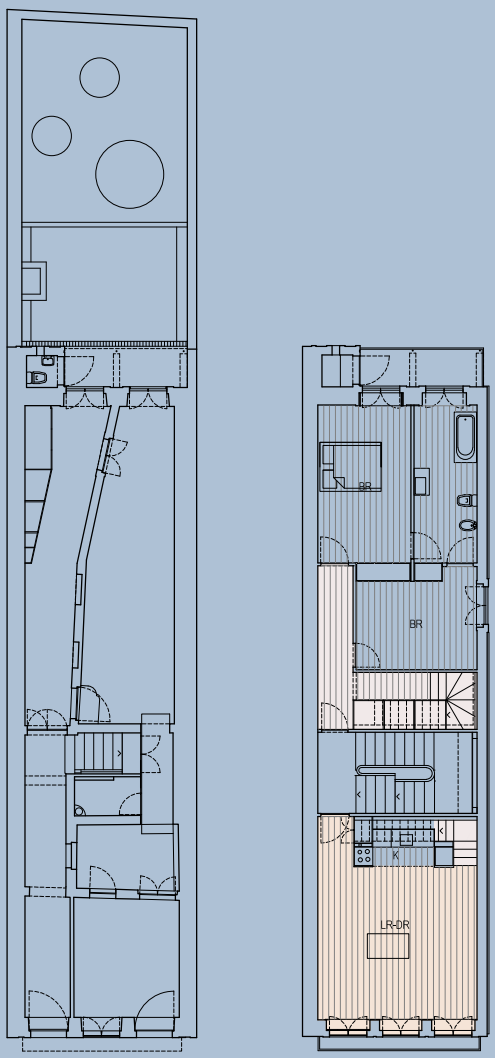
Ground floor | First floor 1:200
Changes introduced by the renovation project



2nd floor | 3rd floor | Attic
Changes introduced by the renovation project



Living room, 3rd floor
Balcony, Attic
(photos | attilio fiumarella)



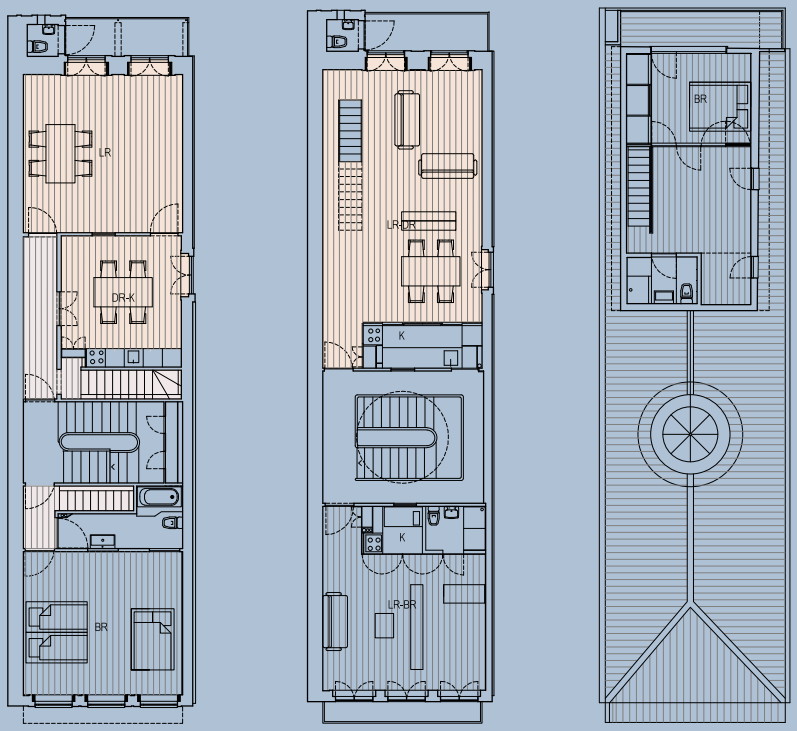
Ground floor | First floor 1:200
Final plan after renovation

Service areas
Social areas
Circulation areas

0 1 5

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



2nd floor | 3rd floor | Attic
Final plan after renovation

Top floor
(photos | Edite Rosa, Joaquim Almeida)

Original construction Early to mid 19th century
Renovation work 2000 · 2001
Initial and current functional type Single-family terraced house

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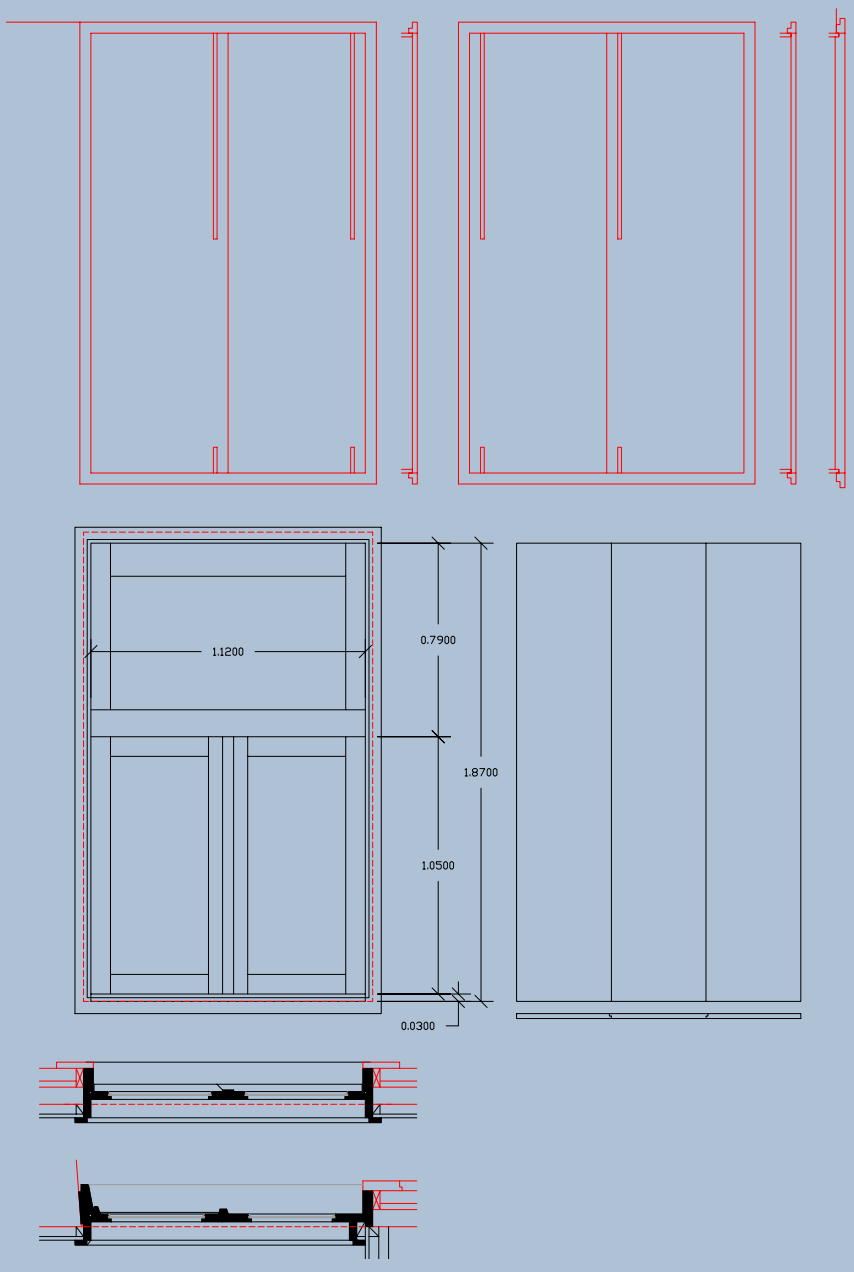
Archive information Arquivo do Licenciamento das Aguas do Porto (n° 3630, 1936) [Connection to sewage network]

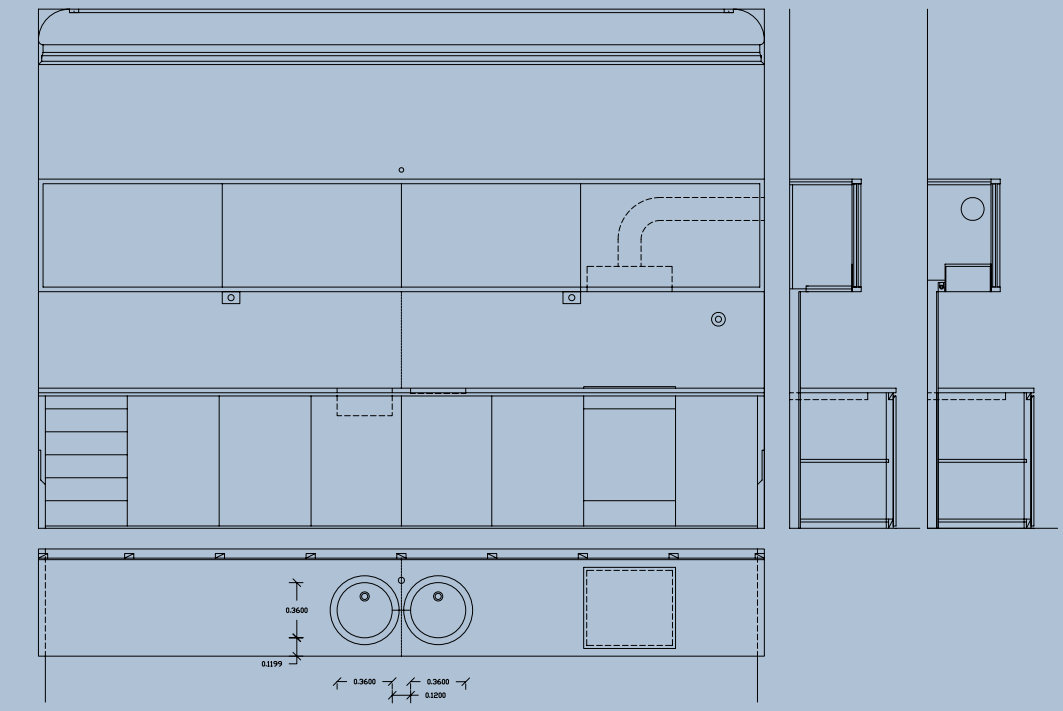
12 | OPORTO

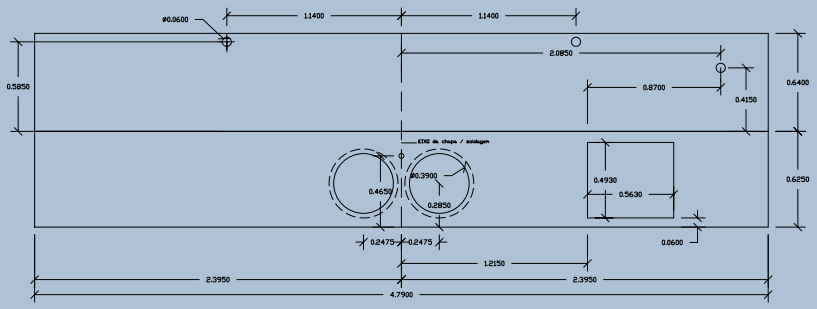
RUA DO DOUTOR ALVES DA VEIGA 213

Staircase to top floor
(photo | Edite Rosa, Joaquim Almeida)

Architectural design Edite Rosa e Joaquim Almeida Arquitectos, Lda.
Structural design and systems engineering GOP – Gabinete de Organização e Projectos, Lda.

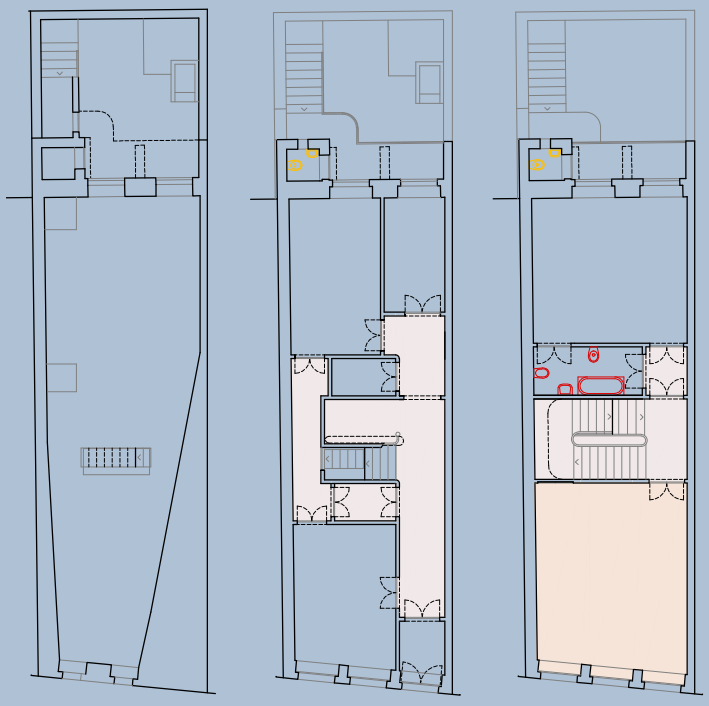

1.1200
0.7900
1.8700
1.0500
0.0300





New windows, top floor 1:25
Kitchen, 1st floor 1:40
(drawings | Edite Rosa, Joaquim Almeida)

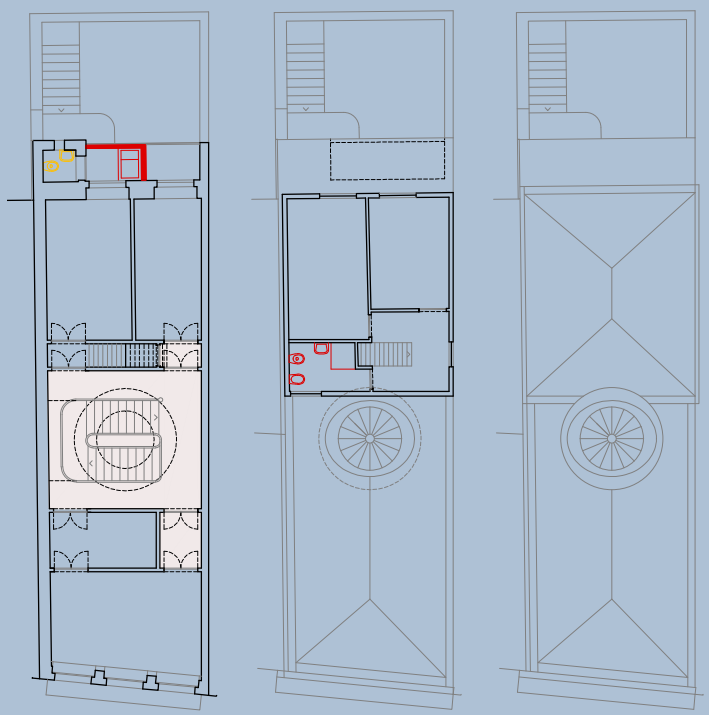
Street façade
(photo | Edite Rosa, Joaquim Almeida)



Lower ground floor | Ground floor | 1st floor 1:200
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

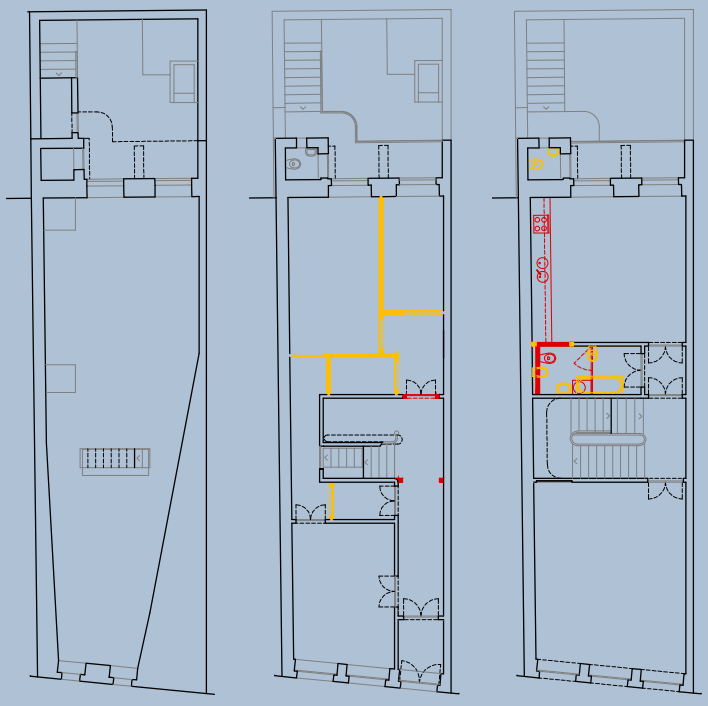
0 1 5



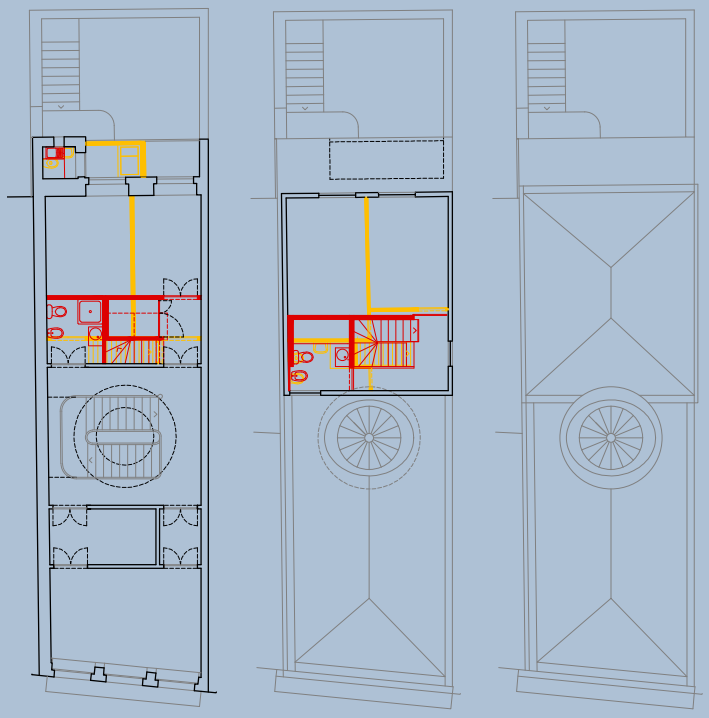
2nd floor | Attic

Changes identified to the original plan throughout the 20th century

Living room
(photos | Edite Rosa, Joaquim Almeida)



Lower ground floor | Ground floor | 1st floor 1:200
Changes introduced by the renovation project



2nd floor | Attic

Changes introduced by the renovation project

Kitchen
(photo | Edite Rosa, Joaquim Almeida)

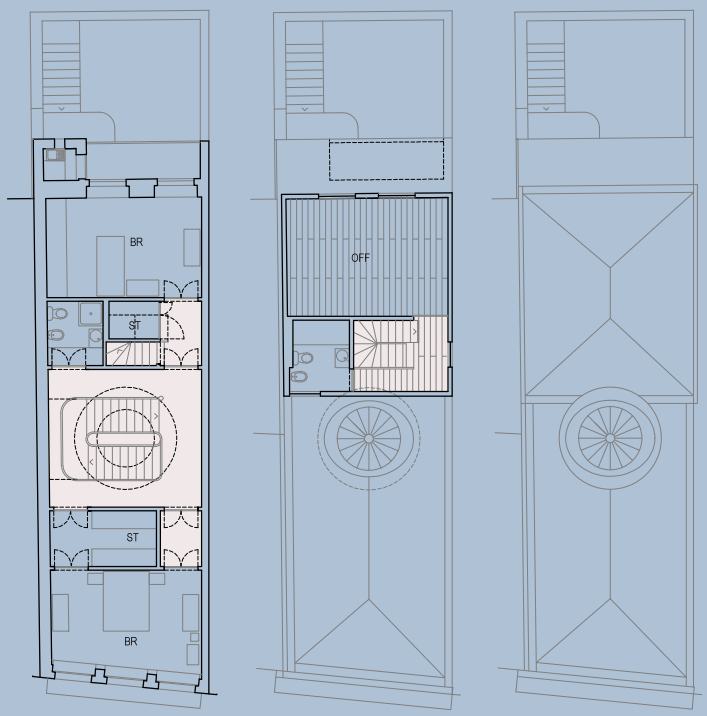
Lower ground floor | Ground floor | 1st floor 1:200
Final plan after renovation

Service areas
Social areas
Circulation areas

0 1 5

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



2nd floor | Attic
Final plan after renovation

Kitchen cupboards 1:50
(drawings | João Moura, Paulo Frutuoso)

Original construction ca. Late 18th century in late 14th century plot
Renovation work 2009 · 2010
Initial and current functional type Single-family terraced house

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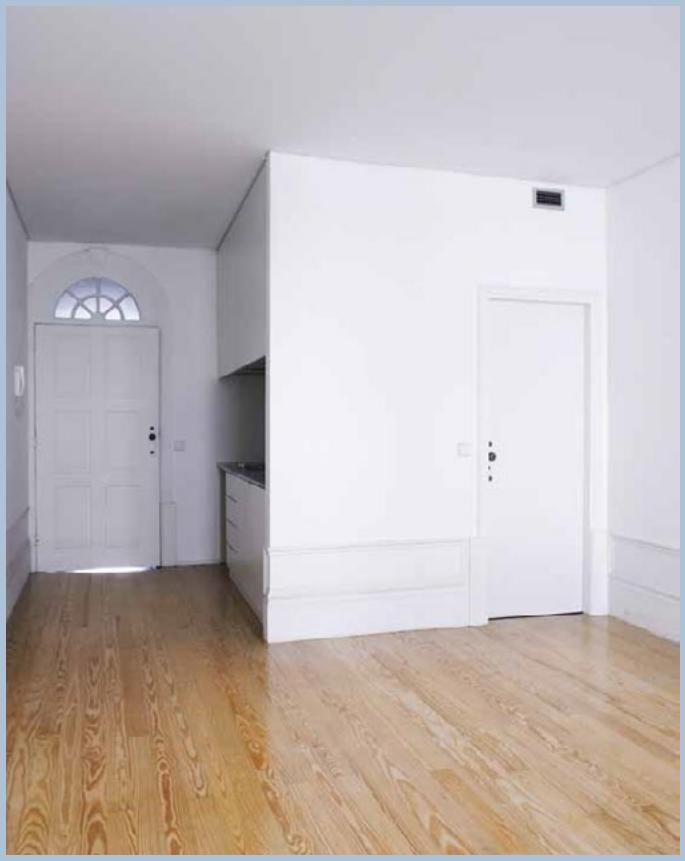
Archive information Arquivo do Licenciamento das Aguas do Porto (n° 3643, 1936) [Connection to sewage network]

13 | OPORTO

RUA DE SÃO MIGUEL 41-43



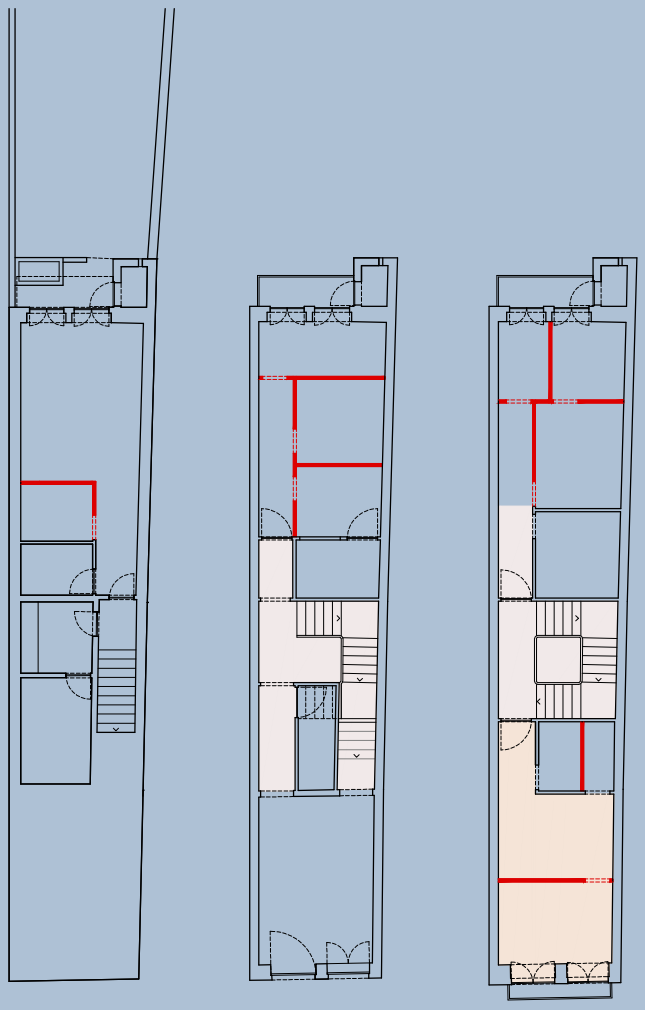
Living room and kitchen
(photo | Pedro Camelo)

Architectural design João Moura and Paulo Frutuoso
Ventilation design João Moura, Pedro Pego

–

Contractor EXMAT – Equipamentos e construções, Lda.

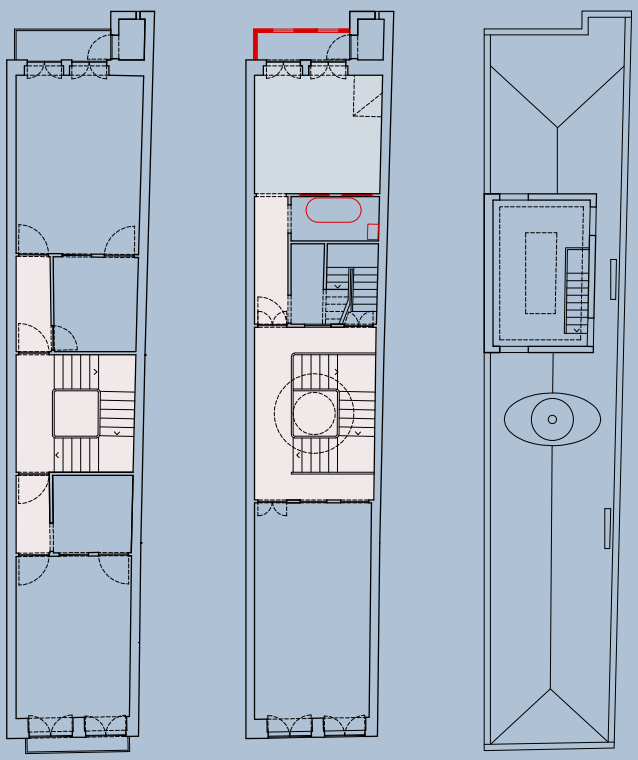
Street façade
(photo | Pedro Camelo)



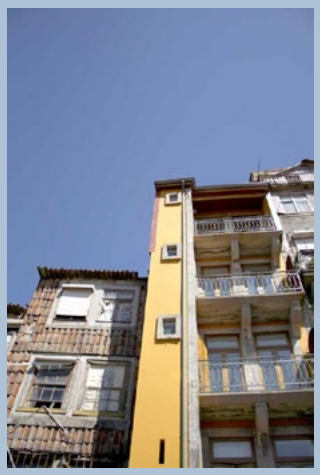
Lower ground floor | Ground floor | 1st floor 1:200
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

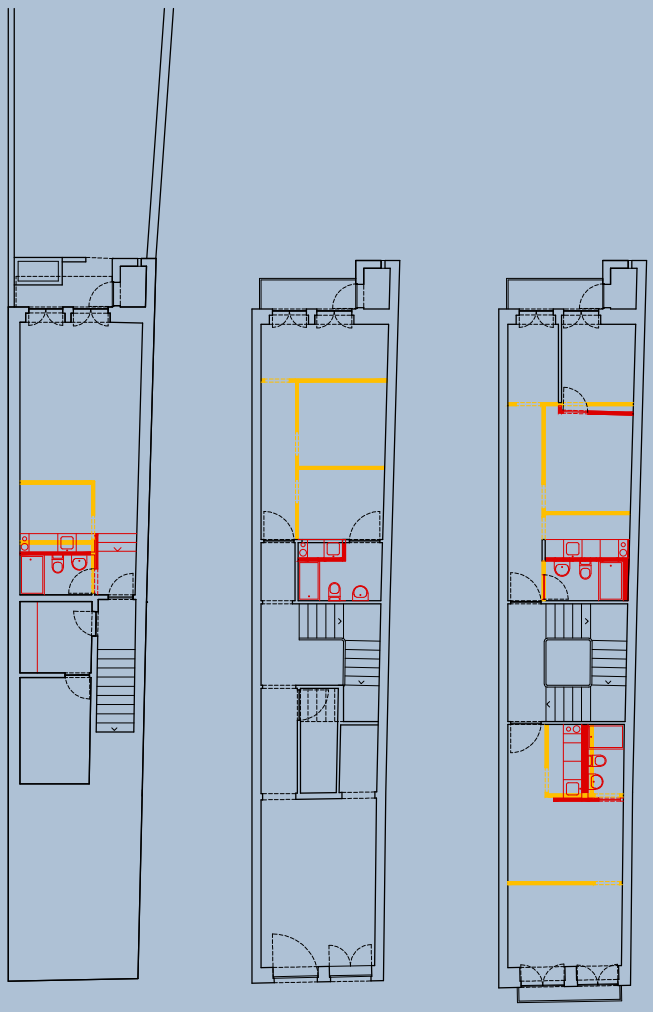
0 1 5



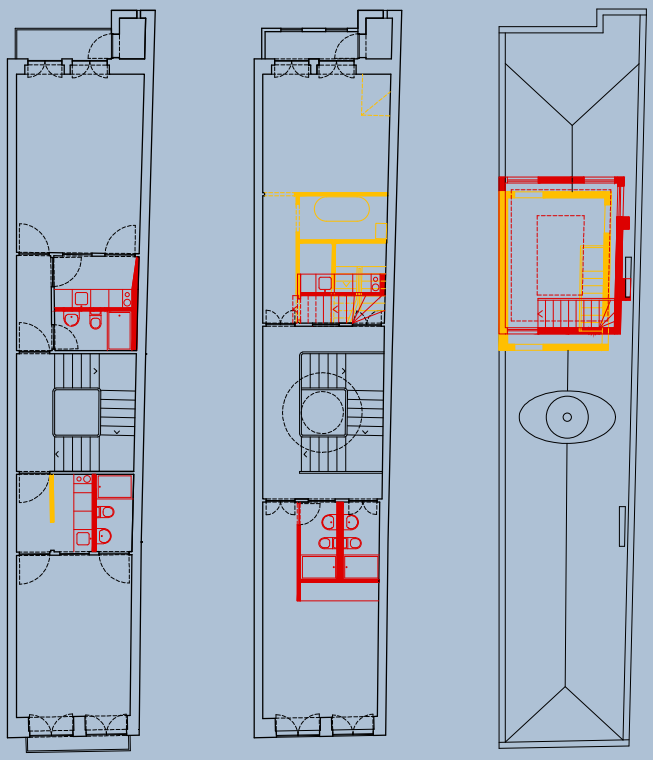
2nd floor | 3rd floor | Attic
Changes identified to the original plan throughout the 20th century



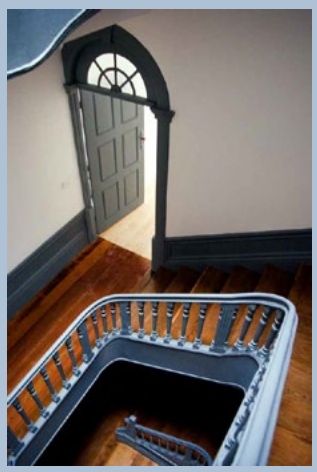
Courtyard façade
(photo | Pedro Camelo)



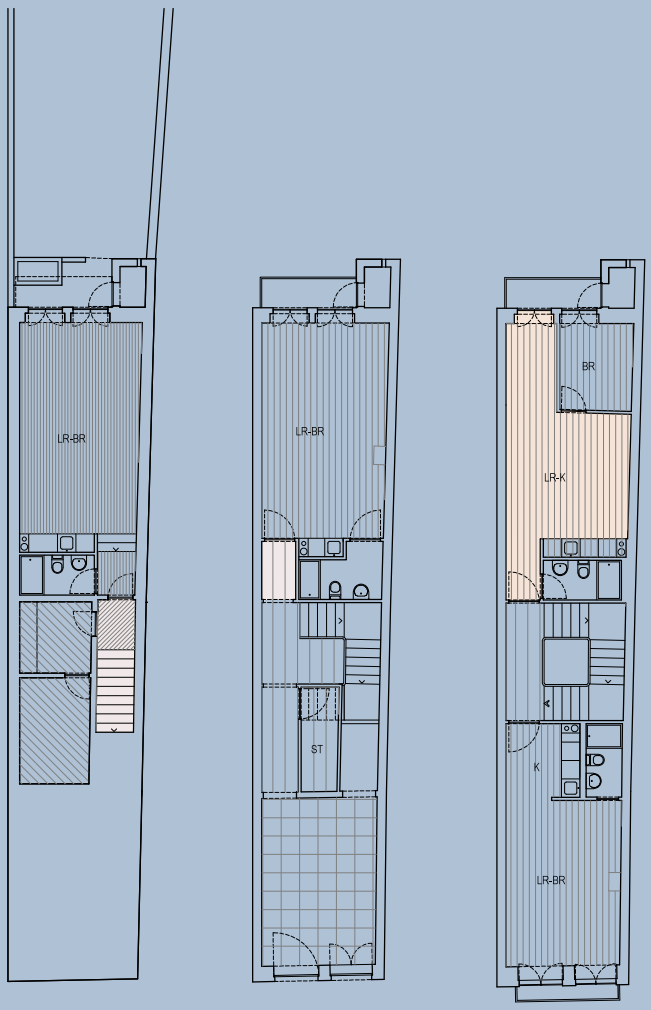
Lower ground floor | Ground floor | 1st floor 1:200
Changes introduced by the renovation project



2nd floor | 3rd floor | Attic
Changes introduced by the renovation project



Staircase
(photo | Pedro Camelo)



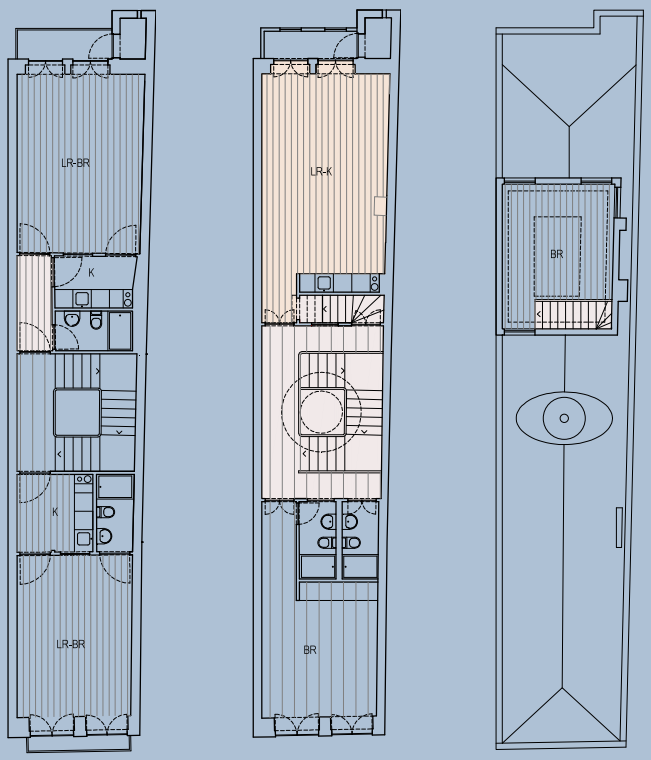
Lower ground floor | Ground floor | 1st floor 1:200
Final plan after renovation

Service areas
Social areas
Circulation areas

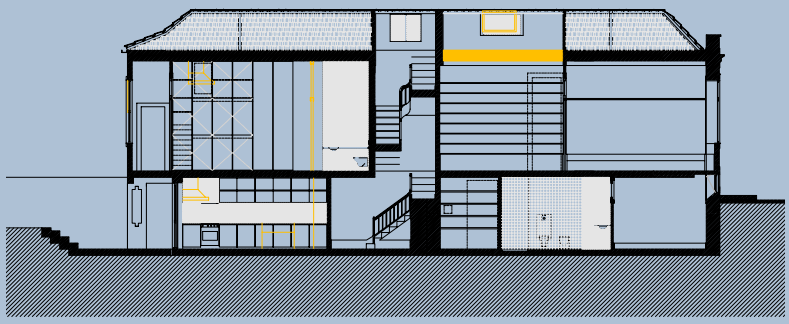
0 1 5

Types of rooms

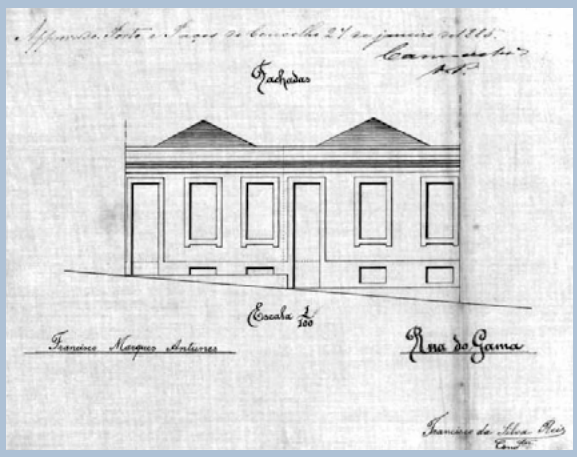
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



2nd floor | 3rd floor | Attic
Final plan after renovation



Section 1:200
(drawing | Nuno Valentim, Joana Sarmento)



Street façade drawing, 1885
(AHMP)

Original construction ca. 1885
Renovation work 2006 · 2009
Initial and current functional type Single-family terraced house

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Archive information Arquivo Histórico Municipal do Porto (D-CMP-07-139 to 140) [Original drawings]

14 | OPORTO

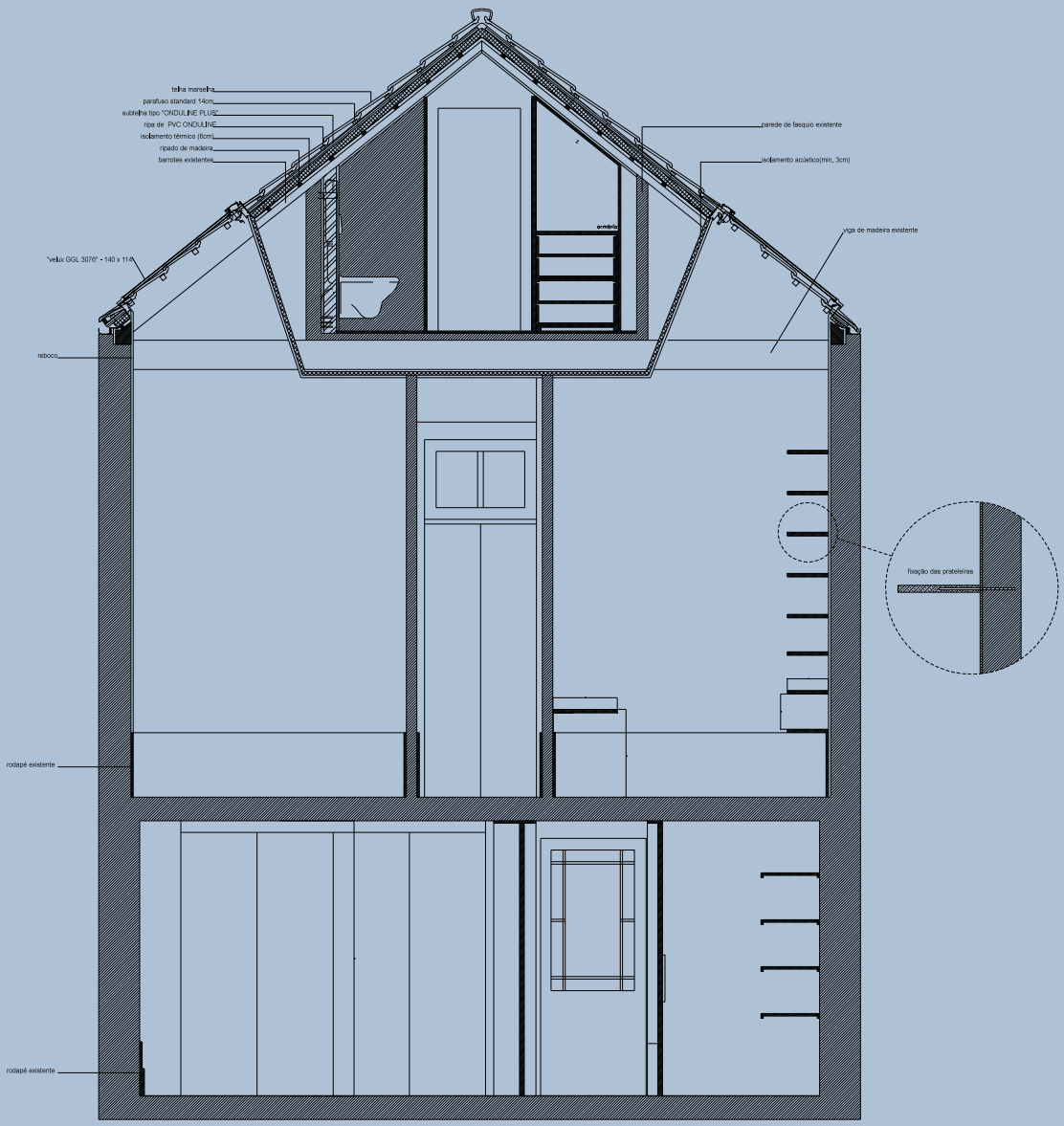
RUA DE DIU 82-86

Top floor during renovation work
(photo | Mariana Themudo/JFF)

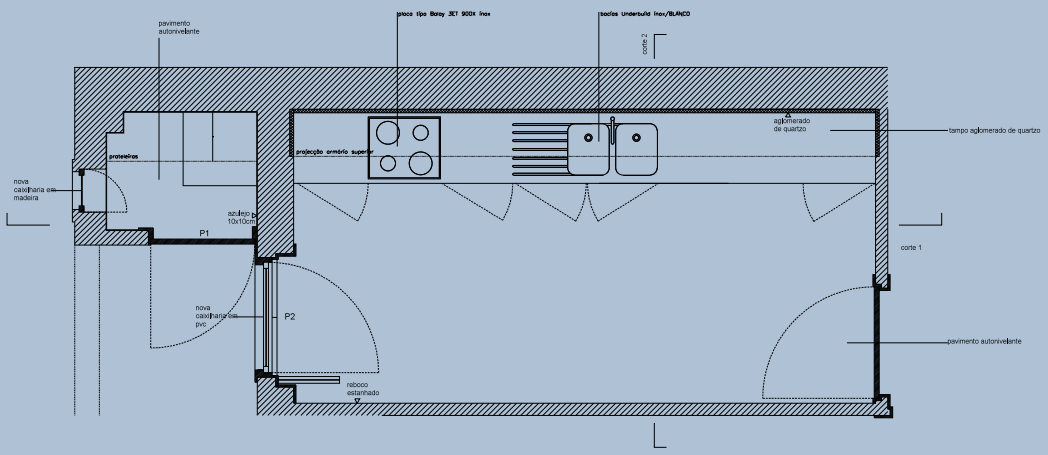
Architectural design Nuno Valentim and Joana Sarmento
Systems engineering João Miguel Bastos

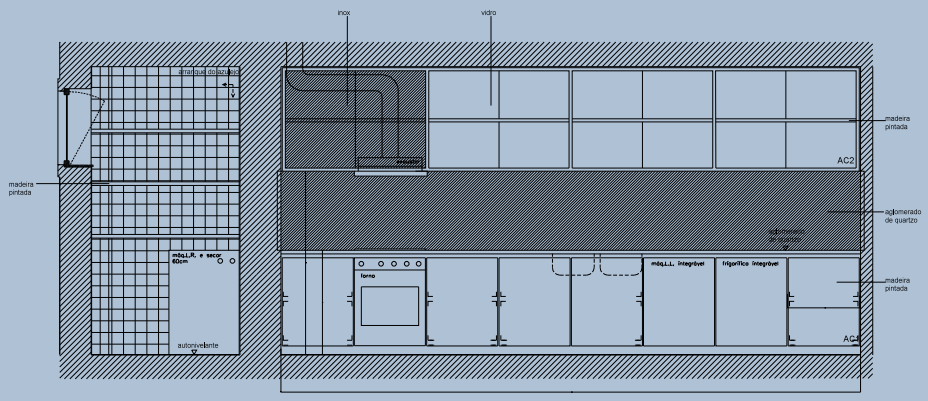
–

Contractor Gernuno



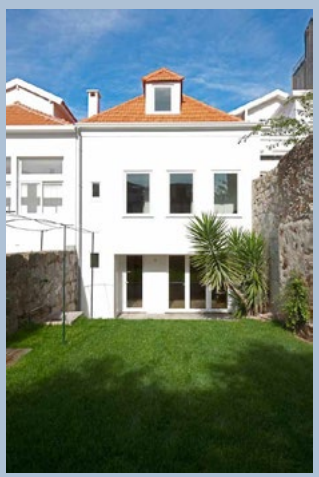
Transverse section
Kitchen plan and section 1:50
(drawings | Nuno Valentim, Joana Sarmento)

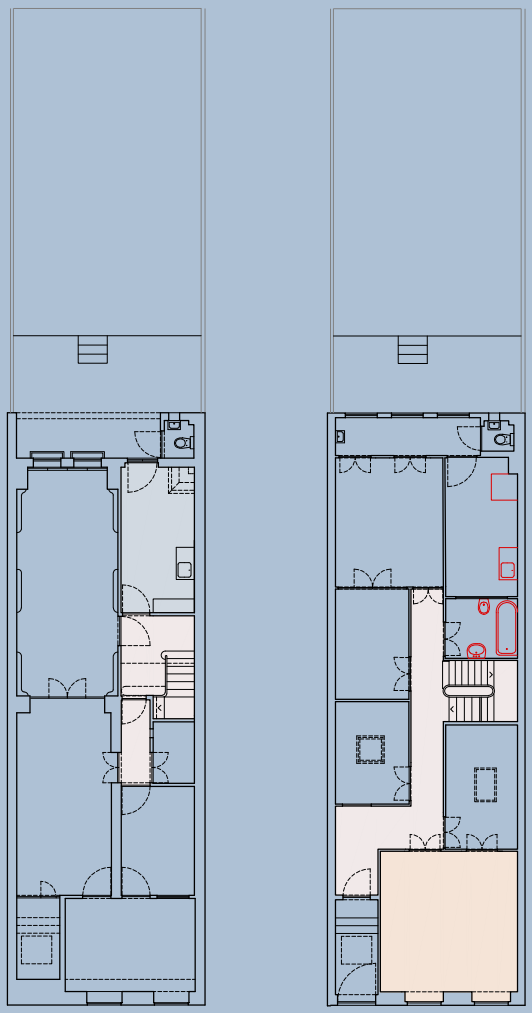




Kitchen 1:50
(photo | Mariana Themudo/JFF)

Street and courtyard façades
(photo | Mariana Themudo/JFF)



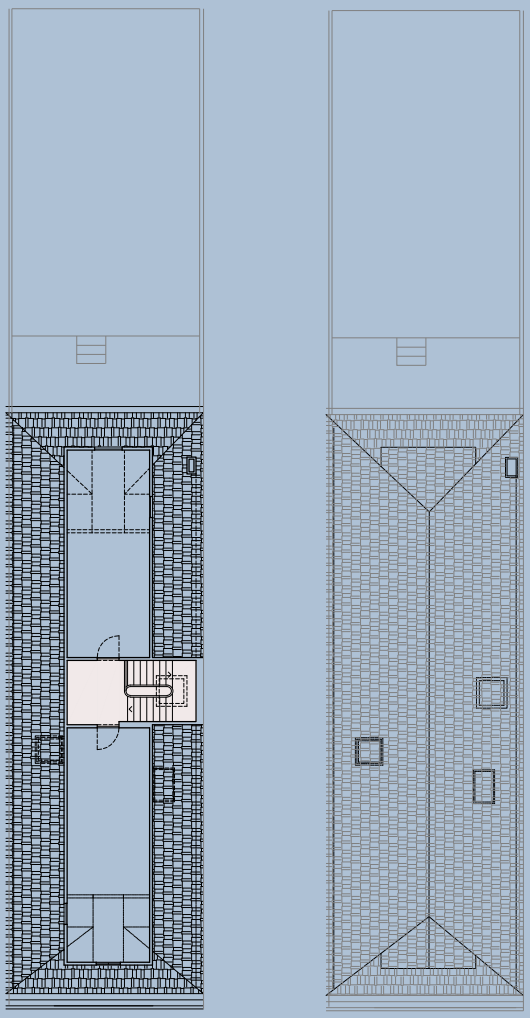


Lower ground floor | Ground floor 1:200
Changes identified to the original plan throughout the 20th century

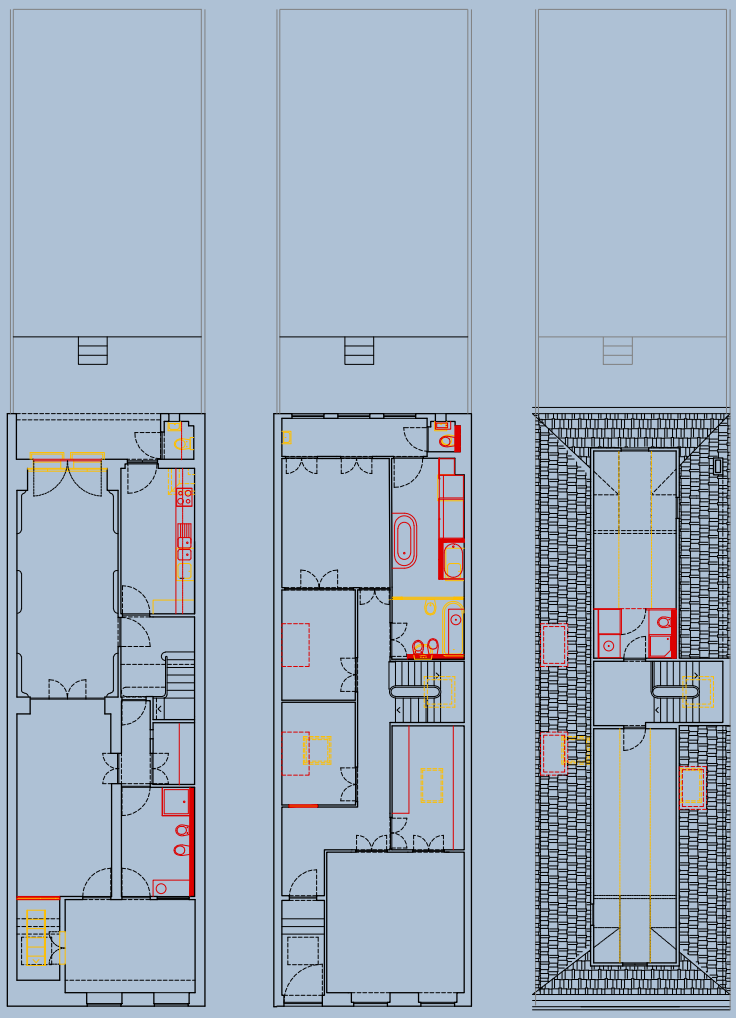
Service areas
Social areas
Circulation areas

0 1 5

Ground floor corridor and staircase
(photo | Mariana Themudo/JFF)



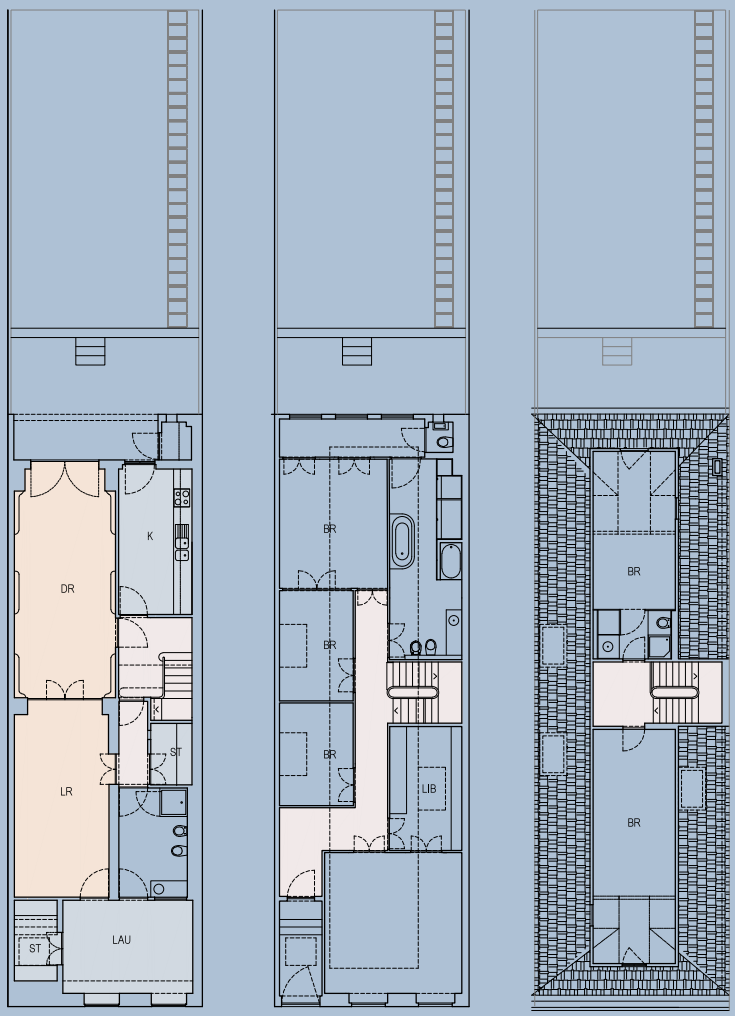
1st floor | Roof
Changes identified to the original plan throughout the 20th century



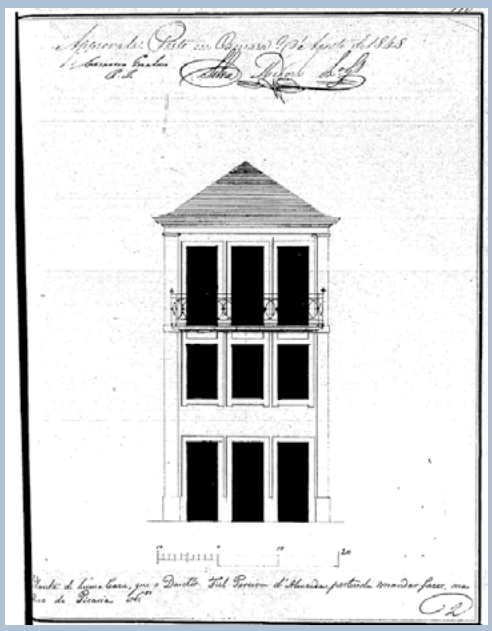
Lower ground floor | Ground floor 1:200
Changes introduced by the renovation project

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



1st floor | Roof
Final plan after renovation



Street façade, 1848
(AHMP)

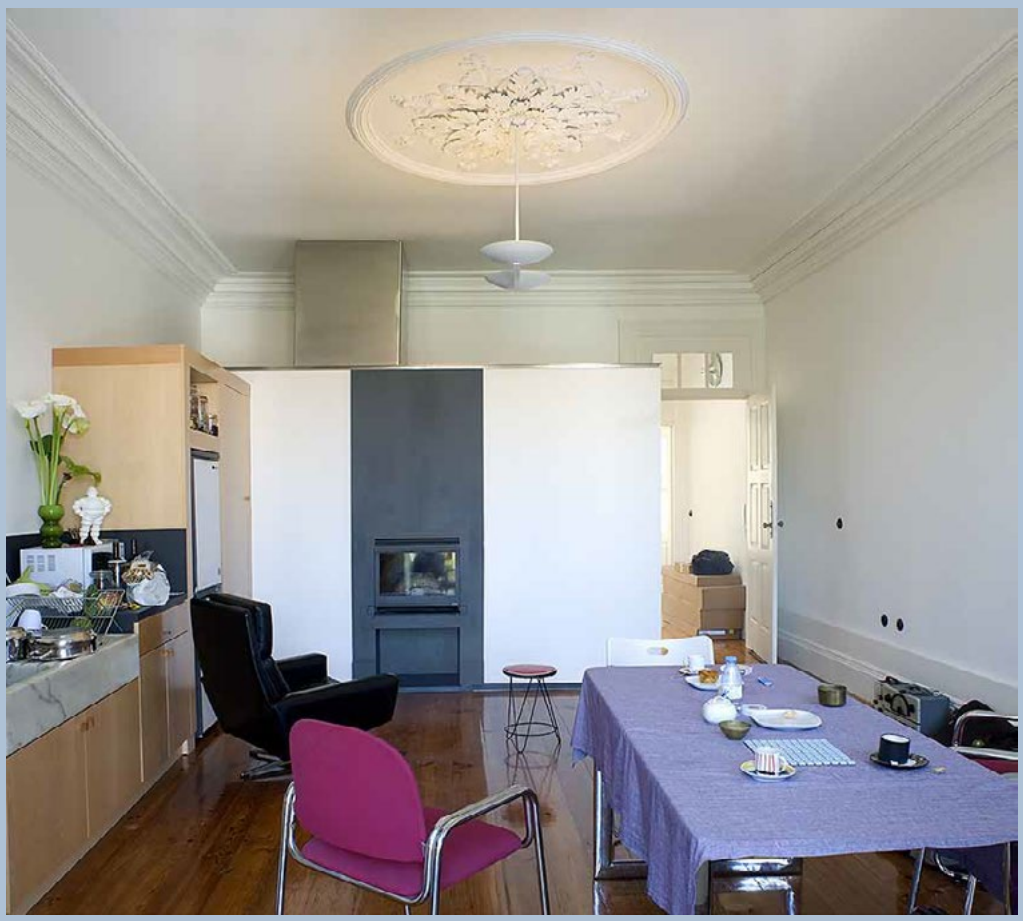
Original construction ca. 1848
Renovation work 2008
Initial and current functional type Single-family terraced house

–

Archive information Arquivo Histórico Municipal do Porto (D-CMP-07-010-110) [Original drawings]
Arquivo do Licenciamento das Aguas do Porto (n° 3257, 1936) [Connection to sewage network]

15 | OPORTO

RUA DA PICARIA 80-84



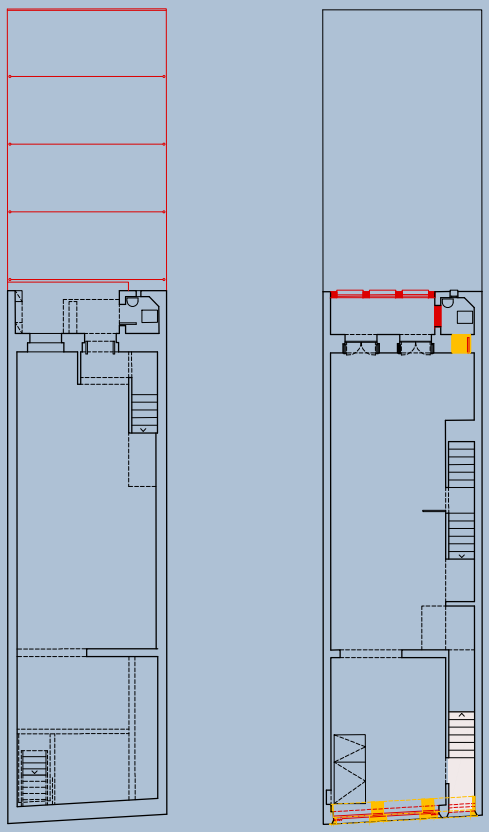
Kitchen
(photo | João Ferrand)

Architecture Cristiano Bartolini
Thermal design Alberto Abreu

–

Contractor Manuel Sousa

Street façade
(photo | João Ferrand)

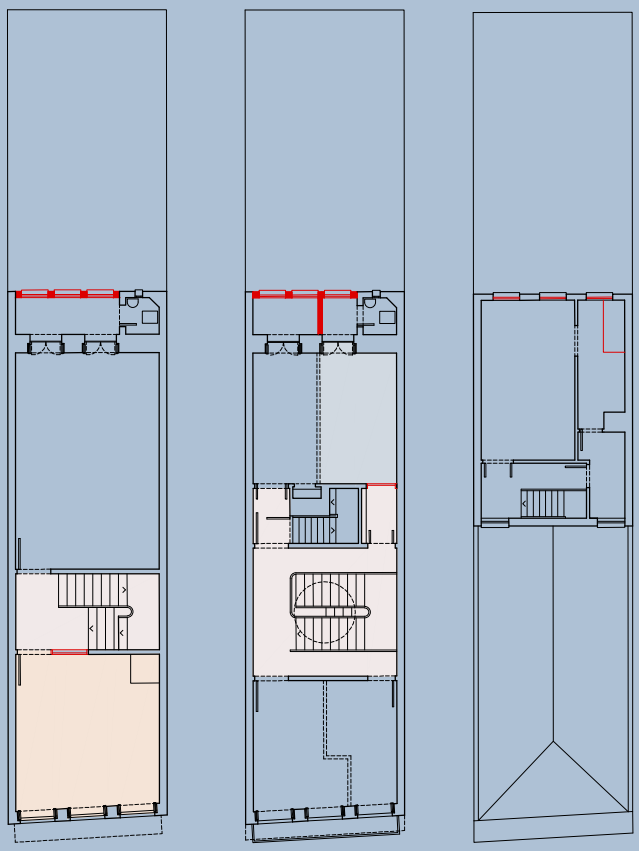


Lower ground floor | Ground floor 1:200
Changes identified to the original plan throughout the 20th century

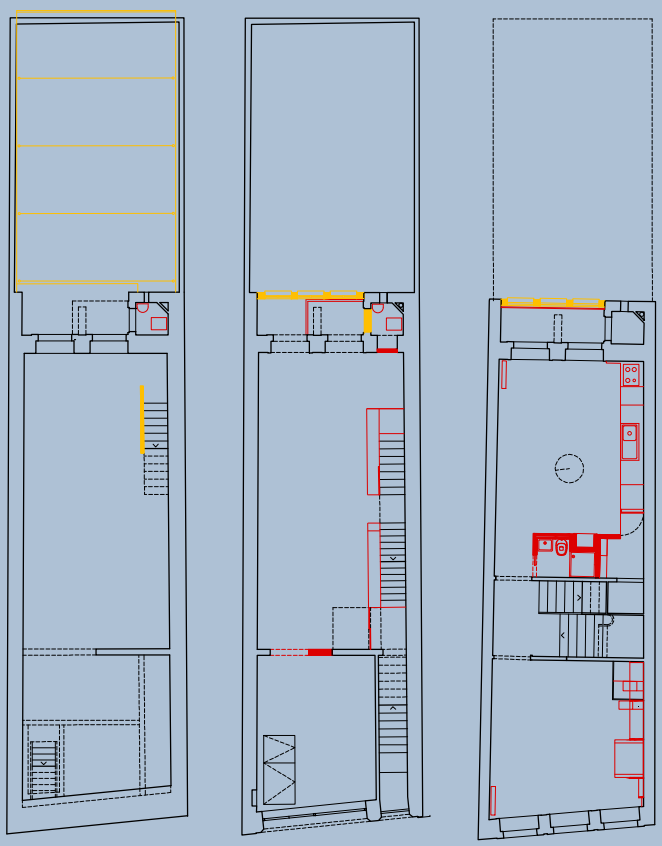
Service areas
Social areas
Circulation areas

0 1 5

Courtyard façade
(photo | João Ferrand)

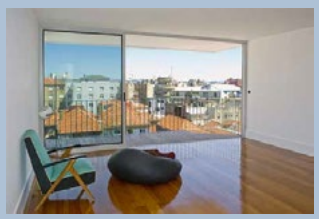


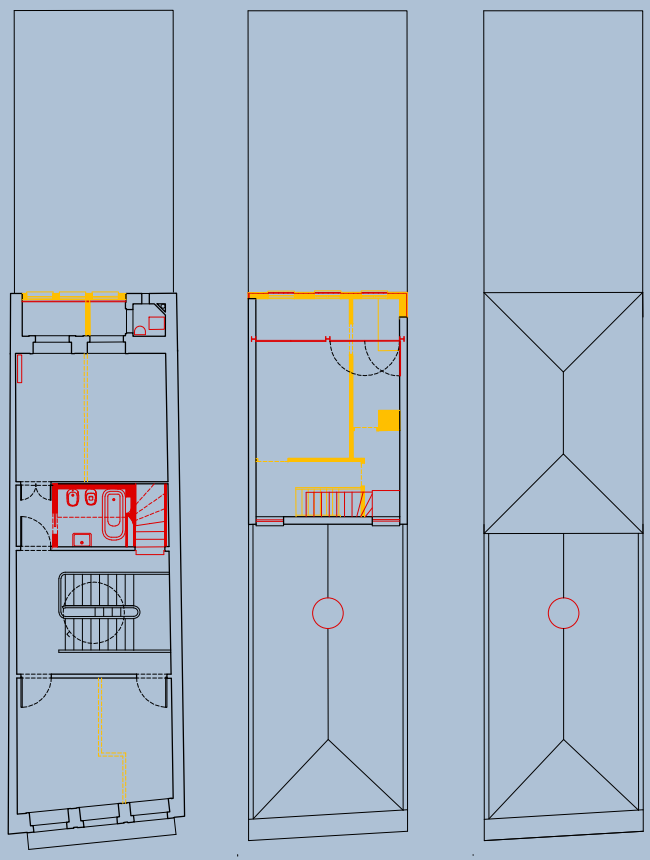
1st floor | 2nd floor | 3rd floor
Changes identified to the original plan throughout the 20th century



Lower ground floor | Ground floor 1:200
Changes introduced by the renovation project

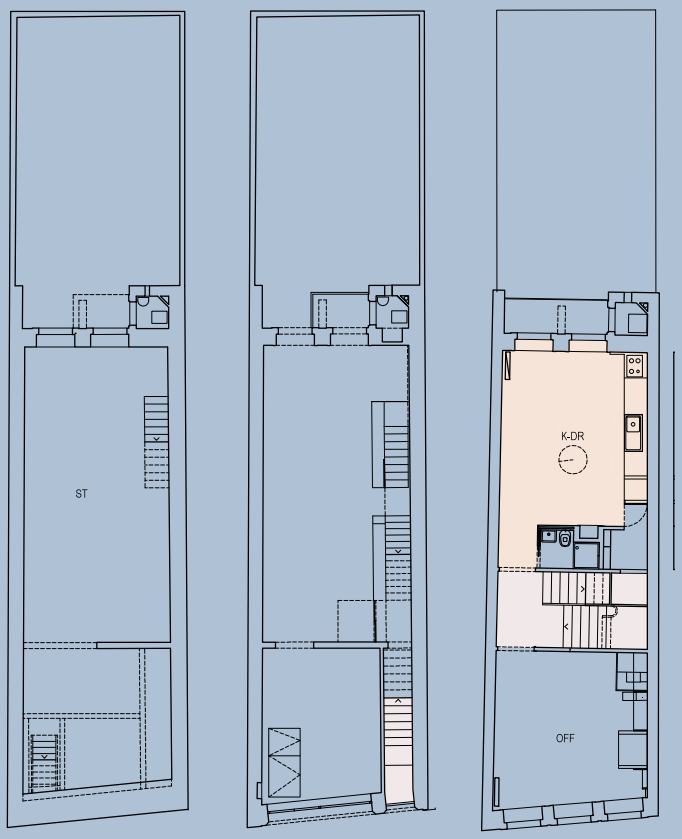
Staircase and top floor
(photos | João Ferrand)





1st floor | 2nd floor | 3rd floor
Changes introduced by the renovation project

Staircase
Shop, ground floor
(photos | João Ferrand)



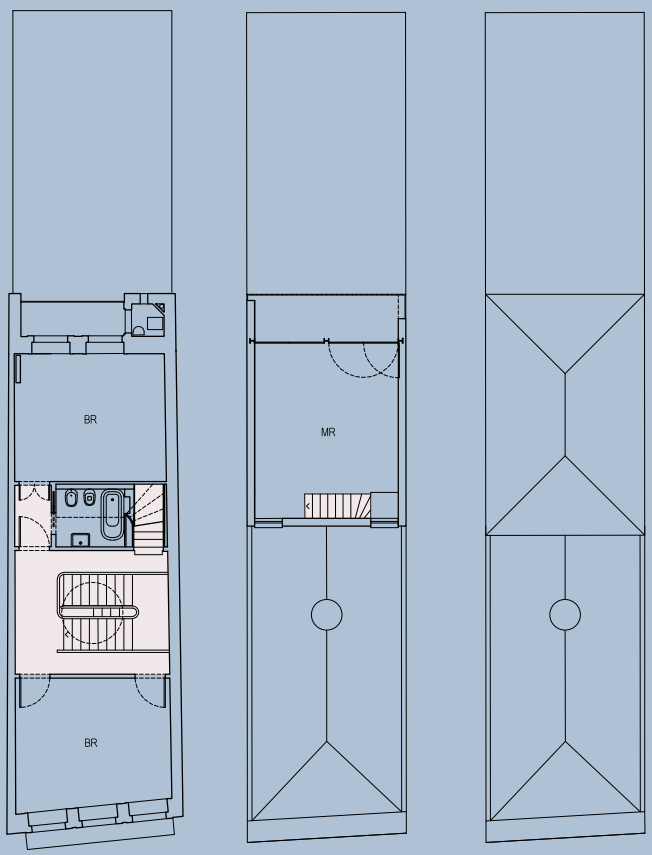
Lower ground floor | Ground floor 1:200
Final plan after renovation

Service areas
Social areas
Circulation areas

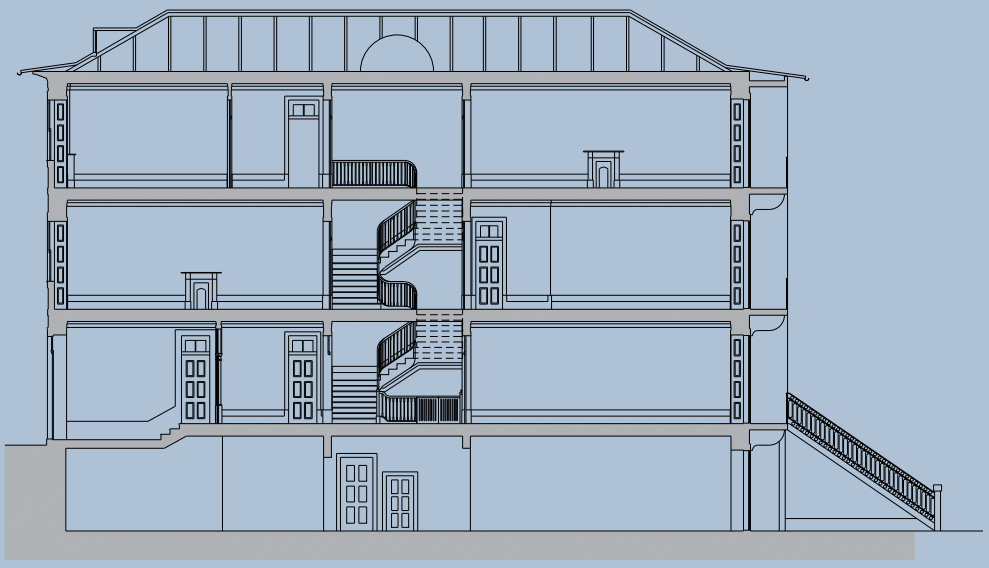
0 1 5

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office
MR Music room



1st floor | 2nd floor | 3rd floor
Final plan after renovation



Elevations and section
(drawings | António Portugal)

Original construction Early to mid 19th century
Renovation work 2005 · 2006
Initial and current functional type Single-family terraced house

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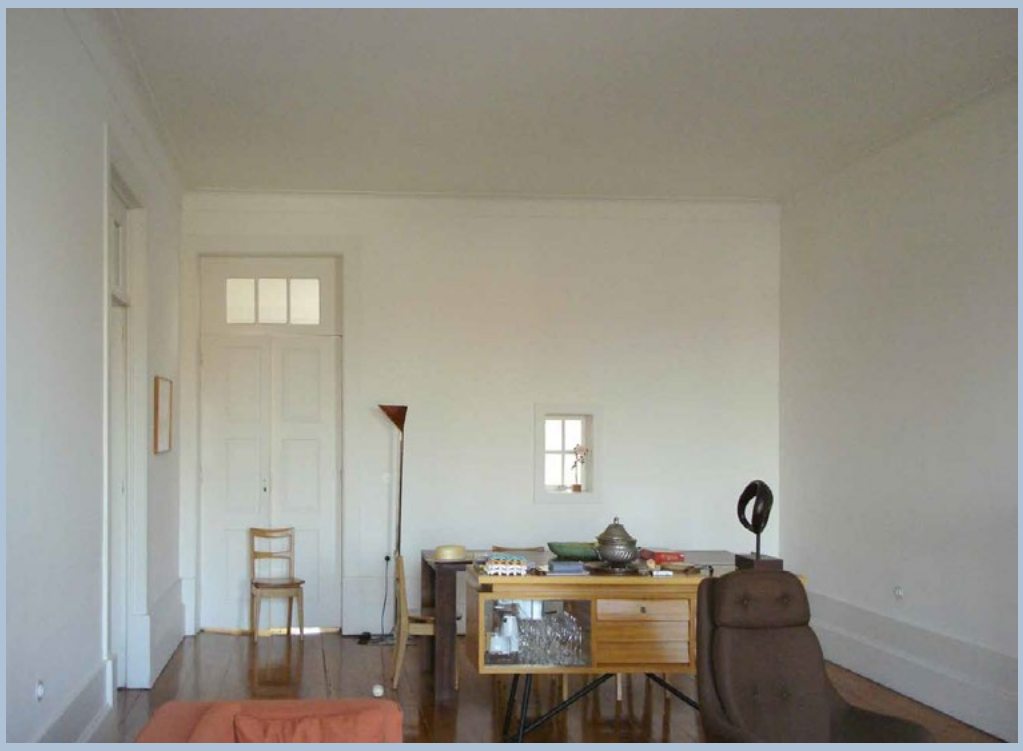
Archive information Arquivo do Licenciamento das Aguas do Porto (n° 1493, 1936) [Connection to sewage network]

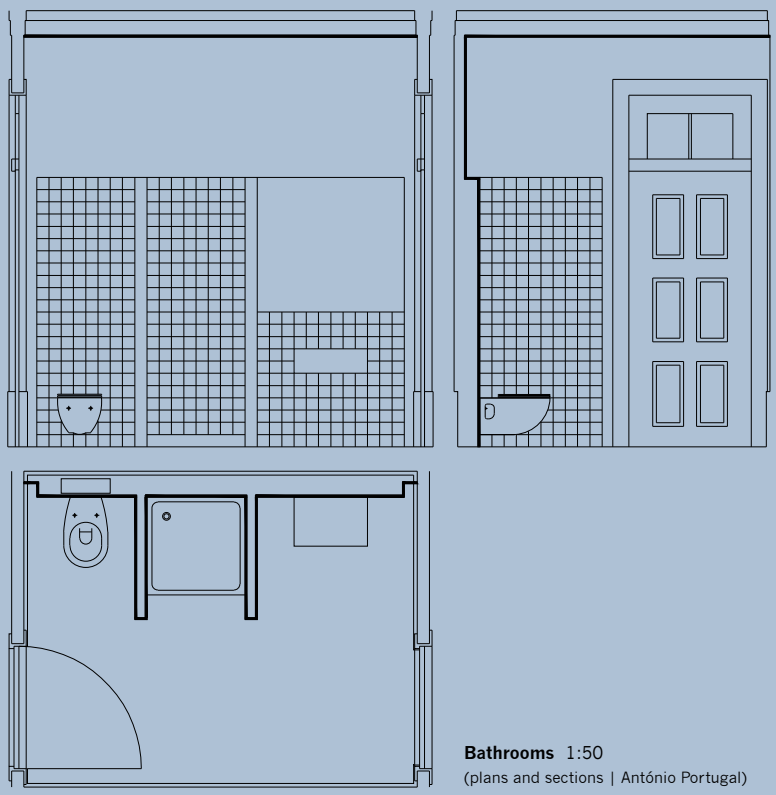
16 | OPORTO

RUA DO BREINER 143 [previously 75]

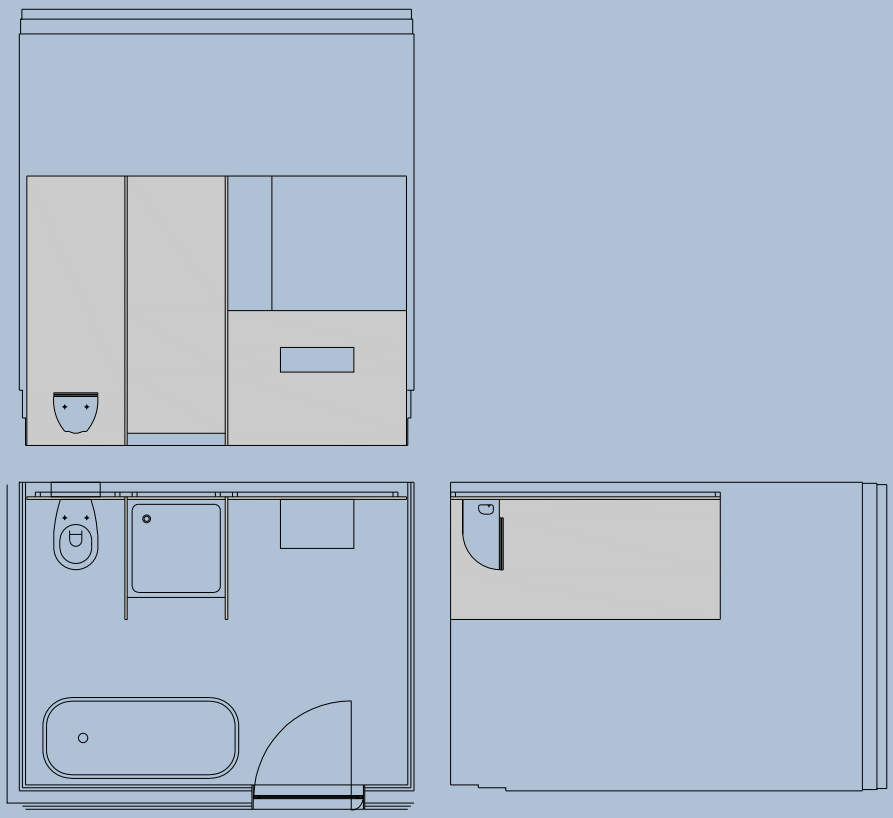


Living room and kitchen
(photos | Catarina Wall Gago)

Architectural design A. Portugal & Manuel M. Reis, arquitectos e associados, Lda. – António Portugal

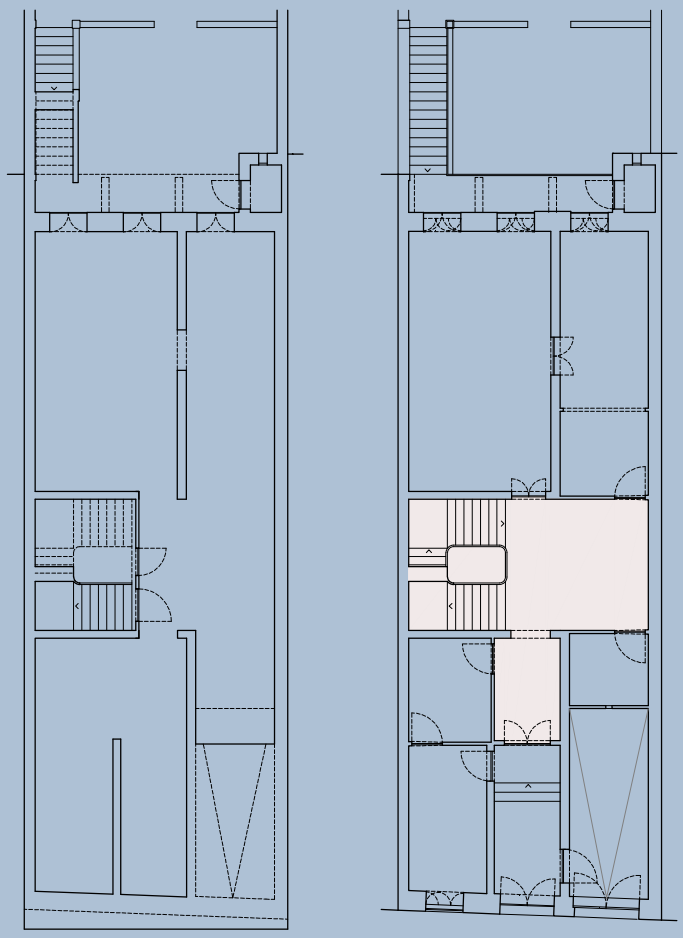


Bathrooms 1:50
(plans and sections | António Portugal)



Bathroom, 1st floor
(photo | Catarina Wall Gago)

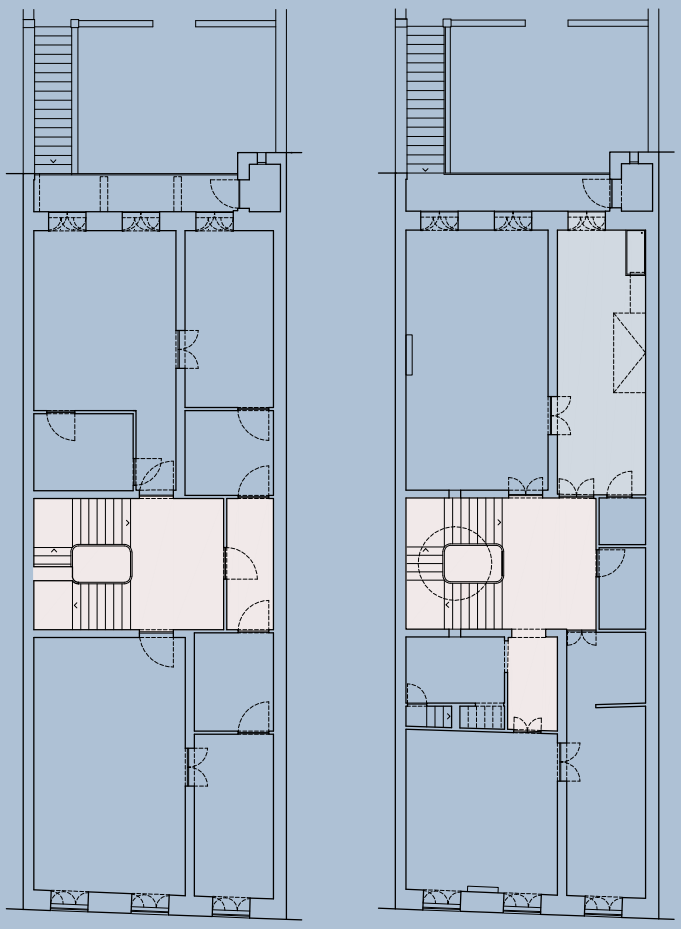
Courtyard façade
Staircase
(photos | Catarina Wall Gago)



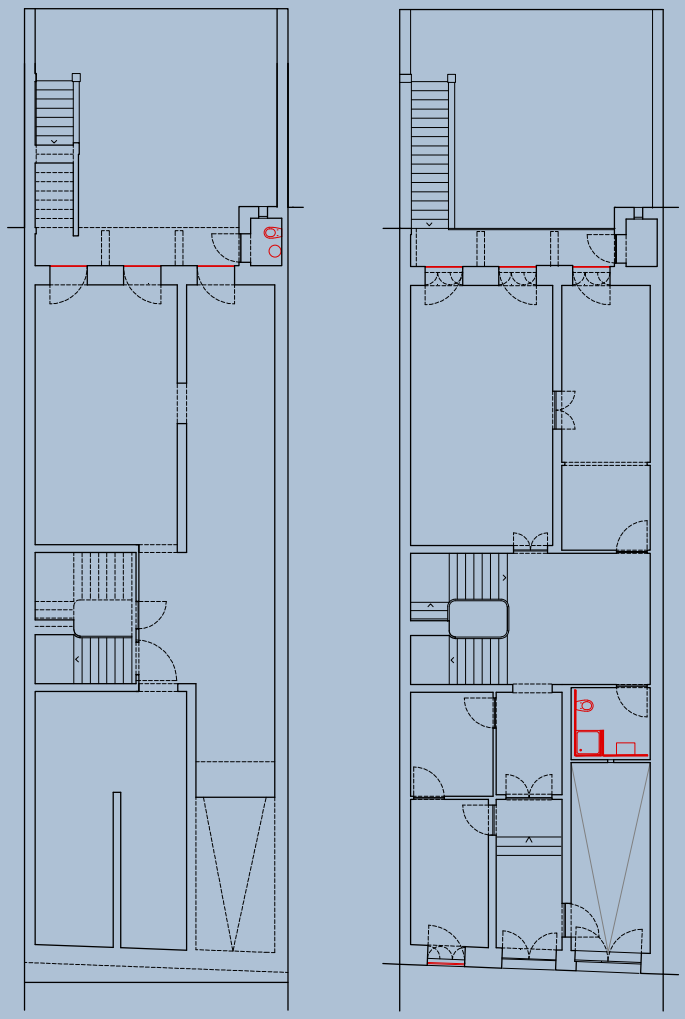
Lower ground floor | Ground floor 1:200
Reconstituted original plan

Service areas
Social areas
Circulation areas

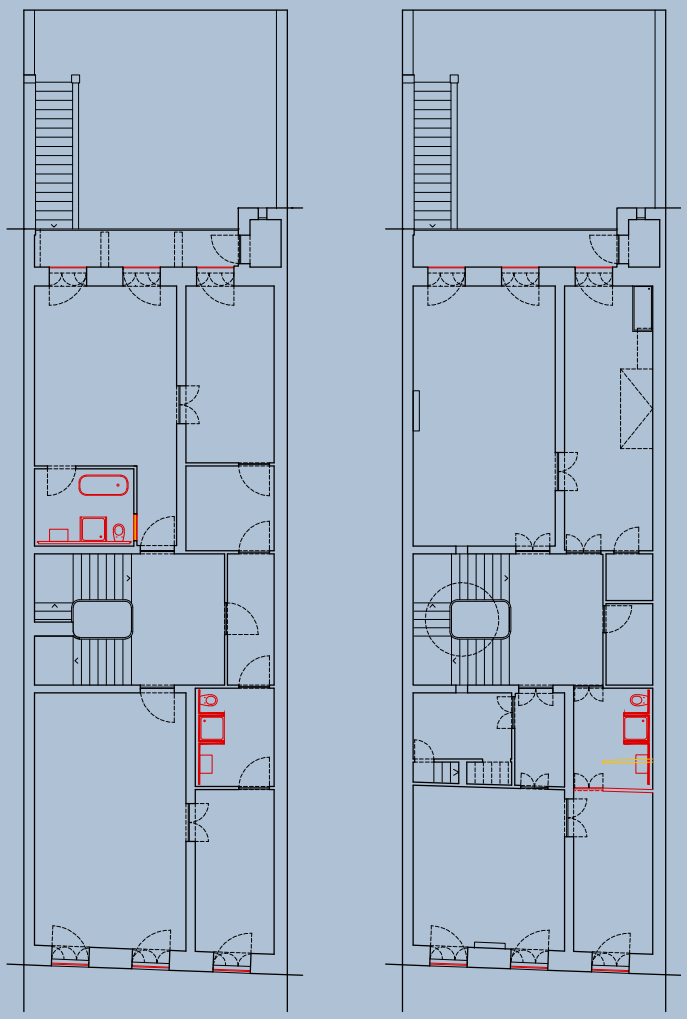
0 1 5



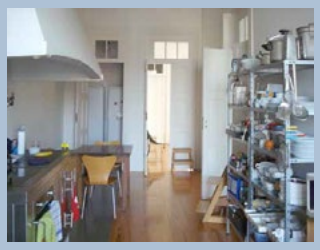
1st floor | 2nd floor
Reconstituted original plan



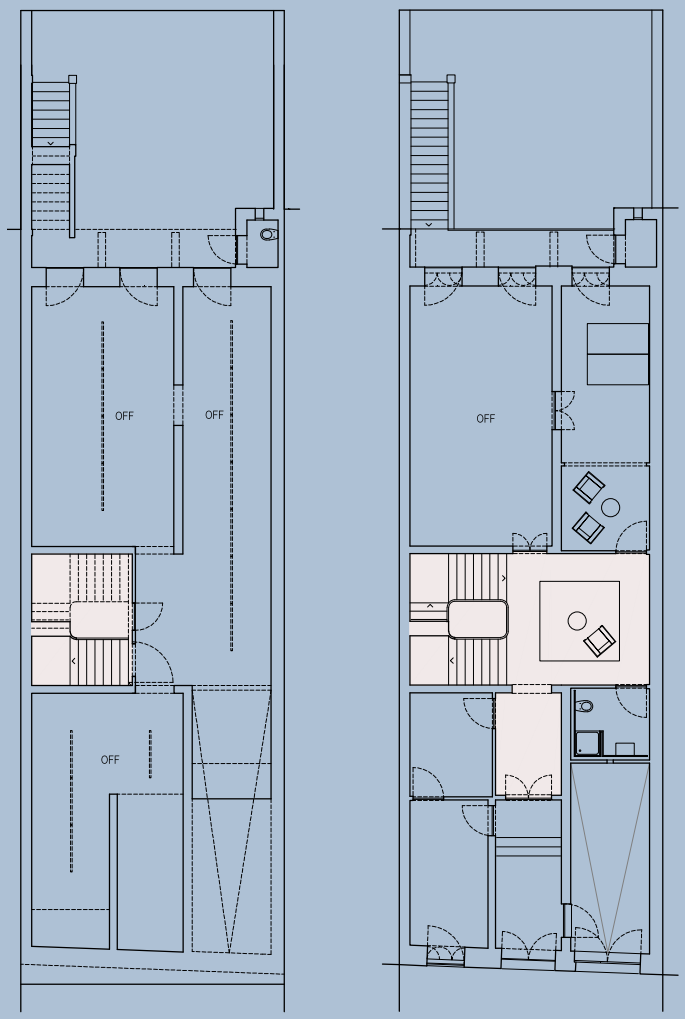
Lower ground floor | Ground floor 1:200
Changes introduced by the renovation project



1st floor | 2nd floor
Changes introduced by the renovation project



Kitchen
(photo | Catarina Wall Gago)



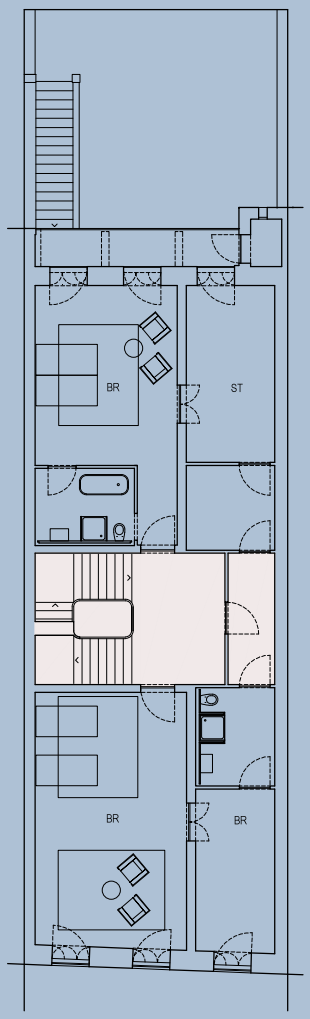
Lower ground floor | Ground floor 1:200
Final plan after renovation

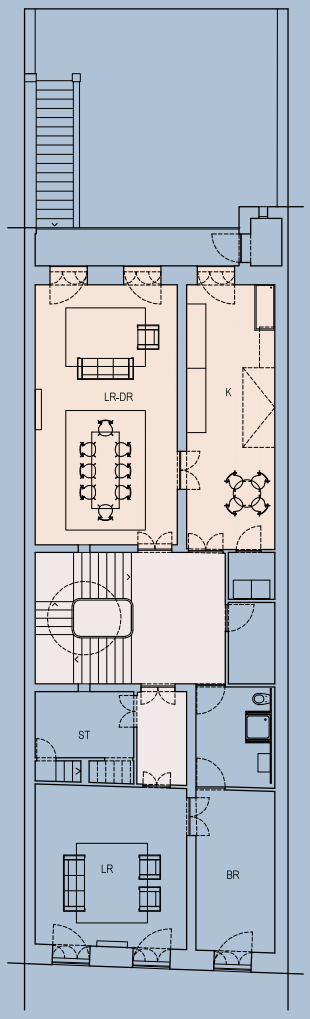
Service areas
Social areas
Circulation areas

0 1 5

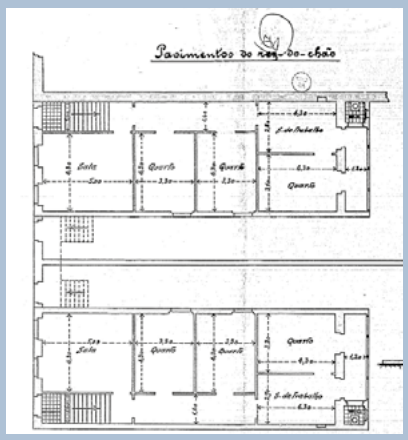
Types of rooms

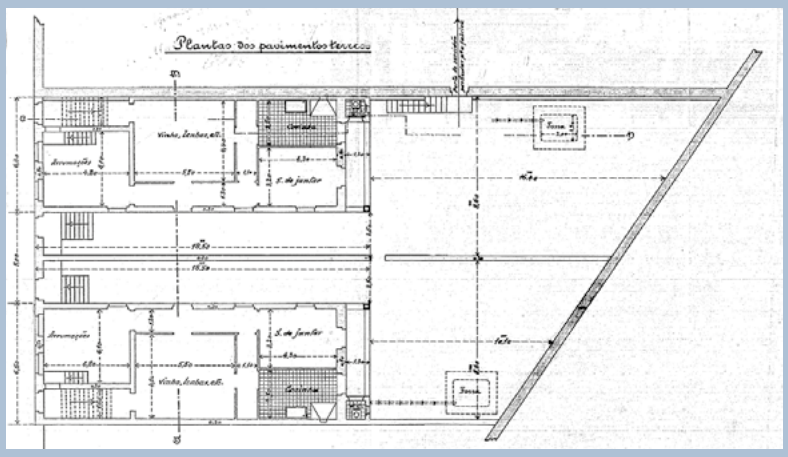
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office





1st floor | 2nd floor
Final plan after renovation





Floor plans, 1918
(AHMP)

Original construction 1918
Renovation work 1992 · 1993
Initial and current functional type Single-family terraced house

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Archive information Arquivo Histórico Municipal do Porto (LO-1918-0625-120 to 123) [Original drawings]
(D-CMP-09-680-001 to 003) [Top floor]
Arquivo do Licenciamento das Aguas do Porto (n° 5318, 1936) [Connection to sewage network]

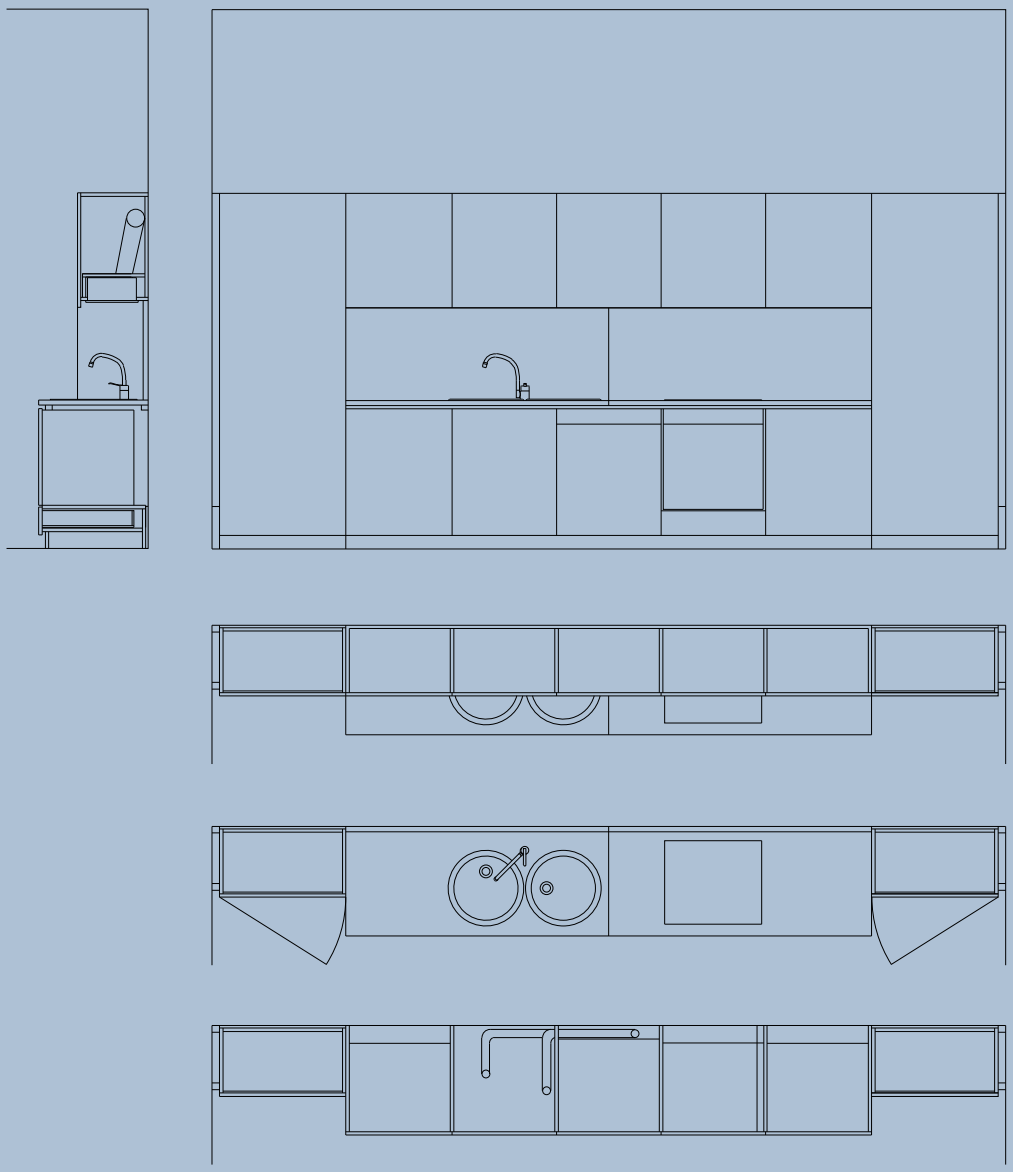
17 | OPORTO

RUA ANTONIO GRANJO 108

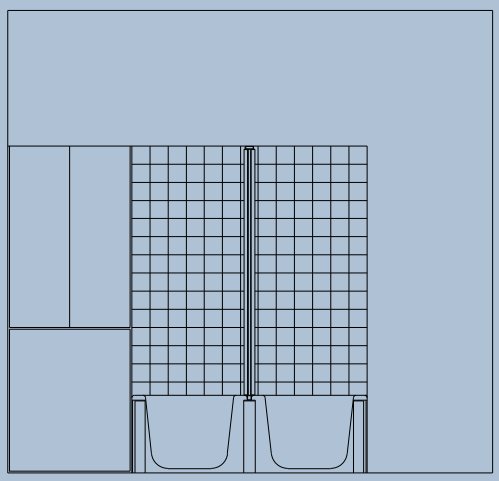
Kitchen and dining room
(photo | Paulo Correia,
Casa & Campo, 1994:84)

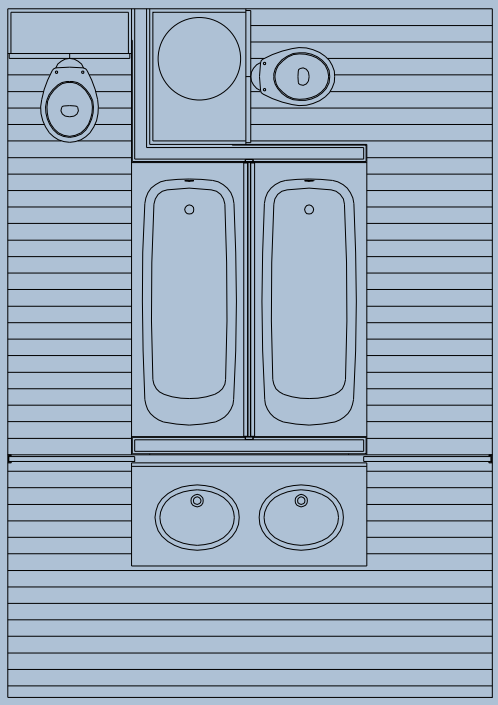
Elevations and section 1:200
(drawings | A.Portugal, A.Wermeille)

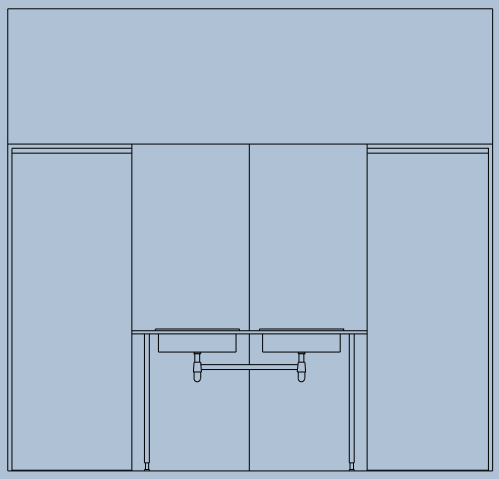
Architectural design António Portugal and Anne Wermeille
Structural design José Mateus Gomes



Kitchen, ground floor 1:50
(drawings | A.Portugal, A.Wermeille)

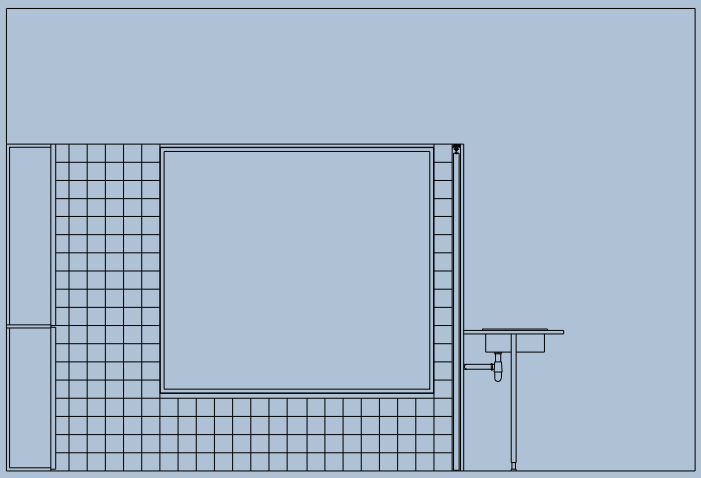




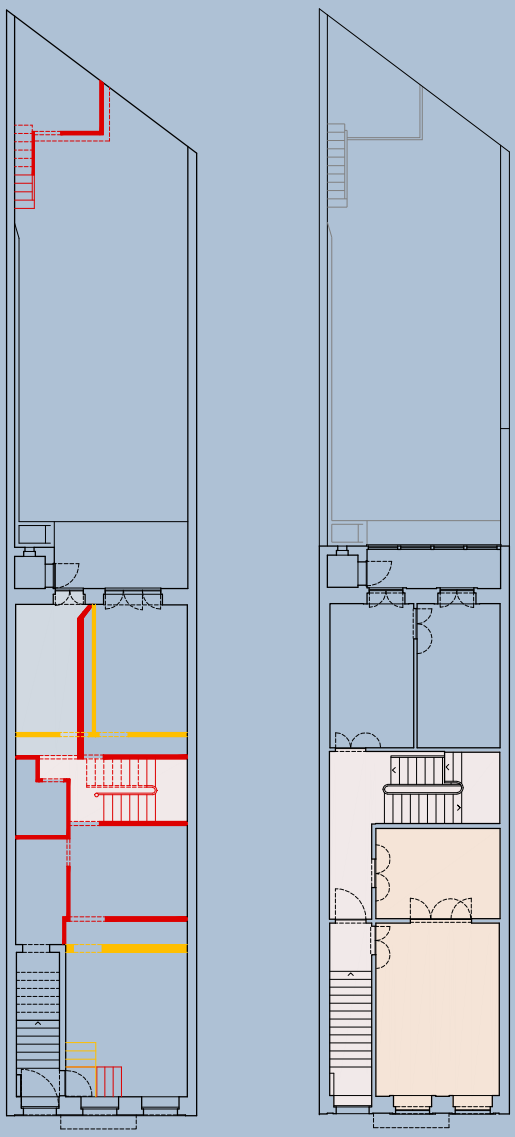


Bathroom, 1st floor 1:50
(drawings | A.Portugal, A.Wermeille)

(photo | Paulo Correia,
Casa & Campo, 1994:84)



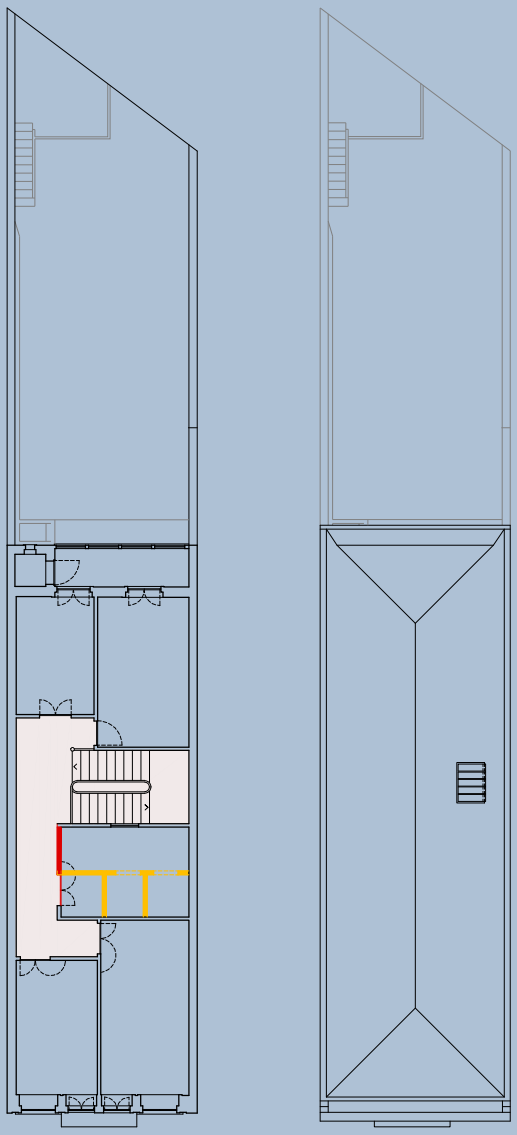
Façades
(photos | A.Portugal, A.Wermeille)



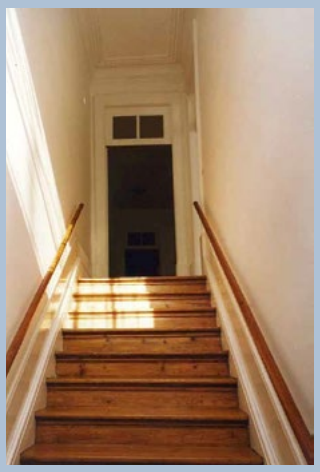
Lower ground floor | Ground floor 1:200
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

0 1 5

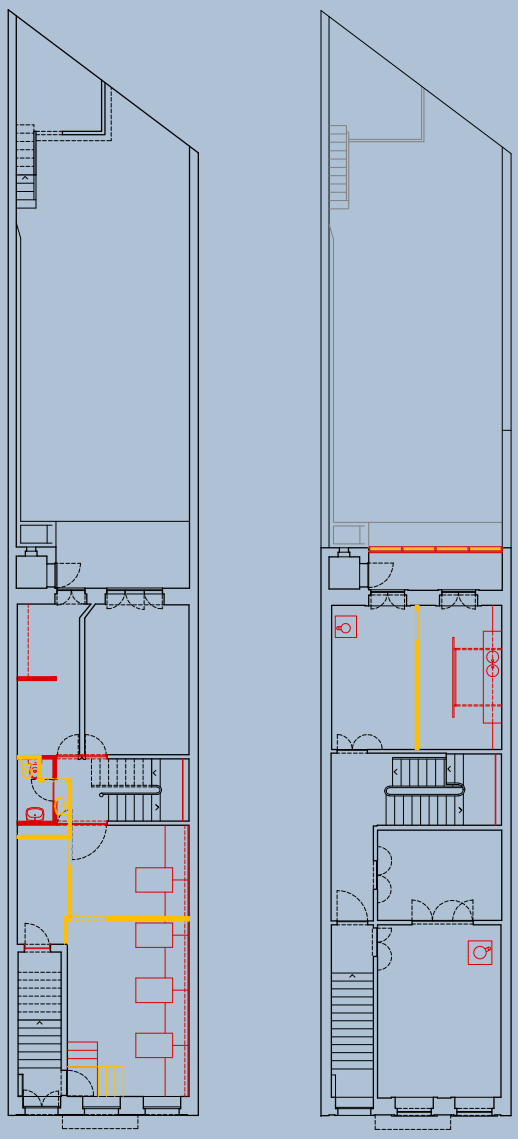


1st floor | Roof
Changes identified to the original plan throughout the 20th century

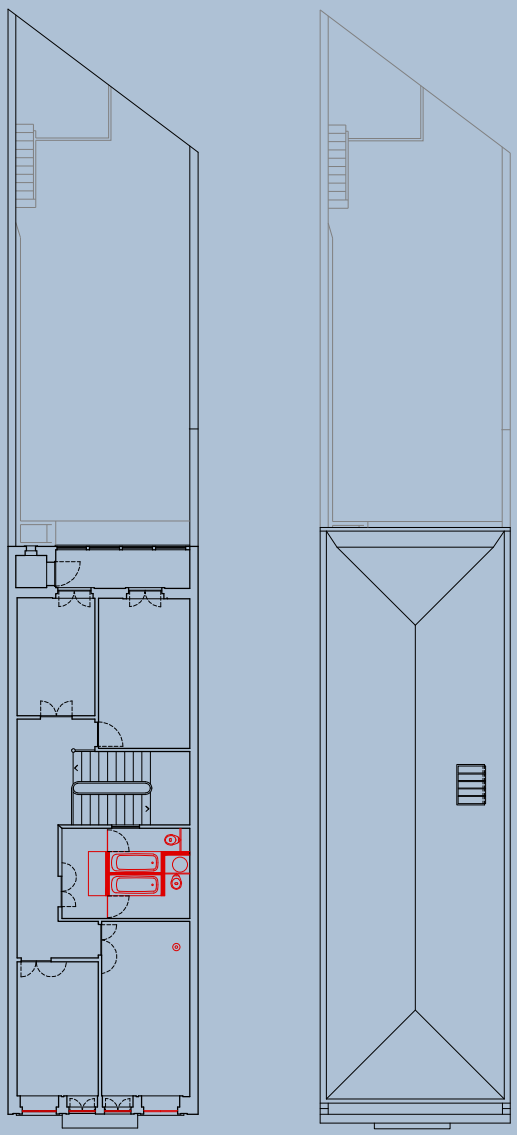


Entrance stairs
(photo | A.Portugal, A.Wermeille)

Bedroom, 1st floor
(photo | Paulo Correia,
Casa & Campo, 1994:83)



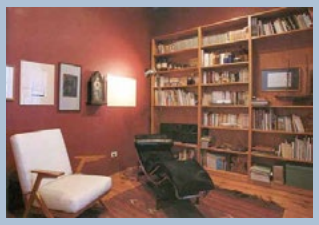
Lower ground floor | Ground floor 1:200
Changes introduced by the renovation project

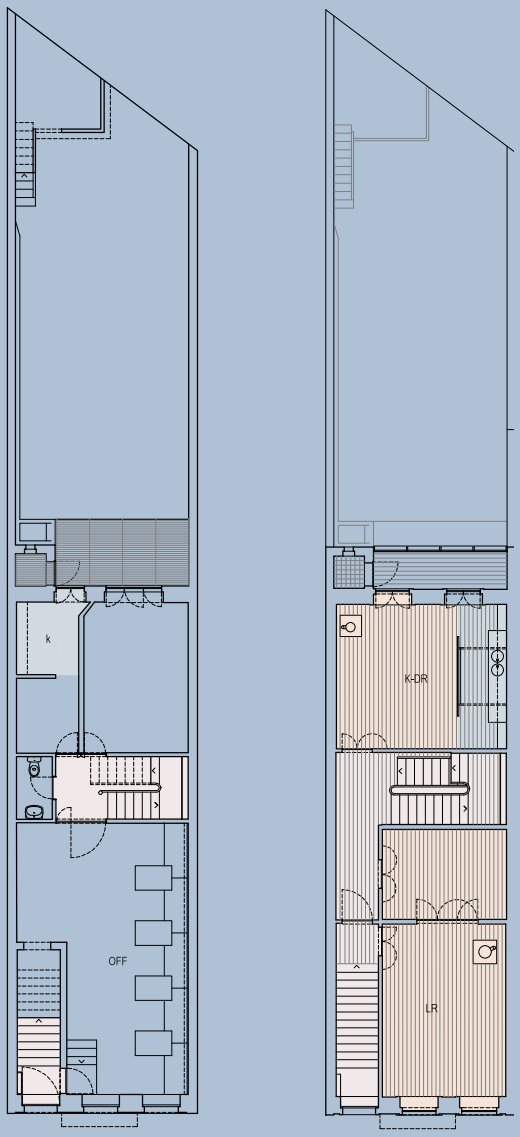


1st floor | Roof
Changes introduced by the renovation project

Living room, ground floor
(photo | A.Portugal, A.Wermeille)

(photo | Paulo Correia,
Casa & Campo, 1994:83)





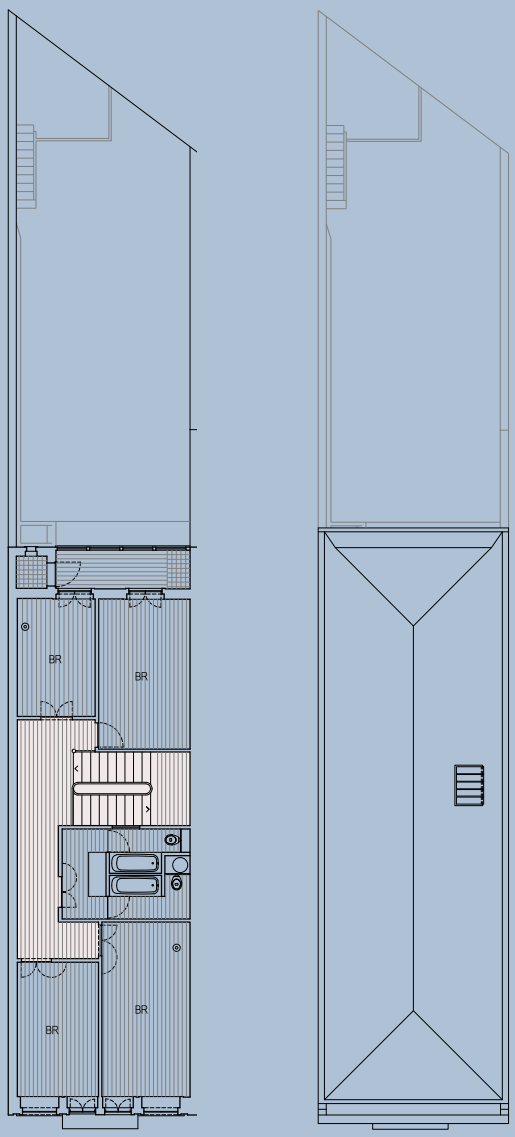
Lower ground floor | Ground floor 1:200
Final plan after renovation

Service areas
Social areas
Circulation areas

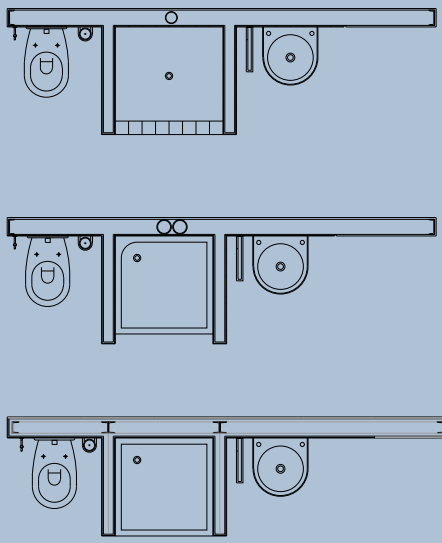
0 1 5

Types of rooms

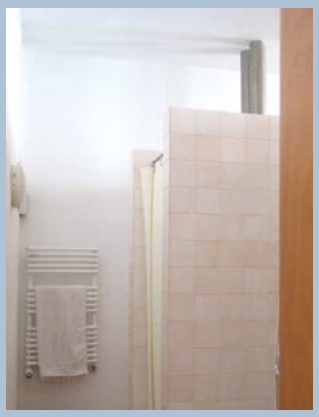
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office

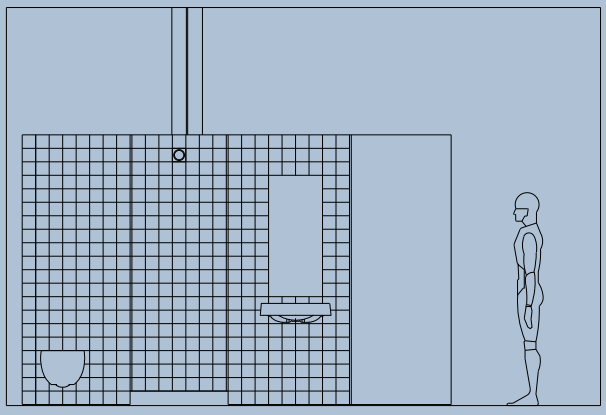


1st floor | Roof
Final plan after renovation



Studies for the bathrooms 1:50
(plans and section | Paula Ribas)
(photos | Catarina Wall Gago)





Original construction Early 19th century
Renovation work 2000 - 2001
Initial and current functional type Single-family terraced house

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Archive information Arquivo do Licenciamento das Aguas do Porto (n° 3598, 1936) [Connection to sewage network]

18 | OPORTO

RUA DO ROSARIO 223

Living room and terrace
(photo | Catarina Wall Gago)

Architectural design Paula Ribas
Structural design Jorge Marques
Structural design – balcony Adriana Barbosa
Landscape design – garden Cláudia Taborda
Agrarian consultant – garden Paulo Monteiro Martins
Furniture design Luís Mendonça

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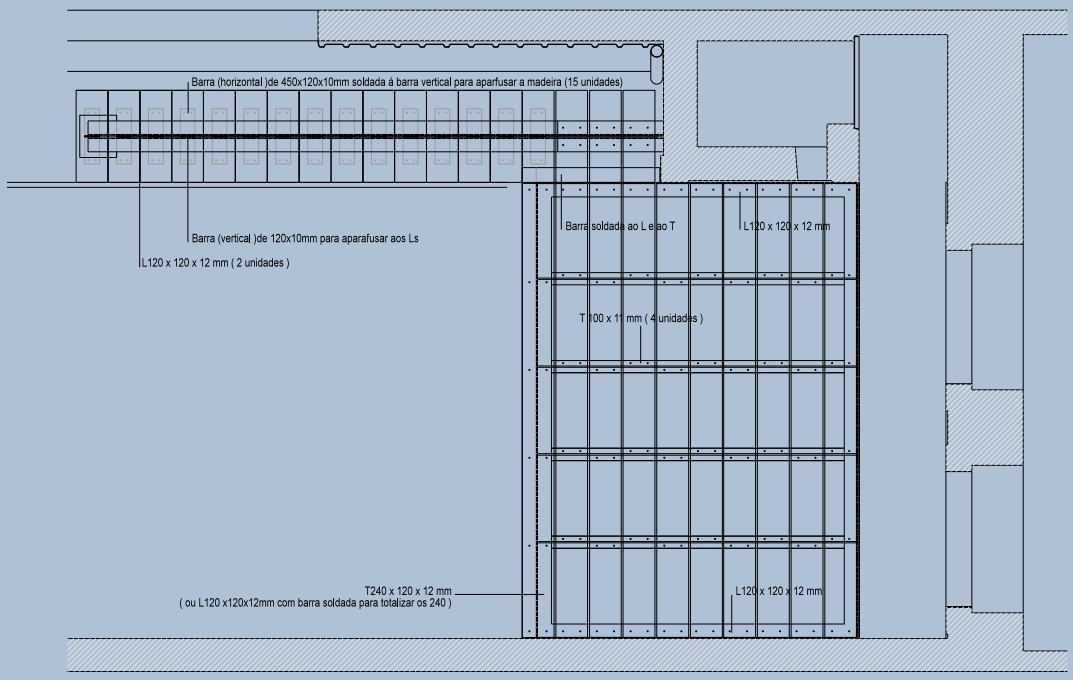
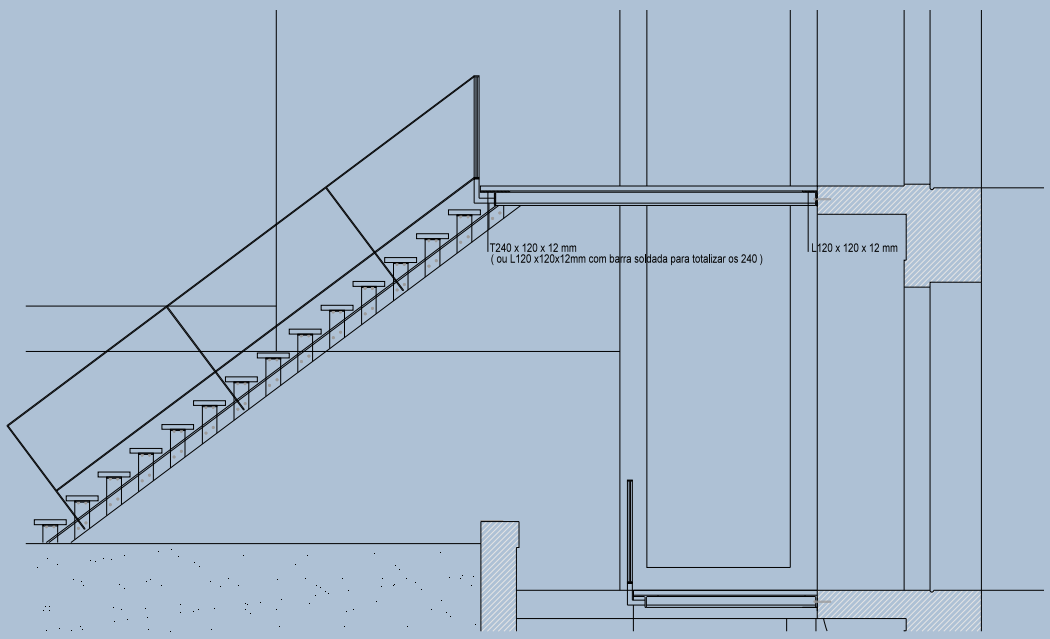
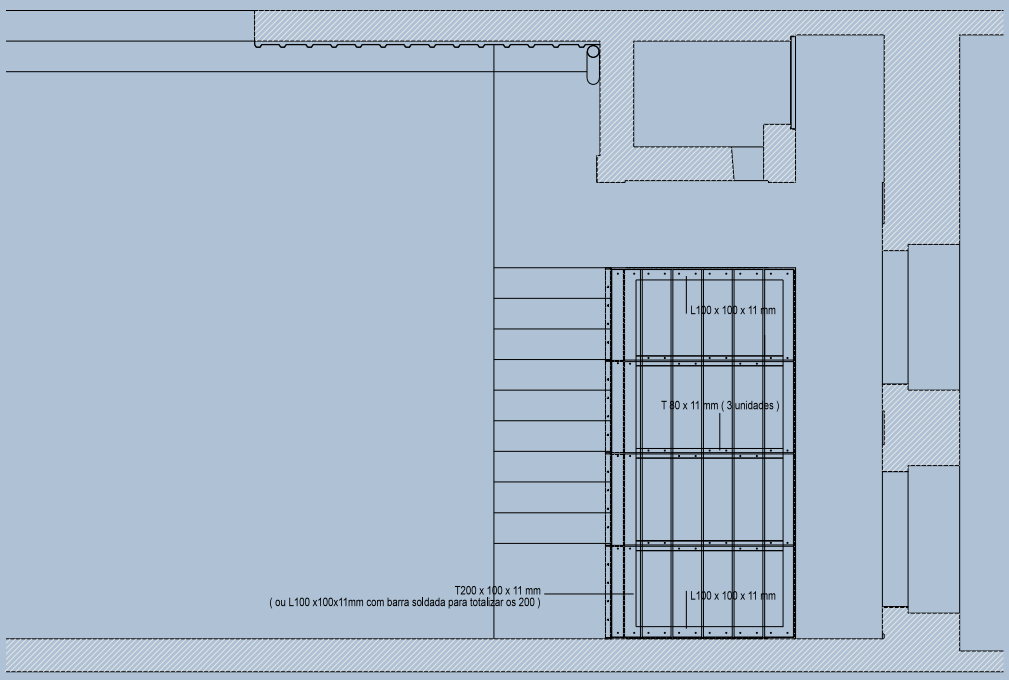
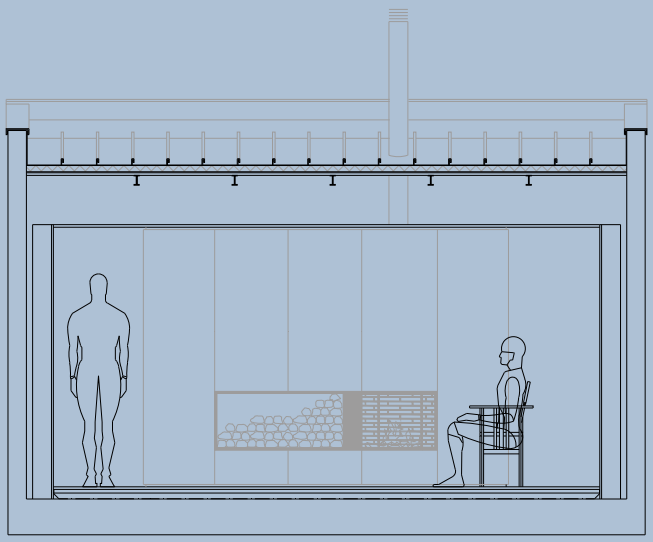
Contractor Silva Marques
Heating installation Sousa Pedro comercial – Energia térmica


Barra (horizontal)de 450x120x10mm soldada á barra vertical para aparfusar a madeira (15 unidades)
Barra (vertical)de 120x10mm para aparafusar aos Ls
L120 x 120 x 12 mm (2 unidades)
Barra soldada ao L e ao T
L120 x 120 x 12 mm
T 100 x 11 mm (4 unidades)
T240 x 120 x 12 mm
(ou L120 x120x12mm com barra soldada para totalizar os 240)
L120 x 120 x 12 mm

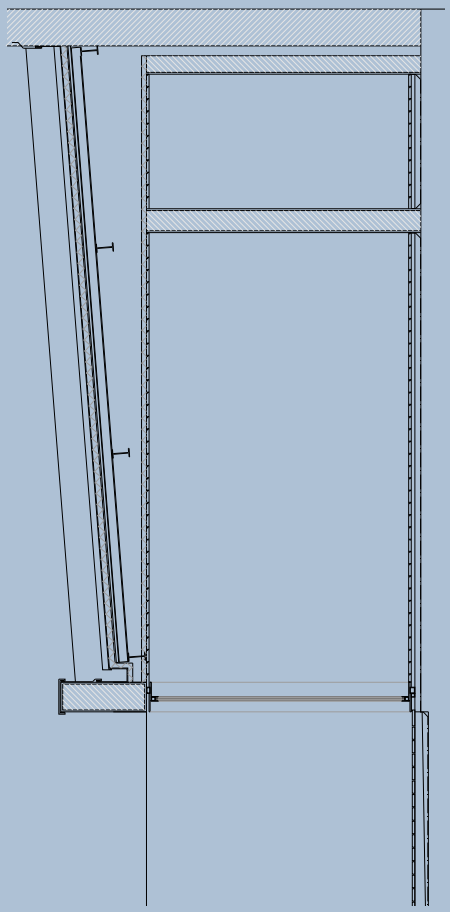

T240 x 120 x 12 mm
(ou L120 x120x12mm com barra soldada para totalizar os 240)
L120 x 120 x 12 mm

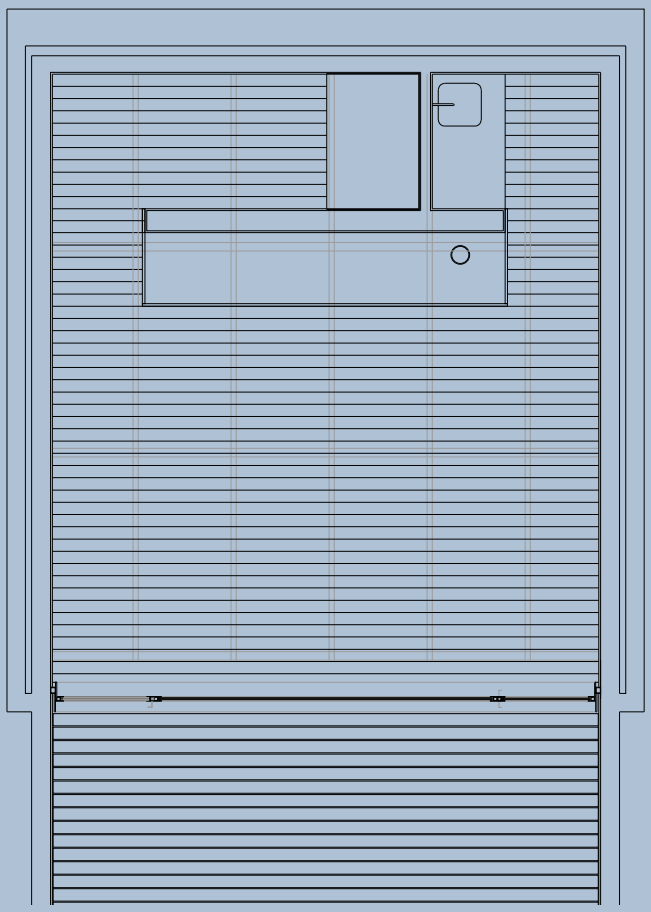


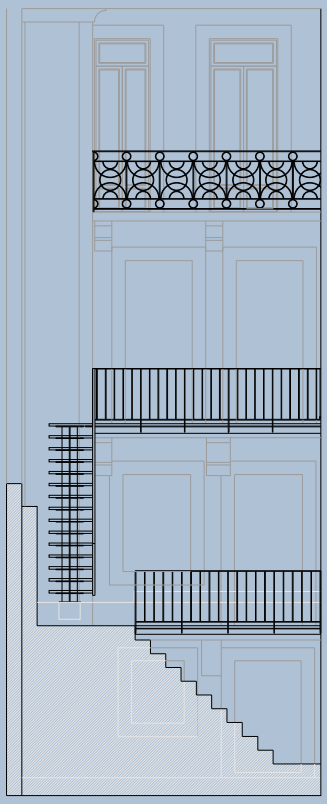
Terrace 1:50
(drawings | Paula Ribas, Adriana Barbosa)
(photo | Paula Ribas, Luís Mendonça)



Garden annex 1:50
(plan and sections | Paula Ribas)

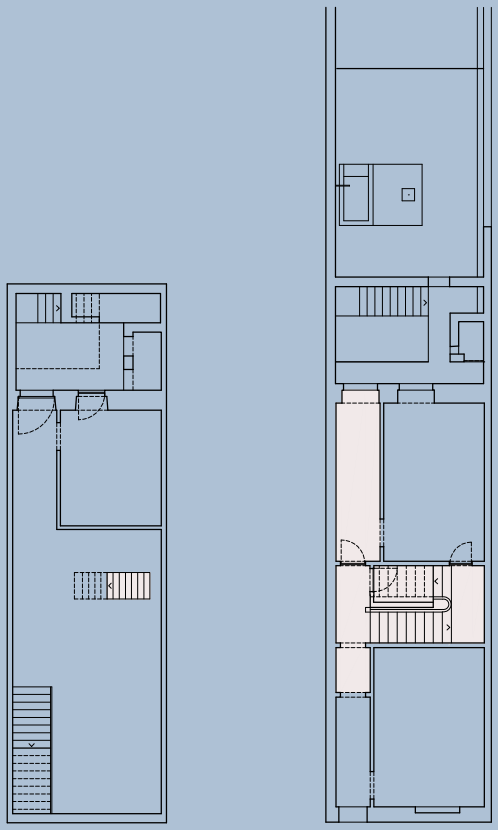






Courtyard elevation 1:100
(drawings | Paula Ribas, Adriana Barbosa)
(photos | Catarina Wall Gago)

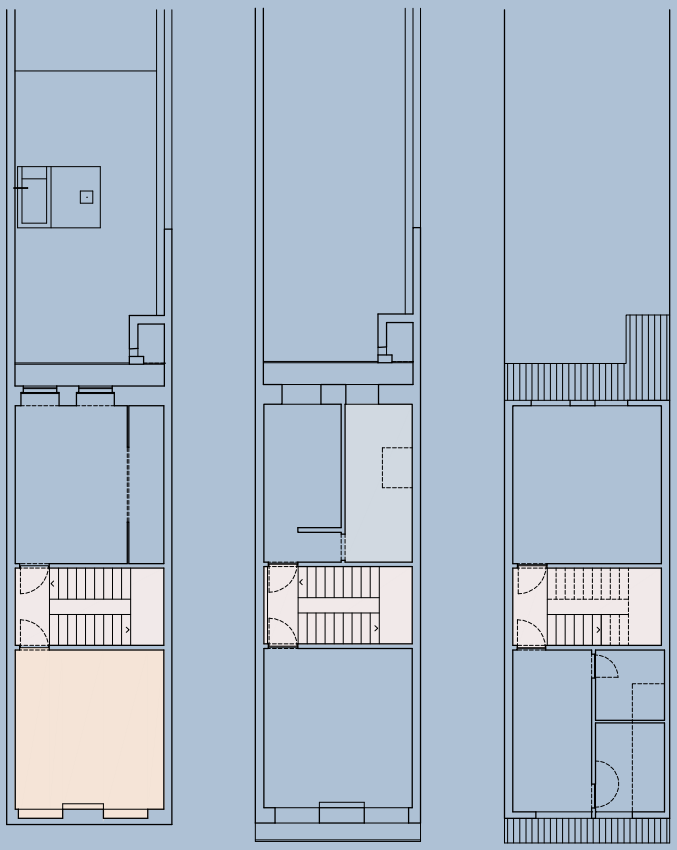
Staircase
(photo | Catarina Wall Gago)



Lower ground floor | Ground floor 1:200
Reconstituted original plan

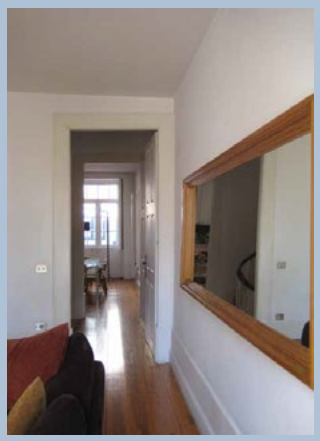
Service areas
Social areas
Circulation areas

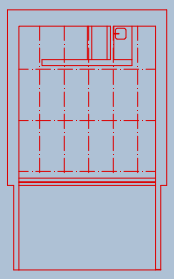
0 1 5

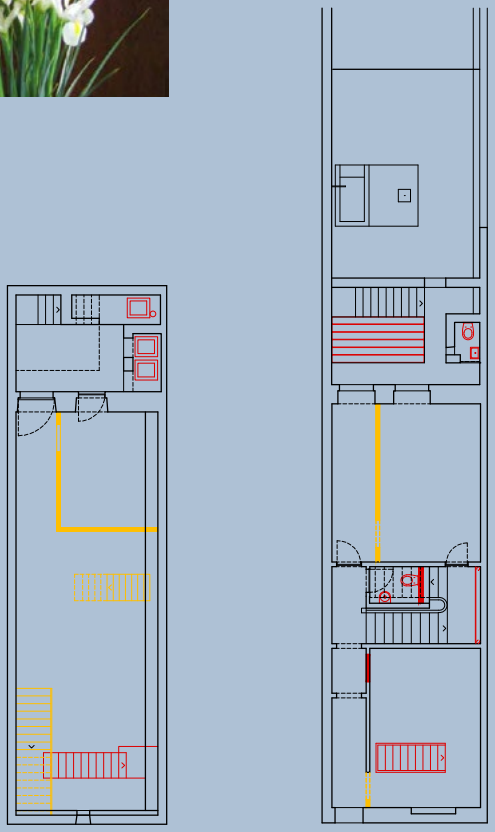


1st floor | 2nd floor | 3rd floor
Reconstituted original plan

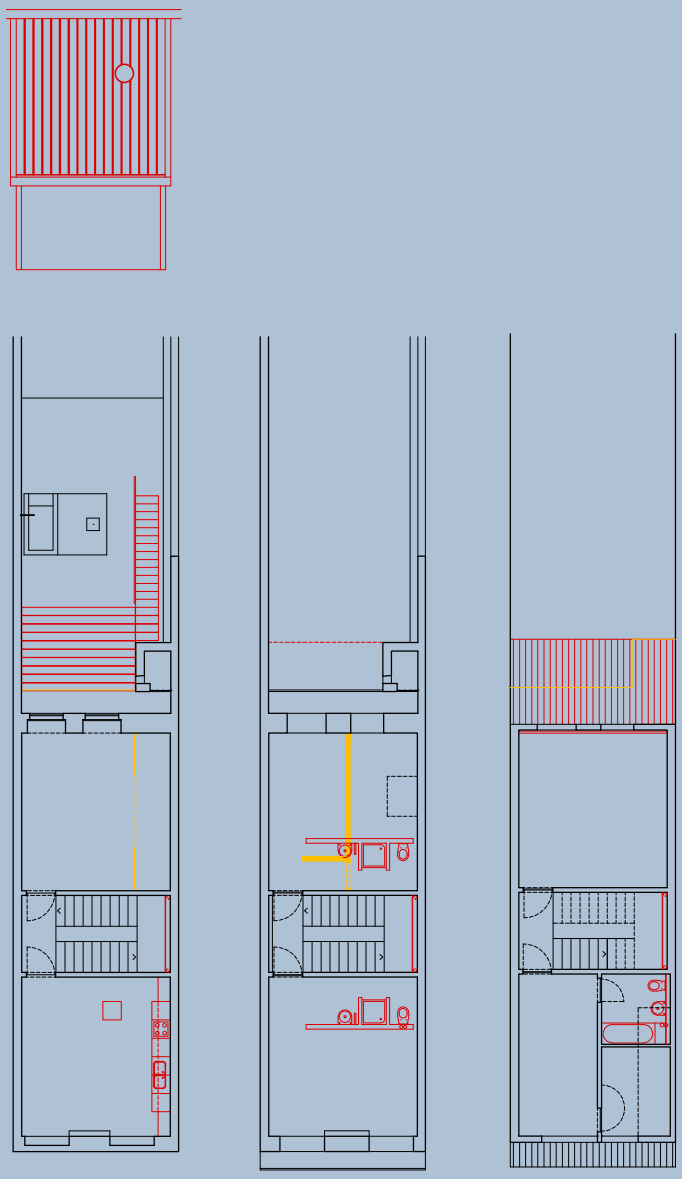
Kitchen and living room
(photos | Catarina Wall Gago)



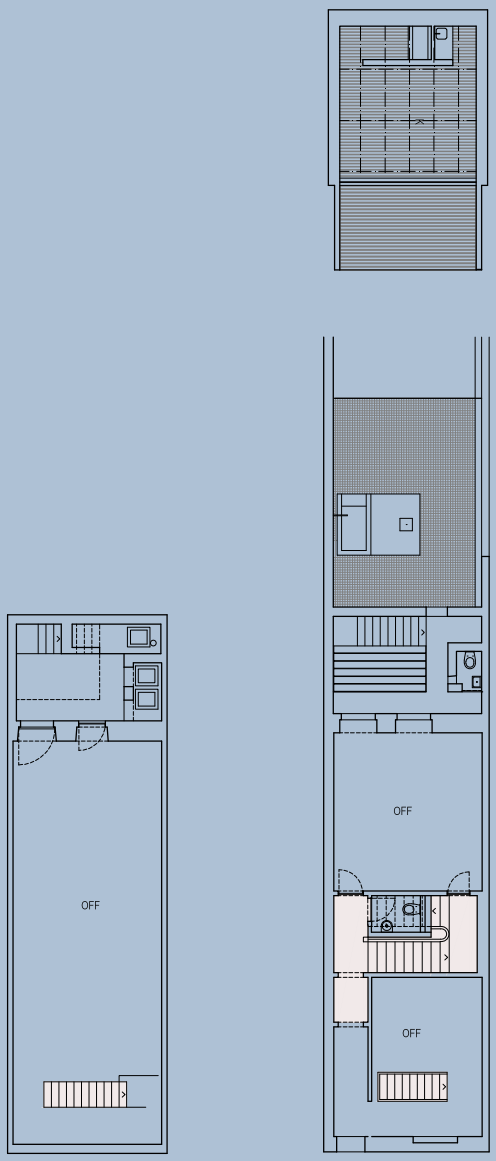




Lower ground floor | Ground floor 1:200
Changes introduced by the renovation project



1st floor | 2nd floor | 3rd floor
Changes introduced by the renovation project



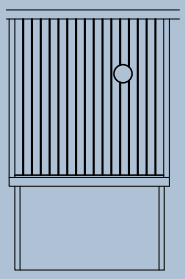
Lower ground floor | Ground floor 1:200
Final plan after renovation

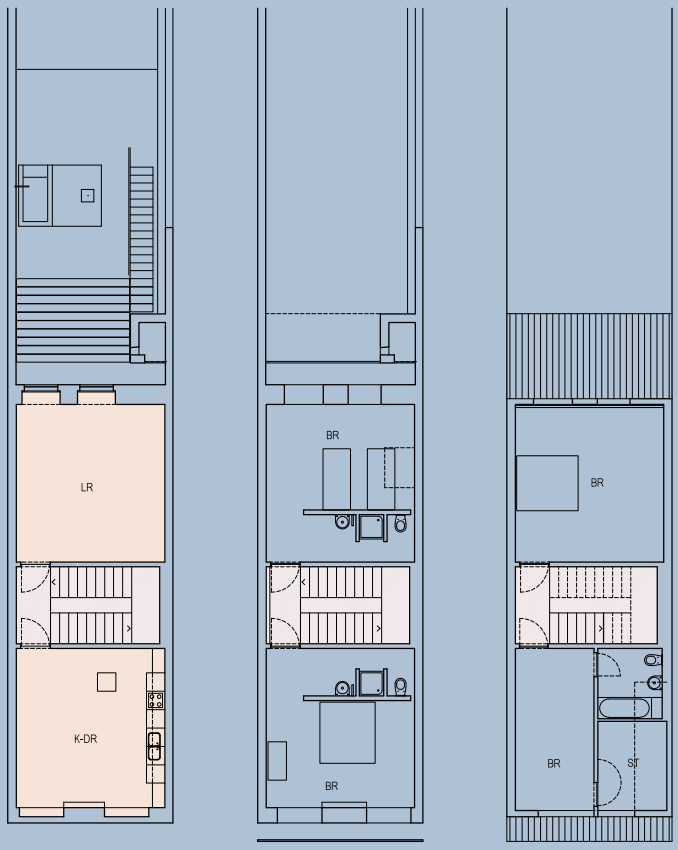
Service areas
Social areas
Circulation areas

0 1 5

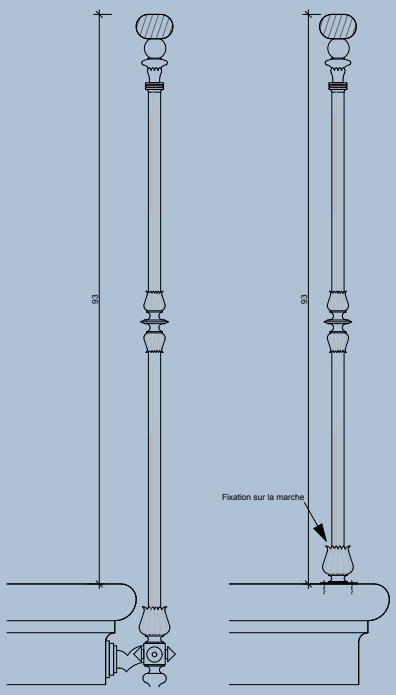
Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



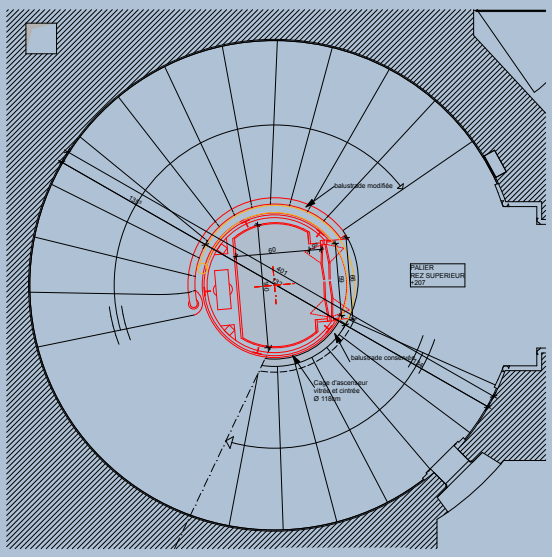


1st floor | 2nd floor | 3rd floor
Final plan after renovation

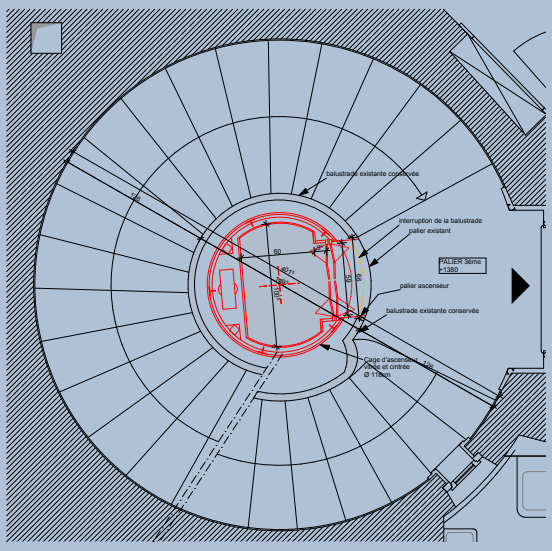


Original handrail
without changes
from GF to attic

Original changed
handrail
from basement to GF



Ground floor



3rd floor

Planned lift 1:50
Changes to handrail 1:10
(drawings | MVT Architectes)

Original construction ca. 1874, Camoletti & Delesvaux
Renovation work, a different project was carried out [March architectes]
Initial and current functional type 1 flat per floor block of flats

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Archive information Archives d'Etat de Genève (TP 1873/24) [Letters from Camoletti & Delesvaux]
Département des constructions et de l'aménagement (Cité – 71/G, 1927) [Plan drawings for garage]

19 | GENEVA

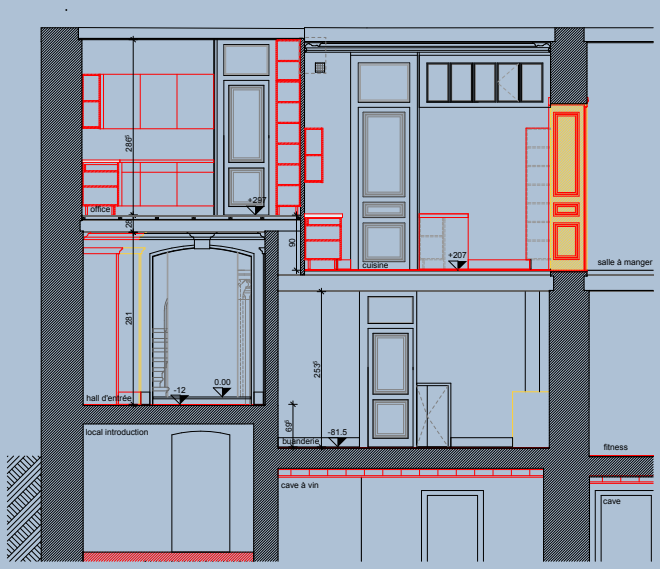
RUE DE SAINT-VICTOR 8

Staircase
(photo | MVT Architectes)

Architectural design MVT Architectes SA

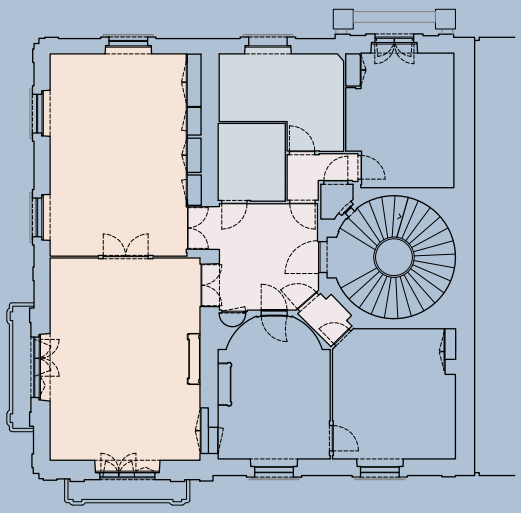
Section 1:200
(drawing | MVT Architectes)

Window detail
Living room
(photos | Catarina Wall Gago)

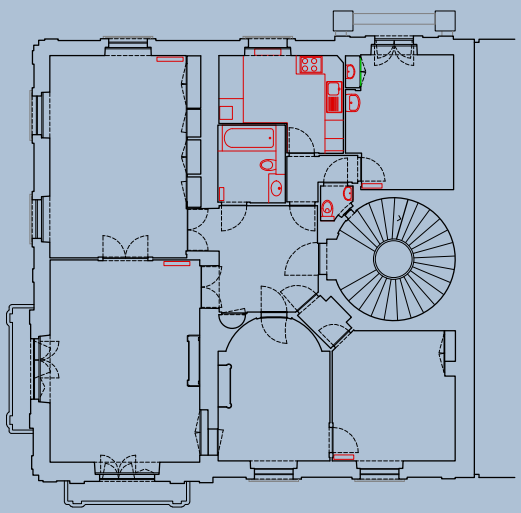


Section through basement and ground floor 1:100
(drawing | MVT Architectes)

View from Rue de Saint-Victor
(photo | MVT Architectes)



1st floor 1:200
Reconstituted original plan



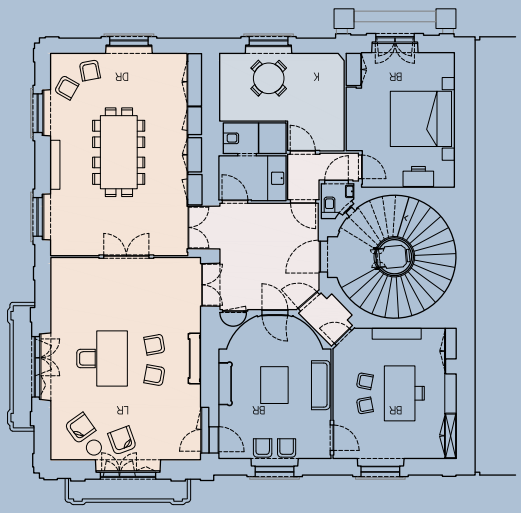
1st floor
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

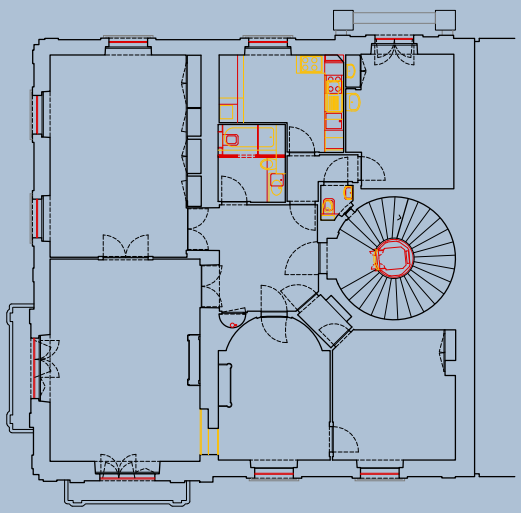
0 1 5

Types of rooms

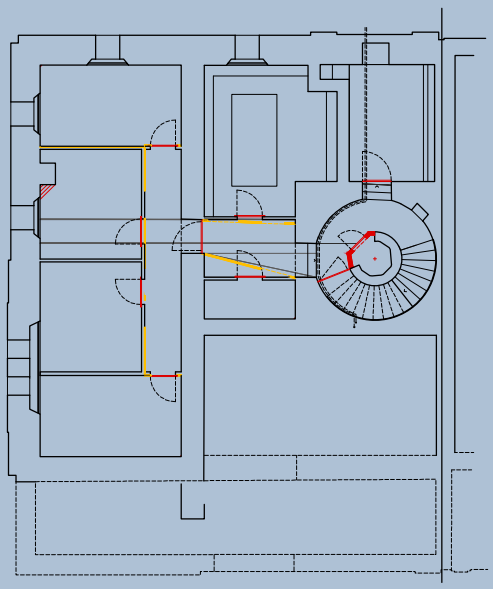
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



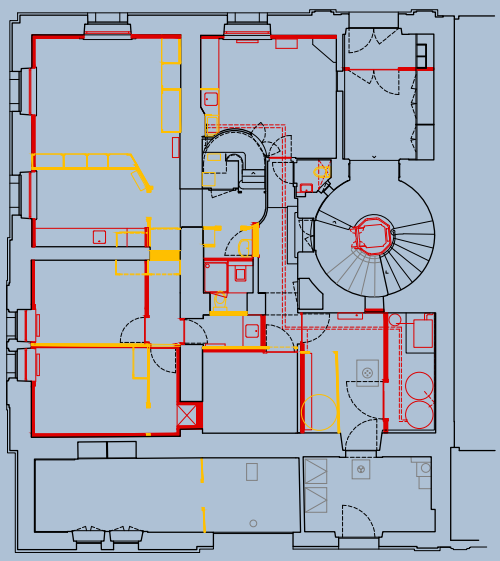
1st floor
Final plan after renovation



1st floor
Changes introduced by the renovation project

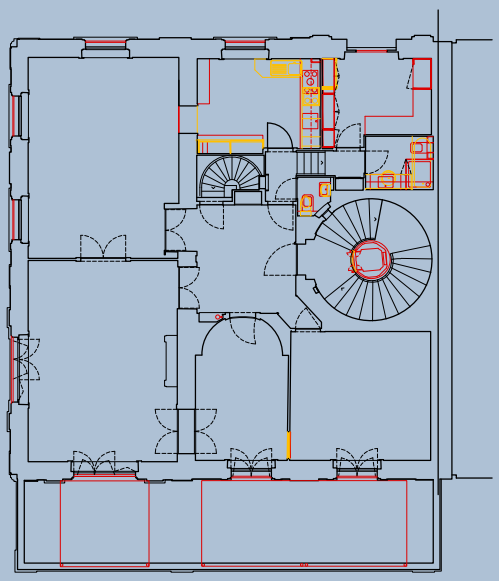


Basement 1:200
Changes introduced by the renovation project



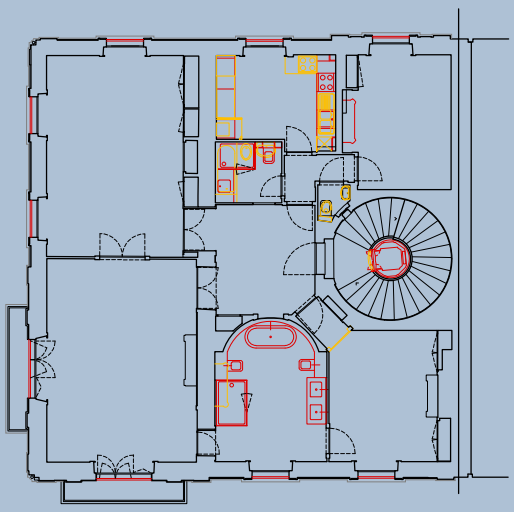
Lower ground floor
Changes introduced by the renovation project

0 1 5

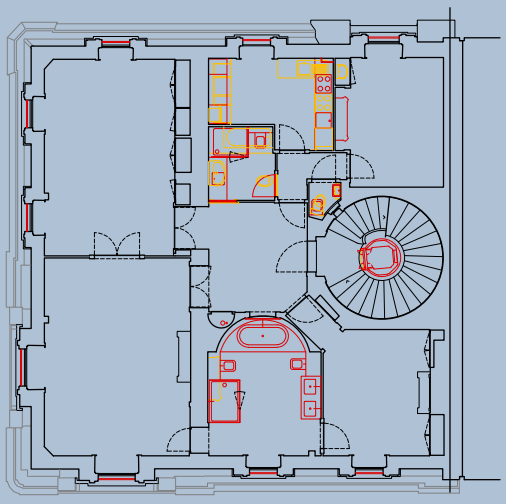


Ground floor
Changes introduced by the renovation project

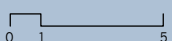
Rue Charles-Bonnet façade
Project for blinds and pergolas
(drawing | MVT Architectes)

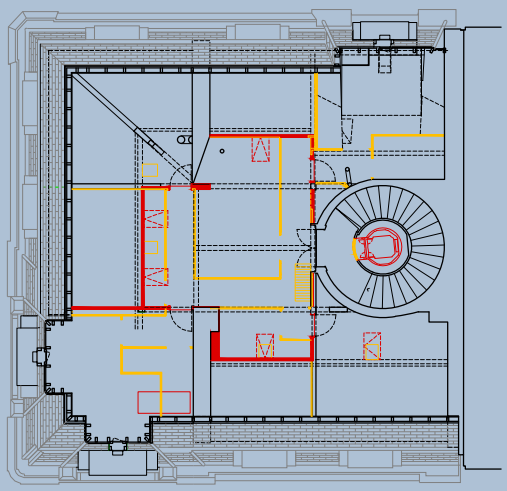


2nd floor 1:200
Changes introduced by the renovation project

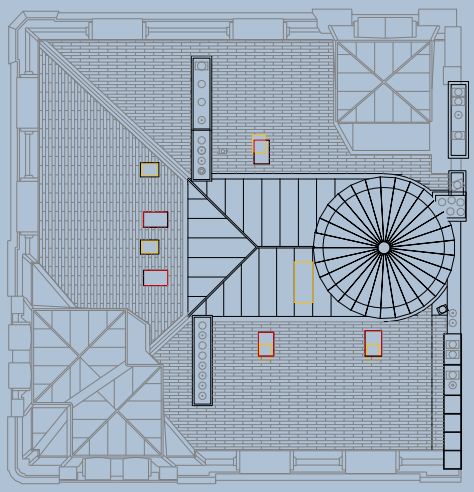


3rd floor
Changes introduced by the renovation project

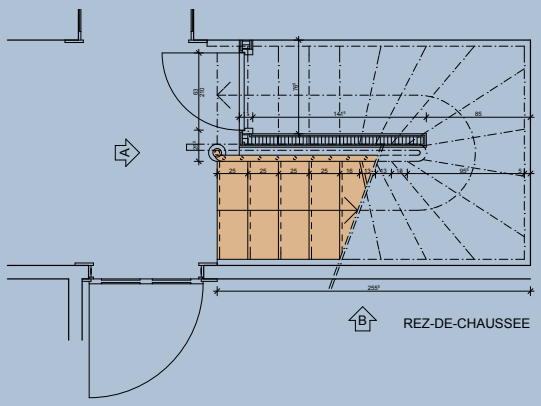


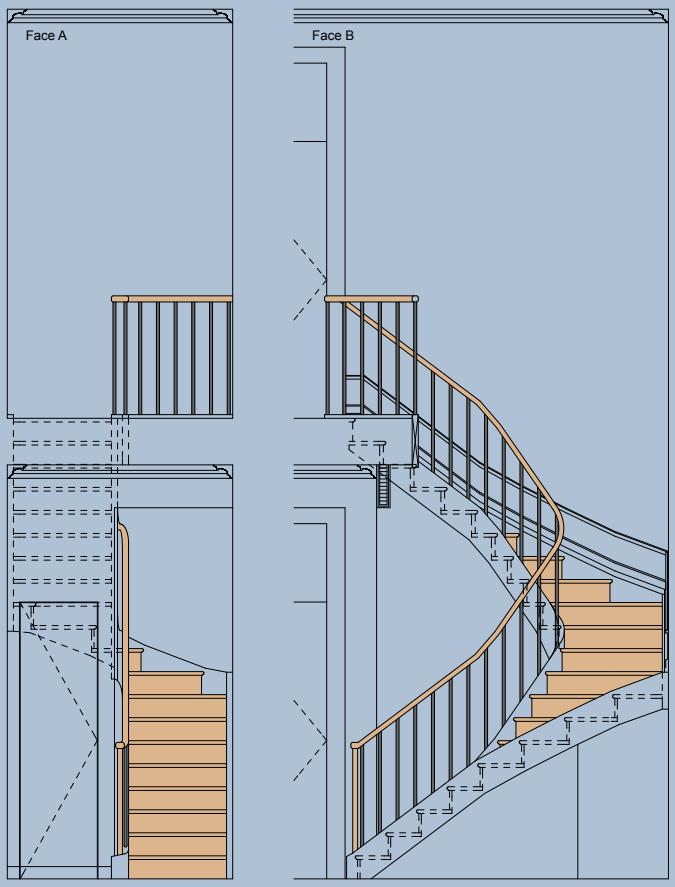


4th floor
Changes introduced by the renovation project



Roof
Changes introduced by the renovation project





Staircase, ground floor to 1st floor
(drawings | MVT Architectes)
(photo | Catarina Wall Gago)

Original construction ca. 1873, Henri Vaucher
Renovation work 2009 · 2010
Initial and current functional type 1 flat per floor block of flats

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Archive information Archives d'Etat de Genève (TP 1872/118) [Letter from Henri Vaucher]
Département des constructions et de l'aménagement (n° 51680, 1967; DD 100.496) [Plan drawings]

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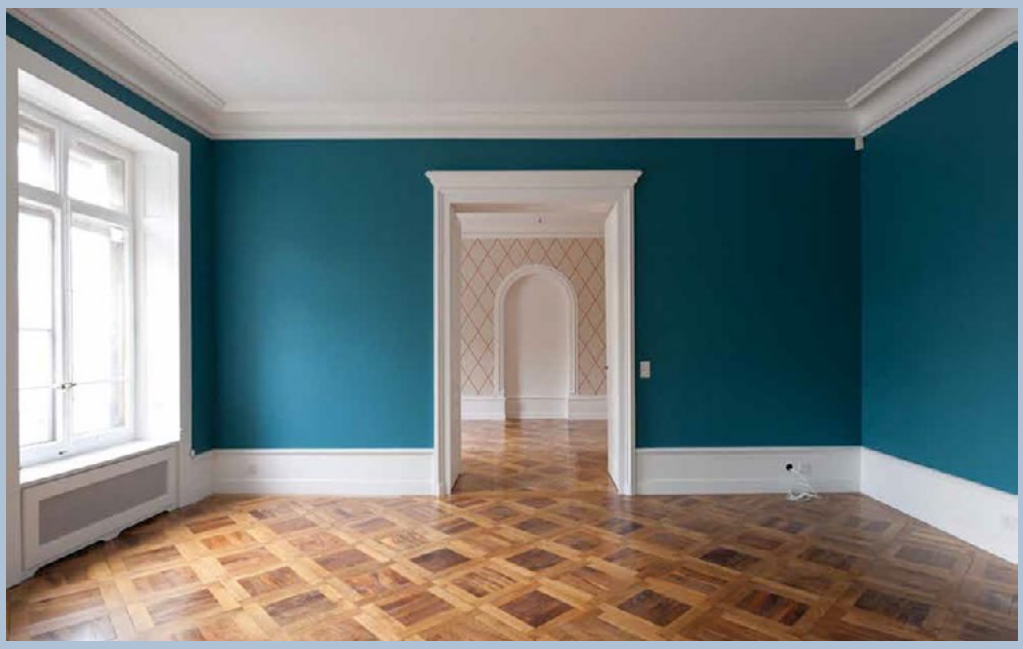
RUE DE SAINT-VICTOR 10



Living and dining room, ground floor
(photo | MVT Architectes)

Architectural design MVT Architectes SA
Structural design JUNDT – D. Esposito
Thermal and ventilation design Raymond E. Moser SA – J.-M. Schneider
Plumbing design BUCLIN – P. Buclin
Asbestos consultant BIRD – J. Rey | **Removal** AD technique
Rendering consultant SIMOND – R. Simond | **Installation** DA SILVA

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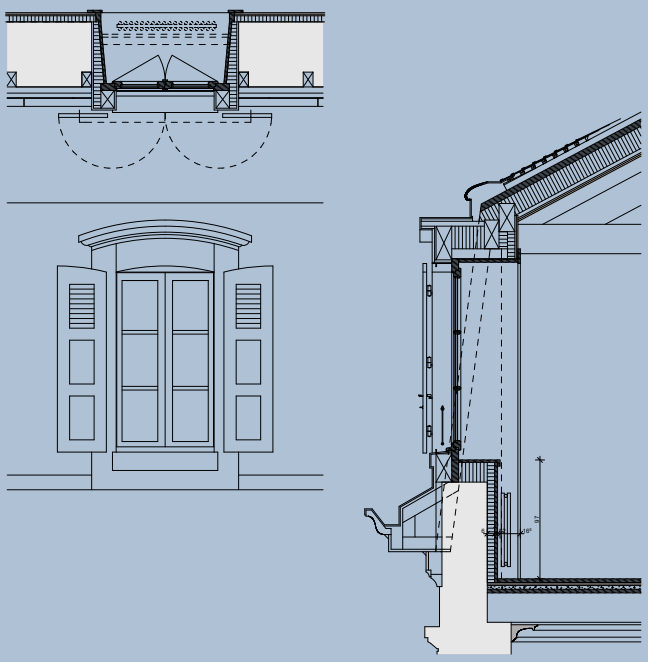
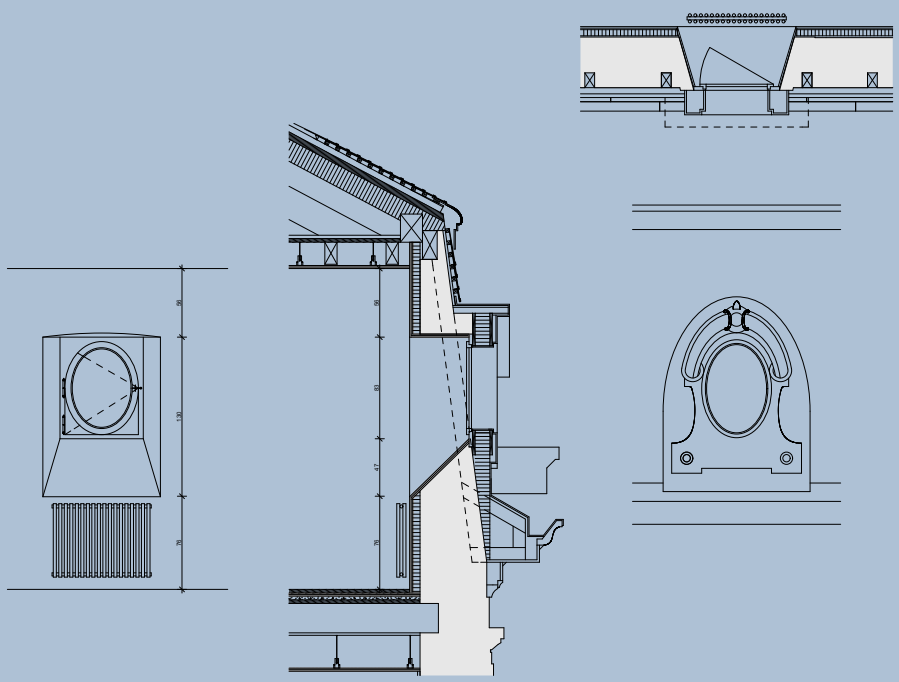
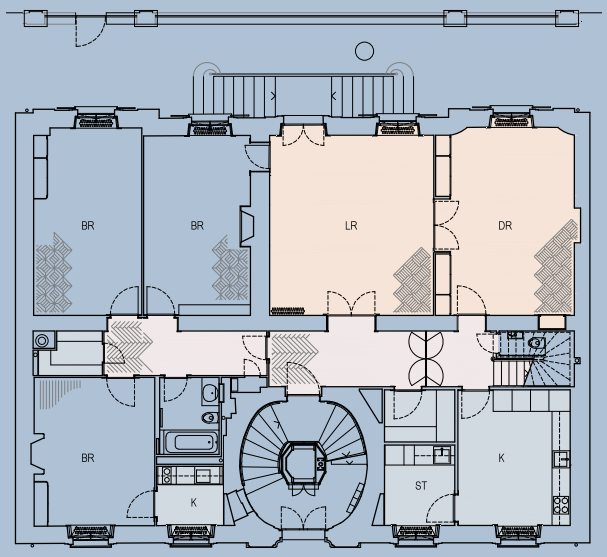
Roof timber frame ASAC CASAI
Tinplate installation MACULLO
Stonework MELLO-LEPRAT
Exterior woodwork BIEDERMANN **Blinds** GRIESSER
Interior woodwork SAVORETTI | DURIG
Wooden flooring COUDREY DE VITO
Plaster and paintwork ERMA CORA EA
Sanitary installation PFISTER & ANDREINA
Electrical installation MONTANIER & SCHWITZGUEBEL
Heating installation BELESTRA-GALIOTTO
Ventilation installation TRAITAIR
Tile installation SEICAL
Kitchen appliances ARC LINEA
Lift MENETREY
Chimney GREMAUD

Street view, Rue Charles-Bonnet
Transverse section 1:200
(photo and drawing | MVT Architectes)

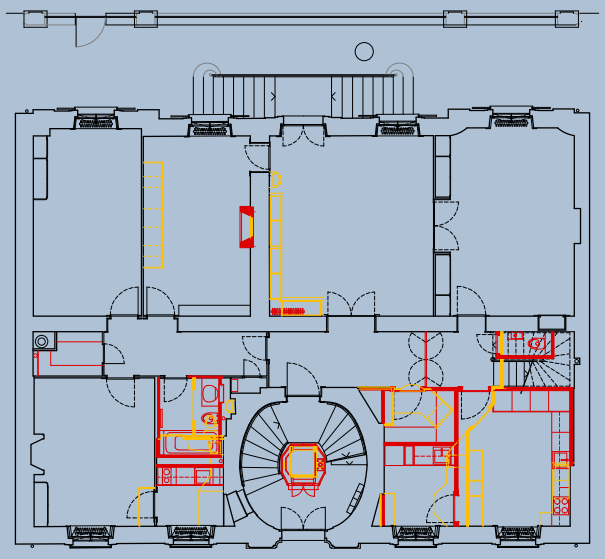


Attic windows with insulated double glazing 1:50
(drawings | MVT Architectes)





Ground floor 1:200
Final plan after renovation



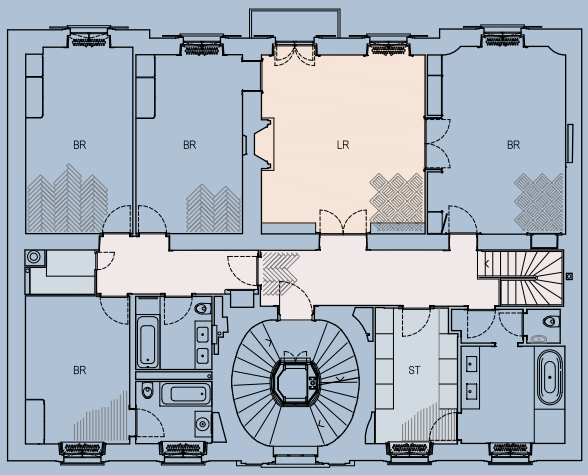
Service areas
Social areas
Circulation areas

Ground floor
Changes introduced by the renovation project

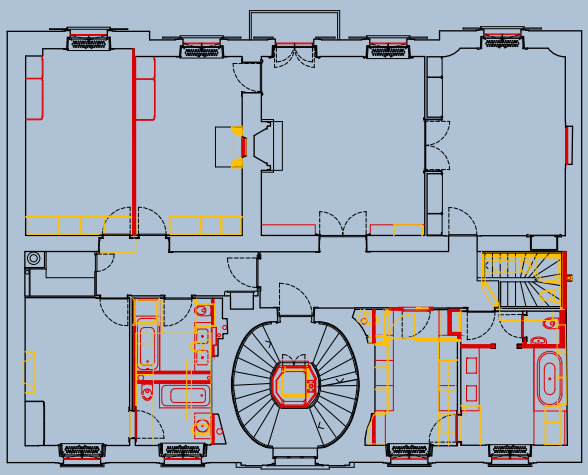
0 1 5

Types of rooms

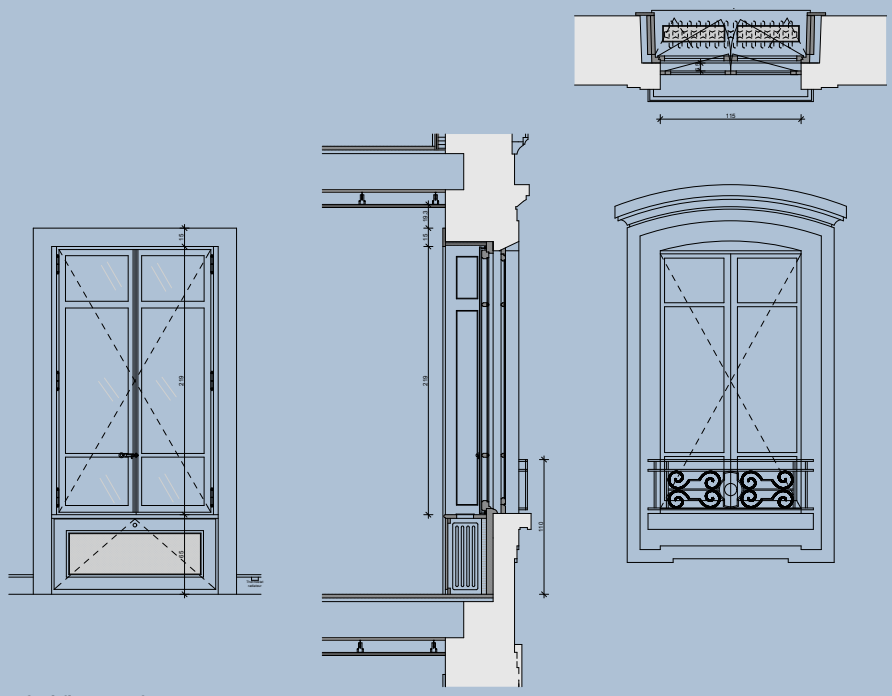
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen



1st floor
Final plan after renovation



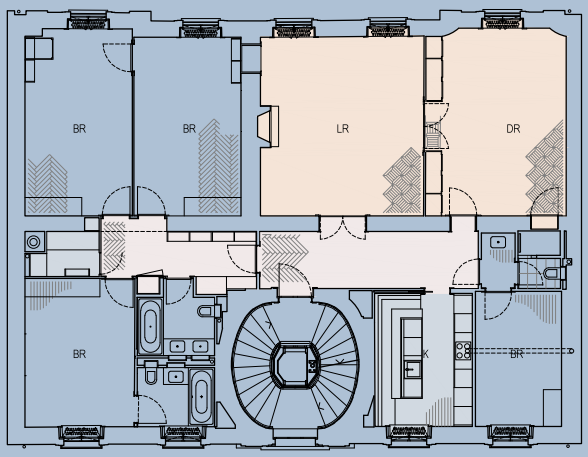
1st floor
Changes introduced by the renovation project



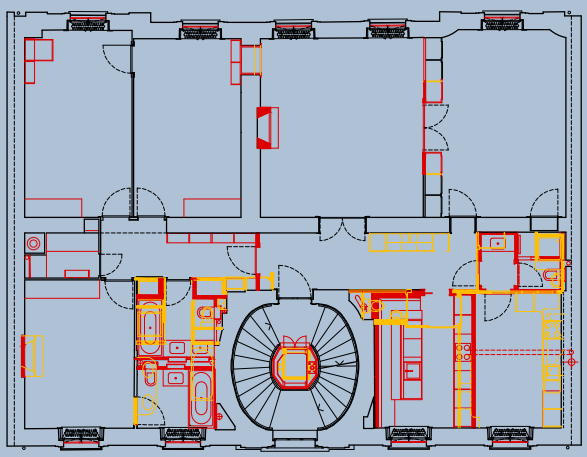
Double windows, 2nd floor 1:50
original or identical, singled glazed
(drawings | MVT Architectes)

Types of rooms

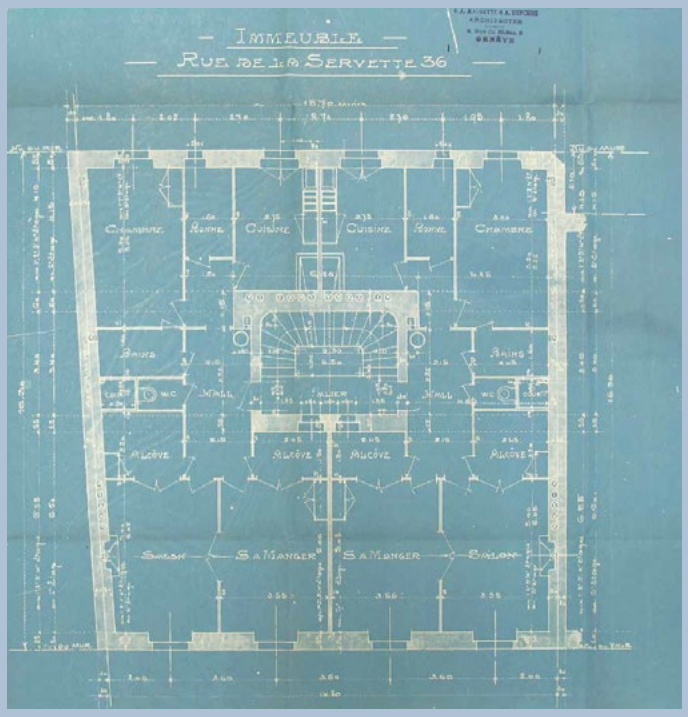
BR Bedroom
ST Storage
LR Living room
DR Dining room
K Kitchen



2nd floor 1:200
Final plan after renovation



2nd floor
Changes introduced by the renovation project



Floor plan, 1910
(Maurette & Henchoz | DCA)

Original construction ca. 1910, J. A. Maurette & A. Henchoz
Renovation work to be carried out
Initial and current functional type 2 flats per floor block of flats

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Archive information Département des constructions et de l'aménagement (Cité 11/E, 1910) [Original drawings]

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RUE DE LA SERVETTE 36

Living room and alcove
(photo | MVT Architectes)

Architectural design MVT Architectes SA and Théodore Necker architecte
Structural design B+S ingénieurs civils
Heating and ventilation design KSC ingénieurs

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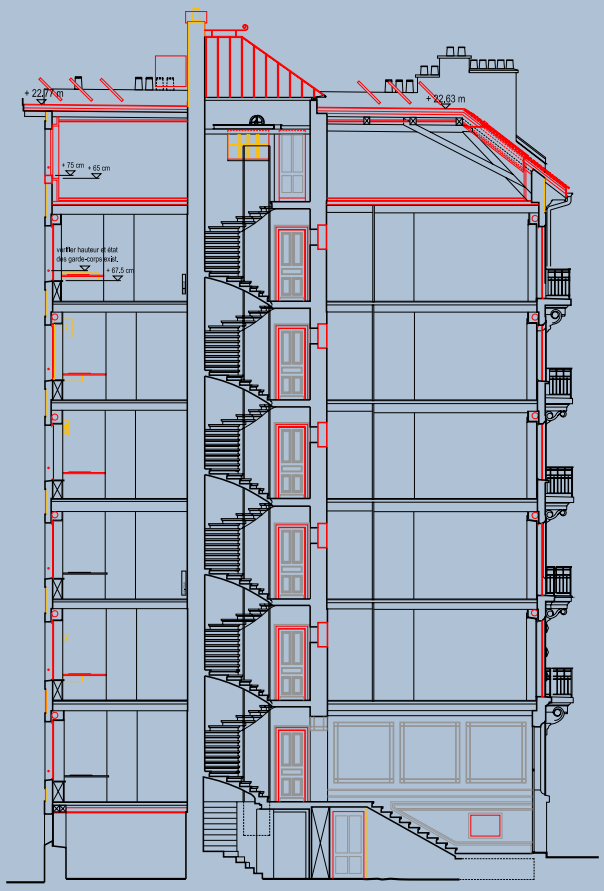
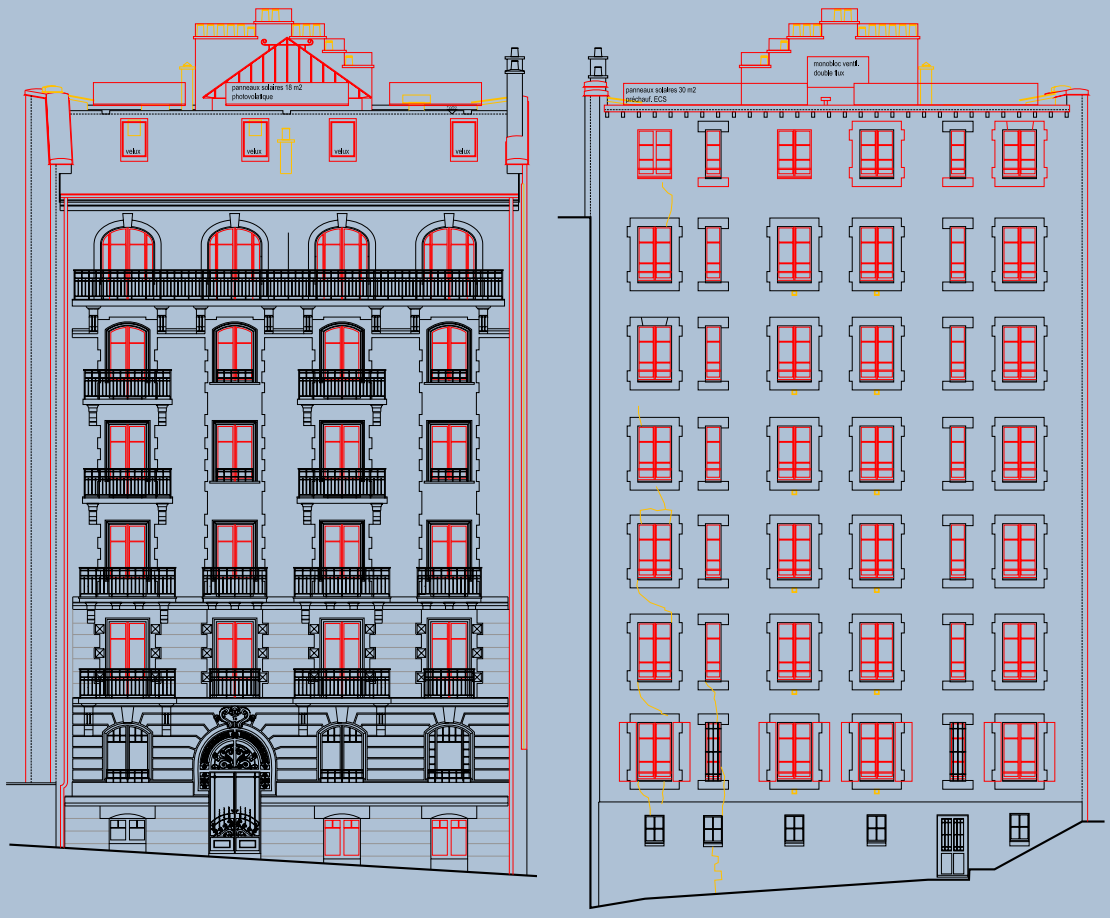
Client Ville de Genève

Street and courtyard façades
(photos | MVT Architectes)

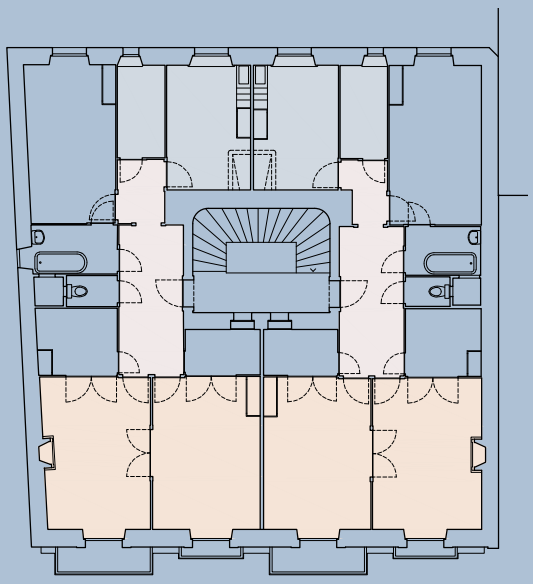




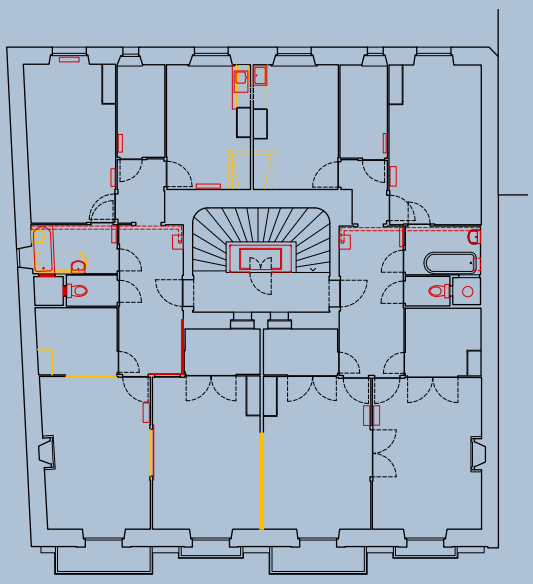
Transverse section 1:200
Street and courtyard façades
(drawings | MVT Architectes)

Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



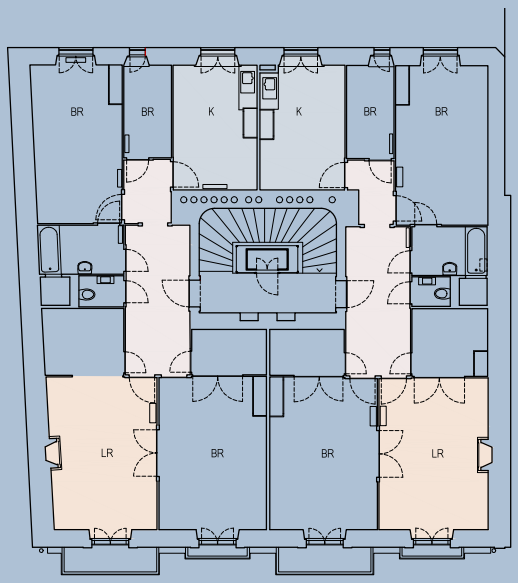
2nd floor 1:200
Original plan

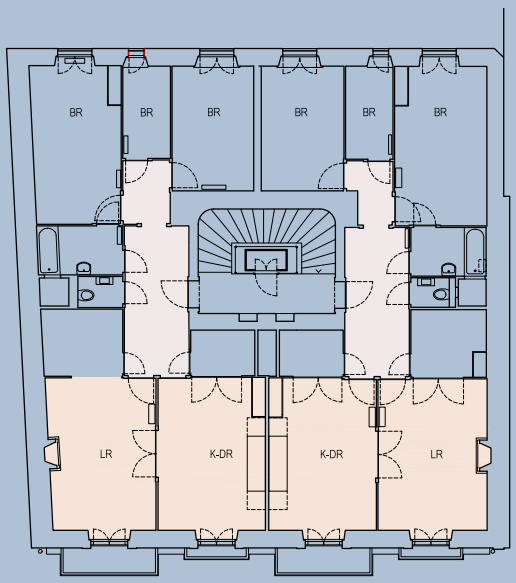


2nd floor
Changes identified to the original plan throughout the 20th century

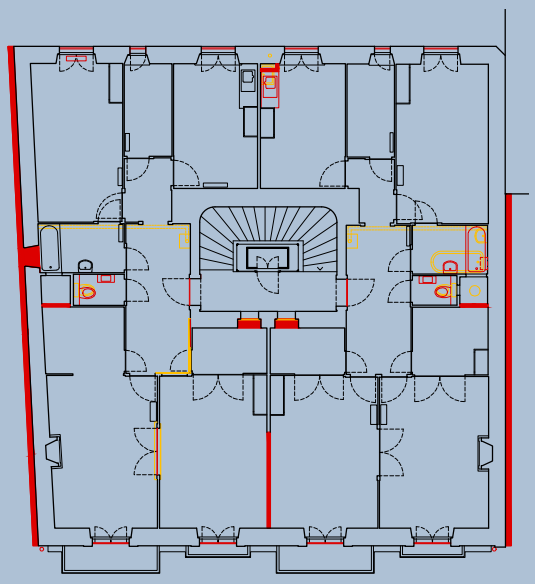
Service areas
Social areas
Circulation areas

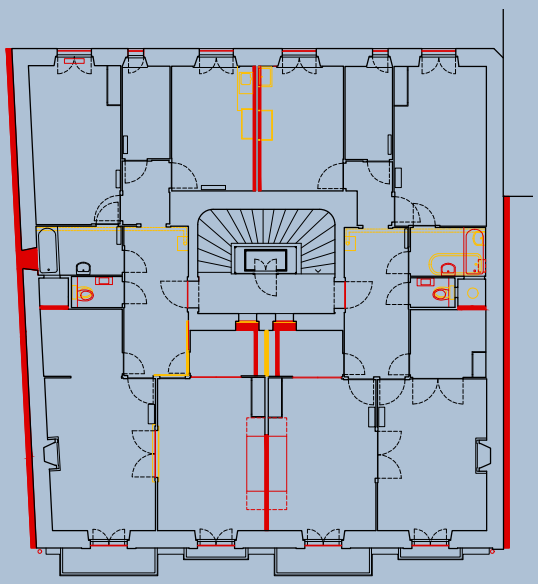
0 1 5



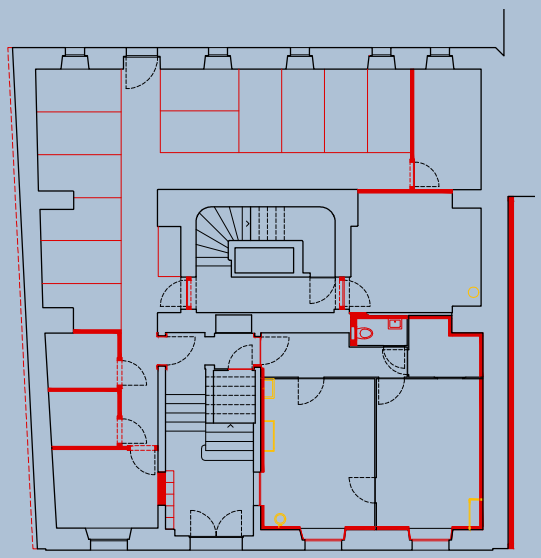


2nd floor
Final plan after renovation

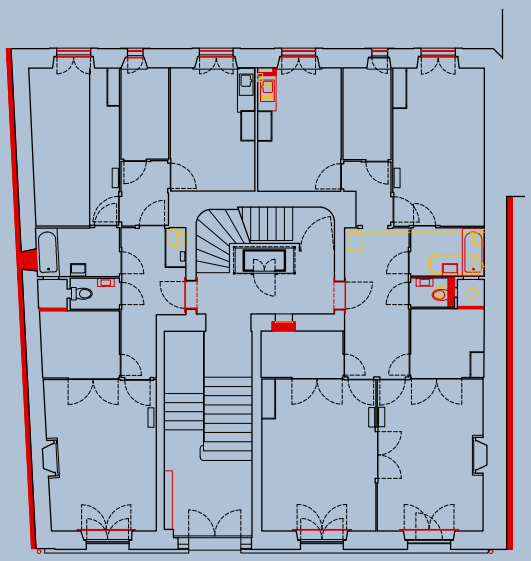




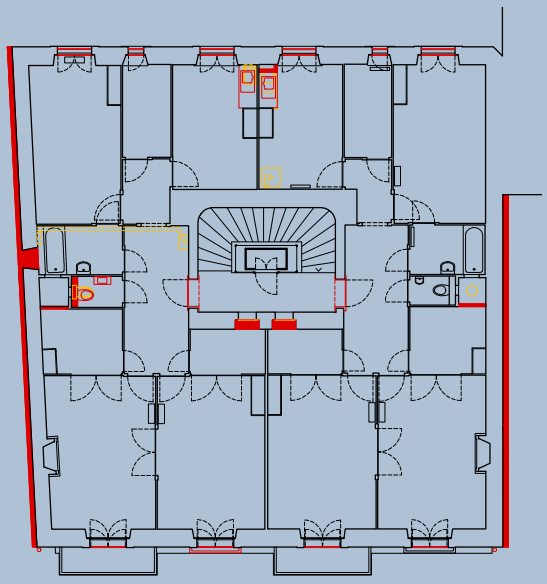
2nd floor
Changes introduced by the renovation project



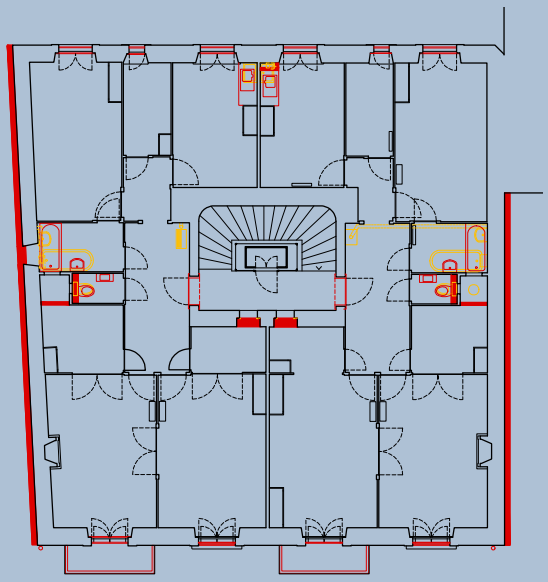
Basement 1:200
Changes introduced by the renovation project



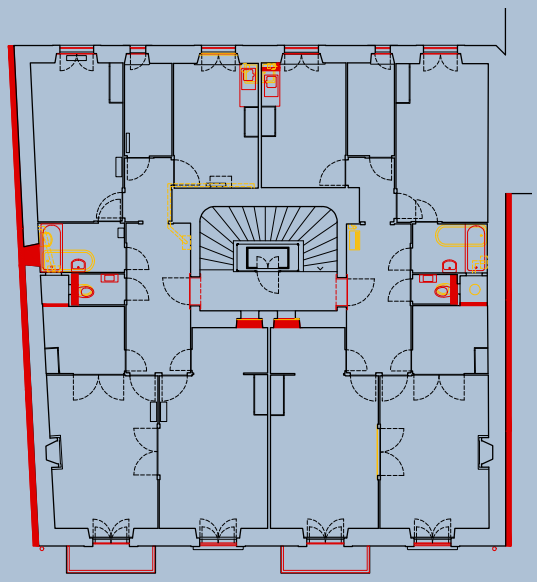
Ground floor
Changes introduced by the renovation project



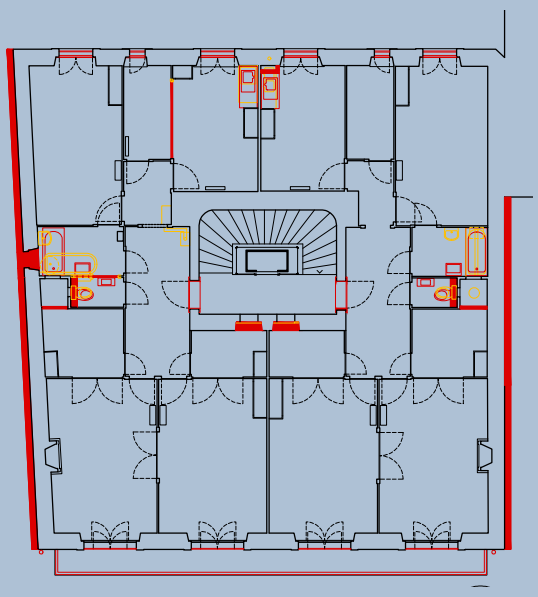
1st floor
Changes introduced by the renovation project



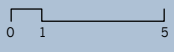
3rd floor
Changes introduced by the renovation project

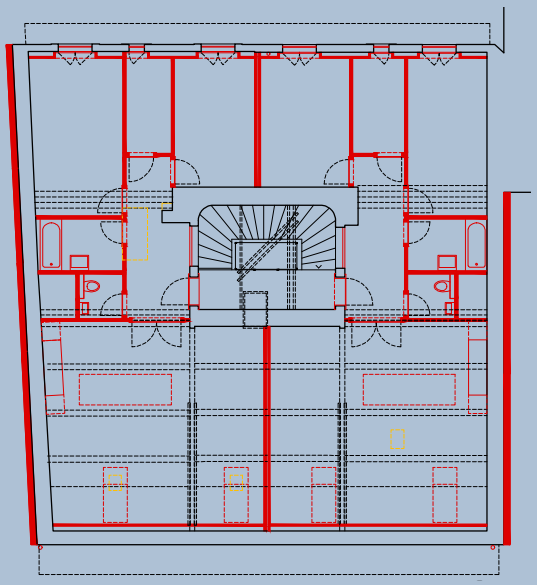


4th floor 1:200
Changes introduced by the renovation project

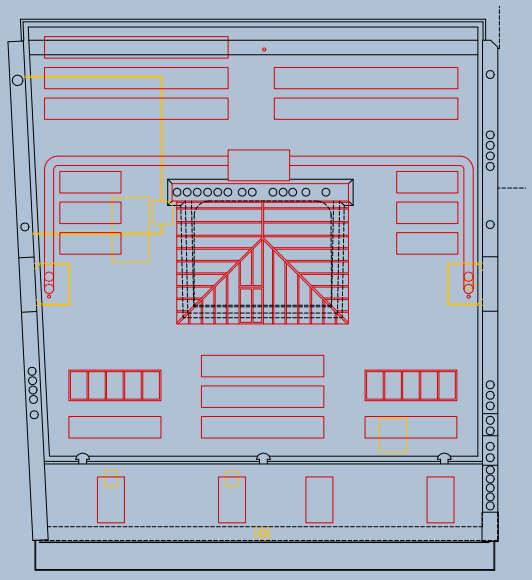


5th floor
Changes introduced by the renovation project





Attic
Changes introduced by the renovation project



Roof
Changes introduced by the renovation project

Aerial photo of the block, ca. 1921
(BGE-CIG | VGP2026)

Recent photo of street façade
(photo | Catarina Wall Gago)

Original construction ca. 1894 · 1898, Adrien Peyrot
Renovation work 2012
Initial and current functional type Offices, 2 flats per floor [4th floor], 1 flat per floor [5th floor]

–

Archive information *Département des constructions et de l'aménagement* (Cité 96/C, 1931 | Cité 1937/47, 10496) [Plan drawings]
Archives d'Etat de Genève (TP 1894/110) [Adrien Peyrot referring to a building on *Tour de l'Ile*]

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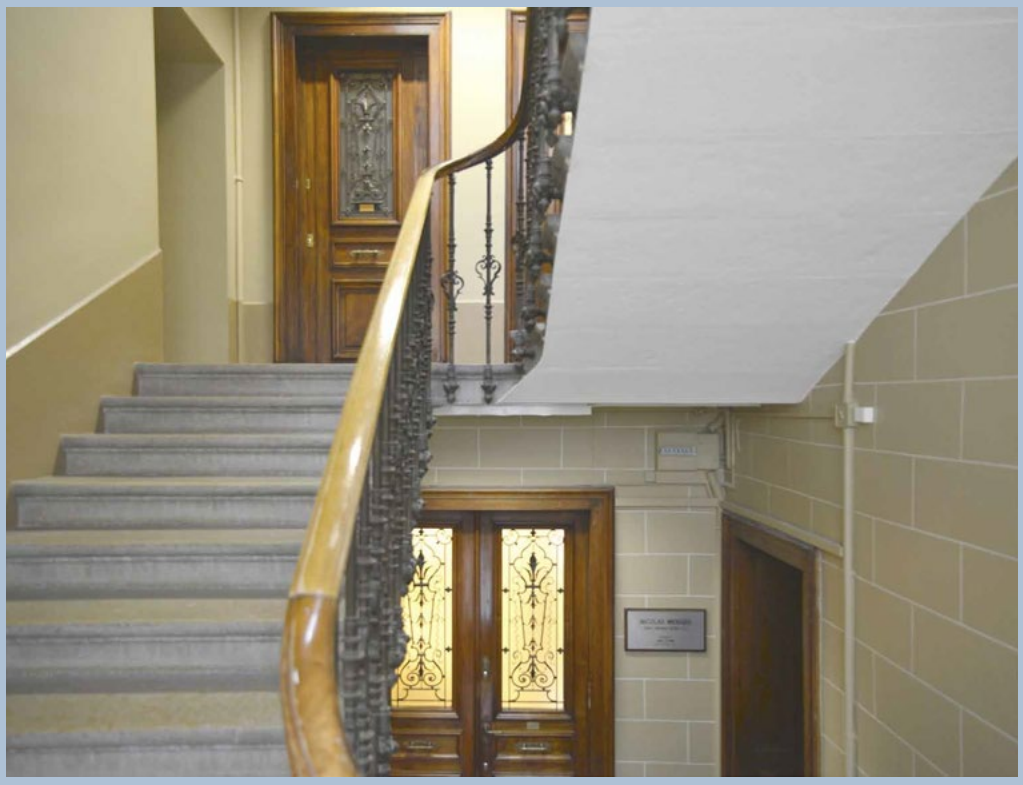
QUAI DE L'ILE 15



Staircase and lift
(photo | Catarina Wall Gago)

Architectural design SRA – Studio de réalisation architecturale
Project manager Claude Morel
Structural design J. Clément
Lift consultant FIECHTER Ingénierie SA
Geotechnical consultant Geotechnique appliquée Deriaz SA

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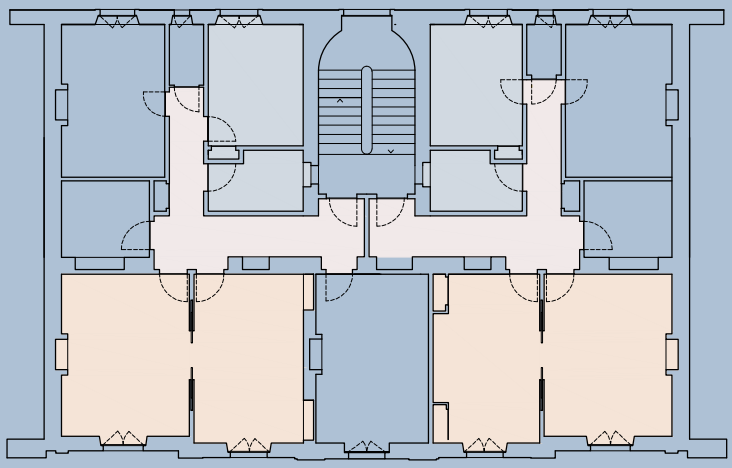
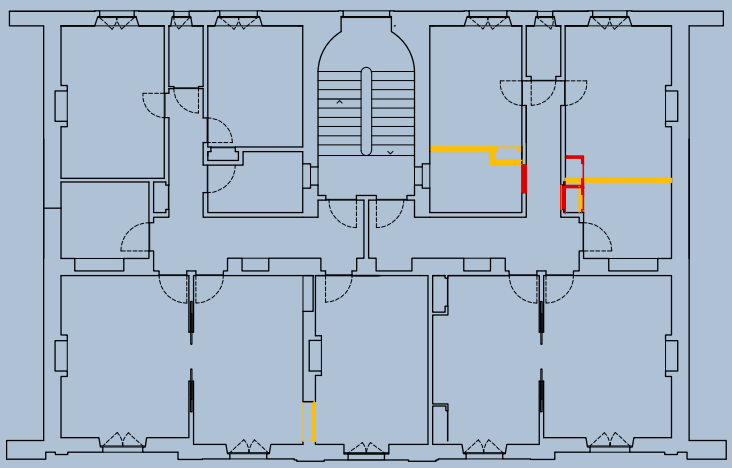
Demolition work PYRRHUS Multi services SA
Interior woodwork DURET SA
Heating installation Balestra Galiotto
Electrical installation Vernet SA
Window renovation Léman rénovation SA
Kitchen appliances Piatti



4th floor 1:200
Reconstituted original plan



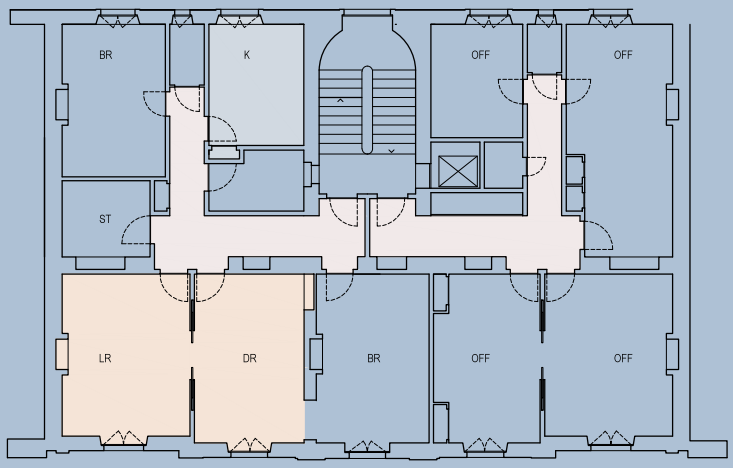
4th floor
Changes identified to the original plan throughout the 20th century

Service areas
Social areas
Circulation areas

0 1 5

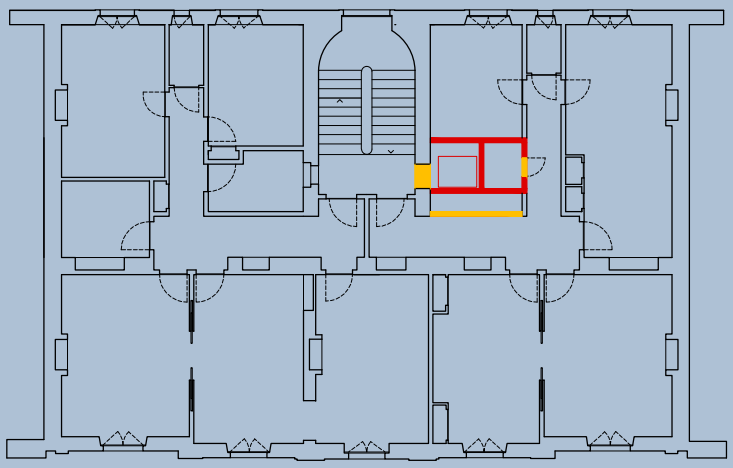
Types of rooms

BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office

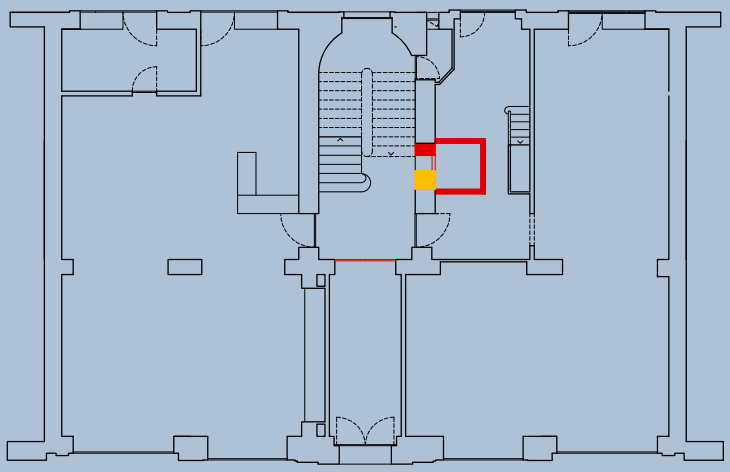


4th floor
Final plan after renovation

Kitchen
Living rooms, 5th floor
(photo | Catarina Wall Gago)

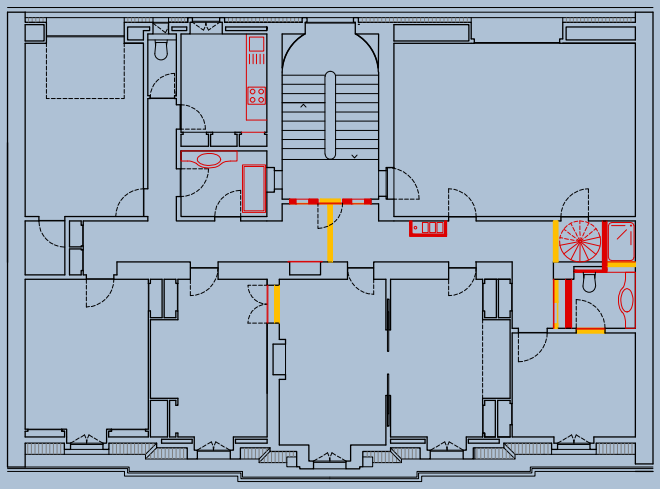


4th floor
Changes introduced by the renovation project



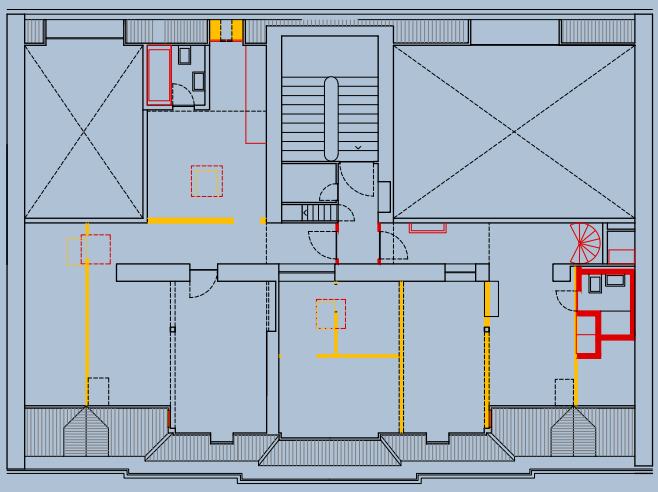
Ground floor 1:200
Changes introduced by the renovation project

Living room, 5th floor
(photo | Catarina Wall Gago)

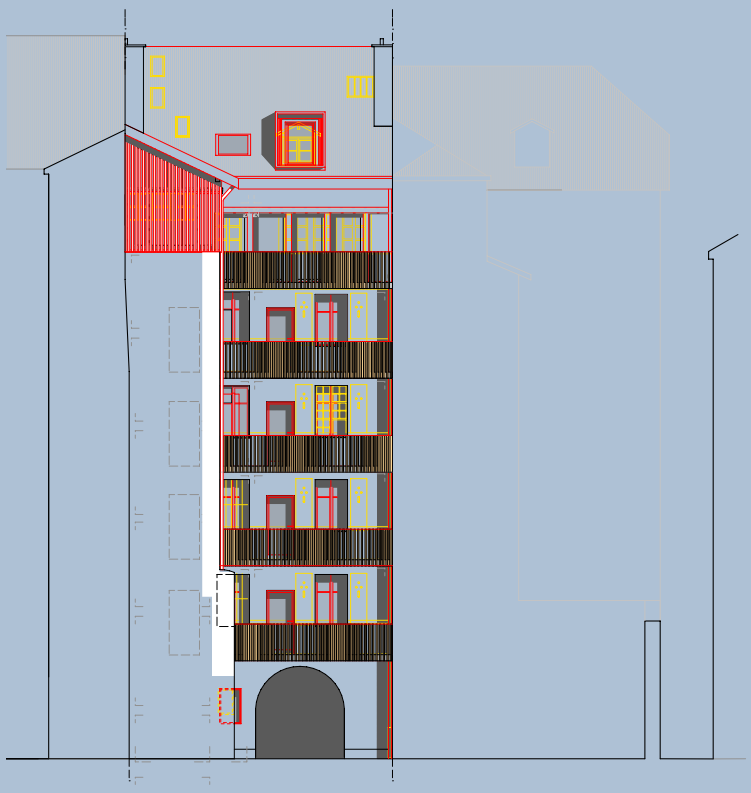


5th floor
Changes introduced by the renovation project

Staircase to attic
(photo | Catarina Wall Gago)



Attic
Changes introduced by the renovation project



Courtyard façade 1:200
(drawing |Atelier March)

Original construction ca. 1786 | Early to mid 19th century [two top floors]
Renovation work 2012 - 2013
Initial functional type 2 flats per floor block of flats (one flat on 2nd floor)
Current functional type 2 flats per floor block of flats with duplexes on top floor

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Archive information Département des constructions et de l'aménagement (DD 95204, 1997 | DD95836, M4672, 1999) [Plan drawings]

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RUE ROUSSEAU 7

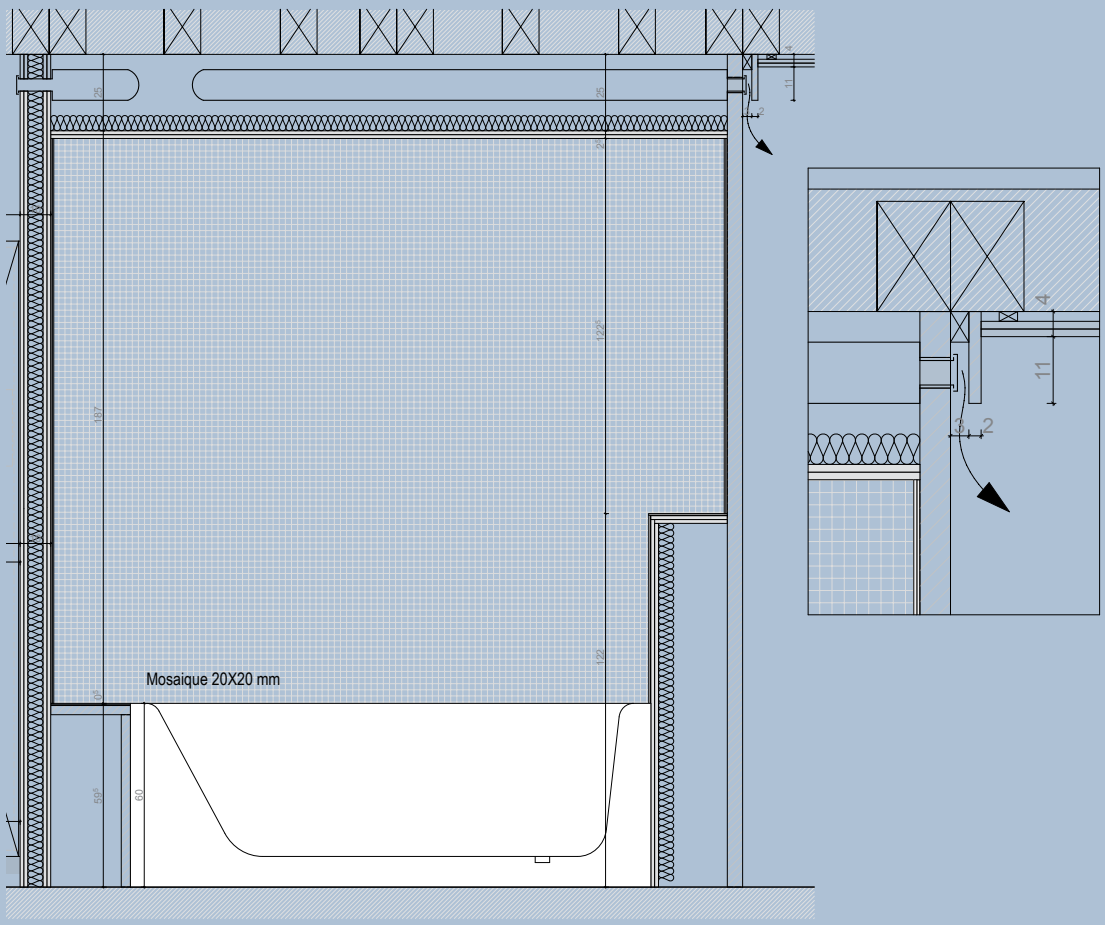
Kitchen in a duplex flat
(photo | Catarina Wall Gago)

Architectural design Atelier March SA
Architectural team Juan Madrinan, David Démolis, Germaine de Bazelaire
Structural design Thomas Jundt ingénieurs civils
Electrical design Rossetti Ingénieurs conseils | **Installation** Savoy SA
Thermal and ventilation design KsC Energie-Tech SA |
Building physics consultant SORANE SA Ingénieurs conseils
Acoustic consultant Architecture et Acoustique – François Lançon
Plumbing design BMB (Bureau Martin & Doy sarl) | **Installation** Schneider
Stonework consultant Atelier Lithos – Olivier Fawer | **Restoration** Mello & Comte
Asbestos and PCB consultant Ecoservices SA | **Lead consultant** Bird
Dendrochronology consultant Laboratoire Romand Dendrochronologie

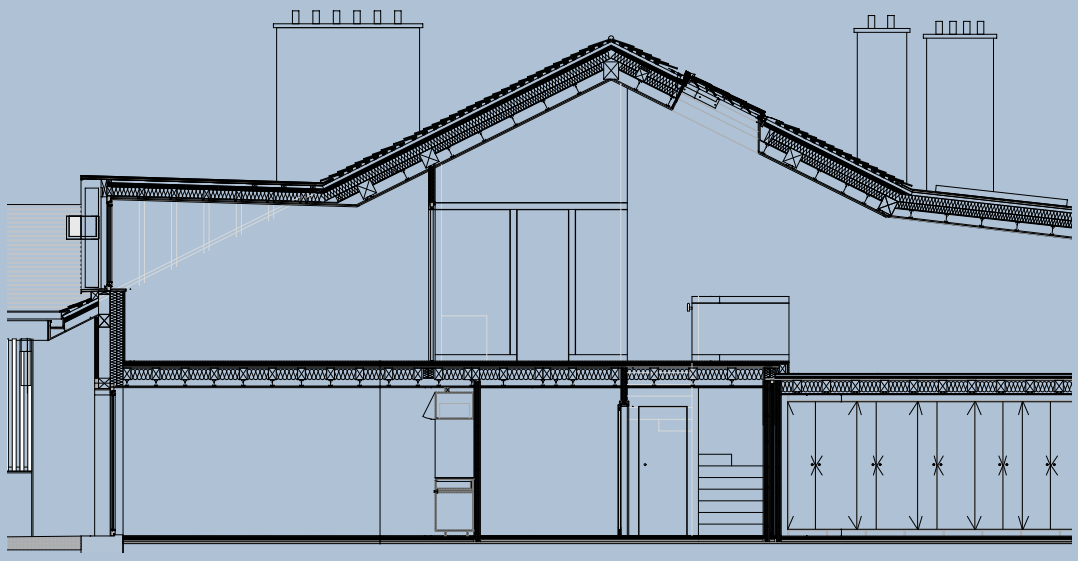
–

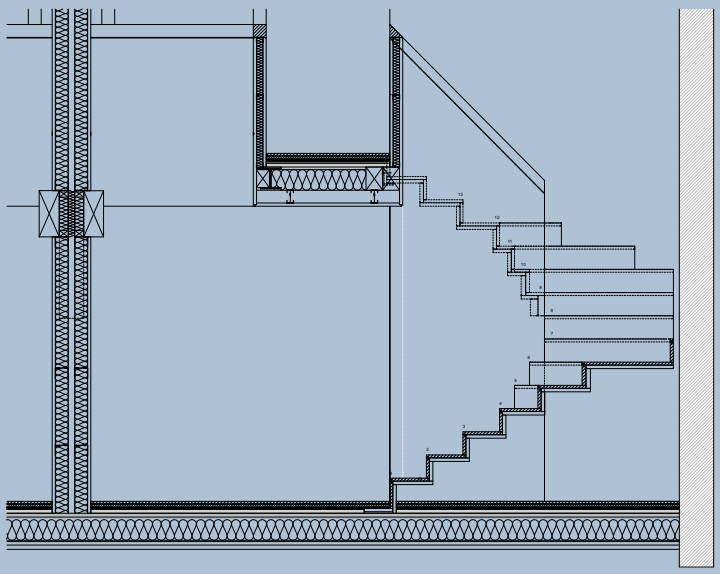
Roof timber frame Associés Successeurs des Ateliers Casaï SA | **Tinplate installation** Duraffourd Ferblanterie
Heating installation Durlemann SA | **Ventilation installation** Climatechnic
Paintwork probing Atelier Josef Trnka | **Paintwork and whitewash** Berchten SA | **Plaster work** Mazzoli SA
Exterior woodwork (new and renovation) Menuiserie Juan Rodriguez | **Blind restoration** Joubert Michel
Shop window frames Cergneux SA and MHB | **Skylights** Stebler
Interior woodwork Aguet Pierre-André
Wooden floor restoration Belsol-Mitterer SA
Chimney restoration Dominique Apothéloz

Living room and alcove
(photos | Catarina Wall Gago)



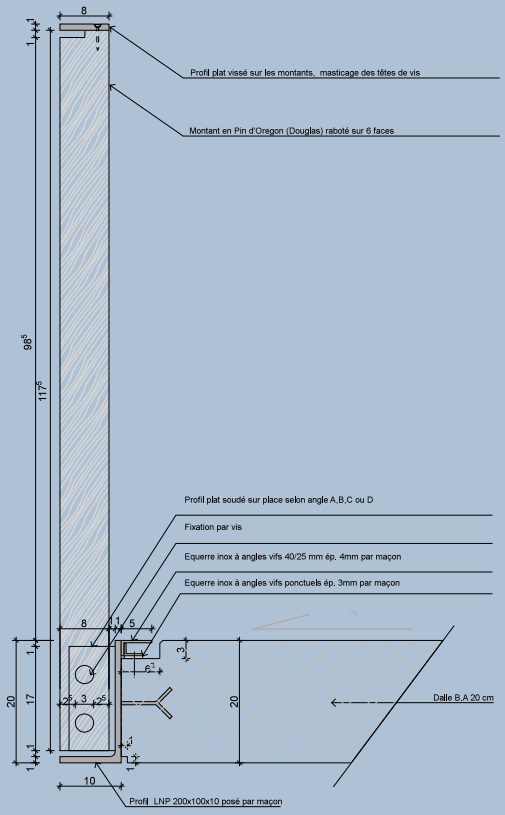
Ventilation – alcove bathroom 1:20
(section | Atelier March) 1:10

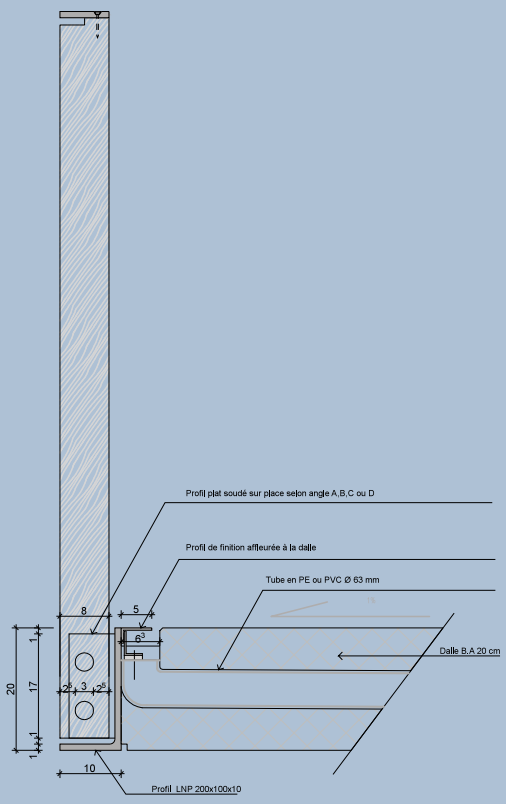




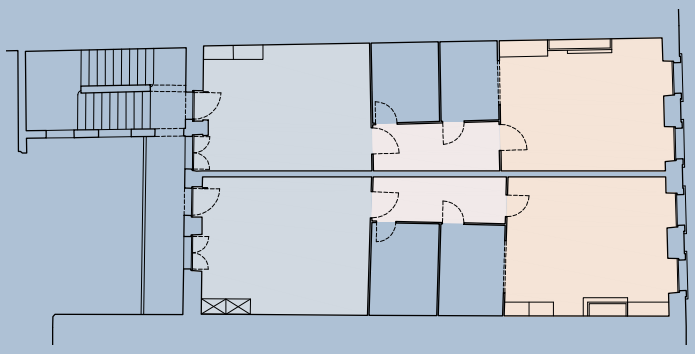
Section, 5th floor and attic 1:100
Staircase vertical section 1:50
(drawings | Atelier March)

Handrail for balconies 1:10
Kitchen and balcony, 5th floor
(drawings | Atelier March)
(photo | Catarina Wall Gago)

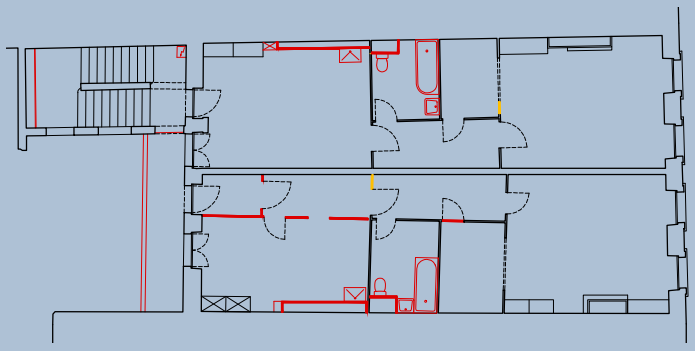

Profil plat vissé sur les montants, masticage des têtes de vis
Montant en Pin d'Oregon (Douglas) raboté sur 6 faces
Profil plat soudé sur place selon angle A,B,C ou D
Fixation par vis
Equerre inox à angles vifs 40/25 mm ép. 4mm par maçon
Equerre inox à angles vifs ponctuels ép. 3mm par maçon
Dalle B.A 20 cm
Profil LNP 200x100x10 posé par maçon


Profil plat soudé sur place selon angle A,B,C ou D
Profil de finition affleurée à la dalle
Tube en PE ou PVC Ø 63 mm
Dalle B.A 20 cm
Profil LNP 200x100x10

Changes to the street façade
(drawings | Atelier March)



3rd floor 1:200
Reconstituted original plan

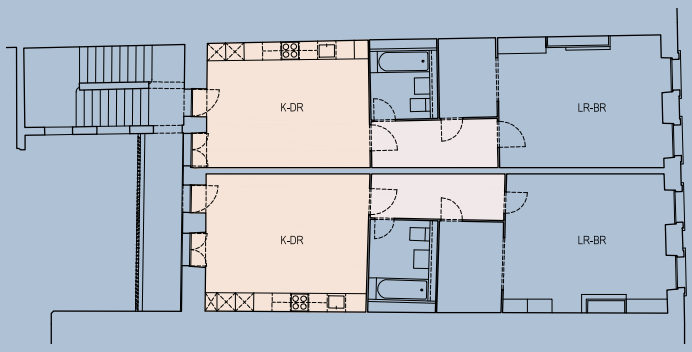


3rd floor
Changes identified to the original plan throughout the 20th century

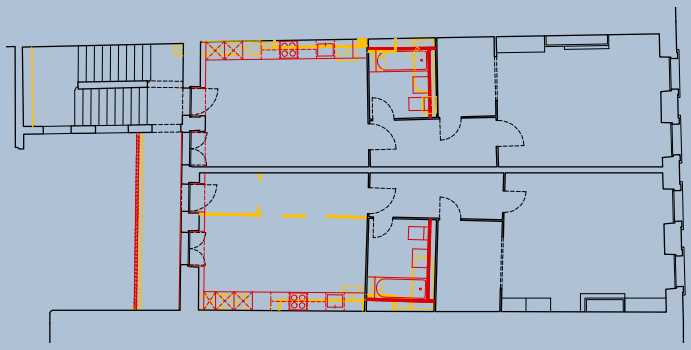
Service areas
Social areas
Circulation areas

Types of rooms

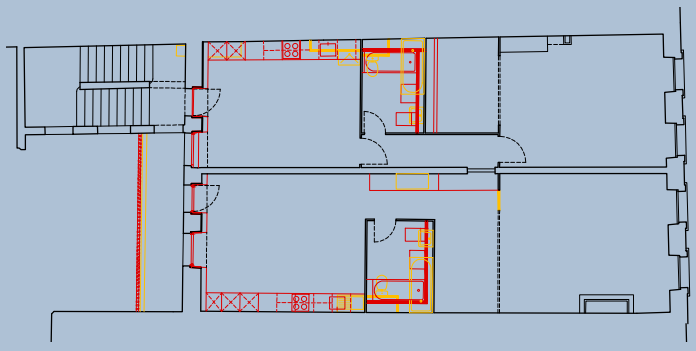
BR Bedroom
ST Storage
LIB Library
LR Living room
DR Dining room
K Kitchen
OFF Office



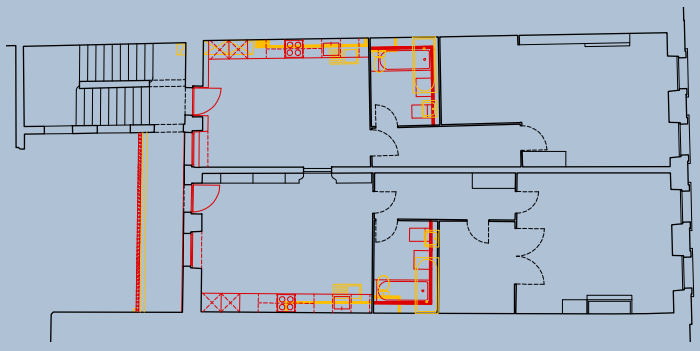
3rd floor
Final plan after renovation



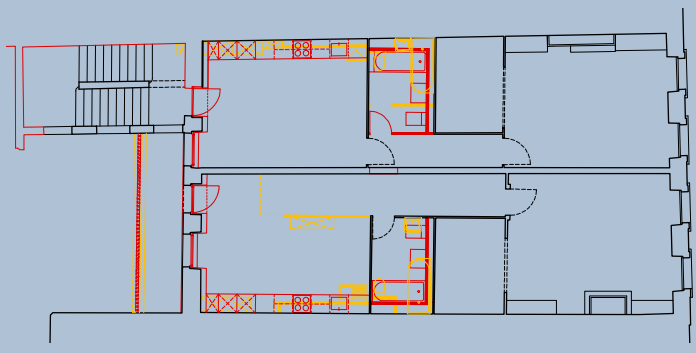
3rd floor
Changes introduced by the renovation project



1st floor 1:200

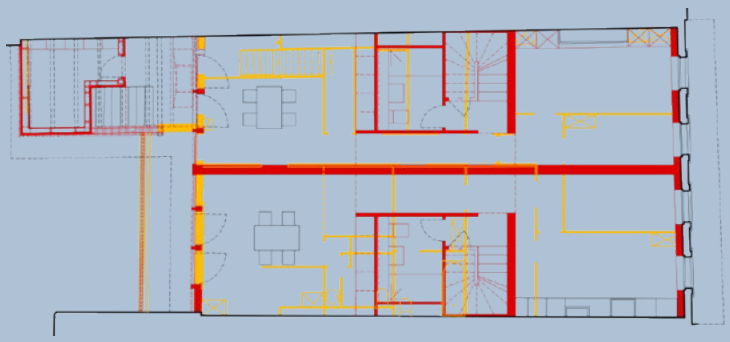


2nd floor

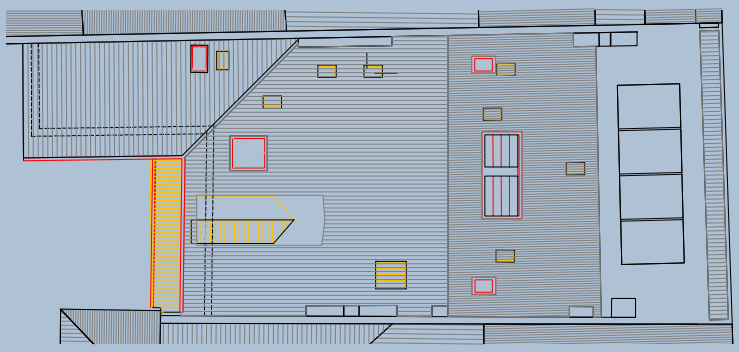


4th floor

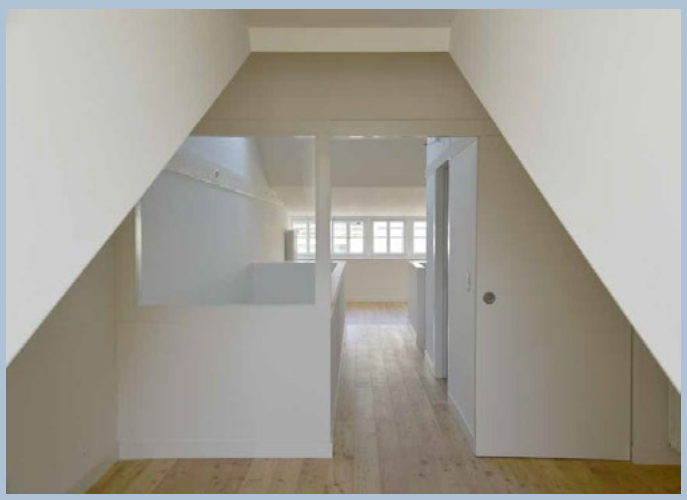
Changes introduced by the renovation project



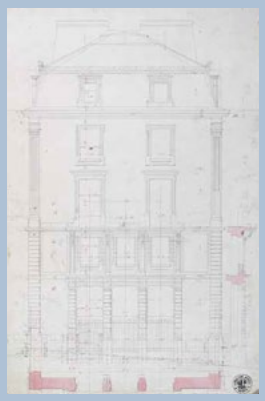
5th floor

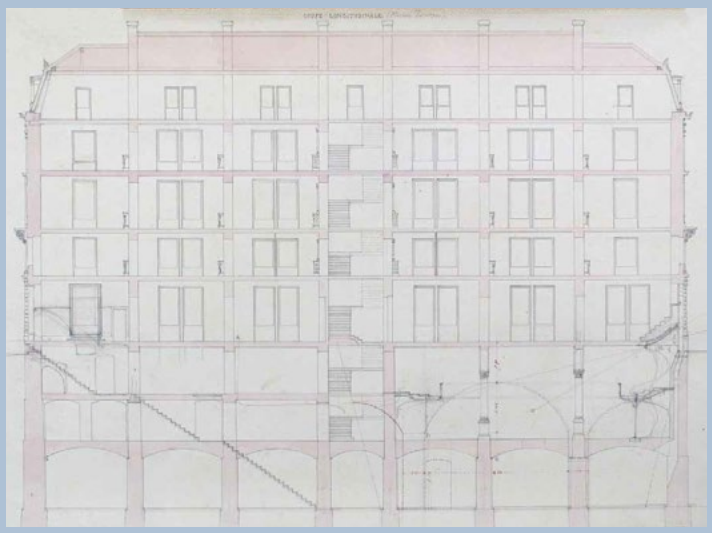


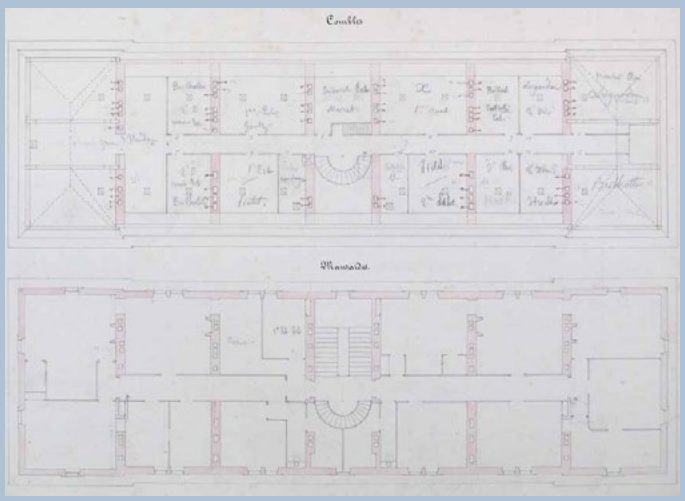
Roof

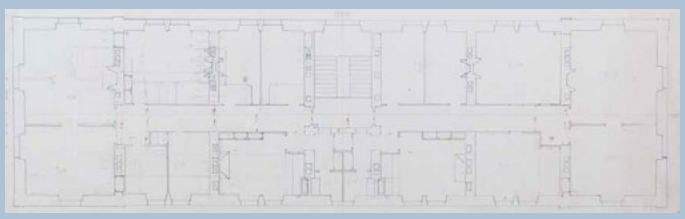


Top floor of a duplex flat
(photo | Catarina Wall Gago)









Elevation, Rue E.-J. Dalcroze
Longitudinal section
Attic, 4th and 2nd floor plans
scaled to aprx. 1:400
(1861, Louis Brocher | AEG)

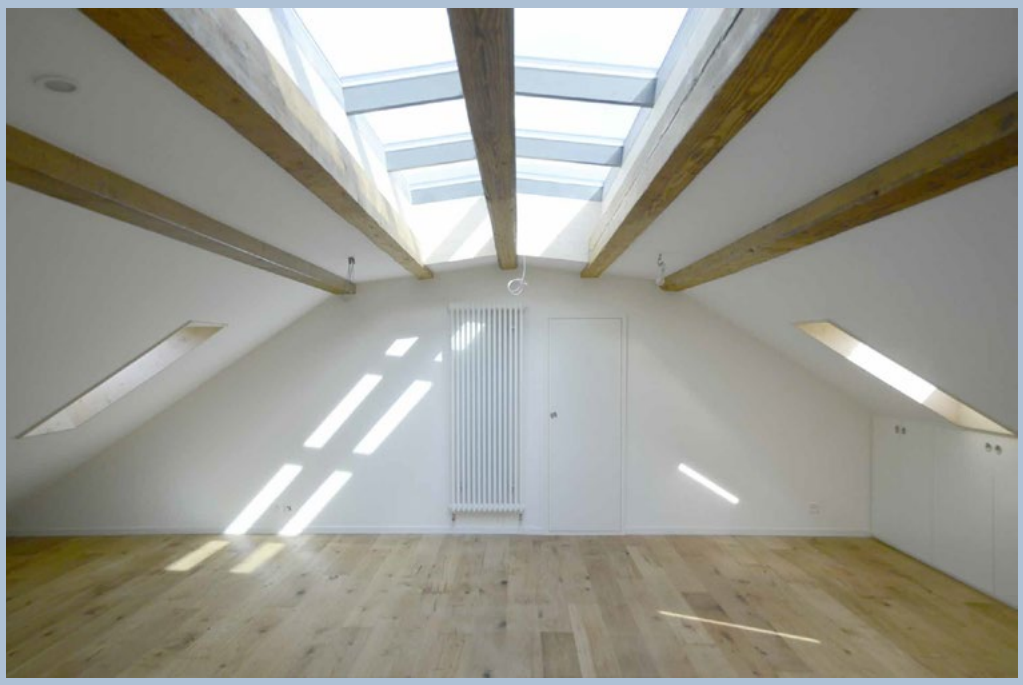
Original construction ca. 1862, Louis Brocher
Renovation work 2013 · 2014
Initial functional type 2 flats per floor block of flats
Current functional type 2 flats per floor block of flats | 3 duplexes on top floors

–

Archive information *Archives d'Etat de Genève* (AP 194/C/86 – T E/9-2) [Original and plan drawings]

24 | GENEVA

RUE DE L'ATHÉNÉE 4, 4th floor and attic



Attic of a duplex flat
(photo | Catarina Wall Gago)

Architectural design AFM architectes – atelier des forces motrices
Project managers Agnès Perreten, Martine Villard
Thermal design SB Technique – Andrew Curd

–

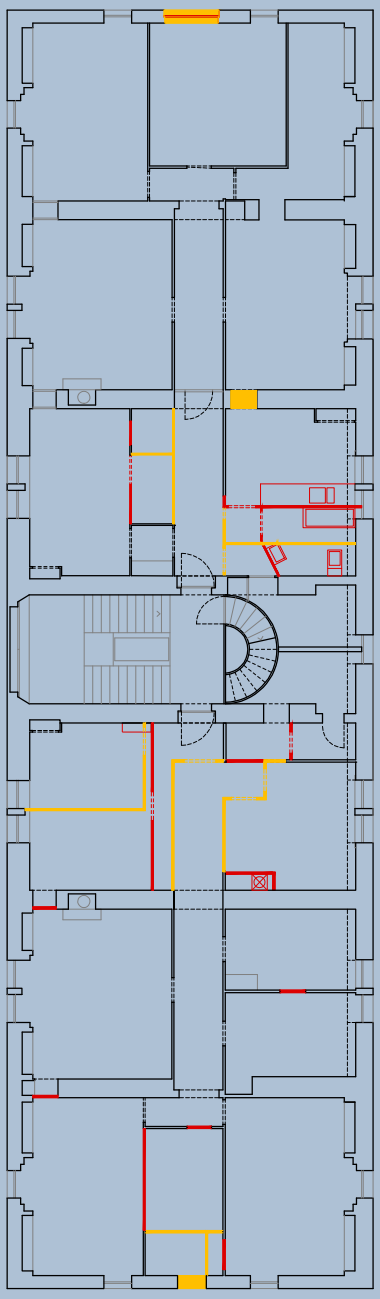
Masonry Metry SA
Scaffolding Echami SA
Roof timber frame probing Dasta Charpente SA
Roofing and tinplate installation Cuivretout SA
Skylights Echami SA
Window renovation Léman rénovation
Interior woodwork Grosjean SA
Wooden flooring Rodriguez & Alvarez
Plaster and paintwork Matamoros SA
Sanitary installation Martin Sanitaires SA
Electrical installation Schwitzguebel SA
Heating installation Durlemann SA
Living room chimney Ph. Gremaud
Tile installation Gatto SA
Kitchen appliances Amann Cuisines

–

Historical study Bénédict Frommel

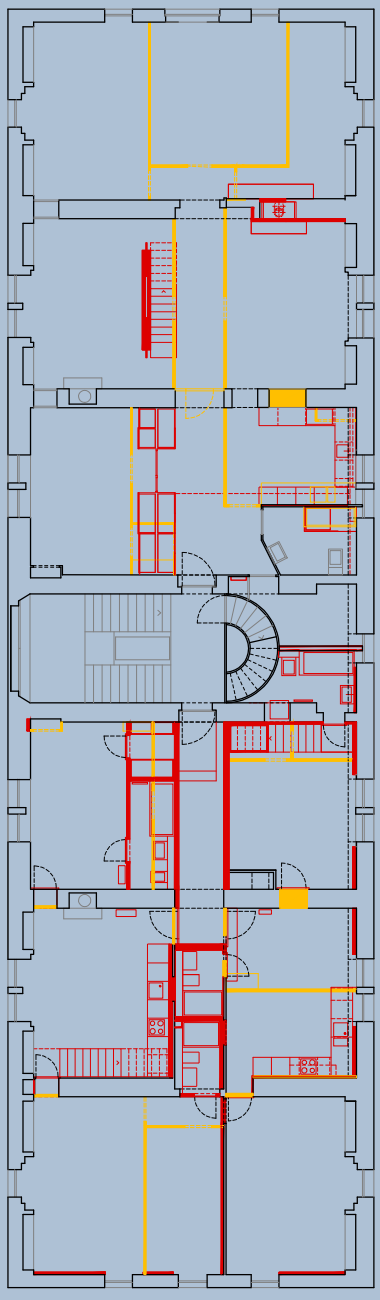
Street view, today – May 1912
(BGE-CIG | Jullien 69824)

Corridor to smaller duplex flats
Bedroom, 4th floor duplex
(photos | Catarina Wall Gago)



4th floor 1:200

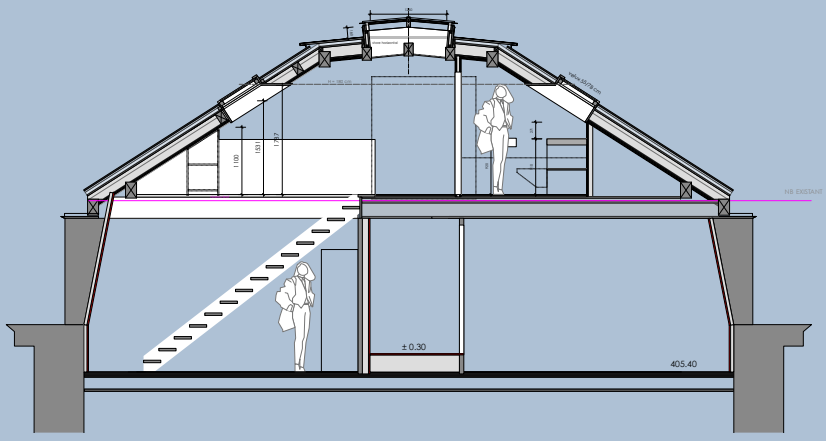
Changes identified throughout the 20th century



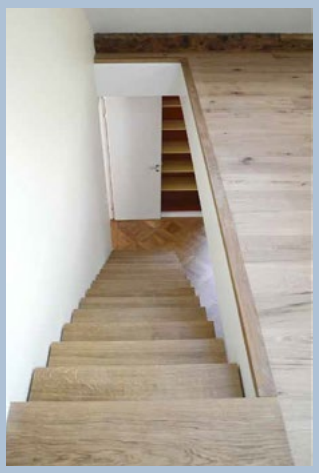
4th floor

Changes introduced by the renovation project

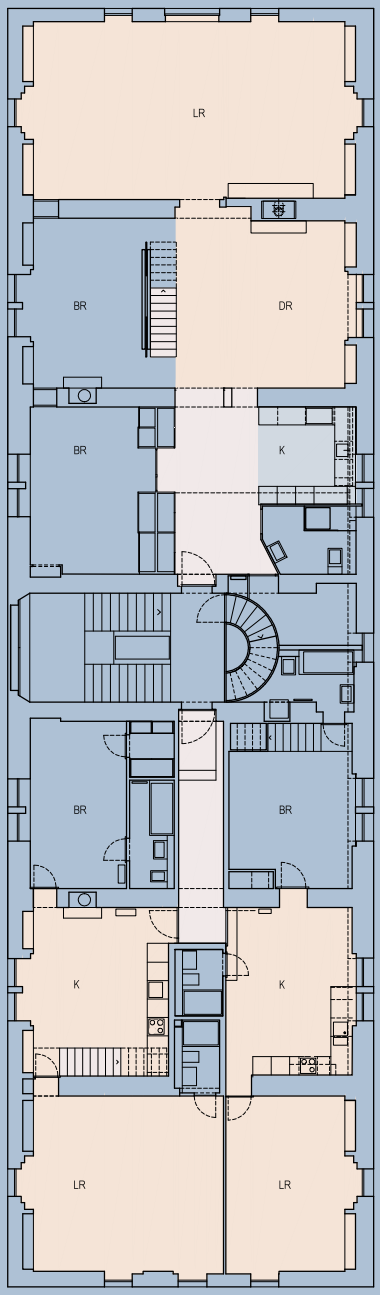
0 1 5



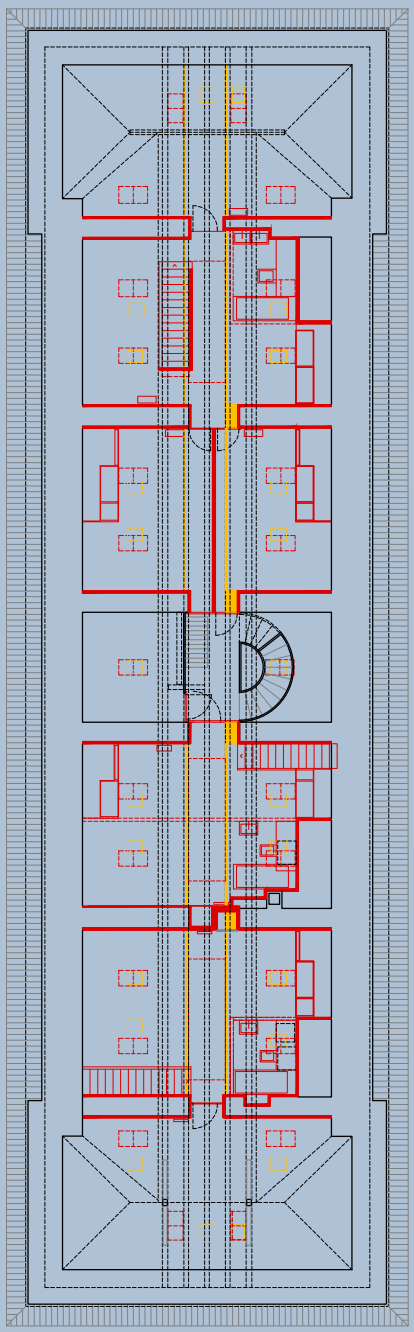
Section of top floors 1:100
(drawing | AFM Architectes)



Staircase in a duplex flat
Attic
(photos | Catarina Wall Gago)



4th floor 1:200
Final plan after renovation



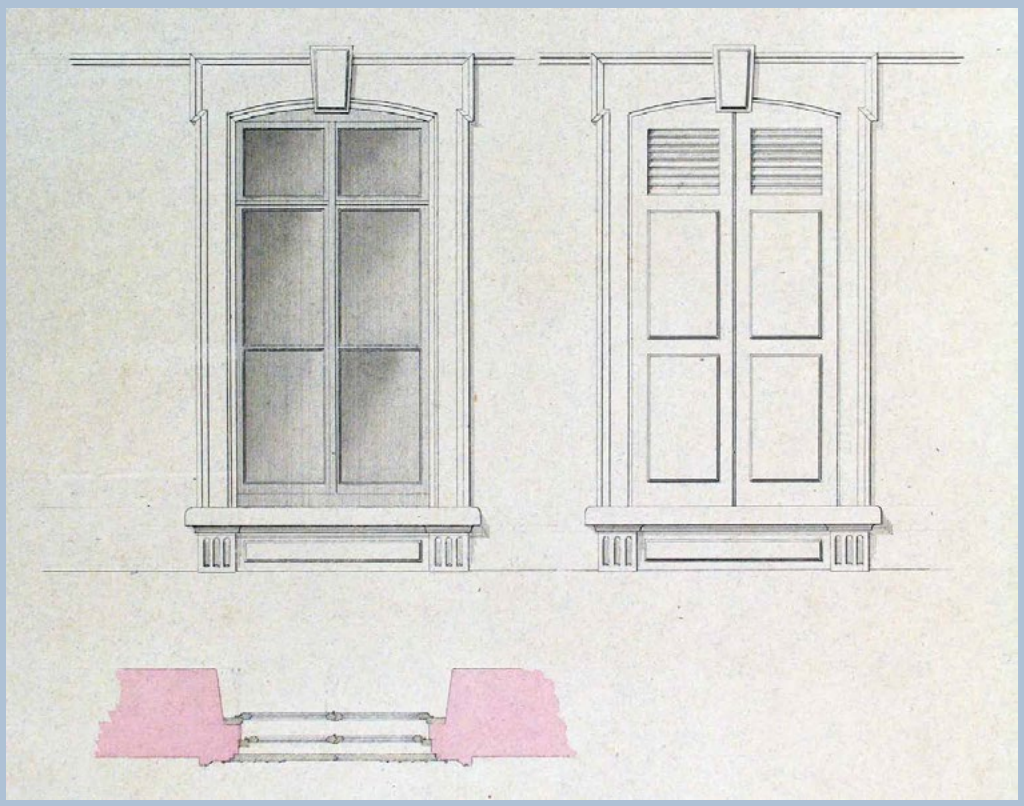
Attic
Changes introduced by the renovation project
(bathrooms not introduced at this stage)

Types of rooms

BR Bedroom
LR Living room
DR Dining room
K Kitchen

Service areas
Social areas
Circulation areas

0 1 5



Maison Piachaud
Boulevard Helvétique 14bis, Geneva
architect Jacques-Elisée Goss
(AEG | AP 194/A/39)

CASE STUDIES – COMFORT AND RENOVATION TECHNIQUES

Part 6

Residents increasingly value distinctive historic features of buildings, while at the same time wanting the added comfort that comes with present-day infrastructure and insulation. These issues are often expressed in a series of legal binding measures at national and regional level, as well as in subventions or tax incentives. A combined increase in patrimonial and comfort measures might be contradictory, especially in the case of ordinary houses, which often constitute built areas with a variable degree of protection. On the one hand, the houses are often not up to date on what residents consider minimal living standards. On the other, overly efficient interventions can have a considerable damaging impact on key characteristic building elements. In examples where both interests are preponderant, discussions for project approval can turn into long drawn-out processes.

This chapter examines three comfort demands that are frequently addressed in contemporary renovations of ordinary late 18th and 19th century houses:

– Thermal insulation of walls and roofs ☞
– Thermal and sound insulation of windows ☞
– Sound insulation of timber floors ☞

The aim was to examine renovation techniques that establish a compromise[1] between the houses' historic elements and present-day comfort demands, and to identify possible conflicts between these two aspects when renovating. The research was carried out by analysing the strategies that are put in place in recent renovations in Lisbon, Oporto and Geneva, and by looking into how different built heritage protection measures and regulations on energy and acoustic demands come together in architecture projects.

The work covers the topics of thermal or sound insulation in renovation, including some calculations to verify whether certain solutions could comply with regulations. Nevertheless, it should be noted that we do not intend to give or replace a specialist's view on those two topics, but to identify some principles and strategies of intervention[2].

The following text identifies a selection of studies that contributed to the analysis of renovated case studies in Portugal and in Switzerland on the topics of thermal insulation of windows, external walls and roofs and sound insulation of windows and timber floors. Regulations and, almost consequently, renovation examples of thermal and sound insulation are rapidly changing domains. The aim was not to conduct to an exhaustive literature review, but to examine mostly recent studies, which focus on how to address thermal or acoustic insulation in historic buildings or in particular building elements, such as wooden simple-glazed windows. Nevertheless, some older publications were of interest since they included important *in situ* data concerning original building elements of historic buildings. This was particularly important concerning the topic of sound insulation, so that the original or changed situations in our case studies could be compared to measured examples. We also selected some general publications that allowed us, for instance, to better compare the characteristics of insulating materials, to understand the impact of regulations or to carry out some comparative calculations. We have purposely left out legislation and regulations that were previously examined in the chapter relating to "Legal conditions for renovation" ☞.

General studies concerning renovation in Portugal

Several general studies have been conducted in Portugal regarding the renovation of historic buildings, addressing both architectural and technical issues. Architect João Guilherme Appleton (architecture office Appleton & Domingos) and engineer João Appleton (A2P Consult) have published several studies on the subject. João Guilherme Appleton's Master's thesis, *Reabilitação de edificios gaioleiros* (Appleton 2005), later published as a book, concerns the renovation of Lisbon's early 20th century buildings, built during the large city expansion designated "Avenidas Novas" (new avenues). The work specifically focuses on buildings dating from 1908 to 1930 in a selected block. Even though the time of building is later the one we examined, some of the building principles remain similar. A section of the book describes the original building materials and systems, namely of the floors with timber joists. The renovation proposals are justified from a technical and patrimonial point of view, mentioning solutions, for instance, for the inclusion of lifts, to change the buildings' technical installations, as well as a solution for the acoustic insulation of existing floors. Thermal insulation issues are hardly examined. In existing timber floors,

the author mentions that it is important to preserve, besides the joists, the floorboards, "sometimes old wood of very good quality, and the ceiling finishes, almost always plastered and that, in main rooms (those next to the front or back façades)"[3] normally have decorative plaster elements (Appleton 2005: 188). In the suggested intervention, the insulation is placed between and above the joists, slightly elevating the existing floorboards to place additional fire protection.

A few years later, engineer João Appleton[4] published *Reabilitação de edifícios antigos: Patologias e tecnologias de intervenção* (Appleton 2003), a book with a general view on a variety of aspects referring to the renovation of old buildings. Even though this study is now over ten years old, its main principles and reflections on renovation remain valid and useful for the present work. The author focuses on the general principles and problems, without including very detailed descriptions or drawings. In regards to thermal performance, the solutions are mainly adapted to the Portuguese climate, where overheating problems are an issue as much as the cold. The author mentions that buildings in Portugal are particularly well adapted to the climate during the summer heat (thick walls, small windows, often sun exposure), but ill-adjusted in winter, with hardly any heating systems. Some typical insulation problems are identified, as well as the compatibility of the solutions with the existing building systems and architectural features. The work goes on to briefly examine several possibilities for wall insulation from the inside or outside, depending on the original wall features (Appleton 2003: 216-220). Several options for roof insulation are also identified according to its existing features. This description mentions, for instance, the traditional system of ventilated tiles to ventilate the space between the ceiling and the roof during the summer, so that accumulated hot air can get out (Appleton 2003: 221). Acoustic insulation is addressed in the same way. Several options are mentioned for window renovation, such as the possibility of placing an additional window on the inside or outside, depending on the façade features, or of replacing the glass of the existing window with thicker or double glazing (Appleton 2003: 227-228). The suggested interventions on timber floors are either above the joist, by placing an insulating material between them and creating a floating floor (without fire protection), or from below the joists by using a false ceiling (Appleton 2003: 230-231).

In 2009, João Guilherme Appleton and Isabel Domingos published another book, *Biografia de um pombalino: um caso de reabilitação na Baixa de Lisboa* (Appleton 2009), concerning the renovation of a late 18th century building in Lisbon's *Baixa Pombalina,* for which they conducted the architecture project[5]. This book describes the building's original architectural and structural features, going on to focus on its renovation. The latter is well depicted through general floor plans and detail drawings, including several interesting aspects for our work, among which we could emphasize the addition of an interior window (Appleton 2009: 111-114), and the detail drawing of the sound insulation between floors by placing insulation between joists and a false ceiling (Appleton 2009: 121-128).

More recently, an important book was published by the northern section of the Portuguese engineers' professional association (OERN) concerning the renovation of old buildings, the *Manual de apoio ao projecto de reabilitação de edifícios antigos* (Freitas 2012). This collaboration between several authors covers a large variety

of topics, including a section with detail drawings of original building elements in Oporto[6], and an important analysis of the applicable legal demands to renovation. Even though the latter is a rapidly changing domain, this remains an innovative synthesis of structural, fire, hydrothermal and ventilation, acoustics and thermal demands in renovation, that remains valid with a few necessary adaptations. Finally, the work presents some examples depicting possible renovation solutions, including, for instance, the detail of the interior insulation of a roof between the existing rafters, the interior insulation of a wall (without connecting details), the doubling of an existing window from the inside, and the sound insulation of a timber floor placed over the existing floorboards.

Calculations for renovation and regulations in Switzerland

The *Element* series are short books on technical building issues directed at architects, and published by the "Swiss association of earthenware industry" (*Association Suisse de l'Industrie La Terre Cuite*). There are two volumes, one concerning thermal insulation *Element 29* (Burkhalter 2011) and another focusing on acoustic insulation, *Element 30* (Glanzmann 2011). The books describe the main principles of building insulation, and then focus on the applicable Swiss regulations. These explanations are particularly useful to understand how to carry out the justification of performance in accordance with the regulations issued by the *Société suisse des ingénieurs et des architects* (SIA) regarding thermal insulation – SIA 380/1 and the SIA 180 – and sound insulation – SIA 181. In the case of sound insulation, the 1995 volume of *Element 30* (Martinelli 1995) was more detailed in relation to calculations for the justification methods, while the 2011 volume focused on giving some examples with their respective acoustic measurements. Both books have been republished several times since the first edition in German in 1980, and adapted to the changing regulations. They were first published in French in 2011.

It is also worth mentioning the *Catalogue d'éléments de construction avec calcul de la valeur U: Assainissement* (Kurt Marti 2002), a study published by the "Swiss federal energy department" (OFEN) focusing on the thermal insulation of existing building elements[7]. It is a good systematic manual for non-experts demonstrating the calculation principles of the coefficient of thermal transmission (U value) through practical examples, mostly in the case of homogeneous layers[8]. The authors present a useful list of thermal conductivity values for numerous types of insulation and common existing building materials to assist with the calculations. The study also includes a catalogue with schematic drawings and values of typical insulated vertical or horizontal building elements.

In regard to sound insulation, the SIA, the agency issuing technical regulations in Switzerland, published the *Bauteildokumentation Schallschutz in Hochbau: Zusammenstellung gemessener Bauteile* in 2005. Exclusively in German, this catalogue provides measured values of sound insulation to airborne and impact noise for a variety of solutions and building elements: façade, terraces, roofs, new windows, inner walls, floors, and doors. The measurements of particular interest to our work

are the different insulation solutions applied to timber floors. In the publication *Bois, systèmes constructifs* (KOLB 2010), we were also able to find several constructive details of differently insulated timber floors, with the respective airborne and impact sound insulation values. Even though the publication is directed at new timber building systems, the described insulation principles of timber floor insulation remain applicable.

Window renovation

The issue of window renovation was addressed by five different cantonal services since the late 1990s in Switzerland [9]. The most exhaustive study amongst them was published by Geneva's *Office du patrimoine et sites* in 2008, entitled *Les fenêtres, vues sur un patrimoine* (ZUMTHOR 2008). This study compares several interventions addressing thermal and acoustic insulation, as well as their architectural pertinence. The work compares several solutions applied in buildings in Geneva, including some that would comply with existing thermal regulations, and others most applicable to protected buildings: changing the glazing with a laminated or double one, placing an interior glazing over the old one, adding an exterior simple-glazed window, an interior double-glazed window, or replacing the window. The comparison of the solutions was carried out from an acoustic point of view, including approximate values, but does not individually examine thermal performance. The text by Hugo Kerhli concerning the protection from noise underlines the historic and present advantages of the double window, that was commonly used in Geneva's 19th century buildings: "Closed, the two windows are equivalent to an insulating one and, half-open, they allow for a gain of 3 to 4 dB in relation to this same window, thanks to the zigzag effect" [10] (KEHRLI 2008: 32).

Two publications have more recently addressed this topic in Switzerland. *Assainissement de fenêtres: Immeubles d'habitation 1850-1920* is the result of a project we conducted at the EPFL's *Laboratoire de Construction et Conservation* [11] concerning windows in ordinary residential buildings in French-speaking Switzerland dating from mid 19th century to the beginning of the 20th century. The work identifies the main types of original wooden simple-glazed windows, and examines several renovation and replacement solutions, both from a thermal efficiency and from an architectural heritage point of view (ORTELLI 2012). A study concerning the same issues in the Swiss German-speaking region was conducted at the *Berner Fachhochschule*, entitled *Energetische Sanierung historisch wertvoller Fenster* (GEYER 2012).

In Portugal, the topic of window renovation was the object of the master's thesis *Reabilitação de caixilharias de madeira em edifícios do século XIX e início do século XX* (LOPES 2005), carried out in 2005 by architect Nuno Valentim. The work examines in detail the most common type of window in 19th and early 20th century buildings in Oporto – a window with two panes, a fanlight, and interior folding shutters – going on to look into possibilities for renovation or replacement. The work presents a constructive analysis of the original window, comprising detail metric surveys where the building materials are identified. The examined renovation options range

from keeping the original window and improving its performance with extra joints, to placing a new metallic window on the inside of the wall. Some possibilities are also examined in case of replacement, such as similarly proportioned window frame with double-glazing, individually designed windows, or those chosen from available market options.

German studies on thermal insulation and on renovation

The *Detail practice* collection includes books on narrowly defined topics concerning building elements or systems. *Energy-efficiency refurbishments* (Richarz 2013), an updated version of the book *Energy-efficiency updates* (Richarz 2008), specifically addresses the thermal insulation and the upgrading of installations in building renovation. The introduction presents a particularly useful table of thermal conductivity measurements (U-values) of several elements of buildings dating from pre-1918 to 1994 (external wall, flat roof, pitched roof, floor over basement), prepared by the German Energy Agency (Richarz 2013: 47). Several renovation solutions are presented depending on the building elements. A few options are examined for the insulation of timber roofs, external masonry walls, and windows (replacement or additional interior window). The work aims for a more technical analysis rather than focusing on heritage preservation. Each drawing is complemented by detailed explanations as to the used materials and to their building purpose. Of particularly interest to our study is the detailed depiction of roof insulation from the inside while retaining the existing roof covering, as well as the insulation of the topmost floor. The work also presents an example of the internal insulation of an external wall paired with a second internal window. In the same collection, it is also important to mention the book *Insulating materials: Principles, materials, applications* (Pfundstein 2008), published a year later. Even though it does not specifically focus on renovation, this study can be useful since it describes the characteristics of a variety of insulating materials (density, thermal conductivity, compressive strength, reaction to fire etc.), as well as their possible building applications and typical delivery forms.
The *Refurbishment Manual*: *Maintenance, conversions, extensions* (Giebeler 2009) is, like the book *Energy-efficiency upgrades*, a translation to English of a German book concerning building renovation. However, the work covers a wider variety of topics, such as building physics (thermal performance, sound insulation and fire protection), installations, building materials and dangerous substances. Regarding thermal insulation, several tables are presented of original U-values for walls, roofs, and windows (Giebeler 2009: 34-40). General refurbishment tasks are presented and, then, the types of interventions are divided by building period. The period that most interests our work is the earlier one, from 1870 to 1920 (Giebeler 2009: 132-153). The original materials and building systems are described, mostly referring to the German case, but also with some international comparisons. In regards thermal insulation, the particular problems of insulating external walls from the inside or outside are described, such as possible condensation near the joist ends with internal insulation (Giebeler 2009: 37, 123). The same work is carried out for

roof insulation in roof conversions. However, it mainly focuses on cases where an additional layer of rafters is necessary to support the insulation (Giebeler 2009: 39, 127). Regarding sound insulation, the book includes a detailed description of original timber floors in Germany – where pugging was common – with occasional comparisons with other countries. The book only includes four examples of interventions improving sound insulation, all implying a new ceiling and floor finish (Giebeler 2009: 148).

Sound insulation

Several French studies concerning sound insulation have been carried out throughout the years, often with the support or within the framework of public institutions. In 1986, the *L'isolation acoustique des logements anciens* was prepared by an ANAH workgroup (*Agende nationale pour l'amélioration de l'habitat*). Even if addressed to a wide public, it is a quite detailed and technical study, giving clear explanations of acoustic notions. Typical insulation problems in historic building are complemented by approximate values taken in a variety of *in situ* locations. For example, masonry walls with different thicknesses are compared and, finally, paired with a different window, to illustrate the greater impact of the intervention on the weakest element – the window – in a wall with a high area density (Coux 1986: 53). The acoustic data concerning the existing features is of particular interest. Several measurements are presented for existing windows with simple, double-glazing, and for a double window (Coux 1986: 84). Several *in situ* measurements are also presented for original timber floors, with or without pugging (Coux 1986: 89, 90, 115, 120, 132), and for some interventions addressing sound insulation. The applied principles remain valid today, even though some new materials and solutions depicted in more recent work could contribute to improving the solutions. Unfortunately, the measurements were mostly carried out for airborne sound, and not for impact sound, which is often a serious issue in timber floors.

L'acoustique du bâtiment par exemple (Meisser 1994) is the second adapted edition of a book published under the initiative of the French insulating committee. The study concerns sound insulation and its correction in new and old buildings, through the detailed analysis of real examples with measured values. Legislation at the time was less demanding, but the authors account for an improvement of insulation in relation to legal demands of the time. The analysis of existing windows is particularly thorough, presenting in situ and laboratory acoustic measurements of windows with different glass thicknesses (Meisser 1994: 204-206). The work includes a detail example of the improvement of airborne insulation of an existing timber floor through the application of a false ceiling with an independent metallic structure, which is still considered one of the most effective systems today. The renovation is described systematically, including measurements taken at different work stages (Meisser 1994: 151-154).

The study conducted in 2002 by Simonin-Adam, *Acoustique et rehabilitation: Améliorer le confort sonore dans l'habitat existant* (Simonin-Adam 2002), published in the context of the *Plan Urbanisme Construction Architecture (PUCA)* is less

technically detailed than the previous ones, aiming for a clear explanation of the general principles and issues involved in acoustic renovations. No comparative values of the existing or of the applied solutions are presented. The changes to building elements are included in charts allowing for a comparative view. Several solutions are presented for windows, comparing possible materials for new joints, and then depicting acoustic and technical issues involved in glass replacement or window replacement. The same strategy is carried out for floors, describing how to change the upper finish (Simonin-Adam 2002: 232-248), the ceiling (Simonin-Adam 2002: 248-255), or applying combined floor/ceiling interventions (Simonin-Adam 2002: 315-317).

Amélioration acoustique: logements existants (Pinçon 2013) is a French study by Pinçon and Maillet that has been republished several times and, it seems, only partially updated. The work is organized by building element: wall, door, roof, window, floor etc. Regarding timber floors, most of the experimental data comes from a study conducted in 1984 at the *Centre scientifique et technique du bâtiment* (CSTB) (Vidal 1984). The data concerns laboratory measurements done with different insulation positions: between the joists, at floor level or by placing a false ceiling. The same procedure is conducted for windows, including a table of airborne insulation values depending on the type of glass (the type of frame is not mentioned). The types of interventions are similar to the ones found in older studies.

Sound insulation in building renovations in Portugal was specifically addressed in the books *A reabilitação acústica na reabilitação de edifícios de habitação* (Silva 2001), and in *Reabilitação acústica*, by Jorge Patrício (2010). The two studies are short books, the first focusing more on basic acoustic principles, the second on applicable acoustic legislation in Portugal. Both include a brief description of calculation methods, and describe some renovation solutions. Martins da Silva prefers to describe key principles of intervention, while Patrício presents a few examples, without comprehensive data or compared information. Regarding windows, *Reabilitação acústica* includes a table with insulation values of windows (material of frame not specified), with simple or double-glazing (Patricio 2010: 39). Two possibilities are depicted for the insulation of timber floors, with laboratory measurements of airborne and impact sound insulation: the first with a false ceiling without replacing the existing floor, and another with insulation from above, placing insulating material between beams and floating floor above the existing floor.

Recently, two cross-European studies focusing on sound insulation were carried out within the COST framework (European Cooperation in Science and Technology), an organization promoting the international coordination of research on several topics. Action FP0702, *Net-Acoustics for Timber based lightweight buildings and elements* (Gerretsen 2012) is a thorough study concerning the "acoustic behaviour of timber based lightweight buildings as well as to develop effective prediction models and measurement schemes" (Gerretsen 2012). Chapter 4 specifically addresses the acoustic design of timber frame constructions. Several building elements in timber construction are examined from an acoustic point of view (party walls, internal walls, etc.). The most relevant part to our study is the analysis of techniques and of insulating materials of timber floors. The work includes, for dry floating floor

systems, the comparison of impact noise using different types of boards over the same layer of mineral wool (Gerretsen 2012: 68) and the comparison of different resilient layers placed below the same board (Gerretsen 2012: 4:70-71). An additional section examines false ceiling systems. Moreover, a number of timber floor details with different insulating compositions are presented, comparing several currently used methods. For each one, impact sound insulation was measured in a laboratory (Gerretsen 2012: 4:83-91).

The second publication stemming from a COST action, TU0901, *Integrating and harmonizing sound insulation aspects in sustainable urban housing constructions* (Rasmussen 2014), includes a collection of articles, each concerning a specific country. Each study describes, from an acoustical point of view, the existing housing stock, some building systems and the legal framework. Out of the depicted data, it is sometimes possible to compare the composition of historic timber floors in different countries, as well as the respective measurements of sound insulation before and after the proposed interventions.

Built heritage protection aims to ensure that buildings and their characteristic elements are preserved even if they are subject to changes, while energy saving regulations aim for more comfortable living environments and, mainly, for an efficient energy consumption. In protected buildings, the conjugation of these instruments can push the design to go further – and apply varied techniques to achieve compromises. Nevertheless, it is important to consider the changes to other 19th century residential buildings that are not protected. In these cases, renovations according to the most economic or to the most energy efficient solutions can lead to losses of important historic elements.
Energy improvement of a building envelope typically focuses on elements such as façade openings, outside walls, and on a building's basement and attic insulation. We chose to focus on the improvement of the thermal performance of building components that can often affect characteristic historic elements, looking at some possible

RELATION BETWEEN PATRIMONIAL PROTECTION MEASURES AND ENERGY DEMANDS

	Elements that might be affected in an intervention	Possible solutions for compromise
Roof	The quality of the roof covering material (slates, tiles, metallic elements; skylight; architectural unity of the building)	Placing insulation between and below rafters to avoid increased thickness problems
Windows	Existing original windows and the woodwork of the window splays and shutters; the architectural unity of the façades	a) Maintain original window, placing a new insulating glass window on the inside or outside b) Renovate existing windows in good condition by replacing the single with insulated double-glazing
Walls	Woodwork of the window splays and of wall panelling; plaster decorations; original wooden flooring Façade stone work; composition and texture of the rendering and particular details	a) Outside insulation of blind gable walls (if possible) b) Insulating rendering on external façades, replacing existing rendering c) Insulation under window-sill and splays (if there is no woodwork) with quite performing materials d) Interior wall insulation if no woodwork or plaster decorations are affected

conflicts and at practical solutions for compromise that were observed in recent examples of building renovation. We examined the thermal insulation of roofs and walls through case studies located in Geneva, where there are more demanding climate and regulations.

Roofs

Original composition of the roofs. The original roofs ☒ of Geneva's 19th century houses were often covered with slate plates or clay tiles. These were directly placed over one layer of wooden battens ☒ that covered the roof rafters at a right angle. Structurally, as in many wooden roofs ☒ of this time, rafters often rested on purlins that were placed over the roof trusses ☒. Trusses were quite varied, even though it is quite frequent to see two pitched roofs where trusses have high collar beams (usually attics used for storage), or mansard roofs known to serve as servant's dwellings[12]. On the inside, the rafters were usually covered in wooden lathes or battens ☒, followed by a final coat of plaster. Skylights ☒ placed over staircases or internal courtyards were also quite common.
Today, the insulation of an existing roof is usually done at roof or floor level, often depending on whether the attic space is used for housing. However, if the roof is in bad condition, it might also be convenient to profit from its general renovation to insulate it. Depending on the solution, characteristic elements might be affected, such as the roof covering materials (like slate plates, ceramic tiles and tin-plated copper elements), the roof frame if it is submitted to additional weight, and the outside volume. The internal plaster finish of the attic ceiling does not usually present any decorative details and is often in bad condition due to poor upkeep. Its replacement does not usually present any conservation problems.

Roof conversions – Insulation placed at roof level. Both for conservation and for practical reasons, the original roof framing is generally kept when insulating, replacing or reinforcing any elements that are structurally damaged[13]. Many insulation solutions are available, that we can easily observe in manufacturers catalogues or in building manuals (Vittone 2010: 552). In examined renovations, when the insulation is placed at roof level ☒, one of the most straightforward solutions is to place most of it between and below the rafters, depending on their height. This system avoids most of the increased rooftop thickness that comes with external insulation, which can induce connection problems with the gutter or with the eaves (even though it minimises thermal bridges). Insulation between rafters is often done with an averagely priced material of good thermal and fire resistance, such as mineral wool (I value around 0,034-0,048 W/(m K). In addition, resilient rather than rigid materials "compensate for the natural swelling and shrinkage behaviour of the timber roof structure" (Richarz 2008: 26). Above the rafters, a layer of sheathing often made out of wood fibre panels is placed to avoid any water leaking, but permeable to vapour. These panels are followed by a layer of wooden counter battens for ventilation, to keep the construction dry and to avoid overheating during the summer (Kolb 2010:

212; Appleton 2003: 221). The wooden tile battens are placed above, supporting the ceramic tiles or slate plates, which are usually new to avoid irregularities. Inside, below the insulation, a vapour barrier is added, followed by a service lathing to pass any necessary cables and prevent damage to the vapour barrier. The final coating is then placed, most frequently using a double layer of plasterboard. This solution was or is going to be applied, with some variations, in projects by MTV Architectes and Théodore Necker Architecte at *Rue de la Servette* 36, MVT Architectes at *Rue Saint-Victor* 8 ☒ and 10 buildings ☒, and in *Rue de l'Athénée* 4 by AFM Architectes. If we recall that according to the SIA 380/1 localised performances method[14], the limit *U* value for a roof is 0,25 W/(m² K), it is necessary to place a total of around 0,14 m to 0,17 m of mineral wool paired with sheathing to fulfil this method's legal demands[15], but more is often added to avoid excessive heat in summer. In addition, rafters often have inferior heights, around 0,12 m. Hence, this insulation is usually composed of two layers: a main one between rafters, and an extra wood-battening layer paired with insulation placed underneath. The possible disadvantage of this solution is the loss of ceiling height, which could become a problem if it is close to the legal limit for housing use. This limit is 2,60 m in most cases, but a value of 2,40 m can be allowed for attics of buildings dating from before 1961 if they are used for housing purposes (Grand conseil 2013: Art.12). Even when the global performances method is applied, the roof is sometimes a place where insulation is reinforced to make up for places where most characteristic protected elements are present.

Insulation placed at floor level. In cases where the attic is not going to be regularly used for housing or other functions, insulation can be placed at floor rather than at roof level. This can be a less expensive intervention since, if the roof is in good condition, no changes are required or additional weight placed on it. In a visited example at Geneva's *Rue des Grottes* 12-14, a project by architects Steeve Ray et Associés, cellulose insulation was injected between the wooden joists. According to Samir Al-Khudri[16], the architect working for the building owner, the city hall, this option was chosen not to loose floor height above or below, and to keep the existing floorboards.

Walls

Original composition of exterior walls. As was often the case in buildings from this time, façade walls of 19th century houses in Geneva were mostly built in rubble stone masonry with a varying thickness between floors. Drawings[17] where wall thickness is indicated put it around 0,60-0,65 m on the ground floor, successively reducing it to around 0,50 m on housing floors. The façades usually rendered ☒, with dressed stonework framing embrasures, façade corners and bases. In more exceptional cases, entire walls present visible stonework ☒. On the inside, characteristic woodwork panelling ☒ often covers the window back and splays, which sometimes include folding shutters. In some cases, inside walls also have dados made up of finely worked wooden panels. In addition, the coved ceilings usually present simple or more elaborate plaster decorations. In less decorated buildings, shutters are often

placed on the outside and, on the inside, a simpler wooden frame is placed around the inside of the rendered splay.

Insulating from the outside. Exterior walls are a key element of heat loss but are very difficult to insulate without damaging any of the historic elements outside and inside. This possibility naturally depends on the characteristics of each wall; in the rare cases where there is an available gable blind wall, it can be insulated uniformly from the outside and largely contribute to the building's thermal performance, reducing some thermal bridges. Several materials can be adopted for compact external insulation. If, for instance, expanded polystyrene is applied (I around 0,032-0,042 W/(m K)), about 0,11 m to 0,14 m are necessary to come to a *U* value of 0.25 W/(m^2 K) for a 0.50 m rubble stone masonry wall, but more is sometimes applied to add to the buildings performance[18]. This solution was applied at *Rue des Grottes* 12-14 (Steeve Ray et Associés) using cellular concrete panels and is going to be applied at *Rue de la Servette* 36 ⊠ (MVT Architectes and Théodore Necker Architecte).
In façade walls, one of the possible interventions is to replace the rendering with an insulating one[19], which has a thermal conductivity (I) of around 0,08 W/(m K) rather than 0,87 W/(m K) for a normal rendering. Nevertheless, the few centimetres that are applied (generally around 0,03 m) can only do so much for thermal insulation, from an approximate *U* value of around 1,2 W/(m^2 K) for a non-insulated masonry wall to 0,84 W/(m^2 K)). It is also important to make sure that the rendering remains slightly behind the stonework limit from a conservation point of view, and to choose a mineral rendering that remains permeable to water vapour. New developments have recently been made in very efficient insulating aerogel rendering (I of 0,028 W/(m^2 K))[20] where, for the same thickness, a *U* value of 0,53 W/(m^2 K) could be achieved. This solution can be interesting, especially in cases where no other wall insulation is possible and where cost is less of an issue.

Insulating from the inside. Interior wall insulation ⊠ is usually part of more general building renovation work. This solution allows for the preservation of the façades. However, the interruption of the insulation at slab level can induce condensation problems that affect the wooden joists due to low temperature paired with humidity. Excessive interior insulation can contribute to this kind of problem, as the temperature on the cold side of the insulation will be even lower, further away from the warm interior. In the cases where insulation thickness is reduced, global heating demands might be easier to satisfy than localised ones (Bachinger 2011). The work on *Energy-Efficient Upgrades* (Richarz 2008: 39) suggests that humidity around timber joist ends can be minimised by exposing them as well as the joist supports, and filling voids with PUR spray foam. This strategy aims to establish a certain continuity of the insulation system, even though a complete continuity seems hard to achieve.
In protected buildings, interior insulation can be applied in places where there are no wooden panelling or particular plaster ceiling decorations near the walls. This is usually the case of basement and mansard walls and, less often, of back façades

onto a courtyard or side street. Unprotected buildings are, naturally, more exposed to interventions that affect important elements, especially inside, where they are less visible. In cases where is no wooden panelling, it is also possible to place insulation on wall surfaces and against the wall ⊠ underneath the window-sill and on splays. This solution was applied to part of the less decorated back façade of a protected building on *Rue Rousseau 7* ⊠ (Atelier MARCH). In this case, the combined insulation of the back wall, the attic, the basement and of the windows, comply with the global performances method.

If the objective is to achieve localised performances demands with a *U* value of 0,25 W/m^2 K it would be necessary to add roughly around 0,11 m to 0,16 m of stone wool to 0,50 m thick masonry walls, if this thickness is feasible from a building physics point of view. Whenever it is necessary, interior insulation should be paired with a vapour barrier on the inside to avoid vapour condensing on the cold side of the insulation. In a global performances calculation (*U* value of 0,40 W/(m^2 K)) it would be necessary to place much less, around 0,06 m to 0,08 m, if other elements can be more insulated. In cases where interventions on window splays are possible, insulation is beneficial to minimise surface condensation. As excessive thickness may affect windows and daylight, very performing materials might be worth considering if financially possible, such as aerogel panels (I around 0,014 W/(m^2 K))[21].

The strategies for the sound insulation of buildings vary depending on whether the source of noise is exterior or interior, and on the types of noise. The latter can mainly be subdivided in airborne noise, impact noise and noise pertaining to technical installations. According to the source of the noise, specific building elements – such as windows, walls or roofs – mark the boundary between the source and the reception location of the noise, thus providing more or less sound insulation.
In this section, we examined the renovation of windows, through case studies in Geneva, Lisbon and Oporto. Windows of 19th century buildings are elements whose performance is usually not up to legal standards both in terms of sound and thermal insulation. First, we examined some strategies for window renovation that mainly address exterior noise, rather than thermal issues: replacing the single for laminated glazing and adding new joints, or adding a second window with laminated glazing. As we shall see, some examples are less thermally demanding – according to the Portuguese climate – but can provide good acoustic responses. Secondly, we looked into examples in Geneva where both thermal and acoustic comfort were addressed, by changing the single for insulated double-glazing, or by adding a second window, also with insulated double-glazing.

Original windows

Original windows ☒ in ordinary 19th century residential buildings in Geneva, Lisbon and Oporto were mostly casement windows with two casements and waist height sills, or French windows that were sometimes paired with balconies. Dressed stonework ☒ elements often framed the embrasures. In some of the late 18th century case studies in Lisbon, we also observed sash windows with smaller partitions. In most cases, one single glazed wooden window was placed on the inside of the stone elements. However, in Geneva it was also common for this window to be paired with a storm window on the outside ☒. This extra window ☒ was usually also a casement window made with simpler details, which was placed as additional protection during the winter months. Each sash was then generally divided in two or three panes of glass with glazing bars in between; sometimes, there was also a fixed or opening fanlight above the window transom.

Thermal insulation demands

Legally, any work done to a building's exterior that increases comfort conditions in the Geneva canton, such as window transformation, is subject to building permission (Grand conseil 2013: Art.1). In the case of buildings included in protected perimeters, the list of protected characteristic elements dedicates a paragraph to window renovation indicating that:

> In order to preserve the architectural unity of the façades, repairing of the existing windows should always be sought first. An improvement of the sound and thermal conditions can be sought by adding a glass layer or a double window. It may also be achieved by changing the glazing or placing joints. Nevertheless, if the window condition should not allow for such an intervention, the rules and detail regarding the new windows should be submitted to the *commission des monuments, de la nature et des sites*. These have to respect the look of the original windows, both by using the same material and by respecting the existing partitions, and the section dimensions, with structural glazing bars. (Service des monuments et des sites 2010)[22]

In Portugal, the protection of specific building elements is usually mentioned in the conservation plan of each area. The one concerning Lisbon's *Baixa Pombalina*, for instance, mentions that:

> 1 – Doors and windows that have traditional features can only be replaced by others with an identical shape and colour. 2 – Doors and windows, without traditional features and without acknowledged formal quality, can be replaced by others that fit into the building and its surroundings, with respect for the dominant metrics, shapes and colours. 3 – The application of reflecting or pigmented glass to doors and windows is not allowed. (Municipio de Lisboa 2011: Anexo 3)[23]

Even though the regulations of the *Baixa*'s conservation plan do not mention possible renovations to improve the thermal or acoustic performance of windows, most of the changes that we examined would probably abide by these conditions.
In Geneva, in addition to specifying the conditions for building permissions and transformations, legislation also defines living standards that buildings can be required to meet regardless of their time of construction, including some energy saving measures. The RCI (*Règlement d'application de la loi sur le constructions et les installations diverses*) states that elements that comprise the façade openings giving onto heated rooms should be adapted to have a $U \leq 3{,}0$ W/(m^2 K) until 2016 (Conseil d'état 2013: Art.56A). This general rule is far less demanding than SIA regulations that need to be applied in case of transformation, but means that original single simple glazed windows may no longer be kept without changes, while original double windows could be kept if they have not been renovated until then. Recent studies on the renovation of historic windows in Switzerland have shown that the *U* value of one simple glazed window is around 4,50 to 4,95 W/(m^2 K), and that of a double single-glazed window around 2,26 to 2,42 W/(m^2 K). In addition, they have also calculated the *U* value of several renovation solutions (Ortelli 2012; Geyer 2012).
As we have seen, the REH regulations (*Regulamento de Desempenho Energético dos Edifícios de Habitação*) in Portugal do not specifically require a minimum *U* value

for windows in case of renovation; their performance is only included in the global building performance in case of large scale renovations, and several exemptions are possible.
In Switzerland, the localised performances method of the SIA 380/1 regulations demands very high performance, as windows should abide by a *U* value of 1,3 W/(m² K). Today, the most obvious solution to fulfil these demands is to replace the window with a single industrial one with triple glazing. These are very efficient from a thermal point of view, but the frames are much wider than the original ones to support the heavy glass, and without the fine detailing. Acoustically, their performance is similar to insulated double-glazing (Coux 1986: 76). Replacing windows for the most currently available industrial ones is not authorised in protected buildings. In non-protected ones, a need for interior comfort might lead to the hasty disposal of original windows in good condition, which affects the logic of the building façade and the architectural character of homogenous urban areas. It is also worth mentioning that the replacement with insulated double-glazed windows using detailing that is similar to the original ones[24] is in principle not acceptable using the localised performances method, with a *U* value of around 1,44 W/(m² K)[25].

Acoustic demands and performance of existing façades

Legislation regarding sound insulation in Switzerland and in Portugal specifies that the necessary sound insulation from exterior airborne noise depends on the acceptable noise reaching the inside, which, in turn, depends on the sensitivity of the given space to noise (in Portugal, residential vs. commercial spaces, and in Switzerland, also depending on the type of room within a house). The levels of emitted noise for day and night time are usually available in municipal noise charts.
In both countries, the minimum sound insulation values for the façade from exterior airborne noise are usually in the vicinity of 30 dB, depending on the exterior emission values and, in Switzerland, on room sensitivity within the house. The sound insulation value is evaluated for the façade of every room, to which are sometimes added adaptation coefficients regarding flanking transmissions and concerning the features of the room (volume/wall surface).
In the buildings examined, the exterior walls were usually made of rubble stone masonry of 0,5 to 0,65 m. A recent experimental study (Pinho 2008) analysing rubble stone masonry walls in Portugal, made of 75 % limestone and 25 % lime mortar using traditional techniques, determined a high average bulk density with an average value of 1 758 kg/m³. Furthermore, the walls also have a high rigidity, which is favourable to airborne sound insulation. According to the study *Elements 30*, it is considered unfavourable if the frequency of the wavelength of airborne sound coincides with the frequency of free oscillations of the building element (Martinelli 1995: 56). The frequency varies according to the composition of element as well as with its thickness. A more rigid thick element, such as the walls examined, has a low critical frequency[26]:

> If the critical frequency fg of the element is within the frequency band of the vibrations it receives, we should expect a reduction of its insulation power regarding airborne waves. [...] We should give a homogeneous partition such a thickness that its frequency fg is lower than 200 Hz. [...] An element with a critical frequency lower than 200 Hz is considered to be rigid enough. (Martinelli 1995: 56)[27]

As a simplified initial calculation method for homogeneous building elements, we can determine the weighted sound reduction index according to the "Gösele curb", an adaptation of the mass law to concrete or masonry elements (Emrich 2006: 54). For a mass density (mv) of 1 758 kg/m^3 and, for instance, a wall of 0,5 m, the mass per unit of barrier[28] (m', in kg/m^2) will be of 879 kg/m^2, corresponding to an approximate weighted apparent sound reduction index, R'w, of 57 dB. In a book concerning sound insulation in renovation, Martins da Silva, quoting a French publication by the ANAH (1985, cité in Silva 2001: 28), also places this value at 55 to 60 dB (A).

According to regulations, a façade should abide by the weighted standardized level difference (DnT,w), to which is sometimes added the traffic A-weighted spectrum adaptation term[29] (Ctr), to account for noise spectrum of low-frequency dominance such as urban road traffic, calculated according to ISO 717-1 (ISO/TC43 2013). The weighted standardized level difference of the envelope (D2m,nT,w), is a function of the weighted apparent sound reduction index R'w, of the volume of the room examined, of the area of the partition, and of the reverberation time, usually considered 0,5 s for housing. When the exposed area is larger (the surface of the wall), airborne sound insulation decreases, and it increases with the volume of the room. A hypothetical situation of a room without windows, with a 50 cm rubble stone masonry wall, would pass sound insulation regulations with flying colours – if only windows were not necessary !

In original 19th century building façades, windows are usually the less acoustically performing element (Cated 1977: 227; Coux 1986: 53). There was often only one single-glazed window, with a thin glass (1,9 to 3 mm) and low airtightness (Coux 1986: 48).

According to the demands for the façade, we can determine the required weighted sound reduction index (R'w) with the spectrum adaptation term (Ctr), should the windows be adapted or changed. As an example, we have followed the calculation that is suggested in the SIA 181 regulations, for an average room with two windows, next to a busy street in Geneva[30]. In this case, regulations would demand a sound insulation of the façade for rooms with an average sensitivity to noise (bedrooms, living rooms) of De=32 dB. If we consider a correctional factor Kp of 2 dB (applied to reduction indexes determined in a laboratory, to account for transmissions not taken into account in the calculations, we determine that the weighted reduction index, with required the spectrum adaptation term Ctr of the room's façade should be (R'w+Ctr)res=32,16 dB, and that of the window only, of 27 dB[31].

Some publications mention values of weighted reduction indexes for original windows (with or without the spectrum adaptation term Ctr). Nevertheless, these should be carefully considered, since the original conception and state of conservation of the window could have a substantial impact on sound insulation. In the Swiss contribution to a European project regarding sound insulation, Victor Desarnaulds

(2014) mentions a Rw value of 23 dB for an original single-glazed window. Other studies have mentioned similar values for windows with thin glazing (Cated 1977: 227; Meisser 1994: 205). Meisser mentions values between 21 and 26 dB (R) for glazing between 2,9 and 3,2 mm (Meisser 1994: 205). As expected, one original window with single glazing does not have nor a sufficient thermal or acoustic performance. However, it was quite common in Switzerland for there to be a storm window placed on the outside of the main one. Assuming the windows were both in good condition, and with fitted joints, their combination could add up to a good sound insulation. According to several studies, double windows are one of the best systems for the protection from exterior noise, due to the insulating effect of the air gap between windows (Cated 1977: 227; Silva 2001: 53; Zumthor 2008: 32):

> Applied to Geneva's buildings, these reflections lead us to rediscover the advantages of the double window, that was once used for thermal insulation and that, measured today, is an excellent anti-noise device. Closed, the two windows are equivalent to a good insulating window and, half-open, allow for a gain of 3 to 4 dB in relation to that same window, thanks to a zigzag effect. (Zumthor 2008: 32)[32]

Improving the sound insulation of the existing window: laminated glass and new joints

Some case studies mainly address acoustic requirements, complemented by a partial improvement of thermal performance. This is the case of some examples in Lisbon and in Oporto, where climatic conditions are milder, and are thus followed by less demanding regulations. Similar renovations were also carried out in protected buildings before the 2009 SIA 380/1 regulations regarding thermal insulation (Zumthor 2008: Fiche 1).

In recent flat renovations ☒ in Lisbon's *Baixa Pombalina*[33] new windows ☒ were added with detailing reproduced from the original, new laminated glazing and rubber joints. The new window frames are slightly thicker to include the new glazing. Laminate glazing – glasses glued together with an interlayer in between, usually polyvinyl butyral – have better acoustic performances than monolithic glazing of the same thickness (Pinçon 2013: 205), and that can be comparable to insulated double-glazing. However, using insulated double-glazing becomes essential when thermal performances need to be improved (Cated 1977: 227).

Some studies detail procedures to be followed when placing new joints, and usually recommend V-shaped polypropylene profiles, or extruded profiles in EPDM, polychloroprene, silicone or PVC, which last longer than glue-on foam joints. Joints should be placed all around the periphery of the window and, in its lower end, located behind the water collecting system (Simonin-Adam 2002: 185; Pinçon 2013: 208). The French windows in the *Rua das Pedras Negras* flat also include an aluminium-silicone profile[34] placed in a slot on the lower part of the window. This profile is pushed down when the window is closed, and contributes to sound insulation and airtightness. It closes the bottom door gap automatically, since the stone element that closed it did not exist or was very worn.

Replacing the single for insulated double glazing

Older publications mention that the renovation of a window by replacing the single for insulated double-glazing could be carried out by placing a metallic element around the existing window opening (Cated 1977: 221; Anah 1989: 84), supporting the new insulated double-glazing, whose thickness exceeded that of the existing wooden frame. Another option was to place an additional single glass attached to the inside of the window frame, leaving the old one in place. Although faster and less expensive, this method had the inconvenient of being less thermally and acoustically performing, and of possible condensation between the glasses. There was also a risk of faster degradation of the window (Simonin-Adam 2002: 187; Coux 1986: 66).
In windows in good condition, one of the most interesting examples that recent technical advances have perfected is the replacing of single for insulated double-glazing ☒ by adding a layer of wood to the prepared external window surface, which is usually the most damaged. A short base document on windows in historical buildings by the *Commission fédérale des monuments historiques* (2003) and an important publication from the Geneva *Office du patrimoine et des sites* (Zumthor 2008) already mention this possibility.
For acoustic purposes, it is best when insulated double-glazing is composed of glasses of different thicknesses, "so that their critical frequency is not the same and that the coincidence dip[35] is minimized"[36] (Kolb 2010: 102). For a window with a wooden frame, insulated double glazing (4-6-4 or 4-6-6 mm) and new joints, Pinçon and Maillet (2013) mention a possible weighted sound reduction index (Rw+Ctr) of 30 dB, which might be improved to 35 dB with the use of thicker glazing (10-6-4 mm).
Window renovation by replacing the single for insulated double-glazing, and increasing the wooden frame thickness, is being increasingly applied. This was the case in the protected buildings examined on *Rue Rousseau 7* ☒ (Atelier MARCH) and *Quai de l'Île* 15 (SRA – Studio de réalisation architecturale). This type of intervention can change the *U* value to an average of 1,44 W/(m^2 K) (Ortelli 2012: 22). If other elements can be more insulated, this technique can be accepted without exemptions, by using the global performances method. In this case, window performances need to respect SIA 180 requirements, with a less demanding *U* value of 2,4 W/(m^2 K).

Adding a second window with laminate glazing

Transposing the idea of the original double window system, it is possible to maintain the old window and place a new one on the inside, keeping the external façade intact. Double windows are systematically described as the most efficient way of significantly increase sound insulation of windows, if the space between them is sufficient[37]. A minimum distance of 12 cm is mentioned by Simonin-Adam (2002: 188). In a building located in Lisbon, *Rua Nova do Carvalho* ☒, architects Appleton & Domingos chose to place an additional window with laminated glazing on the inside

of the original one. This solution was applied both with double casement windows ☒ and with sash windows ☒, using less detailing and partitions on the new interior windows. The original interior shutters were also kept. This solution applies the same principle as the intervention architect Alvaro Siza Veira carried out in Lisbon's Chiado buildings ☒, whose details ☒ have been published (CML 2013). In the Chiado example, the original windows and shutters had been damaged in a fire and had to be replaced. Therefore, the interior window was placed on the inside of the stone lintel, where the shutters would have been originally located, which facilitates the simultaneous opening of both windows. The new shutters were placed around 8 cm behind the interior window.

In another example, a single-family house in Oporto on *Rua Alvares Cabral* 44 (Pedra Líquida architects), a new single-casement window with laminated glazing was placed on the inside of the original one. Compared with a double casement interior window, this type of intervention has the advantage of being nearly invisible. However, it could be less practical depending on the use of the room, since the new opening span goes beyond the interior limit of the wall. This type of renovation of windows in Oporto was also depicted in a Master's thesis by Nuno Valentim Lopes (Lopes 2005: 76-79), detailing the proposal of an interior iron double casement window ☒ that would be as invisible as possible.

In some renovations in Geneva dating from before the enforcement of the most recent energy law revision, architects chose to add an exterior window with simple glazing and thin metallic profiles (*Rue du Général-Dufour* 20, SRA-Studio de réalisation architecturale) (Zumthor 2008: Fiche 4), or with wooden profiles very much like original storm windows (*Rue Saint Victor* 10, MVT Architectes). In the latter, the new storm windows were made ☒ with similar details and proportions to the original windows. This strategy was taken to the extent of applying glazing made by glass-blowing (*verre soufflé*) so that its reflections would be similar. The new windows for the top floor of the same building were made with insulating double-glazing, with an external drawn sheet glass[38] (*verre étiré*).

Adding a second window with insulated double glazing

There are some solutions for compromise that can be applied to improve interior comfort as well as keeping characteristic elements intact, even when the objective is to abide by the Swiss SIA 380/1 localised performance method. A new window with insulated double-glazing can be placed on the inside ☒ or, alternatively, a new window can be placed on the outside ☒, leaving the inside one intact. As condensation problems could arise from this solution, it is important to insure minimal ventilation between windows[39].

The fact that there are two windows increases thermal insulation so that the new window frame can have proportions that are more similar to the original ones by not supporting the triple glazing. However, the feasibility of this option at large scale would require an industrial production of profiles for insulated double-glazing smaller than for triple glazing, which is often unfortunately not the case.

In a solution depicted by Desarnaulds (Desarnaulds 2014: 501), where a second window was added on the inside, with reduced insulated double-glazing (3 mm + 1 mm of PVB + 5 mm), the weighted sound reduction index Rw was 41 dB.

COMPARISON BETWEEN U VALUES OF DIFFERENT WINDOWS AND SIA REGULATIONS[26]

Type of window or intervention	*U* value W/(m² K)	SIA regulation limit *U* values W/(m² K)
Single glazing original window	4.95	-
Double original window (with storm window)	2.31	1.6 (SIA 180)
Replacing of the glass pane	1.44	
New window with similar details	1.42	1.3 (SIA 380/1)
New external window with insulated double glazing	1.18	
New internal window with insulated double glazing	1.13 – 1.14	-

Regarding interior noise, sound insulation often needs to be improved between commercial areas (usually located on the ground floor) and the dwellings, between common areas and dwellings and, very frequently, between different dwellings. Interior sound insulation is often addressed at the same time or following an intervention improving the thermal and acoustic performance of windows, since a better insulation from the outside tends to increase the residents' awareness to interior noise. The building elements that establish the boundaries between interior spaces are the walls and doors, and the floors with timber joists ⊠. In each case, improving sound insulation can affect different characteristic original features. Noise perception within the same dwelling is not legally binding both in Switzerland and in Portugal. As far as we could determine, no strategies were put in place to improve the sound insulation between rooms in the renovations examined of single-family houses in Oporto.

Inside the buildings, we looked into strategies to improve the sound insulation of timber floors, mainly comparing situations with existing or new massive wooden floorboards. This is one of the interventions that can most affect existing historic elements, such as the structural timber joists, the finishing elements (wooden flooring ⊠, original ceramic flooring) or plaster decorations ⊠. Again, we examined strategies for compromise between heritage conservation and comfort needs. Our analysis focused on three different situations improving the sound insulation of timber floors by doubling existing elements: sound insulation of ceilings; sound insulation of floors; sound insulation of floors and ceilings. As noted by Martins da Silva, the intervention principle both above and below the timber joists, is usually to eliminate rigid connections between the existing and new elements, typically through resilient hangers for a false ceiling and a resilient support for floating floors (Silva 2001: 59).

Given the complexity and imprecision of calculations to predict the sound insulation of heterogeneous elements such as old timber floors, the comparison of sound insulation values was carried out through empirical examples of laboratory or field measurements that were found in different studies.

Historic timber floors

Original composition of timber floors. The original floor structure ⊠ of late 18th and 19th-century buildings in Lisbon, Oporto and Geneva was composed of timber joists

running between load-bearing rubble stone masonry walls. In the case of Lisbon's *gaiola* structure ☒, aimed at increasing earthquake resistance, the walls supporting the wooden beams were reinforced with a wooden structure, more simplified in the outside masonry walls and more complex in the interior bearing walls (the *frontais*), which presented a wooden triangular structure filled with masonry. The joists were placed on the rim joists, incorporated in the outside masonry walls, or that were part of the structure of the *frontais*. In the three cities, bridging was usually placed between the main joists to prevent their rotation or lateral displacement. In some visited examples located in Lisbon's *Calçada do Correio Velho*[40], in the *Baixa Pombalina,* the bridging boards were narrower and lower than floor joists, and were placed horizontally and diagonally between them without contact with the wooden flooring. Smaller wooden battens were attached to them, running parallel to the joists and aligned with their inferior side. The lathing was then nailed in rows to the joists and battens. It was made out of thin pieces of wood in a trapezoidal shape, in which the smallest side was placed upwards to promote the binding of the rendering. According to Teixeira and Póvoas, it acted as a supporting structure for the rendering, a double mortar of lime and sand, and for the plaster finish (Teixeira 2012). The ceiling often had decorative motifs ☒, especially in the houses' reception rooms. In the buildings we visited on *Rua Cecílio de Sousa* and *Rua dos Fanqueiros*[41], also in Lisbon, there was mostly solid bridging with the same dimension as the remaining beams, without any additional battens. As before, the lathing and rendering were placed underneath. In the structural description of another case study in Lisbon, located on *Rua Nova do Carvalho*, bridging had not been placed, possibly due to the proximity of the main joists[42].

In Oporto's narrow single-family houses, joists ran between party walls, which were usually distanced by about 5 to 7 m (Fernandes 1999: 144). Joists were often only partially flattened to place the floorboards, unlike in Lisbon, where the observed examples had beams with a rectangular section. There was usually solid bridging between the joists and, underneath, boards or smaller beams to which the lathing and rendering were attached. This system was depicted, for instance, in a Master's thesis by Tiago Dias (Dias 2008) and by Joaquim Teixeira and Rui Póvoas (Teixeira 2012).

In the examples located in Lisbon and Oporto, we did not observe any original material specifically destined to provide sound insulation of the timber floor. The floorboards were generally placed directly over the floor joists ☒, where small board sections could be placed to level the floorboards. The main difference in floors of buildings located in Geneva was the almost invariable presence of three layers ☒ above the wooden floor joists. The first layer was made of rougher wooden planks, while the second layer was made up of sand, gravel or plaster, as well as the floor battens, which supported the parquet. The parquet was often placed in a herringbone pattern ☒. In reception rooms, this pattern was often replaced by one with square panels ☒, which could have different kinds of wood. Underneath the floorboards, the floor composition was similar to the one in Lisbon and Oporto. Between the joists, we sometimes observed solid bridging and, below them, the lathing and rendering. Data included in the publication *Building acoustics throughout Europe*[43] (Rasmussen 2014)

shows that similar floor composition also exists in buildings of the same time in Austria (Lang 2014: 31), Croatia (Horvat 2014: 91), and in the Czech Republic (Novacek 2014: 97). Even though we did not observe it, a similar system is mentioned in the articles on Switzerland (Desarnaulds 2014: 495), Denmark (Hoffmeyer 2014: 114) and Norway (Høsøien 2014: 321), in which the sand filling was placed between the timber joists, over a layer of wooden planks.

Original sound insulation of timber floors. Sound insulation ⊠ varies depending on the composition of the original floor, its state of conservation, and on other factors, such as the connections between the floor and the walls, which may cause flanking transmissions. A few publications mention measurements taken on site and in laboratory conditions. Out of the original types of timber floors described, the one in Lisbon and Oporto (wooden flooring, joists, lathing and rendering) has the least insulating measurements. In consulted publications, this type of floor had field measurements of airborne sound insulation (weighted standardized level difference, DnTA) usually ranging between 36 to 44 dB (Coux 1986: 90,115,132). Only one consulted study included impact sound insulation measurements, placing it, in that particular case, at 73 dB (weighted standardized impact sound pressure level, LntA) (Beentjes 2014: 302)[44]. If renovation projects were to follow RRAE (*Regulamento dos requisitos acústicos dos edifícios*) demands in Portugal, which have several possibilities of exemption, the demanded values would be a minimum DnT,w 47 dB and a maximum L'nT,w of 63 dB, both for renovations in historic buildings, where a tolerance of 3 dB is accepted.

As previously mentioned, the original timber floors in Geneva had a first layer of wooden floorboards that was overlapped by a layer of battens and sand, over which the parquet was laid[45]. The additional weight of this layer contributes to substantially improving airborne sound insulation when compared to the previous example. Field measurements of similar situations place the weighted standardized level difference (DnT,w) between 50 and 55 dB (A), and the weighted apparent sound reduction index (R'w) between 45 and 60 dB[46] (Lang 2014: 31; Meisser 1994: 151). This means that, under certain conditions, Geneva's original timber floors could respect the regulations concerning airborne sound insulation, with a required value (Di^3 DnT,w + Ctr – Cv – KP) between living rooms or bedrooms in a dwelling equal to 52 dB or higher. However, as we shall see, impact sound insulation values are usually not up to the required values.

There is less available data concerning the standardized impact sound pressure level (L'nT) of Geneva's original timber floors. An apparently identical situation in Austria (Lang 2014: 32) placed it at 48 dB, a very optimistic value that probably cannot be generalised. Similar examples – but with sand or gravel filling placed between the joists, instead of above – had standardized impact sound pressure levels between 63 and 70 dB (Desarnaulds 2014: 495; Hoffmeyer 2014: 114). Swiss regulations require that L' values (L'nT,w + CI + CV + KP) between dwellings (living-rooms, bedrooms) be equal or lower than 55 dB in case of renovations.

COMPARISON BETWEEN SOUND INSULATION VALUES FOR DIFFERENT TYPES OF ORIGINAL TIMBER FLOORS

	Airborne sound insulation[47]		Impact sound insulation
Lisbon/Oporto type: Wooden floor boards Timber joists + bridging Lathing and rendering	D_{nTa}=39 dB (BEENTJES 2014: 302) D_{nT}=36-44 dB(A) (COUX 1986: 90) D_{nT}=40-50 dB (SILVA 2001)	**R'w=38-45 dB** [48] R_{rose}=46 dB(A) (VIDAL 1984: 9)	**$L'_{n,w}$=75-80 dB** L_{nTa}=73 dB (BEENTJES 2014) Ln=73-76 dB(A) (VIDAL 1984: 9)
Geneva type: Parquet Filling (sand, plaster, etc.) + boards Wooden boards Timber joists + bridging Lathing and rendering	D_{nT}=52dB (A), 55 dB(A) (MEISSER 1994: 151) Austria: $D_{nT,w}$=53 dB D_{nT}=50-55 dB (A) (COUX,1986: 90) $D_{n(rose)}$=51 dB (A) (VIDAL,1984)	**R'w =50-55 dB** R'w=45-60 dB (measured 60 dB) (NOVACEK 2014: 90)	**$L'_{n,w}$ =65-70 dB** L_n=61 dB(A), with plaster filling between joists (VIDAL 1984: 4) $L'_{nT,w}$=48 dB (LANG 2014)
Wooden floor boards Timber joists + bridging + filling (sand, plaster, etc.) Lathing and rendering	D_{nT}=46-56 dB(A) (COUX 1986: 90)	$R'_w(C,C_{tr})$=47 (-2,-7) dB (DESARNAULDS 2014: 495) R'_w=45-50 dB (HOFFMEYER 2014: 114) R'_w=35-45 dB, without ceiling (HØSØIEN 2014: 321)	$L'_{n,w}(C_I)$=63 (1) dB (DESARNAULDS 2014: 495) $L'_{n,w}$=63-70 dB (HOFFMEYER 2014: 114) $L'_{n,w}$=65-75 dB (HØSØIEN 2014: 321) $L_{n,w}+C_{I,50-2500}$=71 dB (GERRETSEN 2012: 84)

Renovation strategies to improve sound insulation

Sound insulation of ceilings. When the ceiling does not present any particular plaster decorations, the intervention can be carried out exclusively from below by placing a false ceiling ☒. An efficient false ceiling system can improve sound insulation in relation to airborne and impact noises, and usually has fewer constraints than an intervention from above. However, it might not comply with regulations and require special building permissions. An intervention only from below allows for the preservation of the existing wooden floorboards or, even if they are replaced by identical ones, for the preservation of the existing floor level. Whenever only one flat is renovated, this solution does not require an intervention on the flat above.
19th century buildings often have main rooms with extensively decorated ceilings, and others where none existed. These were usually rooms outside the main enfilade, placed on the courtyard side or in the intermediate line of rooms or alcoves. In these cases, a false ceiling is sometimes applied ☒ to the rooms where these decorations

do not exist, leaving the others intact. This partial intervention is a compromise between what would be ideal from an acoustic point of view and the preservation of historic elements, since flanking transmissions still occur between the ceiling and the walls of next-door rooms.
Sound insulation through a false ceiling applies the double wall principle (mass–spring–mass), by placing "a new partition against the existing partition, while keeping a layer of air and trying as little rigid connections as possible between the two partitions"[49] (Coux 1986: 95). In practice, this is carried by placing a false ceiling with a high surface mass and low rigidity to flexion, as decoupled as possible from the existing floor (Kolb 2010: 272; Pinçon 2013: 99), and by filling the void to avoid resonances:

> The impact sound insulation will improve with the surface mass of the ceiling. In practice this means more (fire resistant) gypsum boards or fire resistant gypsum boards combined with heavier boards. The added mass will lower the resonance frequency and hence increase the sound insulation.
> Inside the cavity, flexible porous material should be added to avoid standing waves and to help increase the sound insulation. Taking into account fire requirements, very often rock wool and cellulose fibres are used. The effect of adding these materials inside the cavity will increase with thickness only if the decoupling from the load-carrying floor is sufficient. (Gerretsen 2012: 79).

It is generally considered better to remove existing ceiling before placing the new false ceiling, to take full advantage of the insulation of the cavity[50] (Kühn 1988: 75). Furthermore, "for an equal thickness and mass, a triple partition (system) is usually less acoustically performing than a double partition. There is a strong possibility of reducing sound insulation rather than improving it"[51] (Pinçon 2013: 99).
There are several false ceiling systems, which are the more efficient the more they are detached from the existing floor. The systems could be listed as follows, from more to less efficient:
– Independent ceiling attached to the walls, to be paired with high-density plasterboards (example: CW by Knauf; MS by Gyproc)
– Resilient hangers with an elastomer[52] (example: Akustic-Sylomer; Knauf; CDM);
– Resilient hangers with flexible disc (example: Knauf);
– Perforated metallic elastic bars (example: Knauf);
– Rigid hanging systems.
We have available constructive details ☒ for three case studies where sound insulation was improved by placing a false ceiling: *Rue Rousseau* in Geneva (Atelier MARCH) and, in Lisbon, *Rua Nova do Carvalho* (architects Appleton & Domingos) and *Rua Cecílio de Sousa* (architects Aires Mateus e Associados). In *Rue Rousseau* and *Rua Cecílio de Sousa*, the false ceiling was only placed in some rooms, since there were particularly important plaster decorations in others.
The intervention principle is similar in all three examples. An acoustically absorbing, flexible material such as mineral wool was placed between the timber joists to avoid cavity resonances[53]. It also improves the global insulation to airborne noise by 1 to 4 dB. According to Josef Kolb, "the bulk density of the filling does not, in this case, have hardly any importance [...]. Moreover, the voids should not be completely filled"[54] (Kolb 2010: 272), to profit from their insulating effect.

In the examples of buildings in Lisbon, a resilient type of hanger was placed (unspecified), while in Geneva it was a standard type of rigid hanger system. The placement of a false ceiling was also combined with elements conferring adequate fire protection. In the Portuguese cases, these elements were high-density boards of cement and wood particles placed directly underneath the joists ($> 1\,000 kg/m^3$). In Geneva, the heavy plasterboards that compose the false ceiling have that function. The free space above the false ceiling was often used for the passage of electric cables. In principle, in the double wall system, it is usually preferable not to create additional separations in the cavity (Kühn 1988: 75), such as the cement and wood fibreboards placed in some of the examples[55]. However, in the examples examined, there is probably a small improvement in sound insulation in spite of the loss in free space due to the use of very heavy cement and wood fibreboards.

With the addition of the false ceiling to the buildings in Lisbon, sound insulation to airborne and impact noise could (depending on the application and on the existing situation) respect current regulations in Portugal. However, it would not comply with impact noise regulations in Switzerland[56]. The situation slightly improves in the Geneva-based example, where there was an existing layer of sand or gravel between the floorboards and the parquet. The weight of the sand contributes to improving insulation to airborne noise, meaning it would probably comply with regulations, at least if resilient hangers had been used for the false ceiling. There could be a loss of insulation of 3 to 4 dB due to the use of rigid hangers. Even though there is also an improvement in impact sound insulation, if it were necessary to abide by regulations further measures would probably be required.

Several studies show that the most effective hanger system for a false ceiling is to attach it to the sidewalls, thus making it independent from the floor. We did not observe an independent ceiling system ☒ in any of our case studies, possibly due to its higher cost. Nevertheless, we applied the constructive detail to the observed examples in Lisbon, by placing an independent false ceiling that would be attached to the sidewalls and not to the floor joists. Its metallic structure would be paired with a mineral wool filling above, and high-density plasterboards underneath. The height of the metallic beams depends on the span. Most available systems cannot exceed a span of 4 to 5 m between the walls:

> One possibility for increasing the span is to subdivide the span into two or more smaller spans using wooden beams (on which the metal studs are fixed just as if it were a wall) that can be placed between the joists of the load-carrying floor. The alternative is a wooden joist system from wall to wall and completely independent from the load-bearing floor joists. (Gerretsen 2012: 76)

In order to reach a larger span it would also be possible to place additional support in the middle of the ceiling, preferably only one hanger and of the most resilient kind, to minimize transmissions. Depending on flanking transmissions, a false independent ceiling could provide insulation to airborne sound in compliance with regulations, and, depending on the original floor features, might also comply with those concerning impact noise[57].

The false ceiling is all the more efficient in noise protection should the walls be more detached from the floor. Flanking transmissions are usually more significant when

side walls are light-built, and less if they are massive and heavy (Kolb 2010: 76). Physically detaching them could be very complicated when there are structural connections between the floor and walls, which is often the case in buildings from our time of study. It would also be possible to insulate the walls to reduce the flanking transmission (Coux 1986: 97; Simonin-Adam 2002: 65, 67).

Sound insulation of floors in Geneva. Interventions from above aiming to improve vertical sound insulation between flats can have a considerable impact on existing historic elements, especially when there is an increase in floor level. An increase in floor level often calls for the adjustment of skirting boards and doors, or even a possible entrance step from the common entrance to the dwelling. Due to its impact, this type of intervention is usually envisaged in large-scale entire-building renovations.

The differences between the original floors ☒ of the Swiss or the Portuguese case studies have particular importance in case of interventions from above. In buildings in Geneva, there are generally around 9 or 10 cm between the finished parquet level and the top of the timber joists, due to the layer of sand or gravel that was placed below the parquet. In Lisbon, the floorboards were usually placed directly over the joists, making it more difficult to place a floating floor: "Indeed if a floating floor is necessary and parquet is desired, a resilient interlayer and an extra board (or lattices) are necessary to be able to nail/glue the parquet" (Gerretsen 2012: 50). As such, it is not surprising that we only observed this type of intervention ☒ in some case studies in Geneva: one of the floors of *Rue Rousseau 7* (DLV architects), and the part of the fourth floor of *Rue de l'Athénée* 4 (AFM architects).

A floating floor can be particularly important when finishing floor materials do not have a very good performance to impact sound. A dry floating floor is usually composed of a resilient, more flexible layer, and a supporting material for the floor finish[58]. The resilient materials below the floor "have the capacity of muffling the intensity of the impacts to the floor" (Simonin-Adam 2002: 234). Several laboratory measurements were carried out in COST action FP0702, using different resilient and supporting layers over a floor with timber joists. The results suggest that while some resilient layers exhibit similar results, others can more significantly contribute to reducing impact sound transmission:

> A brief look at the single value results (L'nT,w), shows rather small differences between the tested samples, except for the […] "pads-based" solutions. Again this shows that effective solutions have to be looked for in 'discrete' applications, such as strips or pads, optimizing the mass-spring-mass effect for the floating floor. (Gerretsen 2012: 70)

In regard to the boards above the resilient layer, which support the finished floor, the same project results show that it is important to consider damping as well as the surface mass of the materials:

> We did not necessarily find worse results for boards with lower surface mass. Ranking the tested complexes by their surface mass, we observe only slightly higher impact noise levels (1 or 2 dB) for simple OSB and particle boards (11 to 13 kg/m^2, 63 dB), compared to nearly

twice as heavy complexes such as an additional 12 mm board (18 to 22 kg/m^2) or 18 mm wood fibre cement boards (23 kg/m^2). On the other hand, for the same surface mass (23 kg/m^2) we observe a difference of 2 dB between the 18 mm wood fibre cement board and the double layer of fibre reinforced gypsum board, in favour of the latter. (Gerretsen 2012: 67, 68)

On the fourth floor of *Rue de l'Athénée,* and in the flats on *Rue Rousseau,* the original floor composition ☒ followed the usual characteristics of the time: floorboards over the joists, sand or gravel filling, and a parquet finish. Since the intervention in *Rue de l'Athénée* was carried out on part of the flat, it was important not to change the finished parquet level. In *Rue Rousseau*, the floor was heightened by 3 cm. The intervention principle ☒ in both cases was similar. A layer with a high specific mass was placed above the first layer of floorboards, which mainly improved sound insulation to airborne noise, and contributed to covering any holes or imperfections in the existing floor. In *Rue Rousseau*, where floor height was less of an issue, it was a 30 mm lean mortar, while in *Rue de l'Athénée* it was a 5 mm layer of made of bitumen and mineral fillers[59] (10 kg/m^2). Above that layer, the aim was to place a resilient layer, to create a floating floor reducing impact noise transmission.
In *Rue Rousseau*, the resilient layer was a 17 mm wood fibre board (135 kg/m^3), over which were placed two reinforced gypsum boards. The wood fibreboard acts as a resilient layer. Instead of the wood fibre board, if the increased floor height was not an issue, and very efficient acoustic comfort necessary, it would also have been possible to place elastomer pads in polyester wool (30 or 50 mm), which obtained the best results in COST Action FP0702 (Gerretsen 2012: 71). Mineral wool is also often used as a resilient layer, with similar results to wood fibreboards. According to results from the same project, while the first performs better in high frequencies, the fibreboards are more efficient in the low frequency range, which are often an issue in timber frame structures (Gerretsen 2012: 73). Depending on the floor features, the applied solution could possibly abide by existing regulations.
In the fourth floor of *Rue de l'Athenée* case study the described strategy was not applied, since it was necessary to level the floor, which was carried out by placing a mineral lightweight-levelling compound, without significant acoustic improvement. Nevertheless, this layer has the advantage of allowing for the passage of electrical cables. If floor height could have been increased and levelling not necessary, this material could have been replaced by a resilient one, such as mineral wool, wood fibre boards etc. Since there a resilient layer was not added, this solution would probably not improve sound insulation in relation to the existing situation, and would thus not abide by regulations concerning impact noise.

Sound insulation of floors in Lisbon. As previously mentioned, we did not observe any solutions in Lisbon where insulation had been placed only from above. Nevertheless, in one of the case studies in Lisbon, the building in *Rua Nova do Carvalho* (architects Appleton & Domingos), the applied solution involved placing wooden floorboards identical to the original damaged ones, which were placed over 25 mm high wooden battens. The floor height was increased so that it could be level with the bathroom and kitchen floors.

Assuming that a small floor height increase was sometimes possible in renovations, most often of entire buildings, we detailed certain possibilities of improving sound insulation ☒ when the intervention is done from above to timber floor where finishing floorboards were originally directly placed over the joists. The depicted solutions were developed together with acoustician Blaise Arlaud, and partially based on those developed by João Guilherme Appleton (Appleton 2005: 189), and in a recent project by Dan Hoffmeyer and Birgit Rasmussen that examined a similar type of timber floor in historic Danish buildings ☒ (Rasmussen 2014: 115).

The first proposal increases the floor height by 35 mm. As in most other solutions, stone wool was placed between the joists to reduce the resonance effect. The top layer of the floor, composed of a sub-layer of reinforced gypsum boards and wooden floorboards, would be placed over elastomers, resilient elements that contribute to reducing the transmission of impact noise. If the joists were level, the elastomers could be placed directly over them. However, when this is not the case, it would be preferable to attach a support for the elastomers to the joists, such as wooden battens or metallic Ls. The gypsum boards would only come in contact with the elastomer and not with the joists. Depending on original floor features, this intervention would probably abide by regulations concerning sound insulation in Portugal and could, in some cases, abide by regulations in Switzerland[60].

This solution would imply that the wooden floorboards be glued to the reinforced gypsum boards, meaning that it would almost always be necessary to use new completely level boards. Even though the sound insulation would be less efficient (not abiding by regulations concerning airborne sound insulation), the new or existing floorboards could be nailed to wooden battens instead, placed over the resilient elements. To reduce noise transmissions, the battens could not be nailed to the support; their solidity would need to be reinforced with transversal elements (Silva 2001: 60, Simonin-Adam 2002: 237).

Keeping a 35 mm floor height increase, this proposal could be acoustically improved by placing an additional layer of high-density elements to improve insulation to airborne noise. These elements – such as small cement slabs (40 mm high) – would be placed over wooden planks placed between joists, and covered in stone wool. As before, stone wool would also be placed underneath, over the existing ceiling. This option would be more complex to carry out and its feasibility would depend on the how much additional weight the existing structure could support. The same strategy could be carried out with larger elastomers topped with metallic rails[61], ideally by raising the floor height by another centimetre. A thin elastomer could thus be placed over the joists, avoiding problems in case of floor compression. The cement slabs would have to be carefully placed so as not to touch the rails. If the existing joists could not support the additional weight of additional floor, the elastomer topped with rails could also be placed only with stone wool.

The mentioned Danish project ☒ evaluated the use of elastic supports on specially developed iron profiles, which would be placed over the joists (Hoffmeyer 2010). In this case, the original sand pugging was replaced by plasterboards and mineral wool inside the cavity. Field measurements show that this solution could provide a

considerable improvement of sound insulation, and abide by regulations (R'w=58 dB; L'n,w=52 dB).

Sound insulation of ceilings and floors. The two top floors of the *Rue Rousseau 7* building (Atelier MARCH), in Geneva, were an addition to the late 18th century building, and did not have any particular ceiling decorations or good quality wooden floors. The timber floor between them could thus be insulated from below and from above ☒. It was however important not to significantly change the floor level in relation to the staircase landing, and not to bring the ceiling down too much due to reduced floor height.

The intervention principle was to form a heavy layer below, through a false ceiling, and a floating floor above. The false ceiling was made of two high-density plasterboards (1 000 kg/m^3), suspended by rigid hangers or metallic rails. If possible – since more expensive – a more efficient solution would have been to use resilient hangers attached to the side of the timber joists[62]. The existing layer of floorboards over the joists was covered with a levelling compound, like in the *Rue de l'Athénée* example, and then topped with a resilient layer of wood fibre boards (17 mm), reinforced gypsum boards and the wooden parquet. As previously mentioned, if additional insulation to impact sound was required, the levelling compound and wood fibre panels could be replaced by another resilient material, such as elastomeric pads in polyester wool. Depending on the flanking transmissions, and assuming that resilient hangers could be used for the false ceiling, this solution would probably abide by existing regulations in Switzerland.

We did not examine any examples in Lisbon where sound insulation of existing timber floors was carried out from above and from below the joists. Nevertheless, the solutions we suggested for interventions from above, such as supporting the floor with elastomer pads, could be combined with a false ceiling ☒. Depending on the cost of the intervention and on the necessary span between walls, the false ceiling could be completely independent from the floor, or attached with resilient hangers. Such combined interventions would probably abide by existing regulations[63].

Preservation of the existing ceiling and flooring. Finally, it is also important to note situations where minimal interventions could be necessary, for conservation or cost purposes. If the existing ceiling should be kept, at least partially, a small improvement in resonance and in sound insulation could be achieved by placing mineral wool in the cavity between the timber joists. This could be carried out either from above, by lifting the floorboards, or from below, through localised openings in the ceiling. Furthermore, a resilient floor covering, such as a carpet, could be placed over the existing floor, in places of more circulation. In order to preserve the wooden floorboards, carpets can be nailed in the corners[64], or placed over a foam layer. However, it should be noted that resilient floor coverings mostly reduce noise in average at high frequencies, while most impact noise issues in timber floors are observed in the lower frequency range (Pinçon 2013: 160; Gerretsen 2012: 52).

[1] As in the previous chapter, the word compromise is used in a positive sense to refer to critical design solutions that achieve a non-conflicting balance between equally important issues.

[2] I would like to thank my colleagues Pierre Zurbrügg (EPFL) and Nicolas Galiotto (AAU) for their advice on calculating and evaluating thermal resistances, and Blaise Arlaud (EcoAcoustique SA) for his assistance in comparing interventions to improve the sound insulation of timber floors.

[3] "os revestimentos de pavimento, – por vezes em madeiras antigas de grande qualidade –, e os revestimentos de tecto, – quase sempre de estuque que, nos casos das divisões principais (as que confinam com as fachadas da frente e de tardoz) incluem normalmente molduras, florões e sancas sobrecarregados de decoração."

[4] The author also took part in a book focusing on the renovation of the Bairro Alto neighbourhood in Lisbon (Cabrita 1993).

[5] This is the building on *Rua Nova do Carvalho* that we examined as a case study.

[6] A large part of this section was carried out by Joaquim Teixeira and Rui Fernandes Póvoas. The first was, at the time, conducting a thesis under the second's supervision, in which a detail building model of the Oporto house was being prepared. We have not yet been able to consult the thesis, which was completed at Oporto's architecture faculty.

[7] An identical publication covers insulation techniques for new buildings: *Catalogue d'éléments de construction avec calcul de la valeur U: Construction neuve* (Kurt Marti 2002).

[8] In certain cases, it is also possible to use the given examples toapproximately deduce U values for some types of heterogeneous elements using the catalogue of building elements. In these cases, such as wooden roof structures, we preferred not to use the catalogue, but to use the simplified method of calculation described in the EN ISO 6946 (ISO/TC 163 2007).

[9] The four brochures were published by the Basel, Bern, Vaud and Aargau cantons (Abteilung kantonale denkmalpflege no date; Marti 1997; Section monuments historiques et archéologie 1998; Kantonale denkmalpflege aargau 2010).

[10] "Fermées, les deux fenêtres valent une bonne fenêtre isolante et, entre-ouvertes, elles permettent de gagner 3 à 4 dB par rapport à cette même fenêtre, grâce à un effet de chicane."

[11] The research for this work was conducted between 2011 and 2012 with the support of *Stiftung zur Förderung der Denkmalpflege*.

[12] Observation based on the analysis of archive drawings of C*einture Fazyste* buildings, including elevations, which give us a general idea of roof shape, and roof framing drawings (building permissions found at the *Archives d'État de Genève* and at the *Direction des constructions et de l'aménagement* archives of the Geneva municipality).

[13] The *Refurbishment Manual* (Giebeler 2009) presents different options as to the insulation of roofs when wooden framing needs reinforcing.

[14] Two procedures can be followed to justify a building's compliance with the regulations: localised performances (*performances ponctuelles requises*) or global performances (*performances globales requises*). In the case of localised performances, the coefficients of heat transmission – *U* values – that should be respected for each element of a building's thermal envelope are defined (walls, roofs, windows, doors, etc). When the global performances procedure is applied, the thermal quality of the envelope is compared with the buildings' yearly heating requirements, Qh in MJ/m^2.

[15] This estimation of thermal resistance was done using the EN ISO 6946 simplified method for heterogeneous layers (ISO/TC 163 2007).

[16] Interview conducted on 02.08.2012.

[17] Observation based on the analysis of archive drawings of *Ceinture Fazyste* buildings (building permissions found at the *Archives d'État de Genève* and at the *Direction des constructions et de l'aménagement* archives of the municipality).

[18] The estimation of thermal resistance was done using the EN ISO 6946 method for homogeneous layers (ISO/TC 163 2007). Thermal conductivity values were taken from the *Catalogue d'éléments*

de construction avec calcul de la valeur U (KURT MARTI 2002) unless specified otherwise. The value for a rubble masonry wall was taken from the Lesosai program values (LESOSAI).

19 This strategy is going to be applied in the *Rue de la Servette* 36 project by MVT Architectes and Théodore Necker Architecte.

20 We refer to the insulating rendering of high performance developed by Empa and Fixit AG and that is being marketed by the latter (FIXIT).

21 Thermal conductivity value presented for Agitec's Spaceloft board (AGITEC)

22 "Afin de préserver l'unité architecturale des façades d'un ensemble, une réparation des fenêtres existantes devra toujours être envisagée en premier lieu. Une amélioration des conditions phoniques et thermiques pourra être obtenue par l'adjonction d'un survitrage ou d'une double fenêtre. Elle pourra être également recherchée par le remplacement des verres et la pose de joints. Toutefois, si l'état des menuiseries ne devait pas permettre de telles interventions, les règles des nouvelles menuiseries ainsi que le détail de pose devront alors être soumis pour approbation à la commission des monuments, de la nature et des sites. Celles-ci devront respecter l'aspect des fenêtres remplacées, tant par l'emploi du même matériau que par le respect des partitions existantes, et les dimensions des sections, avec petits bois structurels."

23 "1 – As portas e janelas que apresentem características tradicionais apenas podem ser substituídas por outras de idêntica forma e cor. 2 – As portas e janelas, sem características tradicionais e sem re- conhecida qualidade formal, podem ser substituídas por outras que se integrem no edifício e na envolvente, com respeito pelas métricas, formas e cores dominantes. 3 – Não é permitida a aplicação de vidro reflector ou pigmentado em portas e janelas."

24 This solution is often applied using the global performances method, as is the case of a visited renovation on *Rue Lissignol* 8 (project by Morten Gisselbaek).

25 Comparative *U* values were extracted from the *ReHAB: Assainissement de fenêtres dans les immeubles d'habitation 1850-1920* (ORTELLI 2012) research in which we participated, conducted at the *Laboratoire de Construction et Conservation* of the EPFL.

26 In the cited work, the table relating the thickness of given building elements to their critical frequencies depending on the building material does not include masonry walls. However, walls with a thickness above 250 mm, made of limestone brick or concrete, would have critical frequencies lower than 80 Hz (MARTINELLI 1995: 56).

27 "Si la fréquence critique fg de l'élément se situe dans la bande de fréquences des vibrations qu'il reçoit, on doit s'attendre à une diminution de son pouvoir d'affaiblissement à l'égard des ondes aériennes. [...] On donnera à une cloison homogène une épaisseur telle que sa fréquence propre fg reste inférieure à 200 Hz. [...] Un élément dont la fréquence critique fg est inférieure à 200 Hz est considéré comme suffisamment rigide."

28 $m' = mv \times t$ (kg/m^2), in which m' is the average mass per unit of barrier in kg/m^2, mv is the average mass density in kg/m^3 and t is the thickness of the wall.

29 This adaptation term is always added in Switzerland, and in Portugal whenever the examined façade has more than 60 % glazed surface.

30 We applied the same room dimensions as the front room of our case study on *Rue Rousseau 7*, as well as the noise chart for that area.

31 Value calculated assuming a Ctr of -3 dB.
As we have noted in the analysis of Swiss legislation, whenever maximum emission values are exceeded, owners can be asked that windows of rooms that are sensitive to noise (bedrooms, living-rooms) attain minimum weighted sound reduction indexes, with the spectrum adaptation term (R'w+(C or Ctr)) of 32 dB or 38 dB, depending on the emission value Lr (CONSEIL FÉDÉRAL 2012).

32 "Appliquées aux immeubles genevois, ces réflexions amènent à redécouvrir les avantages de la double fenêtre autrefois utilise dans un objectif d'isolation thermique et qui, mesures faites aujourd'hui, s'avère constituer un excellent dispositive anti-bruit. Fermées, les deux fenêtres valent une bonne fenêtre isolante et, entre-ouvertes, elles permettent de gagner 3 à 4 dB par rapport à cette même fenêtre, grâce à un effet de chicane."

33 *Rua das Pedras Negras* 5 by architect Pedro Pacheco, *Rua da Alfândega* 108 by Atelier do Bugio and Calçada do Correio Velho 1-3 by architect Pedro Reis.

34 Profile produced by Planet DGZ AG (PLANET)

[35] There is a coincidence effect when "the incident sound wave coincides with the flexion wave of the element" (Glanzmann 2011: 15).

[36] "afin que la fréquence-critique de chacune des vitres ne soit pas la même et que l'effet de coïncidence ne se manifeste que faiblement."

[37] Pinçon and Maillet note that double windows are one of the few solutions to obtain Rw+Ctr values above 45 dB, and mentions an example of two wooden framed windows with 8 mm glazing where an insulation of 50 dB was measured (Pinçon 2013: 204).

[38] Several companies produce this type of insulated double-glazing, which is mostly applied in the renovation of specific monuments, due to its cost. In *Rue Saint-Victor* 10 the glazing was made by the Saint-Just glassworks (Saint-Just 2014). The double windows were made by Biedermann joiners.

[39] P. Martins da Silva mentions that the condensation can be reduced with two holes with a diameter of about 1 mm between the air gap and the outside (Silva 2001: 53).

[40] We refer a few visited buildings located in the eastern area of the *Baixa Pombalina*: the building on *Calçada do Correio Velho* 1-3, renovated by architects Pedro Reis, João Felino and Tiago Mota, and the building on number 9 of the same street, where the first floor was renovated by architect Pedro Mendes (not examined further as a case study).

[41] These are the buildings on *Rua Cecílio de Sousa* 52, renovated by architects Aires Mateus e Associados, and on *Rua dos Fanqueiros* 73-85, renovated by José Adrião Arquitecto.

[42] According to the architects Appleton & Domingos and engineer Vasco Appleton, in charge of the renovation project of *Rua Nova do Carvalho* 43-51, the fact that no bridging was originally placed was a structural mistake that had to be corrected during the renovation (Appleton 2009: 46).

[43] This is volume 2 of the e-book of COST (European Cooperation in Science and Technology) Action TU0901, "Integrating and harmonizing sound insulation aspects in sustainable urban housing constructions". Both volumes are available online.

[44] Consulted acoustician Blaise Arlaud (EcoAcoustique SA) indicated an approximate R'w value for this type of timber floor between 38 and 43 dB (airborne sound insulation of the element), and an approximate L'n value between 75 and 80 dB (impact sound insulation of the element), depending on the characteristics of the original floor.

[45] In kitchens and bathrooms, the first floorboards were usually covered with a cement screed and tiles. These materials are more rigid than the parquet over a layer of sand, thus less insulating to impact sound.

[46] In this case, consulted acoustician Blaise Arlaud (EcoAcoustique SA) places the possible weighted apparent sound reduction index (R'w) between 50 and 55 dB, and the standardized impact sound pressure level (L'nT) between 65 and 70 dB, depending on the conservation of the existing floor and on flanking transmissions.

[47] "il faut apporter face à la paroi à traiter une nouvelle paroi, en maintenant une lame d'air et en s'efforçant de ne pas créer trop de liaisons rigides entres les deux parois."

[48] According to the study *Protection des constructions en bois contre le bruit,* there is an approximate gain of 1 to 2 dB per cm of distance (limited to 20-25 cm) (Kühn 1988: 75).

[49] "à épaisseur égale et à masse égale, une triple paroi est généralement moins performante qu'une double paroi sur le plan acoustique. On a donc de fortes chances, dans une telle situation, de dégrader l'isolation acoustique plutôt que de l'améliorer."

[50] Elastomers are elements made of very resilient materials such as rubber, foam or cork.

[51] "Composed building elements have air gaps or connecting systems. These gaps produce resonances at certain frequencies (specific to the building element). It is necessary to use materials with high absorbing capacity to reduce the resonance" (Glanzmann 2011: 15).

[52] "La densité brute du remplissage utilisé n'a, dans ce cas, presque aucune importance [...]. De plus, les vides ne doivent pas être entièrement remplis."

[53] According to Pinçon and Maillet, if such a filling is placed it should have a reduced thickness: "when the air gap is reduced, the resonance frequency increases, which generally reduces the global sound insulation" (Pinçon 2013: 98).

[54] Consulted acoustician Blaise Arlaud considered that values of airborne sound insulation (R'w) could be between 48 and 53 dB, and of impact sound insulation (L'n) between 63 and 68 dB. The depicted examples of kitchens and bathrooms have more rigid and heavy finishing materials,

which would improve insulation to airborne noise, and decrease insulation to impact noise by a few decibels.

55 Depending on the existing elements and on flanking transmissions, approximate values of 53-58 for R'w and 55-60 dB for L'n could be achieved, according to data from COST action FP0702 (Gerretsen 2012: 88, 89) and consulted acoustician Blaise Arlaud.

56 For rigid finishing floor materials, such as a parquet, it is also necessary to place a resilient strip between the floor and the walls, to avoid impact sound transmission (Kolb 2010: 273).

57 5 mm of IDIKELL boards, which can be directly glued to the existing floor.

58 According to consulted acoustician Blaise Arlaud R'w values could approximately range from 48-53 dB, and L'n values from 55-60 dB, depending on the existing building features.

59 Such as the isolated steel floor batten system CDM-ISO-LAT (CDM).

60 Such as the elastomer hangers produced by CDM (CDM-ISO-PSJ/PRJ) that are attached to the side of the joists (CDM).

61 Meetings with consulted acoustician Blaise Arlaud.

62 This strategy was applied on the first floor of *Rue Saint-Victor* 10, in Geneva (MVT architects).

63 DnT,w and R'w values were placed in different columns. The weighted standardized level difference (DnT,w) represents the airborne sound insulation value between two locations, and depends not only on the sound reduction index (R) of the separating element, but also on flanking transmissions and room features (wall surface, volume, reverberation time). The weighted apparent sound reduction index (R'w) characterizes the airborne sound insulation of the building element or material only, over a range of frequencies.

64 R'w and L'n,w values in bold are approximate values indicated by consulted acoustician Blaise Arlaud (EcoAcoustique SA).

CONCLUSIONS

The strength of an architectural project lies in-depth knowledge of an existing reality in order to be able to act upon it. A second element of that strength is the analysis and comparison with other projects in similar contexts. Looking at other examples, with their own diversity but applicable to a comparable reality, can provide new views on the potential of the building itself, as well as new perspectives on the possibilities for architectural intervention. This comparison provides the foundation for renovation. This research is based on these two elements of observation. Since the aim was to identify renovation strategies for 19th century housing, it was necessary, on the one hand, to acquire a better knowledge of the founding principles of this reality and, on the other hand, to search for examples – case studies – of renovation projects that had been or were being carried out. These renovations, in our view, would have to draw on the first strength identified above, that is, to take into consideration the main original features of the houses to build up their own work strategy.

Having arrived at this point, it is important to introduce a third element of an architectural project: the objective(s) or issue(s) that it addresses. This point is usually discussed at the beginning of a project. Clients might mention, for instance, the wish for a two-bedroom house, a larger living room, an additional bathroom, or a way of maximising their investment after purchasing a piece of land or a building. At other times, more practical aspects might arise first: making sure the house will stand the next earthquake, no longer being cold in winter, not hearing the next-door neighbour snore, maximising the efficiency of the networks to reduce the bills… Nevertheless, we should note that this third element, although it may be discussed months or years before the opening of the building site, is likely to change over time. The issues that a project needs to address depend, necessarily, on the changing perspectives of the main actors involved – the owners, the residents, the architects, the engineers, the approving agencies, to name a few – and also, in part, on the changing legal framework and its stricter or more flexible enforcement. The actors' perspectives, the legal context, and its application evolve as a reaction to the issues that are brought forward by another actor, such as economic unfeasibility, legal limitations, destruction of original features, structural safety, or the lack of space. These issues are often brought about by the research concerning the building that is being renovated.

From these observations, it is clear that, since this present research project was in the field of architecture, it was necessary to adopt an interdisciplinary approach based on diverse research methods. It was also clear – as often happens in an architecture project – that those methods had to combine different working scales, starting with

the city, going on to the house and also to the building element. The work would, therefore, have to take into account different levels of detail, as well drawn on knowledge from different fields covered by renovation projects, such as history of architecture, law, or engineering. Moreover, the research would compare examples from cities in two different countries, adding renovation examples that would, according to our second element, broaden the variety of comparable renovation strategies.

First working scale: urban morphology ☞

Urban morphology, or the study of structure and form pertaining to a city or town is the largest working scale of the project, and a fundamental connecting thread between the analysed cities.

Throughout history, ordinary housing in urban settlements has been a defining component of their visual identity as a whole. While emblematic elements play a fundamental role in structuring a city – a particular building, a park, a river or the perspective along an avenue – it is the sheer repetition of traits in residential buildings along with certain typological variations that undeniably contribute to its character. It is the lasting image of dimension and colour that can be recalled from afar, giving us the uniform features of a city and, as we go into detail, the types that define periods of building and topographically or socially different city areas.

Coherent urban areas are closely related to the definition of types of housing and, sometimes, to the stabilisation or development of house building systems. Moreover, they have often stemmed from urban plans, which outline block dimension and alignments and, sometimes, plot division, façade modularity and building rules. Plans could also promote a standardization of building materials and techniques due to cost rationalisation, influencing inner proportions and layout. Even in less planned areas, the maintenance of certain ways of life, as well as of building systems and materials, have generally contributed to defining long lasting features of urban morphology and types of housing. These elements can often be repeated and adapted in further city expansion areas.

In this part of the research, our goal was to identify main 19th century expansion areas and to choose areas with a more homogeneous design, where housing types could then be compared or identified. The three cities examined have in common the presence of large late 18th or 19th century areas where housing plays a main role, globally contributing, if not defining, their urban identity. A large part of these areas were planned, using instruments mainly targeting how the buildings influence public space or concerning building safety, such as urban plans, building regulations and, sometimes, previously established façades.

Second working scale: a typology of housing ☞

Based on the examination of secondary sources and on the analysis of historical cartography, we chose to compare housing in Lisbon's late 18th and early 19th century

Baixa Pombalina, to housing in Oporto's *Almadina* city expansion dating from the same time ☞. This comparative work was particularly important, since housing in these two cities had yet to be examined from an equal standpoint. Even though both cities had a simultaneous development, they had some different urban design features – the more regular block design in Lisbon, the street alignment with variably sized courtyards in Oporto –, as well as a fundamental residential typological difference: the block of flats was more common in Lisbon, while the single-family terraced house was predominant in Oporto.

Since there were comprehensive studies on this topic, we were able to compare their main conclusions in relation to housing in both cities, while adding some floor plans of houses in Oporto, which was the empirical material that was most lacking. The analysis confirmed the mentioned differences, but also showed some common features reflecting domestic ways of life of the time. Room function and location depended chiefly on the reception of visitors, on the privacy of the house in relation to the latter, and on placing service spaces away from the public eye. In Lisbon, these principles were mainly applied in the flats according to the distance of rooms from the entrance, and to their position in relation to the street or courtyard façades. In Oporto's single-family houses, these principles were also applied but, in addition, there was a progression by floor, depending on the distance to the street. It is also interesting to note how the conclusions of social studies contribute to a more nuanced view of the opposition between the block of flats and the single-family house. Even though it is clear from the examination of floor plans that this principle existed, we also learned that, in Oporto, it was not uncommon for part of a house or rooms in a house to be rented out, while in Lisbon wealthier residents sometimes occupied two vertically adjoining floors. In both cases, it was common for the people running or working in the ground floor establishments to live on the floors above: depending on their status, occupying all the floors of a house, one flat, part of a flat, or part of a house.

Geneva has one of the largest, if not the largest planned mid to late 19th century expansion area in French-speaking Switzerland, the so-called *ring* or *Ceinture Fazyste*. Even though there were also other building functions, it was largely made-up of residential buildings, which were included in slab blocks or blocks with a central courtyard. At the time of building, the urban features of this area were defined precisely by plans and comprehensive building regulations, contributing to its unique urban identity and regular features. Furthermore, this area had the specificity of having a main house type – the block of flats – as well as some blocks in a slab formation made up of single-family terraced houses, making its comparison with the cities of Lisbon and Oporto particularly interesting.

In Geneva, we examined a large number of original and survey floor plans ☞ that were available in the archives and found that layout (room function, relative position and connections) had not yet been systematically analysed. The analysis allowed us to identify three types of housing and their main features: the blocks of two or three flats per floor, of one flat per floor and the single-family houses. Geneva's single-family houses have quite similar features to some of Oporto's late 19th century houses, which were exclusively used for housing. The kitchen was often placed in the

basement, away from the public eye but in proximity with the ground floor, which was usually used for social and reception functions next to the terrace or garden. There was generally a vertical progression in privacy, with the main bedrooms located on the first floor, while secondary and maid's bedrooms were placed above.
Many of the one-flat per floor buildings in Geneva seem to be an intermediary solution between the wealthier single-family houses and the more modest blocks with two to three flats per floor. One-flat per floor buildings had very comfortable living areas, especially on the ground floor flat, which was sometimes paired with the basement and a terrace. The most common type – the block of flats – usually had a main and a secondary façade. As in Lisbon and Oporto, the service areas were placed, whenever possible, next to the secondary façade, away from the view of passers-by; living – dining room pair, in *enfilade*, usually had the most prominent location next to the main street. Nevertheless, it was possible, in some cases, for the kitchen in Geneva's flats to give on to the street façade, which was unlikely even in late 19th century examples of flats in Lisbon.
There were clear layout differences due to the time of building between the floor plans of the examined houses in Geneva and the ones of earlier houses in Lisbon and Oporto. In Geneva, most rooms were accessible via a mediating space (even if they could also communicate directly), and there was invariably a small toilet. As in Lisbon and Oporto, the bathroom started becoming more common in the late 19th and early 20th century examples, especially in the largest, most comfortable houses.
The examination of types of domestic space organisation, namely room distribution and functions, later contributed to our understanding of how the houses' original layout features were addressed in the renovation case studies.

Examining the legal framework ☞

The applicable legal framework contributed to contextualise the renovations in each of the examined cities. The issues that are addressed in the legislation reveal the weight that is given by public policy to a particular issue, usually by addressing specific situations that have become important in each context. Moreover, legislation gives us an idea of the rights and obligations of the actors involved in particular operations, namely of public authorities when approving a project, and of building owners. The comparison of legislation referring to different fields allows for the identification of possible conflicts that could arise between them in project evaluation, which could imply negotiations between different consulted authorities, or lengthier processes. We examined main legal diplomas concerning the topics of heritage protection, measures promoting housing and renovation, and technical requirements, particularly those relating to thermal and acoustic performance.

Measures promoting housing or enforcing renovation ☞ In each of the analysed contexts, it is important to mention legislation that was issued addressing (possibly temporary) situations that were considered as particularly urgent. These pieces of

legislation usually increase the capabilities of specific public authorities, in detriment of the building's owners. In Geneva, a law was issued focusing on the extreme lack of housing in the canton (the LDTR), while in Portugal specific legislation addressed the large-scale degradation of buildings in several city areas, among which the main one is the RJRU. Geneva's LDTR refers to housing responding to the main needs of the population. It supported programs for their renovation, measures limiting rent increase in case of transformation and, in extreme cases, introduced the possibility of public authorities temporarily taking over a building that could be rented if it was left unoccupied without just cause. Regarding renovation, it is important to note that this piece of legislation does not allow for a reduction in the number of liveable rooms in a house, preventing changes such as the placing of an additional bathroom in a room that could, for instance, be used as a bedroom. In Portugal, the RJRU allows for additional flexibility in relation to technical regulations and financial incentives for buildings located in specific areas. Under certain circumstances, exemptions in relation to technical regulations can also be granted for residential building located outside those areas. The main specifications of the RJRU give municipalities (or societies designated by municipalities) additional powers to promote or enforce building renovation in chosen city areas. The mechanisms can range from providing more favourable conditions for renovations by the owners to, in certain cases, more drastic measures such as arranging for forced sales with future requirement to renovate, expropriation, or property restructuring.

Heritage protection instruments ☞ Our research concerning heritage protection mainly focused on the instruments used to protect the buildings and the identity of large city areas, usually comprising important housing areas.
In Geneva and in Portugal, the protection of quite homogenous urban areas is enforced either through specific heritage protection mechanisms, namely by creating of conservation areas, or through regulations applicable to different types of areas in local land-use plans. In conservation areas, the protection is usually applicable to the features of the site, as well as to each building including its interior elements. Land-use plans in consolidated areas generally establish that existing buildings stay in place, but mostly protect the main building features influencing urban space. In our view, legislation protecting buildings in conservation areas, and particularly those mentioning interior structure and characteristic elements, are a buffer against the demolition of ordinary residential buildings with a significant role in urban identity. Nevertheless, the need for individual project approval from heritage protection authorities, as well as others (building departments, energy departments, etc.) can induce drawn-out project approval demands preventing renovation. To try to address these issues, specific local commissions including actors from several authorities have sometimes been created to accelerate project evaluation in both countries. In Portugal, the particular delay in issuing detail conservation plans (as was the case, until recently, of the *Baixa Pombalina* [CML 2011: 21]) has also sometimes contributed to delaying conservation strategies and, as such, possible renovation projects.

Technical regulations concerning thermal and acoustic performance ☞ We mainly examined technical regulations concerning thermal and acoustic performance for the renovation of residential buildings in Switzerland and in Portugal. Regulations are usually applicable to changed building elements or, in case of energy performance calculations, to the global energy consumption in large-scale building renovations (global performances method in Switzerland, large building renovations in Portugal). However, one exception in Geneva cantonal legislation is worth mentioning: the requirement of improving the thermal performance of single single-glazed windows by 2016. In both countries, there are usually different values applicable to new buildings and to renovations.

In Switzerland, the regulations have enforced increasingly stricter demands on sound insulation and, mainly, on energy efficiency. Especially in cantons with less vast protection areas, it would be important to evaluate the impact of very demanding regulations regarding thermal performance on the characteristic elements of unprotected buildings. Legislation regarding the buildings' acoustic performance allows, in principle, for more flexibility in case of disproportionate interventions or protection of original elements. In the Geneva canton, sometimes contradictory demands concerning thermal performance and heritage protection have led to the creation of a commission including members from the cantonal heritage protection office and from the energy office, to resolve possible conflicts and avoid long project evaluation processes. Nevertheless, from the case-study analysis, we know that the latter can still be quite prolonged due to the necessary evaluation by several agencies, who examine issues ranging from technical regulations, heritage protection or possible rent increase concerns stemming from the LDTR. Lengthy project approval was also often mentioned by actors carrying out renovations in Lisbon and Oporto.

In Portugal, the promotion of renovation to prevent large-scale building deterioration and a reduction of renovation costs, has introduced in the legislation several possibilities of exemption to technical demands – namely those concerning thermal and acoustic performance –, as long as structural and safety conditions are not worsened. This is the case of the exemptions mentioned in the RJRU and, in 2014, of a 7-year exemption regime applicable to the renovation of residential buildings. The recent regime was introduced in view of exceptional circumstances, both in relation to the Portuguese economy, and considering that there are numerous buildings in bad conditions in large city areas. Nevertheless, in our view, the need to build up future regulations for renovation that address comfort issues should not be disregarded.

Third working scale: Renovation strategies

The main research issue of this work are case studies of 19th century houses renovated for the purpose of housing. We identified renovation strategies that made use of the houses' original features to address changes in domestic life and current comfort demands, with a view to informing future interventions responding to both aspects.

We followed a multi-method approach to examine the case studies at different scales and from different perspectives. Whenever possible, we looked at historical maps to identify the main urban morphology features of the area, and identified the original layout features of the houses, based on archive drawings or metric surveys. The main work method was, then, to compare the layout of the houses before and after the interventions, to pinpoint which changes had been carried out, and how. The discussions with architects and residents contributed to ascertaining the objectives of the interventions and how they were experienced in daily domestic life. Occasionally, the analysis of legal aspects also contributed to understanding possible renovation choices.

Changes to domestic space use and distribution ☞ Depending on the original layout features observed, and on the issues addressed in the renovations, we examined six main renovation strategies that made use of original layout features to adapt the houses to current living demands: re-using alcoves for new functions; dealing with privacy issues while taking advantage of the *enfilade*; addressing the kitchen's role in domestic sociability; creating additional housing units through division; attic reconversion; promoting accessibility through the introduction of lifts.
As previously noted, our objective was to inform future renovations by examining a variety of examples. It was, therefore, essential to look at case studies located in three different cities, and in two different countries, with varying types of housing, different contexts and renovation concerns.
Most of the changes to flat layout were observed in the Portuguese cities, especially modifications of space function and distribution. This can be explained by the original layout features, particularly of the earlier examples analysed, which had multiple alcoves and, in flats, a distribution often based on intercommunicating rooms. Moreover, the application of the LDTR in Geneva has sometimes prevented additional changes initially envisaged in the projects.
The types of renovation strategies observed each respond to different objectives related to current domestic life. In the first topic, we looked at the possibilities put in place in some case studies to re-use alcoves – small rooms without direct light – for contemporary living. The development of health and hygiene conditions played a role in their progressive elimination in early 20th century. In current renovations, these very conditions sometimes contributed to their adaptation and re-use. Today, sleeping most often takes place in the rooms with windows, and the bed is no longer located in the alcoves. Since many houses did not have bathrooms, alcoves were often used for this function. Others have – almost as originally intended – new functions associated to the adjoining rooms, such as closets, libraries, laundry rooms etc. In the second topic, we examined how the privacy of bedrooms and bathrooms was addressed while making use of the possibilities of an intercommunicating distribution. In the renovations, bedrooms were often placed at either end of circulation systems and accessed by social or mediating areas, and central spaces in the houses were sometimes used as alternative circulations.
A third aspect observed in our assessment of the original layout of 19th century homes was the usual segregation of service spaces in relation to social areas, especially

those visitors might enter. Several strategies have been used in renovations to create a greater proximity of once detached functions: cooking, eating and entertaining. Sometimes, social functions were brought to the kitchen next to the back façade: either the kitchen was big enough to accommodate extra uses, or it was sometimes paired with the adjoining room. At other times, bringing these activities together was combined with placing the bedrooms in a quieter area next to the courtyard. Therefore, it was the kitchen that was moved to one of the rooms in the social area of the house. This type of intervention was mostly carried out in full building renovations, since it was usually implemented on all floors and required new infrastructure.

The strategies examined for the division of houses into smaller dwellings and for the placing of lifts – respectively the fourth and sixth strategies examined – both depended mainly on the features of the original circulation and entrance systems. The division of flats or single-family houses by making use of these two aspects was sometimes carried out more or less formally during the 20th century. We examined how flats were divided by using multiple flat entrances as individual flat entrances, and the conversion of single-family rooms into separate flats by using the original staircase as a common access to the flats.

The particular features of staircases analysed in Lisbon and Geneva allowed us to examine diverse solutions to improve accessibility to the floors by introducing a lift. When there were multiple entrances to the flats, the lift sometimes replaced one of the entrances, or was otherwise placed in the inner room next to it. When the staircase and layout features made it difficult to place a lift without damaging characteristic elements, another option examined was its location next to the back façade, on the courtyard side. In Geneva, the original staircase design with a large central well often made it possible to place a lift in that place.

Contrary to the first and second renovation strategies examined, the topic of attic reconversion analysed examples of renovations mainly located in Geneva. The lack of available housing in this city, and the fact that attics in buildings were often originally used for storage, allowed for the study of examples where attics were used to create new flats, or to extend the flats below. We were particularly interested in examining how the new flat layout is similar or differs from the flats on lower floors, for instance, by using the location of alcoves to place the staircases between duplexes, or by reversing the location of social and service spaces.

A detailed scale of analysis: techniques for comfort demands ☞

The research looked into a final, more detailed scale of building renovation. The objective was to identify and examine renovation techniques responding to current comfort demands while taking into account the original characteristic features of the houses. We chose to examine the thermal and sound insulation of specific building elements where interventions are often carried out and where they can have a significant impact on original features: improving the thermal performance of roofs, walls and windows, and the acoustic performance of windows and timber floors between flats.

The analysis of case studies in two different countries – Portugal and Switzerland – was particularly important to examine varied renovation strategies responding to different climates, applicable regulations, as well as to the original design of the building elements. The methods used were the identification of original building systems and materials, the examination of renovation techniques, as well as the comparison of applicable heritage protection measures and technical regulations.

The thermal insulation of roofs and walls was examined for case studies in Geneva, where there are more demanding regulations in relation to this aspect. In the renovations, we observed that strategies designed for different building elements were important to achieve global solutions adapted to original building features. Generally, the roof and the floor above the basement could be more easily insulated than the walls, due to the lesser impact on characteristic elements and the possibility of carrying out the intervention without emptying the building. When wall insulation was necessary and possible, the rooms giving onto the courtyard side of buildings were usually more adaptable to interior insulation, since they often had less or no plasterwork on the ceiling and woodwork on the walls. Even though we did not observe their application, we also looked into recent possibilities for wall insulation, such as very efficient aerogel-based rendering or rolls.

Original windows of 19th century buildings were usually single simple glazed windows that, in Switzerland, were sometimes paired with storm windows. They are among the key elements to the urban identity of built areas that are most at risk of destruction due to the weak thermal and acoustic performance of the houses. Moreover, their replacement is often considered general conservation work. We looked at interventions addressing thermal and acoustic performances of window renovation in both countries.

The reinterpretation of the double window system was used in examples in the three cities examined, with a new window either on the outside or on the inside of the original one. It is a solution particularly adapted to places where very efficient sound insulation from exterior noise is important. Depending on the necessary thermal performance, we examined solutions where the new second window had laminate or insulated double-glazing. When the original windows were in quite good condition, one recent method of renovation in Geneva-based examples was to replace the single for insulated double-glazing. A thin layer of wood was added to the prepared exterior surface of the window to make up for the new thickness of the glazing. This type of intervention is an example where increasing demands in the fields of heritage protection and of thermal performance have pushed the design further, to find strategies for compromise.

The issue of sound insulation was mainly examined with regards to original timber floors separating flats, by looking at interventions carried out in case studies and, also, in relevant publications. Besides the timber joists, the floors of 19th century houses often have important characteristic elements such as original wooden floorboards or plaster ceiling decorations. Again, we analysed interventions adapted to the original features, thus varying according to floor level, and of the elements to preserve in each room. Reception rooms often had decorated ceilings, while kitchens or alcoves usually did not. It was, therefore, important to examine varied strategies

of renovation: from below, with a false ceiling, from above, with a floating floor, or on both sides of the joists. Moreover, in Lisbon, floorboards were originally placed directly over the joists, while in Geneva there was an additional layer of sand between the boards and the parquet. As such, we looked at renovation examples of floating floors in both cities that aimed to limit the changes to the original finished floor level.

Final remarks

Throughout this work, it has been increasingly my belief as an architect that our role in renovation is to find compromises. The word "compromise" is understood in a positive sense to refer to critical design solutions that achieve a non-conflicting balance between equally important issues, as well as between the actors involved. Renovations have to address a variety of issues, of which a few were examined in this research: original house layout and building features, current domestic life, thermal and acoustic comfort, legal framework, etc. There are also other issues that we did not examine, such as structural safety, the placing of new infrastructure, or the socioeconomic context.

Renovating by using the original layout and building features as guidelines means, in this sense, to find middle ground by making use of existing elements to respond to objectives that are sometimes different from the ones they were originally designed for. Taking these guidelines into account is especially important when the buildings have a fundamental value to the image of a city, as is often the case in 19th century housing areas. The image of a city area is necessarily shaped by outside building features, such block shape, façade proportion, building height or distance from the street. However, from our perspective, the urban character and identity of a city are also shaped by the interior features of buildings, even in the way houses relate to public space. 19th century neighbourhoods of contiguous single-family houses would loose part of their magic if hidden gardens could not be made out through an open door at the end of a narrow plot. In the twilight, before the shutters are closed for the night, series of 19th century blocks of flats reveal sequences of high ceilinged rooms in *enfilade* next to the street with plaster decorations. Moreover, everyday urban life is to experience the street, the threshold and interior spaces: they are the shops, the offices, the cafes, and the homes.

As noted throughout this work, renovation of ordinary historic housing is necessary to avoid the loss of cultural values, to address changes in family life, comfort demands, and to ensure building safety. It is never too much to mention that residents increasingly want the comforts of a contemporary home as much as finding techniques and elements of a building's past character. Demanding yet flexible legislation can contribute to better technical results and to dialogue between the actors, especially in cases where different interests diverge. As such, it is not surprising that lifestyle, comfort and memory go hand in hand, and, hence, that the everyday work of actors involved in renovation is to collaborate to achieve better results.

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The following sources were divided into three sections according to their type: "Iconographic and manuscript sources", "Cartographical sources" and "Bibliography". We listed mainly the sources that were mentioned in the text, but occasionally added other relevant sources that were examined during the research.
Cartographical sources were organized chronologically according to their original publishing date. In the Bibliography, the sources were organised alphabetically by author, coordinator or producer. Whenever there is more than one author, the original order of names in the work was maintained. The section concerning iconographic sources only mentions the collections that were examined in archives, which were individually referenced in the text. Secondary sources that were also used as iconographical sources were not repeated in the iconographical section. The selection of project drawings were included and referenced in the respective sections.

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