

Renewal of urban ecological transportation network based on inclusivity design

Take Sydney's "Livable Green Network" plan as an example

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Abstract

In recent years, as a means of maximizing ecological and sustainable urban life, the network of pedestrian and bicycle lanes has expanded dramatically in importance as a metric of livable cities. It connects people to the main transportation, hotspots for entertainment, cultural centers, parks, and open areas in the city. City people can travel around the city on foot or by bicycle while simultaneously fulfilling their basic daily needs for food, healthcare, and education thanks to the integration of urban ecological transportation networks. In order to achieve the objectives of reducing pollution and emission, promoting people's wellbeing, and improving the environment and climate, the ecological transportation network has improved the inclusion planning of people and climate compared to the traditional automobile transportation. The "Livable Green Network" design in Sydney is used as an example in this paper. And starting from the three aspects of integrated transportation network, dynamic public space, and pedestrian guidance system, this article analyzes the construction of livable green network in the city with the goal of sustainable Sydney development; investigates the high-quality connected pedestrian environment provided by urban dynamic public space; discusses the role of inclusivity pedestrian guidance system in supporting people's choice of safe travel in the city; and strives to promote the development of livable green network in the city; and aims to explore a more inclusivity urban ecological transportation network update scheme. Building an inclusive urban ecological transportation network can help people live in livable environments, foster social inclusion and trust, and successfully encourage engagement from all city stakeholders in support of urban ecological space governance and sustainable development. This is important given the growing severity of climate issues and the goal of urban sustainable development.

Author keywords

Inclusivity; Eco city; Green transportation network; Public space; Joint participation

Introduction

By 2025, more than 70% of the world's population will reside in cities, according to projections made due to the ongoing

urbanization process (United Nations, 2008). The concentration of a high number of people in cities will provide issues in terms of population, transportation, sustainability, energy, and other factors, as well as cause urban designers to sound the alarm. For the purposes of future urban development, "car first" transportation planning is no longer relevant (Register, 2006). Over the past 20 years, the idea of a "inclusive and sustainable city" has grown significantly. Transport and other services play a significant part in the development of an inclusive and sustainable city, and can successfully address the accessibility, safety, and other social inclusion challenges of vulnerable groups.

There are around 1 billion disabled people in the world, or 15% of the total population, according to data from the UN. Nearly half of those aged 60 and older have one or more disabilities, and more than 250 million have moderate or severe disabilities. In addition, the percentage of pregnant women, children, and other vulnerable populations must not be overlooked. The basic principle of the 2030 Agenda for Sustainable Development is "let no one fall behind," underscoring the fact that the solution to inclusive development is not simply a legal matter but also an investment in the future of all people. Their ability to fully participate in society, exercise their right to health, well-being, and public participation, and use urban transportation can all be facilitated by a physically and socially accessible, joyful, and inclusive environment. Planning an inclusive transportation network will help cities become more urban, provide a safe, comfortable, and healthy social environment, raise the temperature of the city, encourage social interaction, and boost public awareness and social cohesiveness.

Walking and cycling are frequently overlooked in traffic thinking when compared to the "City of Cars." However, due to the current economic and environmental issues, many cities are reevaluating their objectives in order to adapt to positive traffic, with the goal of making walking and cycling the norm, particularly for short trips. Sydney made an effort to alter the mode of transportation, which has historically been dominated by automotive traffic, in 2007 by creating a systematized network planning for urban slow traffic and developing a number of bicycle action plans. The 10 strategic goals of Sustainable Sydney 2030 were presented in 2008



as part of a citywide sustainable planning city in Sydney. The planning and construction of bicycle and pedestrian traffic networks as well as the green connectivity of the entire city were highlighted in the seventh, eighth, and ninth items of the particular goal planning.

- » TARGET 7: By 2030, at least 10 per cent of City trips will be made by bicycle and 50 percent by pedestrian movement.
- » TARGET 8: By 2030, every resident will be within a 10 minute (800m) walk to fresh food markets, childcare, health services and leisure, social, learning and cultural infrastructure.
- » TARGET 9: By 2030, every resident in the City of Sydney will be within a three-minute walk (250m) of continuous green links that connect to the Harbor Foreshore, Harbor Parklands, Moore or Centennial or Sydney Parks.

In the context of urban regeneration and sustainable development, the implementation of the "Livable Green Network" plan based on inclusive design would serve to increase the accessibility of disadvantaged groups, ensure the travel safety of pedestrians, and encourage people to deliberately select a more environmentally friendly form of slow traffic as an alternative to automotive transportation. Under the premise of meeting the travel demands of daily life, it will increase the allure of short-distance travel and realize the network inter-connection of traffic throughout the city.

This paper describes and examines the inclusivity and sustainability of Sydney's green transport network construction through case study using the "Livable Green Network" plan as an example. Our research intends to address the difficult issue of inclusive planning for urban green transportation networks and investigate a broad framework to enhance the current environment for transportation networks.

Literature Review

Sustainable cities

At the second UN Habitat meeting in 1996, the concept of a "sustainable city" was formally introduced (UN-Habitat, 2001). The concept of a sustainable city is defined as the continuity of the three facets of environment, society, and economy, which calls for the city to be able to keep sustainability use at a sustainable level and to be highly resilient to hazards. This concept first emerged simultaneously from Howard's "Garden City" and Geddes' Eutopia hypothesis. "Ecocity" and "Sustainable urban planning" have gained popularity in the field of urban planning as a result of its concept. Since then, researchers have started looking into novel space forms, transportation planning, land use, and other topics (Jabareen, 2006). The phrase "smart city," which has the meanings of sustainability and inclusivity, first appeared in 2010 with the advancement of science and technology and the passage of time. It is a city concept that combines cutting-edge technology and methods of urban planning to address economic, environmental, and social issues, provide for people, and enhance quality of life. Sustainable cities have become an obvious alternative for people who wish for a better living in the context of coping with climate change. With the continuing advancement of research, they are gradually expanding into urban environment, transportation, social equality, inclusivity, and health-related fields.

Ecological Transportation Network

The concepts of "eco city" and sustainability are currently seen as the ideal city for urban growth, and the development of eco cities is impossible without the construction of transportation. The concept that the ecological transportation network is built on a composite ecosystem, which is made up of three systems: social, economic, and natural, was first advanced by Shijun Ma and Rusong Wang in 1984 (Ma & Wang, 1984). In order to fulfill the goals of fairness and reasonableness, structural optimization, and sustainable development, it uses the flow of people and logistics as its central tenet and includes land, energy, natural ecology, etc. in the scope of planning and management. Prof. Carlos Moreno put up the "15-minute City" planning concept in 2016 (Moreno et al., 2021). In addition, the 20-minute community life circle in Melbourne, the 15-minute community in Ottawa, and the 15-minute community life circle in Shanghai also use travel distance as a gauge of living convenience. Green transport is frequently equated with slow-moving traffic and public transport systems that are mostly made up of walking and cycling routes. Planning for safe, reasonable, fair, and inclusive transportation can improve people's travel options and inspire them to utilize more environmentally friendly transportation.

Inclusivity Design

In an effort to remove the obstacles preventing the elderly from using design products in the context of Britain's aging population, Coleman, a British researcher, established the concept of inclusive design in 1994. It is known as "Design for All" or "Universal Design" in Europe and the US, and it refers to a general design approach that designers use to make sure that their products and services satisfy the demands of as many customers as possible, regardless of the customer's age or ability. A national standard for barrier-free design architecture was created in the United States in the 1950s with the intention of making it simple for disabled troops and other disabled people to enter and exit the structure (Persson et al., 2015). As large-scale urban construction in the United States came to an end in the 1950s and 1970s, professionals started to focus on small-scale planning and design ideas including transportation oriented development (TOD), new urbanism, and universal design. These ideas promote inclusive design by offering accessible public spaces, alternative means of transportation, housing, and housing, as well as a neighborhood that can be reached on foot (Fletcher et al., 2015). From the standpoint of service objects, inclusive design intends to benefit everyone, including the full life cycle of users (Heylighen et al., 2017), in contrast to traditional design, which is less fair, less just, unhealthy, and unsafe. It also aspires to help all people, unlike the early sole focus on the elderly, children, or the disabled.

A Case Study of Sydney's "Livable Green Network" Plan

Overview of "Livable Green Network"

Sydney holds a significant role in the economic, social, cultural, and other spheres as Australia's largest city. Sydney is regarded as one of the world's most livable cities at the same time. However, as a result of the effects of global warming and the ecological issues caused by the city's rapid development, the Sydney Municipal Government has started to rec-

ognize the enormous difficulties that the city's sustainable development would confront in the future. In response to the goal of sustainable Sydney 2030 urban development, Sydney performed a planned assessment and analysis of pedestrian traffic and public space in the city, highlighting the benefits of ecological transportation such as walking and cycling as well as the lack of inclusive facilities, and produced the "Livable Green Network" plan based on this. The "Livable Green Network" is based on slow traffic impediments and pedestrian data from important places collected through Sydney study and renovates the city's pedestrian and cycling networks based on the city's slow-moving traffic lines.

By connecting the city center, village center, public transport, important parks, entertainment facilities, and other destination locations, it is proposed to provide a thorough and

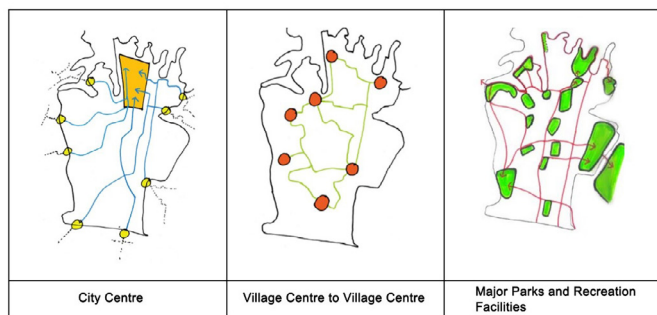


Figure 1. Insert a caption below each figure, and number all figures.

Table 1. An Investigation on the Obstacles of Walking and Cycling in Sydney(2017).

Place	Problem	Obstacle causes
Woolloomooloo	Topography	Steep slopes and cliffs increase traffic difficult-ties
Regent Street Redfern	Traffic speed	Busy trunk roads cross, limiting the frequency of safe passage
Erskineville	Infrastructure barriers	The railway corridor restricts the accessibility and direct connection of the destination
Botany Road	Narrow sidewalks and obstacles	Narrow sidewalks reduce traffic convenience, and improperly placed facilities hinder walking
Kent Street Underpass	Public domain quality/safety	Poor quality urban space makes pedestrians feel unsafe and hinders walking
Southern Industrial Area	Poor street connectivity	Rough street networks reduce choice and restrict direct connections to destinations
Street	Lack of infrastructure	The construction of toilets, bubblers and rest areas will encourage walking and cycling
Street	Lack of guidance information	Clear information helps increase the experience of walking and cycling

clear barrier-free slow traffic network for people and visitors. This will encourage and meet the travel needs of people with disabilities, which will increase the share of walking and cycling in the city and lower greenhouse gas emissions. At the same time, the plan focuses on the needs of inclusive access, sidewalk facilities, road improvement, and composite transportation in order to address the challenges and obstacles that people walking and cycling face. The goal is to construct 10 key Livable Green Network corridors, attractive public area streets and lanes, and a safer and more comfortable inclusive biking and walking environment in the city by the year 2030 in order to connect the sustainable slow-moving traffic network of several regional centers and encourage people to prioritize walking and cycling.

Integrated Transportation Network

Famous urban planner Jan Gehl noted in the research report "Sydney Public Space and Public Life" from 2007 that while Sydney benefited from its stunning coastal environment, expansive parks, and unique terrain, the city's center could not adequately serve pedestrians due to walking obstacles and regulations that made it difficult for pedestrians to easily enjoy slow-moving traffic (Matan & Newman, 2016).

According to the study's findings, the primary factors affecting a network with slow traffic are slow traffic speeds, congested roads, limited pedestrian facilities, uncomfortable walking conditions, weak public space security, and a lack of guidance systems. The elderly, disabled children, and others with disabilities are most affected by these barriers, which to some extent discourage people from preferring to walk or ride. On the basis of this information, Sydney studied and analyzed the city's transportation network, the central transportation network, and the village center transportation network, and advanced the concepts of slow traffic route connection, road alignment, and public domain quality improvement. The prioritizing of transport methods designed to increase spatial efficiency and sustainability while preserving the flow of business and delivery vehicles serves to further support these developments.

Sydney has been gathering data on local walking patterns since 2013 by conducting two walking count surveys each year in the months of March and October. Approximately 100 locations will be chosen for counting and statistics between the hours of 6:00 a.m. and 12:00 a.m. The locations that are involved in building livable networks are based into construction while choosing a location. According to changes in populated regions and new urban project areas, survey locations will be changed. In order to study and analyze the walking data for the entire city, pertinent statistical data are counted in increments of 10 minutes each hour, multiplied by 6, and then divided by 24 to get an approximation of a count for the entire hour. Then increase the statistics of public water fountains and trash cans. The Sydney City Data Center will get universally summarized data from the automatic sensors that have been utilized to count pedestrians in Sydney as of 2020. Sydney now has a clear and focused research base on which to keep promoting the construction of a livable green network thanks to the collection and administration of data. Pedestrian travel will be prioritized throughout the traffic reconstruction and facility setting, and GIS pedestrian penetration analysis will be used to analyze the pedestrian accessi-

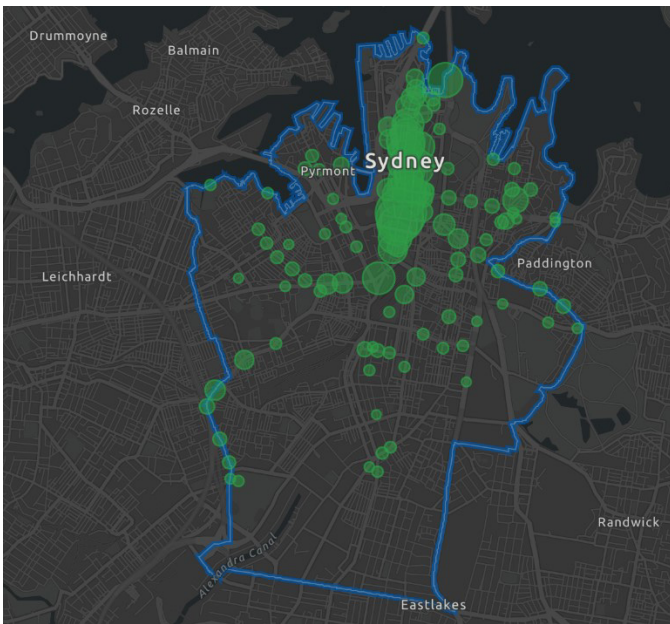


Figure 2. Map of Sydney Walk Count Survey Locations.

bility of activity centers, community facilities, schools, and traffic stations.

Currently, Sydney's traffic problems of road congestion and public transport overcrowding will persist for some time, necessitating the ongoing construction and modernization of a comprehensive urban network to ease traffic issues. A thorough plan has been made for this by the "Livable Green Network." First and foremost, with the overall traffic planning of one main line and three squares, the construction of George Street Central Pedestrian Road will be reserved, connecting the three key sites of Ring Wharf, City Hall, and Central. Second, as the central walkway gradually moves to the south, new streets are added, and public squares are constructed to accommodate increased community traffic. Last but not least, to meet several traffic goals, a clear hierarchy of streets should be developed. The construction of a comprehensive traffic network has redistributed the limited road space, connected the network consisting of main traffic providing bicycle lanes and shared spaces or paths for passengers, and made walking and cycling more pleasant and convenient, such that the primary community amenities are within walking distance. Walking, cycling, and public transport all work together to make a city more sustainable, green, and healthy.

There are currently 392000 bicycle trips among the over 16 million daily trips of less than 10 kilometers in Sydney's downtown. The percentage of people who commute by bicycle has increased by 50%, while the number of people who commute by bicycle has increased from 1.9% to 2.5%. Initial results from the construction of an integrated transportation network have been positive, and its inclusive network design and sustainable transportation planning have successfully boosted the potential of urban slow traffic to some extent.

Dynamic Public Space

The "Livable Green Network" plan will improve urban space's attractiveness in addition to the planning of a comprehensive transportation network by walking an active public space and an open city to encourage people to visit the entire city on foot or by bicycle. The potential of a safer, more

desirable, and more appealing space to offer more options for social activities and transform into a hub for cultural interaction is referred to as the vitality of urban public space (Jalaladdini & Oktay, 2012). The plan primarily originates from three issues when it comes to creating dynamic public space. First, there is the resurfacing of lanes. By expanding the small-scale space available on streets and driveways, it offers fine-grained space for the setting of small retail shops to meet the increasingly diverse lifestyle needs of pedestrians, attracting more pedestrian traffic and generating vitality for the area. Second, there is street reconstruction. Streets serve as both a connection between places and significant public places. The public space is the main focus of the main street restoration. The goal of highlighting the unique qualities of the street and extending a sincere invitation to everyone to stop by is to enhance the street's public realm, create a gathering place for the community, and enhance the traditional link and traffic-corridor functions. Thirdly, it is where public art is displayed. The placement of public art in urban public space contributes to the enhancement of space characteristics, the highlighting of urban culture, the attraction of more people to visit and interact, the enhancement of space vitality, and the encouragement of walking tours. While improving the quality of urban life, the inclusivity and public participation of public art can increase recognition of the city's public sphere, generate additional places for communication, relaxation, and recreation, and stimulate the enormous development potential of urban space.

The space of vibrant public space will contribute to the construction of interesting new urban areas and increase the city's appeal to residents, employees, and visitors. The fundamental space of inviting everyone to visit is determined by how public spaces are advertised. As the place where the road connects, a high-quality, vibrant public space may efficiently link the pedestrian street and provide for the basic needs of the community in terms of everyday health care, leisure, socializing, education, and culture. Whether they are elderly, young, or disabled, everyone can enjoy public people and public life in a safe, convenient space, which will substantially increase their level of travel confidence. Therefore, offering a high-quality linked walking environment and significant public space for all people to meet the value of people's social and recreational needs is seen as an important criteria to measure the livability and sustainability of the city.

Inclusive Pedestrian Guidance

A inclusive pedestrian guidance system provides everyone with clear and identifiable information about traffic road guidance and infrastructure along the way as a crucial component of a slow traffic network. The installation of pedestrian priority streets and comprehensive guidance systems in high-traffic sections of the city can offer pedestrians with clear traffic information and boost people's confidence in their ability to navigate the city on foot with ease. The installation of inclusive guide signs was finished in 2015, gradually creating a significant component of Sydney's traffic guidance system. In 2014, Sydney established an installation trial to explore and evaluate the sign kinds of tactile/Braille signs. It offers an inclusive guarantee system for all types of people to pass on the road safely and conveniently on the basis of practical pedestrian use and safe road guidance.

Maintain the importance of physical access issues and ensure that people with disabilities have access to the public domain, including transportation, parking and signage:

- » Continue to install and maintain roadside ramps in Sydney.
- » Periodic inspection or audit of all access curb ramps.
- » Audit the current bus stops to assess whether they meet the requirements of barrier free public transport standards.
- » Ensure that the needs of users with disabilities are considered in the following aspects: design, maintenance and layout of facilities and fixtures; The planning process for the development of parks and other outdoor spaces, including the placement of street furniture.
- » Develop sidewalk trading policies considering best practice examples and the rights and needs of all pedestrians.

From a sociological standpoint, inclusive design encourages social harmony and satisfies the travel requirements of many groups by creating social cohesiveness and ensuring accessibility of public areas and services (John Clarkson & Coleman, 2015). All kinds of people are able to access the urban traffic network and facilities without any obstacles thanks to inclusive traffic information improvement, which also enhances urban equality. By efficiently addressing the safety needs of pedestrians on the road, increasing accessibility for all kinds of people, and providing clear information on the slow traffic network, clear and accurate inclusive guidance can encourage more pedestrians to move freely, safely, and comfortably around the city. The convenience of eco-friendly transportation is ensured by inclusive pedestrian guidance, which also reflects the temperature of the city.

Discussion

By examining the inclusive design used in the “Livable Green Network” in Sydney, it is discovered that its inclusion extends to everyone rather than just a select few. In the planning and implementation process, social fairness and a safe and comfortable environment are taken into account as they may affect people’s travel preferences in addition to the reduction of travel barriers. The concepts of walkability and recyclability can be characterized as the quality of walking and cycling circumstances, including safety (excellent vision, no intentional damage, well-maintained public areas, pedestrians and cyclists have priority over cars), comfort (sidewalks, ramps, rest spots for the elderly or the rehabilitated), convenience (lines of hope, meeting special needs), Connection (round-trip destination, public transportation node), and readability (sign, travel time, distance, danger).

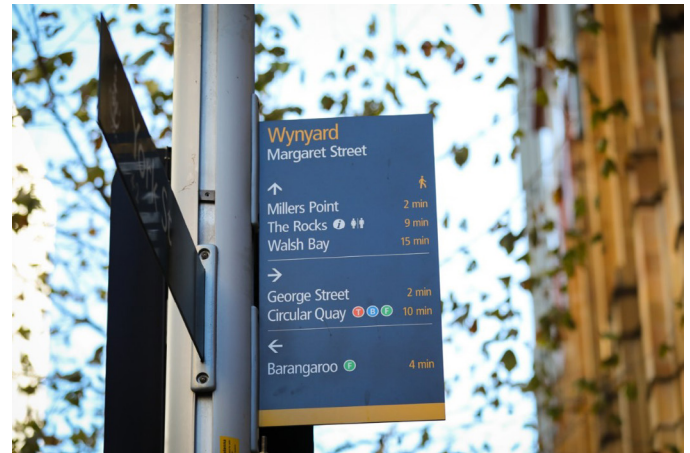


Figure 3. Sydney pedestrian information guide.

This case merits additional attention due to its inclusive planning strategy and positive outlook for the construction of future urban transportation networks, even though it is still in the process of continuous practice and is not at the point of completion. A growing number of academics and urban decision-makers are focusing people and nature in response to the current climatic difficulties and urban issues. Future urban planning will surely center on creating people’s cities and ecologically smart cities for the general public. Inclusion and sustainability objectives will be integrated into the construction of ecological transportation networks.

Conclusion

The case of Sydney’s “Livable Green Network”, which is based on updating an inclusive urban ecological transportation network, is described and discussed in this essay. In order to meet the expanding practical needs of social equity and sustainable development, it aims to develop and implement an inclusive transportation network plan for all people. Through the analysis and discussion of real-world people, it has been discovered that the design of an inclusive traffic network can not only provide high-quality connected traffic environments and remove all travel-related barriers for everyone, but also successfully promote people’s walking preferences. This research is light on the inclusive design of urban transportation systems, analyses the construction of future urban ecological transportation systems from the standpoint of inclusive and sustainable development, and places a strong emphasis on creating a safe, just, and comfortable environment with slow traffic for everyone. People are urged to deliberately embrace a green travel lifestyle to actively address the difficulties posed by social equity and climate change.

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