Towards Greener Neighborhoods: A Case Study for Street Renovating Solutions in Cairo

Zeina Mohamed Zedan, Germin El-Gohary, and Sherouk Mohamed

Abstract

A sustainable "green" city outlined while thinking of the social, economic, and environmental effects. It considered energetic living space for the existing residents while considering the impact of these sites on the upcoming generations and the population growth, fulfilling the resident's needs without ignoring the future society's capacity to meet their needs. The continuous increase in population is imposing challenges globally, leading to urban poverty and limited resources. Having overpopulated cities leads to deficiencies in infrastructure and residents' quality of life. Handle the city's problems and needs, and it is necessary to organize and thoughtful, considering solving the city's desires without distorting other vital factors of people's living situations. This specific paper will focus on the green mobility network and its impact on Cairo's quality of life. The Capital of Egypt. The purpose of this paper is to implement good street designs from a public space perspective. The way was to review neighborhood hierarchy, street classifications, and design. Introducing the Green Mobility Network that combines bicycles and pedestrians (Officials, C. T. (2019). Lane Width. 1–11.). Two international case studies networks were analyzed. Introducing findings and recommendations by proposing a project in Cairo's problematic streets in Nasr city to find solutions for Cairo's neighborhood streets will help make it more efficient and sustainable.

Keywords

Green mobility • Road design • Overpopulation • Streets • Renovation

Z. M. Zedan · G. El-Gohary (✉) · S. Mohamed
Ain Shams University, Cairo, Egypt
e-mail: germin_elgohary@eng.asu.edu.eg

Z. M. Zedan · S. Mohamed
British University in Egypt, Cairo, Egypt

1 Introduction

Cairo's streets are always a challenge for people due to the overcrowding of streets with cars and other mobility problems. Roads used for different purposes beyond directly linking destinations act as shared spaces for multiple users, including different genders and ages, where they engage in social, cultural, political, and economic activities (Tobergte & Curtis, 2013). Therefore, streets signify the main factor of public space that embodies different users with several interests.

Investigating sustainable neighborhoods and their green dynamics in general and Cairo's streets in specific is a multidisciplinary topic. It attracts Egyptian urban designers, city planners, environmentalists, public health authorities, and city managers. UN Habitat (2013) mentioned that streets designed for different activities, like; walking, cycling, and public transportation, rather than being car-oriented streets, would result in fewer crowds. If it intended to encourage this, people could cycle or walk rather than taking cars or public transportation. As a result, it cuts down the need for fossil fuels and fewer carbon emissions, which is more ecofriendly and will lead to more sustainable urban development (Ewing & Handy, 2009). These streets can inspire social variety and connectivity; therefore, having neighborhoods that are more unified and lively is more attractive for the residents and the visitors (Kheir-El-Din et al., 2012).

2 Problem Statement

Cities that are considered more developed are the ones that recognize the importance of having proper public spaces. In contrast, cities with lower productivity and quality of life often fail to have adequate street designs and functions (Tobergte & Curtis, 2013). Cairo is the most populated city in Egypt, with highly congested neighborhoods and streets. According to the world population review in 2018, Cairo has

F. Rosso et al. (eds.), *Advances in Architecture, Engineering and Technology*, Advances in Science, Technology & Innovation, https://doi.org/10.1007/978-3-030-86913-7_5

Fig. 1 Cities problems

a population of 16.4 million, with an expectation to reach 24 million by 2027 compared to the second-largest city in Egypt, Alexandria, with a population of 5.71 million. Accordingly, this statistic indicates the severity of overpopulation in Cairo's neighborhoods and its outcome on Cairo's streets. Our roads are jammed and filled with problems to be solved regarding design and planning, as shown in Fig. 1. We are trying to address Cairo's street problem as a public space, making people more comfortable while walking, driving, cycling, or other physical activities (Jan Gehl, 2011).

3 Overpopulation Street Impact

A. Population Growth has Harmed the Surroundings

For living purposes, people use more land; thus, the surrounding environment changes. The population grows in certain cities, so they use more resources to the realm of the population's well-being (Weber & Sciubba, 2018). "On November 17, 2016, the world population clock displayed the existing world population: 7, 465, 023, 315, and increasing quickly. World widely, overpopulation threatens the world. According to the UN's medium plan, the growing population of seven billion expects to reach at least nine billion. Every year, the world population grows by 1.2%. Although this number may not sound shocking, the global population is doubling in less than 50 years. Every second of every day, the birth of nine lives into the world. Every 10 s, 44 people are born, which counts around 140 million people per year" (Doris, 2017).

Overpopulation is one of the biggest problems on streets and living standards, as shown in Fig. 2 in Cairo's streets, the capital of the 14th largest country in population. Its purpose is to have better street designs, more green spaces, a healthier lifestyle, and more appropriate ways to solve Cairo's street problems for a better quality of life. Our cities should grow without fearing the future; low environmental quality, economic problems, and cultural breakdown-threatened city life (Rudofsky, 1969).

Fig. 2 Streets of Cairo, Egypt

B. Impact of Population Growth on Infrastructure

Various perceptions have been progressed with an end goal to realize the connection between infrastructure request and improvement. To begin with, the supply of infrastructure prompts social, financial improvement, and besides, the improvement potential makes interest for better infrastructure. Along these lines, infrastructure facilities are imperative to the social development of urban and rural regions through direct and indirect advantages (Asoka, THUO, & Bunyasi, 2013). The exponential growth in population and the rising improvements have put difficult stress on the essential framework in the neighborhood. This incline that requires an extended or upgraded foundation to have the capacity to successfully carry important and basic infrastructure needs. For example, the place to stay, water supply, security, instruction, health & waste management components, and road networks. All these are considered the main public spaces of neighborhoods to address the necessities of the expanded population (Asoka et al., 2013).

C. Impact of Population Growth on Road Network

Street structures and transportation systems form the spatial organization of any city. The quality of the roads and streets is important in improving accessibility and connectivity. Considering a street as a main public space, people should feel comfortable in. They should be relaxed while transferring from one place to another by; driving, walking, or cycling in the street (Asoka et al., 2013). However, the increase in population may affect street productivity. As a result, road traffic congestion resulted from poor street conditions. According to a 2007 report by the World Bank, 20% of the streets are in a good state but suffer from low service quality and are at risk of early disaster. It can be rescued if there is a considerable rise in maintenance actions (IFC, 2007). The report also stressed that the area is loaded with infrastructural inefficiencies and old-established constructions. These harmfully affect the movement of trade, the effectiveness of Egyptian manufacturing, and road safety.

D. Overpopulation in Egypt

Overpopulation in Egypt remains a threat to the country's resources and sustainable growth, according to Egypt's improvement toward Vision 2030. "Throughout the 1st gathering of the 4th National world Youth Conference in Alexandria on July 24, 2017, President Abdel Fatah al-Sisi said that overpopulation and terrorism are Egypt's two real dangers. Later in October 2017, the Central Agency for Public Mobilization and Statistics (CAPMAS) stated that the population in Egypt has doubled over the last 30 years as it increased from 48 million in 1986 to 95 million in 2016, that increased the traffic specially in Cairo as shown in Fig. 3. Furthermore, according to CAPMAS, Egypt drops approximately 60,000 acres per year as a result of soil erosion and construction to meet population needs, including housing" (Al-Wahaidy, 2005).

Fig. 3 Cairo traffic and street problems

E. Egypt's Attempts for Managing Overpopulation

Egypt announced its first population target to back off the population growth rate and speed up financial development in the mid-1960s. In 2013, the human population's effect anticipating the personal satisfaction and economic improvement stated at the National Population and Development Conference. It created an interministerial group organized by the National Population Council (NPC) to build up a complete National Population Strategy (NPS) 2015–2030 to confront overpopulation (Asoka et al., 2013). The National Population technique defines enhancing population control and all Egyptians' satisfaction. It understands administrations and endeavors, including government, private and public segment, media foundations, and volunteers (Al-Wahaidy, 2005).

F. Negative Human Behavior in Egyptian Streets

There are a lot of factors affecting the streets other than its design; the truth is that traffic congestion is caused by multiple causes. One of them is human behavior, which is a very important factor (Rosen, 2013). Egyptian visitor's first reaction is its national hymn: vehicle sirens, the famous

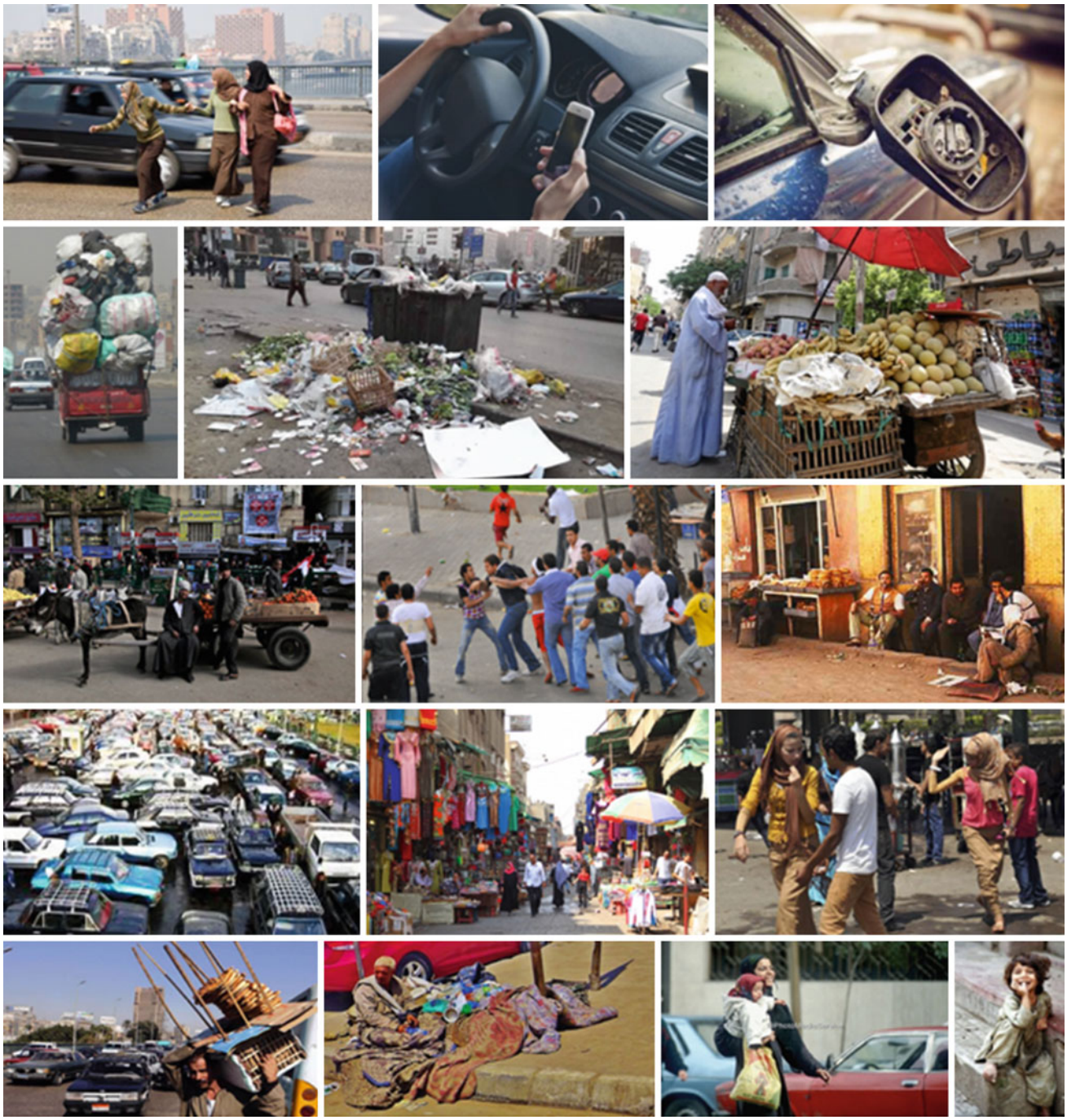


Fig. 4 Disorder on Egyptian roads (*Source* The author

Egyptian traffic. Car horns say "Hello" for the warning, "Watch out I am mergin into your lane whether you like it or not," shouting (EFGHERNES, 2013). Egyptian disorder roads impact, leads to more than 10,000 deaths per year, as shown in Fig. 4. Accidents range from crushed citizens by lorries while crossing the street to crash into busses. For example, Assiut's school bus disaster, which killed 51 children in 2012 (EFGHERMES, 2012).

The malicious Human Behavior in Egyptian streets is collected in Fig. 5, which shows around 14 specific negative behaviors.

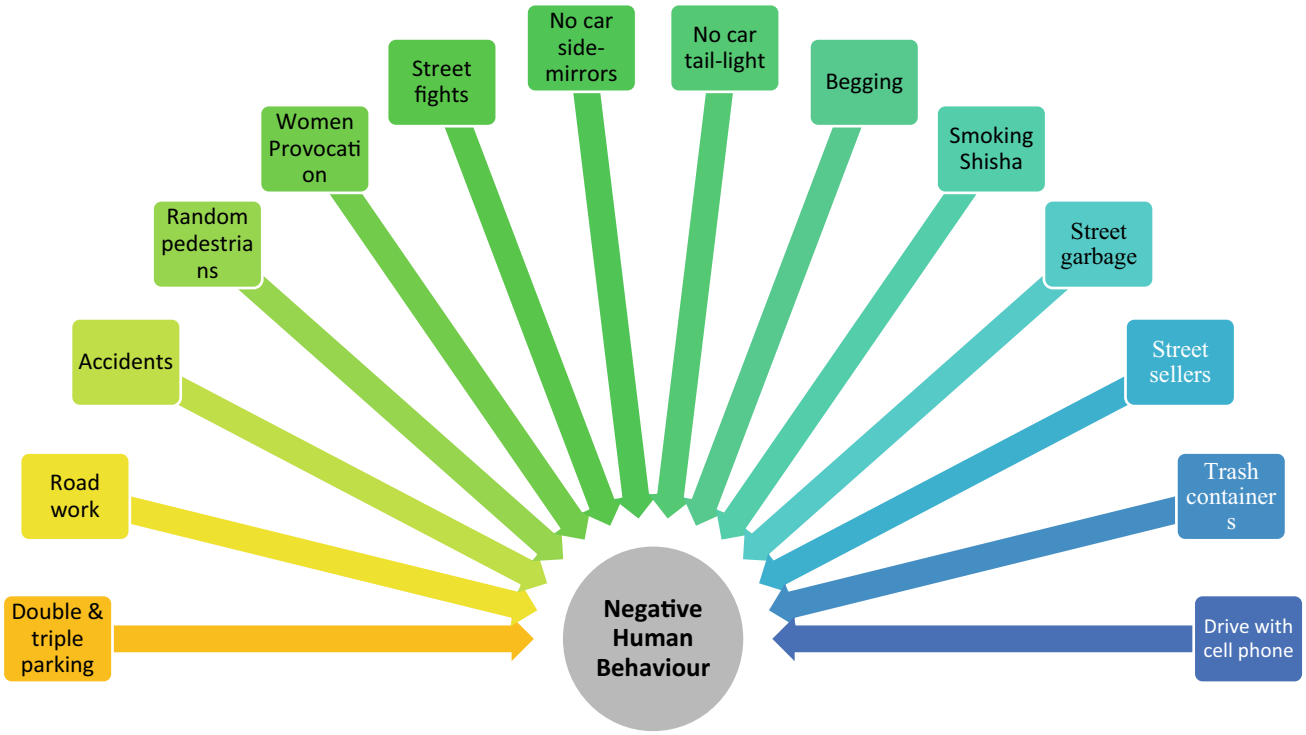


Fig. 5 Negative human behavior in Egyptian streets (*Source* The author)

4 Neighborhoods and Its Importance

A neighborhood is a local community within a larger city town, district, or country. To understand what a neighborhood is and how it was created, we must realize the urban hierarchy to form a city (Fig. 6) Urban Hierarchy in the creation of the City (Table 1): This hierarchy is concluded by the author; 2 District. City.

Residential group. ⇨ Neighborhood. ⇨ District. ⇨ City.

Specifically discussing neighborhoods, it is defined as a specific physical area and functionally as a social network. Neighborhoods are also a place where face-to-face social communications happen, the personal situations to recognize conventional morals, socialize youth, and keep real social control. Good communities result from careful planning and thoughtful designs that generate sustainable, vibrant, walkable, livable, and social, which increases the quality of life

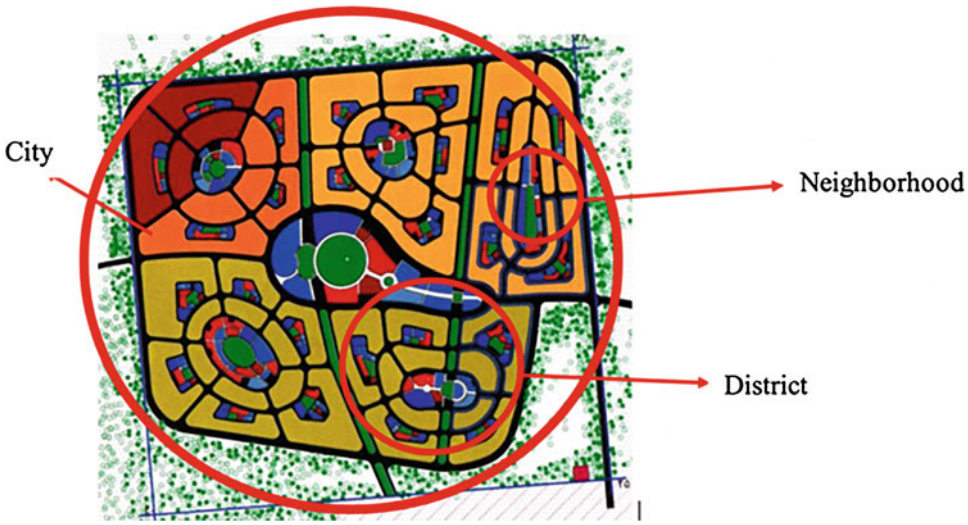


Fig. 6 Urban city hierarchy (*Source* The author)

Table 1 Urban hierarchy in Neighborhood importance as the main base for a good urban city (*Source* Deer 2013)

Hierarchy	Components	Number of residents
City	4 or 8 districts	150 000–300 000 resident
District	4 or 8 neighborhoods	20 000–25 000 resident
Neighborhood	Smallest residential space that offers educational services	5000–7000 resident
Residential groups	It is a group of similar or different residential buildings that are assembled in one place	_

for citizens. Great neighborhoods are the base of a great city. An excellent healthy planned base neighborhood will lead to a better-planned city (Deer, 2013).

5 Neighborhood Main Components

It is the smallest scale of residential space that accommodates from 5000 to 7000 residents. Its size is determined to provide a school for primary education see (Fig. 7). Depending on the number of children at the age of five to eleven. There are certain circumstances that make a living in the neighborhood great; lifestyle match, great schools, pride in ownership. A sense of ease and calm come from low crime rates, outdoor activities, stepping back in time, medical care access, family-friendly, close to public transportation, nearby shopping and restaurants, nightlife and entertainment, and walkability (Trulia, 2014). Therefore designing the outdoor space and street network is very important for living a high quality of life in the neighborhood (Fig. 8).

Fig. 7 Primary school in a neighborhood

Fig. 8 Good neighborhood (Trulia, 2014)

6 Residential Categories

Residential land is divided into three categories based on the research findings see (Fig. 9), as shown in Table 2 and listed in the following;

A. 1st category, small area.
B. 2nd category, medium area.
C. 3rd category, large area.

7 Analysis of Findings

7.1 Neighborhood Streets Classification

Neighborhood street classification is derived from the relationship findings between all neighborhood categories. All three categories of areas in the neighborhood must be connected by streets. Different kinds of streets float in any neighborhood.

Fig. 9 Residential categories analyzed by the (author)

Table 2 Residential program (Bevan & Croucher, 2011)

Category	Description	Area	Street width
Small area	The distance between the two successive streets is sufficient for the existence of two pieces of land (back-to-back), and this distance is approximately 36 m	150 m^2 or less	9 m
Medium area	The distance between the two successive streets is sufficient for the existence of two pieces of land (back-to-back), and this distance is approximately 54 m	150–400 m^2	12 m
Large area	The distance between the two successive streets is sufficient for the existence of two pieces of land (back-to-back), and this distance is approximately 72 m	400–700 m^2	12 m

Fig. 10 Neighborhood main street

A. **Neighborhood Main Streets**

The neighborhood life connection is the main neighborhood streets with high pedestrian capacities. Main streets should limit traffic speeds and create a well-designed pedestrian crossing. Roads should be from four to three lanes of car travel lanes, with bike lanes and a median see (Fig. 10). The main streets should contain the following elements shown in Table 3.

7.2 Neighborhood Local Streets

Native streets in residential neighborhoods should be safe and pleasant walking areas with direct access to different zoning, as shown in Fig. 20. They can be 10–20 m wide (McCutchan, 2013) Its primary function is serving the building since most of the building facades and building entrances overlook this type of road, as shown in Fig. 21. Neighborhood streets differ in design types according to

Table 3 Main streets elements (*Source* The author)

Element		
1. Lane reduction or road recanalization	Road diets increase traffic flow and decrease clashes with turning cars or any vehicle while improving the road's efficiency In a 3-lane arrangement, the conflicts eliminated	Figures 11 and 12
2. Turn lanes	It is a single lane in the center of a road that is used for turning cars. It allows cars to turn left without disturbing the traffic movement. See Fig. 13	Figure 14
3. Bike boxes	It's a bike sign on the car lanes that allows bikes to turn left or right in front of traffic at the red light. See Fig. 15	Figure 16
4. Parklets	It is a sidewalk extension that offers more space for people using the street. Usually installed on parking lanes. Parklets generally range out from the sidewalk at the same level to the width of the adjacent parking space (NACTO, 2013). See Fig. 17	Figures 18 and 19

Fig. 11 Road diets

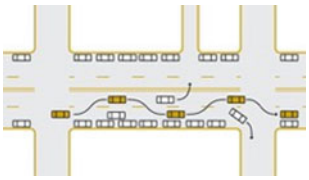


Fig. 12 Three lanes arrangement

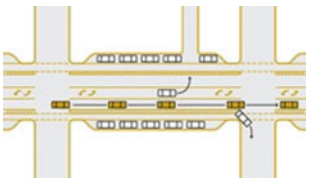


Fig. 13 Turn lane

Fig. 14 Turn single lane

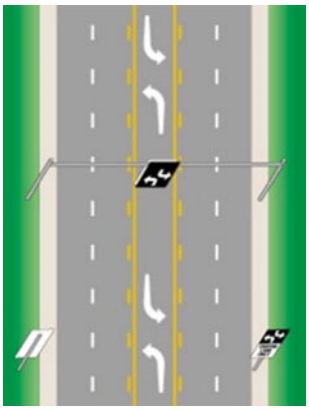


Fig. 15 Bike boxes in Vancover

their described speed, parking, signals, lanes, and sidewalks density; for example, high-speed streets design don\t allow parking lots while urban streets allow it and so on, as shown in Table 4.

7.3 Street Elements

Street elements are the components that create the city roads including; sidewalks, drive lanes to see (Fig. 22), curb extensions creating safe crossing, gateways, bus bulbs, pinch points, and chicane (NACTO, 2013).

7.3.1 Road Lanes

The width assigned to lanes (Fig. 23) for bikes, motorists, trucks, buses, and parked cars is a critical feature of any street design. Each lane width should be well-thought-out after understanding the traffic goals of each street. Travel lanes are lined to describe the planned path of travel for

Fig. 16 Bike box

Fig. 17 Parklets

Fig. 18 Parklets

Fig. 19 Parklets

Fig. 20 Local streets

Fig. 21 Local streets (McCutchan, 2013)

automobiles. Generally, broader travel lanes (3–4 m) were preferred to make a more forgiving barrier to drivers, particularly in high-speed streets where thin paths or roads may feel uncomfortable or lead to sideswipe crashes (NACTO, 2013).

A. Car Lanes

The sizes of car lanes usually range from 9 to 15 ft. or 2.7 to 4.6 m. Lane widths are often finer on low-volume roads and broader on higher volume roads. There's no proof that more wide paths are secure. At the point when trails turn out to be very wide, they turn out to be less protected. Crash frequencies increase once path width exceeds 3.4 m, and have notable more significant amounts of accidents at 3.7 m or more. One possible explanation behind this is drivers may increase the speed with more wide paths (McCutchan, 2013).

B. Bike Lanes

A Bike lane definition is; a well-defined space of the road labeled by signage and pavement markings for bicyclists. It is logical, to begin with, basic concepts and characteristics. (Wisconsin Department of Transportation, 2009).

The minimum width of a bike lane should be 1.2 m in "No curb" roadways. If parking is allowed, the bike lane should be placed between the parking area and the travel lane and have a minimum width of 1.5 m (Fig. 24) (Flowers, D., Warne, T., & Pyers, 1999) (Fig. 25).

- If no curb/no parking: 1.2 m.
- If curb and gutter/no parking: 1.5 m from the curb face.
- If parking: generally 1.5 m (Flowers, D., Warne, T., & Pyers, 1999).

Bicycles are between 0.60 and 0.9 m wide. An adult tricycle or a bicycle trailer is approximately 0.80–1.1 m wide. The length of a bicycle is about 1.5–1.8 m. The longitudinal distance grows from 2.6 to 2.9 m see Figs. 26 and 27 (Wisconsin Department of Transportation, 2009).

Table 4 Design types and elements (*Source* The author)

Design types	Description	Parking	Signals	Lanes	Sidewalks
High-speed streets	These are the streets with very low driveway	No parking is allowed	Signals are rare, spread out at long distances	Maybe multilane	A moderate-high density roadside expansion
Suburban streets	They signify streets of low driveway	Parking is allowed in some parts	Moderate signals	Maybe multilane	A moderate-high roadside expansion, unlike suburban streets
Intermediate design streets	They signify urban streets with reasonable driveway	Parking is allowed in some parts	Moderate signals	Maybe multilane	High roadside expansion, unlike roads on suburban streets
Urban streets	They signify urban streets with high access point density	They usually provided with roadside parking	More signals	Maybe multilane	Highest roadside expansion density between all previous types

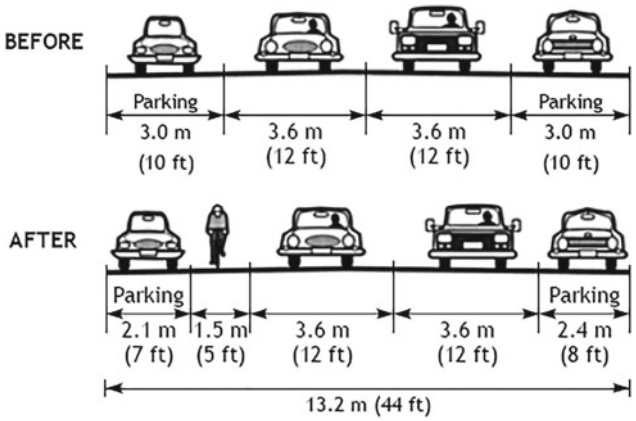


Fig. 22 Street elements

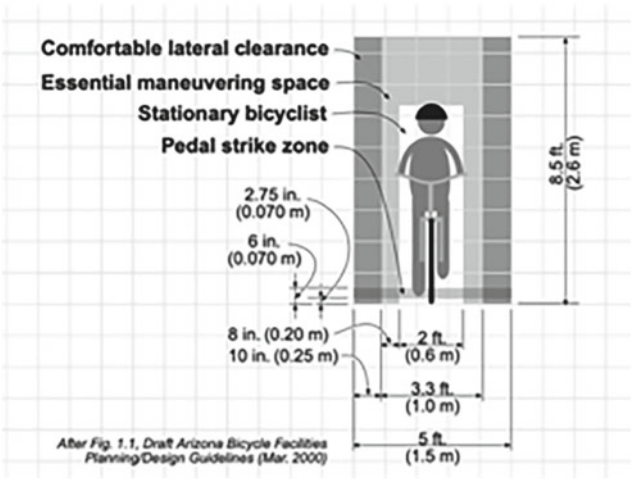


Fig. 24 Bike lane dimensions

Fig. 23 Parallel parking

Fig. 25 Bicycle lane at Austin Texas (Smith et al., 2019)

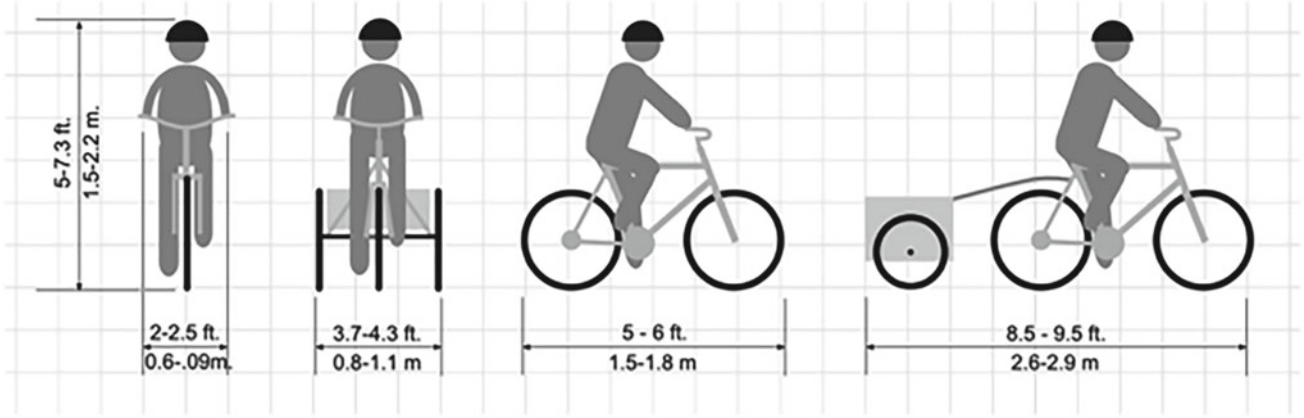


Fig. 26 Common dimensions for bicycles, tricycles, and bikes with trailers (*Source* Wisconsin Department of Transportation 2009)

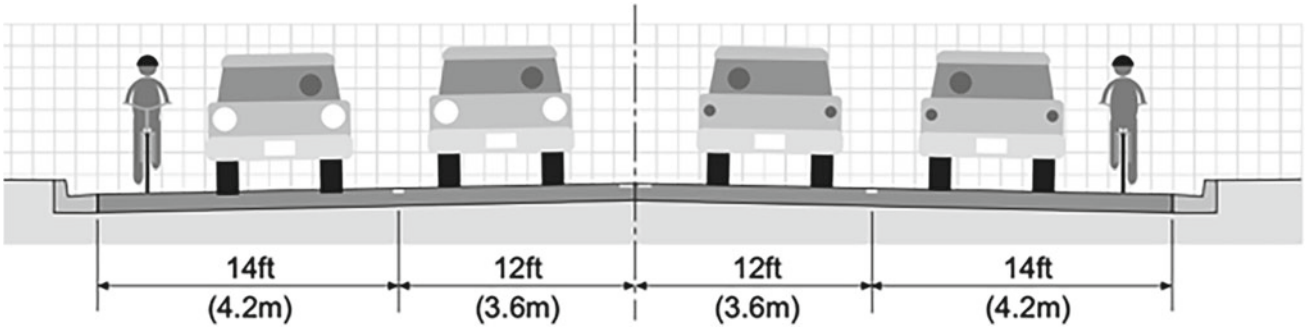


Fig. 27 Standard "wide outside lane" configuration showing a (4.2 m) outside lane and a 12ft (3.6 m) inside lane

7.3.2 Conventional Bike Lanes

They are bike lanes that use pavement markings and signage. The bike lane is adjacent to car travel lanes, and in the same direction, it flows as shown in Fig. 28). hey are usually on the right side of the streets, between the travel way and the road edge, or the parking lane. It can be located on the left side when used in a one-way street. This type increases comfort for cyclists on busy roads and creates a separation between both cyclists and motors for more safety. Bike lanes can be applied on streets with 3000 fewer motor vehicle traffic daily, on roads with high transit vehicle volume, streets with high traffic volume, and regular truck traffic as shown in Fig. 29 (Cart, 2019).

Fig. 28 Conventional bike lanes

Fig. 29 Bike Lane, Portland, OR (*Source* NACTO 2013)

7.3.3 Buffered Bike Lanes

It is a conventional bike lane that is joined by a buffer space, separating between the cyclists and motor vehicles or parking lanes, as shown in Fig. 30. It allows extra space created in between the cycling lane and travel lanes (Cart, 2019) A buffered

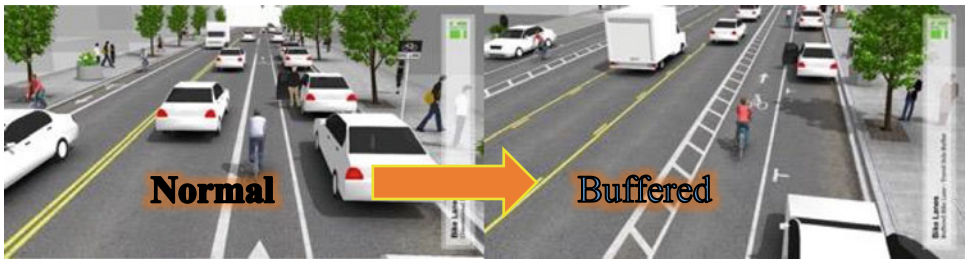


Fig. 30 Buffered bike lane (*Source* The author)

Fig. 31 New York buffered bike lanes (*Source* NACTO 2013)

bike lane trial has been installed in New York, as shown in Fig. 31, creating a safe zone for bikes in crowded streets.

In Los Angeles, there was an additive trial in Spring street by adding a green buffered bike lane, as shown in Fig. 32. The city's first green lane was created first by the buffered bike lane; bike counts were taken before and after showing a 52% increase in cyclists on Spring Street. Figure 33 indicates a 250% increase in cyclists on weekends and a 161% increase in female riders. His evidence encourages the city to increase the investment in; bike lanes, bike paths, and separated or buffered infrastructure (Newton, 2012).

7.3.4 Contraflow Bicycle Lanes

Contraflow bicycle lanes' design allowed cyclists to ride in the opposite direction to the travel lane. They provide access to bicyclists traveling in both directions and connectivity, as shown in Fig. 34, to decrease sidewalk riding. In the streets, large numbers of bicyclists use them to ride in the wrong direction. Thus they work better at low speed and low volume streets unless the provision of buffer separation or physical protection to see (Fig. 35) (Cart, 2019).

7.3.5 Left-Side Bike Lanes

They are conventional bike lanes located on the left side of one-way streets or two-way streets with medians. Left-side bike lanes offer advantages along roads with heavy transit use and frequent parking on the right side. It avoids possible right-side bike lane clashes on streets, reduces door zone clashes next to parking because of rarer door openings on cars' passenger side. In Commonwealth Avenue, in Boston. The bike lane is located either; to the left of the vehicle road or the park's right see (Fig. 36). It is easy for a bike to travel faster

Fig. 32 Spring street (*Source* Linton et al., 2020)

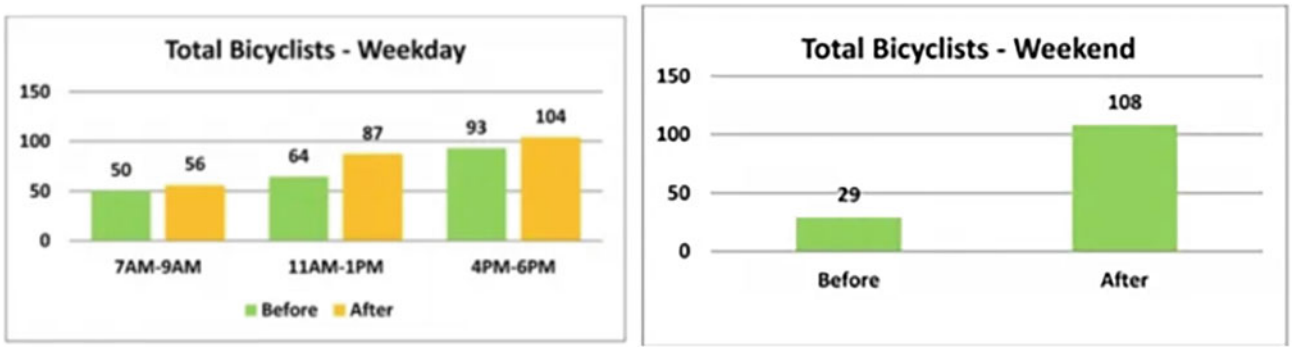


Fig. 33 The stats from Spring street (*Source* Newton, 2012)

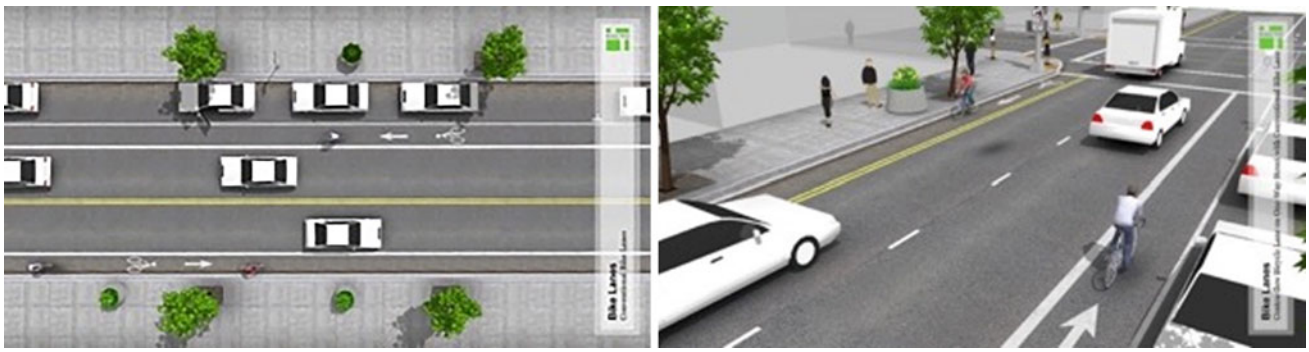


Fig. 34 Contraflow bike lanes

Fig. 35 Contraflow bike lanes can provide direct access to high-use destinations

than a car in heavy traffic, it is not next to any parked cars, and so there is no risk of dooring see (Fig. 37) (Almy, 2012).

7.3.6 Sidewalks

Walkways fill in as the visible strides to the city as open spaces, socially and financially activating roads. Sidewalks see (Fig. 38) play an active part in city life. They increase their connections, thus encouraging walking (NACTO, 2013).

Sidewalk zones are (NACTO, 2013);

A. Frontage zone
   The front zone includes the walkway piece that serves as an extension of the building, either entrances and doors or walkway cafes. The frontage zone contains both the structure and the building's facade facing the street; space ends to end to the building.
B. Pedestrian sector
   The pedestrian zone is the leading open path that goes equivalent to the street. The pedestrian region confirms that walkers have a safe place to walk and should be 1.5–2 m wide in residential locations and 2.5–3 m wide in commercial areas.
C. Street furniture
   Space of street furniture is well-defined as the pedestrian sidewalk zone in which street furniture, such as benches, lighting posts, newspaper booths, trees, and bicycle parks. It also includes green substructure elements, such as rain gardens or flow-through planters.
D. Buffer zone
   Buffer zone directly follows the walkway that might include a range of different elements as; curb extension parklets, bike racks, parking, stormwater management features, cycle paths, and bike-share stations see (Fig. 39).

Fig. 36 Left-side bike lane (*Source* NACTO, 2013)

Fig. 37 Commonwealth Avenue in Boston with left-side bike lane (*Source* Almy, 2012)

Fig. 38 Sidewalks

7.3.7 Curb Extensions

Curb extensions narrow the roadway (Fig. 40), creating safe and small walking passages while expanding space for street furniture, benches, vegetation. Also, they reduce the roadway's width and serve as a visual signal to drivers entering a neighborhood street. Its length should be at least equivalent to the width of the crosswalk. The four types of curb excisions is shown in Table 5.

Gateway. B. Pinch point. C. Chicane. D. Bus bulbs.

A. **Sidewalk eight principles of design see** Fig. 45 (Maneola, 2015);
   1. Proper sizing.
   2. Quality surface.
   3. Efficient drainage.
   4. Universal accessibility.
   5. Secure connections.
   6. Attractive spaces.
   7. Permanent security.
   8. Clear signage.

B. **Sidewalks widths**

The recommended sidewalk width for each street type is shown in Table 6. Sidewalks below the minimum width for widening the relevant street type as opportunities allow, as shown in Figs. 46 and 47.

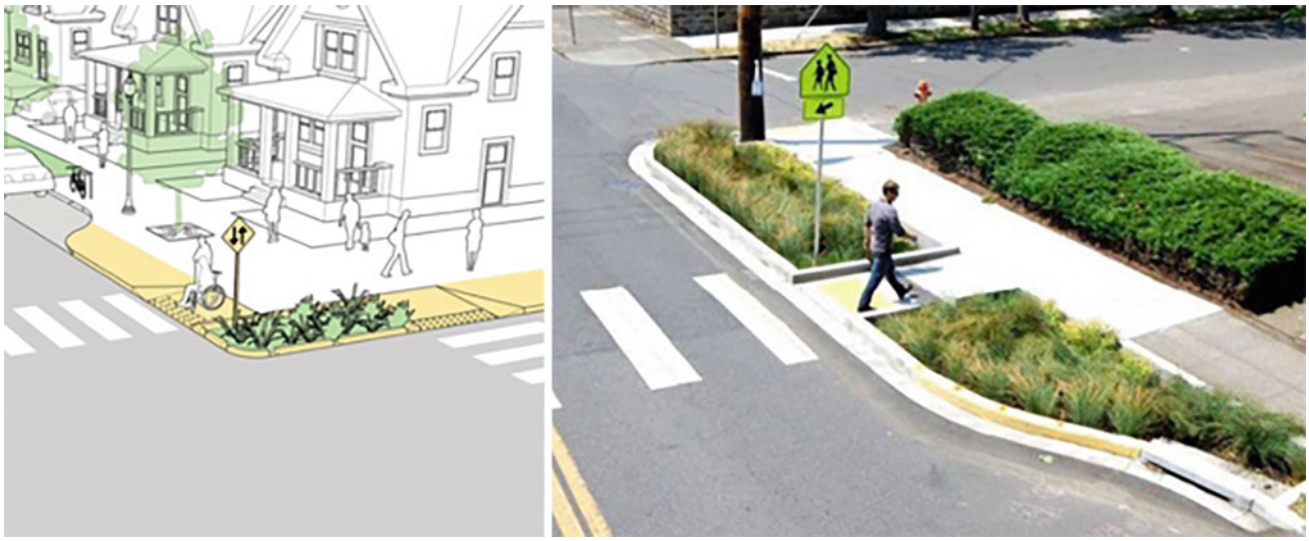


Fig. 39 Buffer zone of sidewalks (*Source* NACTO, 2013)

Fig. 40 Curb extension in Vancouver, Canada (*Source* Thomas Elli, Serwicka Ilona, 2015)

Table 5 Types of curbs (*Source* The author)

Curb extensions types	Description	Pictures
Gateway	We are using them at the connections and entrances of less speed streets. It is planned to spot the shift in streets	Figure 41
Pinch point	Curb extensions located at midblock for traffic slow down and public space addition	Figure 42t
Chicane	This type creates a chicane in low-traffic streets that significantly reduces traffic speeds. It increases the area of public space and street furniture	Figure 43
Bus bulbs	Bus bulbs' design is to line up the bus stop with the parking road, letting buses stop and board people without leaving the travel lane. It helps buses transfer quicker and more consistently by reducing the total time lost when merging in and out of traffic	Figure 44

Fig. 41 Gateway

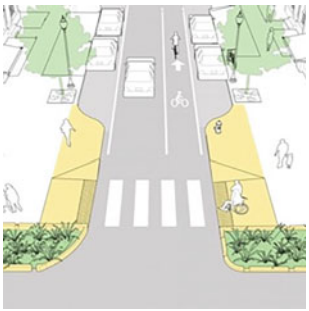
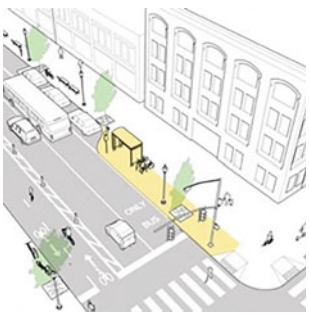


Fig. 42 Pinch poin

Fig. 43 Chicane

Fig. 44 Bus bulbs



8 Vertical Speed Control Elements

Vertical speed control elements manage traffic speed and strengthen pedestrian-friendly rates. It may be suitable in a variety of street types but mainly used in merchandise traffic of the neighborhood, residential, or low-speed streets see Table 7. Vertical speed control elements include three types (Namee & Witchayangkoon, 2011);

A. Speed bumps to see Figs. 48 and 49.
B. Speed table to see Figs. 50 and 51.
C. Speed cushion to see Figs. 52 and 53.

9 Transit Streets

Devoted transit roads, as shown in Fig. 54, are suitable base signal controls and operational activity upgrades. They guarantee that traveling vehicles encounter insignificant holdup time at crossing points and can move openly, paying less respect to traffic congestion (NACTO, 2013). Safe and appropriate access to transit stops to take advantage of higher ridership and income. Transit street increases user safety, secure access to the transit stop is necessary to the public. If pedestrians do not feel safe and protected, they will not walk to the bus stop. All transit customers are pedestrians for some part of the trip. Transit street includes the walk from one's origin to the halt, better access to transit leads to better conditions for other walking journeys. The more direct a transit route is, the less time and cost it is necessary to offer a certain level of service (SUDS-RP-UD, 2012).

A. Dedicated Offset Bus Lanes

A bus lane shown in Fig. 55 is a lane made only for buses and is usually used to hurry up public transportation that would be else held up by traffic overcrowding. Bus lanes are a vital component of improving bus travel speeds by decreasing interruption caused by other traffic. A bus lane can take place as a part of a road, which also has lanes serving other motorized transport. In New York City, The 34th Street Select Bus Service design, is based on an analysis of the traffic, transit, and curbside access needs on the corridor. By community participation techniques and after many discussions with residents, businesses, institutions, and rigorous traffic analysis, as shown in Fig. 56 (New York City, 2010).

B. Median Bus Lanes

Median bus lanes are useful on main roads with numerous movements, as shown in Fig. 57. Using a median bus lane parallel to the centerline of a multilane roadway combined with nearby transit stops. In South Korea, they are implementing Median lanes, where they use alternative or public transportation more often. In Midtown Seoul, median bus lanes cut through heavy traffic and reduce pollution, as shown in Fig. 58 (Jang, 2014).

The following Table 8 is comparing the street elements and their description and show the importance of each component.

Fig. 45 Sidewalk best design (*Source* Maneola, 2015)

Fig. 46 Sidewalks

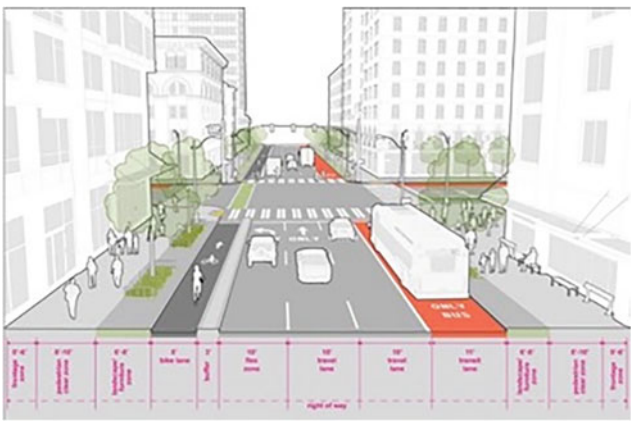


Fig. 47 Sidewalks and road way zones

9.1 Middle Islands in Streets and Their Importance

A middle island is a part of the roads that separate the two directions of the street; it's defined as an area between the two sides of the street that controls traffic movements. It may be low, raised, or the same as the road's surface height. Raised islands offer space for pedestrian safety features, traffic control devices, services, landscaping, and stormwater management.

9.2 Median Refuge Island

They are safe areas in the middle of streets, where people may securely wait while crossing a street. Pedestrian refuge islands are mainly helpful as relaxing areas for elders, people with disabilities, kids, and anyone who cannot pass the road at one stage. They offer a protected space for bicyclists and pedestrians to pause for an acceptable gap in traffic, decreasing the complete crossing length to automobile movement for a bicyclist or pedestrian see Fig. 63 (Corner, 2019).

9.3 Median Island Placement

Islands should be well-thought-out under the following situations:

A. Streets with high bicycles and pedestrian movement.
B. They are crossing spaces of eighteen meters or more.
C. Close and inside neighborhood selling areas, public and institutional uses, and schools.
D. Places with many transmissions between transportation lines (Corner, 2019).

Table 6 Sidewalks width (*Source* SFPD, 2010)

	Street type	Minimum width	Recommended width
Commercial	Downtown commercial	Per downtown streetscape plan	
	Commercial throughway	12′	15′
	Neighborhood commercial	12′	15′
Residential	Downtown residential	12′	15′
	Residential throughway	12′	15′
	Neighborhood residential	10′	12′
Other	Industrial	8′	10′
	Mixed-use	12′	15′
Special	Parkway	12′	17′
	Park edge	12′	24′
	Multiway boulevard	12′	15′
	Ceremonial	Varies	Varies
	Alley	6′	9′
	Shared public way	NA	NA
	Paseo	Varies	Varies

Table 7 Vertical speed elements (*Source* The author)

Vertical speed control elements	Description	Pictures
Speed bumps	Devices that custom vertical bend to slow motor vehicle traffic to increase safety conditions (Namee & Witchayangkoon, 2011). See Fig. 48	Figure 49
Speed tables	Speed tables are traffic calming devices that raise an automobile's whole wheelbase. They decrease their traffic haste. They are Longer than speed bumps and flat-topped (Ewing, 1999). See Fig. 50	Figure 51
Speed cushions	Speed cushions are considered speed bumps or speed tables that contain wheel cutouts, for significant automobiles pass unaffected while decreasing average car speeds (Namee & Witchayangkoon, 2011). See Fig. 52	Figure 53

Fig. 48 Speed bumps

Fig. 49 Speed bumps

Fig. 50 Speed tables

Fig. 51 Speed tables

Fig. 52 Speed cushions

Fig. 53 Speed cushions

Fig. 54 Transit streets (*Source* NACTO, 2013)

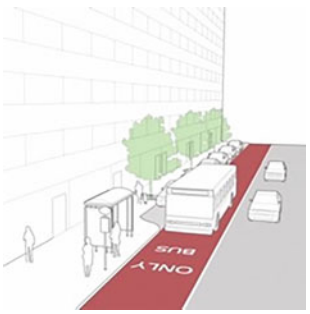


Fig. 55 Bus lanes (*Source* NACTO, 2013)

Fig. 57 Median bus lanes (*Source* NACTO, 2013)

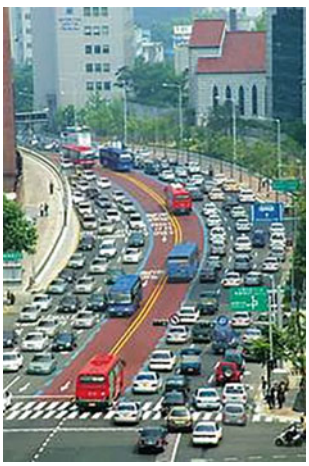


Fig. 58 Bus lanes in downtown Seoul (Jang, 2014)

Fig. 56 34th Street New York (*Source* New York City, 2010)

Table 8 Shows the street elements that can be found in any street (*Source* The author)

Street elements		Description
Lane width		Width assigned to bike lanes, trucks, motorbikes, buses, and car parking
Sidewalks. See Fig. 59	Sidewalks	They are paths for pedestrian access, and increase their connections and encourage walking
	Frontage zone	It describes the walkway's piece that purposes as an extension lead of the building, either entrances and doors or walkway cafes
	Pedestrian zone	It is the primary, open path that goes equivalent to the street
	Furniture zone	It is well-defined as the sidewalk and the pedestrian zone where street furniture as; lighting, seats, newspaper booths, trees depth, and bicycle parking
	Buffer zone	It includes; curb extensions, bike racks, parking, stormwater management features, bike share stations, and cycle paths
Curb extensions. See Fig. 60		It narrows the roadway, making safer and smaller passages for walkers while allowing extra space for street furniture
Vertical speed control elements. See Fig. 61		Manage traffic speeds and strengthen pedestrian, fast, safe speeds. It may be suitable for various street types and broadly used in the neighborhood, residential, or low-speed streets
Transit streets. See Fig. 62		They guarantee that the travel vehicle encounters can move openly, paying less respect to traffic congestion

Fig. 59 Sidewalks

Fig. 60 Curb extensions

Fig. 61 Vertical speed control elements

Fig. 62 Transit streets

Streetscape Elements

Trees, lighting, pedestrian furnishing, pavement, and other elements fill the places of the streetscape with life and make a street more comfortable and usable space for people.

Trees. B. Lighting. C. Benches. D. Bicycle racks. E. Trash receptacles. F. Bus shelters.

A. Street Trees

Shown road trees in Fig. 64, and other landscaping, used to give unique characteristics to specific streets and neighborhoods. Trees and gardens need structure in coherence with

Fig. 63 Median Island (NACTO, 2013)

Fig. 64 Road trees in Japan (*Source* Images, 2015)

Fig. 65 Street trees (Street, 2020)

road lighting, walkway services, and building locations (SFPD, 2010). Planting trees in urban areas is for the sake of the planet; thus, it is essential to allocate plants in the right place, to avoid removing that valuable tree, later on, to see Fig. 65 (Street, 2020).

10 Tree Placement

Classically planting trees were in basins or sidewalk cut-outs in sidewalks. It is not essential to have tree basins specifically. In some conditions, the placement of trees could be above ground. Tree locations and spacings are determined according to the mature scope of the tree. Small trees (<6 m in diameter) were planted at four and a half meters in the center.

- Medium trees (six to ten and a half meters in diameter) were planted at 7.5 m in the center.
- Tall trees (>10.5 m in diameter) were planted at ten and a half meters in the center.

In general, trees with smaller diameters (less than 6 m) should be planted at closer space, while trees with larger diameters (>12 m) should be afforded wider spacing.

We should think in a futuristic term when it comes to planting trees. Incorrect trees placement can lead to untold damage to hard surfaces and infrastructures (Street, 2020).

B. Street Lighting

Street lighting is one of the main street features; this includes roadway and pedestrian paths lightings. Lighting supports the night driving and any other night activities. It shows the street quality for traffic safety and pedestrians' security (Fig. 66).

11 Lighting Placement

Locating street lighting should be as the following:

- **Entrances**: lighting around residential building entrances doorways make it safer.
- **Edges**: the boundaries of any place, such as a park, that help in identifying the space. Even buildings placed on its

Fig. 66 Street lights

Fig. 67 Street benches (Description, 2020)

side can also have seasonal lights conveying attention to the more prominent district outside the park.

- **Selling places**: light even if stores are locked. This method helps raise the number of people on the street, which is a significant donor to safety.
- **Architectural details**: grazing technique in lighting at entrances, cornices, arches, columns attracts attention toward a specific building detail.
- **Signage**: lighted signage and maps should be visible for all street users, both driving or pedestrians, to correctly identify those signs.
- **Traffic-calming device**: the difference between a pedestrian-lit street and a highly illumined road directly leads drivers to enter a new zone. It also forces them to slow down their speed.
- **Streets with high pedestrian volumes**: with small sizes, considering their safety and security. For example, backstreets, muses, parks, pathways, and pedestrian paths (Cityscape Institute, 2008).

C. Benches

Installing benches in the streets is for people's comfort and relaxing. The preferred materials in street benches are; wood, stone, granite, concrete, and metals, as shown in Fig. 67.

D. Bicycle Racks

The term bicycle rack or bike rack refers to a bicycle carrier. Bicycles are mounted for transport, as shown in Fig. 68. It is considered a parking rack, a stationary fixture to which a bike can be secured by using a bicycle lock.

E. Trash Receptacles

All streets must have trash receptacles for hygiene and waste disposal. Nowadays, there must be four trash receptacles for recycling purposes, as shown in Fig. 69.

Fig. 68 Bicycle racks

Fig. 69 Trash receptacles

Fig. 70 Different bus shelters (Newman, 2020)

Fig. 71 Pedestrian-friendly streets

F. Bus Shelters

Waiting for a bus needs a shaded area for users' comfort with embedded seats. They can vary in design and materials for giving a unique esthetic ambiance to the street see Fig. 70.

Pedestrian-Friendly Streets

Pedestrians, generally, are people physically walking instead of traveling in a car. Pedestrians can also be using skateboards, roller skates, scooters, wheelchairs, or other mobility aids. The automobile power in the streets has had a harmful effect on the deterioration of public life. They are improving urban environments into an energetic space rather than to destroy essential connections (Appleyard, 1981). Accordingly, numerous urban design ideas came out. "Traffic-free zone" term is applied to a wide range of urban spaces as plazas, squares, promenades, esplanades, and parks. On the other hand, this expression describes a more detailed concept, representing urban areas with forbidden private vehicles, and priority to pedestrian movement and public transportation Brambilla & Longo, 1977). The priority to pedestrian and vehicle access is banned totally. If vehicles are allowable, their speeds are limited to have a protected, excellent, and safe environment, as shown in Fig. 71.

12 Designing Considerations for Pedestrian Paths

A. The design follows function: the pedestrian paths are planned upon the following;
   - Spaces you want to access.
   - The residents' age and physical abilities differ.

B. Safety for pedestrian should be applied: to smear protection for pedestrian paths, this can be done by;
   - The separation between pedestrian paths and vehicle roads.
   - Intersection studies.
   - Study pedestrian paths that meet vehicle roads.
   - Façade that sees open paths should allow social interaction.

C. Comfort for the pedestrian: the user has to reach his target without feeling tired;
   - Users must avoid difficulties to ease movement.
   - Use of un risky materials for the path finishing, not sliding, and will not cause feet pain.

D. Pedestrian path and its relation to the journey purpose: the number of pedestrians using the road;
   - Users are either children (nursery) or senior (shops and terminals)
   - There are special conditions, such as the desire for quick access in the case of going to work or carrying bags in a travel case.
   - The goal is, either sport or recreational.
   - It can take two paths to the same goal, the first primary and short, and the second secondary and more extended.

E. Automated service streets and its relation with pedestrian paths.

F. Street furniture details.

13 Recommendation on Solutions for Cairo's Street Problem

The followings are research findings recommendation to resolve the issue on Cairo's Urban Street:

A. Smart Parking

Smart parking, or multistory smart parking lots, is a leaving technique that combines innovation and human advancement with an end goal to use few resources. For example, fuel, to accomplish quicker, less demanding. Denser leaving of vehicles for most of the time, they stay inert. It combines innovation, functionality, and economy (Offer, Implementations, Company, Parking, & European, 2019). It is a vertical structure that can take up to 16 cars in the space of just two cars. An automatic multistoried car parking system reduces and minimizes parking areas needed in urban neighborhoods, as shown in Fig. 72. It offers extra flexibility of optimum parking solutions like; speedy tower, rotary carousel, optima, multi, and lift & side parking, as shown in Fig. 73. Vertical and horizontal movements simultaneously ensure fast parking and retrieval times, so it helps in time-saving (Of & Parking, 2019). High-rise buildings are proof of old architecture; It is cheaper to build up than out; the same is valid for parking spaces. New designs now construct fully automated and mechanical parking systems. This technological design will encourage using robotic car parking systems in areas where land is scarce and expensive —also, sites with problematic congestion, zoning, and crime.

The first multistory smart park in Egypt was opened on Al-Gomhouria Street in El-Mansoura, Dakahlia. It is the first attempt to reduce traffic congestion in the city. El-Mansoura governorate indicates that the city is suffering from a horrific traffic problem and then will repeat the trial to build more 20 multi-story smart parking to solve the parking problems see Fig. 74 (Ramadan, 2019).

A. Carpooling

They share car rides to travel in a car with more than one person. Having more individuals using one vehicle reduces every individual's movement costs—for example, fuel costs, tolls, and the worry of driving. It is a sustainable and eco-friendly traveling way. They are sharing rides decreases, air pollution, carbon emanations, traffic blockage on the streets, and the requirement for parking spots. Someone can share

Fig. 72 Automated and mechanical parking systems (Solutions, 2020)

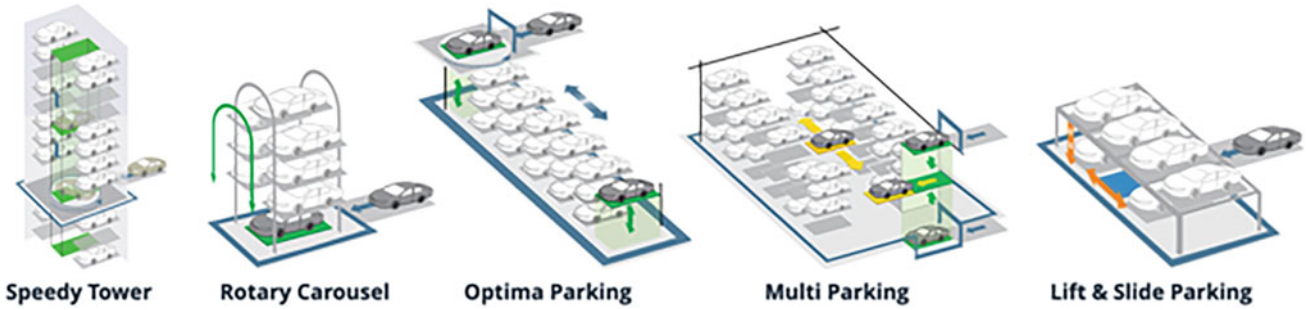


Fig. 73 Automated and mechanical parking systems (Solutions, 2020)

Fig. 74 The first multi-story Smart Park in Egypt (Ramadan, 2019)

his neighbors who work at different companies located only a short distance apart and have the same work hours see Fig. 75. Runner passengers can carpool to and from stations together. Green cities are leading now to shift people to public transport and restrict single-occupancy vehicles in urban centers (Forecasting, 2019).

14 Research Methodology: Case Studies

Two case studies will be analyzed by using the specific matrix to reach a comparative analysis between them.

A. Downtown Kenton Redevelopment and Denver Ave Streetscape Plan Washington

In North Portland, the downtown Kenton District area is a historical, commercial area. It has been struggling to maintain and attract a viable economic base for thirty years now. They suffered from high storefront vacancy rates, dilapidated buildings, commercial services not complementary to a neighborhood commercial core, and a high crime rate. For future development planning, hiring a professional team to perform development opportunity studies for six volunteer sites in the corridor for assisting property owners. Concepts included building and façade improvements and recommendations for new mixed-use and transit-oriented buildings, as shown in Figs. 76 and 77 (Downtown, District, Portland, & Avenue, 2008).

For the construction improvements to the project, BergerABAM is an organization for event management services. Creating a strategic communications plan; drafted key speaking points; arranged for on-site support, such as tents and sound equipment; and pitched the event to local media as shown in Fig. 78 (BergerABAM, 2020).

B. The Better Block Project (2010), Norfolk, Virginia

Norfolk is an independent city in the state of Virginia in the United States. It's residents decided to follow a new project for three months period, as shown in Fig. 79, to refresh a single commercial block in an underused neighborhood corridor. A group of community planners, neighbors, and property owners gathered together servicing the project for the better block. These residents realized their ability to be assets that can help make their community economically generative. They used digital fabrication, CNC routers, laser cutters, and 3D printers to adapt to the built environment

Fig. 75 Carpooling (*Source* The author)

Fig. 76 Denver renovation cityscape project (Downtown et al., 2008)

Fig. 77 North Denver avenue streetscape improvements Berger ABAM (Berger ABAM, 2020)

rapidly. The project incubated temporary businesses with residents, testing market viability for creating permanent businesses. By creating rapid-prototyping events and marketplaces, street safety had increased too (Roberts, 2020). Residents participated to have a better quality of life as shown in Fig. 80.

15 Research Recommendations

A. A Proposed Project at Hassan Maemoon, Cairo, Egypt

The street is a secondary street, deprived of Mostafa El Nahas road in Nasr City, Cairo. It is full of residential buildings in a two-way road 44 m wide, with 5 m median in-between. The median had been transformed into a garbage area and a relaxing sitting area for people. The street's condition was riddled with cracks, with no trees, no parking lots, no street furniture, no leading signs at all, and animals in the streets as shown in Fig. 81 (Alyoum, 2016).

The researcher proposed a project to renovate the street quality shown in Fig. 82, adding bike lanes, bus lanes, parking lots, shading trees, and proper sidewalks as shown in Fig. 83. The proposal should add better conditions for the whole area and elevate the quality of residents' lives.

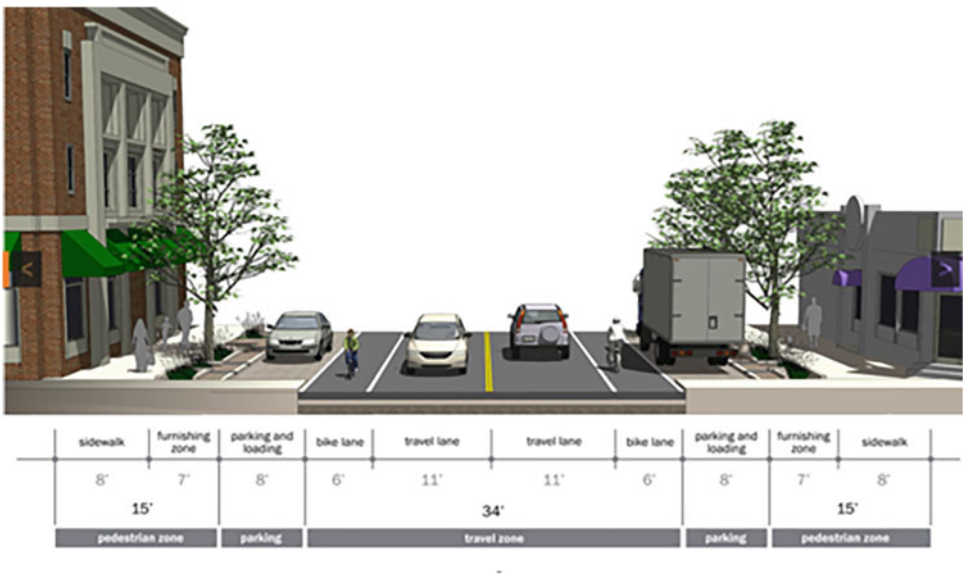


Fig. 78 A section in the renovated street (Downtown et al., 2008)

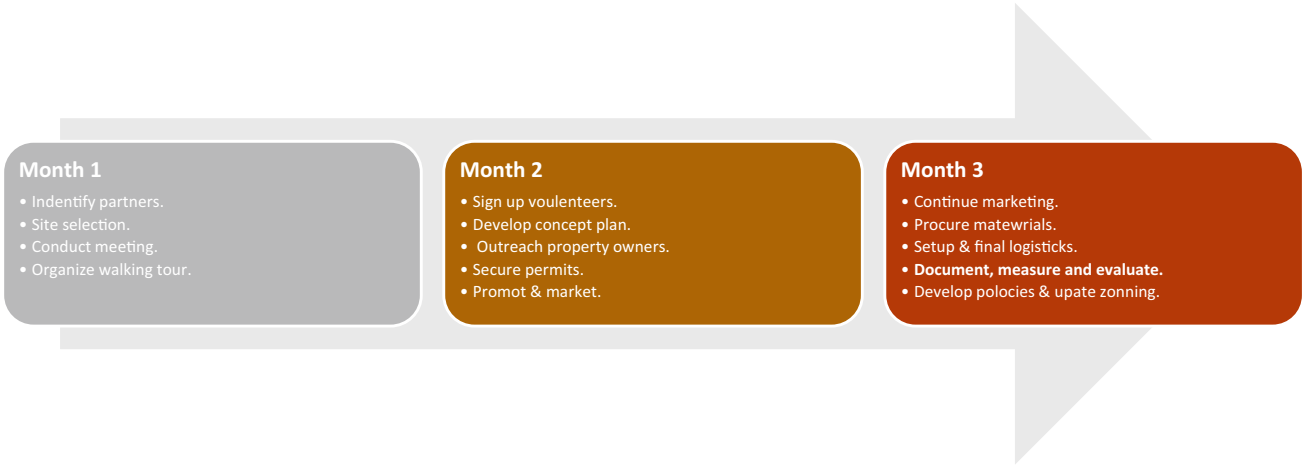


Fig. 79 Norfolk Better Block project time line (*Source* The author)

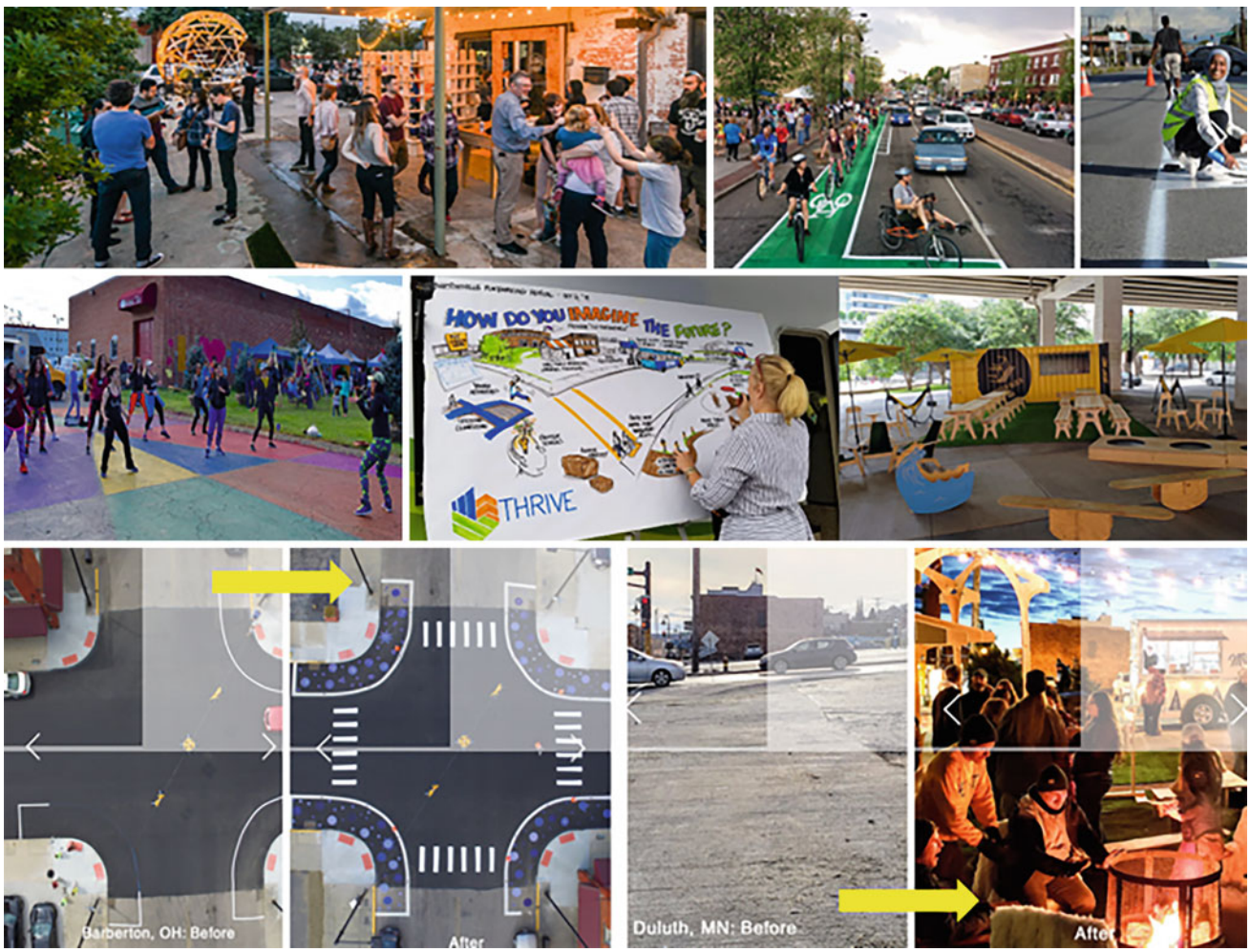


Fig. 80 Community participation development in "Better Block Project" (Edited by the author: *Source* Block, Donate, Mission, & Our, 2020)

Fig. 81 Raising animals in Hassan Maomoon street (Alyoum, 2016)

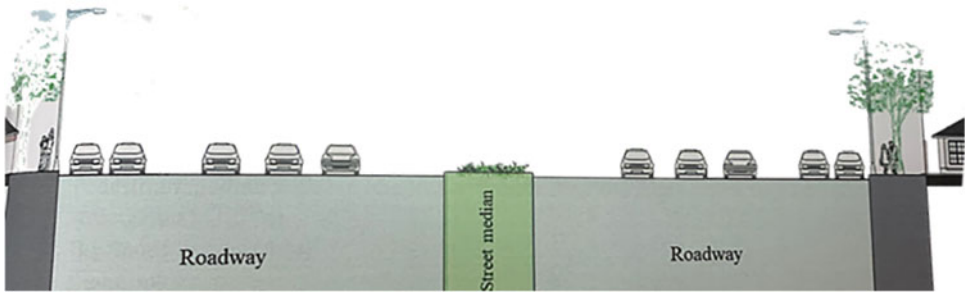


Fig. 82 Existing road situation of street Hassan Maemoon (*Source* The author)

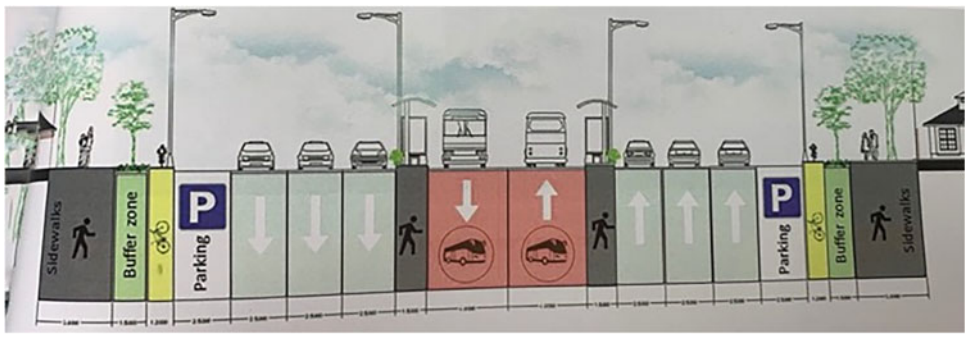


Fig. 83 Proposed project for renovation of Hassan Maemoon street (*Source* The author)

B. Services Program

Neighborhoods offer a mix of housing, selling, and employment usages that are always located in their centers. The feature of lifetime neighborhoods has the potential to allow local authorities and residents to meet a variety of similar aims, such as; striving toward sustainability and helping to decrease harmful impacts on the environment. Residents working in the service sector are 20–30% of all residents and 18–24% of existing jobs. Each service has a minimum and a maximum load of capacity, in which the residents can use the service with the maximum possible efficiency (Bevan & Croucher, 2011). Services that need to be in a neighborhood; are a primary school, three to four nurseries, a mosque, and commercial facilities. Table 9 shows the percentages of services according to the areas of urban hierarchy (Thomas Elli, Serwicka Ilona, 2015).

Table 9 Services percentages (Thomas Elli, Serwicka Ilona, 2015)

Centers locations	Percentage of services
City center	12–15% from the whole city area
District center	8–11% from the whole district area
Neighborhood center	13–18% from the whole neighborhood area

Land Use

Great neighborhoods hold a combination of land uses, as shown in Fig. 84 with a recognizable commercial center. These areas provide goods and services to meet the resident's daily needs and are an essential community assembly place. Neighborhood nodes may also be locations of recreation and transportation. Nodes can differ in size depending on the context; they provide options for living, learning,

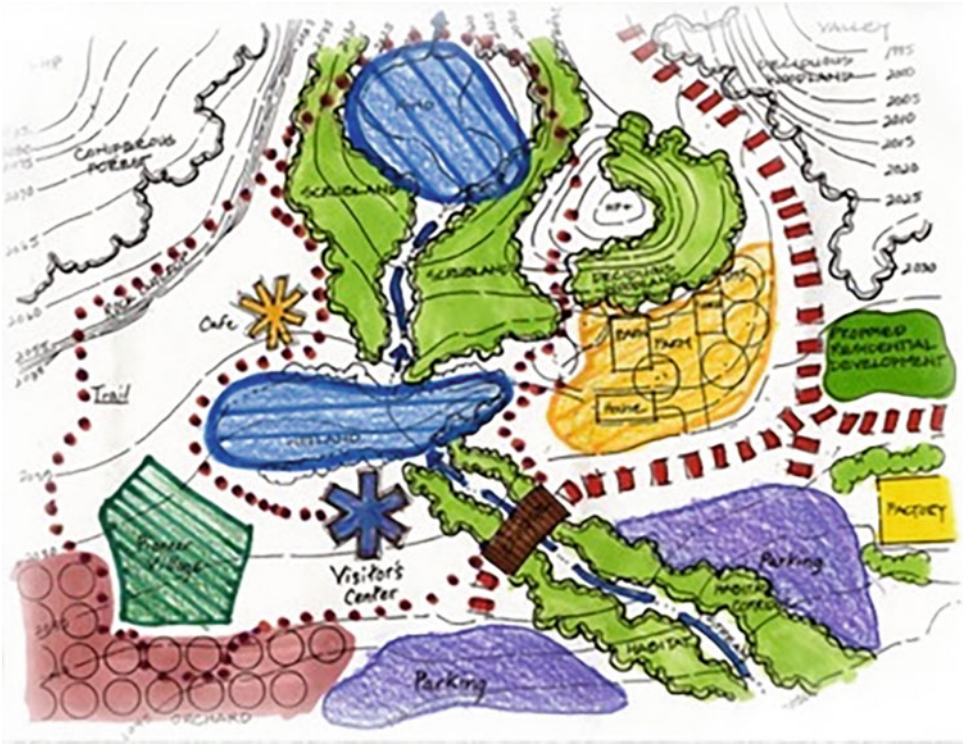


Fig. 84 Land uses (Deer, 2013)

working, and playing. More concentrated land uses are linked and focused around transportation, other transportation styles, and parks. All citizens can easily access daily shopping and recreational needs in their neighborhoods.

The best neighborhood nodes include: A mix of uses, combined higher density residential housing, a pedestrian public land, and are within a short walking space of most residents in a neighborhood (Deer, 2013). The prosperous neighborhood should include both; buildings as a mix of residential, services, and open areas.

16 Road Networks

Each neighborhood offers mobility choices for residents to travel to, from, and within the neighborhood. Its relationship with the nearest entrance depends on the neighborhood's location and different ways to access services. Streets and paths are well connected to inspire active modes of travel. Traffic and parking are managed and do not control the neighborhood (Bevan & Croucher, 2011). Road types in neighborhoods vary as the following.

Neighborhood Road types

1. Substreets that occur from high streets.
2. Main streets get along with the central services of the neighborhood.
3. Secondary streets drive to residential buildings.

Healthy Neighborhoods Regarding Streets

This research concentrates on renovating Cairo streets, starting with the neighborhoods as they are the main base for a healthy city. Roads and highways must provide multiple transport choices and better access for people of all ages and physical mobility levels. They should target different users, not only links between destinations for drivers, as roads are considered a public space for all people. Many activities take place in the streets beyond driving, such as cycling, shopping, and walking. So, the road participants are drivers and pedestrians, disabled citizens, motorcyclists, and cyclists. According to the city scale, road classification is either arterial or central, local, or collector (secondary) roads. Understanding roads and considering people's needs and health should have good street designs and

Table 10 Street elements comparison matrix (*Source* The author)

Points of comparison							
Neighborhood residential groups			Percentage of surrounding land use		Road network		
Small area	Medium area	Large area	Bbuildings	Open spaces	Sub-streets	Main streets	Secondary streets
Points of comparison							
Street elements							
Lane width			Sidewalks				Curb extensions
Cars		Bikes	Buses	Frontage zone	Pedestrian zone	Street furniture	Car way
2–3 m	*3–4.6 m*						
Points of comparison							
Street elements							
Curb extensions			Vertical speed control elements			Transit streets	
Pinch point	Chicane	Bus bulb	Speed pumps	Speed tables	Speed cushions	Offset bus lanes	Mediun bus lane
Points of comparison							
Streetscape elements							
Trees	Light post	Benches	Benches	Trash receptacles		Bus shelters	

thoughts that will lead to a healthy, green, and sustainable neighborhood. Finally, traffic engineers undertake a big responsibility of providing safe traffic movements to the road users and ensure their safety (Mathew & Bombay, 2014). Adding accessibility to streets for all types of users and create more ecofriendly cities. Drivers of urban prosperity are contribution to cities' success. This task integrates roads into five dimensions of well-being; productivity, infrastructure development, ecofriendly, quality of life, and equity. All sizes detangled the quality of the street pattern (Tobergte & Curtis, 2013).

Creating an efficient road transportation system, serve effectively different land use in an urban area, and guarantee network improvement. It is vital to set up a pathways system separated into frameworks. Each one serves a specific capacity or specific reason. It improved city extreme road classification with a specific transportation benefit capacity (Mathew & Bombay, 2014).

17 Conclusion

It concludes the previous work in a collective matrix (Table 10), for all streets and landscape elements in neighborhoods, facing different road networks of different residential groups. The research helps in analyzing any neighborhood retrieving problems to focus on adding elements.

Cairo's streets are facing a huge problem; unplanned streets, no correct designs, garbage in every corner, and overpopulation, and this impacts the whole environment and harms the streets as a public space.

Having a green and sustainable city is outlined with thought for social, economic, and environmental effects and healthy living space for the current population, taking into attention the effect of these neighborhoods and cities on the upcoming generations and gross in populations.

Egypt's problem lies in that the streets were designed many years ago and cannot be used by the new generations and the generations to come by new environmental and technological standards, as it had not planned for such from the beginning. That is why street design is an essential element in our daily lives; it is a public space we interact with every day. Therefore, it should be planned well and accurately for the safety of people and their importance.

References

Almy, I. (2012). Calm streets boston student reviews of traffic calming and bike-pedestrian treatments in the Boston area. Left-side bike lane on commonwealth but not including transition from right to left. https://calmstreetsboston.blogspot.com/2012/04/left-side-bike-lane-on-commonwealth.html.

Al-Wahaidy, F. (2005). T a t a. *Building*, (January 2018) (pp. 172–190). https://doi.org/10.5433/2176-6665.2012v17n1p172.

Alyoum, A. (2016). سكان حسن مأمون يشكون انتشار الزرائب وتربية الحيوانات داخل الكتلة السكنية. *AlMasri Alyoum* (pp. 1–3). https://sharek.almasryalyoum.com/cities/cairo/500158/.

Appleyard, D. (1981). *Livable streets/Donald Appleyard, with M. Sue Gerson and Mark Lintell*. In: M.S. Gerson & M. Lintell (Eds.). Berkeley: University of California Press.

Asoka, G., & THUO, A., & Bunyasi, M. (2013). Effects of population growth on urban infrastructure and services: A case of eastleigh

neighborhood Nairobi, Kenya. *Journal of Anthropology & Archaeology, 1*, 41–56.
BergerABAM. (2020). North Denver Avenue Streetscape Improvements. https://www.abam.com/portfolio/project/436.
Bevan, M., & Croucher, K. (2011). Lifetime neighbourhoods. In: *Department for communities and local government*. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6248/2044122.pdf.
Block, B., Donate, V., Mission, O., & Our, V. (2020). Using design to activate spaces and bring people together. https://www.betterblock.org/.
Brambilla, R., & Longo, G. (1977). *For pedestrians only: Planning, design, and management of traffic-free zones*. https://www.books.google.com.eg/books?id=6i9SAAAAMAAJ.
New York City. (2010). Bus rapid transit—34th street select bus service. *Bus Rapid Transit*, (3).
Cart, S. (2019). Urban bikeway design guide (2nd edn). *ISLANDPRESS* (pp. 1–3).
Corner, M. (2019). Medians and Islands. *SF Better Streets*, 1–5.
Deer, R. (2013). *Neighbourhood planning & design standards*. Red Deer City.
Description, P. (2020). *Vario-bench Leander*. https://www.stylepark.com/en/union-public-street-furniture/vario-bench-leander.
Doris, B. (2017). Overpopulation and the Impact on the Environment. *CUNY Academics Works*, *60*. https://www.academicworks.cuny.edu/gc_etds/1906?utm_source=academicworks.cuny.edu%2Fgc_etds%2F1906&utm_medium=PDF&utm_campaign=PDFCoverPages.
Downtown, T., District, K., Portland, N., & Avenue, N. D. (2008). Downtown Kenton Redevelopment & Denver Ave Streetscape Plan. https://www.seradesign.com/projects/kenton-redevelopment-denver-avenue-streetscape-plan/.
EFGHERMES. (2012). *Assiut train disaster: 51 Egyptian children killed*. https://www.egyptianstreets.com/2012/11/18/assiut-train-disaster-51-egyptian-children-killed/.
EFGHERNES. (2013). *Egyptian roads: A trip through hell*. https://www.egyptianstreets.com/2013/01/24/egyptian-roads-a-trip-through-hell/. Accessed 30 June 2019.
Thomas, E., Serwicka, I., & Paul, S. (2015). Why people live where they do. In: *Citylab*. https://doi.org/10.13140/RG.2.1.1053.8965.
Ewing, R., & Handy, S. (2009). Measuring the unmeasurable: Urban design qualities related to walkability. *Journal of Urban Design, 14* (1), 65–84. https://doi.org/10.1080/13574800802451155
Ewing, R. (1999). *Traffic calming state of practice*. https://www.safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa09028/resources/TrafficCalming-stateofthepracticeSLIDESHOW.pdf.
Ramadan, S. (2019). □□□ "□□□□ □□□□□`□□□□□ □□□ □□□□□□□□ □□ □□□□□ □□□□. https://www.elwatannews.com/news/details/4053404.
Flowers, D., Warne, T., & Pyers, C. (1999). *Guide for the development of bicycle facilities*. 86. http://www.azmag.gov/Documents/pdf/cms.resource/PWB-RBTF_2008_Guide-for-Development-of-Bicycle-Facilities83606.pdf.
Forecasting, W. (2019). *Can carpool reduce emissions and congestion in Indian cities?|WRI INDIA*, 1–6. http://www.wri-india.org/blog/can-carpool-reduce-emissions-and-congestion-indian-cities.
Gehl, J. (2011). Life between buildings: Using public space. *Landscape Journal, 8*. https://doi.org/10.3368/lj.8.1.54.
IFC. (2007). *An integrated report*. https://www.openknowledge.worldbank.org/handle/10986/11849.
Images, R. (2015). *Explore Log in*. https://www.pixabay.com/photos/japan-shinagawa-mall-street-trees-828429/.
Cityscape Institute. (2008). Lighting use & design. *PPS.Org*, pp. 1–7. https://www.pps.org/article/streetlights.
Jang, Y. (2014). CityNet blog global warming from a Korean perspective. https://www.citynetmembers.wordpress.com/2014/01/14/global-warming-from-a-korean-perspective/.
Kheir-El-Din, H., El Ehwany, N., Ragab, A., & Fouad, H. (2012). Roads and highways in Egypt: Reform for enhancing efficiency. *Toward More Efficient Services in Egypt Reforming Tourism, Construction, Information Technology, Wholesale and Retail, Roads, and Banking Services, 152*, 217–254. https://doi.org/10.5743/cairo/9789774164941.003.0007
Linton, J. O. E., Street, S., Street, S., Angeles, D. L., Avenue, C. C., & Angeles, L. (2020). Los Angeles eco-village reinventing how we live in the city beautiful new buffered green bike lane on spring street. https://www.laecovillage.wordpress.com/.
Paula Maneola. (2015). Os 8 princípios da calçada. https://www.wribrasil.org.br/pt/blog/2015/04/os-8-principios-da-calcada.
Mathew, T. V., & Bombay, I. (2014). Transportation systems engineering: accidents studies. *Transportation Systems Engineering*, 1–28. https://nptel.ac.in/courses/105101008/downloads/cete_42.pdf.
McCutchan, S. (2013). How Wide Should a Neighborhood Street Be? – Part 1. *Planning Commissioners & PlannersWeb.Com*, *September*, 1–3. Retrieved from http://plannersweb.com/2013/09/wide-neighborhood-street-part-1/
NACTO. (2013). Street design elements. *Urban Street Design Guide*, *Island Pre* (New York) (pp. 31–70). https://doi.org/10.5822/978-1-61091-534-2_2.
Namee, S., & Witchayangkoon, B. (2011). Crossroads vertical speed control devices: Suggestion from observation. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 2*(2), 161–171.
Newman, N. (2020). How can I find a list of companies that make bus shelters? https://www.quora.com/How-can-I-find-a-list-of-companies-that-make-bus-shelters.
Newton, D. (2012). Add a green buffered bike lane and number of cyclists explode—Streetsblog Los Angeles. http://www.la.streetsblog.org/2012/05/11/add-a-green-buffered-bike-lane-and-number-of-cyclists-explode/.
Of, A., & Parking, M. C. A. R. (2019). Multi-storey car parking system —Project.
Offer, O. U. R., Implementations, P., Company, W., Parking, S., & European, T. (2019). *Smart parking systems*. http://www.smartparking-systems.com/.
Officials, C. T. (2019). *Lane width* (pp. 1–11).
Roberts, J. (2020). Better block. http://www.visitfinland.com/about-us/.
Rosen, A. (2013). What really causes traffic congestion? https://www.bklyner.com/what-really-causes-traffic-congestion-sheepshead-bay/.
Rudofsky, B. (1969). Streets for people: A primer for Americans. https://www.books.google.com.eg/books?id=2uJUAAAAMAAJ.
SFPD. (2010). *San Francisco better streets plan*. https://www.sfplanning.org/sites/default/files/archives/BetterStreets/docs/Guide_to_BSP.pdf.
Smith, A., Zucker, S., Ladó-Farrulla, M., Friedman, J., Guidry, C., McGrew, P., & Duchesne, J. (2019). Bicycle lanes. *Journal of Trauma and Acute Care Surgery, 87*(1), 76–81. https://doi.org/10.1097/ta.0000000000002328
Solutions, R. P. (2020). *Commercial and residential parking solutions rotary display system automated multi parking lifts speedy automated parking rotary carousel parking lift and slide puzzle parking parkmatic provides automated and mechanical click for digital catalog free Quot* (pp. 3–5).
Street, A. (2020). Addressing street and front yard tree issues in cities. https://www.goodnewstree.com/2019/08/29/addressing-street-and-front-yard-tree-issues-in-cities/.
SUDS-RP-UD, A. (2012). Design of on-street transit stops and access from surrounding areas. *APTA Sustainability and Urban Design*

Program. http://www.citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.278.4944&rep=rep1&type=pdf.

Tobergte, D. R., & Curtis, S. (2013). Streets as public spaces and drivers of urban prosperity. *UN habitat* (pp. 1–152). https://doi.org/10.1017/CBO9781107415324.004.

Trulia. (2014). 12 Things that make a neighborhood truly great. *Forbes*, 1–5. https://www.forbes.com/sites/trulia/2014/11/29/12-things-that-make-a-neighborhood-truly-great/#25d3d1735f6a.

Weber, H., & Sciubba, J. D. (2018). the effect of population growth on the environment: Evidence from European regions. *European Journal of Population = Revue Europeenne de Demographie*, *35* (2), 379–402. https://doi.org/10.1007/s10680-018-9486-0.

Wisconsin Department of Transportation. (2009). *Wisconsin bicycle facility design handbook*.