CAIRO BUS RAPID TRANSIT PROJECT

Corridor access audit

Institute for Transportation and Development Policy

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Contents

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1. Introduction

Greater Cairo is a sprawling metropolis known for its daunting traffic jams. A lack of sufficient rapid transit options and rapidly increasing ownership of private cars leads to daily traffic snarls on the many wide roads that criss-cross the metropolitan area. Responding to these issues, the New Urban Communities Authority (NUCA), in partnership with the United Nations Human Settlements Programme (UN-Habitat), the United Nations Entity for Gender Equality and the Empowerment of Women (UN Women), and Institute for Transportation and Development Policy (ITDP), is planning a bus rapid transit (BRT) system in Greater Cairo. In the initial phase, the BRT network aims to provide improved connectivity between the New Communities of New Cairo and 6th of October City and central Cairo and Giza (Figure 1).

Besides transforming public transport service, the BRT project has the potential to achieve a dramatic improvement in conditions for pedestrians and cyclists. Since many BRT passengers will arrive on foot, corridor designs should promote safe access for non-motorised transport (NMT) users. In particular, corridors require footpaths that are unobstructed, continuous, shaded, and well lit. BRT corridors also require high-quality facilities for cyclists. This report assesses the existing street conditions for NMT users across six key locations along the eastern and western BRT corridors.

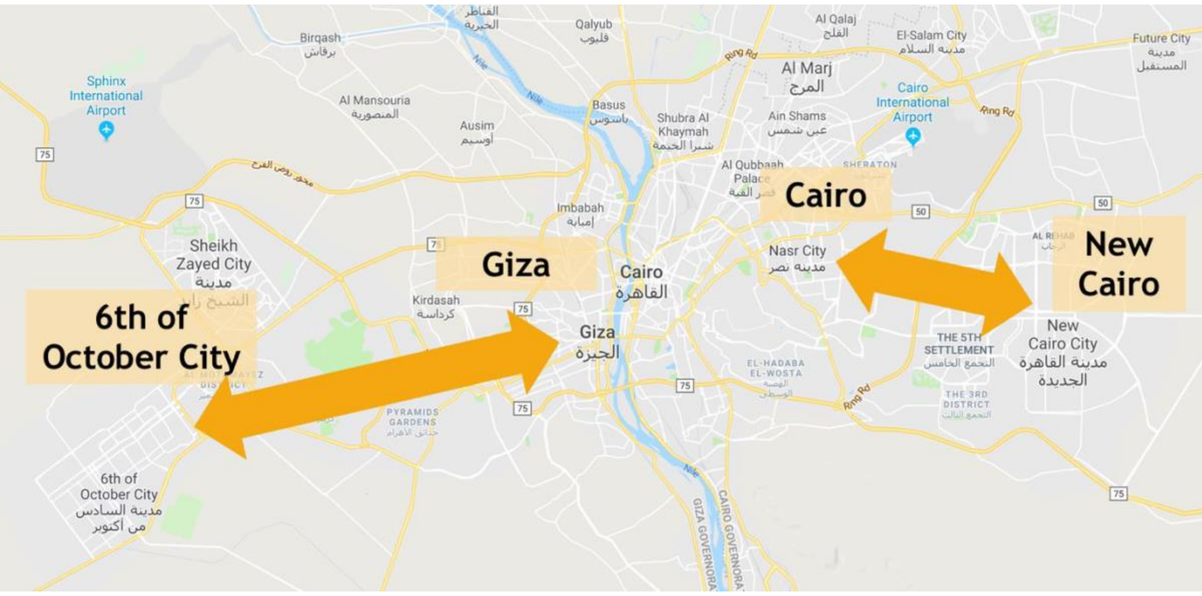

Figure 1. The Cairo BRT study is examining the feasibility of corridors connecting 6th of October City to Giza and New Cairo to central Cairo.

2. Elements of a high-quality walking and cycling environment

Well-designed station access can ensure that a BRT system can be used by everyone, including persons with disabilities. An accessible environment has ample, well connected pedestrian facilities with unobstructed space for movement, consistent pavement surfaces, appropriately sloped ramps, and safe pedestrian crossings. Multiple elements of the streetscape must be designed in an integrated manner in order for the space to work. Beyond the streetscape, buildings oriented to the street can help create a safer environment for pedestrians. In addition, fine-grained pedestrian networks can help reduce the time needed for pedestrians to access BRT stations.

2.1 Street design

Too often, streets are designed from the centre-line outwards without taking the needs of all users into account. After the median is marked and the carriageway is constructed and after parking takes over the kerbside, pedestrians, trees, utilities, street vending, and social activities have to compete for the little remaining space. The lack of proper infrastructure forces people to walk on the carriageway. This arrangement reduces the available space for vehicles, and is therefore inconvenient for everyone, including motor-vehicle users. Therefore, it is in everyone's best interest to develop balanced and demand-led street designs that serve all modes of transport.

Making NMT modes viable and convenient requires rebalancing street space so that it caters to all modes of transport. Accommodating NMT involves two basic techniques:

- **Systematic traffic calming on smaller streets** to provide safe places for the mixing of pedestrians and other modes (shared lanes); and,
- **Pedestrian and cycle infrastructure that is physically separated from motor vehicle traffic on larger streets.** Pedestrian footpaths should provide clear space for walking, with other elements positioned in a strategic manner. These elements include paving, landscape planting, street lighting, street furniture, public facilities, underground utility access points, and other sidewalk amenities. There are also features that make streets more accessible, including curb ramps, tactile paving, and accessible traffic signs. Safe crossings should be provided at regular intervals. Similarly, dedicated cycle tracks should be provided, separate from the mixed traffic carriageway.

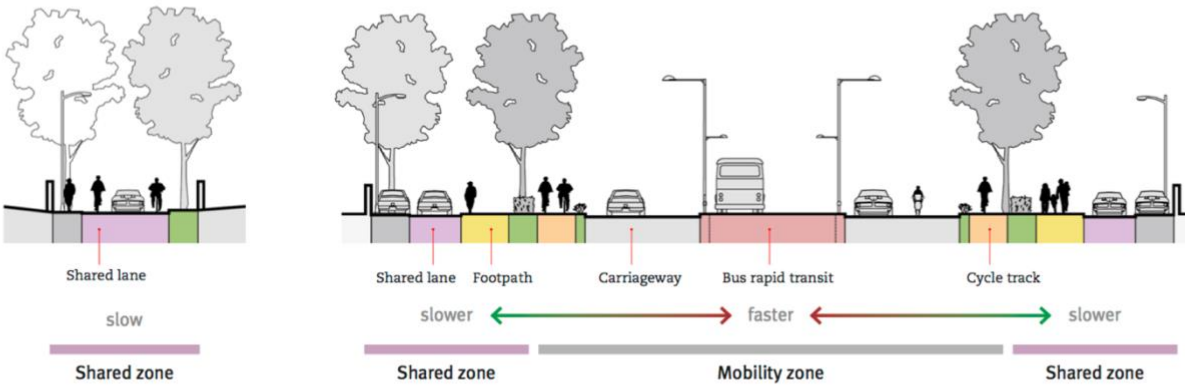

Figure 2. Smaller streets can function as shared spaces where pedestrians walk together with slow-moving vehicles (left). On larger streets with heavy vehicles and faster speeds, separate space for pedestrians and cycles is needed (right).

Footpaths need to be unobstructed, continuous, shaded, and well lit. Footpaths should consist of three zones (Figure 3):

- The **frontage zone** provides a buffer between street-side activities and the pedestrian zone and should be 0.5 to 1 m wide.

- The **pedestrian zone** provides continuous space for walking. The pedestrian zone should be clear of any obstructions, level differences, or other obstacles to pedestrian movement and should have a clear width of at least 2 m.
- The **furniture zone** offers space for landscaping, furniture, lights, bus stops, signs, and private property access ramps.

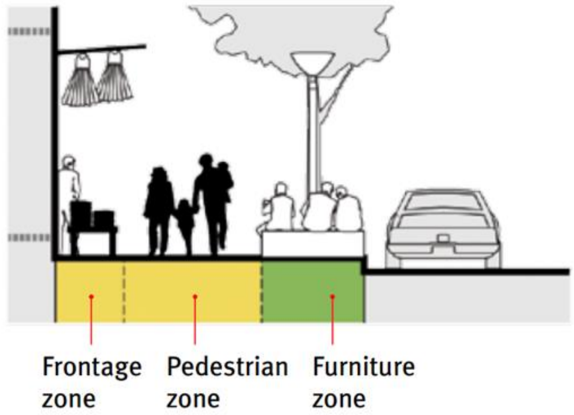

Figure 3. All streets need to have safe and accessible spaces for pedestrians incorporating three main zones: the frontage zone, pedestrian zone, and furniture zone.

Crossings and junctions are also essential components of a well-connected street network. When properly designed, crossings and junctions allow pedestrians, cyclists, and other NMT users to cross busy streets safely and conveniently. Many cities have sought to increase vehicle speeds by erecting barriers at junctions to prevent pedestrians and cyclists from crossing at-grade. NMT users are thereby forced to use foot overpasses or underpasses, which are inconvenient and potentially unsafe with regard to sexual assault and general crimes. When provided, such facilities are poorly lit and often devoid of users. Instead of providing grade-separated facilities, a more viable approach is to create safe at-grade crossings that are accessible to all. At crossing points where multiple vehicle users interact, it is important to reduce vehicle speeds to safe levels (e.g. below 15 km/h).


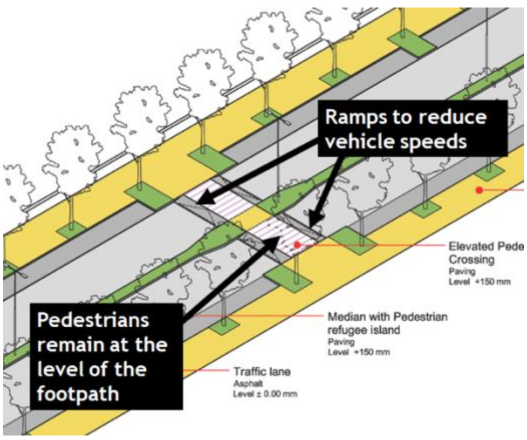

Figure 4. High quality pedestrian crossings, such as a crossing at a BRT station in Dar es Salaam, reduce the speed of motor vehicles through tabletop crossings and other physical elements. The crossing is at the same level as the adjacent footpath to ensure universal access.

2.2 Building design

The built environment surrounding pedestrian routes must be conducive to walking. Walking is safer and more enjoyable when sidewalks are populated, animated, and lined with useful ground-floor activities and services such as storefronts and restaurants. In turn, being closer to passing pedestrians and cyclists increases the exposure and vitality of local retail. Architectural design elements such as building setbacks, the ratio of building height to street width, and the articulation and permeability of building street wall (e.g., the number of doors and windows) have a major impact on the quality and safety of pedestrian spaces. Blank compound walls isolate the street from private uses and contribute to unsafe conditions for pedestrians. Building control regulations can help ensure that private developments contribute to the public realm rather than functioning as isolated islands of activity.

Figure 5. Windows and building entrances contribute to a safe and attractive pedestrian environment. Buildings that combine commercial and residential uses help to activate the pedestrian realm at different times of the day.

2.3 Network design

There are many types of urban road networks. However, the key to mobility for NMT users is a high ratio of intersection nodes to road links so that streets and pathways are well connected. The maximum recommended block size for people friendly streets is 100 m.[1] Prioritised connectivity creates finer grained networks for walking, including pedestrian-only streets. A fine-grained walking and cycling network helps to reduce trip distances and improves access to public transport.

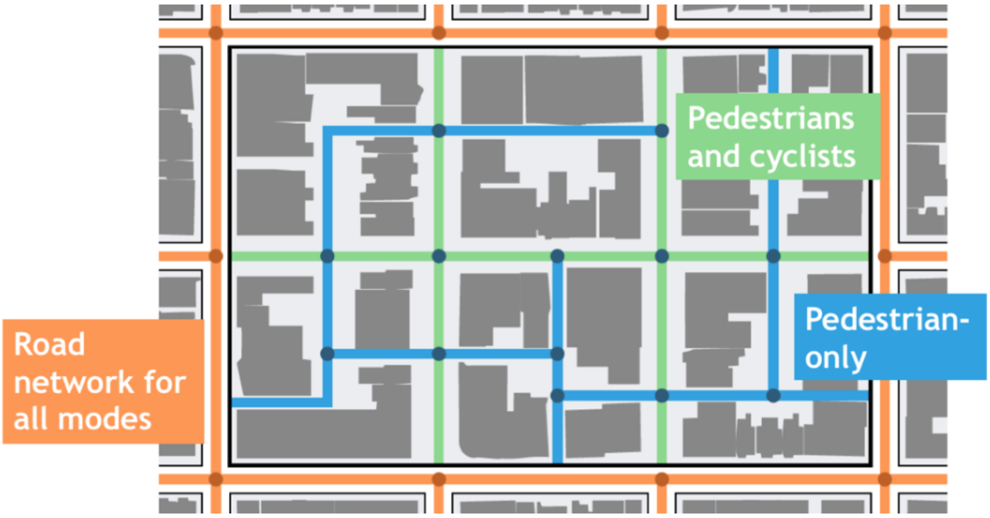

Figure 6. A fine-grained network of streets improves access for NMT users. The blue and green lines indicate the network for pedestrians and/or cyclists, providing direct access to the core of each block. The orange lines indicate streets with vehicle access.

3. Assessing the NMT environment in Cairo

Key to developing an effective NMT strategy is having an in-depth understanding of the existing walking and cycling environment, and the extent to which it provides safe, convenient access for NMT users. To develop this understanding in Cairo, a detailed survey was conducted focusing on the three themes discussed above: street design, building design, and network design. The following section outlines the survey methodology, locations, and findings.

Daytime and night time surveys were conducted at six representative study areas along the East and West BRT corridors in Cairo (Figure 7). The areas were selected to capture areas with high pedestrian flows and a variety of typologies with respect to road sizes, street network types, and land use typologies. Each study area has a size of 0.3-0.6 sq. km, equivalent to 7 to 8 km of street length. A description of each area is provided in Table 1.

[1] Institute for Transportation and Development Policy. (2017). The TOD Standard. Retrieved from https://www.itdp.org/tod-standard/

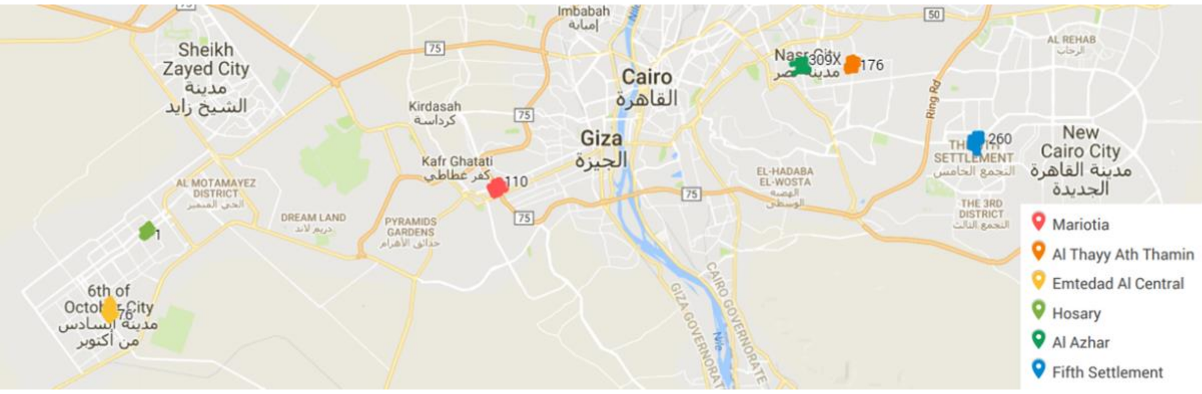

Figure 7. The study areas for the NMT survey.

Table 1. Study area descriptions.

Fifth Settlement, New Cairo The survey location is located along the South Teseen Road, a major commercial artery in the new urban community of New Cairo City. It incorporates both residential uses south of S Teseen and business uses to the north.	

<table>
<tr>
<td>Mostafa El Nahaas, Al Hayy Ath Thamin, Nasr City
Mostafa El Nahaas Street is one of the longest streets in Nasr City. It is known for its retail activity and dense residential zones on both sides of the street.</td>
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<tr>
<td>Al Azhar, Nasr City
Al-Azhar University, a chief centre of Islamic and Arabic learning, is located in the study area, drawing large volumes of pedestrians and public transport users. East of the campus is a dense residential zone.</td>
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<tr>
<td>Mariotia, Giza
The study area captures a dense residential zone along Faisal Street in Giza. The study area includes retail uses along the main roads.</td>
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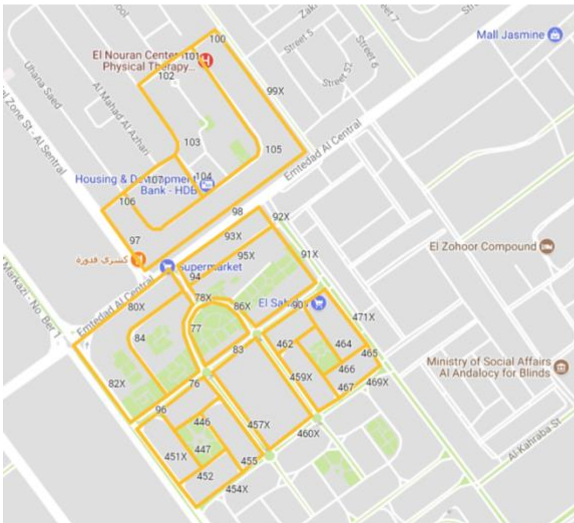
Hosary, 6th of October The Hosary area includes a mix of residential and retail uses across Al Mehwar Al Markazi Street. Hosary Mosque, which is captured in the study area, is the largest mosque in 6th of October City. The surrounding area incorporates many universities, institutes, and company offices.	
Emtedad Al Central, Industrial Area, 6th of October The surveyed area is located toward the end of the western BRT corridor and includes both residential and market areas.	

The daytime walking survey involved observing the existing environment during peak commuting periods and feeding the findings into a smartphone survey application known as Device Magic.[2] The application is a convenient tool to record and geo-locate the collected data. The majority of the walking survey data were collected in this manner, except for street right-of-way and block length, which were ascertained from satellite imagery sources such as Google Earth and mapping tools such as Open Street Map (OSM).[3] The night time survey was used to assess illumination levels along pedestrian footpaths and crossings at the same six locations as the daytime survey.

The data collection exercise was designed to collect both qualitative and quantitative information relating to the following elements of the pedestrian environment:

- **Street design:** Footpath presence, footpath widths, number and type of obstructions, surface paving conditions, presence of vendors, shade, street furniture, and night time illumination.

2 https://www.devicemagic.com
3 http://www.openstreetmap.org

- **Building design and land use mix:** Number of building entrances.
- **Street network:** Block sizes.

The surveyed street elements and the respective findings are discussed in detail in the following sections.

4. NMT survey findings

4.1 Footpath presence

Al Hayy Ath Thamin, Al Azhar, and Emtedad Al Central have some basic footpaths that provide a comfortable environment for walking and social interaction. However, inconsistent street design practices and building envelopes have resulted in a disjointed network. The position of building façades varies with respect to property edges, resulting in a staggered alignment of footpaths. While some individual sections of footpath may be well designed—having pedestrian, zones separated from furniture zones—these sections do not line up with one another and pedestrians are compelled to shift back and forth from one section to the next. Footpath heights also vary widely, forcing pedestrians to climb up and down several steps even within a single block. The usable width of footpaths in the surveyed areas is often around 1 m—well below the clear width required to accommodate the volume of pedestrian traffic found in the city. This forces many pedestrians into the carriageway. Footpaths should have at least 2 m of clear width in all cases and 3 to 5 m on busier streets.

Figure 8. New Cairo (Left) and Emtedad Al Central (Right) have some footpaths with ample clear space for walking.

Several stretches of footpath have been developed by adjacent properties as part of redevelopment projects. Yet in the absence of standard guidelines, each footpath has a unique level, width, surface treatment, and arrangement of street furniture elements. Some newer developments have neglected the need for pedestrian space altogether, instead creating extensive setback parking that forces pedestrians to walk in the carriageway.

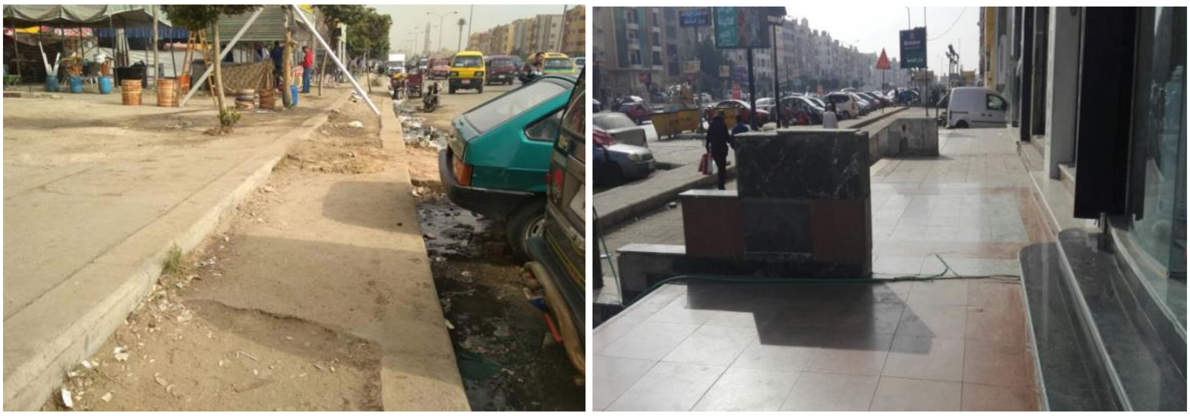


Figure 9. A lack of consistent design guidelines has resulted in frequent height differences, forcing pedestrians to walk in the carriageway: Emtedad Al Central (left) and Hosary (right).

In other areas, footpaths are poorly designed, thereby compromising usability. For example, the existence of trees in the middle of a wide footpath—rather than in a consistent furniture zone on the side—blocks pedestrian movement. Cleaning and proper maintenance are also key factors in having a continuous accessible footpath. Even in newly developing areas such as New Cairo, a lack of maintenance results in a poor-quality pedestrian environment.

Figure 10. Trees positioned in the middle of footpath reduce clear space available for pedestrians: Al Azhar (left) and Hosary (right).

Figure 11. Street utilities, such as electricity poles, traffic signs, and plantation pots in the Hosary area are placed randomly, forcing pedestrians to do navigate around the objects.

Figure 12. Poorly maintained footpaths: New Cairo (left) and Al Azhar (right).

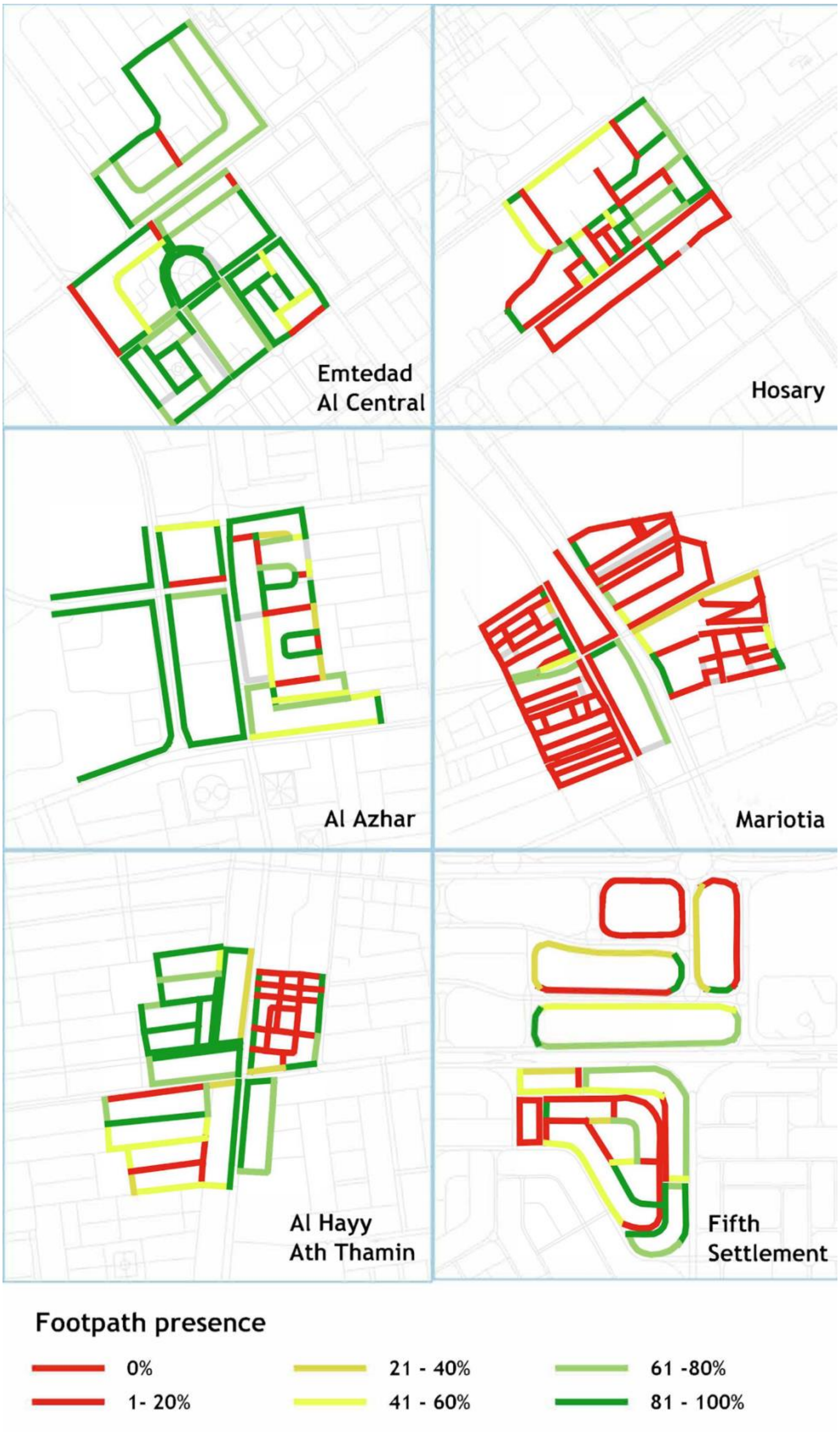


Figure 13. Footpath presence.

Figure 14. Effective footpath width.

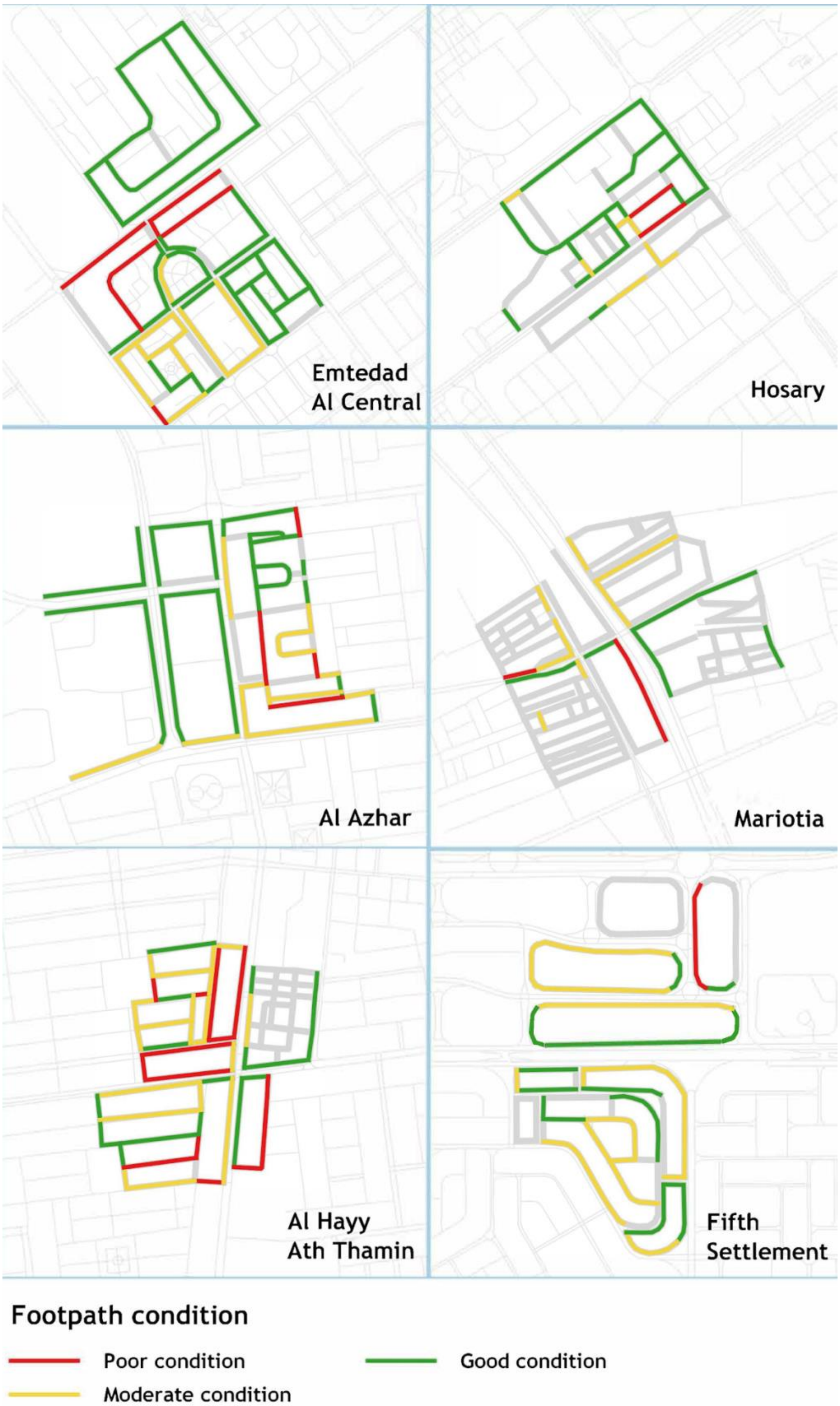


Figure 15. Footpath condition.

4.2 Pedestrian crossings

Intersections and midblock locations along major arterials must provide direct, intuitive pedestrian crossings. Designated crossings should reflect pedestrian desire lines, avoiding detours. Crossing distances should be minimised, and pedestrian refuges are required to give pedestrians a safe space to wait before crossing successive streams of traffic. Pedestrian refuge islands must also be provided in medians. The refuges should be large enough to handle observed pedestrian volumes.

At present, Mehwar Markazi, Industrial Rd, Faisal St, Mostafa El Nahaas, and S Teseen lack formal pedestrian crossings. Crossings are sometimes indicated with zebra markings, but they rarely feature other protective elements such as refuge islands, signage traffic calming, or traffic signals. Intersections typically have wide turning radii, which encourage higher vehicle speeds and create longer crossing distances for pedestrians. Traffic calming measures are scarce. The few speed bumps that were identified were found to be unmarked, impairing visibility, particularly at night, and more importantly, their locations are not aligned with pedestrian crossing points.

Figure 16. At several locations, pedestrians are forced to navigate wide crossings that lack signals and traffic calming.

Figure 17. Roads and intersections without formal crossing facilities: New Cairo (left) and Al Hayy Ath Thamin (right).

Figure 18. In spite of the presence of a busy median busway, Mostafa El Nahaas in Al Hayy Ath Thamin lacks formal crossing locations and has long stretches of fencing that restrict pedestrian mobility.

4.3 Shade

Continuous shade from street trees or tall buildings reduces the street temperature, making it comfortable for people to walk, cycle, or gather for social activities, even during summer afternoons. This is especially important in cities with a humid climate or harsh daytime sun.

Given Cairo's hot summer climate, shade is critical to pedestrian comfort. Unfortunately, most of the study areas lack continuous shade. For new communities like 6th of October and New Cairo where buildings are more spread out, there is no adequate source of shade. In dense areas with tall buildings and narrow streets such as Mariotia and Al Hayy Ath Thamin, buildings provide some shade.

Figure 19. A lack of shade in Fifth Settlement, New Cairo, (left) and Hosary, 6th of October City (right) contributes to a poor quality walking environment.

Figure 20. In areas with narrow streets and tall buildings, buildings contribute to a shaded walking environment: Al Hayy Ath Thamin (left) and Mariotia (right).

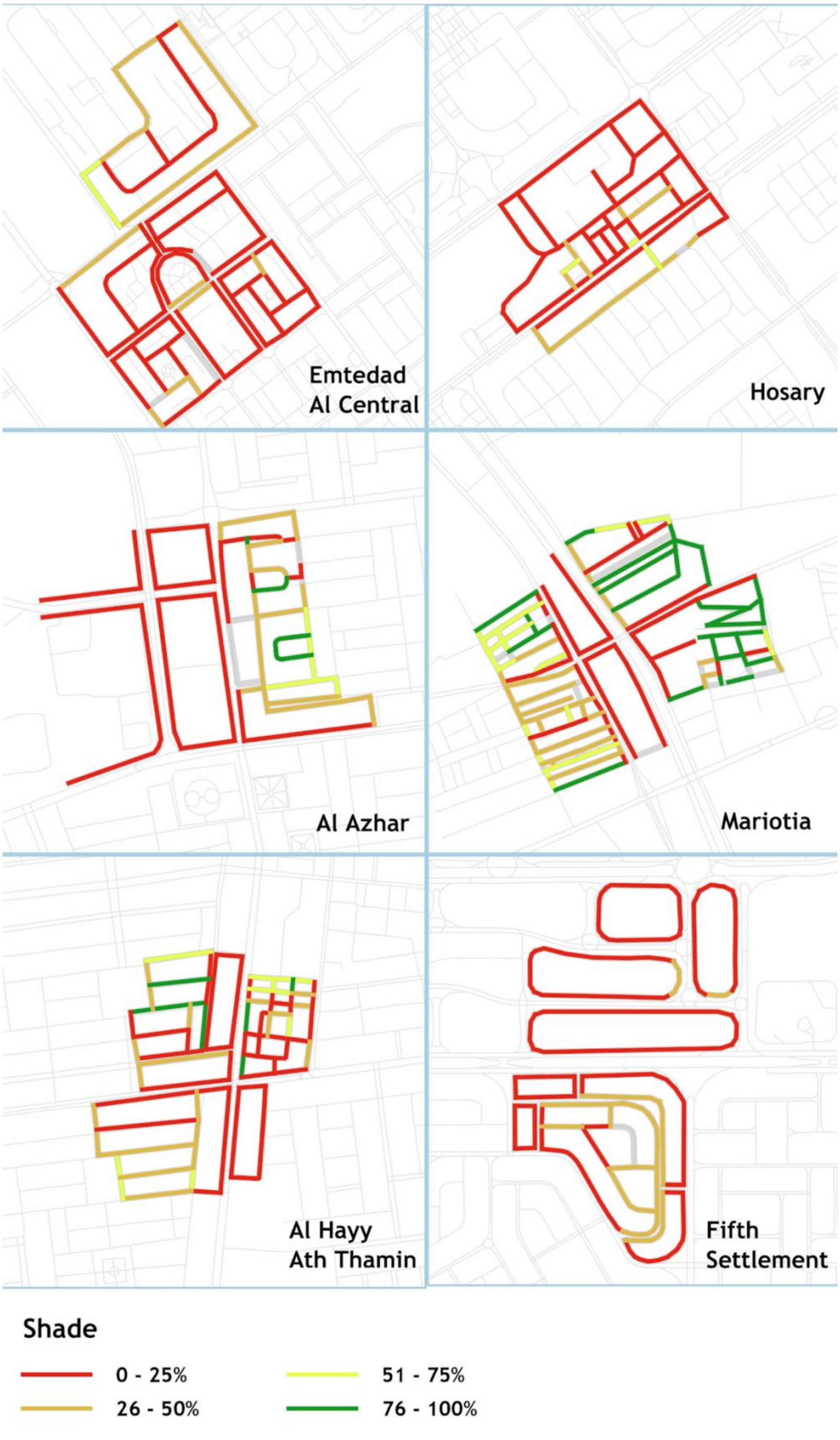


Figure 21. Availability of shade.

4.4 Street furniture

The survey assessed the design of the physical environment and quality of facilities that enhance pedestrian comfort and encourage street activity. This involved evaluating the presence and placement of street furniture, including seating, transit shelters, bollards, and bike racks. The survey noted that there is scarcity of street furniture. While some furniture exists, it is neglected and worn down. Critical pieces of street furniture were found lacking, including benches, rubbish bins, water points, and public toilets.

Figure 22. Recently installed bus shelters in Al Hayy Ath Thamin have a large step, compromising access for persons with disabilities (left). In the new communities like 6th of October City (right), shelters are often absent.

Figure 23. Most formal furniture is in a neglected state, so provision of street furniture tends to be informal: Hosary (left) and Mariotia (right).

4.5 Street vending

Street vending provides essential goods and services to a wide range of population groups. It also makes public space safer by contributing "eyes on the street," particularly on streets lined with compound walls. If designed properly, vending can be accommodated in the streetscape without interfering with other uses. The furniture zone of the footpath or a bulbout in the parking lane are ideal locations for vending.

Where good footpaths exist, they are often designed without provisions for vending, resulting in limited space for pedestrians. Vendors tend to be attracted to spaces under trees or close to bus stops. Vendors also prefer spots that are visible to passers-by. Street vending is not spread uniformly across the city—it is concentrated at main roads such as Al Mehwar Al Markazi (Hosary) and Mostafa El Nahaas (Al Hayy Ath Thamin). Adequate provisions for vending in these locations can improve the usability of footpaths while enhancing safety and convenience for pedestrians.

Figure 24. Many existing footpaths do not have planned vending spaces: Mariotia (left) and Al Azhar (right).

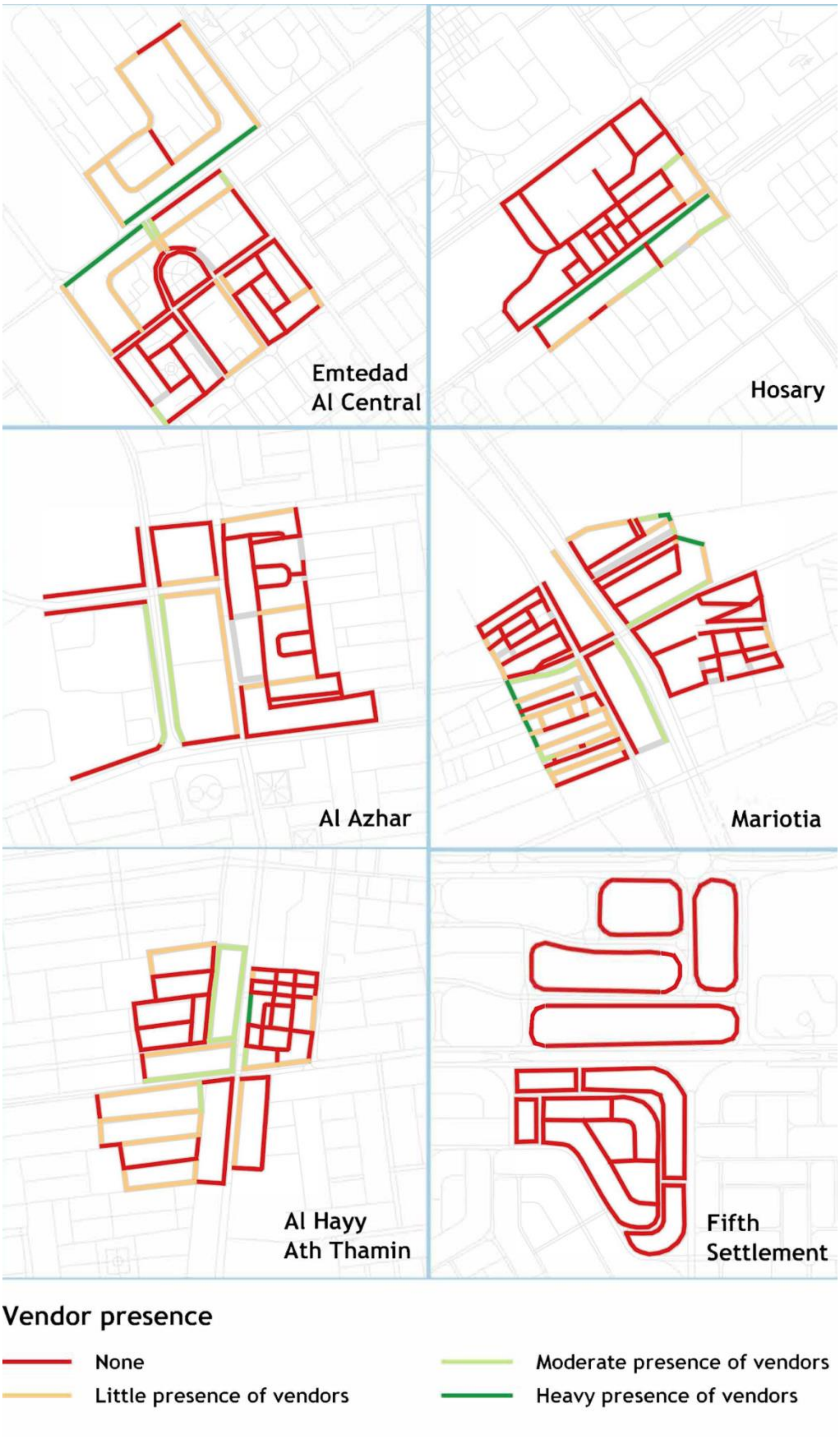


Figure 25. Vendor presence

4.6 Pedestrian activity

A mix of complementary land uses—such as residences, workplaces, and shops—reduces trip distances, thereby making it possible to complete trips by foot or bicycle. Different uses have different peak hours, so a variety of activities keep local streets active at various times of the day. This is vital for ensuring personal security.

Figure 26. Single-use developments limit pedestrian activity and increase the distances that people need to travel to reach shops and places of employment: Emtedad Al Central

Figure 27. A mix of land uses contributes to an active walking and cycling environment at all times of the day: Mariotia.

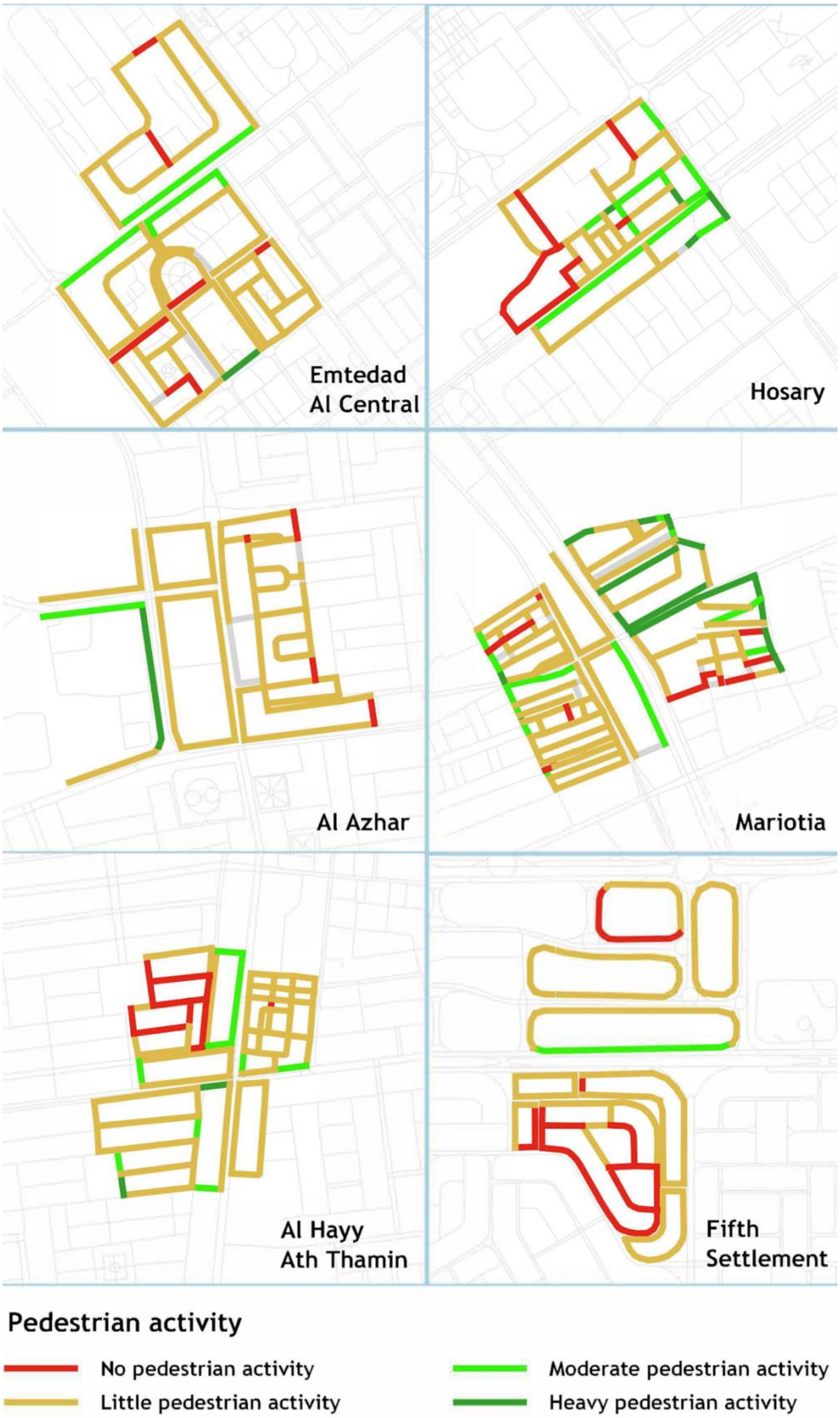


Figure 28. Pedestrian activity.

4.7 Gender balance among street users

In reality, women and men have different perceptions of security. Thus, street and building designs need to respond to these differences. Women's sense of security and safety increases in places where adequate lighting, existence of shops and high pedestrian activity are present. Higher levels of insecurity usually occur in the evening and at night. As a result, women's mobility is restricted to certain hours of the day, and women have earlier curfews during the winter when the sun sets earlier than in summer days. In addition, both shops and residences with a visual connection between private and public spaces are considered to improve security for users; especially for women. While parts of Cairo have good visual permeability, some areas are characterised by blocks surrounded by compound walls, thereby preventing passive surveillance of public spaces.

Figure 29. Buildings with activities on the ground floor contribute to a secure, vibrant walking environment: Mariotia (left). Compound walls, on the other hand, contribute to a feeling of insecurity: Al Azhar (right).

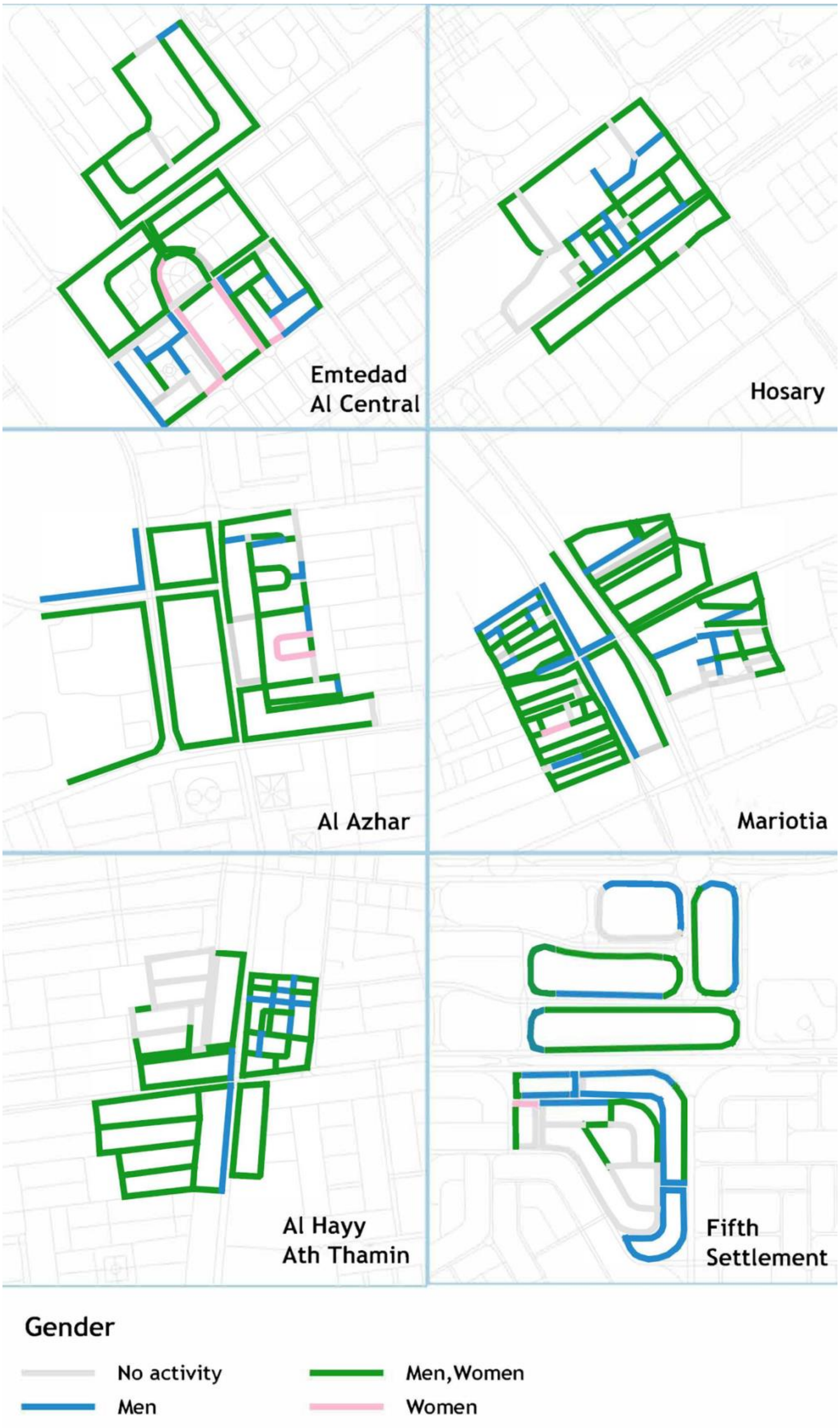


Figure 30. Gender balance among street users.

4.8 Building design

Ample visual connection to building interiors is present in most of the study areas, thereby creating a secure, friendly atmosphere for pedestrians. However, in an area such as Fifth Settlement, building design detracts from the walking environment as pedestrians are greeted by uninviting compound walls and office building gates. A lack of active frontage, both on major arterial streets and on smaller residential lanes, compromises pedestrian safety. Active frontages create an eyes-on-the-street effect where the presence of shop owners and other individuals keep an eye out on pedestrians and help ensure that they are secure as they walk through a neighbourhood. Compound walls, security gates, and large setbacks do not contribute to promoting the perception of an attractive and secure walking environment.

Figure 31. Comfortable walking environments are often found near buildings that combine residential and commercial uses, where frequent building entrances and a softer boundary between public and private spaces is present.

Figure 32. Compound walls and office building gates make streets unattractive for walking, even if good infrastructure exists: Fifth Settlement (Left) and Al Azhar (Right).

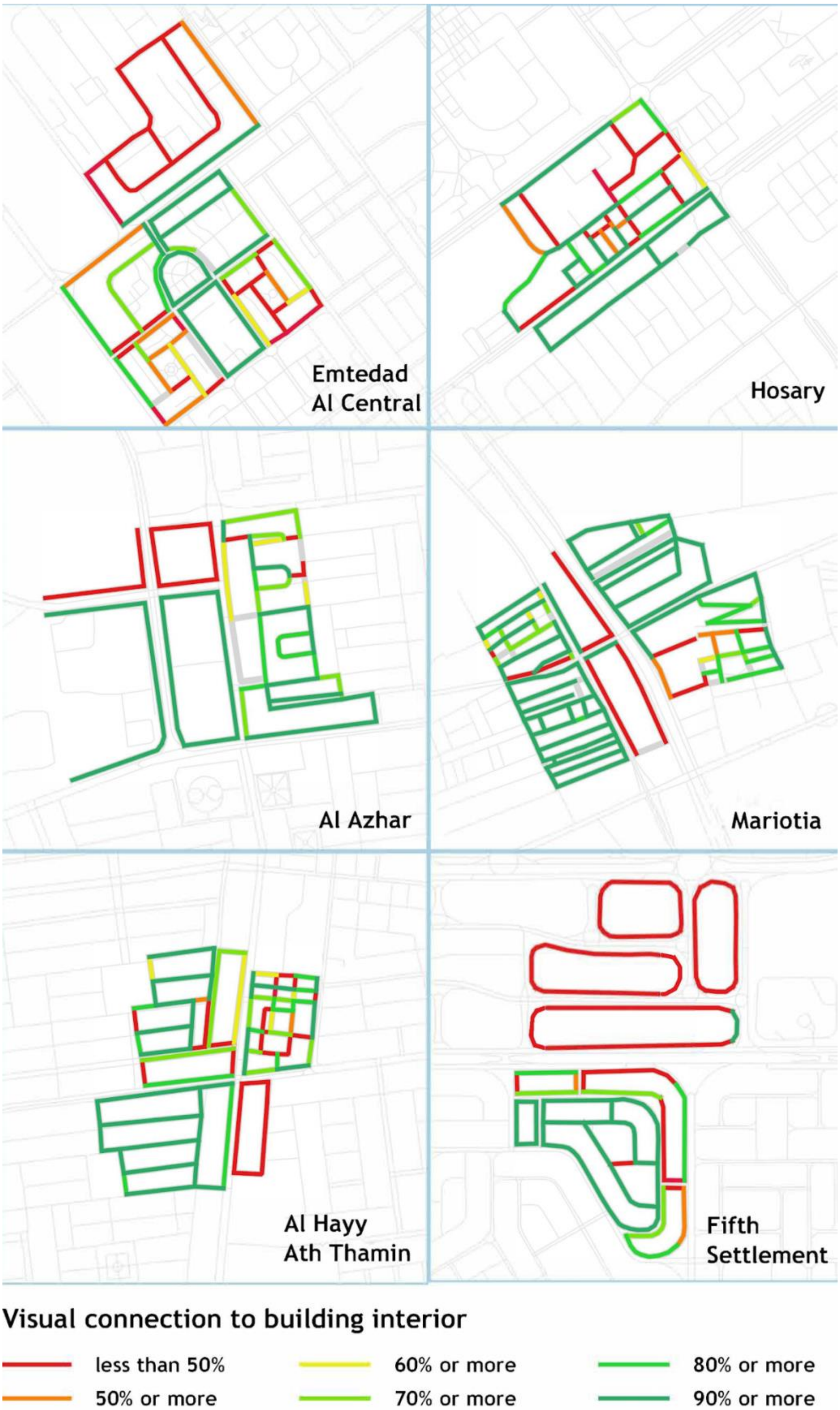


Figure 33. Visual connection to building interior.

4.9 Street network and block size

Long block lengths are observed in most of the study areas. For example, some of the blocks surveyed in Fifth Settlement are as long as 500 to 600 m—compared to the maximum recommended block size for people friendly streets of 100 m. An interconnected pedestrian network, whether organised as a grid or a more loosely formed spider web, provides more convenient and direct routes to destinations with minimum detour distance, and helps in reducing travel distance.

Thus, shorter block lengths would create a more welcoming pedestrian experience and encourage walking in these neighbourhoods. Currently, pedestrians must take circuitous paths through these areas. In some cases, informal connections already exist but lack lighting or paving. These connections could be strengthened through a local area physical planning process.

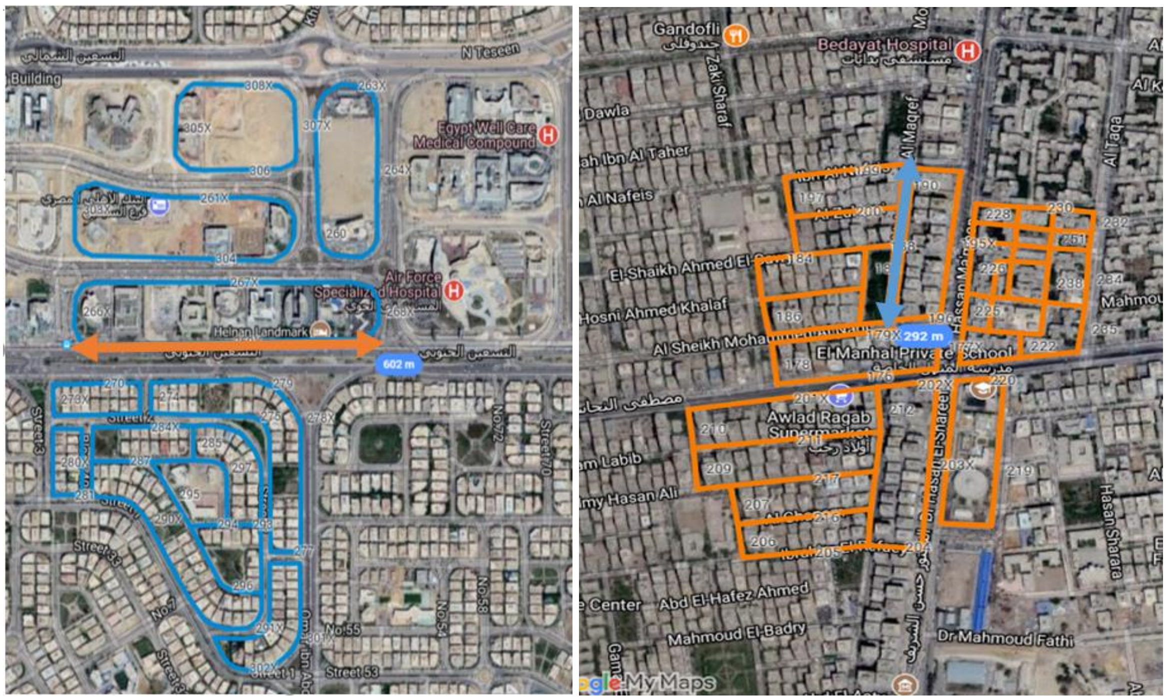


Figure 34. Blocks as long as 600 m are found along S Teseen in New Cairo (left). Even in denser areas like Al Hayy Ath Thamin, block lengths of up to 300 m hinder pedestrian connectivity (left).

Figure 35. In some cases, informal connections exist but lack proper lighting and paving: a bus terminal on an open plot in the Fifth Settlement creates a connection between two blocks.

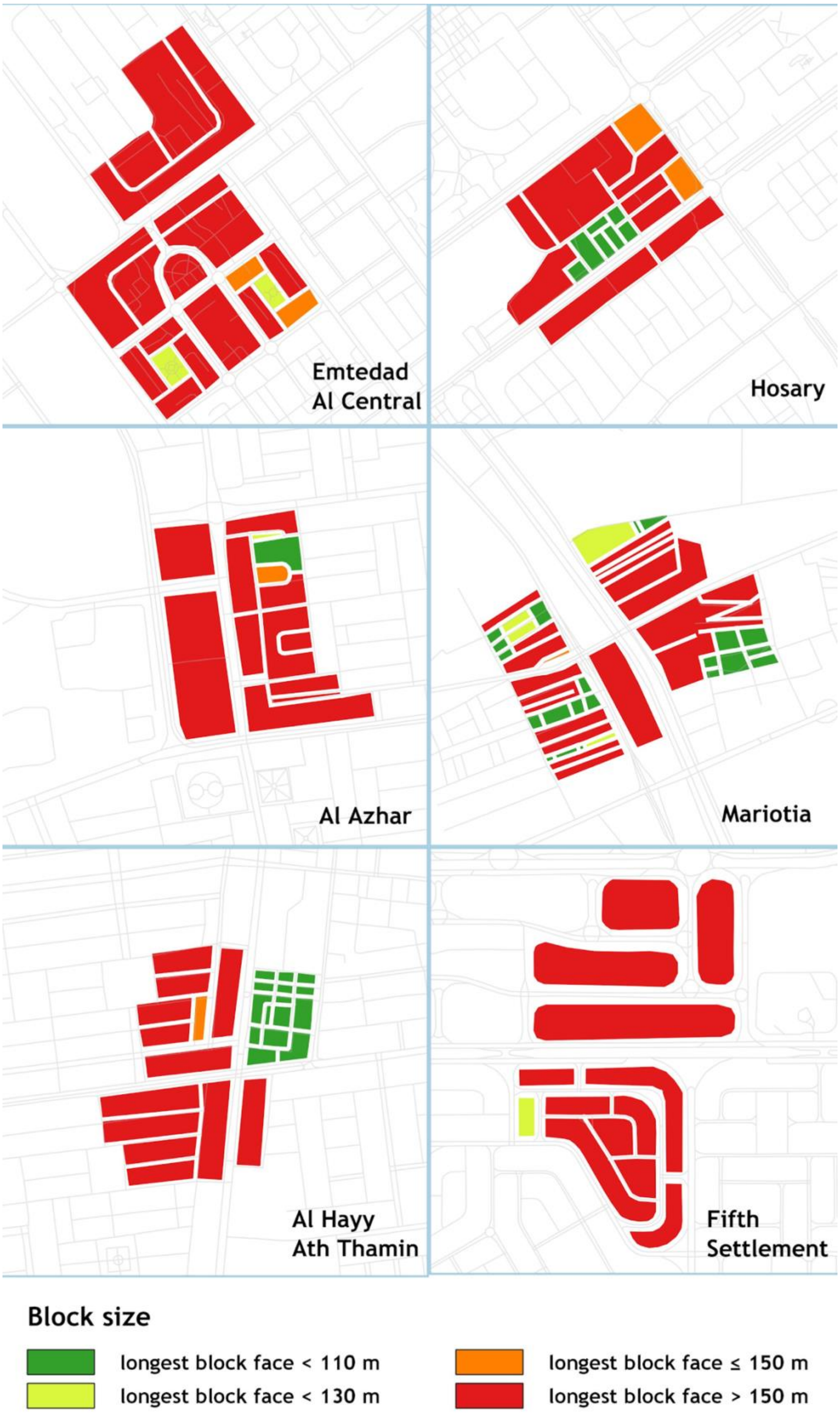


Figure 36. Block size.

4.10 Cycle facilities

Dedicated cycle facilities can improve safety and convenience for cyclists on city streets. Such cycle infrastructure can take the form of physically separated cycle tracks or traffic calming measures to reduce motor vehicle speeds. In the six study areas, no dedicated cycle facilities were observed. Instead, cyclists are forced to ride in mixed traffic, close to fast-moving vehicles.

Some cycle lanes exist near the Mostafa El Nahaas study area, along El Moshir Mohamed Aly Fahmy in Nasr City (Figure 37). Inspection of the cycle lanes revealed several design flaws. The cycle lanes are built at the lowest point in the carriageway, resulting in the accumulation of dirt and debris. While the lanes are delineated with rubber separators, the separators are too low to prevent encroachments by parked vehicles. Finally, the cycle tracks are not resolved at intersections, leading to unsafe interactions between vehicles and cyclists. The design of cycle tracks along the BRT corridors should consider the lessons learned to ensure that future facilities are usable and free from encroachment.

Figure 37: Cycle lane in Nasr City.

5. Conclusion

Cairo has a strong urban core with a well-connected grid. As the city grows, the city must develop design standards, institutional mechanisms, and creative sources of infrastructure funding to ensure that best practices are implemented citywide. In the initial phase, the BRT network aims to provide improved connectivity between the New Community of 6th of October City and central Giza. The project has the potential to improve accessibility in Greater Cairo by extending the reach of the metro, bus, and paratransit systems. Since access to BRT stations is critical to the success of the system, BRT will develop good NMT facilities along the corridor and consequently developing high-quality perpendicular connections near the stations. The conceptual designs will include NMT elements such as footpaths, pedestrian crossings, and cycle tracks.

The following actions are recommended to establish a better walking and cycling environment in Cairo:

- **Create a continuous pedestrian realm on all BRT corridors.** Corridor designs should incorporate wide, shaded footpaths with adequate clear width for expected pedestrian volumes. To cross the corridor, safe at-grade crossing should be provided at regular intervals.

- **Where space is available, BRT corridor designs should include physically separated cycle tracks** in order to make it easier for customers to use cycles as a feeder mode. Dedicated cycle tracks will enhance connectivity and safety for cyclists and to expand the catchment area of BRT stations. In general, cycle tracks should be physically separated from mixed traffic to provide a clearly defined, safe space to travel and should be raised above the level of the carriageway to prevent the accumulation of dirt, trash, and storm water. To ensure a smooth riding surface, cycle tracks should be constructed in concrete or asphalt (not paver blocks).
- **Provide secure cycle parking at major stations and terminals.** Safe cycle access can increase the catchment area of BRT stations. Secure bicycle parking should be provided within the paid area of BRT terminals.
- **Create citywide design standards.** To ensure consistent implementation of the pedestrian facilities, it is essential for agencies responsible for the planning, design, construction, and maintenance of Cairo's streets to adopt a uniform set of street design guidelines. The design guidelines can build on the existing Egyptian Code for Road Design and Traffic, but should offer specific standards for street elements (e.g. footpaths, cycle tracks, bus shelters, street vending, on-street parking, underground utilities, etc.); standard cross sections for different ROWs; and guidelines on intersection design.
- **Manage on-street parking.** The city must rationalise its parking by indicating where drivers are permitted to park and enforcing those rules. Parking must be given a rational price that discourages drivers from leaving their vehicles parked in valuable on-street spaces all day and encourages the use of the BRT system and other forms of public transport. Occupied on-street parking contributes to congestion in central Cairo as drivers circulate until they find an open space. Greater turnover can be encouraged so other drivers are able to find open spaces when they need them. A more robust enforcement system is needed so that drivers do not park on footpaths and cycle tracks.
- **Update development regulations to promote good urban form.** Building control regulations can help ensure that private developments contribute to the public realm, rather than functioning as isolated islands of activity. Building regulations concerning building setbacks, plot coverage, compound walls, and other elements should be reviewed to ensure that they promote a pedestrian friendly environment. In addition, physical plans for street networks should be revised to incorporate a mechanism to reduce block sizes in existing built-up areas and in areas of urban expansion.
- **Identify sustainable sources of financing for street improvements.** Greater Cairo will require new sources of funding to develop a complete walking and cycling network that provides safe access to BRT stations. Vehicle user charges, especially parking fees, are a potential source of revenue, but existing mechanisms for parking fee collection will need to be strengthened to reduce revenue leakage. The city should also explore opportunities for land value capture around the newly developed corridors of the BRT system.

Active design and management of street space can foster a pedestrian environment that is convenient, safe, and accessible to all. The best practices learned while constructing the BRT corridors should be applied to all new roadways, not just those with BRT infrastructure. These steps are vital if Greater Cairo is to develop into a vibrant global city.