

# **Movement Patterns and their impact on the sustainability of urban spaces in Cairo C.B.D**

Presented by :

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## **Abstract:**

The ideas of sustainable development concerning the field " urban planning " with special reference to that of " urban design ", are still subject to amendments and adaptation. Thus, judging these ideas demands years of experimentation and practical observation examining cities and urban settlements on various spots all over the world.

The paper, at first, summarizes the principles of sustainable urban design which have been developed during recent years. Consequently, characteristics of sustainability in urban spaces and their inter -relation with the elements of movement network shall be deducted.

Then, an analysis of the existing situation in Cairo C . B . D (characteristics of sustainability in urban spaces and their inter -relation with the elements of movement network) will be conducted through an analogous approach according to the theoretical reflections debated in the first part.

The paper will determine each element in the movement network in Cairo C.B.D (roads, viaducts, tunnels, public transports, vehicles, pedestrian) and its role in the sustainability of urban spaces.

## **1- Principles of Sustainable Urban Design**

Theories elaborated in this field can be summed up in the following main points:

- 1.1** Achieving the most possible **self-sufficiency** for any urban project. In other words, accomplishing the widest range of activities together with elements of urban design (buildings and their uses - roads - spaces - means of movement - etc... ). This must take place in a way that allows the urban project to be comprehensive and independent from its surrounding environment in order to prevent any negative interactions.
- 1.2** Satisfying the various **human needs** since the social and environmental dimensions proceed in parallel pace. Thus, submitting the economic dimension to the demands of the two fore-mentioned dimensions, works in favor of the needed sustainability of any urban project. Hence, the diversified economic levels must be respected through offering the main services and avoiding any unilateral level of economic development.
- 1.3** Planification of **movement network** and means of transportation characterized by their flexibility of use and their **diversity of choices** for their users. A planification which decreases also, as much as possible, energy consumption and pollution rates.
- 1.4** **Preserving natural elements**, land form and adopting a development policy which favors the **rehabilitation** of the existing urban environment instead of its total destruction for any renewal. In addition, maintaining the **historical buildings and urban legacy** is a must to be integrated with the new development.
- 1.5** Planning a **comprehensive network of urban spaces** together with **green and open areas** in order to act in an integrated pattern instead of dealing with every urban space as an independent unit. The infiltration of green spaces into the urban block in a continuous manner is also a means of decreasing pollution and noise.
- 1.6** **Energy strategy** for any project. Thus, the urban design serves in decreasing dependence on non-renewable energy and in making best use of the available sources. This takes place through gathering buildings, controlling their heights, respecting the elements of micro climate, making best use of the present buildings and of local building materials. In parallel, the planification of networks (water, drainage, gas ... ), must take place, in order to minimize lost energy and resources.

## **2- Criteria for sustainability of urban spaces :**

The urban space is one of the elements of urban design, thus matching principles of sustainable development that are related to the elements of movement ( which is our research point ) will be applied to it:

Three main Factors could be advocated:

- 2.1 Diversity within each space
- 2.2 Integrity of spaces
- 2.3 Permeability to each space

## 2.1 Diversity within each space:

Diversity is meant to exploit the possibilities of the space by various types of motorized means, and the pedestrians (moving or still). Diversity is also concerned with the activities exercised within the space and on its borders such as relaxation, recreation and commerce (Figures 1,2,3) Diversification of uses is also possible (sun and shade, day and night) or as the time goes on diversity of activities becomes possible for the space and the buildings overlooking it that are characterized by their robustness. Their norms of depth, height, and positions of entrances (Figure 4) must be flexible and allow possible changes of activities (offices, houses, hotels, commercial activities...). This leads to more flexibility and efficiency in using outside spaces.



Figure (1): Diversity of activities, within the same space



Figure (2): Diversity of means of movement in a main road

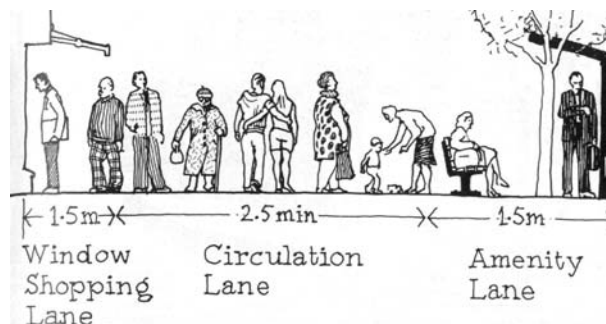


Figure (3): Flexibility of space design for pedestrians according to the density of movement  
(Example of a main commercial street)

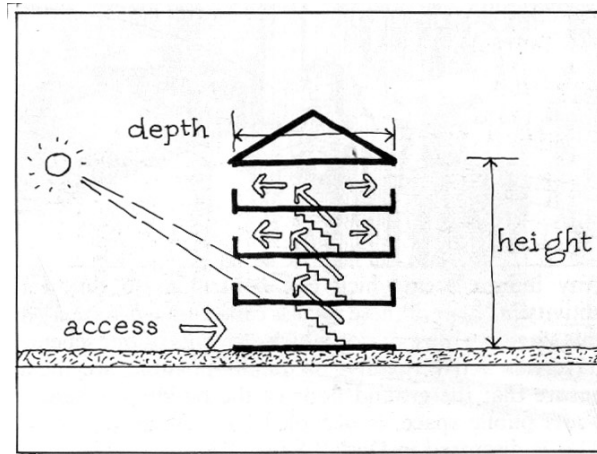


Figure (4): Elements effecting robustness of a building (depth, height, entrances) towards any possible changes of activities

## 2.2 Integrity of spaces :

Planification of the urban spaces network should take place within the framework of an integrated, interlinked system in which movement from one spot to another is easily achieved. These various points are of proportional importance in a way that endows every space with harmonious concordance between :

- 1) Uses surrounding the space and the density of movement inside it.
- 2) Space form in the framework of a system that links hierarchal paths and spaces of the integrated urban project. (Figures 5,6)

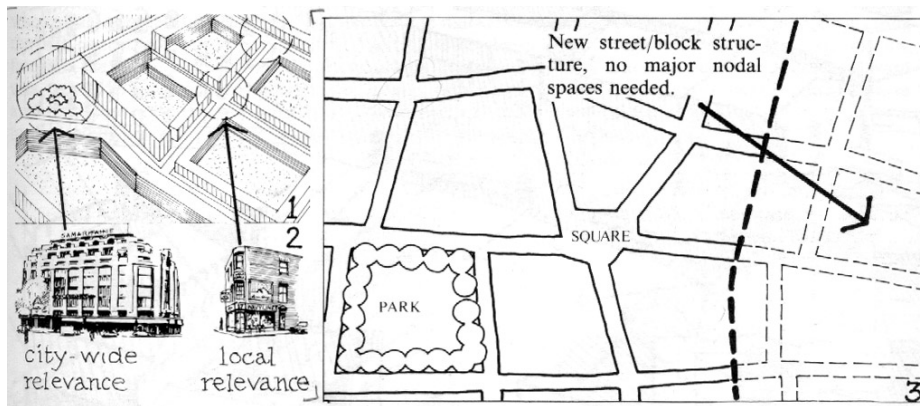


Figure (5): Concordance between space form and the uses surrounding the urban space within a comprehensive system of spaces

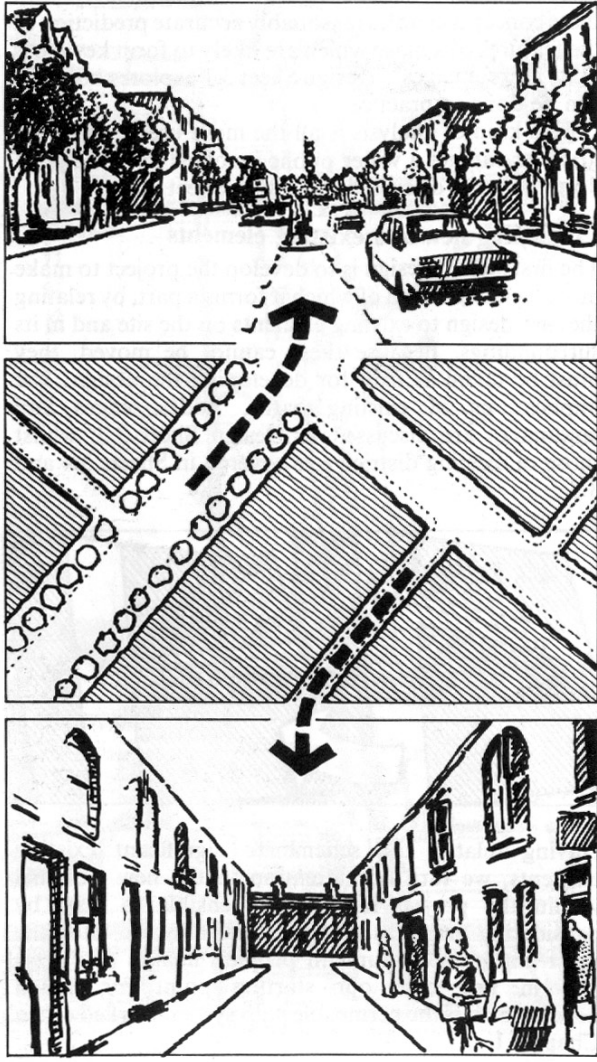


Figure (6): Longitude spaces where the width and the elements of furnishing the space are decided according to the role of the axe in the hierarchal system of movement

### 2.3 Permeability to each space:

Planification of these spaces should be easily reached through various means of movement (motor or pedestrian). This is called physical permeability (As in figure 7), where as visual permeability means that the space can be easily seen and its potentials can be facilely noticed. (Figure 8)

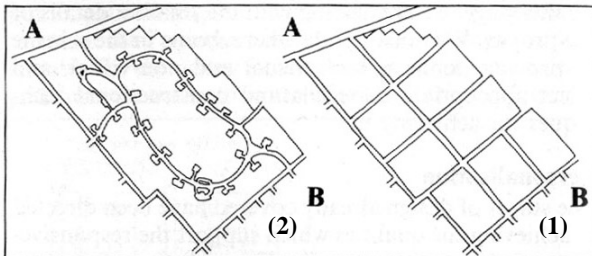


Figure (7): Physical permeability where solution (1) gives more permeability to the spaces and to the possibility of moving from one point to another



Figure (8): visual permeability where public spaces must be within the urban fabric so that it could be easily noticed and reached

### 3- Elements of Movement From the Perspective of Sustainable Development:

Planification of the network concerning the means and paths of movement from this perspective must be available for all categories of the society. It must take into consideration, while setting several choices of movement from every point to the other, saving consumed energy and fighting pollution. In addition, available means of movement must be in full harmony with uses zoning and density of movement.

These principles leads to the following ideas:

- I- Less use of private vehicles in favor of more use of public means of transportation (Bus - metro etc... ).
- II- Better use of pedestrian paths and interlinking them in a highly secured network. offering more chance to the means of transportation that are environmentally friendly (like bicycles, etc ... ).
- III- Considering the hierarchy of movement paths (their length, width and their special features of road furniture) according to their uses and the expected traffic density.
- IV- Enforcing the means of reaching every spot through the availability of the suitable means of movement.
- V-Controlling pollution emitted from motor means of transportation.

Figure 9 illustrates a guide scheme of the diversified means of movement together with, the hierarchal development of paths and urban spaces of an urban project from a sustainable development perspective.

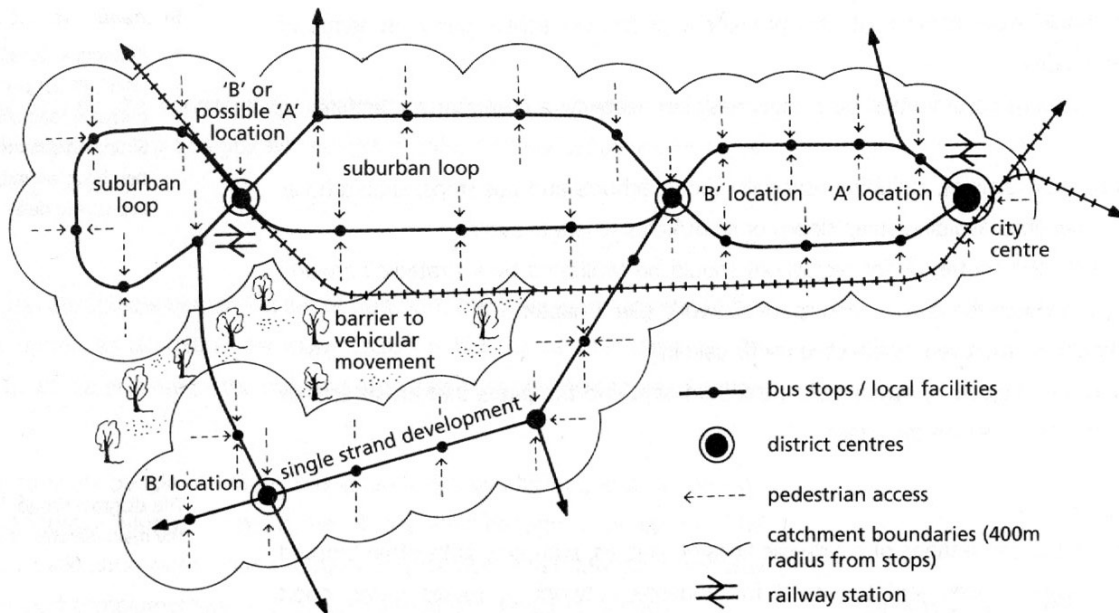


Figure (9) (Source : Hugh Barton, Going Green by Design) : Interactive relationship between movement paths, urban spaces and means of movement in order to achieve the principles of sustainable development

#### 4- Case Study:

The Study area is in the center of Cairo within the borders of the semi-triangular form that takes place between Al Tahrir square (south), Al Attaba square (east), Ramses square (north). (Figure 10)

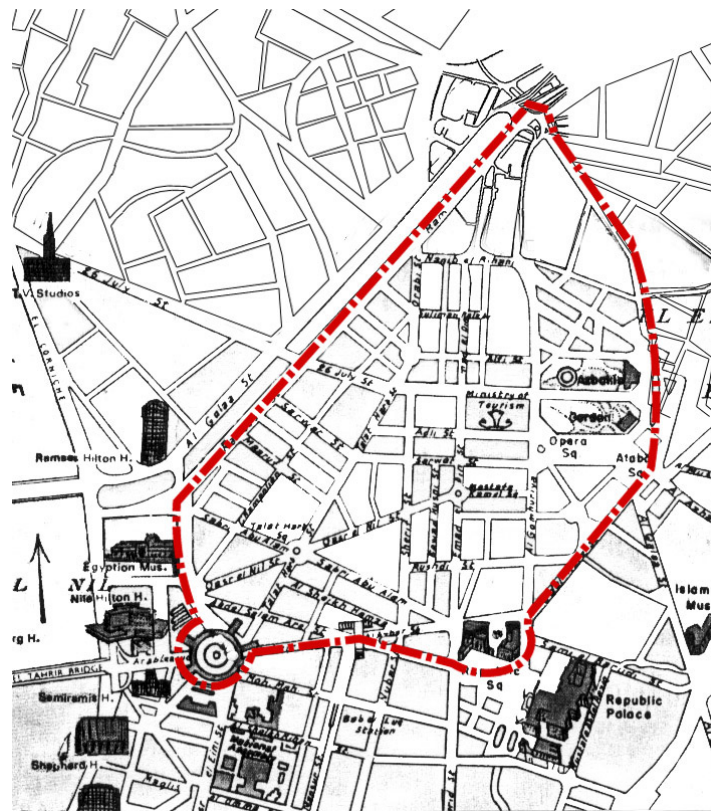


Figure (10) : The study area in the center of Cairo

The choice of this area depends on two main reasons:

First: This area is interrelated historically. It is mostly located within the borders of what is called Ismail Pasha's Cairo (Ismaileya). It was planned in the second half of the 19th century. This was the first time on which Cairo was subjected to a planning of spaces that gave the priority to the network of roads respecting the buildings that were to be established on the European style, these buildings were composed of similar apartments arranged in a geometrical system compositions. On the contrary to the usual type of collective houses in historical Cairo known as "el rabaa" which is marked by more informal compositions.

Second: This area comprises the various elements of movement that could be studied and analyzed from the perspective of urban spaces and sustainable development :

- Motor movement (surface ways -viaducts - tunnels).
- Means of motor movement (private cars - means of public transportation).
- Pedestrian paths and open spaces.





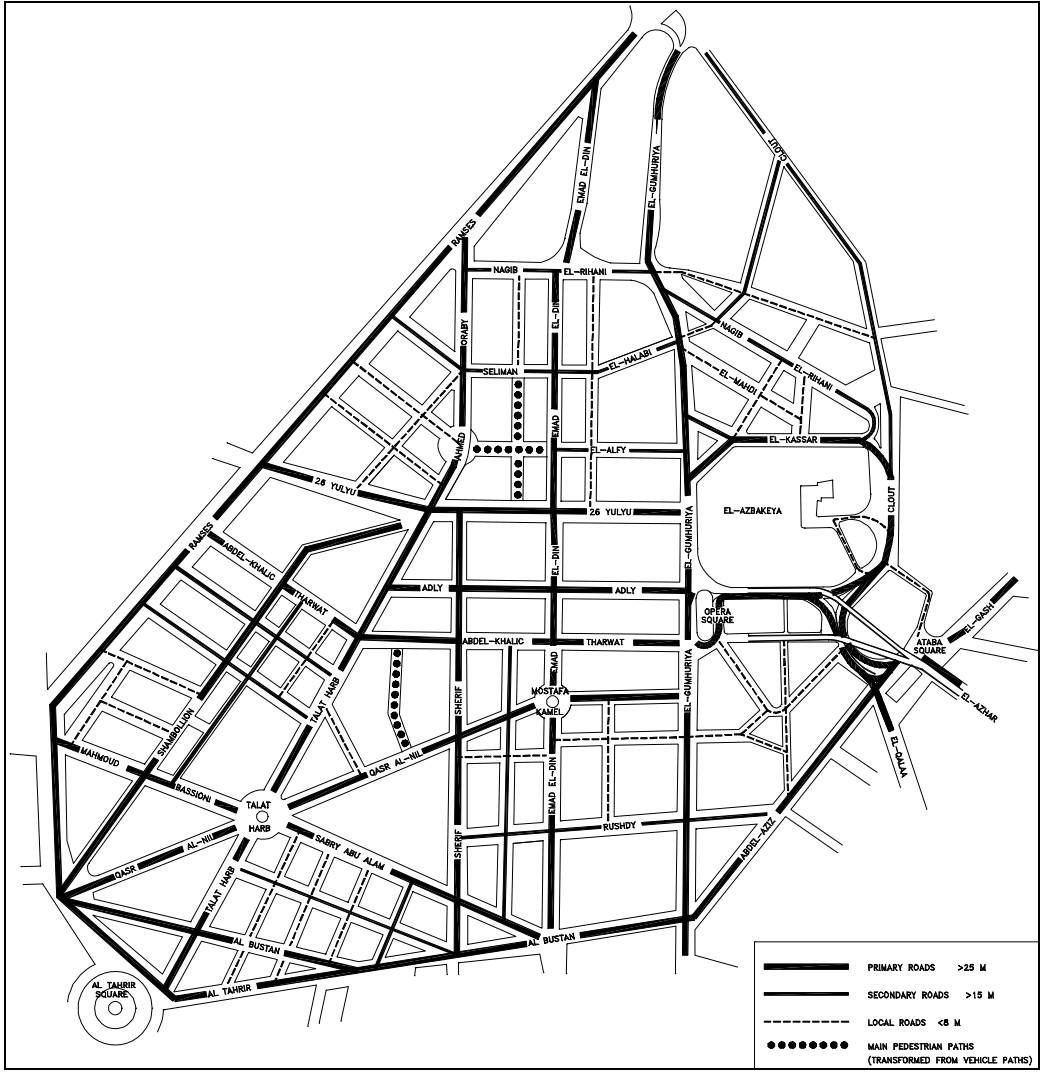


Figure (12): Clear hierarchy of road paths and flexible relationships allowing the transformation (according to the change of needs) of motor axes into pedestrian paths and vice versa.

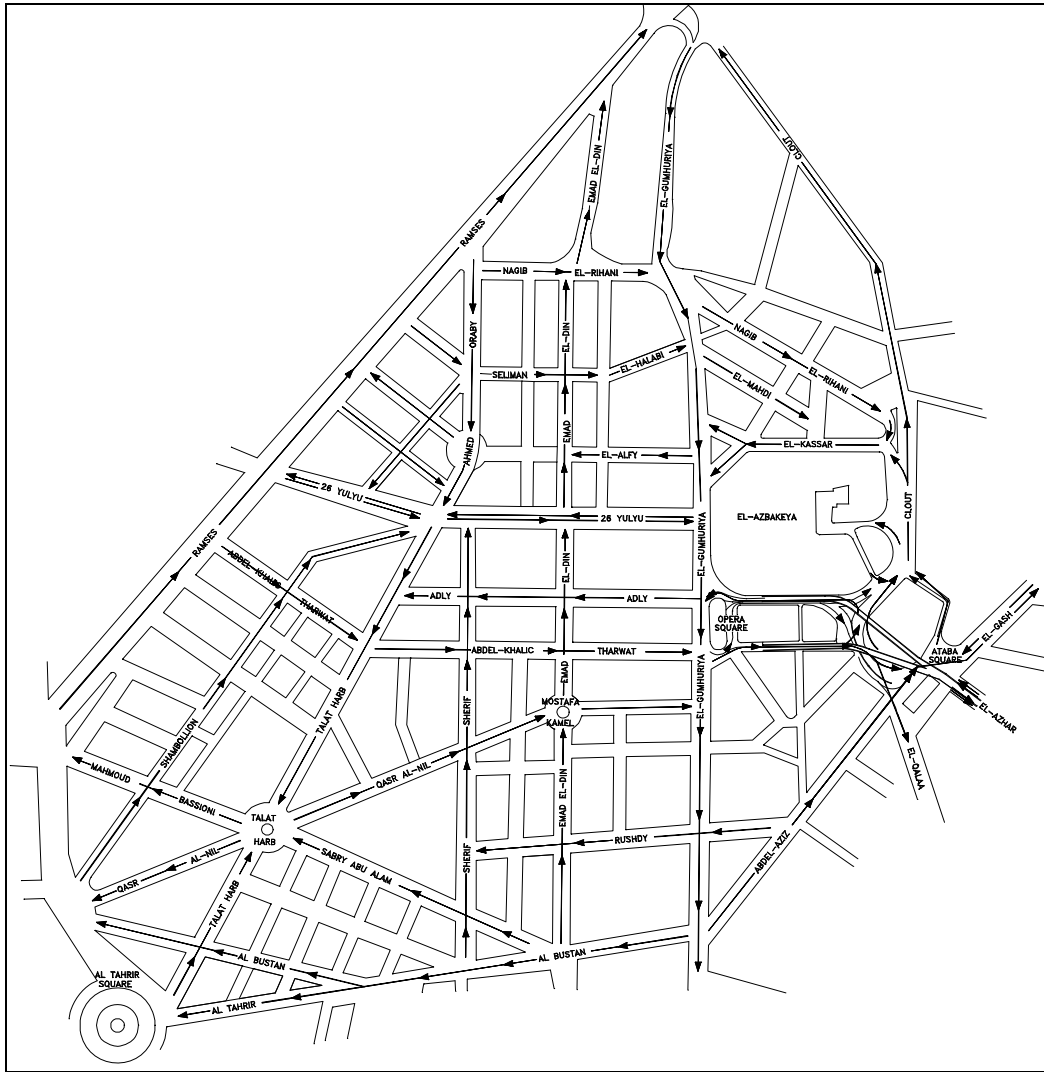


Figure (13): Transforming the main axes (except for 26th of July axis) into one way paths for motor traffic which limits physical permeability of spaces.



Figure (14): Talaat Harb Square (formerly Solaiman Pasha). The first photo dates to 1898 while the second is an up to date one. The predominance of the transit movement on the form of the space is noticeable from the very beginning and got more settled along the time.

#### 4.1.2 Viaducts:

viaducts within the main urban spaces at the limits of the study area (Ramses square, Opera square, Attaba square, Al Galaa road) are negative elements to the sustainable development of these spaces and their inter-relationship with the other network spaces. Not to mention visual and environmental pollution, they limit to a great extent the variation of activities and uses within these spaces. Large spaces are divided into smaller unrelated ones that can hardly be exploited. Thus, the vast space is transformed to a transit space with a limited visual permeability and legibility of spaces (figure 15/a,15/b)



Figure (15/a): Ramses square before and after the viaducts



Figure (15/b): Attaba square before and after the viaducts

**Figures (15/a & 15/b): The negative impact of viaducts on sustainable urban planning and design of public spaces**

### 4.1.3 Tunnels :

They are of two types: metro tunnels & car tunnels:

the impact of metro tunnels on spaces is concentrated on the points of pedestrian flow from and to the stations. These stations serve the sustainable development since it facilitates pedestrians arrival to urban spaces. Yet viaducts together with lack of necessary spaces suitable for pedestrian crossing outside the entrances and exits of stations (figure 16), minimized the benefit of stations for pedestrian paths. This is a normal result for the absence of an integrated plan of pedestrian network down town.



Figure (16): weak interconnection between the entrances and exits of metro stations on the one hand and pedestrian paths in the study area on the other.

Car tunnels in Al Azhar street end at the limit of the study area in Attaba and opera squares. The elimination of viaducts from this area will serve the exploitation of the space which will consequently promote the sustainable development of this area (Figure 17a,17b)



Figure (17a) : The existing situation at Attaba / Opera Squares with viaducts.



Figure (17b): One of the propositions related to the project of Al Azhar car Tunnels. The interconnection between Attaba and Opera spaces with Al Azbekeya garden offers the possibility of an urban space with varied activities at the service of sustainable development (After the elimination of the viaducts).

Certainly tunnels, in general, (whether car tunnels or metro tunnels) are paths working in favor of sustainable urban development. moreover, they limit noise and air pollution (on condition of being totally secure) and promote pedestrian use of urban spaces.

## **4.2 Means of motor movement:**

### **4.2.1 Private vehicles:**

Private vehicles are considered the major means of transportation within the study area. They exploit to a great extent the high permeability offered by the block / road system since all public spaces can be reached by cars. This is a double-edged weapon since permeability is a positive factor that serves sustainable development of urban spaces, yet, the dominance of car lanes of the available spaces within public areas, affects the needed variety of activities and elements of movement. The lack of parking areas whether on the axes or in several storey garages or underground ones, creates a considerable problem that limits the capacity of urban spaces to fulfill sustainable development.

**First:** The accumulation of cars on both sides of axes and the infringement upon the side-walks (Figure 18).

**Second:** The increase of surface traffic density, since considerable number of trips take place in the study area in search of a parking space. This over-use of private vehicles instead of other public means of transportation adds to the noise, visual and air pollution. This in its turn limits the possibilities of sustainable development .



Figure (18): Accumulation of cars on both sides of roads and their invasion of side-walks

#### 4.2.2 Public means of transportation:

Public means of transportation form an essential element of the motor means of transportation and a promoting factor of sustainable urban design. Yet the role of public means of transportation is marginalized due to:

- 1- Insufficiency of service circles within the southern part of the studied area (The farthest distance from bus and metro stations should not exceed 200 m.). (figure 19)

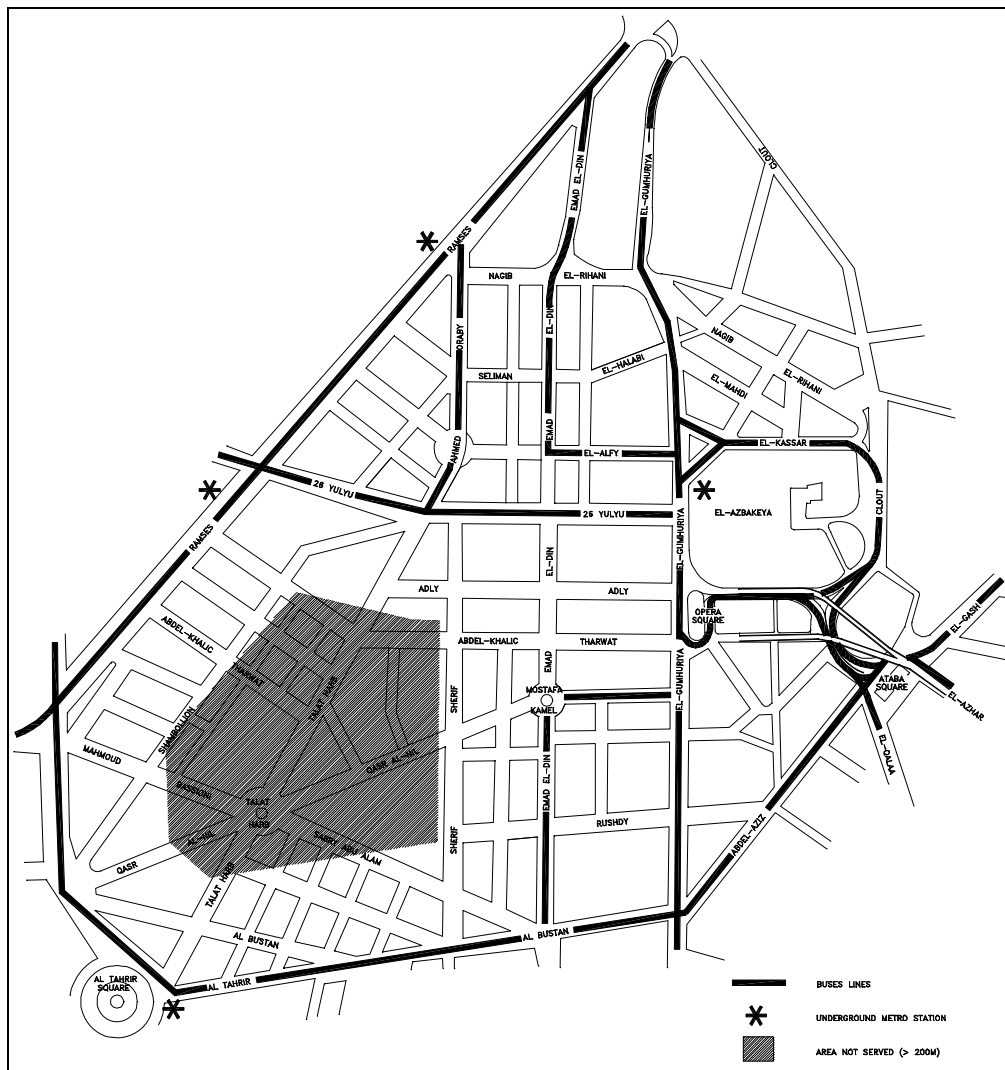


Figure (19): Insufficiency of public transportation service circles (200 m) within the center of the southern area.

- 2- Inefficiency of these means of transportation (except for underground metro) due to the lack of appropriate maintenance, insufficiency of trips from and to other districts of Cairo, and irregularity of the service as a result of the increasing traffic density. These factors contribute to the abstention of various classes and categories of the society from using public means of transportation. moreover, the high rate of pollution emitted from buses limit the role of this service in promoting the sustainable development.

### 4.3 Pedestrian network

Permeability of pedestrian movement from and to urban spaces is considered one of the most important pillars of sustainable development. This permeability must be entailed by inter-linking these urban spaces in an integrated network in addition to exploring the possibilities of every space on its own. The original network of spaces and movement paths (within the study area) is characterized by the flexibility of linking pedestrian paths and motor ones in a way that allows transformation from and to pedestrian or motor path according to the development of needs and uses in the area (on the contrary to the typical isolation between pedestrian and car networks). This flexibility is a positive element that contributes to sustainable development of urban spaces on condition of taking good care of the elements of space, which is the case in the streets of Al Alfy, Al Boursa, and Al Shawarby.



Al Alfy



Al Alfy



Al Boursa



Al Shawarby



Al Boursa

Figure 20: Several examples of the transformation from motor traffic paths to pedestrian paths as a result of the change of uses. This transformation took place thanks to the flexibility of planification and design of the original network of movement axes.



In spite of the positive elements on both the visual and the physical levels, yet the predominance of car movement negatively affected pedestrian activities and movement within the studied area. This can be considered on two levels:

#### **4.3.1 level of movement paths:**

Pedestrian paths exist on both sides of all motor movement axes, yet, lack of the elements of street furniture that promote pedestrian movement: trees, surfaces finishes, suitable width to the density of movement, prohibiting illegal occupation of the side-walks, suitable light at night (figure 21). Comparison with the past condition shows great deterioration in pedestrian paths (figure 22).



Figure (21): Lack of suitable width for the density of pedestrian movement.  
Ignoring the elements of road furniture



Figure (22): Pedestrian paths in Abdel Khalek Tharwat street (1896).  
Suitable width of path and elements of furniture compared to the density of movement and uses

Another negative element affecting pedestrian movement within the paths is the lack of crossing points in several spots (Figures 23,24). Moreover, paths limited to pedestrian movement within blocks lack harmony with the surrounding uses. Hence, they are transformed, in most cases, to deteriorated areas (figure 25).



Figure (23): Difficulty of pedestrian crossing at squares and along main roads.

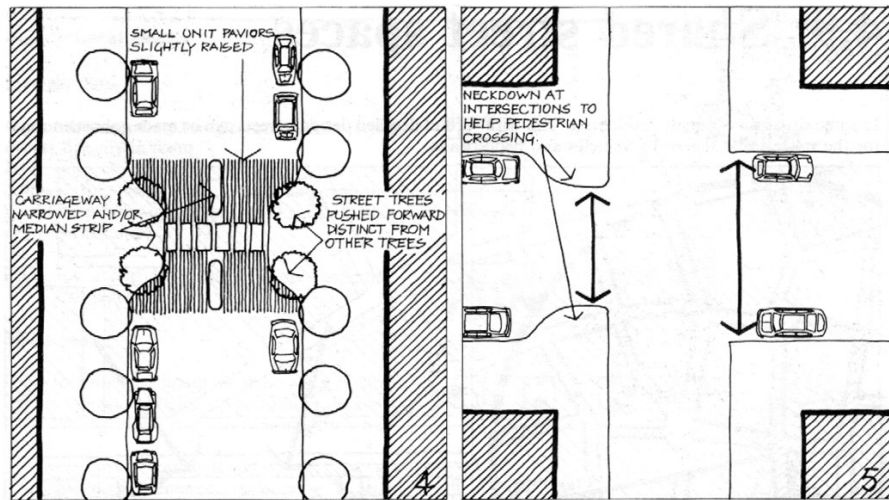


Figure (24): Solutions for pedestrian crossing of roads that were not taken into account within the study area



Figure (25): Examples pointing out the transformation of pedestrian paths within blocks into ignored areas with random uses

### 4.3.2 The level of urban spaces:

The scarcity of relaxation activities within urban spaces in the study area together with the limited chances of pedestrian movement on space edges (due to ignoring elements of street furniture) constitute the most negative impact of car movement on pedestrian movement. This is due to the lack (from the very beginning) of spaces needed for pedestrian activities and fixing the same form along the years (figure 14). Spaces in general were transformed into transit spaces, specially in the presence of viaducts in several public spaces. As a result, variety in the elements of movement, which is considered one of the main pillars of sustainable development of spaces (figure 26) is limited to a great extent. Diversity in activities practiced inside buildings on the edges of the space does not alter the fore-mentioned fact. Moreover, the positive attempts of inserting relaxation activities inside the present spaces as AL Alfya and AL Bursa streets (figure 20) must be integrated in a general framework comprising the whole area to achieve an integrated scheme of pedestrian urban spaces network.



Figure (26): Limited chances of variety of pedestrian activities within the urban spaces

## 5. Results:

The study area is most suitable for the application of sustainable development principles. It comprises elements for and against this development. The role of urban planner and designer is to boost the positive factors and to limit the negative ones. These elements can be summarized as follows:

<b>Patterns of movement</b>	<b>Factors favoring sustainability of urban spaces within the study area</b>	<b>Constraints affecting sustainability of urban spaces within the study area</b>
<b>1) <u>Motor paths</u></b>		
<b>1-1 <u>Surface road paths</u></b>	1. High physical and visual permeability despite the transformation of several streets into one way direction .	1. Predominance of motor traffic lanes and its impact on the form of urban space
<b>1-2 <u>Viaducts</u></b>		1. Division of large spaces into smaller spaces that could hardly be exploited and are extremely limited in activities .  2. Transforming urban spaces into transit spaces .
<b>1-3 <u>Tunnels</u></b>	1. Promoting pedestrian movement to urban spaces .  2. Minimizing noise and air pollution	1. Lack of suitable spaces and planning for pedestrian network in front of stations .  2. Deficiency of service cycles within the study area (together with surface public means of transportation ) .
<b>2) <u>Means of transportation</u></b>		
<b>2-1 <u>Private vehicles</u></b>	1. Reaching almost all places by cars.	1. Inadequacy of car parking areas which results in increasing pollution, noise and crowdedness.  2. Transgressing in several spots pedestrian axes .  3. Increasing traffic density since it is the means of transportation most used.
<b>2-2 <u>Public means of transportation</u></b>	1. Promoting pedestrian movement to urban spaces .  2. Decreasing traffic density through limiting the use of private vehicles.	1. Inefficiency of service cycles and the incapability of satisfying pedestrian needs within the urban spaces at the centre of the southern area.  2. Inefficiency of this means of transportation due to the malfunctioning of buses and irregularity of the service.

<b>Patterns of movement</b>	<b>Factors favoring sustainability of urban spaces within the study area</b>	<b>Constraints affecting sustainability of urban spaces within the study area</b>
<p><b><u>3. Pedestrian network</u></b></p> <p><b><u>3-1 Pedestrian movement paths</u></b></p>	<ol style="list-style-type: none"> <li>1. Providing spaces for pedestrian movement on both sides of motor paths.</li> <li>2. Great flexibility and integration of the original pedestrian network plan with vehicles.</li> <li>3. The availability of (a somewhat limited) service of public means of transportation that serves pedestrian movement.</li> </ol>	<ol style="list-style-type: none"> <li>1. Transgressing the paths and ignoring space furniture which harm pedestrian movement.</li> <li>2. Weak planning of pedestrian crossing of roads.</li> <li>3. Ignoring pedestrian paths within big blocks.</li> <li>4. Lack of integrated visualization of secure pedestrian network within the specified area.</li> </ol>
<p><b><u>3-2 Pedestrian within urban spaces</u></b></p>	<ol style="list-style-type: none"> <li>1. Variety of uses and efficiency of buildings overlooking public spaces in promoting pedestrian movement.</li> <li>2. New (but limited) attempts to insert relaxation activities within the space.</li> </ol>	<ol style="list-style-type: none"> <li>1. Marginalizing pedestrian movement on space edges as a result of the predominance of motor traffic movement.</li> <li>2. Scarcity of relaxation activities within spaces.</li> <li>3. Lack of integrated concept interlinking urban spaces pedestrian network.</li> </ol>

The reciprocal harmonious relationship between the hierarchal paths network & urban spaces on the one hand and the hierarchal means of transportation together with offering users the possibilities of choice, on the other hand, is suffering unmistakable deficiency. In other words, public means of transportation are available in areas and totally lacking in other ones (of the same importance). Moreover, pedestrian paths and their interlinkage with spaces are efficient in some spots while suffering several problems in many other areas. On the contrary, cars have the first priority of roaming everywhere without the least consideration of planned paths hierarchy.

Greenery network is nearly inexistent in the studied area. Thus, planification of this network in integration with paths network and the existing spaces can play a pivotal role in promoting sustainable development within the studied area. It is also capable of re-embellishing Cairo CBD ( figure 27 ).



Figure (27) : Opera square ( in the study area ) in late 19th Century . An example which illustrates the original opportunities of sustainable development in Cairo C.B.D .

**Finally, this research is only an attempt to analyze the present impact of movement patterns on planning and designing urban spaces in Cairo CBD according to sustainable development criteria. In order to promote the sustainable development in the study area, the process must be accompanied by an overall analysis of several other elements such as: economic activities, buildings & uses, densities, social conditions, available services, networks and most important of all the reciprocated impact with the surrounding environment and the possibility of planning sustainable development on the short, medium and long term.**

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