PERMEABILITY
A KEY MESURE FOR RESPONSIVENESS IN URBAN DESIGN
(CASE STUDY OF CAIRO C.B.D.)

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ABSTRACT :

This paper highlights the quality of permeability as a major factor in obtaining *a responsive urban environment*: this last means an urban context where the urban designer has made a concrete effort to work out the *form* implications of their *social* and *human* ideals. In fact, the quality of permeability arises among other qualities (to which the author consecrates a chain of papers) covering together key issues in making places responsive. The whole subject is based on the following idea: The built environment should provide its users with an essentially democratic setting, enriching their opportunities by maximizing the degree of choice available to them, we call such places responsive.

Keywords :
Responsiveness, urban environment, visual / physical permeability, pedestrian / vehicle segregation public / private space, Front / back areas, hierarchical layout, perimeter block development.

I- Introduction :

Only places which are accessible to people can offer them choice. The extent to which an environment allows people a choice of access through it, from place to place, is therefore a key measure of its responsiveness. This quality is called permeability [1].

Permeability has fundamental layout implications. In the diagram below (see fig.1), the upper layout offers a greater choice of routes than the lower one: it is therefore more permeable.

Because it is so basic to achieving responsiveness, permeability must be considered early in urban design. The urban designer must decide how many routes there should be, how they should link together, where they should go and where they should not; finally, how to establish rough boundaries for blocks of developable land within the site as a whole.

In this paper, we will analyze the different implications of the so called *quality of permeability*. In parallel, applications on a specific area of Cairo C.B.D. will be conducted in order to appreciate how far this quality could affect the opportunities offered by a given urban design.

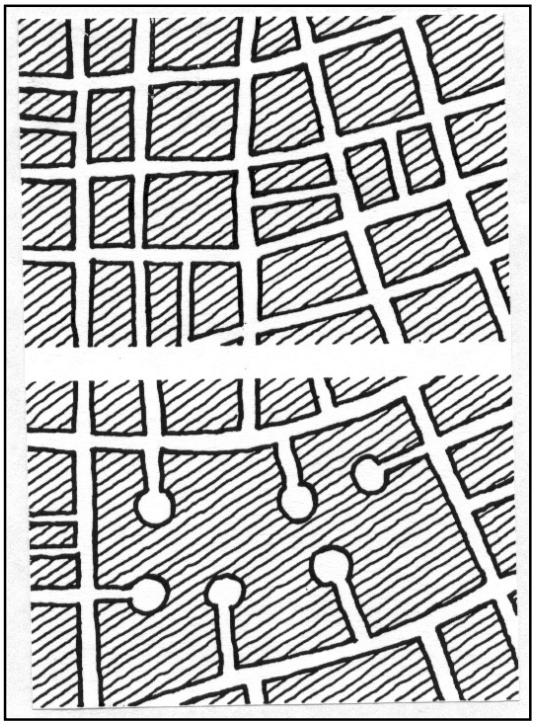

Fig. 1 : Two layout solutions within same area

1 The term "permeability" has been used by a group of urban designers in a series of lectures and seminars running in both the department of architecture and the Joint Centre for Urban Design at Oxford Polytechnic, England, under the general title "responsive environments".

The selected area as shown in (see fig.2) is considered as the heart of the Cairo C.B.D. (constructed in the last century by ISMAIL pasha) and is quite representative of the urban design opportunities and constraints of the whole Cairo C.B.D.

Beforehand, we can precise four main issues affecting the quality of permeability in any urban design , they are linked together and lead to other sub-issues which will be discussed in this paper.

The four main issues are :

- Type of development of block/road system.
- System of hierarchy of public roads.
- Vehicle/pedestrian segregation.
- Public/private space interface.

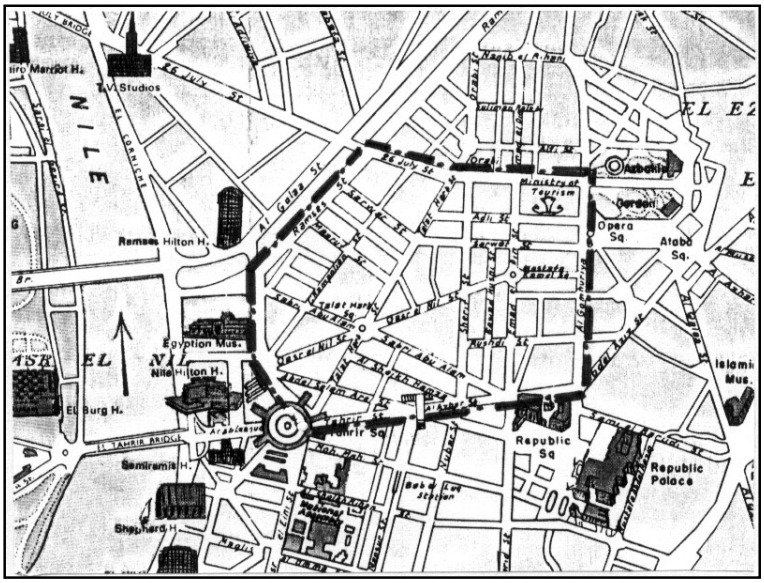

Fig. 2 : The study area of Cairo C.B.D

II- TYPE OF DEVELOPMENT OF BLOCK/ROAD SYSTEM :

II.1- The advantage of small blocks :

A place with small blocks gives more choice of routes than one with large blocks. In the example (see fig.3), the large-block layout offers only three alternative routes, without backtracking. The version with small blocks has nine alternatives, with a slightly shorter length of public route.

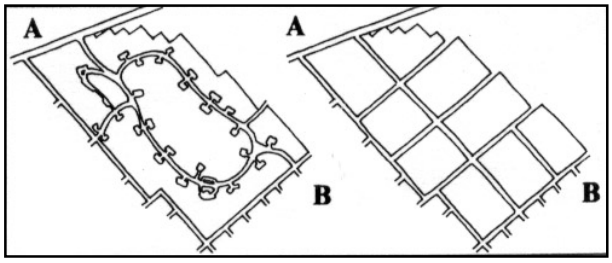

Fig. 3 : Two block/road system alternatives for the same site

In our study area of Cairo C.B.D (see fig.2). There is a disparity between sizes of blocks in despite of similarity of land uses . This creates "unintentionally" places with high permeability where small blocks exist (may be too small in some places), and others with lower permeability (fortunately, few places) owing to large blocks as shown in (see fig. 4). Here, we must insist on the responsibility of the urban designer in creating as much as he can smaller "but practicable" scale of blocks depending on the expected uses to be accommodated in these blocks and the level of surrounding roads [2].

2 If uses are already known, practicable sizes of blocks regarding accommodation of uses can be easily defined, if not, 80-90 meter blocks will do for most purposes. At the same time, The level of surrounding road is important. For instant, the min. spacing between roads crossing a primary distributor is 275m while for local roads this min. spacing can reach down to 30m (the applicable traffic engineering rules should be respected in this matter)

II.2- Physical and visual permeability :

The permeability of any system of public space depends on the number of alternative routes it offers from one point to another, we call such quality a *physical permeability.* We have shown that smaller blocks, give more *physical permeability* .

But Those alternatives must be *visible*, otherwise only people who know the area can take advantage of them, therefore, we are looking for a *visual permeability.* Smaller blocks can help to increase visual permeability (by improving people awareness of the choices available) but it should be accompanied with another factor which is the shape of blocks itself: The Simpler the orthogonal shapes of blocks the easier it is to see from one junction to the next in all directions.

Our study area is rich of orthogonal shapes of blocks as wee could see in (see fig.4). The general visual permeability is highly appreciated from one point to another. It is enhanced by several main nodes where main routes as well as shapes of blocks are intentionally diverted in order to allow legibility of squares and landmarks as shown in (see fig.5).

This does not mean that the deformation of shapes of blocks is always negative, it could be accepted, even desired when a specific purpose (such privacy or surprise…) in a specific location is added to a simple shaped blocks layouts. The point is to avoid a whole layout depending on multitude of deformed shapes of blocks as shown in (see fig 6). This last is a pure decline of visual permeability.

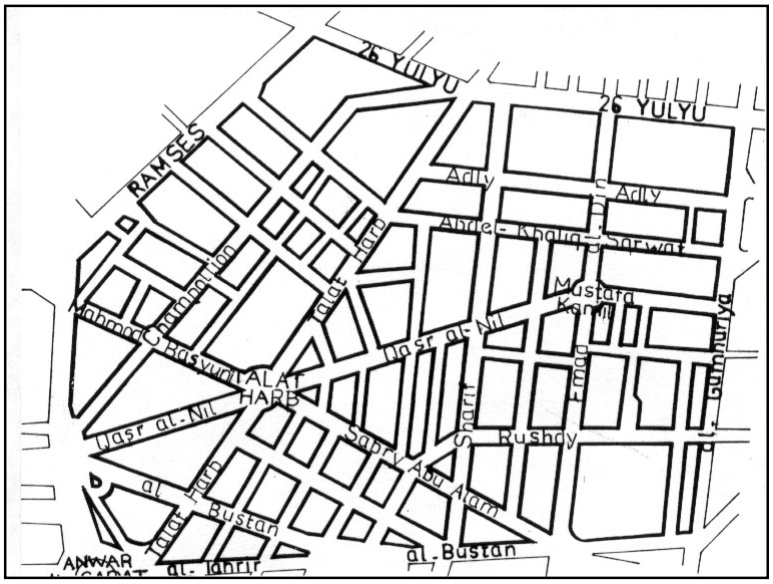

Fig. 4 : Block/road system in the study area (Cairo C.B.D)

Fig. 5 : Diversion of blocks to allow legibility of squares

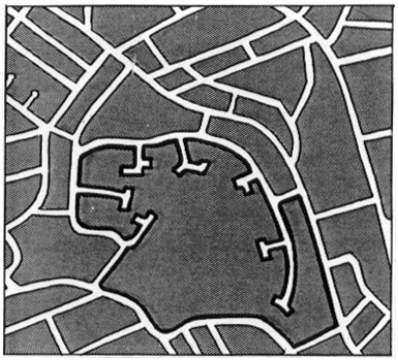

Fig. 6 : Systematic deformation of shape of block/road layout

II.3- The effect of one directional roads :

Initially, the roads in any urban area are designed and implemented to support two directional traffic. The congestion problems arise when urban expansions are promoted around the area and/or densities are increased within the area itself. Then, traffic engineering solutions vary from viaduct to underground paths passing by limitation of road directions, this last is our concern here.

Our study area suffers badly from the two above-mentioned factors engendering traffic congestion. In consequence, since viaduct and underground paths are excluded in this central area, almost all main roads have become one directional roads, this affects dramatically the physical permeability from one point to another as shown in (see fig 7). This situation is depressive for vehicle users especially that visual permeability between two points is highly maintained (you can easily see the place but you can't reach it).

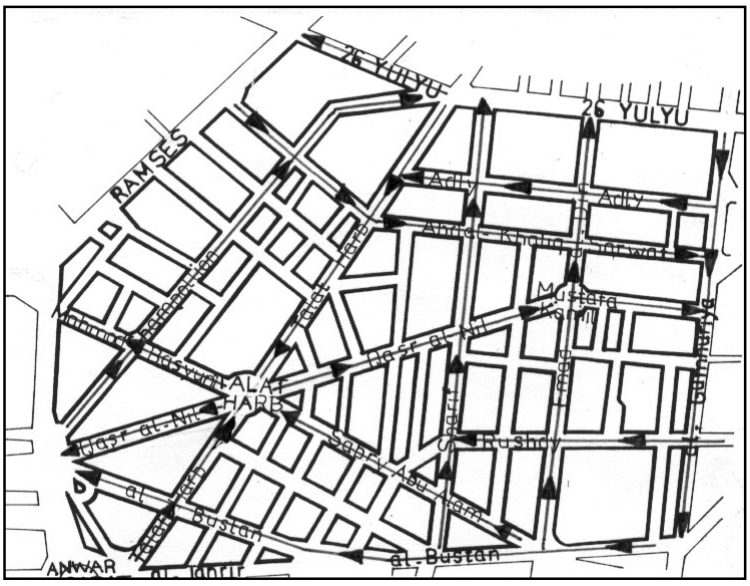

Fig. 7 : One directional main roads in Cairo (C.B.D)

III- SYSTEM OF HIERARCHY OF PUBLIC ROADS :

III.1- Rigid Hierarchy :

When layouts depend on a strict hierarchy of roads relationships, this will reduce permeability: in the example below at the left (see fig 8-a) there is only one way from A to D, and you have to go along B and C: never A-D directly, or ACBD, but always ABCD. If we imagine this hierarchy systematically repeated in a whole area, it will generate a world of culs-de-sac, dead ends and little choice of routes.

III.2- Permeable Hierarchy :

This is not to say that culs-de-sac are always negative: they support responsiveness if they offer a choice which would otherwise be missing (especially, for the purpose of privacy). But they must be added, in specific locations, to a permeable layout, not substituted for it as shown in (see fig. 8.b.).

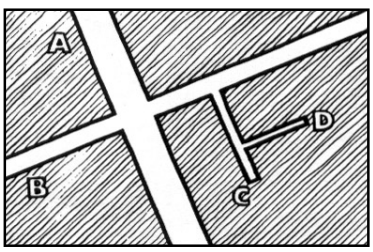

Fig. 8-a : Rigid hierarchy

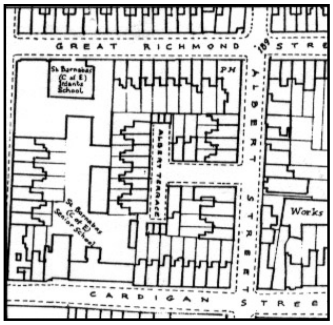

Fig. 8-b : Permeable hierarchy

In our study area,the overall organization of road system offers a permeable hierarchical layout (see fig 9) The only problem exists at few larger blocks where culs-de-sac seem to be inserted in an obligatory way so as to reach inner places as we will see later (see fig.11). This does not match with uses requirements (no need for privacy in this area), it is a direct result of large blocks size (see section II.1).

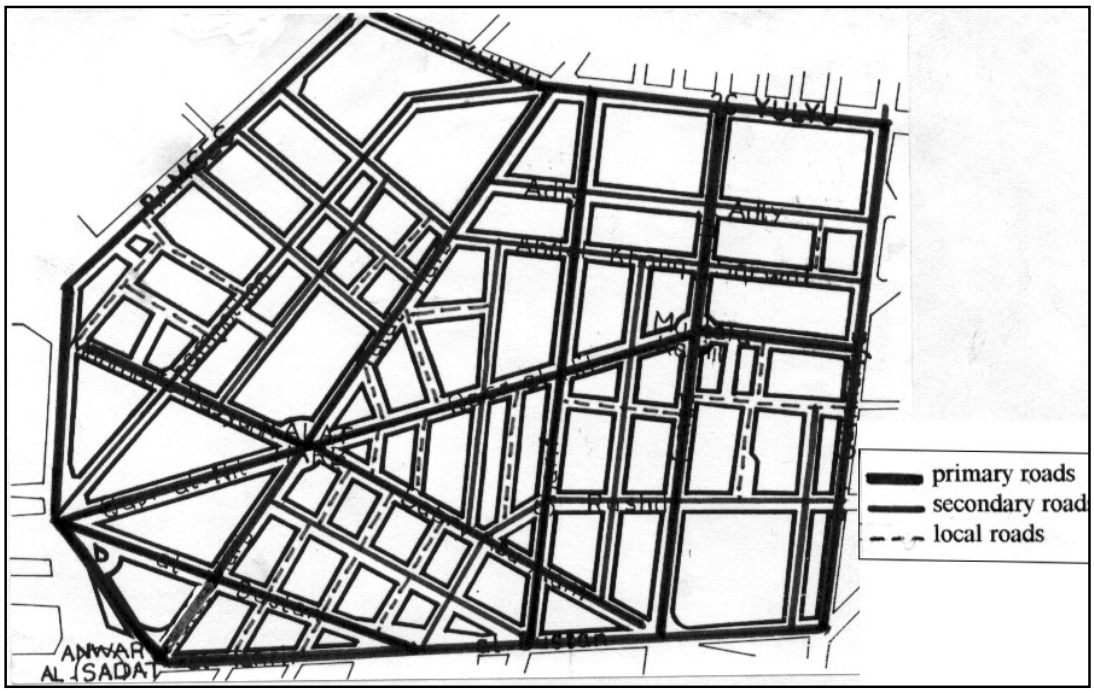

Fig. 9 : Permeable hierarchical layout in Cairo (C.B.D)

IV- VEHICLE/PEDESTRIAN SEGREGATION :

IV.1- Built-in segregation :

Permeability is effectively reduced by segregating systematically the users of public space into different categories, such as vehicle users and pedestrians, and confining each to a separate system of routes. When this happens, the only way to give both categories a level of permeability equivalent to a de-segregated system is through an expensive duplication of routes As shown in (see fig. 10).

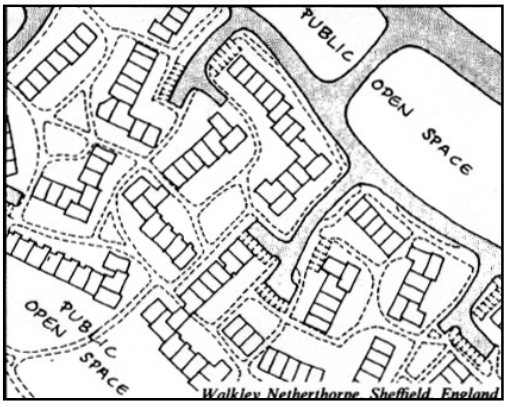

Fig. 10 : Duplication of vehicle & pedestrians paths

IV.2- Permeable segregation :

It is not necessary, in general, to build segregation irrevocably into a layout early in urban design. If we initially make a high level of permeability for everyone (motorists and pedestrians), then segregation can be achieved later, if necessary, by detailed urban design or management. This gives future users control over how they want to use the place, because they can de-segregate if circumstances change.

This is what exactly exists in our study area, all actual pedestrian paths come directly in & out from vehicle road paths, They appear together as a whole one big complex network where vehicle and pedestrian paths are tightly linked. This offers much flexibility to segregate/de-segregate if circumstances change as shown in (see figs.11,12).

Fig. 11 : Permeable segregated system of vehicle/pedestrian routes in Cairo (C.B.D)

Note : Pedestrian paths inside large blocks are exploited informally by vehicle users to reach far inner places ending by culs de sacs

Vehicle routes

Pedestrian routes

Fig. 12 : Types of permeable linkage which allow to segregate vehicle or de-segregate vehicle and pedestrian users if circumstances change , in Cairo (C.B.D)

V- PUBLIC/PRIVATE SPACES INTERFACE :

V.1- The interface: Physical permeability :

physical permeability between public and private space occurs at entrances to buildings and private gardens. This can enrich public space by increasing the level of activity around its edges. It implies that as many entrances as possible should be located round the edges of public space, without disturbance of private uses inside buildings.

Regarding this point, our study area is more than rich. The interface public/private space is physically enhanced by multiplication of entrances between buildings and public spaces either for residential, administrative, or commercial uses (see fig.13-a,13-b). The distinction is clear and net due to perimeter block development system as we will explain later.

Fig. 13-a : Enhanced public/private interface in Cairo (C.B.D)

Fig. 13-b : Enhanced public/private interface in Cairo (C.B.D)

V.2- The interface: visual permeability :

Visual permeability between public and private has two implications in order not to confuse the vital distinction between public and private altogether:

A- the need for fronts and backs for buildings: a front onto public space, for entrances and the most public activities of the building (such as shops, cafeterias, magazines,…) and a back where the most private activities can go such as private garden in houses as shown in figure (see fig.14-a), or any exclusive activity for the only users of a common building (administrative bldg., commercial bldg., entertainment bldg., etc.…).

B- The effects on private spaces: For the public/private interface to make private life richer, instead of destroying privacy altogether, it is vital that its degree of visual permeability is under the control of the private users. This could be achieved by using normal building elements like level changes , windows, porches, curtains, sound-reducing glazing and venetian blinds (see 14-b).

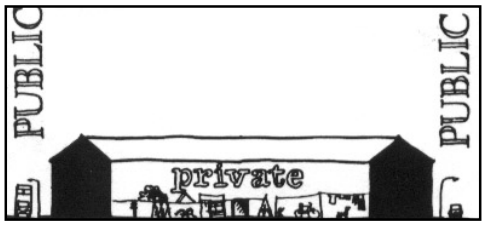

Fig. 14-a : Public/private interface enhanced by the need for fronts and backs

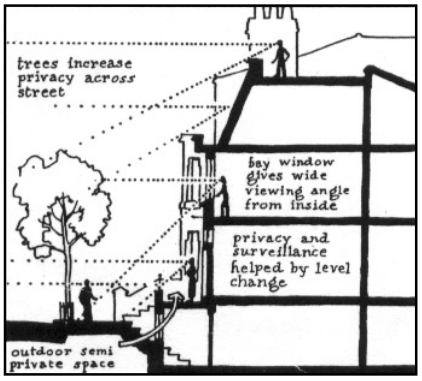

Fig. 14-b : Enhanced public/private interface by normal building elements

V.3- Perimeter block development :

The implications of physical and visual permeability and its effects on the interface public/private space make powerful demands on design. The easiest way of meeting these demands is by designing what we call *perimeter block development*, that means:

- fronts facing outwards onto public space (street, square, or park) close enough to enjoy its liveliness.
- backs facing inwards to the center of the block.
- private outdoor space at the back.

In our study area of Cairo C.B.D, the perimeter block development system is partially applied: although interface public/private space at the fronts is often successful, the problem still exist at the inner open spaces inside the blocks (the backs). The solid/ void relationship within blocks is generally designed in a way to maximize built up area in a central business district. This has created many sub-utilized small inner spaces linked to pedestrian paths, these last are initiated from the beginning by vehicle/pedestrian segregation system as shown in (fig.11). The confusion exists because these marginal spaces are now used informally rather for public and/or private purposes, whenever it allows (see fig.15).

Fig. 15 : Informal Public/private uses at back areas of large blocks

VI- CONCLUSION :

The quality of permeability can play a major role in order to make places more responsive towards their users. This is quite applicable in all circumstances wherever public areas exist. However, the required degree of permeability -partially to be under the control of users- varies from one place to another depending on uses type and variety.

The main variables which affect the degree of permeability : blocks size and shapes, hierarchy of public roads, vehicle/pedestrian segregation, and finally the delicate transition between public and private spaces; these variables have to be put into consideration early in urban design. A design which neglect from the beginning these variables could create irrevocable relationships, and users will have a very little margin to modify or to re-adapt a certain situation.

The case study of Cairo C.B.D has shown how far these variables are important, they have been -in general- applied successfully in a way to promote permeability of places such as: small block size, orthogonal shapes of blocks, permeable hierarchy of roads, permeable segregation vehicle/pedestrian, and finally good interface public/private spaces at fronts of blocks.

However, precautions should be taken when we talk about one directional roads in this strategic areas, for traffic considerations. This has led to a certain decline of physical permeability in many places for vehicle users. Considering permeability implies that this action should be taken after exacerbation of all other transportation solutions such as collective parking areas, efficient on-surface mass transportation, Underground metro stations, etc…

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