

## A Vision of New Cairo Districts as a Model of Sustainable, Walkable Urban Liveability

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**Abstract:** The concept of carbon footprint and the increasing awareness of green energy alternatives and the call to conserve resources has advocated walkable communities and planning for liveable communities to strengthen sustainability. Land use patterns, transport systems, public facilities, housing and design features of the built environment, all contribute to the planning process. A major concern is to consider the neighborhood framework and how the buildings within the territory form housing groups and communicate with the space they sit in. Planning should consider improved walkability and the critical factors enabling independence and autonomy in walking. A core principle recognizes transportation as integral to this vision leading to a greater community connectivity and liveability. This paper discusses how the planning framework could be used to enhance the sustainability of the built environment, an example is captured from New Cairo districts where sustainable issues are implemented. Guided by LEED for Neighborhood Development, this paper attempts to focus on the sustainable issues incorporated in the urban design of the captured example. The physical design issues are examined represented in the well connected system of streets and paths, the incorporation of a range of pedestrian oriented amenities, and the emphasis on the sense of community by providing a mixed housing type and the integration of common open spaces in the form of plazas and green spaces. A special focus is set on the integration of public transport and the accessibility to downtown as well as the incorporation of other alternative means of transport. Other sustainable urban design issues, such as water sensitive design, xeriscaping, the steep slope protection and respect of site topography, are presented. By the demonstration of this example, planners and decision makers could visualize how to incorporate the principles of sustainability in planning urban communities.

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## 1. Introduction

In response to the ever increasing housing problem and the scarcity of vacant land spots in greater Cairo, and as response to plentiful demands of housing projects that range from low cost houses for low income citizens to mansions for the tycoons, greater Cairo's map has been swelled over the last twenty five years to encompass either new satellite cities, or dependable housing projects and residential compounds. It is believed that those new residential settlements offer a great opportunity to achieve better qualities in the home environments, through the application of the 'Home Range' or 'Home Zone' concept. AL REHAB compound -thought as convenient for application- is chosen, and analyzed in terms of sustainability probabilities.

The district is acknowledged as being one of the most successful gated, communities in the GCR carried out by the private sector real estate developers. A Residential project which incorporates many aspects that gated communities offer, "provide character, promise privacy and security, feature desirable local amenities, and manage traffic effectively" (Grant et al. 2004,83).

## 2. Alrehab Urban analysis:

Al Rehab is a private sector constructed and built district, situated at the North East side of New Cairo, planned to serve as a fully fledged community, which creates a comprehensive integrated residential scheme within the New Cairo plan, (Figure 1). It covers an area of ten Square km to accommodate 200 thousand residents. The district includes educational, medical, commercial, recreational and maintenance facilities distributed among the different neighborhoods (phases).

The Project constitutes ten whole neighborhoods (labeled "Phases"), the neighborhood sizes ranges between 280 (1 square km ) and 320 acres (1.28 square km), or half a square mile, these figures contribute to the neighborhood sizes determined by LEED-ND to be considered as a LEED project, (Figure 2).The residential clusters vary from apartments buildings to villas, with different models and sizes all surrounded by greenery and connected through pedestrian paths that extend to connect them to the different phases. Pedestrian paths

cut through, equipped with benches and adorned with a lot of plants and greenery.



Figure 1 Location of AL Rehab district in Greater Cairo Region Plan (2)



Figure (2) Al Rehab District Master plan (9)

### 3. Rehab Sustainable Urban Design Principles

Al Rehab establishes the following in response to walkable community requirements

- The district has got distinct community centers that offer a variety of land uses including retail, recreational and civic uses that cater to the needs of local residents. Also the district planning encourages residents to walk more and allow them to accomplish more in one trip, resulting in an overall reduction in the number of trips.
- The district provides a well connected system of streets and paths both internally and to surrounding uses, to allow users to choose from a variety of transportation modes including walking and biking.
- It also incorporates a range of pedestrian-oriented amenities (i.e. wide sidewalks, street trees, street lighting, benches, etc.).

- It also fosters a sense of community by providing housing with a mix of product types and densities in close proximity to each other and integrates common open spaces in the form of plazas and green spaces to provide places for people to relax, play, and interact.

### 4. Smart Location and Linkage

#### 4.1 Rehab Preferred Location

When analyzing the project location it could be classified as a site adjacent to a previously developed land as more than 25% of the project boundary is adjacent to a developed housing and business community offering legible jobs, education facilities and recreational areas. About 90% eligible intersection per square mile, within 1/2 mile of boundary segment, are adjacent the developed housing and business community (Figure 3).



Figure 3 New Cairo Districts Master plan (5)

#### 4.2 Reduced Automobile Dependence

Rehab is about ten Km<sup>2</sup>, as it is a Project exceeding 2km<sup>2</sup> therefore at least 30% of its dwelling units and non residential building entrances should be within 1/4 mile walk distance of bus stops, or within a 1/2 mile walk distance of bus transit stops, light rail stations.

4.2.1 Transit corridor: an important transit corridor is planned to be contiguous to the southern boundary of Rehab district. This corridor is a light rail line

(Super Tram) to link the district and the adjacent district to the nearest intermodal station in East Cairo, where interchange occurs between the Light Rail line and the Underground Metro Network. The link shall be with Line 3 underground metro at Stadium station that will be put into service by 2013. Line 3 will join East Sector of Cairo with its west sector passing by downtown and exchanging with underground Metro Line 1 and Line 2 that connect North Cairo to its south.



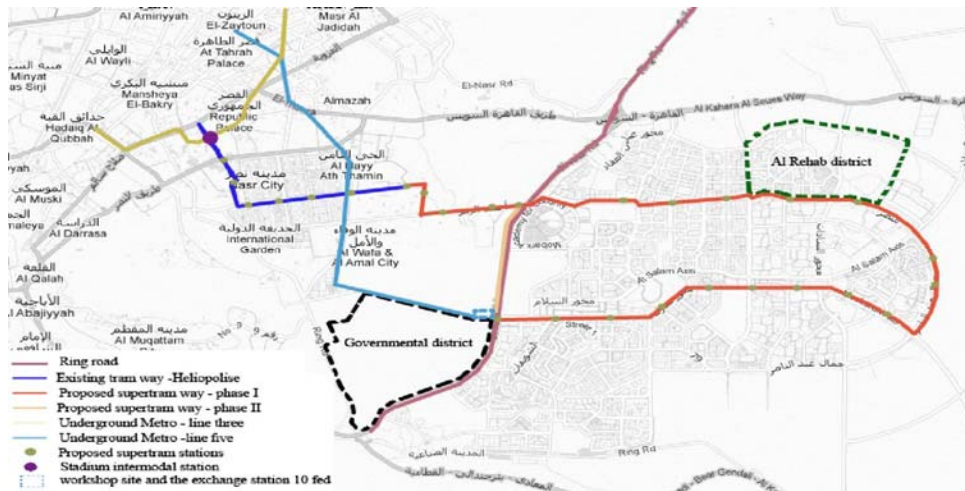


Figure 4 Super-Tram line extensions to Al Rehab (1)

4.2.2 Existing Bus Service:



Figure 5 At least 50% of the dwellings are within 1/4 mile walking distance from the bus stops.

4.3 Bicycle Networks and Storage

As a residential project encouraging biking, an existing bicycle network connects to schools and central services of the district not exceeding 3 miles' bicycling distance (4.8 km) from the neighborhood boundary. The network extends as sideways adjacent to the vehicle road linking to the pedestrian paths.

Also Bicycle racks for bicycle storage are provided for visitors of the recreational and the commercial nonretail spaces (Fig. 6).



Fig 6 Bicycle Racks at recreational areas

#### 4.4 Steep Slope Protection

As a site that has not been previously developed, special care has been taken regarding the treatment of slopes in Rehab district. The land slopes varied between 15% and 30%. Buildings have been constructed within not less than 15 meters from the toe of the slope and more than 30 meters from the toe of the slope has been left free of construction of buildings and used for landscaping. The slope have been 100% cultivated with native trees and adapted native plants (Fig. 7).



Figure (7) Slopes protection and Treatment in Rehab district

#### 5. Neighbourhood Pattern and Design

Al Rehab neighborhoods pattern promotes walking – and reduces the vehicle miles traveled (VMT),- by providing safe, appealing, and

comfortable street environments This appears in respecting the width of the sidewalks and the distances of the building facades from the property line.

#### 5.1 Walkable Streets

The design developed the district into a more green and walkable community. The district incorporated more green space. Four types of green space were included: urban parks, streetscapes, linear parks and tree-lined boulevards and streets. Secondary streets would also include landscaping at the corners of the blocks. Urban parks are incorporated into the block structure. This park system includes additional landscaping and urban furniture, including lighting and benches.

- Al Rehab has been planned so that for 90% of building frontage, a principal functional entry on the front façade faces a public space, such as a street, square, park, paseo, or plaza, but not a parking lot, and is connected to sidewalks or equivalent provisions for walking. The square, park, or plaza are at least 50 feet wide at a point perpendicular to each entry. Building heights with regard to streets has a minimum building height-to-street-width ratio of 1:3 (Fig. 8), such aspects contributes to LEED requirements for promoting walking.



Figure (8) At least 15% of existing and street frontage within and bordering the project has a minimum building height-to-street-width ratio of 1:3

Two types of non-motorized right of way exist in Al Rehab district, the first type is represented in sideways adjacent to the main streets (Fig. 9). Sideways are used by cyclists and pedestrians.



Figure (9) Sideways adjacent to the vehicle road for biking and safe pedestrian walk

Vehicles could only share it to enter a residential building garage by a limited velocity (20 km/hr). The second type is a complete network of pedestrian paths shared by cyclists and pedestrians (Fig. 10).



Figure (10) A complete network of pedestrian paths

- 100% of such spaces have a minimum of building height to street width ratio of 1:1.



Figure (11) minimum building height to street width ratio 1:1

- Widths of sidewalks, at least 8 feet wide on retail or mixed-use blocks and at least 4 feet wide on all other blocks (Figs. 11 and 12).



Figure (12) The market sidewalk width more than 8 feet wide

## 5.2 Compact Development

Al Rehab achieves the LEED Prerequisite NDP Compact Development as the density of the residential and non residential components exceeds the minimum requirements of this prerequisite. Differences between the various neighborhoods are in the form of height requirements, floor-area ratio and residential units per acre. For example, in phase 1,2,3, and 4 neighborhoods, residential blocks are five stories with a maximum height of 70 feet while

phases 5,7,8,9, and 10 neighborhood blocks are 6 stories with a maximum height of 80 feet. These figures impose differences in the number of dwelling units per acre.

According to credit NPD 2 Credit 2 Compact Development, the densities per acre should achieve the figures indicated in table 2 to acquire the LEED points. Densities are calculated with regard to number of dwelling acre (DU/Acre), and for non residential according to floor area ratio (FAR).

Table 1 Analyses the densities of buildable land in Al Rehab district.

Non residential density (FAR)	Residential densities DU/acre	Residential densities No of DU/area of buildable land in acre excluding parking	Type of residential buildings	Neighborhoods
1.47	7.74	658/85	2.25 storey villas	Phase 1
	55.79	3515/63	5 storey blocks	
1.47	7.74	658/85	2.25 storey villas	Phase 2
	55.79	3515/63	5 storey blocks	
1.47	7.72	626/81	2.25 storey villas	Phase 3
	49.05	3385/69	5 storey blocks	
1.47	32.11	4656/145	5 Storey blocks	Phase 4
1.44	39.90	5746/144	6 Storey blocks	Phase 5
1.15	4.57	694/152	2.25 Storey villas	Phase 6
1.15	5.38	312/58	2.25 storey villas	Phase 7
	40.83	3144/77	6 storey blocks	
1.15	4.85	223/46	2.25 storey villas	Phase 8
	45.06	4416/98	6 storey blocks	
2.98	5.02	211/42	2.25 storey villas	Phase 9
	42.95	3780/88	6 storey blocks	
1.15	4.97	388/78	2.25 storey villas	Phase 10
	41.27	1692/41	6 storey blocks	

Table 2 LEED Points for density per acre of buildable land (4)

Points	Non residential density (FAR)	Residential density (DU/acre)
1	>0.75 and ≤ 1.0	> 10 and ≤ 13
2	> 1.0 and ≤ 1.25	> 13 and ≤ 18
3	> 1.25 and ≤ 1.75	> 18 and ≤ 25
4	> 1.75 and ≤ 2.25	>25 and ≤ 38
5	>2.25 and ≤ 3.0	>38 and ≤ 63
6	> 3	>63



From the above tables, we deduce that neighborhoods which could achieve greater LEED points are those with the predominant residential block component, while phase 6 for example that incorporated villas only are less than density requirement by LEED ND. Also from this table it appears that the majority of the neighborhoods fell in the non-residential density of between 1.25 and 1.75 Floor Area Ratio.

### 5.3 Connected and Open Community

According to LEED requirements at least 140 intersections must exist per square mile to achieve successful connectivity. Also all streets and sidewalks that are counted toward the connectivity requirement must be available for general public use and not gated. A through street or non-motorized right-of-way intersects at least every 400'. Al Rehab district satisfies this requirement to a great extent.

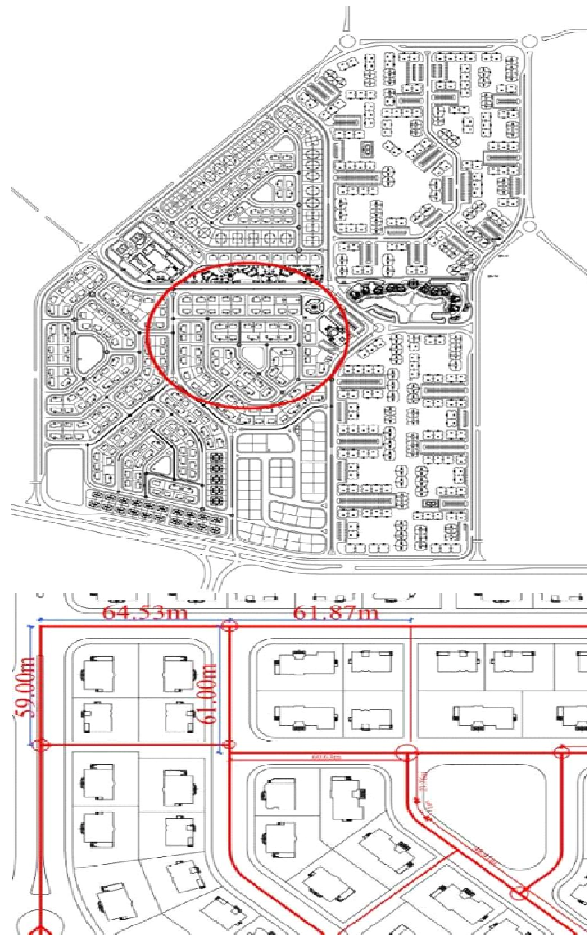


Fig (13) diagram shows intersect interval distances in Phase 2 neighborhood

### 5.4 Mixed-Use Neighborhood Centers

Successful cities, urban districts and urban neighborhoods have proven the value of a diversity of use, such as residential and commercial. The fabric of these urban districts calls for mixed-use building typologies and a more vibrant and compact city. Compact building design allows the transformation of a one-story suburban office park to a multi-story, mixed-use neighborhood. All the necessary services are available in Al Rehab, also the district contains a cinema theatre, restaurants and cafeterias. Also Al Rehab provides its residents with other services, a sporting club, medical center, clinics with ambulance,

transportation means, 24 hours security system, electricity and telephones, irrigation, sewage system and drinking water & fire resistance.

The district service center is centrally located between the residential groups, comprising a mosque, school, shopping facilities, and district park. Further, district service centers are located on a ring road that facilitates use of services for all residents in any district, (Fig. 14). As such, services complement each other, repetition of same services is limited, and residents' flexibility of choice among these services is maximized. This distributional layout of service facilities at the district level has minimized the need

for providing facilities at a higher level to serve the whole population expected to reach about 200,000 inhabitants. At this level facilities included only the social/recreational club in the center of the

community, in addition to some administrative, service and utility areas at the project's outside periphery(6).

- Workshops
- Retail and Commercial
- ▲ Elementary School
- Integrated Language School
- Main Mosque
- secondary mosque
- Hospital
- + Church
- Administrative Centre
- Administrative Services
- Recreational Area
- sports and social club
- Police and firefighting station
- Service station



Figure (14) General plan for Rehab District showing different types of services ( 9 )

5.5 Mixed Income Diverse Communities

Al Rehab community engages a wide range of economic levels, household sizes, and age groups thus promoting social equity.

5.5.1. Diverse of housing types

The development was planned as gated community of six residential districts (20,000

Inhabitants each), and later extended to ten, including a variety of amenities and service facilities (Fig. 2). The residential component for each district includes plot subdivision, villa, and apartment building housing. A variety of housing units is offered to suit a wide variety of needs. Apartment

sizes range from 60 to 320 square meters in area. To date, there are 52 different prototypes building apartments in the developed phases. All apartment building areas are designed in groups, where clusters of buildings enclose green open spaces, interconnected together to by a pedestrian network that is totally separated from vehicular roads and parking lots. Villa prototypes have reached 26, and range from 170 square meter semidetached villas to 520 square meters luxurious ones. Villa plots range from 200 to 800 square meters in area, with private gardens representing at least 60% of the plot area. (<http://www.alrehabcity.com>)

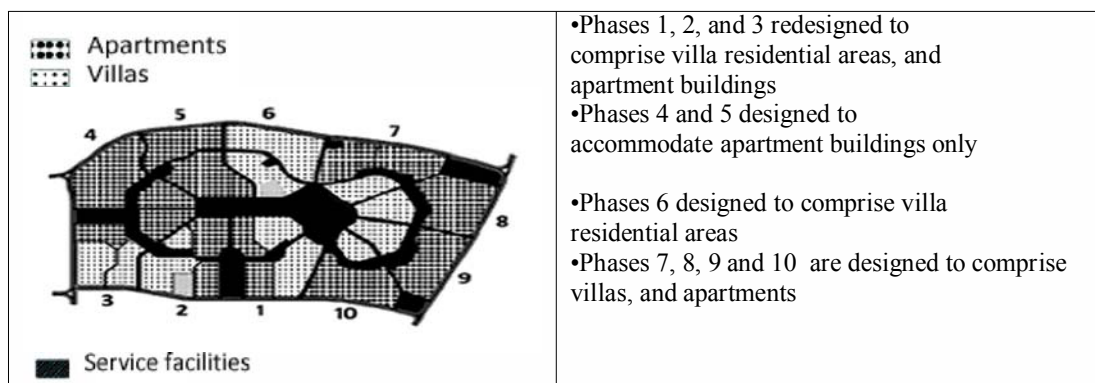


Figure (15) Diversity of housing Types(6)



### 5.6 Reduced Parking Footprint

Off street surface parking lots at the side or near of multiunit residential buildings, are located so as to leave building frontages facing streets free of surface parking lots, using about 14% of the total development footprint, (LEED requirement specifies no more than 20% are for off street surface parking facilities).

### 5.7 Access to Civic and public Space

Most of the dwelling units entrances are within 1/4 mile walk distance of square, park, paseo or plaza that vary in size and exceeds the least recommended area (1/2 acre for projects larger than 7 acres)

### 5.8 Access to Recreational facilities

The district has been designed so that a publically accessible outdoor recreation facility at least 1 acre in area lies half a mile walk of 90% of new and existing dwelling units and nonresidential building entrances.



Figure (16) Shared parking tables allow for reductions in parking. This reduction can accommodate up to 25 percent fewer automobiles in keeping with the appropriate mixed uses.



Figure (17) recreational area food court and Access to recreational areas with ramps for the disabled.

### 5.9 Visitability and Universal Design

The planning of the district considered the needs of the physically impaired, sidewalks and entrances of recreational areas the markets and are all designed with ramps complying with Egyptian code for the handicapped.

Al Rehab district home zone concept is manifest in Al Rehab, Responsive Environments incorporate some basic principles of urban design that would support the concept of Home Zone. The most renowned principles were private back gardens and fronts that actively communicate with streets by looking at them. As for the buildings, the principles suggested they should have windows that make you feel you might be being watched, by having doors that go in and out, local people should view the street

as an extension of their external and internal living space, and so on. Permeability were among the basic principles that would characterize the Home Zone of the 1980's. (3)

### 5.10 Community Outreach and Involvement

AL Rehab established a TIF System as the developer maintains control during the post-construction phase. A TIF District is a common economic development tool that has been used in Rehab district. TIF Districts can pay for infrastructure, land acquisition, parking garages or even the redevelopment of buildings. A TIF District offers benefits in economic development, identifying development objectives and rebuilding infrastructure. "A TIF District is a planning tool that supplies economic incentives to the developer and builder in

redeveloping urban districts. TIF District monies can be used for a variety of infrastructure needs: roads, streetscapes, parking garages and even construction costs of new buildings. This, in conjunction with an Overlay District, helps promote redevelopment" (7).

#### 5.11 Tree-Lined and Shaded Streets



Figure (18) Specific street trees are recommended. Urban space adjacent to the primary street front is allowed for approximately 20 percent of the total façade and a maximum depth of 50 feet.

#### 5.12 Neighborhood Schools

The project is designed so that each neighborhood is served by an elementary and middle school provided that 80% of the dwelling units are within 1/4 to 1/2 mile walking distance of such schools. High schools are not more than 1 mile walk

To encourage walking, bicycling, and transit use the district was designed to provide street trees on both sides of all the streets within the project (LEED requirements at least 60%) and on the project side of bordering streets, between the vehicle travel way and walkway, at intervals averaging no more than 40 feet.



Figure (19) Trees or other structures provide shade over at least 40% of the length of sidewalks on streets within or contiguous to the project.

distance but because of an excellent bus system they are also in reach.

Because the city is safe, during the daytime children may go to the, neighborhood parks in adjacent neighborhoods as well as their own, neighborhood stores and fast food restaurants. They may go to their sports team's practice.



Figure (20) Safe walking paths to school

### 6. Green infrastructure and buildings

Buildings require several categories of resources for their creation and operation: materials, energy water and land. The term green building refers to the quality and characteristics of the actual structure created using the principles and methodologies of sustainable construction. Green buildings can be defined as "healthy facilities designed and built in a resource efficient manner, using ecologically based principles." (8).

#### 6.1. Site Planning and Design

Although Al Rehab buildings did not apply for a certification under one of the green building rating systems, it features a number of the requirements of the sustainable design:

- Buildings placement has been sensitive to site topography. The project site is designed to maintain natural stormwater flows by promoting

infiltration. Techniques and materials such as pervious paving, and other measures to minimize impervious surfaces have been implemented.

- Constructed surfaces on the site are shaded with landscape features and utilize high-reflectance materials and materials to reduce non roof heat island effects. Shading roofs by pergolas to minimize roof heat islands effects.
- Landscape is designed with native or adapted plants to reduce or eliminate irrigation requirements. Drought tolerant landscaping is encouraged.
- Use of non- potable water resources, air-conditioning condensate has been utilized in Al Rehab for irrigation of gardens surrounding the blocks

## 6.2. Building Design

The following principles were adopted to guide the construction of buildings in the plan area.

- Design buildings to maximize interior daylighting and provide for a connection between indoor spaces and the outdoors. Strategies considered include building orientation, most of the residential blocks has been designed with the east west axis within 15 degrees of the geographic east west.
- On-site renewable energy sources have been utilized in the water heating systems thus contributing to energy savings.

## 7. Conclusion:

The key for liveable cities has been discussed through the process followed above which suggested the critical elements as follows:

- Availability of mass transit connectivity for the inhabitants of new districts.
- Design for safe pedestrian and bicycle travel the neighborhood area is designed to be totally accessible for the movement of children, disabled people and older people. to provide direct, accessible, and attractive links to local amenities and public transport facilities. This may require works out with the immediate Home Zone boundary, For cyclists, given the low traffic speeds and low traffic volumes, al rehab district is an attractive environment for cyclists of all ages which were encouraged by cycle network that links the neighborhoods and by the provision of suitable cycle storage facilities and connections
- Creating a visually attractive environment, with a sense of place and identity.
- Supporting community activity and play in public space, reducing social isolation, particularly for the elderly and those who have mobility problems.
- Developing a system of pedestrian and bike paths especially through a system of linked parks, would

encourage school children walking, bike or take public transportation to events within the city, thereby becoming familiar with and feeling like citizens of their urban place.

- Developing a TIF district thus offering a mechanism for redevelopment.

The preceding findings are regarded as indicator for the possibility of application for a LEED ND Certification for Al Rehab neighborhoods and supporting further studies regarding new Cairo districts in terms of their sustainability.

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