*https://erjm.journals.ekb.eg*
*ISSN: 1110-1180*

DOI: ---------

**ERJ**
**Engineering Research Journal**
**Faculty of Engineering**
**Menoufia University**

# Waterfront Slow-motility development (Mansoura - Egypt)

**Ahmed Salah Eldeeb[1*], Ahmed Al-Hussein Tohlob[2]**

*[1]Department of Architecture Eng., Faculty of Eng., Kafr Elheikh University, Kafr Elsheikh, Egypt.*
**(Corresponding author: Ahmed_Aboelnaser@eng.kfs.edu.eg)*
*[2]Jeddah International College, KSA*
*Misr Higher Institute of Engineering and Technology in Mansoura, Egypt.*

**ABSTRACT**

Slow mobility spaces on the waterfront are different from urban roads, which are functionally used for movement and traffic. It contains a set of various functions for entertainment, sports, nature viewing, tourist attractions, etc., and is also public places for users to perform slow activities located in the spatial scale of the waterfront and distributed along the facade, connecting many green squares, parks and gardens overlooking the waterfront, facilities and services supplementary.

The research studies the waterfront and the slow mobility on it, the behavioral characteristics of the slow mobility, like Walker activity, Slow mobility speed, Characteristics of the movement period, The length of the movement distance, and Movement path and the most important features specific to it, in addition to identifying multifunctional uses on the waterfront areas such as environment, economy, culture, history and Aesthetics, as well as its development, goals and factors of the development process that help in the development process..

Some of waterfronts in Egypt are suffering from deteriorating conditions, taking Al Mashaya area in Mansoura city in Egypt as a case study it is located on Nile River. The existing situation of that waterfront area was studied and some elements were analyzed through visits, According to its multifunctional uses and slow mobility behavioral characteristics, At the end of the research, a proposed development plan for Al Mashaya area was developed based on two axes, the first is to divide the area into six parts, and the second is to apply the behavioral characteristics of slow mobility.

***Keywords***: *Slow mobility; waterfront; development; Mansoura.*

## 1. Introduction

Different methodologies for the development of waterfront have emerged in world cities, depending on the conditions and possibilities available in terms of location conditions, water body width and the history. Globally, the design development of waterfront has gone through many stages over the decades from the late 1950s until now. During this period, waterfront have been typically viewed as strategic and important locations. Studies aimed to study the characteristics of pedestrian behavior in the on both sides of the waterfront, including a strategic analysis of how to plan a pedestrian path on the green areas of the waterfront, as well as how to design the landscape of the waterfront path.

Other studies dealt with characteristics of slow-mobility spaces and their components, properties and visual perception of waterfront path.

This paper deals with the slow mobility on the waterfront, some behavioral characteristics, and multifunctional uses and then studying and analyzing these elements and characteristics for different examples and how can the waterfront be developed?

### 1.1. Research Problem:

A lot of Waterfront slow-mobility spaces in Egypt are currently suffering from deteriorated conditions due to several factors, As a result of congestion and disorganization of slow mobility on it, the research question deals with the extent to which this reached Al-Mashaya area in the city of Mansoura in Egypt, and the availability of places and spaces for slow mobility on the waterfront in Al-Mashaya area in Mansoura, The extent to which the waterfront and its multiple uses are connected to the rest of the city, it is

evident from previous studies, that the natural, environmental, tourism, and archaeological potential of the Nile woterfront is not employed properly.
In addition to what extent has the development of the waterfront reached regionally and globally.

**1.2. Research Methodology& Methods:**
A brief study of the waterfront and its multiple uses, then a brief study of slow motion and some of its behavioral characteristics and the defining elements of it, a brief study of waterfront development plans and objectives and the most important elements that must be included during development, a brief study of examples of developing waterfronts globally, regionally and locally.
Study of the development of the Jeddah waterfront project, and the current situation of the waterfront in Al-Mashaya area in Mansoura.
Finally, an attempt to develop a proposed development plan for the Al-Mashaya area waterfront according to the previous study.

**2. Waterfront definition**
The waterfront is the area where water and land meet, and it is not only an edge or a land boundary, but rather an edge and a water boundary as well, and water covers some areas of it sometimes Figure (1), it has the highest intensity of human activities and various functions in some cities, and it may be considered Some as a city (the area of ports and places of shipbuilding, etc.) [4]
Most of the waterfront land is belted along the waterway, and people want to take advantage of these places so planners started thinking to make it more attractive by connecting traffic, creating different activities and areas and finding a way to connect with the heart of the city.

Fig.1: Elements and activities in waterfront Ref: [4]

**2.1. Urban Waterfront Concept**
The waterfront is defined by more than some define it as a boundary or edge, some described it as an open space, and some link it to the urban functions of city, Also, waterfront properties may not necessarily need to be directly fronting water but are tied to it visually or are linked to it as a part of a larger scheme[1].
It should be seen to waterfront as a network of spaces and functions that connect the water to the city and its public activities that can be cultural, recreational and environmental Figure (2) [23]

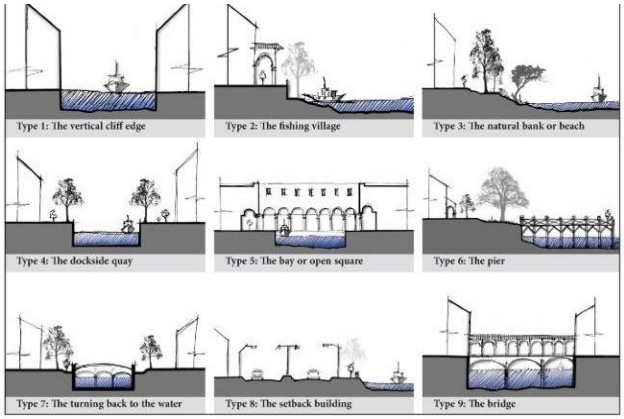



Fig.2: Typologies of the Urban Waterfront Ref: [23]

**3. Waterfront Multifunctional uses**
Throughout the ages, the waterfront has played a vital role in the urbanization over the world, and many cities have arisen along waterfront which was used as a source of subsistence through agriculture and fishing, as well as a means of transport, trade and industry. However, with the development of waterfront spaces, high competition has emerged between industrial, commercial and tourism activities and the waterfront has become a place for investments, which change the image of the city as Dubai waterfront Figure (3) [19].

Fig.3: Dubai Waterfront Development Designed by OMA Architects Rem Koolhaas 2007 Ref: [43]

So Cities have tended to implement a multifunctional system for waterfront development to increase its value and enhance users' connection with the city. The term “multifunctional” - means the ability to perform many functions, “the coexistence of different areas such as environment, economy, culture, history and aesthetics.” It means “the ability to provide

multiple functions, by integrating activities and land uses across Green infrastructure [1], so research depended on previous multi uses for development.

**4. Slow-mobility**

There are many ways to express slow mobility, such as Non-Motorized Transportation (NMT), which includes walking, cycling, running and skating.

As well as Pedestrians and Cyclists (P&C), it combines the movement of pedestrians and the movement of cyclists, and in comparison with the non-motorized transport , there are two types of transport, which are **first**: Human Powered Mobility, which is basically the same as non-motorized transport, human forces are used as a driving force. **Second**: Soft Mobility, which appeared for the first time in Switzerland, which includes bicycles, pedestrians, skateboards, and others [8]

Slow Mobility has main characteristics defined for it as a low average speed of no more than 15 km/h, a walking speed ranging from 0.5 m/sec to 2.16 m/sec, and a bicycle speed of 10 km/hr. The distance travelled by slow traffic is relatively short, within 3 km. Therefore, slow mobility is characterized by being free, clean, free from pollution and exhaust, and flexible. It also helps to do sports and is considered a green way of movement [7], also the concept of movement and stopping can include the meaning of sustainability and green [24]

**4.1. Slow-mobility urban concept**

Slow-moving urban space is a form of space that contains a slow-mobility system Figure (4). It is a space in which movement is available using slow-moving such as walking or bicycle [17].

It is generally divided into a commuting slow-mobility space and a non-commuting slow-mobility space, the first is a movement corridor for necessary activities such as study, work, pedestrian paths, corridors adjacent to sidewalks, etc. the second is a space for a variety of recreational activities sports, commercial trails, hiking trails, and walkways [8].

Fig.4: Aerial views of Singapore, The city rank in the top 10 for urban layout and mobility Ref: [17]

**4.2. Slow-mobility behavioral characteristics**

The theory of "behavior space and area" depends on the relationship between the space and the users' behavior, so the success of the Urban is based on the compatibility between the characteristics of the users' behavior and the space [46], therefore, some behavioral characteristics will be reviewed:

- Walker activity: the type of walking behavior in the waterfront can be refined such as hiking - viewing - sports - talking others, most walking behavior are mainly a spontaneous activity.
- Slow mobility speed: the free walking speed is "1.14m/s" (30-44 years old). Except for the specific period of 5-14 years old, males are faster than females, especially at the age of 15-39. So the characteristics of slow mobility speed depend on purpose of movement, the nature of the walker, topography of the place, climatic conditions, and gender and walkers group [13].
- Characteristics of the movement period: People choose to walk in leisure time, the characteristics of the movement period depend on a group of elements such as leisure time, morning and evening, and the year four seasons [42].
- The length of the movement distance: The maximum movement distance is approximately 2 km - the normal movement is from 400-500 m within 5-7 minutes, a complete path sequence length can be controlled within 600m or 1000m. Seats or active nodes should be placed above 600m and 1000m. At the same time, it is also possible to extend the walking distance by enriching the functions, spaces, visual and perspectives of the path, the shape of the path and the fluctuation of the terrain [8].
- Movement path: When a person walks, the route is not a strict straight, but with a tendency to fluctuate with curvature Figure (5) the natural movement path takes a curved shape with a length of 48 m and a curvature within 3 m, therefore, the path that takes the shape of the curve is better.

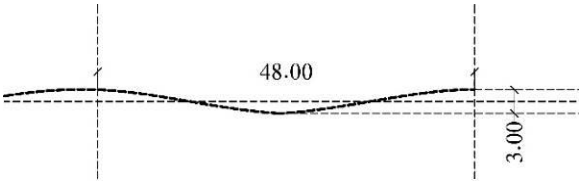



Fig.5: The nature of human movement, Redrawing by the author, Ref: [13]

**5. Waterfront slow-mobility development**

Waterfront Cities no longer depend on physical elements of buildings, but also contain flexible elements such as population, mobility, historical and social aspects, and culture as a living organism where

different components are intertwined, so any plan for waterfront development must contain elements to create a dynamic spaces [18].
Research dealt with waterfront development in general, for behavioral characteristics and multiple uses, regardless of nature of water, salty or fresh.
There are some factors that strongly contribute to the development and revitalization of waterfronts [21]:

- **Available land:** It is almost impossible to build a waterfront in coastal areas with no flat land.
- **Environmental regulations:** Waterfronts have to be clean, which is perfect for environmentalists who promote eco-friendly development.
- **Historic preservation:** There are also lots of local groups that demand the historic preservation of the landscape, so the only solution is to rebuild waterfronts and make them resemble the original.
- **Urban revitalization:** one of the main reasons to (re)build waterfronts is to revitalize urban areas and make cities more comfortable.

## 6. Waterfront Slow-mobility Development example – Global and Local experiences:

Brief Examples will be presented globally like Siofok in Hungary, The green lane in China, Jeddah in Saudi Arabia, and locally Mamsha Ahl Masr in Cairo, in an attempt to study the development methods used and the objectives, these examples have been addressed and analyzed in many international scientific researches, some of which have won awards.

### 6.1. Siofok waterfront Development:

Siofok located in southern bank of Lake Balaton and it's the capital of Lake Balaton in Hungary [12], The Idea of development for the waterfront was based on dividing the area into four main parts, the western part, the central part, the eastern part of the port and the eastern part of the coast.
The goal of Development was to create a plan, which is based on a comprehensive action plan, and call for all the participants. According to study and design strategy, the partnership and cooperation will be the key role and challenge for the cities, In addition, car traffic replaced by pedestrian surfaces [2]
*The western part:* The required functions were placed in a building to serve users. Social and community rooms were formed, shops and workshops together with the storage, near the industrial area [2]
*The central part with the peninsula and island:* The two main users, have been moved from the island to the peninsula. The industrial area opens inwards, and by means of retraction, an independent space were created as a work area. The car park was designed.
*The eastern part:* A new passenger traffic building was placed in the new events square, near the waterside. To develop touristic functions, reconstruction of the block bordered by Krudy promenade and Martirok Street was suggested.
*The eastern part of the coast:* To give value to the promenade, a 'dry dock' has been created, the promenade has connection with the beach. Shades, humidity gates, and lightweight structures were recommended on the pier, in different colors [2].
A new 'pier system' was added, other functions were proposed (sunbathing terrace, waterside bar, etc.) placed on the water surface Figure (6).

Fig.6: Siofok, landscape elements Ref: [36]

### 6.2. Guangdong waterfront Development:

Among the studies that dealt with slow mobility, Chinese study, which dealt with slow motion systems within an area called green lane on Shanghai River in Guangdong Province, where the study suggested different requirements and standards for the slow motion system in the green lane. It was proposed to activate the vital squares and add the slow movement system on both sides of the river, a proposal to plan a channel for the slow movement, as well as relying on the method of continuous displayed scenes with path for bicycles [15] Figure (7).

Fig.7: The green lane, Shanghai River Ref: [9]

### 6.3. Jeddah Waterfront Development

Jeddah is located in middle of the eastern coast of the Red Sea and is considered the economic and tourist capital of Saudi Arabia, with an estimated population of about 4.3 million people, as the second largest city after Riyadh, the capital [16], It is the first stop where pilgrims from the world on their way to Mecca, through its international airport, and its seaport [28].

Jeddah waterfront project has won many awards for those interested in construction and sustainability like Big Project Middle East award [37].

The Idea of development was based on Development of Northern Corniche, middle Corniche, southern Corniche, and The open museum with two other project: development of Palestine Street and south Obhor corniche located to the north of Jeddah [35].

The project aims to creation of safe sites for the practice of various hobbies such as fishing, walking and watching the sea, applying the principle of approved studies on transport and traffic to facilitate motion and traffic, providing the necessary points for pedestrian and the sufficient number of parking, confirming the auxiliary sublines [20] Figure (8).

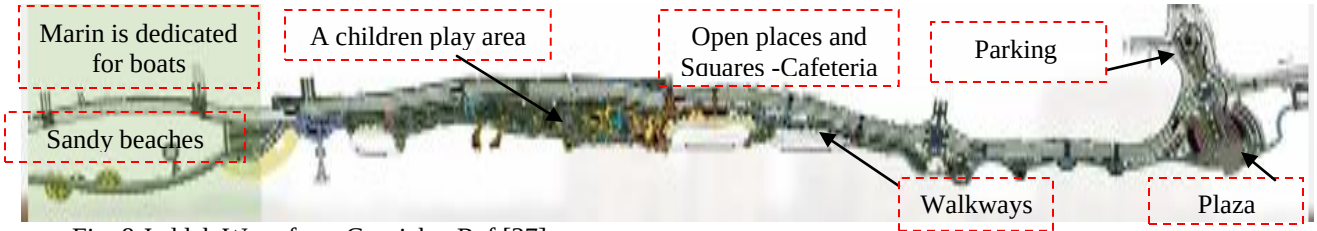



Fig: 8 Jeddah Waterfront Corniche, Ref [37]

The project content of 4630m Sea walk, it can accommodate 120,000 people, A picnic area, Swimming beaches, parking, plaza area, port hiking boats, shark protection network, fountain, Watchtowers, Buildings, Sea taxi, Marin is dedicated to boats, Playgrounds and aesthetic figures, Suspended footbridge, Fishing pier and Educational games for children Figure (9).

#### 6.3.1 Goals of Jeddah waterfront Development

- Make the waterfront as one designing model with multi functions with services.
- Historical and cultural assets in the development.
- Create social and recreational spaces for all.
- Provide both safety and enjoyment for users and for practice different hobbies.
- Rely on smart transportation to facilitate traffic.
- Providing advanced systems for electricity, water supply, sewage and others.
- Re-design the exits of the commercial area to determine the identity of the spaces.
- Providing services with standards [16].

Fig.9: Elements in the project, Ref: [27]

*Development of Northern Corniche:* Consisting of two parts, First included Water Park, sand beach, marina, open-air celebration, Public Park, open air restaurants, kid's area and family entertainment, Second included developing of waterfront, adding green areas, promenade, swimming beaches, public toilets, observation towers, marine taxi, sculptures, marine docks, parking lots and central control room.

*Development of Middle corniche:* This part was developed in both landscape features paving, flowers boxes, lighting elements, fountains, seats and baskets, adding parking areas, and rain drainage [16].

*Development of Sothern corniche:* Including garden 3 km along the sea, making attraction points for users and visitors, and providing the needed services.

*The open museum:* location is considered one of the world largest open museums, including many sculptures and art works made by famous artist [35].

The development of the Jeddah waterfront has been studied and analyzed according to the multifunctional uses and behavioral characteristics of slow mobility:

#### 6.3.3. Waterfront Multifunctional uses

##### 6.3.3.1. Environment

The project contains a large green areas with aesthetic view, various types of trees and flowers.

It contains a grassy area and interactive fountains, in the middle, there are industrial lakes [22] Figure (10).

Figu.10: Plants and Trees and Water yards, Ref; [37]

**6.3.3.2. Economy**

Jeddah waterfront has been exploited so that it has a lot of projects, the most important Lamar Towers Figure (11), Jeddah waterfront is also characterized by a lot of shopping malls, amusement parks, restaurants, parks, hotels and tourist resorts [35]

Fig.11: International hotels, Lamar Towers. Ref; [27]

**6.3.3.3. Culture**

Jeddah Museum of Stereoscopic, features a collection of the world's rarest sculptures, with up to 400 works, made by world sculptors [16] Figure (12).

The museum also houses a workshop where specialists are carrying out restoration work, this gives the place a distinct identity and culture.

Fig.12: Sculptures in Jeddah Museum, Ref; [37]

**6.3.3.4. History**

The city of Jeddah has a historical value and thus its waterfront, and one of the objectives of the project is to preserve buildings of historical value, among these buildings is the Floating Mosque, built on stilts so that it looks like floating on the sea. It is considered one of the architectural heritage Figure (13) [20].

Fig.13: Floating Mosque, Ref; [39]

**6.3.3.5. Aesthetics.**

Jeddah waterfront development project is at the forefront of waterfront development projects, giving the vast space and creative design a refined character in innovation and implementation, and a civilized example in structural beauty and integrated infrastructure, The project contains Seven waterfront picnics, including pearl square, shells, sand, uniformity, hunter and other squares, each characterized by its names[39] Figure (14).

Fig.14: Jeddah cornice, Ref; [27]

**6.3.4. Slow-mobility behavioral characteristics.**

**6.3.4.1. Walker activity**

The project contains a 125-meter fishing pier inside the sea, recreational places suitable for all ages and educational games next to traditional games and area for restaurants, mobile vehicles and seating areas, In addition to sports and walking activities[39] Figure (15)

Paths, Seating and Children's play area Author, March. 2022

Fig.15: Jeddah Waterfront activities.

**6.3.4.2 Slow mobility speed**

Provide infrastructure to help walking, cycling and other non-motorized means. Movement lanes are designed differently, allowing for slow movement at most hours of the day, taking into account the nature of the walker, topography of the place, and gender.

**6.3.4.3. Characteristics of the movement period**

Connecting the waterfront as a single design block with multiple uses interspersed with public services, recreational and social services, and provide recreational and social areas for all users Figure (16),

this is to take into account the different periods of hiking and walking during the day and the year.

Fig.16: Slow-mobility Path, Ref; [27].

**6.3.4.4 The length of the movement distance**

Dividing project into parts and creating squares and spaces along the path of movement helped in finding natural walking distances for users, With the distribution of landscape elements through path, which Stretching from Nawras Roundabout to Jaber Bin Al-Harith Street, 4,500 m long [38] Figure (17).

Fig.17 Jeddah Waterfront, Ref; [27]

**6.3.4.5 Movement path**

The movement during the project takes a curved shape due to the design idea, the design was inspired by the stripping of bird shape and the entanglement of its parts and wings, the design Project logo was inspired by the seagull, which spreads on the shores of Jeddah, and has a unique shape Figure (18).

Fig.18: Project Idea from the seagull, Ref: [27]

**6.4. Mamsha Ahl Masr:**

The last example is Mamsha Ahl Masr (The Walk of the People of Egypt), is a multi-segment project that starts in Cairo, Egypt and extends north and south to the upper and lower ends of the Nile. The waterfront Development aimed to secure three objectives. The first is to offer public access to the waterfront, sometimes difficult due to the privatisation of several parts of Corniche. The second is to provide sufficient income for "the maintenance and sustainability". The third is to reconnect Corniche to heart of Cairo and to reintegrate it as part of its visual and physical character of capital [33] Figure (19).

Fig.19 Mamsha ahl Masr Waterfront, Ref; [33]

The project consists of three phases, the first from Imbab Bridge to 15 May Bridge, opened in 2022.
The project included various projects for tourism and investment such as a yacht marina, plazas, an open theater on the Nile, restaurants, cafeterias, seating areas, fountains, and pergolas Figure (20, 21), It included establishment of services and outlets, works to encourage the practice of water sports, rowing and sailing. It provides parking at a low level and the exploitation of its surface and facade for activities, providing the needs of special people [34].

Fig.20 Mamsha ahl Masr Waterfront, Ref; [33]

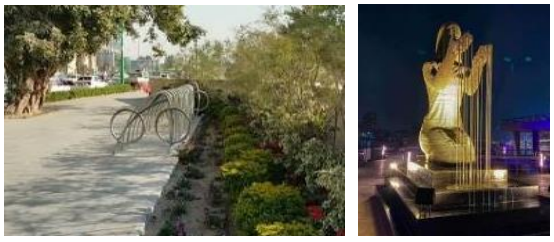


Fig.21 Mamsha ahl Masr Waterfront, Ref; [34]

*The second phase* includes the construction of a gradual walkway along the Corniche with a length of 4.7 km. The project includes many buildings, restaurants, shops, garages and theaters [33].

*The third phase* consists of two sectors, first, from Tahya Misr Bridge to the Sahel Bridge, second, from Qasr Al-Nil Bridge to Qasr Al-Aini Bridge.

**7. Al-Mahaya area in Mansoura city**

The case study that the research studied in order to develop based on previous studies is Al-Mashaya area which located in Al Mansoura.

Mansoura located about 120 km to the north Cairo, Mansoura city is the capital of Dakahlia Governorate in Egypt [4] Figure (22&23). It lies on the east bank of Damietta Branch of the Nile Delta, opposite to the City of Talkha city on the west bank [28].

Al-Mashaya area is the main in Mansoura Figure (24), linking areas and buildings along the Nile, from Governorate building, passing through Happy Land area, Talkha Bridge, Mansoura University.

Fig.22: Mansoura Location, Delta Egypt, Ref: [11]

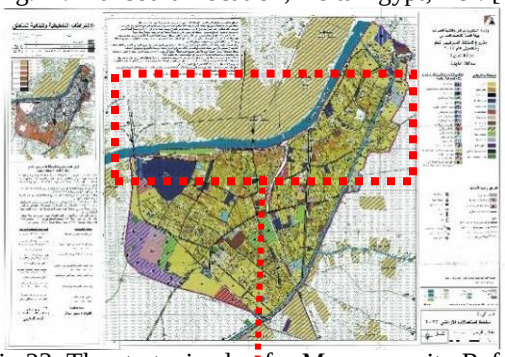


Fig.23: The strategic plan for Mansoura city Ref: [3]


Fig.24: Part of Al-Mashaya waterfront, Ref: [44]

There were several transformations on region. In 1990, a number of casinos have been opened. In 2000, the gardens, parks and spaces were upgraded. In 2010 was the transformation of the low level of the river into a walkway which was a significant shift in the development. Services have been added that enabled pedestrians to Connect River, but the path was again used to establish projects such as cafes and restaurants, which blocked river access Figure (25).

Fig.25: Mansoura waterfront 2019, Ref: [5]

In 2020 a bridge were constructed to reduce traffic congestion from Mansoura to Talkha and to link Mansoura with Gamasa, Mahalla and Damietta Roads[12], But it lost contact with the river Figure (26).

Fig.26: Riverfront of Mansoura City 2021.

**7.1. The current situation of Al Mashaya area: First,** the case study dealt with identifying multifunctional uses, which contain Environment, Economy, Culture, History and aesthetics as section 3.

**7.1.1 Environment**

There is a few percentage of environmental elements. There are some spaces used for activities, but it is for clubs such as Al-Jazira Club, Nile Club, Police Club and others, surrounded by high walls and gates, which obscures the view Figure (27).

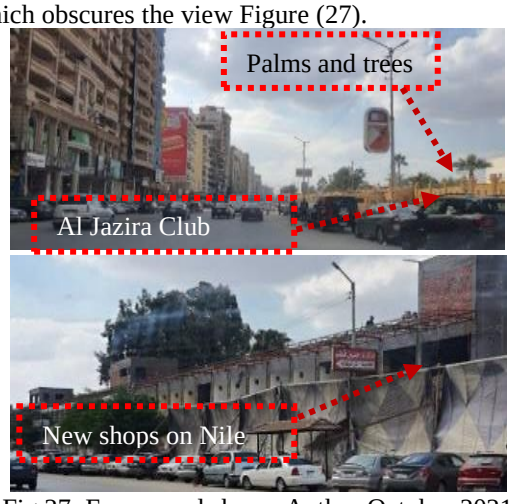



Fig.27: Fences and shops, Author October 2021

**7.1.2 Economy**

The projects presented aim to economic benefit without looking at importance of waterfront and linking it to city. As is happening now in an agreement was concluded between the Dakahlia Governorate, the Ministry of Irrigation, Culture and Agriculture to establish a housing project (Tahya misr) [23] regardless the rights to benefit and slow-mobility waterfront for all Figure (28).


Fig.28: Proposal for housing project, Ref: [3]

**7.1.3. Culture**

Mansoura is famous for its cultural landmarks, including buildings on the waterfront such as; Mansoura Palace of Culture and Egypt Library Figure (29), next to the Governorate. Established in, 2005. The library is the third library to be opened after the New Valley and Port Said libraries.


Fig.29: 1.Culture Palace, 2.Library, Ref: [3]

**7.1.4. History**

There are historical monuments, but it have been changed to use for a financial purpose, like the Khedive's rest Figure (30), which back to the era of Muhammad Ali, converted into a motel.

Fig.30: The rest and use change Ref: [3].

**7.1.5. Aesthetics**

A large percentage of the waterfront has been allocated to private clubs. These clubs construct fences and barriers, which are a barrier between city and river, which in turn affects the aesthetics of the area, As well as the establishment of shops along Nile, in addition to the traffic congestion Figure (31).

Fig.31: Traffic congestion, Author October 2021.

**7.2. Second**: The case study dealt with the behavioral characteristics of slow Mobility as section 4.2:

**7.2.1. Walker activity**

Pedestrian activities differ in Al Mashaya area as a result of the different uses, for example; University students and employees, as well as those frequent hospitals Figure (32), those frequent the clubs on the Nile and the shops and restaurants, which affects the nature of the activity and the type walker.

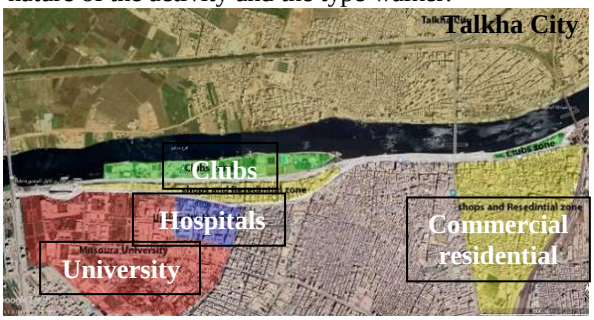



Fig.32: Multiple activities in Al Mashaya, Ref: [44]

There are some none shaded seating on the sidewalk Figure (33), or walking in groups in the parking lot because there is not enough area for pedestrians.

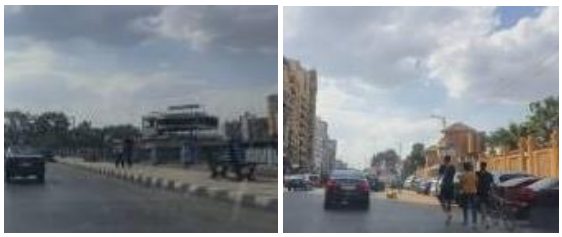


Fig.33: Walkers Activities, Author October 2021.

### 7.2.2. Slow mobility speed

Al Mashaya area is known for its high density of pedestrians which reaches up 2,600 people per hour in some area, due to its multiple uses Figure (34). [25] As a result of this high density and different topographical of the area, this is effect on movement.

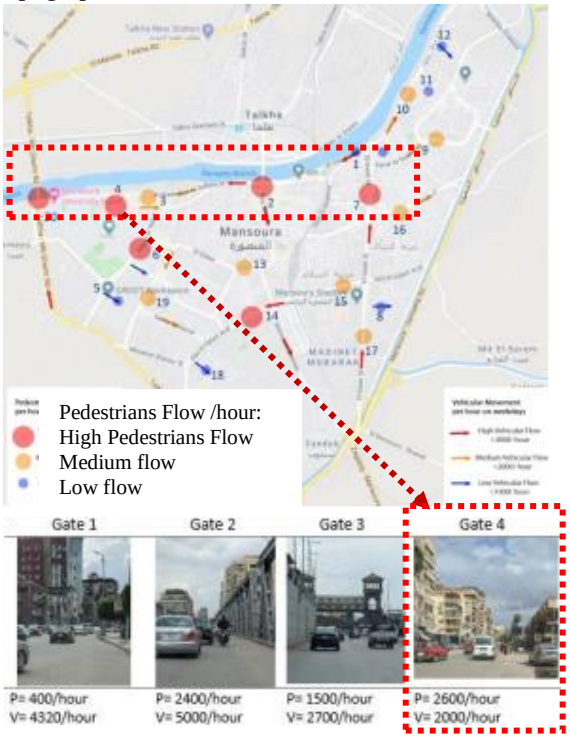



Fig.34: Main Gate in al Mashaaya area, Pedestrian flow per hour (P) & vehicular flow per hour (V) in the main areas Ref: [25]

### 7.2.3. Characteristics of the movement period

The characteristics of movement in Al-Mashaya, varies according to the time, in the morning, the movement of students and visitors to the service buildings is until noon, and then the peak is when the users leave, And the movement of those who frequent some shops, in the evening the movement of those who frequent the clubs, restaurants and shops, This differs somewhat in the vacation.

### 7.2.4. The length of the movement distance

The waterfront of Al-Mashaya extends from Governorate building to University Bridge, with a length of up to 4000 m, There are 5 main Parts, represented in Governorate Square to Talkha Railway Bridge with a length of 600 m, from Talkha Railway Bridge to Talkha pedestrian and car bridge with a length of 850 m, from Talkha pedestrian and car bridge to Shajarat Al Dorr Garden of 850 m, from Shajarat Al Dorr Garden to Eastern Weavers Building 1500 m long, and from Eastern Weavers to University Bridge 450 m long Figure (35).

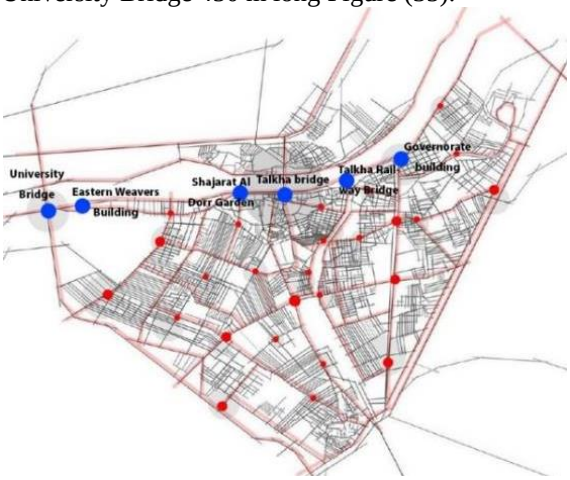



Fig.35: Main nodes on Al Mashaya Ref: [25]

### 7.2.5. Movement path

Because of the nature of the Al mashayaa, which is formed as a result of Nile River Figure (36), which takes form of a curve similar to the movement of pedestrians, Therefore, we find the effect of this shape on the corridors and streets on both sides of the Nile, and thus on the paths of pedestrian.

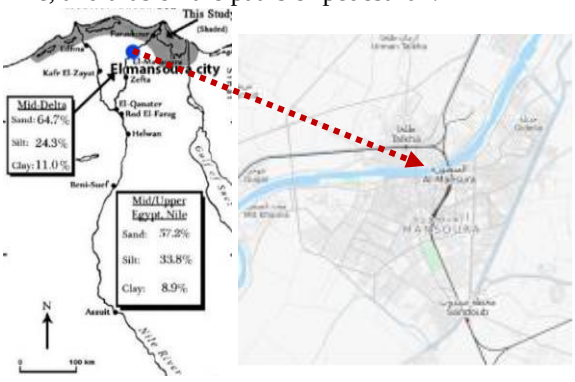



Fig.36: The birth of Mansoura on the Nile

**8. Results, Proposal development plan for Al-Mashaya waterfront:**

After studying the Multifunctional uses on the waterfront and the characteristics of slow mobility, Studying experiences for waterfront development, and knowing the current situation in the Al-Mashaya, it was possible to work out a proposed strategy plan for waterfront development, A general conception of the area so that it is combined by a comprehensive design that shows the nature, history and identity of the area and is divided into a group of parts. Through two stages, **The first** includes dividing the area into five main parts, and some actions that can be taken when developing each part, **The second** depending on the elements studied during the research, whether behavioral characteristics or multiple uses.

**8.1. Parts of a development plan and aims:**

It relied on five main parts, According to length of movement path (7.2.4) and some distinctive features in that area, the division may vary according to other criteria, the main parts are shown by Figure (37).

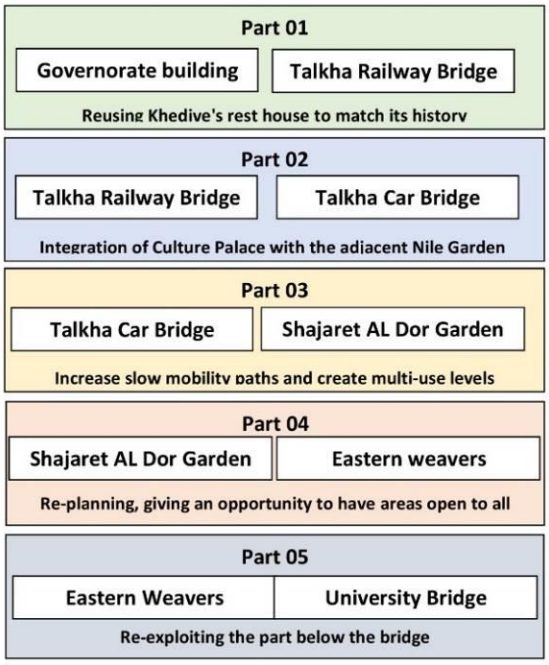



Fig.37: Five parts for development plan, By: Author.

The strategy aims to provide contact with water, reconnect the city with river, and give everyone the right to benefit from waterfront. In each of parts the elements of slow-mobility development are used, Identifying spaces and places that can be developed, preserving valuable elements, whether buildings or trees, while relying on environmentally methods.

*The development plan is based on the following:* Replacing car lanes with pedestrian tracks, Establishing light facilities for social, commercial, recreational and other uses, Establishment of a multi-story car park so that it does not prevent contact with the river, Dealing with distinctive and historical monuments and reviving them, Pay attention to the visual sequence of pedestrians during movement, Provide slow motion elements for pedestrians, bikes, etc., Providing collection Squares and spaces, Adding complementary elements such as umbrellas and equipped seating seats, and adopting a range of appropriate colors, Urging users and visitors to the region to cooperate and express their views on the development plan, while relying on recent research and studies, Re-studying and planning the streets leading to the area so as to help connect the city and the river, Creating opportunities that provide income that helps the project to continue and maintain it.

Encouraging users to use slow mobility systems as it is cheap, clean and environmentally, Establishing attractions distributed along waterfront that illustrate the identity of the area, in addition to focusing on characteristics of slow movement on the waterfront, which will be summarized in the next part.

**8.2. Elements of a development plan:**

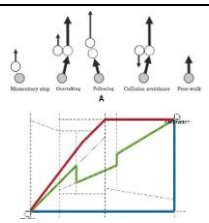
The second stage of the development plan depends on two parts: *the first part*, the multifunctional uses on the waterfront and the importance of the role it plays in the prosperity and development of the region and the city, and creating competitive opportunities between the different uses, whether they are environmental, economic, cultural, historical, or aesthetic and others.

Some guiding elements for Multifunctional uses have been clarified in the plan, which helps to understand the uses and how to deal with them, either through different experiences around the world and some of the places visited by the researcher Table (1).

*The second part:* Behavioral characteristics of slow motion as Walker activity, slow mobility speed, Characteristics of the movement period, the length of the movement distance and Movement path.

Which are linked to movement by Non-Motorized Transportation Like walking, cycling, running and skating etc. Where it helps to exercise and at the same time is cheap and environmentally, as well as relying on spaces for slow mobility and dividing them according to important activities such as work, studying, and places for people with special needs. And other interactive activities such as sports, commercial trails, hiking trails, and walkway. Finding other opportunities that help to combine the behavioral characteristics of users and spaces.

**Table1: Proposal of a development plan elements for Al-Mashaya waterfront according to the Multifunctional uses and Slow Mobility behavioral characteristics, Author.**

| **A. Multifunctional Uses** | | | | |
|---|---|---|---|---|
| Environment | Economy | Culture | History | Aesthiecs |
| Increasing the percentage of green areas open within the elements of Landscape with the addition of water elements such as fountains and water pools and working to make Al-mashaya area as a green that will be the nucleus of a green city. | Benefiting from the currently proposed project, (Tahya misr), so that it is economically feasible and exploiting the waterfront and maximizing the benefit of it with the work of small projects along the waterfront, whether kiosks or carnivals. | Preserving buildings with a character and identity, such as Mubarak Library, the governorate building, and the Palace of Culture, and maximizing the use through an open museum path in which the most important artworks are showed. | Inventory of buildings and archaeological elements, Preserving and restoring them and dealing with them with great care and adding lighting and sound elements. Like the Khedive's rest house, As well as traditional residential buildings. | Giving the opportunity to make open gathering spaces distributed along the waterfront divided over the area and presenting proposals to re-plan with the addition of aesthetic elements, solve traffic congestion and random ads. |
|  Hunter's Point South Waterfront Park, New York, Ref [29]. |  Kiosks with Outdoor Seating, Waterfront Pier Park, Ref [30]. |  Metal Sculpture Large Wing Art Décor, Ref: [40]. |  Städel Museum, Art museum, Frankfurt, Germany, Nov. 2021. |  Cheonggycheon River, Seoul, South Korea, Ref [31]. |
| **B. Slow Mobility behavioral characteristics** | | | | |
| Walker activity | Slow mobility speed | Movement period | Lenght of movement | Movement path |
| Creating movement paths for pedestrians to benefit from the activities associated with the waterfront to ensure the quality of life, Also specifying places for seats. With the separation of activities in the area from the activities of the waterfront through tunnels or increasing the width of the waterfront etc. | Separating the different paths, for pedestrians or bicycles (P&C), identifying places for the elderly and people with special needs, and taking advantage of the topographical, Designating places as stations for mass transit, using Eco environmentally transport, solutions for congestion. | Receiving different types of users in the morning, noon and evening of university students, employees and visitors, and integrating their requirements with the waterfront, While working to relieve stress and insomnia for them throughout the day, By creating interactive social spaces for everyone. | Dividing the paths into acceptable distances within its standard limits (600-1000 m), and enriching the functions, spaces, visual and perspectives of the path, the shape and the fluctuation of the terrain, Through multiple landscape, Taking into account the different users. | Relying on the free movement of users in shaping the movement paths for them and using it in re-planning the waterfront, And take advantage of the free water front of the Nile River in that area, Taking into account the nature and identity of the historical and cultural place. |
|  MainRiverwaterfront, Frankfurt. 2021. |  Eco environmentally transport, Ref: [6]. |  A views of public use Hafencity, Ref: [41]. |  Iron Footbridge, Frankfurt, 2021. |  Different pedestrian behavior, Ref: [17]. |

**9. Recommendation:**

The research recommends a set of points, some of them are general and others are specific to al mashaya area directed to the responsible authorities, such as the Dakahlia Governorate, the Ministry of Culture, Agriculture and Transportation, the Traffic Department, the Urban Communities Authority and the Urban Planning Authority in Egypt:

Paying attention to the water interfaces in Egypt and working to develop them, whether they are on the sea or the river, because of their effective role in developing the area in which they are located.

The importance of providing the means and methods of slow movement in the waterfront, while integrating its behavioral characteristics in the design.

Providing a number of multiple uses on the waterfront increases the chances of competition there.

Studies and research indicate the importance of the connection between the city and the water through the public activities on the water front.

Establishment of a sustainable infrastructure network (electricity, water, sewage, networks, etc.)

Enhancing the pedestrian and bicycle paths, parking spots, etc., in any project that is designed.

Disseminating Mamsha Ahl Masr to the entire Egyptian state to include all including Mansoura.

Stopping projects, which represent an obstacle to the connection between the city and the river, and developing a complete vision along the waterfront.

Adopting new sustainable methods of transportation to solve the congestion.

Enhancing the use of environmental elements, whether plant or water, in future projects.

Any proposal developed is reviewed and the extent of the connection between the river and the city studied.

Paying attention to the distinctive landmarks and showing their role such as the Khedive's rest house.

Show the identity of the region on the waterfront, whether cultural, historical, economic and others.

**10. References**

[1] Ayham Mouad, 2013, "Multi-Functional Urban Waterfronts, Case study – The Nile River in Central Cairo", MSc, Ain Shams University, Egypt and Stuttgart University, Germany.

[2] Beri M. , 2017, Detected space, thoughtful space, lived space: The tripartite of spatiality is an example of a brownfield rehabilitation berth in Budapest, Vol. 31, No. 2, pp. 23−43.

[3] Dakahlia government, www.dakahlia.gov

[4] Diyun Hou, 2009 Urban Waterfront Landscape Planning,MSC, Blekinge Institute, Sweden.

[5] Doha Al-Saied, Sherif Sheta, Nanees El-Sayad, 2018, "Urban Upgrading of the Riverfront of Mansoura city in Egypt – Using LEED-ND Criteria", Journal of Engineering Sciences, Assiut University, Vol. 46 No. 5, PP. 587 – 598.

[6] Eco environmentally friendly transport, June, 2022 https://www.vectorstock.com/royalty-free-vector/eco-environmentally-friendly-transport.

[7] Fernando Alves, Sara Cruz, Anabela Ribeiro, Ana Bastos Silva, João Martins and Inês Cunha, 2020, "Walkability Index for Elderly Health, https://www.mdpi.com/journal/sustainability

[8] Gedan, (2018)," Landscape design method of the urban waterfront slow-mobility space", Architect DLA Dissertation Marcell School.

[9] Hu Min, 2019, Best path to future is along a greenway, shine, shanghai daily, April, 2022. https://www.shine.cn/news/metro/1903261922/.

[10] Hussein, R. M. R., (2014), Sustainable Urban Waterfronts Using Sustainability Assessment Rating System, World Academy of Science, International Journal of Architectural and Environmental Engineering, Vol.: 8, No.: 4.

[11] I.R. Hegazy, M.R. Kaloop, 2015, " Monitoring urban growth and land use change detection with GIS and remote sensing techniques in Daqahlia governorate Egypt", Gulf Organization for Research and Development International Journal

[12] Janos G., Gedan, Peter P., 2018, Concepts for Waterfront Developments focusing on Siofokm, Hungary, Pollack Periodica, International Journal for Engineering and Sciences.

[13] Japanese Architecture Society 2007, Japanese Architectural Design Data Integration (Human Space) [M], Tianjin University Press.

[14] Li Wei, 2008, slow traffic system planning Discussion—taking Shanghai as an example, Urban Planning Journal.

[15] Liu Yang, Wang Yun, Lu Junyao, Sheng Siyuan, 2017.Construction of Bicycle Greenway in Binjiang Section of Huangpu River Expo, Journal of Shanghai Jiaotong University.

[16] Lobna A.Mostafa, 2017, Urban and social impacts of Waterfronts Development, case study: Jeddah Corniche, International Conference, Procedia Environment.

[17] Maria Bezbradica& Heather J. Ruskin, (2019) "Understanding Urban Mobility and Pedestrian Movement", Smart urban, Intechopen, Vito Bobek, Universities of Applied Sciences.

[18] Marichela Sepe (2013) urban history and cultural resources in urban regeneration: a case of creative waterfront renewal, Planning Perspectives, 28:4, 595-613.

[19] MÁRTIRES, L. (2007). Waterways in Urban Tokyo. M.Sc. Department of Social and Cultural Environment, the University of Tokyo.

[20] Mujahid Malik, 2017,"The effect of the visual formation of waterfronts in the urban environment", Architecture Engineering, Sudan.

[21] Planning Tank, 2020, Waterfront development background, need & example, School of Planning & Architecture, New Delhi, India,

[22] Report / Mayor of Jeddah Governorate to "SPA": The Jeddah Corniche, first addition.

[23] Riham A. Ragheb, 2017, "Sustainable Waterfront Development—A Case Study of Bahary in Alexandria, Egypt ", Journal of Civil Engineering and Architecture.

[24] Rosa Anna La Rocca, 2010, "Soft Mobility and Urban Transformation", Journal of Land Use, Mobility and Environment.

[25] Sara elgamal, 2021 "space syntax evidence-based urban solutions", MSc, Architecture Engineering, Mansoura University, Egypt.

[26] Saudi Cities Future Program, 2019, the comprehensive urban vision of Jeddah, Ministry of Municipal and Rural Affiars.

[27] Saudi Government, https://www.jeddah.gov.sa

[28] The Egyptian Green Building Council, (2014), the Report of Delta Cities, April, 2018.

[29] The website of (SWA) an international landscape architecture, planning and urban design firm, June, 2022, https://www.swagroup.com/

[30] The website of Hudson County in New Jersey, https://hudsoncountyview.com/ , June, 2022.

[31] The website of architectural and design publishing, Down by the river, June, 2022. https://architecturenow.co.nz/articles/

[32] The website of Big project Middle East awards, https://bigprojectmeawards.com/ march.2022.

[33] The website of Egypt State Information Service, Mega Projects, Mamsha ahl Masr, June,2022 https://www.sis.gov.eg/?lang=en-us

[34] The website of Egypts Projects Map, June,2022, https://egy-map.com/ .

[35] The website of Emirate of Makkah Region, Jeddah Governorate, April, 2022, https://www.jed.gov.sa/Arabic/aboutjeddah.

[36] The website of expedia group company for Travelling, June, 2022 https://www.expedia.com/Siofok.dx5911

[37] The website of Midrar Company, Saudi founded in 2007, https://midrarksa.com/portfolio/lamar-towers-jeddah-ksa. , December, 2021.

[38] The website of Saudi Gazette, https://saudigazette.com.sa/article March, 2021.

[39] The website of Saudi Salco company, https://salco-sa.com/portfolio, October, 2021.

[40] The website of YouFine Art and Sculpture Company, Quyang County, Hebei, China, June, 2022, https://www.metalssculpture.com/

[41] Umut Pekin Timur (2013) Urban Waterfront Regenerations, Advances in landscape Architecture, IntechOpen, www.intechopen.com

[42] Urban Times, 2021, The Beauty of urban planning from space.

[43]www.dezeen.com/2008/03/12/waterfront-city-masterplan-by-oma October, 2021.

[44] www.googlemap.com

[45] Yan Ming, 2017, Research on Urban Line-type Riverfront Greenland Landscape Design based on Behaviour (D) Southwest University.

[46] Zhang Houcan, 2003, Behavioral Psychology (M) Hangzhou: Zhejiang Education Press.