

# Towards Jeddah Smart City: Assessing People Perception Of Spacious Quality Indicators In Open Spaces

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## 1 ABSTRACT

Strengthening sustainability within a smart community often begins with a clear vision but it is really a process of creative, local, balanced decision-making that continues to adjust to changing realities of community and urban living. Jeddah, a city with Waterfront communities that attract people all year round, has a strong character and economic backgrounds. It includes dramatically improving access to the waterfront, that is subject to continuous renovations while maintaining attractive, environmentally sound parks, open spaces and recreational opportunities, stimulating mixed use development. The research demonstrates people responsiveness against promenade experience applying wearable sensors that reflects stress levels along studied areas. The results of data will highlight potential of further design recommendations and modifications in order to maintain a sustainable community that supports and encourages diversity taking in consideration long-term and external impacts into account during municipalities decision-making.

## 2 INTRODUCTION

Strengthening sustainability within a smart community often begins with a clear vision but it is really a process of creative, local, balanced decision-making that continues to adjust to changing realities of community and urban living. Studies have been extended on many cities waterfront related to their historical impact as well as potential of futuristic developments.

The fundamental principle is to elaborate and enhance the public realm, through transformation of the Gardiner corridor, the creation of networks of public space and parks, of developing park streets to the water that arrive at extraordinary waterfront plazas, of creating a public water edge, and enlivening the whole waterfront with new mixed-use residence and work environments (Nicholas, 2011).

Through Smart Growth, natural resources should be protected through open space design and conservation. Therefore Jeddah Waterfront communities are designed to attract people all year round with its strong character and economic backgrounds.

The aim of the project research presented in this paper is to investigate the quality of openspaces provided along the seafront. In addition to analysis of measured emotional stress along the site studied a methodology adopted to answer similar research potentials (Taha et al., 2012,2013) which can define to what extent different cultural environments can influence the perception of the surrounding situations.

### 2.1 Jeddah City Developments

Jeddah City is the most cosmopolitan city due to its location on the seafront and the main gateway to the two holy cities. Its population is almost 3.2 million but expects more than 15 million visitors yearly.

Jeddah municipality strategic plan 2009, "what makes a city successful", figure 1.

The municipality is proceeding and enhancing their strategic plan related to jeddah waterfront since 2014 till now with upgrading the refurbishing. The main points of development are:

- Introduce integrated waterfront management
- Protect and enhance Jeddah's waterfront area
- Provide high quality facilities on the waterfront
- and Increase public accessibility

The waterfront Coastal Development extends on 12 km out of Jeddah Corniche is the 30 km coastal resort area of the city of Jeddah. Located along the Red Sea, the corniche features a coastal road, recreation areas, pavilions and large-scale civic sculptures as well as King Fahd's Fountain, the highest fountain in the world.

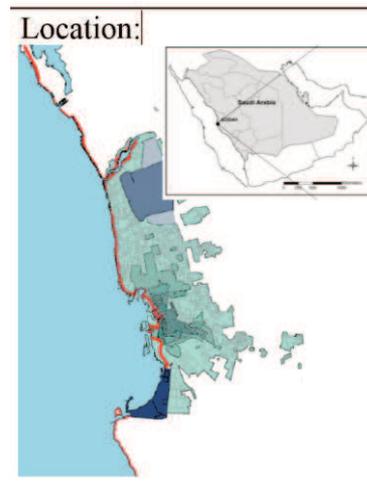


Fig. 1: Jeddah Corniche developments according to municipalities plan, 2009.

### 2.2 Waterfront Developments impact on Jeddah Community:

Jeddah, the second largest city of Saudi Arabia, a city with Waterfront communities that attract people all year round, has a strong character and economic backgrounds. It experienced a rapid urban growth, spatial expansion and transportation infrastructure expansion over the last 40 years with rates of change ranging from 0% to over 100 throughout the city indicating a wide variability across space and complex urban dynamics. Jeddah’s population grew rapidly from 147,900 in 1964 to 3,247,134 in 2007 (Aljoufie et al., 2012).

Currently undergoing renovation, the Corniche will be renewed, expanded, and upgraded with restaurants, play areas, and entertainment (A.Nayer, 2015). The entire renovation phase should be completed around early 2014. Strengthening sustainability within a smart community often begins with a clear vision but it is really a process of creative, local, balanced decision-making that continues to adjust to changing realities of community and urban living by adopting strategies focusing on the elements of successful waterfront development in figure2.



Fig. 2: Elements of successful waterfront development.

### 3 STATEMENT OF RESEARCH

The research paper represents the results for investigation done with groups of participants along specified walkways along the most populated Research Case study suggested will investigate the degree of responsiveness of various features on Jeddah coastal road, recreation areas, pavilions and large-scale civic sculptures through various undertaken experimental effects during different daytimes.

Data Collected through wearable devices interfaces consider the development of these emerging technologies and their social implications and applications. Tools admitted for the study The Physiological Stress Reaction (Bergner et al. 2011).

### 3.1 Methodological approach

Investigation for Urban Development regarding community response relative to urban spaces potentials by assessing physiological response, which involves the future collaboration with research team engaged with urban spaces by using wearable computing devices (Taha et al., 2012); briefly set out some contexts of public responses in entertainment open spaces along the developed cornice where artifacts are emerging.

The main demonstrated responses against stress points indicate the change of normal responses, causes are documented via cam recording and tracking specific site location via GPS location. Main steps of the research includes:

- Data analysis from collected data
- Benchmarking against actual surveyed case
- Explicit listing for prospect solution

### 3.2 Participants and trip selection

Project participants were selected based on average age of 30 to 40 years old. Female majority contributed, since the approach is encouraging the families for outdoor activities in most comfortable way possible.

After observation the research team took decision to maximise the stress level by considering the trips on weekends ( Friday evening, Saturday morning and evening).

The time selected for the trips was based on family gathering routines as well as peak hours for mostly populated part of the cornice as presented in figure 3, based on the methodological approach presented earlier in (A. Nayer, 2015).

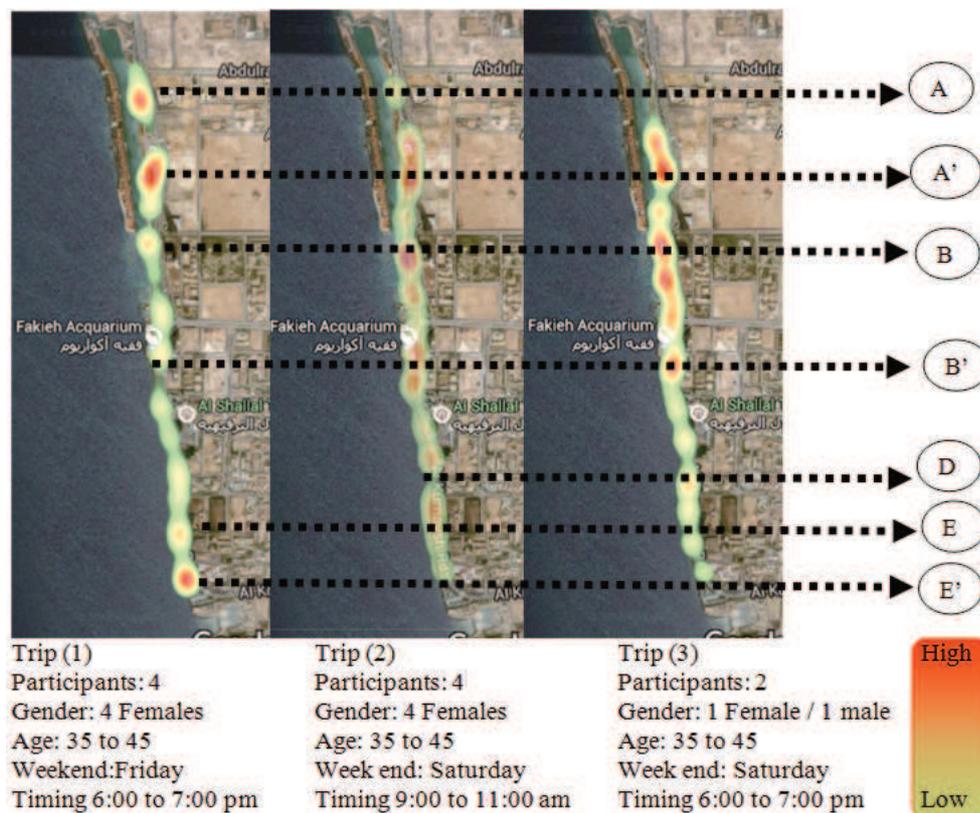


Fig. 3: Stress analysis on trips 1, 2 and 3 on weekend days.

## 4 ACTUAL INVESTIGATED SITE SPACIAL FEATURES :

Waterfronts are dynamic places by nature. As an edge environment, the overlap of different communities of users and dramatically different conditions make for enormous amounts of complexity and energy as described in Jeddah experience as follows:

#### 4.1 Spatial features:

The walkway along the experienced path is paved with a green boundary towards the edge of the main street, slightly slopped towards sea view. Along the waterfront, where no fishing or swimming is allowed, there is a handrail benches and artifacts as well as open slots for families' settings.

In Figure 3 high stress points are indicated at point A, A', B , E and E' are related to parking area with proximity to walkways. Point B as per figure 4, has a crossing point for cars drop off for entertainment facility.



Fig. 4: Entertainment facility at zone B crossing point, extended to a narrow walkway.

#### 4.2 Typical Refurbishment:

along the cornice for the prototype area investigated with total length of 3.5 km walkway with an interruption point B with entertainment facility that requires potential of car access. Areas are allocated for kids playground with green areas as well as seats and shaded areas. special safety measures along the coastal edge, paving and lighting features as demonstrated in figure 5.



Fig. 5: typical refurbishment for Jeddah cornice.

#### 4.3 Derived Areas of potential developments required:

Point A , A' and B stress is again increased due to the undfined boundaries between parking areas as well as high concentration due to accessibility points for mosque in Point A, Restaurants in Points A' and B.

Stress is increased on Point B due to the narrow width of the walkway. In addition to Proximity of service roads at points A, B and E' increasing noise, crowded and stress levels, as per figure 6.

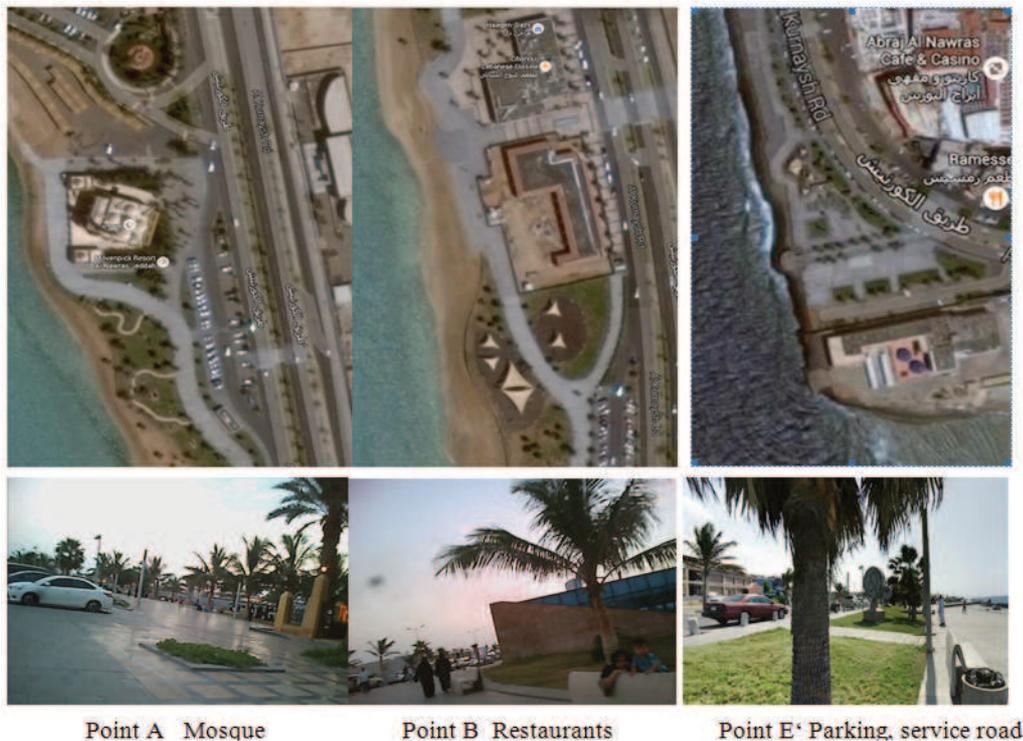


Fig. 6: Proximity of service roads at points A, B and E' increasing noise, crowded and stress levels.

Through analysis of responsive stress level per participant on each trip, considering average path traveled under stress points ( A to E) results varied according to complexity of the space configuration or crowded level due to time frames selected.

In figure 7 the results shows that more than 50% of the extended walkway requires amendement to release the obstacles on the walkway, or provide for proper segregation from the amended facilities wether parking areas, service lots, food and beverage outlets or wc's and praying areas.

Comparaison between paths traveled under stress within the three ttrips are verified in table 1, and figure 8. The results shows that the major service roads and parking area needs to be seen through for better solution. As well as segregation between large restaurants and families sitting areas overlapping the paved walkways.

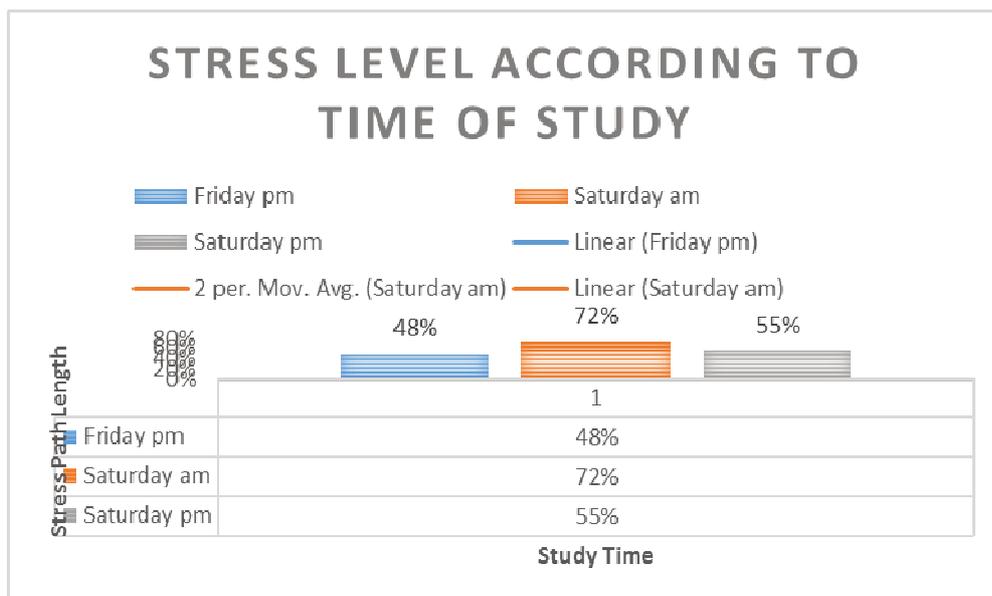


Fig. 7: Title of Figure 1. Please do not use automatic numbering of figures and tables.

Major stress points	Functions attractions and	Friday pm Week end Total 3.5 KM		Saturday am Week end Total 3.5 km		Saturday pm Week end Total 3.5 KM	
		Density of pedestrians	Average Stressed	Density of pedestrians	Average Length	Density of pedestrians	Average Length
A	Mosque	high	5%	medium	2%	none	0%
A'	Food & Beverage	high	8%	high	12%	high	15%
B	Entertainment	Midium	2%	high	15%	high	25%
D	Food & Beverage	Moderate	8%	high	20%	medium	10%
E	Kids area	Midium	5%	medium	15%	moderate	2%
E'	Parking	High	20%	moderate	8%	moderate	5%
Average			48%		72%		55%

Table 1: Trip 1 & 3, Stress relevant points against functional digestions on weekend

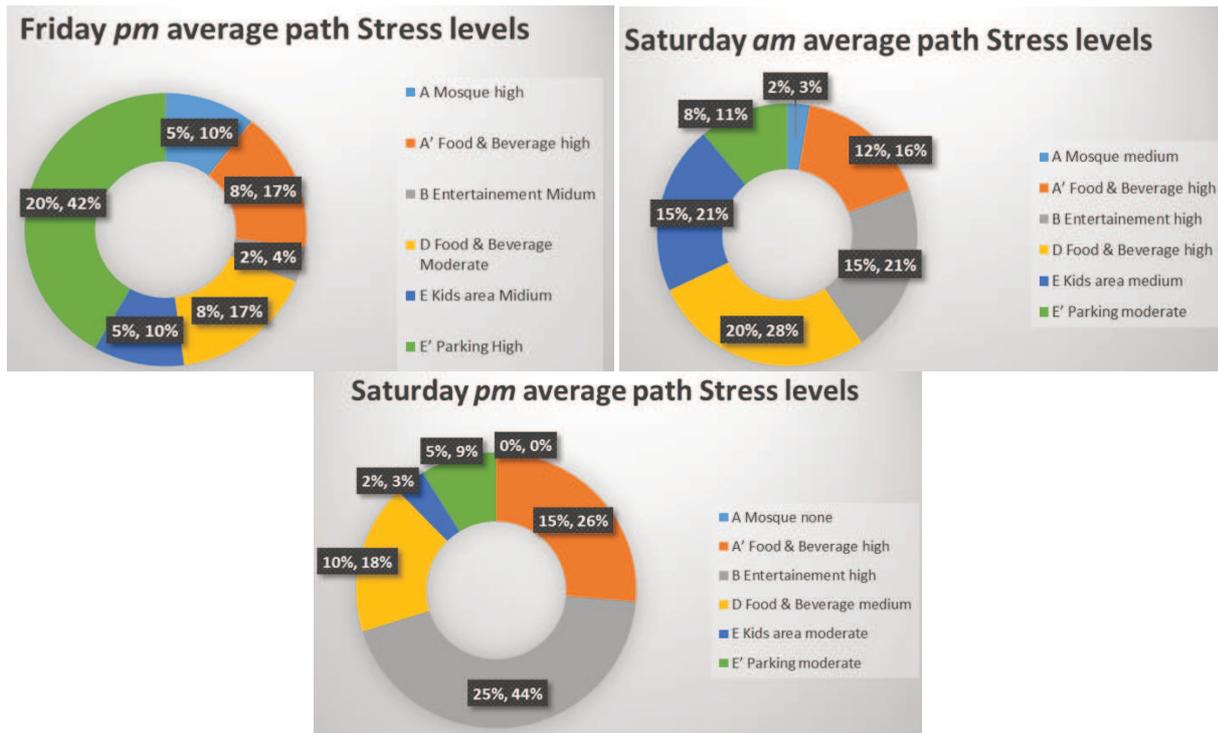


Fig. 8: Trip 1, 2 & 3, Average Stress levels in terms of Path Length .

## 5 IMPLEMENTATION OF SMART CITY APPROACH:

Coastal and waterfront communities have a distinctive sense of place created by their history and characteristic sights, sounds, and smells ( EPA, 2015). Enhancing the services provided for Jeddah Residents and visitors, with potential of increased expatriotes visiting. This issue bring more challenges to be faced to satisfy a vast variety of interests and add creativity to the existing spaces for all ages and genders expected along everyday life not only weekends with high occupancy.

The research suggested to follow the progressive doptation of smart city approach starting with main focal points represented above, and extend the experience towards more paths along the remotly outdoor areas within the city fabric.

### 5.1 Take Advantage of Compact Design:

Through Smart Growth development, natural resources should be protected through open space design and conservation. Strategic planning of waterfront development will clearly outline the boundaries of development space and conservation space. Because of the limited amount of waterfront, compact design is recommended. This issue is really important regarding to walkways width of clear paths which is considered a necassity for pedestrian accessibility with proper family sitting shaded zoned , and related services.

## 5.2 Foster Distinct and Attractive Communities

Municipalities should continuously provide for tools and resources for Coastal and Waterfront Smart Growth. This would allow users of the openspaces along the waterfront developed corniche also take benefit of natural resources such as fishing activities and or added activities that will foster attractive communities within specified attraction points along the 12 km of existing development

## 5.3 Protect the Waterfront

Codes and regulations provided by the municipalities enhances the Watershed Plan to restore and protect waterfront property, nevertheless the degree of awarress of potential users should be raised as part of an organization to plan, coordinate and implement revitalization strategies, like the initiation of campains among young generations as well as regular visitors.

## 6 CONCLUSION

Under the theme of Smart Developmets, Community interest in public open spaces becomes more challenging especially on waterfronts of cosmopolitan cities such as Jeddah. The results of data presented in the paper highlights potential of further design recommendations and future modifications in order to maintain sustainable entertainment areas as well as enhancing the quality of outdoor activities and sitting areas along the extended coastal development. Smart city approach suggested is implemented in order to explicitly generate solutions for further developments. Such Requirements provides implicit supports and encourages diversity taking in consideration long-term and external impacts into account during municipalities decision-making.

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