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HOLISTIC STRATEGY FOR URBAN DESIGN: A MICROCLIMATIC CONCERN TO SUSTAINABILITY

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Abstract: The paper investigates the compatibility study and proposal for public space design strategy for Agrabad central business district area at Chittagong, Bangladesh. It examines the daylight factors, shadow parameters and thermal analysis to examine the performance level of proposed public spaces. The mentioned analysis leaned to optimized solutions through application of a thermal simulation program named ECOTECT. In the long run an overview of conclusions with design guideline from the investigated outcomes is cited. Findings from this investigation indicate possible optimized solution for Agrabad Central Business District (CBD). Resilient urban design concerns about the quality of built environment. Consideration of micro climatic factors can contribute to achieve sustainable and comfortable outdoor environment for better urban design. Learning from the global practice and application in a local context requires deeper understanding and knowledge. Traditional urban design methods cannot meet the needs of the citizens. This paper therefore provides a resilient analysis evolved from the local aspects, derived from Carmona's 'Values of urban design'. This work intends to open up a new frontier in the field of sustainable built enviroment, and expects to be useful for readers interested in urban design or related fields.

Keywords: Public space; public realm; comfort; micro climate; ease of movement; connectivity

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INTRODUCTION

This paper is concerned with the microclimatic as well as comfort aspects of design. It particularly focuses on compatibility study of potential public space proposal of Chittagong city. It aims to identify design approaches that rely on natural systems in order to develop a comfortable outdoor environment. Table 1 shows the present scenario of Chittagong. Chittagong district possesses several artificial lakes and ponds or dighis (water body), of them two important ones are Deba at Agrabad and Jordighi or Horseshoe pond at Pahartali which are shown in **Fig.1** and **Fig. 2**. Present condition of *Deba*, located in the southern part adjacent to the downtown central business district name Agragad commercial area is studied which is engulfed with various problems as squatters have come up around it. Agrabad area of Chittagong has been selected here for evaluation as a case for simulation. Depthmap and ECOTECT computer generated software have been used as simulation tool for the analysis.

Macro climate: The climate of Bangladesh is categorized as warm/hot humid for much of the year (Koenigsberger, 1973; Muktadir, 2010). Warm humid zone; Air temperature (a) Monthly mean maximum is 27°C-32°C, (b) Monthly mean minimum is 20°C-25°C; relative humidity 60%-100%. In the warm humid climate the sky condition is cloudy most of the year; solar radiation is partly reflected and partly scattered by the cloud blanket, and so radiation reaching the ground is often diffuse but strong; wind velocity is typically low (2–7 m/sec) having one or two dominant prevailing wind directions (south or south-east); vegetation grows quickly because of the presence of moisture in the soil (Muktadir, 2010).

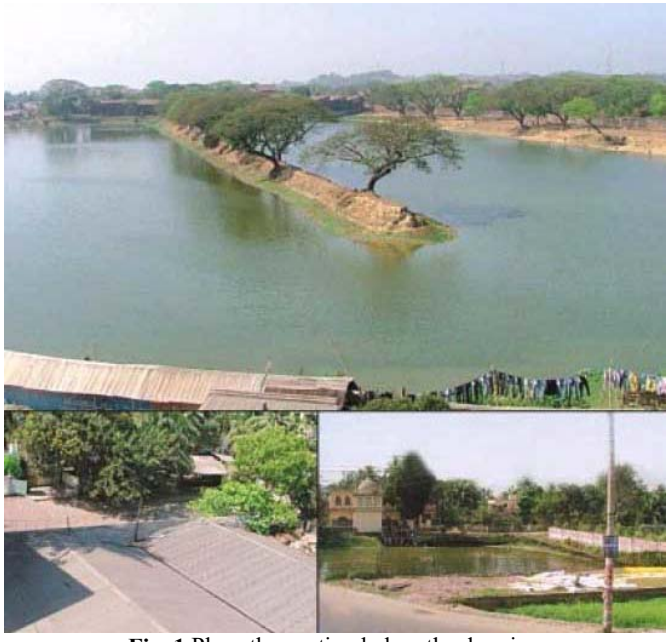

Fig. 1 Place the caption below the drawing.
Source: www.thedailystar.net

Table 1. Chittagong facts

Population	3.3 million
Area	100 sq mile (260 sq km)
Total open space	200 acres (0.80 sq km)
Available Open area average	0.06 acres per 1000 persons
Required area average	4 acres per 1000 persons

Fig. 2 Water body 'Deba' at Agrabad, Chittagong, Bangladesh.
(Source: www.thedailystar.net)

Micro climate: Every site may have its own micro-climate which is better known as site climate. In order to get better result for site specific; the best approach seems to be to start with the regional data and assess the local factors. Factors like topography, ground surface and three-dimensional objects affects solar radiation, air temperature, precipitation, humidity and air movement (Muktadir, 2010).

LITERATURE REVIEW

Contrary to the common practical problem like overwhelming populace in the urban areas of Bangladesh, Agrabad downtown area or Central Business District (CBD) is facing the problem of mono-

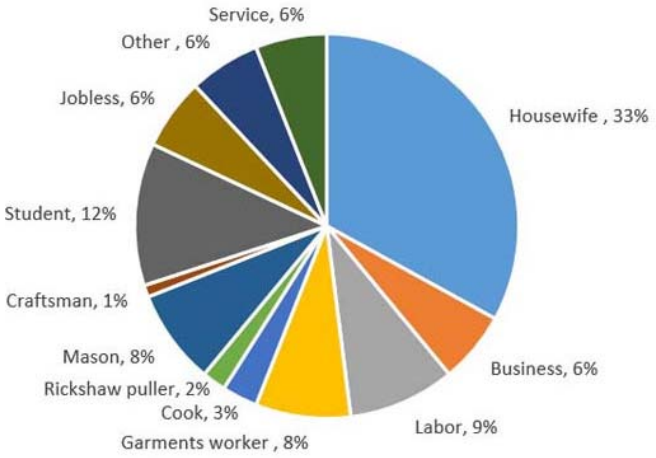

Fig. 3 Chittagong Job sector analysis.
Source: Social survey 2006; Detailed Area Plan for CMMP

functionality because of the outflow of working population after office hour in the evening. As there is no amusement or any other facilities available in the area, the Agrabad CBD lacking public gathering except for some scattered shopping centres. Agrabad CBD is also suffering from dilapidated negative spaces or lost spaces within its periphery. Concept of third place (Oldenberg, 1991, 2001) draws attention to propose vibrant public space for the area which might bring the idea of mixed use in place of mono-function.

Monofunctionality (Dikec, 2007) makes a place less interesting while mixed use development (Hassenpflug, 1997) makes a place more vital. Urban designers have long supported mixed use (Robert, 1997) as a necessary ingredient of successful urban design. Jane Jacobs have expounded the importance of mixed use (Robert, 1997) in providing the foundations for a lively, safe and interesting neighbourhood. Oldenburg (1991) argues that third places are important for establishing a sense of place. He calls one's "first place" the home and those where one lives. The "second place" is the workplace, where people may actually spend most of their time.

Third places, then, are "anchors" of community life and facilitate broader, more creative interaction. Urban renewal (Rose, 1993) is cost effective for third world economy that can ensure better urban environment of mixed use, with natural surveillance (Crowe, 2000; Friedmann, 1987) and a vibrant third place (Oldenberg, 2001) or public realm (McIndoe, 2005). Design proposal inspired by the values of urban design (Carmona, 2001) and public realm has taken as the prime focus of the design strategy. Major factors contributing to the problem are the mixed use development and public realm (Accessibility, Variety of options, Micro-climate, Safety & security, Maintenance).

ATTRIBUTES OF VALUES IN URBAN DESIGN

*(McIndoe, 2005; Carmona, 2005)**:***

1. Character: *A place with its own identity.* Character in the townscape and landscape is ensured by responding to and reinforcing locally distinctive patterns of development, landscape and culture.
2. Continuity and Enclosure: A place where public and private spaces are clearly distinguished. The continuity of street frontages and the enclosure of space by development define private and public areas.
3. Public realm: A place with attractive and successful outdoor areas. The public spaces and routes that is attractive, safe, uncluttered and work effectively for all in society, including disabled and elderly people (McIndoe, 2005; Carmona, 2001).
4. Ease of Movement: Accessibility and local permeability by making places that connect with each other and are easy to move through, putting people before traffic and integrating land uses and transport.
5. Legibility: A place that has a clear image and is easy to understand. Legibility is ensured by development that provides recognizable routes, intersections and landmarks to help people find their way around.
6. Adaptability: A place that can change easily. Development that can respond to changing social, technological and economic conditions and context.
7. Diversity: A place with variety and choice can be promoted through a mix of compatible developments and uses that work together to create viable places that respond to local needs (Robert, 1997).
8. Social Learning: Interactive skills of Social Learning: (a) Openness, (b) Trust, (c) Willingness to appreciate other points of view, (d) Search for ways of accommodating all interests, (e) Planners act as challenging intermediates between communities and powerful structures of the society (Freidmann, 1987).

Public realm

Provides settings for everyday life & civic occasions.
To welcome a broad range of people.

(a) A successful place has a system of open and green spaces that respect natural features and accessible. The public space network should respond to the needs established by the patterns of local economic, social and cultural life. Ensures wide range of options (pedestrian, disable friendly etc.). Streets and street junctions as public spaces (rather than just traffic routes) are likely to be more convenient for all users. Street trees and street lighting can reinforce the character and relative importance of a route. Making use of natural assets such as water, riverside, slopes, trees to create attractive spaces and encourages biodiversity.

(b) Ground floors occupied by uses that relate directly to passing pedestrians create activity and interest. Facades can be enlivened by active uses (such as shops and restaurants), entrances, colonnades, and windows (views into the building give interest to passers-by and make the building's function apparent, while views out of the building facilitate overlooking, which contributes to safety). Privacy for ground floors of residential development on busy streets can be maintained by raising the floor above street level. Street entrances at frequent intervals help to ensure activity. Buildings on busy street corners that are designed to accommodate shops, restaurants and other similar activities can contribute to local identity and activity.

(c) Well-designed public space relates to the buildings around it. Public space should be designed with a purpose in mind. Space left over after development, without a function, is a wasted resource and will detract from a place's sense of identity. It is likely to be abused and vandalized, diminishing safety and security.

(d) Streets and spaces that are overlooked allow natural surveillance, feel safer and generally are safer. Buildings of all types which have front on to streets, squares or parks, contribute to overlooking by showing their public face. Making separate footpaths or cycle tracks as direct as possible, and well overlooked; this will help to avoid unsafe feeling. There are advantages in play areas, other communal space and parked cars being overlooked. Living over shops encourages natural supervision and evening activity. Lighting and planting can help or hinder surveillance and perceptions of safety.
(e) Micro-climate: The layout and massing of development should take account of local climatic conditions, including daylight and sunlight, wind, temperature and frost pockets. The micro-climate will both influence and be influenced by the form of development, including the orientation of buildings and the degree of enclosure. Public spaces should be protected from down draughts from tall buildings, as well as from lateral winds. Deciduous trees and climbers can filter heat and pollution in summer and allow low winter sunlight.
(f) Works of art and street furniture give identity and enhance the sense of place. Avoid clutter and confusion- signage, lighting, railings, litter bins, paving, seating, bus shelters, bollards, kiosks, cycle racks as well as sculpture and fountain. Streets cape need maintenance, resistance to vandalism and access to underground services. Street furniture such as benches and bus stops should be sited with the safety of users in mind.

Ease of movement

(a) Network of connected spaces and routes, for pedestrians, cyclists and vehicles. New routes should connect into existing routes and movement patterns. The degree of connection in a new development is often the key to its success. Public transport should be designed as an integral part of the street layout. Minimizing walking distances between major land uses and public transport stops makes public transport easier to use and available to as many people as possible. A junction can be designed as a point of entry. Such junctions can help identify a place and define the routes through. Transport routes should reflect urban design; not just traffic considerations. Streets should be designed as public spaces. Allows for stopping, parking and slow traffic, accommodates local shopping and economic activity.
(b) A development's access and circulation should contribute to a fine-grain network of direct and connected routes within and beyond the site rather than creating big blocks.
(c) Encourage low traffic speeds.
(d) Higher density supports public transport.
(e) Integrated transport interchange: A center where all mode of travel is available and interchangeable. Suitable for Higher density commercial and mixed-use development.

METHODOLOGY

Agrabad downtown area is mostly hard paved which is absorbing enormous heat at daytime and radiating at night. To find a suitable location for public plaza initiative should be taken to evaluate comfort factors. Software has been applied to explore the daylight and shadow analysis round the year at site area. The issue of daylight and the overcast shadow of the existing structures has approached from two distinctive viewpoints- in shadow pattern and thermal analysis. The shadow is taken round the year at a specific time and specific month of different seasons and analyzes the data in order to locate a suitable option for outdoor plaza. ECOTECT is building performance analysis and design tool. It combines an interactive building design interface and 3D modeler with a wide range of environmental analysis tools for a detailed assessment of solar, thermal, lighting, shadows & shading design, energy & building regulations, acoustics, air flow, cost & resource performance of buildings. In the Downtown area there are two potential open spaces primarily chosen for public space. One is at museum boundary and another one is future site of World Trade Center. These are the only open spaces available in the downtown area, which are located in between the dense building blocks and have high potentiality to connect with the water body and further. These two locations will evaluate and tested in terms of Daylight factor and thermal analysis. Daylight factor analysis will help to find out the reasonable solution about designing the plaza. Thermal analysis will come out with optimized result about the plaza.

SITE ANALYSIS

Agrabad is a predominating commercial district with a grid iron street pattern. The existing Agrabad C/A is ripe for transformation into high-rise development. Chittagong Development Authority (CDA) consolidates 2 to 4 or more plots to obtain a larger plot for high-rise development and unlimited FAR (Floor Area Ratio), with 40% plot coverage of the ground and first floor and 65% coverage in other floors. CDA encourages Mixed Use Development comprising residential, shops, offices, civic buildings, specialized markets, religious facilities, parking towers and off street parking sites. Creation of public plazas will also be encouraged. High rise buildings are preferable to create open spaces, road network, pedestrian and cycle paths and comprehensive development of the area.

Table 2. Agrabad facts

Zone	DPZ-03
Population	440,654 in 2001 (BBS).
Population density	132 persons per acre in 2001
Land ownership	PWD, Chittagong Port, Military, Bangladesh Railway
Literacy rate	65.66 %

Source: BBS-Bangladesh Bureau of Statistics, PWD-Public Works Department

Micro-climate:

Comfort (Daylight, wind & temperature)

Downtown area is mostly hard paved which is absorbing enormous heat at daytime and radiating at night. To find a suitable location for public plaza initiative should be taken to evaluate comfort factors. Software (ECOTECT) has been applied to explore the daylight and shadow analysis round the year at site area. The issue of daylight and the overcast shadow of the existing structures have approached from two distinctive viewpoints- in shadow pattern and thermal analysis. The shadow is taken round the year at a specific time and specific month of different seasons and analyzes the data in order to locate a suitable option for outdoor plaza. ECOTECT (http://ecotect.com) is a building performance analysis and design tool. It combines an interactive building design interface and 3D modeler with a wide range of environmental analysis tools for a detailed assessment of solar, thermal, lighting, shadows & shading design, energy & building regulations, acoustics, air flow, cost and resource performance of buildings. In the Downtown area there are two potential open spaces primarily chosen for public space. One is at museum boundary and another one is future site of World Trade Center. These are the only open spaces available in the downtown area, which are located in between the dense building blocks and have high potentiality to connect with the water body and further.

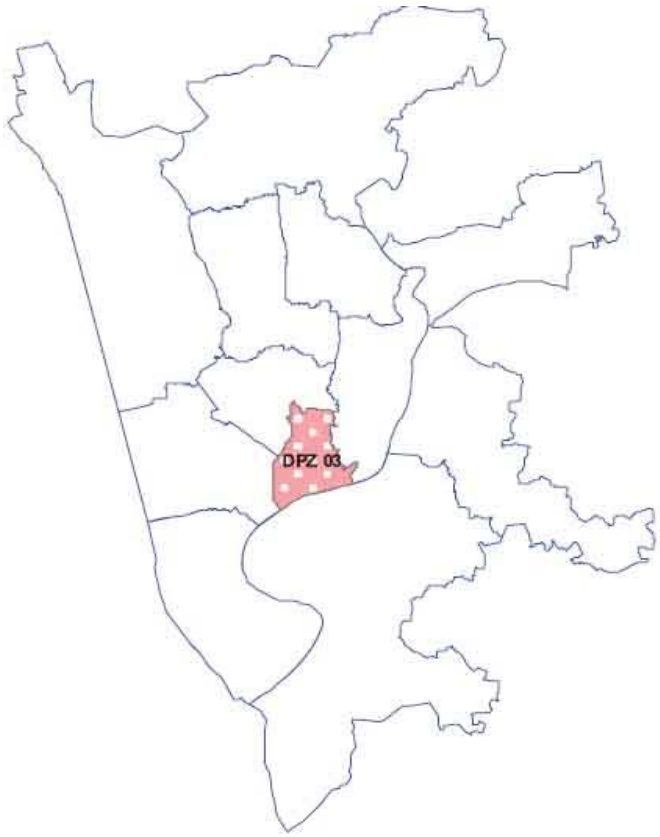

Fig. 6 DPZ 03.
Source: Chittagong Development Authority

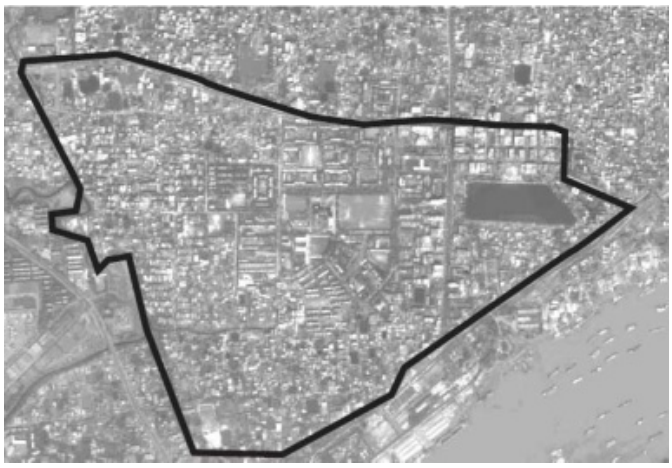

Fig. 4 Edge of Agrabad district. (Source: Goole Earth)

Fig. 5 Agrabad district spatial segregation. (Source: Author)

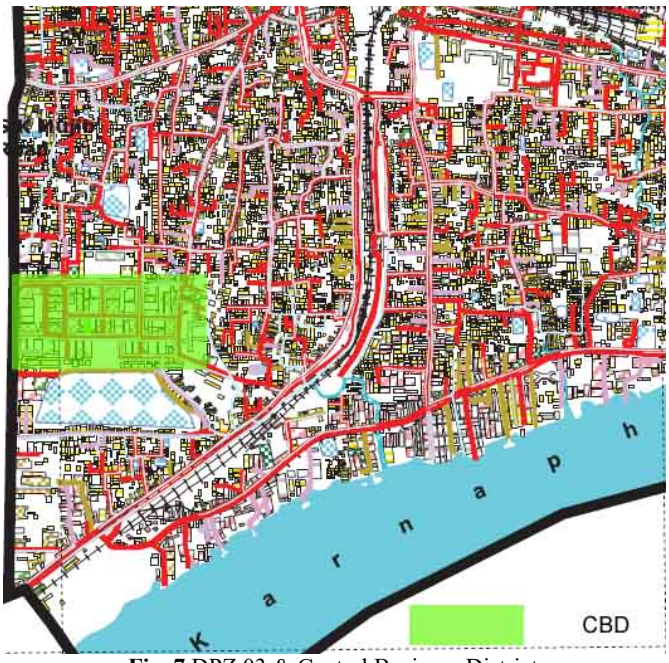

Fig. 7 DPZ 03 & Central Business District.
Source: Chittagong Development Authority

Fig. 8 Grid-Iron pattern of Agrabad CBD. (Source: Author)

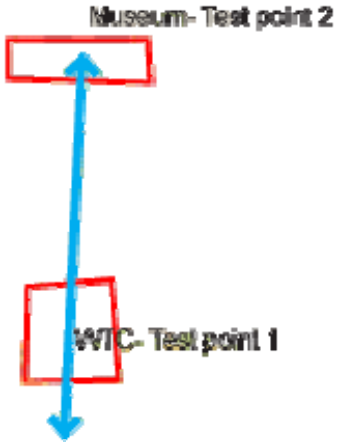

Fig. 9 Potential accessibility. (Source: Author)

These two locations will evaluate and tested in terms of Daylight factor and thermal analysis. Daylight factor analysis will help to find out the reasonable solution about designing the plaza. Thermal analysis will give proper suggestion to choose whether the plaza will be soft or hard.

Chittagong: Coordinates -22°22′0″ North**,** 91°05′0″ East, Time zone BST (UTC+6).

Thermal comfort analysis: *Micro-Climate*

Summer analysis: The Test point 1 shown in **Fig. 9** is a controversial site as there is a proposal for 20 story structure (World Trade Centre) and would invite enormous traffic flow. Daylight factor analysis has been generated to find the future effect of this tall structure in the site area. Result shows the preference of design for the plaza with or without the WTC tower. Analysis has done both for summer and winter to find the optimal solution for 'test point 2' in **Fig. 9**. Daylight factor calculation is based on a scale ranged from 0 to 100 where the color variation from blue to yellow shows the gradual increase in intensity. The blue color means least shaded zone and yellow color means most lighted zone. From the summer analysis it is clearly visible that Test point 1 is getting better daylight without the tower seen in **Fig. 11**. Test point 2 is in average showing the similar result. The existence of the tower is creating more shaded zone in 'point 3' seen in **Figs 10–11** and surrounding. Point 4, 5, 6 shown in **Figs 10–11** have also potentiality to become successful public space.

Winter analysis: Winter is not severe in Chittagong as the city is having moderate temperature due to close proximity to sea as shown in **Figs 12–13**.

Shadow analysis: *Daylight factor* in **Fig. 14** to **Fig. 21**

Shadow analysis simulation tested in summer on 15 April at three different times (9.00 am, 02.00 pm, 05.00 pm) of the day with and without the tower.

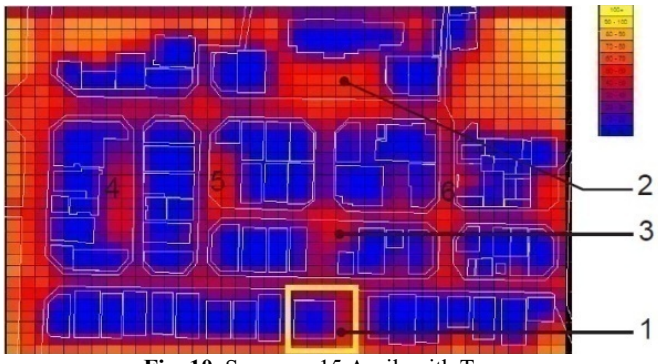

Fig. 10 Summer, 15 April, with Tower.

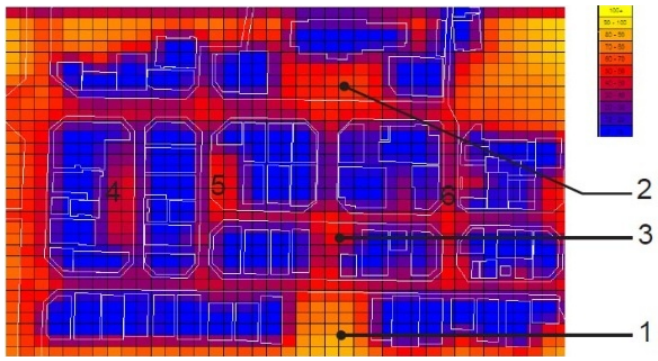

Fig. 11 Summer, 22 April, without Tower.

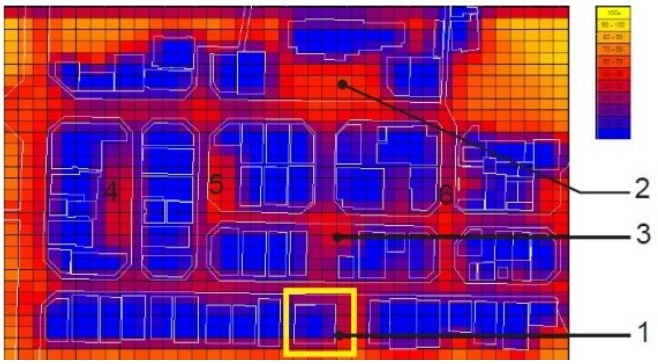

Fig. 12 Winter, 15 December, with Tower.

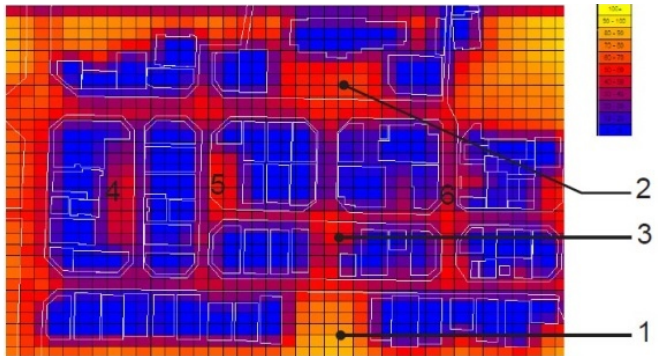

Fig. 13 Winter, 15 December, without Tower.

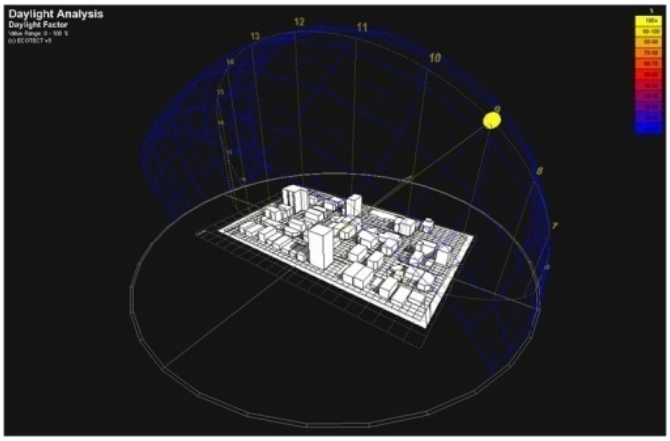

Fig. 14 Summer, 15 April, 9.00 am with tower.

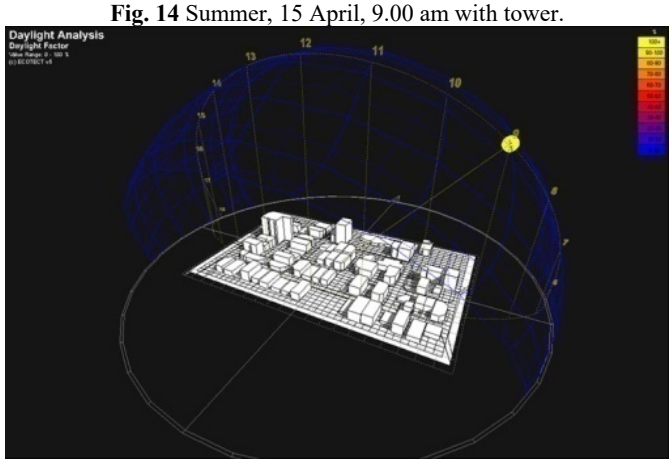

Fig. 15 Summer, 15 April, 9.00 am without tower.

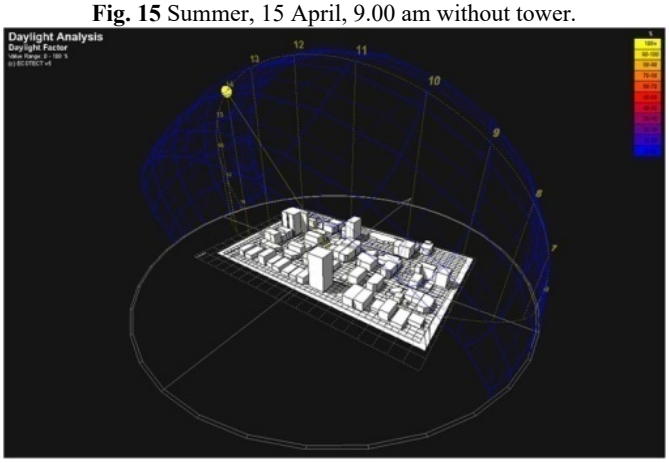

Fig. 16 Summer, 15 April, 2.00 pm with tower.

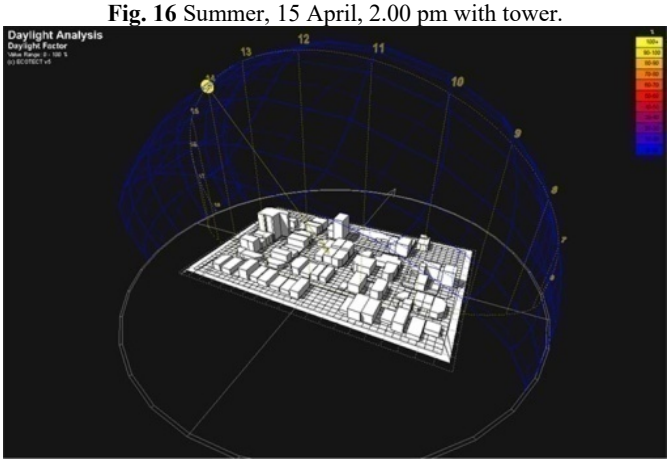

Fig. 17 Summer, 15 April, 2.00 pm without tower.

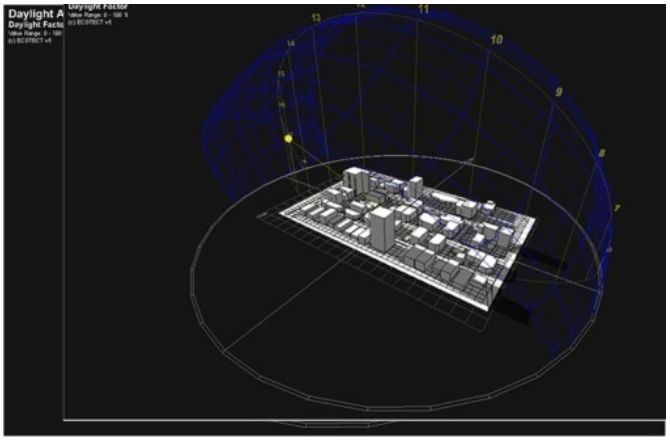

Fig. 18 Summer, 15 April, 5.00 pm with tower.

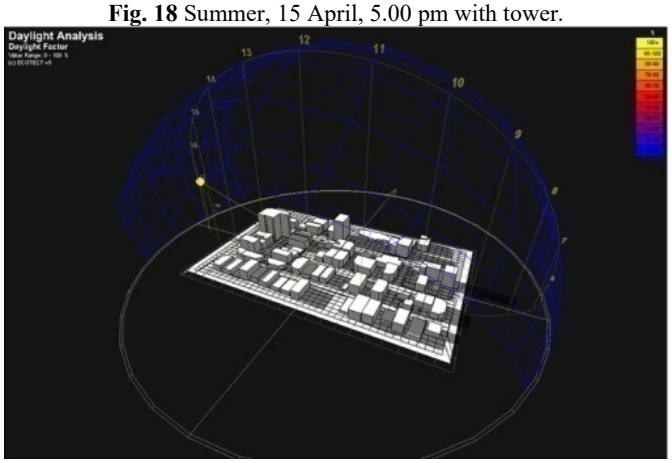

Fig. 19 Summer, 15 April, 5.00 pm without tower.

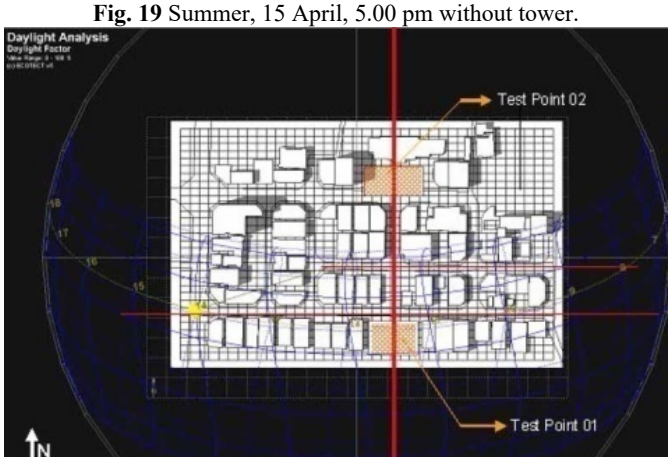

Fig. 20 Summer, 15 April, 02 pm, without Tower.

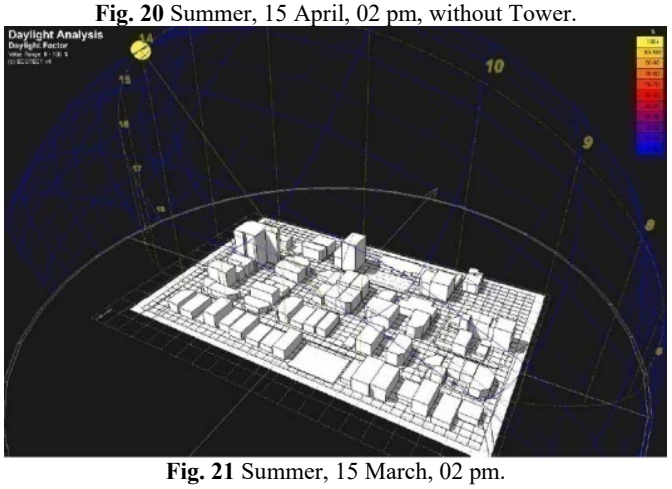

Fig. 21 Summer, 15 March, 02 pm.

Thermal Analysis: To ensure the comfort of the plaza it is necessary to find out the solar heat gain.

Two test points (Test point 01 & Test point 02) has been selected to generate heat gain simulation graph. The findings will show what should be the quality of the pave; hard or soft, or combination of both. This will give guideline about the vegetation level in the site specific.

Human comfort level (max 26°C, min 18°C).
Human deep body temperature: 37°C.

Thermal impact simulation: Simulation generated for two test points to figure out the type of pave prior to construction.

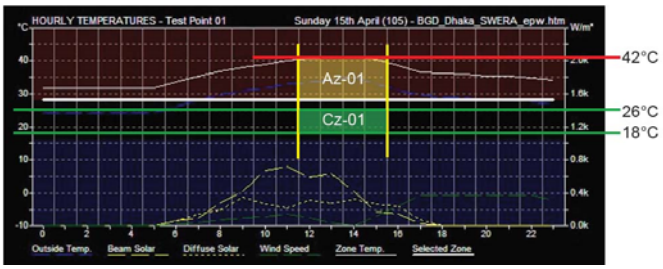

Fig. 22 Summer 15 April 2.00 pm average temperature 25.9°C

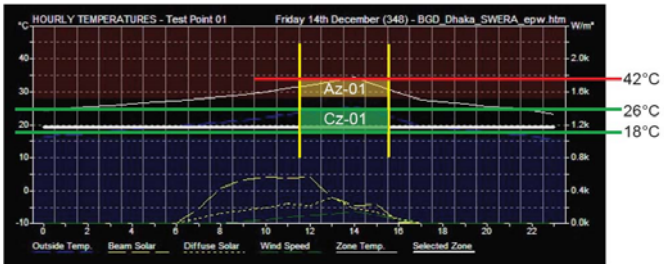

Fig. 23 Winter: 14 Dec, 2.00 pm average temperature 19.2°C

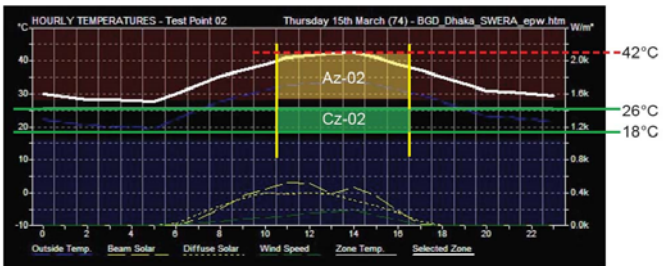

Fig. 24 Summer 15 March, 2.00 pm average temperature 25.9°C

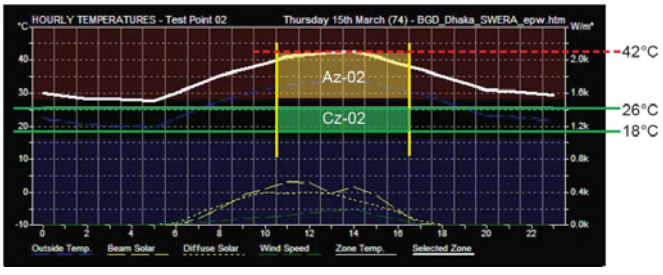

Fig. 25 Summer 14 Dec, 2.00 pm average temperature 19.2°C

Thermal impact on Test point 1 seen in **Fig. 26**:
Az 01- Applied zone
Cz 01- Comfort zone
Human Comfort level: 18°C to 26°C
Human deep body temperature: 37°C

Material assumed for Test point 01 is hard type pave. The result shows that the Az 01 is exceeded the human comfort zone level (Cz 01). The result indicates that the proposed pave material of the test zone 01 should be softer and less heat absorbing. Vegetation might be applied to decrease the heat absorption rate. For winter the test result is negligible for pave consideration.

Thermal impact on Test point 02 seen in **Fig. 26**
Az 01- Applied zone
Cz 02- Comfort zone
Human Comfort level: 18°C to 26°C
Human deep body temperature: 37°C

Material assumed for Test point 01 is hard type pave. The result shows that the Az 02 is exceeded the human comfort zone level (Cz 02). The result indicates that the proposed pave material of the Test zone 02 should be softer and less heat absorbing. Vegetation might be applied to decrease the heat absorption rate. For winter the test result is negligible for pave consideration.

Evaluation: For modeling and its parameters analysis- the ECOTECT 5.2v is used for this analysis seen in **Fig. 22** to **Fig. 25**. The detailed precise analysis according to the surrounding, trees, material assign, the daily cloud overcast is not applicable here but for overall result it is very useful. These test results helps designer to predict about the future situation and opens up the opportunity to find out the way for better optimized solution.

Ease of movement: *Connectivity* shown in **Fig. 27**
Space & route (direct & connected)
Vehicular & pedestrian (direct & connected)
Public transport
Minimize walking distance
Slow Traffic (Stop, Park, Walk & Activity)
Transition point (Bus stop, parking & pedestrian)

Downtown area: Around 700 city service buses, 13,000 CNG-run auto-rickshaws, 1,000 inter district buses, 5,000 trucks, 1,000 tempos, 30,000 rickshaws are playing in the city. (The Daily Star, 11-10-06) Presently downtown surface parking capacity is 1000 cars (approximately). More than 50% of people took their work-trips on foot.

Connectivity: Possible connections between downtown, water body (North, south, east and west bank) and residential areas are necessary which will help to integrate physical planning and will help to avoid future collisions.

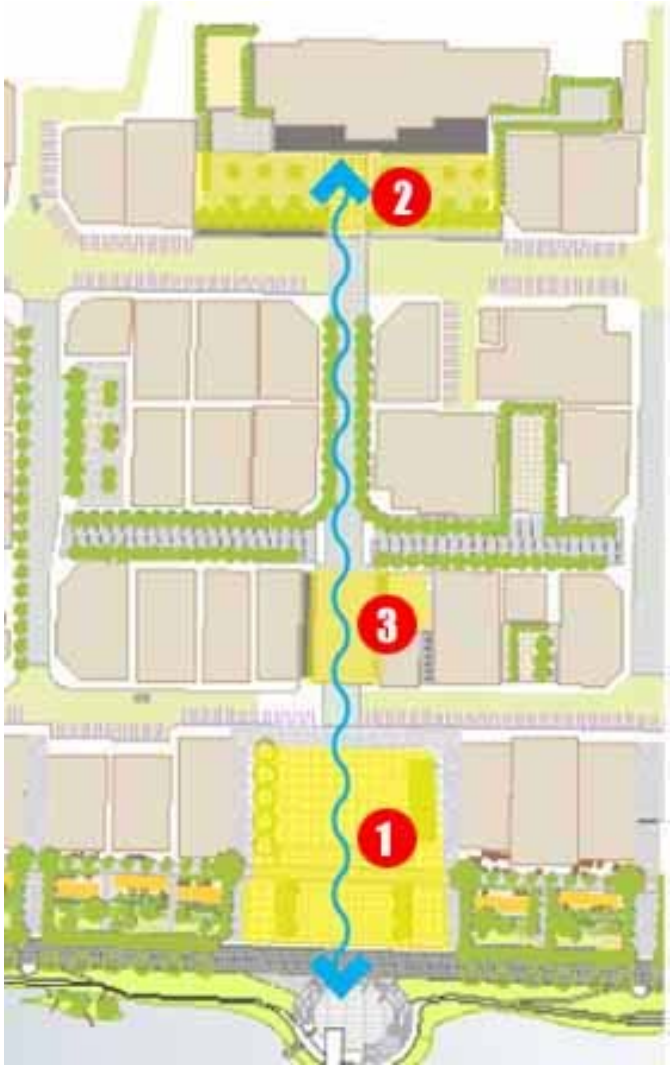

Fig. 26 High potential public spaces. (source: Author)

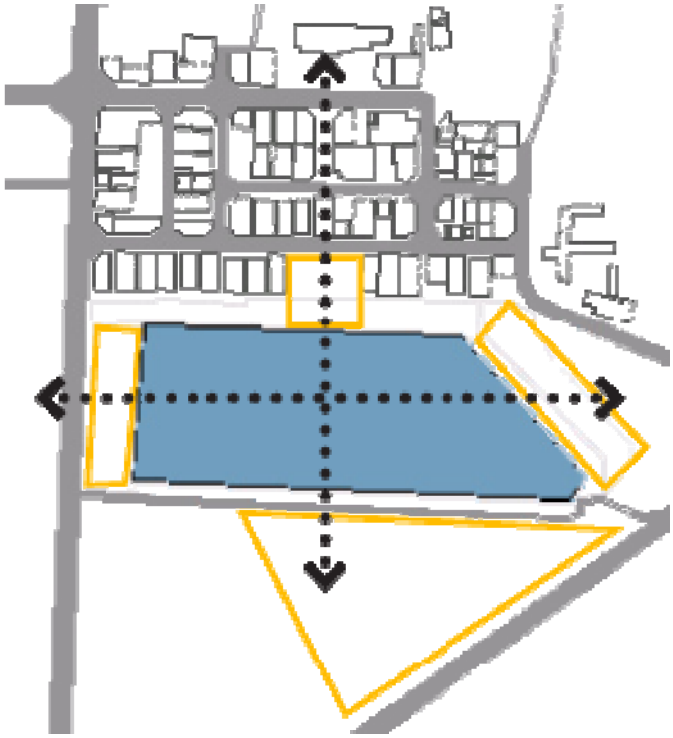

Fig. 27 Potential connections.
Source: Author

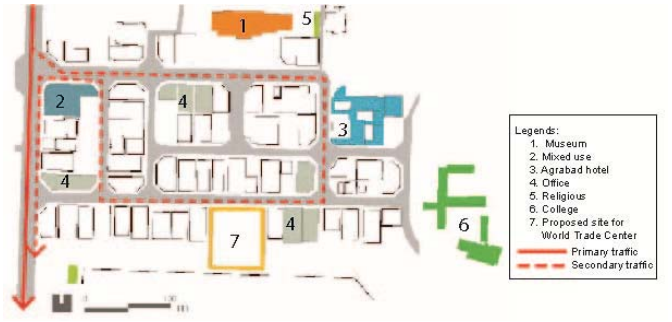

Fig. 28 Traffic attractors.

Fig. 29 Existing interrupted pedestrian way.

Public transport: *Downtown area*

Traffic flow: Primary data's are collected through field survey on vehicular and pedestrian movement per hour shown in **Figs. 33–36** and **Table 3** in point A, B, C & D at downtown área. There are basically two types of vehicles are available in Chittagong metropolitan area. These are fast moving (motorized) like bus (40-45 persons), minibus (30 persons), maxi (12 persons), rider (14 persons), tempo (10 persons), car (4-8 persons) and slow moving (Human powered transport) like Rickshaw (2 persons), Vans (goods carrier).

Survey findings shown in **Fig. 30** that, point A and D attracts more traffic rather than point B and C. At point C most hotel Agrabad attracts most of its traffic but still it has lowest rate of car flow. It is clear that Sheikh Mujib Road (A) is the main route of motor vehicle because it is serving the inter district traffic movement.

Fig. 30 Data collection locations.
Source: Author

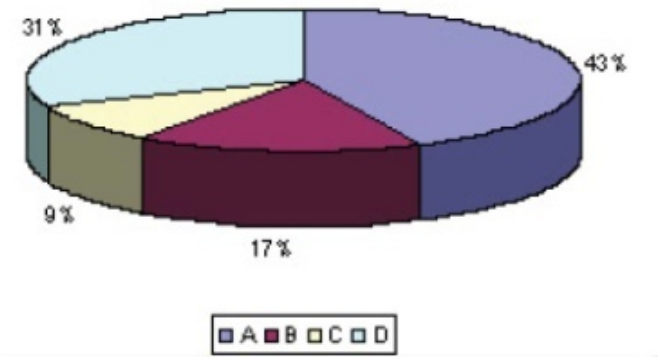

Fig. 31 Traffic flow pattern at different points of Downtown area.

But B, C and D point are serving the local demand. Overall traffic flow of point D(31%) is quite closer to point A(43%) shown in **Fig. 31**. This situation indicates that future development should have the capacity to allow the increased rate of motor vehicle or find some other alternative to decrease pressure in the area. Downtown area is also connected with other means of transport like rickshaw (non motorized). About 50% people are taking their work trips on foot at Agrabad. That means pedestrian and non motorized vehicles should also have to have options in the future development.

Proposal: From the findings it is clear that the Downtown area needs a combination of traffic pattern which have variety of options. Single mood of transport cannot satisfy the need. That is why a vehicular loop is suggested seen in **Fig. 34** which will cross point B, C and D surrounding a motor free zone inside. This motor free zone derived to create a pedestrian friendly zone to connect the public spaces (museum square and WTC). Findings from Daylight factor and thermal analysis helped to come to such decisión shown in **Fig. 34**.

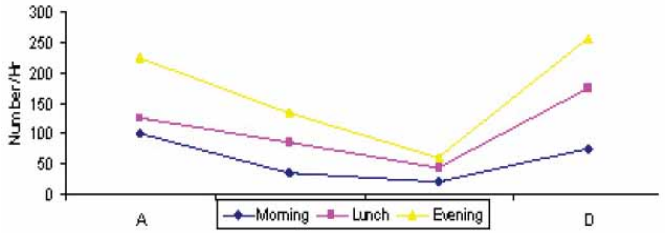

Fig. 32 Car flow per hour.

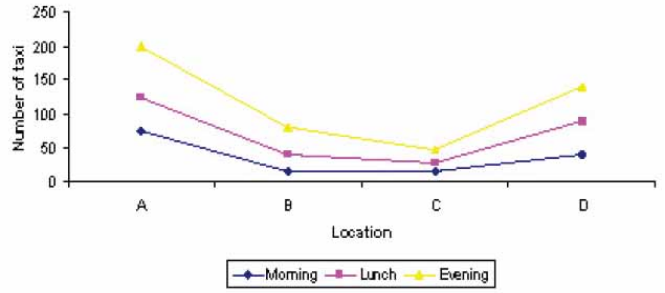

Fig. 33 Taxi flow per hour.

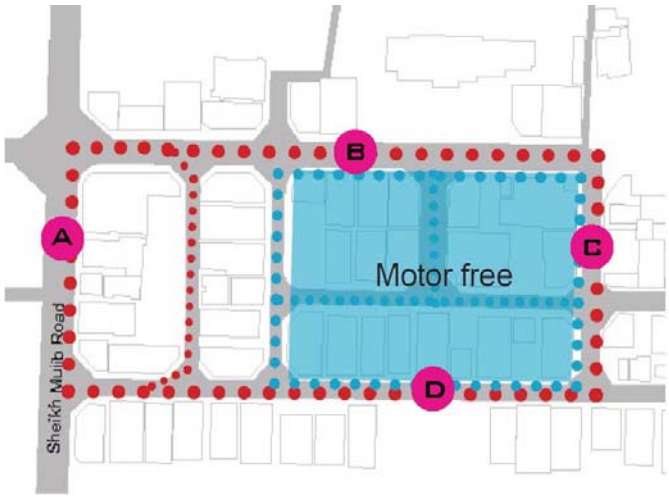

Fig. 34 Taxi flow per hour. (Source: Author)

Table 3. Traffic flow rate in points A & B at Agrabad Downtown area

Vehicle	A			B			C			D		
	Morning (8.00-10.00)	Lunch time (13.00- 15.00)	Evening (17.00-19.00)	Morning (8.00-10.00)	Lunch time (13.00- 15.00)	Evening (17.00-19.00)	Morning (8.00-10.00)	Lunch time (13.00- 15.00)	Evening (17.00-19.00)	Morning (8.00-10.00)	Lunch time (13.00- 15.00)	Evening (17.00-19.00)
—Bus	25	15	25	–	–	–	–	–	–	–	–	–
Car	100	25	100	35	50	50	20-25	25	15-20	75	100	80
Taxi	75	50	75	15	25	40	15	13	15-20	40	50	50
Tempo	50	30	50	–	–	–	–	–	–	–	–	–
Rickshaw	–	–	–	10	15	25	20	10	25	25	40	30
Person	1850-2000	750-850	1850-2000	350-400	500	500	300	25-40	150-200	500	650	750

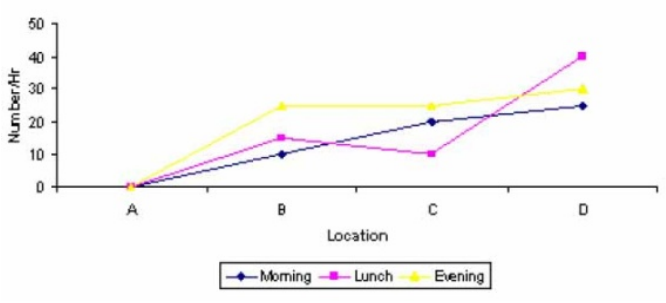

Fig. 35 Rickshaw flow per hour.

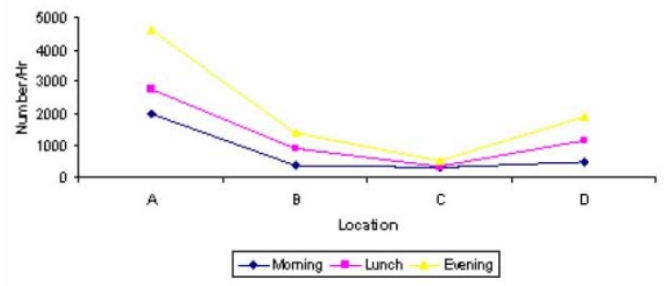

Fig. 36 Persons per hour.

Nearest rail stations and rail tracks

LOCATION	NEAREST STATION	NEAREST TRACK	LOCATION	NEAREST STATION	NEAREST TRACK
FARHADABAD	NAZIRHAT	H	NASIRABAD I/A	----------	E
HAT HAZARI	HAT HAZARI	H	AGRABAD C/A	BANGLABAZAR	K
SITAKUNDAI/A	SITAKUNDA	A	PORT COLONY	----------	C
BHATIARY I/A	BHATIARY	A	HALISHAHAR R/A	----------	B
PATENGA I/A	----------	L	CHANDGAON R/A	----------	F
C.E.P.Z.	----------	I	KULSHI R/A	JHAUTALA	D
SAGARICA I/A	PAHARTOLI	C	NASIRABAD R/A	SHOLASHAHAR	D
KATTALI I/A	----------	B	PATIYA	PATIYA	F
KALURGHAT I/A	JALANIHAT	F	BOALKHALI	GOMDONDI	F

Comparison between travels by bus and rail

ROUTE	TIME		FARE (Tk./Km.)	
	BUS	RAIL (40Km./H)	BUS	RAIL
PATIYA?SHOLASHAHAR	2 H 30 M	40 M	0.62	0.20
HATHAZARI?SHOLASHAHAR	1 H 40 M	30 M	0.67	0.20

Fig. 37 Comparison between Bus route and Rail track in Chittagong city. (Source: Vol. 5 Num 321, http://www.thedailystar.net/2005/04/22/d5042219.htm)

Survey findings shown in **Fig. 34** that point A and D attracts more traffic rather than point B and C. At point C most hotel Agrabad attracts most of its traffic but still it has lowest rate of car flow. It is clear that Sheikh Mujib Road (A) is the main route of motor vehicle because it is serving the inter district traffic movement. But B, C and D point are serving the local demand. Overall traffic flow of point D (31%) is quite closer to point A (43%) seen in **Fig. 31**. This situation indicates that future development should have the capacity to allow the increased rate of motor vehicle or find some other alternative to decrease pressure in the area. Integrating public transport might be a better solution as Sheikh Mujib road is suffering from severe traffic jam. The reason is the road is allowing both fast and slow moving vehicle. The traffic jam problem could be solved with extensively introcuding public transport like buses or trains in place of slow moving vehicles.

Existing train route can be introduced to decrease pressure on the Sheikh Mujib Road. There is an existing rail track trespassing through the south east part of

Fig. 38 Potential railway Connection with other parts of the city. (Source: Author)

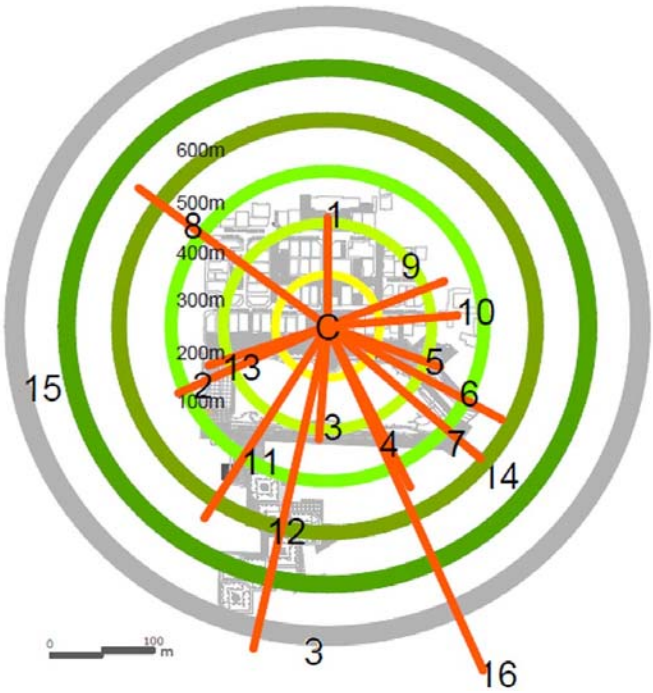

Fig. 39 Distance Wheel. (Source: Author)

Table 4. Distance Wheel legends.

1	Museum	210	02.50
2	Bus stop	314	23.70
3	Deba south plaza	220	02.60
4	Deba south retail	350	04.20
5	Deba east square	230	02.70
6	Deba east green	380	04.50
7	South-east plaza	390	04.60
8	Badamtolir mor	450	05.40
9	Hotel Agrabad	240	02.80
10	College	250	03.00
11	Railway housing bazaar	440	05.30
12	Railway housing	640	07.70
13	Mosque	240	02.80
14	Rail	440	05.30
15	Hospital	840	10.00
16	River	730	08.70

Agrabad which is only used for cargo transportation to the port. If railway can be introduced for passenger service beside existing bus route, traffic system will be improved obviously) Report shown in **Fig. 37** that rail track is more convenient in terms of saving money and time. It has also positive impact in terms of less emission. Achievement in public transport thus improving the living environment in terms of physical and sustainable manner.

CONCLUSION

People need to hangout, linger and engage. Scarcity of open space enhances the quest for place making in the Chittagong city. Agrabad has great opportunity to become a notable example of a successful and interactive urban area. Recovering the mono functionality and decaying image, Agrabad should accommodate mixed use development to create a successful network of public spaces. Mixed-use development refers to the practice of more than one type of use in a building or set of buildings. In planning zone terms, this can mean some combination of residential, commercial, industrial, office, institutional, or other land uses. Jane Jacobs argued that a mixture of uses is vital and necessary for a healthy urban area. Benefit is the Retailer has the assurance that they will always have customers living right above and around them, while residents have the benefit of being able to walk a short distance to get groceries and household items, or see a movie. Enriched public realm with good level of connectivity is the tool to manipulate the urban design process. Integrating sustainable solutions will increase the public realm and user satisfaction. Preservation of natural landscape and existing vegetation is ensured. Softening the hard pave in the downtown will decrease the heat radiating in the evening and will improve the physical environment. Agrabad must renew its image not only to survive, but also to contribute to the community. Renewable forces are able to generate the new trend with the old one. Incorporating social engagement along with economic benefit in the long run provides a viable urban space; a space that is interactive, versatile and with a sense of place. Kahn says,' What will be has always been.' Urban space has its own language- what we can do is to understand and respond to it. The revitalized urban space will offer culture to the people. People will come to public place to celebrate people, to feel the sense of space.

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