

Changes of land use with urban growth- A study on Cox's Bazar, Bangladesh

Imran Bin Hussain, Nobel Mallick

Abstract— A street pattern can explain the basic characteristics of the area and also the history of it. Sometimes, changes of street pattern changes type of land use in sub urban cities. Streets and public spaces are the permanent and unchanging features of a settlement over its life time. This paper investigates the changes of land use for the modifying character of street pattern in sub-urban cities by the growth of urban economy. For this study, the Cox's Bazar city in Chittagong is selected as the city experienced a huge growth in tourism for the last few years and millions of tourists visit Cox's Bazar and consequently, its hotels, motels and guest houses are full every time and specially the peak seasons of a year. A quantitative analysis is done by using Space Syntax for determining the integrity of existing city. Spatial relationship is also analyzed from this research. This paper describes a rational recommendation from the axial analysis which will support reinforcement of urban economy that affects the future land use character & its growth tendency.

Index Terms— Land use, Space syntax, Urban economy, City growth, Urban morphology.

1 INTRODUCTION

1.1 Background

Cox's Bazar is the main sea-beach town of Bangladesh and it is considered as the longest sea-beach of the world.

Cox's Bazar district with an area of 2491.86 sq km, is bounded by Chittagong district on the north, Bay of Bengal on the south, Bandarban district, Arakan (Myanmar) and the Naf River on the east, the Bay of Bengal on the west. district. Cox's Bazar municipality was constituted in 1869 and was turned into a town committee in 1959. The town committee was replaced by municipality in 1972 and it was elevated to B grade in 1989. The CBD (Central Business District) has determined "Laldighi" but on behalf of spatial growth and tourists demand new town has shifted to north side.

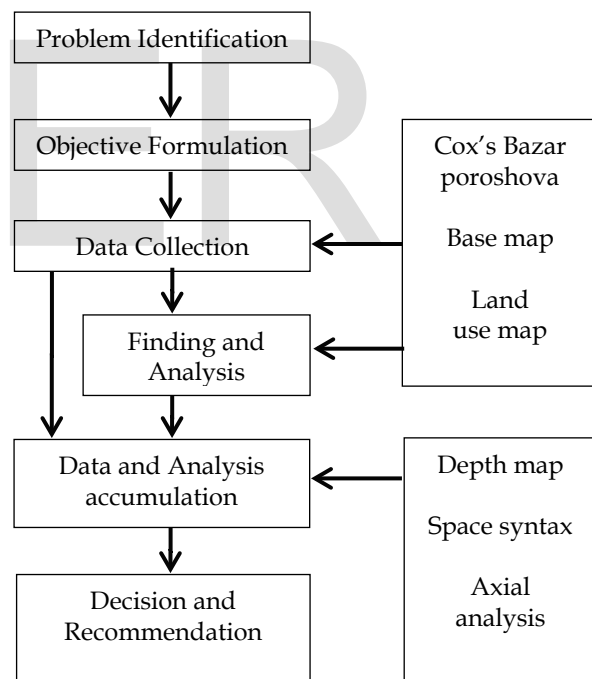
1.2 Objectives

The overall objective of this study is to develop a comprehensive understanding of spatial relationship and city integration. The specific objectives are to identify the integration core of Cox's Bazar & probable location for next urban center.

1.3 Methodology

The report will be compiled through both primary and secondary research. For the primary research the researcher accomplished a field survey & collected the existing plan of city. An axial map is prepared using Space Syntax software after the study of basic street pattern and land use. Secondary data was composed of various studies made available through library work and via searching through journals available in the internet.

1.4 Methodological Framework



1.5 Scope and Limitation

The study is based on the secondary data and map based. Any kinds of primary data has not conduct and no field survey has done for the lack of time. The domain of the study of the most integrated route is very intestine in terms of expansion of the city and urban rural linkage. The present study tries to explain the pattern of integrated in Cox's Bazar city with most economic hub. In this study, Global Integration $R=n$ has considered.

- Author Imran Bin Hussain is currently pursuing masters degree program in architecture in Bangladesh University of Engineering and Technology, Bangladesh. He is also working as a lecturer in the Department of Architecture at Premier University, Chittagong. E-mail: architect.imranbinh@gmail.com
- Co-Author Nobel Mallick is currently working as a lecturer in the Department of Architecture at Premier University, Chittagong, Bangladesh. E-mail: nobel.mallick@gmail.com

2 LITERATURE SURVEY

2.1 Street and Land Use in Coastal Area Planning

Buildings and land uses may change as a place grows but the streets and public spaces form and sustain spatial organization of the place. Streets within coastal settlements reinforce and extend street patterns providing attractive, landscaped, legible and well-connected networks that encourage walking, passive recreation and deliver easy access to public places, activities and transport. Streets reinforce a settlement's character and its setting within the landscape in terms of views, vistas and topography.

2.2 Space Syntax

Space Syntax is a science-based, human-focused approach that investigates relationships between spatial layout and a range of social, economic and environmental phenomena.^[1] These phenomena include patterns of movement, awareness and interaction; density, land use and land value; urban growth and societal differentiation; safety and crime distribution.

Space Syntax was pioneered in the 1970s by Prof Bill Hillier, Prof Julienne Hanson and colleagues at the Bartlett, University College London.

Today, Space Syntax is used and developed in hundreds of universities and educational institutions as well as professional practices worldwide. Built on quantitative analysis and geospatial computer technology, it provides a set of theories and methods for the analysis of spatial configurations of all kinds and at all scales.

Research using the Space Syntax approach has shown how:

- Movement patterns are powerfully shaped by spatial layout
- Patterns of security and insecurity are affected by spatial design
- This relation shapes the evolution of the centers and sub-centers that makes cities livable
- Spatial segregation and social disadvantage are related in cities

2.3 Cox's Bazar City

Cox's Bazar is a town, a fishing port and district headquarters in Bangladesh. It is known for its wide sandy beach which is the world's longest natural sandy sea beach. It is an unbroken 125 km sandy sea beach with a gentle slope. It is located 150 km south of the industrial port of Chittagong.

Today, Cox's Bazar is one of the most-visited tourist destinations in Bangladesh^[2], however it has yet to become a major international tourist destination, with no international hotel chains operating here, due to lack of publicity and transportation. Cox's Bazar started to get the administrative attention. In 1972, the town committee of Cox's Bazar was again turned into a municipality. In 1975, The Government of Bangladesh established a pilot plant at Kalatali. Later, in 1984 Cox's Bazar subdivision was promoted to a district. Cox's Bazar municipality was constituted in 1869 and was turned into a town committee in 1959. The town committee was replaced by municipality in 1972 and it was elevated to B grade in 1989. The municipality covers an area of 32.90sq km^[3] with 27 mahallas and 12 wards; population 60234; male 57.09%, female 42.91%.

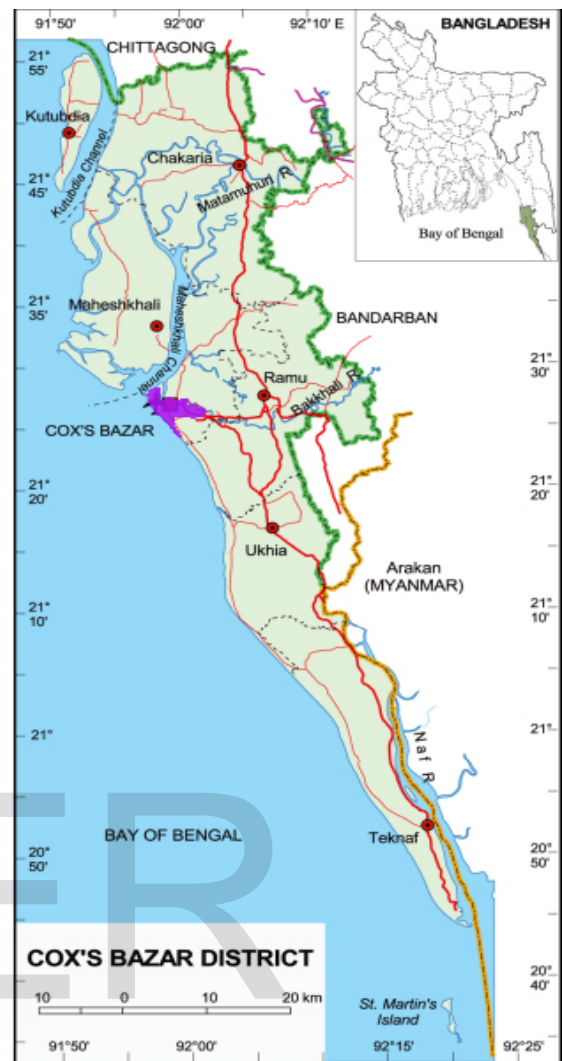


Fig-1: Cox's Bazar District



Fig-2: Cox's Bazar Sadar upazilla map

The literacy rate among the town people is 52.2%.

Cox's Bazar having been a great tourist resort various establishments have developed in the town including 6 big hotels, 30 medium hotels, 50 semi-medium hotels, Jhinuk market for the tourists and the Burmese market dealing in luxury goods from Burma, Thailand and China.

Fig-3: Cox's Bazar sadar road network plan

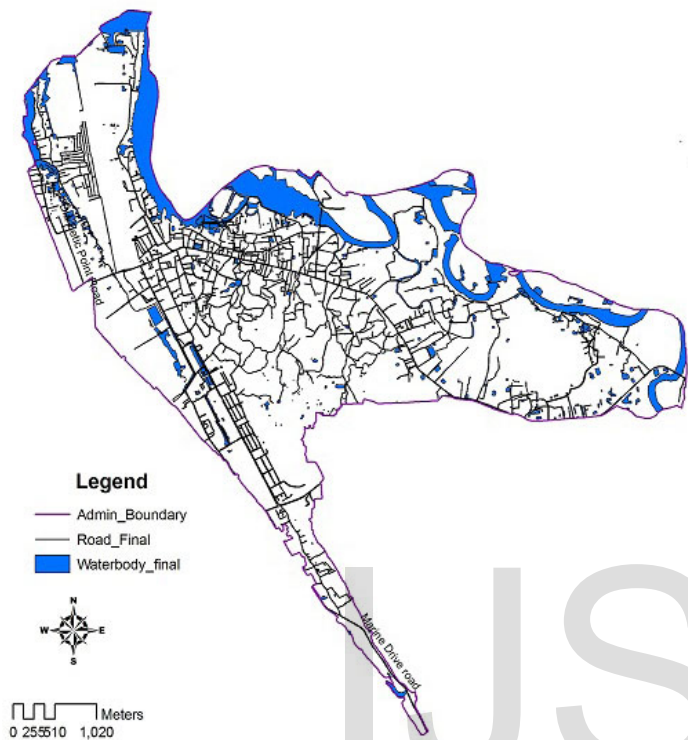
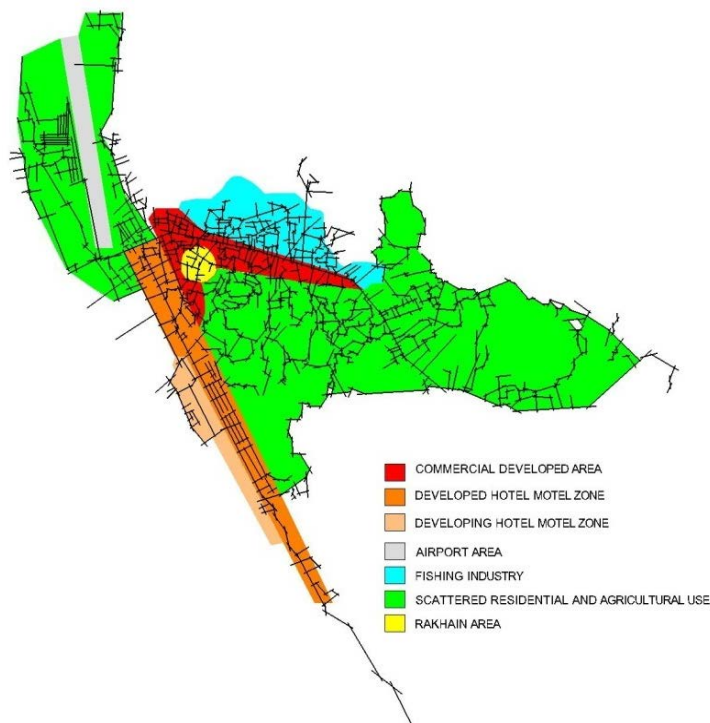


Fig-4: Land use of Cox's Bazar Sadar



As one of the most beautiful and famous tourist spots in Ban-

gladesh, the major source of economy in Cox's Bazar is tourism. Millions of foreigners and Bangladeshi natives visit this coastal city every year. As a result, a large number of hotels, guest houses and motels have been built in the city and coastal region.

Many people are involved in hospitality and customer service orientated businesses. Number of high-end hotels in the city was about 2 or 3 about 5 years ago.

Now-a-days there are dozens and counting, however no renowned international hotel chains operate in the city, but many hotel chains are planning to build hotels here.

An existing road network plan is collected from Cox's Bazar pourashova [4] for preparing axial map. The existing land use of the city is studied which is shown here in figure -4. It is clear that from the image is most of the area of Cox's Bazar city is undeveloped such as scattered residential and agricultural use. The hotel-motel zone is so far developed by the side of beach area.

3 SYNTACTIC ANALYSIS

A plan of exiting road layout is collected from Cox's Bazar pourashova is used for the study. Based on that, the axial map of Cox's Bazar is drawn which is given in figure-5

Spatial analysis of Cox's Bazar with radius 'n' is given in 'figure- 5'. It is a derivation of the process in which each line is picked up in turn and the complexity distance or depth is calculated to all other lines in the system.

The map is then shaded dark to light or red to blue in color. In this analysis, the shallowest lines, which means the lines with the lowest total of depth and higher integration value, coincides with the Jhaoutola main road, running through the city from the south towards north up to Ramu road.

Fig-5: Axial map of Cox's Bazar



Fig-6: Axial map of Cox's Bazar with global integration (R=n)

4 ATTRIBUTE SUMMERY

Attribute	Minimum	Average	Maximum
Integration (HH)	0.276718	0.661349	1.16356
Integration (HH), R3	0.333333	1.34142	3.57706
Connectivity	1.00	2.68187	26.00
Mean depth	7.30913	12.9679	27.529
Line length	1666.39	7554.74	87444.2
Node Count	965	965	965



Fig-7: Axial map of Cox's Bazar with global integration (R=3)



Fig-8: Axial map of Cox's Bazar with Integration core

Here again topography plays the vital role. Some region of main Kolatoli road is consisting of hilly area which may act as one of the breathing spaces for the city. A tendency to annihilate the natural hill is also observed. Cox's Bazar development authority may assist to prevent this unauthorized development.

Jhaotola main road was the hub for commercial activities and later new beach road and motel is developed to accommodate huge amount of tourist. Tourism has been considered as an effective vehicle for economic development of many countries in the world. Globally it is regarded as the fastest growing industry, with economies benefiting from its positive impacts. The measures of the analysis follow different types of relations with each other.

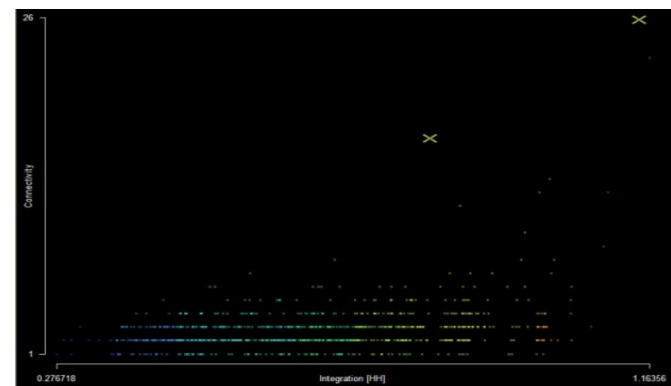
Some of those are given in 'figure 9'.

(A) Integration HH and Connectivity: Highly integrated lines are well connected.

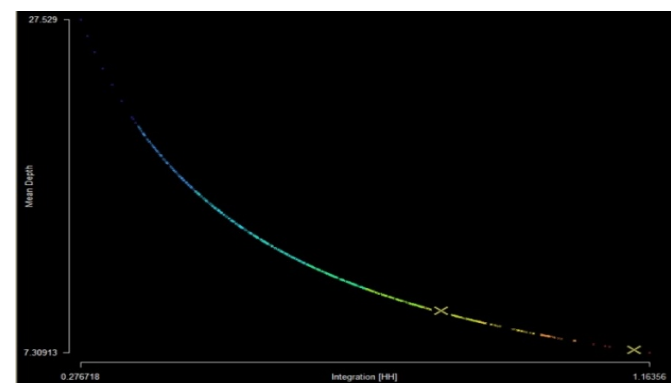
(B) Integration HH and Mean Depth: These are inversely related. The shallower the lines, the more integrated they are.

(C) Integration HH and Line Length: Generally, long lines show high integration. It is not universal.

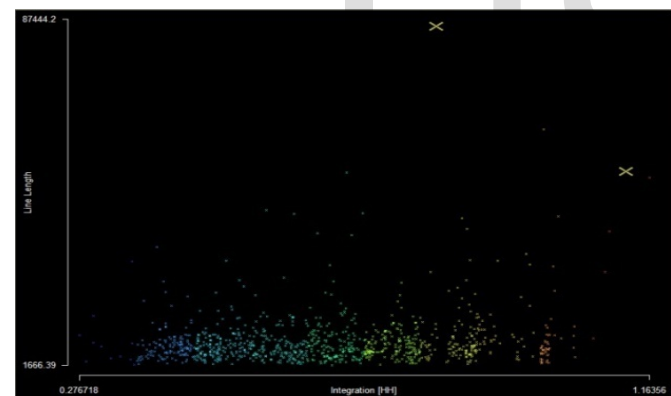
(D) Line Length and Mean Depth: It is the similar type of 'C'. Long lines are generally in shallow location



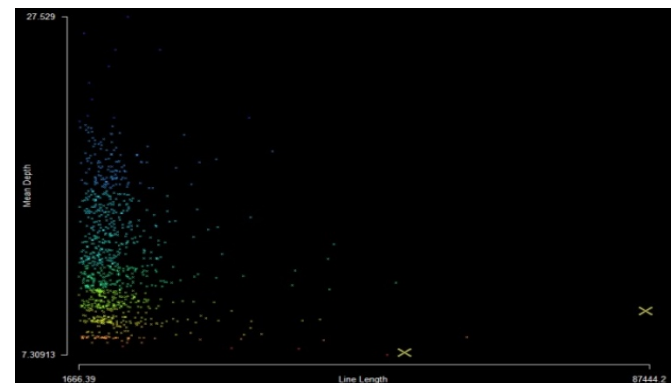
(A) Integration HH and Connectivity



(B) Integration HH and Mean Depth



(C) Integration HH and Line Length



(D) Line Length and Mean Depth

Fig-9: Relationship with the measure of Space Syntax

The axial line analysis explore that the city integrated core have a tendency to shift from Ramu road to motel road. Jhautola main road and Laldhighi is also important for city administrative and historical business center. But the motel road is adjacent to sea beach for this many development has taken place due to tourist's interest of staying night nearby the beach area. Most of the tourists accommodate at Kalatai road, motel road, and new beach road .For this case, these road is developing very fast. Consequently, the land value of this area is also increasing at a high rate. There are no significant connection between them and main city.

Table 2: Comparison between Jhautola road and New Beach road measured on Space Syntax

Road Name	Connectivity	Integracion HH	Integracion HH(R3)
Jhautola Road	26	1.15032	3.57706
New Beach Road	17	0.836795	3.11946

5 RECOMMENDATIONS

From the above axial analysis, it is clear that Cox's Bazar city is running to growth pole theory. It is going through a linear way from Ramu road to Airport road node and then breaking for sea and turn around to motel road. So from here some prediction & recommendation can be drawn such as follows:

- The economy of the city is going from east side to west side so the next economic zone will be motel road and kalatoli.
- A well connected road is proposed within two area for easy transportation and increased integrated area
- It can be also forecasted that new development is going to south, kalatali more and marine drive road. So proper planning and infrastructure must be developed at that area.
- Some growth center and economic hub or modern tourist facilities should be placed at south portion of the city



Fig- 10: Axial map of Cox's Bazar with global integration(R=n) after incorporate a proposed road

Table 3: Comparison between Jhautola road and New Beach road measuring by Space Syntax after incorporating a connecting road.

Road Name	Connectivity	Integration HH	Integration HH(R3)
Jhautola Road	27	1.25697	3.67502
New Beach Road	18	1.09683	3.11993

It is seen that integration HH and integration HH (R3) are both increased after incorporating a connecting road between two roads.

6 CONCLUSION

Land is a very important and scarce resource of Bangladesh. Therefore, it should be managed very carefully to ensure the best possible use of this limited resources for the benefit of the maximum number of people and their economic development. The level of urbanization has been raising very rapidly in Cox's Bazar due to Millions of foreigners and Bangladeshi natives visit this coastal city every year and the local community is involved in tourism activities and benefiting from tourism development but significant scope exists to increase their active participation and equitable benefit sharing. As a result, a large number of hotels, guest houses and motels have been built in the city and coastal region. For this reason it is very necessary to take action with the urban economy.

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