ACCESSIBILITY OF ROAD NETWORK BASED ON CONNECTIVITY ANALYSIS TECHNIQUE IN MORATUWA URBAN AREA OF COLOMBO.

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ABSTRACT: The road connectivity in development activities plays a key role in the urban spatial structure. In recent years such developments have been built using a road design concept that uses poor road connectivity. This road patterns does not provide travelers with alternative paths to complete their Journeysand therefore the traffic concentrates on the main arterials. In this background,Moratuwa M.C area was selected for analysis which is a one of the commercial capital of Colombo city and Sri Lanka. This urban area also is functioning with high traffic concentration.The objective of this paper is to identify the hierarchical structure and formation of the road network and to analyze the connectivity levels of the selected nodes in spatially. For that purpose a method to assess how connectivity affects the hierarchical structure was developed. Secondary data like City Profile of Moratuwa MC area and Statistical Hand Book of Moratuwa D.S Office and google map with a Moratuwa and Colombo regional network were used for this research. The process used in this study involved the selection of some nodes to know connectivity level and demand analysis of road networks. Then roads were coded in greater detail to show existing road patterns and then new links were added to provide better connectivity. Very high, high, moderate and law or Poor criteria were used as connectivity levels using space syntax analysis and connectivity analysis methods. Results from this paper reveal that forms of the roads and connectivity levels of roads were known. Positive and negative aspects were identified in the study area and given some recommendations which can help spread out traffic volumes more efficiently throughout a network. In that respect more studies about design criteria, safety and livability levels of residential areas with interconnected road patterns are needed. When we do this, traffic congestion can be avoided or delayed and the transportation facilities would be more sustainable in the future. However as a spatial analysis method connectivity analysis is more reliable.

Keywords: Spatial structure, Connectivity analysis

1. INTRODUCTION

In the fields of planning and urban design, spatial analysis is playing vital role. In recent years such developments have been built using a road design concept that uses poor road connectivity. This road patterns does not provide travelers with alternative paths to complete their trips. In this circumstance, Moratuwa M.C area has been selected for analysis which is a one of the commercial capital of Colombo city and Sri Lanka. This urban area is also functioning with high traffic concentration. According to the location of the Moratuwa area, it has higher connectivity to major centres of the country by better road network as well as rail network. The objective of this paper is to identify the hierarchical structure and formation of the road network and to analyze the connectivity levels of the selected nodes in spatially. For that purpose a method to assess how connectivity affects the hierarchical structure was developed. 'Connectivity Analysis' technique is one of methods was developed in the paradigm of 'Graph Theory'. Despite the profound applications in computer network analysis recently connectivity analysis was applied in spatial analysis in the

field of urban planning and design. This is mainly because of its capability to model, forecast and explain the matters related to accessibility. This technique can be defined as an analysis of the connectivity among systematically linked points, lines and areas in terms of the degree of properties such as number, distance, travel time, optimal path. Then positive and negative aspects were identified in the study area and given some recommendations which can help spread out traffic volumes more efficiently throughout a network.

2. STUDY AREA

Moratuwa town is located in the Colombo District of the Western Province on the Southern direction of the City of Colombo. It is bounded by Dehiwala-Mt.Lavinia Municipal Council to the North, Indian Ocean to the West and Bolgoda River to the South and to the East. Total extent of the municipal area is approximately 23.4 sq. km. The Municipal area is divided into 17 wards. The Moratuwa area which is having a natural peninsula surrounded by the natural barriers of the Bolgoda Lake as the Eastern boundary the Southern Boundary the ocean as the western boundary. Due to this, the area is naturally given the peninsula form which character is not seen in any other towns in the Colombo District.

3. METHOD OF STUDY

This study evaluates the capability of connectivity analysis technique as a method to identify the relationship between connectivity and urbanization. Therefore connectivity analysis technique applied into a Moratuwa Urban area in Colombo district and the results correlated with current level of urbanization of the nodes, to test the applicability of the technique to identify the pattern or form of this urban area. I have used readily available data and Google map with a Moratuwa and Colombo regional network for this research. The process used in this study involved the selection of some existing nodes to know connectivity level and demand analysis of road networks. The roads were coded in greater detail to show existing road patterns and new links were added for increasing connectivity. Very high, high, moderate and law or Poor criteria were used as connectivity levels using space syntax analysis and connectivity analysis methods.

4. RESULTS AND CONCLUSION

This area is part of an urban agglomeration. Basically I look at the hierarchical structure of the roads which are A, B, C and D class roads. Eighty percentages (80 %) of the roads are D class roads. Primary roads (A Class roads) are 60 feet. Secondary roads (B class roads) have 30 feet width of roads. Other tertiary roads are in between eight to ten feet. Four percentages (4%) of the total land area are used for the road network. The main transport corridor is the Galle road which connected by secondary and tertiary roads. If we look at the road density, it is very high and well connected compared to the Colombo district level and national level which ensure efficient circulation with its strong other linking roads. When we look at the roads under the physical infrastructure we can understand that.

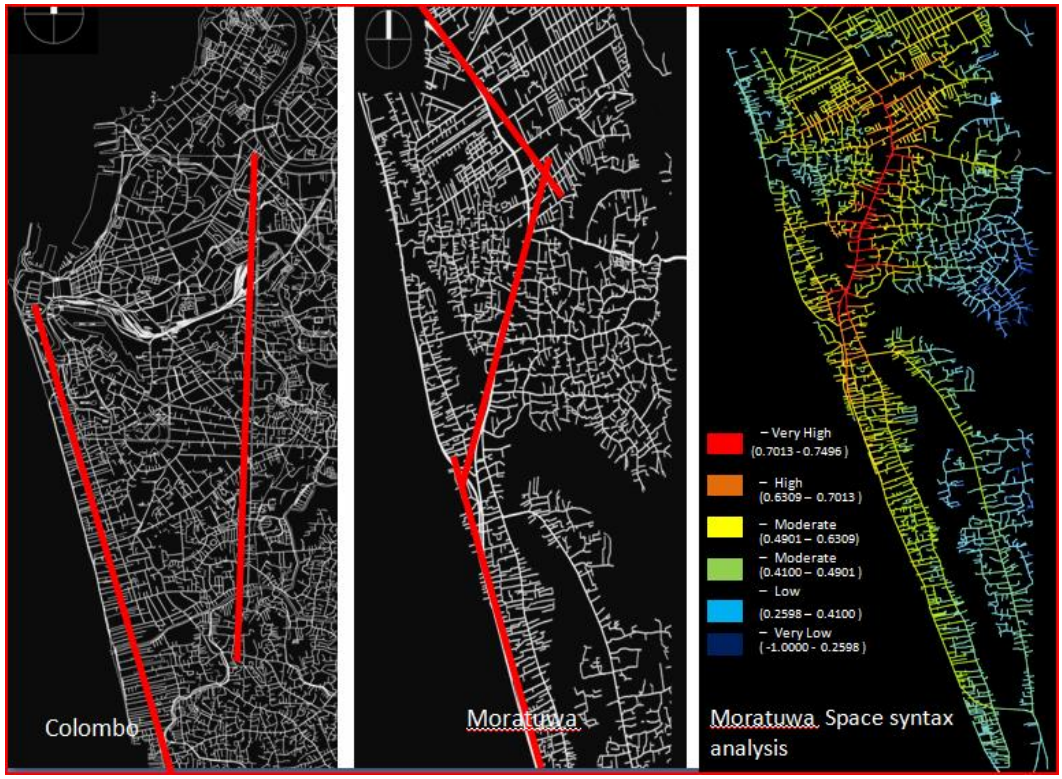
Table 1. High Road density in Moratuwa

Aspects	Moratuwa DSD	Colombo District	Sri Lanka
A Road density (km per sq.km)	0.80	0.50	0.06
Total road density (km per sq.km)	7.09	5.60	-

Source: Resource Inventory, Moratuwa DSD, 2013.

According to the table one (01), Moratuwa DSD has 0.80 km per sq.km of road density. This is higher than Colombo district (0.50) and Sri Lanka also. (0.06).

If we look at in comparison of these road network, we can't consider Moratuwa as only separate part because it is tied to a larger scale with Galle road which starting from Pettra area up to Panathura . it shows the critical pattern of the Galle road and indicate the same kind of pattern in the road hierarchy. If we take Northern part of the Colombo, more integrated places are Galle road area and Elwitigala Mawatta. That is why we continue to see the high integration along the Galle road when we analyze the Moratuwa area's road network.



Map 1. Road Comparison - with Northern Part of the CMR.

When it becomes a larger urban agglomeration we see few characters in the network or pattern. We have sea side linear pattern, Grid pattern and cluster organics as formation of the road network but these are very common in all parts of metropolitan area because it also indicate that we are also part of urban agglomeration and it is not very sort of special to Moratuwa only. Therefore we are small part of a larger urban agglomeration.

Road Patterns in study area

Angulana Moratuwa Railway Station-Moratuwa Egodauyana

Figure 1.Sea side – Linear Parallels

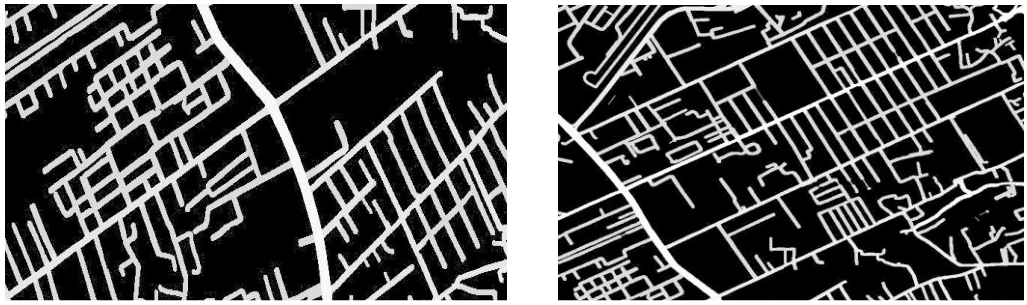


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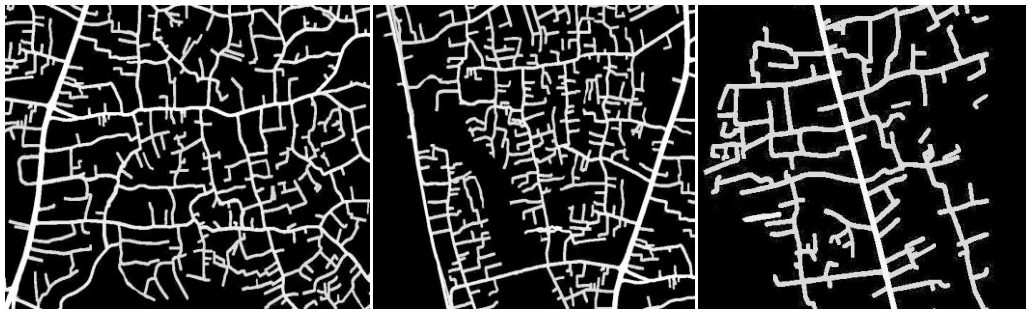
Figure 2.Grid Patterns



Moratumulla Lunawa Panadura

Figure 3.Cluster – Organics

Connectivity analysis and space syntax analysis have been done to check the connectivity level of this region. Five main junctions were taken for the analysis as the samples namely Katubedda junction, Rawathawatta, Cross junction, Angulana and Golumadama junction.

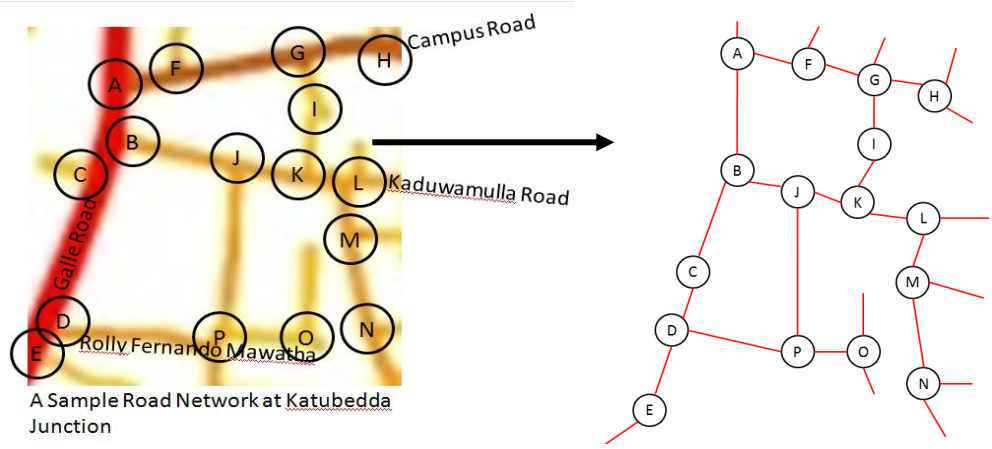


Figure 4. Connectivity Analysis for main node (Kattubedda) Junction

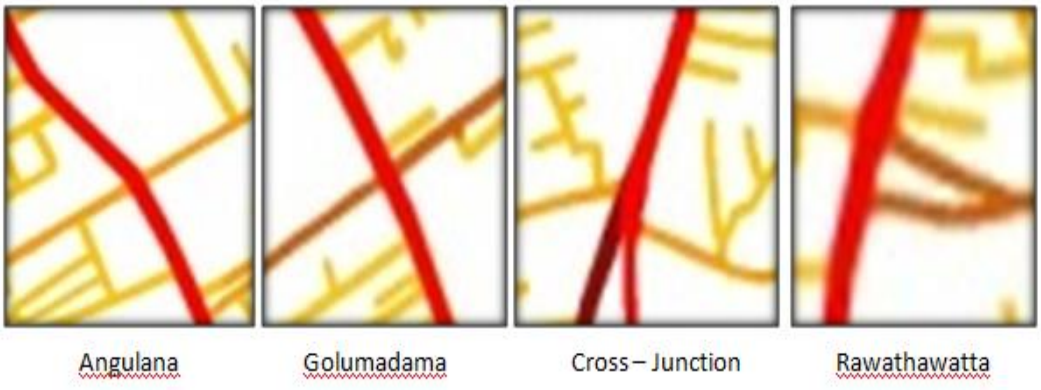


Figure 5. Connectivity Analysis for other Junctions

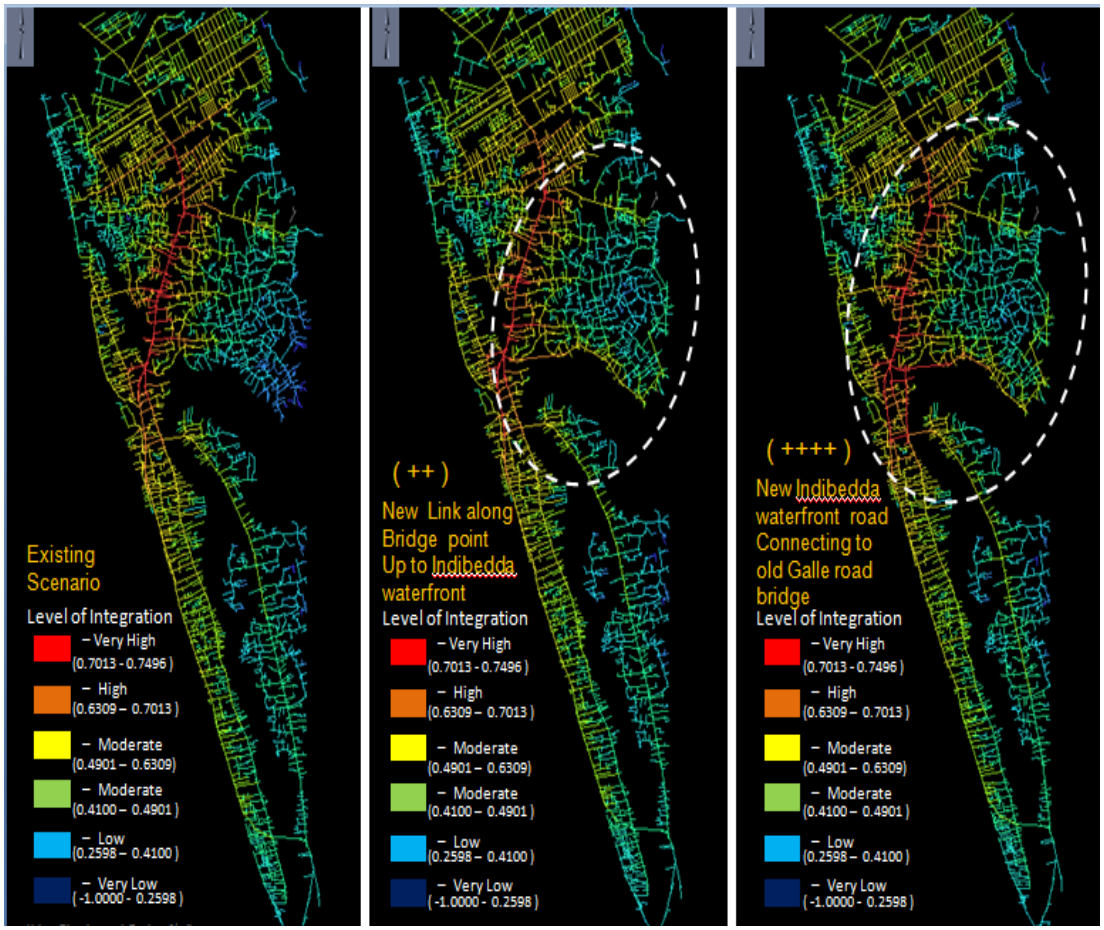
Table 2. Connectivity Analysis for the five Junctions

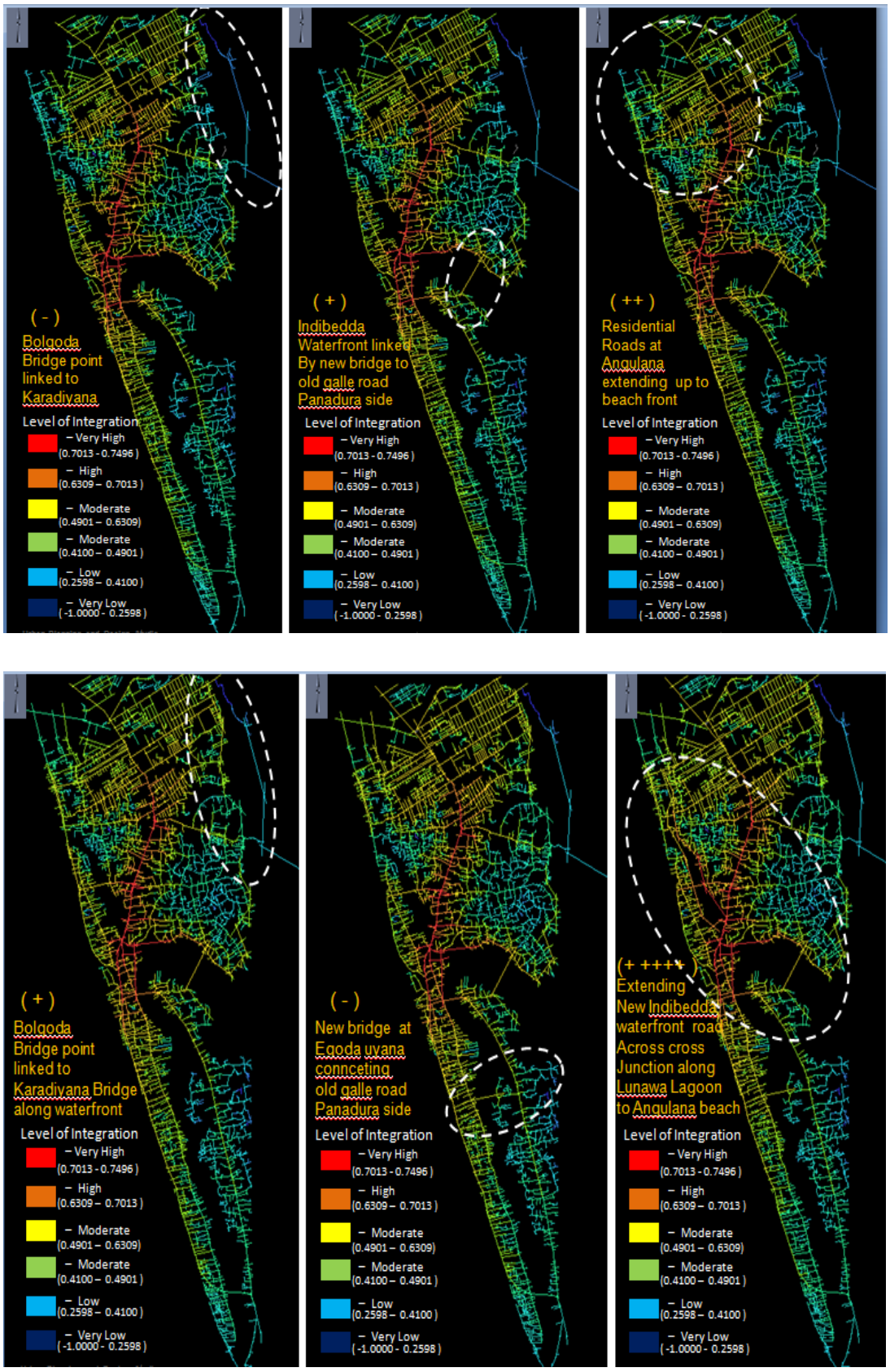
Locations	**Levels of Connectivity (%)**				
	Very High	**High**	**Moderate**	**Low**	**Overall**
Katubedda	50	19	25	06	**69**
Rawatawatta	40	30	20	10	**70**
Cross Junction	46	23	08	23	**69**
Angulana	44	19	13	25	**63**
Golumadama	50	20	30	00	**70**

Source: Author, 2015

I have noticed that there are between 60 to 70 % of overall connectivity in among all those junctions. Therefore, it shows the road network is highly connected and accessible. It is noted that the prevailing clear hierarchical structure of road network in the study area promotes sustain to this predominantly linear spatial form. The spatial form simultaneously provides high connectivity (70%) the road network and inherently has high integration of spaces spread along the Galle road, transport corridor.

Eight new linking roads were selected and applied into the space syntax analysis. According to those analyses, there were got existing space syntax map and some new space syntax maps. In the existing map show the existing integration of roads. Other maps show new integrations for the new linking roads in Moratuwa. Following the maps indicate eight new linking roads with space syntax map.





Map 2. Existing and new Space syntax analysis for Moratuwa Urban Area.

When we compare the new space syntax maps, highly integration shows with joining the existing new Indidedda water front road across cross junction along the Lunawa Lagoon to Angulana Beach. Therefore this new road construction is proposed through this research to increase the efficiency of the roads.

In this respect more studies about design criteria, safety and livability levels of residential areas with interconnected road patterns are needed. By doing this, traffic congestion can be avoided or delayed and the transportation facilities would be more sustainable in the future.

Further, Positives and Negatives aspects of Road Network were identified in the study area. High Connectivity, High accessibility and Serviceability, Strong Hierarchical structure enforce legibility and Road network ensures efficient circulation with its alternative routes were identified through this research as positive aspects. Current Traffic flow of the roads exceeds the expected capacity at design stage which creates traffic congestion and surface damages to roads and existing road conditions not maintains at the graded level of services by type of secondary and tertiary roads. These are the negative aspects of the road network.

5. REFERENCES

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