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The Strategy Planning For Urban Traffic Congestion: A Case Study of Nashik

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Abstract— Traffic congestion is a major problem of urban transportation at present which is caused due to development of large human settlements in cities. Traffic congestion results in increase in costs which is due interference among road users. The resulting congestion reduces mobility and increases driver's stress, vehicle costs and environmental pollution. In this paper, traffic congestion problem of Nashik city is identified and studied. Urban traffic congestion in Nashik is a fast growing phenomenon and it is a big challenge for the city planners, the city administrators and the general residents of the city and therefore it is a need for effective urban traffic management to reduce traffic congestion, if ignored it can be a nightmare in coming days to city residents in order to access the major parts of city as well as in entry and exit points in Nashik city during peak hours in the morning and evening. The objective of this study is to develop a strategy towards the reduction of urban traffic congestion to decongest the Nashik city with a view of suggesting ways to improve the quality of the speed of mobility within the city and suggest ways for optimizing the use of the existing traffic facilities within the city at a larger extent.

Keywords— Traffic congestion, environmental pollution, PCU, hypothesis testing, short and long term strategy.

I. INTRODUCTION

Urbanization is a global phenomenon. It is taking place at faster pace in developing cities of country. Rapid and On going urbanization in Nashik has resulted in increasing of traffic congestion. With the rapid growth of the number of vehicles, the traffic congestion is more and more serious in the urban road system, which not only increases the traffic accidents, but also affects development of the society. The effective urban governance required a careful balancing between the benefits of agglomeration and the disadvantages of excessive congestion. Road traffic congestion poses a challenge for all large and growing urban areas. The report on which this summary is based aims to provide policymakers and technical staff with the strategic vision, conceptual frameworks and guidance on some of the Practical tools necessary to manage congestion in such a way as to reduce its overall impact on individuals, families, Communities and societies. Traffic congestion refers to the increase in costs which results from interference among road users. The impacts are most severe during peak hours when traffic volumes approach a road's capacity. The resulting congestion reduces mobility and increases driver's stress, vehicle costs and environmental pollution. Nashik, the fifth largest urban area in the state of Maharashtra, is witnessing rapid motorization along with increase congestion and pollution. Urban traffic congestion in Nashik is a fast growing phenomenon and it is a big challenge for the city Planners, the city administrators and the general residents of the city and therefore is a need for effective urban traffic management to reduce traffic congestion. Strategies to reduce urban traffic congestion in the Nashik city is a challenge and if traffic congestion is ignored it can be a nightmare in some days to city residents in access to the major parts of city as well as in entry and exist in Nashik city during peak hours.

A. RESEARCH OBJECTIVE

- To examine the urban transportation system in Nashik and identify the urban traffic management problems, which lead to urban traffic congestion.
- To assess the urban land use patterns and their relationship to the urban transportation system and how this relates to the urban traffic congestion in the Nashik.
- To formulate traffic improvement proposal for long term span
- To carry out surveys within the study area like traffic volume survey.
- To make recommendations on effective urban traffic congestion management strategy to reduce the urban traffic congestion in the city.

II. LITERATURE REVIEW

[1] Sun Ye et al. focus on major problem of traffic congestion in urban area which reduces urban traffic sustainable development. In this paper, congestion charging is use to reduce urban traffic congestion. This paper consider several issues such as the goal, the pricing, the scope , the method and the redistribution of congestion charging from theoretical angle. In this paper, charging method is discussed such as manual charge and electron charge. And Singapore and

London congestion charging practice was studied and then conclusion were drawn for traffic congestion charging which suggest that congestion charging should take in way of scientific plan, support of public, public transportation development as the premise or fully. [2] Zhang Dahai et al. present strategy for reducing traffic congestion using Foshan city as an example. In this paper, integrated green traffic strategy is used for urban group development with four basic design characteristics such as safety, convenience, access to provide on efficient safe, comfortable and clean transportation services. This paper concluded that, integrate green traffic strategy helps effectively to solves a variety of current traffic problem in group urban development and it also suggest that it provide validity with extensive application. [3] Sourabh Jain et al. paper present an idea for reducing traffic congestion on urban arterial and sub-arterial roads of city by studying traffic behaviour on the aggregate level. And heterogeneous traffic conditions are studied by breaking the route into independent segments and the origin- destination based traffic flow behaviour of segments. In this paper, Delhi city routes are studied and data were collected on site using video camera for recording node base traffic parameters and moving car method for measuring the real travel time then data were pre-processed and segment variables were calculated. Congestion Index, which is an efficient route length independent measure of congestion, can be calculated. In this paper, different combinations of situation were analysed to have efficient model and one with best statistical values was chosen. And paper concluded that, this method help in improving road network planning and management but has some limitations that were duly noted. [4] Shekhar Rahane, U.R.Saharkar et al. paper present cause for traffic congestion of Talegaon Dabhade city and gives solution for traffic jam in city. [5] S. B. Raheem et al. paper mainly focus on cause, effects of traffic congestion in Nigeria. And Basorun-Akobo road in Inbadan Oyo state is taken as case study which is been analysed using experimental and theoretical approaches. In this paper, traffic counting and delay survey is carried out for effective research work and method used in this paper is traffic counting and traffic delay survey. Data obtained were compared with the Level of Service A as best highway condition and with service C as fairly condition. This paper concluded that effect of traffic congestion on study area are waste of time delay movement, accident Inability to forecast, travel time, fuel consumption, road rage, environmental pollution. And suggest solution to traffic congestion and provide recommendation to it. [6] JIA Hongfei et al. researcher studied traffic congestion of Chinese cities based on the massive data of intelligent platform. Three evaluations (average travel speed, the average delay/unit distance, saturation) are selected in this paper to build the traffic congestion evaluation system by the fuzzy comprehensives evaluation model. The traffic congestion evaluation system is conducted on evaluation of traffic improvement measures in Jianhe district. In this paper, the traffic congestion degrees of road section is divided into five grades such very smooth, smooth, mild congestion, moderate congestion and serious congestion. [7] Yitian Wang et al. researcher uses a bi-level programming model to mitigate traffic congestion and reduce carbon dioxide emission by considering carbon dioxide emission. Schemes is analysed in this paper such as, schemes 1 does not implement traffic congestion pricing ; scheme 2 only considers the congestion into the objective function; scheme 3 consider both the congestion and carbon emission costs into the objective function. In this paper, upper level function is to minimize the sum of travel costs and the carbon dioxide emission costs and lower level is to a multi modal transportation network equilibrium model. MSA and the shuffled frog leaping algorithm are introduced to solve the model and tested through the numerical example. Paper concluded that proposed model of congestion pricing strategy can mitigate traffic congestion and reduce carbon emissions effectively and paper also provide references for future congestion pricing strategy and has practical significance.

III. METHODOLOGY

Prior to the actual work, preliminary survey was carried out along the case study city to determine the best approach to be used in the research problem. The survey was carried out and it was observed that noticeable congestion was within mainly Dwarka circle where traffic congestion is rapidly growing with planned and unplanned development. Based on research work, the experimental investigation and theoretical study was done. The experimental investigation involved traffic counting, traffic pattern and delay survey. At location site, visible examination was carried out to know the causes of congestion on the road, studying traffic streams mainly traffic direction during peak period and easy flow of traffic along the study area. Below table summarizes the main traffic survey conducted in the study

TABLE: OUTLINE OF TRAFFIC SURVEY

Survey	Objectives	Method
Questionnaire survey (carried out for short term planning)	- For hypothesis test - To collect necessary data	- Google form
Videography survey (carried out for long term planning)	- To obtain traffic density, traffic volume - To obtain total passenger car unit factor	- Vehicle traffic count at peak period

IV. ANALYSIS OF DATA

A. VIDEOGRAPHY SURVEY (for long term planning)

The data was taken to find out the peak hour. The traffic volume of each vehicle was converted to Passenger Car Units (PCUs). The PCU values for each vehicle were taken as per IRC code as shown in table 3.2.1. The number of vehicles i.e values of traffic volume count in 10 mins interval was entered in excel sheet. The values were converted automatically into corresponding PCU values and maximum traffic flow was determined. The value for 1 hour was clubbed from 9.30 to 10.30 a.m. And so on. PCU values were determined for peak hour. The peak hour and corresponding volume found out at the location are plotted as shown in figure. Table shows Total PCU values obtained during peak hour(9.30 TO10.30 a.m.).

TABLE: TOTAL PCU VALUES OBTAINED DURING PEAK HOUR (9.30-10.30 a.m.)

Direction	**Traffic volume count**	**Total PCU**
Direction 1	1773	1619
Direction 2	2879	2996
Direction 3	3784	3716
Direction 4	1756	1429
Direction 5	1904	1634
Direction 6	2806	2724
Direction 7	2004	1964
Direction 8	1499	1928

1. ***PROJECTION****:*

The necessity of Grade separated intersection is better emphasized by working out the future traffic volume. This is known as Projection. Roadway improvements are normally based on volumes of traffic projected to a "design" year. Present demand may increase due to:

a) Growth of the region

b) Attraction of traffic by new facility due to improved level of service offered

As per IRC 102: 1988, a twenty year period is normally assumed to be the design period for a road project and 7.5% growth rate is considered for projection.

Calculation of Projection:

A=18,010PCU

R=0.075

n=20

P= 76,504 PCU

Projected peak hour obtained is 76,504PCU

Reference: As per IRC SP 73 – 2007, "The vehicular underpass/overpass structures shall be provided at the intersection of the Project Highway where the total traffic on all the arms of the intersection is in excess of 10,000 PCUs in peak hour" PROPOSAL OF UNDERPASS/OVERPASS IS FEASIBLE- based on volume criteria.

2. ***SPECIFICATIONS FOR OVERPASS i.e. FLYOVER*****:**

- As per IRC 92-1985 the design speed is limited to 80km/hr. in urban area.
- Radius of curvature values have been worked out for a maximum super elevation of 7% .
- Pavement width - IRC 92-1985 provide two lane, 7.0m wide if capacity exceed 2500 pcu/hr roads with one meter wide paved shoulder on either side.
- A cross-section with 225 mm wide kerb and open-type parapet will generally be suitable for most cases.
- Entrance and exit of terminal: The entrance terminal should be provide for sufficient length of acceleration to enable a driver to increase his speed from that on the turning ramp road way to that of operation speed of highway and exit terminal should be provided with sufficient length of deceleration lane to enable vehicle leaving the highway at high speed to reduce their speed to negotiate the turning curve on exit.
- Pavement design should be provided as per IRC 37-2002.

3. SPECIFICATIONS FOR UNDERPASS:

- No footpaths are provided in the underpass.
- Service roads of 7m width are provided with footpath of 1.5m width.
- Underpass carriageway width of 7m is provided with kerbs 0.25m width.

- As per IRC codes the speed on the underpass is limited to 25km/hr. Therefore design speed is taken as 30kmp.Sky light and ventilation arrangement provided opening of 5m width.
- Vertical clearance at underpass shall be at least 5m. However, in urban areas. It should be increased to 5.5m.

B*. *QUESTIONNAIRE SURVEY: (for short term planning)

With a view of fulfilling the objective of research problem some relevant hypothesis have been formulated for this study, which is as follows:

1. HA: Construction of flyover will reduce the traffic congestion?
2. HA: Encouraging people to use public transport will reduce the traffic congestion?
3. HA: Development of traffic signalling system will reduce traffic jam?
4. HA: Imposing more taxes on private cars will reduce the traffic congestion?
5. HA: The number of rickshaw should be reduced for controlling traffic congestion?
6. HA: Providing BRT (Bus Rapid Transit) system will reduce the traffic congestion?
7. HA: Increasing road lanes will reduce traffic congestion?
8. HA: Posting of more traffic police at intersection will reduce traffic congestion?
9. HA: Illegal parking on road/road side increases the congestion?
10. HA: Less capacity of roundabout (circle) increases the congestion?
11. HA: For reducing congestion, every educational institution must have their own transportation service for their student?

Hypothesis testing was carried out w.e.t above questions by using goggle form and following table shows the summary of responses.

TABLE: SUMMARY OF REPONSES THROUGH GOGGLE FORM

	H_1	H_2	H_3	H_4	H_5	H_6	H_7	H_8	H_9	H_{10}	H_{11}
1= Strongly Disagree	2	3	2	20	7	4	5	6	4	2	2
2= Disagree	4	6	4	39	22	3	5	13	4	8	8
3= Neutral	5	8	14	25	29	20	15	26	4	35	18
4= Agree	55	51	58	15	36	48	56	51	35	48	52
5= Strongly Agree	44	42	32	11	16	35	29	14	63	17	30
Total	465	453	444	288	362	437	429	384	474	400	430
Average	4.22	4.12	4.03	2.62	3.29	3.97	3.90	3.50	4.30	3.63	3.90
Standard deviation	0.84	0.95	0.85	1.21	1.13	0.98	0.99	1.03	0.97	0.89	0.93
Z test value	21.5	17.8	18.8	1.01	7.33	15.73	14.83	10.18	19.5	13.3	15.8

V. CONCLUSION

- Solving the problem of traffic congestion should be done by both short term as well as long term strategies.
- Short term include re-adjusting school and office timing, re-routing public transportation, replacing and reducing private transport etc. and long term may be construction of flyover and underpass.
- Intersection provide proportionate share of traffic problem.
- As a result , I choose dwarka circle junction which is rotary intersection with heavy traffic and serve safety problem.
- Analysis of all junction feature and major problem was done.
- Traffic volume count , PCU ,Topographic survey, hypothesis testing with questionnaire survey were conducted and result were analyzed.
- Vehicular overpass/ underpass seems to be effective solution for longer duration.
- According to the hypothesis testing illegal parking, providing BRT, encouraging public to use public transportation, posting traffic police seems to be effective solution for short duration.

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