Movable Traffic Divider: A Congestion Release Strategy

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Abstract—In recent years, with an ever increasing rate of development in metro cities around the world, there has been proportional increase in numbers of automobiles on the roads. Although the number of vehicles using the roads has increased, the static road infrastructure is almost the same and is unable to cope with changes like congestion, unpredictable travel-time delays and road-accidents that are taking a serious shape. Traffic congestion has been one of the major concerns faced by the metropolitan cities today in spite of measures being taken to mitigate and reduce it. It has emerged as one of the main challenge for developers in urban areas for planning of sustainable cities.

In developing countries, like India, traffic is inherently chaotic and noisy. Identification of magnitude of traffic congestion is an essential requirement for defining the congestion and finding appropriate measures. The paper studies the existing traffic congestion on one of the major route of western express highway in Mumbai with the help of instruments like Metro Count, which counts the data for the no. of axles as well as the speed of the vehicles simultaneously recording the results obtained and carefully analyzing the data. The main focus of this study is aimed at understanding the recurring urban congestion, its measurement, precautionary measure and suggests a remedial measure for the same. The implication of widening existing roads or building new ones will only results in additional traffic that continues to rise until peak congestion returns to the previous level. The total available space within the city for the construction of roads, railways and other transportation is restricted. The paper discusses implementation of movable traffic dividers as congestion release strategy for metropolitan areas instead of traditional solution of widening the roads. The moveable traffic divider helps in there configuration of road capacity, so as to attain optimum benefit from roadway usage on the existing road.

Keywords: Congestion, Traffic, Movable traffic divider, metro count, Mumbai.

I. INTRODUCTION

Countries around the world are day by day facing problem of traffic congestion due to increase in number of vehicles in society Although the number of vehicles using the roads has increased, the static road infrastructure is almost the same andis unable to cope with changes like congestion, unpredictable travel-time delays and road-accidents that are taking a serious shape in spite of actions being taken. Measuring reasons of congestion is foremost thing in deciding the solution to it. The designing of the roads is done considering the adverse conditions and the clear distance amidst the vehicles vary depending on the actual conditions suggesting the difference between theoretical derivation and practical conditions. Regulations & legislations study help us in determining the actual onsite and the government determined flow of traffic. Traffic congestion can be determined with respect to travel time delay, speed change, volume occupied and level of service. Traffic congestion also depends on the pattern of city, weather it is centric, grid or organic pattern. Depending on different congestion scenarios every country has adopted its own measures like high density traffic toll way in US, vehicle exclusion zones in UK and flexible working hours in UAE. Many other countries are in progress of adopting different measures for lowering down the effects of congestion. India with its growing economy is also experiencing growth in vehicular population although great variations in vehicle are seen but traffic free road is still in ideas. Now a day the conventional method of building more roads is no longer a solution. Traffic intelligent system is the step taken in providing good transport system to human community. In view to the above paper deals with study of traffic in Mumbai and suggesting a movable traffic divider technique for the same which can be used irrespective of the topographical, climatic, geographical obstructions and in combination which can help us to solve the traffic congestion problem in an optimal manner.

II. STUDY AREA

Mumbai being economic capital of India daily experiences 4.5million of people plying on roads of Mumbai, having a road network of 2000km it daily faces a problem of congestion on several arterial roads. Some of the key issues concerning to traffic congestion which are specifically factors affecting the city of Mumbai are Pot holes, Improper parking, Limited space, Growing no. of registered vehicles, Proliferation of slums, Bottle necks, Traffic indiscipline, Tighter budget. For study Purpose one of the main road western express highway was considered. A survey was conducted on Western express highway near Goregaon, Mumbai, India figure no.1. A 10 lane road was selected after

noting the congestion points; the western express highway was so selected to understand the current traffic scenario for long distance maneuver.

Fig 1: Survey Site

The survey was carried out for a span of 7.00 am to 9.00 pm using Metro-count 5600 the data collected from the survey was no. of vehicle passing a point, speed of vehicle and axle type. The results have been presented by the simple extraction from Metro count presenting the data of various classes of vehicles passing on the selected 10 lane wide road at their respective timings and also, the count of such class of vehicles in a time span of over 60 minutes is put forth. The average speed of the respected class in that particular slot of time i.e. 60 minutes is also put forward to have a clear understanding of the actual congestion issue. Apart from helping us to understand the actual congestion issue, it provides an understanding of the time delays which happens to be the prime concern in devising the solution for this issue.

III. METHODOLOGY

Metro count is used for traffic survey; it works on the Doppler Effect. Instrument was established on current traffic dividers at the road and pneumatic tubes were laid on both sides of the roads, the tube is to be laid perpendicular to the direction of traffic flow. The pneumatic tube is attested in to the A and B side of the Metro count the arrangement of instrument done is as shown in figure no.2 during installation a large no. of factors are taken care of such as, the rubber pneumatic tube has to be homogenous, should have sufficient length required for covering the width of lanes, free from any physical intervention inside the pipe, perfectly aligned, perpendicular to the direction of traffic flow, equal length on both sides, etc. To minimize the lateral movement each tube shall be stressed10-15% of original size. After following the above mentioned norms, the Metro count is set on active state by using MC Setup software. The equipment starts to store and record the data by no. of axles passing over the tube. After the span is completed the data of the Metro Count is unloaded into the computer and the results were obtained

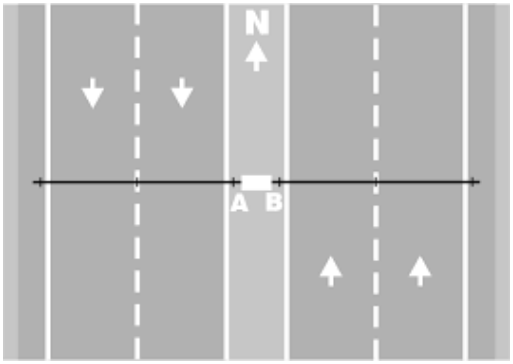

Fig 2: Layout of Metro Count

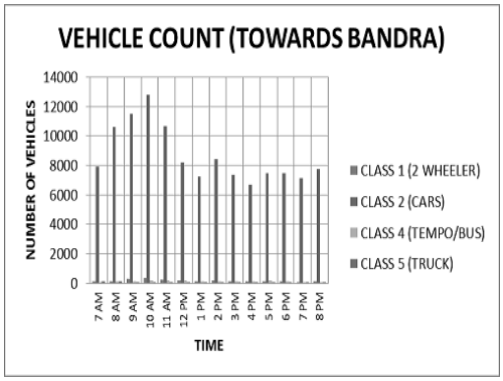

Fig 3: Graph of no. of vehicles v/s time towards Bandra

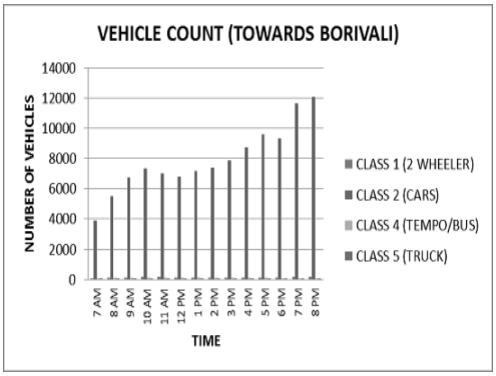

Fig 4: Graph of no. of vehicles v/s time towards Borivali

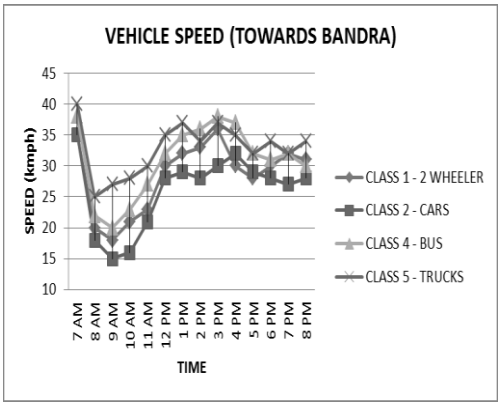

Fig 5: Graph of speed of vehicles v/s time towards Bandra

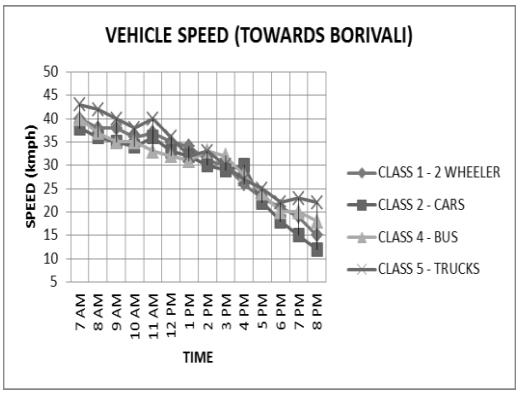

Fig 6: Graph of speed of vehicles v/s time towards Borivali

IV. RESULT

It can be seen from figure no 5&6 that the speed of the vehicle reduces significantly during the peak hours. The major drop in the value is accounted to the remarkable increase in the number of vehicles flowing. It was observed that the count of vehicles heading towards Bandra is as high as 12500 during the morning peak hours as depicted in figure no 3. Meanwhile on the opposite side at the same time the total count of vehicles heading towards Borivali is roughly around 7000 as shown in figure no 4, which states that the discrepancy is around 5500.On this grounds the reverse phenomenon is observed during the evening peak hours where the traffic flow is seen to increase towards Borivali to around 12000 and that towards Bandra is7000, difference being of 5000. This variation in the count is working as a symbolizing factor for the vehicular delay, reduced speed, increased pollution, inefficiency in optimum utilization of the available space. Having a close look at the graph depicts the drop and rise in the average speed of the vehicles but in a definite pattern. Supposedly, lane A is considered, the average vehicular speed is high at around 7.00hours and as the time passes, the number of vehicles passing also increases significantly showing a drip in their average vehicular speed but this pattern is observed only for some time. As the day progresses the reduction in vehicular count is noticed with the subsequent rise in the velocity of the vehicles. But as the peak hours in the evening time is observed, the dripin velocity is again observed. Although the reduction in speed is noted, it is not as significant as that in the morning peak hours. Therefore, a careful analysis with the proper study of the data is done to provide a viable solution biding by the guidelines and the limitations has to be incorporated.

V.CONCEPT OF MOVABLE DIVIDERS

As observed from above result Intelligent Transport System is the need of the hour as a solution for the congestion issue as the road expansion and development scheme will come to a halt after the area for development will be completely utilized and after conducting the survey and understanding the traffic flow and its behavior the suggested solution to the problem scenario mentioned above can be put together in the form of a Moveable Traffic Divider (MTD). This MTD can be used to effectively change the configuration of the existing roadway so as to optimize its usage by the incoming vehicular traffic which solely aims to minimize the traffic congestion issue with the optimum efficiency of the already existing road structure. Instead of having traditional non movable dividers, a mechanical setup of movable divider is to be installed on road such that during peak hour period on congested direction lane,

width of road can be increased by just moving the divider. Assuming a 4+4 lane road connecting location A (residential areas) and location B (official areas), the traffic density is high on the carriageway going from A to B as shown in figure 7 and low on the carriageway going from B to A during morning hours. Whereas at evening time the traffic density is high on the carriageway going from B to A as shown in figure 8 and low on the carriageway going from A to B, for this kind of pattern moveable traffic dividers can be installed on road so that during morning hours carriage way towards location B can be widened by mechanical movement of divider making the lane 6+2 as shown in figure 9 in place of original 4+4 lane. This repositioning would result in the roadway going from A to B widening by 2 lanes. Consequently, the number of lanes going from B to A is reduced from 4 to 2. As the number of vehicles going from B to A during the morning peak hours is very less, this reduction in the number of lanes would not cause traffic congestion in that stretch. Same can be done on carriage way towards A in the evening hours by making lane 2+6 as shown in figure 10.

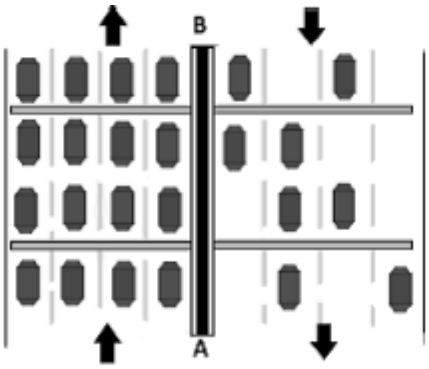

Fig 7: Scenario without MTB

Morning Peak Hours

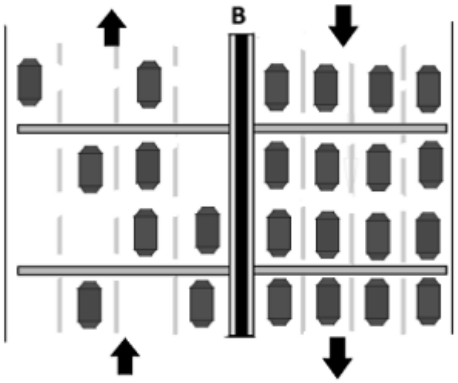

Figure 8: Scenario without MTB

Evening Peak Hours

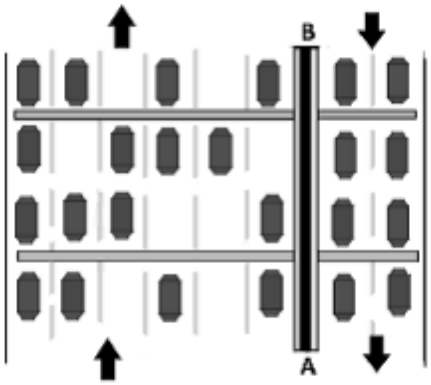

Fig 9: Scenario with MTB

Morning Peak Hours

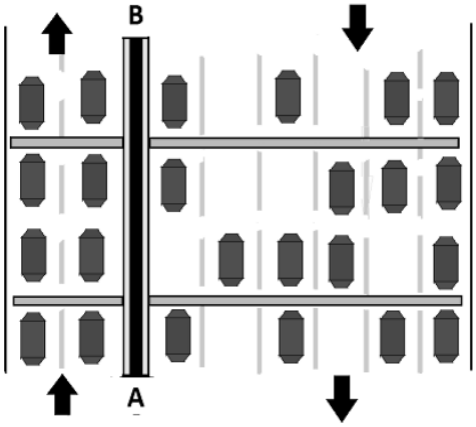

Fig 10: Scenario with

MTB Evening Peak Hours

Congestion issues rise and the construction of a new road structure or another mode of transport as an alternative solution seems lucrative and apt as a solution. But over the time it has turned out to be ludicrous as the congestion tends to rise with rise in the ever growing population, the rise in number of private automobiles registered, personal needs and demands, lifestyle, etc. The expansion will be out of question after thearea allotted for development terminates. An intelligent transport solution meeting all the needs should be implemented as the solution. The guideline for such a solution is presented in the above paper which is suggested after examining and studying the current scenario of Mumbai. Their causes, hindering factors and their solutions based on their own geographical conditions, economic structure, topographical conditions, etc are studied and presented. The relationship between these aspects reveals some interesting insights and after careful study of this issue an analytical solution is suggested which aims to alleviate the local decongestion protocol and thus turning it to be an Intelligent transport solution. The solution aims to maximize the efficiency of the existing road structure and minimize the congestion. The movable traffic barrier being flexible yet rigid structure acts as an interim solution. For the traffic heading in a particular direction, the widening of the roads, thus adding an extra lane by the movement of the traffic divider assures the decongestion in the traffic. The above study presents framework which can be largely implemented. The paper can be used as a basis forre-planning the new road structures like bridges, flyovers which are yet in the design phases and assess the suitability and viability with a proper validation of the suggested solution. If a system is devised, which can move the traffic barrier based on the direction of peak hour traffic congestion it can result in vast reduction in the quantum of the parameters such as travel time, fuel Cost, noise Pollution, air pollution due to vehicle emissions, stress on the driver and passengers and vehicle wear and tear. In order to get to the next stage of product development, a significant amount of research is needed in the material development department. This would ensure better economic and environmental feasibility of the Moveable Traffic Divider.

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