ANALYSIS OF TRAFFIC CONGESTION IN SRINAGAR CITY - A REVIEW

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***ABSTRACT*: The increasing imbalance between the volume of traffic on the urban streets of developing countries and their physical capacities is resulting in severe congestion scenario. The disparity between demand and supply is the result of fast improving socioeconomics of the people resulting in steep rise of vehicle ownership, accompanied by slow development of transportation infrastructure. Srinagar in India is one such city wherein the streets have lately experienced sudden rise of traffic volumes, catching the concerned departments unawares. The scenario is made worse by occupation of street space by hawkers, mobile shops and standing vehicles. The present study primarily focuses on analysing the traffic congestion scenario of the city streets and determining the influence of on-street parking on the same. It divides the study area (Srinagar City) into five broad zones. Twenty-two arterials and sub-arterials of road network are considered for the study. Data are collected for traffic volume count, road geometry, pedestrian count, free flow and average travel speed, varying travel speed, travel time and travel cost at different links and major intersections. Household interview survey is also conducted. Roadway congestion index is the indicator used to quantify congestion. Roadway congestion indices are separately determined for arterials and sub-arterials. Both the width and length of the street space occupied by parked vehicles have an influence on traffic flow and hence volume to capacity ratio. The relationship between the ratio of volume to capacity and the ratio of street area occupied by parked vehicles to total area of street-space is also being modelled. The study also reports the levels of congestion on various links of both arterials and sub arterials. The results are expected to help the authorities in framing and prioritising the improvement schemes.**

***KEYWORDS*: Congestion, level of service, roadway congestion index**

INTRODUCTION

In urban areas,traffic congestion is a major issue.Heavy traffic flow on national highways with high speed,when mixed up with local traffic at crossings,traffic congestion is likely to occur.This results in many negative problems like pollution,delay,accidents and congestion at intersectios.Traffc congestion in urban and sub urban areas has emerged from mere annoyance to a severe problem.Road congestion is spreading,movement of goods and people are slowing to a crawl and transportation cost escalating.

Most of the cities in Asian countries are experiencing such problems as a result of rapid urbanisation.Urban congestion is one such problem afflicting urban agglomerations in Asia and has multiple effects on urban economies.Urban congestion is broadly defined as excess demand for travel over it's supply.Infact,the reason why governments are forced to revisit their policies for urban mobility is because of growing demand for travel with limited supply of services.The presence of urban congestion affects free movement of traffic.

In many respects, rapid urbanization is an indicator of economic growth in Asia,and it is expected to continue if the scenario remains same.As per an estimate by the Asian Development Bank(ADB), about 44million people are added to Asia's urban population every year.Asian cities are also characterized by high population density.For instance,Dhaka,Bangladesh,grew rapidly during the last decade and became the most densely populated city in the world,whereas Mumbai stands at number two.

As per situation in India,road traffic conditions are getting worst day by day.The average number of vehicles in India is growing at the rate of 10.16% annually,since last five years.Spending hours in traffic jam has become part and parcel of city lifestyle which leads to health and environmental hazards.Traffic congestion is a major problem for the transportation professionals in India.Most of the cities are suffering from medium to high level of traffic congestion.Although,in some major cities the growth of private vehicle usage has increased at the faster rate,in general car ownership and usage has remained at much lower level in Indian context.The poor roadway condition,non uniform roadway features in terms of carriageway and shoulder width,abutting land use,pedestrian activities,poor lane discipline,improper bus stop location and design,vehicles of wide ranging characteristics of the technology and operating condition,heterogenity of traffic,unauthorized parking etc,indicate that the nature and cause of congestion in India might be substantially different from that in developed countries.As traffic congestion on urban and sub urban roads in India is due to only volume of traffic but also other casual influences,the problem of traffic congestion is more complex in nature and measures for congestion mitigation are also likely to be different from those in developed countries.

The migration of rural population to urban areas in search of better job prospects has made cities densely populated.

LITERATURE REVIEW

There is no single definition of traffic congestion and the problem can be interpreted in different ways, although in general it is a situation in which demand for road space exceeds the supply (ECMT, 2007; Lascano Kezic, Durango-Cohen, 2012; Talukdar, 2013). Traffic congestion occur when traffic is delayed due to the presence of excess number of vehicles on the same portion of the road way at a particular time resulting into slower than the normal or "free flow" speeds (Department of transportation U.S., 2005, p. 1; Link et al. 1999, p. 9). There shall be long queues of vehicles, which move in constant start and stop basis because the number vehicles trying to use the road exceeds the design capacity of the road. Consequently, it results into delay in traffic movement and the traveller cannot move in a desirable manner (ECMT, 1999; Goodwin 2004; Levinson et al., 1997; Lomax, 1990; Lomax, Turner and Schunk, 1997; Taylor, 2003; Thomson, 1998, p. 94; Weisbrod, Vary, et al. 2003, p. 1). Thus, traffic congestion can be described in two ways; (1) the high vehicle concentration moving at low flow speed, and (2) the number of vehicles on the road is close to or exceeds the maximum capacity of the road causing an imbalance between travel demand and transport system supply (Hon, 2005, p. 24; Talukdar, 2013). Congestion is generally categorised into recurrent, non-recurrent congestion and precongestion state (Brownfield et al, 2003). Recurrent congestion occurs mainly when there are too many vehicles at the same time, consequently reducing traffic speed and increasing commuting time, which may relate to rapid growth in population, urbanization and growth in car ownership and use. It occurs typically during peak hours but can also occur off peak hours. However, non-recurrent congestion is associated with random conditions or special and unique conditions, including traffic incidents (ranging from disabled vehicles to major crashes), work zones which slow traffic down, weather and special events. Pre congestion state occurs where free-flow conditions breakdown but full congestion has not yet occurred (Banjo, 1984; Brownfield et al, 2003; Chakwizira, 2007; HCM, 2000). 836 According to the Department of transportation, United States (2005, pp.1-2), there are generally seven reasons of traffic congestion. These seven reasons are generally grouped into three broad categories, such as, traffic influencing events, traffic demand and physical road features. Traffic incidents, work zones and weather are the traffic influencing events. Traffic incidents include vehicular crashes, breakdowns, debris in travel lanes, events that occur on the shoulder or roadside, etc. A construction activity on the roadway is the example of a work zone. Reduced visibility, bright sunlight on the horizon, presence of fog or smoke, wet, snowy or icy road way are the examples of poor weather. Traffic demand includes fluctuations in normal traffic, such as day to day variability in demand and special events. Physical highway features include road way physical and geometrical characteristics, poor traffic control devices and physical bottlenecks (capacity) of the road (Talukdar, 2013). A wide number of indicators have been developed to measure traffic congestion (Dijker, Piet, Bovy, and Vermijs, 1998; Grant-Muller, 2005). However, literature suggests that only a small number form the basis for regular monitoring of the road network and more concrete indicators are needed to measure congestion at a practical level (GrantMuller & Laird, 2006). One of the major indicators, which mostly favoured is the total amount of delay encountered calculated across all traffic from the difference between the actual speed encountered and free flow speed (Dft, 2000, 2000b; Dodgson, Young, and van der Veer, 2002). This leads to the measurement of average delay by a vehicle travelling per kilometre. It was believed to be advantageous in providing a better picture of how changing traffic levels and different policy packages can affect time lost to congestion, although delays are measured purely in terms of vehicle journey time and no allowances are made for differences in occupancy rates, values of time, or for additional factors, such as additional operating or environmental impacts that congestion can generate. Similarly, simple measures relating to speed are also used to indicate congestion, particularly for a motorway environment (Grant-Muller, 2005). These indicators include mean journey times, variability of journey times, throughput (total number of vehicles per time interval that pass a point on the carriageway), queue lengths, speed differential between lanes and delay per hour/day (Graham and Glaister, 2004; Grant-Muller, 2005; Grant-Muller & Laird 2006; Noland and Polak, 2002). Besides, the congestion reference flow (a quantified measure of congestion for a link -junction must be considered separately) and the level of service (LOS) are other basic congestion measures applied widely in some countries like USA and Scotland, (Highways Agency, 1997; State-wide Planning Scenario Synthesis, 2005). The concentration of trip destinations in a small area – particularly central area of the cities poses the challenge of providing large transportation capacity in limited physical space, while preserving the historical, political, cultural, economic and environmental heritage/values of the areas. It has been observed that there are larger share of trips to the city centres (with a defined and preeminent central area) in cities. As such, the total number of trips grows exponentially with the city size. Simultaneously, city centres are characteristically areas of high concentration of activities, and space is scarce. Therefore, there exists a dichotomy of high demand for transportation capacity in a geographic environment where space is limited (Lascano Kezic, Durango-Cohen, 2012). The various approaches to address the problems of congestion in urban areas particularly in the city centers fall in three broad categories: supply management, land use management and transportation demand management. Supply management includes all measures taken to increase the number of people and trips served by the transportation system in order to accommodate as much demand as possible. This includes added capacity for vehicles as well as transit, bicycles, pedestrians, and multi-mode facilities (Gao and Song, 2000; Yang and Bell, 1998; Zanjirani Farahani et al., 2013; Meyer, 2003) and traffic signal timing optimization (Ceylan and Bell, 2004; Stevanovic et al., 2013). However, according to critics of this method, majority of the traffic jams are caused by 837 accidents and events – not because of lack of capacity (STPP, 2001), so adding capacity to alleviate the problems becomes controversial on account of induced demand argument and the environmental and health effects of additional travel and land consumption (Gifford, 2005). Besides, supply management methods do little to mitigate congestion caused by non-recurring incidents. Land-use management describes the use of growth management, planning, and zoning to promote local density to encourage transit. Transit oriented development and high-density land use are both examples of this type of management. Critics of the land use management measures cite two major challenges that increased congestion is created by high-density development, and it takes long time to change land-use patterns and behaviors; they also doubt regarding the connection and causality between the two (Taylor, 2002). Transportation demand management (TDM) is a strategy of instituting largely financial incentives and disincentives to encourage motorists to use alternate routes, times and modes, or to defer trips entirely in order to reduce the demand for traffic facilities. TDM arises out of a desire to consider alternatives to "supplyside" measures because of the negative community effects of induced

demand. The measures include: congestion pricing, park-and-ride lots, high-occupancy-vehicle lanes, high-occupancy-toll lanes, employer commute option programs, telecommuting, alternative work schedules, and traffic calming measures. Of all the measures, congestion pricing tends to be both most effective and politically legitimate as a funding source (Gifford, 2005); however, due to the cost it places on drivers, it is one of the hardest methods to implement (Bass, 2008). Besides, meticulous traffic design, use of technology – use of intelligent traffic system, Global Positioning System (GPS), inter vehicle communication and vehicle simulator, and variable message signs approaches are the other ways, which are used to reduce traffic congestion (Alterkawi, 2006; Chen, Yu, Zhang, Guo, 2009;Furth, Muller, 2009; Hardjono, 2011; Salicru, Fleurent, Armengol, 2011; Santos, Coutinho-Rodrigues, Current, 2008; Yin, Lam, Miller, 2004). Efficient vehicle routing, punctuality of routes and diversion of vehicles are also considered as other options to alleviate traffic congestion particularly in the congested urban areas. However, the problem of vehicle routing lies at the heart of the distribution management and the conditions vary from one setting to other; and the objectives and constraints encountered in practice are highly variable. Although, some research has been done in this area, the focus is limited to a number of prototype problems, and the literature on vehicle routing – segregation of vehicular traffic (modal split), optimal traffic assignment on different alternative roads and reengineering of the traffic system at the local level, and their impact on the road network – congestion and travel time under the effect of combination of the parameters is scarce (Cordeau, Laporte, Savelsbergh, Vigo, 2007). Overall, the studies and practices, which deal with the traffic congestion mitigation, include increasing of road infrastructure supply or decreasing of travel demand, or both. Current studies have however demonstrated that increasing the size of infrastructure could be only part of the answer (OECD, 2013), as many measures are intrinsically interactive, which may need to be addressed jointly. With increased growth of traffic flow, it is crucial to develop cost-efficient policies, which would alleviate traffic congestion and address negative externalities in terms of environmental impact and cost to the economy (Watling, Milne, Clark, 2012).

OBJECTIVES

The main objectives of this research are to study the Vehicular Traffic Congestion in the Srinagar city to help alleviate traffic congestion. The specific objectives of the study include

(i) To study the vehicular traffic congestion in Srinagar city to help alleviate traffic congestion.
(ii) To zone the Traffic Congested areas for analysis to identify which zone has the highest Vehicular traffic during the peak hours (9:30-10:30am
4-5pm.
(iii) To apply various indices and measures to quantify traffic congestion.
(iv) To help the authorities in framing and prioritizing the improvement schemes.

SCOPE OF THE STUDY

The study aims at bringing to the fore the extent and causes of congestion. It also models the effect of on-street parking on the volume by capacity (V/C) ratio and hence level of service (LOS). The study is dedicated to the central area (CBD and periphery) of the SMR which the most congested area is. The study area in Srinagar City has been divided into five zones. Seventeen arterials and five sub-arterials are selected for the said study from within the study area. Data are collected for traffic volume count, road geometry, pedestrian count, free flow and average travel speed, varying travel speed, travel time and travel cost at different links. Household interview survey is also conducted. Roadway congestion index is separately determined for arterials and sub-arterials. The relationship between the ratio of volume to capacity and the ratio of street area occupied by parked vehicles to total area of street-space is also being modelled. It also locates the peak traffic volume so that people can change route during that time.

FIG:Showing traffic congestion at Jehangir Chowk, Srinagar

CONGESTION DEFINITION

The travel time or delay in excess of that normally incurred under free flow traffic condition.

OR

The travel time or delay in excess of agreed upon norm which may vary by type of transport facility, travel mode, geographical location, and time of day.

TYPES OF CONGESTION

- **Recurrent congestion** It generally occurs at the same place, at the same time every weekday or weekend day.
- **Non-recurrent congestion** It results due to incidents such as accidents or roadway maintenance

Fig.: Traffic congestion at Delhi

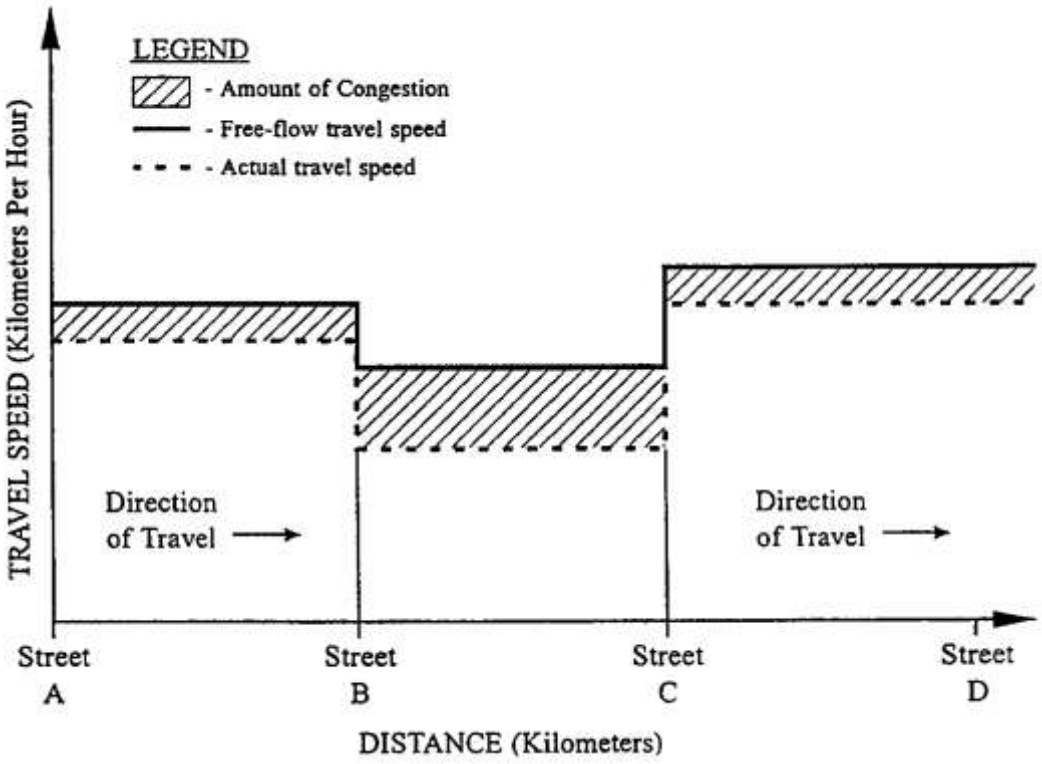
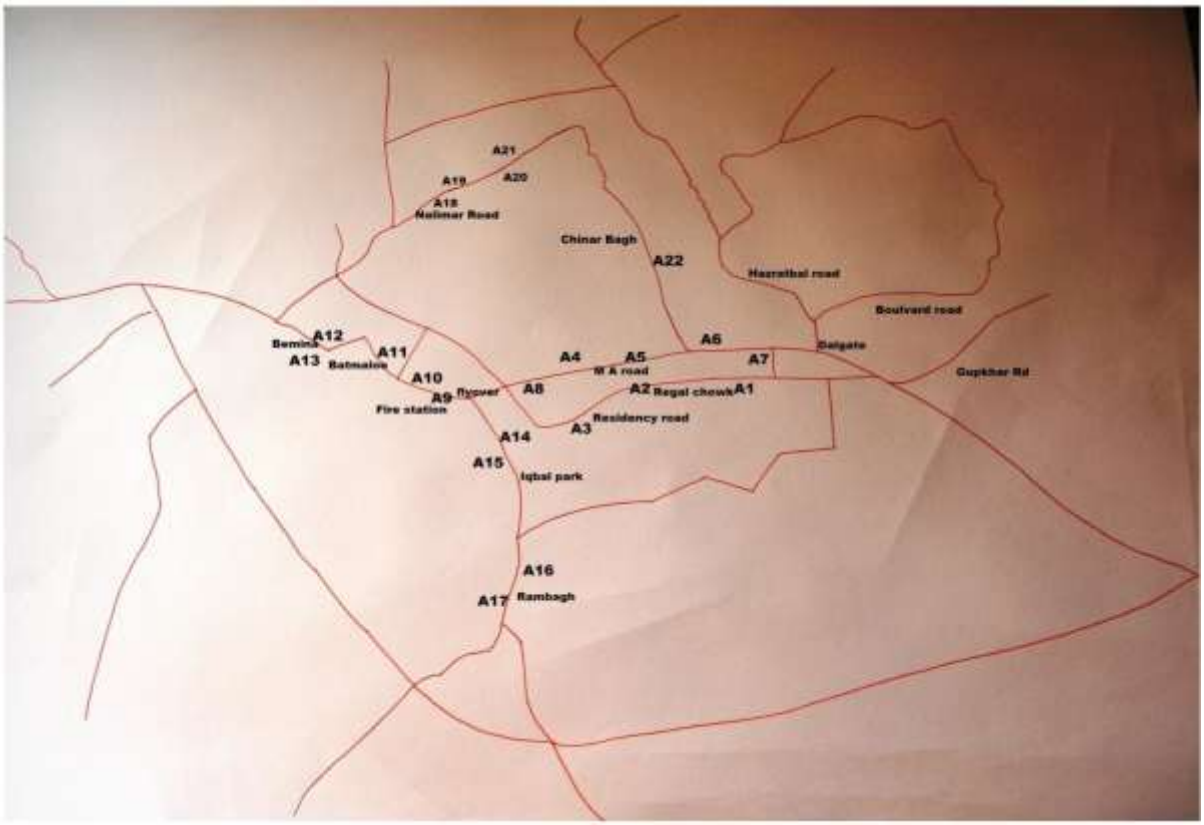


Fig.: Definition of traffic congestion



MAP OF SRINAGAR CITY

Fig.: Map of Srinagar city with arteries and sub arteries from A1 to A22

CONCLUSIONS AND RECOMMENDATIONS

Traffic in Srinagar is reaching stupendous proportions with non-controllable migration from peripheral areas which aggravates the congestion scenario on the roads. On any day, on any road, one can always witness transport expanding its hydra deaded tentacles. The mess is only becoming unmanageable and there seems no plan from government to tackle the mess. Roads have not expanded commensurate with the volume of traffic. The road deficit, as a result, is gaping. If no drastic measures are taken, the situation can explode. The roadway congestion of 2.35 manifests the severity of traffic congestion in Srinagar city.

The government by its policy of stressing horizontal expansion has only improved the traffic bearing capacity of our roads. Roads are being expanded as per the national standards, two to four lanes are in existence, but as soon as the road passes through a major town the traffic from bye lanes congests the main highway. The local transport has to mix with the highway transport to cross the highway and the result is slowing of traffic movement. National standards which require segregation of traffic tubes can only be achieved by overhead bridges and flyovers and in our case, both are missing. Roads have been expanded horizontally only and no efforts are made for vertical expansion. Vertical expansion of roads in the form of flyovers, metros, subways etc has proved helpful across the globe for traffic mobility. Among the major towns of Kashmir Srinagar has to face lot of traffic-oriented problems not just because of being the capital of the state but because of host of other peculiarities. The city of Srinagar is situated on both banks of river Jhelum and as such the river has to be navigated, negotiated, crossed by all the inhabitants as well as the visitors frequently. Besides the city has to be circumnavigated along the famous Dal lake banks by those living on its banks as well as by those intending to visit the Mughal gardens and Hazratbal shrine. Both these factors restrict the choice for expansion of roads as the roads have to be led towards the bridges which are few in number, narrow in expanse and old fashioned. The bridges are a vestige of the Budshah era and for the last 600 years no further bridges are constructed which speaks of the irony of the state we live in. Unless the city gets crises crossed with about half a dozen more bridges the traffic mess will continue to haunt. The uptown is burgeoning with business activities and shopping complexes are mushrooming on either side of every road. The, hospitals, school's government departments and every important establishment want a space in and around the Dalgate Batmaloo axis. The space is becoming shorter and government is trying to fill the deficit by culling the chinar trees around the Residency Polo Ground and squeezing the city parks like Pratap Park etc by including its boundaries for road expansion. The shopping complexes are not standardized as no guidelines for parking area are followed. The greed of businessmen who construct such complexes and the authorities who sleep over the issue only makes the roads congested with the vehicles of intending customers. There are only few parking spaces and people have no option but to leave their vehicles outside on roads with every risk of traffic cop towing the vehicles. Recently the government has taken away the parking space at Clock tower. The space was used by all the shopkeepers in the vicinity for parking of their vehicles. The government seems insensitive towards the parking spaces as if the vehicles are to be carried on our backs after you switch the engine off.

The parking spaces in place seem to be politically motivated. Parking space constructed near museum side adjacent to Foot Bridge is being used by Mallinson and Biscoe school buses for parking and similarly horticulture department orchard land near Convent has been converted into parking space which is only used for parking of vehicles of parents of wards studying in the said school. Complete disregard is shown to the landscape while constructing parking places. Millions of rupees were lost in landscaping the Jhelum banks and the hard-bought beauty is allowed to be pock marked by vehicles being parked on its banks. The parking of vehicles on Dalgate Batmaloo axis is galore except near high court and secretariat for obvious reasons. Vehicles are parked on either side of the road which gets narrowed and makes traffic to slow down. The road which otherwise is 40 feet is narrowed down to 20 or 15 feet, first by outside display by shopkeepers, then by the static or mobile vendors, then by the parked vehicles with pedestrians walking in a zig zag motion between whatever space is left for them. The road management at this axis has to be done keeping this aspect in mind and the traffic has to hope to get not more than this space in the present context.

In order to remedy this axis of traffic mess the government has to think big. Think big in the form of thinning the government offices along this axis, the government establishments like the old secretariat. The Food and Supplies department, the Deputy Commissioner and Divisional Commissioner office, the Zonal Police Headquarters, the CID office etc have to be relocated and the space thus acquired need to be earmarked for parking and business establishments. The relocation of government establishment towards the Bemina and Sharifabad can help establish new city on the pattern of New and old Delhi, Hyderabad and Secunderabad, Gandhinagar and Ahmedabad. New cities have come up only when the offices and important public establishments have been shifted and we have the same opportunity in hand, as some of the offices like SDA office, BOSE, etc has already being relocated to Bemina. The land around the area is still available and if government does not rise to the occasions we will lose the same to shanty towns, and unorganized house building.

The Jhelum bank has been developed and beautified and the so-called bund constructed to hold the river during floods holds opportunity for laying narrow gauge rail track on which a city railway connecting Panthachowk to Sangam Eidgah can be laid. This can address the traffic mess and change the habits of people for roadside parking as commuter can take short distances on the said track in a speedy and cheap manner. This track can change the character of the city and will make commuting easier and fast. Delhi metros can be a guideline for constructing this track without having to deteriorate the landscape. A cheaper possibility can be the use of electricity driven trams in shorter circuits like Budshah bridge to Zerobridge, Budshah bridge to Habba Kadal, Zero Bridge to Shivpora and if the project succeeds the same can be extended to other routes. The intra Kashmir railways from Islamabad to Baramulla has been a great success. All said and done, the traffic management is a multifaceted problem and needs multipronged strategy with contribution from the multiple stake holders and it needs consistent and concerted efforts to tide over the problem. The suggestions' stated are just an effort to ruffle some feathers and prick the conscience of those involved.

The following are the recommendations:

1. The most vital task to improve traffic condition is to widen the roads because links are exceeding the capacity.
2. The parking facilities should be made possible through roof or basement parking.
3. Sufficient footpaths and footways should be constructed to facilitate free movement of pedestrians on major roads
4. Floating shops, mobile hawkers, artisans, and temporary traders should be removed from roads and roadsides.
5. Required number of speed breakers, zebra crossing, traffic signals, light posts with street light are to be constructed.
6. Parking for rickshaws, buses, trucks should be restricted on the road pavement by way of heavy fines.
7. Congestion charges should be introduced

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