Indian Road Traffic Congestion Problems, its reasons with focus on Road width

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Abstract

Traffic Congestion problem has universal impact whereas many developed countries are working on the solutions which are workable. Whereas in case of developing countries as the requirements are of heterogeneous in nature the solutions are also found to be unique. The limitations in terms of infrastructural developments and improper utilization of road infrastructure also pose a problem of traffic congestion. Proper traffic management noticeably avoids unnecessary traffic, and reduced travel times contributing towards better social and economic impacts. This paper presents a brief overview of traffic congestion related factors like infrastructure, capacity utilization, etc. The development of the society categorically impacted due to inefficient movement of commodities, manpower impacting on increase in the wastage of fuel, time, and productivity of the manpower. Policy decisions from the government lead to resolution of the traffic congestion problems.

Introduction

The substantial movement of the people, goods is taking place through road transportation within the city and across the cities. Road transportation is significantly used for the short distance travels due to its convenience and flexibility. In the Indian context this mode of transportation is used by majority of the population. The road infrastructure developed over a period of time needs to be reviewed and modified as per present requirements as density of the population is shifting from rural to urban premises at rapid pace. The Road transportation is widely used to reach remote localities across the length and breadth of the India. The road transportation is used for the movement of goods as well as commutation purpose. The utilization of roads for intercity transportation is comparatively more than rail, metro, monorail etc. The road network efficiency in terms of traffic congestion, traffic density, road infrastructure contributing factors for analysis of it. The width of the road is designed based upon or proportion with density of the population and number of private vehicle users.

Background of study:

India is urbanizing. Its urban populace is developing at an normal rate of around 3% per year. The normal rate of development of the urban populace isn't anticipated to alter altogether in next 10 years or so.

Be that as it may, the number of metropolitan cities – those with a million also populace – has expanded strongly over this period. From 35 in 2001, the number of metropolitan cities rose to 50 agreeing to the Census of India, 2011. Out of these 50, eight cities – Mumbai, Delhi, Kolkata, Chennai, Hyderabad, Bangalore, Ahmedabad, and Pune – have populace more than 5 million. India's huge cities presently account for a bigger share of adds up to urban populace – a slant that has been watched since autonomy. In 2011, the share of metropolitan cities was 42.3%, up from 37.8% in 2001 and 27.7% in 1991.(Singh, 2012)In the majority of nations, the road system plays a crucial role in infrastructure.For instance, the majority of passenger and freight transportation in the UK more than 90% and 65%, respectively takes place on roads. Given the significance of road transportation for the movement of people and goods, the evaluation of the impact of road investments is also important for economic policy as a whole. Understanding the relationship between transportation improvements and economic outcomes is essential for the design of transportation policy. (Ministry of Road Transport & Highways, 2017-2018)Given its level of penetration in populous regions, road transportation is the most economical means of transportation in India for both freight and passengers.

Therefore, it is essential for the nation's economic growth and social integration.When compared to the total contribution of the transport sector in India, which was 4.77 percentage points for the fiscal year 2017–18, road transport emerged as the dominant segment, contributing about 3.06 percent to **Gross value added** (GVA), compared to 0.75 percent for rail, 0.15 percent for air, and 0.06 percent for water transportation.The road travel time for roads is affected by delays related with road geometry, traffic control devices (eg. Roundabouts, traffic signals, etc) and relations with other vehicles.

(Jepson, 1999)

Traffic congestion:

Traffic congestion is defined as the mutual obstruction between vehicles due to the existing correlation between vehicle travel speed and flow volume in conditions of exhausting infrastructure capacity. In other words, congestion refers to the extent to which vehicles exceed the capacity of a given roadway leading to a reduction in vehicle speed or a complete ban on free movement of vehicles. (Weisbrod & Treyz, 2003), (Goodwin, 2004). Congestion is the result of an imbalance between the demand for travel and the supply of the transport system. Bridge is the result of the concentration of motion in space and time.

Supply is constrained by the historical form of the infrastructure, investment levels, and transportation management and operations practices (Falcocchio & Levinson, 2015).

Major reasons for traffic congestion:
The colossal activity issues of Indian Metropolitan cities can be credited to the following (T. Krishna Prasad, 2018):

a) The rise in pay levels of urban families in common and metropolitan cities in particular has raised the standard of living. Financial success has made huge demand for customer items as well as expanding the capacity of individuals to go in for luxuries like individual vehicles etc. This has come about in an colossal development in number of vehicles acquired.

b) The expanded concentrated of activity, combined with the acquired spiral design of roads, has brought about in intense activity clog in and around the Central Trade Areas in the cities. Individuals moving from one portion of the city to another portion got to travel through the Central Trade Locale (CBD) driving to gigantic blockage within the CBD area.

c) The restricted street space available is encourage decreased due to on-street stopping. Off-street parking offices, multi-level car stopping or stopping parcels are deficiently within the city. This has come about in congestions in commercial regions of Indian cities.

d) Wild indiscipline among street clients is to a great extent credited to disappointment due to traffic congestion. Most of the street clients are not mindful of the activity rules and regulations.

Recurrent congestion is a complex phenomenon, influenced by socio-economic, technical and human factors. The importance of each factor varies from city to city and over time. The degree of congestion in a city depends on a range of supply and demand factors. On the supply side, the key factor is the size and capacity of the road network. Insufficient road network capacity can be attributed to lack of investment in transport infrastructure or lack of expansion opportunities. Other supply-side factors include the level of investment in developing public transport as an alternative means of transport. On the demand side, the main drivers are the number of trips taken by the population, the proportion of the workforce traveling by car, and population density. (OECD, 2007)

(Chandra & Kumar, 2003) studied the effect of lane width about the ability to use data from ten two-lane road sections in India. They found that the capacity (C) in passenger car unit per hour (PCU/h) of the two channels the line increases with the total width (W) of the road and the relationship between both according to the second level curve,
such as

$$C = -2184 - 226W2 + 8574W.$$

Possible relationship provides an estimate of the capacity of a two-lane road with width of roadbed from 5.5 to 8.8 m. Currently. It uses area, as opposed to the length and speed of a vehicle. The data was collected from ten two-way road sections in different parts of India. Sidewalk width ~ this term is commonly used in India to refer to the total runway surface width of a road excluding its shoulders ranges from 5.5 to 8.8 m. This is attributed to more freedom of movement on wider roads and thus a larger speed difference between the car and the type of vehicle. The traffic capacity of a two-lane road also increases with the total width of the road and the relationship between the two lanes according to the quadratic curve.

Do not provide narrow lanes appropriate margin of error for the vehicle and thus the vehicle speed falls of private vehicles. Effect of larger lane width in mixed traffic conditions when vehicles do not obey each other and tend to move side by side.

Estimating road capacity is essential in the planning, design and operation of road facilities. Traffic and geometry data obtained from twelve rural two-lane road sites in Governor Minoufiya, Egypt, was used. Each position consists of a tangent element and the following horizontal curve. Transport Flow and velocity are collected at each element in the study sites. A method of capacity estimation based on extrapolation from a basic diagram showing the relationship between traffic volume and traffic density was used. The best regression models for each case (i.e. probability at the tangent, capacitance at the curves and capacitance loss between two elements) were introduced. (Ministry of Urban Development, 2006)

Combating with traffic congestion through Capacity building

Responsibility for planning and implementing urban transport system rest of state governments and municipal agencies. However, with the problems relating to urban transport of relatively recent origin in India, has emerged It was not until the early 1990s that the ability to fully understand and deal with these problems was Still fully grown. This requires concerted efforts to build state capacity and at the city level to solve these problems and fulfill the mission of development urban transport system. (Ministry of Urban Development, 2006)

It is recognized that there are several proven technologies for public transport around world has not been adopted in India. To acquire the necessary competencies to application of these technologies in the country, the central government will facilitate joint ventures and cooperation agreements between providers of this technology and appropriate Indian companies. Necessary, needs Incentives will be provided to allow these technologies to get marketing in India. It may be through appropriate financing prototype, develop designs for Indian conditions, test operations, technical staff training, etc. The ultimate goal will be to build Level playing field for all technologies. (Ministry of Urban Development, 2006)

(Loder, Ambühl, Menendez, & Axhausen, 2019) Traffic in the urban network becomes congested as soon as there is a large number of vehicles in the city network. To improve traffic operations, develop new congestion mitigation strategies and reduce negative traffic externalities, understand the basic laws governing the significant amount of media and network traffic capacity is required.

However, so far an overall understanding of this critical point and the empirical quantification of its determinants is lacking. Congestion is difficult to resolve because of repetitive human travel patterns (González, Hidalgo, & Barabási, 2008) (Sun, Axhausen, Lee, & Huang, 2013) and additional capacity is quickly consumed caused by demand and population growth. Physically, traffic is a multi-particle system4 where congestion is defined as the state where an increase in the number of vehicles reduces the output of trips. On the other hand, in free-flow states, an increase in the number of vehicles increases the output of trips. The point of the system then is lies at the border between the free-flowing and congested states of the network.

At this time, the maximum in achieve the output of trips, the traffic capacity of the urban network. Thus, the tipping point marks both, border between mobility and congestion, and the frontier of tourism production possibility. Urban road transport systems can be analyzed at the link and network level. Good level of association procedures are understood and the design is standardized (Board., 2016); but not understanding the whole network can be compared. Differences in the tipping points of the urban network have been observed since 1960 (Ardekani, Williams, & Bhat, 1992) (Smeed, 1968)

Traffic congestion is a source of major problems worldwide. The existing infrastructure is not capable of meeting the new traffic demand. In addition, limited space and outdoor activities affect traffic congestion. Emerging countries like India, where traffic conditions include heterogeneous traffic without lane discipline, create even more complex scenarios for researchers. A significant portion of working time is wasted on the roads due to traffic congestion, which adversely affects the overall economy. There have been many publications and studies to analyze traffic congestion and its impacts. However, the results were not very positive. In this study, congestion prediction aims to determine the inherent viability of diverse traffic situations in the case of mixed traffic without lane discipline and to provide better recommendations for control. and avoid such prolonged congestion. The urban road network is considered a study area. Mandatory details were collected using the license plate matching method using a video graphic survey for peak daytime hours considered between 8am and 10am and off-peak hours to estimate travel time. Movement of a particular type of motor vehicle selected urban road sections. (Samal, Kumar, Santhosh, & Santhakumar, 2020) In 2014, traffic jam cost the United States (US) a total of $160 billion from 6.9 billion hours of travel and 3.1 billion gallons of additional fuel purchases (Schrank, Eisele, Lomax, & Bak, 2015). This happens because the existing roads unable to accommodate the growing number of cars. Following the INRIX . route Analysis in 2017, over the next 10 years, the 25 most congested cities in the US are estimated costs drivers $480 billion in lost time, wasted fuel and carbon emissions in traffic jams (Pishue, 2017)

Root Cause of Congestion (Falcocchio & Levinson, 2015)
Congestion in urban or central areas can occur for various reasons, such as excess requests, signals, incidents, and work areas, weather-related or special events. Follow many
The root causes of road traffic congestion can generally be classified into two categories:
(1) Recurrent congestion and
(2) Non-recurrent congestion

Congestion Recurrence
In most metropolitan cities, travelers face daily traffic jams during daily rush hour. According to the FHWA 2019, about half of traffic jams encountered by road users are recurrent (FHWA, 2019).
Common reasons for recurrent congestion are:
Congestion often occurs during rush hour, when the number of lanes converging on roads, bridges, or tunnels that exceed the number of lanes reserved for these structures (Suresh & Whitt, 1990) (Cassidy & Bertini, 1999) (Laval & Daganzo, 2006). It can also happen when demand exceeds the capacity of a route. Capacity of any route indicates the maximum number of traffics that can be processed. Power can be determined by number and width of lanes, length of consolidation at intersections and alignment of roads.

• Bottleneck and capacity: As shown, congestion is the most common cause of congestion.
The bottlenecks typically occur during rush hours when the number of lanes decreases.
Joining roads, bridges and tunnels will exceed the number of lanes in these facilities (Suresh & Whitt, 1990) (Cassidy & Bertini, 1999) (Laval & Daganzo, 2006). Demand can also exceed the capacity of the road. Each capacity the street shows the maximum amount of traffic that can be processed.

•Insufficient infrastructure: Insufficient infrastructure is one of the maximum sizeable motives for congestion, specifically in fairly populated areas. Because of the better populace rate, the quantity of automobiles additionally will increase with it. When the present quantity of infrastructures fails to occupy this growing quantity of cars, congestion occurs (Wang, Zhu, Li, & Wu, 2013).

Nonrecurring Congestions
Nonrecurring congestions typically befell because of unpredictable activities, consisting of visitors incidents, paintings zones, climate, or different specific circumstances (Falcocchio & Levinson, 2015). Nonrecurring congestion can provoke new congestion with inside the off-height periods, in addition to can boom the postpone because of ordinary congestion.
Some not unusual place examples of nonrecurring congestion are:

•Traffic incidents/accidents: The maximum not unusual place shape of incidents is vehicular crashes, breakdowns, and particles in tour lanes. These activities disrupt the everyday float of visitors, usually via way of means of blockading the tour lanes, which in addition consequences in ability discount (Robinson, Collins, Jordan, Foytik, & Khattak, 2018) (Haselkorn, Yancey, & Savelli, 2018).

•Work zones: Work zones consult with the development sports at the roadway via way of means of making physical adjustments to the dual carriageway environment. These adjustments result in a discount with inside the quantity or width of tour lanes, lane `shifts`, lane diversions, discount or removal of shoulders, and brief roadway closures.

•Weather: Changes in environmental situations or climate can have an effect on visitors float and driver behavior. These may additionally adjust the visitors manage systems, consisting of indicators and railway. Bottlenecks in a dual carriageway (Highway Bottleneck Blues: 3PL Cleveland Trucking Solutions to Cut Costs—On Time Delivery &Warehouse. , 2019).

Suggestions to mitigate the traffic congestion problems in the cities are as follows:

Integration of Land use and transport planning:
Transport planning is intrinsically linked to land use planning and both need to be developed together in a manner that serves the entire population and yet minimizes travel needs. In short, an integrated master plan needs to internalize the features of sustainable transport systems. In developing such plans, attention should be paid to channel the future growth of a city around a pre-planned transport network rather than develop a transport system after uncontrolled sprawl has taken place. In city municipal Corporations and Urban Development Authorities sustainable representations should be given to transport planners as well as representatives from transport department and traffic police. All new layouts formed in the outskirts should have a minimum of 20% area earmarked for transportation and traffic purposes.

Parking Management:
Land is valuable in all urban areas. Parking places occupy large portions of such land. This fact should be recognized in determining the principles for allocation of parking space.

Integrated Public Transport systems and last mile connectivity:
All cities have corridors that have varying densities of travel and hence need technologies that best match the level of demand on the corridor. This often requires different operators managing such systems.

Unified Traffic Management Authority:
Traffic management being under different agencies in a city makes it difficult for co-ordination and implementation of the project. Who will prepare transportation plans – Development Authority as a part of overall perspective, Urban Development Policy.

Effective Utilisation of Alternate Roads:
Generally in larger cities, many roads and streets remained underutilized.
Whereas majority of the roads have traffic congestion and jams. There is a need to ensure optimal utilization of the entire road network by utilizing all the under-utilized roads and streets.

Pedestrian Facilities:
Pedestrians form a major proportion of commuters (about 25% to 30%). Though they are short distance travelers, they are spread all over the city. As facilities furnished for them are encroached upon by vendors or for road space, they have to spill on roads.

Intelligent Transport System (ITS):
Intelligent Transport Systems is a collective name for a number of technology based approaches that are designed to improve the quality, safety and efficiency of transport networks. The systems often combine communication, processing and data storage

modules to provide integrated travel information and traffic management systems from one or more organizations. The systems collect information about the current state of transport network, process that information, and either directly manage the network or allow the people to decide how best to use the network.

Greater emphasis on educating road-users:
Road users must be explained about the traffic rules and regulations through different media like press, posters, pamphlets, slides in theatres, banners etc. If possible, the road users should be educated about the traffic rules and regulations by conducting awareness camps in which safety of road users should be taught. Habitual and repeated offenders should be made to undergo training sessions in the traffic training institutes established by the Traffic Police.
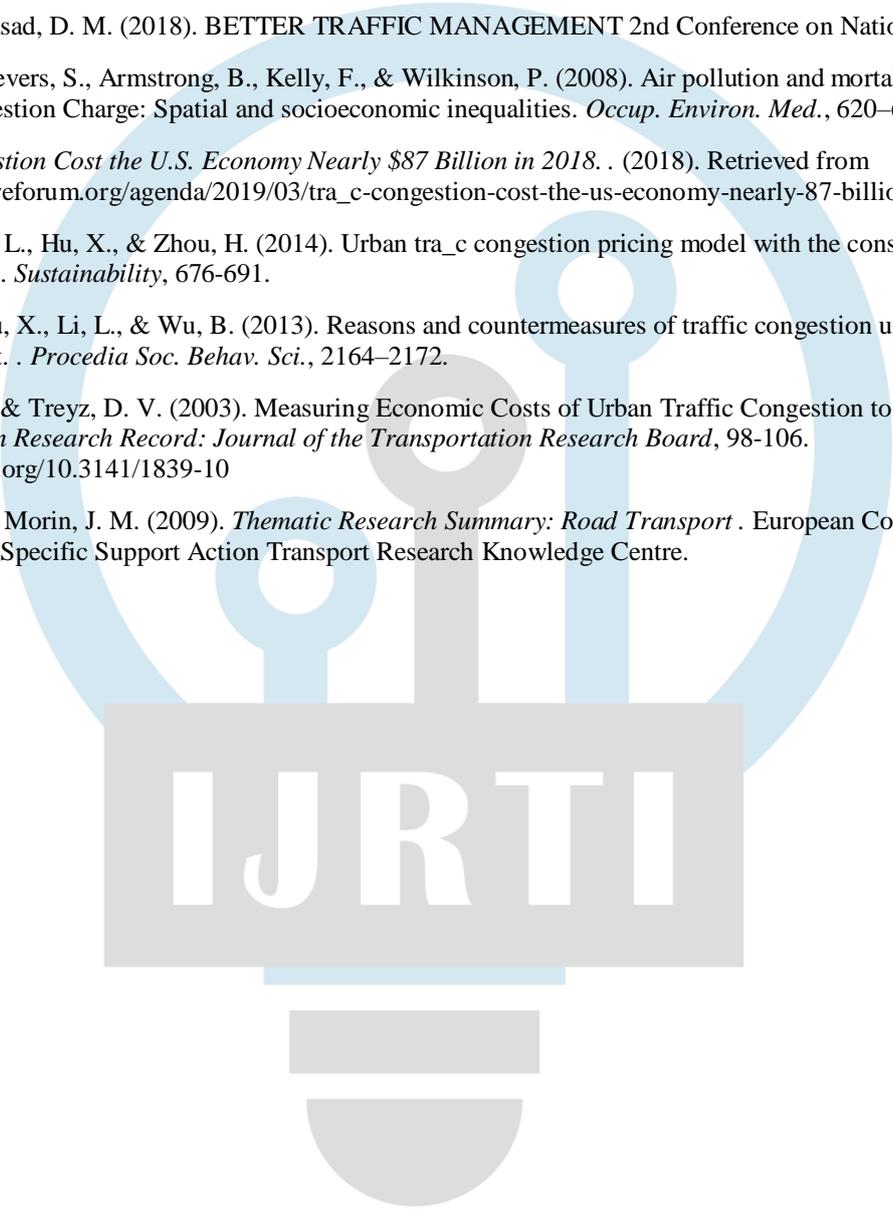
Conclusion

This research paper concludes that the road traffic management is a vital activity for the smooth movement of goods or peoples. The studies carried out by various researchers are also illustrated the same. There are lot of factors contributing towards the traffic congestion at city levels as the density of the population and number of vehicles are also are increasing day by day. The researchers had attempted to identify the insufficient infrastructure adds traffic congestion at various stages. Even the road infrastructure is sufficient at many places but due to improper utilization of it contributing toward the reasons of congestion. The road geometry i.e. uneven width of the roads particularly at the junctions, trade areas, etc. is making the traffic situation worse.

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