Analysis of Road Congestion Condition: A Review

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Abstract- *In Madhya Pradesh. Bhopal, as the capital city, must sustain its growth momentum, and this event is classified as household characteristics, which are one of the factors influencing trip generation and attraction, as well as assigning traffic signals, channelization, and intersections to each zone in Bhopal. The purpose of this research is to identify the factors that contribute to traffic congestion in Bhopal, as well as potential solutions to these issues.*

In this study, we investigate solutions to road traffic congestion caused by rotary intersections. Rotary intersections, or roundabouts, have been proposed as a solution to traffic congestion.

Keywords *-* Traffic System, Road Blocking, Rotary Intersection or Roundabout, Congestion and Major Performers, Rotary Intersections or Roundabout.

In this paper we are conducting an audit of writing regarding "Road congestion"

I. INTRODUCTION

Nowadays, road congestion is a major concern. Traffic signals are devices that automatically direct traffic to stop and proceed at intersections using red and green traffic lights. These work by allocating right of way to a specific set of movements in a cyclical sequence. The first area investigated is Jyoti Talkies Square. It is one of Bhopal's busiest intersections because it is located in an important commercial area (MP Nagar). It manages traffic from a Board Office Square, BHEL, and MP Nagar Zones I and II. Because of the high traffic flow at the intersection, simply increasing the signal's total cycle time is not an option.

II. LITERATURE REVIEW

Satya Ranjan Samal et.al (2022) author examined the congestion in the urban roads of Bhubaneswar, a smart city in India. Travel time for various categories of vehicles was estimated and congestion indices in terms of buffer index were evaluated. Multiple linear regression modeling has been used to evaluate the congestion parameters.

The p-value for all the independent variables in the developed model was < 0.05. Four elements, namely Strict traffic law implementation, Adequate parking facilities, Decentralization and Controlling the road side activities were required to improve the serviceability and mobility of urban road networks.

Muneera C P and Krishnamurthy K (2020) author estimated the traffic congestion cost at signalized intersection located in Thiruvananthapuram, an Indian city which prevails heterogeneous traffic condition. Research was taken into account both engineering and economic aspects while dealing with signalized intersection, and estimated passengers delay cost separately for each approach in the signalized intersection. Seven four legged signalizedintersection was considered and delay cost is estimated by considering its components such as delay, occupancy, traffic volume and value of travel time for different vehicle types. From the developed model, value of travel time for car, bus, auto and two wheeler are estimated as 240 Rs/hr, 60 Rs/hr, 150 Rs/hr and 180 Rs/hr respectively and further used for delay cost estimation. Annual congestion delay cost for each vehicle type is estimated and aggregated for each approach and the delay cost is expressed in terms of Crore Rupees.

Conclusion stated that congestion cost reduced as 38 % from original after mode shift process. Therefore, mode shift from personalized vehicle to public vehicle reduces the congestion in the roadway and this study proposes as a policy measure to encourage the usage of public transport by reducing the usage of two wheeler in Indian Cities.

Nidhi Singh and Dr. S. K. Katiyar (2020) author conducted analysis out for the Bhopal city road network traffic congestion locations by taking input from the real time information of congestion using open source Google Maps. GIS based analysis can be used as an effective tool for the Road Transportation and Management system for the vehicle routing and traffic congestion related studies. The road traffic conditions/volume in real time can be indirectly interpreted to some extent using the open source Google Map data. GIS based network analysis can help in the identification of shortest route between two places, which are helpful in the

route analysis and alternative route generation in minimum time after considering the road traffic conditions also.

S R Samal et.al (2020) in the research paper, congestion forecast was aimed under mixed traffic with no lane discipline towards identifying the inherent viability of the diversified traffic situation and presents better recommendations in controlling and evading these prolonged traffic jams. The urban highway systems were considered as a study area. Required particulars were collected by a License Plate Matching method using video graphic survey for the day rush timing considered from 8:00 AM to 10:00 AM and off peak hours to estimate the travel time of a distinct class of motorized vehicles for selected sections of the urban roadway.

The impact of traffic congestion adversely affects the economy, health, environment and traffic safety, which is the major concern for the researcher to come up with the comprehensive and new dimensions to tackle these challenges. Lane discipline, though a major factor no work is described to measure the congestion indices with account of Lane discipline in mixed traffic environment. Although the number of non-motorized vehicle are not so high, but it plays a significant part in city network and its impact on traffic jam eventually may not be ignored.

Rakesh Kumar Chhalotre and Dr. Y. P. Josh (2016) author aimed to solve the problem of traffic congestion and unusual delay to the traffic movement at Prabhat Square Raisen Road Bhopal by suggesting the design of fixed time signal in place of the rotary intersection.

Results stated that the traffic approaching at the intersection is very high exceeding 3000PCU/hour and we know that a rotary can handle a maximum traffic volume of 3000 PCU/hour. The existing rotary was not able to handle this much amount of traffic. And if can divide the traffic by introducing traffic signal with the rotary, this will divide the traffic to approximately half of the traffic which is currently approaching to the intersection.

Ruchira Ghosh et al (2014), this paper discusses urbanization challenges in India and initiatives to address them. Urbanization in India is characterized by skewed urban growth between cities due to large population influxes, resulting in distinct variations in urban form and services between the core and periphery. Key challenges include slum expansion, inadequate solid waste management, decreased per capita water availability and unreliable water quality, insufficient sewage coverage, and deteriorating ambient air. Although these issues are not unique to India, the drivers and pressures behind them are.

According to the findings, the study highlights the challenges of Indian urbanization in terms of resource inefficiency, resistance to adopting emerging technologies that do not provide direct financial benefits, lax enforcement of laws, and inadequacy in regulatory frameworks. It also shows examples of non-formal and formal sectors actively addressing sustainability challenges. There is also recognition that city governments are dealing with multiple sustainability agendas for climate adaptation. This creates a decision-making challenge for planners and city administrations. Benefits incidental to a specific policy goal can help drive its implementation and long-term viability, but only if the inherent risk trade-offs, if any, can be managed.

Sun Ye (2012),the paper begins by delving into several key issues, including the goal, pricing, scope, method, and redistribution of congestion charging from a theoretical perspective. Then it discusses congestion charging practices in Singapore and London, and it concludes and suggests that traffic congestion charging should be based on scientific planning, public support, and public transportation development.

According to the findings of London's investigation, if the congestion charge is used solely to manage transportation demand, public support drops to 43%; however, if the congestion charge is returned to the municipal transportation system to improve road infrastructure or develop urban public transportation, public support rises to 63%. It indicates that establishing a reasonable congestion charge fund is an important action that receives public support. The public transportation network must be capable of meeting people's needs for accessibility, convenience, and comfort. Also, public transportation should be given some management priority, such as free congestion charging, the establishment of public transportation exclusive lanes, the transfer of a portion of the charge fund to public transportation investments, and so on, in order to encourage more people to use public transportation instead of driving and thus reduce traffic congestion.

Manoj Kumar et al (2021),this article summarizes the findings of studies on road traffic congestion. Different traffic congestion measurement metrics have been discussed. These matrices are divided into three categories: travel time-based, speed-based, and service level-based. Additionally, congestion data collection techniques used in various studies have been discussed. Traffic congestion is one of the most visible, pervasive, and immediate transportation issues confronting not only India, but most cities around the world on a daily basis. It affects all modes of transportation, particularly roads, and all socioeconomic groups. Congestion is primarily caused by

rapid population growth, increasing urbanization, inadequate/unplanned transportation infrastructure, poor public transportation systems, and an increase in the number of personnel vehicles.

The study's findings show that improved traffic management and control, better public transportation services, increased funding for transportation infrastructure, the use of modern technology, and overall coordination of transport and land-use policies are all important parameters for reducing congestion.

Dr. Nilesh R. Mate (2022),this paper provides a brief overview of factors related to traffic congestion, such as infrastructure and capacity utilization. The development of society has been significantly impacted by inefficient movement of commodities and manpower, resulting in increased waste of fuel, time, and manpower productivity. Government policy decisions lead to the resolution of traffic congestion problems. Traffic congestion is also caused by limited infrastructural development and improper use of road infrastructure. Proper traffic management significantly reduces unnecessary traffic and travel times, which contributes to positive social and economic outcomes.

This research paper concludes that road traffic management is an important activity for the efficient movement of goods and people. The studies conducted by various researchers demonstrate the same thing. Many factors contribute to traffic congestion at the city level, including increasing population density and vehicle numbers. The researchers attempted to identify how insufficient infrastructure contributes to traffic congestion at different stages. Even though the road infrastructure is sufficient in many places, its improper use contributes to the causes of congestion. The uneven width of the roads, particularly at junctions and trade areas, is exacerbating the traffic problem.

Yangyang Qi et al (2023),this study proposes a deep spatial and temporal network model (DSGCN) to predict traffic congestion status. First, the authors divide the traffic network into grids, with each grid representing a separate independent region. In this paper, the grid regions' centroids are abstracted as nodes, and the dynamic correlations between them are expressed as an adjacency matrix. The spatial correlation between regions is then captured using a graph convolutional neural network, while the temporal correlation is captured using a two-layer long and short-term feature model (DSTM). Finally, experiments on real PeMS datasets show that the DSGCN outperforms other baseline models and predicts traffic congestion more accurately.

The experimental evaluation results show that our model improves the spatial correlation features of traffic data while ensuring adequate representation of temporal dependence. Meanwhile, our proposed DSGCN model outperforms the existing baseline for prediction. In the future, we will consider additional types of traffic data and use them to generate a wider range of traffic congestion forecasts. As a result, the prediction model's generalization improves, as does the algorithm's applicability.

Abhishek Singh Chauhan et al (2019),the current study examines the existing problems with automobiles in the city area of Madhavganj Chowk, focusing on the difficulties that vehicular traffic faces. The study also considers potential solutions for expanding road infrastructure. The goal of this study is to identify the factors that contribute to traffic congestion in Vidisha city, as well as to find solutions to these problems. The Madhavanj area is also heavily influenced by Indian railways because Vidisha railway station is too close to the market area, and the entire area is influenced by the travelers generated by the rack points located near the Vidisha railway station. A percentage of the answers represent corrupted police who take bribes from low breakers.

According to the findings, traffic-related organizations should devise effective strategies to reduce the number of private vehicles and find a way to raise public awareness of traffic rules. Additionally, traffic-related organizations should file complaints against top government officials who frequently violate traffic rules, as well as members of political parties. And the survey shows that auto and taxi drivers do not follow traffic laws because they are aware of them.

Ayush Verma et al (2020),in this study, the authors examined the Gol Chakkar Kirti Stambh Rotary Intersection in Greater Noida. Rotary intersections, also known as roundabouts, are a type of channelized intersection at the same grade that is designed for one-way traffic movement around a central traffic island. Essentially, all major conflicts at an intersection, such as the collision of through and right turn movements, are reduced to milder conflicts, such as merging and diverging. The rotary intersection of roads, also known as a traffic rotary, is simply an enlarged intersection of roads where vehicles cross or change direction without stopping. All vehicles coming from various roads travel in a single direction around the central island and diverge at the required exit. They weave out of the rotary, heading in the desired direction.

According to IRC 65, traffic rotaries can handle traffic volumes ranging from 500 to 3000 PCUs per hour. According to the current traffic conditions, the capacity of the

traffic rotary at Gol Chakkar Kirti Stambh Rotary Intersection is 3104 PCU per hour in the east-south direction, which is nearly satisfactory for an urban rotary intersection. However, because Greater Noida has a high rate of traffic growth due to its rapid development, we recommend installing a traffic signal at this rotary in the future to ensure efficient movement at the intersection. According to our research, the Gol chakkar kirti stambh Rotary intersection in Greater Noida is currently considered a satisfactory intersection.

Prashant Tiwari et al (2020),the study's main goal is to identify the specific cause of congestion and propose practical solutions to reduce congestion at Ramleela Square SH 19 Vidisha City. The study's goal is to provide a strategic vision, conceptual framework for the methodology, logical sense, and guidance on some practical ideas for reducing congestion in order to reduce its overall impact on individuals and civilization. The conservative and conventional approach of building new roads is a temporary relief, but it does not always work for a variety of reasons such as political, environmental, and monetary; additionally, it may promote the development of new vehicles and forced occupancy.

Rotaries are suitable when traffic entering from all four approaches is roughly equal. A total volume of approximately 3000 vehicles per hour can be considered the upper limit, while a volume of 500 vehicles per hour is the lower limit. A rotary is very beneficial when there is a high proportion of right-turn traffic, usually more than 30%. Rotaries are appropriate when there are more than four approaches or there are no separate lanes for right-turn traffic. Rotaries are ideal for complex intersection geometries.

Panita Pongpaibool et al (2007),this paper presents a road traffic evaluation system based on image processing data that employs manually tuned fuzzy logic and adaptive neuro-fuzzy techniques. The system is intended to emulate human expertise in specifying three levels of traffic congestion within the Bangkok Metropolitan Area. The traffic data is generated by vehicle detection and tracking software, which uses a road-traffic video signal to calculate vehicle volume and velocity. The results validate the accuracy of our system by comparing its outputs to the opinions of volunteers who watched the same traffic video. Furthermore, the results show that manually tuned fuzzy logic achieves 88.79% accuracy, whereas the adaptive neuro-fuzzy technique achieves only 75.43%. The results show that using both parameters as inputs produces higher accuracy than using only velocity information. Furthermore, because our test road is a multi-lane street, we examine the effects of using single-lane traffic information rather than two-lane information. The results indicate no difference between the two cases. This is most likely due to the fact that each lane of the test road has relatively similar traffic flow characteristics. However, the results may differ depending on the road. We also observe how the evaluation interval affects the system's accuracy. The results are inconclusive on whether a longer interval improves accuracy. We believe that this effect is dependent on the nature of traffic flow on specific road segments and at specific times.

Peter R. Stopher (2004),this paper examines the reality of these policy directions and questions whether they are desirable, let alone achievable end states. The paper begins by discussing congestion and whether or not it is inherently bad. The negative and positive aspects of congestion are discussed. The concepts of accessibility and mobility are discussed, particularly in relation to congestion and capacity increases, with the goal of better understanding the impact of capacity increases or increased congestion on these two measures. Congestion levels must be expected to rise in the future, owing to increased population, real wealth, and shifting preferences. This section of the paper concludes that the market can mitigate some of the negative effects of congestion.

It is discovered that the effects of such an achievement would be relatively minor in terms of overall road system congestion, and that these effects would also be likely to be relatively short in duration. At the same time, the investments required in the public transportation system are enormous, and it is unlikely that such an increase in ridership can be achieved within current development patterns. The paper also discusses the possibility of congestion pricing or road user charges affecting congestion. It is concluded that charging motorists a politically acceptable amount will most likely have no significant impact on overall system congestion, whereas the potential for serious economic consequences increases if the charges are sufficiently high or the area covered is sufficiently large.

Vipin Jain et al (2012),in this paper, we first present a simple automated image processing mechanism for detecting congestion levels in road traffic using CCTV camera image feeds. Our algorithm is specifically designed to handle noisy traffic feeds with poor image quality. Based on live CCTV camera feeds from multiple traffic signals in Kenya and Brazil, we demonstrate that this congestion collapse behavior persists over long time periods in multiple locations. To address this issue, the authors propose a local de-congestion protocol that coordinates traffic signal behavior within a small area and can prevent congestion collapse while sustaining time-variant traffic bursts. Based on simulation-based analysis of simple network topologies.The authors demonstrated that our local de-congestion protocol can increase road capacity while preventing congestion collapse in localized settings.

The authors investigated the issue of road traffic congestion in high congestion hotspots in developing countries. The authors first describe a simple image processing algorithm for estimating traffic density at a hotspot using CCTV camera feeds. Based on an analysis of traffic images from live traffic feeds, the authors demonstrate evidence of congestion collapse that lasts for extended periods. According to the free-flow traffic curve behavior of links, critical road segments that are subjected to short bursts of traffic can operate at low capacity levels for extended periods of time.

S R Samal, et al (2020), the current study's congestion forecast is aimed at mixed traffic with no lane discipline, with the goal of identifying the inherent viability of the diverse traffic situation and providing better recommendations for controlling and avoiding these prolonged traffic jams. Urban highway systems were considered as a research area. To estimate the travel time of a distinct class of motorized vehicles for selected sections of the urban roadway, a License Plate Matching method was used in conjunction with a video graphic survey for day rush timing from 8:00 AM to 10:00 AM, as well as off peak hours.

Congestion indices for both up and down traffic on a specific road were calculated using data from the video recording. The effects of traffic congestion were assessed, and potential mitigation strategies were proposed. The study focused on traffic jam indices and travel time reliability measures to assess the functional effectiveness of the urban road network.

Tanzina Afrin et al (2020), the authors of this study investigated traffic congestion. Traffic congestion is an ongoing issue for the sustainability of transportation development. Traffic congestion causes delays, inconvenience, and financial losses for drivers, as well as air pollution. Identifying and quantifying traffic congestion is critical for decision-makers to implement mitigation strategies that improve the overall sustainability of the transportation system. This paper describes and compares the currently available measures using a daily and weekly traffic historical dataset.

The results revealed that each measure showed significant variations in congestion states while indicating a consistent congestion trend. The data analysis reveals each measure's advantages and disadvantages. This study summarizes current road traffic congestion measures and offers useful insights into the creation of a sustainable and resilient traffic management system.

Wan Noratikah Wahidah Binti Wan Ghazali et al (2019), this study seeks to determine the extent to which traffic congestion can influence the quality of community life through daily routines and lifestyle. The study used an on-site survey strategy as primary data, with a sample size of 382 respondents. Data were gathered using a valid and reliable questionnaire divided into four sections: demographic information, mobility (opinion on traffic jams), daily routines, and lifestyle. The collected data sets were statistically analyzed.

The analysis found that traffic congestion had a negative impact on the quality of life in the community. Traffic congestion has a significant positive correlation with quality of community life ($r=.589$, $p<.05$). Daily routines were primarily influenced by traffic congestion rather than the community lifestyle. This study also makes recommendations for traffic planning and policies that should be implemented in order to improve the transportation system and improve the quality of community life.

III. CONCLUSION

In this paper we have reviewed several authors who have investigated the concern of road congestion in different areas.

REFERENCES

[1] Satya Ranjan Samal, Malaya Mohanty and Moses Santhakumar Selvaraj, [assessment of traffic congestion under indian environment - a case study], communications 24 (4) d 174-d1 8 2, 27 september 2022.

[2] Muneera C P and Krishnamurthy K, [Economic Evaluation of Traffic Congestion at Intersection: Case study from an Indian City], Transportation Research Procedia 48 (2020) 1766–1777.

[3] S R Samal, P Gireesh Kumar, J Cyril Santhosh, and M Santhakumar, [Analysis of Traffic Congestion Impacts of Urban Road Network under Indian Condition], IOP Conf. Series: Materials Science and Engineering 1006 (2020) 012002.

[4] Rakesh Kumar Chhalotre and Dr. Y. P. Josh, [An Evaluation of Rotary Intersection: A Case Study of Prabhat Square Raisen Road Bhopal], International Journal of Engineering Development and Research, 2016 IJEDR | Volume 4, Issue 3 | ISSN: 2321-9939.

[5] Nidhi Singh and Dr. S. K. Katiyar, [GIS BASED TRAFFIC FLOW ANALYSIS IN THE ROAD NETWORK USING REAL TIME OPEN SOURCE DATA], International Research Journal of Engineering

and Technology (IRJET), Volume: 07 Issue: 06 | June 2020, ISSN: 2395-0072.

[6] Ruchira Ghosh and Arun Kansal (2014), "Urban Challenges in India and the Mission for a Sustainable Habitat" INTERdisciplina, Vol. 2 | num. 2 | January-April 2014.p.p.281-304.

[7] Sun Ye, [Research on Urban Road Traffic Congestion Charging Based on Sustainable Development], Elsevier B.V., 2012

[8] Manoj Kumar, Kranti Kumar, Pritikana Das, [Study on road traffic congestion: a review], research gate, 2021, DOI: 10.1201/9781003193838-43