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Investigation And Analysis of Traffic Flow Capacity And Level of Service Determination of Three Bridges Across Sabarmati River In Ahmedabad Metro City

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Abstract - *India is developing country in the world. There are many complex problems related to transportation system is observed in the country. These include ever increasing population, vehicular growth and traffic congestion. Gujarat is the one of the top five fastest developing state of our country. Ahmedabad city is developing city. The city is 1st biggest city in Gujarat. Out of the 11 bridges across the Sabarmati River in Ahmedabad city, some of the bridges which is connecting the commercial and residency area in the city are witnessing heavy amount of traffic during pick hours which leads to traffic jam and bottlenecks condition at some places. After reckoning survey the three bridges namely Swamivivekanand Bridge,Sardar Bridge, Subhash Bridge are selected for Traffic flow capacity and level of Service analysis. Therefore, it is necessary to quantify the Traffic characteristics in existing traffic conditions on selected bridges and understand the responsible factors for suggesting improvement in existing Traffic congestion over selected bridges. In this study, I will find to traffic flow capacity and Level of Service by measuring traffic speed, flow and density parameters on the selected bridges during peak hours. This may be helpful to check whether existing bridges are capable to handle existing as well as future increased traffic flow safety or not.*

Keywords: **Bridge,Traffic,Population.**

1. INTRODUCTION

In developing country like India, Traffic congestion has been one of major issues that most metropolises are facing and thus, many measures have been taken in order to mitigate congestion. Identification of congestion characteristics is the first step for such efforts since itis an essential guidance for selecting appropriate measures. Basic knowledge of traffic flow characteristics like traffic volume under such Traffic conditions is fundamental traffic volumeis basic variable in planning, designing, and operation of roadway systems. Congestion - bothin perception and in reality - impacts the movement of people and freight and is deeply tied to the history of high levels of accessibility and mobility. Traffic congestion wastes time and energy, causes pollution and stress, decreases productivity and imposes costs on society. India's transport sector is a rapidly growing sector and contributes 6.4 % to the GDP of the country. The sector is largely oil dependent and accounts for 13 % of the country's energy- related CO2 emissions (MoEF 2010). Crude oil imports have been increasing steadily and making India the third largest oil importer globally. Nearly 80 % of India's current crude oil consumption comes from imports raising challenges of national energy security.

2. OBJECTIVE

- To quantify Traffic capacity Parameters such as traffic volume, Traffic composition, Traffic Speed and Traffic density and Travel time on the selected Bridges.
- To Find Level of Service of the selected bridges.
- To suggest remedial measures for reliving traffic congestion on the selected bridges

3. LITERATURE REVIEW

In 2022, D. Koll´ar , B. K¨ovesdi , I. V¨olgyi , I. Bir´o [1] In this research paper The analogy of Abbott-Firestone curve, in accordance with normalization of out-of-flatness results based on permitted total deformation limit of EN 1337–2, is assessed for each measurement scenario to describe the deformed shape of the contact area. It is a novel application of an established approach in the field of bridge engineering for evaluating such a problem. Specific surface roughness parameters such as material ratio (bearing area) at a specified out-of-flatness and minimum secant slope are particularly useful in evaluating the extent of defects in the contact area. The magnitude of out-of-flatness is not inevitably sufficient for classifying contact surfaces. A qualitative comparison is made showing that the magnitudes and shapes of simulated and measured distortions are in good agreement. Larger structural bearings may not mean directly that a better performance will be ensured for service loads. The structural layout of the superstructure could have an out-of-flatness shape dramatically reducing bearing area e.g., due to welding of additional stiffeners.

In 2022, P´eter Bucsky , Mattias Juh´asz [2] In this research paper The results of the analysis demonstrated that induced traffic is very significant in urban areas, and not only in the case of motorway and trunk road developments. The literature on induced traffic is well established, but case studies on urban environments are still scarce, mainly due to

the complexities of data collection. Due to this limitation, most of the studies focused on questionnaires and less on traffic countings. 55 years of real-life data from Budapest's bridges and the continues development of bridges and connecting roads made it possible to study the effects of capacity extensions and reductions on traffic volumes. A linear regression model was developed to separate the major influencing factors on traffic changes statistically. Capacity (represented by DSV), GDP, urban transport usage and the price of gasoline described ADT over a long time period with a high explaining power. The results suggest that the elasticity ratio between induced traffic and capacity change is around 0.5. This ratio was relatively stable throughout the analysis period. It was found that there is no significant difference between the elasticity of capacity extension and reduction. This means that road capacity reduction can serve as a very effective way for traffic calming.

In 2022, Ludovic Fülöp, Miguel Ferreira, Edgar Bohner, Jani Valokoski, Jussi Vuotari, Timo Tirkkonen [3] In this research paper The results of an extensive and systematic inspection of 96 bridges in Finland was carried out, with the goal of determining whether excess air entrainment is present in the structures and whether this affects the safety of the bridges. The inspection was the most extensive systematic inspection carried out on bridges in Finland. The goal of this inspection was not to perform individual condition assessment of each bridge, but rather to observe trends in the bridge portfolio, identify the safety critical bridges, providing FTIA with vital information needed for bridge ageing management. It was a success, and it reached its target of rebuilding confidence in the safety of bridges, following a string of worrying findings after smaller scale inspections. To make sure that the findings are statistically sound, larger sample sizes than generally used were chosen. This proved to be useful with regards to the confidence of the findings. The study showed that as many as 46 of the 105 test regions within the 96 bridges, contained

concrete with an air entrainment ratio of more than 7.5%, a threshold imposed as highest acceptable in this study. In addition, the study established that the amounts of air entrainment increased steadily in recent years. Hence, corrective actions are needed in the concrete production process to eliminate this trend.

In 2019, Dong Guo, Colin C. Caprani [4] In this research paper Current codes and standards use a conservative load patterning approach to determine the live load effect on the bridge. This approach only considers the worst-case scenario theoretically but ignores the probabilities of occurrence. Following some preliminary studies of the load patterning phenomenon, this paper puts forward a new load patterning method which is more reflective of the real traffic loading phenomenon while remaining conservative. In the new traffic load patterning proposal, adverse portions of an influence line are loaded as normal, but instead of zero loading, the beneficial portions are loaded with a mean free-flow traffic loading. For accidental or extreme conditions, alternative load models with appropriate partial factors of safety should be used. Since the proposal adds a small loading to the beneficial portion of the influence line, reductions in the traffic load demand for the considered bridge element will be found using the new approach. Such reductions can be invaluable in the design of super-long span bridges, or the assessment of existing bridges.

In 2019, Shi-Zhi Chen, Gang Wu, De-Cheng Feng [5] In this research paper B-WIM is a promising technique for the bridge maintenance and has been developed over several decades. To solve these issues, a B-WIM system only based on LGFBG sensors without additional devices is proposed in this study, considering the presence of multiple vehicles. To initially verify the feasibility of this method, a series of indoor experiments were carried out considering various combinations of the vehicle parameters. Apart from the scenarios with a single vehicle, a series of scenarios with two vehicle models were designed on the established experimental set-up to study the performance of this method under the presence of multiple vehicles considering various vehicles' transverse locations and relative velocities. The results indicate that this method is feasible under the designed scenarios without much variation in the identification accuracy. In this study, this method was merely tested on several designed scenarios based on an indoor experimental set-up. In the future, more detailed parametric studies and on-site tests are demanded to testify the reliability of this method.

In 2021, Naida Ademovi [6] In this research paper For determination of the state and the mechanical characteristics of the Emperor's bridge, only several nondestructive and minor destructive tests were conducted. The results were used for the creation of a finite element model of the existing bridge and proposed bridge rehabilitation. From the possible 25 non-destructive tests (NDT), nine for steel, and sixteen for concrete , only a few have been exploited in this particular case. Dynamic characteristics (eigenfrequencies and eigenmodes) obtained numerically of the original and strengthened structure were compared and it was seen that the difference is very small. The structure is being further deteriorated due to soft water corrosion (corrosion by leaching) as combined with general acid corrosion (soluble gases CO2, H2S). Urgent repair and reconstruction of the structure is needed as it falls into the damage class D. An ambient vibration testing of the bridge together with a more detailed FE modeling, which will be calibrated should be done which will contribute to better results and overall understanding of the bridge behavior.

In 2021, Lu Zhang , Xiaoxiang Cheng , Gang Wu [7] In this research paper the proposed method is effective and can be applied as a reference for identifying the parameters

of vehicles in random traffic flow in obtaining bridge strain responses recorded by LFBG sensors. An indoor experimental platform is built to further validate the practicability of the proposed method in practical engineering. The identified parameters show similar regularity with the results of the numerical simulation; the vehicles that have unrecognized axles in the traffic flow lead to a greater weight identification error, and other vehicle parameters still show high accuracy. The experimental results are not perfect due to the small axle spacing of the designed vehicles, the identification deviations in gross weight and the axle weight are large. However, all these problems can be avoid by using sensors with smaller gauge lengths in practical engineering. The vehicle lateral position is an important influencing factor in wheelbase and vehicle weight identification, and it is still necessary to investigate an accurate vehicle lateral position detection method to improve the identification accuracy in the future.

In 2020, Martina Šomodíková, Marie Horňáková, Pavla Rovnaníková [8] In this research paper The analysis of chloride profiles, pH concentration, and the c(Cl-)/c(OH-) ratio for the chloride-induced corrosion risk on the concrete samples is evaluated for 14 selected main road and motorway bridges. The results of 298 cores with 803 samples were analyzed It was found that the motorway bridges are more susceptible to corrosion risk comparing to main road bridges. Chloride profiles and pH values analyzed independently give similar results compared to the c(Cl-)/c(OH-) ratio to the risk of corrosion initiation; in case of comparison the average values per all groups of main roads and motorway bridges. Future research will be aimed at the influence of the strength classes with respect to evaluated parameters of chloride profiles, pH concentration and the c(Cl-)/c(OH-) ratios and bridge classes.

In 2019, Shi-Zhi Chen , Gang Wua De-Cheng Feng [9] In this research paper A damage detection method based on long-gauge FBG sensors was first proposed to detect the potential damage location and damage extent within monitored highway bridges, utilizing long-gauge strain time history under stochastic traffic flow. This method is not only applicable for rapid diagnosis but also has the potential for long-term monitoring of bridges under normal daily traffic conditions. In numerical simulations, the stochastic traffic flow condition was simulated based on the WIM measurement on a highway bridge in China. Simulated traffic density seems do not have evident influence on damage identification results. Meanwhile, sensor with shorter gauge length is more sensitive to local damage than longer gauge length. Overall, this method could still work with acceptable identification results under simulated stochastic traffic flow conditions Therefore, for further study, an in-situ application of this method on a highway bridge is needed to test this method's real performance under actual environment.

In 2021, Marek Szafran´ ski [10] In this research paper The objective analysis of bridges under moving loads requires the determination of the real dynamic parameters of both spans and moving vehicles. Their basic advantage is the use of high-quality data and the fact that it is uncontaminated by environmental and railway track interactions.The basic disadvantage of using wedge tests is the necessity of removing the railway vehicle from operation (the vehicle should be parked). The discussed results prove that an ERA can be successfully applied to the developed methodology. However, in the case of bridge spans, only the first bending modes could be identified using the applied type of excitation and sensor arrangements. Regarding the identified modes, a high repeatability of the modal parameters among the individual tests has been observed. This research is being further refined. The vehicle model can be upgraded by identifying additional modes of vibration (i.e., pitching, lateral and yawing) and by considering the separated masses of bogies. In this case, however, the vehicle model would be significantly expanded and different strategy of model definition should have been applied. The developed vehicle- bridge model can be extended into a vehicle-track-bridge system by considering the real track parameters (parametric identification) as well as the track irregularity and gauge (measurements). Additionally, the wider speed ranges and bridge types may allow for more objective inference.

In 2017, Bismark R.D.K. Agbelie , Samuel Labi , Kumares C. Sinha [11] In this research paper analytical approach for estimating the costs of bridge damage repair costs due to overweight vehicles using empirical data on bridge life-cycle expenditures on reconstruction, rehabilitation, and maintenance. This addresses a gap in the literature that is dominated by studies that mostly used simulation of mechanistic relationships rather than empirical field data; relatively short-term loading applications rather than long-term (life-cycle) impacts; considered damage effects (rather than costs of repairing the damage); or did not discriminate the damage costs across different bridge material types, functional classes, and age. In presenting and implementing a methodology for doing this, the paper duly recognized that OW trucks span a wide range of vehicleclasses. An incremental cost analysis for OW trucks was carried out, whereby the additional costs accrued by a vehicle class are allocated to all vehicle classes, including the particular vehicle class being considered and heavier, in proportion to their traffic volumes. Incremental designs were performed and cost functions were developed based on the AASHTO design vehicles. Each FHWA vehicle weight group was classified into an equivalent AASHTO loading using the MEV model, which is based on the GVW, axle loading, and axle spacing.

In 2020, Chuang Cuia, You-Lin Xu, Qing-Hua Zhang, Feng-Yang Wang [12] In this research paper The annual average hourly traffic (AAHT) volume should be used to include the effects of hourly-varying traffic loading and pavement temperature on fatigue damage accumulation. The

accuracy of hourly traffic flow and loading simulation has been verified. The number of cycles in the vehicle-induced equivalent dynamic stress response time history at the critical DTR joint can be counted just by the number of axles passing through the critical DTR joint and the cycle range can be taken as the corresponding response amplitude of equivalent dynamic stress. The fatigue damage of the critical DTR joint is underestimated if the time-variant temperature of asphalt pavement and the degeneration of road surface condition are not considered but the fatigue damage is overestimated without consideration of variable transverse locations of vehicles. The accumulated fatigue damage of the critical DTR joint reaches about 0.111 in 2020. The accumulated fatigue damage without consideration of time-variant pavement temperature, road roughness, and vehicle transverse location is respectively 0.082, 0.095 and 0.143 in 2020.

In 2018, Wenqi Hou, Yankun Li, Wei Guo, Junlong Li, Yehong Chen, Xiaoxu Duan [13] In this research paper Considering the multi-body dynamic model of the railway vehicle, wheel-rail interaction relationship and the dynamic finite element model of the track-SPA bridge system together, the dynamic responses of the TTB system were analyzed. Results show that the vibration responses of the track slab and the bridge are all qualified with the requirements of the normative standard. The peak value of the power density of the proposed EM-VEH is 176.5 mW/cm3, which is much higher than that of the most existing similar devices. The economic and environmental benefits of applying the device on practical urban mass transit SPA bridges are worthy to be expected. Meanwhile, the proposed harvester needs further optimization in mass and geometric dimensions, cost of the permanent magnets and energy harvesting efficiency.

In 2021, Xiaodong Liu , Wanshui Han , Yangguang Yuan , Xiao Chen , Qing Xie [14] In this research paper The measured traffic load can be divided into four level based on the hourly distance between vehicle by the clustering method of GMM and EM algorithm. When increasing the number of components N of the GMM, the value of the coefficient of DBI index decreases. However, the variations in DBI are not pronounced for values of N greater than four. The average growth ratio is considered in the process of the sampling of traffic load, and the corresponding time-variant corrosion fatigue model is built to involve the four-level growing traffic load. The stochastic traffic load that considers annual growth rate significantly accelerates the corrosion fatigue speed of the wires of a short suspender. Specifically, the average lifespan of the wires shortens by 8 years under this condition. However, the wind load that considers the annual distribution of mean wind speed has little influence on the average lifespan of the wires. The average lifespans of the wires of short suspenders are significantly influenced by the average growth ratio (*RAG*) of the traffic flow, in which the lifespans are 22 years, 19 years, 16 years, 14 years, and 12 years with *RAG* of 1.0%, 1.5%, 2%, 2.5% and 3%, respectively. The corresponding time-variant reliability indices can be divided into two stages, and the reliability indices decrease slightly during the first decade in the early stage and decrease dramatically in the late stage. In addition, the *RAG* has more influence on the reliability indices in the late stage than those in early stage.

In 2021, Ke Ma, Hao Wang, Tiancheng Ruan [15] In this research paper we developed a road capacity gain formula for mixed traffic flow which varies with CAV MPR and several parameters. The FVD model and CAV model were used to simulate the MV–CAV mixed flow. Based on the simulation, the impacts of CAVs on the capacity and pollutant emissions were studied. The main conclusions are as follows. CAVs contribute to a significant increase in road capacity as CAV MPR increases. Among them, the marginal effect of CO2, PM and NOx decreases with CAV MPR, while that of VOC increases. For CAV platoon size limitation, there is a little benefit of enlarging platoon size when the CAV platoon size is over 5 for CO2, VOC and NOx, while there is a significant benefit for PM. The rapid development of CAV technologies has attracted the attention of many researchers. To ensure the stable and environmental-friendly operation of CAVs, further experiments are needed. In this paper, we developed a capacity gain formula for CAV platoons, but it has not been verified in field tests. The impacts of V2V communication topologies on the mixed traffic flow need field tests, which will be conducted by us in the future.

4. CONCLUSION

Find the gap that, study the results of the analysis demonstrated that induced traffic is very significant in urban areas, and not only in the case of motorway and trunk road developments. The literature on induced traffic is well established, but case studies on urban environments are still scarce, mainly due to the complexities of data collection. There are many complex problems related to transportation system is observed in the country. These include ever increasing population, vehicular growth and traffic congestion. Gujarat is the one of the top five fastest developing state of our country. So i was decided After reckoning survey the three bridges namely Swamivivekanand Bridge,Sardar Bridge, Subhash Bridge are selected for Traffic flow capacity and level of Service analysis. In this study, I will find to traffic flow capacity and Level of Service by measuring traffic speed, flow and density parameters on the selected bridges during peak hours. This may be helpful to check whether existing bridges are capable to handle existing as well as future increased traffic flow safety or not.

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