Effect of Traffic Congestion & Proper Solution for Karad City

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Abstract— Due to increase in population and the attraction of human activities into urban region which in turn leads to the growth of vehicle ownership and use, there is demand for road space which has led to increase in the number of public transport operation. Consequently, the demand for road space is greater than the supply because the rate of provision of transport facilities is less than the rate of growth of vehicle ownership and use which result into traffic congestion. Traffic congestion is the impedance of vehicles imposed on each other due to speed-flow relationship in conditions where the use of transport system approaches capacity. Traffic congestion in Nigeria, taking Basorun-Akobo Road in Ibadan Oyo State as a case study has been analysed using experimental and theoretical approaches. These involve traffic counting and delay survey. In order to carry out effective research work on the case study road, the method adopted were traffic counting and traffic delay survey. The effect of traffic congestion on the study area are Waste of time, Delay movement, Accident, Inability to forecast travel time, Fuel consumption, Road rage and environmental pollution. Possible solutions to traffic congestion on the case study area is to: Dualize the Road, Provide Adequate Parking Space, Construct proper Drainage and Install Traffic Control Devices.

Key words: Traffic Congestion, Karad City

I. INTRODUCTION

Road became important means of transportation during the reign of Roman Empire. Roman's kingdom modernized, used road effectively compared to the existing usage of road whereby ox, man, chariot, camel, bull were used as major carrier in road transportation. But the invention of the motor vehicle meant that roads were no longer meant for pedestrians, chariot and animals. The invention called for improvement of the state of the roads, which led to increased speeds and danger to road users. This then called for a proper construction and control of traffic to increase efficiency of the roads in traffic performance. Demand for highway travel by people continues to grow as population increases, particularly in the metropolitan area and the construction of new highway capacity to accommodate this growth in travel has not kept pace. Congestion results when traffic demand approaches or exceeds the available capacity of the road system.

While this is a simple concept, it is not constant because traffic demand may vary significantly depending on the season of the year, the day of the week and even time of the day. Nevertheless, the overall effect of congestion on Nigeria Highway cannot be accurately quantify due to uncounted and diversified effects it has on the national capacity but its significant effect can be seen on service delivery, good delivery, pollution, discomfort, excessive fuel consumption, excessive vehicle maintenance – all these accounted for economic loss. The problem of traffic congestion has reached an alarming rate in Nigeria especially in many cities. However, there is a general feeling that the traffic flow should be free to allow free movement of goods and service but reverse is the case own to the overcrowding of the road users (vehicles) on the road and this manifest through a number of problems which include:

- Delay: this is the time lost while traffic flow is impeded
- Inability to forecast travel time accurately, leading to drivers allocating more time to travel and less time on productive activities.
- Wastage of fuel and increasing air pollution: releasing of CO (carbon monoxide) and other pollutant by congested car account for environmental and health problem which range from nose running to global warming.
- Wear and tear on vehicles as a result of idling in traffic and frequent acceleration and braking, leading to more frequent repairs and replacements.
- Stressed and frustration: discomfort that comes from stop and go condition of the traffic congestion cause discomfort and weakness of passengers and motorists. More so, congestion increases the tendency of collision which may lead to series of injuries and fatality.
- Perishing of some agricultural produce: Many agricultural products such as tomatoes, mangoes etc.

The overall effects of traffic congestion can be broadly be categorized under Health effects, Environmental effects, and Economy effect. It must however be noted that the mobile court was recently introduced in Ibadan but the frequent strive action of the public transportation union partly face it to park up. The attempt and the willingness of the researcher to cover all congested roads in the country in executing this research work would be tedious, time wasting owing to distance security and the complexity of the Nigerian roads.

Cities and traffic have developed hand-in-hand since the earliest large human settlements. The same forces that draw inhabitants to congregate in large urban areas also lead to sometimes intolerable levels of traffic congestion on urban streets and thoroughfares. Effective urban governance requires a careful balancing between the benefits of agglomeration and the disadvantages of excessive congestion. Road traffic congestion poses a challenge for all large and growing urban areas. The full report on which this summary is based aims to provide policymakers and technical staff with the strategic vision, conceptual frameworks and guidance on some of the practical tools necessary to manage congestion in such a way as to reduce its overall impact on individuals, families, communities and societies. Urban traffic congestion is a significant and growing problem in many parts of the world. Moreover, as congestion continues to increase, the conventional approach of building more roads doesn't always work for a variety of political, financial, and environmental reasons.

In fact, building new roads can actually compound congestion, in some cases, by inducing greater demands for vehicle travel that quickly eat away the additional capacity? Against this backdrop of serious existing and growing

congestion traffic control techniques and information systems are needed that can substantially increase capacity and improve traffic flow efficiency. Application of ITS technologies in areas such as road user information and navigation systems, improved traffic control systems and vehicle guidance and control systems has significant potential for relieving traffic congestions. Traffic congestion and the cost of providing mobility are compelling issues to planners, decision makers and members of both the business community and the general public transportation and the degree of efficiency with which it is accomplished, affects us all. Therefore we are constantly in search of solutions to our transportation problems that will give us not only increased mobility, but also greater economic productivity and a cleaner environment.

While new road construction can temporarily relieve congestion in the longer term it simply encourages further growth in car traffic through increased travel and a switch away from public transport. Beside this, suitable corridors in our cities for major roadwork's is becoming more and more difficult, and many of the recent major projects involve turrets to minimize environmental disruption and community opposition, thereby raising costs. In the past decade, a new wave of Intelligent Transport Systems (ITS) has emerged around the world to provide additional tools to help solve our transport problems. Intelligent Transport Systems can produce major benefits in reducing congestion, accident and environmental impacts, and can make significant improvements to the efficiency of commercial and public transport fleets, and to inter-modal integration. ITS can also reduce the need for expensive new transport infrastructure by maximizing the efficiency of our existing facilities.

II. LITERATURE REVIEW

A. Amudapuram Mohan Rao, Kalaga Ramachandra Rao [2012],

Traffic congestion has been one of major issues that most metropolises are facing. It is believed that identification of congestion is the first step for selecting appropriate mitigation measures. Congestion - both in perception and in reality - impacts the movement of people. Traffic congestion wastes time, energy and causes pollution. There are broadly two factors, which effect the congestion; (a) micro-level factors (b) macro-level factors that relate to overall demand for road use. Congestion is 'triggered' at the 'micro' level (e.g. on the road), and 'driven' at the 'macro' level. The micro level factors are, for example, many people want to move at the same time, too many vehicles for limited road space. On the other side, macro level factors are e.g. land-use patterns, car ownership trends, regional economic dynamics, etc. This paper gives an overview and presents the possible ways to identify and measure metrics for urban arterial congestion. A systematic review is carried out, based on measurement metrics such as speed, travel time/delay and volume and level of service. The review covers distinct aspects like definition; measurement criteria followed by different countries/organizations. The strengths and weaknesses of these measures are discussed. Further, a short critique of measurement criteria is presented.

B. M.H. Othman, A.H Abdul Hamid [2012],

Traffic route choice using road network modeling can play a key role in preventing and minimizing traffic problems during disasters. Using road network modeling, real road conditions during flooding are simulated in order to produce a response plan for road users to evacuate based on the roads' real risks and situation. Using a Geographical Information System (GIS) we can forecast and provide road users with available alternatives when certain access roads or links need to be closed due to catastrophic hazards such as floods. This study focuses on floods as it is the most common form of natural disaster occurring in Malaysia, and due to the fact that the chance and risk of a flood occurring cannot be accurately predicted nor measured. Therefore, as a response to this problem, the outcome of this study is highly useful for the retrieval of information on flooded roads and the impacts on road users. Using GIS's capability to display both spatial and attributive information, we have provided an attractive alternative to conventional methods in order to show available traffic route choices and a transportation network plan.

These alternative route choices provide one of the measures for a Traffic Management Plan (TMP) during flooding. This study covers utilization, adjustment and adaptation of existing roads to meet specified objectives such as improving traffic circulation in a flooded area without the need for new road construction. These alternatives and measures will help road users in their decision making when choosing the best route according to their needs and destination whenever a certain road is flooded. The results presented discuss the conditions where the speed variable on a flooded road is zero, i.e. no movement is possible. This situation represents a worst case scenario during flooding. Other conditions of road usage, such as where only limited travel is possible, were also studied. These scenarios where speed was set at 5 km/h, 10 km/h and 30 km/h can show other traffic management alternatives using the same methodology. The different speeds scenarios gave different result of LOS, density and travel time. These alternative settings can hopefully be used to alert road users so that they are aware of what they have to do in case of flooding. Similar approaches can be used to study situations where there are accidents and crashes since these events have a similar effect on traffic, namely, causing delays and congestion.

C. Mr. Udit Batra, Mr. Mandar V. Sarode [2013],

Rapid industrialization and the consequent urbanization has brought about an unprecedented revolution in the growth of motor vehicles all over the world and India is no exception. Such growing urbanization, combined with rising number of vehicle ownership, has led in recent years to an increased demand of traffic survey and analysis, for both long term and short term period. Traffic analysis is basically the process of intercepting and examining the number of vehicles on the road and deducing the pattern of traffic movement. A Traffic survey on specific road sections of Nagpur city has been carried out which included Calculation of present traffic density and comparison with previous year data, Average velocity of traffic. Manual method of counting was used with the help of video recording.

- Width of the Residency Road 7.4 meters Traffic density per hour for Residency Road is 5002 vehicles
- Width of the WHC Road is 8.85 meters & Traffic density per hour for West High Court Road is 1697 vehicles
- The traffic density from liberty square to Smruti Theatre square is 5000 vehicles per hour which is substantially more than Wardha Road where flyover has been constructed hence there is an urgent need to distribute heavy traffic density at Residency Road
- The width of the Residency Road is 7.4 meters which is comparatively less than that of Wardha Road hence frequent traffic congestions are observed
- There are schools on the Residency road & during school timing more traffic flow is observed.
- Possibilities of restricting four wheelers during peak traffic hours need to be examined.
- On street parking of vehicles should be prohibited.
- Taking into account development taking place in western Nagpur, WHC road with limited width will not be able absorb increase in vehicular traffic. Hence, traffic distribution through alternative routes or construction of flyover may be envisaged.
- Two wheelers, particularly motorcycles is the most preferred mode of transport.
- Public transport system needs to be strengthened so that use of individual vehicles is restricted, thereby reducing traffic density.

D. Robaka Shamsher, Mohamamd Nayeem Abdullah [2013],

One of the most challenging and complicated issues in city management in the present decade for Bangladesh is the traffic problem. It is a very common phenomenon in almost all the cities of Bangladesh. Presently, traffic congestion problem in Bangladesh are increasing at an alarming rate. The traffic problem has become to a very dangerous arena and has already implicit agonizing extent in the cities of Bangladesh. This type of study has been conducted in Dhaka but not in Chittagong city. Traffic management in Chittagong is not well organized as Dhaka so that the problem is becoming more complicated as the number of people in Chittagong is increasing and it is getting the priority after Dhaka. This article is dedicated to determine the current condition of traffic management in Chittagong City. This article explore the causes involved in traffic congestion including heavy concentration of vehicles, absence of adequate public transport, inadequate road infrastructure, faulty signaling equipment and poor enforcement of traffic rules. At the end of the paper the researchers tried to identify the solution of traffic jam in Chittagong Metropolitan City.

Traffic congestion is a global as well as local problem. All over the world, the prime cause of traffic congestion is on street parking. In Bangladesh, traffic congestion is a common issue in the big cities like Dhaka, Chittagong and Khulna and in Dhaka it is severe. It is one of the most important problems of modern time. In Dhaka, different infrastructural and managerial projects are granted for reducing traffic jam. However in Chittagong this type of policy is not addressed yet. Moreover development projects in Chittagong move slowly compared to Dhaka and development budget is also comparatively lower than Dhaka. For Chittagong, traffic congestion constraints can be ameliorated by embarking on various strategies such as road capacity expansion, improved road infrastructures, restricting routes for Rickshaw, financial penalty to the traffic law breakers, building bus stoppages and application of Fly over. Most importantly, proper traffic management system along with appropriate implementation of traffic rules is necessary to mitigate the problems of traffic congestion.

E. Shekhar K. Rahane, Prof. U. R. Saharkar)[2014],

Traffic congestion is a major urban transport problem .Due to traffic congestion, there is possibility of accidents because of poor traffic management. To eliminate road accidents and to save precious human life it is essential to find proper solution for traffic congestion. In this paper traffic congestion problem in Talegaon Dabhade, Tal-Maval. Dist-Pune is identified and studied for finding out the causes and proposed solution of it. In the recent years there has been a considerable loss due to the accidents to the precious human life and to the vehicles to some extend in Talegaon Dabhade.

Traffic congestion is a global as well as local problem. All over the world, the prime cause of traffic congestion is on street parking. In Talegaon, traffic congestion is a common issue like Mumbai. Different infrastructural and managerial projects are granted for reducing traffic jam. However in Talegaon this type of policy is not addressed yet. Traffic congestion constraints can be ameliorated by embarking on various strategies such as road capacity expansion, improved road infrastructures, restricting routes for Rickshaw, financial penalty to the traffic law breakers and application of Fly over. Most importantly, proper traffic management system along with appropriate implementation of traffic rules is necessary to mitigate the problems of traffic congestion in Talegaon Dabhade.

F. S. B. Raheem1, W. A. Olawoore, D. P. Olagunju, E. M. Adeokun et.al. [2015].

Due to increase in population and the attraction of human activities into urban region which in turn leads to the growth of vehicle ownership and use, there is demand for road space which has led to increase in the number of public transport operation. Consequently, the demand for road space is greater than the supply because the rate of provision of transport facilities is less than the rate of growth of vehicle ownership and use which result into traffic congestion. Traffic congestion is the impedance of vehicles imposed on each other due to speed-flow relationship in conditions where the use of transport system approaches capacity. Traffic congestion in Nigeria, taking Basorun-Akobo Road in Ibadan Oyo State as a case study has been analysed using experimental and theoretical approaches. These involve traffic counting and delay survey. In order to carry out effective research work on the case study road, the method adopted were traffic counting and traffic delay survey. The effect of traffic congestion on the study area are Waste of time, Delay movement, Accident, Inability to forecast travel time, Fuel consumption, Road rage and environmental pollution. Possible solutions to traffic congestion on the case study area are to: Dualize the Road, Provide Adequate

Parking Space, Construct proper Drainage and Install Traffic Control Devices.

The conclusion for this research work is based on the results obtained in the experiments as follows.

- The case study road operates under level of service F (in most time) which is generally unacceptable and level of service E during low traffic period.
- Defects on the road also constitute significantly to congestion.
- The case study road lack parking bay and thus parking vehicles inhibit the free-flow of traffic.
- Average delay on case road is 6minute which is unacceptable as ideal time on that road course is just 15seconds.
- The pick hourly traffic is found between 7:45am and 8:30am and 4:00pm – 4:45pm for morning and evening peak period respectively.
- Private cars are the most vehicular type that ply the road.
- Most congested section of the road was found between Yanbule and General Gas.
- Morning congestion (coming) exceeded afternoon congestion (going).
- Factors such as bad road (pothole) responsible for congestion (especially between general gas and Olopomeji junction.

G. Aya Aboudina, Hossam Abdelgawad, Baher Abdulhai Ph.D , Khandker Nurul Habib et.al. [2016],

Congestion pricing is one of the widely contemplated methods to manage traffic congestion.

The purpose of congestion pricing is to manage traffic demand generation and supply allocation by charging fees (i.e., tolling) for the use of certain roads in order to distribute traffic demand more evenly over time and space. This study presents a framework for large-scale variable congestion pricing policy determination and evaluation. The proposed framework integrates departure time choice and route choice models within a regional dynamic traffic assignment (DTA) simulation environment. The framework addresses the impact of tolling on: road traffic congestion (supply side) and traveller's choice dimensions including departure time and route choices (demand side). The framework is applied to a simulation-based case study of tolling a major freeway in Toronto while capturing the regional effects across the Greater Toronto Area (GTA). The models are developed and calibrated using regional household travel survey data that reflect the heterogeneity of travelers' attributes. The DTA model is calibrated using actual traffic counts from the Ontario Ministry of Transportation and the City of Toronto. The case study examined two tolling scenarios: flat and variable tolling. The results indicate that: (1) more benefits are attained from variable pricing, that mirrors temporal congestion patterns, due to departure time rescheduling as opposed to predominantly re-routing only in the case of flat tolling, (2) widespread spatial and temporal re-distributions of traffic demand are observed across the regional network in response to tolling a significant, yet relatively short, expressway serving Downtown Toronto, and (3) flat tolling causes major and counterproductive rerouting patterns during peak hours, which was observed to block access to the tolled facility itself.

H. Feifei He, Xuedong Yan, Yang Liu, Lu Ma [2016],

This study aimed to analyze traffic congestion in urban road networks. The speed performance index was adopted to evaluate the existing road network conditions of congestion, then road segment and network congestion indexes were introduced to respectively measure the congestion levels of urban road segment and network. This study also carried out a traffic congestion analysis for Beijing expressway network, based on the speed performance data collected from January 1 to November 1, 2012, by Beijing Traffic Management Bureau (BTMB). Based on these analyses the proposed congestion indexes can well assess the traffic congestion conditions of urban road networks, more importantly, such an assessment study provides traffic control and management agencies an accurate and clear understanding of operation status of traffic networks.

This study selected the speed performance index as the road network state evaluation indicator, and divided the traffic state into four categories: heavy congestion, mild congestion, smooth and very smooth. Based on the traffic state classification standards, the study proposed the road network congestion index and the road network congestion index to measure the congestion degree of road segment and road network respectively. Taking Beijing expressway congestion analysis as a case study, this study carried out Beijing expressway network characteristics analysis, road segment co According to the Beijing expressway network state analysis, we can have an accurately and clearly grasping of network traffic operation status in Beijing, which provides important information for future traffic management. Overall, 78.8% of the Beijing expressway network is very smooth all the year round. The morning peak has the congestion delay phenomenon in the way that road network congestion continues to about 10:00. According to road segment congestion assessment and road network congestion assessment, the Beijing expressway network during the morning peak is much better than the evening peak, and season is also an important influence factor to urban road network congestion. The Beijing expressway network congestion has seasonal pattern that the road congestion concentrates mainly on the Second and Third Ring Road throughout the year, but spreads to the Fourth and Fifth Ring Road in autumn and winter, which can be found from the road segment congestion assessment. The road network congestion is the worst in autumn, followed by summer and it is severer on weekdays than weekend congestion assessment and road network congestion assessment.

I. Matt Grote, Ian Williams, John Preston, Simon Kemp et.al. [2016],

Tailpipe emissions from vehicles on urban road networks have damaging impacts, with the problem exacerbated by the common occurrence of congestion. This article focuses on carbon dioxide because it is the largest constituent of road traffic greenhouse gas emissions. Local Government Authorities (LGAs) are typically responsible for facilitating mitigation of these emissions, and critical to this task is the ability to assess the impact of transport interventions on road

traffic emissions for a whole network. This article presents a contemporary review of literature concerning road traffic data and its use by LGAs in emissions models (EMs). Emphasis on the practicalities of using data readily available to LGAs to estimate network level emissions and inform effective policy is a relatively new research area, and this article summarizes achievements so far. Results of the literature review indicate that readily available data are aggregated at traffic level rather than disaggregated at individual vehicle level. Hence, a hypothesis is put forward that optimal EM complexity is one using traffic variables as inputs, allowing LGAs to capture the influence of congestion whilst avoiding the complexity of detailed EMs that estimate emissions at vehicle level. Existing methodologies for estimating network emissions based on traffic variables typically have limitations. Conclusions are that LGAs do not necessarily have the right options, and that more research in this domain is required, both to quantify accuracy and to further develop EMs that explicitly include congestion, whilst remaining within LGA resource constraints.

J. Min Xu, Qiang Meng, Zhongxiang Huang [2016],

The traffic-restraint congestion-pricing scheme (TRCPS) aims to maintain traffic flow within a desirable threshold for some target links by levying the appropriate link tolls. In this study, we propose a trial-and-error method using observed link flows to implement the TRCPS with the day-to-day flow dynamics. Without resorting to the origin–destination (O–D) demand functions, link travel time functions and value of time (VOT), the proposed trial-and-error method works as follows: tolls for the traffic-restraint links are first implemented each time (trial) and they are subsequently updated using observed link flows in a disequilibrium state at any arbitrary time interval. The trial-and-error method has the practical significance because it is necessary only to observe traffic flows on those tolled links and it does not require waiting for the network flow pattern achieving the user equilibrium (UE) state. The global convergence of the trial-and-error method is rigorously demonstrated under mild conditions. We theoretically show the viability of the proposed trial-and-error method, and numerical experiments are conducted to evaluate its performance. The result of this study, without doubt, enhances the confidence of practitioners to adopt this method.

A trial-and-error method for implementing the TRCPS with day-to-day flow dynamics has been proposed to maintain traffic flow within a desirable threshold for some target links. More importantly, the feasibility and efficiency of the proposed trial-and-error method to achieve the TRCPS under the day-to-day flow dynamics has been theoretically demonstrated and further evaluated by numerical experiments. It can be seen that the proposed trial-and-error method is a variation of the approximate sub-gradient method for solving the dual formulation of the link capacity constrained UE traffic assignment problem with elastic demand. The proposed trial-and-error method has several merits. First, its implementation does not require the explicit knowledge of O–D demand functions, link travel time functions, drivers' VOT and the mechanism of day-to-day flow dynamics. Second, compared to the existing trial-and-error methods for congestion control and dynamic pricing mechanisms, the proposed trial-and-error method tallies more with the actual situation by incorporating the day-to-day flow dynamics. Additionally, it has great practical significance because the link toll pattern can be updated at any arbitrary time interval without the condition that the network flow should achieve the UE state. Third, the global convergence of the proposed trial-and-error method is rigorously demonstrated under the mild conditions without relying on the specific form of day-to-day flow dynamics.

K. Xiaohan Yu, Shengwu Xiong, Ying He, W. Eric Wong, Yang Zhao et.al. [2016],

The automatic congestion detection of campus traffic presents a significant challenge to the traffic congestion research community. Typically, campus road users can be classified into four types including pedestrian, bike, vehicle and motorbike, which enhances the complexity of traffic condition. Thus, existing descriptors of traffic congestion for highway traffic are not valid when describing the traffic congestion in campus. In this paper, we propose a novel descriptor, road occupancy rate, for measuring campus traffic congestion level, which is statistically proved to be the most effective descriptor among other descriptors (including speed of pedestrian, vehicle, motorbike and bike).Two existing models — Markov mode land back propagation neural network (BPNN) — are introduced in this paper to detect the campus traffic congestion combined with the proposed descriptors. And three phases are defined based on three-phase traffic theory to describe the campus traffic congestion levels. Experimental results indicate that the proposed detecting methods are both capable of detecting campus traffic congestion, while the BPNN-based method achieves higher accuracy and more stable performance.

In this paper, an analysis of campus traffic congestion condition is implemented based on the real video data collected from campus. The three-phase traffic theory is introduced to help define the traffic congestion level in campus. We also conduct the correlation analysis and utilize the top three ranking parameters to represent the final descriptors of campus traffic congestion condition. Then, the BPNN based method and Markov based method are combined with the proposed descriptors to provide the campus traffic congestion detection methods. The comparable experimental results show that our proposed methods can achieve desirable performance for detecting traffic congestion in campus, while the BPNN based method obtains more stable performance. And the result also indicates the potential significance of the proposed method for traffic congestion detection in campus.

L. Kehan Wu, Yanyan Chen, Jianming Ma, Song Bai, Xiru Tang [2017],

Congestion charging is being considered as a potential measure to address the issue of substantially increased traffic congestion and vehicle emissions in Beijing. This study assessed the impact of congestion charging on traffic and emissions in Beijing using macroscopic traffic simulation and vehicle emissions calculation. Multiple testing scenarios were developed with assumptions in different charging zone sizes, public transit service levels and charging methods. Our analysis results showed that congestion charging in Beijing

may increase public transit use by approximately 13%, potentially reduce CO and HC emissions by 60–70%, and reduce NOx emissions by 35–45% within the charging zone. However, congestion charging may also result in increased travel activities and emissions outside of the charging zone and a slight increase in emissions for the entire urban area. The size of charging zone, charging method, and charging rate are key factors that directly influence the impact of congestion charging; improved public transit service needs to be considered as a complementary approach with congestion charging. This study is used by Beijing Transportation Environment and Energy Center (BTEC) as reference to support the develop end of Beijing's congestion charging policy and regulation.

In this study, we analyzed the impact of a congestion charging policy on traffic and vehicle emissions in Beijing using a combination of macroscopic traffic simulation and vehicle emissions calculation. The congestion charging scenarios we simulated in this study were composed by three charging factors, including charging zone, charging method and associated public transit service level. Our simulation results showed that congestion charging in the central Beijing urban area will possibly increase the use of public transit by up to about 13% and will potentially reduce CO and HC emissions by 60– 70%, as well as reduce NOX emissions by 35–45% within the charging zone. However, it also has a potential negative impact; it might increase the emissions in the external area and the entire main urban area by up to 30% and 5%, respectively.

The impact of charging fees was simulated through the concept of monetary value of time in this study. The target charging rates were determined by the ideal effects of congestion relief in this study. We analyzed the impact of charging zone, charging method and public transit service level in a potential congestion charging policy for Beijing. Results show that a larger charging zone can reduce the emissions within the charging area, but it may increase the emissions outside the charging zone; it may also have different impacts in the entire urban area, depending on the public transit service level. Improving public transit service can effectively reduce urban area emissions and is important when developing the congestion charging policy in Beijing. Selecting a larger charging zone with sufficient public transit service may enhance the citywide emissions benefit. In some cases, cordon-based charging may optimize emissions reduction effects slightly: cordon-based charging may reduce emissions in the main urban area slightly when the 2nd ring road is taken as the boundary of the charging zone. Due to data availability, our study was limited to analyzing the impact of congestion charging during the afternoon rush hours; the impact during daytime hours should be further evaluated. Further research is also needed to determine charging rates and to statistically assess the relationships among charging, traffic, and emissions in a practical congestion charging policy.

III. Conclusion

Rapid industrialization and the consequent urbanization have brought about an unprecedented revolution in the growth of motor vehicles all over the world and India is no exception. Such growing urbanization, combined with rising number of vehicle ownership, has led in recent years to an increased demand of traffic survey and analysis, for both long term and short term period. Traffic analysis is basically the process of intercepting and examining the number of vehicles on the road and deducing the pattern of traffic movement. The work up till now was carried out on traffic data analysis and its forecasting. But some questions are unanswered for reducing congestion problem.

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