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Traffic management under smart city: Challenges and opportunities in economic growth

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Abstract
The Smart City Mission is on several major urban development programs focused on India's rapid growth and its challenges and opportunities. The aim is to promote economic growth, strengthen governance, and improve results for urban residents by improving transportation management, as transportation plays a vital role in the economic growth of a country.

Keywords: digitalization, e-governance, urbanization, dynamic rerouting, road tolling

Introduction

A 'smart city' is an urban region that is highly advanced in terms of overall infrastructure, sustainable real estate, communications and market viability. It is a city where information technology is the principal infrastructure and the basis for providing essential services to residents. There are many technological platforms involved and not limited to automated sensor networks and data centers.

"The idea of smart cities has aroused an unprecedented enthusiasm ever since it was first in 2014. This applies more to the launch of Smart City Mission in our country."

Cities and towns will redevelop and retrofit areas to become smarter. This means a city like Bhubaneswar will redevelop the area around its railway station in the heart of the city and Jaipur on the other hand will enhance its visual appeal and tourist experience within the walled city. For these purposes the center will contribute 200 Crores with the states contributing an equal amount in the first year. Overall 50,802 Crores has been proposed to be invested over five years has been chosen to execute the plans to make these cities smart cities.

According to the documents released on the smart cities, the core infrastructure in a smart city would include:

1. Adequate water supply
2. Assured electricity supply
3. Sanitation, including solid waste management
4. Efficient urban mobility and public transport
5. Affordable housing, especially for the poor
6. Robust IT connectivity and digitalization
7. Good governance, especially e-governance and citizen participation
8. Sustainable environment
9. Safety and security
10. Health and education

Traffic: A Big Problem

Traffic congestion is a big problem for everyone within the city. The main reasons why traffic congestion occurs are more cars, poor road management, and poor practices on behalf of employers.

One of the main reasons why there's more congestion is due to more cars on the road. The adult population is increasing and therefore more people want their own personal transport to get around with. As the number of cars increase the chance of congestion also increases.

This coupled with a lack of proper infrastructure. Councils and national governments fail to act on the looming threat of heavy congestion until it happens. The city doesn't expand along with an increasingly car reliant population. Alternate routes are also a problem. Cities have limited capacity to expand due to poor funding and planning restrictions.

Employers can also play a part in dealing with congestion. Congestion almost always happens when people are travelling to and from work. Traffic congestion has eased in recent years as a result of growing unemployment and the introduction of more flexible work hours. A lack of public transport, or poor public transport options, will also cause problems. If there isn't enough buses, trams, or local trains people are forced to take their cars to work. The ratio of passengers to vehicles decreases, whereas if they were able to take the bus people would feel less of a need to drive their cars.

The problem of traffic has several effects on people and city. The most significant effect is increased anger and frustration. Every day, people experience a delay in reaching their workplaces or universities. This leads to high tension and stress among them.

Another feasible effect worth mentioning here is the environmental effect. The quality of air declines because of the exhaust fumes generated by cars which may result in severe health problems such as asthma, bronchitis and heart attacks. The waste of time on average is huge and this is another major drawback the bad traffic is causing.

Overall, traffic is mainly caused by overpopulation and people's reliance on their own cars. If governments provide more facilities and encourage people to use public transport, I am sure that the level of traffic will decline in the near future.

Proper traffic management through innovative measures and ideas can definitely help to solve such a big issue which is big obstacles in India's biggest project- Smart City.

Traffic Management in Smart Cities

Traffic management is a key branch within logistics. It concerns the planning, control and purchasing of transport services needed to physically move vehicles (for example aircraft, road vehicles, rolling stock and watercraft).

Traffic management is implemented by people working with different job titles in different branches:

- Within freight and cargo logistics: traffic manager, assessment of hazardous and awkward materials, carrier choice and fees, demurrage, documentation, expediting, freight consolidation, insurance, re-consignment and tracking.
- Within air traffic management: air traffic controller.
- Within rail traffic management: rail traffic controller, train dispatcher or signalman.
- Within road traffic management: traffic controller.

Innovative Techniques to Improve Traffic Management

Urbanization comes with a cost and terrible traffic is just one of them. Our times strongly call for an innovative plan for traffic management, but at cost effective rates. Road traffic management mainly involves a smooth flow of traffic and avoidance of accidents. Maintaining discipline on the roads is the end view. The primary methods used to achieve road discipline are traffic signal control, traffic monitoring, and access management. These methods are more effective, when combined with innovative but simple traffic management techniques.

i) Speed Harmonization

Speed harmonization is a method to reduce congestion and improve traffic performance. This method is applied at points where lanes merge and form bottlenecks, the greatest cause of congestion nationwide. The strategy involves gradually lowering speeds before a heavily congested area in order to reduce the stop-and-go traffic that contributes to frustration and crashes.

Benefits

Speed harmonization has the potential to smooth traffic, increase the number of vehicles that a roadway can handle, and improve safety by making it easier for drivers to change lanes when necessary. It also has the potential to reduce the number of rear-end crashes caused by drivers who do not brake early enough when they encounter slow-moving or stopped vehicles.

How It Works

Mobile traffic sensors send real-time conditions at a congested location to a traffic management center. A computer uses this information to calculate optimal speeds for vehicles approaching the congestion and sends the speeds to connected vehicles on the road via wireless communications. The drivers receive the recommended speeds and can adjust accordingly, or, in an automated vehicle, the vehicle could adjust to the recommended speed automatically.

ii) Dynamic Rerouting

Dynamic rerouting is an active traffic management strategy that presents drivers with viable alternate highway routes when their normal route is severely congested due to incidents, special events, or other abnormal traffic conditions. The alternate route is determined based on prevailing traffic conditions along nearby highway routes between a given origin and destination. Alternate route information is typically disseminated using hybrid guide signs, dynamic message signs, or via broadcast media. This not only benefits drivers by shortening their travel time but also keeps the congested corridor from becoming more so.

Benefits

- Reduce congestion by shifting traffic to alternate routes.
- Maximize efficiency and capacity of the network by spreading traffic across the network.
- Increase safety by decreasing the likelihood of secondary car crashes.

Dynamic rerouting works well on busy highway and major street networks with viable alternate routes. It can be implemented quickly in regions with traffic management centers and existing intelligent transportation systems (ITS). The strategy pairs well with speed harmonization.

Requirement for its Effective Implementation

An effective implementation of dynamic rerouting along a freeway/highway route requires a viable parallel corridor that has adequate capacity to serve as an alternate route with minimum negative impacts. The concept requires operational knowledge of the status of the road network, typically through intelligent transportation systems and a regional traffic management center (TMC) that manages the system. The availability of adequate sensor and sign infrastructure to ensure that reliable alternate route information can be generated and provided is required.

iii) Queue Warming

Differences in speed tend to cause vehicle conflicts and can lead to abrupt stopping and slowing leading to increased congestion and the potential for collisions. Queue warning's basic principle is to inform travelers of the presence of downstream stop-and-go traffic (based on real time traffic detection) using warning signs and flashing lights. Drivers can anticipate an upcoming situation of emergency braking and slow down, avoid erratic behavior, and reduce queuing-related collisions. Dynamic message signs (DMS) show a symbol or word when stop and-go traffic is near. Variable speed limits and lane control signals that provide incident management capabilities can be combined with queue warning. The system can be automated or controlled by a traffic management center operator. Work zones also benefit from queue warning with portable dynamic message sign units place.

Benefits

- Queue warning can help reduce primary and secondary crashes by alerting drivers to congested conditions. Furthermore, the incident severity is reduced because drivers are prepared for impending congestion.
- Environmental benefits with queue warning can include decreased admissions, decreased noise, and decreased fuel consumption.
- Queue warning can help delay the onset of congestion. With more uniform speeds, traffic flows more smoothly and efficiently.

iv) Junction Control

This innovative technique use variable traffic signs, dynamic pavement markings, and lane use control to direct traffic to specific lanes based on varying traffic demand.

Benefit
To effectively utilize available roadway capacity and manage traffic flows to reduce congestion.

v) Use of Public Transport rather Than Private
The rising levels of congestion and air pollution found in most of the world cities can be attributed directly to the rapidly increasing number of private vehicles in use. In order to reverse this decline in the quality of life in cities, attempts must be made to encourage people to use their private vehicles less and public transport more.

Benefits
People do not have to spend lots of money on gas, petrol or diesel that they have to fill the tank. Also they do not have to find a place for parking as well.
Using less private cars save environment and people's health as well. It causes less air pollution because carbon dioxide releases to the environment from vehicles become less. There will have no heavy traffic jam.

vi) Open Road Tolling
Open road tolling (ORT) or free-flow tolling is the collection of tolls on toll roads without the use of toll booths. An electronic toll collection system is usually used instead. The major advantage to ORT is that users are able to drive through the toll plaza at highway speeds without having to slow down to pay the toll. In some installations, ORT may also reduce congestion at the plazas by allowing more vehicles per hour/per lane. ORT determines whether the cars passing are enrolled in the program, alerts enforcers for those that are not, and electronically debits the accounts of registered car owners without requiring them to stop. Each car would be equipped with a transponder. "The transponder's personalized signal would be picked up when the car passed through an intersection, and then relayed to a central computer which would calculate the charge according to the intersection and the time of day and add it to the car's bill". Electronic bill toll collection has facilitated the concession to the private sector of the construction and operation of urban freeways, as well as made feasible the improvement and the practical implementation of road congestion pricing schemes in a limited number of urban areas to restrict auto travel in the most congested areas. This will make the ride for people more efficient.

vii) Smarter Road Design
There is a need to introduce the concept of smarter highway which provides, which features luminescent lone lines to improve road safety. In building smart city, there is need to put attention on road design. Today even many urban innovation companies are focused on working towards smarter mobility. Be it safer highway engineering or using better cities. Organic resin can be used by replacing traditional asphalt as a material for eco-friendly roads. It is becoming increasingly evident that poorly planned roods not only increase the negative impact on the environment, but also involve high costs for maintenance.

Overall Benefits of Adopting Innovative Ideas
a) Safety and Security
Innovative transportation technique improves safety and security by providing transport managers with real time information on the location of vehicle, better surveillance of transport stations and stops and better management of road system and performance.

b) Environmental Benefits
Studies have shown that Innovative Transportation Technique has positive impact on environment. The results include reduced congestion, improved traffic flow. It is worth noting that all these factors decreases total vehicle emissions. Improvements in traffic flow will have a positive environmental effect by reducing the fuel consumption. Improved fuel economy also reduces other emissions such as particulates, carbon monoxides and hydrocarbons which affect human health, cause smog and damage to the environment.

c) Reduction in Road crashes
Road crashes will be reduced due to the introduction of innovative transportation ideas. It will provide a significant benefit due to the reduction in primary crashes, better road management and reduction in secondary crashes as incidents are better managed and resolved.

d) Quality of Travel
Implementation of Innovative Transportation ideas can improve quality of travels to customer satisfaction by making trips more enjoyable and safe for motorists, particularly through improved driver information.

e) Effective Road Capacity
Innovative transportation Technique increases the effective capacity of road network by using variable speed limit system as the variable speed varies depending upon the traffic density. The results have also indicated an increase in effective capacity during peak hour.

Contribution of Government in Transportation Management
The Government of India has set ambitious targets of developing public transportation system to support the ever growing urban populace. Green Transport The Government of India has approved a US$4.13 billion plan to spur electric and hybrid vehicle production by setting an ambitious target of 6 million vehicles by 2020 Electric vehicle charging stations in all urban areas and along all state and national highways by 2027 Railways Metro: Ministry of Urban Development plans to invest more than US$20 billion on the metro rail projects in coming years High Speed Rail: The proposed 534 km Mumbai-Ahmedabad high speed rail project will have an investment of around US$10.5 billion Monorail: India's first monorail project at Mumbai will cost around US$500 million, of which US$183 million has been spent on phase I.

Conclusion
Finally it can be said that we are likely to enhance our capabilities in many fields like commerce, industries, setting-up higher education centres while using these techniques. It will definitely be helpful in the growth of our economy and we can step towards sustainable development which creates many employment opportunities. Per capita and national income increases so we can achieve our standard of living

which in turn creates economic development and image building in front of other countries.

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