USE OF TECHNOLOGY FOR EASING TRAFFIC MOBILITY IN SMART CITIES

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ABSTRACT:

A smart city is defined as a city which has the ability to integrate multiple technological solutions in a secure fashion to manage the city's assets – the city's assets include, but not limited to, local departments information systems, schools, libraries, transportation systems, hospitals, power plants, law enforcement, and other community services. The goal of building a smart city is to improve the quality of life by using technology to improve the efficiency of services and meet residents' needs. Business drives technology and large-scale urbanization drives innovation and new technologies. Technology is driving the way city officials interact with the community and the city infrastructure. Smart city initiatives cover a wide range of projects, but urban mobility is becoming a lynchpin issue that ties together energy reduction, sustainability, and technology innovation," says research director Eric Woods. "Devising an environmentally friendly, economically efficient, and voter-acceptable mobility strategy" for the modern city is at the top of the priority list for many smart city planners.

This paper intends to document the initiatives taken by Bangalore city aiming to become a smart city in a larger perspective, and the results it is drawing as on date.

Key Words: Tender Sure, Bus Bay, Road Intersections, Road Sign, Zebra Crossing, Master Plan,

INTRODUCTION

Urban communities are the doors into a nation, showcasing the best conventions of its general public's advancement along each measurement. They are the monetary magnets, hubs for relocation and communities for the progression of learning and fabulousness in science, innovation, craftsmanship and society. India's circular segment of urbanization went into a deep slumber under the British Raj. We remained locked-in, to a great extent, as a land based economy, whilst in whatever remains of the world, amid the eighteenth and nineteenth hundreds of years, urban communities were the impetuses of nations transforming from agrarian social orders to clamoring mechanical center points. This walk hasn't halted – even today, these urban areas are proceeding with their urban trip to embrace and absorb advancements in science and innovation, fuelling monetary advancement over the whole range of present day financial movement – from assembling of products to goods handling and transportation, from buyer business to money related administrations, from exchange and tourism to advanced education and healthcare. Critically, these urban areas assembled powerful city frameworks that have supported their exceptional readiness to adjust to the changing tides and stay at the focal point of the most energizing advancements in today's learning economies driven by innovation, data and correspondence.

Indian urban communities are attempting to play make up for lost time, even as they contribute 65% to the nation's GDP – energetically endeavoring to manufacture their urban establishments, strategies and framework with pitiful assets and with an urban populace blast.

The physical type of urban communities in the developed countries changed quickly in light of monetary movements and specialized technical advancement. Industrialization made mass relocation to urban communities concentrating individuals near occupations, transport innovation – the steam motor, air travel, electric railroads – encouraged national and worldwide exchange systems and tourism, material and building sciences made urban extensions conceivable with scaffolds and passages and constructional innovation made skyscraper towers and large scale manufacturing of homes, the roadway engineering designs, motor cars and rising land costs in downtown areas catalyzed the de-convergence of urban communities and the ascent of the fringe rural areas bringing about a commuting culture amongst homes and employments.

At each phase of the advancement of these urban areas, the arranging, building and outline groups and establishments in these urban areas were galvanized and got effectively occupied with tending to the spatial difficulties of movement in their urban communities, reacting with new arrangements, thoughts for mass transport frameworks, inventive zoning, monetary redevelopment of inward urban communities, interest in expressions and society etc.

We look upon the consequences of these steady recurring pattern of spatial inventiveness with esteem and amazement – the person on foot

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avenues of Paris, the cycling roads of Amsterdam, the transport network of Hong Kong, the notable horizons of New York, the Marina Bay of

Singapore – urban communities peppered with colleges, exhibition halls, libraries and parks. Indian urban areas today are roosted dubiously on the incline of inflexibly managed end-all strategies on one hand and totally clumsy free-for-all business sector decided development on the other. The outcome is unmistakable in the turbulent extension of our urban areas and in the conflicting, alternative nature of open foundation being constructed.

This is incomplete in light of the fact that we have stayed with obsolete aftereffect contemplating arranging from the times of the Raj, while unexpectedly the British themselves have re-examined their own particular Planning Acts various times to be more receptive to the changes. These decayed way to deal with spatial arranging results in ground breaking strategies that have important influence in molding the structure and eventual fate of our urban communities, consigning them to administrative references that simply direct, "What would you be able to utilize this piece of land for and what amount would you be able to fabricate." It is additionally on the grounds that there is no initiative or aggregate possession in the current spatial arranging process. Making arrangements for the future can't be unbendingly thrown into unendingness – rather, the guidelines for arranging our urban communities should empower and adjust to financial movements and resultant downstream outcomes.

The "Urban Spatial Planning and Development" (USPD) guidelines are based upon the premise that bringing such an approach to spatial planning, which takes the middle ground between top- down rigidly regulated planning and completely laissez-faire spontaneity, requires a planning framework. Reflecting this middle ground, the prescriptive perception of the term "Master Plan" has been replaced in USPD with a humbler nomenclature of "Spatial Development Plan". The USPD guidelines rest on two pillars, the first is the strategic framework and the second is the physical framework.

The key structure is worked around three profound principles – Environment, Economy and Equity. These are basic rules that give a reference to the arranging process, taking an adjusted way to deal with each of the three. The principles are not intended to be prescriptive rather they are the framework whereupon outline imagination can happen at any scale and whereupon the organizer can work out the one of a kind qualities and requirements of the specific city. Today, the nonappearance of such an empowering system in our urban communities is reflected in the gaps in all the three profound principles.

This system can just succeed with the venture of political capital and in addition individuals' cooperation. Accordingly,　the vital system is joined by suggestions on vital viewpoints, for example, legitimate and institutional structures, the

connection amongst provincial and neighborhood arranges, the timetables around arranging and amendment forms, forms for fruitful execution and requirement, decentralized structures in agreement with protected procurements and native interest in the arrangement.

The physical structure characterizes the fundamental systems of transport and arranged foundation, whereupon every one of the standards of efficient arranging can be bolstered – zoning developments, travel situated development, thickness portions, redevelopment and so forth. Starting with such a physical structure gives key points of interest to India's urban communities. To begin with, urban development will take after improvement, instead of advancement taking after urban development. Second, state spending plans and consumption plans for open foundation can be connected to get needs that leave such an organized framework arrangement and can be intended to give budgetary and operational productivity. Third, these systems if embedded can address both urban redevelopment and urban expansions. Fourth, this methodology gives instantly noteworthy unique advancement plans for new townships or augmentations. The organized framework arrangement can give a sound base plate to urban development without getting excessively prescriptive, over which different systems can be arranged after some time; financial systems, group systems, green systems, transport systems, density networks and so on.

A look back in to the historical backdrop of India's urban settlements demonstrates that conventional examples of street systems reacted to the utilization of that time – streets and paths were utilized as systems for limited development, group cooperation and flourishing markets . These examples made conservative city shapes and blended use neighborhood where work and home were firmly and closely located. With the coming of cars and far flung development of real urban communities, these examples have been supplanted with a similarly far flung and indiscriminate street system. Walking and cycling as a method for mobility, have been sidelined at a disturbing rate. Individualized methods of engine transport have reacted to the desires of a monetarily engaged white collar class and the inability to give open transport options.

Ensuring that the advantages of mechanized transport are saddled, even as their negatives are minimized, will require numerous progressions including open strategy and behavioral changes. An intelligent beginning stage for any important change in urban mobility, is to enhance our urban street system. This basic system experiences a fivefold disappointment in Indian urban areas:

☐　Our city roads aren't planned in a clear, networked hierarchy of connectivity.
☐　They aren't planned to integrate public transport networks: local buses, city buses, rail and mass rapid transit.

- ☐ They do not provide a continuous network of pedestrian and cycling pathways, thereby ignoring the mobility needs of above 30% of the population.
- ☐ They are constantly under assault by multiple agencies with no planning or coordination between each other. Networked utilities beneath and above the roads – drains, telecom lines, power lines, sewage, water, electric poles, transformers – are haphazardly laid, resulting in a sense of chaos and un-usability of much of the road and footpaths.
- ☐ They have a poor life cycle with inadequate quality assurance on execution and maintenance.

The movement disarray and traffic chaos on Indian streets exhibits a dreary scene of misfortune and harm to life and property of a large number of individuals. Blockage, poor street foundation, rash and careless driving and lacking law authorization are a few reasons for this confusion. In most Indian urban areas the actual for driving congestion is the expansion in number of vehicles and lack of common sense for urban activity administration.

Bengaluru today is obviously one of the most sought after cities in the country, with the rapid growth in the IT industry and the rise in the number of job opportunities in the city. With the rising population in the city there is also a corresponding increase in the number of vehicles in the city and a huge increase in the demand on land. What adds to the traffic pressure in Bengaluru in particular is that there is very little scope for expansion of roads and the need to use existing roads for smooth movement of vehicles is even more pronounced. It thus becomes mandatory for the administration to ensure better parking facilities.

Rapid population growth because of IT and other associated industries in Bengaluru led to an increase in the vehicular

pollution to about 1.5 million, with an annual growth rate of 7-10%. With the increase in population and the expansion of the city, the problem of connectivity of the populace has arisen. Quite obviously personalized modes of transport have grown at a tremendous rate and two wheelers along with the cars almost comprise 90% of the total registered vehicular population in the city. Two wheelers constitute more than 70% of the total volume, while cars comprise 15%, auto rickshaws comprise 4% and the remaining 8% includes other vehicles such as buses, vans and trucks.

A large number of projects by various agencies like BMRCL, BDA, BBMP, Railways and NHAI are currently in progress, which will help in easing traffic congestion in long term. These projects include both the aspects of traffic congestion i.e. creation of efficient transportation system and addition / improvement of road infrastructure. It is worthwhile to highlight here that all these ongoing works will be adding to traffic congestion and it will continue to do so till completion. In fact with the initiation of Metro work and seamless travel plan Outer Ring Road, traffic woes and jams are going to be aggravated for next two years before the benefits are experienced by public in long term. Traffic Police is working in close co-ordination with all civic agencies for creating effective Traffic Management plans which could minimize the misery of common public to the extent best possible.

Following is a list of ongoing projects that contribute to traffic congestion in Bengaluru City:

- ☐ Construction of Bengaluru Metro Rail
- ☐ Construction of grade separators / flyovers / underpass etc. taken up by the Bengaluru Development Authority (BDA)
- ☐ Construction of subways / grade separators / road widening projects etc. taken up by the Bruhat Bengaluru MahanagarPalike (BBMP)
- ☐ Construction of flyovers / roads / car parking spaces etc. by the National Highway Development Authority of India (NHAI)

Few observations on the impact of growth of traffic:

- ☐ All or most of the roads are operating above their capacity and the volume: capacity ranges from 1:2, 1:3 and 1:5.
- ☐ Travel speed has dropped to 15 kmph during the peak hours.
- ☐ Insufficient or no parking spaces for vehicles.
- ☐ Public transport vehicles vying for road space with private modes. Vehicular Traffic in Bengaluru City: (up until 31.03.2015)

Two Wheelers	69,1%
L.M.V	20,5%
A/R	2,7%
H.T.V	2%
H.G.V	1,3%
Others	4,4%
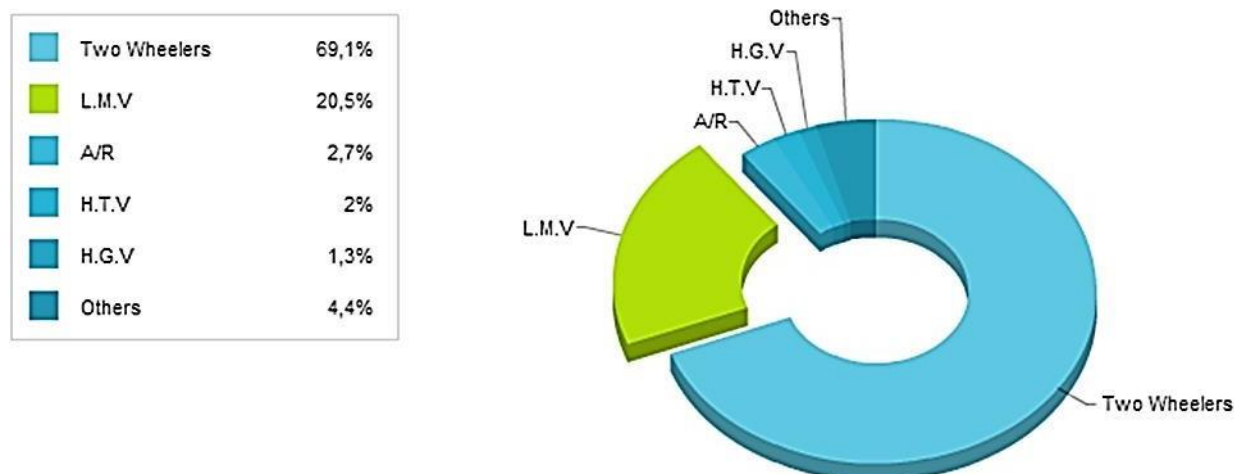
Despite the importance of our urban roads, why is it that we are not getting this critical network infrastructure right? Two critical gaps standout; first, the lack of designs pecifications and the second poor procurement / maintenance contracts.

The potholes on the streets reflect potholes all the while. Befuddling particulars, absence of design standards and guidelines and the discontinuity and fragmentation of the work to numerous small contractual workers are the current norm. We see the outcome in the poor results of street works more than once – corrective surgery that goes on for a couple of days and washes out in the first rain.

As per Miss Swati Ramanathan (Co-founder, Janagraha), Tender SURE (Specifications for Urban Roads Execution) addresses both these gaps in the current system of city road works execution, in two volumes. The first volume contains recommendations for design standards for a range of existing road widths and intersections. Importantly, these volume also details standards for the networked utilities that are housed beneath the road surface. The second volume of Tender SURE is a Typical Contractor Agreement (TCA), intended as a guideline for the municipality in preparing road contracts and inviting requests for proposals (RFPs).

The TCA aims to provide clarity of work specifications, execution, quality, contractual obligations etc. the TCA also aims to bring in transparency in the tendering and bidding process. Typical Contract Agreement (TCA) is aimed at eliminating ambiguity for the contractor about the technical planning and design specifications. The typical TCA requires that contractors be provided with clear survey measurements of proposed site of road works along with RFPs, as well as detailed drawings, design and engineering specifications of work to be executed.

The expectation of Tender SURE is not to re-evaluate the wheel – all things considered, world over Governments are figuring out how to fabricate great streets in their urban areas. It pulls everything together joining expansive brush with prudent subtle element – laying the ground for enhancing the nature of urban streets and arranged base. Streets today are an everyday wellspring of vexation to all. Concentrating on our city streets, the most reproachful of urban systems – Tender SURE can deliberately empower urban change, one street at once.

As of today, Tender SURE has successfully transformed the look and feel and the physical features of St Marks Road and Cunningham Road, and further another 50 roads in the Bengaluru City will soon get the Tender SURE makeover. Since these roads are linked to Metro stations they will be transformed into pedestrians' and cyclists' paradise with wider footpaths and dedicated bicycle lanes. Tender SURE specification roads adhere to three sacred rules — no cutting of trees, no land acquisition and streamlining the traffic flow. The strategic criteria for picking roads are proximity to metro, bus and railway stations, to link phase one of Tender SURE and create a grid- network of roads. Each grid covers at least two kilometers. All the roads have been GIS mapped. The genesis of Tender Sure road is to have transparency and strategic planning of road design. Design is like science. No designs are approved on the table and no plan has been approved in isolation. Co-ordination meeting are being arranged with all the civic authorities.

Mobility indicators to measure performance: (Bengaluru mobility indicators 2010-11)

- Road Safety Index
- Congestion Index
- Travel Time Index
- Slow Moving Vehicle Index
- City Bus Supply Index
- Para transit Index
- Cycling Index

- Walkability Index
- On-street parking interference Index
- Vehicle kilometers Traveled
- Passenger kilometers Traveled
- Total Delay (vehicle-hours and person-hours)
- Public Transport Accessibility Index
- Service Accessibility Index

THE STUDY

a. Research description:

The research has been carried out in the city of Bengaluru, India, where the project Tender SURE is being implemented, with the aim of finding out the effectiveness of the project and how it is easing the problem of mobility for commuters in the city.

The research was conducted in two phases:

- In the first phase, surveys were conducted to find out the problems that people face while commuting in the city and their suggestions to lessen these.
- In the second phase, surveys were aimed at finding out people's knowledge of Tender SURE and their perceptions about the changes they saw after the implementation of the project.

b. Objective of the research:

- The study intends to document the initiatives taken by the city, i.e. Bengaluru, aiming to become a smart city in a larger perspective, and the results it is drawing as on date.
- It strives to find out the kind of innovative technology used to design and implement these initiatives.
- It aims to track the success and progress of the project Tender SURE in Bengaluru and how people have benefitted from it.

c. Hypothesis:

- Implementation of the Tender SURE Project brought significant changes in the Traffic System of Bengaluru.
- Smart City concept entirely depends upon Innovative Technology and people's involvement.

d. Methodology:

- Survey method was used to gather data from the respondents. The data was collected with the help of electronic questionnaires via Question-Pro.
- The respondents of the survey were the netizens of Bengaluru randomly selected from different regions and from different economic strata as well, mostly of the age of 20 years and above.
- Sampling method: Snowball Sampling - It is a non-probability sampling technique where existing study subjects recruit future subjects from among their acquaintances.
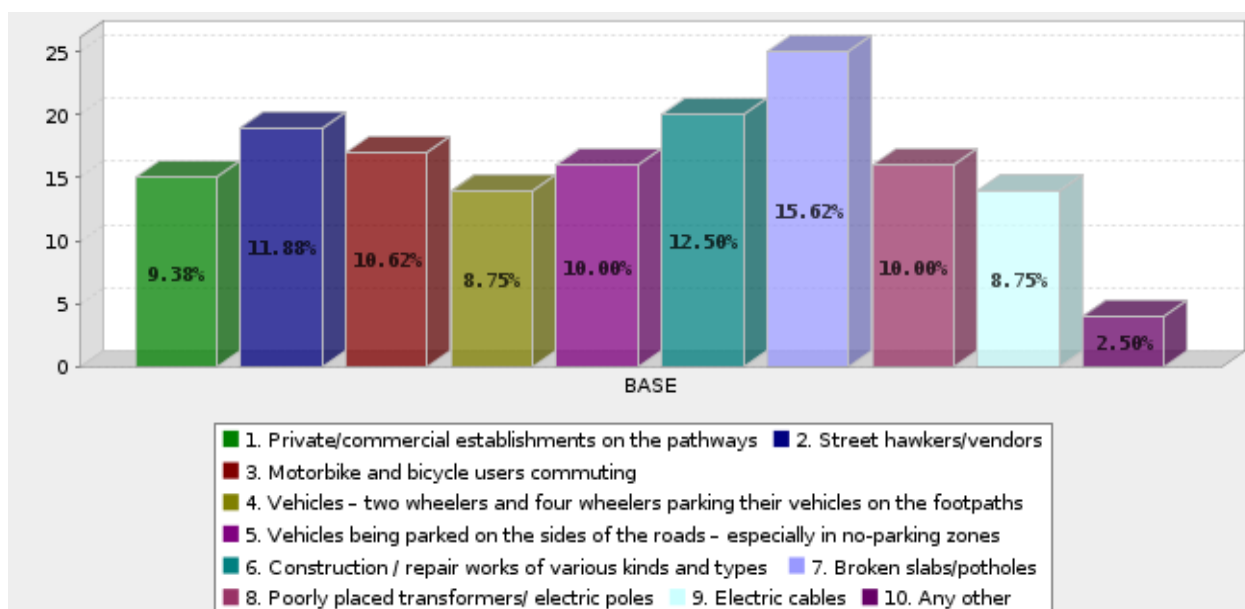- Sample size: 200

OBSERVATIONS AND FINDINGS

1. Tender SURE 1.0: To find out   the problems that   people face while commuting in the city and their suggestions to lessen these

problems.

The survey conducted among the netizens of Bengaluru based on the common areas to analyze had some interesting results. To summarize a few general ones from the respondents' data:

- It was found that 96.55% of the respondents do not have separate demarcated by-lanes for bicycle users in their areas. While outlined by-lanes for bicycle users are not accessible in many regions in Bengaluru, these are gradually coming up under the Tender SURE venture. Since the introduction to this improvement is restricted to particular territories as of not long ago, individuals are not mindful of it. Not with standing, as the task extends to different regions in Bengaluru by mid- 2017, bicycle users would discover paths uniquely intended for them.

- The respondents gave mean ratings of 2.24 and 2.23 respectively (on a scale of 1 to 5) to the roads in their areas for the parameters such as proper width and timely maintenance, which thus indicates that the roads are somewhat up to the mark as desired by the people. The reason for this would be the fact that, since Bengaluru has a huge population, further expanding and a humungous IT base, hence the transportation and communication in this city is constantly given utmost priority to facilitate easy traffic mobility.

- 78.57% of the respondents indicate that the electronic traffic signaling system in their areas were fully functional. This is an indication of the improving traffic management system in Bengaluru and that it is efficient and effective to make use of electronic signaling and reduce human intervention.

- However, following the traffic regulations is still a matter of concern as even today there seem to be man traffic rule offenders who refrain from obeying rules and thus create chaos at the busy traffic junctions. Out of the respondents who confirmed to having fully functional electronic traffic signaling system in their areas, 60.71% of them agreed that they found commuters regularly jumping these signals. Out of the rest who agreed to not having electronic traffic signaling in their areas, 31.58% of them confirmed that there even were not any traffic police officers managing the traffic inflow manually.

- 60.72% of the respondents were dissatisfied with the way traffic signals functioned and traffic inflow was managed in their areas. The reason for this dissatisfaction could be traced to few factors such as unruly behavior of commuters and lack of traffic discipline, incapability of traffic police officials to manage the traffic during peak hours at major junctions, and the increase in congestion on roads due to increasing vehicular population in Bengaluru.

- While 64.71% of the respondents agreed to having dedicated pedestrian tracks in their areas, only 5.88% agreed to having specific tracks for bicycles and 2-wheelers, on the other hand 23.53% of them agreed to having dedicated tracks for LCVs and HCVs. This initiative of having separate demarcated tracks for different categories of commuters is being addressed by the Tender SURE project, and since it's still in its nascent stage much of Bengaluru's population is not aware of such initiatives.

- 63.64% of the respondents have zebra crossings in their areas, while only 27.27% and 9.09% of the respondents have foot bridges and subways respectively in their areas. The concept of foot bridges and subways, though not very old, is slowly coming up in Bengaluru to facilitate pedestrian mobility in busy junctions. On the parameter of how helpful these zebra crossings, foot bridges and subways were, the respondents gave them mean scores of 3.07, 3.14 and 3.14 (on a scale of 1 to 5) respectively. These bear the brunt when it comes to proper maintenance as the civic authorities remain a tad bit slow in this front, thus adding to people's discomfort.

- 1. Private/commercial establishments on the pathways
- 2. Street hawkers/vendors
- 3. Motorbike and bicycle users commuting
- 4. Vehicles – two wheelers and four wheelers parking their vehicles on the footpaths
- 5. Vehicles being parked on the sides of the roads – especially in no-parking zones
- 6. Construction / repair works of various kinds and types
- 7. Broken slabs/potholes
- 8. Poorly placed transformers/ electric poles
- 9. Electric cables
- 10. Any other

☐ of the respondents did not have dedicated and well maintained footpaths in their areas. The respondents mentioned the following reasons that impede pedestrians from using the footpaths:

Out of these, broken slabs/potholes and the construction/repair works were the most common reasons that highly affected pedestrian mobility on the footpaths. However, upon further enquiry it was found that these problems were the outcome of the Metro Rail construction work being carried out in different parts of Bengaluru. Although, the cause of the problems might be cited as genuine, but this on the other hand also shows utter lack of responsibility on part of the civic authorities who ought to have taken steps to minimize the inconvenience caused to the commuters on a daily basis.

1. **Tender SURE 1.1: To find out people's knowledge of Tender SURE and their perceptions about the changes they saw after the implementation of the project.**

This survey was done as a pilot test to find out people's knowledge about the Tender SURE project. However, due to people's lack of knowledge regarding the same, the survey could not generate much response that would have been helpful and sufficient to draw meaningful conclusions in this regard.

CONCLUSION

Bengaluru, as a city, has shown the initiative of transforming itself from a populous habitat with underdeveloped facilities to a Smart City with the amenities that are developed with the efficient use of technology. The secret lies not with the technology, but with the innovative way the technology is used. This is what Tender SURE aims at achieving. Starting from the roads to the footpaths to the metro rail work, Tender SURE ensures optimum usage of these resources with desired outputs in the form of easing the traffic mobility for the commuters.

As should be obvious from the discoveries of the study, Tender SURE has possessed the capacity to make a positive effect in the territories it was actualized. Before long, it will be mapped out to all of Bengaluru and within the following couple of years, Bengaluru will be the retribution case of a Smart City.

Speaking about the hypothesis of the research, Tender SURE has brought critical changes, in spite of the fact that these changes were nevertheless small, to the traffic management and mobility framework in Bengaluru. Likewise, it is consistent with fact that the idea of a Smart City exceedingly relies on the creative innovation utilized and the process as a part of which it is actualized, and inclusion of the general population at the arranging/execution level and at the user base level.

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