Review of BTRAC and Setting up ITS for Mysore City

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Abstract— **The scope of this paper was to conduct detailed study of B-TRAC project with the help of site visits and opinion survey from public. A study of ITS used in other countries was also reviewed. The gap between present technologies implemented in B-TRAC and other ITS systems in the world were given due importance while planning the components of M-TRAC. Studies were conducted to gather the details about the road network and present condition of roads in Mysore. The studies also included the present traffic management scenario and the signal inventory survey. Opinion survey to understand road user needs was conducted and analyzed.**

Keywords— BTRAC, ITS.

I. INTRODUCTION

Intelligent transportation systems vary in technologies applied, from basic management systems such as car navigation, traffic control systems, container management system, variable message signs, automatic number plate recognition, speed cameras, security CCTV systems, to more advanced applications that integrate live data and feedback from a number of other sources, such as parking guidance and information systems, weather information etc.

B-TRAC is the first of its kind project in the country to address the issues of traffic congestion, safety etc, by utilizing the latest traffic management technologies and techniques, which are appropriate to the context. This has given the much needed scope and infrastructure to be planned and implemented for improving the transportation system in Bangalore city.

The population of the city Mysore and vehicular population are growing because of fast developments in the city like IT companies etc. This growth in vehicular population has triggered problems like traffic congestion; increase in travel time, vehicular pollution etc., In order to reduce the traffic congestion and also to make the roads of Mysore safer the Mysore Traffic Improvement project (M-TRAC) has been conceived.

II. LITERATURE REVIEW

Russell et al, (1995) studied the understanding of parking guidance information systems in shinkuju of Japan and found that 61% drivers of the total interviewed noticed sign boards and 81% of drivers understood information to total drivers who noticed the sign boards and out of total understood drivers around 34% drivers used or followed sign boards.

Chatterjee, et al (2002) conducted interview surveys in London revealed that 97% percent of drivers were aware of the existence of Variable message signs, 62% completely understood the information presented on Variable Message Sign, 84% considered the information presented to be useful, and 64% had at least on occasion diverted in response to the travel time information.

Marell et al (1996) studied the difficulty of the drivers to reduce speed and maintain within the permissible limits with very short notice in the restricted areas like hospitals, primary schools, etc.; where ESC functions as an alerted in such situations. It was found that 43% of respondents perceived that they would be able to keep speed limit with the help of an ESC.

S.S.Jain, et al, 2011 conducted a study of about 200 users are surveyed and among them, about 50% of age group 40 to 50 years, 60% of the drivers who were educated to 12th class and 68% of occasional trip frequency respondents have not understood the information of VMS. And it also states that around 45% of the requested information of the drivers if for parking guidance while 31% is for parking location.

III. BANGALORE TRAFFIC REGULATION AND CONTROL (BTRAC)

B-TRAC was envisaged by the Bangalore Traffic Police in order to address the ever growing traffic operational needs of Bangalore City Traffic. The Bangalore City Police obtained the approval for this project from Government of Karnataka to initiate immediate steps for traffic improvement in Bangalore City. Bangalore City Police has signed a Memorandum of understanding with Karnataka Road Development Corporation Limited (KRDCL), a special purpose vehicle to implement the project on its behalf. The B-TRAC project is divided into five Phases covering a time period of five years starting with 2006-2007.

3.1 Benefits of B-TRAC
The following were the expected benefits of B-TRAC project,
1. Reduced congestion in the Central Area of Bangalore City.
2. Substantial compliance of Traffic Laws Rules.
3. The junction improvement to streamline traffic.
4. The road markings and the signs will help in considerably improving traffic safety.
5. Variable Message Signs (VMS) to divert traffic from the congested portion of the city to alternate routes.

6. The establishment of Traffic Management Centre to help in better management of traffic in Bangalore City.

3.2 Components of BTRAC:

3.3.1 Intelligent Transportation System

The following are the components of Intelligent Transportation System

- o Automated Signaling system
- o Vehicle actuation
- o Signal processing
- o Area traffic control system

Fig. 3.1 Vehicle Actuation System Based Signal

Fig. 3.2 Loop Detectors for Vehicle Detection

3.3.2 Surveillance / Enforcement System

The following are the system used in Surveillance and Enforcement

- o Surveillance / enforcement camera system
- o Mobile surveillance /enforcement system – interceptors
- o Traffic scanning and traffic automation center
- o Monitoring of BMTC buses
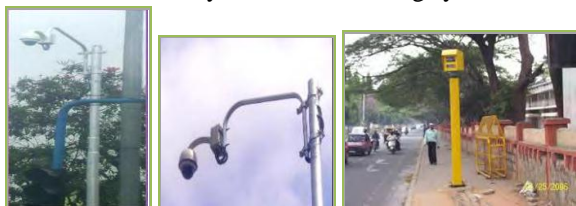- o Blackberry based e-challaning system

Fig. 3.3 Photos of Dome type PTZ Camera and Red Speed Camera

3.3.3 Information Dissemination System

Information dissemination system (also for Parking information system) divides into,

- o VMS
- o FM channels
- o SMS based dissemination system

Fig. 3.4 SMS Alert System and VMS System

3.3.4 Public Interface

One of the important aspects of any traffic management scheme is to educate the road users and have constant touch with public. Bangalore traffic police is also using a number of methods using IT based methods. The methods used by them are:

- o Bangalore traffic police Web-site
- o Bangalore traffic Facebook account
- o Interactive Voice Response System (IVRS)
- o Education / awareness and capacity building

Fig. 3. 5 Web – Page of Bangalore Traffic Police, Facebook Account Page

IV. SURVEY CONDUCTED AND ANALYSIS

Subsequent to review of B-TRAC, the following surveys were conducted at Mysore City.

- Road Inventory and Signal Inventory

This was followed by Opinion Survey

- Opinion Survey of B-TRAC and M-TRAC

Mysore, one of the largest districts in Karnataka, is an important tourist and heritage Center. It was the erstwhile capital of the princely Mysore State. It is now the headquarters of Mysore District covering an area of more than 40 sq. km.

Mysore is located at 770 m above sea level at 12.18° N 76.42° E and is 140 km from Bangalore, the state capital. The population of the city is 8, 87,446 consisting of 4, 62, 617 males and 4, 24,849 of females according to the census of 2011.

Table 4.1 Land Use Distribution

| Category	Area in hectares	% Area 2001	Category	Area in hectares	% Area 2011
Residential	2849.91	39.9	Residential	6097.87	43.45
Commercial	215.95	3.02	Commercial	344.07	2.45
Industrial	962.61	13.48	Industrial	1855.05	13.22
Park and open spaces	981.7	13.74	Park and open spaces	1055.05	7.52
Public semi-public	639.69	8.96	Public and semi-public	1180.78	8.41
Transportation	1150.27	16.1	Traffic and Transportation	2380.56	16.96
Public utility	36.48	0.51	Public utility	43.35	0.31
Water sheet	143.99	2.02	Water sheet	178.95	1.27
Agricultural	162.33	2.27	Agricultural	898.99	6.41
Total	7142.93	100	Nehru Loka	1634.82	-
Nehru Loka	2078.14		Total	15669.49	100
Total	9221.07				
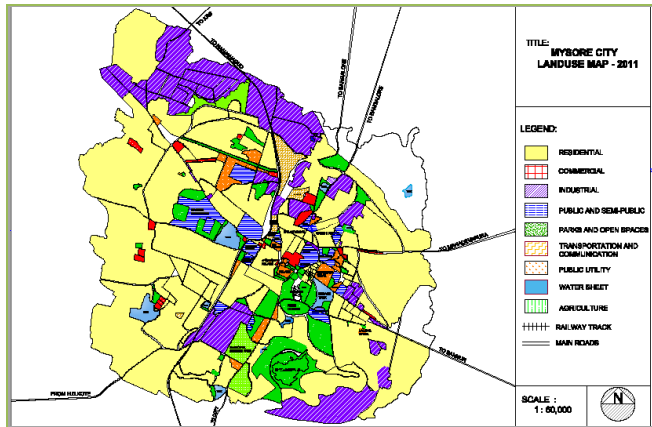
Fig. 4.1 Land Use Map – 2011

Table 4.2 Existing Road Details in Mysore City

Road and road transport	
Municipal Roads (km.)	1,093
PWD (km.)	57.78
NH (km.)	5
SH (km.)	45
Outer Ring Road (km.)	32.2
Intermediate Ring Road (km)	21.7
Inner Ring Road (km)	7.12
Public Transport	
- Number of Buses (both inter and intra city)	767
- Bus Capacity / passengers(Ratio)	255
Private Registered Vehicles	2,89,278

The total number of intersections in Mysore City is 210 out of which 30 have traffic signal lights, 22 have blinkers and 158 are controlled manually by policeman. Table shows some of the major intersections and lane wise distribution having traffic control measures.

Out of the eleven locations, Columbia Asia Hospital intersection has two surveillance cameras whereas all other location have a single surveillance camera each.

4.1 Opinion Survey:

Opinion survey has been conducted to find out the condition of B-TRAC Project in Bangalore and ITS in Mysore. Opinion survey will help us to find out whether the B-TRAC project and ITS components has really helped in terms of better movement of traffic, safer movement of traffic etc., apart from opinion survey field visits has been made to various junctions to collect the relevant data.

The surveys were conducted at different location for Bangalore City on a normal working day along the present traffic corridor. The opinion survey was conducted for sample of 500 people at main areas such as, Majestic, Shivajinagar, Malleswaram, K R Puram, Kengeri, Vijayanagar, Banashankari, Jayanagar, M G road, BTM Layout, Indiranagar, etc.

The surveys were conducted in Mysore city at different locations to know the present scenario of ITS components and the people's awareness of ITS components. The survey was conducted

on a normal working days. The opinion survey was conducted for sample of 500 people at main areas such as Main bus stand, City Bus stand, Siddarthanagar, M G Road, Vijayanagar, outer ring road etc.

The opinion survey questionnaire was prepared in such a way that all the technical and general questions were included. Opinion survey format for BTRAC and MTRAC are attested in the annexure part.

4.2 Analysis of Opinion Survey for BTRAC:

- Majority of the respondents knew about the B-TRAC project.
- Majority of the respondents saw improvement in the flow of traffic after junction improvement, signal up gradation and installation of new signals.
- Majority of the respondents saw the advantages of road marking like lane markings, edge line markings, center line markings and pedestrian markings which helped in systematic movement of traffic.
- Majority of the respondents saw the advantages of signage like informatory signs, warning signs and regulatory signs. The informatory signs provided at majority of the junctions helped the drivers to reach their destinations safety.
- Majority of the respondents said that the blackberry's and printers provided to the police were really advantageous. The survey respondents told that the blackberry saves time, avoids going to court, good for enforcement, excellent tool for catching over speeding vehicles, signal jumping vehicles and malpractices and they are also happy because they get on the spot receipts for payment of fines.

4.3 Analysis of Opinion Survey for MTRAC (ITS components):

- Majority of the respondents knew about the ITS Components.
- Majority of the respondents saw improvement in the flow of traffic after junction improvement, signal up gradation and installation of new signals.
- Majority of the respondents saw the advantages of signage like informatory signs, warning signs and regulatory signs. The informatory signs provided at majority of the junctions helped the drivers to reach their destinations safety.

Some of the suggestions given by the respondents of opinion survey are,

1. Pedestrian zebra crossings are fading away and they should be repainted.
2. There is improper/illegal parking near malls, Hotels, Cinema Theatres.
3. General public and the drivers should be educated about the traffic rules regularly.
4. Provide adequate amenities for pedestrian, bicyclists, physically challenged people and provide landscaped medians etc.,
5. Traffic laws should be strictly enforced.
6. There should be proper maintenance of traffic junctions, sign boards etc.,

7. Drivers who are violating speed limits and jumping red signal should be heavily penalized.

8. Maintenance of surveillance cameras, enforcement cameras, traffic signals etc., should be done periodically to make sure maximum number of cameras and signals are working at any given time.

9. Increase traffic awareness among the general public about traffic laws and giving right of way to pedestrians and bicyclists.

10. Police should enforce traffic laws and prevent more traffic violations.

11. There were too many signs provided at one location which will distract drivers but it also confuses the drivers.

V. SETTING UP ITS FOR MYSORE CITY (MTRAC)

Based on the experience gained from B-TRAC the first agenda for M-TRAC should be

1. Traffic Improvements
   - Junction Improvement
   - Signage, road markings
2. Surveillance and Enforcement elements
   - Cameras
   - Control Centre
   - Blackberry and e-challaning
3. Information and Messaging system

M-TRAC can be envisaged as a 5 year program. For the total M-TRAC project, it is considered essential to have an operational plan that has earmarked funds and identified activities. The operation plan is to be chalked out annually for the next five years

The above action should be taken up in the first two years. The computerization of registration records should be completed before the first year and automatic challaning of vehicles should commence as soon as possible.

The Emergency Management ITS components like way for Ambulance and Fire Engines should be implemented in the 3rd year

The following years should focus on installing corridor management through ATC's. It would useful for review BTRAC on this subject before this could be implemented as lessons learnt will help.

The Bus ITS that is currently been deployed in Mysore should be integrated with M-TRAC and this could be pursued in the 4th year. The Freight Management system should also be pursued in the 4th year.

5.1 Junction Improvement

Mysore as of now has about 210 intersections and out of these about 60% are located on arterial and sub arterial roads that cater to more than 80% of the city's traffic. Some of these junctions relate to crossings between two major roads and others between a major and a minor road. There are few junctions with 5 or more legs also. Since the capacity of a road network depends on the junction capacity, a focused approach on this component would definitely provide substantial relief to the traffic.

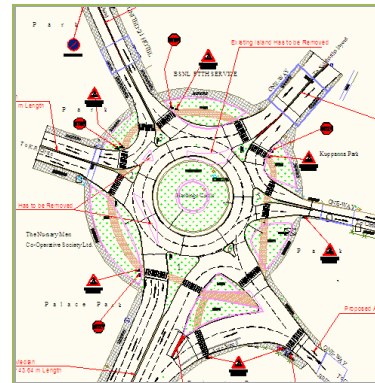A sample of specific improvements to junctions is shown as junction plans below.

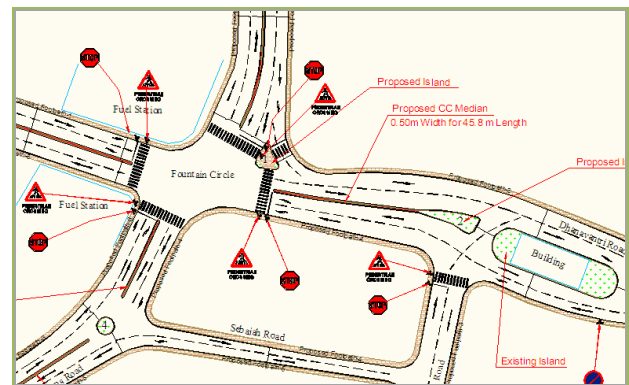Fig. 5.1 Improvements to Harding Circle

Fig. 5.2 Improvements to Fountain Circle

5.2 Street Furniture and Road Marking

Mysore has about 1,100 Kms of roads and of this, about 200 Kms of roads fall under arterial and sub arterial category. It is proposed to improve all arterial roads in Mysore with state of the art signage, road markings and street furniture including safety devices.

Fig. 5.3 Street Furniture and Road Marking

5.3 Surveillance and Enforcement Cameras

The ratio of number of police personnel in Mysore to the number of vehicles is roughly about 1:600. Since this situation is going to worsen over the next few years due to rise in number of vehicles, in order to manage the situation with better productivity, automated enforcement system is required. This requires state of the art equipment. The Enforcement Cameras are installed primarily to capture two key violations i.e. over speeding and red signal light jumping.

The camera uses Digital Technology to capture images of offending vehicles.

Traffic Surveillance cameras are already installed at 42 locations, of which some are not in working condition. Hence it is proposed to install High Definition Cameras on all the locations.

Also, surveillance cameras have to be installed at event – specific location, i.e. the palace, the Police Commissioner's Office, Airport, Chamundi Hills, Brindavan Gardens and along the route envisaged by the Dasara procession starting from the Palace to Banni Mantap.

5.4 Establishment of Traffic Management Center:

The Traffic Management Center (TMC) should be the hub that connects all the city's traffic control devices. TMC should have the various components of traffic management (signals, control boxes, real time video) effectively managed by a team of qualified traffic personnel who monitor and control all signals throughout the city.

This center should also act as the database for all traffic data in the city. This should also be the place where information management for the traffic website for the city is carried out. All information about the traffic pattern in the whole of the metropolis is brought over here on an online mode. Experts and highly trained staff will be monitoring the entire traffic system form this place. The general characteristics of the transportation system like the street pattern, road widths, restricted turning movements, restrictions on certain types of vehicles from using the network will be available on a map. Live information such as which phase of signals are green will be displayed live. All these information will be used to produce road user information and transmitted to appropriate places.

TMC will be the focal point for communicating transportation related information to the media and the travelling public, and a place where agencies can coordinate their response to transportation situations and conditions. The TMC links various elements of ITS such as VMS, closed circuit video equipment, and roadside count stations enabling police officials to identify and react to a traffic incident in a timely manner based on real time data.

The existing TMC is functioning from the Police Commissioner's office equipped with LCD Monitors and connectivity has been established in order to receive live feeds from existing signal installation location, surveillance cameras and enforcement camera.

5.5 Expected Benefits from the MTRAC Project

The MTRAC project when successfully implemented will provide a much better environment for the pedestrians, drivers of vehicles and other road users in terms of comfort and better mobility. The benefits that are likely to be achieved through MTRAC are listed below:

- Reduced in Traffic Congestion
- Reduced in Accidents
- There will be significant reduction in pollution

- Compliance of Traffic Laws and Rules by the road users
- Establishment of ITS enabled Trauma Care System
- Coordinated traffic management
- Enhanced awareness about traffic rules and road safety

5.6 Recommendations for M-TRAC

Fast growing economic climate in Mysore has contributed to increased vehicle ownership and population. This has resulted in more number of trips being performed which explains the ever increasing demand side of the situation. The present traffic operational problems are that of congestion, safety and environmental degradation. The immediate need is to find traffic management solutions which can buy certain amount of time while long term transportation planning solutions are implemented.

Special types of enforcement cameras need to be used in selected locations to enforce speed regulations and also to monitor and prosecute road users who violate traffic rules. A Traffic Management Center has to be established which will act as the main control center for all traffic managing activities. All the traffic signals, cameras, automated parking areas and Variable Message Panels are to be connected to this center and should be controlled by this center.

The expected benefits should be quantified and then converted into monetary units so that appropriate economic and financial analysis can be carried out. The data that needs to be collected pertains to speed and delay, volume, intersection performance, accidents, environmental performance and road user satisfaction.

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