



Moving smoothly, nationwide

Traffic management systems are the need of the hour across the country. The following case studies show how the complex issues are being tackled in various locations nationwide

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Bangalore city traffic monitoring system

Bangalore's Traffic Improvement Project aims to reduce congestion, accidents and pollution in one fell swoop

Bangalore is notorious for its traffic congestion. Traversing the city at the best of times is a pain. Most arterial roads and intersections are already operating over their capacity, and commuters in the city centre manage average speeds of no more than 10km/h. With the aim of turning around this sorry state, the Bangalore traffic police launched the Bangalore Traffic Improvement Project B-TRAC 2010 in 2008. The project adopts a technology-driven approach to reduce traffic congestion in the central area and road traffic accidents by 30%, reduce pollution and substantially improve compliance with traffic laws and rules.

The project was kick-started by the establishment of a hub for the intelligent transportation system (ITS) at the Ashok Nagar police station. The centre also houses a traffic helpline (103) for motorists to register their grievances, which are then addressed in a time-bound manner. In a few months' time the centre will be relocated to a 60,000ft² area built specially for the purpose on Infantry Road.

Managing junctions is a core function of the ITS. Each signal is programmed to operate one of several plans during the day and separate plans at weekends. Live feeds from 179 surveillance cameras and detector loops laid beneath the surface of major junctions across the city yield a steady flow of traffic density data. These streams of real-time data transmitted through dedicated lease lines help monitoring teams adjust signal timings and queue lengths to reduce instances of temporary congestion. Called the Area Traffic Control System, this covers 14 corridors carrying about half of the total peak hour traffic. It allocates green signal time based on demand while also ensuring non-stop passage through adjacent junctions. If temporary instances of traffic pressure recur frequently, the signals are reprogrammed.

According to Praveen Sood, additional commissioner of police (Traffic), "The new system ensures that traffic signals are never switched off and managed manually as was done earlier during peak

hours, heavy rainfall followed by water-logging or during VIP movements."

One hundred signals are already working in the vehicle-actuated mode – if no vehicle is sensed waiting for four seconds, the signal automatically turns red to clear oncoming traffic. Adjacent signals are partially synchronised using the signal progression method to minimise delays.

Together, the surveillance cameras, five additional enforcement cameras and nine mobile interceptors positioned across highways entering the city capture and beam over-speed, signal jumping and line-crossing violations as they happen in the city centre. Monitoring teams record the instances to use as evidence in court.

Feeds showing errant motorists are then transferred to an automated system, which uses a central digitised database of driving licences and vehicle registrations to issue traffic tickets to offenders. Citizens can also find out about violation notices pending against their vehicles via SMS. Additionally, photos and videos of violations and offending motorists are posted on the traffic police website, only to be removed after the fine is paid. Hence the transition towards evidence-based enforcement.

Close networking with the office of state transport commissioner made the databases available and helped establish the automated enforcement system. Without this cooperation the camera system would be reduced to mere traffic monitoring devices.

Other components of the ITS include 20 variable message sign (VMS) boards to inform motorists about the expected travel time between two locations, and provide incident data. Similarly, Traffic Scan uses video analytics, mobile phone density and data from BMTC buses equipped with GPS to generate real-time congestion information and calculate the 'live' average speed along certain roads.

A parking information system initiated at five locations conveys information about the availability of parking slots in paid car parks across the city through parking information boards, VMS boards, SMS or the traffic police website. This is coming into effect as more and more paid car parks become computerised.



All 650 senior traffic police officers have been provided with Blackberries and Bluetooth-enabled printers to migrate the paper-based manual enforcement system to a Blackberry-based spot fining system. Besides reduce paperwork at traffic police stations, implementing m-governance has helped reallocate traffic personnel for field duty. Statistics show that it has also increased traffic violations booked, from 14.4 lakh in 2007 to 33.3 lakh in 2010. Fine collections have also risen from Rs 19.9 crore to Rs 47.5 crore in the same period. Sood says, "The ITS has helped reduce incident response times, disseminate traveller information, reduce congestion and enhance road safety."



(Above) **Bangalore traffic police officers have been equipped with BlackBerry smartphones, giving them access to the large central database of vehicles, drivers and offenders**

(Left) **B-TRAC 2010 is the first of its kind project in the country to address the issues of traffic congestion, safety, etc, utilising the latest traffic management technology**

“ Photos and videos of traffic violations and offending motorists are posted on the traffic police website, only to be removed after the fine is paid ”

A TECHNICAL CONSULTANT'S EXPERIENCE

The need to make sense of the chaotic traffic in Indian cities and traversing the country's growing network of highways, bridges and tunnels presents lucrative opportunities for traffic system vendors. Still, the way forward is riddled with challenges. PwC India, in association with the Karnataka state e-governance department, provided technical consultation and designed the intelligent traffic system deployed in Bangalore. Sharing the results from the experience, Neel Ratan, executive director, e-Governance Practice of PwC India, says, "Building the capacity of field personnel takes the longest lead time. Overhauling the existing weak infrastructure posed some difficulties too, as did resolving pockets of 'network shadow zones' or 'no

signal zones' in Bangalore's high-rise, urban environment. With a large number of vendors coming together for the project, solving existing inter- and intra-vendor coordination issues and converging all the existing vendors to a single vendor platform/single cellular matrix also caused a few hiccups. Lastly, we had to change the vendors' focus from SLA availability to the actual delivery of services. Sometimes individual SLAs of vendors may be met but still impact service availability."

Despite the challenges, the project went on to win the National e-Governance Award gold prize in the Innovative E-Governance Projects category at the 14th National Conference on e-Governance held in February 2011.



Bandra-Worli Sea Link

Traffic management systems can help attract more commuters to use newly constructed bridge infrastructure

The cable stays of the iconic Bandra-Worli Sea Link (officially the Rajiv Gandhi Sea Link) – an engineering marvel off the coast of Mumbai in the waters of the Arabian Sea – glisten from afar during the day and, lit up, twinkle as brightly at night. The 5.6km-long, 126m-tall express-bypass cable-stayed bridge is built with pre-stressed concrete viaduct approaches, and was hailed as Mumbai's big-ticket infrastructure project. Built at a cost of Rs 1,634 crore by Hindustan Construction Company for the Maharashtra State Road Development Corporation, the project marks a milestone for the country and all the stakeholders, including its septuagenarian designer – structural engineer Seshadri Srinivasan, design and project managing firm Dar Al-Handsah, and Eikon, the company that implemented the toll collection and traffic system management for the bridge.

This open sea link between Bandra and Worli was designed to ease the flow of traffic between suburban Bandra and central Worli, and hasten the commute between these two busy centres. Travellers can save nine-tenths of the time it takes to drive through the inland Mahim Causeway during peak hours. At each entry point of the sea link, commuters pass through a



Eikon India's Bandra-Worli toll plaza

“ There are space constraints, the installation procedures are different and when the bridge is a sea link, environmental conditions play a significant role ”



It was initially predicted that 1.2 lakh vehicles would be using the sea link by 2011

toll plaza built to serve all 16 lanes of the bridge, eight in each direction of travel. Four of the 16 lanes operate an ETC system to ensure non-stop flow of traffic in those lanes. The fully automated system on the free-flow lanes reduces the transaction time to three seconds. The remaining toll lanes operate using the semi-automatic touch-and-go methodology.

A robust traffic management system secures passage over the bridge. It provides three VMS boards to share traffic updates and inform commuters about the road conditions ahead, as well as the weather and any accidents that may be slowing down movement; they also pass on general awareness messages. Four pairs of emergency call boxes are fitted on each side of the bridge for commuters.

The Pan-Tilt-Zoom (PTZ) functions of CCTV cameras installed at six strategic locations on the link are controlled from the main control room situated near the toll plazas. Two meteorological systems collect weather parameters on the bridge. A traffic counter/vehicle classification system is installed on the gantry. “This was preferred to in-road sensors because installing in-road sensors requires digging on the road, which is best avoided on a bridge,” explains Hari Nair, senior vice president, Marketing & Sales, Eikon India. Technically, though, Nair believes both systems offer comparable results.

Signals for the intelligent traffic system are transmitted via a fibre-optic cable housed in PVC conduits running parallel to the bridge corridor. Facilities to assist enforcement are also worked into the design in the form of pull-out places, to

allow drivers and enforcement officers to safely pull out of traffic.

Speaking about the challenges faced in completing this project, Nair says, “Designing a bridge system requires a completely different approach to a system for a normal road. There are space constraints, the installation procedures are different and when the bridge is a sea link, environmental conditions play a significant role. Besides, this project was rolled out in two phases. In the second phase, we had to install equipment without disturbing traffic.”

Rlnfra won the concession to collect tolls and operate the link for 40 years, and also the Rs 5,000 crore contract to construct and operate its 7km leg extension from Worli to Haji Ali. Motorists pay Rs 50 for a one-way journey on the existing leg of the sea link and Rs 75 for a return journey. The toll for a minibus (12-seater) or goods vehicle is Rs 100; for a truck or a bus the one-way toll is Rs 130. Regular commuters opting for monthly, daily or night passes get a 40% discount.

Usage of the sea link currently stands at 50,000 vehicles on a weekday and drops to anywhere between 30,000 and 35,000 at weekends. The traffic system will help drive usage by facilitating several promotional schemes. First-time users will be offered discounts on travel, and discounts for weekend travel will be introduced. The intelligent traffic system will help prevent the abuse of such schemes because it records vehicle registration numbers. The lanes will also be made one-way to avoid bottlenecks at the exit points.

Tunnel traffic management system

New tunnels being constructed present opportunities for tunnel traffic management system vendors

It is commonplace for long tunnels to be equipped with basic life support systems such as ventilation and lighting. But the increasing traffic density through them necessitates the use of advanced traffic management systems encompassing central control and management systems installed in an operations management centre and devices installed in the tunnel. Such technology plays a vital role in tunnels, where even the most minor accidents can cause great loss of human lives and damage. Together, the components help ensure the highest possible level of traveller safety and superior motoring conditions.

India does not have a large number of road traffic tunnels. Still, the roll-out of ambitious road infrastructure projects is giving the country some new landmarks, including tunnels that promise to improve motoring conditions in far-flung northern mountainous regions. The Rohtang tunnel and tunnels under high passes in Ladakh have been planned to ensure uninterrupted transport all year round.

In November 2000, the Himachal Pradesh State Electricity Board (HPSEB) inaugurated the first phase (800m long) of a tunnel connecting Thalout and Aut on the Manali-Kiratpur Highway. In August 2006, the second phase of the tunnel was launched. At 2.809km, the completed tunnel is said to be the longest in India, constructed to the specifications of the Ministry of Surface Transport.

Constructing tunnels does not fall under the purview of the HPSEB, but this double-lane traffic tunnel is in the Larji hydro-power project area, located some 40km from Mandi. The need to construct the D-shaped tunnel arose because part of the existing national highway would be submerged after the new reservoir was constructed. The tunnel – with a diameter of 10.5m, a 7.5m-wide carriageway, and an additional 1.25m footpath on either side – was constructed after a detailed study of traffic volume, bearing in mind that it is expected to help promote tourism in the hilly state. The tunnel also has two drainage/cable trenches beneath each footpath for telecom cables.

At present the tunnel uses no modern technology to monitor the efficacy of its ventilation systems, which comprise two ventilation shafts that are 2.5m in diameter, and 94m and 76m high. No CCTV has been installed to monitor the traffic passing through the tunnel and broken-down vehicles parked in the four lay-bys within the tunnel. Motorists must rely on road delineators for visibility.

The HPSEB is operating and maintaining the traffic tunnel and is not charging motorists any toll. A proposal to initiate toll tax has been submitted to the state government. Anil K. Dutta, director (Projects), HPSEB, hopes that toll collection will be permitted, thereby generating resources for meeting the essential annual expenditure on the tunnel.

“So far we have only asked IIT-Roorkee to look into the better functioning of the ventilation shafts. If collection of toll is allowed, a fire detection system, air quality measurement system, power supply management system, emergency route management, tunnel lighting management, speed limit signs, lane control signs, emergency call system, CCTV system and traffic data management system could be installed. As it is, the bare minimal lighting is costing the HPSEB about half a crore rupees annually. Better amenities would in turn increase the comfort level of the traffic passing through the tunnel, besides promoting better safety,” opines Dutta.

“...the tunnels promise to improve motoring conditions in far-flung northern mountainous regions”

Another opportunity for vendors of tunnel control and monitoring systems that is likely to come up is the US\$500 million Chenani-Nashri tunnel project in the state of Jammu & Kashmir. This 9.2km two-lane (13.3m diameter) tunnel and parallel escape tunnel (5m diameter) is being constructed by Leighton Welspun Contractors. When completed, the tunnel and its approach roads will provide a 10km alternative all-weather route for 41km of the existing NH1A passing through steep mountainous terrain. As such, the tunnel has significant geometric, weather and safety issues.

Jammu & Kashmir will be much better connected after this tunnel is commissioned, replete with advanced ventilation systems, electrical power distribution system, fire hydrant system, lighting systems, systems for the measurement and control of air quality, fire detection systems, evacuation systems, CCTV surveillance and automatic incident detection systems, emergency telephone system, public announcement broadcasting systems and traffic signage system.



Highway traffic management system

Joint ventures may be the best way forward for intelligent traffic system vendors entering the price-sensitive Indian market

The 28km-long Delhi-Gurgaon Expressway on National Highway No 8 is not long, but its significance stems from the sheer volume of traffic it sees: more than 200,000 vehicles per day, necessitating three toll plazas. Of these, the toll plaza at the Delhi-Gurgaon border is India's largest and the world's fourth largest, boasting of 36 lanes (32 plus four reversible). The project has more than 25 ETC lanes, which allow non-stop passage of the vehicles.

DS Constructions awarded the project to design, supply, install, test and commission the toll systems and traffic control equipment for the section, and also maintain the systems for 36 months post-installation, to a joint venture of Kapsch TrafficCom AG of Austria and Delhi-based Metro Infrasyas P Ltd. They were given three months to commission the systems. "It was a scope-sharing JV created specifically for this project, with the provision to be extended for future projects as well," explains Sachin Bhatia, director, Metro Infrasyas.

Metro Infrasyas entered into the tie-up with the vision that ETC technology would be the future of tolling, well-suited to the class of vehicles and commuters expected on an expressway connecting the capital city with a city that is almost its suburb. The reckoning turned out to be right. More than 100,000 users have opted for the microwave tag-driven ETC and

non-stop commutes instead of using the services of the manual operator handling cash or semi-automatic terminals using contactless smartcards.

Kapsch perceived the JV as an opportunity to enter the burgeoning Indian market for toll systems. According to Kapsch TrafficCom AG's Gerald Becvar, director, Marketing & Sales Asia, Road Telematics, "It is impossible for a foreign company to carry out an infrastructure project in India without local resources; therefore a JV with a local partner was necessary and Metro was the best choice."

"We conducted test runs of all the equipment on our own mock toll lane and development centre for software, hardware, and simulation in Manesar," reveals Nitin Thakur, product manager, Metro Infrasyas.

At the toll plaza, a lane controller controls all the core components of the lane system and integrates and controls all the peripheral equipment – the barrier, user fare display, lane traffic lights, toll booth, light curtain and treadles, frame capture system, overhead lane sign and ETC systems for the access of the lane.

At the start of the project in 2008, most of the equipment was imported. Now Metro Infrasyas manufactures all the manual and automatic systems, with only the automated vehicle classification and ETC components coming from Kapsch.

According to Thakur, the most challenging aspect of executing this project was the limited time given to complete the installation, and the parallel execution of civil works. "It



The fourth-largest toll plaza in the world

“ The best part of working with Kapsch has been its understanding of the price sensitivity of the Indian market ”

also took us some time to learn how to simultaneously manage the ETC tags and cash transactions, and how to achieve the desired accuracy level of AVC," Bhatia adds. "But the experience served us well, and we've gone on to implement similar projects. Still, it was a wonderful learning opportunity. The best part of working with Kapsch has been its understanding of the price sensitivity of the market and willingness to transfer technology to indigenous systems. Now Kapsch just provides the key subsystems that are critical for the success of traffic systems, thus ensuring world-class quality at reduced costs."

For Kapsch, the experience was useful too – it discontinued its turnkey technical solutions as these proved too expensive for the price-sensitive Indian market. "But Kapsch supports Metro in developing their solutions and delivers subsystems to Metro to integrate in their solution," adds Becvar. That, for the time being, seems the best way forward for high-end overseas traffic technology companies.

Kapsch's experience in supply, technical and commercial operation of tolling systems and the acquisition of MARK IV, a leading RFID player from USA, has enhanced its capacities in designing clearing houses and in RFID-based ETC systems. With the National Highways Authority of India finalising the specifications for rolling out ONE ETC tag RFID-based technology throughout the nation, Kapsch and Metro look forward to taking their collaboration to the next level.



Gautam Budh Nagar district surveillance-cum-traffic system

Established and new players may be attracted to bid for a contract to install a district-wide comprehensive traffic management, e-governance and surveillance system

Gautam Budh Nagar isn't well known to many Delhi residents. But Noida, one of the constituents of this 650km² district falling in the state of Uttar Pradesh as well as in the Northern Capital Region, is. Noida, no less a satellite city to the capital than Gurgaon, has always lurked in the shadow of its upmarket southern counterpart. One reason for this is that the city carries the baggage of being located in Uttar Pradesh, which often makes headlines for the wrong reasons – crime, notorious traffic, etc. Now, however, the city is poised for an image makeover, as the Noida Authority envisages setting up an intelligent traffic system for the district of Gautam Budh Nagar encompassing Noida, Greater Noida and a part of the Yamuna Express Authority.

The first phase of this Rs 380 crore endeavour will be rolled out in the second half of 2011 and is expected to be completed within 18 months from the day of awarding the contract. For starters, it will help residents breathe easy when setting out on the road, as traffic status updates to help commuters stay clear of jams at about a dozen main junctions will be available on electronic display boards.

These signboards will be fed by streams of data originating from 1,150 high-tech cameras installed at 10 major crossings and 17 border points. The cameras will help police officers enforce traffic rules and adjust traffic signal timings to cope with the traffic detected. Traffic signals will also be adjusted when the cameras spot the occurrence of incidents (such as accidents) that are likely to cause bottlenecks.

“ The rapid scale at which vehicles are being added to the city and country's roads makes such intelligent systems an essentiality ”



New ITS technologies are coming to Noida to improve safety on its busy roads network

According to Pragyal Singh, associate vice president, Infrastructure & Government Services, Ernst & Young, consultant to the Noida Authority for the project, “The entire district will need many more than 1,150 cameras. Phase one of the project will pilot the larger proposal. It aims to demonstrate that the system is workable in a smaller scale. We do not envisage funds to ramp up the system once the first phase is successfully implemented to be a constraint.”

Besides assisting real-time traffic policing, the proposed intelligent traffic system based on the Command, Control, Communications & Intelligence (C4i) concept will help control crime by ramping up the city's security and surveillance capabilities. The high-tech monitoring cameras will keep watch over the district's border crossing points.

As a comprehensive e-governance platform, the system will also help the police monitor land encroachments, with the implementing agency taking up process mapping for digitisation of land records in the first phase of the project.

The vendor will operate, supervise operations and maintain the system for seven years. Although the police

will depute 150 personnel to man the systems, the vendor may initially need to employ more operational staff to run the systems while the police personnel are put through intensive training.

On paper at least, it is noteworthy that this project is designed to avoid the mistakes made by other technology-driven traffic policing endeavours in the country. In Pune, for instance, the intelligent traffic system infrastructure is handled by the municipality and is not easily accessible by the police. “Enforcing law and order is a police subject. So it makes sense for the police to have access to this information,” adds Singh. “Although the hub of the Gautam Budh Nagar district traffic system will be located in a command centre located in the premises of the Noida Authority, 16 police circles [stations] will also receive these feeds. Dedicated bandwidth has been allocated for this project, which will also be supported by a tetra-based radio communication system.”

Traffic inspector Saifuddin Beg, who manages the Facebook account of the Noida Traffic Police, believes the new intelligent traffic system is the need of the hour. “Public response to our Facebook page has been very encouraging. People have uploaded pictures of errant traffic policemen to the wall. Going forward, we will book violators, issue traffic tickets and charge fines on the profile as well. It's time we moved to the next level of traffic enforcement too. The rapid scale at which vehicles are being added to the city and country's roads makes such intelligent systems essential.” He particularly looks forward to the day when the auto enforcement component of the system is activated: “Speed cameras will look up the registration number of the photographed vehicle using a digitised database made available by the office of the state transport commissioner, and generate traffic tickets to be despatched.”

Nevertheless, Singh notes the absence of standardisation of numberplates is likely to create additional challenges: “Devising technology that can read different kinds of plates will take some doing.” In time, though, auto enforcement will help weed out corruption and lower the cost of issuing traffic tickets.