INNOVATIVE TRANSPORT SOLUTIONS

Road Safety

Public Transport

Road Planning & Design

Transportation Engineering

Geographic Information Systems

Intelligent Transport Systems

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INTELLIGENT TRANSPORT SYSTEMS

Intelligent Transport Systems is a general term defined as the application of computing, information and telecommunication technologies to achieve the near-real time management of vehicles and transport networks to facilitate the movement of people and goods.

Sensors are deployed in the field collecting a wide spectrum of information about the transport network. Information is relayed to a Traffic Management Centre in real time where it is processed and analysed.
This allows transport authorities to make informed decisions about the transport system and include rapid response options to advise, control and intervene. In the medium to long term historical data can be used to identify trends and inform systems planning.

The broad definition of ITS includes numerous applications, inter alia, Advanced Traffic Signal Systems, Freeway Management Systems, Incident Management Systems, Traveller Information Systems and Bus Rapid Transit systems. Note that our experience in BRT systems is given under Public Transport ITS has been involved in the planning, design, implementation and operation of numerous Intelligent Transport Systems since 2002.

We have extensive experience in various Intelligent Transport projects with a deep understanding of the technologies, underpinned by our knowledge of local conditions and desired operational Key Performance Indicators (KPI's).

Key focus areas are:

Surveillance and CCTV systems

In the transport environment CCTV systems serve a dual purpose. The primary purpose is visual surveillance of the road network by operators in a control centre, supported by video incident detection. Recorded footage can be used to review and investigate transport incidents.A secondary benefit is crime deterrence and to aid investigations into criminal activity.

In some instances Licence Plate Recognition might be necessary, but typically requires a dedicated LPR camera.
Digital CCTV systems have been adopted internationally and are preferred over legacy analogue installations.

Digital CCTV has developed into a mature technology and a wide range of systems for different applications are available.

Some considerations when choosing cameras and a Digital Video Management System (DVMS) include Pan Tilt Zoom (PTZ) vs. fixed camera, Field Of View (FOV), suitability of video analytics or discreet alarm triggers, low light conditions, system scalability, video compression, video streams and volume of data generated, distributed or centralised video storage, archiving requirements and viewing and reviewing of recordings.

Only by understanding both user requirements and the technologies involved can design flaws be avoided.

ITS has broad experience in this field and was responsible for the design, specification and supervision of installations of the following CCTV systems including cameras and Video Management System:

- SANRAL Freeway Management Systems (FMS) in Gauteng, Cape Town and Ethekwini
- MyCiti BRT Cape Town, in buses, stations and along routes
- A Re Yeng, Tshwane Rapid Transit (TRT), in buses, stations and along routes
- Polokwane BRT in buses, stations and along routes
- Mangaung 2010 soccer world cup system

ITS further advise on the implementation of CCTV systems including licence plate recognition for Century City and the Huguenot toll tunnel.

Traffic Detection

Traffic detectors or sensors assist in the real time monitoring of traffic, be it on freeways, traffic signal controlled arterial roads, ramp meters or other applications. Different technologies are available including:

- Inductive loops
- Magnetometers
- Microwave frequency radar
- Video detection
- Laser detection

Parameters that can typically be provided include speed, volume / occupancy, headway and vehicle classification.

ITS has been involved in the assessment, evaluation, specification and implementation of the above traffic detector technologies considering the most suitable product to every situation and desired outcomes.

The benefits and disadvantages of each technology depends on various factors, from ease of deployment, cost, required accuracy, road complexity i.e. number carriage ways, number of lanes, peak volumes, road furniture, etc.

Another improvised non-conventional technique to monitor flow includes tracking Bluetooth and/or WiFi activated devices in vehicles.

This technique may not be suitable for all applications and requires careful consideration before pursuing this as a solution.

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Traveller Information

Various methods can be used to disseminate information about the transport network. Variable Message Signs (VMS) are placed in strategic positions after analysing the road network and considering other signage.

VMS's are specified according to the latest E 12966 standard and each application considered achieving low life cycle costs, optimised energy consumption and good optical performance in different light conditions.

Important design parameters are environmental requirement such as operating temperature, IP protection class and wind load , LED colour class, LED driver current, pixel size, pixel pitch and font size.

Ambient light sensors should be used for auto-dim control. In cold humid conditions the use of extractor fans and heaters must be considered.
involved can design flaws be avoided.

ITS has extensive experience in this field and was responsible for the design, specification and supervision of installations of VMS's as follows:

- SANRAL Freeway Management Systems (FMS) in Gauteng, Cape Town and Ethekwini
- City of Tshwane Urban Traffic Control (UTC) system including strategic and Parking Guidance (PG) VMS's
- Parking Guidance VMS's for Century City

Other methods of dissemination of information to road users include via SMS, radio, twitter, websites and Apps. ITS has assisted authorities in employing an integrated and holistic approach in disseminating information using all available technologies to ensure travellers remain informed.

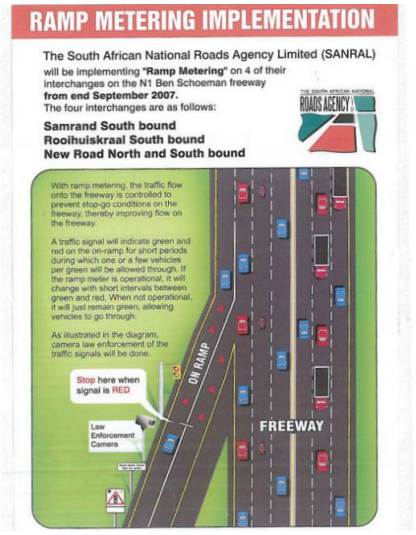
Ramp Metering

Where on-ramps merge with the mainline of a freeway, a breakdown in traffic flow can occur due to the ramp volume resulting in the mainline capacity to be exceeded, or there is a breakdown in flow because of an uneven distribution of gaps in the traffic stream.

ITS was responsible for the planning, design, implementation and evaluation of the first ramp meter pilot sites on a national road in South Africa.

Ramp meters were installed at 4 on-ramps and various control strategies were tested to determine the impact and potential benefits of ramp metering.

At some of the on-ramps, the ramp meters resulted in a significant reduction in mainline travel times.



Communication Networks

Reliable operation of an Intelligent Transportation System requires fast, reliable and resilient communications between field devices and the TMC.

The implementation of an Ethernet/IP based single mode fibre optic backbone is required for ITS systems. Older networks implemented 1Gb/s bandwidth with trunked links if higher speeds are required.

Lately the cost of implementing 10Gb/s fibre has become more affordable and is the preferred choice as it also allows future network growth. A 10Gb/s network is further critical to support high resolution CCTV cameras. In certain instances a wireless backhaul might be considered.

Depending on the device and the environment, last mile links to field devices can be either fibre, copper or wireless with different bandwidths as appropriate. Communications network redundancy is essential to ensure a robust and resilient network. Both logical and physical redundancy needs to be considered. Most networks should be designed to benefit from the logical ring redundancy protocols inherent to switchgear. For this purpose switchgear interoperability needs to be considered.

Physical redundancy provides higher percentage network availability even if the primary fibre cable fails. This level of redundancy is however costly as it requires duplication of infrastructure to a large degree. Different fibre installation techniques are suitable to different environments and include blown fibre, HDD, CST and aerial (ADSS).

ITS has been involved in the planning, design and supervision of installation of extensive communications networks using fibre, wireless and copper in both the urban environment and along freeways.

This includes the communications networks as part of the SANRAL freeway management systems in Gauteng, the Western Cape and KwaZulu Natal and the IRT systems for City of Cape Town, City of Tshwane and Polokwane Local Municipality.

These deployments have included innovation in trenching, ducting, fibre blowing and manhole construction in order to maximise production rates and reduce vandalism. Close coordination with different municipal departments enable the use of existing communications infrastructure resulting in cost savings.

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Traffic Signals – Area traffic Control (include a section for UTC)

Nelspruit
Strategies
Interaction with other systems

CCTV for queue length detection
Urban Traffic Control

Power and Communication Solutions for remote Traffic Monitoring Sites

Freeways extend to areas where power is not readily available and where it will be too costly to provide a fibre optic backbone. Solutions have been developed by ITS to implement cameras and /or traffic detectors that operate off renewable energy supplies. These supplies include solar panels and wind turbines which use the sun and wind to keep the batteries charged.

Such sites have been constructed where mains power is not available, or the cables would be too costly.
The development includes theft and vandalism mitigation measures such as satellite tracking and dedicated security cameras.

Traffic Management Centres

The Traffic Management Centre forms the heart of the Intelligent Transport System where all inputs form field devices such as cameras, detectors, information from other centres or authorities are collated and an overview of the transport situation is formed and analysed.
The TMC is where information and technology, through the human interface forms an intelligent system where transport situations are dealt with or where responses to incidents are generated. Understanding the flow of data, standard operating procedures and developing response plans for various scenarios is essential in the layout and design of a TMC. To this end the TMC is divided into two main areas namely a data centre and control room.
Data centre design must consider level of redundancy and therefore Tier 1 to 4 classification. Power supply, generator and UPS backup, fire detection and suppression systems, Heating, ventilation and air conditioning (HVAC) and raised floor are technologies that need to be specified.

Design of the control room must be consistent with the scale of operations to determine number of personnel to be present during any shift. The ergonomics needs to be considered to create a comfortable working environment for the operators. Consideration must also be given to the following components: video wall, access control, air conditioning, CCTV cameras inside the control room and number of displays required per operator.

ITS Engineers has been involved in the design and implementation of several traffic management centres, namely:

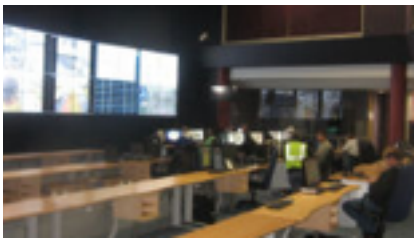
- Gauteng Network Management Centre
- Cape Town TMC
- City of Tshwane Centralised Control Centre
- Polokwane TMS
- Mangaung Transport Hub, which was used during the FIFA Soccer World Cup.

The photos show the Gauteng TMC and the Mangaung Transport hub in operation during the FIFA Soccer Confederations Cup.

INTELLIGENT TRANSPORT SYSTEMS

Operations & Maintenance

The operation of any Intelligent Transport System is the critical element that will ensure the success of the system. ITS has been involved in the operations of the Gauteng Network Management Centre since operations started in 2006. We have also assisted and advised on the operations of the City of Tshwane IRT Control Centre.



Valuable experience was gained in the practical implementation of the system and to develop the operational concept to accommodate the practical implementation realities. Typical tasks included in the operations comprise of the following:

- Development of the requirements for the operational staff and supervisors, interview and selection of personnel
- Development of a training program and presentation of training courses
- Develop Standard Operating Procedures and adapting them to meet operational requirements
- Assisted with operations and the implementation of the incident management system
- Assist in developing the communication with other role players.
- Integrating private services related to traffic information dissemination into the operations.
- Development of Business Intelligence (BI) reports and evaluation of Key Performance Indicators (KPI's).
- Setup of maintenance system, maintenance plan and Service Level Agreement (SLA).

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