

DEPLOYMENT OF ITS TO ADDRESS VEHICLE OVERLOADING IN GAUTENG

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ABSTRACT

The Gauteng Department of Public Transport, Roads and Works has launched a major new initiative in partnership with the metropolitan municipalities and other role players for the development of an integrated transport information system for Gauteng. The main drive behind this initiative is the fact that the functional transport areas do not correspond with municipal boundaries, which necessitated the sharing of information and other resources to address the challenges in the transport environment. It is anticipated that this integrated transport information system will form one of the building blocks for the deployment of Intelligent Transport Systems (ITS) in Gauteng, as the co-ordination of national, provincial and metropolitan activities and initiatives is one of the major challenges facing transport in Gauteng, but also presents a major opportunity for the use of technology to improve transport in our country.

Weighbridge data forms an integral part of the overload control law enforcement function in Gauteng and whilst the computer network infrastructure and the computerised traffic management system deployed by the Department makes provision to automate the operation of the weighbridges and incorporate the notices issued in respect of overloading on the consolidated central database, the provincial weighbridges must be equipped with better equipment and systems and the information on vehicles, offenders etc. be linked together with the data from other weighbridges in Gauteng and neighbouring provinces. The deployment of Intelligent Transport Systems thus offers a unique opportunity to address issues such as overload control and road safety.

The paper will thus highlight the initiatives of the Department to deploy the latest technology to share information between all role players in the field of overload control, and the use of technology to improve the efficiency of overload control operations.

INTRODUCTION

Gauteng is one of the central provinces in South Africa, as can be seen from the map below. Although it is geographically the smallest of the nine provinces it is the economic powerhouse of Southern Africa as it produces about 42% of the gross domestic product (GDP) of the country. From a transportation perspective it is interesting to note that more than 40% of all registered vehicles in South Africa are in Gauteng. Major national roads such as the N1 (between Zimbabwe in the north and Cape Town in the South), the N3 (between Johannesburg and Durban) and the N4 between Mozambique in the east and Namibia in the west pass through the province. Gauteng also has some of the busiest roads in the country, such as the Ben Schoeman freeway between Johannesburg and Pretoria and the R59 freeway between Johannesburg and Johannesburg International Airport.

Politically South Africa has three levels of government, namely national, provincial and metropolitan/district municipalities. This poses several challenges to the management of transport in the country, particularly in traffic law enforcement and overloading control where each level of government has a role to play – National on strategic level, Provincial on a strategy implementation/coordinating level and metropolitan/district on operational level. It is important to note that the metropolitan traffic police also formed the core of the recently established metropolitan police forces (with wider responsibilities), and that there are infrastructure agencies such as the South African National Roads Agency Limited (SANRAL) and the Johannesburg Roads

Agency (JRA). Other role players include private sector companies like the toll road concessionaires, which have a vested interest in traffic law enforcement (overload control.)

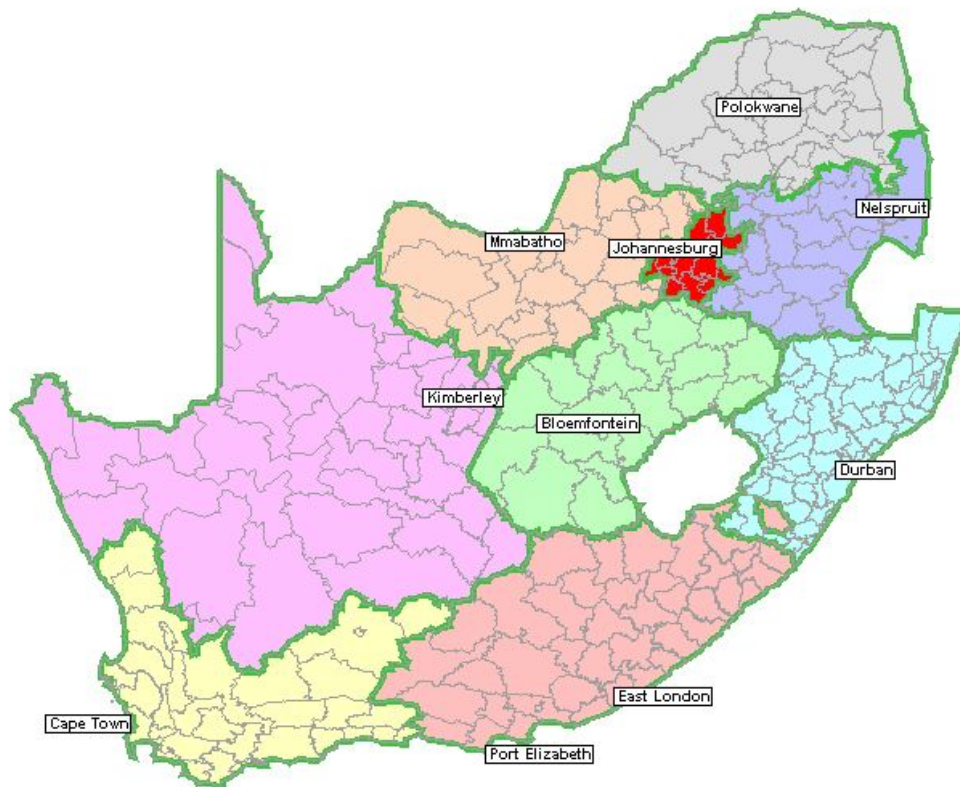


Figure 1. Locality map of Gauteng and South Africa.

On a political level congestion management and traffic law enforcement are two major priorities in Gauteng – congestion on our roads as it is choking economic growth and traffic law enforcement to address the severe overloading on our roads and the appalling death rate on our roads.

THE BUSINESS CASE FOR THE GAUTENG INTEGRATED TRANSPORT INFORMATION SYSTEM

Changed political landscape

The political landscape of the country changed dramatically with the new constitution for South Africa in 1994. In terms of this constitution transport is a concurrent function, which mandates and tasks all three levels of government (national, provincial and local) with the responsibility for transport related matters. The former four provinces were increased to nine, which increased the challenge to manage and integrate transport on national level and across provincial boundaries, and the backlogs inherited from the former “homelands” (self-governing territories) placed severe demands on the available funding for transport.

The consolidation of the local municipalities into fewer and more viable metropolitan/district municipalities also created challenges for the management and integration of transport related functions, as the local municipalities that were consolidated were not always using the same management information systems. The emphasis of government on improved service delivery to the citizens and cooperative governance made the sharing of transport related information essential for the new consolidated metropolitan/district municipalities.

As a result of the fact that the boundaries between these municipalities were mainly based on considerations not directly related to transport, the functional transport areas do not correspond with the metropolitan boundaries. A public transport vehicle such as a minibus- taxi can thus have an origin in one metro, and the destination in another, and in the process travel roads managed by National, Provincial and Metropolitan

government! Truly a challenge for transport planners and operators, and the key to this challenge is the sharing of information.

Move to public transport

In order to address congestion and make optimal utilisation of the existing transport infrastructure, a policy decision was taken to promote and support the use of public transport. To a large extent the success of public transport depends on the extent of integration of the different public transport modes. Modal integration can only be possible if information on all modes of transport is freely available to the managers of these modes and the commuters that make use of these modes. It is also very important in for the commuters and operators that adequate information on supply and demand for public transport is available to facilitate the management thereof (regulation and control), especially where more than one transport authority (metro) and minibus –taxi (backbone of public transport but prone to violence) are involved.

Optimal use of resources

Adequate information to ensure the optimal use of the scarce and limited resources available for the management of transport in Gauteng is a key issue, as the demands on the provincial fiscus exceeds the funds available, and there is a bias towards spending on social services. A further constraint is the shortage of skilled transport and transportation engineering professionals within all levels of government, including national. It is thus important that these personnel, which are already under severe work pressure, to have adequate management information on transport available. A Major problem is that this information is not always freely available and difficult to share with other users as a result of different data standards and systems access and interoperability issues.

Changed legal environment

Recent changes to legislation and new legislation such as the National Land Transport Transition Act and the Gauteng Public Passenger Road Transport Act has specific requirement for data collection and dissemination, such as the requirement for Current Public Transport Records that must be available for the issuing of operating licenses to public transport operators (including minibus-taxis).

Efficiency gains

The efficiency of traffic law enforcement officers is severely compromised by the fact that the traffic fine collection rate for enforcement agencies in Gauteng vary between 80 - 30 %. To illustrate the seriousness of the issue it should be considered that during 1993 there were more than 150 000 outstanding warrants of arrest issued fore non-payment of traffic fines in Tshwane Metro alone. There is no consolidated database for all or regular traffic offenders, which compromises the effectiveness of traffic law enforcement efforts and causes these agencies to lose credibility. The impact of lack of efficient law enforcement is reflected by the appalling death rate on South African roads and the extent of overloading of heavy vehicles in our country.

Cost savings

Although the efficiency gains that can be realised by the establishment of an integrated transport information system for Gauteng is important, it should also be considered that there can be significant cost savings in obtaining management information. The internet technology has created a common platform for information sharing, and systems development cost can be significantly reduced by sharing systems development costs or systems that have already been developed. Available resources can be directed towards developing new systems, and not re-inventing the wheel by duplicating available systems. System development and implementation time can also be significantly reduced, to reap the benefits of shared information at an earlier stage. Better management of existing transport infrastructure will result in cost savings, and a holistic (and not fragmented) approach to the management of transport related information will also reduce costs.

BUSINESS MODEL FOR GAUTENG INTEGRATED TRANSPORT INFORMATION SYSTEM

The business model for the Gauteng Integrated Transport Information System is based on a vision for the sharing of transport related information. This views the province as consisting of contiguous metropolitan/district municipalities, where the information on infrastructure, traffic operations, public

transport and freight is shared and will be freely accessible and available to all the role players to enhance decision making.

As organisational/institutional issues and constraints are viewed as the key to the success of this initiative, this was a key aspect addressed in the vision. The system development was thus initiated under the auspices of the Gauteng Transport Coordinating Committee (TCC). This committee was established as a vehicle to ensure coordination on all transport related matters in Gauteng, and all the institutional role players such as the metropolitan/district municipalities, Gauteng Department of Public Transport and Works, South African Roads Agency, National Department of Transport etc. have the opportunity to participate in decision on an equal footing and on a consensus basis. This will ensure that functional solutions support the organisational structure and objectives of the TCC.

In order to ensure that the system is developed according to actual user needs and priorities, the application domain is based on users/customers that are sharing fundamental base datasets irrespective of their own in-house systems or domain approach used.

The legal requirements and business objectives are important considerations during systems development. The system must be able to meet the information requirements of national and provincial legislation such as the National Land Transport Transition Act, Gauteng Public Passenger Road Transport Act and guideline documents and strategies prepared in terms of these acts such as the Gauteng Provincial Land Transport Framework.

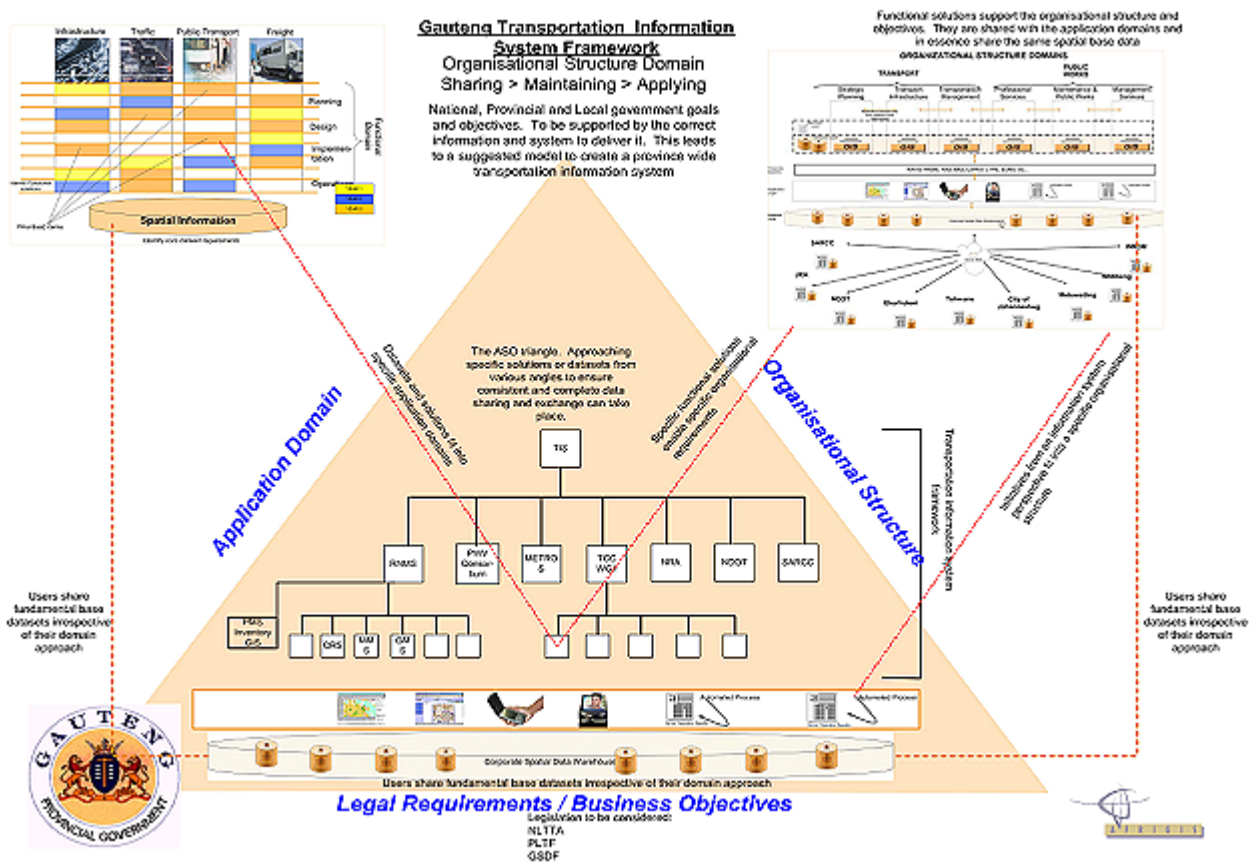


Figure 2. Vision for Gauteng integrated transport information system.

Figure 2 above illustrates the three dimensional approach followed for system development. The first dimension addresses the institutional/organisational domain, the second the legal requirements/ business objectives and the third the applications to be developed.

As can be seen above the applications will be based on a common spatial database for Gauteng. This database of spatial information will include aspects normally captured on a geographical information system,

and will also facilitate the sharing and integration with other departments such as housing, development planning, etc. It is thus seen as an important tool for the integration of land-use and transport planning. The applications domain will focus on the actual systems development/integration for transport infrastructure, traffic, public transport and freight related information. The application focus areas will be the information required for the planning, design, construction/implementation and operations in these areas. Traffic law enforcement and overload control will typically be provided for in the traffic focus area, which will seek to optimise activities that take place on the transport infrastructure.

Intelligent Transport Systems (ITS), which is the use of technology to improve transport and transport operations, will provide key technologies for systems development and integration. In order to illustrate the challenges and benefits of the Gauteng Integrated Transport information System the deployment of ITS to address heavy vehicle overloading in Gauteng will be discussed in more detail. Several projects have been initiated, such as the construction of the Heidelberg Traffic Control centre on the main route (N3) between Gauteng and the Durban harbour, the upgrading of smaller provincial weighbridges and the provision of mobile overload control offices (vehicle based). These initiatives, which are seen as quick wins for the Gauteng Integrated Traffic Information System, will eventually be linked to or integrated in national initiatives such as the development of the e-NATIS (National Traffic information System, which is used to manage information linked to vehicles, drivers etc.).

DEPLOYMENT OF ITS

ITS in broader perspective

The use of ITS related measures for traffic law enforcement and overload control should not be seen in isolation, but part of the broader strategy of the Gauteng Department of Public Transport, Roads and Works. As discussed in the previous paragraph ITS will provide the technology base for the Gauteng Integrated Transport Information System, but ITS is also a key element of the Gauteng Congestion Management Strategy.

ITS is thus part of a broader provincial strategy to:

- Address road congestion (optimal utilisation of road infrastructure)
- Promote use of public transport (key element of national taxi recapitalisation project)
- Address unsatisfactory road safety situation (education, engineering, enforcement)
- Address overloading of heavy vehicles

The use of ITS has been identified as a cost effective solution, as ITS measures can address several of these issues simultaneously and facilitate system integration. A key element that has been identified is the fact that ITS measures can significantly increase the efficiency of traffic law enforcement (and lead to change in behaviour). The fact that the private sector is willing and able to contribute to the improvement of traffic law enforcement by a public private partnership process to deploy ITS technology is also an important consideration.

ITS in traffic law enforcement

All traffic law enforcement agencies in South Africa are experiencing increasing levels of unpaid fines following the issuing of fines for traffic offences. The results of surveys undertaken by the National Department of Transport in 1989 and 1997 showed that the rates of payment by and the successful prosecution of traffic offenders were diminishing. During this period the average compliance rates country-wide dropped from more than 70% in 1989 to 25% in 1997. It is disturbing to note that this downward trend is continuing as the Department currently experiences a payment rate of less than 8% and the Metro Police of Tshwane only 9%. These statistics underscore the general attitude of a large proportion of drivers and operators to ignore fines issued for traffic law violations, which include fines for overloading of heavy goods vehicles. This aspect has not received the level of attention warranted by the consequences thereof for traffic law enforcement and road safety. The Gauteng Department of Public Transport, Roads and Works started a demonstration programme to redress the situation by introducing new technologies.

The programme, which aims to change the behaviour of road users and operators, address the overloading of vehicles and improve road safety, demonstrate best practices in traffic law enforcement, prove the efficiency gains of using ITS technology, quantify the cost and benefits of ITS in traffic law enforcement in order to obtain additional funding and to obtain data for levelling the playing field for PPPs in traffic law enforcement includes the following projects:

- Use of number plate recognition of vehicles involved in offences and an online remote communication computer system which communicates with the traffic contravention and National Traffic Information (Natis) databases live and in real time from the roadside in order to identify vehicles and drivers with outstanding n 341 notices, summonses and warrants of arrest, to enable the serving of warrants at the roadside and also enables the service of summonses at the roadside by scheduling a court date online;
- Speed camera support, by streamlining the process and introduce digital technology to convert the wet film photographs to digital images that can be processed in an automated fashion, thereby increasing the capacity, shortening the turnaround time from date of the offence to the date on which the owner of the vehicle receives a notice of offence in the mail and reducing the opportunities for human intervention (fraud);
- Specialist administrative support services, by consolidating the administrative function in respect of the high volume camera law enforcement cases at a centralised office, introducing alternative payment methods to enable ease of payment for the offender who wishes to comply with the notice issued, and the consolidation of the provincial traffic offences databases in a single data base. This is seen as the first step in sharing of data on traffic law enforcement agencies in Gauteng and ultimately South Africa when the new Natis system is implemented.
- Upgrading of weighbridge equipment and systems, and the provision of a mobile office. This was a key focus area of the project, and included the replacement and upgrading of computer equipment and systems, calibration, maintenance and upgrading of existing weighbridges and a mobile office for use at sites where weighbridge equipment is prone to theft and vandalism. This mobile office is fully networked and data downloaded to the central database on a daily basis. A further enhancement is that axle loadings will be transferred electronically from the scale to the computer used for the issuing and recording of traffic fines for overloading. This will eliminate opportunities for fraud and corruption, and enable record keeping of companies/ vehicle owners that habitually overload their vehicles. A further enhancement will be the use of mobile weigh-in-motion scales at roadblocks to identify overloaded vehicles which can then be escorted to static weighbridges for the issuing of fines. The data from all weighbridges, including Heidelberg Traffic Control Centre, will be integrated and shared with other law enforcement agencies.
- Accident data is the starting point for operational analysis and identification of hazardous locations for law enforcement and engineering purposes. For the analysis to be of significance and enable an operational enforcement plan that will be effective, the accident data and location must be captured accurately. This data will also be shared with and data obtained from other law enforcement agencies as part of the Gauteng integrated Transport Information System.

A key component of this programme to deploy ITS in order to improve the effectiveness of traffic law enforcement in Gauteng will be to maximise the impact of the programme by extending the programme to include participation and co-operation with other traffic law enforcement agencies in Gauteng (and ultimately in the RSA). Although participation by other traffic law enforcement agencies is not part of the initial, it is anticipated that all the groundwork to facilitate their co-operation and participation will be carried out, and by demonstrating the advantages of ITS technology it will encourage them to carry out similar projects. A schematic representation showing the inter-relationships is shown below. This programme also represents an element of the traffic information application domain of the Gauteng Integrated Traffic information System.

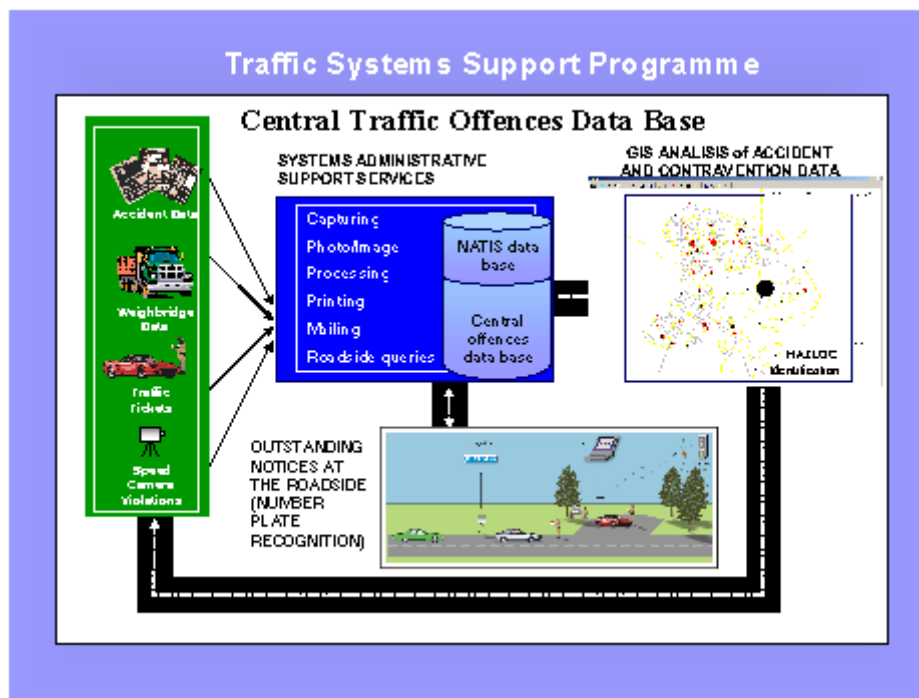


Figure 3. Schematic representation of deployment of ITS in traffic law enforcement.

Deployment of ITS in overload control

Overload control strategy

After the 1994 elections a National Overload Control Strategy was developed by the National Department of Transport (NDoT). A key element of this strategy was the construction of overload control facilities at strategically placed locations and in terms of a national priority list to address overloading on the main transport corridors. The NDoT and provinces contributed a percentage of their annual roads budget towards a National Overload Control Fund, which was used to fund the construction of these facilities, which included the Heidelberg Traffic Control Centre on the main route between Gauteng and the coast (Durban). The current situation is that the fund is depleted as provinces are unable/unwilling to continue with their contributions, and experience has shown that the operational costs of these centres are very high, and the staffing of these facilities by the law enforcement agencies is problematic due to financial constraints. As a result the Gauteng Department of Public Transport, Roads and Works has commissioned the CSIR to draft an updated overload control strategy for the province, and to prepare a strategy for the provision and utilisation of overload control facilities in Gauteng. The overload control strategy has been completed, and a draft strategy for facilities tabled. The focus has thus shifted from the provision and operation of extensive traffic control centres to the optimal utilisation of smaller weighbridges, from a corridor approach to an area approach with emphasis on joint operations between the Province and Metros and the use of technology to ensure optimal utilisation of overload control resources.

Heidelberg Traffic Control Centre (TCC)

The design of Heidelberg TCC makes extensive use of state-of-the art technology such as weigh-in-motion systems, digital cameras etc. ensure that no overloaded vehicle is travelling on the N3 corridor to the coast. When this facility was commissioned about 20 000 vehicles per month were screened, and the overloading rate was more than 16%. Currently more than 50 000 vehicles per month are screened and the overloading rate has dropped to about 3.3%. Initially a 24% success rate for fines paid was achieved, and the average payment rate currently at 40% (compared to less than 8% for all traffic fines).



Figure 4. Heidelberg TCC (mirror image on other side of freeway).

Departmental programme

The programme of the Gauteng Department of Public Transport, Roads and Works for the provision, maintenance and upgrading of overload control facilities in the province has been delayed by a lack of funding, and the fact that the National overload Control Fund is depleted. In order to make optimal use of the available funds essential maintenance work has been carried out on the five provincial single-deck weighbridges, with the focus on the upgrading and replacement of the computer equipment used at these weighbridges. The processes used for weighing the trucks were automated to increase throughput and eliminate opportunities for corruption. Direct interfaces between the law enforcement software and the telemetry of the scale, recording axle mass readings from the scale electronically without the need to manually key in readings from the scale display into the system, were installed. A fully equipped and networked mobile office has been commissioned for use at the weighbridges which are not operated on a continuous basis and therefore vulnerable to theft and vandalism. Mobile weigh-in-motion scales have also recently been procured for deployment during roadblocks. A contract for the supply and operation of permanent weigh-in-motion equipment will also be issued shortly.

CONCLUSIONS

Overload control facilities at Heidelberg TCC

- The accuracy of weigh in motion (WIM) equipment depends heavily on speed, and more than one may be required to achieve the desired throughput.
- Operators are able to consistently benefit from 5% overload margin allowed (competitive edge?)
- Continuous enforcement essential, as operators have good communication systems and overloading increases immediately if there is no law enforcement
- Possible delays and not only traffic fines seem to be a good deterrent for overloading
- Operational costs and related issues need to be clarified before considering construction, and overloaded vehicles are often not roadworthy. Overload control should thus be combined with roadworthiness testing, checking vehicle and drivers licenses, etc.

- Payment rates for traffic fines can be increased if offenders can be identified, and companies should be targeted and not only vehicles/drivers, as the records have shown that it the same companies that regularly overload.

Departmental programme

- It is important that an integrated approach be followed, e.g. the integration of the traffic offences database directly benefited overload control.
- Stress-testing of ITS equipment and systems is important, as problems may only be identified during this phase
- The cost of equipment can be recovered very quickly from traffic fines, especially if the law enforcement strategy for overloading is efficient
- Functional specifications are not a cure-all, as vendors may blame each other. ITS projects are more difficult, costly, time and energy consuming than normally anticipated
- People and processes are just as important as the technology – watch out for vested interests/ comfort zones
- Political buy-in and support can be a valuable asset!
- There is enthusiasm and support for a new model for traffic law enforcement (including overload control) that provides for joint operations between law enforcement agencies, public private partnerships and the sharing of infrastructure and facilities for overload control
- ITS can work in traffic law enforcement (including overload control), and can pay for itself – we just need to work out how, and more important, when!

Way forward

It will be important to finalise the revised strategy for overload control facilities, and re-prioritise funds for implementation. Further ITS measures such as extensive use of weigh-in-motion technology for enforcement is important, and may be combined with other ITS systems to increase cost efficiencies. Joint operations between law enforcement agencies must be encouraged to increase efficiencies, and public-private partnership initiatives for overload control must be encouraged. It is also important that existing infrastructure for overload control must be fully utilised before new facilities are considered, and consideration should be given to the upgrading of existing single-deck scales to multi deck scales to increase throughput during overload control operations.