Out of space?

by PJ Ware

The problem is not new Around the world, increasing volumes of traffic compete for road space that cannot keep pace with demand. And as the available space effectively diminishes, the requirement for management/enforcement of traffic regulations becomes more acute. In turn, this leads to a sharply increased potential for conflict between the regulatory authorities and the driving public

There exists, as never before, a need for systems of detection and enforcement that leave nothing to chance. A failure of even modest proportions will, almost inevitably, lead to a crisis of confidence of the motoring public in the fairness of the system and the subsequent collapse in the ability of the authorities to enforce traffic legislation.

Nor is that the only consideration. Governments and local authorities have increasingly come to rely upon the considerable revenue streams that come from road transport. Whether as a result of design, build, finance and operate schemes, urban congestion charging systems, national distance-based tolling regimes or speed and red light running cameras, the requirement for a highly accurate audit trail is of paramount importance to all concerned - from the individual driver through the network operator to the government. All have an acute interest in the ability of the technology to provide a fair and detailed picture of what is happening. What was considered technologically acceptable 10 or even five years ago, in terms of error rates and 'downtime', no longer holds true.

A wide range of innovative systems based on a bewildering array of technologies has grown up in response to the demand. End-users are faced with difficult choices on the merits of one system over another. And these are compounded by the need to purchase several different technologies in order to produce a functional whole; a problem for which a systems integrator is required.

First impressions

The mounting costs of such an exercise are bound to concern those tasked with finding the most cost-effective solution to the problem. Yet there are few technologies capable of functioning under all conditions and fewer still that do not require regular maintenance if the accuracy is not to be compromised. On top of that, the law of suppressed demand exercises its silent hold on the expectations of the end user. One system - one job. Another job - another system. The idea that a single, highly robust and accurate technology exists that is capable of producing data across a range of uses has yet to be fully grasped.

Inductive loop technology has come a very long way since the original analogue work-horse was deployed to count traffic, at accuracy levels that were barely acceptable, even for the purposes of statistical analysis. The arrival of digital technology and advanced algorithms will now, typically, provide not just an indication of a vehicle's presence but also its speed, direction and classification, together with the precise time and date on which it passed over the sensor.

"It is simply not possible, in any meaningful way, to compare the simple inductive loops of 10 or 15 years ago with what is now available in the market-place," says Bob Lees of Diamond Consulting Services, the UK-based developers of the Idris inductive loop technology. "Whereas you could not expect to achieve count accuracy rates better than 1:100, with an indication of speed that was accurate to ±10km/h, we can now expect a count accuracy rate of 1: 10,000 and a speed accuracy of ±1.5km/h with vehicles travelling at upwards of 200km/h."

These developments have some far-reaching implications for traffic engineers, including the ability to deploy a single technology to deal with a number of problems, including bus lane violations, excess speed and red light running offences. Buried under the road surface and with no moving parts, the hardware is inexpensive, impervious to wear and tear and capable of operating under all weather conditions, including snow, ice and fog with no depreciation in the level of performance.

"Inductive loop arrays," says Neil Clapperton, a product specialist for data collection with Peek Traffic, "rely on a magnetic field set up by the passage of a vehicle overhead. Because there are no moving parts to deteriorate, they will continue to function for as long as the road surface lasts. The advent of digital technology has allowed the use of a high number of deterministic switches, adding hugely to the accuracy and range of the data produced. It means that, for the first time, one fully integrated system can be deployed to detect different offences."

This is especially relevant in the urban environment where the ability to detect a number of offences at the same location may be required. Current red light running cameras, for example, cannot be used in the UK to also deal with excess speed. Nor will they provide information on the number and speed of vehicles passing through the lights on the green phase. Similarly, ANPR systems located in bus lanes deal solely with the

Site Layout for Red Light Speed Enforcement.

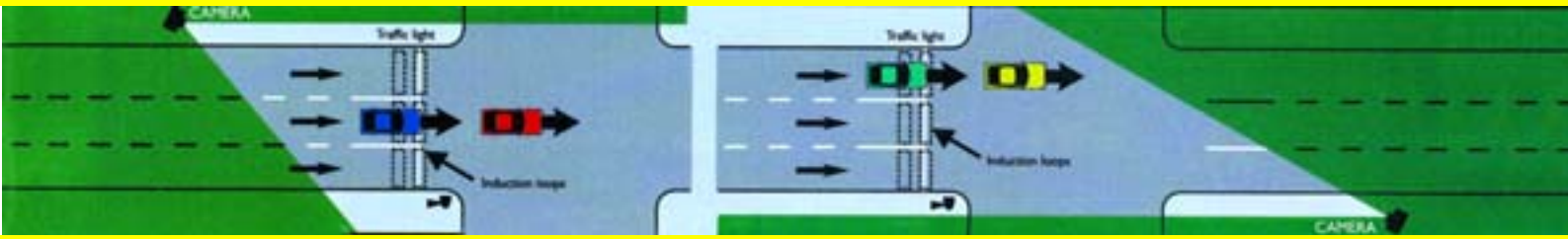

Figure 1: Enforcement site layout

Frontal photography

presence of unauthorised vehicles and fail to detect inappropriate speed. Even speed enforcement cameras using laser or radar fall short of the mark and are incapable of enforcing the different speed limits to which different classes of vehicles are subject other than the rough segregation between short and long vehicles.

First impressions

The Idris software behind the sophisticated loop sensors is capable of being programmed to recognise the classification of the vehicle passing overhead, compare it with the statutory speed limit relating to a vehicle of that class and trigger the enforcement process if the speed is inappropriate. The same principle also allows a duality of purpose to red light running and bus-lane enforcement cameras.

"The advantage of Idris is that it uses a single technology in place of several, to perform a number of functions," says Lees. "Using modified vehicle classification algorithms, the Idris system is able to ascertain when an erroneous speed has been detected and positively prevent any miss-image triggers. This creates a totally secure evidential trail for enforcement camera systems, be they speeding through traffic-signal controlled junctions, at unmanned rail crossings, on urban or rural highways or at sections of the highway where traditional detection methods are unsuitable, such as bends or the brows of hills."

The versatility of a system would, however, count for little without the high levels of accuracy demanded by the police and other enforcement agencies in relation to speed. But here again, a complex series of algorithms developed by Diamond Consulting Services is claimed to be able to deliver measurements of speed accurate to within ±1.5km/h at speeds up to 200km/h. Simultaneously, the system will produce a graphical signature that positively identifies the classification of the vehicle concerned. According to the firm, a link to an enforcement camera is, where necessary, triggered to within ±30cm to ensure a pin-sharp focus in the resulting photograph/digital image.

It was clearly important for the credibility of the system that these claims should be substantiated in a type-approval process that would allow evidence obtained by the system to be given in criminal/road traffic proceedings. The opportunity came in March 2003 when DCS were asked to submit the Idris system to a series of tests to be conducted by the Victoria State Police in Australia as a preliminary step in the type-approval process.

The subsequent tests were carried out at two locations near Melbourne. The first was at a driver training track where low speed testing up to 120km/h was to be conducted, while high speed testing was carried out at Avalon Airport, allowing for speeds of between 200 and 230km/h. In both cases one metre loops with a separation of one metre, resulting in a complete array length of three metres were used. Data verification was provided using a laser gun and, later, piezo sensors.

At speeds up to 125km/h, accuracy levels of around ±1.3 per cent were achieved. The following month, at the high-speed tests, the original target of ±2 per cent accuracy was altered to ±k2km/h at speeds up to 200km/h and achieved ±1.5 per cent or better. As a result of these tests, police indicated that the granting of type-approval for the system should present no difficulty. That process is now on-going.

The choices faced by highway authorities in urban areas in relation to detection systems have rarely been so simple. The London experience has shown the very high cost of ANPR systems while tolling operators readily testify to the cost and gradual degradation of data obtained from infra red and laser light curtains.

Traditional enforcement systems produced by companies such as Gatso and Truvelo, while capable of dealing with both speed and red-light running, have not been type-approved for both, at least not in the UK. Piezo technology has a limited lifespan and, by comparison with inductive loop sensors, are expensive. Only inductive loop technology will produce consistently high accuracy rates over sustained periods at a low cost. A humble loop, a simple detector, and Idris technology creates the 2lst century answer to accurate traffic enforcement. ■