Making New York's TUNNELS SAFER

ERIC TOFFIN EXPLAINS THE BACKGROUND TO A MAJOR US IMPLEMENTATION OF EUROPEAN-DEVELOPED VIDEO INCIDENT DETECTION TECHNOLOGY

Tunnels are critical road infrastructures. Designed to grant easy access from one point to another, they are also the 'weakest link' of the overall road infrastructure.

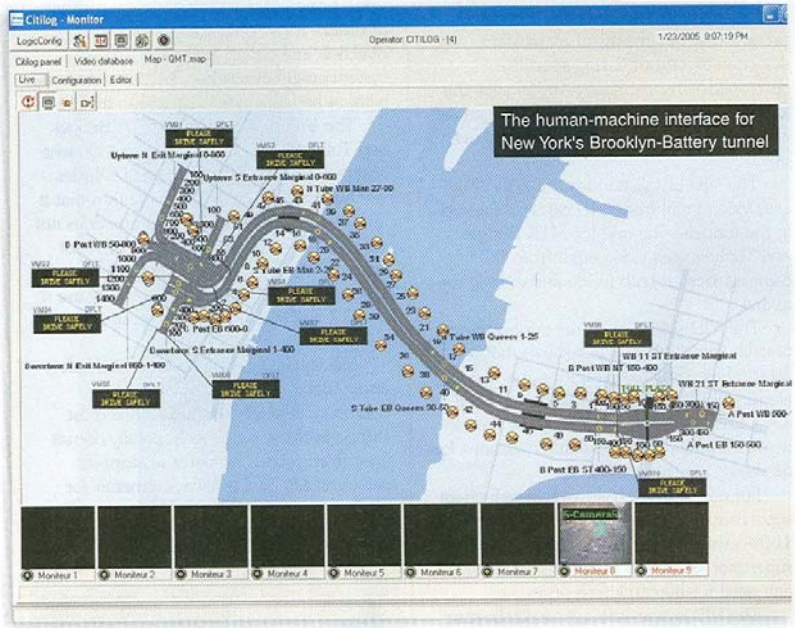
Also, because they are difficult to access in case of incidents or accidents, response and incident clearing times are of the greatest importance. Quickly to spot and respond to any incident on the roadway is the number one priority of tunnels' traffic operation centres (TOCs).

Not only does this help to prevent unnecessary congestion, thus keeping road users happy; it can also avoid secondary accidents and save lives. One of the key tools available to a TOC a video surveillance system, using CCTV cameras to monitor traffic and provide visuals of incidents or accidents.

However, the large number of cameras needed efficiently to monitor the entire infrastructure produces too much information for traffic operators (TOs) to handle efficiently. This is why a large number of tunnels worldwide have turned to automatic incident detection (AID) systems.

These have been widely used in European tunnels since 1997. In December 2002, the European Commission (EC) proposed a new Directive to define common technical and operational safety requirements for road tunnels, which made video detection a de facto standard for AID.

Video incident detection (VID) has multiple advantages. It provides TOs with an alert soon after an event occurs, even before an operator of a traditional surveillance system can pick up its consequences. It fits easily into existing infrastructures, ie CCTV systems, and is highly flexible, having none of the constraints imposed by the use of roadway sensors, eg the need to close lanes for repairs or deterioration of the road surface.



▼ INTO NORTH AMERICA

Awareness of these advantages lay behind the recent decision of the Port Authority of New York and New Jersey (PANYNJ) and MTA (Metropolitan Transportation Authority) Bridges and Tunnels to install AID on the four New York tunnels. These link the central business district of Manhattan to other districts of New York and to New Jersey, and are a crucial part of the city's transportation network. PANYNJ manages the Lincoln and Holland tunnels, while MTA Bridges and Tunnels manage the Brooklyn-Battery and Queens-Midtown links.

The Lincoln Tunnel is the world's only three-tube underwater vehicular tunnel operation. It provides a vital link between midtown Manhattan and central New Jersey, and forms part of New Jersey Route 495. It carries approximately 120,000 vehicles per day, making it one of the busiest vehicular tunnels in the world, and has a combined length of 7222m.

The Holland Tunnel carries approximately 90,000 vehicles per day and its two tubes have a combined length of 5158m.

The Brooklyn-Battery Tunnel is the longest continuous underwater vehicular tunnel in North America. It carries approximately 150,000 vehicles per day and its two tubes have a combined length of 5806m.

The Queens-Midtown Tunnel carries approximately 80,000 vehicles per day and its two tubes have a combined length of 2041m.

The contract for installing new AID systems went to Citilog, based in Philadelphia, US and Paris, France, after thoroughly testing its technology, which is now operational on over 200 tunnels and bridges worldwide. The VID system deployed uses video signals from existing CCTV cameras (fixed or pan-tilt-zoom (PTZ)).

It feeds these signals to video detection

Automatic incident detection in operation in a tunnel

units (analysers), which digitise them and process them by means of an incident detection algorithm. Using specially-developed 'vehicle tracking' techniques, this identifies moving vehicles within the images and follows the trajectory of each and every one.

The VID installation for the PANYNJ uses video input from 116 cameras located in the tunnels. The one for MTA Bridges and Tunnels uses video input from 96 cameras located both inside and outside the tunnels.

The VID system analyses the trajectory of each vehicle. When this shows that a vehicle has come to a stop, it raises an alarm. All VID units are equipped to send alerts to supervisors, which provide data to workstation and central software systems for displaying alarms to TOs.

For each tunnel, a set of two redundant supervisors ensures that the overall system is 100% available. In case of failure, a second supervisor takes over automatically, without any need for human intervention.

The VID system can automatically save a video clip relating to each and every incident for which it gives an alert. The TO can then see, in real time, the sequence of events before and after detection of the incident.

This function is a powerful operational tool. It enables both rapid evaluation of incidents or accidents as these occur, to assess the type of emergency response likely to be needed; and later, more detailed analysis, eg as part of an official inquiry, or to allow monitoring of the behaviour of road users during and after the event. All video sequences are stored into a database.

The VID system installed for MTA Bridges and Tunnels is operating on a stand-alone basis during the first phase of the implementation. In a second, it will be integrated into MTA's advanced traffic management system (ATMS).

The system for the PANYNJ is already integrated into an overall ITS operation. (California, US-based control and communications systems specialist Transdyn carried out the integration).

▼ PROJECT SPECIFICS

All four tunnels are among the busiest in the world and are often hit by slow-downs and recurrent traffic stops. Citilog's VID system is designed to detect indications of congestion and slow-downs early and efficient filtering stop-and-go patterns.

Only a significant level of congestion is drawn to the attention of TOs. This is a paramount consideration, in order to maintain the credibility of the system in the eyes of TOC staff.

In the Lincoln tunnel, the center tube is designed to switch direction to provide flexibility in response to traffic patterns. As well as operating with three lanes in either direction, it can offer four lanes in one direction and two in the other. The VID system automatically handles these changes without any need for intervention by TOs.

The VID system used in MTA Bridges and Tunnels' Brooklyn-Battery and Queens-Midtown tunnels detects stopped vehicles without configuration. The algorithm that it uses self-learns traffic patterns and does not require any setup or calibration. This not only makes the system is easy to deploy and maintain, but enables it to be used to use it on PTZ cameras used for highway and bridges monitoring.

Initially designed to address road safety applications, VID systems can also contribute to security issues. While most stopped-vehicle incidents hopefully do not arise from serious incidents, a stopped vehicle in a tunnel is always a matter for concern. "Before 9/11, a breakdown was a breakdown; but now we always wonder: 'Is it...?'", says one US TOC manager.

To this extent, the application of VID technology to video surveillance is a true bridge between ITS and US interest in homeland security. Nothing sums this up better that the following extract from an ITS America briefing.

"I see CCTV as an ITS technology that will most effectively enhance homeland security because it provides a snapshot of what is occurring. CCTV can aid in the protection of the transportation system. The snapshot will allow protective agencies (police) to stop an attempt prior to disaster.

"The problem with CCTV is the ability to view all cameras, all the time. There are not enough eyes; there are some shortcomings that would need to be resolved."

This is what VID is all about: by monitoring all cameras 24/7, it makes traffic operations more efficient and tunnels safer.

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www.panynj.gov

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New York VID system architecture