

AID AND TRAFFIC MONITORING USING VIDEO DETECTION IN TUNNELS

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ABSTRACT

In this paper, we discuss a general system using **video detection** modules for **traffic monitoring** and **incident detection in road tunnels**, together with some of the underlying detection principles. Video detection is the means by excellence to provide the correct traffic data for both a reactive and a pro-active traffic management and all of these features are being integrated into one system.

INTRODUCTION

There are no more incidents in tunnels as there are on normal roads, but the consequences of these accidents can be more severe in tunnels. Therefore, most tunnels are actually equipped with video cameras and a CCTV system to see what is happening in the tunnel. Most of these CCTV images are only looked at when some alarm has been generated, mostly by the SOS telephone. Studies have shown that most of these calls are only made after an average time of more than 3 minutes, if they are made at all. Here, an automatic incident detection system can largely improve the speed of detection and thus the safety in the tunnel. Video detection for incidents is actually the most reliable and fastest way of detecting incidents in tunnels.

Besides detecting accidents, video detection makes it also possible to detect other incidents such as: stopped vehicles in a stop niche, very slow moving vehicles, speeding vehicles, vehicles driving in the wrong direction and queues in the tunnel.

Normal traffic data such as volume, speed occupancy and class of vehicles can also be collected using video detection. These data can be used for statistics, for ventilation control or for tunnel travel time calculation.

2. DATA AND INCIDENT DETECTION

The state of the art makes it now possible to have video detectors that are:

- Providing conventional traffic parameters using a set of optical loops in a video image
- Tracking vehicle patterns on a series of detection lines
- Measuring global flow parameters of the traffic on the image
- Detecting stopped vehicles over zones covering several 100m
- Tracking vehicles in definable zones



Figure 2: Video detection technology

The following parameters and events can be collected using video detection in tunnels:

- Stopped vehicles
- Slow moving vehicle
- Occupancy of the road
- Queues
- Inverse direction
- Smoke
- Number of vehicles
- Class based on length
- Dirty lens of the camera

This wide range of techniques offers traffic managers the maximum information as needed for the efficient handling of incidents or dangerous situations.

This will result in fast and correct information for the tunnel users. It will also lead to an enhanced safety level by avoiding primary or secondary incidents.

3. AID SYSTEM IN TUNNELS

A normal state of the art AID (Automatic Incident Detection) system in a tunnel consists of the following elements that are all interconnected (see fig. 3):

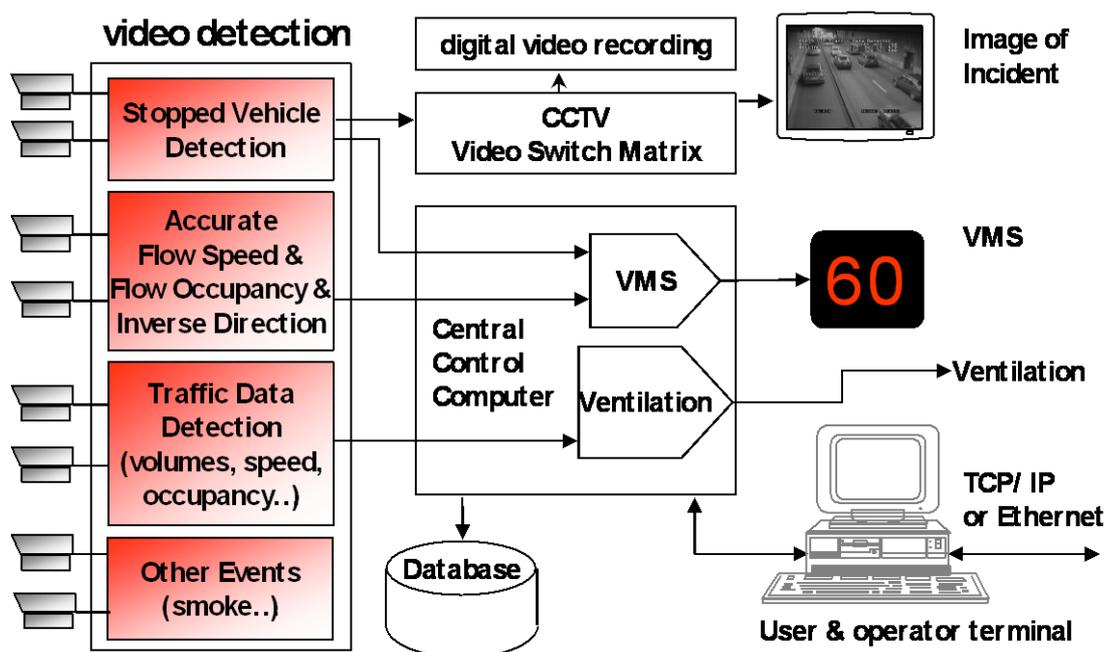


Figure 3: Automatic Incident Detection system in tunnels

The Traficon solution is a modular solution where one VIP board serves one video source

The outputs from the VIP Boards in such a system are RS485 links. These are all connected to one COM board. The COM board will poll the VIP boards to monitor their good functioning, ask for detected incidents and to collect traffic data.

Advanced traffic management is based on the principles of **management by exception** and is both **pro-active** and **reactive**.

Traffic Management by exception means that the traffic manager should focus on the problems in the traffic situation and that he should not be overloaded with excessive information.

Only the most relevant information for action is needed for effective traffic management.

Pro-active Traffic Management: Design a system that collects traffic data without human interference, select the abnormal situations and trends, use these to set the different controls and inform the traffic manager on the action taken. The main purpose of these controls is to prevent incidents as long as possible.

Reactive Traffic Management is based on incident detection of which the essential characteristics are:

- High detection rate
- Short time to detect
- Small false alarm frequency
- Fast incident verification

Video detection can provide all the above characteristics in one integrated system.

The older loop based incident detection systems used a large number of inductive loops in the road, this made the mean time between failure quite short, and the reported detection rates were still below 80% with times to detect set at 2 minutes.

Video detection is in this area a real and unique break-through.

5. CONCLUSIONS

The use of video signals for detecting traffic data and incidents in tunnels has proven to be highly reliable as a means for improving safety and health of tunnel users, whilst the availability and the potential capacity of the tunnel are kept at an optimum.

1. It is cost effective.
2. It is efficient, fast and reliable.
3. All necessary traffic data are provided;
4. Our analysis and results are based on the practical experience of more than 1300 video-based detectors that are operational in more than 40 tunnels.