THE PRACTICAL APPLICATION OF ANPR FOR JOURNEY TIME MONITORING IN ESSEX

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Over recent years, Essex County Council has invested in several major technology updates to their traffic management infrastructure. As part of the Essex ITS partnership, the original SCOOT UTC system which was the core of Essex traffic control, has been expanded with the addition of new management and monitoring modules and is now part of the new Essex Traffic Control and Information Centre. One of the key additions to the Essex Traffic Control Centre has been the use of Automatic Number Plate Recognition (ANPR), used for journey time monitoring as part of the Comet system from Siemens.
With over 80 cameras now installed, the system monitors seven major routes which link the Essex Regional Interchange Centres (RICs) of Chelmsford, Harlow, Basildon as well as Braintree and key routes to and from the M11 and M25. In addition to the inter-urban routes, monitoring is also available on the main arterial urban routes into Chelmsford town. Expansion of the system is currently being planned covering routes to RIC of Colchester. Overall, the system provides real time monitoring of the routes for day to day traffic management and incident detection as well as long term monitoring of the network for performance analysis.

ANPR is often seen as a fit and forget technology. Whilst the latest generation of cameras may bring this closer to reality, there are still several challenges to making it operate successfully. If these are not considered early on in the project process, the remedial work required later can be significant in order to prevent the system falling into disrepute amongst operators, elected members and road users.

The primary challenge of journey time monitoring with ANPR is obtaining a high match rate of vehicles between the camera pairs whilst minimising the physical number and optimising the location of cameras. Whilst this may seem obvious, there are several factors which can limit the match rate in reality. This paper explores some of the issues which have been addressed during the course of implementing JTMS in Essex.

On inter-urban routes, obtaining a good match rate is (relatively) easy. The majority of vehicles are transiting the link from one RIC to another and so O-D patterns can be predicted with reasonable confidence. Within the urban environment this is much less easy to achieve — and hence determine the optimum location for ANPR cameras to obtain a high enough match rate. Installations in Essex on dual-carriageway routes have typically looked at lane 1 only although in some locations where there is a well defined split of the traffic, such as at an approach to a roundabout, two lanes are monitored to ensure a high capture rate of traffic both continuing straight on and as turning.
As part of the project, floating vehicle data was compared with ANPR data for journey times on a specific link on the A127. The result of this was that the floating vehicle data consistently calculated a faster journey time than the ANPR based calculation. This led to initial questions about the accuracy of the ANPR data, with perceptions from the system operators that it was not related to the real situation. Looking at this in more detail the ANPR data consistently gave a journey time which equated to an average speed of around 55mph. As this road is a dual carriageway and typically lane 1 is being monitored the reason was immediately obvious - a high match rate was being obtained but this was primarily from heavy goods vehicles. For long term monitoring this is not an issue as the overall trends will still be visible and for incident detection, vehicles in lane 1 are just as likely to be affected as vehicles in any other lane.

The location and field of view of the camera is absolutely critical to obtain a clear image of the vehicle and offer a good chance for a successful number plate read. In some cases in Essex a difference in location of 20 yards has been a determining factor in whether or not a suitable match rate has been achieved as a result of traffic behaviour on the approach to or just after the chosen location.

Journey time monitoring using ANPR in the urban environment has initially not been as successful which was primarily due to origin and destination of the traffic and the ANPR sites that were installed initially. The original installations seemed appropriate and hence were chosen considering issues like power and access. The actual results equate roughly to one third providing accurate journey times, one third no useful data and one third acceptable at certain times of day where vehicle flows are acceptable e.g. morning peak only.

As a result of this, one of the major lessons learnt from the original installations in the urban environment is that the first issue to consider is the origin and destination patterns within the town and the links that you wish to monitor. If there is not enough traffic passing a particular detection point, regardless of whether it is a perfect site with power and access readily available, then the match rate will be poor and the data unreliable. In the urban environment, possibly more so than inter-urban, the location of the ANPR camera is absolutely critical to ensure an acceptable match rate for journey time calculation.
Having carefully considered the locations for camera installations to ensure a high match rate for accurate journey times as described here, it may then be thought that nothing further is required. Unfortunately whilst the system will report obvious faults (communications failures or equipment failures) it is still possible for more subtle failures to occur which can adversely affect the quality of the data.

Primarily these are due to camera alignment issues and the potential for cameras to be knocked out of alignment. The ANPR camera may be working perfectly but will not read any plates if it is pointing at the sky! Issues such as these can only be detected by careful monitoring of the system to see where links which had previously provided quality data may now be reporting a suspiciously low match rate and then taking prompt action to investigate. If this is not done, then the quality of any data being recorded for long term trend and performance analysis can quickly become suspect.

Vandalism of the cameras is also an issue in some locations. Media hype over speed cameras does not help in this area as the ANPR cameras are sometimes perceived by members of the public as speed detection devices, despite best efforts to disguise them as above ground detectors in varying forms. Petty vandalism affects all traffic signal equipment e.g. traffic signal hoods being removed and ANPR cameras are subject to this as with any equipment installed on a traffic signal pole or similar location.

In Essex however there are some sites which are suffering from persistent, target attacks with the instigator clearly going equipped with cable and bolt cutters with 5 cameras being removed within the last 12 months. It is believed that the cameras which have been removed are simply being destroyed as a result of the instigator knowing that they are ANPR devices and being unhappy with their installation – possibly as a result of some un-related criminal activities. In one case, two cameras have been removed from one side of the road, whilst the cameras on the other side of the road have not been touched. The effect of the vandalism can be combated with attempts to discourage by installing the cameras higher on the pole, but this then has knock on effects to the maintenance of the devices requiring access equipment and associated traffic management and lane closures.

ANPR offers benefits by providing data continuously and this business model helps to support the expansion of the system. The typical costs to add cameras to the existing system permanently are no more than the costs for a traditional three week before and three week after survey. Whilst this requires the power to be available and the basic system to be installed (as is the case in Essex), it makes it relatively easy to justify expanding the network of cameras on the basis of year round data, rather than short period of data available from a traditional survey.
The output from the JTMS system is also being published on variable message signs with positive feedback from the public. Currently the signs will display “expected time” in associated with the journey time data, but with no links in Essex typically longer than around 11-12 minutes, the data is updated relatively quickly and hence remains accurate.

In one location the VMS displays both the expected journey time into the town centre as well as the number of spaces available in the approaching P+R site to encourage greater use of the park and ride facility.

As a result of the positive feedback from the publishing of VMS information, consideration is now being given the installation of an ANPR camera on all new VMS installations. In addition, expansion of this element of the system is looking at displaying comparative journey times for routes to the M25 as within Essex there are several locations where two options exist when making a route choice for a journey to the M25.

Initially the data from the system was not considered useful by the police and hence was only used for journey time monitoring. This is still true, however the police are interested in the plate data and work is underway to see how the cooperation with Essex Police can be enhanced. This is constrained by the volumes of data being collected and the relatively short periods for which actual plate data, as opposed to processed journey time data can be stored for.

Overall, the use of ANPR to provide journey time information in Essex has been a valuable addition to the overall traffic management strategy although as described here, not without issues which needed to be addressed as the project has progressed. As with many systems, the optimum use is only gained when a solid understanding of the capability, as well as any limitations is known. This has been particularly important with the JTMS system when locating camera sites and ensuring that the traffic flows and origin/destination patterns are appropriate to provide a high match rate for accurate journey time calculation.