
ITS RADAR Intelligence Report

TEMPO Project Results in the Field of Variable Speed Limits

Relevant Topics:

Background: This Intelligence Report has been produced as part of the ITS RADAR project. The aim of the project is to summarise key information for Highways Agency decision makers and practitioners alike regarding innovative pilot projects worldwide and emerging ITS technologies.

This particular report concerns the current and forthcoming results of evaluation projects carried out within the TEMPO programme in the field of variable speed limits (VSL).

Summary: This document summarises some of the results of evaluation reports for VSL projects carried out across Europe and prepared in TEMPO format. It also gives details of other projects in this area expected to report their findings in future.

Complete project reports can be found on the TEMPO website – tempo.austriatech.org in the library section.

In summary, the results suggest that Variable Speed Limits can deliver benefits, but that these are by no means guaranteed. It is clear that care is required in the planning stages to ensure that the scheme is well designed and algorithms tuned to ensure they deliver appropriate performance. If not, then public confidence in such systems will be undermined.

There are a number of schemes due to report in the near future and these results should be watched with interest.

The Finnish example of use of Variable Speed Limits on the approach to key road junctions may have application on the All-purpose trunk road network.

Projects which have reported

Traffic management applications on the Køge Bugt Motorway, Denmark

Jens Toft, Danish Road, Directorate, jens@vd.dk

The main objectives of this project were to minimise congestion and rear-end accidents on the Køge Bugt Motorway. The Danish Road Directorate installed a temporary traffic management application to be used throughout the construction period from summer 2002 to summer 2003. It was considered that congestion problems and accidents were more likely to occur during periods of roadworks than during normal conditions.

Evaluation of the system found that there were a number of examples of errors made in the use of variable speed limits. There seemed to be errors in the displayed speed limits toward Copenhagen almost every day. Wrongful speed limits (or malfunctions) occurred in up to 18% of the morning rush hour. However, there were also days without obvious errors. Problems seemed to be worst in situations of deactivation after a period of congestion.

Considering the displayed speed limits away from Copenhagen, the application seemed to work as specified. However, in situations of traffic breakdowns (following accidents) the application had a tendency of malfunctioning, resulting in a variety of errors, ranging from wrongful speed limits to the variable message signs turning off completely. This also applied for driving toward Copenhagen during times of traffic breakdowns. In addition, there were some minor technical problems regarding replacement of light bulbs etc.

Motorists did not adjust speeds according to the displayed speed limits unless the traffic conditions forced them to do so. However, motorists did reduce speeds when confronted with dynamic speed limits, but only to a certain degree. Speed reductions were generally less than five kilometres per hour, depending on the level of speed prior to the variable message signs. The faster people drove the greater the reduction. Accordingly, speeds and traffic flow only became more homogenous in situations of heavy traffic and congestion.

The above results are supported by answers/comments received in the questionnaire. Most of the complaints made were about the speed limits being too low considering the traffic situation at hand. Drivers could not understand why they had to reduce speeds by 20km/h in situations without visible congestion. This problem tended to arise because of the long distances between the variable message signs. The distance used was approximately 750m, meaning that drivers might be told to reduce speeds as early as 1.5 km before the congestion becomes visible. As for the technical performance, quite a few drivers had noticed that there had been flaws in the displayed speed limits.

46% of the participants to the user acceptance questionnaire responded that they felt safer after the implementation of the variable speed limits. Only 4% said they felt less safe, whereas the remaining respondents said that they did not feel any more or less safe.

Radar Team Thought – This highlights the importance of ensuring credibility when piloting or trialling applications on road.

Variable Speed Limits at T-Junction of Highways 6 and 13 in Selkåharju, Finland

Jaakko Myllylä, Finnish Road, Administration, Jaakko.Myllyla@tihallinto

The site of this project is located on the T-Junction of main roads 6 and 13 at Selkåharju, in southeast Finland. Traffic safety problems and difficulty in traversing from the minor road to the major road occur in that junction during rush hours and summer weekends. The objective of the telematics application was to lower the speed limits of the major road during heavy traffic and make it safer and easier to access, especially in poor weather conditions.

Control and monitoring devices and variable speed limit signs were implemented in autumn 2001. After the implementation, the system was tested without showing the variable speed limits to the road users. The system was launched June 2002. At the beginning of 2003, a road weather station was implemented at the junction. In future the system will also take account of road weather information.

The impacts of the system were evaluated in the autumn of 2003. These showed that the control system did not affect the distances between the vehicles. The traffic volume had an effect on the speed so that the mean speed decreased as the traffic volume increased. Adopting the speed limit of 60 km/h decreased the mean speed by 7 km/h when the weather conditions were normal, 6 km/h when the weather was poor and 4–8 km/h depending on the driving direction when the weather conditions were hazardous. This effect did not depend on the traffic volume.

In summer, the mean speeds were 1–2 km/h higher depending on the driving direction compared to normal weather conditions in winter. Vacation period did not affect the speeds. The speed limit of 60 km/h reduced mean speeds by 7–9 km/h in summer. The LED signs increased the mean speed by 2–3 km/h in hazardous weather conditions compared to traditional plate signs when the speed limit was 80 km/h. In

particular, the lowest speeds increased, but the sign type did not affect the top speeds, nor did it affect the driving speeds in other weather conditions.

Radar Team Thought – Possible application on All-purpose Trunk Road Network.

The T3 Project (Società delle Autostrade di Venezia e Padova S.p.A.), Italy

Giovanna Marchionni, giovanna.marchionni@polimi.it

Marco Ponti, marco1.ponti@polimi.it

Luca Studer, luca.studer@polimi.it

Eleonora Veronesi, eleonora.veronesi@polimi.it

Politecnico di Milano

The T3 (third lane) project aimed to improve traffic conditions by making optimal use of the available resources. By increasing the road capacity, the project aimed to make conditions more homogeneous, i.e. reducing the amount of stop-start behaviour drivers have to endure. The project consisted of the 'dynamic' use of the emergency lane on the highway near Mestre. This emergency lane could be opened to all road users during busy periods by means of instructions on overhead gantries, which alerted drivers to its availability.

Evaluation of the system showed that traffic flows increased in the sections under control (7.5% on average in time bands when the third lane was more frequently opened in winter, and 8% in summer). The highest average increase was recorded in winter working days (12.6%). The differing traffic increased on the Mestre Beltway with respect to the volumes registered at the Mestre barrier and on adjacent motorway networks indicated a substantial increase of short-distance flows. This proved the improvement in the accessibility of the infrastructure on the part of local traffic using the beltway. Flow speed has increased, especially in summer (by 23.6%, corresponding to 15 km/h), and more clearly on working days. Journey time on the beltway has therefore decreased, allowing users to save on journey time. Speed limits imposed and indicated by VMS were generally observed, thus proving the effectiveness of their use in indicating speed limits.

Safety has increased on the infrastructure where the T3 system was implemented. The number of accidents per direction has significantly decreased (-57.7% eastbound, -49% westbound); even the number of collisions has decreased, both in absolute terms (-71% eastbound, -66.7% westbound) and as percentage on the number of accidents. Accident peaks have decreased at ramps and junctions, caused by 'stop-start' behaviour, thanks to a better traffic flowing. The standard deviation of hour speed has significantly decreased (-7.2% in winter and -43.7% in summer when the third lane was most frequently opened), thus indicating greater consistency of traffic and a reduction of the potentially risky phenomenon of 'stop-start' behaviour. Vehicle linear density has significantly decreased (-31.0% in winter and -41.1% in summer) thus allowing an overall increase in headways between vehicles.

Radar Team Thought – HA should compare results with those achieved on ATM.

M25 Controlled Motorway, England

David McGuigan; david.mcguigan@fabermaunsell.com

John Paddington; john.paddington@fabermaunsell.com

This project concerns the Controlled Motorway implementation between Junctions 15 and 16 of the M25 London orbital motorway. It involved the collection of before and after data, which was analysed to inform a wide range of performance indicators. This led to the development of a business case and generic assessment tool.

Evaluation of the system performance showed that while no overall journey time benefits had been achieved, with decreases in peak travel times on the anticlockwise carriageway being cancelled out by increases on the clockwise carriageway, there had been a small improvement in overall journey time reliability, indicating a smoother journey.

More significant were the safety benefits arising as a result of a culmination of impacts on the driving environment and on driver behaviour. Injury accidents were reduced by 15%, and there has been a 20% drop in the ratio of damage only to injury accidents, due to more uniform headways and hence a reduction in the level of harsh braking. Weekday traffic noise adjacent to the scheme has been reduced by 0.7 decibels, whilst emissions have decreased overall by between 2% and 8% due to the smoothing effect that variable speed limits had on individual vehicle speeds.

There has been a reduction of 6% in the amount of stop-start driving during peak periods, along with a 9% reduction in the amount of time the flow on the anticlockwise carriageway was broken down (average speeds less than 25mph), and a 3% reduction in the number of flow breakdowns occurring. There has been some increase in flow breakdown on the clockwise carriageway. A long term effect (observed on Junctions 10-15) has been a reduction in the number of shockwaves during the morning peak period. As drivers become accustomed to the Controlled Motorways system, they can modify their behaviour to reduce the effect of flow breakdown.

Projects due to report in the future

Feasibility Study of Mosel-Saar Network Rerouting, France/Germany

This project considers traffic management along the Mosel-Saar corridor and surrounding routes. There are two possibilities for cross-border re-routing, via Trier and via Metz respectively. The study has taken into account high traffic volumes with recurrent congestion at Trier as well as the overlap with the Nancy-Brussels corridors. The project relies on cooperation with road operators in France (both public and private sector) and Luxembourg. An internal re-routing system in the Saarland (A6/A8/A620) and a line control (VSL) system are included in the cross-border re-routing corridor for which an efficiency analysis is currently being elaborated.

Results from this project are expected during summer 2006.

Speed Control Evaluation on ASF Network, France

The A7 motorway in France, well known as the "Autoroute du Soleil", is one of the strategic road corridors in Europe linking north to south. This route is very busy especially during summer, when congestion is regularly observed. The solution retained by ASF is based on real-time systems allowing detection of traffic destabilisation 30 to 45 minutes before it occurs and the display of "speed limits" to drivers in order to adjust the traffic flow, thus contributing to a decrease in accident risks. An evaluation was carried out between Orange and Valence (a 90 km section) in August 2004.

Results from this project are expected during summer 2006.

Impact Analysis of Line Control System on the A61 between Meckenheim and Mendig, Germany

Due to the topography of the motorway A61 between Meckenheim and Mendig there have frequently been accidents and traffic congestion. With a line control (VSL) system the accident risk should be decreased and traffic kept flowing.

Results from this project are expected during autumn 2006.

Traffic Management by Line Control Systems and Variable Message Signs, Austria

ASFINAG (the body responsible for planning, financing, maintaining and operating the Austrian motorway and road network) will implement traffic control systems on the high-level road network, especially on routes with heavy traffic near the main cities.

Results from this project are expected during autumn 2006.

Efficiency Analysis of the Line Control System on the A5 between Friedberg and Nordwestkreuz Frankfurt, Germany

The temporary hard shoulder in use along the motorway A5 between Friedberg and Nordwestkreuz Frankfurt has been available since 2005. The hard shoulder is integrated into a line control (VSL) and video monitoring system (one camera for each direction every 500 m).

Results from this project are expected by the end of 2006.

Motorway Control Systems in Germany

The Motorway Control System (MCA) on the A1 near Bremen started operation in 1997. It is situated between approaching sections to the motorway junction at Delmenhorst-Ost and motorway junction Posthausen in both directions (total length each direction 34 km). Since the implementation in 1997 the system has been in operation continuously. The system was evaluated in 2003 and showed positive results. Meanwhile the system has been improved through the installation of further gantries and VMS, in order to reduce the distance between the VMS.

Results from this project are expected during summer 2007.

M42 Active Traffic Management, England

Active Traffic Management (ATM) is designed to improve traffic flows and postpone flow breakdown on the busy M42 east of Birmingham, through use of temporary reduced speed limits and hard shoulder running, etc. This sub-project will assess levels of user acceptance, technical performance and the impact of ATM on the M42 in the Birmingham area.

Results from this project are expected by the end of 2007.

Evaluation of Traffic Management on M3, Denmark

Parts of the M3 near Copenhagen will be widened in a three-year period from March 2005 – 2008. Traffic management (variable speed limits, VMS with text information, video surveillance, traveller information services) will be implemented and used during roadworks and after widening. Yearly evaluations of M3 traffic management and other evaluations in connection with the project will be undertaken.

Results from this project will become available between 2006 and 2009.