

# EVALUATION OF 3 ITALIAN ITS PROJECTS

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## ABSTRACT

The paper reports on the activities of the study “*Evaluation of the facilities and telematic services projects within CORVETTE and SERTI*” carried out by the Department IN.D.A.CO. – Sistemi per la Mobilità of the Politecnico di Milano in behalf of the Italian Ministry of Infrastructure and Transportation (MIT).

The study aim is the evaluation of the impact of some ITSs planned on the Italian area included within the Euro-regional SERTI and CORVETTE. The following projects were defined:

- Società delle Autostrade di Venezia e Padova S.p.A. – Third Lane project (T3);
- Società delle Autostrade Brescia–Verona–Vicenza-Padova S.p.A. – Companion project;
- Autostrada dei Fiori S.p.A. – integration of several ITS implementations.

## ACKNOWLEDGEMENTS

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## BACKGROUND

In Italy the CORVETTE project regards motorway sections in the north-eastern area, while the SERTI project involves motorway concessionaires in the north-west. Therefore the SERTI and CORVETTE projects cover the whole northern Italy, thus involving a relevant part of the Italian motorway network in terms both of kilometric extent and above all of circulating traffic.

## METHODOLOGY

For the first time in Italy the evaluation of ITS services has followed an European common method agreed by Expert Evaluation Group (promoted by DGTREN) that makes it easier to compare the results achieved by similar ITS projects implemented on different areas, thus increasing the importance of the single projects.

This report will specifically analyse the location and evaluation, where it is possible, of the consequences of the ITS on the following issues:

- safety;
- effectiveness;
- environment;
- users acceptance;
- integration;
- accessibility.

The projects CORVETTE (CO-ordination and Validation of the dEployment of advanced Transport TElematic systems in the alpine area) and SERTI (Southern European Road Telematics Implementation), together with other Euro-regional Projects included within the MIP (Multi-annual Indicative Program for the Trans-European Network), are all the main means for promoting and diffusing the ITS (Intelligent Transport System) on both the Italian motorway network and the Trans-

European road network (TERN). These projects aim at promoting a harmonious and synchronized development of the systems. Their final objectives are:

- optimising the use of roads capacity and traffic flows of both people and goods;
- improving road safety by reducing accidents and their consequences;
- reducing damages on the environment by decreasing traffic jams.

An evaluation is required for all the Euro-regional projects to:

- account for the funds allocated by the European community;
- prove the benefits of single applications;
- prove the benefits of the whole of the applications;
- prove the benefits of the higher information exchange among the several projects.

The idea of having a common evaluation method makes it easier to compare the results achieved by similar ITS projects implemented on different areas, thus increasing the importance of the single projects.

## GENERAL PRINCIPLES

There are some general principles to be taken into consideration during the evaluation process in order to underline the most important aspects of each stage in the development of the ITS projects in hand.

First of all, evaluation aims shall be made clear. They are:

- describing of the ITS performance,
- proving to both national authorities and the European community the benefits thus obtained,
- evaluating the positive aspects of applications,
- accounting for funds allocated.
- last but not the least the chance, either for those who are willing to apply similar methods or those who have similar problems, to make use of analyses to actually evaluate the progress made in achieving results and to correct the technologies applied

Secondly, by carrying out an evaluation before the implementation (ex-ante) it is possible to check that the expected results have actually been achieved, while also creating a database to be applied to the subsequent evaluation (ex-post).

The clearer the objectives stated by the project in hand are, the more effective the evaluation will be; thanks to this statement our attention can be focused on the progress made in achieving the expected results.

An evaluation shall generally include:

- a clear description of both place and context, where the ITS application was carried out, to make it easy to evaluate the exportability of the results to other similar ITS implementations;
- a complete description of the survey methods and techniques employed to make it easy to read the results achieved;
- a set of specific indicators fully acknowledged at European level to evaluate the effects and to improve results comparability at both national and European level;
- assessment of the statistical significance degree of the results achieved.

## RESULTS OF THE STUDY

### Third Lane (T3)

The Third Lane project (T3), implemented by the Società delle Autostrade di Venezia e Padova S.p.a. (CORVETTE area), aims at improving traffic conditions by using the facilities available; the project aims at making traffic conditions more smooth-flowing during rush hours. The capacity of this road shall be increased by letting vehicles travel on the emergency lane.

**Safety:** potential and actual safety has increased on the infrastructure where the T3 system was implemented.

- The number of accidents per direction has significantly decreased (- 57,7% eastbound, -49,0% westbound); even the number of collisions has decreased, both in absolute terms (-71,0% eastbound, -66,7% westbound) and as percentage on the number of accidents.

- A higher evenness of traffic and a reduction of the potentially risky phenomenon of “stop & go” has been obtained.
- Vehicles linear density has significantly decreased (-31,0% in winter and -41,1% in summer) thus allowing an average increase in safety distances between vehicles.

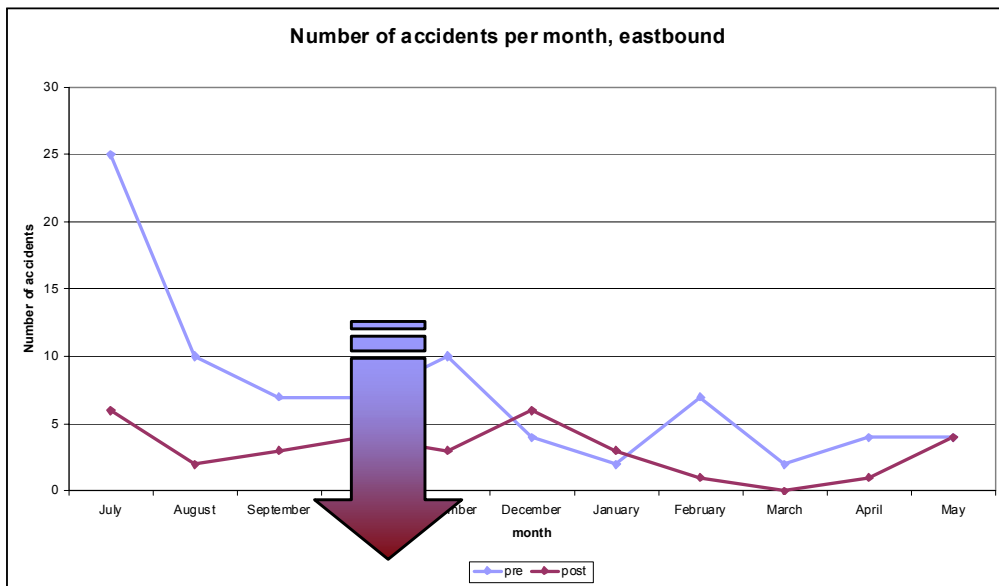


Figure 1 – Number of accidents per month surveyed eastbound in the period before and after the T3 system implementation.

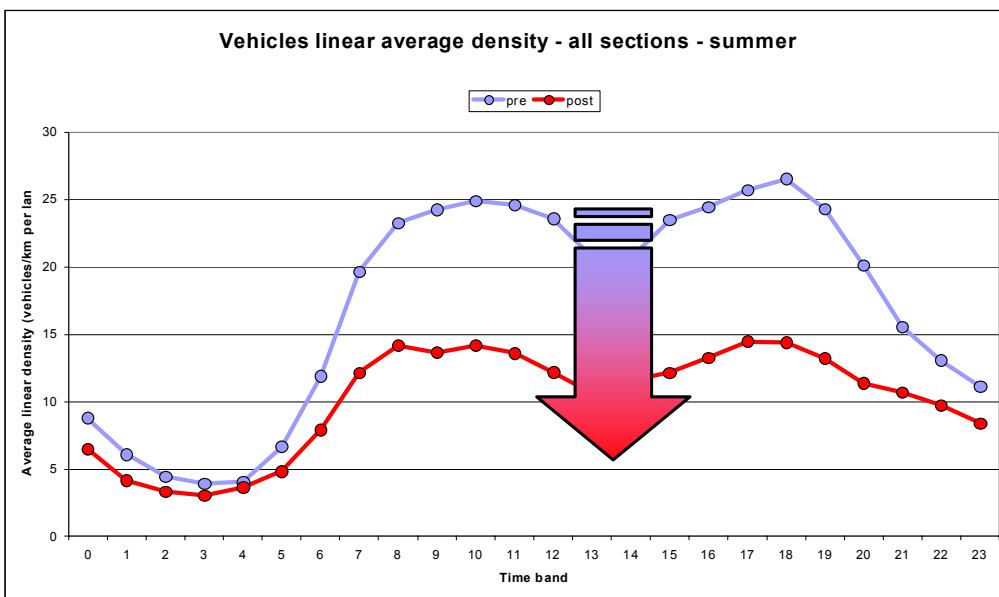


Figure2 – Average linear density of vehicles – all sections – summer.

### Effectiveness

The third lane was most frequently opened between 5-23 in winter and 5-21 in summer. In the remaining time bands the third lane is less often opened with a frequency under 50%, with minimum frequency (lower than 10%) at night during winter.

- Traffic flows have increased in the sections under control (+7,5% on average in time bands when the third lane was more frequently opened in winter, and +8,0 in summer). The highest average increase was recorded in winter working days (+12,6%).
- Flow speed has increased, especially in summer (+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.
- The different amount of traffic increases in winter on the several sections under examination indicates a substantial increase of short-distance flows which cover only part of the sections under examination. This result proves the improvement in the accessibility of the infrastructure on the part of local traffic using the beltway. Before the T3 implementation local traffic had to use other roads because of the high congestion on the beltway.
- Speed limits imposed and indicated by VMS are generally observed, thus proving the effectiveness of their use in indicating speed limits.

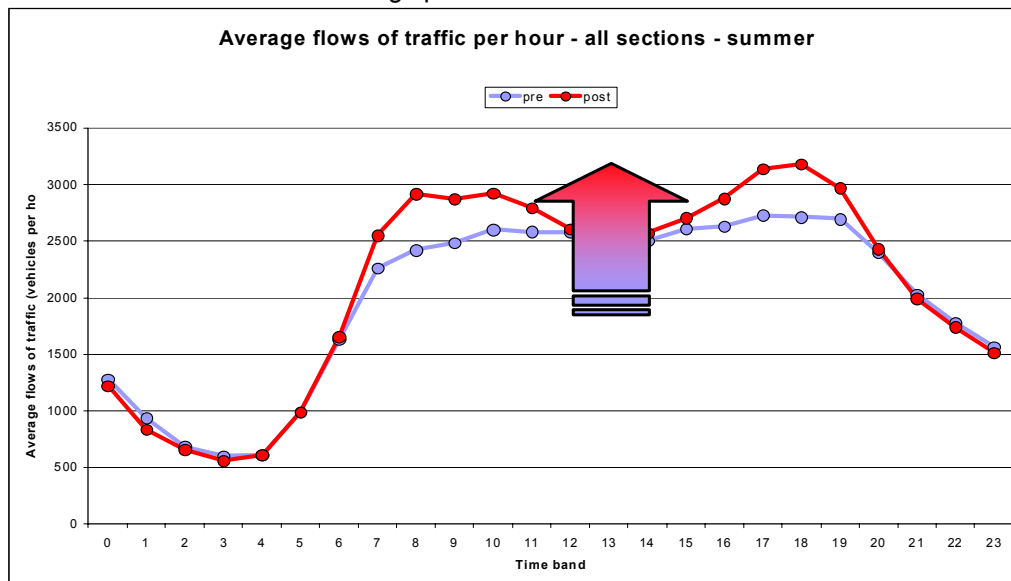


Figure3 – Average traffic flows per hour – all sections – summer.

### Environment

- The regularization of flows and speed after the T3 implementation ensures improved traffic flows and the sharp decrease in traffic jams, which usually cause a particularly polluting way of driving. The effect on the environment may therefore be considered positive, even if no quantity indicators for emissions and air quality were developed.

## ITS on the Autostrada dei Fiori

The Autostrada dei Fiori (SERT1 area) implemented several ITS along the whole motorway in order to improve both safety and traffic management in general.

This implementation is the only cross-system to include many transports-telematics related aspects. It is therefore very interesting thanks to the extension and synergy achieved by a joint management of different technological systems.

### Safety

- The selected indicators showed a reduction in the number of accidents per vehicle - kilometre between 1996 – 2003 and a significant decrease in their seriousness both in terms of casualties every 100 accidents and in terms of casualties per vehicle - kilometre.
- Furthermore, the most satisfying results were given by comparing the value of indicators on the AdF with those recorded on Italian motorways in the same reference periods. In particular, the percentage change in the number of accidents per vehicle – kilometre, of casualties and injured per vehicle - kilometre between 1996 and 2003. We can therefore see a national tendency to improve motorway safety, but a better performance of the AdF especially in reducing the number of accidents per vehicle – kilometre and the number of casualties per vehicle - kilometre..

Table 1– Safety indicators of the AdF – Years:1996 – 2003 – Elaborated on Aiscat data.

Year	Accidents per million vehicle-km	Fatal accidents /Total accidents	Injured per million vehicle-km	Casualties per million vehicle-km	Death rate (casualties every 100 accidents)
1996	0,57	1,58%	0,28	0,013	2,26
1997	0,57	1,58%	0,28	0,013	2,26
1998	0,57	1,58%	0,28	0,013	2,26
1999	0,57	1,58%	0,28	0,013	2,26
2000	0,57	1,58%	0,28	0,013	2,26
2001	0,57	1,58%	0,28	0,013	2,26
2002	0,38	1,03%	0,29	0,007	1,89
2003	0,33	0,71%	0,20	0,002	0,71

### Effectiveness

- The AdF showed an increase in traffic volumes higher than the average increase recorded on all Italian motorways.
- With the increase in traffic there is also a small but significant increase in the average speed. This allows to conclude that the motorway was able to contain traffic flows without reducing its average performance.

Table2 – Percentage change of vehicle – kilometre on the whole Italian motorway network and on the AdF. Evaluation of the percentage change of data on each single section with respect to the national level. – Elaborated on Aiscat data.

Years of change	% change vehicle-km National trend	% change vehicle - km AdF	Change in AdF value with respect to the national average
1997 - 1996	3,95%	4,24%	0,30%
1998 - 1997	4,41%	32,07%	27,66%
1999 - 1998	3,25%	4,66%	1,41%
2000 - 1999	3,45%	3,23%	-0,22%
2001 - 2000	3,78%	2,21%	-1,56%
2002 - 2001	2,85%	4,67%	1,82%
2003 - 2002	2,94%	2,61%	-0,33%
<b>2003 - 1996</b>	<b>27,36%</b>	<b>63,28%</b>	<b>35,92%</b>

Table3 – Average speed on all sections per day. – Years: 1999 – 2004.

Average speed per day (km/h) Average on all sections		
Year	Light vehicles	Heavy vehicles
1999	108,01	108,47
2000	110,11	111,59
2001	110,64	110,59
2002	110,88	110,71
2003	110,97	111,46
2004	110,18	109,98

**Users' acceptance:**

- Results emerging from the number of visits to web pages prove a good acceptance of pre-trip information on the part of users.

**Companion Project**

The Companion project, carried out by the Società Autostrada Brescia Verona Vicenza Padova (CORVETTE area), aims at reducing accidents, in particular those caused by the first one in emergency situations or when visibility is low due to weather conditions. A lighting posts system shall be therefore used to timely warn drivers in case of danger.

**Safety:** it will potentially increase thanks to:

- the technical effectiveness of the system.; it can give a timely and consistent warning in case of an impending danger;
- the reduction, although limited, of vehicles speed when light posts are activated;
- the lower number of accidents and collisions recorded on the historic Soave Montebello section.

*Table4 – Number of accidents per km per section.*

Section	Number of accidents	Section km	Accidents per km
Sirmione - Sommacampagna	366	19	19,26
Soave - Montebello	130	9	14,44
Grisignano - Padova Est	268	19	14,11
Other sections	1596	99	16,12
Autostrada Brescia Padova	2360	146	16,16

**Effectiveness**

The system proved technical effectiveness and it automatically activates when visibility is low. The system activates in a consistent and timely way facing the danger to be signaled and it can:

- follow and go ahead queues expanding before or ahead; it always activates well ahead the point of sharp braking.
- follow the extent of a foggy area, thus effectively warning users approaching a fog bank;
- provide consistent information thus avoiding the excessive alternating of activation and deactivation phases and properly filtering temporary and hardly relevant changes of parameters controlled by sensors, without having to change the state of activation in vain.

In analyzed cases regarding light posts activations due to low visibility, a speed reduction of vehicles from -0,4 to -15,2 km/h was recorded, corresponding to a percentage of -0,4% and -13,6%. Safety distance between subsequent vehicles showed no clear changes, but alternating increase and decrease.

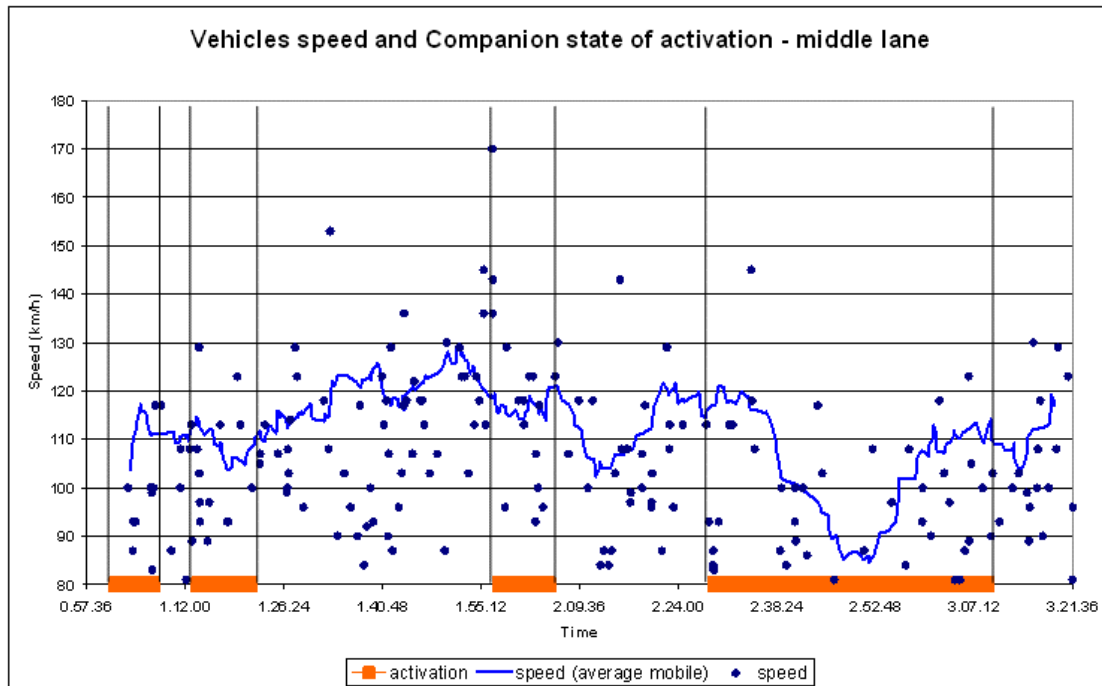


Figure4 – Trend of vehicles in time and state of activation of Companion – Soave – Montebello section, eastbound – 08/02/2004.

## CONCLUSIONS

The evaluation carried out and synthetically described, evidenced some circumstances, in part predictable but in part also unexpected, with respect to the effectiveness of ITS systems to improve safety conditions of the highway circulation, especially compared to the remarkable increase of traffic flows recorded in these last years.

These considerations are justified above by the consistent reduction of the accidents in quantitative terms and with respect to their seriousness, demonstrated by the reduction of the number of casualties.

The results stimulate two considerations. The first regards the opportunity to integrate single ITS implementation made available by the technological progress; their usefulness and their effectiveness, in fact, are greater when the single implementation participates to the constitution of complex and centralized systems that facilitate the observation of several phenomena and the definition of action aimed to traffic control.

The second one regards the usefulness of the evaluation of ITS systems, that have allowed to obtain quantitative and objective estimations of the effectiveness of technological innovation and of the opportunity of investments towards an increased safety. This result should induce to go on with this activities, considering that the increased availability of observations and surveys allow to execute statically more and more reliable appraisals.

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