

ON-TRIP AND PRE-TRIP INFORMATION ON A MODERN MOTORWAY MADRID2003

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The realization of new motorway infrastructures or the strengthening of existing ones meets ever increasing difficulties due to costs and environmental impact that such actions causes. In Italy the situation is made worse by mountainous orography and strict urbanistic provisions. Traffic levels are also constantly increasing and consequently mobility becomes more and more problematic. In the light of these considerations, it becomes of fundamental importance to set motorways to adequate technological levels, in order to optimize traffic fluxes flowing in safety conditions in existing infrastructures, and also to increase mobility information.

1. ASTM/SIAS Group presentation

The ASTM/SIAS industrial group gather these motorways companies:

ASTM	A4	Torino – Milano	km	127,0
SATAP	A21	Torino – Piacenza	km	164,9
SAV	A5	Quincinetto – Aosta	km	59,5
SALT	A12	Sestri Levante – Pisa Nord / Viareggio – Lucca	km	154,9
AdF	A10	Savona – Ventimiglia (French border)	km	113,3
Autocamionale Cisa	A15	Parma – La Spezia	km	101,0

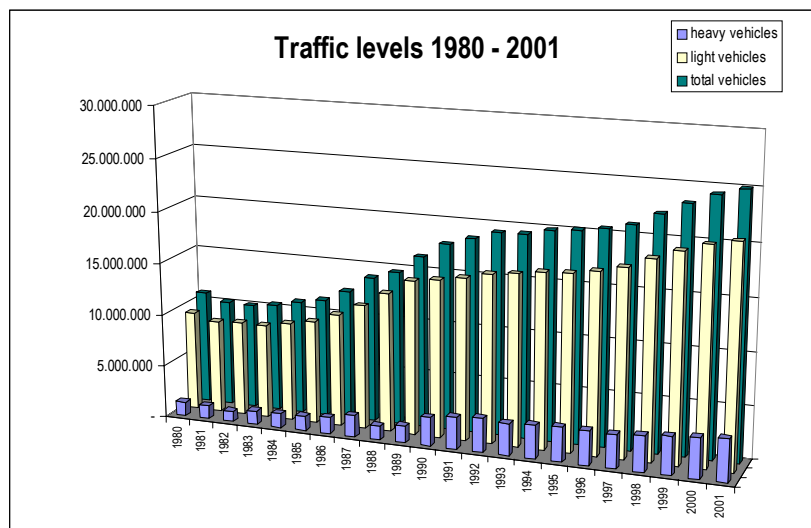
ASTM Telecomunicazioni is the group's company involved in telecommunications and infomobility.

Autostrada dei Fiori SpA (AdF) is the company that operates the A10 motorway between Savona and the French border, belonging to E80 (Roma – Marseille – La Coruña) motorway itinerary, a route of primary commercial and tourist importance.

The motorway stretch spans 113,3 km, is made of nr.90 viaducts and nr.67 couples of tunnels, 62 of which measure more than 150 m in length and equipped with lighting plant with strength circuitry at the beginning. Tunnels longer than 1.050 m are also equipped with forced ventilation system. The motorway stretch has a maximum outdoor slope of 4%, of 2.5% inside tunnels and is characterized by the absence of emergency lane.

2. Traffic levels

AdF traffic levels have notably increased in time and tend to grow constantly year by year in connection with commercial trades increasing among France, Spain, Portugal and general mobility increasing (Fig. 1). This, together with the difficulties of the described route, has made necessary a careful attention in handling the viability service by means of the motorway company.

Fig.1

A damage or wrecked vehicle along a Ligurian motorway by the way represents a heavier traffic nuisance than along other motorway stretches, due to the large number of tunnels and viaducts and emergency lane missing, though of difficult implementation since the described territory orography.

To reach the maximum road user safety target, AdF persecuted and still persecute the following strategies:

- ✓ fast incident and traffic jam detection;
- ✓ traffic data and weather data collection;
- ✓ (pre-trip and on-trip) road user information broadcast;
- ✓ coordination with other traffic handling actors (Road Police, other Italian and French motorway operators, CCISS, mass-media, etc.).

During last years in connection with bursting technology evolution the Company promoted a series of investments aiming to set new special plants at the disposal of the infrastructure operational management.

3. Existing motorway special plants

In connection of what said before, the motorway stretch has been equipped with various special plants in order to make traffic management safer and easier.

Along the motorway a SOS system exists, made of nr.287 columns situated outdoor about every 900 m, and about every 300 m inside tunnels (Fig. 2). Outdoor columns allow the user to request mechanical and medical aid; inside tunnels columns are also equipped to allow fire aid request. Recently the implementation of voice capability has been completed, allowing users to talk with the motorway Operative Control Center operators, based in Imperia, with great advantage in case of accident or mechanical wreck.

An iso-frequency radio system set at 170 MHz is provided for company communications, covering also tunnels, and an analogous system set at 70 MHz is provided for Road Police patrols working on the motorway (Fig. 3).

The motorway stretch is also equipped with a close circuit TV system: 48 colour cameras are placed in open field, with pan-and-tilt and zoom capabilities, and 24 fixed angle cameras are placed inside major tunnels. Inside Orco, Fornaci and Siestro tunnels an automatic incident detection (AID) system has also been implemented. The images from the cameras are transmitted to the Operative Control Center where, in the case of special events, operators have the ability of handling the situation with the help of real time images.



Fig. 2



Fig. 3



Fig. 4

Along the motorway there are also 10 traffic counting stations, made of inductive electromagnetic loops. Such a system is able to detect the flow, the speed and the type of passing vehicles (divided in six categories: cars, lorries, buses, lorries with trailer or vehicles with trailer or any other vehicle); the system sends an alarm whenever the average vehicle speed decreases beneath a fixed threshold, or whenever the vehicles flow increases over a predetermined level. Evaluation of these information, gathered every 5 minutes, allows the operators to verify the traffic evolution trend and detect the overcoming of any nuisance (Fig. 5).

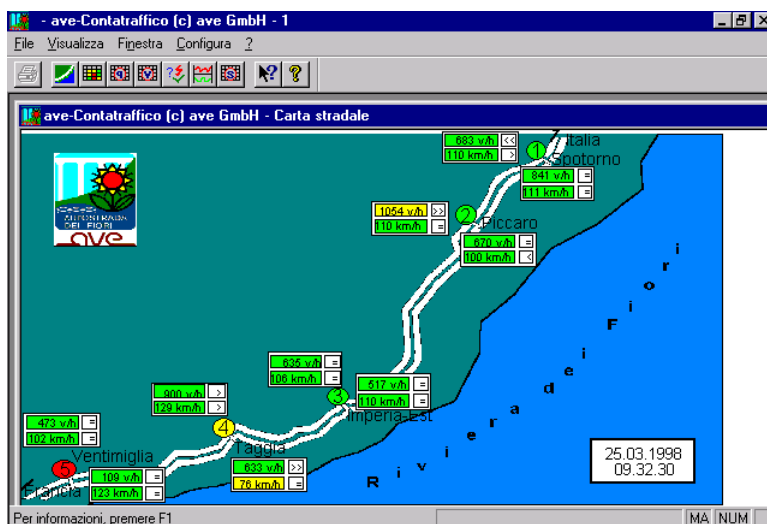


Fig. 5

In every road stretch with a significant climatic risk nr.8 weather data detection systems have been placed; these detectors can measure air temperature, precipitation intensity, wind direction and speed, air humidity level and road surface temperature and state (dry, wet, icy, with snow, treated with saline solution). These data and correlated alarm signals are collected every 15 minutes and displayed at the COC level; this way all the necessary intervention can be quickly organized, for example the preventive antifreezing treatment.

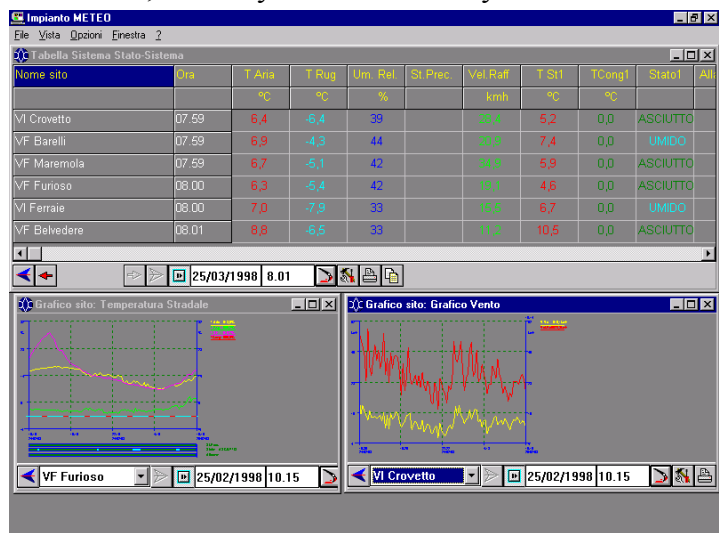


Fig. 6

In forced electron-ventilation equipped tunnels a remote control system have recently been implemented, in order to allow Operative Control Center operators to handle the ventilation system in

an optimal and fast way, even in the case of traffic queues or emergency situations. An experimental plant has been installed inside Fornaci tunnel, able to measure smoke opacity, carbon-oxide concentration and air flow intensity and direction.

Fig. 7

Agreements have also been signed with mobile phone operators (Tim, Omnitel-Vodafone, Wind), to implement adequate motorway field coverage plants, including tunnels inside (Fig. 8).

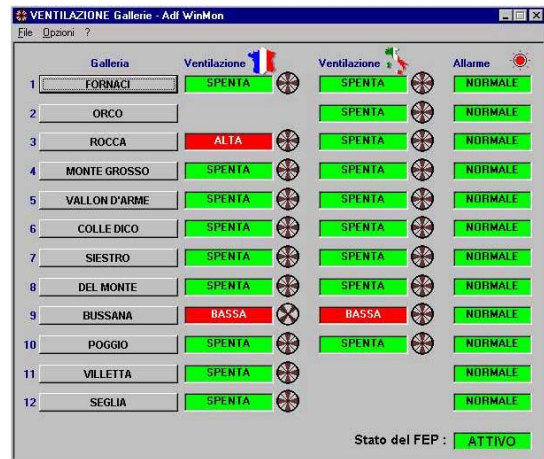
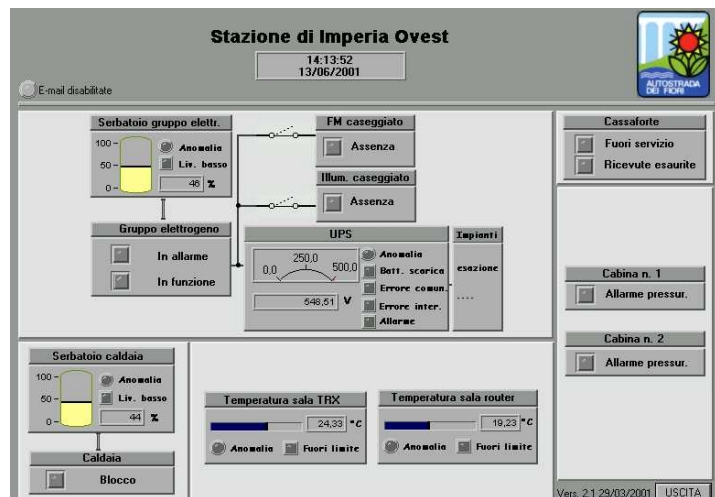


Fig. 8

A remote control systems for toll station plants have also been implemented, thus controlling electrical power presence, UPS battery activity or generator activity, conditioning or heating system alarms, etc.. (Fig. 9).

Fig. 9

A variable message sign informative system (VMS) has been created, to give road users adequate information; it consists in 14 road-side emplacements and 14 toll station areas emplacements, and it is being extended to service-areas and parking zones (Fig. 10). Road side portals sport 2 graphic panels with multicolor capability and an alpha-numeric display with amber light (592 nm wavelength) led, displaced in 3 lines of 15 characters each; toll stations portals offer text-only capability, with an amber light alpha-numeric panel made of 4 lines up to a maximum of 80 characters.



**Fig. 10**

The same information that are given to road users by means of the described systems are also available to broadcast services such as the ones supplied by RAI, CCISS – OndaVerde, RMC Autotraffic, or television services such as RAI Televideo or CCISS. In medium

term the installation of further 40 cameras inside major tunnels is planned. All these cameras might be equipped with automatic incident detection system in the near future. Moreover the company plans to install 10 more VMS panels along the roadside, in major service areas and parkings, to increase the informative infrastructure available to road users.

Finally, an iso-frequency radio system set at 103.3 MHz (ISORADIO), in collaboration with national broadcasting service RAI), will be installed and made available to road users, broadcasting traffic-specific information on a same frequency, also inside tunnels.

4. Operative Control Center structure

The Operative Control Center heads all information and data collected in various ways from the motorway field; service is guaranteed 365 days per year, 24 hours a day by two operators from 6 am to 22 pm and one operator during night-time.

The COC receives also Meteosat satellite images, thus allowing short term weather forecast with a certain degree of approximation. The company is also connected to Bologna's Meteorological Center for custom tailored weather forecast based upon motorway collected data. Finally, the COC receives a daily report from Sanremo – Portosole weather forecast station.

A telematic connection is available with the Operative Control Center of the French motorway operator of the close span (ESCOTA) in Nice, to better handle the traffic management along the border; by means of that connection TVCC images are exchanged in real time. Other services are planned for the near future.

The company COC has at its own disposal a private radio telephonic system, a number of public phone lines and a geographic optical fiber link that handles various communication systems. When needed, COC operators – by means of proper authorization from the management – can inform competent public authorities (Polizia Stradale, Prefettura, Protezione Civile, Vigili Urbani, Vigili del Fuoco).

One of the most important roles of the COC is to answer all the emergency calls from road users; in emergency cases, it also has at its own disposal an automatic answer system that can handle pre-recorded messages.

In the extent of the technological development of systems and service integration, AdF created an Informative System for mobility and emergency handling, based upon the COC local network: it provides three consoles that collect all special plant front end processors interfaces, this way empowering the operativeness, especially in emergency situations.

The system integrates the following services: traffic monitoring system by means of TVCC



images, emergency calling SOS system, traffic counting stations data, weather data collection systems, environmental monitoring plant for tunnels, variable message signs system, remote control for tunnel forced ventilation system (Fig. 11).

Fig. 11

Developing such a system required successive step procedures, thus guaranteeing the

operativeness of the Control Center and its institutional duties.

The local telematic network has been built upon Microsoft Windows NT technology, with personal computers and workstation of various computational power, with an open architecture capable of integrating future developments. New technologies have been widely adopted to guarantee the “openness” of the system.

In the near future an expert system and operator guidance platform will be developed, to lead Control Center operators by means of artificial intelligence rules in a semi-automatic way, to better handle complex emergency situations.

A road operator telematic network, based upon European standard protocols (DATEX), will soon be put into operation together with other motorway operators, national and international, to exchange data.

5. Pre-trip and on-trip information by means of modern applications



In connection with the ever increasing spread and user hits on the Company Internet site (evaluated in an average amount of 200 per day with peaks of more than 500 hits), the Company stated to set available in real time on the web site some information about road conditions, road works, weather conditions and messages displayed on VMS. On the web site users can also access the images from 3 web cameras displaced along the roadside (Fig. 12).

Fig. 12

At experimental level, the same information are provided upon WAP based services to mobile phone WAP capable devices (Fig. 13). Effort is also made, for uses intended just to road management, to make the web cameras images available to hand held terminals based on Microsoft PocketPC platform, with a good quality level.

Fig. 13



6. Possible new Information Technology applications

It is likely that in the near future new forthcoming technologies will come in support of motorway operators to allow, at a reasonable cost, important applications. Think for example to service vehicles localization, yet in advanced experimental state in AdF, by adopting a GSM transmitter together with a GPS localization system and a processing unit. A potential application will be the positioning of salt-cellar vehicles or snow-shoveling lorries, at a very reasonable cost (Fig. 14).

(Fig. 14).

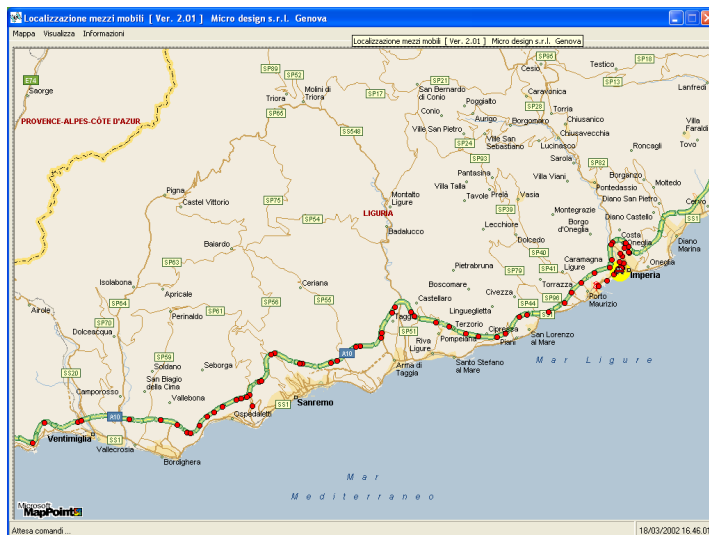


Fig. 14

It is also likely to guess a future development of such transponders for dynamic toll-payment systems and infomobility applications, to evaluate for example travel time or sending complementary on-trip information or an alternative to traditional VMS systems.

It is not daring even to imagine a synergic collaboration with mobile phone operators, by means of whose network it may become possible to position the road user in real time and feed him with useful real time information (Fig. 15).

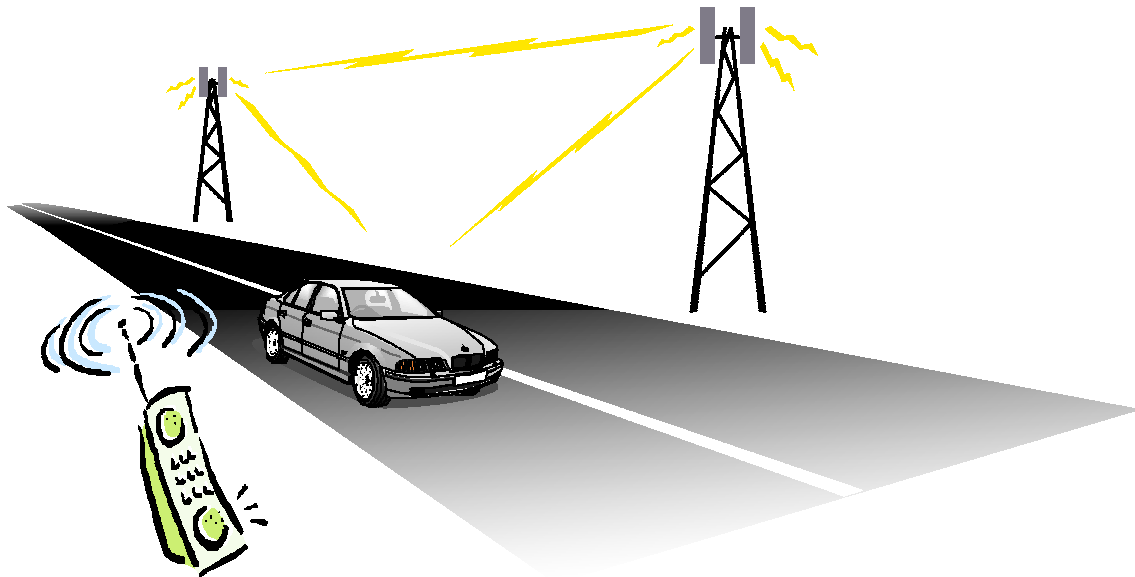


Fig. 15

Aiming at this ASTM Telecomunicazioni is putting maximum effort, in order to make cutting edge technologies available to all ASTM/SIAS group companies, thus guaranteeing the road users the best services about infomobility and telecommunications.