

Safe Keeping: One Concessionaire's Success in Protecting Italy's Motorway Users

By Paolo Berti

Autostrade per l'Italia (ASPI), based in Rome, Italy, is a top European concessionaire in tolled-motorway construction and management (Figure 1 shows the ASPI motorway network). But the organization is also a leader in safety, as a special campaign ASPI has undertaken this decade indicates.

Figure 1: The ASPI Group Companies



Since 1999, ASPI has made an ambitious commitment to increasing the safety of its segment of the Italian Motorway Network, with a significant emphasis on infrastructure improvement. In the process, the company has developed new guidelines for road design and operation that include specifications for hard components, such as pavement and safety barriers; soft components, such as road signs and markings; and tools of compliance, including speed checks, advertisements and press releases to encourage safe driving, and Italy's Safety Tutor speed-monitoring system (see Figure 2).

In this time, ASPI's efforts have helped reduce the death rate on its network by 70 percent, from 1.14 deaths per 100 million kilometers traveled to 0.34 deaths as of mid-May 2008 (see Figure 3). This improvement markedly exceeds the 50 percent death-rate reduction targets set by the European Union, more than two years ahead of schedule.

The success ASPI has realized offers some intriguing lessons and insights for others in the transportation industry to consider.

Hard Components: Improving the Roadway

Since 1999, ASPI has improved the hard components of its network road design and infrastructure noticeably.

Specifically, the company has:

- Added draining pavement (which covers more than 78 percent of the ASPI network's surface).
- Adopted a shorter road-surface-renewal cycle, down from an average of every four to five years to three years.
- Added a high-grip wearing layer on stretches of road on which the accident rate exceeds the network average. (The so-called Grip Road is a special asphalt layer that increases the sideways force coefficient, or the value of the road surface's skidding resistance.)
- Improved 520 kilometers worth of safety barriers (currently, 76 percent of the ASPI network includes such structures), increasing the barriers' crash-absorption levels.
- Completed the closing of all central openings in existing safety barriers (totaling more than 1,200 openings), replacing the openings with removable sections that allow passage of emergency vehicles.
- Installed protective life nets at the center of all bridges with separated carriageways (constituting approximately 300 kilometers) to prevent people from falling over.
- Adopted a plan to install impact attenuators designed and tested by ASPI. So far, 435 attenuators have been installed; when the plan

Figure 2: Steps to Better Road Safety

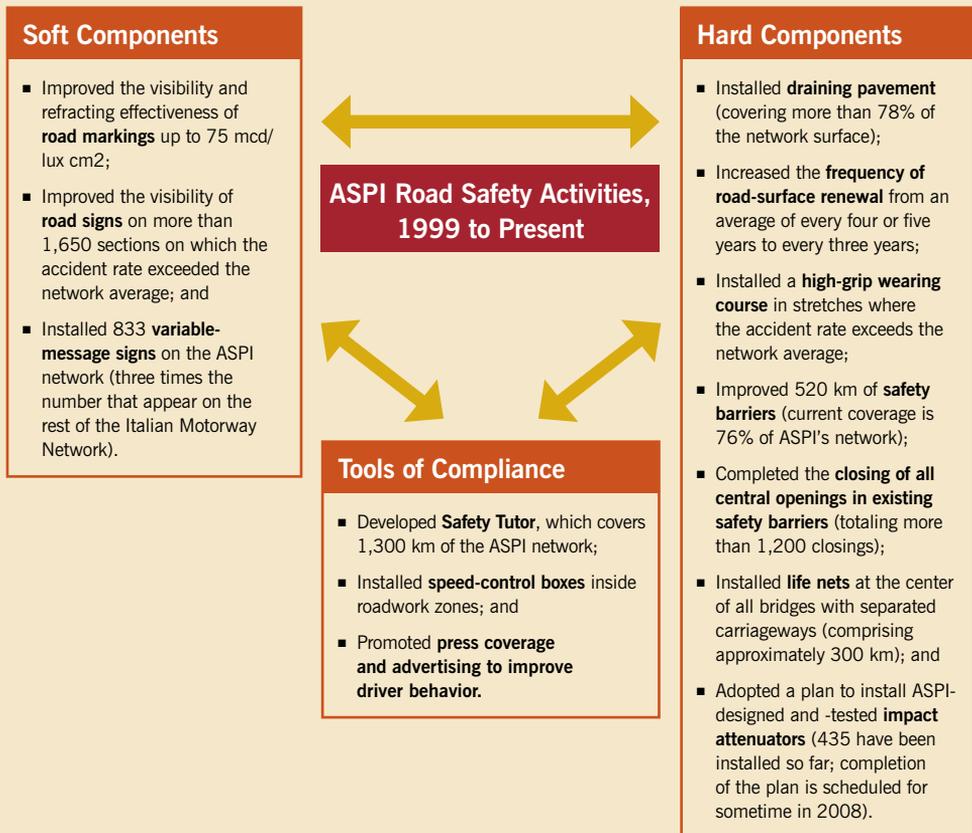
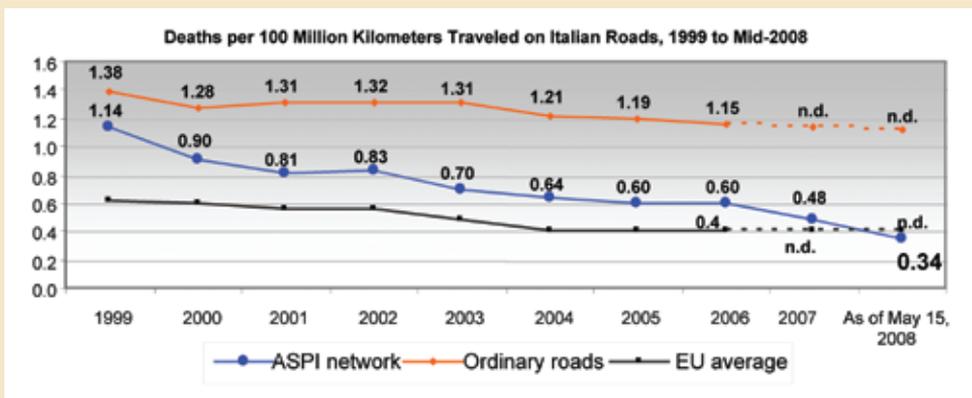


Figure 3: ASPI's Success in Reducing the Death Rate



is completed in 2010, nearly 900 attenuators will have been installed.

Soft Components: Beyond the Standard

To help increase driver safety, ASPI this decade has enhanced the visibility of road markings on Italy's roads in both normal and low-light conditions and improved the visibility of road signs on more than 1,650 motorway sections on which the accident rate exceeds the network average. The concessionaire has also installed 833 variable-message signs on its network (three times the amount that appear on the rest of the Italian Motorway Network) to keep travelers informed.

Since 2006, ASPI has introduced a series of innovations in addition to the variable-message signs that exceed the safety standards required by Italian

regulations. The changes were made to better protect motorists approaching and driving through roadwork zones and to minimize hazards to road workers.

The innovations include:

- Introducing flashing lights in advance of the presignalization sets required by Italian regulations. Flashing lights have been installed since 2002 and enhanced since 2006.
- Providing flashing arrows at all detours, even in daylight conditions.
- Upgrading the standards for the type and power of refracting film used for lights and signals.
- Providing additional protection in roadwork zones in the presence of workers, and requiring a minimum weight of 75 quintals for trucks hauling flashing signs versus 90 quintals for trucks without such signs. Protection in some cases has included attaching crash attenuators to trucks hauling flashing signs (see Figure 4).
- Providing, in agreement with the motorway police, speed-control boxes with mobile laser operation (via an autovelox, or speed-measuring camera) inside roadwork areas (see Figure 5).
- Moving from a broadcast-type traffic news system to a direct-contact system in which traffic updates are sent directly from ASPI to its subscribers (see Figure 6).

Improving road safety, of course, also entails performing regular mainte-

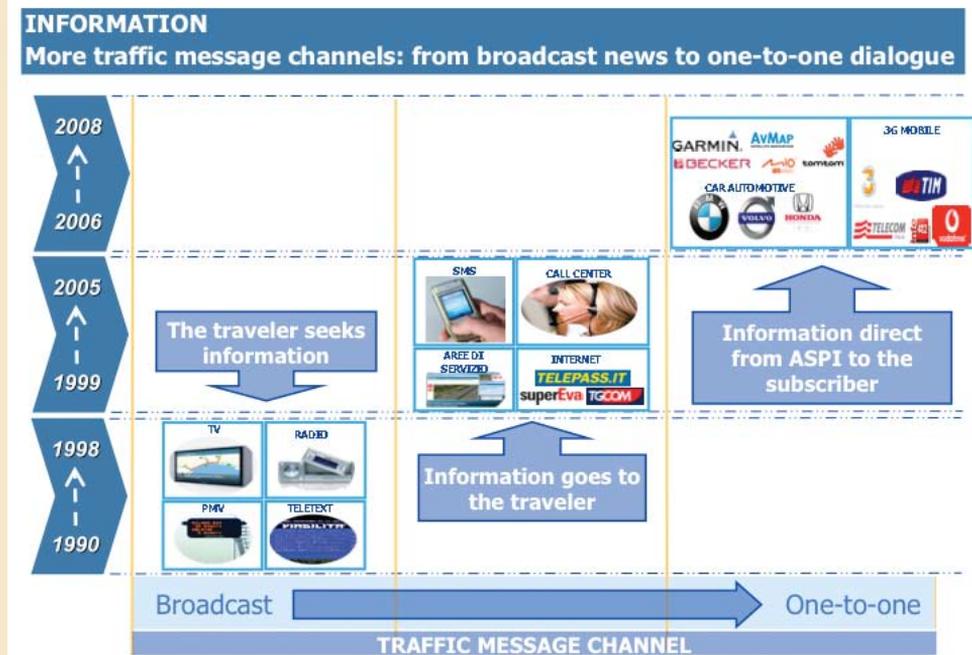
Figure 4: Example of the Crash Attenuators Installed on Trucks Hauling Flashing Signs



Figure 5: Examples of Autovelox Devices Used by police in Roadwork Areas



Figure 6: Evolution of ASPI Communications with Travelers



nance. ASPI uses planning software to formulate short-, medium-, and long-term plans to identify periods of low traffic flow when roadwork can best be conducted and motorists least inconvenienced. Such plans enable the company to perform regular maintenance activities and design roadwork areas so as to optimize the efficiency and consistency of the tasks, reduce their duration, and minimize their impact on traffic flow.

Tools of Compliance: The Safety Tutor System

Balancing the hard and soft components of road design and operation has been key in helping ASPI exceed the EU targets for reducing the number of deaths on its roads. But better roads and infrastructure alone aren't enough to ensure safety; driver behavior must be improved too, as reflected in the statistic that more than 60 percent of deaths on Italy's motorway network are caused by excessive speed.

The biggest weapon against road accidents on the Italian motorway is Safety Tutor, so named because it acts like a tutor in teaching travelers to drive safely. Fully developed by ASPI,

the speed-monitoring system has been operable in Italy since December 2005. The data-collection boxes that make up the system are installed on various structures on the motorway, including variable-message signs.

The goal of Safety Tutor is to increase the safety of the motorway by limiting the speed at which vehicles may travel. The system measures the average speed of vehicles on a motorway section, determines which motorists are not respecting the speed limit, and automatically fines noncompliant drivers. Currently, Safety Tutor operates on 23 percent of ASPI's network, with plans for inclusion on 38 percent of the roadway by the end of this year (see Figure 7).

Safety Tutor performs several valuable functions, including:

- Data identification for vehicles traveling its section of the motorway (including plate number, vehicle class, and speed);
- Automatic searches of vehicle owners through the Motorizzazione Civile (Department of Motor Vehicles) database;
- Automatic verification and printing of speed-limit violations;

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Figure 7: Italy's Safety Tutor System



- Automatic delivery of violation data to the police server; and
- Maintenance of violators' license plate numbers for use in statistical analyses by the police.

One truly innovative feature of Safety Tutor is its ability to employ various methods of measuring speed and travel times. For example, the system can detect the average speed of vehicles on a stretch of motorway using both laser and integrated-system technologies. A laser odometer is used

to measure the stretch in question to minimize the chance of error, and vehicle data such as class and plate number are read at two points on the roadway using an integrated method such as a loop detector, a camera, or optical character recognition. The integrated system can also be used to obtain a vehicle's speed instantaneously. Finally, Safety Tutor calculates travel time using two GPS-based timers.

Safety Tutor's architecture includes many on-road systems for acquiring

Figure 8: Rates of Accident, Injury, and Death on the Italian Motorway Network before and after the Adoption of Safety Tutor, per 100 Million Kilometers Traveled

	Period between Sept 2005 and Aug 2006	Period between Sept 2006 and Aug 2007	Change in rate
Accident rate	50.04	40.47	-19%
Injured people rate	23.60	17.28	-27%
Death rate	0.84	0.41	-51%

vehicle data. Each system secures the data using techniques such as cryptography, electronic signature, and secure data transmission that connect the system to a central server that is used for more elaborate data analysis. The police can access these systems via the police intranet to verify violations

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and transmit fines to vehicle owners. For proper system synchronization and data storage, Safety Tutor is linked to a server inside the police intranet. This arrangement permits the transmission of violations data to Motorizzazione

Civile, P.R.A. (the national license plate database), and the police server for fine management.

Specifically, the system architecture consists of:

- A loop detector for vehicle classification and speed detection;
- A high-definition camera (1,600 x 1,200) with IR (infrared) flash;
- A communication unit;
- A UTC (unit time chronograph) time-synchronization unit; and
- A personal computer for local storage and security.

Thanks to SICVe, the integrated software the system uses, Safety Tutor can:

- Classify vehicles in seven classes (1: motorcycles; 2: cars; 3: cars with trailers; 4: lorries; 5: trucks; 6: buses; 6+1: undefined vehicles);
- Detect speeds up to 255 kilometers (158 miles) per hour at an error rate of less than 3 percent; and
- Recognize license plates at a software

frame rate of five plate images per vehicle at speeds up to 260 kilometers (163 miles) per hour.

Since September 2006, when enough of the Safety Tutor system (460 kilometers) had been installed on the Italian Motorway Network to conduct valid analyses, the system has reduced the accident rate on the area it covers by 19 percent and the death rate by 51 percent (see Figure 8). The system

has influenced driver behavior, as well. Before Tutor was adopted, the average motorist's speed was 139.7 kmh (86.8 mph); since the system's introduction, that number has declined to an average speed of 123.0 kmh (76.4 mph).

Clearly, Safety Tutor, along with the other infrastructure improvements ASPI has shepherded in the past nine years, has helped protect and enhance the lives of Italy's 4 million motorists.

Paolo Berti is operations director for Autostrade per l'Italia in Rome, Italy. He may be reached at paolo.berti@autostrade.it.