TWO FRENCH EXPERIMENTS TO ENHANCE AWARENESS OF SPEED LIMITS

L. BLAIVE
French Ministry of Transport, Equipment, Tourism and The Sea (MTETM)
Road and Motorway Technical Studies Department (SETRA), France
Direction.setra@equipement.gouv.fr
& J. BOUSSUGE
French Motorway Companies Association (ASFA), France
jacques.boussuge@autoroutes.fr

SUMMARY

Improving road safety is a public interest target both at French and European level. Also, both are convinced that speed limits must be better observed in order to reach the European Commission's ambitious target for 2010, which is to cut the number of fatal and serious casualties by 50% on the Union's roads. Apart from repression, technical progress can help to reach this goal.
Today, intelligent speed adapters (ISA) can be put on the market, but they lack data to operate. All professionals agree that supplying these systems with reliable data is vital to their efficiency. The French BALI project was launched to prove the feasibility and interest of a speed limit data collection and delivery device on the scale of a French test district : Yvelines. This means creating a technical data collection infrastructure, but above all including data holders, with local authorities at the forefront.
At the same time, French motorway concession companies started experimenting to collect and broadcast speed limits on their networks, not only permanent, but also temporary (road works) and dynamic (traffic control) speed limits. This approach is fully complementary with the latter.

1 CONTEXT

In 2001, the European Union Commission published the following white paper: "European Transport Policy for 2010: Time to Decide" [1]. Among its proposals, transport safety and especially road safety were highlighted and ambitious targets were set. Its proposals included "promoting new technologies at the service of road safety". After this, the e-Safety initiative was launched by the Directorate-General for the Information Society (DG INFSO), in order to bring together and catalyse all field participants and works on a European scale. Numerous projects and working groups worked on this theme, including: SpeedALert, PROSPER, Maps&ADAS, PReVENT, etc… At mid-term, the Commission reviewed this white paper, which resulted in publishing a communication entitled: "Keep Europe moving – A transport policy for sustainable mobility" in June 2006. The latter observes existing progress, especially in the fifteen member states before the 2004 enlargement, and confirms the use of new technologies in this field, which results in continuing e-Safety and launching the "Intelligent Car 2010" initiative.

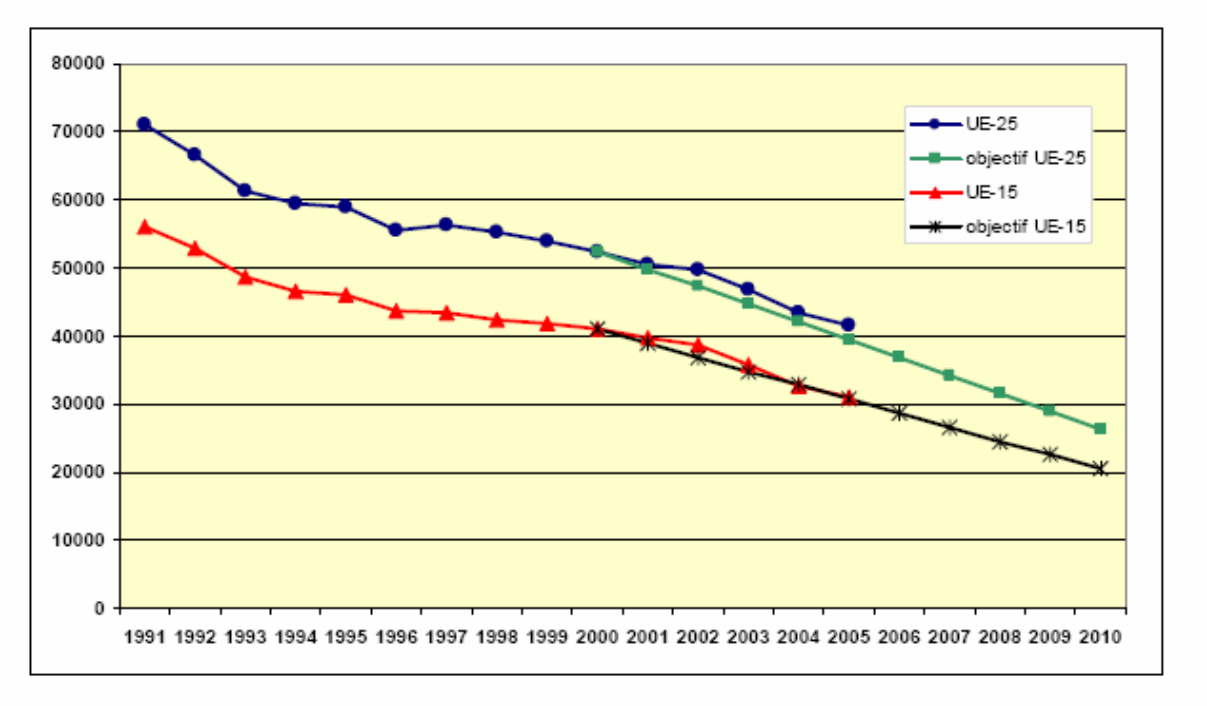

Figure 1 – Number of fatalities per road accidents in Europe (source: CARE - EC)

At the same time, in France, road safety became a nation-wide cause initiated by the President of the French Republic in 2002. An action plan followed, dealing with drivers' behaviour among others. As speeding is involved in one fatal accident out of 2, speed checks were drasticly intensified with new automatic equipments. Very good results were obtained, the number of fatalities being cut by 40% between 2002 and 2006. However, this increased speed enforcement will better be accepted if a work on speed limit consistency is launched and if their awareness by drivers is improved.

In July 2004, the cabinet of the French Minister of Transport, asked the French Steering Council for Public Works (*Conseil Général des Ponts et Chaussées - CGPC*) for proposals about developing new technologies in the ministry's competence fields ("e-Quipment"). Circulating speed limits was one of the subjects covered. Already previously, within the framework of PREDIT (French inland transport research and innovation programme), the LAVIA project, from the French acronym for "*Limiteur s'Adaptant à la Vitesse Autorisée*" (Intelligent Speed Adapter or ISA), was launched by the French National Institute for Transport and Safety Research (*Institut National de Recherche sur les Transports et leur Sécurité - INRETS*) and French Public Works Research Laboratory (*Laboratoire Central des Ponts et Chaussées - LCPC*) to perform a feasibility and acceptability study for such equipment by motorists (http://www.lavia.fr).

2 PRESENTATION AIMS

CGPC report [2] proposals include the following: "Show how the Speed limit database operates in a pilot district (in French: *département*) (…) i*n order to validate* planned *technical process* options (collecting, processing and broadcasting data via the Internet) as well as *administrative and legal provisions*, (…). The experiment would involve organising and implementing the proposed operational device, on the scale of a district and during a sufficiently long observation period."

This is the BALI project, from the French acronym for "*BAse de données des LImites de vitesses*" (speed limit database), which started at the end of 2005 and should run until the

end of 2008. This experiment was entrusted to SETRA. The latter is currently taking part or has taken part in European working groups and projects whose subjects relate to BALI, such as the European SpeedAlert project [3]. This paper aims to present the BALI project, its initial results and a few future prospects.

3 PROJECT ORGANISATION AND AIMS

3.1 Aims

The BALI project has a dual aim:

- Analyse the technical and operational conditions and methods for building a national database (initialisation and update) of speed limits and assess investment and future management economic costs;
- Implement a demonstration / prefiguration operation on the scale of one (or several) pilot district(s) (computer development will be required), foreshadowing the management of a future national database, enabling to validate costs and partner interest (service editors, order issuers, map makers etc.). This demonstration will be led accordingly to the Europe-defined recommendations for this topic

Legal aspects, such as penal responsibility or the legal impact of data certification are not part of the project. On the other hand, the intellectual property rights of information providers, notably mapping, supplying information from a national database to third parties must be assessed.

Such a national database is indeed acknowledged to improve the reliability, and thus pertinence of in-vehicle devices providing motorists with speed limit data. We can therefore rightfully expect a positive impact on road safety. The significance of this kind of action was greatly highlighted within the framework of European research projects such as SpeedAlert.

Also, it could enable bodies in charge of setting police regulations to improve the management of speed limit choices and locations throughout networks under their responsibility.

3.2 Participants

The Directorate for Road Safety and Traffic Management (*DSCR - Direction de la Sécurité et de la Circulation Routières)* is in charge of the project's client function for the French ministry of transport

Technical Centre for Highways & Motorways (SETRA) has been entrusted with conducting and monitoring the project.

The region-level office for infrastructure in Île-de-France (West Paris Regional Laboratory - *LROP*) ensures the whole project design, due to its LAVIA project experience. Design and technical development have been outcontracted to the private sector.

3.3 Experiment area

The chosen initial experiment area is the Yvelines district. Indeed, the LAVIA project experiment area was mainly located in this districtt. Data is available, following the project, but the area must be widened to the whole district for more significant cover. At the end of

the experiment, the latter may be extended to another district, which did not enjoy this precedence.

3.4 Projet Development

The project is divided into four stages:

- Stage 1 has two aims. The first aim is to observe the field's present situation, either via the results of two completed European projects or the evaluation of safety data (speed limit data and other similar data such as police information) supplied by the main market map providers. The second aim is to define the demonstrator's performance engineering and functional specifications.
- Stage 2 aims to design, produce and put the demonstrator into service. At the same time, the project team will explain to local authorities and make them aware of the experiment area in order to obtain their support for this experiment.
- Stage 3 is the experiment itself for a twelve-month period.
- Stage 4 is project assessment.

Spring 2007, the first stage is completed and the second stage is currently in progress. The schedule target is to be able to launch the field-experiment stage, in real conditions, with local authorities in September 2007.

4 INITIAL RESULTS AND EXPECTED PROBLEMS

4.1 Initial results

At the end of the first stage, documents were produced in response to its two aims. The main results that can be highlighted are as follows:

- At present, commercial geographical databases for France have been scarcely input. Their contribution is important for data geometry and locating, but limited in the content of safety features. Indeed, they almost only include information about a motorway network whose impact in reaching road safety and speed limit observance improvement remains rather limited.
- For the two given European projects - SpeedAlert and EuroRoadS European research project (6th PCRD - eContent), which aimed to "build a platform for a pan-European road data solution" [4]), they were found to be of real interest and a worthwhile base for future progress:
    - In SpeedAlert, the proposed speed limit typology has become the reference in Europe and henceforth almost all European or national projects and studies about this issue are based on the latter. It also proposes the definition of several scenarios for installing such systems (BALI is clearly within the framework of the "autonomous system with digital maps" scenario). Finally, it proposes a global architecture of the speed limit data production line:

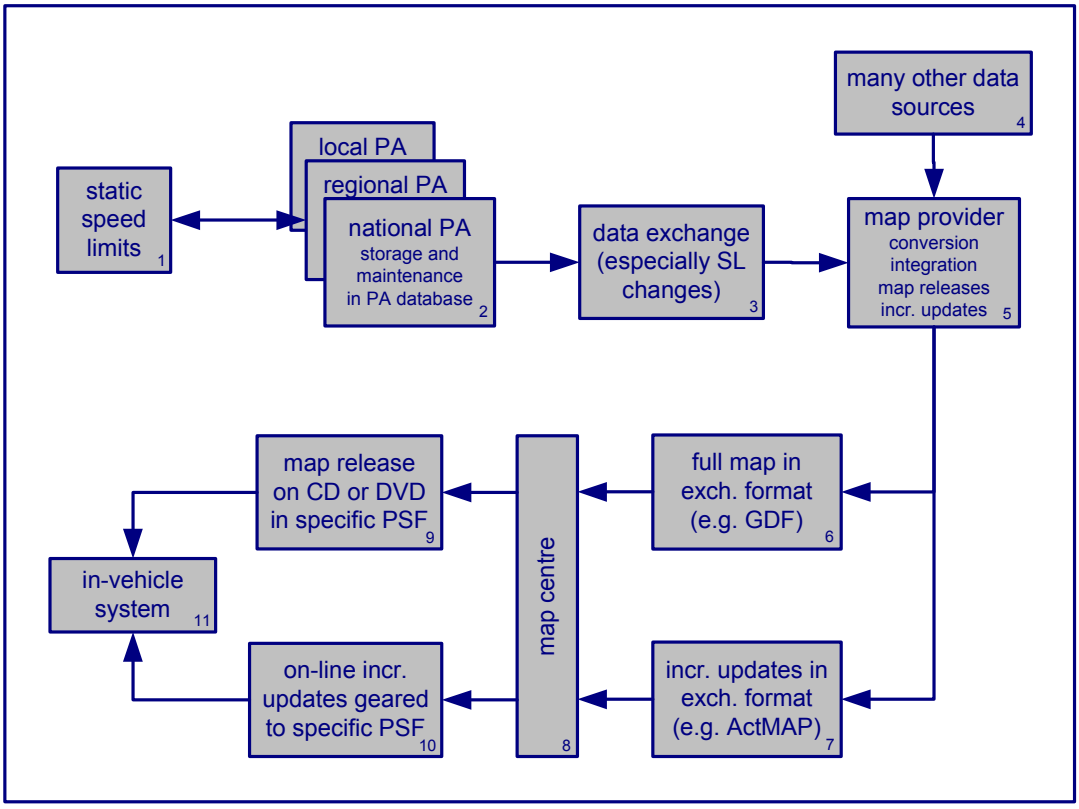

Figure 2 – Overview of the data chain for static speed limits (from SpeedAlert)

- The EuroRoadS project offers a conceptual model defining road network objects and a method for relating attributes to these objects; a definition of core European road network data; specifications of this data's exchange model and format, as well as a metadata catalogue. All road network object definitions are based on the GDF standard [5], which is the base for geographical data files of various intelligent transport applications. Among possible representations of road network features, dynamic segmentation enables to store specific data, such as a speed limit, without having to change how features are input in the network divided into homogeneous segments. This also enables the dual representation of a speed limit as:
  - point objects corresponding to road signs;
  - linear objects corresponding to sections impacted by road signs.

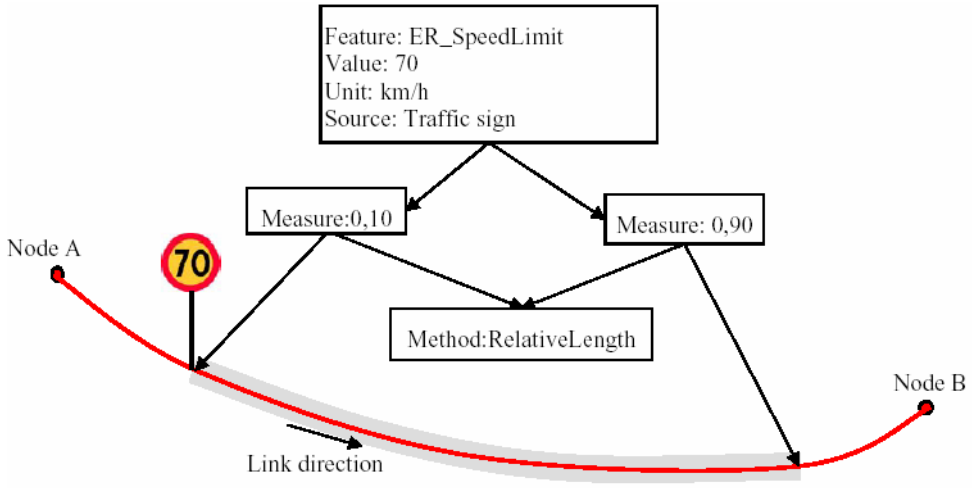

Figure 3 - Representation of a speed limit via dynamic segmentation (from EuroRoadS)

- Finally, the BALI demonstrator's functional architecture is defined with the outline of additional functions to be produced for a truly operational application [6]:

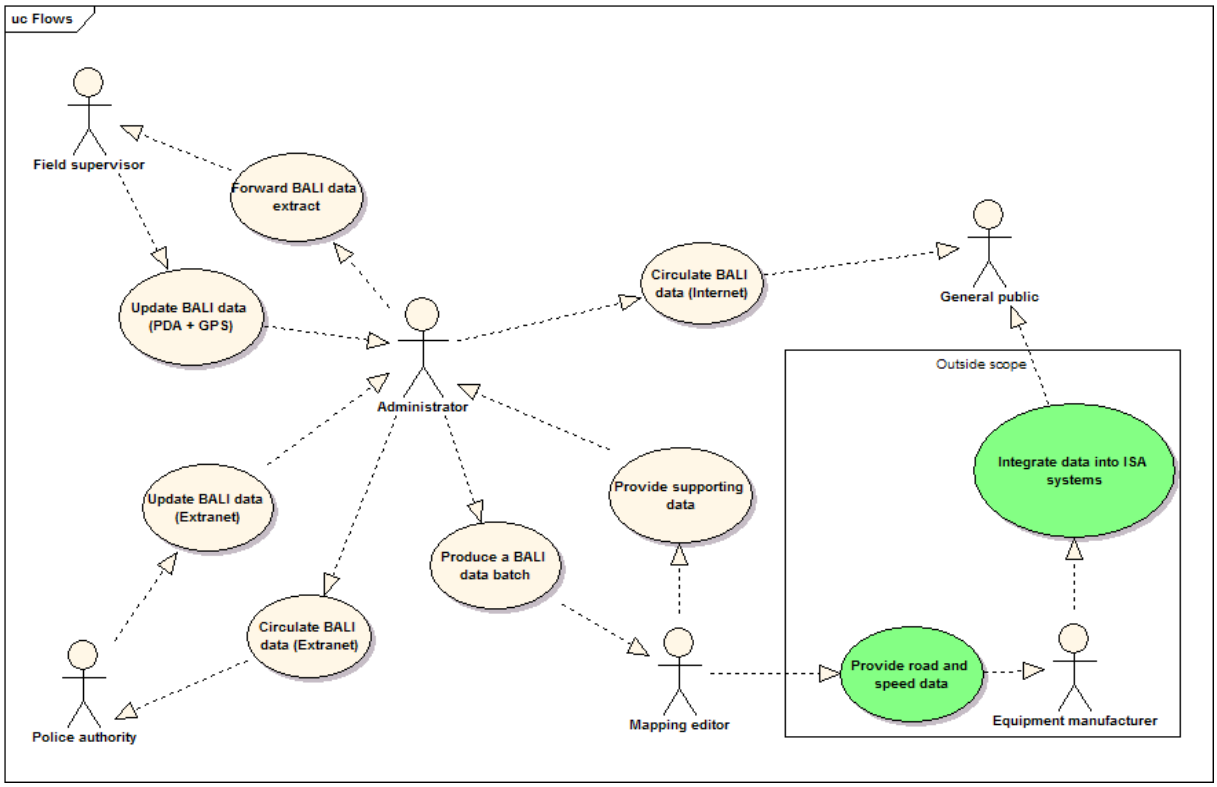

Figure 4 – BALI functional diagram

Various data input and thus interface solutions linked with potential sources, were taken into account:

- Database administrator input via a dedicated application. For example, this kind of solution is convenient for data input from a paper document transmission;
- Police authority representative input via a "thin client"-type interface. This kind of solution could be chosen by local authorities equipped with computer tools that provide them with a mapping view of this data;
- Data input from a field terminal with a satellite positioning system (GPS with EGNOS), for on-site input or correction;
- Producing data batches that only include modifications performed since the last production (increment) using the EuroRoadS exchange format. This same format could in future be proposed to receive data from road sign management systems used by certain operators. This latter kind of import has not been implemented.

Only significant functions were chosen to be shown for a limited time because of cost and limited development time. Consequently, some major functions, and which are sometimes complex in a fully operational system, were ignored, such as updating basic geographical data for example.

Mandatory prototype development deadlines, as well as simplifying the performance of certain functions like dynamic segmentation also led to choosing a technical solution that

does not necessarily prefigure the final tool. In particular, developments are not supported by freeware tools, as the latter do not (yet ?) offer all the features required for the management of such data.

4.2 Expected problems

Producing a demonstrator that includes the management of geographical data will undoubtedly present problems linked to the type of data (technologies that are still too recent). But the main problems are expected to be functional and organisational. This kind of project can only survive if the project finds support from key participants:

- Local authorities, as the vast majority of them decide upon which speed limits and more generally police signalling to set. Their co-operation is obviously essential to the BALI project's success. They must therefore be mobilised, while also taking account of various contexts, their size and resources. The demonstrator must enable to cover all those cases, which various process and display interfaces allow. Time and cost must be minimised and it is essential to show them the benefits that they can reap from this collection. The demonstration also aims to assess this additional charge.
- French motorway concession companies. As they often have innovatory policies (for example, speed control according to traffic on the A7 motorway for ASF), they were quickly aware of the stakes linked to circulating speed limits. In particular, they performed the initial work of collecting and centralising data on their network (see next chapter). It is therefore important to enhance synergies, while respecting each other's missions.
- Map makers, as they are both upstream project participants as information providers for the BALI system and BALI data clients. It may seem a natural thing in principle, but it is more difficult to obtain their concrete participation. They will in future delivery speed limit data in vehicles, which is an essential way of obtaining updated data.

  Also, intellectual property issues must quickly be sorted out, involving the use of a given supplier's mapping data provided in an application whose goal is to produce data that is meant to be distributed to all map makers and service operators.

5 SPECIAL EXAMPLE OF SETTING UP A SPEED DATABASE ON THE CONCEDED MOTORWAY NETWORK

Through the impetus given by the French Motorway Companies Association (ASFA), the French motorway companies initiated a project, in early 2006, to transmit speed limits to drivers over the 8,233 km of the conceded network. It aims to inform road users of their speed limits, via their navigation system (exactly where they are at a given time). For this, motorway companies must firstly collect all speed limits. At the same time, partnerships will be sought to enable this collected data to be transmitted aboard vehicles as widely as possible. This project is more than just a study as it aims to be operational in the medium term.

On motorways, the average speed of motorists has dropped by 5 to 6% in three years and the number of fatalities has been cut by 35%, including two-thirds, which are directly due to reduced speed.

5.1 Permanent speed limits

Static speed limits are those for a road in a normal state (special road profile, for example). They are set by police orders, in co-operation with motorway companies and only rarely change (about ten changes a year over the whole network).

All companies agreed to quickly set up static speed limit collection. This work was performed in May 2006, from police orders available to concessionary companies.

The Autoroutes-Trafic economic interest group is in charge of centralising data. A full common database was produced in June 2006, from corporate data. A data check process based on a map available via the Internet will enable to perform initial validation, then update speed limits.

Motorway companies have three aims in collecting static speed limits. The first aim is to produce a map available via the Internet (www.autoroutes.fr: site of the concessionary companies), enabling to display all speed limits to road users, as well as explain their consistency and logic in order to become a tool in speed limit awareness campaigns. The second aim is to work with route providers (Mappy, ViaMichelin, etc …), in order to display sections with speed limits below 130 km/h (like static speed checks presently). The last and most important aim is to transmit these speed limits to drivers, aboard their vehicles, while they are driving. For this, the database could be included in various on-board navigation systems, via a partnership with the mapmakers that produce updating CD/DVD for terminals.

5.2 Temporary and variable speed limits

So-called temporary or variable speed limits are those linked to causes limited in time. They involve speed limits due to the presence of traffic guidance equipment (road works, etc.) – temporary speed limits - and speed control operations – variable speed limits -, like those performed on the A7 motorway, which will be generalised in the next few years.

Collecting and transmitting these limits is both a major driver safety and comfort element, but also important for field staff.

The technical stakes linked to collecting and transmitting these temporary speed limits to vehicles are more complex than those generated for permanent speed limits. Indeed, collecting temporary speed limits must be performed in real time and thus, automatically. Therefore, this will not result in extra work for operators, but require setting up a computer process in the motorway company network’s operating system. Two companies are currently testing this innovation’s implementation: ASF (Southern France motorways) and ATMB (motorway and tunnel of Mont Blanc).

Autoroutes-Trafic is in charge of centralising "temporary speed limit" events from various companies, collecting and converting them into a format that can be used by external partners (converting reference points localisation , called "kilometre posts" (mileposts) into geographic co-ordinates, for example).

If the motorway companies are pioneers in the operational implementation of transmitting temporary speed limits to drivers, this approach is part of the continuing development of on-board services to drivers.

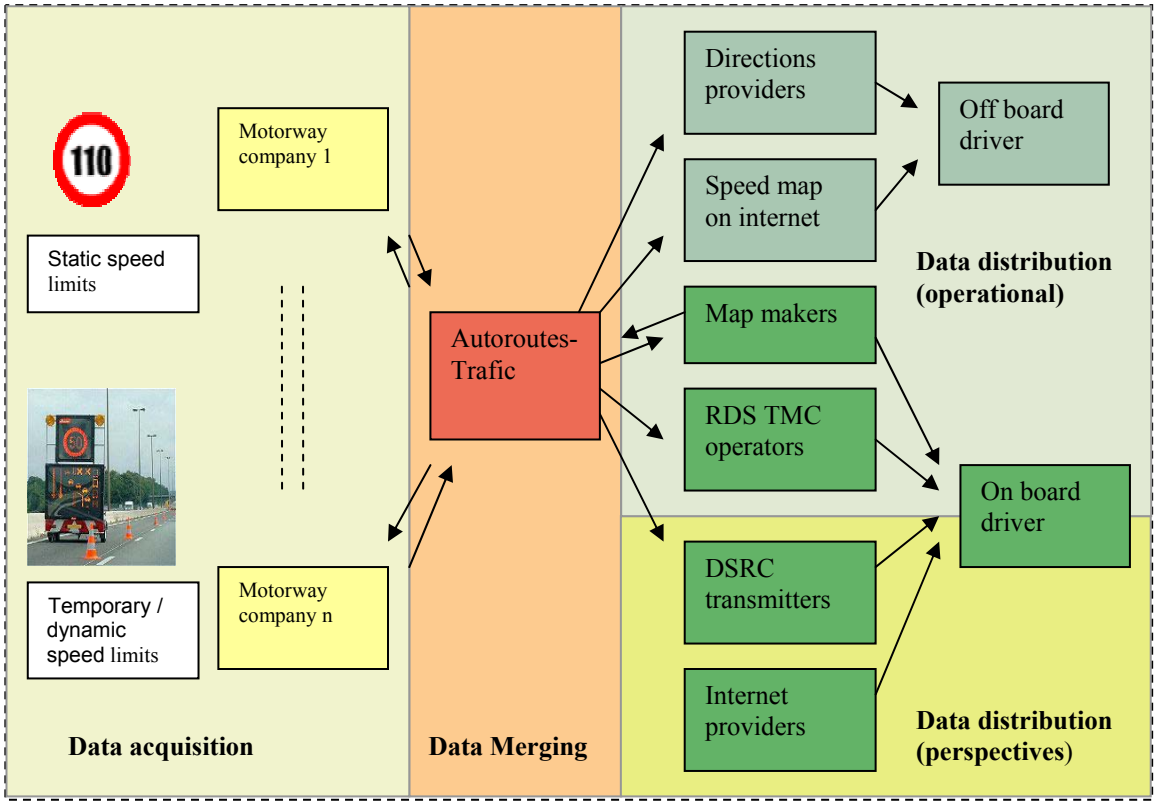

Figure 5 – Global information flow diagram

5.3 Demonstration

A first large-scale test enabled to successfully check this innovatory project's feasibility. Representatives from motorway companies, authorities and the European Commission were invited to take part in a demonstration day organised by ASFA near Bonneville, on 12 June 2006.

A vehicle specially equipped by the Robotics Laboratory of the *Ecole des Mines de Paris* and the national research institute for computing and automation (INRIA) travelled on a section of the A40 motorway between Cluses and Bonneville, transmitting the current, static or temporary, speed limit to the driver, according to circumstances, as the given route made the vehicle travel in a work site area limited to 90km/h. Data used for the demonstration was provided by ATMB, via Autoroutes-Trafic, thus proving that the full line of information operates correctly.

Figure 5 – Transmitting real-time speed limits

5.4 Speed limit map

A map, via Autoroutes-Trafic as the system's operational platform, gathers together all permanent and temporary speed limits (for work sites on ASF and ATMB networks) for light vehicles: 130, 110, 90 km/h, etc…

It will initially be available on the motorway company portal: *www.autoroutes.fr*, to inform drivers before their departure. Action could be engaged with route providers to display this information, as is presently the case with static speed checks.

5.5 Deployment prospects

Beyond the demonstration and Web map, the project must result in real implementation, thus transmitting speed limits to drivers, which is already the case via partnerships with other participants.

For static speed limits, once the database has been collected by Autoroutes-Trafic, this information should be transmitted to vehicles via mapmakers' CD-ROMs and DVDs.

For temporary speed limits, the link between Autoroutes-Trafic's real-time database and vehicles requires a communication mean between an infrastructure equipped with the database and vehicles. There are various possible channels: GPRS (but few vehicles are currently connected), RDS/TMC (Radio Data System – Traffic Message Channel: all vehicles can receive it, but not all present navigation system receivers can interpret speed

limit-type messages). Conceivable participants are traffic information providers, which already transmit real-time data to vehicles.

The interfaces (visual, sound, etc…) that will transmit information to drivers in vehicles must be studied and developed with the support of car manufacturers. An ever-increasing number of vehicles are equipped with the GPS navigation system (in 8% to 20% of new vehicles, according to manufacturers), even if they remain a minority. Also, there is currently a boom in the mobile navigation systems market (PDA + GPS, i.e.: TomTom, etc…): in 2006, over 12 million of these devices were sold in Europe.

6 CONCLUSIONS AND PROSPECTS

Improving road safety is a public interest target both at French and European level. Also, both are convinced that speed limits must be better respected in order to reach the European Commission's ambitious target for 2010, which is to cut the number of fatalities and seriously injured by 50% on the Union's roads.

Apart from repression, technical progress can help to reach this goal. Today, intelligent speed adapters can be put on the market, but they lack data to operate. All professionals agree that supplying these systems with reliable data is vital to their efficiency. This requires creating technical collection infrastructure (prefigured by the BALI tool). Work conducted by motorway companies should be taken up and generalised to the rest of the road network in future years., Their project is indeed deliberately in line with European trends that are presently specified in a document produced by the e-Safety forum [7].

But above all success will come with support from data producers, with local authorities or motorway companies at the forefront. It will certainly be one of the most highly awaited issues of the BALI experiment.

REFERENCES

1. European Commission – White paper: "European Transport Policy for 2010: Time to Decide" and communication of 22 June 2006 "Keep Europe moving – A transport policy for sustainable mobility " (http://ec.europa.eu/transport/white_paper/index_fr.htm)
2. Conseil Général des Ponts et Chaussées (CGPC) – 3rd section – Report n° 2004-0185-01 "e-Quipment: Using New Information and Communication Technologies Within the Ministry" - July 2005
3. SpeedAlert Project Web site – "D4 Evolution of SpeedAlert concepts, deployment recommendation and requirements for standardisation" - July 2005 (http://www.speedalert.org)
4. EuroRoads Project Web site – Various deliverables – version 2.0 – October 2006 (http://www.euroroads.org)
5. EN ISO 14825 standard "Intelligent Transport Systems – Geographical Data Files – Global Data Specification"
6. BALI Project – Stage 1 – SETRA – LROP – Sté Générale d'Infographie: "BALI Project – Functional Analysis File" - June 2006.
7. e-Safety Forum Web site – Final Report of the "Digital Maps" Working Group of 25 November 2005 (http://ec.europa.eu/information_society/activities/esafety/forum/digital_maps/)