In search of ISA's holy

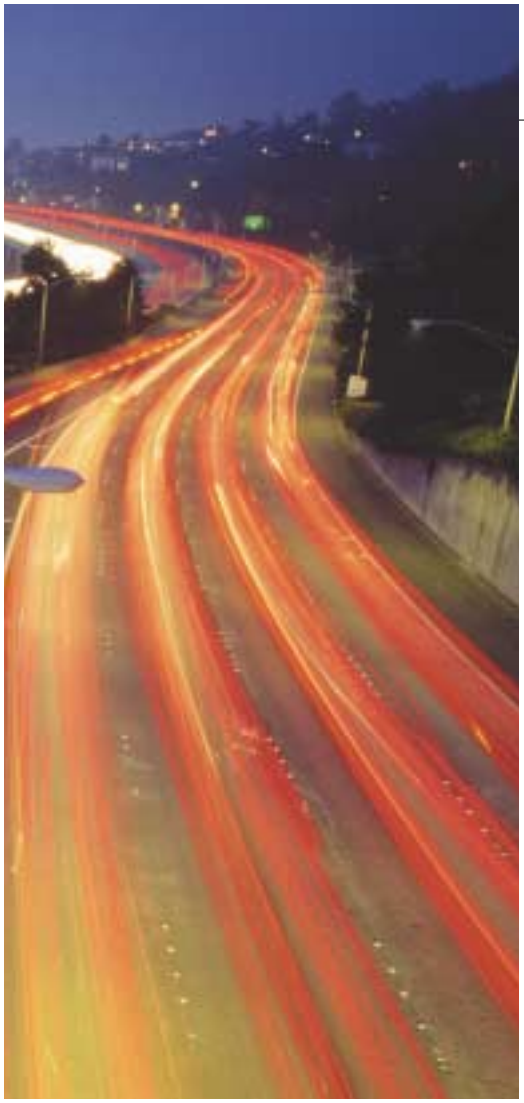
ISA works. Trial after trial has demonstrated that the technology is robust and delivers lower average speeds. But, without an accurate digital speed map and the means to distribute the data to vehicles in real time, ISA will never move from the drawing board to a European-wide system. A report by Carol Debell.

The drive to create a European e-Safety map has stalled. That was the message Rob van Essen, Vice President Strategic Research and Development with Tele Atlas, gave to delegates at the ITS in Europe Congress in Aalborg, Denmark. This has implications for the many eSafety initiatives which rely on the availability of accurate mapping, Speed Alert or ISA being a prime example.

The concept of accurate digital mapping of Europe's road network was a key recommendation of the original eSafety Forum. The eSafety Working Group on digital maps was set up and its initial brief was to create a public/private partnership to produce, maintain and distribute a European safety map with agreed road safety attributes.

The Working Group, co-chaired by TeleAtlas and Navteq, met between April and December 2005 doing essential work on the various attributes that the European safety map would require and their safety applications. Equally important, it made a series of recommendations about how to more forward in terms of deployment. However, says Rob van Essen, the working group's suggestion that it should liaise with the European Commission on next steps was not followed up and the key results were not disseminated to member states. An informal group, working under the ROSATTE banner coordinated by ERTICO – ITS Europe, took up the baton and has been meeting in the meantime but without producing any concrete results. In essence, he says, it will not be possible to move forward without external funding. And without accurate mapping a whole raft of road safety applications, from curve warning and intersection assistance through to collision avoidance and speed limit assistance, will remain pipedreams so far as Europe-wide roll out is concerned.

As things stand the availability of speed and other public safety information is very patchy. Within MAPS&ADAS activities (part of EC FP6 PReVENT Integrated Project) a European-wide survey showed the diversity of safety attributes availability and accessibility. Looking across Europe, some information is available at local level, other data at regional and some at national level. It varies in completeness and quality and it is



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available in varying forms, some in analogue, some in digital format. There is no set way of accessing this data and it is currently impossible to envisage a uniform approach. Because of all these factors, says Rob van Essen, it is very difficult to create a complete overview of what is available, let alone tackle the challenge of building a single, comprehensive and accurate map. It is possible, he adds, to reach the quality levels required but at a cost that society is not prepared to pay.

So what is needed to get the project back on course? The ROSATTE Co-operation Platform submitted a project proposal under FP7 for financial support. This would be to develop, test and validate the road safety attributes exchange infrastructure, associated tools and related applications. In particular, the group is looking for support from the Commission to:

- help the ROSATTE Co-operation Platform submit a successful project proposal under FP7;
- increase the awareness of the result of the digital maps working group at member state level; and
- request the Member States to facilitate the creation of a national registry of available eSafety attributes in co-operation with the ROSATTE Co-operation Platform.

The ROSATTE project will have three main objectives. The first is to facilitate access to, and exchange and maintenance of EU-wide core road safety spatial data from national, regional and local sources by standard procedures. This would require the creation of common specifications both for road safety data access and for data exchange. The second key objective is to enable multi-level aggregation and update of European-wide safety map data. And the third objective is to assess the technical and organisational feasibility of this infrastructure by setting up and evaluating cross border pilot trials.

And the benefits? Rob van Essen says ROSATTE should result in a significant increase in the coverage of safety-related road information. 'We should see a considerable decrease in the time delay between a change in reality and an update in the safety map for the end user. And we should also see a significant increase in the quality of attribute values at an affordable cost.'

He adds that the development of data management tools will result in both more efficient sourcing of data by road authorities and its maintenance. And at the map provider end, there should be increased efficiency of data integration due to the implementation of common solutions instead of specific solutions.

Certainly the experience of ISA trialists indicates that developing and maintaining digital speed maps is not easy. In North Jutland County, Denmark, an ISA trial is underway, organised by Aalborg University under the Spar paa Farten ('Cut your speed') banner. As the trial is based on 'pay as you speed' principles, the accuracy and maintenance of the speed map is crucial.

The challenge facing the team building the map was that there was no central database in existence, and where data was available it was rarely up to date. As a result it decided to start from scratch and record the position of every speed sign in the county, along some 9,300km of public roads – some 5,600 signs in total. It requested local authorities to help correct errors.

Ongoing maintenance uses feedback from participants, mostly by email, which a project member then verifies. The county's municipalities also supply feedback using a web application specially developed to provide a simple updating tool. However, since its introduction in autumn 2004, over 50% of all municipalities have failed to use it – which means that the team has received no updates during this period from authorities that, between them, administer some 4,000 km of public roads. One possible explanation is that no changes have taken place, but empirical evidence suggests otherwise.

The project team admits that maintenance of the speed map has not worked as well as expected. They conclude: 'Our experience shows that it is relatively easy and economic to make a digital speed map, the real challenge is to maintain the map. Our conclusion is that you can't get a high quality speed map based on voluntary maintenance. Our recommendation is that the Danish Parliament changes the law so that it becomes obligatory for road authorities to make a digital map of their roads, including speed limits, available for the public. Only in that way can we develop reliable ISA systems in large scale.'

Oliver Carsten of the University of Leeds, Project Manager of the UK ISA trial, which concluded in December 2006 in conjunction with independent automotive research organisation MIRA, is of the same mind. The UK trial used a positioning system supplied by Navteq with additional speed limit information supplied from a number of sources. Navteq already had access to some speed limit data from the English Highways Agency for trunk roads although this proved not to be completely accurate.

For the greater Leeds area part of the trial, the project team built the speed map from scratch. They made an initial assumption that all roads outside the outer ring road would have a 60mph (96km/h) speed limit, and that all roads inside were 30mph (48km/h). This assumption gave them about 90% of all speed data they needed, the exceptions being a number of 20mph (32km/h) zones within the ring road, and 30mph and 40mph (64km/h) zones outside the ring road, essentially through rural villages.

Having obtained information from Leeds City Council on the exceptions, the team checked the relevant speed limit orders which indicated where the signs should be sited, and then these were checked on the ground. In all, this took about six person months. The ISA trial also ran in the rural county of Leicestershire, where the County Council provided an existing digital speed map.

Oliver Carsten's team discovered that speed limit data does not necessarily fit comfortably with the way the navigation maps have been built. 'Every road on the map is a link, and between junctions there is a sublink. These links will have a number of attributes; for instance, it could be that the road is single or dual carriageway, or one way. We added an additional attribute, the speed limit. The problem we faced was that this can change between junctions, so we had to create new sublinks at the places at which the speed changed and the sign was

positioned. This is necessary because it is important that a car joining a road will pick up the speed limit immediately, not just when it passes a sign.'

Technically, he says, this was relatively straightforward. Where it proved to be something of a problem was with the data from Leicestershire, where the speed limit changes tended to be recorded as occurring at the nearest junction. So, in practical terms, if a car turned off the main road onto a B road and there was a village a mile (1.6km) further on, the new speed limit was embedded in the system as taking effect from the turnoff, rather than from outside the village. This would not have been too much of an issue with advisory ISA; but with intervening ISA it meant that the car slowed down well ahead of the speed limit change – which was annoying not just for the driver but also for the cars behind.

This experience underlines the need for accuracy and raises a number of issues. Most importantly, If the speed limit sign on the road says one thing and the ISA database another, which takes precedence? Perhaps, with an advisory system, people will be able to live with the odd discrepancy; but if enforcement is involved, or, as in Aalborg, the discrepancy could cost the driver money, it is vital that the two are in harmony.

This also raises the question of updating. Oliver Carsten believes that ideally, when the database changes, the maps should change instantly, delivered direct to the car. 'I get in the car, turn on the engine, and new map data is downloaded, perhaps via a mobile phone line or direct broadcast link. We have to get over the problem of issuing new CDs.'

Uploading data whenever the car is driven sounds good, but where is that data coming from and who is going to keep it up to date? The conclusion in Aalborg is that the law will have to change and the maintenance of an up-do-date digital speed map become mandatory. Oliver Carsten agrees. In the UK a speed limit order is issued before a sign is erected. He wants to see a requirement that, when an order is issued, it is supplied in digital format to a nationally-held database, which could then be updated immediately. It is an idea which is apparently circulating in the UK Department for Transport, but there has been no final agreement.

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The 'Spaar paa Farten' project team, Denmark

But, without that infrastructure in place, agreed formats for downloading data and the means to distribute it, there can be no question of mandatory fitment of ISA. Sweden is already some way down this road, with the decision to create a nationwide road database (NVDB) taken as long ago as 1996. The aim of the NVDB was to meet the immediate and long-term need for fundamental road information and to make this information accessible to both the public and private sectors.

This has proved to be a major undertaking, as much as anything because the initial project has grown in scope far beyond what was originally planned. It is a process which is not over yet, as Jan-Eric Oscarsson, sales engineer with Vägverket Svd, the southern region of the Swedish Road Administration (SRA), explains. 'You could say that, by about 2003, we had something to work with. But it has involved a lot of hard work and thinking, because it hasn't been done before and because of the way the original specification has grown. We now have some 40 different features which we have to accommodate.' And, he points out, it has been a priority to ensure that the data is not only high-quality but will also be found for every road where it should be.

Speed data for the map is supplied both at local level and nationally. Local authorities are required by a local traffic regulation to inform the NVDB whenever a speed limit changes. Historically this was done using paper; but, in future, authorities will supply the data digitally using a specially-developed application. The

NVDB also relies on SRA employees, many of whom have ISA installed in their cars and who report back inconsistencies. Road data is also available online, so that anyone can check it and feedback is encouraged – although only authorised personnel have clearance to update data.

The current situation, then, is that Sweden has a digital map and all speed limits are on the database. It may not be 100% accurate – for instance, there is sometimes a divergence between what a speed order says and the position of the sign on the road – but it does rest on a legal requirement for changes in speed limit to be notified. In practice, there are a lot of changes every month and so a new file is made and posted on the web.

The SRA has an application which enables ISA users to go online and download the data. Most do this once a month, some less frequently. This means that, for ISA drivers, data is not being updated in real time and, at present, there are no plans to provide this level of service, says Jan-Eric Oscarsson. 'We don't currently have an application, and there would be concerns about the cost of using, for instance, a mobile phone to download data.'

Voluntary or mandatory

By contrast, the Dutch are operating a voluntary system and have no plans to move to a mandatory framework. Frans Tillema of the Centre for Transport and Navigation (DVS, formerly AVV Transport Research Centre) reports that reasonable progress has been made towards building a national speed map for The Netherlands. The project started in 2005 using an internet application for creating and updating the data. Some 60-70% of local administrations are using the tool on a regular basis although Frans Tillema dmits that it is not possible to oblige them to co-operate and there are no guarantees as to the accuracy of the data. 'We did a small random exercise and we found that the quality varied greatly from city to city, but on average was 70%. We were pleased with the progress but, of course, this is far too low for ISA. We are now working hard on improving the accuracy.'

A pilot study within North Brabant province, where a trial focussed on an area around three schools, has shown just what can be done on a voluntary basis. Working with the local administration, the team put in a huge amount of effort to ensure the accuracy of data, including the development of a PDA application that used GPS to map roads automatically as an ISA-enabled car drove round the area. The result was a speed map which is 99% accurate in terms of coverage. This has highly successful in encouraging local buy-in, says Frans Tillema. 'The region is very positive about using the speed map and this has had an effect on neighbouring ones. We are now working together with the whole of North Brabant, where it would be a major breakthrough to have a 99% accuracy.'

The current plan is to get the national map to this level of accuracy by 2008. What is clear from this exercise, he says, is that what matters is getting local involvement, getting people excited about what the speed map can deliver. He doesn't think that a mandatory system would necessarily result in more accurate data, because coverage is not the only issue. 'Coverage could be 100% but the speed limits could be wrong. We have difficulties because local administrations themselves do not always know the exact location of speed signs. We can know that, outside a city, the speed limit will be 80km/h while inside it will be 50km/h. But

it is not always clear exactly where the line is, so our map could be 50m out . Again, we are using GPS, which is not accurate down to the last metre. So this map would not be accurate enough for interventionist ISA. There is no easy answer to that dilemma, but we are working on it.'

On the issue of data delivery, however, the Dutch are way ahead. They are now developing methods to use GPRS to upload new maps to ISA cars, and send data updates rather than complete maps, reducing communications costs. The Transport Ministry is thinking about equipping all its own cars, some 2,500, with ISA starting in 2008. The most effective way of promoting ISA to the rest of the country, says Frans Tillema, is to do it yourself.

Early tests of the data updates have run into a few problems; for instance, some cars garaged overnight have lost their connection to the central computer and missed a download. Looking ahead to the growing intelligence that is being built into roadside infrastructure, Frans Tillema believes that a move to a real-time information update might be possible within the next ten years – in cooperation with map providers.

If this all looks very positive, it is worth remembering that behind Frans Tillema and his team stands the Dutch Government's very strong commitment to the road safety. From that commitment comes a large budget specifically earmarked for the speed map. The then Minister of Transport put building it into a 2005 White Paper, recognising that it is essential if ISA is become a reality. And, if all goes to plan in The Netherlands, it will. The Ministry has adopted ISA as a very promising tool for increasing traffic safety and has started discussion on introducing informative forms of ISA into all cars in the country. That is a commitment that road safety experts in other countries would give their eye teeth for.

www.esafetysupport.org
http://vbn.aau.dk/front.do
www.its.leeds.ac.uk/projects/isa
www.mira.co.uk
www.vv.se
www.rijkswaterstaat.nl/dvs

How do the commercial map makers manage speed?

Bob Denaro is responsible for Navteq's global ADAS business of which ISA is one application. Historically, the Navteq database had speed categories based on the class of road rather than the posted limit and it is only in the last three years or so that the company has actually started focussing on the posted limit, where the sign is located, and how it varies by time of day or type of vehicle.

Navteq obtain their data by driving the roads and if they get information through a local authority about a change of limit, they will go and check the change and it will be made available at the next quarterly update. Bob explains that they have broken roads into five function classes from major motorways down to residential streets. Taking the UK as an example, functions 1 and 2 have been completed and at a minimum the roads will be driven every two years. But as you come down the classes to 3 and 4, typically rural roads, it all becomes more challenging. For a start there are a lot more miles to drive. But as a matter of policy, all new roads will be driven and there is a budget for maintenance so some roads will be redriven every year. And while the initial speed range was for an entire link, typically when collecting actual speed data, the exact position of the speed change will be recorded.

But complete accuracy is elusive, says Bob. For a start they are dealing with dynamic data. A database that is accurate today will be no longer be perfect tomorrow. Just how quickly are changes taking place is not clear 'We would like to get a handle on this and we are doing some studies to measure how often signs do change. If we aim for 95% accuracy, how long does it take to exceed 95%?'

The other major problem they face is the system of quarterly updates. 'We update quarterly but the systems suppliers, who actually service the customer, may only update once a year. That means that the data in the car is not as updated as would be ideal– the whole food chain has to change to meet higher requirements. We are working to move to more frequent updates and over the last four years we've revised our database infrastructure to lend itself to more rapid continuous update.'

Along with this comes a move towards electronic delivery and Navteq are studying possible avenues with a number of partners. For instance, might it be possible that when the car comes into the dealership for an oil change or service, an automatic data update takes place? 'We are working on a number of research projects looking at wireless applications and the possibility of sending updates direct to the car. Incremental updates are the ideal but there are a number of complexities that we need to address.'


Bob Denaro, Navteq

One of the most exciting options is looking at how the intelligence in the car can be used to extract the data that it needs rather than managing the whole database – the in-vehicle system, after all, is only looking for information relevant to the route. It all comes down, says Bob, to what is the best way to use the communications link, where to put the intelligence, the best client/server mix. 'There are a lot of issues to address here, for instance if you have an incremental update for one region, then the others around it won't match. But this is where we want to go and we are definitely making progress.'

www.teleatlas.com
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Photographs for this feature were provided by Navteq, the Centre for Transport and Navigation in the Netherlands and the Swedish Road Administration.