

New technologies managing historic cities

Matt Cowley of Trakm8 and **Andy Graham** of White Willow Consulting look at how technology being developed in the UK can improve travel across Europe's historic cities.

As Europe's population becomes more mobile and eastern Europe continues to attract inward investment, more and more historic cities will face a new challenge: that of balancing traffic congestion with ease of access. This applies equally to visitors, residents and freight demands, and is a challenge many western European cities have previously addressed, using fixed infrastructure such as urban traffic control and inductive loops.

In the UK, Trakm8 and its partners are looking at new ways of providing network managers and travellers with better transport intelligence to achieve this balance. This approach means joining up new sources of data about conditions on urban networks with new channels for delivery of intelligence built from this data. This is of interest worldwide, but especially in historic European cities.

One key target is helping to improve travel for both visitors and network managers, particularly where there may be large numbers of visitors unfamiliar with the local network, language and geography. Many historic cities have similar characteristics – narrow streets, limited access through historic walls, river crossings which are sometimes affected by floods, and a demand for high accessibility for tourism. And in many such centres, the emphasis is on movement of pedestrians, with park and ride on the boundaries and strong public transport priority. This offers opportunities for seamless travel intelligence for people arriving by car who then continue on foot. These people may be visitors or regular commuters, for example, when travel arrangements are affected by special tourist events or other events.

One of the key themes of this approach is that information supplied directly to customers should be a new and valuable tool for network managers. It has to provide ways to influence the behaviour of travellers in a city, over and above the control of traffic signals and use of variable message signs. This influence needs to supply consistent and useful information to all the people in the city, delivered to their mobile phone, satellite navigation or other devices such as kiosks or route planners. Currently the information people receive this way from mobile services may be inconsistent with the network managers'



The box in the centre shows the location of a parked vehicle near Prague airport

objectives. The result of this inconsistency is that travellers may not know which source of information to believe and so may adopt neither.

The new approach recognises that it is not good enough to simply provide information about any problems that exist, it is also necessary to offer realistic means of solving these problems. It is necessary to predict problems, look for examples of the impact of similar problems in the past, and forecast how conditions may develop in the short term.

A further advantage of providing tailored information via mobile phone is that it can help eliminate the need for additional variable message signs or other fixed infrastructure in sensitive environments. Mobile phone services can work in any language, unlike VMS, and cause less visual impact on historic centres. Moreover, in an increasingly connected world, more and more people regard mobile phones not simply as a way of making calls but as a gateway to a host of other services personalised for their needs. This includes tourist-related information, mapping and personal navigation.

However, high-quality intelligence depends on having the best data sources. As more historic cities consider imposing a congestion charge as a means of managing demand on networks, the technology used for this charging can provide

new sources of data such as travel times. This means users can access new services and get better information in return for paying a congestion charge. Even for cities not considering a charge, vehicles are increasingly able to act as probes by providing journey-time data, for example from fleet management systems. By looking at the extent of data likely to become available in the future, it may be possible for network managers to reduce the volume, cost and environmental impact of fixed monitoring infrastructure.

Trakm8's SWIFT service is already in use in the UK and Czech Republic for vehicle tracking. It offers a low cost solution for vehicle management and hence a potential source of future data. The intention is to add to this tracking data the other sources that network managers already use and share the resulting view with the public.

Trakm8's fleet management system works by using a global navigation satellite system - currently GPS but in the future Galileo - to calculate the location and velocity of a vehicle. This data is then transmitted to Trakm8 servers using a mobile data service such as GPRS. The GPS data is enhanced by 'map matching' to the available road network. This is particularly important because GPS is subject to a wide variety of errors.

A key example is the multi-path effect caused by reflected signals from the large and tall build-

ings and narrow lanes prevalent in historic cities. The map matching algorithms which are used work on a sequence of consecutive locations to reduce errors. This also works better if the GPS readings are made frequently, because then the matching algorithms can be very confident in the solution, especially in urban areas. This GPS sampling frequency ranges from two minutes to 15 seconds, depending on the product. The main limitation in this case is the need to balance air-time cost against the accuracy needed.

There are many key challenges that have to be considered, including privacy, quality and trust. End users are rightly concerned about today's surveillance society and about the danger of data being abused. To address this, the map-matched data is aggregated by removing all identifying attributes. This ensures it is anonymous and in a common format for fusion with other sensor sources. At this stage, the data is ready for use by one or more transport network models, which can be used for predicting future behaviour of the road network.

But monitoring speed is just the first stage. The new approach is also focused on developing advanced knowledge, and with the latest telematics platform – the T6 – it is possible to connect to the vehicle's engine management computers. This is done via the controller area network bus. This enables direct measurement of the vehicle's performance, fuel usage, emissions, faults, and much more. Trakm8 has already delivered basic functions with reporting within its web-based fleet management application SWIFT. The real advantage of this is to make it possible to reduce fuel costs for the user, but this linked-up approach also offers network managers the ability to directly measure emissions from vehicles on the street.

Eventually, as more and more vehicles are fitted with such equipment and become connected, the need for installation of fixed infrastructure such as emissions sensors will be reduced. This joined-up approach to data and services will open the way for many new value added products, such as 'pay-as-you-drive' road insurance, discounted congestion charging, and many other services.

As well as looking at improved network monitoring and channels for personalised services, Trakm8 sees that with further tools, it will be possible to process and refine this raw data to help cities manage their networks more intelligently. These tools include advanced simulation, prediction and data-mining, to make the best use of a variety of sources of data now and in the future. By offering a 'pick and mix' approach, the solution will be able to be accurately tailored to an individual city's policy needs, local conditions and data availability. This means that all services will need to adopt open standards and protocols, to ensure an interoperable approach across Europe.

A specific key to delivering this approach is the use of consistent network mapping. It is important that travellers and tourists not familiar with



The use of the vehicle in a graphical form – green indicates when the vehicle is in use.



Grey arrows map a 20 minute journey in the city of Prague; the red chevron in the centre indicates where the speed limit was exceeded.

the city can find their way around in their own language, yet that local people and network managers can also access it quickly.

With the recent acquisition of PJSoft in Prague, Trakm8 now has a wealth of cartographic expertise. The company has been re-branded as Digital Atlas, to give it a global appeal and extended mapping coverage to all Europe, North America, Africa, Australia, the Middle East and many other regions. The client map browser application is open source, in order to let developers customise their own solutions.

The Digital Atlas map server is fast and scalable, and it can be delivered as an appliance so LAN speed GIS data is available at a low cost. Digital Atlas provides what the company believes is the first commercial 64bit routing engine, as well as the geocoding, map matching and integration required to link to external data sources such as a city's existing traffic information.

Its mapping technology, combined with Trakm8 fleet management, provides a strong foundation for achieving the joined-up approach to information and data collection. It is possible to envisage a future where all vehicles are fitted with a GPS or Galileo device and intelligent transport is available to all travellers, being an accepted feature of daily travel throughout Europe. The key is to proactively assist travellers and network managers via a wide range of devices and technologies.

Initially, Trakm8 is testing its system in York and other cities in the UK, but believes this approach of connecting visitors and network managers has Europe-wide, if not global, potential. The move from fixed infrastructure at the roadside to mobile infrastructure for monitoring and delivery of services is a challenge, but one which the future connected world relies on meeting.