Using GIS for efficiency

Using GIS technology boosts asset management efficiency.

The economic downturn is focussing more attention on asset management systems in the highway sector, and the need to make better and more informed judgements about repair, reconstruction and new build for roads. Alongside there is also the need to deploy tight resources more effectively in both inspecting roads and associated infrastructure.

One answer is to display data spatially and see where different features of a road network overlap, such as accident rates, carriageway condition, sharp corners and a multitude of other features.

The multiple layering possible in computerised maps offers an effective solution, especially if it is associated with software to automatically pick up connections and coincidences. And the GIS companies have long advocated the spatial display of data and the overlay of information to find clusters and grouping of problems, and spatial analysis to help with these problems, allowing limited funds to be prioritised where needs are greatest or the greatest benefit can be seen.

The savings might come from reducing the need for road inspections for example, according to Dominic McNeillis at Confirm, the UK based asset management system provider. This operation was bought by GIS provider Mapinfo some years ago and is now owned by information and data management company Pitney Bowes.

He said, "If the locations of potholes repaired by term contractors are recorded over time and displayed against the network, you can see which road sections are the most vulnerable and change the frequency of necessary inspections for example. That might means staff being more efficiently used."

But a key problem has been the nature of road network data. The linear reference system developed by the engineers of old, locating data points with reference to a distance from a fixed start like a junction, or state boundary line and with an offset from the road centre, has proved not only resilient but increasingly more important as technology has developed.

There are various reasons and McNeillis explained, "Firstly the alternative X,Y position, which is gathered usually by GPS, is not accurate enough – errors can fluctuate between 1m and even 10m according to satellite positions and other factors. Only by spending much more for reference correction data and the equipment to handle it, can smaller errors be achieved."

He continued, "For road surface condition data and other errors of this size are not usable. Measuring a distance is a much more precise way to locate data for less expense, especially with the modern road surface measuring tools. Secondly the GPS and other systems are first of all for national defence and therefore vulnerable in crisis moments. The military can deliberately add error signals to make them unusable without counter-corrections."

Thirdly linear data is just easier to process. Ralph Diment, UK sales manager for Intergraph, a GIS firm with a strong presence in the municipal and road authority sector said, "Map position data just carries too much information when you are processing deflectograph and other road scan data." Computers have to handle terrabytes of such information.

An LRS allows the vast quantity of information about changes in road surface, position of objects and so forth to be much more easily processed and matched up without the complete fragmentation of data into multiple segments that a GIS would need.

Intergraph has had a linear referencing capacity for the wide range of road and management data gathering and asset management tools it offers for many years he says. Firms which have specialised in the asset management sector, such as Bentley Exor in the UK, have also got such capacity, in fact Bentley Exor's road and asset tracking and management systems were

An array of sophisticated mapping options are available on the market place

"built around an LRS core" said Steven Voller the company's business development director. Unlike some of its competitors in the highly regulated UK market where the national street Gazetteer has proved a sufficient base for network recording and analysis, it wanted to expand worldwide and the LRS was seen as the key.

Bentley Exor tied in GIS display components as it developed its system of multiple modules for asset tracking, public customer responses and work order systems but always with the LRS as the basis of its data organisation.

It has sold its systems to transport authorities worldwide, especially in English speaking countries but also in markets like Greece where the Egnatia highway has a Bentley Exor system or more recently Italy, where a first major implementation is underway for a consultancy that is being used to enable maintenance of other networks such as water and drainage; its first major contract there sees it being used for maintenance of drainage and cables alongside motorways.

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>
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A key aspect for this work is the capacity to handle multiple different linear reference systems together, allowing road and pipe networks to be synchronised, despite them having different origins. The same capacity may prove useful too in winning work in the important US market. The company has had ambitions there for some time and its recent purchase by Bentley Systems whose design and other software is almost exclusively dominant in the transportation departments gives it new leverage.

The proliferation of functions and regional divisions in the state DoT's has seen most of them develop a variety of different databases and asset management systems in a piecemeal way divided by engineering function and region, usually all on different linear reference systems. Very often these cover both modern electronically stored data and paper records which may date back for decades, when the linear reference was first established, each country or township operating separately perhaps.

These references can vary considerably says James O Brown, transportation specialist at Intergraph. Some might be state level, referenced back to the state line as the origin, known as "state cumulative" systems, some are county cumulative, others more locally based on street names and property numbers or perhaps "marker offset" from local junctions or other reference points.

Intergraph has been tackling this issue which it says in a technical paper, has been around since the early 1990s. Its solution is the recently launched "Multi-level" LRS which is a software module to translate and map assorted LRS references onto a common database of "datum points" using a standard reference. These standardised datum points then allow recorded data from the various systems in a state to be overlapped and matched.

"They also allow relatively simple control and editing of updates in the system," said Brown. A key problem with linear reference is that stored events, like accident locations or surface defects are "moved" if the road alignment changes, maybe by taking out an awkward bend which shortens the road; a point 20km along shifts to a new position. But with the MLRS it is fairly simple to ensure an accident recorded for the sharp bend remains in that now disused location.

The system allows new referencing methods such as GPS location to be entered into existing records without disrupting the existing road-naming and measurement attributions.

This "conflation" has complications in LRS systems says Intergraph, "...because the two data sets are not usually segmented identically, so there is no one-to-one correlation between elements." On top of that an MLRS adds another complexity in that the merged information needs to go to specific tables. It explained it has developed special tools that understand and handle these complexities.

With the MLRS the states will be able to merge existing data with the kind of off-the-peg solutions that use GIS capacities for both web display and information provision and for tasks like routeing, says the company.

Usually solutions will need tailoring said Brown, who says the company believes in delivering a "mix of software" and specific business solutions, often working in conjunction with other software providers as it did for the Oklahoma heavy vehicle routeing system. There are others looking at this market, not least the biggest of the GIS suppliers software makers ESRI, whose ArcView and ArcServer products are widespread and often embedded in other software systems. It recently announced it was building its own MLRS capacity which is coming out in spring next year.

The capacities of GIS display and geographic analysis have not been much taken up in DoT said Terry Bills, transportation industry manager at ESRI. On top few of them have installed complete or even partial asset management systems, but rather they have developed their own systems piecemeal over the years, unlike the city and county administrative bodies. Bridge inspection systems are separate to highway condition monitoring, accident tracking to lighting.

"Different engineering functions have tended to build up their own methods and databases, perhaps with decades of legacy data in them too. And they have been able to tailor systems to their specific needs with bespoke software," he suggested.

Mostly this has been data collecting and organisational with GIS map display seen as an extra, nice-to-have but not core function.

But economic downturn may create new pressures to make the best of data analysis to carefully direct limited funds he says, and the power of geographic organisation and comparison of data can help do that. He also suggested that so-called COT, or "commercial off-the-shelf" software will become more cost effective as the purpose built systems age and need upgrading.

ESRI does not want to provide the back end asset management and business analysis tools he said but it can enable the process of accessing the data "which may be in a variety of different databases from Oracle, SQL Server and so on."

GIS browser based methods and map presentation tied to a MLRS can then be used to disseminate the data widely. He said, "The goal is to give everyone good access to the data whether or not they have GIS skills or not and to tie it all together."

With that in place states could then use specific back-end software like IBM's Maximo to carry out business analysis and management he suggested, something that ESRI does not see as its own role.

Firms like Exor meanwhile, argue that they have a complete solution developed over the years specifically for the back-end functions of highway departments, like work order placing and tracking. Embedded GIS provides visual functionality.

The back end processes have been upgraded with a whole range of enhancement in the latest 4.3 version in fact said Steve Voller with the focus on cost saving in mind by automating many jobs. A key change is that certain types of defects can be defined for automated issuing of work orders once inspections have reported them in.

"It means users can focus their attention away from minor work to more complex issues," said Voller.

That will help keep us in the UK market where rivals like Confirm are constantly making improvements. Many of these are responses to suggestions made by its users in dozens of local authorities. The Pitney Bowes owned company has made user groups and web consultation a key part of its development said McNeillis, to pick up on a host of small improvements that are suggested.

New modules have been added to its range of 140 or so options, including analysis for risk and hazard for jobs and, with an eye on cost saving, new capacities for mobile working. Confirm has made field interactions with GPS enabled rugged handheld devices a central part of its offering for many years and now adds on a GIS based capacity for the office to track the locations of all its field workers and push tasks out to them.

"That means if emergencies are flagged up or clusters of tasks are found in the same area, they can be assigned to someone nearby, saving time and journey costs," said McNeillis.

Confirm has had less of an international presence in the past, though it has systems in New Zealand and Australia, and even in Fiji. But that does not mean it may not also look to the US as well. ■

Bentley Exor
www.bentleysystems.com

Esri
www.esriuk.com

Intergraph
www.intergraph.co.uk

Mapinfo
www.mapinfo.co.uk
Company name
Web address

Lighting

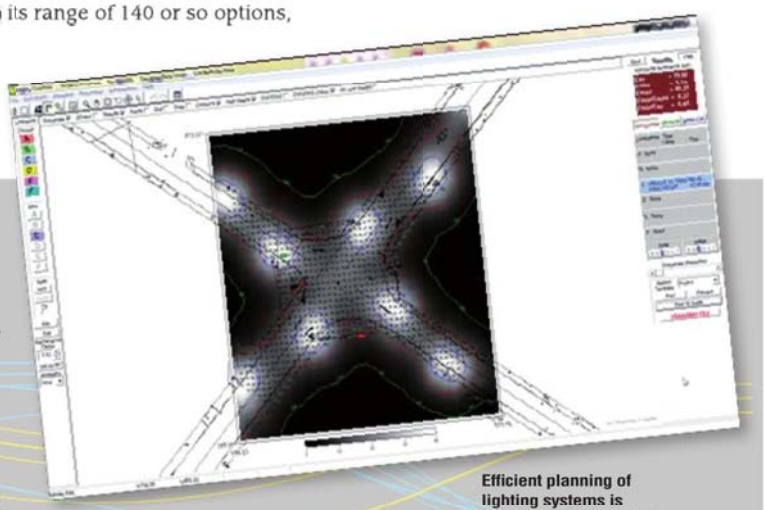
An international version of its 3D lighting design program has been launched by software company Lighting Reality. Versions are now available in Dutch French and German, as well as in English. The Reality MSV Pro designer is specifically aimed at lighting engineers for outside projects and especially highways and roads, carparks, and vehicle traffic areas. Tunnels and bridges can also be handled.

The program allows lighting displays to be set up and manipulated in real time with a display of the results immediately on screen as fittings are selected, moved, or changed. The firm says designs can be worked up in a very short time even by a relatively new user.

"In most light programs the columns and fittings are set up first and then the light levels calculated," said a spokesman for Lighting Reality. "But in this the lighting levels are altered as you alter the geometry." A different maker's light fittings can also be substituted using the same project file and the levels are recalculated.

The program has an auto-optimisation feature to allow designers to adjust and optimise the light levels to any major international standard. Complete lighting plans can be created in a short time according to the firm. The program supports a variety of the major international standards including US IESNA Standard Grid RP-8, EN 13201, CIE 115/140 and BS5489: Parts 2, 3 and 10.

In addition, the software also includes local standards variations, where applicable, such as Longitudinal Uniformity – a requirement in France – and the Dutch "S" class option which brings in levels of uniformity varying upon the type of road and its level of usage.



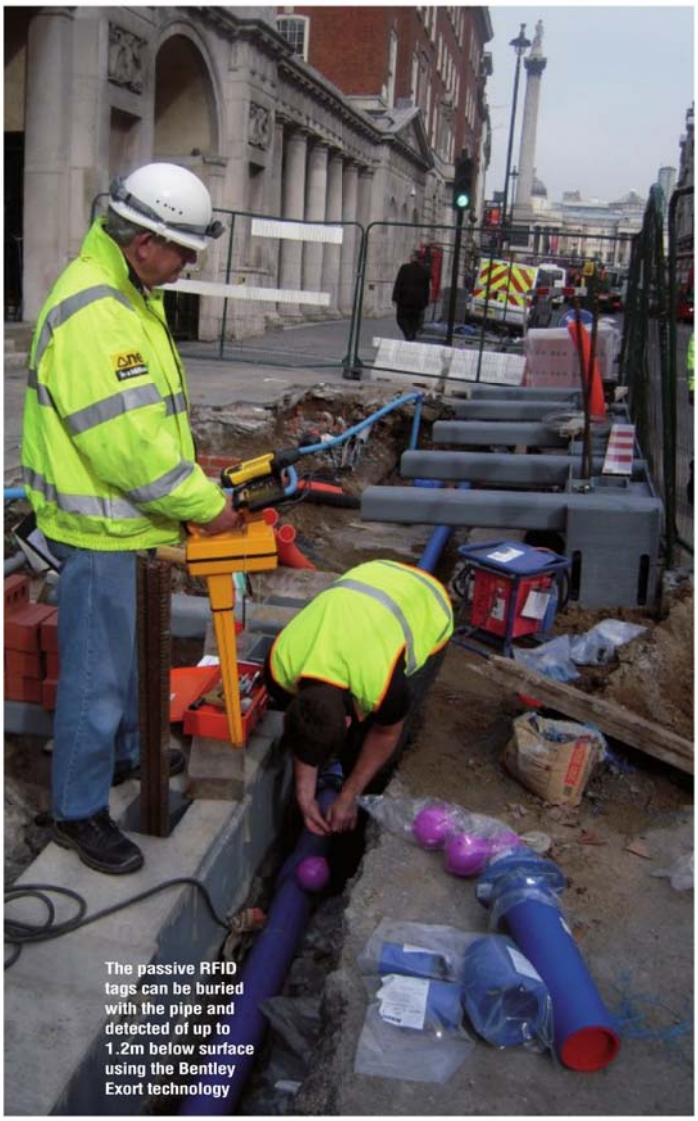
Efficient planning of lighting systems is possible with the latest software from specialist firm Lighting Reality

Drawing data is imported using standard CAD formats, either DXF or DWG AutoCAD files up to the 2010 version. A variety of lantern manufacturers' photometry data is integrated within the program. ■

Lighting Reality
www.lightingreality.co.uk

Intelligent trenches

Would it not be useful if underground assets could tell you exactly where they are located? Damage could be prevented during road works, workers on site would be protected from the dangers of hitting unexpected gas or power lines, and the costs of so-called dry digs made in the wrong place could be avoided.



The passive RFID tags can be buried with the pipe and detected of up to 1.2m below surface using the Bentley Exort technology

These are persistent problems for anyone managing assets or for utilities carrying out work. They cost municipal and road authorities dear, in direct cost and in the reduction of road life.

Nationally an economy like the UK is estimated to suffer nearly €6.6 billion (US$9 billion) costs annually. They will also now cost utility and other companies additionally if they do not properly record and make available the location of their underground assets under new rules for carrying out streetworks in Britain. Similar regulations are likely in other industrialised countries particularly.

Of course good as-laid records can help locate buried underground utilities, cables and pipes. But these are not always correct. There are detectors too but they are only a guide to what is in the ground.

A self-identifying cable or pipe is the answer proposed by a group of technology companies including highway asset management firm Bentley Exor. Using RFIDs (radio frequency identification chips) they have developed a system for tagging pipelines and cables when they are laid.

The Intelligent Trench system has been trialled by the important central London council in Westminster and has been adopted for its own projects. It is likely to be made compulsory there in the future for utility companies doing work. Meanwhile several other councils are starting trials.

The little RFID tags it uses have a microcircuit on board which responds to radio waves sent out by a transmitter unit, generating a small electric current and in turn sending off a signal. This carries a unique number which can then be fed into a database where as much information as needed can be stored and then made accessible on handheld units or a website.

"You can not only give location and details at this point but full information of the pipe type, purpose size and so on, links to the manufacturers website perhaps and other useful details," said Steven Voller marketing director for the company. "You can also take a picture, which is worth a thousand words and present that too."

The RFIDs are buried in special balls attached at intervals to the utility line. These keep the tag orientated correctly for later detection by a locator unit produced by 3M, which is similar in appearance to pipe detector units currently in use.

The passive tags, which do not need batteries or anything else, work to a depth of 1.2m. Shallower trenches up to 0.6m deep can use a cylindrical unit. The firm is providing its expertise in running asset database systems with a site where the data can be uploaded, stored and accessed. It works with Infotec to produce the software for the uploading and data capture.

National streetworks survey and asset data from the system will be available for free in a basic form with a charge for advanced and detailed information. The system is paid for partly that way and partly by a fee to mark the sites. Bentley Exor may add other information to the website as well according to Voller, as gathering information from advance notice data from companies about to carry out work at particular locations.

There are interesting possibilities for the future too, suggested Voller. "Bentley has been looking at RFID technology alongside design software. It is possible eventually that a drawing or detailed 3D information could also be called up."

In combination with GPS positioning it may even be possible to display a 3D model at the right orientation to match the direction that someone is pointing their handheld display, or perhaps just a mobile phone. But that is just speculation. ■

Bentley Exor
www.bentleysystems.com