

Fit for purpose

Assessing hard shoulders for their expanding role within the motorway network

The UK government is looking to a combination of motorway widening and Active Traffic Management as a more sustainable alternative to building new roads to relieve congestion.

There are obvious savings from a reduced road building programme as well as a significant reduction in the environmental impact.

Both approaches make new demands of the performance of the hard shoulder.

Active Traffic Management (ATM) was first piloted on the M42 between junction 3A and 7, to the south-east of Birmingham.

The aim is to use existing road space to help reduce congestion, provide more reliable journey times and improve safety.

The hard shoulder is used as an extra running lane during busy peak periods or incidents to provide additional capacity for vehicles.

During such use, it is subject to heavy loads and sustained trafficking at speeds up to 50 mph - very different to the occasional vehicle break-down for which

it was originally designed.

Similarly, in the growing programme of motorway widening, the hard shoulder is also 'shifting lane'.

As well as being used for traffic during construction work, it is being redeveloped as lane 1 in the wider scheme of things.

Sound data

In widening motorways or introducing ATM, there is a need for sound data on existing hard shoulder construction.

Since December 2005, Fugro Aperio has been collecting and adding hard shoulder data (HA areas 10 and 11) to REVEAL, its UK database of highways construction data.

The non-destructive investigation specialist has carried out GPR (ground penetrating radar) surveys in these areas for the Highways Agency and its agents. The data will help build a better understanding of the construction of the hard shoulders for widening and maintenance schemes in these areas of the motorway network.

Some of the GPR data has been specifically used to assist in assessing and designing construction solutions for the M1 junctions 6a to 10 widening scheme.

Sketchy

Hard shoulders are an area of pavement construction where condition data is most sketchy compared to other elements of the UK trunk road network. Up and until now, there have been few records on hard shoulder construction in HAPMS.

Historically, they have been built to a less demanding specification than the main carriageway, and data on their construction and condition is very limited.

The UK's first motorway, the M6 Preston by-pass opened in 1958, was originally a dual two-lane motorway with "soft" shoulders and no central barrier.

The UK's third major motorway - the 67 mile stretch of the M1 between Crick and Berrygrove opened in 1959 - included strengthened hard shoulders and was the first dual three-lane motorway.

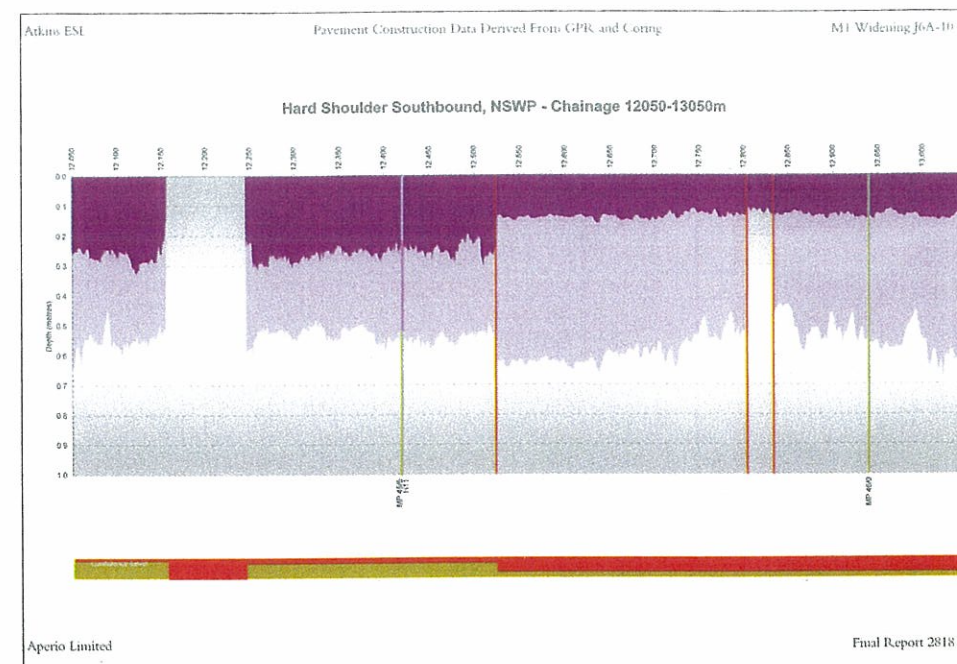
In all, there have been some 322 schemes of motorway construction between 1958 and 2005.

With the expansion of the motorway network over this period, hard shoulder construction has evolved and changed.

The move to ATM and motorway widening will now demand a picture of these changes, and reliable information on hard shoulder construction to see how it may need to be strengthened to fulfil new functions.

Historical

In areas 10 and 11, Fugro Aperio has combined its new survey data with available historical data to build as comprehensive picture as possible of the constructional evolution of the hard shoulder.



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The GPR will help pavement engineers to assess the fitness of the hard shoulder to carry traffic during main carriageway remedial works without risk of unforeseen failure.

Likewise, it can be used to assess condition for carrying traffic during peak flow periods on ATM schemes.

It is also useful in evaluating designs to strengthen sections of hard shoulder to bring them up to modern standards.

Approach

In areas 10 and 11, Fugro Aperio surveyed around 95% of the hard shoulder construction in both directions.

This data can be drawn from the REVEAL database to provide a construction summary to guide evaluation, planning, design and budgeting of improvement schemes.

In the long term, creating a bank of construction data for hard shoulders nationally could be of value for future ATM or widening schemes.

Fugro Aperio is already very experienced in broadscale GPR surveying through its on-going programme of construction data collection from UK primary routes used to populate the REVEAL on-line database.

Due to the detritus that exists on hard

shoulders, surveying needs to be carried out at a slower speed - around 15mph - with a rolling barrier. Fugro Aperio believes that hard shoulder surveying on a national scale may be best achieved by taking representative samples.

The typical construction scheme length across the UK is 10km, so a 5km sample would allow for differentiation between original constructions and later treated sections.

Surveying could be confined to the hard shoulder of one carriageway, assuming that the other carriageway would have been built to the same construction standard.

Difficulties

As mentioned, surveying ground conditions on the hard shoulder is fraught with difficulties.

The dangers of working close to high speed traffic are ever present and a rolling barrier is essential. Punctures and blow-outs from build-up of road debris are common, and the need to negotiate numerous junctions further complicates the task for the survey vehicle.

However, GPR is highly effective at segmenting the network into common structural elements and therefore very useful for building a picture of hard shoulder construction.

It is much safer in terms of risk

management than people working outside vehicles to collect cores and provides far more information.

For similar reasons, GPR is also highly suitable for slip roads and roundabouts.

It is one of the few tests that can be conducted on these key intersections without closing them to traffic - an extremely disruptive course of action.

Benefits

Having GPR data for hard shoulders delivers all the usual benefits of GPR.

It provides valuable data on pavement thickness and construction changes so that design options can be more accurately matched to the varying characteristics of the pavement.

In comparison to taking cores at intervals, GPR fills in much more of the picture of the subsurface, picking up construction changes in terms of layer thickness and constructional type.

With extra confidence from having representative continuous detail of hard shoulder construction, pavement designers are able to value engineer different solutions for different areas rather than apply one design throughout the scheme.

GPR also benefits risk management, by significantly reducing the element of 'unknowns' which can manifest as problems once work begins on site.

Early contractor involvement

Site investigations, including GPR surveys, are proving to be a vital element for contractors under 'Early Contractor Involvement' in DBFO projects.

The data can reduce project risk in the short term (bidding and building), in the medium term (operating) and in the long term (handing back to government after the contract term 30 plus years).

Project teams are using Fugro Aperio's hard shoulder data at the very earliest stages of planning, for example, to assess viable options for traffic management prior to widening or maintenance work.

With the role of the hard shoulder in the ascendant, piecing together its construction is set to become integral to highway asset management.

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