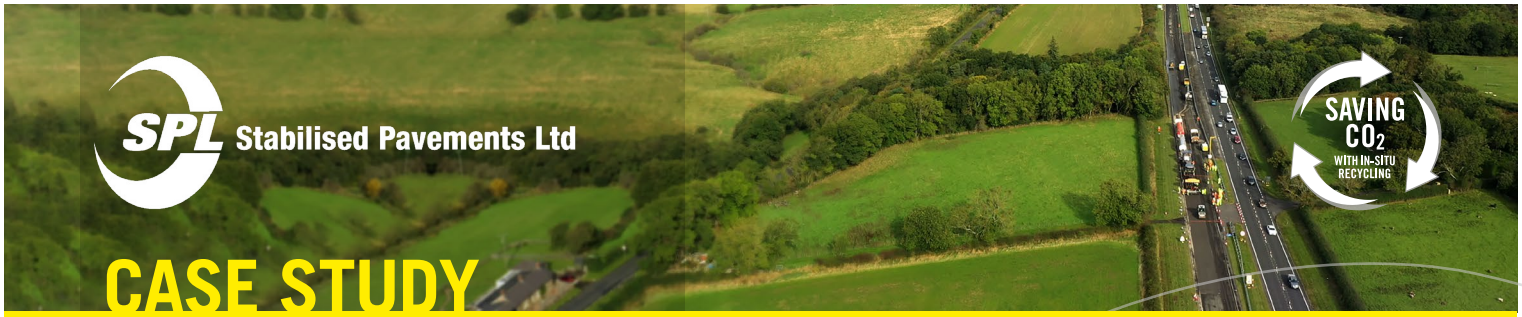


Stabilised Pavements Ltd

# CASE STUDY

## In-Situ Foam Mix Recycling

'A1 receives over 14,000 Tonnes Foam Mix... created in situ and laid over 12 shifts reducing Carbon by 50%'

| | |
|---|---|
| **Scheme:** | A1 Newton on the Moor, Northumberland |
| **Principal Client:** | National Highways |
| **Main Contractor:** | Galliford Try |
| **Date:** | September 2021 |
| **Area:** | 38,157m² |
| **In-Situ Process:** | In-Situ Foam Mix Recycling |
| **Surface:** | 40mm Ultipave 10mm TSC |
| **$CO_2$ Saving:** | 477 Tonnes or 50% over Traditional Asphalt |

GallifordTry

national highways


The scheme is located on a dual carriageway APTR section of the A1(T), subject to the national speed limit, and located between Newton-on-the-Moor and West Cawledge. Situated approximately 5m south of Alnwick in Northumberland and located on the Northbound carriageway over a length of 5.2km (10.4 lane kilometres).

The proposal was to undertake in-situ recycling of the exiting binder/base layers. It was envisaged that a prior scheme, A1 West Moor to Newton on the Moor (210647) constructed in 2016 covering the pavement 4km immediately to the south of the proposed works will provide a benchmark for comparison.

The proposal was for a pilot scheme to trial the new draft SHW Cl 949 'Cold In-situ Recycling Process'.

The development, design and delivery of the scheme was to be in collaboration with National Highways Asset Needs and Pavement SES. National Highways procured the services of a laboratory testing supplier to develop the mix design in collaboration with the pavement contract.

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The existing pavement surface varied throughout the scheme extents. The carriageway consisted of a mixture of Thin Surface Course, Hot Rolled Asphalt and Ageing Base and Binder Courses. The sections of TSC were at the end of the design life. The carriageway had been deteriorating over time in the form of cracking and some carriageway depressions.

Also, tar was located at a uniform depth of between 190mm and 250mm. The intention was to encapsulate the tar within the recycled layer thereby mitigating the hazard rather than needed to be disposed of off-site.

Before finalising the design proposal detail, sampling works were instructed and carried out in February 2021. In line with CD 226, the accuracy of sampling was ensured by using the Wirtgen 380Cri recycling machine to extract and pulverise the design samples since this latest generation cold recycler would be undertaking the delivery of the work.

The findings lead to a final design involving a foamed bitumen bound recycled material constructed to 160mm and 180mm in depth. Depths were set in order to reach a minimum 15-20 year life and strengths of 5500 MPa or 5.5GPa were required to achieve this.

The recycled layer was overlaid with Tarmac's Ultipave 10mm TSC at a depth of 40mm. The deeper 180mm recycling was carried out to the Southern half of the site, then at 160mm to the North end of the works. The slightly deeper recycling was specified in order to capture a historical surface layer, which at testing had been identified as having failed, so needed to be included in the re-engineered material prior to being overlaid.

A trial of Graphene inclusion was also to be undertaken into the recycled material over a specific length of carriageway in Lane 2 at a depth of 160mm. The Graphene was introduced to the recycled material suspended in the blended cement – expectations are that it has the potential to improve the strength and durability of the pavement and forms part of an ongoing study in the use of Graphene in pavement applications; monitoring of the performance and strengths in this area are ongoing.


Work began on site on September 25th with pre-planing carried out at 60mm in order to accommodate the new surface material depth of 40mm as well as the potential bulking from the recycling process. The Wirtgen 380CRi was deployed and mixed pre-spread blended PFA/Cement and introduced foamed bitumen within the mixing chamber to create the recycled foundation.

The final mix contained 90.5% Recycled Carriageway, 5% Pulverised Fuel Ash, 2% Ordinary Portland Cement and 2.5% Foamed Bitumen.

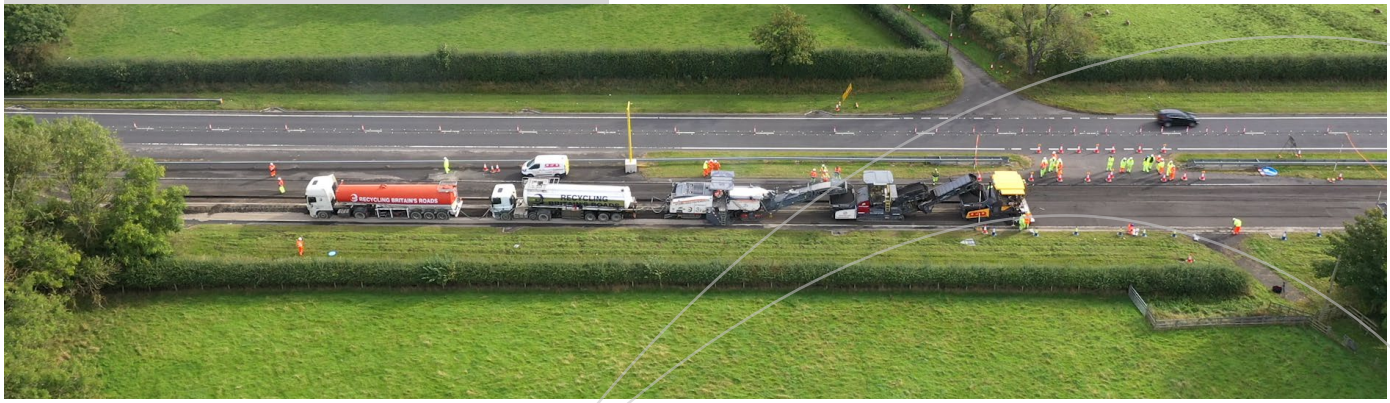
As a result of the PFA increase, gradings were suitably adapted to compliant zones in order to optimise the impact of the foam and provide a long-lasting flexible pavement layer able to achieve an indirect tensile stiffness modulus of between 3.1 GPa (min) and 6.5 GPa (max).

# In-Situ Foam Mix Recycling

SPL's 380 Cold Recycling train produced on average 1184 tonnes of recycled material per shift over a total of 12 shifts. This equates to just over 38,000 $m^2$ at an average of 170mm depth. The greater outputs clearly resulting in less time onsite, less disruption to the travelling public as well as less Carbon generated both on and around the site due to the reduced construction activity and lorry movements respectively.

In line with National Highways' sustained action towards decarbonising England's motorways and A-roads this project has brought significant benefits to motorists, communities and businesses. Through recycling 90% of the existing carriageway in situ, around 1400 lorry movements were not required to transport materials approximately 40km to and from the site. At a challenging time for logistical operations in terms of both labour and material shortages this was another benefit of re-engineering materials on and in the road.

Using technology and innovation SPL continue to make efforts to help push towards Britain's net zero future and we acknowledge the importance of measuring our Carbon expenditure in order to effectively manage and improve our processes. The 477 Tonnes of Carbon saved on this site over traditional asphalt solutions is heading the right way and for perspective is the equivalent of $CO_2$ emissions from burning 240 Tonnes of coal or driving 1.2 million miles in an average sized passenger vehicle.




Through further collaboration as seen here, alongside like-minded partners, at SPL we would hope to continue to build and enhance these achievements and make this approach to highway maintenance a bit less extraordinary.

"This scheme is a perfect example of how working collaboratively with our partners we can make great strides on our sustainability, environmental and social value goals. To recycle 14,000 tons, achieve a 50% $Co_2$ reduction and prevent 1400 unnecessary HGV movements are just some of the highlights we are proud of.

Shifting to the left, before finalisation of the design, allows such trials and innovations to be explored, incorporated into projects and successfully delivered. The exceptional results and learning from the A1 Newton on the Moor project will naturally support further growth, innovation and development on how we deliver subsequent schemes."

**David Lowery, MD Highways, Galliford Try**

"National Highways alongside SPL, GEIC, PTS and many other key supply chain partners carried out a world's first by adding Graphene directly into an in-situ recycled material; producing an end product like no other. This is the first step in a long journey to yield the significant Carbon benefits in-situ recycling brings with an enhanced end product only achievable with Graphene. Over the coming months we will be assessing many other in-situ recycling locations and working to make this process the norm instead of the exception.

It has been a long (and sometimes frustrating) journey so far … thank you to everyone internally and externally for getting this to site. It truly is a team effort and a demonstration of what we can achieve working as one."

**Graeme Watt I National Highways I Operations Directorate**