

## APPENDIX 3

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<b>Title of Briefing:</b>	<b>Live Labs – Cumbria’s Plastic Roads</b>
<b>Author(s):</b>	<b>Matthew Waning</b>
<b>Unit/Directorate:</b>	<b>Capital Programme</b>
<b>Audience:</b>	<b>Carlisle Highways and Transport Working Group</b>
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### 1. INTRODUCTION

The delivery of innovation into routine and planned maintenance can be problematic and this is sometimes used as an argument to restrict initiatives. However, Cumbria County Council recognises that innovation is vital for development of asset management solutions that meet stakeholder demand and deliver the service within the agreed budget.

According to the UN Environment more than 8 billion tonnes of plastic has been produced since the early 1950s, and around 60% has ended up in landfill or the environment. Despite the environmental risks associated with plastics and packaging the construction industry is the second largest consumer of plastic in the UK”. [Innovation Today March 2019]

With this in mind, Cumbria County Council (CCC) identified an opportunity via the Live Labs funding to investigate the benefits of using plastic waste as an additive in the production of the bituminous pavement materials that it uses in its highway maintenance works across all parts of the County’s highways network.

### 2. BACKGROUND

Cumbria was allocated £1.6m, one of just eight local authorities in the country - and the only one in the North of England - to be selected as part of the ADEPT SMART Places Live Labs Programme to carry out real world tests using new highways technology and methods on local roads which could revolutionise the highways and waste industry.

Cumbria’s Live Lab project has investigated the sustainability and suitability of using additives derived from waste plastics as part of their highways surfacing programme to reducing carbon footprint and provide a more resilient road network.

The initiative was developed following an offer by a local SME company, MacRebur, to supply a new additive for use in materials used for surfacing work materials; this additive having been developed from processing recycled plastic waste.

CCC have worked with MacRebur on and off for around 4 years now but have never had any financial freedom to look at academic work, extended monitoring, multiple material testing and so forth. However, the Live Labs project has allowed CCC to do this and to closely inspect and scrutinise the detail with Nottingham University and PTS with great success.

As the project progressed CCC were approached by surfacing partner Hanson Contracting to trial a waste plastic derived additive from their bitumen supplier Shell

### **3. SUMMARY**

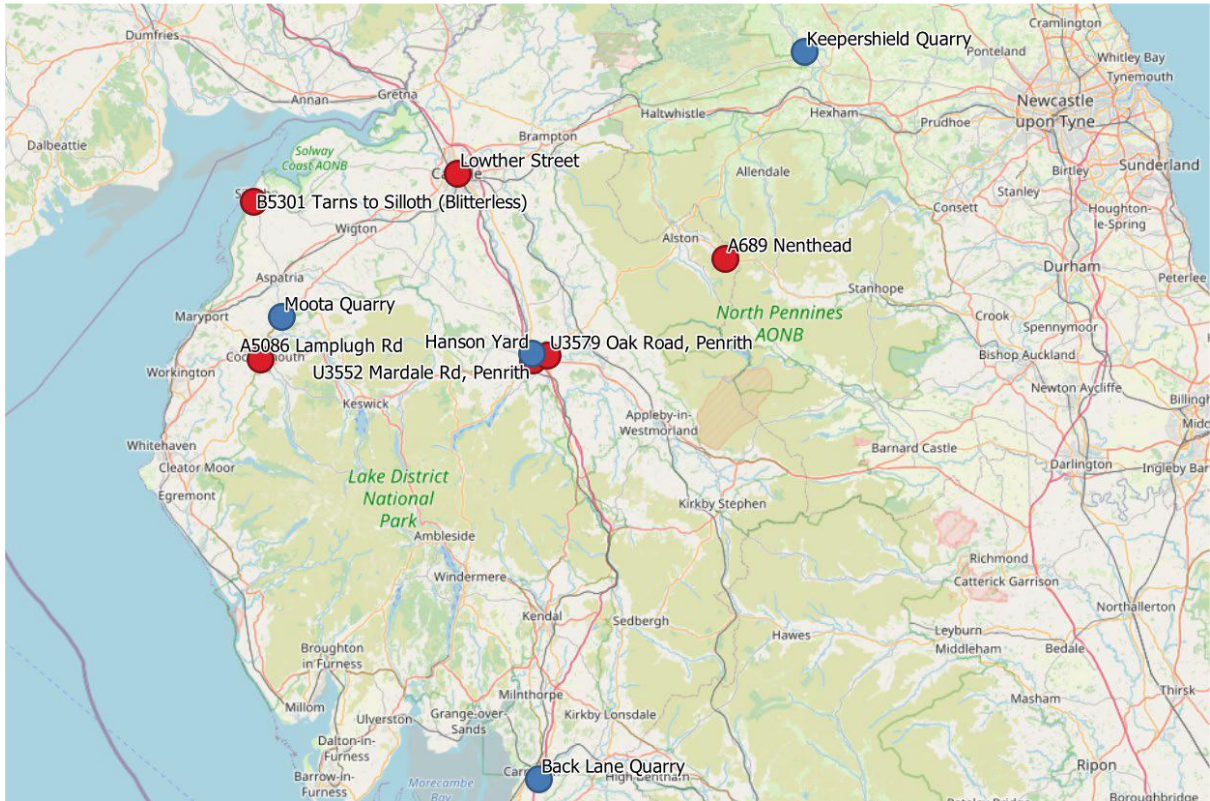
Cumbria County Council have been working with MacRebur (trailing two of their dry mix products) and Shell Bitumen (trailing their wet mix Low Temperature Binder) on the project with WSP as our lead consultant on writing the report as we wanted it to be as independent as possible. As part of the Live Labs scheme we have undertaken ten active trials, four quarry trials and six highways schemes.

Additive 1 (MacRebur) comes in the form of fine shredding which replaces part of the bitumen and can be used in any asphalt mix, e.g. Asphalt Concrete (AC), Stone Mastic Asphalt (SMA), Hot Rolled Asphalt (HRA), etc. Information provided by the manufacturer suggests that the A1 product should be selected to increase stiffness and deformation resistance, without compromising flexibility. The recommended use is for surfacing high stressed areas of the highway such as intersections, roundabouts and heavy, slow-moving traffic areas.

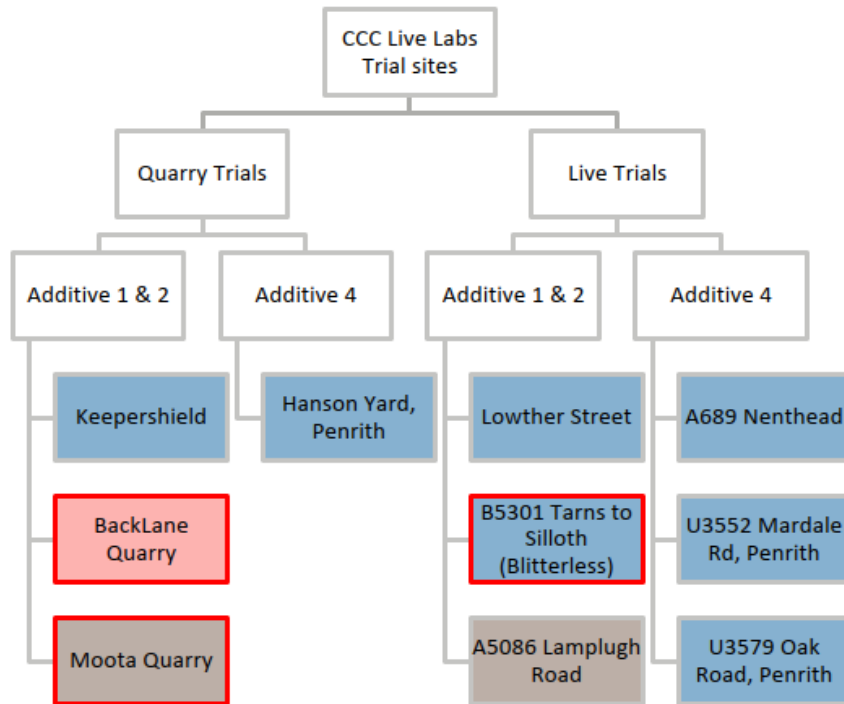
Additive 2 (MacRebur) also comes in the form of shreadings and is designed as an extension/replacement of the bitumen. Information provided to date has shown that the product would be selected to maximise environmental and economic benefits, in that there is no adverse impact of performance, suggested use is low trafficked areas, car parks, driveways and local roads.

During the lifetime of the project, an additional product (Additive 4, by Shell) became available, the product contains a wax additive which has been derived from waste plastic. The wax product shown in Figure is pre-blended with bitumen using the wet process; the additive is derived from waste plastic that has been subjected to a depolymerisation process. The effect of the product on asphalt materials is to allow a reduction in the temperature that they are mixed at, known as Warm Mix Asphalt (WMA). Production temperatures are around 30°C lower when compared to traditional hot mix asphalt. WMA typically offers a reduction in energy usage at batching and consequently provides carbon savings.

A range of locations across the county were selected and surfaced to test the plastic waste materials as part of the project including high traffic areas such as the A7 Lowther Street in Carlisle city centre and areas exposed to some of Cumbria's most extreme weathers such as the A689 at Nenthead. These sites will continue to be inspected and reported on annually. All sites are performing as inspected, with no issues to Report. Please note, though there has been some early life issues at 'Bitterlees' towards Silloth, it appears this is not material failure attributed to the plastic additive.



## SUPPLIERS AND ADDITIVES



### Key

- Aggregate Industries
- Hanson Contracting
- Breedon

### Figure 7-2 - Live Lab trial sites, suppliers and additives

Figure 7-2 shows the relationship between the Live Lab trial sites, suppliers and additives used. The diagram indicates which trials were conducted at suppliers' quarries, and which suppliers provided material for the live road trials. The red outlined boxes indicate where samples were taken for specialist rheological testing at Nottingham University, which is presented in Chapter 9.

The findings from the trial have now been published in conjunction with our Consultancy Partner WSP and are available to view on the ADEPT website. The conclusions and recommendations will help to inform the DfT and other local authorities on using waste plastic in their own road schemes.

The Live Labs project has provided several successful and satisfying experiences at a project level but also a wider corporate level.

A key success of the project is the provision of a fully independent research report. WSP have collated a huge library of existing information from partners and existing international research to show the gaps that have needed filling. They have gone on to develop site selection criteria, testing requirements, design options and so forth to pull together all the information possible within the budgetary and time constraints.

The literature review highlighted that the scientific and engineering understanding of using recycled plastic is still at an early stage and more research is required. In general, the literature review demonstrated that most research is laboratory based, with insufficient technical information from studies based on the in-service performance of pavements.

Road trials have proved to be an excellent way to evaluate the performance of new materials. It is essential to include a control section that incorporates a standard or established material of known performance. The project undertook six live road trials and four quarry trials. There is a five-year monitoring and inspection programme in place to allow CCC to continue to feed into the Live Labs library.

There are lessons to learn from the project and advice that can be given to authorities who want to try innovation for themselves to get ahead start.

- Don't leave it too late to speak to others. A common theme throughout all projects in the Live Labs Programme has been legal and procurement challenges and Cumbria has been no different. Working with suppliers outside of existing frameworks, who aren't on financial systems, have no contractual agreements or detailed knowledge of procurement and legal obligations for example has been without doubt extremely tough and probably the most challenging aspect of the last two years. However, should we and other authorities have come together sooner to share these problems it would be much easier for all. Once these issues were discussed at programme level other authorities, ADEPT and the DfT shared tips and experience speeding up some of the processes.
- Don't be afraid to add in new ideas and to accept scope creep as time moves on. Over a two-year project products, technology, social and economic desire can change and providing communication is clear then it should only help a project. Cumbria as other projects in the programme

have done added ideas, amended objectives and changed or added partners. This isn't in itself a bad thing, but there was a naivety from us in supply chain experience in project change and as a result didn't communicate clear enough intentions and reasons for scope creep.

- Don't underestimate the importance of clear concise communication no matter how trivial things can seem there can be a lack of experience between public and private parties and so huge problems can come from missing what can be seen as the small details.

But being part of the programme has made the authority aware to other initiatives which could contribute towards our decarbonisation goals. It has also opened up innovation and decarbonisation partnerships which will hopefully extend beyond that of Live Labs. The project has led on to new opportunities with providers with technology completely outside of plastic roads, such as and EV charging bid in partnership with Shell, which would have been missed if not for the programme.

Simon Gallagher summarised the aims of Local Authorities and the industry well when he said we need to consider and prioritise the Environment, the Economy and Social desire. Cumbria County Council have tried to put this at the front of its project goals and objectives when researching the sustainability and suitability of using waste plastic additives in highways construction.