

Future Highways
Research Group



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Association of Directors of
Environment, Economy, Planning & Transport

Highways
PART OF TRANSPORT NETWORK

In-Situ Recycling

Daniel Morgan, Paul Acock (Colas)

An aerial photograph of a complex highway interchange with multiple lanes and overpasses. The image is overlaid with thick, bright yellow graphic elements: a vertical bar on the left, a diagonal bar crossing the center, and a horizontal bar on the right. A thin yellow line with a circular end extends from the right side towards the center.

Daniel Morgan

**Executive Director - Products &
Surfacing Solutions**

**In Situ Carriageway Recycling
Industry overview**

The COLAS logo consists of the word "COLAS" in a bold, black, sans-serif font, centered within a yellow diamond shape. The diamond has a double-line border.

COLAS

CARRIAGEWAY RECYCLING

In-Situ Recycling



- **Single pass road train, Minimal HGV movements,**
- **Different formulations for different road types etc**
- **Low scale but maximises carbon reduction - 65-80%**

Ex-Situ



- **A Decentralised Recycling hub, serves the whole county**
- **100% RAP – All excavated material comes to the hub**
- **Widescale and good carbon Reduction - 40-50%**

Standards for highways works



EXISTING STANDARDS

SHW 947 - In situ cold recycled bitumen bound material

SHW 948 - Ex situ cold recycled bitumen bound material



INCOMING PROPOSALS FOR 2024

SHW 949 – In-situ Recycling (Down Cut process)

947 (05/18) In Situ Cold Recycled Bitumen Bound Material

(05/18) Scope

1 (05/18) In situ cold recycled bitumen bound material shall be designed and produced to form the foundation or main structural layer of the road pavement. The primary aggregate source shall be obtained by cold pulverisation of all, or part, of the existing road structure. The primary binder (stabilising agent) shall be a foamed bitumen, with cement or lime as an adhesion agent. The aggregate grading may be adjusted by the addition of a filler. Lime may also be used to modify any cohesive sub-grade soil incorporated in the pulverised layer.

2 (05/18) Prior to commencing the pulverisation and stabilisation works, the Contractor shall demonstrate, to the satisfaction of the Overseeing Organisation, using the results of mix design procedures described in sub-Clauses 58 to 65 of this Clause, that the existing pavement materials in the sections of the works defined in contract specific Appendix 7/18 are capable of being recycled by pulverisation to form the primary aggregate component of an in situ cold recycled bitumen bound material which can meet the specified end-product performance requirements.

(05/18) Component Materials

(05/18) Aggregates and Fillers

3 (05/18) The pulverised pavement material and any supplementary aggregate and/or filler shall normally be granular material with not less than 5% and not more than 20% passing the 0.063 mm sieve (Zone A graded material). Approval for use of pulverised granular material containing up to 35% passing the 0.063 mm sieve (Zone B graded material) shall require confirmation by the Overseeing Organisation, subject to the results of the mixture design procedures described in sub-Clauses 58 to 65 of this Clause.

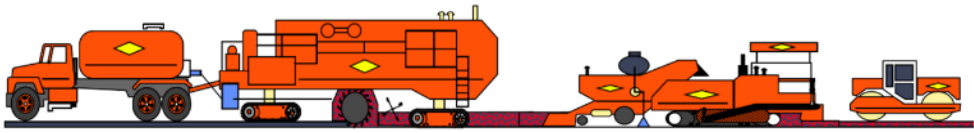
4 (05/18) The pulverised granular material shall contain not more than 2% of organic matter as determined in accordance with BS 1377-3 clause 3.

(05/18) Bitumen Binder

5 (05/18) The primary binder shall be foamed bitumen. The base bitumen shall comply with BS EN 12591 and shall be 100/150 penetration grade.

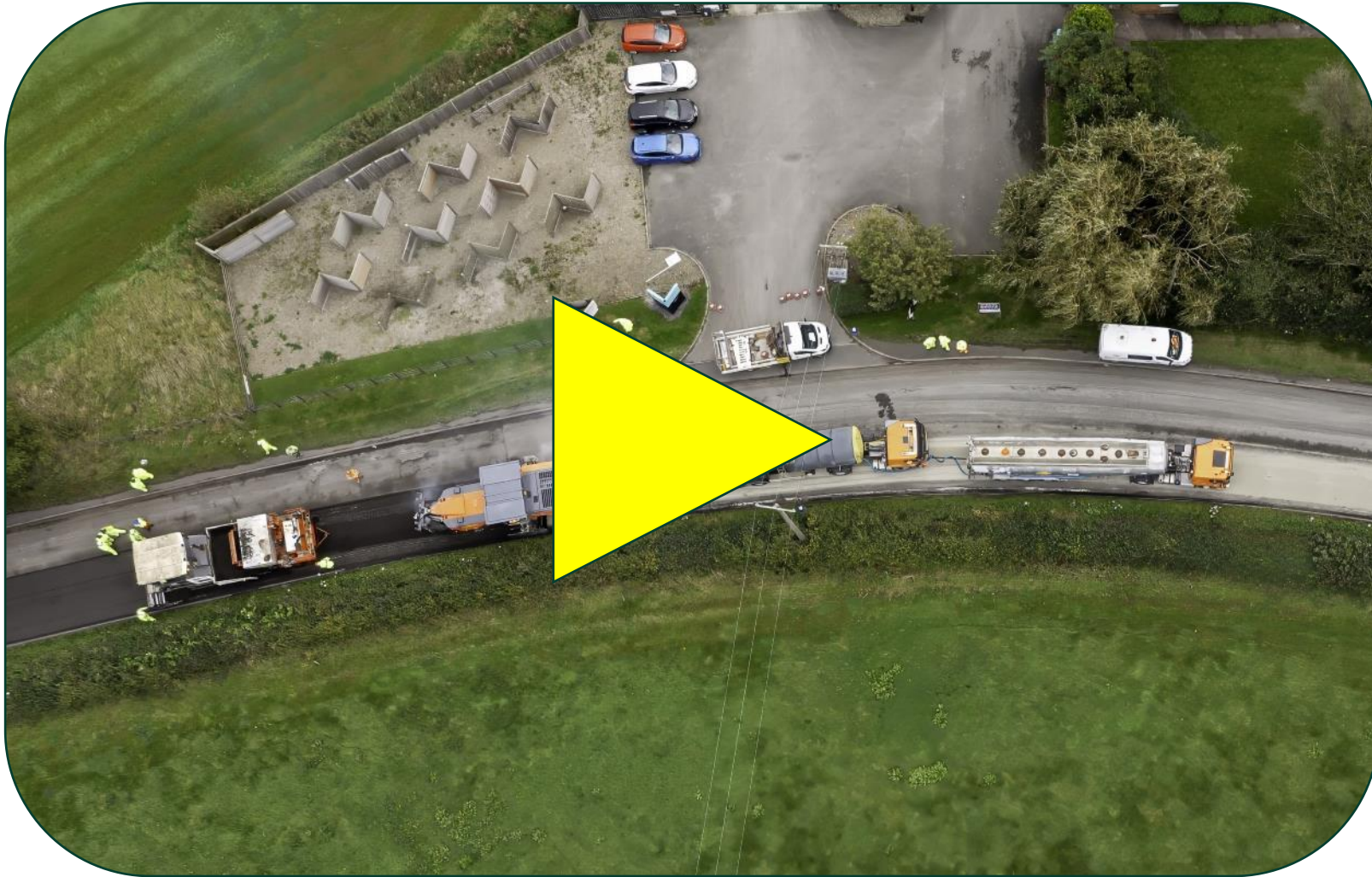
6 (05/18) Other than foaming agent(s), bitumen modifiers shall not be used unless approved by the Overseeing Organisation for special purposes or conditions.

THE RECYCOL SOLUTION



- Recycling 100% of the binder course, cold and in-situ
- Versatile Mix of emulsion and cement
- Typically ~70% carbon saving – Cheshire ~65% saving
- 20+ years of experience in France

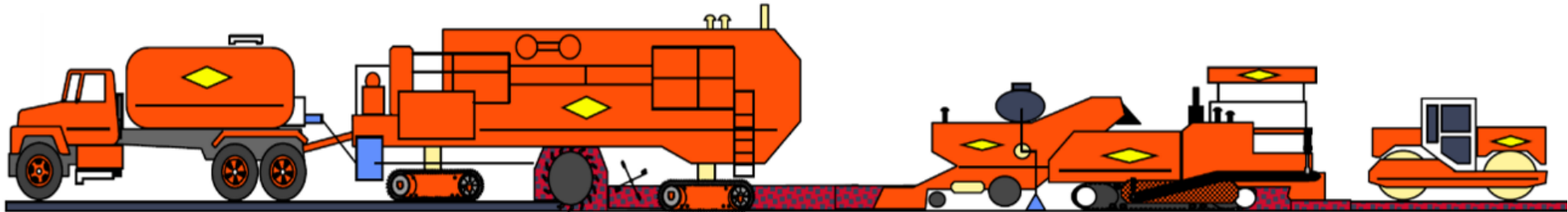




INDEPENDENT EVALUATION

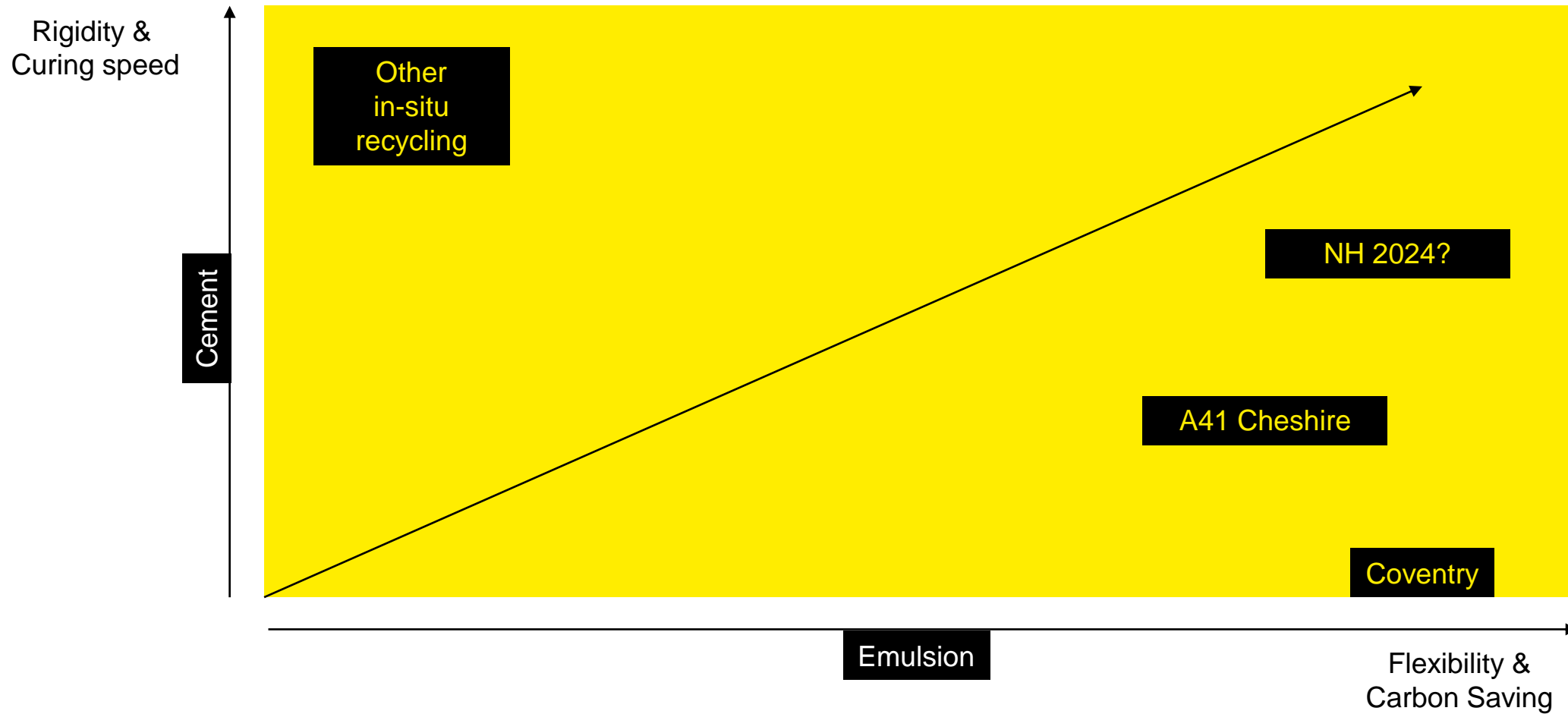


Department for
Energy Security
& Net Zero



The University of
Nottingham

EMULSION VS CEMENT



RECYCOL ROUTE MAP

2000
**>20 YEARS RECYCLING
IN FRANCE**

An aerial photograph showing a long conveyor belt system at a recycling plant. A train of trucks is positioned along the belt, which is situated in a rural area with golden-brown fields.

2022
**UK URBAN ROAD
COVENTRY**

A construction site in Coventry, UK, featuring large orange recycling machinery. A worker in a high-visibility vest is visible in the foreground, and the ground is being prepared for road construction.


2023
**LOCAL MAJOR
ROAD**

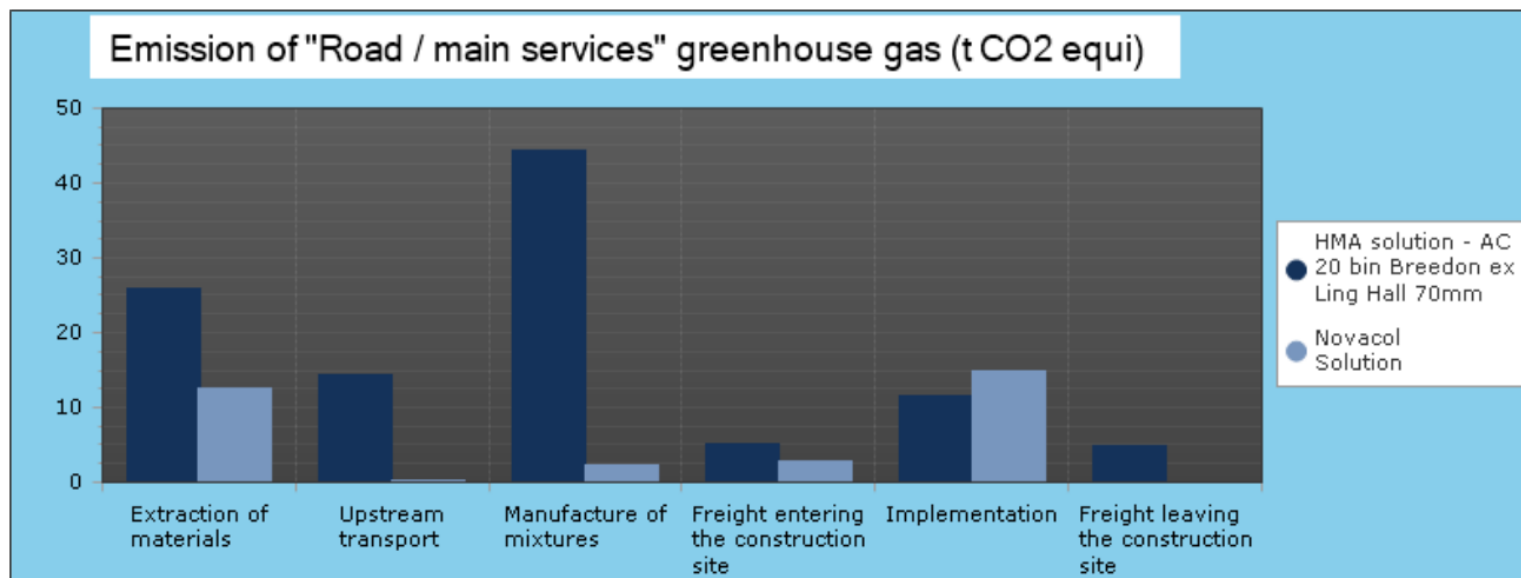
A large recycling machine is shown in operation on a road construction site. A concrete mixer truck is positioned nearby, and the machine is processing materials for road use.

2024
**NH & STRATEGIC
ROAD NETWORK**

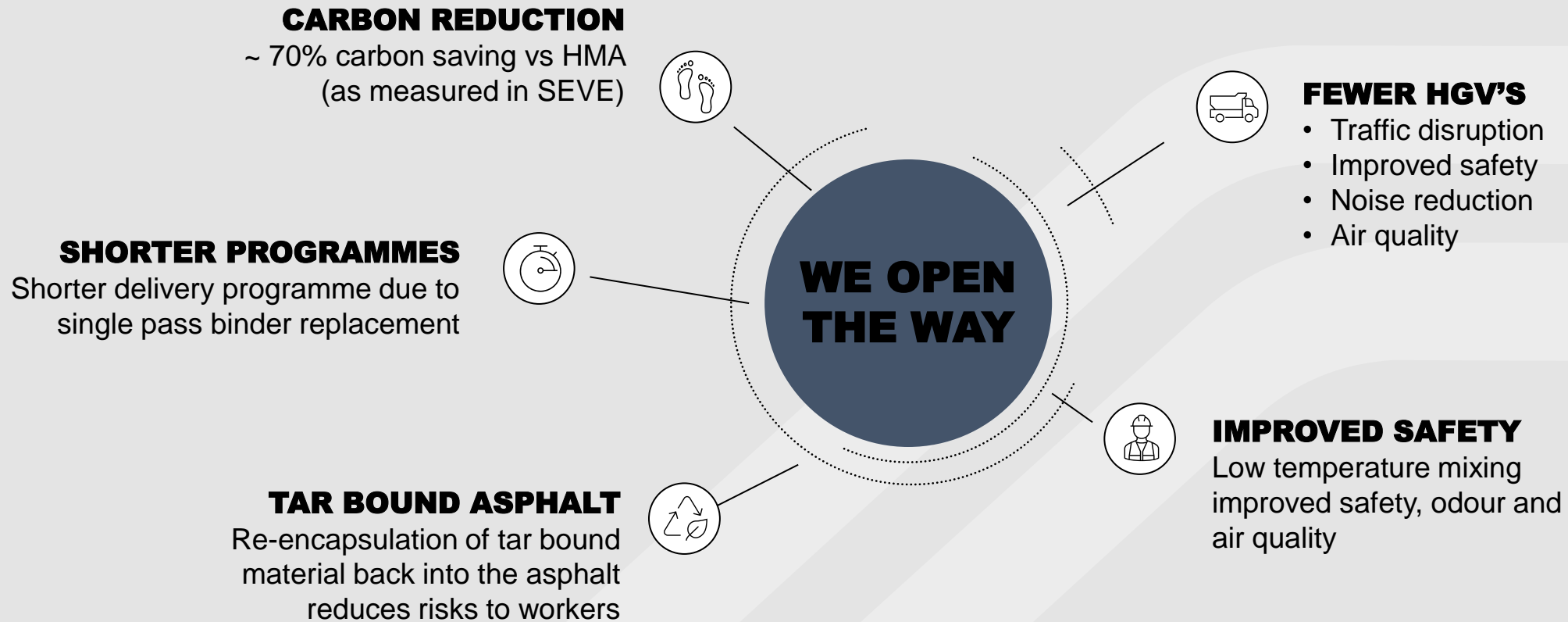
A wide-angle view of a multi-lane highway with several vehicles, including a large white truck, driving on the road. The surrounding area is green and hilly.

RECYCOL CARBON EVALUATION

		Emissions of greenhouse gases (t CO2 eq)							Comparison / Base
		Materials extraction	Upstream transportation	Manufacture of mixtures	Freight entering the site	Implementation	Freight leaving the site	Total	
HMA solution - AC 20 bin Breedon ex Ling Hall 70mm	Roads and Networks	26,0	14,4	44,4	5,0	11,4	4,9	106,1	
Novacol Solution	Roads and Networks	12,6	0,5	2,3	2,7	14,9	0,0	33,0	-68,9 %



BENEFITS



FINAL WORD

- A growing market
- Versatile solution – different blends
- A mix of In-situ and Ex-situ
- 2024 programme





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AI Robot for Pothole Identification & Repair

Chris Faires, Chris Allen-Smith, Hertfordshire CC



Hertfordshire County Council and AI-powered robots

Chris Allen-Smith, Group Manager Asset Management
Chris Faires, Digital and Technology Manager



Creating a cleaner, greener, healthier Hertfordshire



Beginnings

- 2020 and all that...

News story

Government to improve road journeys across the country with £93 million investment and cutting-edge transport tech

Investment to target current pinch points on local roads.

Another project known as Shape-Pot will create 3D pothole models to create a fully autonomous repair platform capable of automatic, uniform repairs – accelerating the transport network of the future.

Senior Lecturer at the University of Liverpool Paolo Paoletti said:

- “ The Shape-Pot project has the potential to change the way roads and their defects are managed, promoting a data-driven approach to management and improving efficiency - making roads safer and more accessible.
- “ Thanks to the T-TRIG funding, the team will create a proof-of-principle autonomous robotic platform to characterise road surface, a first step toward autonomous maintenance of roads.”

Discussions 2020

- **How can we be more pro-active and less reactive**
- Shape-pot is about data collection
- Idea is that find and fix approach
- Need higher resolution than SCANNER
- **Aim- faster, cheaper, greener road maintenance**

Partnership

- Two research projects, “Unframed” and “Shape-pot”, resulted in the spinout company Robotiz3d, led by Lisa, Paolo and Sebastiano
- Complimented by Herts’ expertise, willingness to contribute feedback, Robotiz3d focused on transforming research into the ARRES family of solutions
- Practical elements
- Treatment types
- National standards
- Feedback and the partnership also helped funding bids

Development

- Herts fed back, bringing in Ringway for operational feedback
- Suggesting that a bigger vehicle might be better and more robust than a lab robot, and a focus on prevention/crack sealing rather than full fix
- Defined products, starting with the ARRES EYE

Products

Meet ARRES® 3-Phased Rollout

Roadmap

Minimum or no
human
intervention

Phase 1 - ARRES EYE
(2022 - developed and
manufactured)



Defect detection,
localisation & classification

**Phase 2 -
ARRES PREVENT**
(2023 - prototype
being worked on)



Defect detection +
Crack sealing

**Phase 3 -
ARRES ULTRA**
(2025 - WIP)



Defect detection + Crack
sealing + Pothole repair

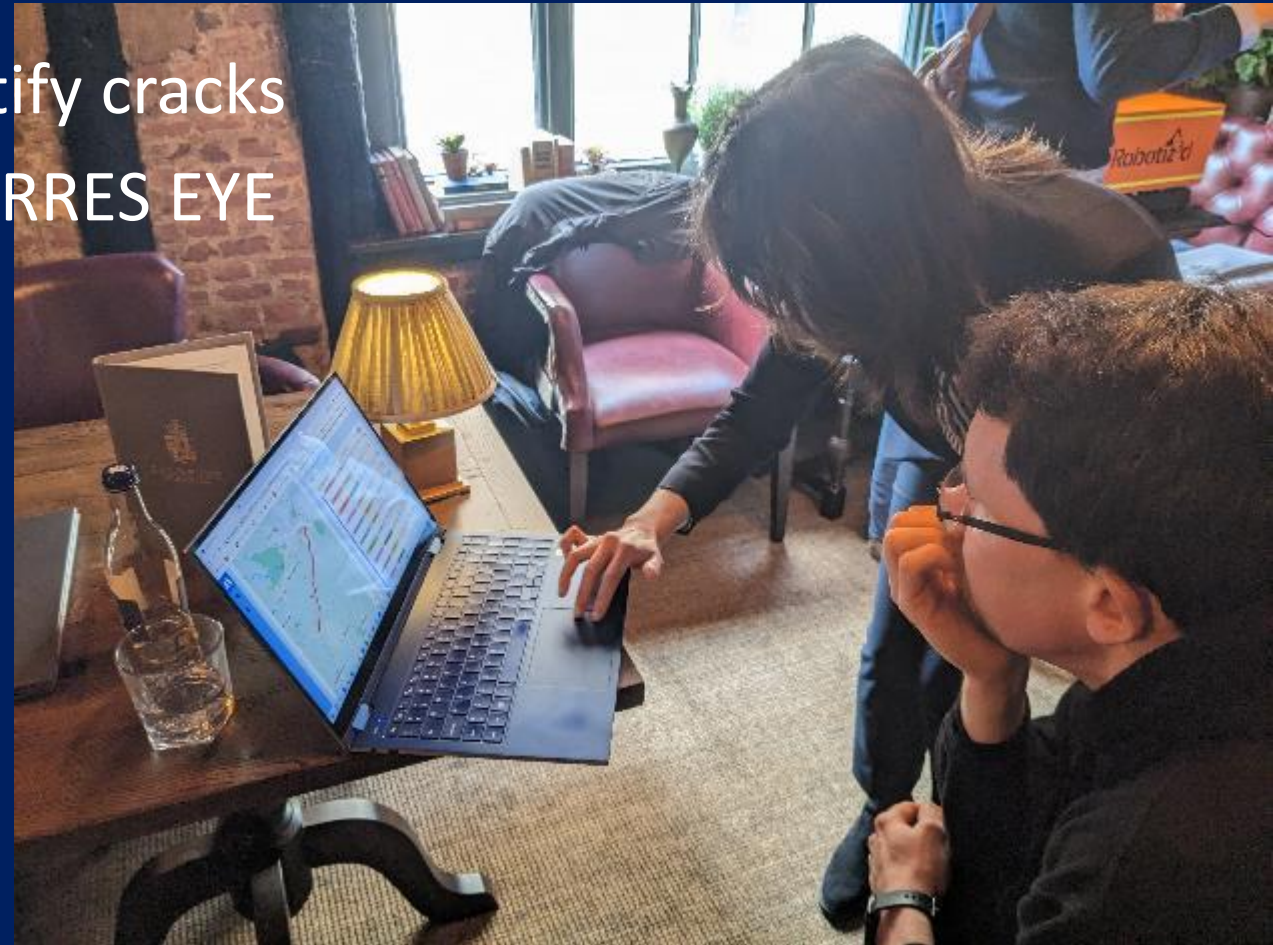


Trial

- We were always keen for Herts to be used as a trial location, and this ramped up in 2023
- A route was selected that would identify cracks
- This was successfully ran twice with ARRES EYE



Creating a cleaner, greener, healthier Hertfordshire



Learning- ARRES EYE

- The model is now more accurate after going around Herts, Up from 65% to >95% pothole detection (100% of major ones)
- Removing false positives from the model
- The trial picked up road features that it hadn't seen in training- drains etc
- Compared to other datasets
- We understood more about capabilities



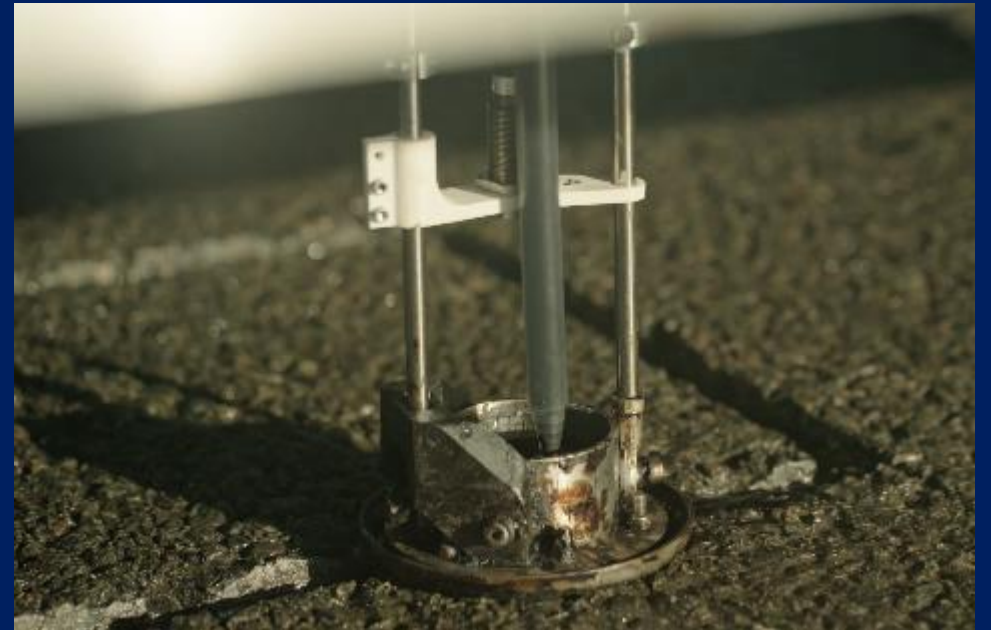
Capturing the imagination- PREVENT

- We tested the PREVENT in late 2023
- We engaged our comms team, they were approached by the One Show
- They captured and collated footage from a test run and Robotiz3d footage
- This led to a positive message in a pothole feature on the One Show
- Then coverage in national, international, local, and specialist media
- Measured reach of over 387 million



Future plans 1

- We are looking to trial PREVENT in Herts shortly
- We plan to have a full road closure for site safety
- We aim to compare interventions to standard patching
- Support Robotiz3d development by supporting locations in Herts as further PREVENT and ULTRA trial
- Proof of concept



Future plans 2

- Continue working with Robotiz3d to support journey to market (They have a lot of interest globally)
- See the robot as a tool to support works such as pre-patching
- Bridge conversations with Highways systems, suppliers and forums
- Progress to the point of autonomous, pothole mending fleet?

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Coffee Break

5 Minutes

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Reimagining Integrated Services Delivery

Phil Horton, Ringway Jacobs

- [See PDF...](#)

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Circular Limestone

Total Aggregates & Jon Evans, Lincolnshire CC

FHRG- Manufactured Limestone Product Assessment

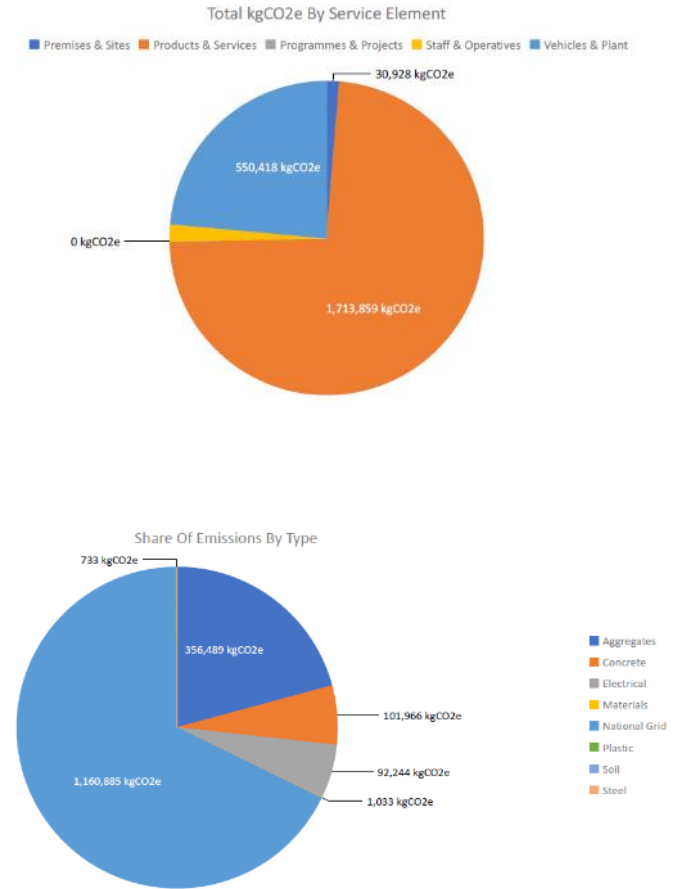


Jonathan Evans – Lincolnshire County Council
Richard Hextall & Phil Cox – Total Aggregates
Justin Thorner – O.C.O

FHRG– Manufactured Limestone Product Assessment

- **Carbon reporting at LCC**

- Contributor to the CCAS and Carbon Analyser pioneer group. LCC has **now produced a baseline** for the Highway Service for Scope 1,2 and 3 GHG emissions.
- Now moving into a **strategic options stage** to review, challenge and potentially change approach to high carbon areas of service delivery.
- **Political steer**
- **Manufactured Limestone (M-LS) trial** and product assessment with the FHRG that is likely to involve Lincolnshire Laboratory and on site assessment to ascertain the full carbon lifecycle of the proposal.



FHRG– Manufactured Limestone Product Assessment

- **Total Aggregates - Who are we?**

Total Aggregates Ltd incorporated 30th March 2004 based in Hucknall Nottingham

Originally set up to complement sister company Total Reclaims Demolition

Total Aggregates Ltd turnover is now circa £24m with the Total Group turning over circa £40 million

Employs 44 people (Within Aggregates)
2 operating centers (Nottingham and Boston)

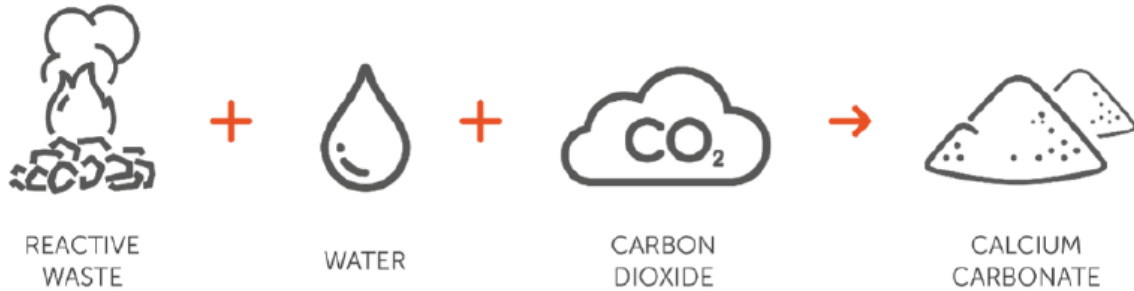
Railhead, Waste Transfer Station and 2 restoration sites for tipping clean soils in Lincolnshire (Boston and North Hykeham)

FHRG- Manufactured Limestone Product Assessment



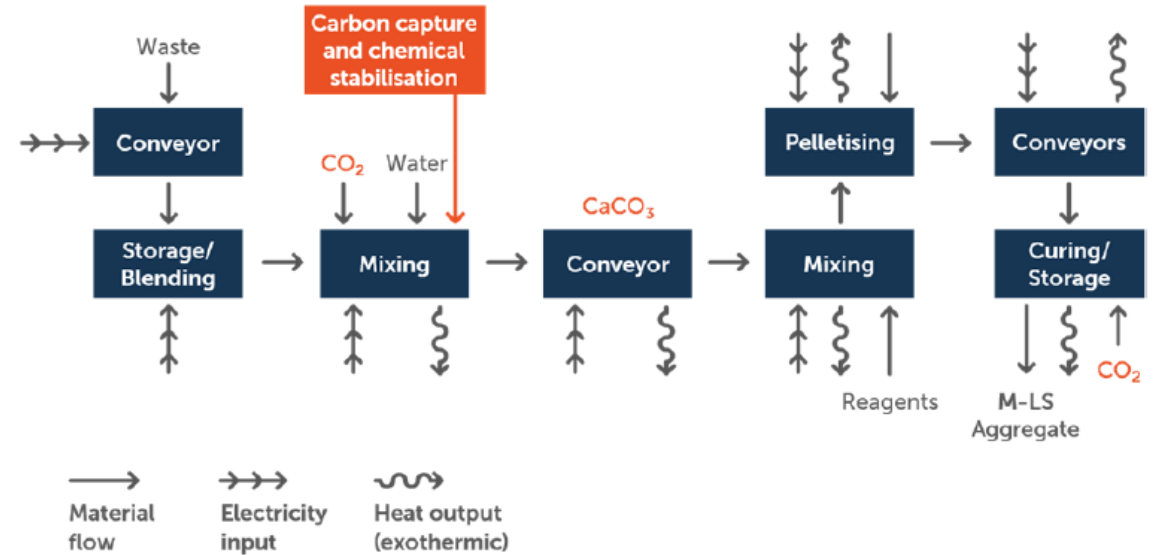
FHRG- Manufactured Limestone Product Assessment

- O.C.O – The Process**



M-LS (Manufactured LimeStone) is artificial rock manufactured by reacting carbon dioxide with industrial process residues.

M-LS is manufactured using a multiple stage process designed to stabilize and valorise industrial thermal residues as a useful construction product



FHRG– Manufactured Limestone Product Assessment

GENERAL INFORMATION

MANUFACTURER

Manufacturer	O.C.O Technology Ltd
Address	Norfolk House, High Street, Brandon, Suffolk, IP27 0AX
Contact details	info@oco.co.uk
Website	www.oco.co.uk

EPD STANDARDS, SCOPE, AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804+A2:2019 and ISO 14025
PCR	EPD Hub Core PCR version 1.0, 1 Feb 2022
Sector	Construction product
Category of EPD	Third party verified EPD
Scope of the EPD	Gradle to gate
EPD author	Dr. Peter Gunning, Head of Research & Development, O.C.O Technology Ltd
EPD verification	Independent verification of this EPD and data, according to ISO 14025: <input type="checkbox"/> Internal certification <input checked="" type="checkbox"/> External verification
EPD verifier	N.C, as an authorized verifier acting for EPD Hub

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	Manufactured LimeStone (M-LS)
Additional labels	N/A
Product reference	N/A
Place of production	Brandon, Avonmouth and Leeds
Period for data	01/10/2019 to 30/10/2020
Averaging in EPD	Multiple factories
Variation in GWP-fossil for A1-A3	19.12 %

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 tonne
Declared unit mass	1000 kg
GWP-fossil, A1-A3 (kgCO ₂ e)	-47.1
GWP-total, A1-A3 (kgCO ₂ e)	-45.7
Secondary material, inputs (%)	37.6
Secondary material, outputs (%)	0.0
Total energy use, A1-A3 (kWh)	163.0
Total water use, A1-A3 (m ³ e)	0.952

FHRG– Manufactured Limestone Product Assessment

- **Bending M-LS with extracted Limestone aggregate**
- Total Aggregates blend high quality high purity Derbyshire carboniferous limestone (delivered by rail) and OCO Manufactured Limestone (currently delivered by road but rail options are available)
- Trial blends to date at 50% 50%
- The LCC / FHRG Trial will test the upper limits of this blend
- The negative EPD of the manufactured limestone
- Initially stock will be ‘bucket blended’ but as demand increases, blending units will be sourced and installed on site

FHRG- Manufactured Limestone Product Assessment



Type 1 – Limestone



O.C.O – M-LS



ReCO2 – Type 1

FHRG– Manufactured Limestone Product Assessment

- **Next Steps**

- Firstly - ‘proof of the pudding ‘ trial underway with LCC & FHRG to assess material
- Secondly - Larger scale trial to show scalability – within Lincolnshire Total Aggregates have circa 75,000t available per annum
- Thirdly - Look to seek approval elsewhere and replicate the operation at Boston Lincolnshire and ensure both products are rail fed
- Finally - Scale up the operation across the East Midlands / Yorkshire and then further a field. Total Aggregates are looking to produce over 500,000t of finished product across the UK.
- Suggest that we return later in the year to update on progress following the FHRG / LCC assessment and product trial

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Carbon Analyser Rollout: Options for Deployment

Simon Wilson, FHRG

Beyond the Pioneer Programme...

- **Lessons Learnt**

- Authorities have needed a lot of support to gather carbon emissions data.
- Data availability and data quality is generally mixed.
- Tier 2 providers are generally better than Tier 1.
- Shortcuts, reducing data demands will be essential moving forwards.
 - See new proforma.

- **DfT: Uniform Carbon Standards Meeting**

- DfT would like to roll out the CCAS process and tools to all authorities.
- Uniform carbon reporting and carbon competence will become increasingly important.
- If FHRG members and ADEPT agree to adopt, DfT may fund the rollout.

- **Self-Assessed & Peer Certified Carbon Footprint Analysis (Preferred Option)**

- Training courses and a certification process replace the *Kick-Starter Programme*.
- Fees reduced to Microsoft License + Software Support + Certification Fee (1 Day).
- Implemented with public sector peer support.
- Supported by specialist partners where required.



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Next Meeting Date:
20th June 2024: Hybrid Meeting
Cranfield School of Management
& Via MS Teams
(Dinner & Accommodation @ Cranfield University)
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End of Document

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