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Sustainable Highway Construction

Dr Helen Bailey

TEF 2023 Gold

Agenda

- **Decarbonising the supply chain**
- **Asphalt recycling and tar remediation**
- **Developing aggregate options**

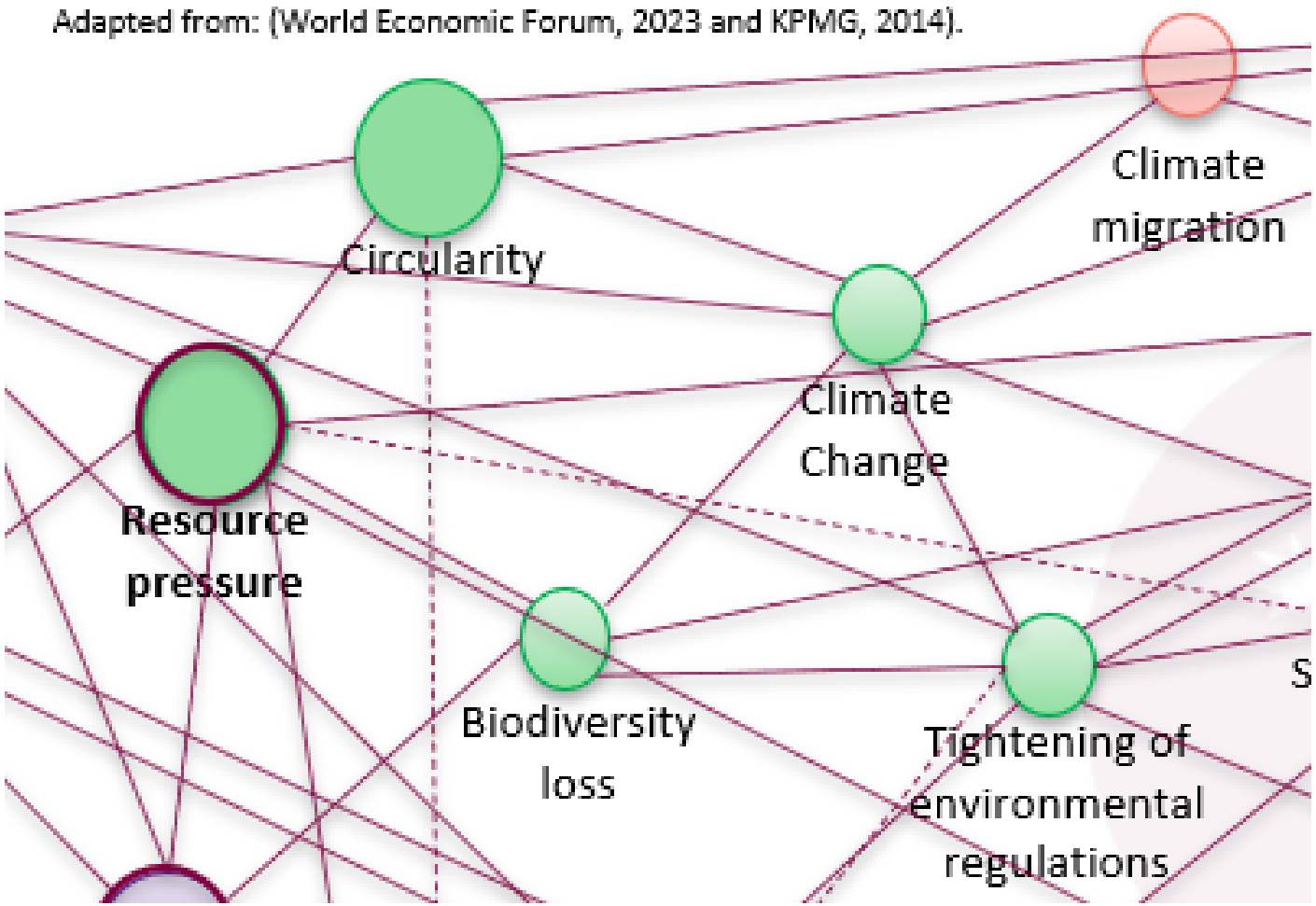
…but first, lets set the scene..

Scene setting

- Big picture/questions
- Client drivers and approach
- Industry response

Megatrend Interlinkages – big picture example

- Rising population
- Urbanisation
- Increase in construction
- Pressure on resource
- Loss of biodiversity



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1. Use less stuff

2. Throw less stuff away

3. Make people happy?

Client drivers and approach

Client drivers and landscape

- Majority (almost all in fact) of local authorities have now **declared climate emergency**.
- **Measuring, benchmarking** and reduction (carbon) is underway.
- Increasing pressure around green claims – **evidence required**
- Offsetting residual carbon only (last 10%) – **longer term solutions required**
- The Chancery Lane Project (TCLP) - **climate contracting to deliver fast and fair decarbonisation**.
- Carbon literacy - **Raising awareness (consciousness), changing hearts and minds**

Representation of the policy backdrop and likely practical responses

2025

At least 50% of asphalt used on SRN to be warm mix.
Recycled asphalt content 15%, and 35% on average in thin surface course and asphalt concrete respectively (SRN)
Embodied carbon in bitumen to reduce by 5% (NH, 2022)

2030

At least 80% of asphalt on SRN to be warm mix.

Aggregate moisture content reduced by 1.5% to reduce energy demand (NH, 2022)

Embodied carbon in bitumen to reduce by 20% (NH, 2022)

2040

Net zero for maintenance and construction by 2040 (with a maximum cumulative cap of 10% for offsetting) – **National Highways**

Embodied carbon in bitumen to reduce by 40% (NH, 2022)

2050

UK's commitment to be a net zero economy by 2050.
Embodied carbon in bitumen to reduce by 50% (NH, 2022)
Alternative binders become standard practice.

Short term

Transition to warm mix asphalt and marginal increases in reclaimed asphalt content. Trialling of longer life binders and biogenic binders.

Medium term

Widespread implementation of warm mix asphalt
Development of half warm and cold mix materials
Reduction in moisture content of aggregates
Reduction in embodied carbon of binders actively targeted

Long term

Significant reduction in embodied carbon of binder (biobinders).

Considerations for the client and going to market

What is the length of the contract/framework?

How many ‘chances’ to go to market before net zero target?

New questions to ask, data to be expected?

Engagement with supply chain? – what are suppliers contributing?

Industry response

Asphalt industry at a glance

National Highways (Strategic Road Network): £27.4 billion budget for investment (2020-2025)

Local Roads: £1.67billion of spend = 84% of network (158,000 miles)

Sector's net-zero aims means:

- **a need for increased use of secondary/recycled materials such as recycled asphalt (RA)**
- **Improved materials handling and processing**
- **greater utilisation of technology**
- **durable resilient materials**
- **(cross) asset management and functional data**

Asphalt market in Great Britain (2022) estimated at 28 million tonnes (an increase of ~3 million tonnes since 2020).

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People

Be a great place to work

Key areas of focus:
- Safety and Wellbeing
- Our People
- Communities

Planet

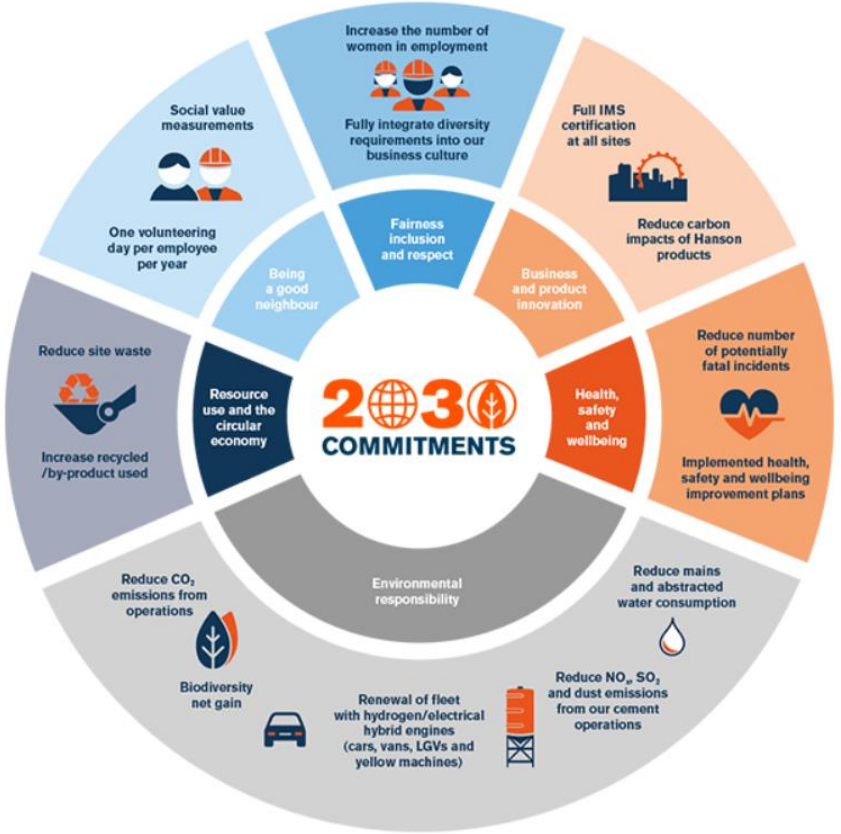
Enhance the environment for future generations

Key areas of focus:
- Climate Action
- Environmental Stewardship
- Circular Economy

Solutions

Provide solutions to create a healthy, sustainable built environment

Key areas of focus:
- Responsible Supply Chain
- Sustainable Construction



Company approaches – state of play

All majors have aligned strategy to UN SDGs and include circularity.

SDG linkages

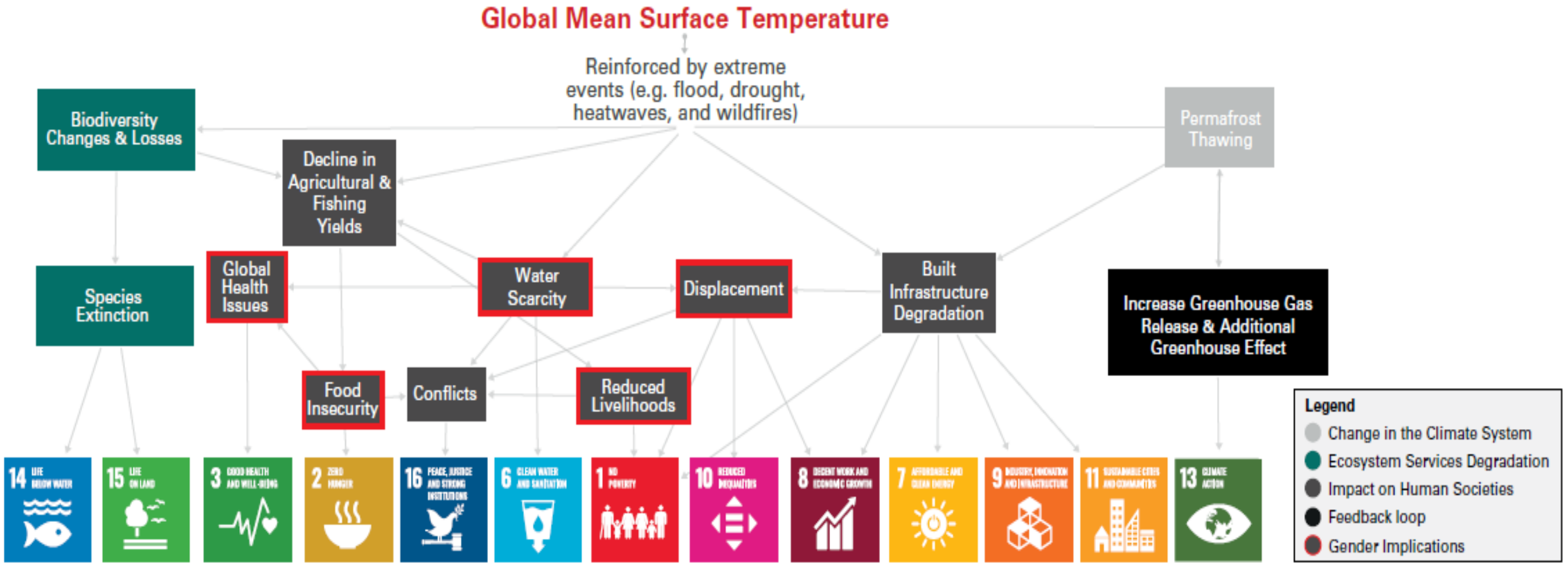


Figure 12. Associated risks of increased GMST and the SDGs

https://public.wmo.int/en/media/press-release/wmo-climate-change-threatens-sustainable-development

Sustainable development goals

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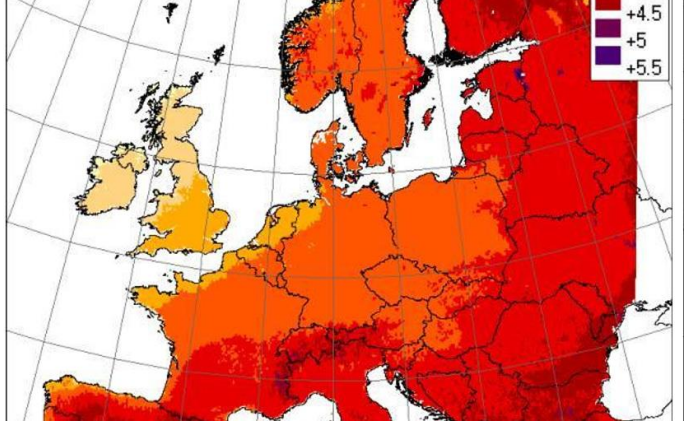
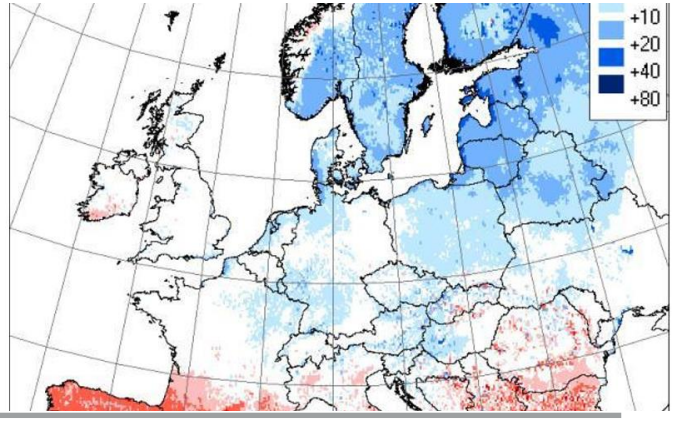
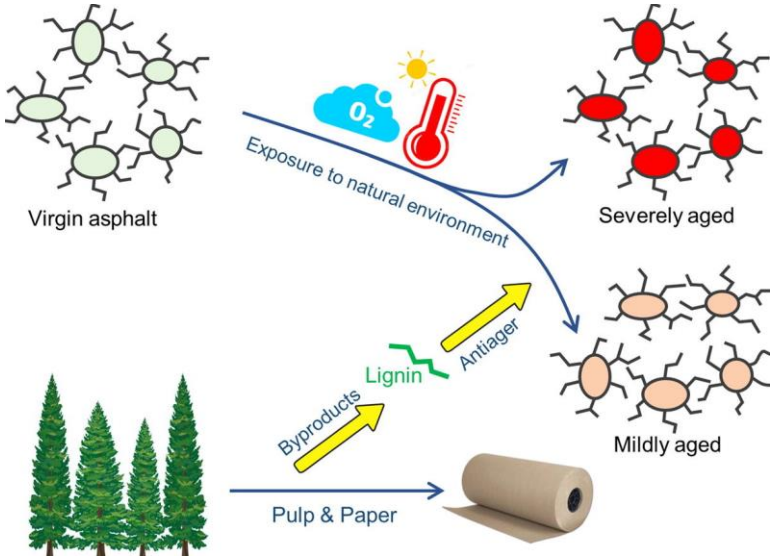
Uncertainty in design?

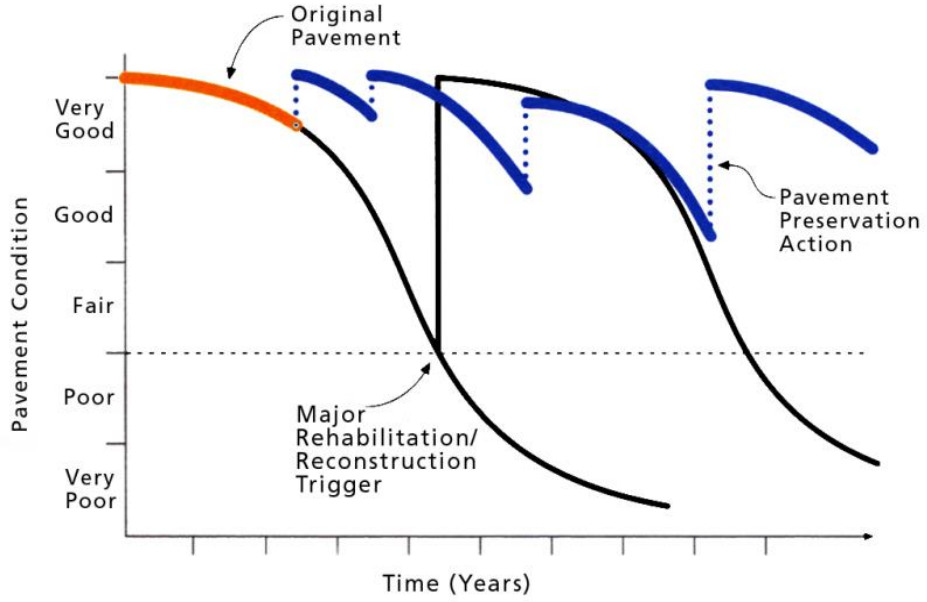




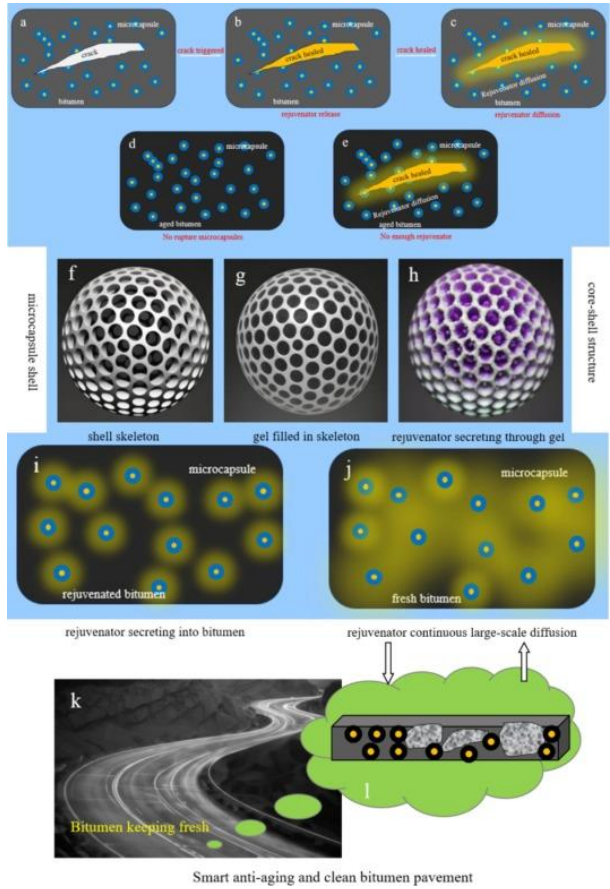
Extending Life

Preservation





Anti ageing / long life materials and additives

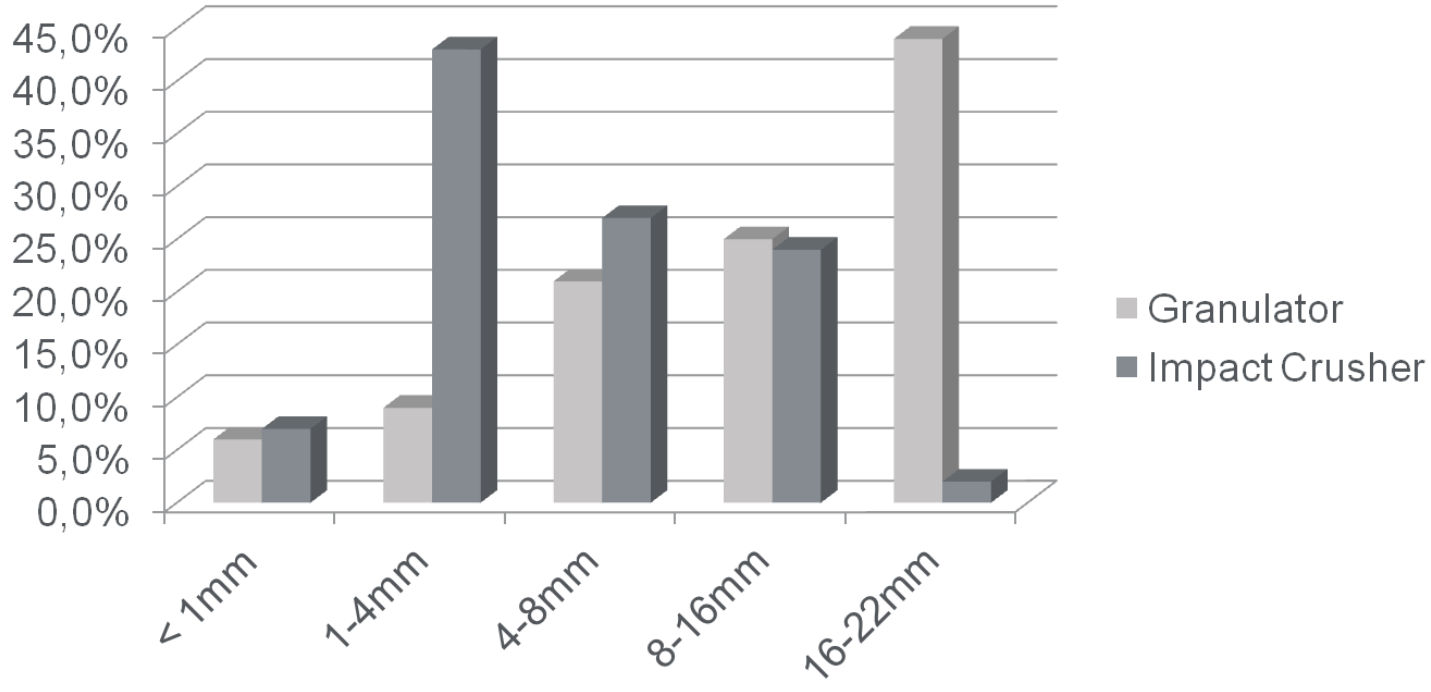


Source:
https://www.sciencedirect.com/science/article/abs/pii/S0167732222008480
https://www.sciencedirect.com/science/article/abs/pii/S0016236124019719

The linear quarry
-reclaimed asphalt (RA) processing

Source: Ammann, Wirtgen

Materials processing



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Hampshire saves £300k a year with new materials recycling centre

24/09/2021
Dom Browne

A partnership between Hampshire County Council, Milestone Infrastructure and specialist recycling contractor, OCL, has set up a new purpose-built recycling centre for road materials.

The plant in Micheldever reprocesses and recycles materials from road repairs, for re-use in road maintenance, leading to reduced carbon emissions, costs, and travel miles.

Hanson HEIDELBERGCEMENT Group

Keywords

PRODUCTS / SERVICES SECTORS SUSTAINABILITY CUSTOMER SUPPORT LOCATIONS ABOUT US CONTACT US

Home / About us / News and community events / Manchester-based waste recycling company joins Hanson family

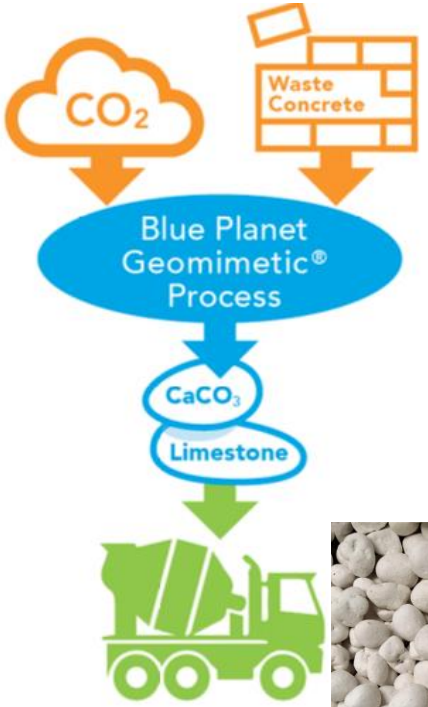
15 February 2022

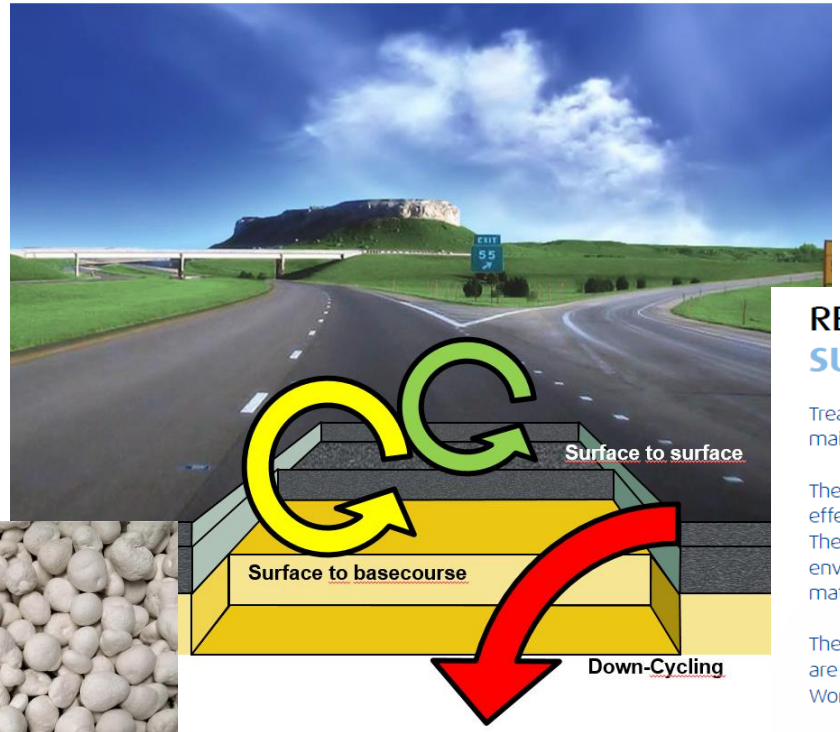
Manchester-based waste recycling company joins Hanson family

CONSTRUCTION MATERIALS SUPPLIER AGGREGATE INDUSTRIES, A MEMBER OF THE HOLCIM GROUP, HAS ANNOUNCED THE ACQUISITION OF WILTSHIRE HEAVY BUILDING MATERIALS LTD, A REGIONAL LEADER IN READY-MIX CONCRETE, PRIMARY AND RECYCLED AGGREGATES, CONCRETE PRODUCTS AND WASTE MANAGEMENT SOLUTIONS.

Getting the best value-

Optimising design, top to bottom, constituent to product.





MANAGING RECLAIMED ASPHALT
HIGHWAYS AND PAVEMENTS

DECEMBER 2024

ADEPT & CIWM Construction, Demolition & Excavation Technical Advisory Group Guidance

ADEPT Association of Directors of Environment, Economy, Planning & Transport

CIWM CD&E TAG

RECOFOAM®
SUSTAINABLE COLD MIX MATERIALS

Treated recycled materials are increasingly being used in the construction and maintenance of road pavement structures.

The Recofoam® range offers contracting authorities a simple, efficient, effective and economical pavement refurbishing technique.
The incorporation of 'non-primary' materials offers demonstrable environmental benefits while reducing the use of non-renewable raw materials and the storage of inert materials.

The Recofoam® range includes two grades: Storage and Heavy Duty, both are formulated to meet the requirements of the Specification for Highway Works, Clause 948, Classes B2 and B4 respectively.

▶ KEY BENEFITS

- **Designed to withstand** heavy traffic
- Low emission, **energy saving** technology
- **Quality** controlled manufacturing

▶ KEY FIGURES

20 years experience

50% reduction in CO_2e compared to conventional asphalt

Incorporating up to **85% recyled materials**

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Devon County Council: A382 (Including Jetty Marsh Link Road) - Carbon Negative Project

East Riding of Yorkshire Council: High visual efficiency for low carbon lighting - decarbonising street lighting

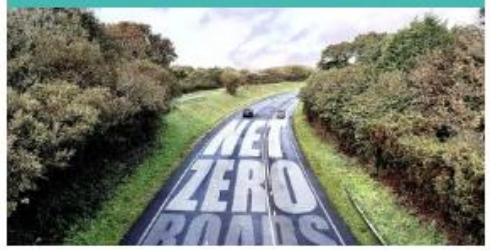
Liverpool City Council: 'Ecosystem of Things' - driving a low-carbon economy

North Lanarkshire Council: UK Centre of Excellence for Decarbonising Roads – North Campus

South Gloucestershire Council and West Sussex County Council: Greenprint

Transport for West Midlands: UK Centre of Excellence for Decarbonising Roads - South Campus

Wessex Partnership: Net Zero Corridors



ADEPT Live Labs 2:

Four interconnected themes

Seven projects

Decarbonising Local Roads in the UK is a three-year, UK-wide £30 million programme funded by the Department for Transport that aims to decarbonise the local highway network.

Source:http://banksy.newtfire.org/html/gallery_pages/graffiti/sweep_it_under_the_carpet.html

Let's not lose sight of future generations….

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Innovation and unintended consequences

-doing less bad is not good enough

Client Questions
The future: Design for perpetuality
Sins of the past: What's in my inventory?

- Look at re-defining assets – not just by their form but also their constituents
- Understand what you have and what you need – timing, design, material neutrality
- Infrastructure as material banks?
- If it's possible to use recycled materials – then why not?

Building as Material Banks (BAMB)

THREE DESIGN DIMENSIONS OF REVERSIBLE BUILDINGS

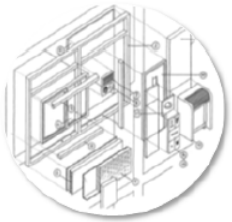
Elma Durmisevic, University of Twente

1

Reversibility of space

Adapt space

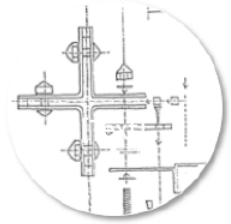
2



Reversibility of structure/

Reconfigure /upgrade structure

3



Reversibility of material/

Separate elements/ material

DESIGN PARAMETERS / ASPECTS OF REVERSIBLE BUILDING :

Project Brief definition: multiple scenarios for use of building if possible draft scheme of possible reuse options for the materials as well

PARAMETERS OF SPATIAL REVERSIBILITY/design aspects:

Transformation Model determines level of spatial reversibility. Parameters that determine Transformation Model are:

Volume dimensions that are compatible with desired scenarios

position of the core elements that is not restricting number of use options,

capacity to carry loads and provide space for services for desired upgradability and use scenarios

Core design: Core is integrated base element, a minimum needed to provide for structural stability and facilitate climate, energy and comfort for different use scenarios.

Core, this most fixed part of the building needs to have capacity to facilitate transformation form one use scenario to another without demolition and waste creation

PARAMETERS OF STRUCTURAL REVERSIBILITY/design aspects :

Functional independence

provided through separation of functions on building, system and component levels

Technical Independence

provided by minimization of relations between different functional modules and creation of structured and open hierarchy that is leaning on well defined base elements of the structure

PARAMETERS OF PHYSICAL REVERSIBILITY/design aspects :

Physical exchangeability

Provided by design of demountable connections that are preventing damages of elements by considering geometry and morphology of product edge, disassembly sequences, type of connection

DELIVERABLE 7

OPERATIONAL MATERIALS PASSPORTS

January 2019

Authors:

EPEA Nederland BV

SundaHus i Linköping AB

Co-funded by the Horizon 2020 Framework Programme of the European Union

PAS 2080:2023

Carbon management in buildings and infrastructure

Construction Leadership Council

The Green Construction Board

ice

bsi.

PAS 2080:2023 New Standard

9.1 Requirements for all value chain members

All value chain members shall:

a) identify roles and responsibilities at each work stage for monitoring and reporting, and for submitting monitoring reports to the relevant stakeholders;

b) report whole life carbon emissions at each work stage defined in Clause **6**, in line with the assessment principles detailed in Clause **7**;

c) report progress made against targets set at an asset or network level, as appropriate;

d) keep records on low-carbon options and the extent to which they can improve performance over a baseline; and

e) share good practice outcomes, including non-carbon impacts and benefits of opportunities, where relevant, with other value chain members to drive low-carbon solutions in similar projects and/or programmes of work.

*COMMENTARY ON CLAUSE **9***

A carbon management process should have robust monitoring and transparent reporting at frequent intervals during the delivery of projects and/or programmes of work to highlight the progress of carbon reductions against targets. Reports should inform decision-making in managing whole life carbon, as well as provide information for future continuous improvement.

Assessment	• Encourage the adoption of robust and validated methodologies for the reporting of carbon emissions in their control and influence. • Develop robust methodologies tailored to the government or regulator, where required. • Incentivize greater data sharing and collaboration within the value chain, allowing improvements in maturity of their sector.

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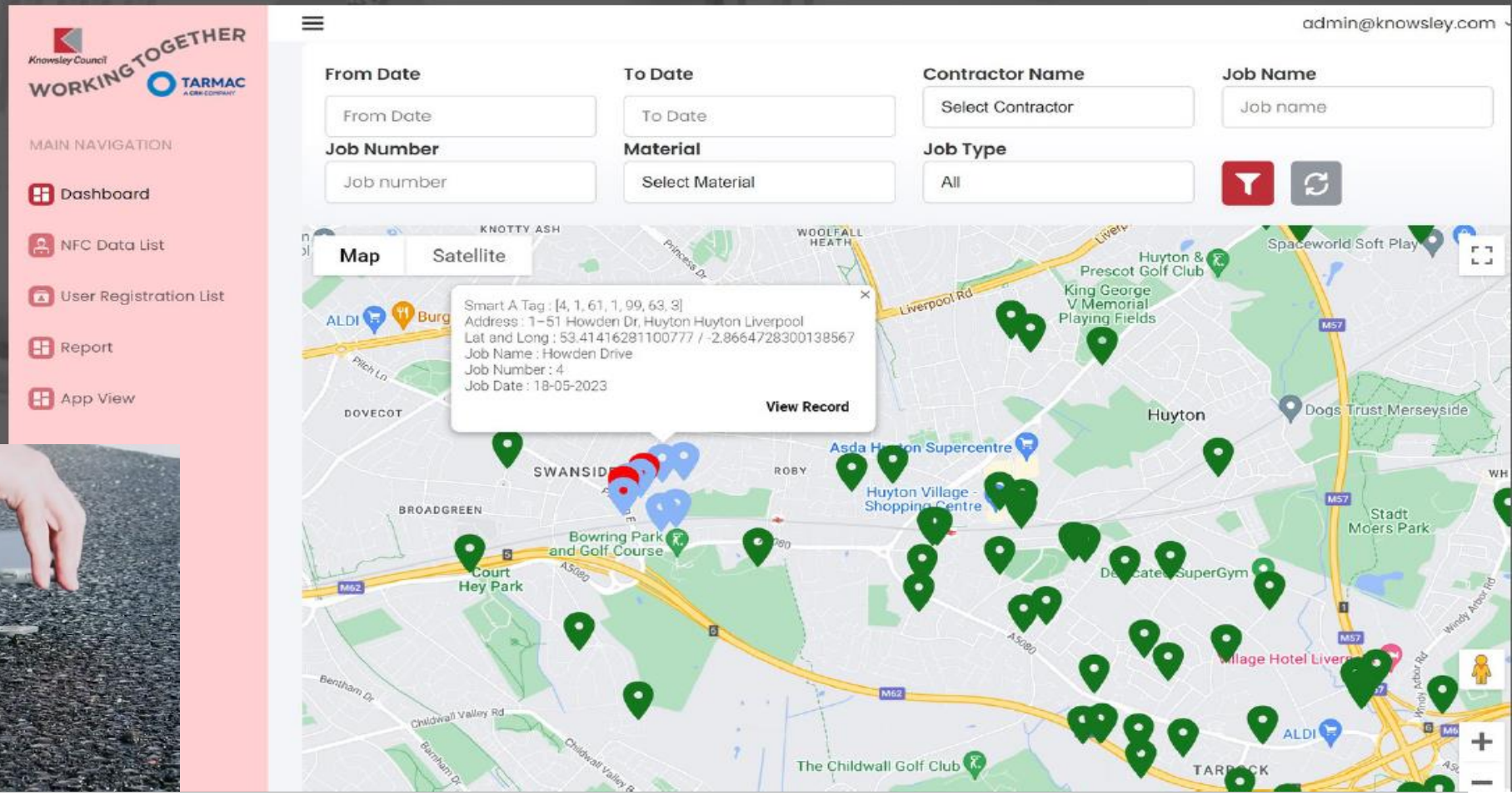
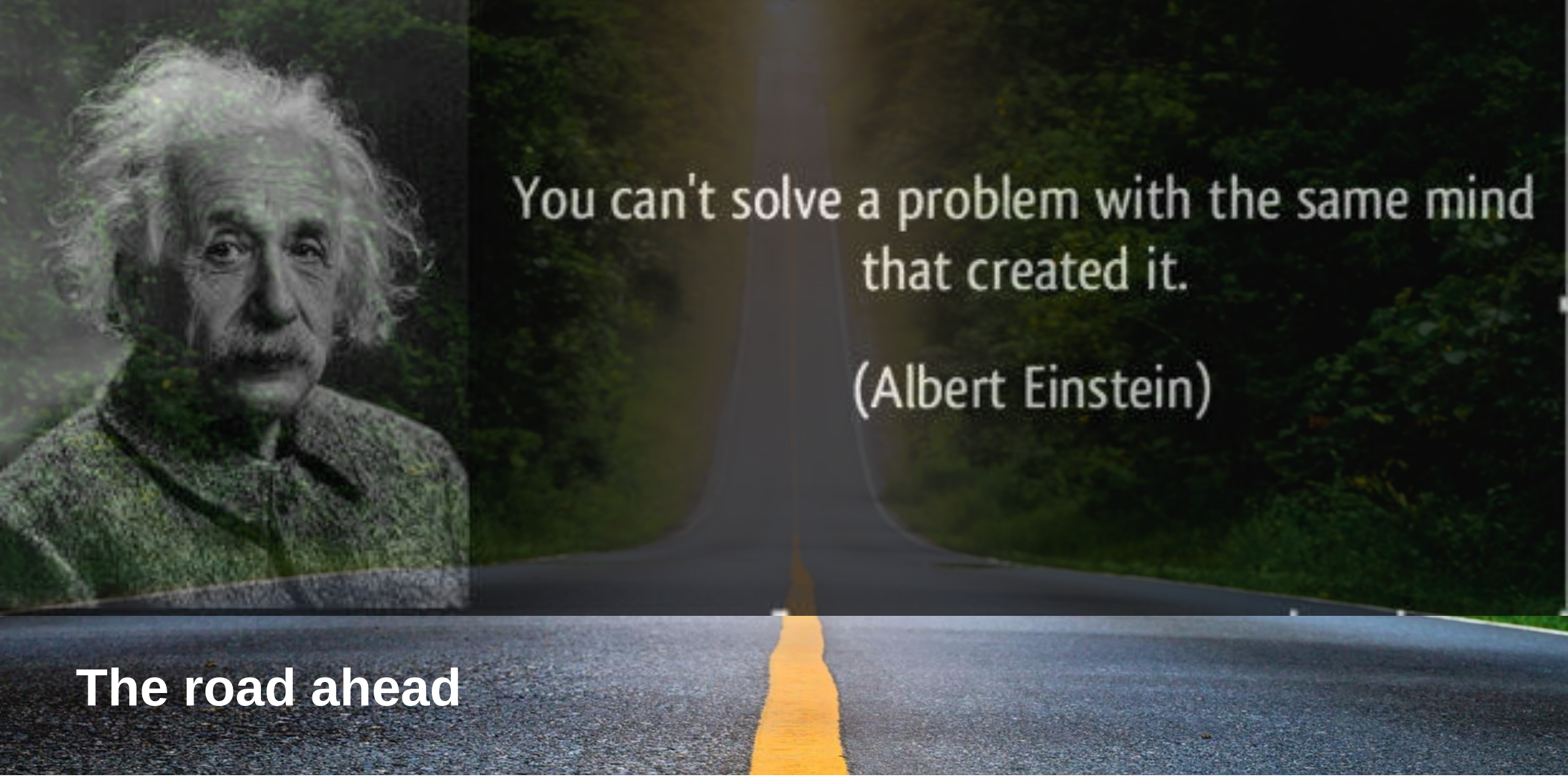
It's all about the data

All Highways Works Carbon Data is Accessible by Desktop or Smartphone Dashboard

The complete carbon footprint of the road repair at your fingertips.....In an easy to understand format





The road ahead

Time to take a systems view

- Measuring and benchmarking within the sector are just the start

- We will need to transform and transition to Sustainability 3.0:
  - Question the model - integrate into business practice (make friends with procurement)
  - Be collaborative and flexible
  - Be visionary and reimagine (product as a service, rental?)
  - People focused – engage the individual, understand implications of choices in relation to behaviour (more effective)

Recap

- **Decarbonising the supply chain**

(PAS 2080, collaboration, systems thinking)

- **Asphalt recycling and tar remediation**

(reuse at maximum value, additives, lifecycle consideration, low temperature mixtures)

- **Developing aggregate options**

(circularity - end of life and reuse, not creating products of harm, products as a service)

A final thought

Design for the future – take a holistic and whole life approach

Incorporate digital; technology, strengthen connections

Sustain and preserve our materials

Rethink processes and procedures, don’t be afraid to challenge

Use waste as a resource but do not lose sight of future generations

Prioritise consciousness – why are you here?, what is your purpose?

Team up (collaborate) and talk to people, grow your ideas

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THANK YOU