Net Zero, Sustainability and Roads

Making net zero everyday in projects

ROADS BITESIZE TRAINING

2021 PROGRAMME

26 May 2021

AECOM Imagine it. Delivered.

Overview

- Introduction
- Sustainability moment
- What is Net Zero?
- Examples of application

X

Introduction and background

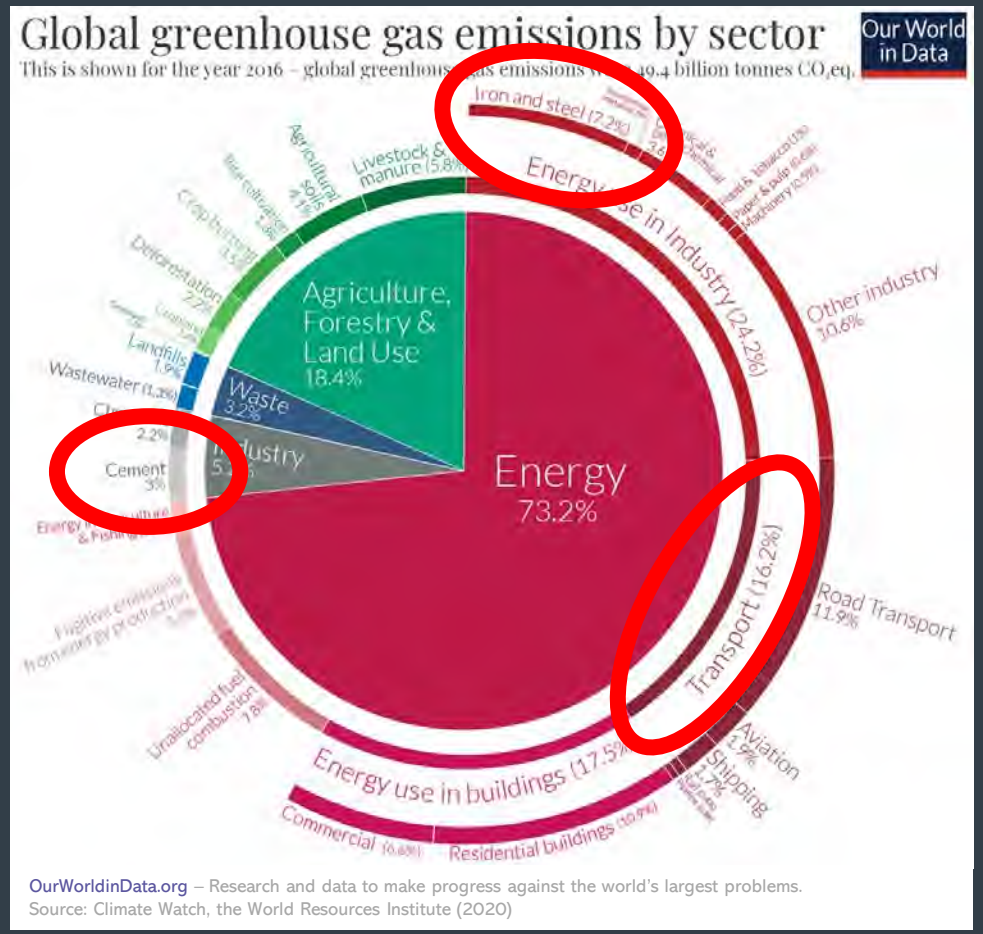
Natural Capital Laboratory

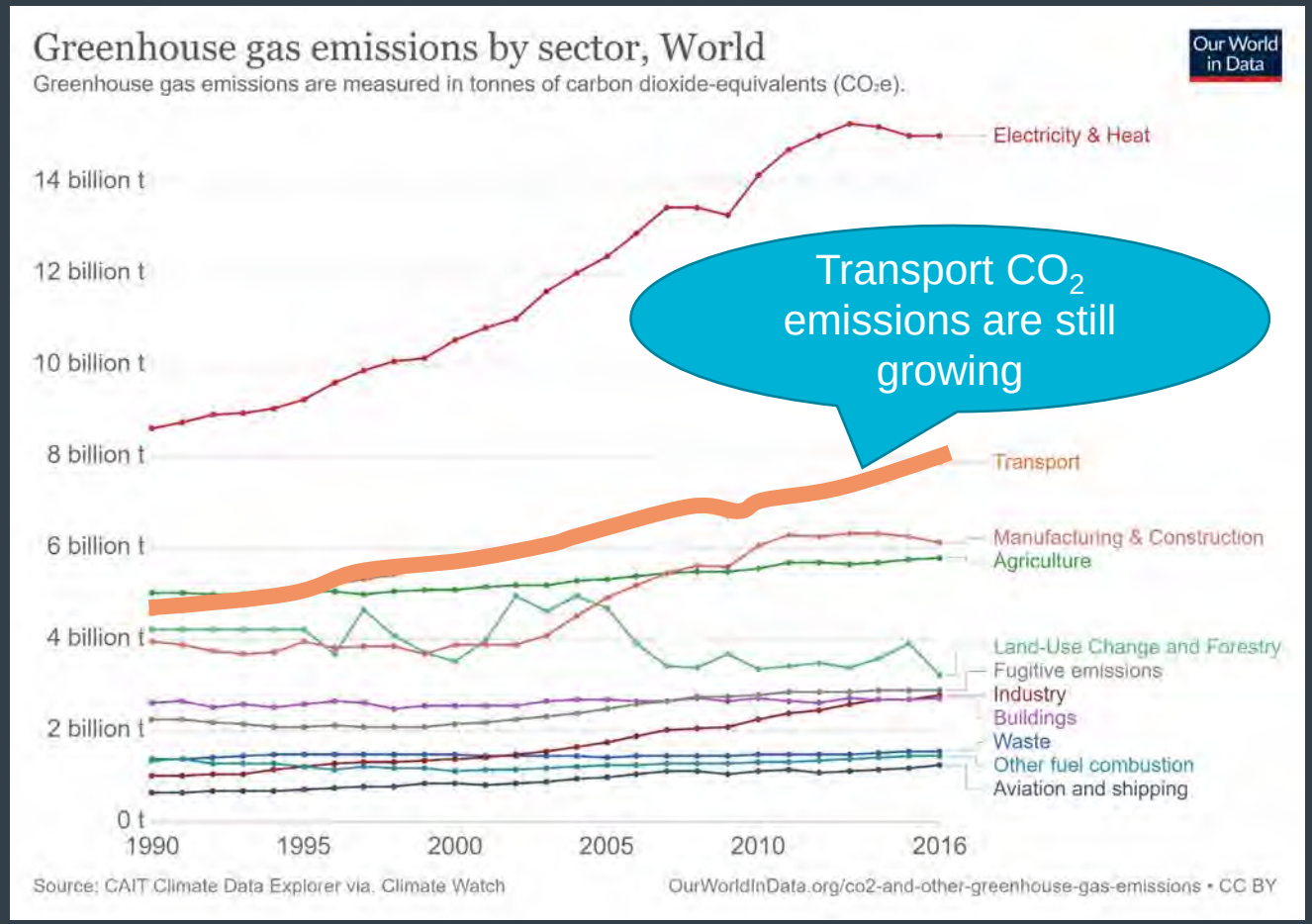
https://aecom.com/uk/natural-capital-laboratory/

https://www.re-tv.org/rebalance/rewilding-highlands

- Joint-venture between AECOM and conservation charity the Lifescape Project
- Rewild 100 acres of land in the Highlands of Scotland
- Bringing back native forest and bog
- Engaging local communities
- Reintroducing locally extinct species

What is the challenge?

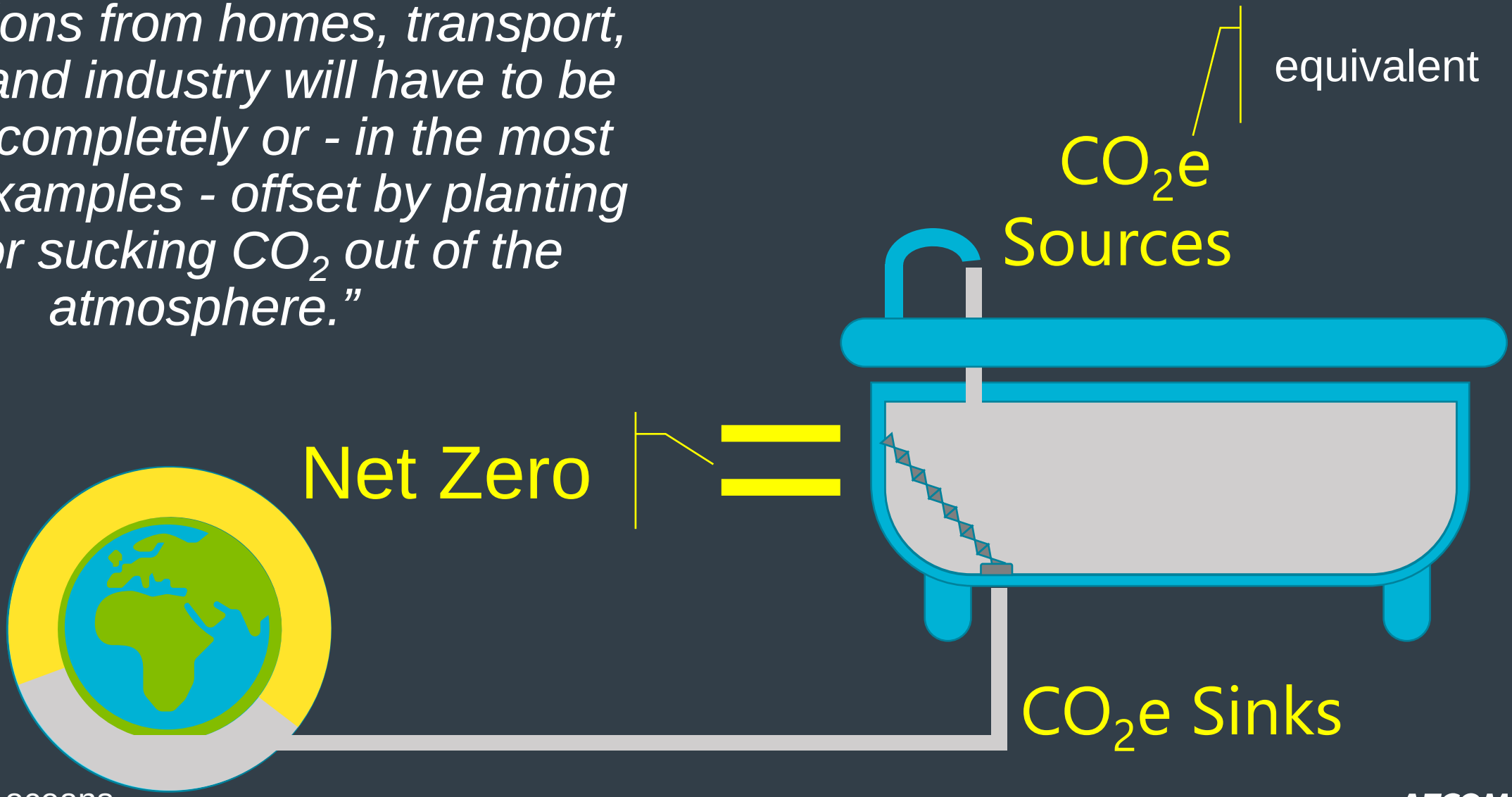




Key direct and indirect emissions from transport

The UK government defines Net Zero as…

"…emissions from homes, transport, farming and industry will have to be avoided completely or - in the most difficult examples - offset by planting trees or sucking CO_2 out of the atmosphere."



1/3
removed by oceans

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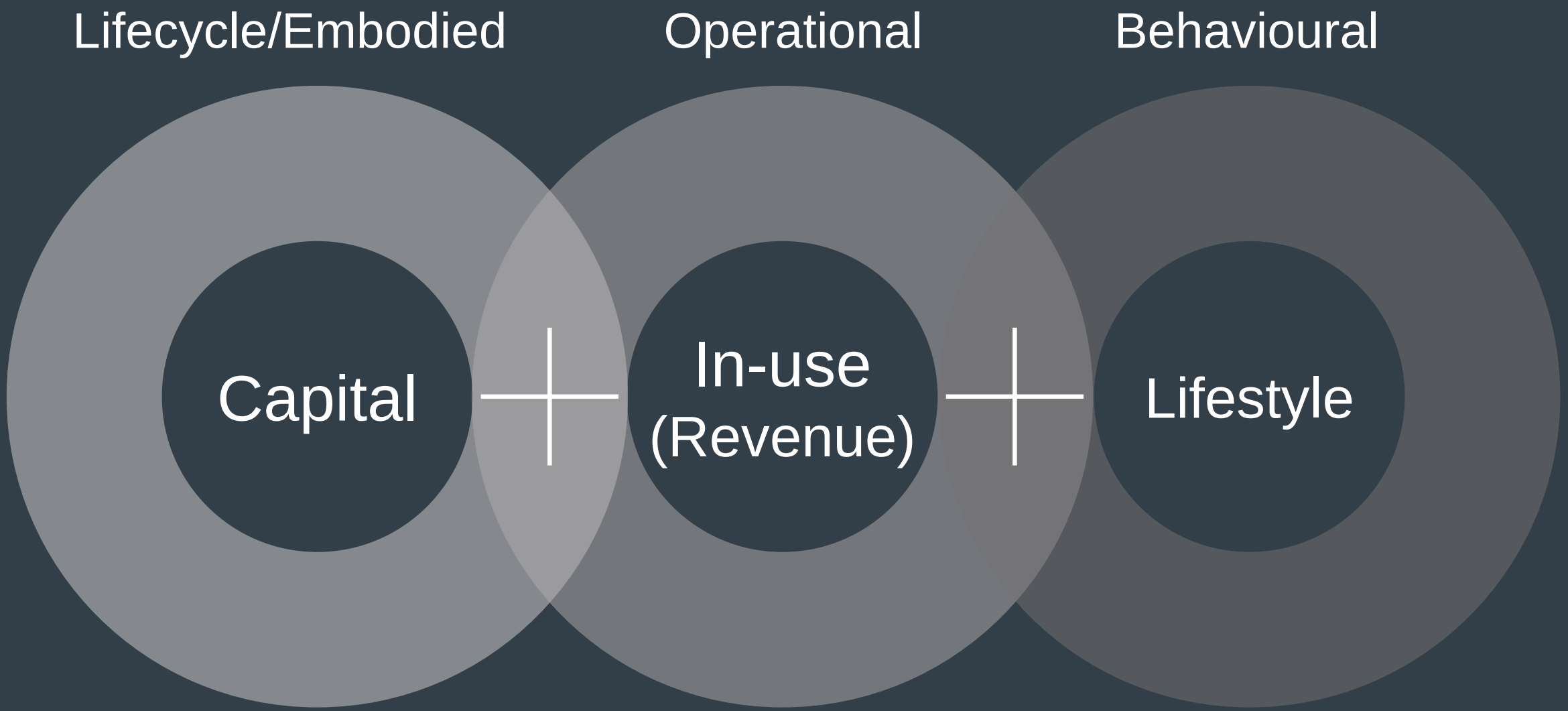
Carbon emissions come from infrastructure construction and use, but also wider behavioural impacts associated with the infrastructure



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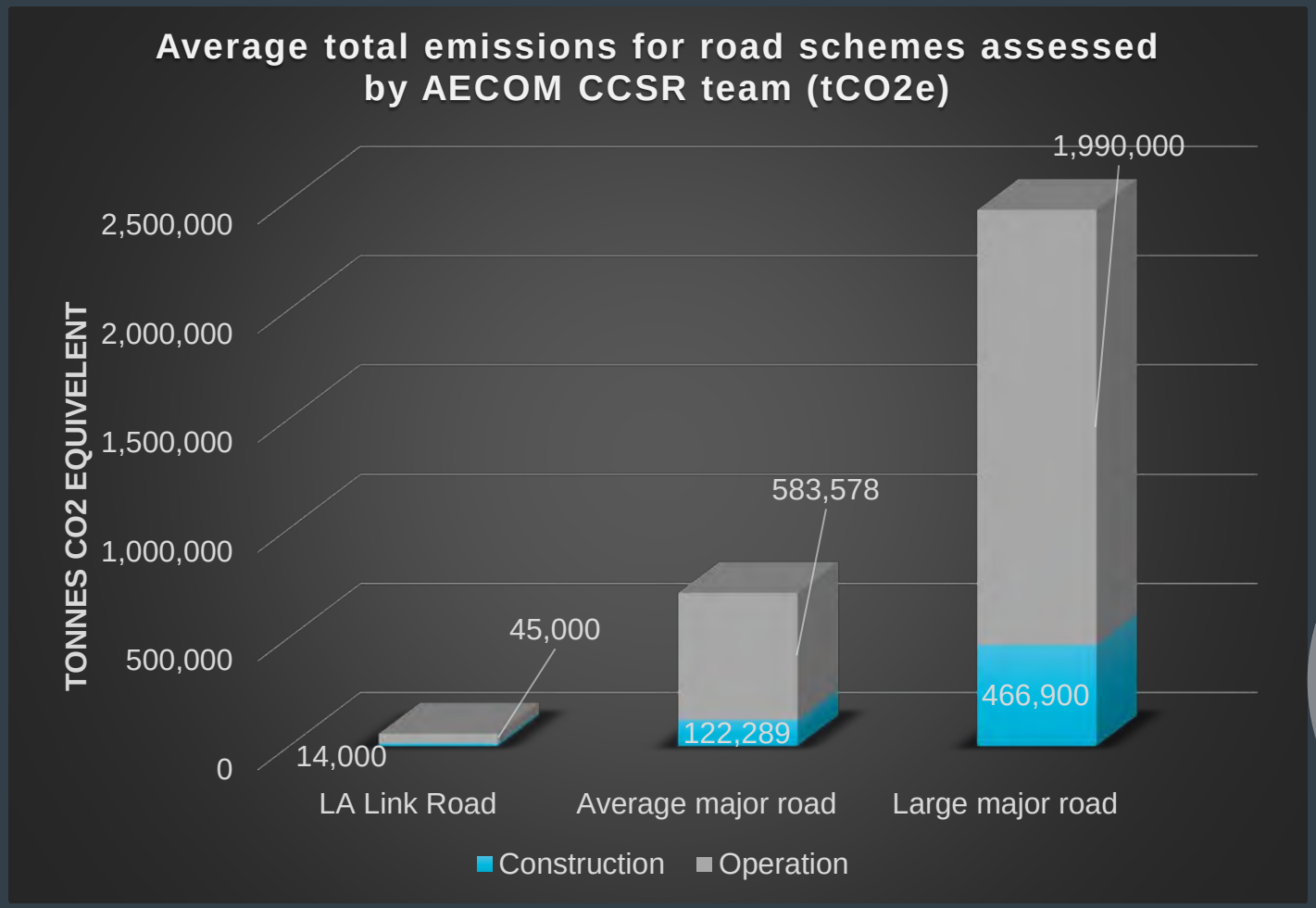
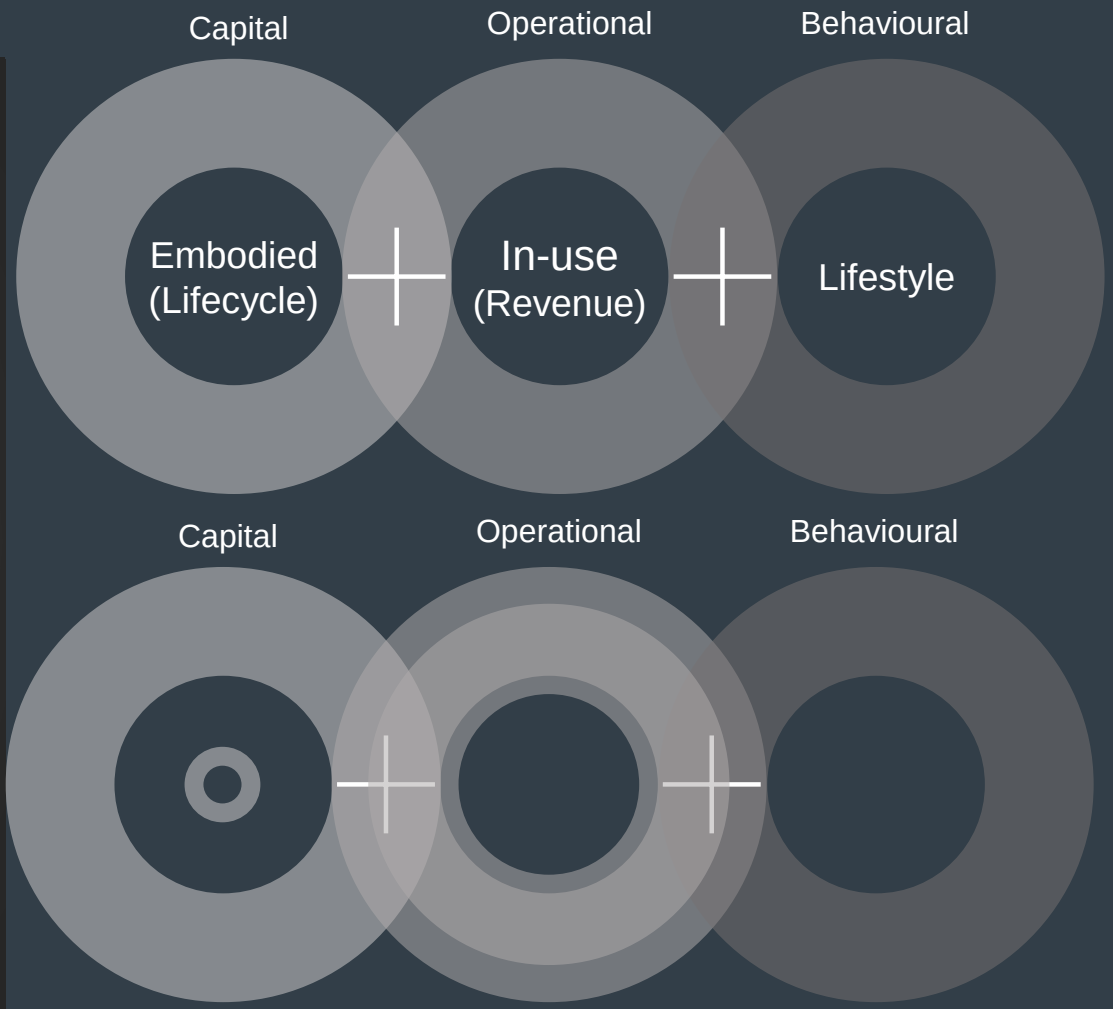
Currently, use and maintenance of roads represents are responsible for 80% of estimated CO_2e emissions from major road schemes





17-24% 76-83%

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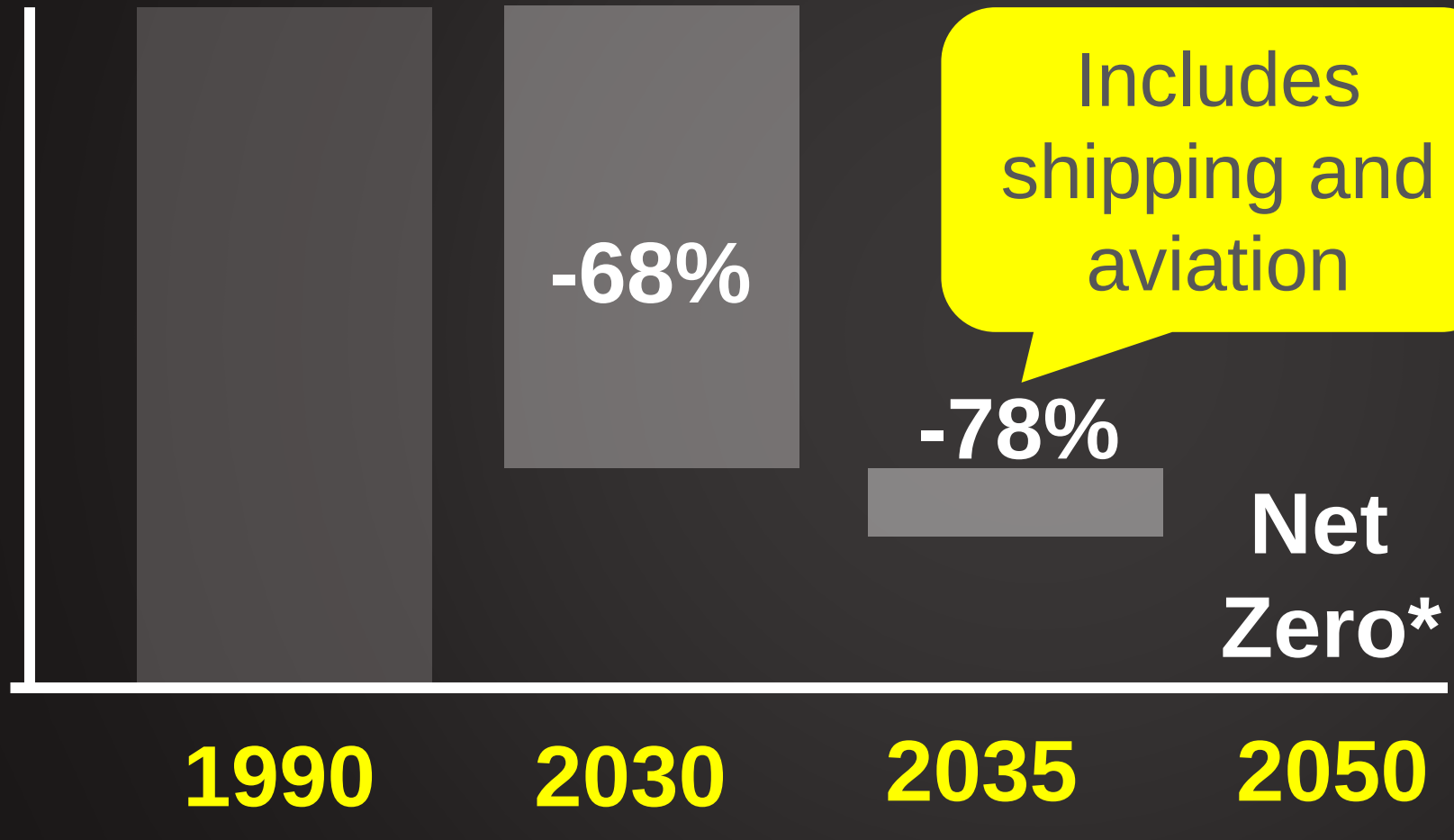
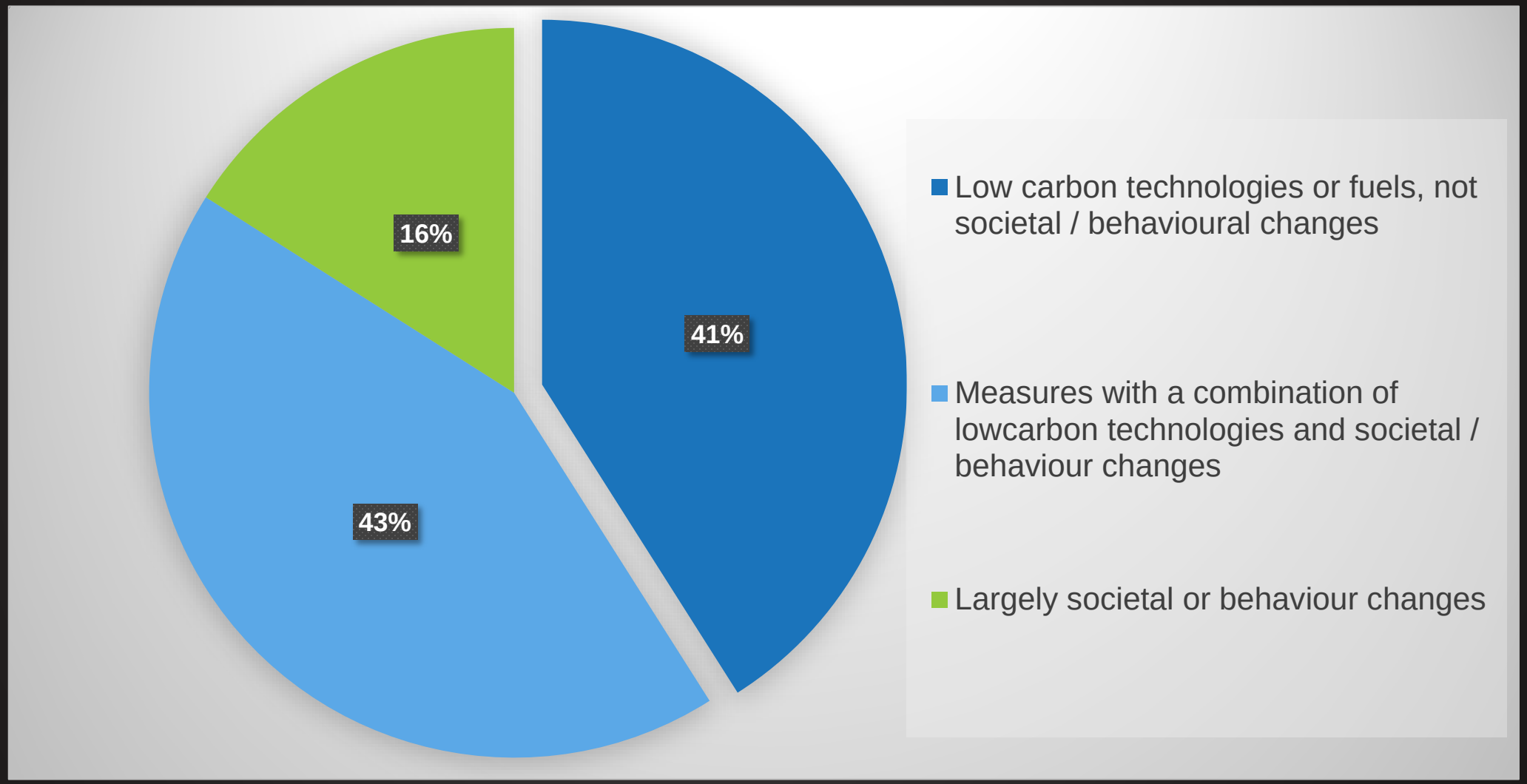
The UK Government stepped up level of ambition ahead of COP26 – reducing emissions by 78% by 2035



*previously this was 80% reduction from 1990 levels

In line with Climate Change Committee (CCC) Sixth Carbon Budget for 2033 to 2037

Where will emission reductions come from?



Source: Sixth Carbon Budget - The Path to Net Zero, Climate Change Committee, https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf

The role of AECOM: Carbon and the climate emergency fit in well with Global and European ambitions to differentiate AECOM in the market

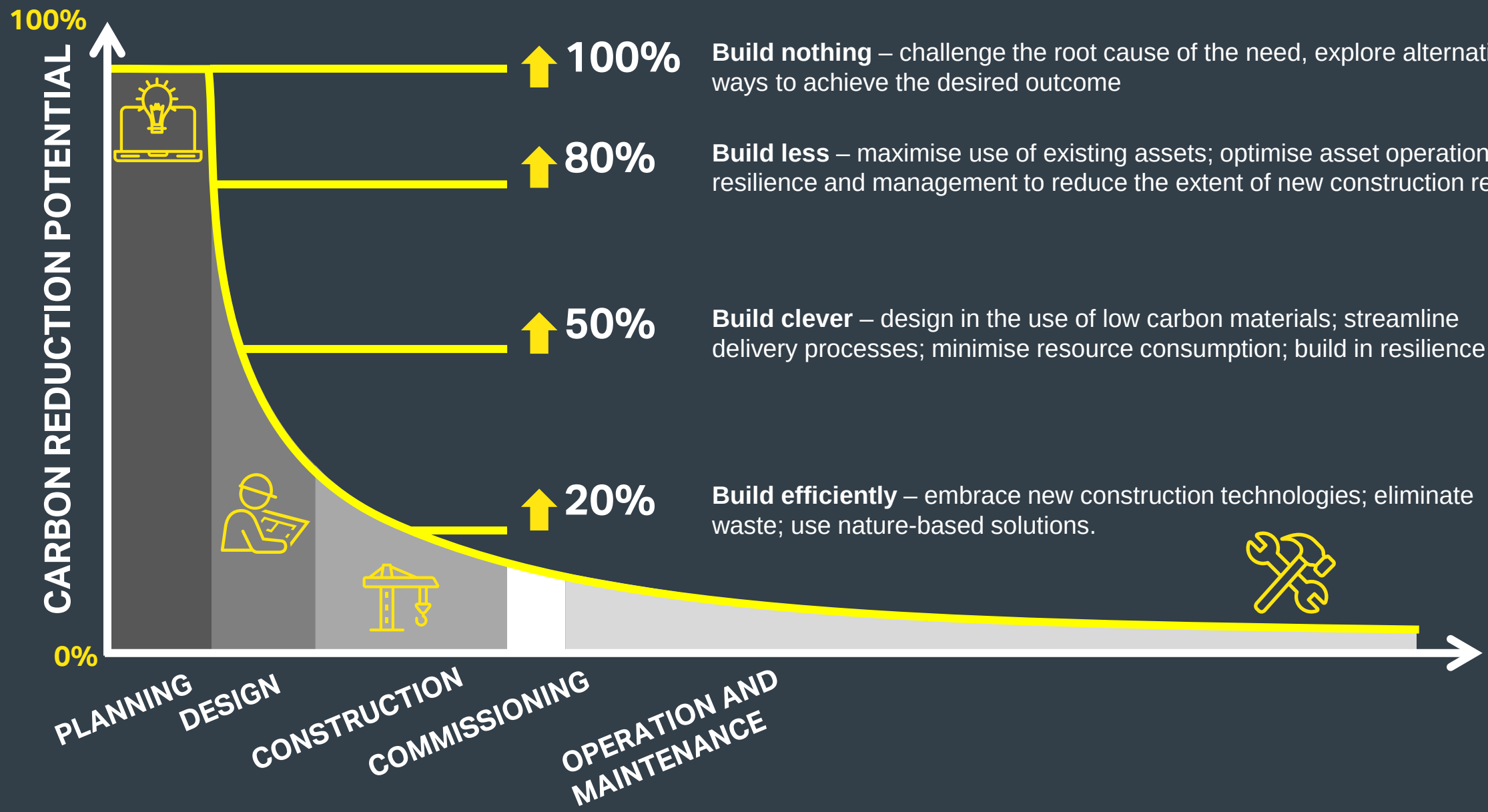
"Net Zero is not an initiative, it is an imperative"

"The challenge is on all of us to bring [Net Zero] to life"

Colin Wood
CEO AECOM Europe

The biggest opportunities to reduce carbon and build in resilience are up front

NET ZERO FUTURE



Build nothing – challenge the root cause of the need, explore alternative ways to achieve the desired outcome

Build less – maximise use of existing assets; optimise asset operation, resilience and management to reduce the extent of new construction required

Build clever – design in the use of low carbon materials; streamline delivery processes; minimise resource consumption; build in resilience

Build efficiently – embrace new construction technologies; eliminate waste; use nature-based solutions.

Tackle carbon early. Adapted from: HM Treasury (2013) and Green Construction Board (2013)

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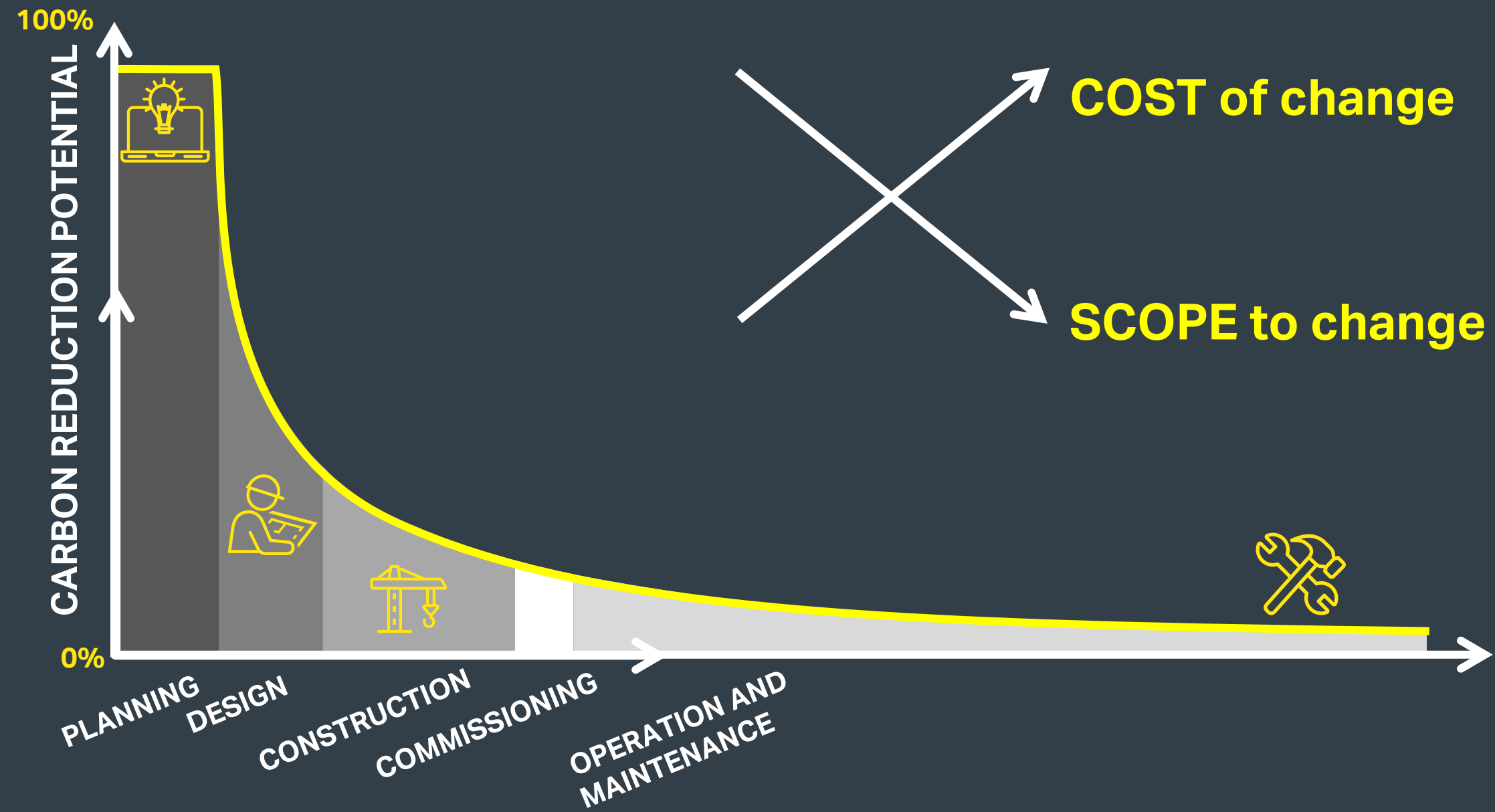
The biggest opportunities to reduce carbon and build in resilience are up front



Tackle carbon early. Adapted from: HM Treasury (2013) and Green Construction Board (2013)

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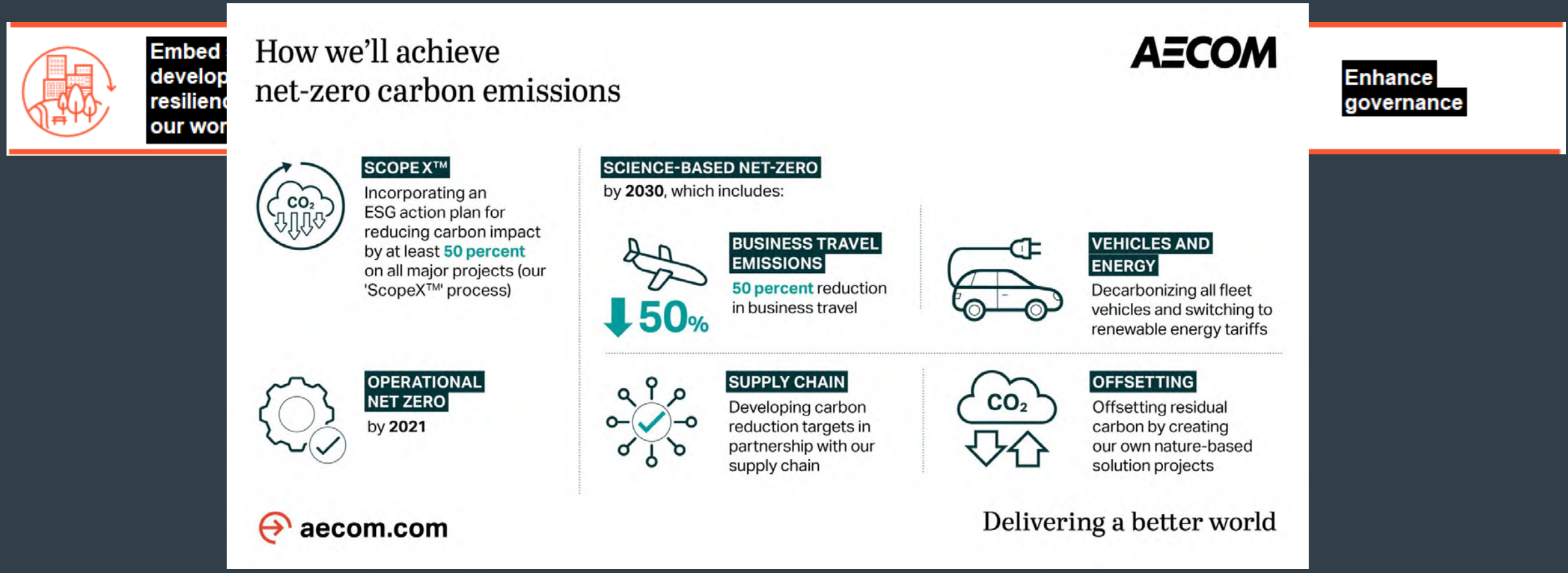
AECOM is already taking a lead in delivering Sustainable Legacies

With ESG principles embedded into everything we do, the goal of our **Sustainable Legacies** strategy is straightforward: to ensure that the work we do in partnership with our clients leaves a positive, lasting impact for communities and our planet.

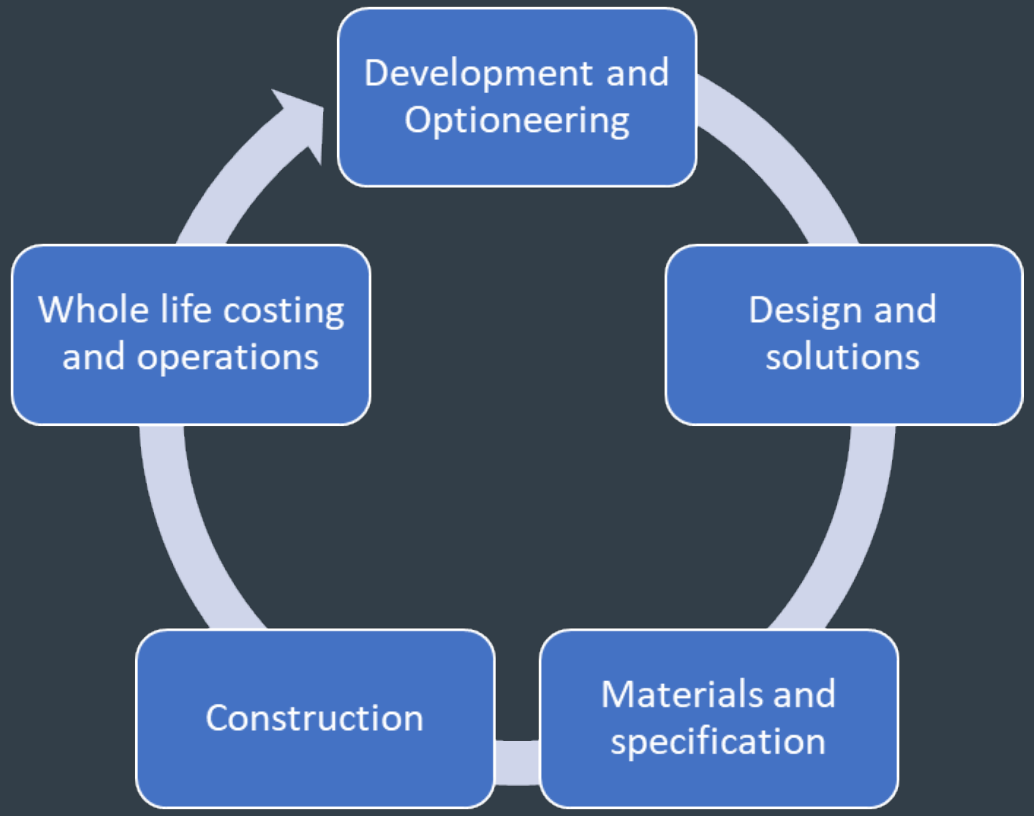


https://publications.aecom.com/sustainable-legacies/

Sustainability, Net Zero, Decarbonisation and the Project Life cycle

- Sustainability and Net Zero needs to be considered across all stages of the project lifecycle
- Different stages provide different opportunities
- Never too early – often left too late to consider

- Education and communication process on opportunities
- Ongoing journey for all clients, consultants, agencies



Hypothetical illustration – the earlier the better

Planning and feasibility design try to fix red line / project boundary the earlier the better:

- Fixing boundary reduces risk
- Narrower corridors are seen to reduce cost (land acquisition) and reduce scope creep

- However, in the context of Net Zero and Sustainability it can limit options

Reduces options to mitigate:

- Water/Drainage
- Noise
- Air quality
- Visual impact
- Bio-diversity
- Waste/spoil
- Provision for different modes

Options:

- Use of woodland/landscape barrier (strip of trees) to mitigate noise, improve air quality, trap carbon, improved visual amenity and support water management
- Use of banks/bunds to:
  - help with noise
  - space for landscape/bio-diversity
  - relocation of cut into banks reducing lorry movements externally and landfill
  - Improved visual amenity over stark barriers
  - Water management

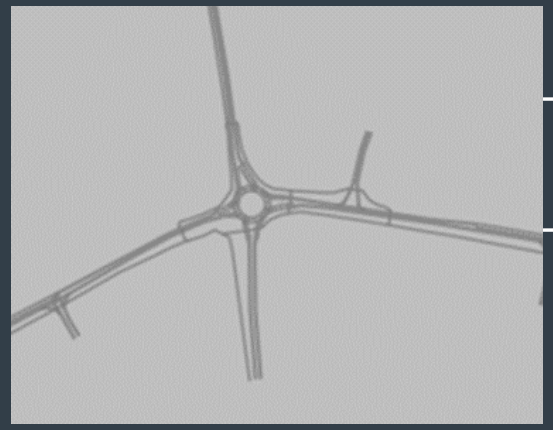
Project examples

Banbury Road Roundabout Oxfordshire, Option development

Development and Optioneering

Junction improvement project going beyond simple congestion/capacity reduction

- Includes an objective to promote alternatives to car use, improve the local environment, and support growth
- A long list of options generated and assessed to identify a short-list of options.
- Three options were:
  - a larger roundabout,
  - a signalised junction with improved pedestrian/ cycle facilities and
  - a CYCLOPS (Cycle Optimised Protected Signals) option.



- Assessment using DfT Early Assessment Sifting Tool (EAST) to identify Preferred Option
- Based on Five Case Model: Strategic, Economic, Financial, Management and Commercial Cases
- Informed by further analysis of the options:
  - Public consultation
  - Transport modelling
  - Cost estimation, and
  - Environmental assessment
- Modelling included all modes: pedestrians, cyclists, buses and motorised vehicles.
- KPIs (delay and journey times) extracted for all modes and fed into the scoring of options.
- Preferred option refined based on all modes assessment and stakeholder feedback– aspects of the CYCLOPS design were incorporated into the signalised junction option to improve it

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TII Carbon Tool – Foynes to Limerick Road

Option Selection Stage:

- Preferred Route Option consisted of a combined development for the N69 and the N21
- Reduced overall length of new road by 22km compared to development of two separate schemes.

TII Carbon Tool Overview:

- Tool measures the carbon emissions at different stages of the project lifecycle.
- Embodied carbon of the construction materials and the maintenance of these materials accounts for 90% of all carbon emissions.
- Pre- construction and construction operations, together with construction waste account for 10% of all emissions.
- Operational GHG emissions from vehicles using the road was calculated separately using the Emission Factor Toolkit (EFT).

Design & solutions

Activity	Tonnes CO_{2eq} / Total
Pre-Construction	1,830
Embodied Carbon	84,549
Construction Activities	19,459
Construction Waste	1,859
Maintenance	97,582
All	205,281

Embodied Carbon Materials	Tonnes CO_{2eq} / Total	% Contribution
Timber fencing	1,597	2%
Galvanised steel safety barriers and guardrails	1,509	2%
Plastic ducting	1,666	2%
Filling - embankments (average)	3,416	4%
Granular material Type 1 depth 150mm	1,894	2%
*Close graded asphalt 40mm nominal size aggregate; depth 80mm	40,656	48%
Dense asphalt concrete 14mm nominal size aggregate; depth: 40mm	6,884	8%
Concrete - standard mix (average)	1,430	2%
Concrete - design mix (average)	11,615	14%
Steel bar reinforcement	4,190	5%
Other Materials	3,380	4%
Transport of Materials	6,311	7%
All	**84,549**	**100%**

Active Travel on TII Highways Projects – N2 & N4

Key Principles:

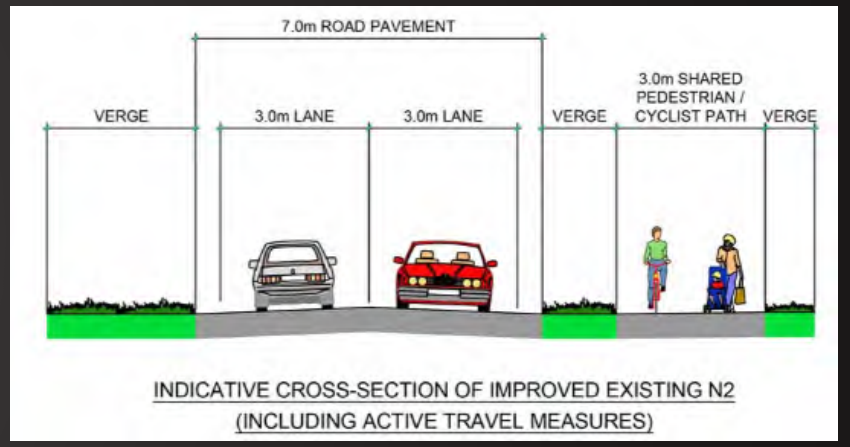
- Step change in attitudes towards active travel
- Integrate active travel into all our projects – not a “bolt on” approach

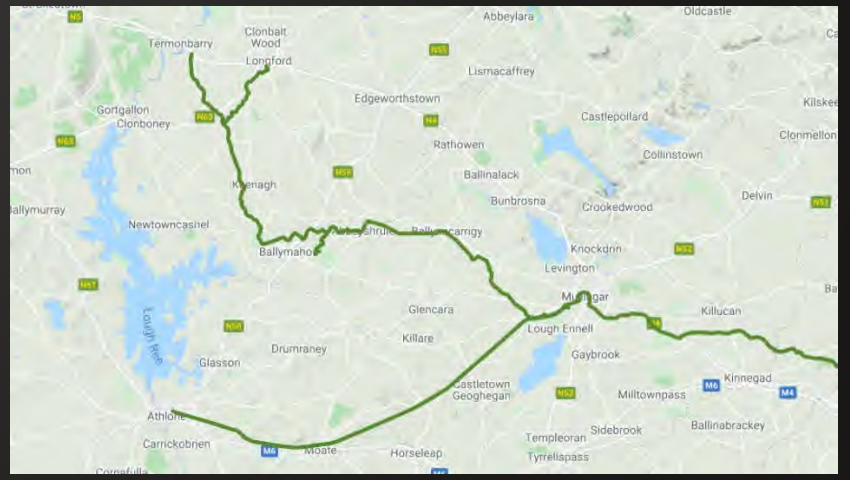
N2 Rath to Kilmoon:

- Repurposing old national road – reduced single carriageway cross-section with segregated pedestrian & cyclist facilities

N4 Mullingar to Longford:

- Improving pedestrian & cyclist facilities from the main settlements to the existing inter-urban greenway along the Royal Canal
- Opportunity – AECOM are working with Westmeath County Council and TII to develop a strategy for active travel on major highway schemes



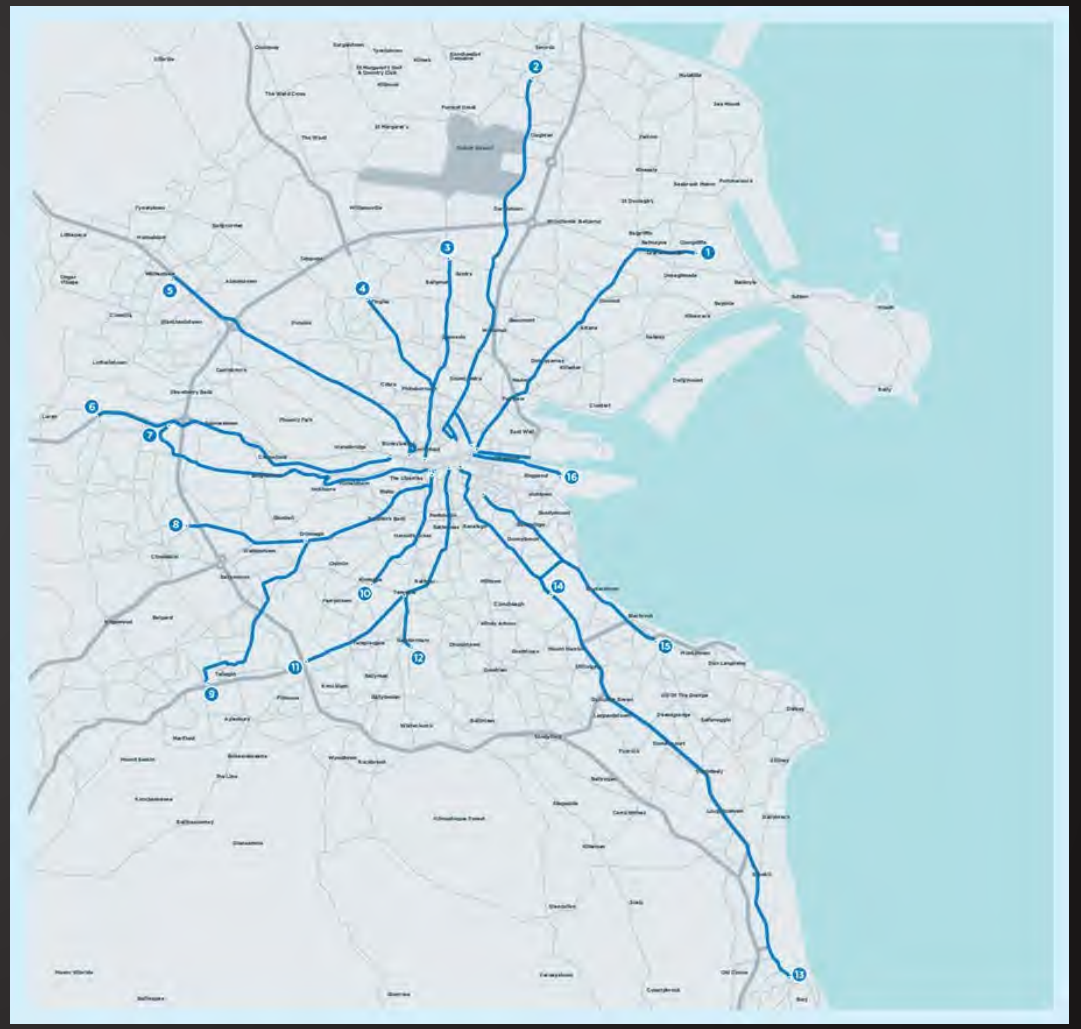


Bus Connects – Dublin

Design & solutions

Bus Connects Overview:

- 16 Core Bus Corridors into Dublin City Centre
- Provision of **230km** of *Bus Lanes*, reallocating the road space to improve the level of service for sustainable transport modes.
- Provision of **200km** of *Cycle Lanes*, segregated from general traffic. This will improve the desirability of cycling to the City Centre from the suburbs.
- Enables a modal shift away from private vehicles within Dublin which supports Ireland's emission reduction targets.
- Carbon calculations initially undertaken – indicates carbon neutral after 8-10 years



MHA Carbon Management Toolkit

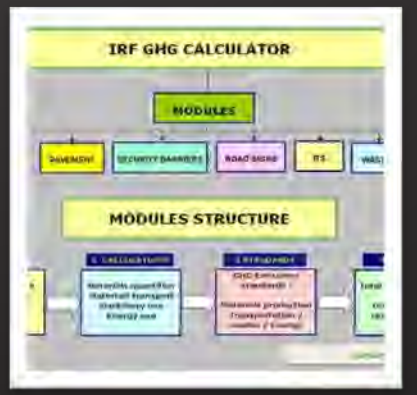
Framework Toolkit

Purpose

- To enable MHA authorities to manage the carbon impacts of their highway design, maintenance and operational activities in a strategic, comprehensive, complete, and most importantly, sustainable manner and to facilitate multiple, wider benefits.

Outputs

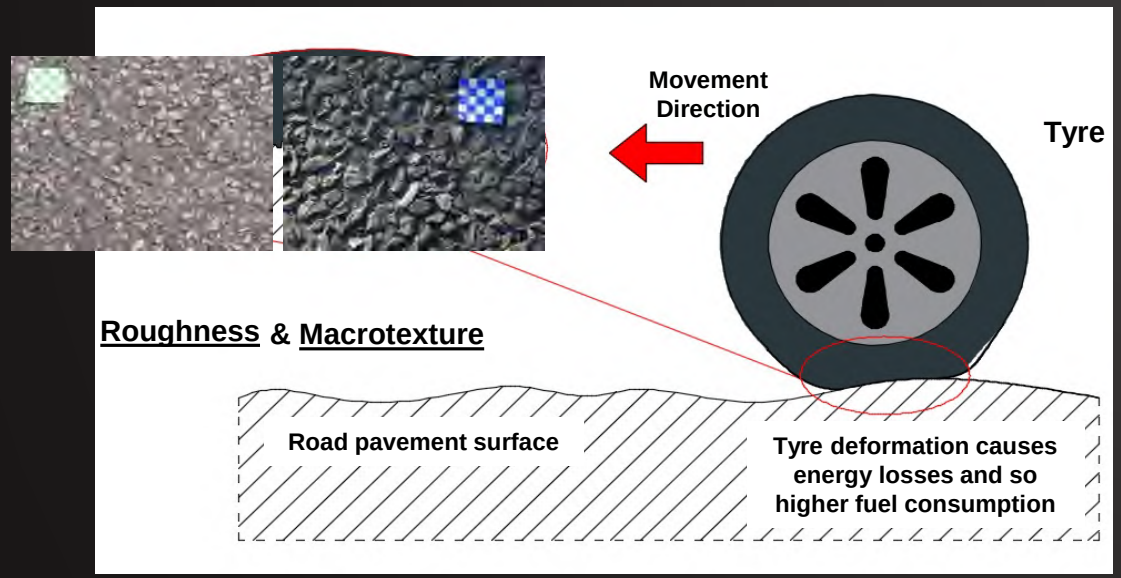
- Embedding sustainable procurement practices and policies;
- Case study material;
- Business case guidance on carbon management and full life-cycle analysis.



Low Rolling Resistance Trial

Materials & specification

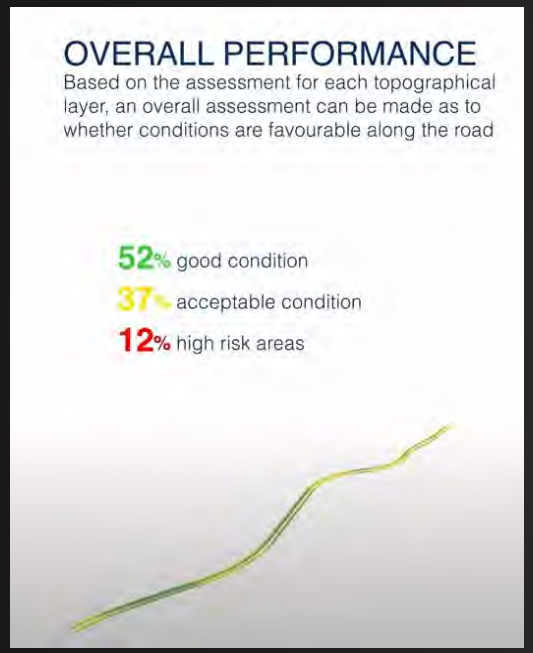
- Project evaluated performance of Low Rolling Resistance (RR) Asphalt Mixtures
- Low RR materials can support Highways England improve the air quality standards in priority locations across the Strategic Road Network.



- RR is the force resisting the motion of a tyre rolling along a road surface and linked to the residual permanent deformation on the tyre and the pavement caused by their mutual interaction.
- Permanent deformations cause the system energy losses, RR affecting fuel consumption which consequently reduces the production air pollutants
- Studies conducted in Denmark found that specific asphalt mixture designs can reduce RR.
- Revising current asphalt mixture design, road construction and maintenance strategies could present an opportunities for Highways England to improve air quality on the Strategic Road Network.

REM (Rapid Engineering Model)

- REM is a digital workflow approach for automated design, that requires digitally captured topographical data to identify the various elements in the highway cross section.



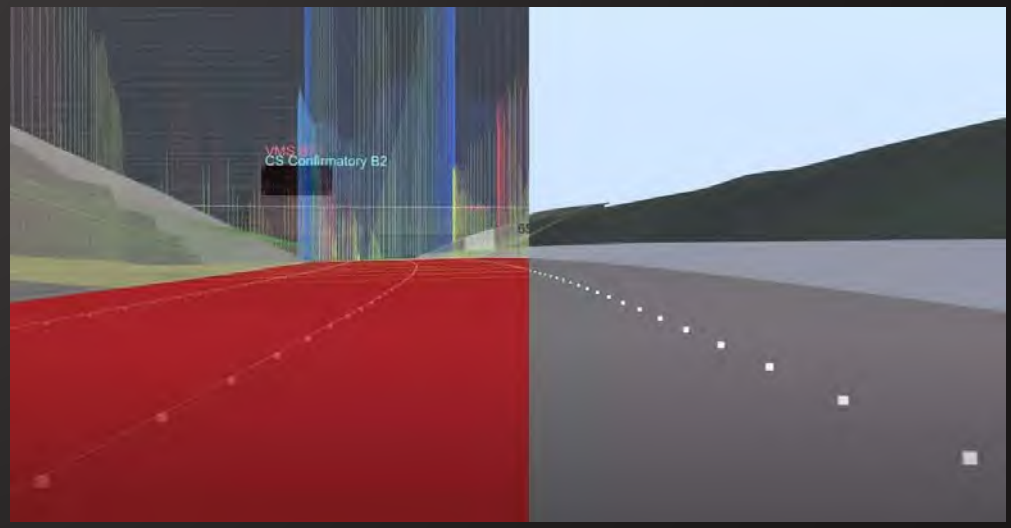
Design & solutions

How does REM work?

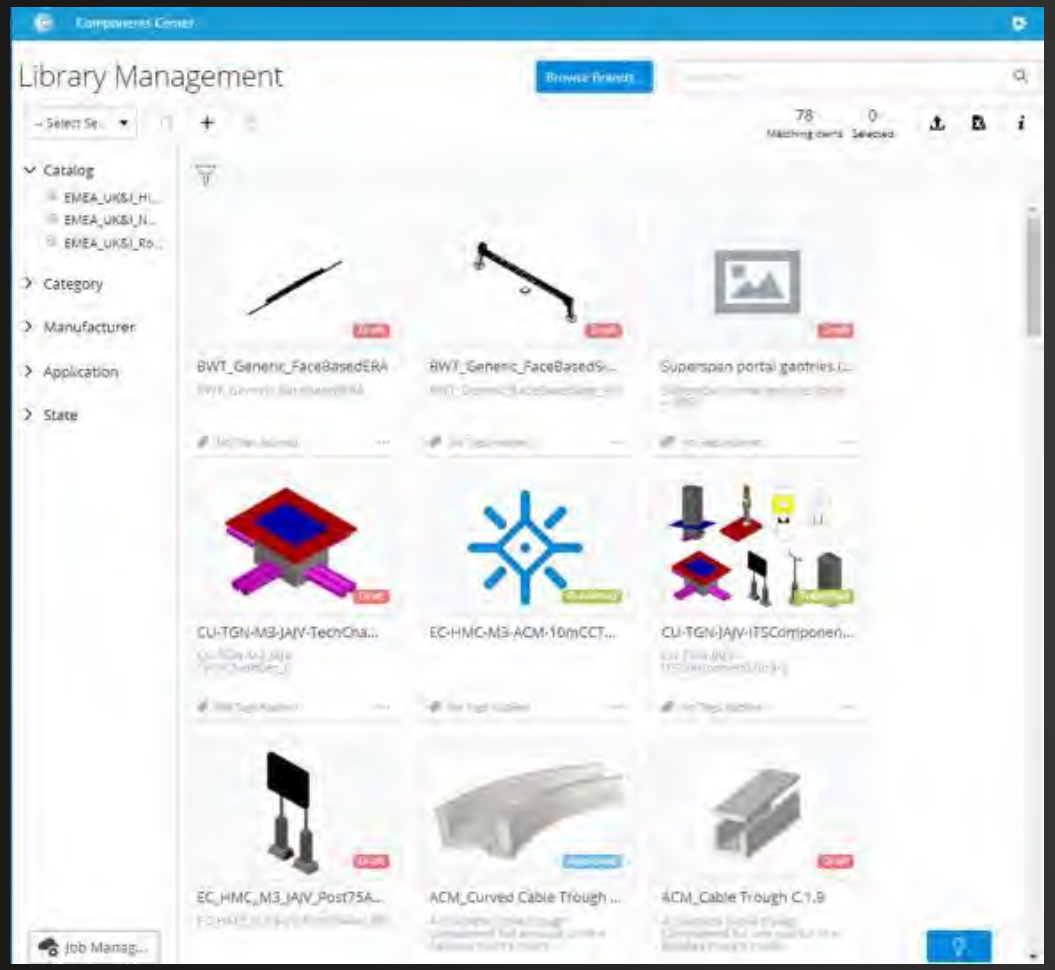
- Layer production from the topographical data
- Layer information analysis (against DMRB requirements).
- Performance ratings generated for highways and environmental aspects (e.g., good, acceptable or high risk).

Process outcome?

- Design automation positions various highway infrastructure at optimal locations (VRS, drainage, ADS's, ERA's, ITS etc.).
- Interactive model for human checking and manipulation.
- Enables early visualisation model development.



REM – Influence on achieving Carbon Zero

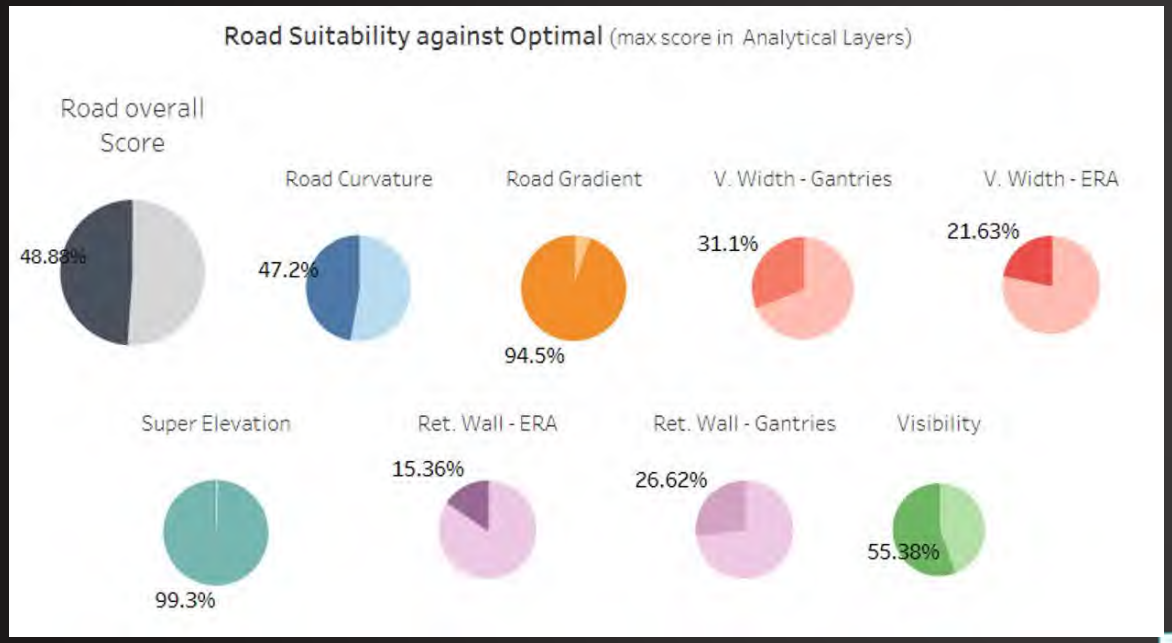


- ✓ Limit visual impact
- ✓ Enhance design quality
- ✓ Reduce construction
- ✓ Reduce materials (e.g., concrete backfilling)
- ✓ Not in highway or environmental “high risk locations”
- ✓ Less WASTE

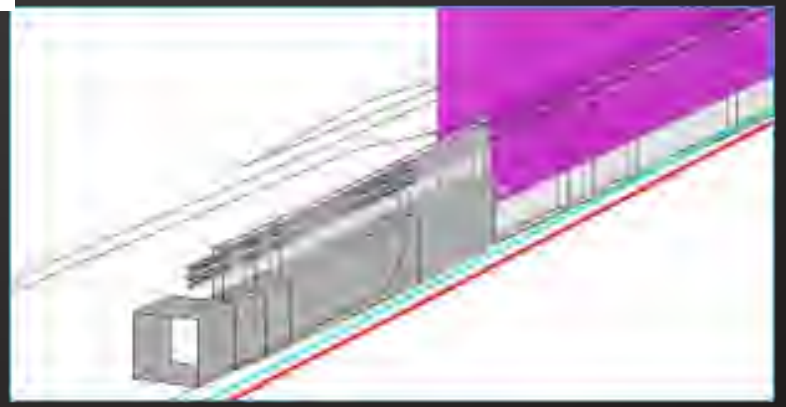
During construction phase:
A standardised component library in accordance with the Department for Manufacture and Assembly (DfMA) is adopted to influence on achieving carbon zero, enabling offsite manufacturing benefits.

REM – M6 J21a to J26 Smart Motorway Programme

- REM was used as a trial-basis to validate design assumptions. The road suitability vs optimal suitability data was extracted to identify ideal infrastructure locations.



- From using automated processes for the VRS design on the M6 J21a to J26 SMP, we achieved:
  - Approx. 10-20% reduction in design/modelling time;
  - Approx. 30% reduction in drawing production time;
  - Approx. 60% increase in design quality.



Pavement Design & Asset Management

Materials & specification

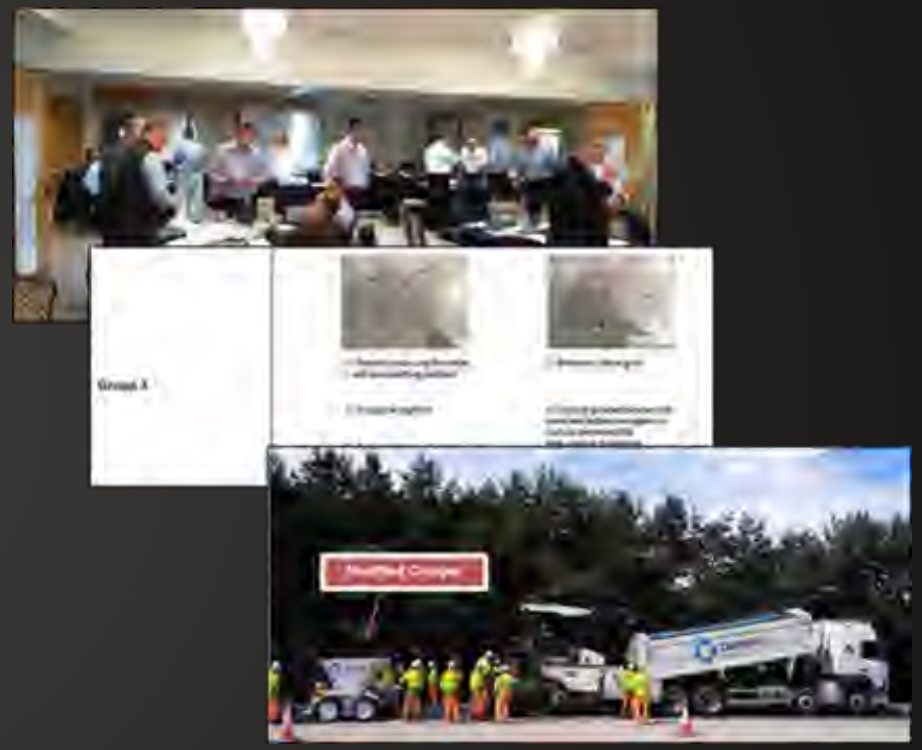
Rethinking how we use materials to make construction more sustainable.

Collaborative research for Highways England, Eurobitume UK and Mineral Products Associations (MPA)

Research and development into:

- specifications for next generation of asphalt surfacing
- low temperature asphalt/warm mix asphalt
- asphalt recycling,
- asphalt preservatives; and
- cold applied ultra-thin surfacing (CAUTS).

Trials on-road with Highways England and feeding into new specifications



Pavement Design - Recycling materials, reducing energy and waste

Materials & specification

Isle of Man Airport: sustainable pavement design utilising recycled materials to rehabilitate the taxiway at an operational airport.

- Estimated 99% reduction in the amount of excavated material sent to landfill, with excavated pavement materials reused to reduce energy use and material consumption
- Estimated 73% reduction in the amount of new material imported to site
- Recycling prevented the costly removal and disposal of the tar bound materials
- Recycling reduced energy consumption by 44% and carbon dioxide emissions by 32%, minimising damage to the environment
- Estimated cost savings associated with the recycling design was 40%, compared to conventional design

Roadside Generation of Electricity

AECOM have been working with Highways England on Sustainable Technologies.

<u>Renewable Energy Noise Barrier:</u>

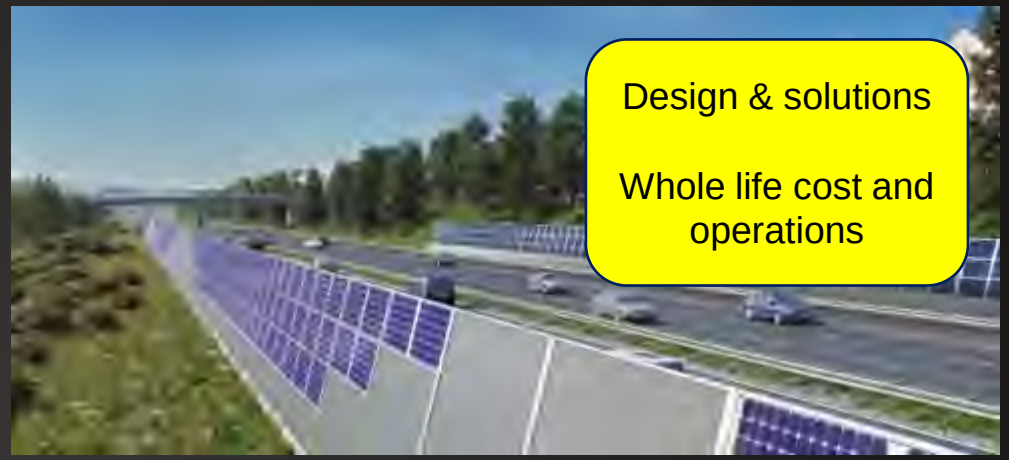
- Dual function, low / accessible maintenance and small footprint

<u>Renewable Energy on Gantry:</u>

- Trials in France in 2019

<u>Renewable Energy on Surplus Highways England Estate:</u>

- Typical “Ribbon” footprint with some larger areas
- Supply to Road Tunnels
- Supply to the Grid - Wider commercial opportunity
- Standard solar industry installation & proven performance



Sustainable Urban Drainage Systems (SuDs)

Design & solutions

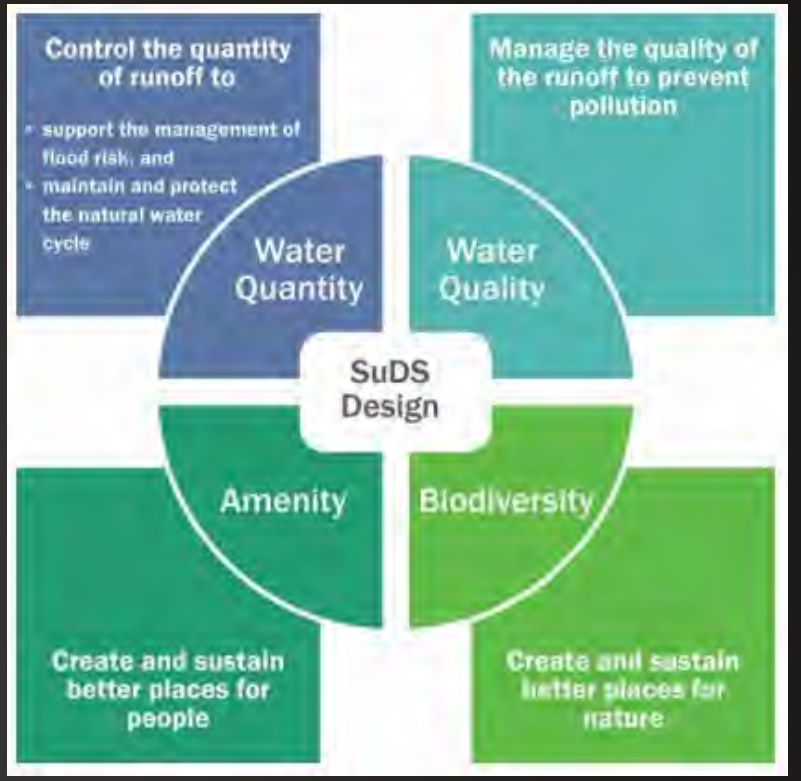
Whole life cost and operations

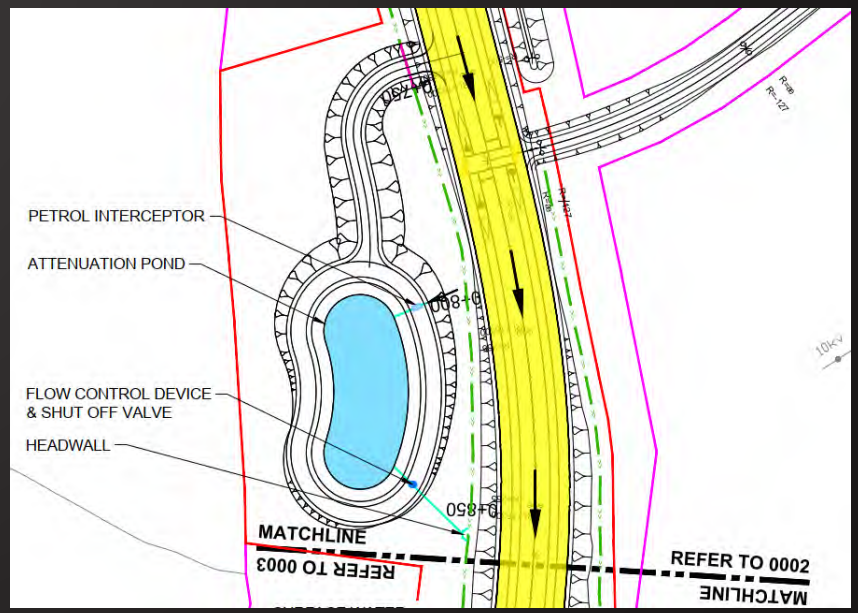
Overview of SuDS:

- SuDS maximise the benefits of surface water management, through the four pillars of SuDS design:
  - water quantity
  - water quality
  - amenity
  - biodiversity.

Project Implementation - LDR4 Abbeylands Scheme, Navan, County Meath:

- Catchment along proposed road
- Ponds
- Supports aquatic vegetation
- Vegetation facilitates:
  - Adhesion of contaminants
  - Aerobic decomposition of pollutants
  - Stabilisation of settled sediment to prevent resuspension.





Consideration of Other Environmental Factors

Holistic approach should be used.

Design & solutions

Whole life cost and operations

LED Street Lighting:

- Advantages: cheap, energy-efficient (low carbon) and easily controlled.
- Disadvantages: harsh blue light

Green Bridges:

- Advantages: Allow birds, mammals and insects to keep moving despite a road or railway blocking their path.
- Disadvantages: Additional embedded carbon.

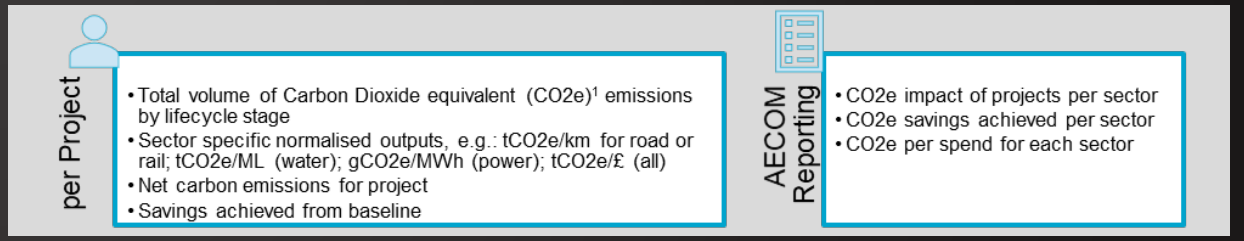
What's next ? Carbon Instinct Tool

Carbon Instinct tool under testing

- Quantification of carbon emissions usually considered across development lifecycle stages in infrastructure projects.
- Tool is aligned to the Publicly Available Specification for Carbon Management in Infrastructure (PAS2080:2016).
- Will be compatible with Highways England carbon tool and assess carbon impact from the outset through to construction.
- Intent to link to PCF stages (for Highways England projects), or similar, project cost and to BIM.

Information / data

Outputs



Next Steps

- AECOM developing tools to support projects at different stages
- Library of examples and best practice
- This is a journey we are all on
- Everyone has a responsibility for reducing carbon use
- Change in in how we think, plan, design and delivery projects
- Sustainability becomes part of everyday
- Doing nothing is not an option

Thank you

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Lifecycle considerations

Scheme development/optioneering	Design solutions	Design/Material specifications;	Construction	Whole life cost and operations
• Ensuring a more balanced assessment of options that equally/equitably considers all modes • better consideration of sustainable transport solutions in a package using Design staff at the outset	• Ensuring opportunities for all modes are adequately considered • Ending a Do Min approach for Non-Private Vehicles and reducing over engineering for PVs. • Changing the design hierarchy. • Supporting non-petrol/diesel vehicles with appropriate supporting infrastructure be it EVs or Hydrogen • Better alignment between objectives/aspirations and packaging of mitigation/benefit measures (e.g. actually build the better high street once the bypass is completed) • maximising offset/generation opportunities (power, drainage, trees, etc) • Supporting wildlife/ecology •	• Use of materials and infrastructure that reduces climate impacts e.g. recycle/reuse, less CO2 during manufacture, etc • Broader consideration of noise, air quality and light impacts and materials/specs e.g. solar lighting, noise reducing surfaces, etc	• More efficient construction approaches and planning e.g. relocating spoil within a site not externally, standardisation of infrastructure, recycling materials, etc • Digital planning tools • Minimising construction impacts e.g. staff travel, freight/logistics movements, noise/light • Opportunity maximising e.g. closing roads early and building the bike/ped/bus facilities first as congestion mitigation, building permanent accommodation for site work that becomes community asset after, etc •	• minimising renewals and maintenance through material spec • maximising offset/generation opportunities (power, drainage, trees, etc) • greening operational costs e.g. EVs for vehicle fleet, reducing salt use in winter, etc •