MOTT MACDONALD

Light Rail for UN Sustainable Development Goals

Stephen Luke

Dag van de Light Rail 2020 | Mind the Gaps

Sustainability in Light Rail

1. Overview
2. UN Sustainable Development Goals
3. Promoting Sustainability

Climate change – a 20 years paradigm shift

September 1999

The Guardian

Environment

The dilemma that confronts the world

Water shortages, global warming and nitrogen pollution threaten the planet's future unless politicians act now, says UN environment report

Paul Brown, Environment Correspondent

In a devastating assessment on the future for the human race in the early part of the next century Klaus Töpfer, the executive director of the UN environment programme, said yesterday that the main threats to human survival were posed by water shortages, global warming, and a new danger - worldwide nitrogen pollution.

"A series of looming crises and ultimate catastrophe can only be averted by a massive increase in political will. We have the technology but we are not applying it," he said.

Launching a report called Global Environment Outlook 2000 in London yesterday Dr Töpfer said it was possible to reverse the process but conspicuous overconsumption by the world's rich countries had to be cut by 50% to do so. He said it did not mean a lowering of living standards but an application of existing science, through recycling, for instance.

December 2009

FINANCIAL TIMES

Opinion **Christopher Caldwell** + Add to myFT

Climate change, the great leveller

Christopher Caldwell DECEMBER 11 2009

The Copenhagen summit on climate change is starting to resemble the August 1928 meeting in Paris at which more than a dozen nations, including Britain, France, Germany, Japan and the US, signed a treaty to abolish war. A real problem, a commitment to solving it and a large dose of arrogance convinced the world – 65 countries, eventually – to sign the Kellogg-Briand pact, named after the American and French ministers who devised it. But the reality of perpetual peace proved harder to advance than the ideal of it.

The leak of a 13-page Danish government document that looked like a draft fo

September 2019

Impacts of Climate Change

IPCC 1.5C Report – October 2018

An increase in extreme weather events

Drought and precipitation deficits

Species loss and extinction

Increased pressure on water resources

Heavy precipitation and flooding

Costly and growing health impacts

Ocean temperature increase and acidification

Disruption to food supplies

What Does Sustainable Infrastructure Mean?

Building Infrastructure Right

Building the Right Infrastructure

"meeting the needs of the present without compromising the ability of future generations to meet their own needs."

United Nations Brundtland Commission, 1987

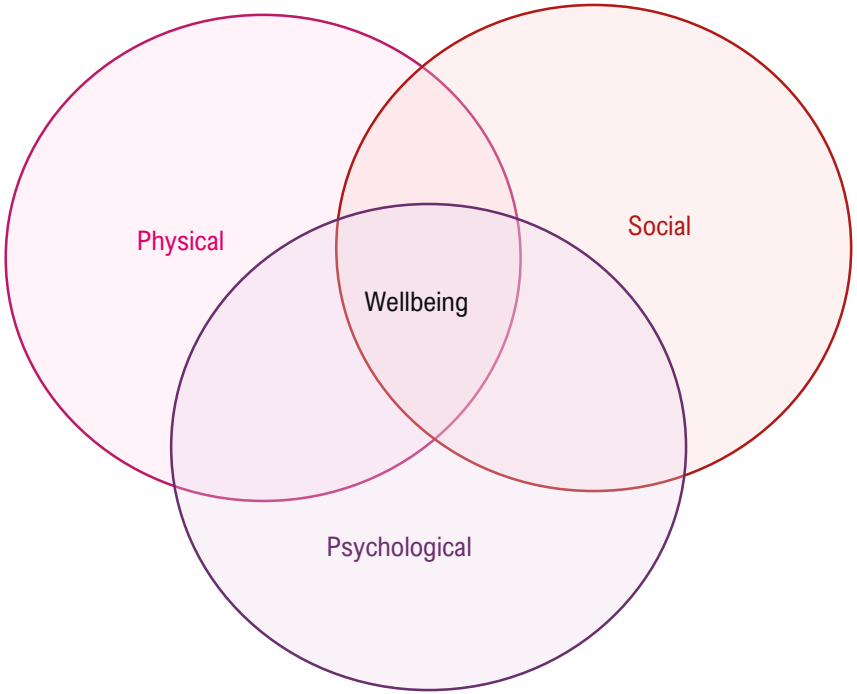
SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

Wellbeing

"A state characterised by health, happiness and prosperity" – Oxford English Dictionary

"The state in which people have the psychological, social and physical resources they need" – Dodge, et al.

- Quality of Life
- Welfare
- Fulfilment
- Life Satisfaction
- Happiness
- Stability



The Wellbeing of Future Generations (Wales) Act

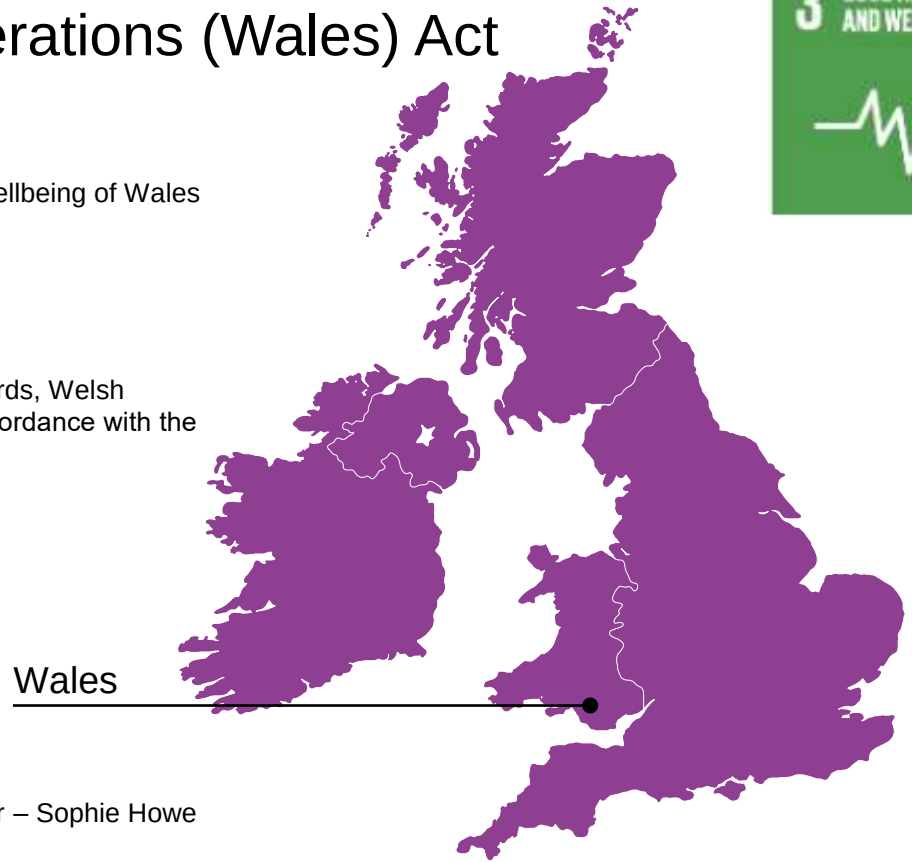
2015

To improve the social, economic, environmental and cultural wellbeing of Wales

“What Wales is doing today the world will do tomorrow”

Requires 44 (so far) public bodies (local authorities, health boards, Welsh Government, etc.) to set their own ‘Wellbeing objectives’ in accordance with the Sustainable Development Principle

Ensure that the needs of the present are met without compromising the ability of future generations to meet their own needs



Established the Wellbeing of Future Generations Commissioner – Sophie Howe

Paramatta Light Rail Stage 2, Australia

Examples

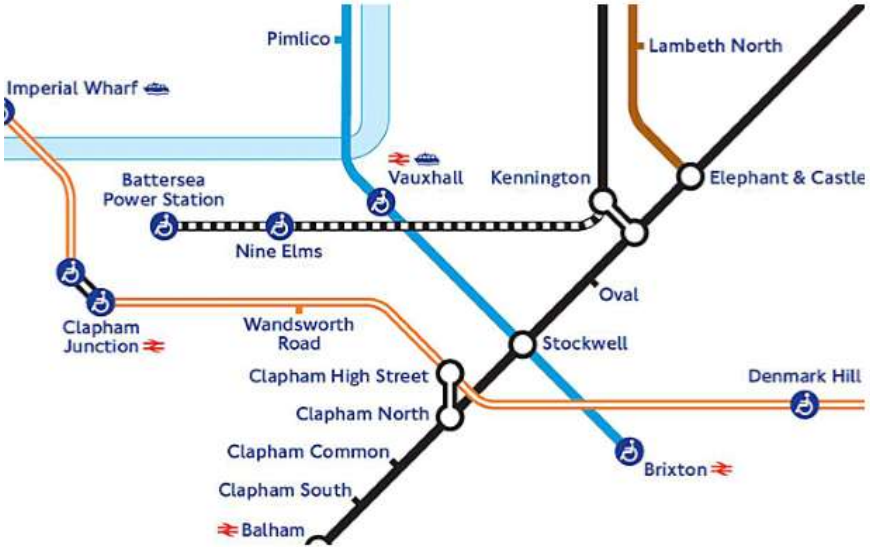
Contribute towards UN SDG 16 by assessing tenders based on criteria that include environmental and social impacts/risks, quality, durability and whole-of-life costs

Contribute towards UN SDG 12 by specifying the use of alternate materials including green concrete, recycled glass and other recycled/low embodied carbon material options

Contribute towards UN SDG 13 through using data, hazard mapping and other tools to manage and quantify increasing catastrophe risks and design for greater resilience to shocks and stresses to the project and community

Northern Line Extension London

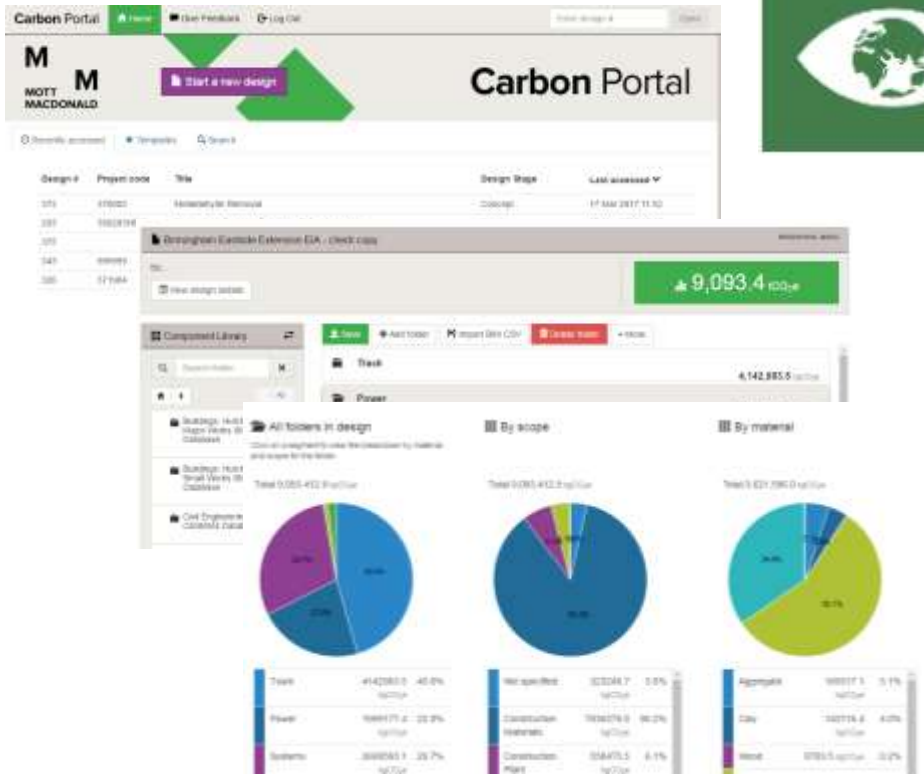
- 16% carbon reduction identified at design stage
- Designed in BIM and assessed with the Carbon Portal
- 50% of carbon savings related to construction logistics



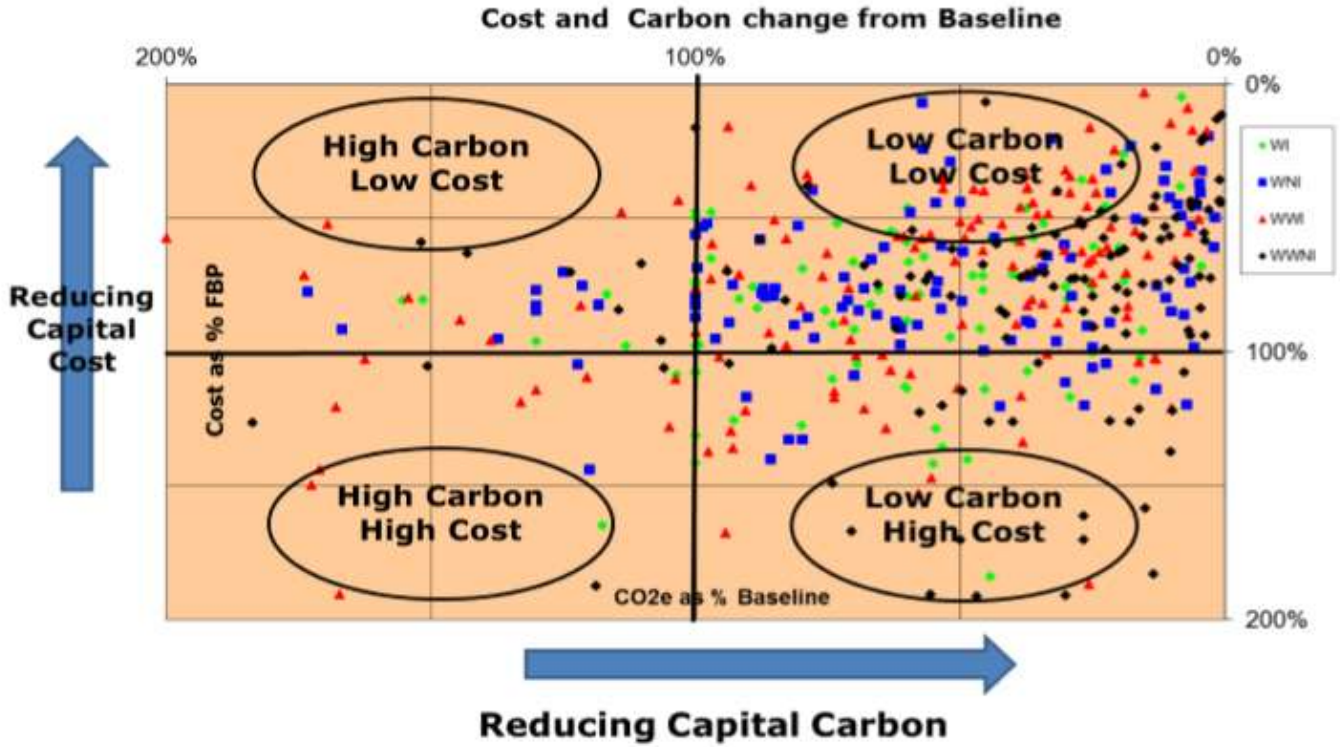
Carbon Portal

BIM enabled carbon calculator

The Carbon Portal is the first carbon calculator to calculate capital and operational carbon, including from BIM designed assets.



Strong correlation between carbon and cost

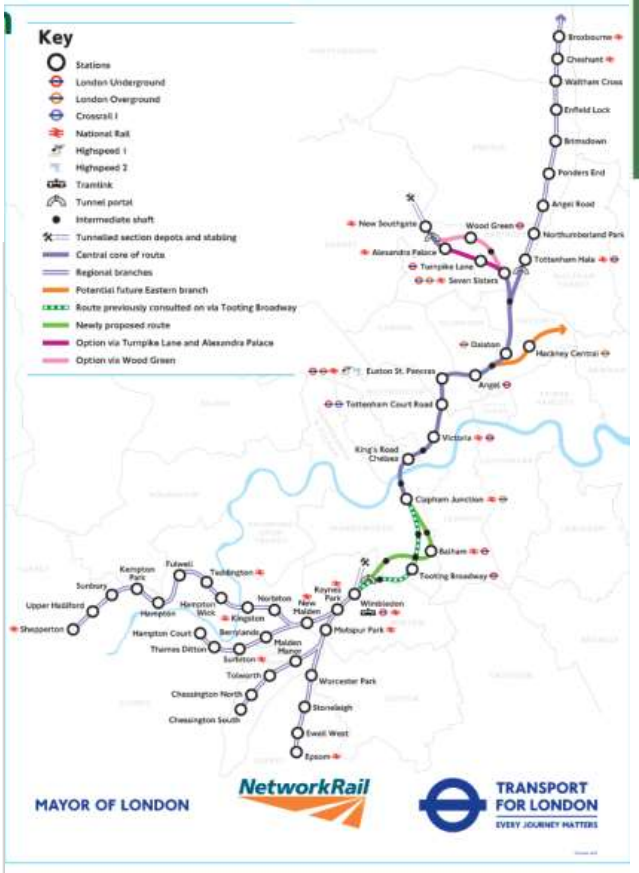


Crossrail line 2 London (Feasibility study)

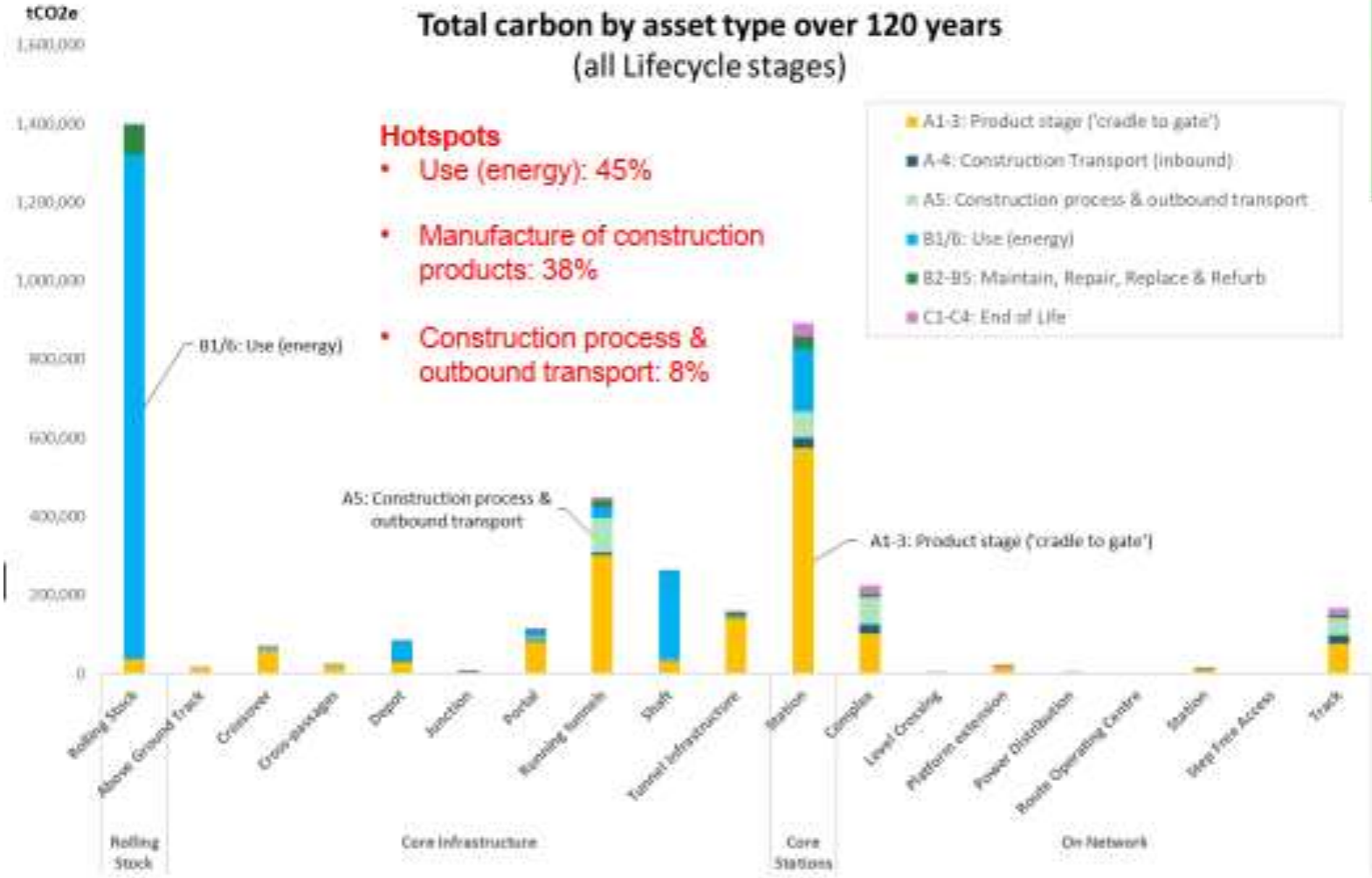
13 CLIMATE ACTION

Carbon Smart design hierarchy

1. Think whole-life	• Over 120 years, 45% of CR2 carbon is due to operational energy (33% traction energy, 12% core infrastructure/station energy). • Upfront Capex/carbon may reduce whole-life energy/carbon. *e.g. Groundwater cooling to reduce tunnel ventilation*
2. Avoid assets	• Can the asset/element be avoided altogether? • Challenge design standards/requirements where appropriate. *e.g. Challenge standards to reduced rebar in concrete*
3. Reduce materials	• Design lean – best in class engineering efficiency using modelling/testing to avoid over-engineering. • Design for offsite manufacture: reduced material wastage along with other benefits. *e.g. Use appropriate GI to reduce structural concrete*
4. Substitute materials	• Materials with high recycled content • Materials/assets with low energy/carbon manufacturing. *e.g. Concrete with cement replaced by slag, recycled plastic cable troughs*
5. Consider end-of-life	• Design for deconstruction and disassembly: replacement and reuse of construction elements. • Maximise chance of recycling: avoid bonds/composites. *e.g. Dismountable modular facades. Bolted rather than welded structural elements*



Total carbon by asset type over 120 years
(all Lifecycle stages)



Hotspots

- Use (energy): 45%
- Manufacture of construction products: 38%
- Construction process & outbound transport: 8%

13 CLIMATE ACTION

Nottingham Express Transit – Phase 2 (Light Rail)

- Use of surcharging techniques to avoid ‘cut and replace’ or piled trackforms
- Re-profiling of earthworks to re-use site won material

Nottingham Express Transit (Phase 2)

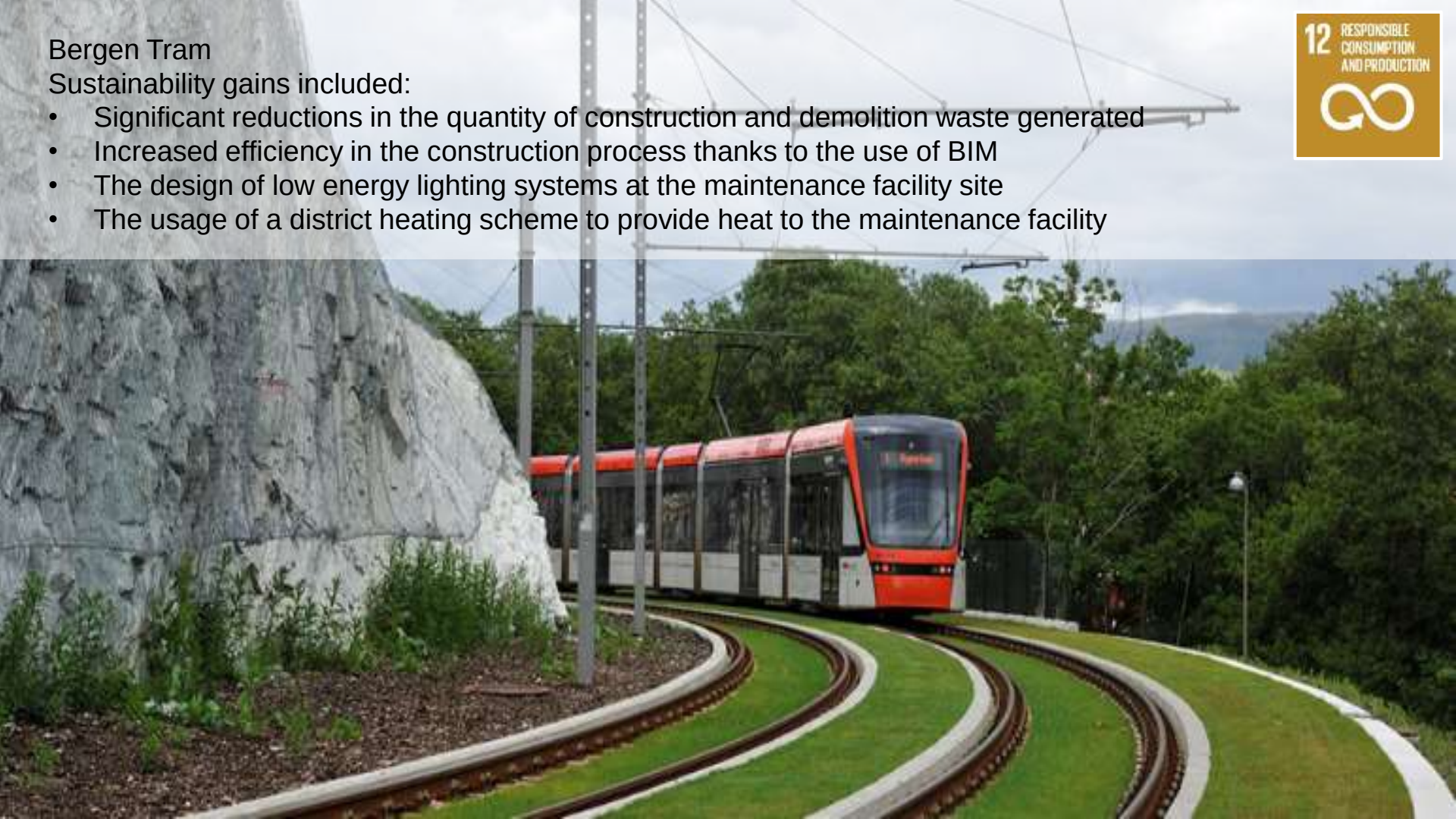
- New drainage infrastructure was designed for 1 in 100 year flood events plus 30% to consider climate change.
- Use of Sustainable Drainage Systems (SuDS)

13 CLIMATE ACTION

Bergen Tram

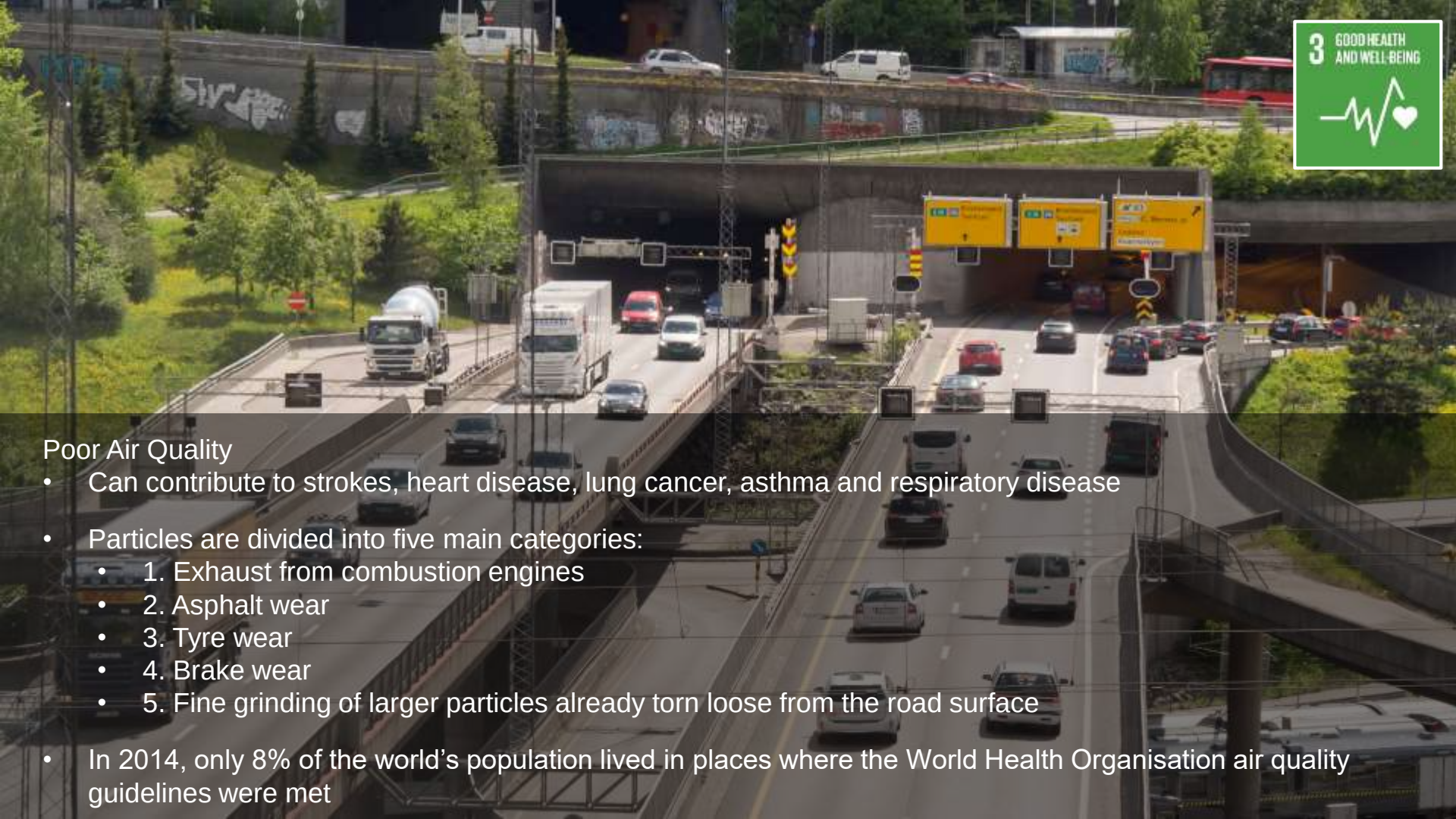
Sustainability gains included:

- Significant reductions in the quantity of construction and demolition waste generated
- Increased efficiency in the construction process thanks to the use of BIM
- The design of low energy lighting systems at the maintenance facility site
- The usage of a district heating scheme to provide heat to the maintenance facility



Nottingham Express Transit UK – Phase 3

1. Sustainability Appraisal Tool
2. Assess routes and mode options against ability to meet UN SDG's
3. Maximises sustainability potential at earliest stage
   - Air quality
   - Accessibility
   - Social Inclusion
   - Road casualties



Poor Air Quality

- Can contribute to strokes, heart disease, lung cancer, asthma and respiratory disease
- Particles are divided into five main categories:
  - 1. Exhaust from combustion engines
  - 2. Asphalt wear
  - 3. Tyre wear
  - 4. Brake wear
  - 5. Fine grinding of larger particles already torn loose from the road surface
- In 2014, only 8% of the world's population lived in places where the World Health Organisation air quality guidelines were met

“The public transport network presents substantial difficulties for people with disabilities: 55 per cent of trains, 41 per cent of bus stations and 39 per cent of buses still do not reach current accessibility standards”

bettertransport.org.uk

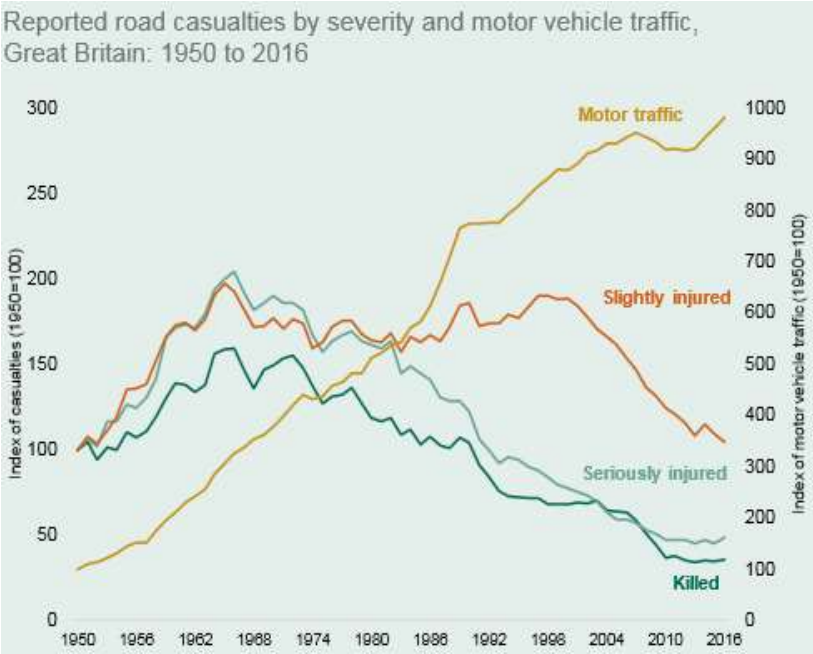
Inclusivity

- All UK tram systems provide level boarding for mobility impaired users
- Equality Act compliant access is provided to the vast majority of tramstops
- Dedicated zones on-board for mobility, hearing and visually impaired users

10 REDUCED INEQUALITIES

“Car-based land use planning can contribute to social isolation and poverty”

bettertransport.org.uk



In 2016:

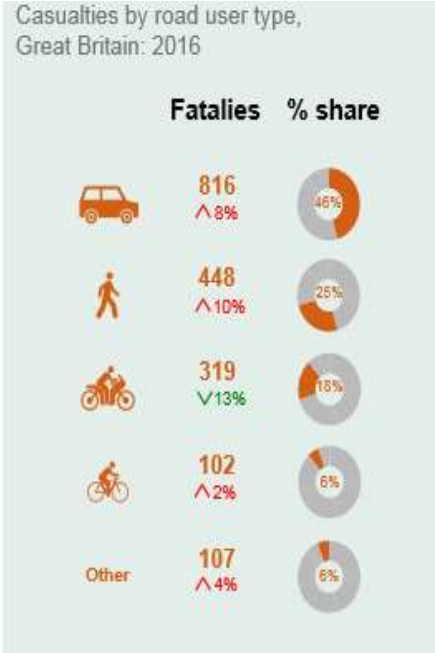
1,792 fatalities

24,101 seriously injured *

155,491 slightly injured *

324 billion vehicle miles
(motor vehicle traffic)

* Comparisons of these figures with earlier years should be interpreted with caution due to changes in systems for severity reporting by some police forces.



Disused or Unwanted Railway Corridors

- Low-cost heavy to light rail conversions
- Increase en route patronage
- Utilise and enhance disused spaces
- Remove inefficient heavy rail services

Blackpool Tram – Extension to Blackpool North

- Key scheme objective is to contribute to the economic growth of Blackpool and Lancashire
- Connects key employment and tourist destinations to the wider sub-region and beyond
- Promotes inward movement of tourists from the North-West into Blackpool

Manchester Metrolink

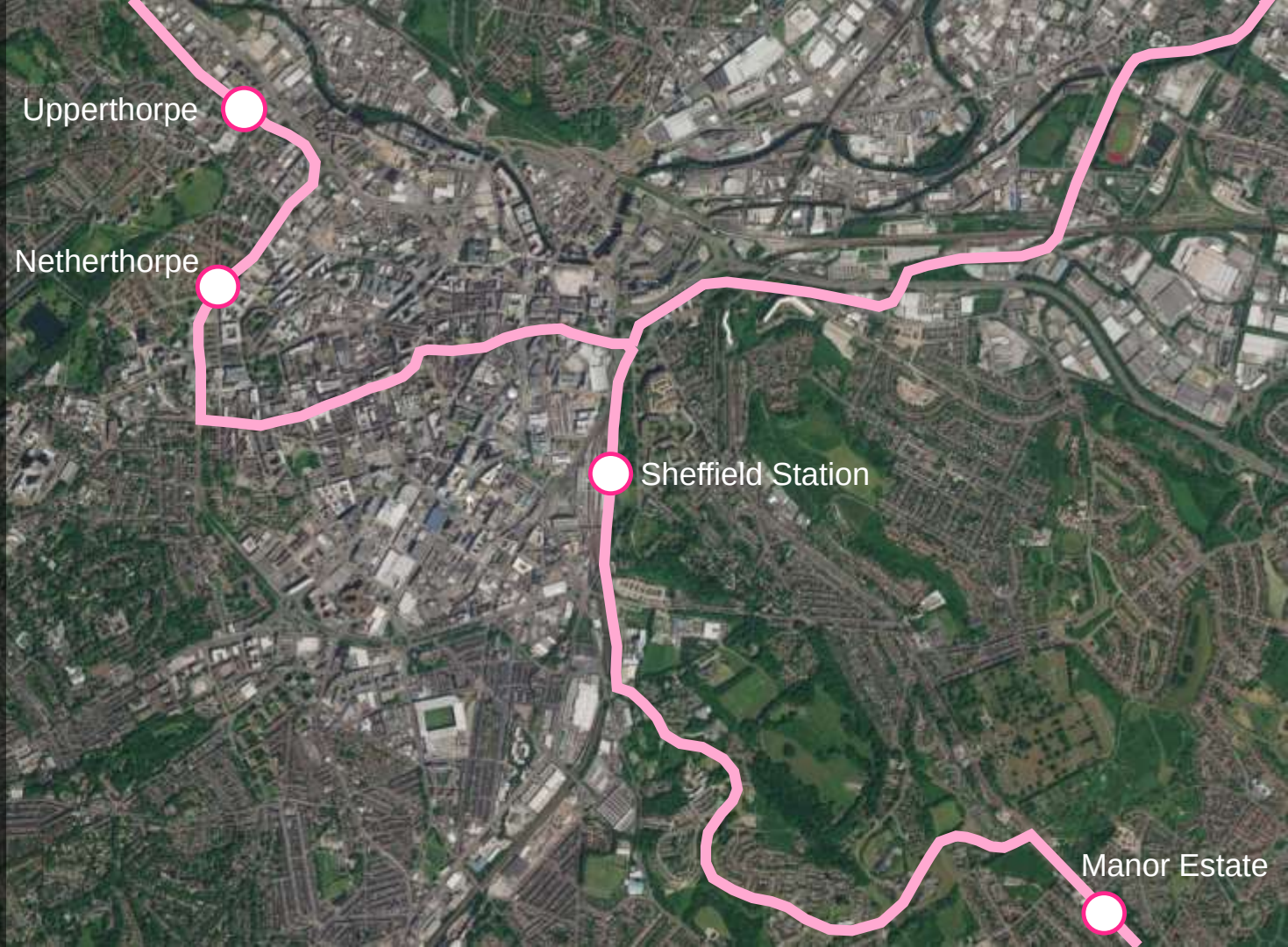
- The tram system has helped attract and stimulate regeneration across the city, for example:
  - Media City at Salford Quays
  - Significant residential development at Deansgate Castlefield

Eglington LRT, Toronto

- 19km “Cross Town” LRT line with a 10km underground section
- We have worked with Metrolinx to promoting Active and Sustainable School Travel

Sheffield Supertram

- Connecting lower-income areas to the city centre
- Helps widen geographical scope of job searching
- Access leisure facilities in other parts of the city



8 DECENT WORK AND ECONOMIC GROWTH

10 REDUCED INEQUALITIES

“The United Nations predicts that, between now and 2030, the number of medium size cities (500,000 to one million) will increase from 551 to 731. It is these cities that need the affordable public transport systems offered by new and future technologies.”

www.railengineer.uk

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Thank you