



Sustainability Statement

Tilbury to Gravesend Tunnel

December 2023

Revision 1

nationalgrid

Contents

Executive summary	Error! Bookmark not defined.
1. Introduction	2
2. Policy and Legal Framework	5
3. Energy and Carbon Emissions	9
4. Biodiversity and Ecology	14
5. Waste and Materials	16
6. Water and Drainage	18
7. Social and Economic Sustainability	19
8. Sustainability Action Plan	21
Appendix A - Carbon Strategy Report	22
Appendix B - Carbon Baseline Report	23
Appendix C - Sustainability Action Plan	24

1. Introduction

1.1 National Grid Background

National Grid Electricity Transmission plc (NGET), owns and maintains the high-voltage electricity network in England and Wales. This network includes approximately 4,500 miles of overhead line, 900 miles of underground cable and over 300 substations. Put simply, our role is to move electricity from where it is generated, down the superhighway of the electricity system, to direct customers and to the distribution companies that deliver power to homes and businesses. Upgrading and replacing existing electrical infrastructure is an important part of our business.

1.2 National Grid Approach to Sustainability

1.2.1 UN Sustainable Development Goals

National Grid's vision is to build a sustainable electricity network, which makes a positive contribution to the environment. To do this, we have reference to the United Nations' 17 Sustainable Development Goals (SDGs) to 'transform our world' which officially came into force in 2016. These goals promote prosperity while protecting the planet.

Businesses such as National Grid have an important role to play in helping to achieve these goals and so we have reviewed the goals to see how to best support them. All the goals are vitally important to the future social and environmental wellbeing of people and the planet. However, listening to stakeholder comments and combining this with the areas where National Grid has the most impact and/or opportunity to improve, has revealed four specific SDGs to relate most closely to National Grid's Environmental Action Plan. These SDG goals are:

Sustainable Development Definition

Sustainable development is often defined as:

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

Brundtland Report in 1987 (Resolution 42/187 of the United Nations General Assembly).



Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all.



Goal 12: Ensure sustainable consumption and production patterns.



Goal 13: Take urgent action to combat climate change and its impacts.



Goal 15: Sustainably manage forests; combat desertification; halt and reverse land degradation; and halt biodiversity loss.

1.2.2 Environmental Action Plan

National Grid plays a dual role in the transition to a low-carbon economy and achieving net zero. As a transmission owner, we connects low-carbon energy sources and influences a whole system approach to creating the UK's net zero

infrastructure. As an infrastructure business, our day-to-day activities in maintaining and constructing assets also have an environmental impact. The National Grid Environmental Action Plan focuses on the latter. It centres on our transition to a sustainable, low-carbon business.

The Environmental Action Plan concentrates on the areas where National Grid can make the greatest contribution to a more sustainable future, aligned to the United Nations' Sustainable Development Goals. It responds to – and is driven by – environmental issues which are most significant to our stakeholders and our business. We are committed to reducing our negative impacts, but we will also focus on the areas where we can bring about positive change.

National Grid Targets

Throughout this report, National Grid targets are shown in blue shaded boxes. These targets are taken from our 2021-2026 Environmental Action Plan and annual reports which are available online [here](#).

If you would like to contact us about any aspect of our Environmental Action Plan, please email box.ET.Environmental@nationalgrid.com

These targets relate to the wider business. Project specific targets are discussed in the Conclusions and Recommendations section of this report.

1.3 Report Purpose and Scope

This report has been prepared to accompany the Town and Country Planning Act 1990 planning applications for National Grid's proposed cable runnel replacement project between Tilbury and Gravesend and associated above ground infrastructure. See section 1.4 below.

The report has focussed on the four environmental sustainability topics that are most relevant to the proposed development and in line with the UN Sustainable Development Goals discussed in section 1.2.1. These are structured as follows:

Chapter 3: Energy and Carbon Emissions

Chapter 4: Biodiversity and Ecology

Chapter 5: Waste and Materials

Chapter 6: Water and Drainage

Social and economic sustainability topics are then addressed in Chapter 7, followed by a discussion of the latest version of the Sustainability Action Plan in Chapter 8. Recommendations and next steps are included within each sub chapter.

1.4 Project Overview

1.4.1 Description

The proposed development will involve boring a new cable tunnel beneath the River Thames, between Tilbury and Gravesend, to replace the existing cable tunnel which was built in the 1960s and has reached the end of its usable asset life. In addition to this, a new Cable Sealing End compound and headhouse is needed at both ends of the tunnel to provide access to the tunnel shaft and connect the cables to the existing overhead lines via two newly erected pylons. Decommissioning of the existing above ground infrastructure does not form part of this project with the exception of 4 pylons which will be dismantled.

1.4.2 Need

The Proposed Development is one of 17 key projects that National Grid has identified as being critical to enabling the rapid transition toward decarbonisation and net zero carbon emissions, in line with the commitments in the Climate Change Act 2008. Specifically, these projects will support transmission of the large movements of renewable energy generated through wind power off the east coast of the country to the highly populated region of the south-east of England. This aligns with the [UK ambition](#) to deploy up to 50GW off offshore wind by 2030.

2. Policy and Legal Framework

2.1 National

2.1.1 Climate Change Act 2008

The Climate Change Act 2008 is the basis for the UK's approach to tackling and responding to climate change. It requires that we reduce emissions of carbon dioxide and other greenhouse gases and that we adapt to climate change risks. The Act also establishes the framework to deliver on these requirements. The Act supports the UK's commitment to urgent international action to tackle climate change.

In 2019, the Climate Change Act 2008 was amended to legislate a long-term, economy-wide target to reach net-zero greenhouse gas emissions, including methane, by 2050.

2.1.2 National Policy Statements for Energy Infrastructure

National Policy Statements are pursuant to section 9(8) of the Planning Act 2008. Whilst this project is being determined under the Town and Country Planning Act 1990, these national policy statements still have relevance as the proposed development connects directly to projects being determined under the Planning Act 2008 that cannot be delivered effectively without the replacement tunnel and associated infrastructure.

In November 2023, Government published final drafts of its updated national policy statements for energy. Relevant to National Grid Electricity Transmission are:

EN-1: Overarching National Policy Statement for energy

EN-5: National Policy Statement for electrical networks infrastructure

2.1.3 NPPF

The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England. The following paragraphs are relevant to this project:

The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Para 152

Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

a) an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

b) a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

c) an environmental objective – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Para 8

2.1.4 Building Regulations Part L1A

Building Regulations Part L1A set standards for new buildings including limits on wasted energy, airtightness, and thermal performance standards that must be met for walls, floors, and roofs. To reduce heat loss, a minimum level of insulation must also be provided for each building element.

2.2 Regional

2.2.1 South Essex Plan

The South Essex Plan is a non-statutory strategic framework being prepared by the 6 south Essex local councils of Basildon, Brentwood, Castle Point, Rochford, Southend-on-Sea and Thurrock, working together with Essex County Council.

The plan will set out a strategic framework for development in the area up to 2038 and will compliment other work being undertaken to make south Essex a better place to live.

2.2.1 South East Water – Water Resource Management Plan

Regions under control of South East Water have been determined by the Environment Agency to be under ‘Serious Water Stress.’

2.3 Local

2.3.1 Thurrock

The current Development Plan for Thurrock Council was adopted in Dec 2011 (updated in 2015) and is the Core Strategy and Policies for Management of Development. In addition, the Council has adopted one SPD relevant to this application: Thurrock Design Guide – Design Strategy SPD (2017).

In winter 23/24, Thurrock is expecting to undergo Regulation 18 consultation on a new Local Plan. Whilst this document carries little weight when determining currently planning applications, the initial policies will be of interest to sustainable design of this proposed development as are likely to be more progressive than those formulative in 2011.

Relevant policies from the 2017 Core Strategy are listed below:

- **Policy CSTP19:** Biodiversity sets out the Council's approach to encouraging development to include measures to contribute positively to the overall biodiversity in the borough;
- **Policy CSTP22:** Thurrock Design sets out the Council's approach to promoting high quality design in Thurrock which balances physical, social, economic and environmental outcomes;
- **Policy CSTP25:** Climate Change sets out the Council's approach to climate change, including adaption and mitigation;
- **Policy CSTP26:** Renewable or Low-Carbon Energy Generation sets out the Council's approach to promoting and facilitating the shift to low-carbon, including the promotion of the delivery of energy networks in appropriate locations;
- **Policy CSTP27:** Management and Reduction of Flood Risk sets out the Council's approach to ensuring flood risk management is implemented and in accordance with the NPPF; and
- **Policy CSTP29:** Waste Strategy sets out the Council's strategic approach toward planning for the additional waste management capacity throughout the Plan period and sets the strategic planning policy context for site allocations within the Minerals and Waste Development Plan Document (MWDPD).

2.3.2 Gravesham

The Development Plan for Gravesham currently consists of the following key documents:

- Gravesham Local Plan Core Strategy and Local Plan Policies Map (2014); and
- Gravesham Local Plan First Review (1994) – saved Policies.

The Local Plan Core Strategy was adopted in September 2014. Within this, the most relevant spatial policies is **CS01: Sustainable Development** which sets out the Council's strategy for the consideration of projects which work in favour of sustainable development contained in the NPPF and the Core Strategy;

The relevant thematic policies comprise:

- **Policy CS12: Green Infrastructure**
- **Policy CS18: Climate Change** sets out the Council's approach to climate change, including adaption and mitigation;
- **Policy CS19: Development and Design Principles** sets out the Council's approach for new development to be fit for purpose; and

3. Energy and Carbon Emissions

National Grid Commitment

By 2026, we will achieve 34% reduction in controllable scope 1 and 2 emissions from a 2018/19 baseline, with additional targets of: 50% reduction by 2030 and net zero by 2050.

Carbon Emission Baseline

Background

According to the Carbon Trust, infrastructure is associated with half of UK Greenhouse Gas emissions and 30% of this is directly attributed to the construction, operation and maintenance of infrastructure assets. To reduce emissions, organisations must know where they come from, report them and set targets to reduce their carbon footprint. To ensure a systematic approach to emissions assessment is followed, the standard known as PAS 2080: Managing Carbon in Buildings and Infrastructure has been developed. PAS 2080 is a global standard for managing infrastructure carbon and meets World Trade Organization requirements. In 2023, PAS 2080 underwent an update and National Grid is currently aligning its approach to this latest version. An approach to how carbon emissions would be managed was outlined at an early stage in the project within the Carbon Strategy Report (Appendix A).

Scope

Project carbon emissions can be categorised according to the following lifecycle stages:

- **Production:** the extraction or creation of raw materials required for a product or activity. This includes processes such as mining, farming or manufacturing;
- **Processing:** once raw materials are obtained they undergo various processes to transform them into usable goods. This includes manufacturing, refining and other processing activities.
- **Transportation:** emissions associated with transporting raw materials, components and finished products. This includes energy use in vehicles, shipping and other modes of transportation.
- **Use:** emissions generated during the consumption of a product or the execution of an activity.
- **Disposal:** emissions related to the end of a product's life cycle. This includes processes like waste disposal, recycling or incineration.

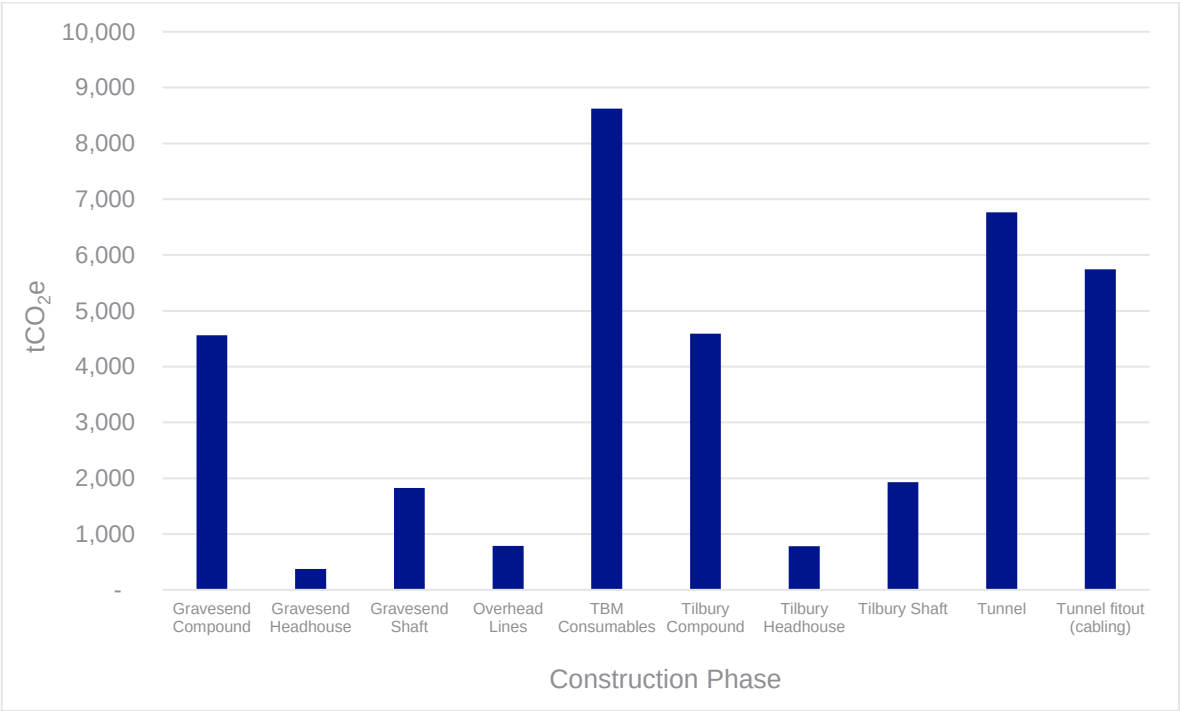
National Grid has assessed emissions from all these stages using the carbon calculator, CarboniCa, to understand the carbon baseline assessment for this project (Appendix B). CarboniCa is better suited to tunnelling projects than National Grid's internal alternative – the Carbon Interface Tool (CIT) – and it is hoped that the appointed Contractor will continue using CarboniCa (or an

equivalent tool suited to tunnelling projects) during the detailed design and construction phases of the works.

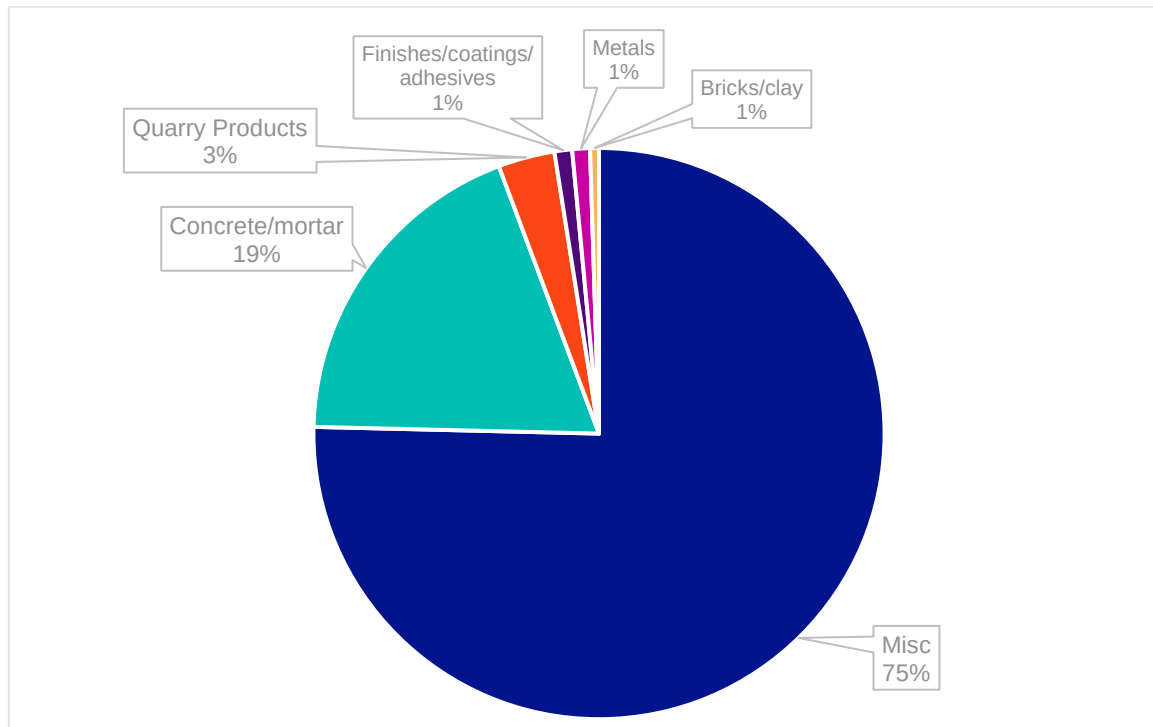
Results

The output of the carbon baseline assessment has found that a total of 37,441 tCO₂e are predicted to be produced during the construction and maintenance of the infrastructure, with the majority (96%) of these emissions produced during construction.

Carbon emissions during construction vary across the phases of work and are summarised in the graph below. The top three most carbon intensive activities associated with the project relate to the tunnelling activity itself rather than construction of the associated above ground infrastructure. In total, these three activities are expected to account for 59% of the construction phase emissions.



When considering the embodied carbon associated with the materials used in construction phase, the majority of materials required (75%) are categorised as ‘miscellaneous’. Concretes and mortars make up the next largest group of materials required (19%), followed by quarry products (3%), finishes/coatings/adhesives (1%), metals (1%) and bricks/clay (<1%). See graph below.



The carbon emissions associated with fuel and energy use are captured within the consideration of materials and construction phases above.

It is noteworthy that this project will not incorporate the use of potent greenhouse gas, sulphur hexafluoride (SF₆), which is commonly used to insulate National Grid's high voltage electricity transmission equipment.

Assumptions

Noteworthy assumptions that have been made in calculating this carbon baseline are listed as follows:

- Transport emissions are assumed to be via road and not on the River Thames
- Generators required to power the Tunnel Boring Machines (TBM) are assumed to be powered by diesel fuel
- The TBM is assumed to be a slurry machine as opposed to an Earth Pressure Balance machine. The latter is likely to reduced emissions by one third.
- It is assumed that the TBM will operate on full power for 8 months
- It is assumed that the TBM will be second hand and reused for other projects

Recommendations and Next Steps

Recommendations

The Carbon Baseline report has identified several opportunities for reducing emissions relating to the sourcing of more sustainable alternatives to the current choice of materials. These are summarised in the table below alongside the priority for action.

Material	More Sustainable Alternative	Priority
Aluminium	Aluminium with high recycled content or Timber products	High
Aggregates and sands	This material has the lowest embodied carbon. Transport distance is the critical factor to consider.	Low
Hot dip galvanised steel	Steel with high recycled content	High
Paint	Lower VOC ecological paints	Medium
Asphalt 4% bitumen binder content	Roofing: recycling bitumen Paving: porous asphalt, grasscrete or gravel	Low
Generic BDA brick	Reclaimed brick (if locally available), slate or local stone or Timber to provide a different aesthetic	Medium
PVC pipe	Non-PVC production / recycled plastic	Low
Copper	Recycled copper from high grade scrap	Medium
British Precast Concrete Blocks	Local stone or reclaimed brickwork or Cement-free blocks such as Greenblock	Medium
Polyethylene	Highly dependent on application, product-specific data preferable, recycled plastic	Low
Concrete – ICE Low Carbon (Routemap Grade B)	Target even lower embodied carbon where possible by minimising cement content further. Consider alternative methods of construction. Where appropriate, consider alternative concrete types.	High
Plastics	Highly dependent on application, product-specific data preferable, recycled plastic	Low

Further recommendations relating to the construction phase are to consider the assumptions made in calculating this baseline and determine if fundamental changes change be made to design and approach at detailed design stage.

As previously explained, the operation of the new infrastructure is a lower priority for action on this project. However, quick wins such as only purchasing electricity from renewable sources are expected and align with National Grid commitments.

National Grid Commitment

By 2026, we will purchase 100% of electricity we use for operational purposes from renewable sources.

Next Steps

Ambitious carbon reduction targets should be actioned with the appointed Contractor and further opportunities sought to drive down emissions as far as possible. Once this task has been completed, the remaining emissions should be offset in a responsible manner in line with National Grid's latest target for carbon neutral construction.

4. Biodiversity and Ecology

National Grid Commitment

By 2026, we will deliver net gain by at least 10% or greater in environmental value (including biodiversity) on all construction projects (including those delivered by third parties building on our land).

Biodiversity and Ecology Baseline

Tilbury

At Tilbury, there are 8 statutory and 6 non statutory designated sites within the 2kn study area. This includes the Thames Estuary and Marshes Ramsar, Special Protection Area and Site of Special Scientific Interest. Further to this, all widespread reptile species are known to occur at Tilbury. Ornithology surveys have recorded gadwall; little egret; avocet; whimbrel; black tailed godwit; dunlin; and redshank. There are no badgers setts which the Tilbury, but they are known to be active in the local area. No bats, great crested newts or otter/water vole were recorded at the Tilbury.

Invertebrate surveys at Tilbury undertaken in 2023 identified a total of 334 species of which 35 are regarded as 'key species'. This is higher than average and suggests that the Tilbury survey area is a diverse site for invertebrates. However, these vary in importance between areas, with some of very high importance (in particular the tall fescue dominated areas) and others of much lower importance.

Gravesend

At Gravesend, there are 6 statutory and 5 non statutory designated sites within the 2kn study area. This includes the Higham Marshes Local Wildlife Site which is within the development site.

Slow worm, common lizard and grass snake are known to occur at Gravesend. Ornithology surveys have recorded Cetti's Warbler, Skylark, Song Thrush, Dunnock and Linnet. No bats, great crested newts, otter/water vole were recorded at Gravesend. Badger is also assumed to be currently absent.

Invertebrate surveys at Gravesend undertaken in 2023 identified a total of 307 species of which 27 are regarded as 'key species'. This is a higher than average and suggests that the Gravesend survey area is a diverse site for invertebrates. A total of 4 Rare Key Species were found.

Biodiversity Net Gain

The BNG Assessment and Strategy Report submitted with this planning application, details the units lost and gained through both the construction and operation of this project. In summary, the project is currently forecast to provide a

Biodiversity net gain of 4.1% (3.6 habitat units) The report explains that to achieve a minimum of 10% BNG, a further 5.3 units are required.

Project Stage	On site	Off site	Total
Before works	88.9	45.5	134.5
After works	79.3	58.8	138.1
Net change	-9.6	+13.2	+3.6

Through our detailed design phase we will continue to seek opportunities to further avoid and reduce habitat losses, alongside proactive biodiversity enhancement opportunities for habitats and species.

Recommendations and Next Steps

Recommendations

Detailed mitigation has been designed for both the Tilbury and Gravesend sites. This includes relocating the project away from noise and disturbance sensitive bird species and reducing the size of construction compounds within sensitive habitat. Minimising the loss of more valuable semi-natural habitats has in turn helped minimise potential losses of reptile, invertebrate, bird nesting and foraging habitats.

At Tilbury, it was identified that additional mitigation would be required to mitigate and compensate for potential impacts on terrestrial invertebrate populations, in particular the tall fescue planthopper. Tall fescue tussocks will be translocated (moved) from the affected areas between mid-July and end of August 2024. Once construction is complete, these tussocks and associated soil will be transferred to the area of hardstanding surrounding the proposed sealing end compound and used to provide enhancement of the habitats to be created in these areas.

Next Steps

In order to deliver our 10% Net Gain commitment, National Grid will continue to explore opportunities to work with local landowners and strategic organisations. We will develop offsite biodiversity enhancement actions that can deliver long term improvements and a range of associated co benefits for biodiversity and people, and in alignment with local and regional nature recovery strategies.

5. Waste and Materials

National Grid Commitment

By 2026, we will achieve zero-waste to landfill across our construction projects.

Project overview

As explained in Chapter 3, material choices are a key part of National Grid’s carbon footprint and so a comprehensive Materials Management Plan will need to be prepared by the Contractor to document how materials will be handled, stored and used throughout the project to enjoy resources are used efficiently. Both embodied carbon, fuel use and transport emissions related to each material will need careful consideration and greener alternatives must be considered. A similar National Grid project has recently completed the world’s largest pour of earth friendly concrete and thus high expectations are set for the Proposed Development.

Low Carbon Concrete

In 2023, National Grid’s London Power Tunnels project used 730m³ of climate friendly concrete. This is enough to fill two swimming pools and is classed as the world’s largest pour. The cement-free alternative uses a geopolymer binder made by the chemical activation of industrial waste products, and provides a 70% saving of CO₂ per m³ poured.

Potential recycled content of key materials that have been recommended and assessed within the Environmental Statement accompanying the planning application and are outline in the table below.

Material type	Potential recycled content (% by weight)
Concrete	16
Asphalt	25
Aggregates	50
Steel reinforcement	100
Structural steel	60
Steel pipework	0

In terms of waste production, the excavated materials from the tunnel and shaft will be the largest waste stream by volume. It is expected that the tunnel spoil will be approximately 72,700m³ (chalk only), the Tilbury shaft will be 13,000m³ and the Gravesend shaft will be 12,850 m³, with both being a mix of chalk, made ground, alluvium and river terrace deposits.

National Grid have a zero waste to landfill target by 2026, which will come into force during the construction phase of the Proposed Development. Numerous

promising local opportunities have been explored for the reuse of the spoil materials to meet National Grid's commitment to avoid landfill. Currently, National Grid are exploring opportunities to transport the spoil to habitat enhancement projects in the local vicinity such as the RSPB site at Cliffe Pools which would provide benefits to aquatic invertebrates and wading birds. Whichever site is chosen, the removal of the tunnel and shaft spoil at Tilbury will be via the River Thames, to reduce the number of HGV required on the local and strategic road network.

National Grid will seek to utilise either:

- the existing and working jetty to the south-east of the proposed Tilbury SEC, delivering the tunnel and Tilbury shaft spoil to the jetty via HGV and transferring to barge. There is an existing road extending to the jetty, however some upgrading of the existing road will be required.
- Berth 5 at the Port of Tilbury, delivering the tunnel spoil to the berth via HGV and transferring to barge. No road upgrading will be required for this option.

Recommendations and Next Steps

In order to deliver our commitments to reducing waste and disposing of waste in beneficial locations, National Grid will confirm which disposal site and transport route will be utilised and ensure the Main Works Contractor is committed to adhering to the waste hierarchy so that beneficial reuse and recycling is always prioritised.

National Grid Commitment

By 2026, we will increase our construction recycling and composting rates and set a target from a 2021/22 baseline

6. Water and Drainage

Project overview

Description

Both the Tilbury and Gravesend headhouses are located within Flood Zone 3. However, these locations also benefit from protection due to defences present along the banks of the Thames estuary. There are two unnamed ordinary watercourses within close proximity to the Tilbury site and a series of ditches that are part of Eastcourt Marshes which are recognised as Main River which bound the west, east and south of the Gravesend site. Ditches under the jurisdiction of the Internal Drainage Board are present to the east of the Gravesend site near to the existing OHL.

During construction, management of surface water shall be in accordance with pollution prevention control measures and all necessary discharge permits shall be obtained from the Environment Agency.

Once the new infrastructure is in operation, surface water runoff from both sites will comprise headhouse roof runoff and water pumped from the tunnel. When the sites are operational, the surface water runoff rates are expected to be relatively low. The majority of surfacing will comprise free draining stone material with a Type 3 sub-base, meaning surface water will soak away naturally.

The surface water drainage design strategy for both Gravesend and Tilbury is to remove the road surface water via filtration trenches, which will collect and convey the water to a traditional pipe drainage system. This pipe system will also collect roof water from the headhouse and any tunnel water seepage, before entering the existing ditches which are to the east of the Proposed Development via a new headwall at Tilbury, and via a new headwall into the existing ditch running around the East/South/West perimeter of the Proposed Development at Gravesend.

Recommendations and Next Steps

National Grid has outlined all requirements to ensure the protection of the water environment within an Outline Construction Environmental Management Plan. It is expected that the appointed contractor will further develop this plan

7. Social and Economic Sustainability

Overview

In addition to the environmental aspects of sustainability discussed in previous chapters, paragraph 8 of NPPF is clear that social and economic strands of sustainability must also be considered by the planning system. Objectives relating to these additional strands of sustainability are defined in NPPF paragraph 8 as follows:

- **social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering well-designed, beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being;
- **economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

National Grid Approach

Whilst National Grid's proposed development cannot influence how housing is developed in Tilbury and Gravesend, we can support local communities through our Community Grant Programme which we have been promoting through public consultation events and meetings with local Councillors. The link for this is provided below.

[Community Grant Programme | National Grid Group](#)

In summary, communities impacted by construction work for new infrastructure projects (e.g. the building of new underground tunnels or a new substation resulting in an increase in heavy goods traffic, noise and other impacts) can apply for grants of up to £20,000.

We support projects in the following areas:

Social benefits

- Initiatives that support hard-to-reach members of the community improving diversity and inclusion.
- Initiatives that support community safety – from electricity safety to protecting at-risk members of society including the elderly and those with special needs.
- Initiatives which achieve improved educational attainment through building confidence and self-esteem of children and young people.
- Education projects especially those that upskill young people with STEM (Science, Technology, Engineering, Maths) skills.
- Activities that promote or support health and wellbeing in the local community, for example addressing energy efficiency.

Economic benefits

- Initiatives that support employment either through a work placement or retraining schemes which increase the employability of people from lower income communities back into the workplace.
- Initiatives that support capacity building for community, charity or voluntary groups to help them improve their services, whether it be reaching more users or extending the hours that the service is available.

Recommendations and Next Steps

National Grid will continue to promote the Community Grant Programme as the detailed design is progressed and encourage our Main Works Contractor to offer employment contracts to local organisations wherever possible. The workforce and project team will also participate in local volunteering opportunities.

8. Sustainability Action Plan

Overview

The Project Sustainability Action Plan encompasses the points raised in chapters 3-7 above. It is a dynamic document that is discussed each month by the project team and regularly updated. For this reason, the copy included within this document as Appendix C should be seen as a snap shot in time only.

The Action Plan is divided into four sections:

- carbon,
- resources,
- the natural environment, and
- wider sustainability considerations.

For each action, an update is provided alongside an action owner, due date and status. At the time of writing, the action plan progress is summarised in the Table below.

Action Progress	Carbon	Resources	Natural Environment	Wider Sustainability	Total
On hold	1	0	2	0	3
In progress	15	10	10	4	39
Complete	9	7	7	0	23
Total	25	17	19	4	65

Appendix A - Carbon Strategy Report

CARBON STRATEGY

TKRE, Grain-Tilbury and Kingsnorth-Tilbury 400kV Uprating FEED

REFERENCE: 30003364-MSE-XX-XX-RP-Y-10088_CARBON STRATEGY (INCLUDING TARGETS)

NATIONAL GRID NUMBER: PDD-100116-REP-057

Prepared for:

National Grid

18 May 2023

DOCUMENT VERIFICATION

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Project number: 30003364

Document title: Carbon Strategy

Document reference: 30003364-MSE-XX-XX-RP-Y-10088_CARBON STRATEGY (INCLUDING TARGETS)

Rev	Date				
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		Description	First Issue		
			Prepared by	Checked by	Approved by
		Name	George Lucas	James MacDonald	Paul Trafford
		Signature			
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		Description			
			Prepared by	Checked by	Approved by
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		Signature			
		Date			

CONTENTS.

- 1. Introduction 4
- 2. PAS 2080 Overview 6
- 3. TKRE Carbon Strategy 9
- 4. Carbon Model..... 15
- 5. Conclusions & Recommendations 20
- 6. References..... 21
- 7. Appendices 22

1. Introduction

1.1. *Project Overview*

The existing National Grid Grain-Tilbury and Kingsnorth-Tilbury 400kV circuits are forecasted to become significantly overloaded in their current capacity and require uprating. The circuits are predominantly overhead line, with cabled sections installed within a deep tunnel crossing the River Thames.

BakerHicks has been appointed to undertake the Front-End Engineering Design (FEED) of the TKRE, Grain-Tilbury and Kingsnorth-Tilbury 400kV uprating scheme and associated works, which will support the project's development at TP500 stage 4.3.

The Front-End Engineering design (FEED) study for uprating of the Grain-Tilbury and Kingsnorth-Tilbury 400kV circuits involves:

- Installation of 400kV cables within a new tunnel connection under the river Thames to match the required 3325MVA maximum rating
- Uprating of 400kV 4TK Grain-Tilbury and 4VG Kingsnorth-Tilbury overhead lines including downleads by reconductoring of the existing 4 x 400 ACSR (2780MVA) OHL sections of the Tilbury-Grain/Tilbury-Kingsnorth circuits (A784/A785) to make the entire route 3 x AAAC (3820MVA)
- Uprating of substation bays at Grain, Kingsnorth and Tilbury substations

1.2. *Scope of the Document*

The purpose of this report is to set out the key factors which needs to be included in the TKRE Carbon Strategy. This strategy is to be aligned with PAS 2080 (2023) Carbon Management in Buildings and Infrastructure.

1.3. *Definitions*

The following definitions are used within the Carbon Strategy:

Baseline

Scenario for what carbon emissions and removals would have been in the absence of planned measures aiming to reduce emissions [1]

Boundary

Physical, process, temporal, and geographical limits of activities to assess greenhouse gas (GHG) emissions and removals [1]

Carbon

Carbon refers to global warming potential (GWP), a metric used for assessing the climate change impacts of carbon emissions, includes several gases that are damaging to the environment, including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and several others including gases commonly used as refrigerants and insulation blowing agents.

The level of impact to the atmosphere is expressed in units of CO₂ equivalent (kgCO₂e) and referred to as 'carbon' emissions.

Whole life carbon

Sum of GHG emissions and removals from all work stages of a project and/or programme of works within the specified boundaries [1]

Net Zero

Reduction of anthropogenic GHG emissions to zero or to a residual level that is consistent with reaching net zero emissions in eligible 1.5 °C pathways (hence time-bound) and neutralizing the impact of residual emissions (if any) by removing an equivalent volume of carbon [1]

2. PAS 2080 Overview

2.1. *PAS 2080*

PAS 2080, Carbon management in buildings and infrastructure (2023) has recently been updated to reflect the increasing importance on reducing carbon across the full design life of infrastructure including construction, use and end of life.

The core components of PAS 2080 (2016) are set out below:

- Quantification of Carbon Emissions - Calculate the projects Carbon emissions
- Baselines – Create a baseline to monitor against
- Target Setting – Set Targets to reduce the Carbon against the baseline.
- Monitoring – Monitor performance against the baseline with updates to the calculations.
- Reporting – Robust and accurate reporting measures on performance against targets.
- Continued Improvement – Improve the Carbon performance, modelling, and reporting.

PAS 2080 (2023) has been updated to cover all the clauses shown in Figure 1, with additional clauses added in and the previous clauses refocused.

- Decarbonization Principles (Clause 4)
- Leadership (Clause 5)
- Integrating carbon management into decision-making (Clause 6)
- Assessment - Previously Quantification of Carbon Emissions (Clause 7)
- Baseline and target Setting (Clause 8)
- Monitoring and reporting (Clause 9)
- Procurement (Clause 10)
- Continual Improvement (Clause 11)
- Claims of Conformity (Clause 12)

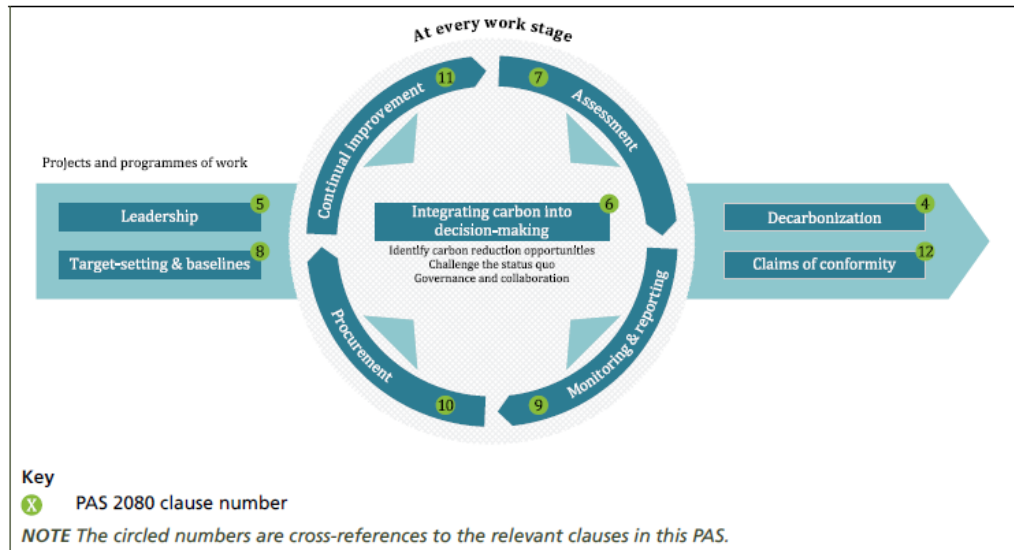


Figure 1 - The PAS 2080 Carbon Management Process [1]

The responsibilities within these clauses are set out for the different value chain members, with some responsibilities applicable for all value chain members. The value chain members are identified as the following

1. Asset owner/manager.
2. Designer.
3. Constructor.
4. Product/material supplier.

Refer to Appendix A for the further detail on the PAS 2080 responsibilities clause requirements.

2.2. TKRE Position

The TKRE project is seen to be at the Optioneering (definition) stage moving into design stage as part of the FEED Study. The Optioneering stage provides opportunities to avoid carbon as per Figure 2, including by switching to lower-carbon design approaches and improving material and performance specifications for lower carbon and resource efficiency. Thus, it is critical a robust Carbon Strategy is in place to realise these reductions.

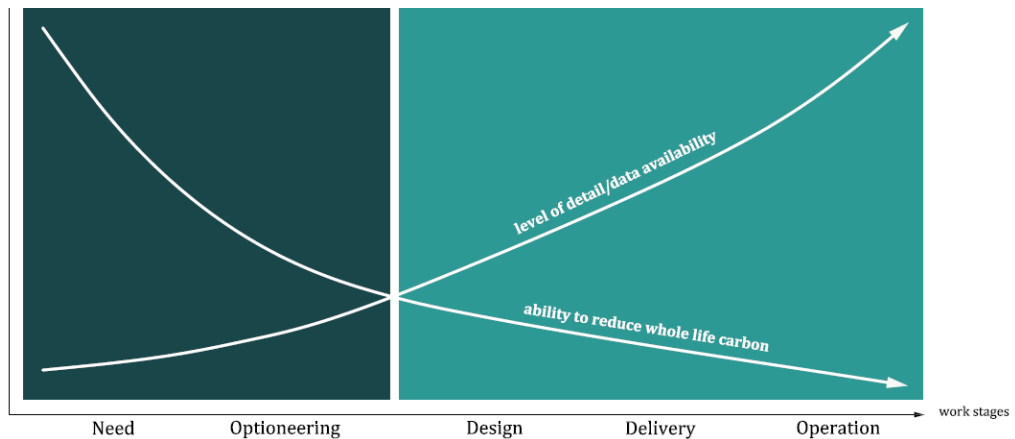


Figure 2 - Conceptual diagram to showing ability to influence carbon reduction across the different work stages of infrastructure delivery (Extract from PAS 2080:2016)

3. TKRE Carbon Strategy

3.1. *Carbon Strategy Overview*

The following are to be included within the Carbon Strategy:

1. Alignment to PAS 2080 Core Clauses.
2. All parties to carry out their responsibilities as set out in PAS 2080.
3. Additional Responsibilities to be clearly identified and set out.
4. Baseline model to be created of the initial early concept stage design.
5. Follow the carbon reduction hierarchy as presented in Figure 3 (in the order of priority shown) when identifying potential opportunities to reduce whole life carbon emissions
6. Carbon consideration to be embedded into the design processes and all key decisions.
7. Carbon Model to be updated once the initial baseline is completed with major design changes and a Carbon Register to be kept showing the impact of these design changes to the baseline.
8. Key Carbon personnel within the project teams to be identified with Carbon Champions across the different delivery teams.

3.2. *PAS 2080 Core Clauses and Carbon Responsibilities*

Table 1 sets out the PAS 2080 requirements that are applicable for the FEED study Carbon Strategy and to be followed.

Figure 3 shows the Carbon reduction hierarchy that is used within PAS 2080.

Where any further roles are identified, such as appointed Carbon Champions, their roles and responsibilities are to be clearly defined within the Carbon Strategy.

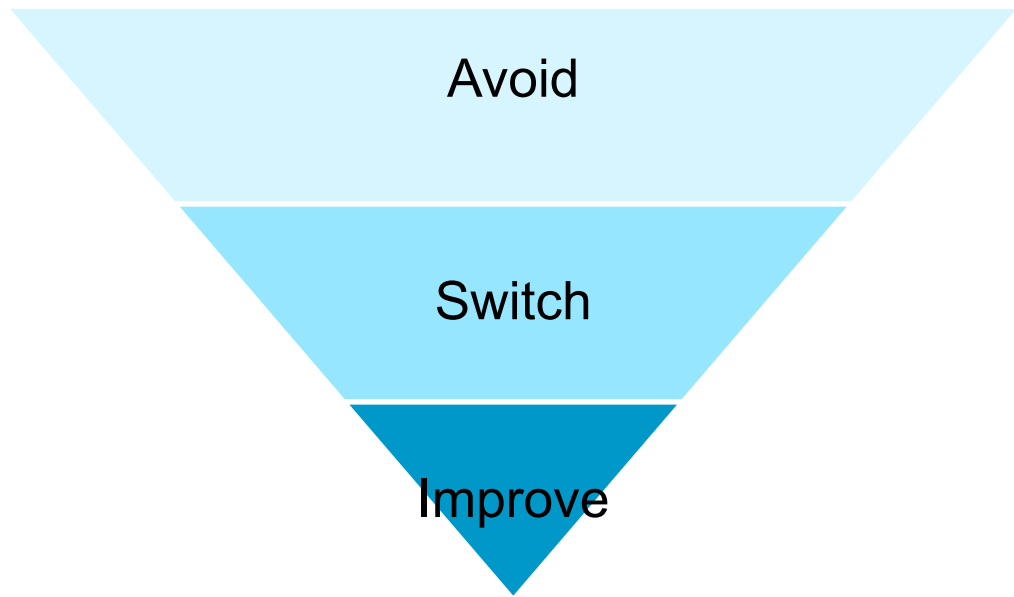


Figure 3 - Carbon Reduction Hierarchy [2]

Table 1 - PAS 2080 Carbon Requirements for TKRE FEED Study

What	How	Carbon Management Benefit	Collaboration Between	PAS Requirement
Leadership	Align carbon management with other business processes, for example: • Map out and communicate key design review dates, and align carbon assessment and reduction opportunity identification requirements to those dates • Monitor carbon reductions and progress towards targets alongside cost, risk, schedule etc and include as agenda items within design reviews	Accountability for designing in carbon reduction	Developer Designer	5.1-2-3 9.1
Carbon Reduction Hierarchy	The carbon reduction hierarchy in the design process would follow the below core principles and questions: • Avoid: Is it needed? Are there alternative solutions to building a certain component? • Switch: Which materials would deliver the lowest-carbon outcome, e.g., timber vs bricks? • Improve – For example, the use of GGBS to reduce the carbon in concrete	Innovation from the supply chain integrated into the project. Optimised, lean and clever design – for example, multipurpose assets Efficient and circular use of resources	Developer Designer	5.3.3 4.3

Innovation implementation strategy	Develop a process to encourage innovation throughout the design process, including innovation related to delivery and climate change resilience, as well as circular economy principles and opportunities	Clear steps to implementation to inform procurement in construction and operation	Developer Designer	5.2 11.1-2-3
Assessment	What is the projected whole-life carbon impact on the control and influence of the project or programme of work? Assess using initial quantities based on optioneering exercise and utilising generic carbon factors, or benchmarks where required Be transparent in assumptions and identify gaps	Clarity of where the carbon is and how this could be incorporated into procurement (e.g., for setting targets for the supply chain) Baseline enables monitoring of reductions to compare benefits during optioneering	Developer Designer	7.1

3.3. Baseline Model and Ongoing Monitoring

As per PAS 2080 an initial baseline model will be undertaken for the FEED study based on the initial proposal and business as usual approach. This model will then be updated as the design is optimised to reduce carbon, with the key design decisions that impact the Carbon being recorded on the Carbon Register to monitor the impacts of these changes.

The changes will fall into two categories:

- 1) Design change - Where a change in design leads to an increase or decrease in carbon
- 2) Scope change – Where a change in scope leads to an increase or decrease in carbon

Refer to Section 4 for further details on the Carbon Model.

When key project and design decisions are being made, the Carbon reduction hierarchy is to be referred to, Figure 3, to ensure that all opportunities for eliminating carbon are considered. This carbon consideration is to be embedded into BakerHicks and all design subconsultants, design processes and standards that are used within the FEED study.

3.3.1. Carbon Champion (CC)

Role: Act as the focal point for carbon consideration within their design team or discipline.

Responsibilities:

- Ensure the Carbon Strategy is followed
- Ensure the Carbon reduction Hierarchy is considered within design decision making for decisions in their area.
- Ensure when any design decisions are made that are likely to impact the overall carbon emissions for the project, that suitable information regarding this design change is sent to the Carbon Modeller and that the change is recorded on the Carbon Register

There will be a Carbon Champion for the following disciplines as set out in Table 2, with the Carbon Champions to be confirmed.

Table 2 - Carbon Champions for the different design disciplines

Discipline:	Carbon Champions
Architecture	TBC
Civil & Structural	TBC
M&E Services	TBC
Tunnelling	Chris Holt
HV Cables	TBC
HV Overhead Lines	TBC
HV Substations	TBC
HV Protection and Control	TBC
BIM & Visualisation	TBC

3.3.2. *Carbon Modeller (CM)*

Role: Calculate the carbon baseline and keep the carbon model and carbon register updated with key design decisions.

Responsibilities:

- Calculate the carbon baseline model
- Maintain and update the model throughout the FEED study
- Keep the Carbon register up to date alongside the Carbon model
- Liaise with Carbon Champions to ensure all design decision which impact the Project's Carbon are captured within the model and the Carbon Register.

4. Carbon Model

A key part of the Strategy is the Carbon model which will be used to calculate the Carbon for the project. The goal in quantifying the project's carbon emissions is to report predicted emissions and identify the main contributors (emissions hotspots) so it can focus its emissions reductions effort effectively.

To ensure consistency both within the FEED study and later project stages the Carbon Strategy sets out the boundary for the Carbon assessment including which Lifecycle Modules are to be included, as well as default transport distances.

4.1. *Carbon Model Boundary*

The Carbon model will consider the following boundaries

- The complete construction phase
- A 120-year operational design life

4.2. *Lifecycle Modules*

Table 2 sets out the modules that are to be considered within the Carbon Assessments for TKRE.

Figure 4 shows the Lifecycle stage approach, showing the life cycle stages and individual modules for infrastructure GHG emissions quantification. Refer to Appendix B for a detailed description of what each of the lifecycle modules covers.



Figure 4 - Modular approach showing the life cycle stages and individual modules for infrastructure GHG emissions quantification (PAS 2080:2016)

4.3. Carbon Calculation Tool

The National Grid's latest Carbon Interface Tool (CIT) will be used to carry out the Baseline. Table 3 shows the scopes covered in the CIT.

Table 3: LCA Scope for CIT (including text extracted from National Grid CIT)

BS EN 15978 Reference	Included	Notes
Before Use Stage		
A0 Preliminary Studies & consultations	Yes	National Grid has compiled an 'average' emission rate for a wide range of equipment and some civils items. These have been taken from a range of supply provided data, drawings and EPDs. For each item, the estimated materials and energy for production has been used to calculate the A1-3 emissions for those. The materials emission rates are based on ICEv3, EcolInvent 2.2, CESMM4 and BEIS
A1 Raw Material Supply	Yes	
A2 Transport (Product)	Yes	
A3 Manufacturing	Yes	
A4 Transport (Construction)	Yes (part)	These are calculated based on the weight of the item and the standard BEIS emission rates for different modes.
A5 Construction Installation Process	Yes	These are calculated for some line items in Earthworks, and otherwise in the Site Energy section. Emission rates are determined from CESMM4 or BEIS.
Use Stage		
B1 Use	No	Emissions associated with the repair and maintenance and replacement are not included. The typical investment lifecycle is set at 40 years.
B2 Maintenance	No	
B3 Repair	No	
B4 Replacement	No	
B5 Refurbishment	No	Energy emissions from buildings is generally small and therefore not included. Emissions associated with Transmission Losses are managed separately.
B6 Operational Energy Use	No	
B7 Operational Water Use	No	These relate to SF6 emissions and are based on the BEIS Global Warming Potential for SF6
B8 Other Operation Processes	Yes	
B8 User utilisation of Infrastructure	No	
End of Life Stage		
C1 De-construction and Demolition	No	

C2 Transport (End of Life)	No	C1-C4 are not included as they are subject to considerable uncertainty and likely to not be significant.
C3 Waste Processing	No	
C4 Disposal	No	
Supplementary Information beyond the Infrastructure Life cycle		
D Benefits and Loads Beyond the System Boundary	No	

4.4. *Default Transport Distances*

To ensure consistency within the baseline and carbon models going forward the following default transport distances are to be used:

Table 4 - Default transport scenarios [3]

Transport scenario	km by road	km by sea
Local	50	-
Nationally Manufactured	300	-
European Manufacture	1,500	-
Global	200	10,000

4.5. Methodology & Data Sources

The following approach will be taken to ensure a consistent carbon baseline and model throughout the Feed study. Table 5 sets out the data sources and types of data that are to be used to carry out the initial baseline model.

Table 5 - Data sources for Carbon baseline model for the Early Design phase project stage

Data Type	Data Source
Quantities for A1–A3 and scenarios	Predicted/estimated quantities provided by drawing/ design teams to Carbon Modellers
Carbon factors for A1–A3 and scenarios	• Generic carbon factors • Appropriate national carbon factors from accepted industry databases • National GRID CIT Carbon Asset Database
Scenarios for A4	Default scenarios, including predicted transport requirements as per Table 4
Scenarios for A5	Default scenario as per the Carbon tool

5. Conclusions & Recommendations

5.1. *TKRE Carbon Strategy*

The below sets out the key parts of the TKRE Feed study Carbon Strategy:

1. Alignment to PAS 2080 Core Clauses.
2. All parties to carry out their responsibilities as set out in PAS 2080.
3. Additional Responsibilities for Carbon Champions and Carbon Modellers have been set out.
4. A baseline model will be created from the initial early-stage concept design.
5. The carbon reduction hierarchy will be used identifying potential opportunities to reduce whole life carbon emissions as the design is updated.
6. Carbon consideration to be embedded into the design processes and all key decisions.
7. Carbon Model to be updated once the initial baseline is completed with major design changes and a Carbon Register to be kept showing the impact of these design changes to the baseline.

6. References

- [1] BSI, *PAS 2080: Carbon management in buildings and infrastructure*, BSI, 2023.
- [2] ICE, *Guidance Document for PAS 2080*, ICE, 2023.
- [3] RICS, *Whole life carbon assessment for the built environment*, RICS, 2017.
- [4] BSI, *PAS 2080: Carbon Management in Infrastructure*, BSI, 2016.
- [5] EFFC, *Sustainability Guides for Foundation Contractors: Guide Mo.1 Carbon Reduction*, EFFC, 2022.

7. Appendices

7.1. *Appendix B: PAS 2080 Responsibilities*

The following key responsibilities are applicable to all value chain members under PAS 2080

- Understand the carbon management objectives of the organisation and how these affect their role
- Take ownership of carbon management within their team to transfer organisational policy to day-to-day working practice and integrate carbon reduction in all decision-making
- Promote collaboration and engagement with value chain and stakeholders to influence whole-life carbon reduction across the networks and systems of which they are part. Engage with those in similar roles in the value chain and other internal practitioners to ensure alignment between working practices and sharing of best practices for optimising reduction of carbon within their control
- Contribute towards continual improvement and innovation for carbon reduction
- Proactively embed climate change-related learning into continuous professional and skills development
- Share knowledge and information

Refer to the Guidance Document for PAS 2080 for the responsibilities for the different value chain members [2]

7.2. Appendix B: Life Cycle Module Definitions

The below tables describes the different Lifecycle modules and what they cover.

Modules	Scope
A: Before use stage (construction)	
A0: Pre-construction	Preliminary studies and works such as strategy and brief development, architecture, design efforts, EIA and cost planning. These functions are largely office-based.
A1 – A3: Product stage	- Emissions associated with the extraction, processing and manufacturing of the construction material. It includes energy consumption and waste management within these processes. - Emissions associated with the movement of materials and goods within the supply chain up to the point of final factory gate.
A4: Construction process stage: Transport to works sites	Transport emissions associated with the delivery of construction material, construction equipment and construction workers to works sites.
A5: Construction process stage: Onsite stage	- Enabling works and ground works - Materials storage and any energy or otherwise needed to maintain necessary environmental conditions - Transport of materials and equipment onsite - Installation of materials and products into the infrastructure asset - Emissions associated with site water demand - Waste management activities (transport, processing, final disposal) associated with waste arising from the construction site - Production, transportation and waste management of materials/products lost during works - Carbon emissions associated with land use change
B: Use stage	
B1: Use	Carbon emitted directly from the fabric of products and materials once they have been installed as part of the infrastructure
B2 – B5: Maintenance, repair, replacement and refurbishment	Works activities and new materials for the maintenance, repair, replacement and refurbishment of the infrastructure during the use stage

Modules	Scope
B6: Operational energy	Emissions resulting from the energy used by infrastructure-integrated technical systems to enable it to deliver its service during operation. This might be to provide heating and cooling, ventilation, lighting, auxiliary energy for pumps, control and automation.
B7: Operational water	Emissions resulting from the consumption of water required by the infrastructure to enable it to operate and deliver its service. It includes all water used and its treatment (pre- and post-use) during the normal operation of the infrastructure.
B8: Other operational processes	Other process emissions arising from the infrastructure to enable it to operate and deliver its service including management of operational waste
B9: User's utilisation	Activities associated with the user's utilisation of the infrastructure during the use stage
C: End of life stage	
C1: Deconstruction	Onsite activities of deconstructing, dismantling and demolishing the infrastructure
C2: Transport	Emissions due to the transport to disposal and/or until the end-of-waste state of waste materials
C3: Waste processing for recovery	Emissions due to the treatment and processing for recovery, reuse and recycling of waste materials arising from the infrastructure
C4: Disposal	Emissions resulting from final disposal of demolition materials (neutralisation, incineration with or without utilisation of energy, landfilling with or without utilisation of landfill gases, etc.)



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Appendix B - Carbon Baseline Report

CARBON BASELINE REPORT

TKRE, Grain-Tilbury and Kingsnorth-Tilbury 400kV Uprating FEED

REFERENCE: 30003364-MSE-XX-XX-RP-Y-10106 CARBON BASELINE REPORT

NATIONAL GRID NUMBER: PDD-100116-REP-065

REFERENCE: 30003364-MSE-XX-XX-RP-Y-10106 CARBON BASELINE REPORT

Prepared for:

National Grid

27 November 2023

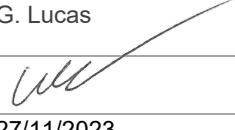
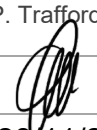
DOCUMENT VERIFICATION

Project title: TKRE, Grain-Tilbury and Kingsnorth-Tilbury 400kV Uprating FEED

Project number: 30003364

Document title: Carbon Baseline Report

Document reference: 30003364-MSE-XX-XX-RP-Y-10106 CARBON BASELINE REPORT

Rev	Date				
P01		File name	30003364-MSE-XX-XX-RP-Y-10106 Carbon Baseline Report		
		Description	First Issue		
			Prepared by	Checked by	Approved by
		Name	A. Rushton	G. Lucas	N. Darbyshire
		Signature	A. Rushton	G. Lucas	N. Darbyshire
		Date	20/11/2023	20/11/2023	20/11/2023
P02	November 2023	File name	30003364-MSE-XX-XX-RP-Y-10106 Carbon Baseline Report		
		Description	Addition of Sections 2 and 5		
			Prepared by	Checked by	Approved by
		Name	A. Rushton	G. Lucas	P. Trafford
		Signature	<i>A. Rushton</i>		
		Date	27/11/2023	27/11/2023	28/11/23

CONTENTS.

- 1. Introduction 4
- 2. Assessment Scope 5
- 3. CarboniCa Outputs 7
- 4. CarboniCa Inputs 8
- 5. Conclusions and Recommendations 37
- 6. Appendix 1 – CarboniCa Output Report 38

1. Introduction

1.1. *Project Overview*

The existing National Grid Grain-Tilbury and Kingsnorth-Tilbury 400kV circuits are forecasted to become significantly overloaded in their current capacity and require uprating. The circuits are predominantly overhead line, with cabled sections installed within a deep tunnel crossing the River Thames.

BakerHicks has been appointed to undertake the Front-End Engineering Design (FEED) of the TKRE, Grain-Tilbury and Kingsnorth-Tilbury 400kV uprating scheme and associated works, which will support the project's development at TP500 stage 4.3.

The Front-End Engineering design (FEED) study for uprating of the Grain-Tilbury and Kingsnorth-Tilbury 400kV circuits involves:

- Installation of 400kV cables within a new tunnel connection under the river Thames to match the required 3325MVA maximum rating
- Uprating of 400kV 4TK Grain-Tilbury and 4VG Kingsnorth-Tilbury overhead lines including downloads by reconductoring of the existing 4 x 400 ACSR (2780MVA) OHL sections of the Tilbury-Grain/Tilbury-Kingsnorth circuits (A784/A785) to make the entire route 3 x AAAC (3820MVA)
- Uprating of substation bays at Grain, Kingsnorth and Tilbury substations

1.2. *Scope of the Document*

The scope of this report is to detail the outputs from the carbon baseline assessment as well as a breakdown on the inputs that went into carrying out the baseline assessment. The carbon baseline assessment was carried out using CarboniCa in accordance with 30003364-MSE-XX-XX-RP-Y-10088 P02 Carbon Strategy.

2. Assessment Scope

2.1. *Assessment Scope Overview*

The following assumptions and exclusions have been made when carrying out the baseline Carbon assessment. A reference study period of 60 years has been modelled with only one fit out of the tunnel and equipment modelled.

2.2. *Carbon Assessment Project Scope*

The scope for the Carbon baseline assessment only includes the tunnel aspect of the wider project overview:

- Installation of 400kV cables within a new tunnel connection under the river Thames to match the required 3325MVA maximum rating

2.3. *Tunnel Boring Machine (TBM)*

The tunnel boring machine (TBM) itself has been excluded from the Carbon baseline assessment itself, this is due to the assumption that a refurbished TBM will be used on the project and the TBM will subsequently be refurbished and used after the project has finished.

Only the TBM consumables, such as power & lubricants, have been modelled within the baseline assessment.

The power is based upon high-level assumptions for the operation durations of the TBM, which is 6 months at 100% load followed by 2 months at reduced load. With the power generated by onsite diesel generators of a power rating of 6.5MW.

2.4. *ICE Low Carbon Route Map – Concrete Mapping*

The carbon assessment has been done in line with National Grid Engineering bulletin 2023/125, which states that “The embodied CO₂e of in-situ and precast concrete used on NGET projects shall be assessed against the benchmark ratings defined in the ICE Low Carbon Concrete Route map report” and that National Grid concrete will be required to have the following minimum grades at the time of the TKRE project

- Reinforced concrete shall achieve a minimum rating of ‘B’
- Unreinforced concrete shall achieve a minimum rating of ‘A’

These grades are shown in Figure 1 and summarised in Table 1 for the carbon factors that are used within the TKRE carbon baseline assessment.

Fig 1.2: GCB/LCCG benchmark ratings for embodied carbon, normal-weight concrete, LCA stages A1-A3 (ready-mix: cradle to batching plant gate; precast: cradle to mould)

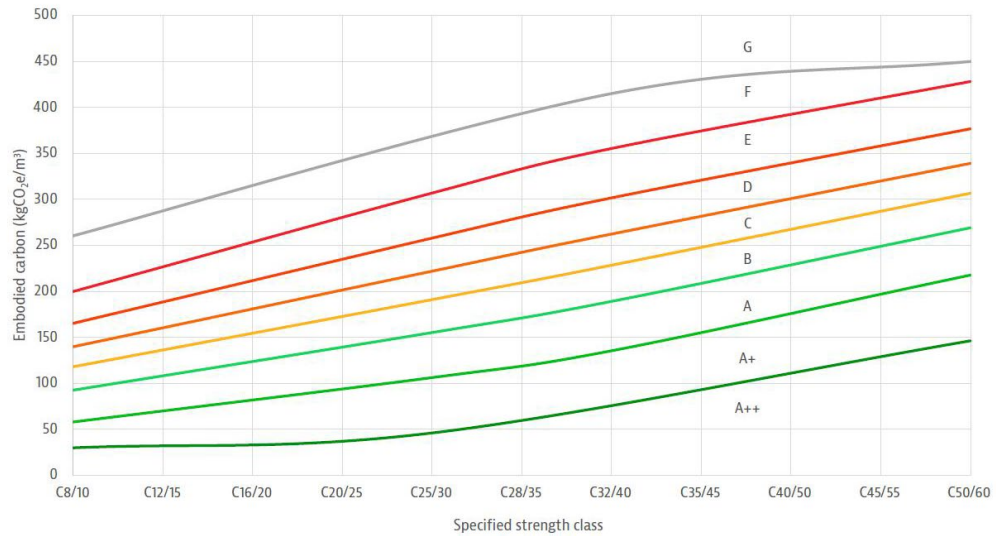


Figure 1 - LCCG benchmark ratings for embodied carbon, normal-weight concrete, LCA

Table 1 - Carbon Factors for concrete aligned to ICE low Carbon Route map

Concrete Grade	A1-A3 Embodied Carbon (kgCO ₂ e/m ³)	
	A (Unreinforced concrete)	B (Reinforced Concrete)
C20/25	140	175
C28/35	170	210
C32/40	190	230
C40/50	230	265
C50/60	265	305
C20/25	140	175

2.5. Other Assumptions and Exclusions

The following assumptions and exclusions have been made when carrying out the baseline Carbon assessment.

- Operational Energy is excluded from the assessment.
- Mechanical equipment has only had one iteration of design life modelled to enable comparison with future tools.
- Material deliveries and removals from site based on road transport

3. CarboniCa Outputs

The baseline carbon emissions from the CarboniCa Report are summarised below in Table 2 - Carbon Baseline Assessment Summary Table. With the breakdown of emissions by different scope category shown in Figure 2. For the full output report see Appendix 1.

The baseline has been built from Bill of Quantities provided by the different design disciplines.

Table 2 - Carbon Baseline Assessment Summary Table

BS EN 15978 Module Reference	Carbon Emissions (tCO ₂ e)
A1 Raw Material Supply	29,121.4
A2 Transport (Product)	
A3 Manufacturing	
A4 Transport (Construction)	2,663.9
A5 Construction Installation Process	4,190.0
Total (A1-A5)	35,975.3

For a full breakdown of the Carbon Baseline refer to the CarboniCa Output Report in Appendix 1 – CarboniCa Output Report.

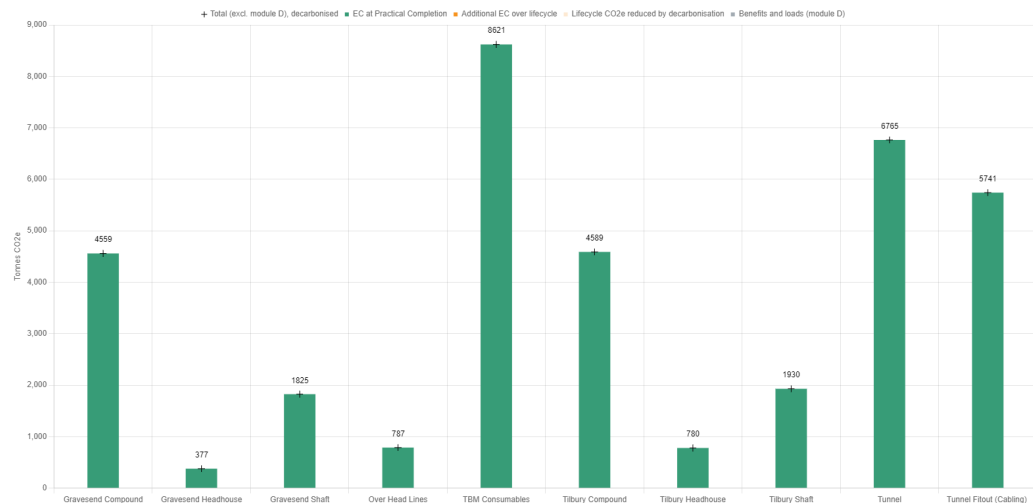


Figure 2 - Carbon Emissions by scope category

As can be seen, the highest carbon impact comes from the use of the TBM, followed by the materials required to construct the tunnel and the cabling within the tunnel. Refer to Section 5 for carbon reduction recommendations.

4. CarboniCa Inputs

4.1. CarboniCa Scope Breakdown

The breakdown of the scope, modelled within CarboniCa can be seen to be detailed below.

- Tilbury Shaft Reference **Table 3**
- Gravesend Shaft Reference **Table 4**
- Tunnel Reference **Table 5**
- TBM Consumables Reference **Table 6**
- Gravesend Headhouse Reference **Table 7**
- Gravesend Compound Reference **Table 8**
- Tilbury Headhouse Reference **Table 9**
- Tilbury Compound Reference **Table 10**
- Tilbury to Gravesend Reference **Table 11**
- Overhead Lines Reference **Table 12**
- Site Waste*
- Site Fuel and Energy*

*Site waste and site fuel and energy are modelled and reported within each category.

4.2. Table 3 - Tilbury Shaft

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
Concrete Jacking Collar	(Concrete (C40/50MPa) ICE Low Carbon Grade B	205m ³	50km	No comments/assumptions.
Concrete Pre-Cast Rings	(Concrete (C40/50MPa) ICE Low Carbon Grade B	743m ³	50km	No comments/assumptions.
Concrete – External Lining	(Concrete (C40/50MPa) ICE Low Carbon Grade B	552m ³	50km	No comments/assumptions.
Concrete Annulus Grouting	(Concrete (C40/50MPa) UK Average)	398m ³	50km	No comments/assumptions.
Concrete – Shaft Base Slab	(Concrete (C40/50MPa) ICE Low Carbon Grade B	530m ³	50km	No comments/assumptions.
Concrete Shaft Portal (2.7m thk)	(Concrete (C40/50MPa) ICE Low Carbon Grade B	189m ³	50km	No comments/assumptions.

Steel Reinforcement – External Lining	(Steel Rebar 97% Recycled Content))	328,000kg	300km	No comments/assumptions.
Aggregate – Slab Subbase	Aggregate	106m ³	50km	No comments/assumptions.
UKC203x203x86	Steel	22016kg	300km	86kg/m x 256m
PFC150x90x24	Steel	14544kg	300km	24kg/m x 606m
UKC152x152x30	Steel	2340kg	300km	30kg/m x 78m
UKC152x152x51	Steel	7344kg	300km	51kg/m x 144m
RSA90x90x6	Steel	402kg	300km	6kg/m x 67m
Cable Tray (200x200x100mm)	Steel	54.24kg	300km	1.13kg/m x 48m
Tunnel Ventilation 1	Steel (Galvanised 15% Recycled Content)	869.4kg	300km	Modelled as ducting / pipework
Tunnel Ventilation 2	Steel (Galvanised 15% Recycled Content)	753.48kg	300km	Modelled as ducting / pipework
Shower Ventilation	Steel (Galvanised 15% Recycled Content)	6.3kg	300km	Modelled as ducting / pipework
WC Ventilation	Steel (Galvanised 15% Recycled Content)	12.6kg	300km	Modelled as ducting / pipework
10% allowance for dampers, flanges and bolts	Steel (general)	164.178kg	300km	-
Sump Drainage – Pump 1	Polyethylene	55kg	300km	-
Sump Drainage – Pump 2	Polyethylene	55kg	300km	-
Domestic Water - external	Polyethylene	45kg	300km	-
Domestic Water - internal	Copper	3.71kg	300km	-
Domestic Water - internal	Copper	2.8kg	300km	-
Refrigerant – liquid line	Copper	5.04kg	300km	-
Refrigerant – vapour line	Copper	9.54kg	300km	-
Refrigerant – supporting tray	Steel (galvanised)	26.46kg	300km	-

Condensate	PVC	3.75kg	300km	-
Domestic Waste	PVC	0.9kg	300km	-
Domestic Waste	PVC	1kg	300km	-
Base Slab Steel	(Steel Rebar 97% Recycled Content)	27712kg	300km	40mm bars at 175mm centres
Portal Steel	Steel (general)	32.1t	300km	30.6t + 1.5t for seal cans
Spoil Removal	Spoil Removal	12,992m ³	50km	Removal of spoil from site

4.3. Table 4 - Gravesend Shaft

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
Concrete Jacking Collar	(Concrete (C40/50MPa) ICE Low Carbon Grade B	205m ³	50km	No comments/assumptions.
Concrete Pre-Cast Rings	(Concrete (C40/50MPa) ICE Low Carbon Grade B	725m ³	50km	No comments/assumptions.
Concrete – External Lining	(Concrete (C40/50MPa) ICE Low Carbon Grade B	539m ³	50km	No comments/assumptions.
Concrete Annulus Grouting	(Concrete (C40/50MPa) ICE Low Carbon Grade B	398m ³	50km	No comments/assumptions.
Concrete – Shaft Base Slab	(Concrete (C40/50MPa) ICE Low Carbon Grade B	530m ³	50km	No comments/assumptions.
Concrete Shaft Portal (2.0m thk)	(Concrete (C40/50MPa) ICE Low Carbon Grade B	158m ³	50km	No comments/assumptions.
Steel Reinforcement – External Lining	(Steel Rebar 97% Recycled Content))	328,000kg	300km	No comments/assumptions.
Aggregate – Slab Subbase	Aggregate	106m ³	50km	No comments/assumptions.
UKC203x203x86	Steel	22016kg	300km	86kg/m x 256m
PFC150x90x24	Steel	14544kg	300km	24kg/m x 606m
UKC152x152x30	Steel	2340kg	300km	30kg/m x 78m

UKC152x152x51	Steel	7344kg	300km	51kg/m x 144m
RSA90x90x6	Steel	402kg	300km	6kg/m x 67m
Cable Tray (200x200x100mm)	Steel	54.24kg	300km	1.13kg/m x 48m
Tunnel Ventilation 1	Steel (Galvanised 15% Recycled Content)	317.52kg	300km	Modelled as ducting / pipework
Tunnel Ventilation 2	Steel (Galvanised 15% Recycled Content)	317.52kg	300km	Modelled as ducting / pipework
Shower Ventilation	Steel (Galvanised 15% Recycled Content)	3.15kg	300km	Modelled as ducting / pipework
WC Ventilation	Steel (Galvanised 15% Recycled Content)	3.15kg	300km	Modelled as ducting / pipework
10% allowance for dampers, flanges and bolts	Steel (general)	35kg	300km	-
Sump Drainage – Pump 1	Polyethylene	35kg	300km	-
Sump Drainage – Pump 2	Polyethylene	35kg	300km	-
Domestic Water - external	Polyethylene	60kg	300km	-
Domestic Water - internal	Copper	4.77kg	300km	-
Domestic Water - internal	Copper	3.36kg	300km	-
Refrigerant – liquid line	Copper	3.36kg	300km	-
Refrigerant – vapour line	Copper	6.36kg	300km	-
Refrigerant – supporting tray	Steel (galvanised)	17.64kg	300km	-
Condensate	PVC	2.25kg	300km	-
Domestic Waste	PVC	3kg	300km	-
Domestic Waste	PVC	0.25kg	300km	-
Base Slab Steel	(Steel Rebar 97% Recycled Content)	27712kg	300km	40mm bars at 175mm centres
Portal Steel	Steel (general)	25.1t	300km	-
Spoil Removal	Spoil Removal	12,358m ³	20km	Includes bulking factor for spoil

4.4. Table 5 - Tunnel Scope

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
Pre-cast Segments	C50/60 – Concrete – ICE Low Carbon Route-map Grade B	7360m ³	300km	Unlikely that C55/60 is locally sourced, assumed nationally.
TBM Annulus Grouting	(Concrete (C40/50MPa) UK Average)	3187m ³	300km	Assumed to be TamCem 9BFG (Normet) or similar Density from internet search suggests 1.48g/cm ³ Cement, Cement Replacement, Bentonite, Retardant, Accelerator
Fore Shunt Sprayed Concrete Lining	(Concrete (C40/50MPa) UK Average)	715m ³	300km	-
Spoil Removal	Spoil Removal	72,690m ³	50km	Includes bulking factor for spoil

4.5. Table 6 - TBM Consumables

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
(EPB) Foam Agent	Underground Admixture	115m ³	300km	Assumed to be similar to underground admixture Underfoam ABF 500 - EPD for this used. Foam Underground Admixture EPD used to model this.
(EPB) Foam Polymer	Epoxide Resin	3.5m ³	300km	Assumed to be TamSoil 260CF (Normet) or similar - Internet search suggests density of 1.03g/cm ³ Modelled as Epoxide Resin
(STM) Bentonite	Clay Tile	1119m ³	50km	Internet search suggests density of milled bentonite clay is 0.8kg/m ³ Modelled as Clay Tile as relevant EPD not found.
(STM) Polymer	Epoxide Resin	34m ³	300km	Assumed to be TamSoil 600CP (Normet) or similar

				Internet search suggests density of 1.01g/m ³ Modelled as Epoxide Resin
(STM) Acid	Sulphuric Acid	1488m ³	50km	Assumed to be sulphuric acid with a density of 1.83g/cm ³ from internet search From Winnipeg.CA database
(General) Diesel	Diesel	87,000 litres	50km	m ³ provided and converted to Litres 1:1000
(STM) Lubricant	Epoxide Resin	2.2m ³	50km	Assumed similar to Epoxy Resin Density of Epoxy Resin as 1.2g/cm ³ - 1.3g/cm ³ . Modelled as epoxy resin as relevant EPD not found.
(STM) Hydraulic Oil	Hydraulic Oil (Oil)	266,400 kWh	50km	Internet search suggests 1 litre of oil will generate 11.84kWh. 1 m ³ = 1000litres Therefore 22,500litres hence 266,400kWh
Power Requirements	Electricity	28,935,000 kWh	50km	24/7 source, 6.5MW for 6 months (4230 hrs) & 1MW for 2 months (1440 hrs)

4.6. Table 7 – Gravesend Headhouse

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
Building Primary Steelwork	Steel (general)	19000kg	300km (Road)	Master series model, rounded up to 18,000. Approx. 5% added for connections.
Building Roof Purlin	Steel (general)	1355kg	300km (Road)	Metsec 232Z18 @ 1m centres (5.3kg/m ² plus 10%).
Slabs Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	106m ³	300km (Road)	Concrete density – 2400 kg/m ³
Slabs Rebar	Steel Rebar 97% Recycled Content	11605kg	300km (Road)	-

Pile Caps Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	13.2m ³	300km (Road)	-
Pile Caps Rebar	Steel Rebar 97% Recycled Content	1521kg	300km (Road)	115kg/m ³
Beams – Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	68m ³	300km (Road)	-
Beams – Rebar	Steel Rebar 97% Recycled Content	15629kg	300km (Road)	230kg/m ³
Piles	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	55.7m ³	300km (Road)	Pile design not complete, assume 450mm diameter, 25m long.
Shaft Stairs Steelwork	Steel (general)	22000kg	300km (Road)	Master series model, rounded up to 21,000. Approx. 5% added for connections.
Plumbing Fixtures	Plastics	0.003243235m ³	300km (Road)	Density assumed to be 970kg/m ³
Roller Shutter 2500mm x3000mm	Industrial Overhead Door – Assa Abloy OH1042F	7.5m ²	300km (Road)	-
RAL 7016	Paint (Wet)	0.422916837m ³	300km (Road)	1300kg/m ³
RAL 7035	Paint (Wet)	0.063m ³	300km (Road)	1300kg/m ³
Glass 910x1210mm	Glass (Toughened)	0.01934856m ³	300km (Road)	2500kg/m ³
Door 1010x2110mm	Timber – Plywood	0.128868428m ³	300km (Road)	540kg/m ³
Door 1010x2110mm Offset 346mm	Timber – Plywood	0.128671221m ³	300km (Road)	540kg/m ³
Door 1010x2110mm	Timber – Plywood	0.9030947424m ³	300km (Road)	540kg/m ³
Window Frame	PVC	0.026891413m ³	300km (Road)	

Default Wall	Brick – Generic Brick BDA UK	0.3552m ³	300km (Road)	1900kg/m ³
Wall Block – Lightweight	British Precast Conc Fed – UK Precast Concrete Block	19.55845228m ³	300km (Road)	2400kg/m ³
Cladding Rail Gap	Steel (Structural 20% Recycled Content)	136.46160671m ³	300km (Road)	7750kg/m ³ Combined volume = 36.0976588m ³ + 44.60251081m ³ + 32.7897597m ³ + 22.9716774m ³
RAL 7035	Paint (Wet)	104.5636474m ³	300km (Road)	1200kg/m ³ Combined volume = 34.46798302m ³ + 27.56823113m ³ + 25.22293892m ³ + 17.30449433m ³
Concrete – Cast-in-Place Concrete Wall	C20/25 – Concrete – ICE Low Carbon Route-map Grade B	1.112m ³	300km (Road)	-
Grass Roof Generic	Green Roof – Urbanscape Extensive (Full System)	513.053892m ²	300km (Road)	80kg/m ² estimated weight
1220x457x356mm Wood – Cherry	Timber - Softwood	0.032634463m ³	300km (Road)	700kg/m ³
Outdoor Condenser	Electrical Machinery	58kg	200km (Road) 10000km (Sea)	-
Indoor Unit	Electrical Machinery	21kg	200km (Road) 10000km (Sea)	-
Electric Panel Heater	Electrical Machinery	37.4kg	200km (Road) 10000km (Sea)	-
Electric Shower	Electrical Machinery	-	200km (Road) 10000km (Sea)	-
Electric Water Heater	Electrical Machinery	-	200km (Road)	-

			10000km (Sea)	
Extract Fan	Electrical Machinery	-	200km (Road) 10000km (Sea)	-
Drainage Pump	Electrical Machinery	141.8kg	200km (Road) 10000km (Sea)	-
Damper Actuator	Electrical Machinery	1kg	200km (Road) 10000km (Sea)	-
LV Switchboard	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
400A ACB	No Carbon Factor Found	2 units	200km (Road) 10000km (Sea)	-
63A MCCB	No Carbon Factor Found	8 units	200km (Road) 10000km (Sea)	-
100A MCCB	No Carbon Factor Found	7 units	200km (Road) 10000km (Sea)	-
250A MCCB	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Digital Meter	No Carbon Factor Found	2 units	200km (Road) 10000km (Sea)	-
Mobile Generator Plugin Point	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-

PFC Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Harmonic Conditioning Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Sump Pump Control Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Stair Shaft Hoist	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
110V Tripping Battery	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Scada Rack	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Radio/Comms Rack	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Emergency Lighting Static Inverter Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Emergency Lighting Static Inverter Batteries	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Distribution Boards	No Carbon Factor Found	2 units	200km (Road) 10000km (Sea)	-
Transient Voltage Surge Suppression Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-

Fire Alarm Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Security Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Tilbury Grain Relay Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Tilbury Kingsnorth CFD Relay Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
DTS Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Leaky Feeder Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Optic Feeder Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
1C 185 Single Core 90 thermosetting insulated non-mag arm LSF	Cable – Miscellaneous	230m	200km (Road) 10000km (Sea)	-
1C 16mm Single Core 90 thermosetting insulated non-arm LSF	Cable – Miscellaneous	50m	200km (Road) 10000km (Sea)	-
3C 16mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	15m	200km (Road) 10000km (Sea)	-
3C 2.5mm FP200	Cable – Miscellaneous	15m	200km (Road) 10000km	-

			(Sea)	
3C 2.5mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	15m	200km (Road) 10000km (Sea)	-
3C 25mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	10m	200km (Road) 10000km (Sea)	-
3C 4mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	30m	200km (Road) 15m10000km- (Sea)	-
3C 6mm FP600	Cable – Miscellaneous	15m	200km (Road) 10000km (Sea)	-
4C 25mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	45m	200km (Road) 10000km (Sea)	-

4.7. Table 8 – Gravesend Compound

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
Fencing Steel	Steel (general)	400m	300km (Road)	2.4m high steel palisade fence @ approx. 30kg/m.
Fencing Foundations	C28/35 – Concrete – ICE Low Carbon Route-map Grade A	44.2m ³	300km (Road)	Estimate 150no. Foundations @ 500m diameter, 1500mm deep.
Fencing – Burrow Beam	C28/35 – Concrete – ICE Low Carbon Route-map Grade A	42.0m ³	300km (Road)	300x350mm beam following fence line.
Surface Chippings	Stone – General (aggregate and sands)	375m ³	300km (Road)	Estimate 5,000m ² @ 75mm thick

Subbase	Stone – General (aggregate and sands)	1500m ³	300km (Road)	Estimate 5,000m ² @ 300mm thick
Road Surfacing	Asphalt 4% Bitumen Binder Content	250m ³	300km (Road)	Estimate 1,250m ² @ 200mm build up above sub base
Road Subbase	Stone – General (aggregate and sands)	525m ³	300km (Road)	Estimate 1,750m ² @ 300mm thick
Footpath	C28/35 – Concrete – ICE Low Carbon Route-map Grade B	7.5m ³	300km (Road)	Estimate 50m @ 1m wide x 150mm thick
Drainage Surface Water Pipe	PVC Pipe	300m	300km (Road)	-
Drainage Surface Water Manhole	Precast Concrete Manhole -1.2m dia	9 units	300km (Road)	-
Drainage Foul Water Pipe	PVC Pipe	25m	300km (Road)	-
Drainage Foul Water Manhole	Plastic Inspection Chamber – 600mm dia 1.2m-3m depth	3 units	300km (Road)	-
Drainage Cess Pit	Cess Pit	1 unit	300km (Road)	https://www.kingspan.com/gb/en/products/water-management/cesspools/cesspools-silage-tanks/
Drainage Headwall	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	1 unit	300km (Road)	Sewers For Adoption SFA20 B Headwall with Steps Althon
Cable Drawpits	Plastic Inspection Chamber – 600mm dia 1.2m-3m depth	25 units	300km (Road)	Estimate up to 25no. Required, typically 1.2m square, 1.2m deep. 150mm
Cable Ducts	Plastic Cable Ducting – 150mm	1760m	300km (Road)	Estimate 4no. following fence, plus 10%
Fire Water Tank	Steel (general)	1 unit	300km (Road)	Approx. 6m diameter x 5m height (120,000 litres)
Fire Water Tank Concrete	C28/35 – Concrete – ICE Low Carbon Route-map Grade B	14.7m ³	300km (Road)	Estimate 7m x 7m x 0.3m thick

Fire Water Tank – Reinforcement	Steel Rebar 97% Recycled Content	1691kg	300km (Road)	115kg/m³
AIS Steel Structures	Steel (general)	5592kg	300km (Road)	Assume 24no. SHS300x8 @ 73kg/m, 2.4m high, plus 33% for other elements
AIS Pile Caps – Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	188m³	300km (Road)	-
AIS Pile Caps Rebar	Steel Rebar 97% Recycled Content	21611kg	300km (Road)	115kg/m³
Piles AIS	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	509m³	300km (Road)	Pile design not complete, assume 450mm diameter, 25m long
Lighting Column Foundation	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	30m³	300km (Road)	Estimate 30no. @ 1m x 1m x 1m
Cable Trough	C20/25 – Concrete – ICE Low Carbon Route-map Grade B	226720kg	300km (Road)	Estimated CSA: Side; 0.25*4.7, Top; 0.225*2.7, Bottom 0.25*2.7
400kV Cable Sealing Ends	400kV Cable Sealing Ends	12 units	200km (Road) 10,000km (Sea)	-
400kV Earth Switch	400kV Earth Switch 3ph	6 units	200km (Road) 10,000km (Sea)	-
400kV Ring Type Current Transformer	400kV Voltage Transformers 1ph	12 units	200km (Road) 10,000km (Sea)	-
(ODxWT) 140x10mm Rigid Aluminium Busbar	Aluminium (extrusion)	1121kg	300km	-
40.2mm Stranded Aluminium Conductor	40.2mm Stranded Aluminium Conductor	170m	300km	Density – 2700kg/m³

Earth Tape – 500mm*4mm	Copper (0% Recycled)	1400kg	300km	-
Earth Tape – 500mm*6mm	Copper (0% Recycled)	270kg	300km	-
Earth Rod	Copper (0% Recycled)	4.3kg	300km	-
HF Earth Rod	Copper (0% Recycled)	8.6kg	300km	-
360kV Surge Arrestor	No Carbon Factor Found	170kg	200km (Road) 10,000km (Sea)	-

4.8. Table 9 – Tilbury Headhouse

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
Primary Steelwork	Steel (general)	27,500kg	300km (Road)	
Roof Purlins	Steel (general)	2809kg	300km (Road)	Metsec 232Z18 @ 1m centres (5.3kg/m ² plus 10%)
Slabs Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	192.7m ³	300km (Road)	-
Slabs Rebar	Steel Rebar 97% Recycled Content	21197kg	300km (Road)	110kg/m ³
Pile Caps – Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	26.5m ³	300km (Road)	-
Pile Caps Rebar	Steel Rebar 97% Recycled Content	3043kg	300km (Road)	115kg/m ³
Beams Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	104.2m ³	300km (Road)	-
Beams Rebar	Steel Rebar 97% Recycled Content	23968kg	300km (Road)	230kg/m ³
Piles	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	111.3m ³	300km (Road)	-
Shaft Stairs Steelwork	Steel (general)	22000kg	300km (Road)	Masterseries model, rounded up to 21,000. Approx. 5% added for connections
Plumbing Fixtures	Plastics	0.0032432 35m ³	300km (Road)	Density assumed to be 970kg/m ³
Roller Shutter 2500mm x3000mm	Industrial Overhead Door – Assa Abloy OH1042F	7.5m ²	300km (Road)	-
RAL 7016	Paint (Wet)	0.4229168 37m ³	300km (Road)	1300kg/m ³
RAL 7035	Paint (Wet)	0.063m ³	300km (Road)	1300kg/m ³

Glass 910x1210mm	Glass (Toughened)	0.0193485 6m ³	300km (Road)	2500kg/m ³
Door 1010x2110mm	Timber – Plywood	0.1288684 28m ³	300km (Road)	540kg/m ³
Door 1010x2110mm Offset 346mm	Timber – Plywood	0.1286712 21m ³	300km (Road)	540kg/m ³
Door 1010x2110mm	Timber – Plywood	0.9030947 424m ³	300km (Road)	540kg/m ³
Window Frame	PVC	0.0268914 13m ³	300km (Road)	
Default Wall	Brick – Generic Brick BDA UK	0.3552m ³	300km (Road)	1900kg/m ³
Wall Block – Lightweight	British Precast Conc Fed – UK Precast Concrete Block	19.558452 28m ³	300km (Road)	2400kg/m ³
Cladding Rail Gap	Steel (Structural 20% Recycled Content)	136.46160 671m ³	300km (Road)	7750kg/m ³ Combined volume = 36.0976588m ³ + 44.60251081m ³ + 32.7897597m ³ + 22.9716774m ³
RAL 7035	Paint (Wet)	104.56364 74m ³	300km (Road)	1200kg/m ³ Combined volume = 34.46798302m ³ + 27.56823113m ³ + 25.22293892m ³ + 17.30449433m ³
Concrete – Cast-in-Place Concrete Wall	C20/25 – Concrete – ICE Low Carbon Route-map Grade B	1.112m ³	300km (Road)	-
Grass Roof Generic	Green Roof – Urbanscape Extensive (Full System)	513.05389 2m ²	300km (Road)	80kg/m ² estimated weight
1220x457x356m m Wood – Cherry	Timber - Softwood	0.0326344 63m ³	300km (Road)	700kg/m ³
Outdoor Condenser	Electrical Machinery	114kg	200km (Road) 10000km (Sea)	-
Indoor Unit	Electrical Machinery	38kg	200km (Road) 10000km (Sea)	-
Electric Panel Heater	Electrical Machinery	60.4kg	200km (Road) 10000km	4.6kg + 4.6kg + 5.9kg + 5.9kg + 8.7kg + 8.7kg + 8.7kg + 8.7kg + 4.6kg = 60.4kg

			(Sea)	
Electric Tubular Heater	Electrical Machinery	0.9kg	200km (Road) 10000km (Sea)	-
Electric Shower	Electrical Machinery	-	200km (Road) 10000km (Sea)	-
Electric Water Heater	Electrical Machinery	-	200km (Road) 10000km (Sea)	-
Tunnel Ventilation Fan	Electrical Machinery	2780kg	200km (Road) 10000km (Sea)	-
Tunnel Ventilation Fan Motor	Electrical Machinery	1300kg	200km (Road) 10000km (Sea)	-
Extract Fan	Electrical Machinery	30kg	200km (Road) 10000km (Sea)	-
Drainage Pump	Electrical Machinery	418kg	200km (Road) 10000km (Sea)	-
Variable Speed Drive	Electrical Machinery	100kg	200km (Road) 10000km (Sea)	-
Damper Actuator	Electrical Machinery	1kg	200km (Road) 10000km (Sea)	-

Auxiliary Transformer 500kVA	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
LV Switchboard	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
800A ACB	No Carbon Factor Found	5 units	200km (Road) 10000km (Sea)	-
63A MCCB	No Carbon Factor Found	9 units	200km (Road) 10000km (Sea)	-
100A MCCB	No Carbon Factor Found	7 units	200km (Road) 10000km (Sea)	-
200A MCCB	No Carbon Factor Found	3 units	200km (Road) 10000km (Sea)	-
250A MCCB	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Digital Meter	No Carbon Factor Found	3 units	200km (Road) 10000km (Sea)	-
Mobile Generator Plugin Point	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Generator Loadbank	No Carbon Factor Found	1 unit	200km (Road)	-

			10000km (Sea)	
400kVA Standby Generator	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Generator Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
PFC Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Harmonic Conditioning Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Tunnel Ventilation Fan 1 VSD	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Tunnel Ventilation Fan 2 VSD	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Sump Pump Control Panel	No Carbon Factor Found	2 units	200km (Road) 10000km (Sea)	-
Stair Shaft Hoist	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
110V Tripping Battery	No Carbon Factor Found	1 unit	200km (Road) 10000km	-

			(Sea)	
Scada Rack	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Radio/Comms Rack	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Emergency Lighting Static Inverter Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Emergency Lighting Static Inverter Batteries	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Distribution Boards	No Carbon Factor Found	3 units	200km (Road) 10000km (Sea)	-
Transient Voltage Surge Suppression Unit	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Fire Alarm Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Security Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Tilbury Grain Relay Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-

Tilbury Kingsnorth CFD Relay Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
DTS Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Leaky Feeder Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km (Sea)	-
Optic Feeder Panel	No Carbon Factor Found	1 unit	200km (Road) 10000km- (Sea)	-
1C 185 Single Core 90 thermosetting insulated non-mag arm LSF	Cable – Miscellaneous	500m	200km (Road) 10000km (Sea)	-
1C 16mm Single Core 90 thermosetting insulated non-arm LSF	Cable – Miscellaneous	50m	200km (Road) 10000km (Sea)	-
3C 16mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	40m	200km (Road) 10000km (Sea)	-
3C 25mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	15m	200km (Road) 10000km (Sea)	-
3C 2.5mm FP200	Cable – Miscellaneous	20m	200km (Road) 10000km (Sea)	-
3C 2.5mm Multicore 90 thermosetting	Cable – Miscellaneous	15m	200km (Road)	-

insulated armoured LSF			10000km (Sea)	
3C 4mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	50m	200km (Road) 10000km (Sea)	-
3C 6mm FP600	Cable – Miscellaneous	20m	200km (Road) 10000km (Sea)	-
4C 25mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	95m	200km (Road) 10000km (Sea)	-
4C 70mm Multicore 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	80m	200km (Road) 10000km (Sea)	-
1C 70mm Single Core 90 thermosetting insulated armoured LSF	Cable – Miscellaneous	80m	200km (Road) 10000km (Sea)	-

4.9. Table 10 – Tilbury Compound

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
Fencing Steel	Steel (general)	9000kg	300km (Road)	2.4m high steel palisade fence @ approx. 30kg/m
Fencing Foundations	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	35.3m ³	300km (Road)	Estimate 120no. Foundations @ 500m diameter, 1500mm deep
Fencing Burrow Beam	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	31.5m ³	300km (Road)	300x350mm beam following fenceline
Surface Chippings	Aggregate	375m ³	300km (Road)	Estimate 5,000m ² @ 75mm thick
Subbase	Stone – General (aggregate and sands)	1500m ³	300km (Road)	Estimate 5,000m ² @ 300mm thick
Road Surfacing	Asphalt 4% Bitumen Binder Content	150m ³	300km (Road)	Estimate 750m ² @ 200mm thick
Road Subbase	Stone – General (aggregate and sands)	225m ³	300km (Road)	Estimate 750m ² @ 300mm thick
Footpath	C28/35 – Concrete – ICE Low Carbon Route-map Grade A	21m ³	300km (Road)	Estimate 140m @ 1m wide x 150mm thick
Drainage Surface Water Pipe	PVC Pipe	325m	300km (Road)	-
Drainage Surface Water Manhole	Precast Concrete Manhole – 1.2m dia	15 units	300km (Road)	-
Drainage Foul Water Pipe	PVC Pipe	50m	300km (Road)	-
Drainage Foul Water Manhole	Plastic Inspection Chamber – 600mm dia 1.2m-3m depth	3 units	300km (Road)	
Drainage Cess Pit	Cess Pit	1 unit	300km (Road)	https://www.kingspan.com/gb/en/products/water-management/cesspools/cesspools-silage-tanks/

Drainage Headwall	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	1 unit	300km (Road)	Sewers For Adoption SFA20 B Headwall with Steps Althon
Drainage Oil Interceptor	Petrol Interceptor – Plastic PP	1 unit	300km (Road)	SPEL Puraceptor® Class 1 Full Retention Separators - SPEL Products
Cable Drawpits	Plastic Inspection Chamber – 600mm dia 1.2m-3m depth	20 units	300km (Road)	Estimate up to 20no. Required, typically 1.2m square, 1.2m deep. 150mm
Cable Ducts	Plastic Cable Ducting – 150mm	1320m	300km (Road)	Estimate 4no. following fence, plus 10%
Fire Water Tank	Steel (general)	1 unit	300km (Road)	Approx. 6m diameter x 5m height (120,000 litres)
Fire Water Tank Foundation	C28/35 – Concrete – ICE Low Carbon Route-map Grade B	14.7m ³	300km (Road)	Estimate 7m x 7m x 0.3m thick
Fire Water Tank Reinforcement	Steel Rebar 97% Recycled Content	1691kg	300km (Road)	115kg/m ³
AIS Steel Structures	Steel (general)	5592kg	300km (Road)	Assume 24no. SHS300x8 @ 73kg/m, 2.4m high, plus 33% for other elements
AIS Pile Caps Concrete	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	188m ³	300km (Road)	-
AIS Pile Caps Rebar	Steel Rebar 97% Recycled Content	21611kg	300km (Road)	115kg/m ³
Piles – AIS	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	509m ³	300km (Road)	Pile design not complete, assume 450mm diameter, 25m long
Lighting Column Foundations	C28/35 – Concrete – ICE Low Carbon Route-map Grade B	30m ³	300km (Road)	Estimate 30no. @ 1m x 1m x 1m
Aux Transformer Bund	C28/35 – Concrete – ICE Low Carbon Route-map Grade B	14.4m ³	300km (Road)	estimate

Aux Transformer Bund Rebar	Steel Rebar 97% Recycled Content	1656kg	300km (Road)	115kg/m ³
Cable Trough	C20/25 – Concrete – ICE Low Carbon Route-map Grade B	408096kg	300km (Road)	Estimated CSA: Side; 0.25*4.7, Top; 0.225*2.7, Bottom 0.25*2.7
400kV Cable Sealing Ends	400kV Cable Sealing Ends	12 units	200km (Road) 10,000km (Sea)	-
400kV Earth Switch	400kV Earth Switch 3ph	6 units	200km (Road) 10,000km (Sea)	-
400kV Ring Type Current Transformer	400kV Voltage Transformers 1ph	12 units	200km (Road) 10,000km (Sea)	-
(ODxWT) 140x10mm Rigid Aluminium Busbar	Aluminium (extrusion)	1121kg	300km	-
40.2mm Stranded Aluminium Conductor	40.2mm Stranded Aluminium Conductor	170m	300km	Density – 2700kg/m ³
11kV/415V Transformer	400kV Voltage Transformer 1ph	2920kg	200km (Road) 10,000km (Sea)	-
Earth Tape – 500mm*4mm	Copper (0% Recycled)	1400kg	300km	-
Earth Tape – 500mm*6mm	Copper (0% Recycled)	270kg	300km	-
Earth Rod	Copper (0% Recycled)	4.3kg	300km	-
HF Earth Rod	Copper (0% Recycled)	8.6kg	300km	-
360kV Surge Arrestor	No Carbon Factor Found	170kg	200km (Road) 10,000km (Sea)	-

4.10. Table 11 – Tilbury to Gravesend (Tunnel Fitout)

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
400kV XPLE Cable	400kV Single-core Cable	32200m	200km (Road) 10,000km (Sea)	-
OpTel Fibre	Cable - Miscellaneous	2500m	200km (Road) 10,000km (Sea)	-
Leaky Feeder	Cable - Miscellaneous	2420m	200km (Road) 10,000km (Sea)	-
Leaky Feeder (Back-up)	Cable - Miscellaneous	2420m	200km (Road) 10,000km (Sea)	-
SCS Fibre	Cable - Miscellaneous	2500m	200km (Road) 10,000km (Sea)	-
DTS Fibre	Cable - Miscellaneous	2500m	200km (Road) 10,000km (Sea)	-
TCS Ethernet	Cable - Miscellaneous	2420m	200km (Road) 10,000km (Sea)	-
400kV Sectionalising Joints	400kV Cable Sealing Ends (Polymetric)	24 units	200km (Road) 10,000km (Sea)	-

500m ² Bonding Leads	Cable - Miscellaneous	480m	200km (Road) 10,000km (Sea)	-
Power Cable Cleats	Aluminium (general)	1728kg	200km (Road) 10,000km (Sea)	3kg/item x 576 items
Power Cable Saddle	Aluminium (general)	9576kg	200km (Road) 10,000km (Sea)	3kg/item x 3192 items
Power Cable Straps	Aluminium (general)	10620kg	200km (Road) 10,000km (Sea)	10kg/item x 1062 items
UKC152x152x30	Steel (general)	22016kg	200km (Road) 10,000km (Sea)	86kg/item x 256 items

4.11. Table 12 – Overhead Lines

Name	Material (material modelled)	Quantity	Travel Distance	Comments/Assumptions
OHL Gantries	Steel – Hot Dip Galvanised	120000kg	300km	-
Gantry Crane Foundations	C32/40 – Concrete – ICE Low Carbon Route-map Grade B	121.5m ³	300km	-
Rebar	Liberty Steel Reinforcement Bar and Fabric (Mesh)	18225kg	300km	-
Gantry Piles	C28/35 – Concrete – ICE Low Carbon Route-map Grade B	814.3m ³	300km	-
Gantry Pile Rebar	Liberty Steel Reinforcement Bar and Fabric (Mesh)	81430kg	300km	-

5. Conclusions and Recommendations

The highest carbon impact comes from the use of the TBM, followed by the materials required to construct the tunnel and the cabling within the tunnel itself.

There are limited changes which can be made to the cabling within the tunnel due to the cabling requirements and itself has already had its design optimised between carbon impact and long term durability. A saving could be made on the total power requirements- if an Earth Pressure Balance TBM is used as this will not require a slurry treatment plant to function, and in general require fewer consumables; *the Contractor* will need to determine the best solution based on their proposed design.

The implementation of other opportunities identified in the Sustainability Action Plan - 100116 - Grain-Tilbury & Kingsnorth-Tilbury Thermal Upgrading (NOA - SE14) will reduce the carbon of the project such as the use of barges for spoil removal and specifying steel from Electric Arc Furnaces with high recycled steel contents and thus reduced emissions.

Currently the carbon baseline assessment is based on the removal of spoil and the delivery of materials to site by road transport. There is the potential to use barges on the Thames to reduce the emissions from this road transport and additionally reduce the number of local road transport journeys by many thousands.

The volume of concrete used in the project is sizable and has a large impact, though by specifying an ICE Low Carbon Route map grade B or A concrete, low carbon concrete will be being used. There is potential to further save carbon by selecting concrete that exceeds the minimum for that grade.

For aggregates, potential to save carbon include reusing site won aggregates where possible, recycled aggregates or new low carbon options such as incinerator bottom ash aggregate.

6. Appendix 1 – CarboniCa Output Report

CarboniCa

Whole life carbon assessment

TKRE

500189

TKRE - Baseline P02

28 November 2023



Data quality check carried out?

**MORGAN
SINDALL**
GROUP

Contents

Whole Life Carbon Assessment Results		
Headline Results		4
Headline Graphs		5
Forest Consumption		6
Whole Life Carbon Assessment - Analysis		
Additional Graphs, Outputs & Scope		9
Material Analysis		11
Whole Life Carbon Assessment - Assumptions		
Inputs and Project Details		15
Assumption Report		16

What is CarboniCa?



A carbon reduction tool
Providing opportunity for carbon reduction by being easily customisable and automatically generating ideas to save carbon



Highly credible
Third-party verified in line with the latest industry guidance, including RICS Whole Life Carbon Assessment for the Built Environment professional statement and EN 15978

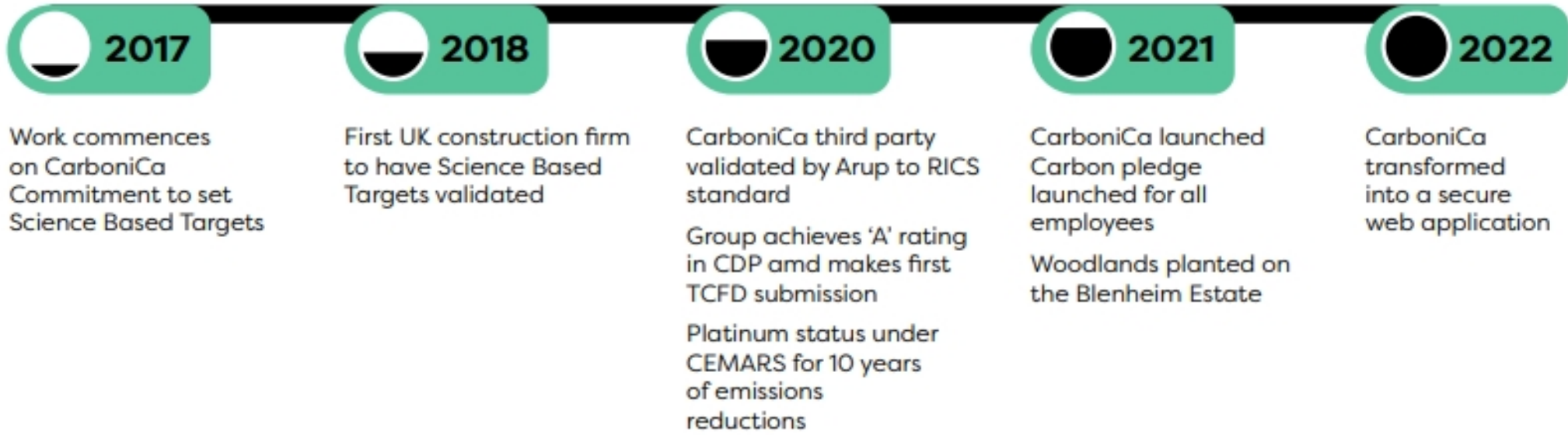


Robust
All assumptions can be evidenced and there is a clear logic and methodology



Easy to use
CarboniCa uses simple questions which align with methods of measurement, with no carbon assessment expertise required

Our Journey



Whole Life Carbon Assessment - Results



Carbon Footprint Table

This table lays out the RICS compliant headline results for a whole life carbon assessment.

Embodied carbon includes material impacts only, whereas whole life carbon includes both material and operational (energy/water) impacts, according to BS EN 15978.

Separate figures are also provided without carbon sequestration. An example of sequestration is where timber products store atmospheric carbon while growing, which is only released again when the product is incinerated or landfilled at end of life. Therefore, when considering up front embodied carbon in isolation of end of life impacts, carbon sequestration should not be taken as a benefit.

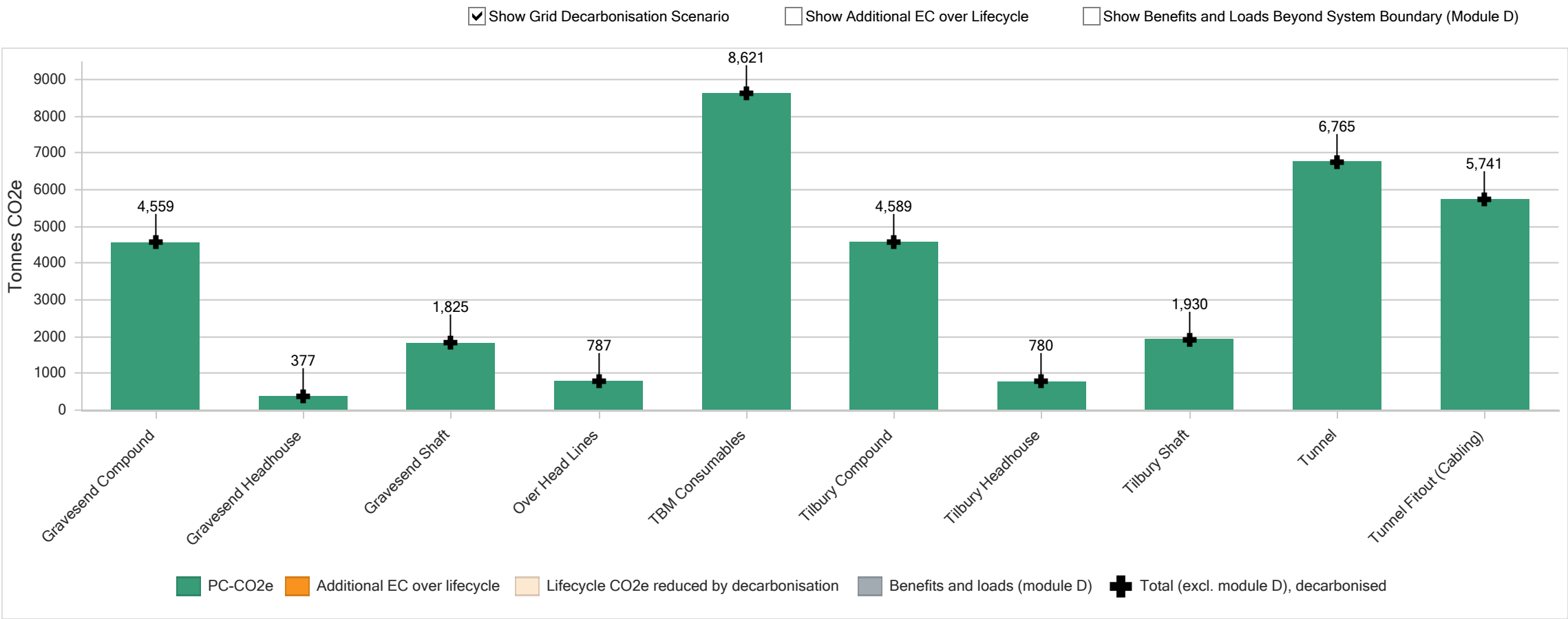
Separate grid decarbonisation figures are provided to account for the anticipated decarbonising of the electricity grid.

Benefits and loads beyond the system boundary are primarily benefits associated with the circular economy - such as obviating the need for manufacturing new materials when repurposing is intended - which are not incorporated into the whole life carbon total for the asset in line with BS EN 15978.

Totals				Magenta box: data used for embodied carbon benchmarking and target-setting	
PC-CO2e	Embodied Carbon at Practical Completion	35,975.3			
		tCO2e			
	PC-CO2e No Sequestration	35,977.1			
		tCO2e			
LC-CO2e	Embodied Carbon over Life Cycle	37,440.8			
		tCO2e			
	LC-CO2e Grid Decarbonisation Scenario	37,440.8			
		tCO2e			
WL-CO2e	Whole Life Carbon	37,440.8			
		tCO2e			
	WL-CO2e Grid Decarbonisation Scenario	37,440.8			
		tCO2e			
	Benefits and Loads Beyond System Boundary	-4,089.9			
		tCO2e			

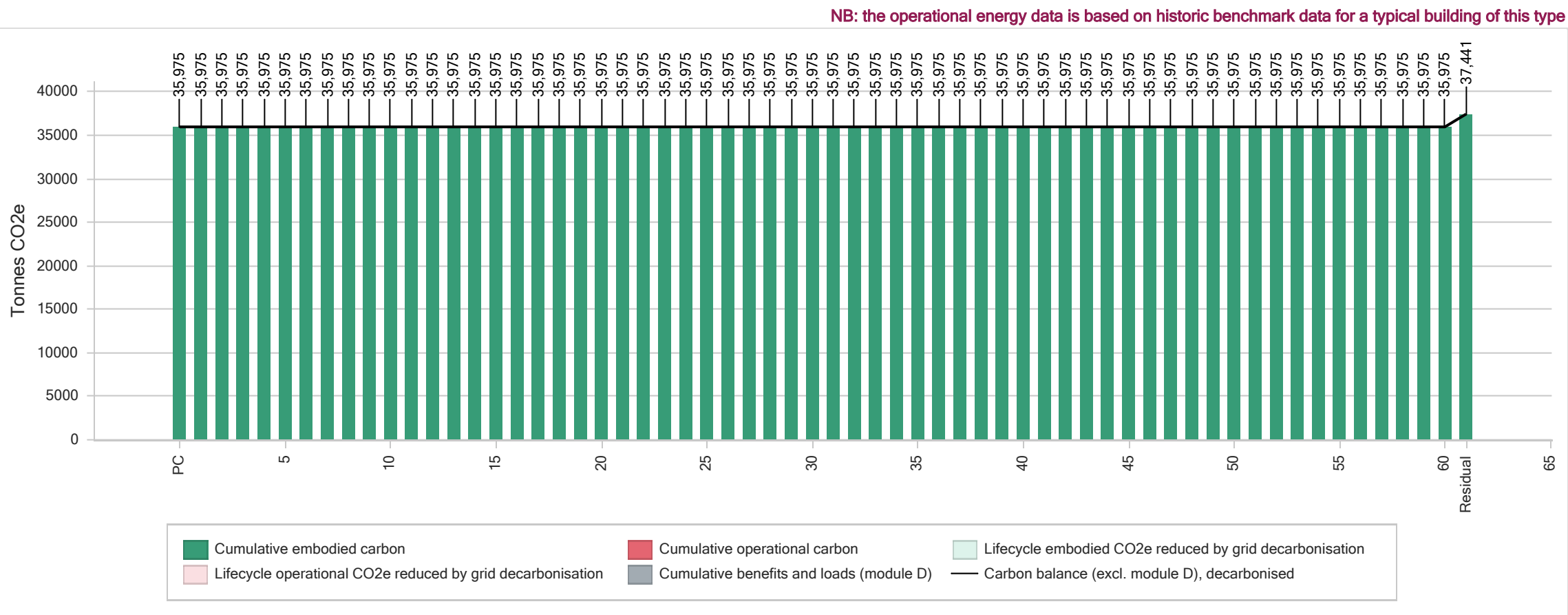
Embodied Carbon

The green bars represent the carbon emitted up to practical completion, and the orange bars represent the additional embodied carbon over a nominal asset lifespan, due to the replacement and end-of-life treatment of components. Embodied carbon hotspots can easily be identified on this graph.



Whole Life Carbon Timeline

In this graph, the green bars represent the cumulative embodied carbon, with the other bars representing cumulative operational carbon. Therefore, the trend line is the cumulative whole life carbon position of the asset played out over its nominal lifespan. The kinks in the trendline identify where material replacements and end-of-life impacts occur.



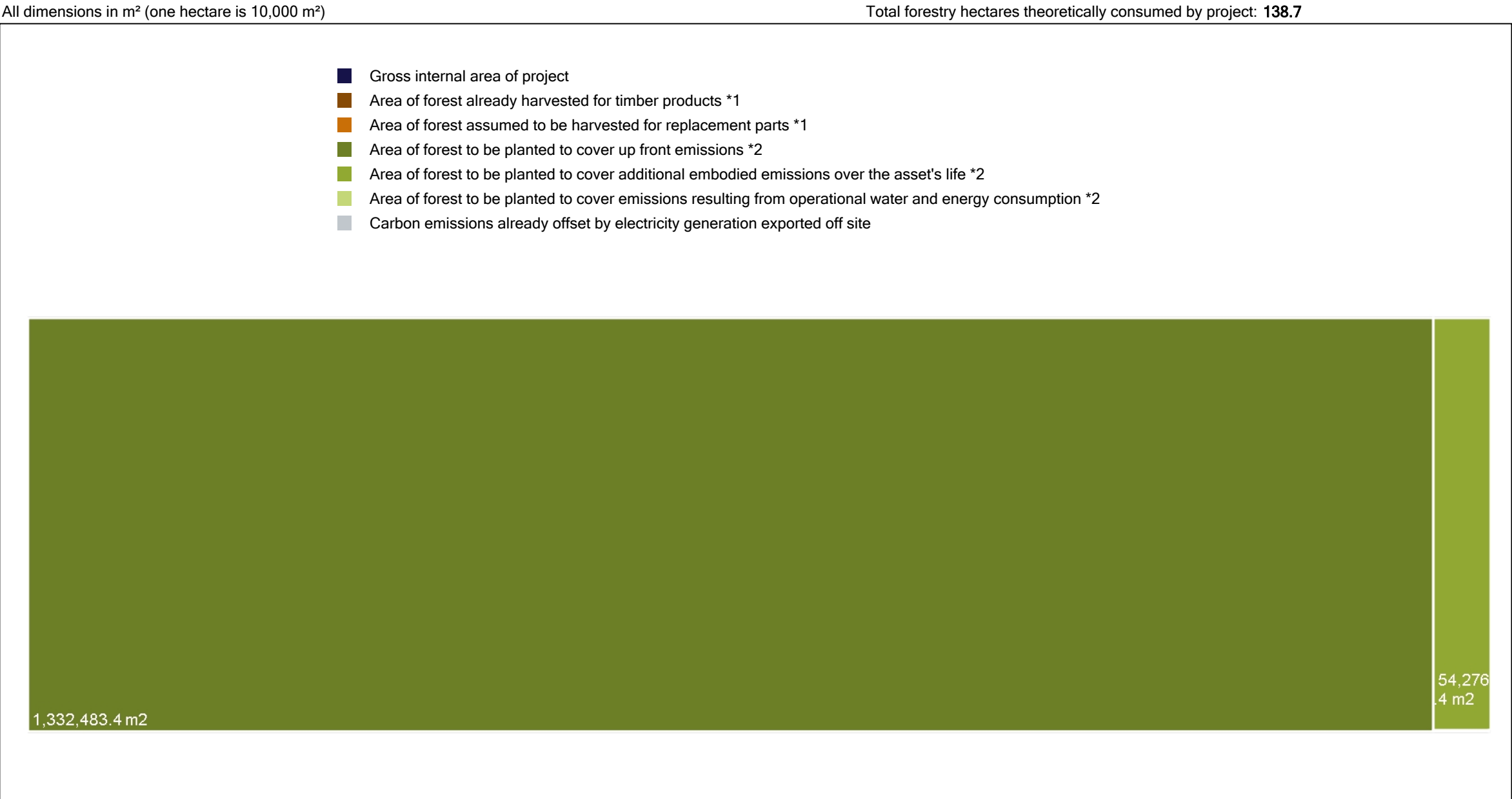
Woodland
Visualisation

This graphic lays out the gross internal area of the building (in navy blue) on plan like a map, comparing it to an indicative size of forest that would be consumed by the project, if tree planting were chosen as an offsetting mechanism for the whole life carbon of the asset.

The brown and orange areas depict the area of forest that needs to be harvested for the timber materials in the project, such as battening and formwork, both up-front and for replacement parts.

The green areas depict the area of tree planting that would be required to offset the residual whole life carbon of the asset. These areas are based on declared assumptions from Forestry Commission data.

With land area for offsetting schemes increasingly in demand, this graphic helps contextualise responsible decision-making for net zero schemes. It clearly points towards the necessity to reduce absolute carbon emissions.

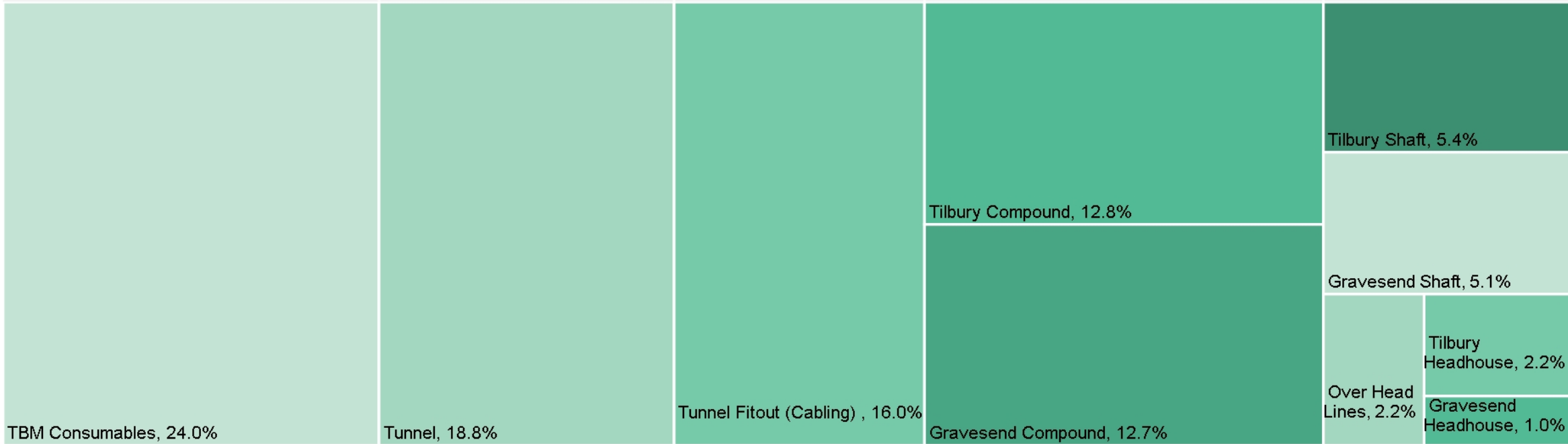


*1 Based on carbon sequestration over 30 years (from year of planting), with the following woodland type:
Mixed broadleaved woodland managed for its biodiversity benefits

*2 Based on the following harvested woodland product:
Upland conifer: managed for timber (Sitka spruce (90%), open space (10%), 52 year cycle)

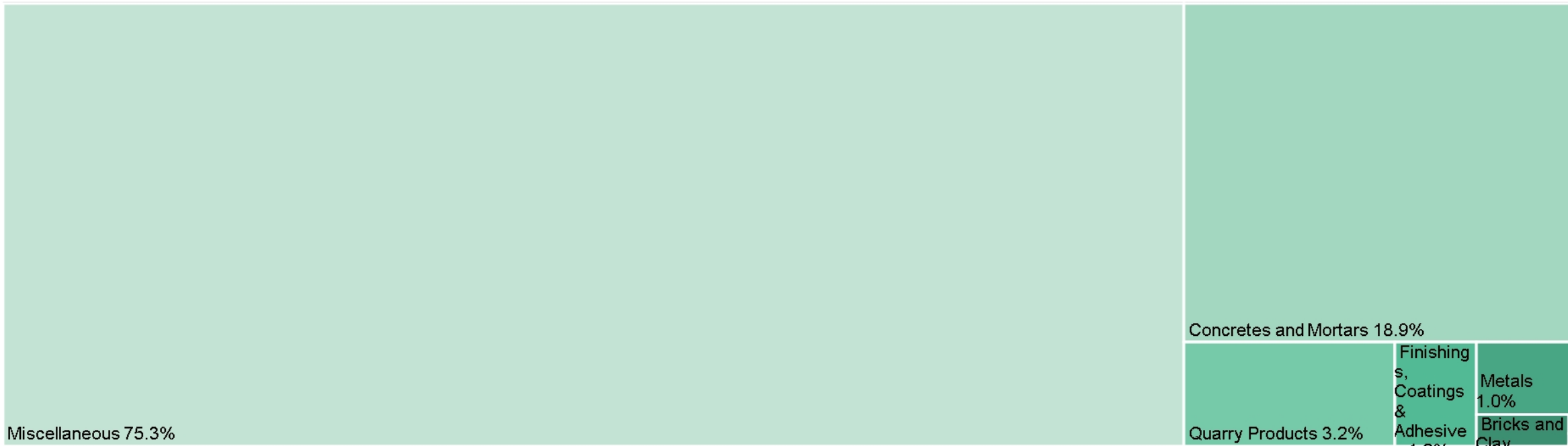
Whole Life Carbon Assessment - Analysis

Embodied Carbon over the Lifecycle (LC-CO2e) by building/asset category:



Grid decarbonisation included for replacement parts

Embodied Carbon over the Lifecycle (LC-CO2e) by material category:



Grid decarbonisation included for replacement parts

Outputs and Project Scope																		
Mandatory (RICS):	YES	NO	YES	YES	YES	YES	NO	YES (façade)	NO	NO	NO	YES	NO	NO	NO	NO	NO	
Scope 3 Totals:	29,123.1	-1.7	2,663.9	2,039.3		474.9	21.9		0	0	0			0	0	1,443.6	-4,089.9	
	Product	Product (sequestered timber CO2)	Transport	Construction	Construction	Construction	Use, Repair and Maintenance	Replacement Parts	Replacement Parts - Grid Decarb. Scenario	Replacement Parts (sequestered timber CO2)	Refurbishment	Energy in Use - Regulated	Energy in Use - Unregulated	Energy in Use (all) - Grid Decarb. Scenario	Water in Use	End of Life	Benefits and Loads Beyond the System Boundary	BCIS category Number
BS EN 15978 Stage	A1-A3	(A1)	A4	A5 (waste)	A5 (direct elec/fuel)	A5 (other elec/fuel)	B1-B3	B4	(B4)	(B4)	B5	B6	B6	(B6)	B7	C1-4	D	
GHG Protocol Category	Cat 1	Cat 1	Cat 4	Cat 5	SCOPE 1 and 2	Cat 10	Cat 11	Cat 11	(Cat 11)	Cat 11	Cat 11	Cat 11	Cat 11	(Cat 11)	Cat 11	Cat 12	Cat 11 & 12	
GHG Protocol Description	Purchased Goods and Services	Purchased Goods and Services	Upstream transportation and distribution	Waste generated in operations	SCOPE 1 and 2	Processing of sold products	Use of sold products	Use of sold products		Use of sold products	Use of sold products	Use of sold products	Use of sold products		Use of sold products	End of life treatment of sold products	Use of sold products / End of life treatment of sold products	
Comments	Includes off-site pre-fabrication	100% Sequestration			SCOPE 1 and 2	E.g. client energy, subcontract fuel etc.	Only refrigerant leakage (B1) and other B1-B3 where the product data provides it			100% Sequestration	Not assessed						Waste heat (cat 12), avoided emissions from circular economy (cat 12) and electric export to grid (cat 11)	Refer to user guidance for BCIS deviations
BCIS Category Name	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	
Gravesend Compound	3,921.3	0	301	271.4	51.2	14.5	0	0	0	0	N/A	0	0	0	0	167.7	-1,074.6	
Gravesend Headhouse	314.1	-0.8	10	51.3	2.2	0.6	10.9	0	0	0	N/A	0	0	0	0	18.7	-64.3	
Gravesend Shaft	1,212.2	0	127.5	224.3	203.5	57.7	0	0	0	0	N/A	0	0	0	0	153.9	-132.9	
Over Head Lines	598.2	0	78.8	88	17.4	4.9	0	0	0	0	N/A	0	0	0	0	64.7	-102.8	
TBM Consumables	8,460.2	0	20.7	106.4	26	7.4	0	0	0	0	N/A	0	0	0	0	80.5	-8.8	
Tilbury Compound	4,037.8	0	223.5	264.5	49.4	14	0	0	0	0	N/A	0	0	0	0	165	-1,016.3	
Tilbury Headhouse	642.1	-1	44.4	81.7	9.7	2.7	10.9	0	0	0	N/A	0	0	0	0	68.8	-118.6	
Tilbury Shaft	1,249.3	0	179.8	226.4	213.8	60.6	0	0	0	0	N/A	0	0	0	0	159.7	-127.7	
Tunnel	3,184.2	0	1,466.6	709.6	1,094.4	310.1	0	0	0	0	N/A	0	0	0	0	418.3	-30.9	
Tunnel Fitout (Cabling)	5,503.5	0	211.6	15.7	8.2	2.3	0	0	0	0	N/A	0	0	0	0	146.4	-1,412.9	
Total All	29,123.1	-1.7	2,663.9	2,039.3	1,675.8	474.9	21.9	0	0	0	0	0	0	0	0	1,443.6	-4,089.9	

Scope 3 GHG Category	Cat 1	Cat 4	Cat 5	Cat 10	Cat 11	Cat 12	Social Value Bank Outputs		Site Impacts		Carbon Reduction		WL-CO2e		WL-CO2e				
Total	29,121	2,664	2,039	475	22	-2,646			Site Fuel and Energy Emissions*		Offset Savings from WL-CO2e Reduction		Whole Life Carbon (RICS mandatory sco		Whole Life Carbon (MS standardised sco				
Unit	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e	tCO2e			1,229 kgCO2e/£100k		0 £		N/A		N/A				
Purchased Goods and Services		Upstream transportation and distribution		Waste generated in operations		Processing of sold products		Use of sold products (decarbonised grid)		End of life treatment of sold products									
Site Waste	Totals	15 01 06 Mixed packaging	17 09 04 Mixed construction and demolition waste	17 01 07 Mixtures of concrete, brick, tiles and ceramics	17 02 01 Wood	17 02 02 Glass	17 02 03 Plastic	17 03 02 Bituminous mixtures	17 04 07 Mixed metals	17 06 04 Insulation materials	17 08 02 Gypsum	17 09 03 Other hazardous waste (including asbestos)	20 03 01 Mixed municipal waste / Other	17 05 03 Hazardous soils and stones	17 05 04 Non-hazardous soils and stones	Circular Economy Metrics			
Theoretical Tonnage	3,982.4	288.7	12.8	2,343.9	0.1	0	1.7	46	260.6	0	0	272.6	0.1	0	755.8	Material recycled content at handover (%):	0%		
Actual Tonnage	No site totals entered															Reused materials at handover (%):	0%		
Theoretical tCO2e	2,039.3	749.1	36.3	417.9	0.1	0	8.5	15.9	676.1	0	0	47.1	0.1	0	88.3	Materials assumed to be recycled at asset end of life (%)	23%		
Actual tCO2e	No site totals entered															Materials assumed to be reused at asset end of life (%):	0%		
																Operational Energy Metrics			
																Annual emissions tCO2e (no export)	0.0		
																Annual emissions tCO2e (with export)	0.0		
Totals / Metrics		Total	Metric 1	Metric 2	Metric 3	Total (Decarbonised)	Metric 1	Metric 2	Metric 3	Total	Metric 1 (RICS)	Metric 2 (RICS)	Metric 3	Total (Decarbonised)	Metric 1 (RICS)	Metric 2 (RICS)	Metric 3	Annual emissions tCO2e (with export)	0.0
		Full Project Scope TnCo2e	kgCO2e/m² Gross Internal Area (GIA)	kgCO2e/m² Net Internal Area (NIA)	kgCO2e/£100k Project Value	Full Project Scope TnCo2e	kgCO2e/m² Gross Internal Area (GIA)	kgCO2e/m² Net Internal Area (NIA)	kgCO2e/£100k Project Value	RICS Mandatory Scope Only TnCo2	kgCO2e/m² Gross Internal Area (GIA)	kgCO2e/m² Net Internal Area (NIA)	kgCO2e/£100k Project Value	RICS Mandatory Scope Only TnCo2	kgCO2e/m² Gross Internal Area (GIA)	kgCO2e/m² Net Internal Area (NIA)	kgCO2e/£100k Project Value	Total consumption kWh/m² GIA/year	No floor area given
PC-CO2e - Embodied Carbon at Practical Completion		35,975.3	17,634,968.7		20,557.3	35,975.3	17,634,968.7		20,557.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Regulated kWh/m² GIA/year	N/A
LC-CO2e - Embodied Carbon over Life Cycle		37,440.8	18,353,333.1		21,394.7	37,440.8	18,353,333.1		21,394.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Unregulated kWh/m² GIA/year	N/A
WL-CO2e - Whole Life Carbon		37,440.8	18,353,333.1		21,394.7	37,440.8	18,353,333.1		21,394.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Heating demand kWh/m² GIA/year	N/A
Benefits and Loads Beyond System Boundary		-4,089.9	-2,004,840.4		-2,337.1	-4,089.9	-2,004,840.4		-2,337.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Potable water use L/person/day	N/A

NB: the following deviations from BCIS Elemental Standard Form Cost Analysis 4th Ed are noted, with respect to inclusion or exclusion from the RICS mandatory outputs. (1) Stairs and Ramps - any finishes are excluded, any escape stairs are included. (2) Roof - any photovoltaic panels are included. It is also assumed that unregulated building-integrated operational energy is excluded from the mandatory scope, and it must be noted that the mandatory scope does not include internal loadbearing masonry.

* [A5] Site Fuel & Energy is arbitrarily apportioned against each material line according to weight; [A5] waste does not include packaging (it is included in the category total)

Material Analysis - Project Totals (all in kgCO2e, no decarbonisation)											
Material Name † user-added carbon factor	Material Category	Product [A1-A3]	Transport [A4]	Theoretical Waste / Site Fuel & Energy* [A5]	Use and Replacement Parts[B1-B4]	Use / Replacements (decarbonised) [B1-B4]	End of Life [C1-C4]	Total	Present in Categories	More Sustainable Alternatives	Priority
Aluminium (general)	Metals	6,269,282	102,545	332,566	0	0	115,174	6,819,567	Gravesend Compound, Gravesend Headhouse, Tilbury Compound, Tunnel Fitout (Cabling)	Aluminium with high recycled content; timber sections	High
† 400kV Single-core Cable	Miscellaneous	5,214,468	204,749	10,713	0	0	131,208	5,561,138	Tunnel Fitout (Cabling)		
† C50/60 - Concrete - ICE Low Carbon Route-map Grade B	Concretes and Mortars	2,244,800	564,365	317,341	0	0	306,621	3,433,126	Tunnel		
! _Immaterial	Miscellaneous	0	868,643	1,599,731	0	0	0	2,468,374	Gravesend Shaft, Tilbury Shaft, Tunnel		
† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	Concretes and Mortars	1,454,585	146,122	210,934	0	0	228,674	2,040,315	Gravesend Shaft, Tilbury Shaft, Tunnel		
† Concrete - (C40/50 MPa) UK Average	Concretes and Mortars	901,842	155,787	109,605	0	0	98,457	1,265,690	Tilbury Shaft, Tunnel		
Steel (Rebar 97% Recycled Content)	Metals	871,844	38,265	159,554	0	0	96,260	1,165,923	Gravesend Compound, Gravesend Headhouse, Gravesend Shaft, Tilbury Compound, Tilbury Headhouse, Tilbury Shaft		
Steel (general)	Metals	810,858	10,531	131,932	0	0	36,452	989,772	Gravesend Compound, Gravesend Headhouse, Gravesend Shaft, Tilbury Compound, Tilbury Headhouse, Tilbury Shaft, Tunnel Fitout (Cabling)		
Stone - General (aggregates and sands)	Quarry Products	491,339	210,151	138,470	0	0	86,190	926,150	Gravesend Compound, Tilbury Compound	Virgin land won Aggregates have the lowest embodied carbon. Transport distance is the critical factor.	Low
† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	Concretes and Mortars	472,121	157,401	80,428	0	0	85,516	795,466	Gravesend Compound, Over Head Lines, Tilbury Compound, Tilbury Headhouse		
† Sulphuric Acid	Finishings, Coatings & Adhesives	381,226	14,500	70,694	0	0	64,366	530,785	TBM Consumables		
Clay (Tile)	Bricks and Clay Products	429,696	4,767	44,120	0	0	15,539	494,122	TBM Consumables		
Steel - Hot Dip Galvanised	Metals	331,322	3,835	53,451	0	0	14,056	402,664	Gravesend Shaft, Over Head Lines, Tilbury Shaft	High recycled content steel	High
Paint (Wet)	Finishings, Coatings & Adhesives	323,738	4,072	37,408	0	0	34,722	399,940	Gravesend Headhouse, Tilbury Headhouse	Lower VOC ecological paints	Medium
† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	Concretes and Mortars	194,439	70,998	35,352	0	0	38,573	339,363	Gravesend Compound, Over Head Lines, Tilbury Compound		
Sealants and Adhesives - Epoxide Resin	Finishings, Coatings & Adhesives	231,962	1,227	12,053	0	0	493	245,734	TBM Consumables	NULL	NULL
Cement (Portland)	Concretes and Mortars	216,302	7,578	13,551	0	0	4,117	241,547	Tilbury Compound	Consider cement replacements or alternative methods of construction	Medium
† 400kV Cable Sealing Ends (Polymetric)	Miscellaneous	232,238	9	2,323	0	0	6	234,576	Gravesend Compound, Tilbury Compound, Tunnel Fitout (Cabling)		
† 400kV Earth Switch 3ph	Miscellaneous	132,994	2	1,330	0	0	1	134,327	Gravesend Compound, Tilbury Compound		
Asphalt 4% Bitumen Binder Content	Miscellaneous	45,936	28,116	12,212	0	0	10,654	96,918	Gravesend Compound, Tilbury Compound	Roofing: recycled bitumen; paving: porous asphalt, grasscrete, gravel	Low
† C20/25 - Concrete - ICE Low Carbon Route-map Grade B	Concretes and Mortars	51,199	22,434	10,659	0	0	12,189	96,481	Gravesend Compound, Gravesend Headhouse, Tilbury Compound, Tilbury Headhouse		
Liberty Steel Reinforcement Bar and Fabric (Mesh)	Metals	68,064	3,184	13,325	0	0	11,669	96,242	Over Head Lines	NULL	NULL
† Plastic Inspection Chamber - 600mm dia. 1.2m - 3m depth	Plastics	69,246	2	3,465	0	0	39	72,752	Gravesend Compound, Tilbury Compound		
Green Roof - Urbanscape Extensive (Full System)	Miscellaneous	49,788	1,957	5,811	0	0	1,433	58,989	Gravesend Headhouse, Tilbury Headhouse		
Aggregate	Quarry Products	4,532	24,866	12,493	0	0	12,052	53,943	Gravesend Shaft, Tilbury Compound, Tilbury Shaft	Virgin land won Aggregates have the lowest embodied carbon. Transport distance is the critical factor.	Low

* [A5] Site Fuel & Energy is arbitrarily apportioned against each material line according to weight; [A5] waste does not include packaging (it is included in the category total)

Material Analysis - Project Totals (all in kgCO2e, no decarbonisation)											
Material Name † user-added carbon factor	Material Category	Product [A1-A3]	Transport [A4]	Theoretical Waste / Site Fuel & Energy* [A5]	Use and Replacement Parts[B1-B4]	Use / Replacements (decarbonised) [B1-B4]	End of Life [C1-C4]	Total	Present in Categories	More Sustainable Alternatives	Priority
Chiller - Mitsubishi Electric A2W Heat Pump	Equipment	3,281	15	39	42,296	42,296	312	45,942	Gravesend Headhouse, Tilbury Headhouse		
† Cable - Miscellaneous	Miscellaneous	22,890	2,893	2,100	0	0	13,346	41,229	Gravesend Headhouse, Tilbury Headhouse, Tunnel Fitout (Cabling)		
† 400kV Voltage Transformers 1ph	Miscellaneous	39,504	5	395	0	0	3	39,906	Gravesend Compound, Tilbury Compound		
† C28/35 - Concrete - ICE Low Carbon Route-map Grade A	Concretes and Mortars	18,224	8,220	3,879	0	0	4,466	34,789	Gravesend Compound, Tilbury Compound		
Brick - Generic Brick BDA UK	Bricks and Clay Products	21,501	3,225	6,212	0	0	1,752	32,691	Gravesend Headhouse, Tilbury Headhouse	Reclaimed brick (if locally available), slate or local stone. Timber is another low carbon alternative but offers a different aesthetic.	Medium
† Plastic Cable Ducting - 150mm	Plastics	18,330	232	1,283	0	0	5,838	25,683	Gravesend Compound, Tilbury Compound		
PVC Pipe	Plastics	14,246	141	934	0	0	3,540	18,861	Gravesend Compound, Tilbury Compound	Non-PVC products / recycled plastic	Low
† Precast Concrete manhole - 1,2m dia	Miscellaneous	18,423	1	184	0	0	0	18,609	Gravesend Compound, Tilbury Compound		
† Cess Pit	Miscellaneous	12,383	193	924	0	0	4,856	18,356	Gravesend Compound, Tilbury Compound		
Aluminium (extrusion)	Metals	15,302	72	802	0	0	275	16,451	Gravesend Compound, Tilbury Compound	Aluminium with high recycled content; timber sections	High
Copper (0% Recycled)	Metals	12,972	109	705	0	0	303	14,088	Gravesend Compound, Gravesend Shaft, Tilbury Compound, Tilbury Shaft	Recycled copper from high grade scrap	Medium
† Foam Agent (Underground Admixture)	Finishings, Coatings & Adhesives	10,752	92	1,117	0	0	68	12,030	TBM Consumables		
British Precast Conc Fed - UK Precast Concrete Blocks	Concretes and Mortars	4,282	1,500	1,746	0	0	815	8,342	Tilbury Headhouse	Local stone or reclaimed brickwork. Also consider investigating cement-free blocks such as Greenblock	Medium
† Electrical Equipment - Machinery	Miscellaneous	3,126	921	102	0	0	1,630	5,780	Gravesend Headhouse, Tilbury Headhouse		
Steel (Galvanised 15% Recycled Content)	Metals	3,691	45	598	0	0	156	4,491	Gravesend Shaft, Tilbury Shaft		
† Petrol Interceptor - Plastic PP	Plastics	1,270	0	64	0	0	1	1,334	Tilbury Compound		
Polyethylene	Plastics	775	10	54	0	0	245	1,083	Gravesend Shaft, Tilbury Shaft	Highly dependent on application, product-specific data preferable; recycled plastic	Low
Industrial Overhead Door - Assa Abloy OH1042F	Equipment	816	6	10	0	0	47	879	Gravesend Headhouse, Tilbury Headhouse		
Timber - Plywood (540 kg/m3)	Timber	-901	36	111	0	0	1,405	650	Gravesend Headhouse, Tilbury Headhouse		
Glass (Toughened)	Glass	81	2	5	0	0	14	102	Tilbury Headhouse		
PVC	Plastics	41	0	3	0	0	11	55	Gravesend Headhouse, Gravesend Shaft, Tilbury Shaft	Non-PVC products / recycled plastic; highly dependent on application, product-specific data preferable	Low
Concrete (32/40 CEM I)	Concretes and Mortars	36	8	5	0	0	4	53	Gravesend Headhouse	Where concrete is required, minimise cement content by using SCMs such as GGBS. Try to obtain a specific carbon footprint for the project, from the concrete supplier, or obtain the mix design and use the Bath ICE 3.0 calculator to establish a more representative carbon footprint.	High
Plastics	Plastics	10	0	1	0	0	3	14	Tilbury Headhouse	Highly dependent on application, product-specific data preferable; recycled plastic	Low
Timber - Softwood	Timber	-63	1	3	0	0	60	1	Gravesend Headhouse, Tilbury Headhouse		

Whole Life Carbon Assessment - Assumptions

Inputs and Project Details	Part of Assessment	Project Detail	Data	General	Data
Facilitating Works	No	Project Name	TKRE	Date Updated	28/11/2023 16:05:53
Foundations	No	Project Number	500189	Reviewed	FALSE
Frame	No	Current Project Stage			
External Walls	No	Project Value (£million)	175.00		
Windows and External Doors	No	Project Metric Type	Infrastructure; bridges, roads, railway lines, power lines, water and fuel pipelines		
Upper Floors	No	Metric 1 - km*	2		
Stairs, Ramps and Walkways	No	Metric 2 - N/A	0	Offsetting cost of carbon £/tCO2e	50
Roof	No	Data Source for Metrics	2. Bill of quantities (BoQ) or cost plan	Reference Study Period - Infrastructure (years)	120
Internal Walls and Partitions	No	Project Description	TKRE tunnelling		
Internal Doors and Screens	No	Division	BakerHicks	Reference Study Period - Construction (years)	60
Wall Finishes	No	Client	National	Transport scenario 'Locally manufactured' (km from site)	50
Floor Finishes	No	Contractor	Unknown at this Stage	Transport scenario 'Nationally manufactured' (km from site)	300
Ceiling Finishes	No	Site Address	Tilbury	Transport scenario 'European manufactured' (km from site)	1,500
FF&E	No	Author Name	George Lucas	Transport scenario 'Globally manufactured' (km from site road)	200
Lifts	No	Author Email Address	George.Lucas@morgansindall.com	Transport scenario 'Globally manufactured' (km from site boat)	10,000
Services (Building Integrated)	No	Author Phone Number		Timber sequestration (%)	100%
Externals	No	Reference Study Period (years)	60	PV Warning (embodied not accounted for)	FALSE
Drainage	No	Project Completion Year (e.g 2023)	0	Display warning to check for partial site quantities	FALSE
Prefabricated Units	No	Building Type		Area Warning (20% out on BRUKL)	FALSE
Services (non-integrated)	No	Project Type	N/A	Category Warning (BRUKL has a different category)	FALSE
Site Waste	No				
Site Fuel and Energy	No			SAP assessments	TRUE
Operational Energy (Building Integrated)	No			BRUKL assessments	TRUE
				PV generation consumed by building (%)	100%
				Default boat emissions factor	Transport Emissions - Contain

Assumptions and Data Sources															
magenta text = changes have been made by the user in the advanced interface															
Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
Gravesend Compound															
Project data sources used in this category: 3. Cost plan or BoQ															
15.01.01	Fencing - Steel	12,000	kg	weight (kg)	12000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
15.01.02	Fence - Foundations	44	m3	volume (m3)	44.2	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade A	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.03	Fencing - Burrow Beam	42	m3	volume (m3)	42	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade A	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.04	Surface Chippings	750,000	kg	weight (kg)	750000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Stone - General (aggregates and sands)	Bath ICE 3.0		No Reuse Anticipated
15.01.05	Sub base	2,331,000	kg	weight (kg)	2331000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Stone - General (aggregates and sands)	Bath ICE 3.0		No Reuse Anticipated
15.01.06	Road Surfacing	550,000	kg	volume (m3)	250	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Asphalt 4% Bitumen Binder Content	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	2200	Project Data									
15.01.07	Road Subbase	815,850	kg	weight (kg)	815850	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Stone - General (aggregates and sands)	Bath ICE 3.0		No Reuse Anticipated
15.01.08	Footpath	8	m3	volume (m3)	7.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.09	Drainage - Surface Water Pipe	1,890	kg	weight (kg)	1890	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC Pipe	Bath ICE 3.0		No Reuse Anticipated
15.01.10	Drainage - Surface Water Manhole	9	nr	Quantity	9	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	1%	† Precast Concrete manhole - 1,2m dia	ICEV3NH		No Reuse Anticipated
15.01.11	Drainage Foul Water Pipe	158	kg	weight (kg)	157.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC Pipe	Bath ICE 3.0		No Reuse Anticipated
15.01.12	Drainage - Cess Pit	1	m2	Quantity	1	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cess Pit	CIT 2023		No Reuse Anticipated
15.01.13	Cable Ducts	1,760	m	Length (m)	1760	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Plastic Cable Ducting - 150mm	ICEV3NH		No Reuse Anticipated
15.01.14	Fire Water Tank Concrete	15	m3	volume (m3)	14.7	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.15	Fire Water Tank Reinforcement	1,691	kg	weight (kg)	1691	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
15.01.16	AIS Steel Structures	5,592	kg	weight (kg)	5592	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
15.01.17	AIS Pile Caps - Concrete	188	m3	volume (m3)	188	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.18	AIS Pile Cap - rebar	21,611	kg	weight (kg0	21611	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
15.01.19	Piles - AIS	509	m3	volume (m3)	509	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.20	Lighting Column Foundation	30	m3	volume (m3)	30	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.21	Fire Water Tank - Foundation	15	m3	volume (m3)	14.7	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
15.01.22	Fire Water Tank - Reinforcement	1,691	kg	weight (kg)	1691	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
15.01.23	AIS Steel Structures	5,592	kg	weight (kg)	5592	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
15.01.24	Drainage - Foul Water Manhole	1	unit	Quantity	1	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Plastic Inspection Chamber - 600mm dia. 1.2m - 3m depth	ICEV3NH		No Reuse Anticipated
15.01.25	Drainage - Headwall	3	m3	volume (m3)	2.85	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated

Assumptions and Data Sources															
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Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
15.01.26	Cable Drawpits	25	unit	Quantity	25	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Plastic Inspection Chamber - 600mm dia. 1.2m - 3m depth	ICEV3NH		No Reuse Anticipated
15.01.27	Fire Water Tank	10,990	kg	volume (m3)	1.4	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	7850	Project Data									
15.01.31	400kV Cable Sealing Ends	12	unit	quantity	12	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Cable Sealing Ends (Polymetric)	NG DATABASE		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
15.01.32	400kV Earth Switch	6	unit	quantity	6	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Earth Switch 3ph	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
15.01.33	400kV Ring Type Current Transformer	12	unit	quantity	12	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Voltage Transformers 1ph	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
15.01.34	(ODxWT) 140x10mm Rigid Aluminium Busbar	1,121	kg	weight (kg)	1121	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Aluminium (extrusion)	Bath ICE 3.0		No Reuse Anticipated
15.01.35	40.2mm Stranded Aluminium Conductor	459,000	kg	length (m)	170	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	Aluminium (general)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	2700	Project Data	Transport Emissions - Container Ship	DEFRA 2020	10000						
15.01.36	Earth Tape - 50mm*4mm	1,400	kg	weight (kg)	1400	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
15.01.37	Earth Tape - 50mm*6mm	270	kg	weight (kg)	270	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
15.01.38	Earth Rods	4	kg	weight (kg)	4.3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
15.01.39	HF Earth Rods	9	kg	weight (kg)	8.6	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
15.01.40	Cable Trough	95	m3	volume (m3)	95.46	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C20/25 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
Gravesend Headhouse															
Project data sources used in this category: 3. Cost plan or BoQ															
14.01.01	Building Primary Steelwork	19,000	kg	weight (kg)	19000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
14.01.02	Building Roof Purlins	1,355	kg	weight (kg)	1355	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
14.01.03	Slabs - Concrete	106	kg	volume (m3)	106	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Concrete (32/40 CEM I)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
14.01.04	Slabs - Rebar	11,605	kg	weight (kg)	11605	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
14.01.05	Pile Caps - Concrete	13	kg	volume (m3)	13.2	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Concrete (32/40 CEM I)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
14.01.06	Pile Caps - rebar	1,521	kg	weight (kg)	1521	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
14.01.07	Beams - Concrete	68	kg	volume (m3)	68	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Concrete (32/40 CEM I)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
14.01.08	Beams - rebar	15,629	kg	weight (kg)	15629	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
14.01.09	Piles	56	kg	volume (m3)	55.7	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Concrete (32/40 CEM I)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
14.01.11	Shaft Stairs Steelwork	22,000	kg	weight (kg)	22000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
14.01.12	Plumbing Fixtures 540 x 360mm	2	kg	volume (m3)	0.00167	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC	Bath ICE 2.0		No Reuse Anticipated
				density (kg/m3)	1300	Project Data									

Assumptions and Data Sources															
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Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
14.01.13	RAL 7016	1,348	kg	volume (m3)	1.12327	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Paint (Wet)	Bath ICE 2.0		No Reuse Anticipated
				density (kg/m3)	1200	Project Data									
14.01.14	1010x2110mm Door	487	kg	volume (m3)	0.90208	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Timber - Plywood (540 kg/m3)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	540	Project Data									
14.01.15	Aluminium Door	179	kg	volume (m3)	0.06631	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Aluminium (general)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	2700	Project Data									
14.01.16	Steel Doors	75	kg	volume (m3)	0.00962	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	7750	Project Data									
14.01.18	Block - Lightweight Wall	26	m3	volume (m3)	25.9562	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C20/25 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
14.01.19	Default Wall	100,271	kg	volume (m3)	71.62202	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	20%	Brick - Generic Brick BDA UK	EPD	18/02/2024	No Reuse Anticipated
				density (kg/m3)	1400	Project Data									
14.01.20	Grass Roof	20,213	kg	area (m2)	252.66273	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Green Roof - Urbanscape Extensive (Full System)	EPD	29/05/2021	No Reuse Anticipated
				weight per m2	80	Project Data									
14.01.21	Furniture Wood - Cherry	23	kg	volume (m3)	0.03263	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Timber - Softwood	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	700	Project Data									
14.01.22	Furniture Metal - Steel	53,184	kg	volume (m3)	6.86247	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	7750	Project Data									
14.01.23	Indoor Unit	21	kW capacity	weight (kg)	21	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	1%	Chiller - Mitsubishi Electric A2W Heat Pump	TM65 Mid-Level		No Reuse Anticipated
14.01.24	Outdoor Condenser	58	kg	weight (kg)	58	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.25	Electric Panel Heater	37	kg	weight (kg)	37.4	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.30	Drainage Pump	142	kg	weight (kg)	141.6	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.32	Damper Actuator	1	kg	weight (kg)	1	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.33	1C 185 Single Core 90 thermosetting insulated non-mag arm LSF	230	m	length (m)	230	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.34	1C 16mm Single Core 90 thermosetting insulated non-arm LSF	50	m	length (m)	50	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.35	3C 16mm Multicore 90 thermosetting insulated armoured LSF	15	m	length (m)	15	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.36	3C 2.5mm FP200	15	m	length (m)	15	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.37	3C 2.5mm Multicore 90 thermosetting insulated armoured LSF	15	m	length (m)	15	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						

Assumptions and Data Sources															
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Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
14.01.38	3C 25mm Multicore 90 thermosetting insulated armoured LSF	10	m	length (m)	10	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.39	3C 4mm Multicore 90 thermosetting insulated armoured LSF	30	m	length (m)	30	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.40	3C 6mm FP600	15	m	length (m)	15	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.41	4C 25mm Multicore 90 thermosetting insulated armoured LSF	45	m	length (m)	45	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
14.01.42	Roller Shutter 3500mm x 2500mm	8	m2	Area	7.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	1%	Industrial Overhead Door - Assa Abloy OH1042F	EPD	14/05/2025	No Reuse Anticipated
Gravesend Shaft															
Project data sources used in this category: 3. Cost plan or BoQ															
02.01.01	Concrete - Jacking Collar	205	m3	Volume (m3):	205	Project Data	Transport Emissions - Rigid	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Density (kg/m3)	1	Project Data									
02.01.02	Concrete - Pre-Cast Rings (m3)	725	m3	Volume (m3):	725	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
02.01.03	Concrete - External Lining	539	m3	Volume (m3):	539	Project Data	Transport Emissions - Rigid	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Density (kg/m3)	1	Project Data									
02.01.04	Concrete - Shaft Annulus Grouting	398	m3	Density (kg/m3)	1	Project Data	Transport Emissions - Rigid	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Volume (m3):	398	Project Data									
02.01.05	Concrete - Shaft Base-Slab	530	m3	Volume (m3):	530	Project Data	Transport Emissions - Rigid	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Density (kg/m3)	1	Project Data									
02.01.06	Concrete - Shaft Portal (2.0m thick)	158	m3	Density (kg/m3)	1	Project Data	Transport Emissions - Rigid	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Volume (m3):	158	Project Data									
02.01.07	Steel Reinforcement - External Lining	328,000	kg	Mass (kg)	328000	Project Data	Transport Emissions - Rigid	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
02.01.08	Aggregate - Slab Subbase	106	kg	Volume (m3)	106	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	10%	Aggregate	Bath ICE 3.0		No Reuse Anticipated
02.01.09	UKC203x203x86	22,016	kg	weight (kg)	22016	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.10	PFC150x90x24	14,544	kg	weight (kg)	14544	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.11	UKC152x152x30	2,340	kg	weight (kg)	2340	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.12	UKC152x152x51	7,344	kg	weight (kg)	7344	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.13	RSA90x90x6	402	kg	weight (kg)	402	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.14	Cable Tray (200x200x100mm)	54	kg	weight (kg)	54.24	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.15	Tunnel Ventilation 1	318	kg	weight (kg)	317.52	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Galvanised 15% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
02.01.16	Tunnel Ventilation 2	318	kg	weight (kg)	317.52	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Galvanised 15% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
02.01.17	Shower Ventilation	3	kg	weight (kg)	3.15	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Galvanised 15% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
02.01.18	WC Ventilation	3	kg	weight (kg)	3.15	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Galvanised 15% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated

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Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
02.01.19	10% allowance for dampers, flanges and bolts	64	kg	weight (kg)	64.134	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.20	Sump Drainage - Pump 1	35	kg	weight (kg)	35	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Polyethylene	Bath ICE 2.0		No Reuse Anticipated
02.01.21	Sump Drainage - Pump 2	0	kg	weight (kg)	35	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Polyethylene	Bath ICE 2.0		No Reuse Anticipated
02.01.22	Domestic Water - external	60	kg	weight (kg)	60	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Polyethylene	Bath ICE 2.0		No Reuse Anticipated
02.01.23	Domestic Water - internal	5	kg	weight (kg)	4.77	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
02.01.24	Domestic Water - internal	3	kg	weight (kg)	3.36	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
02.01.25	Refrigerant - liquid line	3	kg	weight (kg)	3.36	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
02.01.26	Refrigerant - vapour line	6	kg	weight (kg)	6.36	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
02.01.27	Refrigerant - Supporting tray	18	kg	weight (kg)	17.64	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel - Hot Dip Galvanised	Bath ICE 3.0		No Reuse Anticipated
02.01.28	Condensate	2	kg	weight (kg)	2.25	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC	Bath ICE 2.0		No Reuse Anticipated
02.01.29	Domestic waste	3	kg	weight (kg)	3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC	Bath ICE 2.0		No Reuse Anticipated
02.01.30	Domestic waste	0	kg	weight (kg)	0.25	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC	Bath ICE 2.0		No Reuse Anticipated
02.01.31	Base Slab Steel	27,712	kg	weight (kg)	27712	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
02.01.32	Portal Steel	25,100	kg	weight (kg)	25100	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
02.01.33	Soil Removal	22,244,400	kg	Volume (m3)	12358	Project Data	Transport Emissions - HGV	DEFRA 2020	20	60	0%	!_Immaterial	N/A		No Reuse Anticipated
				Density (kg/m3)	1800	Project Data									
Over Head Lines															
Project data sources used in this category: 3. Cost plan or BoQ															
12.01.01	OHL gantries	120,000	kg	Weight (kg)	120000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel - Hot Dip Galvanised	Bath ICE 3.0		No Reuse Anticipated
12.01.02	Gantry Foundations Concrete	122	m3	m3	121.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				Density	1	Project Data									
12.01.03	Rebar	18,225	kg	Weight (kg)	18225	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Liberty Steel Reinforcement Bar and Fabric (Mesh)	EPD - Product & Manufacturer Specific	23/02/2026	No Reuse Anticipated
12.01.05	Gantry Piles	814	m3	m3	814.3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
12.01.06	Gantry Pile Rebar	81,430	kg	weight (kg)	81430	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Liberty Steel Reinforcement Bar and Fabric (Mesh)	EPD - Product & Manufacturer Specific	23/02/2026	No Reuse Anticipated
TBM Consumables															
Project data sources used in this category: 3. Cost plan or BoQ															
10.01.01	TBM Consumables (EPB) - Foam Agent (Underground Admixture)	2,875	kg	Volume (m3)	115	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	† Foam Agent (Underground Admixture)	EPD	18/10/2027	No Reuse Anticipated
				Density (kg/m3)	25	Project Data									
10.01.02	TBM Consumables (EPB) - Foam Polymer	3,605	kg	Volume (m3)	3.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Sealants and Adhesives - Epoxide Resin	Bath ICE 2.0		No Reuse Anticipated
				Density (kg/m3)	1030	Project Data									
10.01.03	TBM Consumables (STM) - Bentonite	895,200	kg	Volume (m3)	1119	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	8%	Clay (Tile)	Bath ICE 2.0		No Reuse Anticipated
				Density (kg/m3)	800	Project Data									
10.01.04	TBM Consumables (STM) - Polymer	34,340	kg	Volume (m3)	34	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Sealants and Adhesives - Epoxide Resin	Bath ICE 2.0		No Reuse Anticipated
				Density (kg/m3)	1010	Project Data									

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10.01.05	TBM Consumables (STM) - Sulphuric Acid	2,723,040	kg	Volume (m3)	1488	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	10%	† Sulphuric Acid	WWW.WINNIPEG.CA		No Reuse Anticipated
				Density (kg/m3)	1830	Project Data									
10.01.06	TBM Consumables (General) - Diesel	26,100	kWh	Volume (Litres)	26100	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60		† Fuel Consumption - TBM	N/A		No Reuse Anticipated
10.01.07	TBM Consumables (General) - Lubricant	2,750	kg	Volume (m3)	2.2	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	5%	Sealants and Adhesives - Epoxide Resin	Bath ICE 2.0		No Reuse Anticipated
				Density (kg/m3)	1250	Project Data									
10.01.08	TBM Consumables (General) - Hydraulic Oil	266,400	kWh	Energy (kWh)	266400	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60		† Fuel Consumption - Hydraulic	N/A		No Reuse Anticipated
10.01.09	Power Requirements	28,935,000	kWh	Energy (kWh)	28935000	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60		† Fuel Consumption - TBM	N/A		No Reuse Anticipated
Tilbury Compound															
Project data sources used in this category: 3. Cost plan or BoQ															
16.01.01	Fencing - Steel	9,000	kg	weight (kg)	9000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
16.01.02	Fencing - Foundations	35	m3	volume (m3)	35.3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
16.01.03	Fencing - Burrow Beam	32	m3	volume (m3)	31.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
16.01.04	Surface Chippings	750,000	kg	weight (kg)	750000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Aggregate	Bath ICE 3.0		No Reuse Anticipated
16.01.05	Sub base	2,331,000	kg	weight (kg)	2331000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Stone - General (aggregates and sands)	Bath ICE 3.0		No Reuse Anticipated
16.01.06	Road Surfacing	330,000	kg	volume (m3)	150	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Asphalt 4% Bitumen Binder Content	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	2200	Project Data									
16.01.07	Road Subbase	349,650	kg	weight (kg)	349650	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Stone - General (aggregates and sands)	Bath ICE 3.0		No Reuse Anticipated
16.01.08	Footpath	21	m3	volume (m3)	21	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade A	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
16.01.09	Drainage - Surface Water Pipe	2,048	kg	weight (kg)	2048	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC Pipe	Bath ICE 3.0		No Reuse Anticipated
16.01.10	Drainage - Surface Water Manhole	15	nr	Quantity	15	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	1%	† Precast Concrete manhole - 1,2m dia	ICEV3NH		No Reuse Anticipated
16.01.11	Drainage - Foul Water Pipe	315	kg	weight (kg)	315	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC Pipe	Bath ICE 3.0		No Reuse Anticipated
16.01.12	Drainage - Cess Pit	1	m2	Quantity	1	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cess Pit	CIT 2023		No Reuse Anticipated
16.01.13	Cable Ducts	1,320	m	length (m)	1320	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Plastic Cable Ducting - 150mm	ICEV3NH		No Reuse Anticipated
16.01.14	Fire Water Tank - Concrete	15	m3	volume (m3)	14.7	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
16.01.15	Fire Water Tank - Reinforcement	1,691	kg	weight (kg)	1691	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
16.01.16	AIS Steel Structures	5,592	kg	weight (kg)	5592	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
16.01.17	AIS Pile Caps - Concrete	188	m3	volume (kg)	188	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
16.01.18	AIS Pile Caps - Rebar	21,611	kg	weight (kg)	21611	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
16.01.19	Piles - AIS	509	m3	volume (m3)	509	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
16.01.20	Lighting Column Foundations	30	m3	volume (m3)	30	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									

Assumptions and Data Sources															
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Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
16.01.21	Aux Transformer Bund	30	m3	volume (m3)	30	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C28/35 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
16.01.22	Aux Transformer Bund - Rebar	1,656	kg	weight (kg)	1656	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
16.01.23	Drainage - Foul Water Manhole	3	unit	Quantity	3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Plastic Inspection Chamber - 600mm dia. 1.2m - 3m depth	ICEV3NH		No Reuse Anticipated
16.01.24	Drainage - Headwall	3	m3	volume (m3)	2.85	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
16.01.25	Drainage - Oil Interceptor	1	unit	Quantity	1	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Petrol Interceptor - Plastic PP	ICEV3NH		No Reuse Anticipated
16.01.26	Cable Drawpits	20	unit	Quantity	20	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Plastic Inspection Chamber - 600mm dia. 1.2m - 3m depth	ICEV3NH		No Reuse Anticipated
16.01.27	Fire Water Tank	10,990	kg	volume (m3)	1.4	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
				denisty (kg/m3)	7850	Project Data									
16.01.29	CBS Surround	237,173	kg	weight (kg)	237173	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Cement (Portland)	Bath ICE 3.0		No Reuse Anticipated
16.01.31	400kV Cable Sealing Ends	12	unit	quantity	12	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Cable Sealing Ends (Polymetric)	NG DATABASE		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
16.01.32	400kV Earth Switch	6	unit	quantity	6	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Earth Switch 3ph	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
16.01.34	400kV Ring Type Current Transformer	12	unit	quantity	12	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Voltage Transformers 1ph	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
16.01.35	(ODxWT) 140x10mm Rigid Aluminium Busbar	1,121	kg	weight (kg)	1121	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Aluminium (extrusion)	Bath ICE 3.0		No Reuse Anticipated
16.01.36	40.2mm Stranded Aluminium Conductor	459,000	kg	length (m)	170	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Aluminium (general)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	2700	Project Data									
16.01.37	11kV/415V Transformer	1	unit	weight (kg)	1	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Voltage Transformers 1ph	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
16.01.38	Earth Tape - 50mm*4mm	1,400	kg	weight (kg)	1400	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
16.01.39	Earth Tape - 50mm*6mm	270	kg	weight (kg)	270	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
16.01.40	Earth Rods 16mm*2400mm	4	kg	weight (kg)	4.3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
16.01.41	HF Earth Rods 16mm*4800mm	9	kg	weight (kg)	8.6	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
16.01.42	Cable Trough	170	m3	volume (m3)	170.04	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C20/25 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
Tilbury Headhouse															
Project data sources used in this category: 3. Cost plan or BoQ															
20.01.01	Primary Steelwork	27,500	kg	weight (kg)	27500	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
20.01.02	Roof Purlins	2,809	kg	weight (kg)	2809	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
20.01.03	Slabs - Concrete	193	m3	volume (m3)	192.7	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
20.01.04	Slabs - rebar	21,197	kg	weight (kg)	21197	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated

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20.01.05	Pile Caps - Concrete	26	m3	volume (m3)	26.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
20.01.06	Pile Caps - rebar	3,043	kg	weight (kg)	3043	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
20.01.07	Beams - Concrete	104	m3	volume (m3)	104.2	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
20.01.08	Beams - rebar	23,968	kg	weight (kg)	23968	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
20.01.09	Piles	111	m3	volume (m3)	111.3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C32/40 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
20.01.11	Shaft Stairs Steelwork	22,000	kg	weight (kg)	22000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
20.01.12	Plumber Fixtures	3	kg	volume (m3)	0.00324	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Plastics	Bath ICE 2.0		No Reuse Anticipated
				density (kg/m3)	970	Project Data									
20.01.15	Roller Shutter 2500mm x3000mm	8	m2	area (m2)	7.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	1%	Industrial Overhead Door - Assa Abloy OH1042F	EPD	14/05/2025	No Reuse Anticipated
20.01.16	RAL 7016	550	kg	volume (m3)	0.42292	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Paint (Wet)	Bath ICE 2.0		No Reuse Anticipated
				density (kg/m3)	1300	Project Data									
20.01.17	RAL 7035	82	kg	volume (m3)	0.063	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Paint (Wet)	Bath ICE 2.0		No Reuse Anticipated
				density (kg/m3)	1300	Project Data									
20.01.18	Glass 910x1210mm	48	kg	volume (m3)	0.01935	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Glass (Toughened)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	2500	Project Data									
20.01.19	Door 1010x2110mm	70	kg	volume (m3)	0.12887	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Timber - Plywood (540 kg/m3)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	540	Project Data									
20.01.20	Door 1010x2110mm Offset 346mm	69	kg	volume (m3)	0.12867	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Timber - Plywood (540 kg/m3)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	540	Project Data									
20.01.21	Doors 1010x2110mm	488	kg	volume (m3)	0.90309	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Timber - Plywood (540 kg/m3)	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	540	Project Data									
20.01.23	Default Wall	675	kg	volume (m3)	0.3552	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	20%	Brick - Generic Brick BDA UK	EPD	18/02/2024	No Reuse Anticipated
				density (kg/m3)	1900	Project Data									
20.01.25	Wall Block - Lightweight	46,940	kg	volume (m3)	19.55845	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	20%	British Precast Conc Fed - UK Precast Concrete Blocks	EPD (generic)	27/07/2022	No Reuse Anticipated
				density (kg/m3)	2400	Project Data									
20.01.27	RAL 7035	125,476	kg	volume (m3)	104.56365	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Paint (Wet)	Bath ICE 2.0		No Reuse Anticipated
				density (kg/m3)	1200	Project Data									
20.01.28	Concrete - Cast-in-Place Concrete Wall	1	m3	volume (m3)	1.112	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C20/25 - Concrete - ICE Low Carbon Route-map Grade B	ICE		No Reuse Anticipated
				density (kg/m3)	1	Project Data									
20.01.29	Grass Roof Generic	41,044	kg	area (m2)	513.05389	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Green Roof - Urbanscape Extensive (Full System)	EPD	29/05/2021	No Reuse Anticipated
				weight per m2	80	Project Data									
20.01.30	1220x457x356mm Wood - Cherry	23	kg	volume (m3)	0.03263	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	10%	Timber - Softwood	Bath ICE 3.0		No Reuse Anticipated
				density (kg/m3)	700	Project Data									
20.01.31	Indoor Unit	21	kW capacity	weight (kg)	21	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	1%	Chiller - Mitsubishi Electric A2W Heat Pump	TM65 Mid-Level		No Reuse Anticipated
20.01.32	Outdoor Condenser	114	kg	weight (kg)	114	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						

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20.01.33	Electric Panel Heater	60	kg	weight (kg)	60.4	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.34	Electric Tubular Heater	1	kg	weight (kg)	0.9	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.35	Tunnel Ventilation Fan	2,780	kg	weight (kg)	2780	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.36	Tunnel Ventilation Fan Motor	1,300	kg	weight (kg)	1300	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.37	Extract Fan	30	kg	weight (kg)	30	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.38	Drainage Pump	418	kg	weight (kg)	418	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.39	Variable Speed Drive	100	kg	weight (kg)	100	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.40	Damper Actuator	1	kg	weight (kg)	1	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† Electrical Equipment - Machinery	CIT 2023		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
20.01.41	1C 185 Single Core 90 thermosetting insulated non-mag arm LSF	500	m	length (m)	500	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.42	1C 16mm Single Core 90 thermosetting insulated non-arm LSF	50	m	length (m)	50	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.43	3C 16mm Multicore 90 thermosetting insulated armoured LSF	40	m	length (m)	40	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.44	3C 25mm Multicore 90 thermosetting insulated armoured LSF	15	m	length (m)	15	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.45	3C 2.5mm FP200	20	m	length (m)	20	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.46	3C 2.5mm Multicore 90 thermosetting insulated armoured LSF	15	m	length (m)	15	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.47	3C 4mm Multicore 90 thermosetting insulated armoured LSF	50	m	length (m)	50	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.48	3C 6mm FP600	20	m	length (m)	20	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.49	4C 25mm Multicore 90 thermosetting insulated armoured LSF	95	m	length (m)	95	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.50	4C 70mm Multicore 90 thermosetting insulated armoured LSF	80	m	length (m)	80	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
20.01.51	1C 70mm Single Core 90 thermosetting insulated armoured LSF	80	m	length (m)	80	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
Tilbury Shaft															
Project data sources used in this category: 3. Cost plan or BoQ															
01.01.01	Concrete - Jacking Collar	205	m3	Density (kg/m3)	1	Project Data	Transport Emissions - Rigid	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Volume (m3):	205	Project Data									
01.01.02	Concrete - Pre-Cast Rings (15m diameter, 350mm thick)	743	m3	Volume (m3):	743	Project Data	Transport Emissions - Artic	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated

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01.01.03	Concrete - External Lining	552	m3	Volume (m3):	552	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Density (kg/m3)	1	Project Data									
01.01.04	Concrete - Shaft Annulus Grouting	955,200	kg	Density (kg/m3)	2400	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	5%	† Concrete - (C40/50 MPa) UK Average	BATH ICE 3.0		No Reuse Anticipated
				Volume (m3):	398	Project Data									
01.01.05	Concrete - Shaft Base Slab	530	m3	Volume (m3):	530	Project Data	Transport Emissions - Rigid	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Density (kg/m3):	1	Project Data									
01.01.06	Concrete - Shaft Portal (2.7m thick)	189	m3	Density (kg/m3):	1	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				Volume (m3):	189	Project Data									
01.01.07	Steel Reinforcement - External Lining	328,000	kg	Mass (kg)	328000	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
01.01.08	Aggregate - Slab Subbase	169,600	kg	Volume (m3)	106	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	10%	Aggregate	Bath ICE 3.0		No Reuse Anticipated
				Density (kg/m3)	1600	Project Data									
01.01.09	UKC203x203x86	22,016	kg	weight (kg)	22016	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.10	PFC150x90x24	14,544	kg	weight (kg)	14544	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.11	UKC152x152x30	2,340	kg	weight (kg)	2340	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.12	UKC152x152x51	7,344	kg	weight (kg)	7344	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.13	RSA90x90x6	402	kg	weight (kg)	402	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.14	Cable Tray (200x200x100mm)	54	kg	weight (kg)	54.24	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.15	Tunnel Ventilation 1	869	kg	weight (kg)	869.4	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.16	Tunnel Ventilation 2	753	kg	weight (kg)	753.48	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Galvanised 15% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
01.01.17	Shower Ventilation	6	kg	weight (kg)	6.3	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Galvanised 15% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
01.01.18	WC Ventilation	13	kg	weight (kg)	12.6	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Galvanised 15% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
01.01.19	10% allowance for dampers, flanges and bolts	164	kg	weight (kg)	164.178	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
01.01.20	Sump Drainage - Pump 1	55	kg	weight (kg)	55	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Polyethylene	Bath ICE 2.0		No Reuse Anticipated
01.01.21	Sump Drainage - Pump 1	55	kg	weight (kg)	55	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Polyethylene	Bath ICE 2.0		No Reuse Anticipated
01.01.22	Sump Drainage - Pump 2	55	kg	weight (kg)	55	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Polyethylene	Bath ICE 2.0		No Reuse Anticipated
01.01.23	Domestic Water - external	45	kg	weight (kg)	45	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Polyethylene	Bath ICE 2.0		No Reuse Anticipated
01.01.24	Domestic Water - internal	4	kg	weight (kg)	3.71	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
01.01.25	Domestic Water - internal	3	kg	weight (kg)	2.8	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
01.01.26	Refrigerant - liquid line	5	kg	weight (kg)	5.04	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
01.01.27	Refrigerant - vapour line	10	kg	weight (kg)	9.54	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	Copper (0% Recycled)	Bath ICE 2.0		No Reuse Anticipated
01.01.28	Refrigerant - Supporting tray	26	kg	weight (kg)	26.46	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel - Hot Dip Galvanised	Bath ICE 3.0		No Reuse Anticipated
01.01.29	Condensate	4	kg	weight (kg)	3.75	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC	Bath ICE 2.0		No Reuse Anticipated
01.01.30	Domestic waste	1	kg	weight (kg)	0.9	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC	Bath ICE 2.0		No Reuse Anticipated
01.01.31	Domestic waste	1	kg	weight (kg)	1	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	PVC	Bath ICE 2.0		No Reuse Anticipated

Assumptions and Data Sources															
magenta text = changes have been made by the user in the advanced interface															
Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
01.01.32	Base Slab Steel	27,712	kg	weight (kg)	27712	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
01.01.33	Portal Steel	32,100	kg	weight (kg)	32100	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (Rebar 97% Recycled Content)	Bath ICE 3.0		No Reuse Anticipated
01.01.34	Spoil Removal	23,385,600	kg	Volume (m3)	12992	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	0%	!_Immaterial	N/A		No Reuse Anticipated
				Density (kg/m3)	1800	Project Data									
Tunnel															
Project data sources used in this category: 3. Cost plan or BoQ															
05.01.01	4m ID Pre-cast Segments (250mm thk)	7,360	m3	Volume (m3)	7360	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C50/60 - Concrete - ICE Low Carbon Route-map Grade B	ICE		General Materials - Standard Practice
				Density (kg/m3)	1	Project Data									
05.01.02	TBM Annulus Grouting	4,716,760	kg	Volume (m3)	3187	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† Concrete - (C40/50 MPa) UK Average	BATH ICE 3.0		General Materials - Standard Practice
				Density (kg/m3)	1480	Project Data									
05.01.03	Fore Shunt Sprayed Concrete Lining	715	m3	volume (m3)	715	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	5%	† C40/50 - Concrete - ICE Low Carbon Route-map Grade B	ICE LCRM		No Reuse Anticipated
				weight (kg)	1	Project Data									
05.01.04	Spoil Removal	130,842,000	kg	Volume (m3)	72690	Project Data	Transport Emissions - HGV	DEFRA 2020	50	60	0%	!_Immaterial	N/A		No Reuse Anticipated
				Density (kg/m3)	1800	Project Data									
Tunnel Fitout (Cabling)															
Project data sources used in this category: 3. Cost plan or BoQ															
24.01.01	400kV XLPE Cable	32,200	m	Length (m)	32200	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	0.01%	† 400kV Single-core Cable	SSEN DATABASE		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.02	OpTel Fibre	2,500	m	Length (m)	2500	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.03	Leaky Feeder	2,420	m	Length (m)	2420	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.04	Leaky Feeder (Backup)	2,420	m	length (m)	2420	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.05	SCS Fibre	2,500	m	Length (m)	2500	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.06	DTS Fibre	2,500	m	Length (m)	2500	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.07	TCS Ethernet	2,420	m	Length (m)	2420	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.08	400kV Sectionalising Joints	24	unit	Quantity	24	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	1%	† 400kV Cable Sealing Ends (Polymetric)	NG DATABASE		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.09	Bonding Leads	480	m	Length (m)	480	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	† Cable - Miscellaneous	ICEV3NH		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						

Assumptions and Data Sources															
magenta text = changes have been made by the user in the advanced interface															
Reference	Material Heading	Total	Unit	Assumption Heading(s)	Value(s)	Assumption Evidence Reference(s)	Transport Emissions Factor Name(s)	Transport Emissions Factor Data Source	Distance (km)	Design Life (years)	Waste Rate (%)	Emissions Factor Name	Emissions Factor Data Source	Emissions Factor Expiry Date (if applicable)	Reuse Scenario * = project-specific considerations have been provided
24.01.10	Power Cable Cleats	1,728	kg	weight (kg)	1728	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	Aluminium (general)	Bath ICE 3.0		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.11	Power Cable Saddle	9,576	kg	weight (kg)	9576	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	Aluminium (general)	Bath ICE 3.0		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.12	Power Cable Straps	10,620	kg	weight (kg)	10620	Project Data	Transport Emissions - HGV	DEFRA 2020	200	60	5%	Aluminium (general)	Bath ICE 3.0		No Reuse Anticipated
							Transport Emissions - Container Ship	DEFRA 2020	10000						
24.01.13	UKC152x152x30	2,340	kg	weight (kg)	2340	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	15%	Steel (general)	Bath ICE 3.0		No Reuse Anticipated
Site Waste															
Project data sources used in this category: [none selected by user]															
60.01.01	15 01 06 Mixed packaging	288,750	kg	Kg waste:	288750	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	15 01 06 Mixed packaging	WRAP		N/A
60.02.01	17 09 04 Mixed construction and demolition waste	12,752	kg	Kg waste:	12752.11065	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 09 04 Mixed construction and demolition waste	WRAP		N/A
60.03.01	17 01 07 Mixtures of concrete, brick, tiles and ceramics	2,343,946	kg	Kg waste:	2343946.4176	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 01 07 Mixtures of concrete, brick, tiles and ceramics	WRAP		N/A
60.04.01	17 02 01 Wood	116	kg	Kg waste:	115.95535	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 02 01 Wood	WRAP		N/A
60.05.01	17 02 02 Glass	2	kg	Kg waste:	2.41857	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 02 02 Glass	WRAP		N/A
60.06.01	17 02 03 Plastic	1,737	kg	Kg waste:	1736.81549	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 02 03 Plastic	WRAP		N/A
60.07.01	17 03 02 Bituminous mixtures	46,035	kg	Kg waste:	46034.75	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 03 02 Bituminous mixtures	WRAP		N/A
60.08.01	17 04 07 Mixed metals	260,576	kg	Kg waste:	260575.55224	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 04 07 Mixed metals	WRAP		N/A
60.11.01	17 09 03 Other hazardous waste (including asbestos)	272,592	kg	Kg waste:	272591.5	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 09 03 Other hazardous waste (including asbestos)	WRAP		N/A
60.12.01	20 03 01 Mixed municipal waste / Other	50	kg	Kg waste:	50.423	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	20 03 01 Mixed municipal waste / Other	WRAP		N/A
60.14.01	17 05 04 Non-hazardous soils and stones	755,846	kg	Kg waste:	755846.33298	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	100%	17 05 04 Non-hazardous soils and stones	WRAP		N/A
Site Fuel and Energy															
Project data sources used in this category: Benchmarked Data															
70.01.01	Company Total Gas Oil Fuel	208,421	Litres	Total fuel (L):	208420.88332	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	0%	Fuel Consumption - Gas Oil	DEFRA 2020		N/A
70.02.01	Supply Chain Total Gas Oil Fuel	138,947	Litres	Total fuel (L):	138947.25554	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	0%	Fuel Consumption - Gas Oil	DEFRA 2020		N/A
70.03.01	Site Electricity - Company	3,805,661	kwh	Total energy consumption (kWh):	3805661.05492	Project Data	Transport Emissions - HGV	DEFRA 2020	300	60	0%	Fuel Consumption - Electricity	DEFRA 2020		N/A



OUR OFFICES.

United Kingdom

- Motherwell (Eurocentral) +44 (0)1698 756100
- Manchester +44 (0)161 873 2500
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- Warwick +44 (0)1926 567800
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Appendix C - Sustainability Action Plan



Sustainability Action Plan

Tilbury to Gravesend Tunnel

December 2023

Revision 1

nationalgrid

Overview

The Project Sustainability Action Plan is a dynamic document that is discussed monthly and regularly updated. For this reason, the copy included within this document should be seen as a snap shot in time only.

The Action Plan is divided into four sections:

- Carbon,
- Resources,
- the Natural Environment, and
- Wider Sustainability Considerations.

Sustainability Action Plan - Carbon

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
Re-using existing insulators and fittings	Resources	Optioneering	Unlikely due to different conductor type and size to be used for refurbishment, but TBC by NG prior to NDP 4.4 stage.	Detailed design	2024	In progress
Using double circuit outage	Resources	Optioneering	Not possible at Tilbury anymore with latest Option 8 layout which necessitates single-circuit outages at different periods, so this will drive the outages for Gravesend works now as well but most of Gravesend compound works can be done offline (outside of outages).	FEED	2023	Closed
Re-using existing towers and tower strengthening	Resources	Optioneering	TBC by NG prior to NDP4.4 stage.	Detailed design	2024	In progress
Re-using existing foundations and foundation strengthening (if required)	Resources	Optioneering	TBC by NG prior to NDP4.4 stage.	Detailed design	2024	In progress
Use of a second-hand TBM	Resources	Optioneering	Unlikely from LTC or LPT2 due to different tunnel diameters of these two schemes to TKRE. Contractors should be able to confirm any opportunities for second-hand TBMs though, during the early market engagement stage.	FEED	2024	In progress
Recovering corroded main members (grade 5) instead of replacement - subject to results of the residual capacity assessment	Resources	Optioneering	Believe this refers to the OHL refurbishment, TBC following OHL condition survey works (in future years).	Detailed design	2025	In progress
Upgrading and re-using existing access routes for construction works / equipment	Natural Environment	Optioneering	Already taken into account in selected options for Tilbury (Option 8) and Gravesend (Option 2).	FEED	2023	Complete
Continued commitment to have 100% waste that is technically and economically feasible diverted from landfill	Resources	Optioneering	This requirement should be passed onto main works contractor and specified in tender package	NGET	2023	Complete

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
Reuse of temporary works into permanent design as much as possible to reduce rework	Natural Environment	Develop and Sanction	Already accounted for in the Tunnel & Shaft FEED designs and proposals.	FEED	2023	Complete
Specify % of reused and recycled steel	Resources	Develop and Sanction	This requirement should be passed onto main works contractor and specified in tender package	NGET	2023	Complete
Use mass concrete rather than reinforced - don't over specify the need	Resources	Develop and Sanction	Preference for reduction of reinforced concrete temporary works, and demolition this entails. Will be accounted for in the FEED designs and proposals for Tunnel & Shafts, Headhouses and CSE compounds.	FEED	2023	Complete
Trenches vs troughs for HV cables	N/A	Develop and Sanction	Troughs have been decided on, as they reduce the overall footprint of the cable corridors and backfill volumes.	FEED	2023	Complete
Shaft design and tunnel size optimisation	Resources	Develop and Sanction	Reduction in concrete should be possible via consideration of segment lengths. Already taking place at FEED but needs to be balanced against planning / CPO requirements, so there will be further scope for optimising at NDP4.4 when the cable manufacturer and fan manufacturer are selected and detailed design is developed (currently tunnel ID sits at 4m and Shafts ID at 15m in the FEED reference design).	FEED	2024	In progress
Spoil transport by barge - utilise existing jetty (could refurb if needed)	Air quality	Develop and Sanction	Discussions underway with POTL re access to jetty	NGET	2024	In progress
Deliveries by barge	Air quality	Develop and Sanction	Cables drums? TBM? TBM more likely than cable drums if the eastern Tilbury jetty is used, but TBC via market engagement. References will be made in the WI developed at FEED.	FEED	2023	Complete
Specify bigger conductor to reduce ventilation (benefit in operation)	N/A	Develop and Sanction	Optioneering exercise already undertaken at FEED but resultant airflow rates seem prohibitive for the 3,500mm ² single cable option, plus type registration wise this would be	Detailed design	2024	On hold

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
			challenging. Option for optimisation at NDP4.4 though.			
Rooftop PV on head houses	N/A	Develop and Sanction	Is this possible on curved roofs? Conflict with green roof? Might be challenging due to our curved roof design, plus you can either have green or PV roof. Will be consulted with the Architects and Electrical team. Final decision was to choose a biodiverse brown roof instead of PV.	FEED	2023	Complete
Collaborate with Lower Thames Crossing for use of hydrogen to power heavy plant.	Resources	Develop and Sanction	Raise at next meeting with LTC (July 2023)	NGET	2024	In progress
Use mains power for TBM and site - existing mains power supply available from Tilbury but could pick up new supply from substation if needed	Air quality	Develop and Sanction	NGET has a target for diesel-free construction sites and is running trials. HVO is also less preferred. Following review of the existing LVAC / Mains power supply at the existing Tilbury headhouse, capacity will be unlikely to suffice for the new TBM in the temporary state. Temporary generators or a temporary supply from existing Tilbury substation more likely now. However, contractor will be challenged to find a better solution	FEED/NGET	2024	In progress
Use earth friendly concrete for structures that don't need to be reinforced (doesn't meet British Standards but fine for non-structural use)	Resources	Develop and Sanction	NGET has experience of using this for LPT2 (world's biggest pour). Needed a deviation but if there's a precedent of an accepted TD, this should be even easier to implement. We will consider in the Civil reference design at FEED.	FEED	2024	In progress
Sustainable design of tunnel segments including material choice i.e.. steel fibres vs steel reinforced cages	Resources	Develop and Sanction	Considered in Baseline Carbon Report will recommendations for alternatives	FEED	2024	In progress
Segment manufacturing location (whilst there are manufacturing plants in the UK, a company known as Shay Murtagh, who are in Ireland, seems	Resources	Develop and Sanction	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
popular so need to consider transport emissions)						
Consider transport emissions from TBM delivery	Resources	Develop and	Emissions depend on whether it's a new machine (probably Germany), or refurbished (anywhere in the world). This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress
Comparison of transport emission from using Tilbury Docks vs IVL jetty	Resources	Develop and Sanction	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress

Sustainability Action Plan - Resources

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
Use of barges to move soil rather than road	Carbon	Optioneering	Discussions underway with landowners re access to jetty/use of berth	NGET	2024	In progress
Work with LTC to find more efficient use and removal of spoil	Natural Environment	Optioneering	Unlikely as LTC are not removing any spoil from site (all reused on site)	NGET	2023	Closed
Local recycling rather than national contract	All Areas	Optioneering	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress
Existing hard standing used for yards	Natural Environment	Optioneering	Achieved as far as possible. Use of soft ground kept to minimum. Already taken into account in selected options for Tilbury (Option 8) and Gravesend (Option 2)	FEED	2023	Closed
Reduced number of pull sites	All Areas	Optioneering	Achieved, all cable pulls aimed to be from Tilbury.	FEED	2023	Closed
Use recycled aggregates for temporary areas	Carbon	Develop and Sanction	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress
Treatment of water from tunnelling prior to discharge	Pollution	Develop and Sanction	MSES to consider in Tunnel / Shaft construction methodologies.	FEED	2024	In progress
Reuse of NG temporary materials by other developers	Carbon	Develop and Sanction	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress
Reuse heat from cables/CSEs	Carbon	Develop and Sanction	Interesting idea but extremely difficult in practice, plus all the drivers in the design are to reduce heat from the cables and/or dissipate it.	FEED	2023	Closed
Reuse of Bentonite (if slurry TBM utilised)	Carbon	Develop and Sanction	MSES to consider in Tunnel construction methodology and TBM spec.	FEED	2024	In progress
Optimise tunnel arisings	Carbon	Develop and Sanction	Considered in Civil design of the CSE compounds and Cut & Fill model.	FEED	2023	Closed

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
Reuse of shaft arisings	Carbon	Develop and Sanction	Considered in Civil design of the CSE compounds and Cut & Fill model.	FEED	2023	Closed
Reuse of tunnel arisings	Carbon	Develop and Sanction	Considered in Civil design of the CSE compounds and Cut & Fill model.	FEED	2023	Closed
Collaborate with Lower Thames Crossing and other developers for reuse of excavated materials - tunnels and shafts and any other efficiencies	Carbon	Develop and Sanction	Discussions with LTC and Statera underway	NGET	2024	In progress
Consider soil stabilisation for temporary, hardstanding areas - reduce volume of required materials - particularly piling mats, instead of aggregates	Carbon	Develop and Sanction	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress
Water supply for TBM	Carbon	Develop and Sanction	Mains water likely to be used but Contractor challenged to find innovative solution	NGET	2024	In progress
Eco cabins for construction	Carbon	Develop and Sanction	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In progress

Sustainability Action Plan – Natural Environment

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
Consider the use of Biodigester/composting toilets for site compounds rather than foul tankers	Wider Sustainability	Optioneering	This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In Progress
Can bird and bat boxes be fitted prior to works starting to discourage nesting on or near towers?	All Areas	Optioneering	OHL work will begin in 2027. To be considered at detailed design.	Detailed Design	2024	On hold
Using CSS crossing protection system for major crossings	Wider Sustainability	Optioneering	No major road crossings	FEED	2023	Complete
Ecological surveys	N/A	Optioneering	Survey work is underway by AECOM and results are being feed into design	NGET	2023	Complete
Outage planning (for bird nest removal)	N/A	Optioneering	TBC	NGET	2024	In Progress
Installation of bird deterrents	Resources	Optioneering	To be considered at detailed design	NGET	2024	On hold
Waste management	N/A	Optioneering	Contractors will be required to prepare SWMP and detail how waste hierarchy will be followed. This requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In Progress
Replacement of the removed trees	N/A	Optioneering	Tree survey indicates some requirements for removal and protection of a veteran tree. Replacement trees are considered in ecological mitigation and landscaping plan	AECOM	2023	Complete
Archaeological survey	N/A	Optioneering	Survey work is underway by AECOM and results are being feed into design. Boreholes will be analysed in 2024	AECOM	2024	In Progress
Spoil use as habitat creation (Thames Estuary schemes - high	Resources	Develop and Sanction	Positive discussions underway with RSPB (Cliffe Pools) and their neighbouring commercial operator, Brett's. 4% BNG achieved to date. A further 6% needed (minimum) so	NGET	2024	In Progress

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
BNG?)			search will continue next year.			
Light pollution	N/A	Develop and Sanction	Natural England have raised issue of light causing bird disturbance. FEED contractor will design in directional columns with less spill and motion activated. Agreed and item already discussed in DRM of 13th July. Lit bollards or motion activated lights will be specified. Now incorporated into planning application	FEED	2023	Complete
Noise barriers during construction	N/A	Develop and Sanction	Noise data being collected by FEED which will inform HRA assessment for main works and determine type of mitigation required. Barriers now incorporated into planning application	FEED/NGET/AECOM	2023	Complete
Green roofs (FEED -> detailed design)	N/A	Develop and Sanction	Advice from AECOM needed. Conflict with rooftop PV? As above. Biodiverse brown roof discussed with NE and Buglife and incorporated into planning application.	AECOM	2023	Complete
Fund/management of SSSI	N/A	Develop and Sanction	Need direction from NE.	NGET	2024	In Progress
Decommissioning of existing head house to create new habitat	N/A	Develop and Sanction	Currently, outside of scope of this project but will keep in mind.	NGET	n/a	Closed
Plastic trackway instead of stones	Resources	Develop and Sanction	To be incorporated wherever possible. Description in planning application and this requirement should be passed onto main works contractor and specified in tender package	NGET	2024	In Progress
Bioinstinct tool test	N/A	Develop and Sanction	NGET leading on this. To be considered in 2024.	NGET	2024	In Progress
Further wildlife projects local to Tilbury identified by Chris Plester to be investigated	N/A	Develop and Sanction	NGET investigating further options in 2024	NGET	2024	In Progress

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
Advice to be sought from Kent Wildlife Site on the East Court Marshes LWS	N/A	Develop and Sanction	NGET have approached KWT but no feedback yet. Will continue to engage.	NGET	2024	In Progress

Sustainability Action Plan – Wider Sustainability Considerations

Opportunity	Secondary Impacts	Stage Identified	Action/Update	Action Owner	Due	Status
Support any local environmental projects?	All Areas	Optioneering	Discussion with County Archaeologist about Riffle Range and local history. Discussions to be continued once have borehole data.	AECOM	2024	In progress
Identify at least one improvement to be undertaken within the local area to improve access to, or knowledge of, local environment and / or local heritage.	All Areas	Optioneering	Upgrade of road leading to the jetty on the south-east of the Tilbury site might be one example, as it will allow easier access to areas of wildlife. Need to be careful here as necessary resurfacing will damage the mosaic habitat. AECOM to advise re BNG.	NGET	2024	In progress
Promote Community Benefit Fund	All Areas	FEED	Fund has been promoted at public exhibitions and workshops and follow up meetings with counsellors and local interested groups. Will continue to promote and encourage applications in 2024.	NGET	2024	In progress
Project team to offer and organised workers to attend volunteering days	All Areas	FEED	To be pursued next year once site is being mobilised.	NGET	2024	In progress

National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom
Registered in England and Wales
No. 4031152

nationalgrid.com

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National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom
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