MOTT MACDONALD

Old Colwyn Coastal Defence and Active Travel Scheme

Carbon Management Plan

July 2020

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Contents

Executive summary

This Carbon Management Plan has been produced to set out the framework for managing and reducing greenhouse gas emissions for the Old Colwyn Coastal Defence and Active Travel Scheme through design and into construction. A target for the Scheme has been set to aim for a reduction of 30% from the baseline of Conceptual Design to Tender Design.

The approach to integrating low-carbon thinking during design is outlined which includes using the carbon hierarchy, challenge important aspects of the design, the implementation of topic specific workshops and how the Scheme is being assessed for the sustainability of the Scheme.

Through different stages of design, the carbon footprint of the Scheme has been estimated to allow focus on the hotspots of carbon and to track the progress of the Scheme. Footprints have been developed for the Conceptual Design and Tender Design with estimates of additional savings through Detailed Design highlighted. Following the low carbon approach through design numerous ideas have been incorporated into the design to show a reduction in carbon emissions. These ideas have resulted in a 32% saving between Conceptual Design and Tender Design meeting the reduction target set for the Scheme. Further reductions have occurred through Detailed Design along with a number of ideas to be implemented or further investigated for construction have been identified which are outlined in the plan to further reduce carbon emissions associated with the Scheme.

1 Introduction

1.1 Purpose of the Carbon Management Plan

1.1.1 This Carbon Management Plan (CMP) sets out the framework for managing and reducing project-related greenhouse gas (GHG) emissions for the Old Colwyn Coastal Defence and Active Travel Scheme (hereafter referred to as the "Scheme").

1.1.2 It also documents the key carbon reduction measures implemented within the project.

1.2 Scope of the Carbon Management Plan

1.2.1 The CMP covers the strategy that has been followed through design and will continue to be used as the design progresses. The CMP defines:

- The relevant carbon objective and targets to which the Scheme is working towards;
- Roles and responsibilities;
- Approach to integrating low-carbon thinking during design;
- Assessment approach;
- Reductions to date; and
- Further required reductions.

1.2.2 The CMP is focused upon the design stage of the Scheme, however the approach should be followed through later stages including construction. In addition, a number of ideas for implementation have been outlined within the CMP that need to be implemented or further investigated for construction.

2 Key Components of the Carbon Management Plan Approach

2.1.1 The carbon management approach has several key components which will support the delivery of low carbon solutions.

2.1.2 These are summarised in Table 2.1.

Table 2.1: Key CMP Components

Component	Theme	Section of the CMP
Strategy	Setting a strong direction for the projects in pursuit of low-carbon solutions	Section 3
People	The CMP identifies key members of the project team that can support the delivery of low-carbon solutions. This includes design, construction procurement and management teams as well as topic specialists and supply chain where relevant.	Section 4
Processes	The process of design and delivery will include carbon in multi-criteria analysis as well as targeted workshops and support throughout.	Section 5
Assessment	The carbon emissions associated with the Scheme at different stages of design will be estimated. The progress through the design and identified reductions will be recorded where possible.	Section 6 - 8

Source: Mott MacDonald 2020

2.1.3 As well as these components, there is further additional information on the assumptions and identified low carbon solutions which are captured in the Appendices of this CMP.

2.1.4 Each of the sections of this report will be updated as design progresses, and as other activities become increasingly important. Any sections no longer relevant will be moved to the Appendices.

3 Strategy

3.1 Mott MacDonald Policy

3.1.1 Mott MacDonald are committed to reducing carbon on projects by certifying its carbon management processes used on projects globally with PAS 2080: Carbon Management in Infrastructure.

3.2 Conwy County Borough Council Policy

3.2.1 The Conwy Local Development Plan was adopted in 2013[1]. Within the plan Policy DP/1 – Sustainable Development Principles references making efficient and effective use of resources, take account and address the potential impact of climate change, reduce waste production. The Natural Environment Strategic Statement states that developments must seek to limit the impact on the environment 'by minimising resource use, increasing energy efficiency and reducing carbon emissions.

3.3 Targets

3.3.1 The Scheme has set out to reduce carbon throughout the design process. To focus the reduction of carbon, a target has been set to show a reduction from Conceptual Design to the end of Tender Design.

3.3.2 The target has been set at 30% reduction from the baseline of Conceptual Design.

3.3.3 Following Tender Design the scheme has continued to reduce carbon through detailed design. Furthermore, the Scheme will continue to reduce carbon through construction however currently there are no plans to measure against a target at construction or operation stages.

[1] Conwy County Borough Council (2013). Conwy Local Development Plan 2007-2022 [online] available at: https://www.conwy.gov.uk/en/Resident/Planning-Building-Control-and-Conservation/Strategic-Planning-Policy/Adopted-Local-Development-Plan-LDP/Assets-written-proposals-maps/Conwy-Local-Development-Plan-2007-2022.pdf (last accessed June 2020)

4 Roles and Responsibilities

4.1 Key Roles

4.1.1 All members of the project teams have the potential to influence low-carbon outcomes. However, some roles have key responsibilities in leading the efforts to implement low-carbon solutions during design and delivery.

4.1.2 These are:

- Project leads – ultimate responsibility for compliance with legislation and client project commitments;
- Design managers – overall responsibility for guiding design to minimise carbon emissions as far as possible. Providing a level of challenge to make sure that focus is given to low carbon options;
- Design team – practical role in developing designs that minimise emissions and capturing and recording low-carbon options;
- Environment managers – supporting the design team to identify low-carbon solutions and providing links to other environmental disciplines to highlight co-benefits or risks;
- QS team – supporting the production of information relevant to the carbon assessment, challenging cost and productivity within their models and identifying associated low carbon opportunities;
- Procurement team – challenging suppliers to provide innovative, low carbon products and solutions;
- Pre-Construction team – minimising carbon through challenging design buildability, planning and integration of activities, optimising / challenging logistics and procurement;
- Carbon Specialists – setting the framework for considering carbon and undertaking the required quantifications. Training and informing the design managers and teams; and
- Client – setting the direction and commitments for the reduction of carbon.

4.2 Communication and Training

4.2.1 The successful implementation of this CMP depends upon there being adequate co-ordination, communication and liaison between the various parties. Any specific construction requirements for carbon reduction will be recorded within the Construction Environmental Management Plan (CEMP). In addition, the CMP will be provided as an Appendix to the CEMP

4.2.2 The appropriate project team members of the list outlined in the Section 4.1 have been provided with the following training or guidance where necessary:

- Carbon baseline and opportunities for reduction through the carbon and Design for Resource Efficiency (D4RE) workshops;
- Mott MacDonald Carbon Portal e-learning module; and
- Reference document: PAS 2080 – Carbon management in infrastructure.

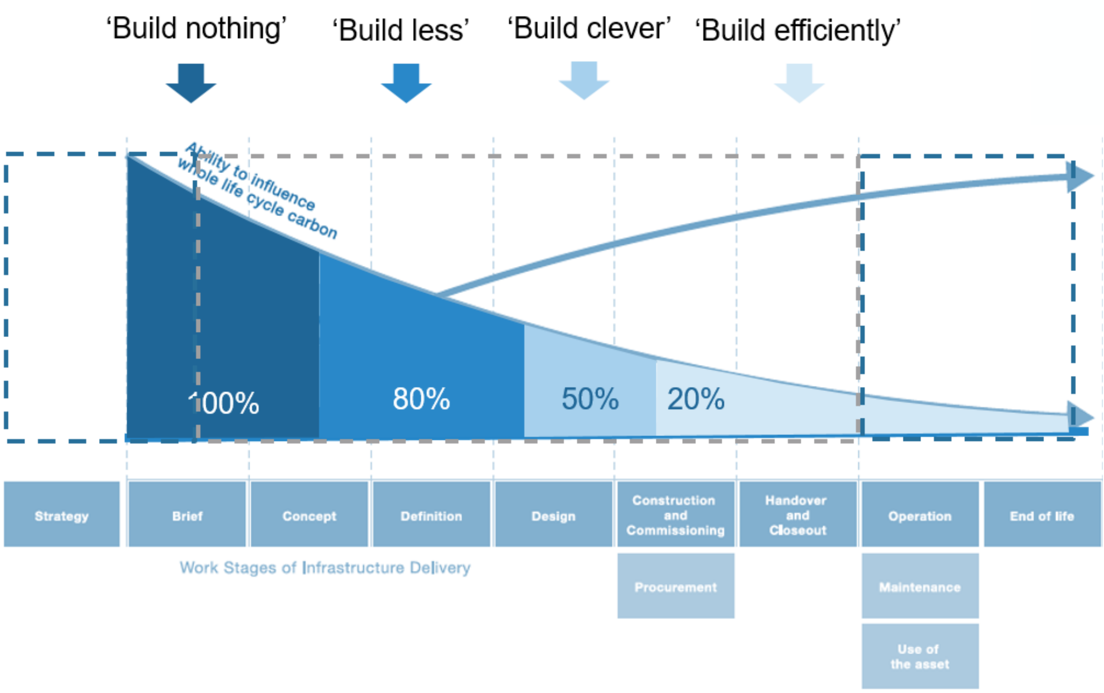
5 Approach to Integrating Low-Carbon Thinking During Design

5.1 Overall Approach

5.1.1 During the design stage, carbon has been evaluated contributing to the value engineering process with design managers being supported by the core carbon team in this process. The different design aspects have been assessed for the impact on low carbon either qualitatively or where possible quantitatively.

5.1.2 Evaluation followed the carbon hierarchy, shown in Figure 5.1, approach of identifying assets which can be designed out (build nothing), opportunities to build less, build clever and build smart.

Figure 5.1: Carbon Hierarchy Approach



5.1.3 The carbon reduction challenge focused on both reducing the amounts of primary materials required and then selecting the best materials available. In simple terms this means first trying to reduce, for example, the amount of concrete and (where compatible with other specifications) selecting the best (low-carbon) concrete available on the market.

5.2 Challenge Points

5.2.1 Key questions that prompt the discussion included the following (depending on the assets to be considered). Answers to some of these questions may not be known at any given point during the design or delivery stage:

Design focus:

- Have you considered all build nothing options? This could include ancillary items such as avoiding the need for diversions (utility / road)?
- Have you optimised material use in scheme and detailed design?
- Have you considered lowest carbon materials? In particular, any impacts from low-carbon concrete?
- Can any existing assets/infrastructure be utilised?
- Has topography and need for excavation works been considered?
- Have low-carbon soil stabilisation materials and methods been considered?
- Has optimal longevity of assets been achieved to minimise replacement vs initial capital carbon?
- Has standardisation / modularisation been considered in design to minimise cut offs and waste?
- Have you considered potential effects for re-use and/or recycling of on-site aggregates and spoil?
- Have maintenance requirements been minimised?
- Has design considered deconstruction where required to optimise recycling and reuse of components?

Construction focus:

- Have you used methods to optimise resource productivity and resource allocation to reduce construction duration and cost?
- Have you considered new construction techniques that minimise construction time, result in less temporary works, use of temporary works as permanent or reduce fuel consumption?
- Has near site assembly/manufacture been considered to minimise transport requirements?
- Have you considered alternative low carbon fuels for construction plant?
- Have you considered energy efficient site cabins and equipment?
- Have you considered optimal material logistics to reduce unnecessary transport during construction?
- Has offsite manufacture been considered to minimise waste?

5.3 Topic Specific Workshops

5.3.1 A carbon reduction or Design for Resource Efficiency (D4RE) workshop has been held with the design team. This workshop was run by the carbon management team within Mott MacDonald. This workshop served to check and challenge the design as it progresses. Members from the specific disciplines as well as other key design and delivery staff were included as part of the workshop.

5.3.2 The focus for the workshop was as follows:

- Reminder of the key drivers for carbon reduction and resource efficiency;
- Focus on the key hotspots per asset/ material type and structural solution;
- Review of any baseline reports available;
- Step through the carbon hierarchy (build nothing, build less, build clever); and

- Note specific actions and ideas to develop further.

5.3.3 Outputs from this workshop were captured within the Old Colwyn Coastal Defence and Active Travel ES Volume 2, Appendix 9.2. These have been shared with the relevant teams throughout the scheme development to monitor the opportunity implementation and impact on carbon.

5.4 CEEQUAL

5.4.1 The Scheme is being assessed under the Civil Engineering Environmental Quality Assessment and Award Scheme (CEEQUAL). A number of the questions being assessed revolve around carbon reduction including producing a carbon management approach, identifying and measuring reduction targets. This further encourages the low carbon thinking throughout design.

5.5 Reporting Progress Against the Target

5.5.1 Progress against the carbon reduction target has been tracked and reported in this CMP. The CMP is intended as a live document to be updated with the project, following carbon reduction from Conceptual Design to the end of Detailed Design. The target will be measured between Conceptual Design and the Tender Design due to the availability of the appropriate information, any further identified reduction measures through Detailed Design have been recorded in this CMP.

5.5.2 During construction, the further carbon reduction measures identified in Section 7.3 should be monitored. Progress against these measures should be tracked, with justification provided where the measures have not been implemented.

6 Assessment Approach

6.1 Activity scope

Life Cycle Stages

6.1.1 All carbon assessments have been broken down by life cycle stages (modules) in Table 6.1 consistent with the principles set out in PAS 2080. The scope of assessment included lifecycle stages A1-3, A4, A5, B2 and B6. The activities incorporated may change depending on the level of detail available in the data as the project progresses.

Table 6.1: Life Cycle Stage Activities

Life Cycle Stage	Activities Incorporated
Product stage (modules A1-A3)	The extraction, processing and manufacturing of all materials required for the permanent assets. This includes all energy and carbon emissions from manufacturing plants, primary and secondary manufacturing stages as well as any transport emission between these stages.
Construction process stage - transport to site (module A4)	The transportation of all materials required for the permanent assets and construction equipment to site from the point of production (or point of storage in the case of plant and machinery).
Construction process stage - construction and installation (module A5)	Construction site works activities including: • temporary work, ground works and landscaping; • materials storage and any energy or otherwise need to maintain necessary environmental conditions; • transport of materials and equipment on site; • 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; and • production, transportation, and waste management of materials/products lost during works.
Boundary of use stage – (module B2)	The works activities and new materials for the maintenance, repair, replacement and refurbishment of the infrastructure during the use stage/operation of infrastructure.
Boundary of use stage – operational energy (module B6)	Represents the carbon 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.

Source: PAS 2080, 2016[2]

[2] BSI (2016) PAS 2080: Carbon management in infrastructure

6.2 Temporal scope

6.2.1 The reference study period is during design, construction and operation of the project. The operational emissions are considered to be minimal and are scoped out for this project.

6.3 Activity Data

6.3.1 Activity data has been sourced from QS data used to produce bills of materials that have been available at certain points in the design process. This has been used to make sure all activities have been captured in the same way for carbon as in cost.

6.3.2 In selecting activity data, the project aimed to use that data which was the most complete, up-to-date and referenceable. During the design process, it was necessary to use interim data in order to support decision making. As far as possible this followed the same criteria however there were be cases where assumptions are required.

6.4 Emission factor data

Data quality

6.4.1 Emission factor data has been selected based on its overall applicability to the project. A number of criteria has been applied:

- Age: the most recently published data has been preferred;
- Geography: data which applies to the location of actual suppliers and/or activities has been preferred;
- Technology: data which represent the actual product/activity in question has been preferred;
- Methodology: data which follow a published methodology or product category rules has been preferred; and
- Competency: data which are produced from proficient entities has been preferred.

6.4.2 Ultimately, there are trade-offs between these criteria. The choices made by the carbon consultant have been documented in accompanying reports.

6.5 Calculations

6.5.1 The Moata Carbon Portal has been used to quantify the emissions associated with the Scheme by inputting the quantities of materials as provided. The Moata Carbon Portal contains a library of materials and activities with the associated emission factor. Items selected within the Moata Carbon Portal wherever possible contain the embodied carbon emissions and plant activities.

6.5.2 The Moata Carbon Portal does not contain information of transport of materials to site. To include this lifecycle stage, calculations have been completed in line with the Royal Institute of Chartered Surveyor (RICS) methodology assumptions on travel distances where scheme specific information is not available[3]. This can be refined as procurement progresses.

6.6 Baseline

6.6.1 Due to the availability of design information and in the interest of efficiency it has not been possible to produce a complete footprint from Conceptual Design to be used as the baseline.

[3] Royal Institute of Chartered Surveyors (2017). Whole life carbon assessment for the built environment.

6.6.2 It has been deemed appropriate for the assessment, and to measure the progress of carbon reduction, to back-calculate the approximate baseline. The D4RE workshop listed the largest reductions which occurred between conceptual design and the Tender Design and a number of these were possible to quantify. These reductions mostly involved removal of design elements and so it was deemed important to capture this ‘build nothing’ decision as part of the carbon management process. The calculations involved adding the quantified carbon reductions on to the Tender footprint.

6.6.3 This methodology for calculating the baseline has limitations and a number of assumptions, listed below:

- Potential omissions of increases between Conceptual Design and Tender Design that have not been recorded;
- A number of the reductions to-date have not been quantified in the latest footprint or in the baseline; this means the calculated baseline is potentially lower than the true value;
- The quantities for headlands and fishing platforms have been multiplied up by 3 to approximate the change in number and size of platforms;
- The quantities for the reductions are based upon the Tender Design footprint quantities; and
- There is potential for aspects in the Tender Design not to have been considered at Conceptual Design.

7 Carbon Assessment

7.1 Pre-tender Design Footprint

Construction

7.1.1 For the purpose of the Climate assessment within the Environmental Statement for the Scheme, the footprint was based upon the Tender Design due to the availability of information. The Tender Design was quantified by a QS to provide a bill of quantities for all the available aspects of the design.

7.1.2 The carbon assessment from has indicated that the Scheme would result in emissions of approximately 44,586tCO2e for construction lifecycle stages A1-3, A4 and A5. The breakdown of which is shown in Table 7.1 below.

Table 7.1 Emissions Split by Lifecycle Stage

Life Cycle Stage	Estimated emissions (tCO_2e)
Product stage (modules A1-A3)	37,820
Construction process stage - transport to site (module A4)	5,221
Construction process stage - construction and installation (module A5)	1,546

Source: Mott MacDonald 2020

7.1.3 The three greatest contributors, as split by category and by individual item are shown in Table 7.2.

Table 7.2 Construction Carbon Hotspots

CATEGORY	
Revetments	86%
Roads and Paving	9%
Retaining Walls	2%
INDIVIDUAL ITEM	
Supply and deliver primary armour for revetments	52%
Supply and deliver underlayer for revetments	24%
Imported regulating course to make up levels	6%

Source: Mott MacDonald 2020

Operation

7.1.4 There will be 1.2km of street lighting in the Scheme, this has been estimated at 246tCO_2e over the 50 year lifetime of the scheme (specification for the Scheme is unknown and emissions have been based on a typical installation specification and operating hours). In the absence of data to calculate the carbon emissions associated with the operation of the kiosk, considering the emissions from street lighting it is anticipated that the operational energy and carbon emissions from operation are likely to be relatively low.

7.1.5 As noted in ES Volume 1 Materials Chapter, the maintenance requirement would not include a total replacement of the Scheme. There would be a requirement to conduct visual inspections multiple times per year, these inspections would not be expected to generate significant emissions. The scheme is being designed with a 50 year lifetime and, unless significant replacement was identified through the routine inspections, the maintenance footprint is considered to be minimal.

7.2 Carbon reductions

7.2.1 Through following the approach detailed in Section 5, the design has resulted in large carbon savings from Conceptual Design to the Tender Design with further reductions identified through Detailed Design and for construction.

7.2.2 The majority of the savings that have been recorded were identified within the D4RE workshop 4th March 2020 and have been quantified where possible, shown in the Old Colwyn Coastal Defence and Active Travel Scheme ES Volume 1 Technical Appendix 9.2. The quantified reductions have either been taken into account prior to the pre-tender footprint whereas others are to be fully implemented and accounted for by the end of detailed design, as shown in Table 7.3. The quantified savings accounted for in the Tender Design footprint results in a reduction of approximately 32%.

Table 7.3 Quantified Carbon Savings from Implemented Measures

Description	D4RE Reference	Status	Carbon Saving (tCO_2e)
Implemented and accounted for in current footprint			
Reuse of existing rock armour	5	Audit of materials require	7,046
In Area 1 raise only the promenade not the road also	22	Fully implemented and accounted for in calculations	1,113
Reuse existing wave return wall within scheme design	24	Fully implemented and accounted for in calculations	100
Recycle existing asphalt as fill within scheme	34	Fully implemented and accounted for in calculations	14
Remove existing concrete promenade to be reused as fill.	N/A	Fully implemented and accounted for in calculations	179
Reduce the number of headland structures from 3 to 1	1	Fully implemented and accounted for in calculations	3,359
Use of rock armour rather than precast concrete armour	14	Fully implemented and accounted for in calculations	9,355
Reduction of fishing platforms from 3 to 1	17	Fully implemented and accounted for in calculations	53
Total			**21,220**
Implemented but not accounted for in current footprint			
Use of recycled cement replacement	10	Included within specification	238
Steepen revetments to minimise material requirements	18	Optimisation on-going, current estimate at 5% saving	1,167
Total			**1,405**

Source: Mott MacDonald 2020

7.3 Further Required Actions

7.3.1 During the design period a number of additional measures were identified to be implemented at a later stage as the Scheme progresses (with the D4RE workshop being the key stage for the identification of these measures. The quantifiable ideas are outlined in Table 7.4.

Table 7.4 Quantified Carbon Savings for Further Actions

Description	D4RE Reference	Status	Potential Carbon Saving (tCO_2e)
Reuse of fill from other site for promenade raising and revetment fill	28	Contractor responsibility	359
Use of precast concrete rather than in-situ concrete where possible	16	Contractor responsibility	1,506
Source slate waste as fill to use for raising levels	20	Contractor responsibility	98
Transport rock revetment material from Scotland or Norway by barge	4	Contractor responsibility	919-1,749
Total			**2,882-3,712**

Source: Mott MacDonald 2020

7.3.2 To continue the reduction of carbon the following measures are required to be implemented wherever possible, confirmed or further explored. The details of the ideas, the further work required and the responsible party are shown in Table 7.5. These ideas will be considered and justified if not possible to implement.

Table 7.5 Further Actions to be Implemented

Description	Further Action Required	Responsible Party	Timeframe
Recycled steel to be used for rebar where possible at a minimum of 85% recycled steel.	Contractor to implement as detailed in specification	Contractor	Through procurement
Recycled material to be used as a cement replacement. 36-85% ground granulated blast furnace slag as a suggested material.	Contractor to implement as detailed in specification	Contractor	Through procurement
Transport of rock revetment potentially to be by boat from Scotland or Norway. The further investigation should consider the distance required to move the rock from the quarry to the port also. For calculations see the following – by boat approx. 0.92 tCO^2e per km versus by road approx. 55.36 tCO^2e per km.	Further calculations required once quarry availability known.	Contractor	Through procurement

Description	Further Action Required	Responsible Party	Timeframe
During quarrying and armourstone extraction, use byproduct as underlayers, fill, aggregate or roadstone.	Contractor to implement where feasible	Contractor	Through construction
Source slate waste as fill to use for raising levels	Contractor to implement where feasible	Contractor	Through procurement
Reuse of fill from other sites for prom raising/behind revetment.	Contractor to implement where feasible once construction dates are known and other developments programme known	Contractor	Through procurement
Re-use of existing materials e.g. lighting, parking meters, ramp, benches.	CCBC to determine what is able to be reused and organise collection and storage	CCBC	Through construction

Source: Mot MacDonald 2020

7.4 Conceptual Design Baseline

7.4.1 The Conceptual Design baseline has been calculated from the Tender Design footprint with the addition of the quantified carbon reductions.

7.4.2 The carbon footprint for the Conceptual Design baseline is estimated to be 65,806tCO_2e for construction lifecycle stages A1-3, A4 and A5. The breakdown of which is shown in Table 7.6 below.

Table 7.6 Baseline Carbon Footprint

Life Cycle Stage	Estimated Emissions (tCO_2e)
Product stage (modules A1-A3)	57,678
Construction process stage - transport to site (module A4)	5,734
Construction process stage - construction and installation (module A5)	2,395

Source: Mott MacDonald 2020

7.5 Progress Through Design

7.5.1 The target was set out to reduce 30% reduction from the Conceptual Design to the Tender Design. There were a number of actions quantified for the reductions between Conceptual Design and Tender Design, as shown in Table 7.7 below. These reductions and the further quantified reductions for Detailed Design and construction, if all implemented, would result in up to a 41% saving.

Table 7.7 Carbon Footprint Through Design

Scheme Stage	Footprint (tCO_2e)	Reduction from Baseline
Conceptual Design	65,806	N/A
Pre-tender Design	44,586	32%
Detailed Design	43,400*	34%
Construction	38,688-40,518*	39-40%

Source: Mott MacDonald 2020
Note: * footprint estimated from the Tender Design footprint with the additional identified savings subtracted.

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