UNIVERSAL DESTINATIONS & EXPERIENCES UK PROJECT

Former Kempston Hardwick Brickworks and adjoining land, Bedford

Appendix 14.1 Carbon Management Plan

Report reference: 4.14.1.0

Revision number: 00

Date: June 2025

UNIVERSAL DESTINATIONS & EXPERIENCES

CONTENTS

TABLES

FIGURES

ANNEX

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. This Carbon Management Plan (CMP) has been prepared for the Proposed Development as described in **Chapter 2: Description of the Proposed Development (Volume 1)** of the Environmental Statement and **Appendix 2.1: Environmental Statement Basis of Assessment (Volume 3)**.

1.1.2. The Site is located south-west of Bedford, Bedfordshire and is broadly to the east of the A421 and west of the Midland Main Line and is on the former Kempston Hardwick brickworks and agricultural land. The Site is divided into four main land areas referred to in the planning proposal as the Core Zone, Lake Zone, West Gateway Zone, and East Gateway Zone. The proposed Entertainment Resort Complex (ERC) lying within these zones would allow a theme park and associated uses including retail, dining, entertainment; visitor accommodation; sport, recreation, leisure and spa facilities; venues with conference and convention spaces; associated services and uses for any operational or administrative functions; utilities generation, storage, collection, treatment, and processing facilities associated with the ERC; vehicle and cycle parking, maintenance and servicing, and transportation hubs; access routes and circulation spaces; landscaping; utility infrastructure; and use of land necessary to support construction.

1.1.3. The planning proposal also includes a series of infrastructure improvements including:

- A new A421 junction;
- An expanded railway station on the Thameslink/Midland Main Line at Wixams;
- Improvements to Manor Road; and
- Improvements to certain other local roads.

1.1.4. It also safeguards land for a potential new railway station on the proposed EWR Bletchley to Bedford line, should this come forward in the future.

1.2. PURPOSE OF THE CARBON MANAGEMENT PLAN

1.2.1. This CMP has been prepared to support the design and delivery of the Universal Destinations & Experiences (UDX) UK Project on behalf of UDX, aligning to UDX's ambition to seek opportunities for energy reduction and a reduced carbon footprint for the Construction and Operational Phases. It has been produced to outline the process that will be followed to mitigate and minimise carbon emissions through design, procurement and delivery.

1.2.2. This CMP outlines the carbon management approach for the UDX UK Project and demonstrates alignment with UDX policies and commitments, and with PAS 2080:2023 Carbon Management in Buildings and Infrastructure.

1.2.3. The CMP does not outline the approach to be taken by National Highways and Network Rail for their scope of works. Both are already certified to PAS 2080 and must prepare their own CMP aligned to PAS 2080:2023 for their works following their own carbon management processes and adhere to this through the design and construction of their works.

1.2.4. The CMP is a live document, updated by the relevant party(s) at the start of each RIBA Stage (e.g. Spatial Coordination (RIBA 3), Technical Design (RIBA 4) and Manufacturing and Construction (RIBA 5)). This CMP is currently written for the Initial Development Phase including construction of the Entertainment Resort Complex. After this, it is intended that this CMP will be updated, as appropriate, for subsequent additional development phases. Carbon will be reported and tracked through design and delivery to provide visibility of the carbon management practices.

1.2.5. The carbon management objectives for the Proposed Development are to:

- Demonstrate alignment with PAS 2080:2023 to ensure a consistent approach to whole life carbon management by all the Proposed Development's Undertakers;
- Minimise the Whole Life Carbon (WLC) impact of the Proposed Development (both through construction and operation) including carbon emissions within the direct control of the Proposed Development, and those which the Proposed Development has influence over;
- Ensure that carbon is considered in decision making alongside other key areas such as cost, programme, safety and risk; and
- Align to Leadership in Energy and Environmental Design (LEED) requirements to maximise credits that can be achieved.

1.3. RIBA PLAN OF WORKS

1.3.1. The most recent revision to the RIBA Plan of Works (RIBA 2020 Plan of Works) includes guidance on what actions project stakeholders should be taking at relevant RIBA stages of a project. This is set out to assist development teams in strategic implementation of low carbon methodologies at times when they can make the greatest impact to overall sustainable outcomes. A more robust process is also highlighted in RIBA's 'Targeting Zero – Embodied and Whole Life Carbon Explained' (2017) publication. Key elements for RIBA Stages 3-5 are summarised below.

- **Stage 3 – Spatial Coordination:** Consideration of design and material choices to reduce carbon impact. A detailed WLC analysis is to be undertaken, for both embodied and operational emissions. Review of carbon budget, benchmarks, and targets. Options to be compared against baseline budget. Carbon Lead to be working closely with the design team to support decision-making.
- **Stage 4 – Technical Design:** Low-carbon design choices made at RIBA 3 integrated into design and tender documentation. Carbon budget should be included in tender. Design team to ensure contractor is aware and comfortable with WLC targets. An end-of-design stage WLC model to be provided capturing pre-construction.
- **Stage 5 – Manufacturing and Construction:** The key issue is to establish a process of monitoring and review of the WLC budgets and carbon through the construction phase of a project. This should be reported at intervals of every 3-6 months. Variations should be brought to client attention, and proposed changes assessed. A final 'as built' assessment will be produced by the Carbon Lead.

1.3.2. The remainder of the CMP will then describe the process of how carbon will be embedded within the decision making and how the actions referenced above will be achieved.

2. PAS 2080:2023 – CARBON MANAGEMENT IN BUILDINGS AND INFRASTRUCTURE

2.1. INTRODUCTION

2.1.1. PAS 2080 is a global standard for managing infrastructure carbon and has been developed to meet World Trade Organisation requirements. PAS 2080 provides the framework for performing whole life carbon assessment and aims to reduce carbon emissions and cost through the whole value chain (design, construction, and operational stages).

2.1.2. Successful carbon management utilises the concepts of systems thinking and co-benefits (e.g., climate adaptation, nature-based solutions) across the entire value chain beyond the context of the project or programme of work. Recognising co-benefits of an approach or innovation in the initial design or optimisation stages can allow for further effective decarbonisation approaches, often beyond the direct scope of the project or programme.

2.1.3. PAS 2080:2023 provides a carbon management process to manage carbon on all projects and programmes in the built environment and includes requirements for developing a carbon management process. The following section outlines the key principles of decarbonisation and the required roles and responsibilities for value chain members.

2.2. DECARBONISATION PRINCIPLES

2.2.1. The carbon management process within PAS 2080 is underpinned by a set of fundamental principles, the core of which is that no asset of the built environment can function in isolation from its surrounds, as the asset's construction, operation, and use impacts on and is impacted by the functions of the networks and systems in which it exists.

2.2.2. The decarbonisation principles apply to all value chain members to an extent. All value chain members will identify those activities that result in carbon emissions or removals that they control and influence, at the asset, network, and system level (see **Image 2-1**). Due to the complexity involved in decarbonising the built environment, a holistic framework is required when informing decision-making and managing WLC emissions. Whilst important to consider influence, the focus of this CMP is minimising emissions that are within the control of UDX.

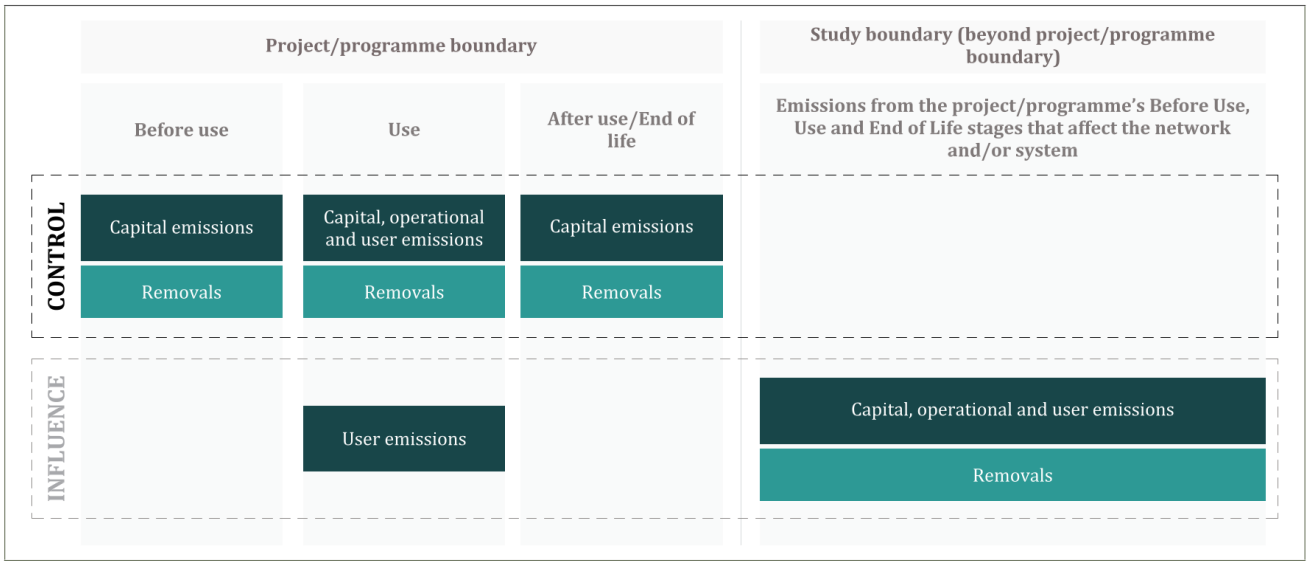


Image 2-1 - PAS 2080 whole life carbon framework for decision making (Source PAS 2080:2023)

2.2.3. **Image 2-2** shows the carbon management process to be followed in managing whole life carbon, which includes the quantification of baseline and projected Greenhouse Gas (GHG) emissions, followed by target setting, continued monitoring, effective procurement, and continual improvement through the identification of further carbon reduction opportunities.

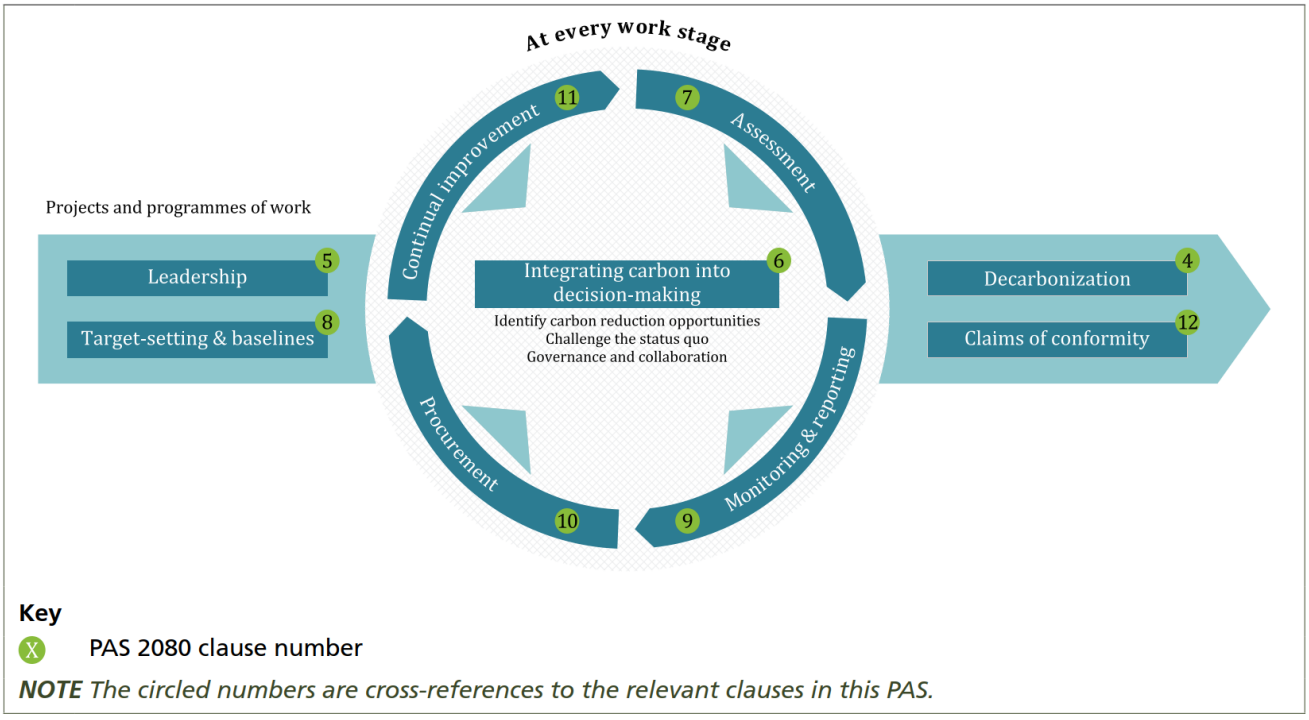


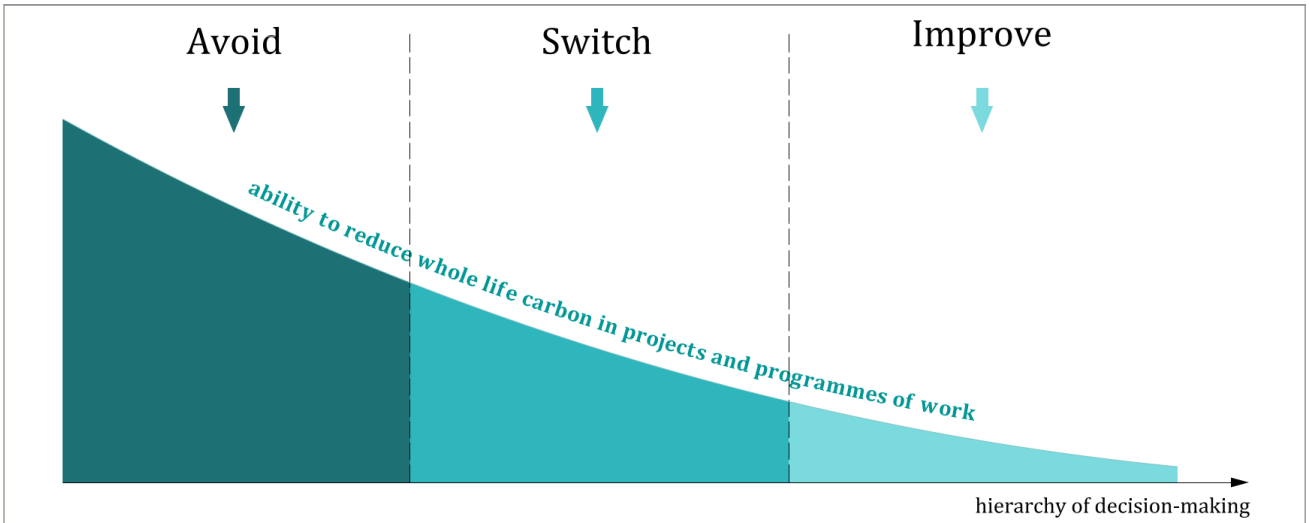
Image 2-2 - Overview of carbon management process based on PAS 2080:2023 guidance (Source: PAS 2080:2023)

2.3. MANAGING WHOLE LIFE CARBON AND ALIGNING TO THE UK'S TRAJECTORY TOWARDS NET ZERO

2.3.1. Carbon reduction measures for the Proposed Development should be prioritised to align with and support the UK's trajectory towards net zero as set out at the system, network, or national level. The greatest ability to influence the whole life carbon reduction is at the 'need' stage, where objectives and outcomes of projects/programmes are still being developed and assessed.

2.3.2. **Image 2-3** illustrates the carbon reduction hierarchy and emphasises that the sooner carbon is considered, the more opportunities there are to minimise the carbon emissions within the design. From the start of the project delivery process, the Carbon Reduction Hierarchy (Avoid, Switch, Improve) should be followed and applied to all emissions. In doing so, the following has been considered:

- **Avoid**: Challenge the need to build or operate an asset, align outcomes of the project with the UK's trajectory towards net zero at the system level and evaluate the basic need at the asset and/or network level.
- **Switch**: Assess and adopt solutions that reduce WLC emissions through innovation, alternative materials, renewable technologies for operational carbon reduction, among others
- **Improve**: Identify and adopt solutions that improve the use of resources and design life of an asset/network, including circular economy principles and efficient construction methods to ensure the assets potential for reuse or recycling at its end-of-life.



NOTE *This figure represents a simplified and streamlined version of the carbon reduction hierarchy presented in PAS 2080:2016 and the* Infrastructure carbon review *[1]. It has been updated to clarify its applicability and relevance to a wider range of projects and programmes within the built environment (i.e. to clarify that the carbon reduction hierarchy is not solely about new builds).*

Image 2-3 - The carbon reduction hierarchy (Source: PAS 2080:2023)

2.3.3. The sections that follow highlight how the carbon reduction hierarchy will be incorporated into the Proposed Development. Carbon hotspots will be evaluated and will contribute to the option identification and selection process. To achieve the greatest opportunities to reduce carbon emissions, it is key to influence the design as much as possible from an early stage. Priority should be given to low-carbon solutions that promote network and system decarbonisation as far as practicable.

3. ROLES AND RESPONSIBILITIES

3.1. INTRODUCTION

3.1.1. This section provides an overview of the roles and responsibilities that key members of the Proposed Development team should have in managing carbon in relation to the Proposed Development. **Table 3-1** summarises the key value chain partners as described in PAS 2080 who are to be coordinated with. The value chain partners will be added to this table when these parties are confirmed on the project and this will be reflected in in the Table when updates to the CMP are made.

Table 3-1 – Value Chain Partners as described in PAS 2080:2023

Role	Value Chain Partner(s)
Asset Owner/Manager	*UDX*
Designers	*<Enter Name(s) when confirmed>*
Constructors/Contractors	*<Enter Name(s) when confirmed>*
Product/Material Suppliers	*<Enter Name(s) when confirmed>*

3.1.2. The Project Manager and Carbon Lead (see Section 3.2 for full descriptions) are responsible for coordinating and collaborating with Value Chain Members to ensure that best practice is shared and implemented on the Proposed Development.

3.2. GENERAL ROLES AND RESPONSIBILITIES

3.2.1. Critical roles and their responsibilities for implementing carbon management throughout the Proposed Development are outlined below:

- **Project Sponsor:** Ultimately responsible for the Proposed Development's carbon performance against targets.
- **Project Manager:** Responsibility for compliance with client project commitments. Ensuring that carbon management is a key part of design and decision making and coordinating with all Value Chain Members.
- **Carbon Lead:** Ensuring the CMP is adhered to and undertaking the required quantification, monitoring and reporting. Training and informing the design and delivery teams. Supporting the design and delivery teams to identify low-carbon solutions and providing links to other environmental disciplines to highlight co-benefits or risks.
- **Design Leads:** Overall responsibility for guiding design to minimise carbon emissions as far as feasibly practicable. Providing a level of challenge to make sure that focus is given to low carbon options.
- **Design Teams:** Practical role in developing designs that minimise emissions and capturing and recording low-carbon options.
- **BIM Team:** Working closely with the Carbon Lead to develop the model framework supporting the production of information relevant to the carbon assessment.

- **Procurement Lead:** Ensuring that carbon management is part of the tender process and that Key Performance Indicators (KPIs) are embedded in contracts with the delivery teams.
- **Delivery Teams:** Responsible for ensuring that construction methods and site operations are minimising carbon emissions. Ensuring the data is collated to enable to as built carbon assessment to be conducted.

4. INTEGRATING CARBON MANAGEMENT IN DECISION MAKING

4.1. APPROACH

4.1.1. The Carbon Lead will support the design and delivery teams to ensure that the impact of carbon has been assessed both qualitatively and quantitatively at each RIBA Stage. A number of carbon reduction measures that are aimed at minimising emissions have already been identified and are summarised in **Annex 1**. These measures provide for further reductions beyond the mitigation measures already identified in **Chapter 14: Greenhouse Gases (Volume 1)**. Whilst not exhaustive, it provides a starting point to start considering how to embed carbon reduction measures in decision making.

4.1.2. A Carbon Opportunities Register will be created by the Carbon Lead at the start of RIBA 3 to capture the options considered to support the achievement of the carbon commitments. An example of what this could look like is given in **Annex 2**. The earlier that carbon is considered, the more opportunities exist to reduce carbon emissions through the whole life cycle of a project. At the same time, the accuracy of assessment will improve with time as presented in **Image 4-1** but initial high-level assessments can be beneficial for enabling the greatest reductions.

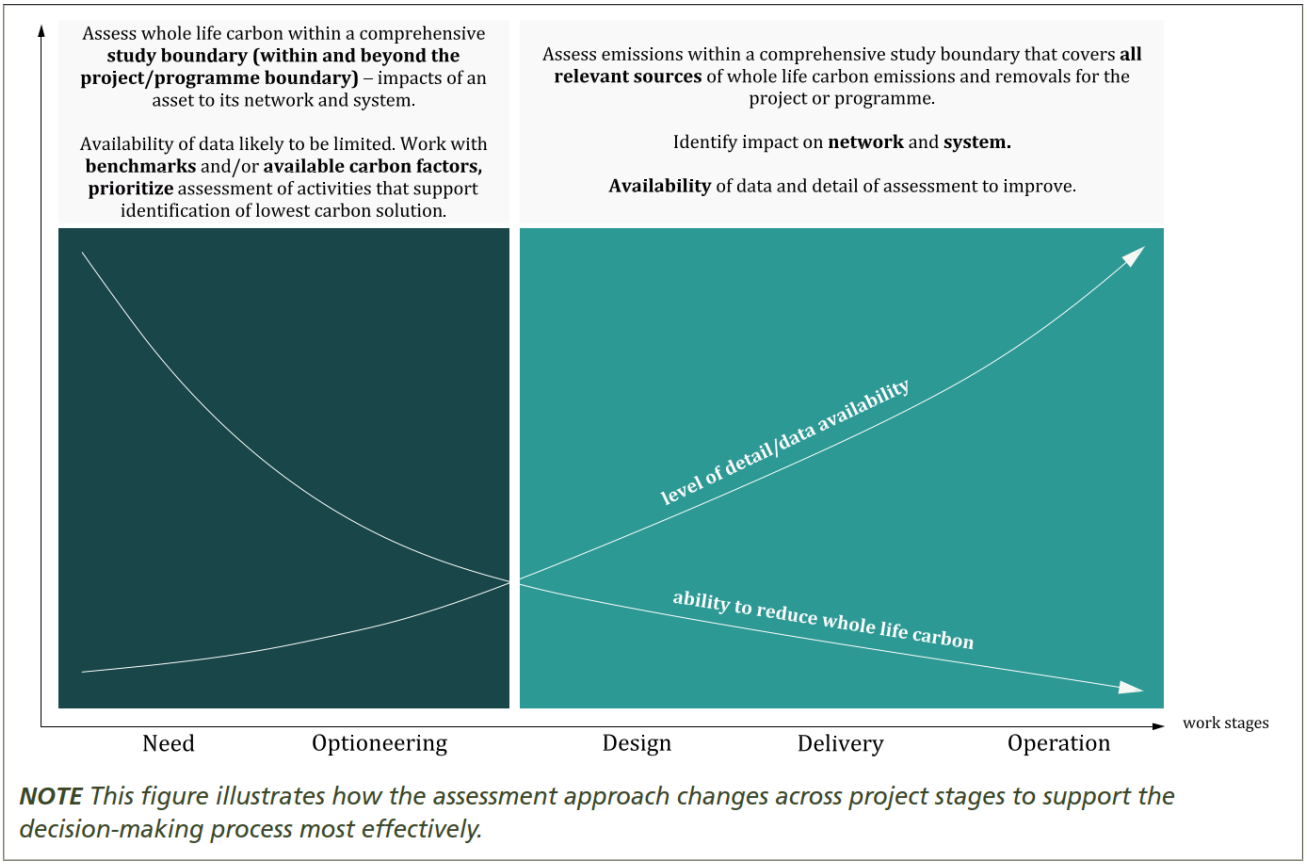


Image 4-1 - Degree of accuracy and data availability in whole life carbon assessments across work stages (Source PAS 2080:2023)

4.2. CARBON WORKSHOPS

4.2.1. To help embed carbon in design and decision making, the Carbon Lead will organise carbon workshops with the Project Team including UDX, designers and contractors on board to challenge the design as it progresses. Workshops should look both at reducing emissions associated with the construction of the development and also ensuring operational efficiency through use. The discussion in the workshops will cover the following key points:

- Identifying the key carbon hotspots with highest impacts;
- Review of carbon reduction opportunities in the materials, design, and construction; and
- Review of the CMP and ideas for further improvement.

4.2.2. It is recommended that a minimum of one workshop is hosted at each RIBA Stage. This should be at the start of the stage and a collaborative approach between the Design Team, Constructors / Contractors and the Carbon Lead should ensure that this takes place at a time where there is still a level of influence that can be had on the design. Whilst not all information will be known at the start, it is helpful to steer direction. As such, it is better to have the first workshop early in the project stage, and if follow up workshops/discussions are required when more detail is available this can be done.

4.2.3. Outputs from workshops will be captured within the CMP by being added to the opportunities register (**Annex 2**). Opportunities will be assessed using the PAS 2080 Carbon Reduction Hierarchy (Avoid, Switch, Improve). These will be shared with the relevant teams throughout the scheme development to monitor the opportunity implementation and impact on carbon.

4.3. CHALLENGES AND OPPORTUNITIES

4.3.1. Workshops are a great way to stimulate discussion and consider innovative ideas that can be taken forward. However, this does require participation from the Carbon Leads and Design/Delivery teams. To help facilitate discussion in the workshops, the following questions have been given as a prompt for considering carbon reduction through the life cycle of the Proposed Development:

- How can any existing infrastructure be utilised?
- How are earthworks going to be considered during the design process, and what opportunities do we have to influence the earthworks design to reduce carbon?
- How can the selected materials in the design been optimised? Can lowest carbon materials be considered?
- What can be done to optimise excavation works?
- Can low carbon concrete or low carbon soil stabilisation materials be considered?
- What is being done to minimise waste? Could off-site manufacturing be considered?
- Can reuse or recycling of site won aggregates been considered?
- How will consideration of deconstruction to optimise recycling and reuse of components be considered?
- How will the design focus on minimising the maintenance requirements?
- How can resources to reduce construction duration and cost be considered?

- How can innovation and new construction techniques be considered to minimise construction time leading to less temporary works and less fuel consumption?
- How can transport be considered, or optimal materials be used to reduce the unnecessary transport?
- Was there any consideration of low carbon fuels for construction plant?
- How can the use of site-won materials be considered to minimise imported materials?
- What local suppliers offer low carbon alternatives to traditionally high carbon materials (cement, steel, etc.)? How can we maximise utilisation of these suppliers?
- What measures will be taken to reduce energy consumption during operation?
- How will water consumption on site be minimised both during construction and operation?

5. CARBON MANAGEMENT PROCESS

5.1. INTRODUCTION

5.1.1. **Image 2-2** provides a high-level summary of the Carbon Management Process within PAS 2080:2023. A full description of each Clause can be found within PAS 2080:2023, with **Table 5-1** providing an overview of the Clauses and Activities that will be undertaken for the Proposed Development.

Table 5-1 - Description of the clauses within PAS 2080:2023 and listed activities which should be implemented

PAS 2080:2023 Clause	Description	Activities
Leadership	Asset owners/managers set objectives, targets, and outcomes for the project/programme of works aligned with the decarbonisation principles (Clause 4 of PAS 2080:2023). Map key collaborators/stakeholders for enabling whole-life carbon management. Set governance structure and principles.	The Carbon Management Process is integrated into Project Management and Delivery activities for the Proposed Development, and the roles and responsibilities for this are assigned. Overall responsibilities will sit with the Project Manager, although specific tasks should be delegated.
Integrate carbon management into decision-making	Asset owners/managers make alignment with net zero transition central to the scope and requirements of work. Identify activities and associated emissions/removals within control and influence across all work stages (as per Clause 4), and the necessary collaborations with value chain members and stakeholders that will enable whole life carbon reductions, and the network(s) and system(s) with which the project or programme of works interfaces. Integrate carbon management into the delivery processes to support system-level low-carbon outcomes. Prioritise implementation of carbon reduction opportunities within control and influence. Integrate the carbon implications of climate resilience (or lack of) in the carbon management at all levels. Prioritise nature-based solutions for reduced carbon and increased sequestration. Follow the carbon reduction hierarchy (Clause 4) across all work stages to identify potential opportunities to reduce whole life carbon emissions: Avoid – Switch – Improve.	At each stage of the project design and delivery, carbon management should be considered a part of normal project delivery and decision-making. The carbon reduction hierarchy shows that the highest carbon reduction potential is at the earliest stages of the project lifecycle.

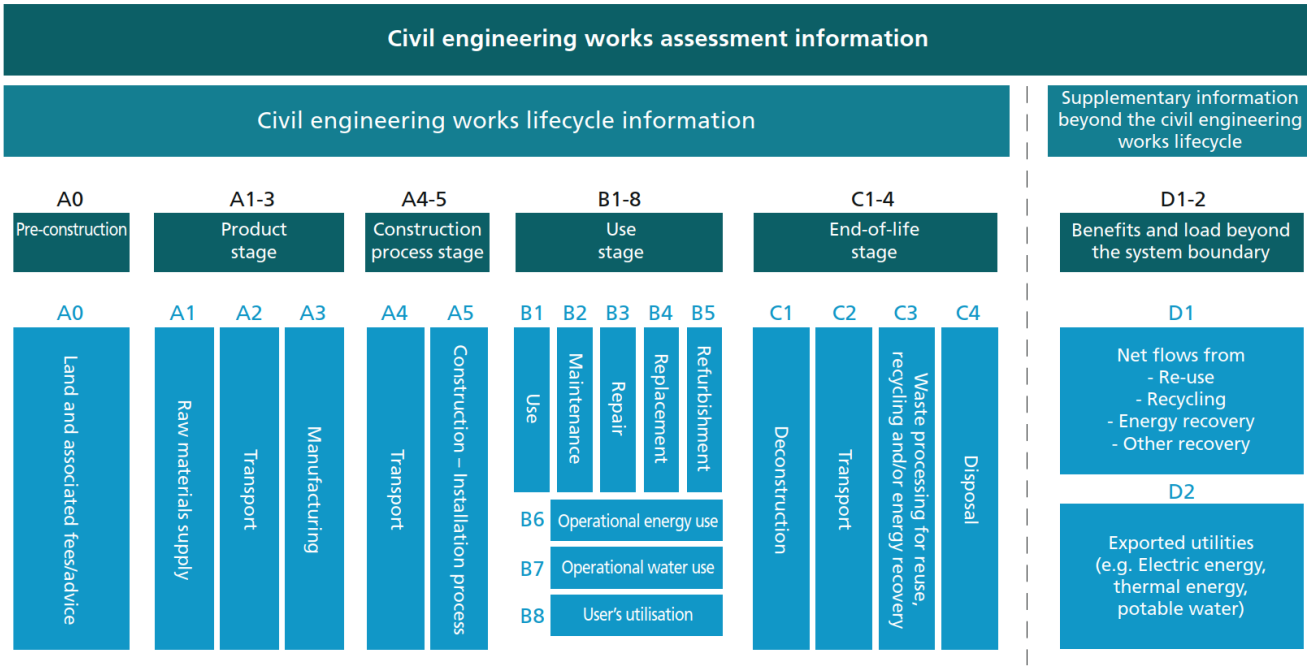
PAS 2080:2023 Clause	Description	Activities
Whole-life carbon assessment principles	Quantification of whole-life carbon emissions with sufficient frequency to inform decision-making throughout the project lifecycle. Principles in PAS 2080 should be followed, such as defining the scope for quantification and use of a chosen study period (i.e., appraisal period)	Carbon assessment accuracy will improve with time; however, preliminary quantification of carbon emissions should be completed as early as possible to maximise opportunities to reduce emissions.
Target setting and baselines	Targets can be set for specific elements such as capital, operational (capital and/or user emissions) and/or whole-life carbon. Targets should relate to a desired outcome and use a fixed timescale by which that outcome is achieved. Where appropriate, targets should align with sector-level or wider national/international carbon reduction targets.	Carbon targets are set that cover an overall carbon budget for the Proposed Development. The carbon budget should reflect both the Before Use and Use stages as considered in the PAS:2080:2023. While carbon budgets/targets will only be set at RIBA Stage 3, it is recommended to align targets with sectoral and national decarbonisation trajectories, and any relevant local policies.
Monitoring and Reporting	KPIs to monitor carbon emissions. PAS2080 recommends these are at a minimum monitored during all infrastructure work stages or at key points where decisions are made that influence whole-life carbon reduction.	It is recommended that the carbon assessment be updated at regular stages of the project lifecycle – at least once per RIBA Stage. This should be used to determine whether the project is on track to meet any reduction target set and identify any carbon hotspots in the design and delivery of the project.
Procurement	Include carbon management process requirements (including objectives, targets, and project outcomes) in the procurement of contracts.	It is recommended that the project design and delivery teams collaborate with suppliers and contractors to reduce carbon and where possible these requirements are included in contracts.
Continual improvement	The PAS 2080 standard recognises the reality of implementing carbon reduction measures and that this may not always go according to plan, e.g. due to material availability or inadequate low-carbon performance specification, so allows for transparency in identifying any issues and decarbonisation progress. This should allow lessons to be learned from applying this carbon management process to improve the delivery of future programmes of work. Acknowledging that comprehensive carbon data or low carbon solutions will not be available at the outset, adopting continuous	Carbon reduction measures identified in **Annex 1** should be transferred to the Carbon Opportunities Register to be implemented as applicable and reviewed across the project lifecycle. This should be informed by the carbon assessments. Any carbon reductions achieved should be recorded at the end of each RIBA stage as well as any reduction measures which are unable to be implemented and why. This should be used to identify lessons learned and identify further opportunities to minimise carbon on the project, in accordance with the systematic approach for carbon management and

PAS 2080:2023 Clause	Description	Activities
	improvement allows promoters to commence carbon management while gradually improving.	reducing GHG emissions provided by adoption of the PAS 2080 standard.

5.2. WHOLE LIFE CARBON – LIFE CYCLE STAGES

5.2.1. Taking a whole life perspective of carbon management avoids the risk of 'burden shifting', where changes made to reduce carbon in construction do not inadvertently lead to increases through operation (e.g. a thinner paving slab which reduces carbon in construction but then needs replaced more frequently due to brittleness). It also ensures that there is alignment with whole life costings, ensuring that the optimal carbon/cost solution is taken forward.

5.2.2. A WLC assessment is broken down into the different lifecycle stages as show in **Image 5-1**. Whilst the image shows the life cycle stages for an infrastructure project (taken from BS EN 17472), the only slight modification for buildings (as in BS EN 15978) is the omission of B8 (user's utilisation). A summary of each module is provided below for information.



Source: BS EN 17472:2022

Image 5-1 - Life cycle stages for an infrastructure project (Source: PAS 2080:2023)

5.2.3. **Module A** accounts for emissions during the Construction period and is broken down as follows:

- Module A0 covers land use change through construction and pre-construction activities;
- Modules A1-A3 cover the material production emissions and are calculated using carbon factors from databases such as ICE (Inventory of Carbon and Energy) or CESMM4 (Civil Engineering Standard Method of Measurement);

- Module A4 covers material transport to site and is calculated based on the transport distance and load; and
- Module A5 covers plant emissions from construction calculated using assumptions on fuel consumption of machinery.

5.2.4. **Module B** covers the Use Stage and is broken down as follows:

- Module B1 is use and is generally considered negligible on infrastructure projects;
- Modules B2 and B3 are maintenance and repair. Assumptions about these modules can be taken from sources such as the RICS Professional Statement for Whole Life Carbon (2023);
- Modules B4 and B5 are the replacement and refurbishment of assets. Replacement of materials is the largest source of emissions through the useful life of the asset. This can be quantified based on assumptions of how often replacement is required (e.g. a new road surface);
- Module B6 and B7 are operational energy and water use respectively. The main source of operational carbon is generally heating, cooling and other MEP systems. Using the energy demand models and projections for grid emissions factors the operational carbon can be calculated; and
- User carbon (Module B8) accounts for the emissions resulting from traffic flows within the scheme boundary. Using traffic models, the emissions from vehicles can be calculated based on the fuel consumption rates of vehicle types.

5.2.5. **Module C** covers the End-of-Life Stage and is broken down as follows:

- Module C1 accounts for deconstruction activities;
- Module C2 covers the emissions from transporting materials from site to waste facilities; and
- Modules C3 and C4 measure the waste processing (e.g. recycling) or disposal of materials at end of life.

5.2.6. Finally, Module D looks at benefits/disbenefits that occur outwith the system boundary of the project. This could be re-use of materials, energy recovery etc. This should always be accounted for separately from Modules A-C to avoid the risk of double counting or including benefits twice.

5.3. STUDY BOUNDARIES AND TEMPORAL SCOPE

5.3.1. The study boundary for this CMP will be the construction activities undertaken within the Site boundary as shown in **Site Location Plan (Document Reference 1.6.0)**. The carbon assessment will include emissions associated with materials produced outwith this area and their transportation to site, and similarly deposition of materials at end of life.

5.3.2. Within this boundary are works which UDX can influence but not control, however both National Highways and Network Rail are certified to PAS 2080 and must produce their own Carbon Management Plans aligned to PAS 2080 for those elements of the Proposed Development.

5.3.3. Within this Site boundary, some elements of the development will be bespoke and there will be limited opportunities to influence carbon emissions, for example some rides and attractions due to specific suppliers or safety considerations. As such, these elements are not included within the scope of the carbon assessment.

5.3.4. The temporal scope for the whole life carbon assessment should be aligned with RICS Professional Standard (2023). This would have a 120-year study period for infrastructure elements and a 60-year study period for each building.

6. ASSESSMENT METHODOLOGY

6.1. INTRODUCTION

6.1.1. This section provides a brief outline of the methodology to be followed to quantify WLC for the Proposed Development. It is recognised that at early Phases of the Proposed Development, data will be more limited or based on higher-level data, and therefore there will be a need to ensure that an appropriate method is followed at each phase of the Proposed Development.

6.1.2. A full outline of the Methodology followed at each Stage of the Proposed Development (e.g. RIBA 3-5) should be presented within that stage's Carbon Management Report (see Section 8 for more details).

6.1.3. This methodology has been broken down into two areas detailed below. Firstly, how to conduct a WLC assessment during design (RIBA 3 and 4) to help influence decisions to reduce carbon emissions during the construction and operation of the development. Secondly, how to quantify the actual carbon emissions arising during construction (RIBA 5) to enable comparison to carbon assessments in design to compare against benchmarks and targets.

6.2. CARBON QUANTIFICATION IN DESIGN

6.2.1. The updated National Planning Policy Framework (NPPF) (2024)[1] states the need to take account the full range of potential climate change impacts. Complying with this, a WLC assessment has been undertaken with the results presented in **Chapter 14: Greenhouse Gases (Volume 1)**. This high-level assessment is proportionate to the level of design information at present, but as the Proposed Development moves into later design stages, and more information is available, the carbon assessment should be updated.

6.2.2. As the design progresses, a carbon assessment will be undertaken at both RIBA 3 and RIBA 4. This assessment should be aligned to the RICS Professional Standard for Whole Life Carbon Assessment (2023)[2]. This outlines the minimum requirements for WLC assessments to be undertaken, provides guidance on scope and boundaries, and assumptions to follow where data is limited.

6.2.3. Aligned with RICS, a suitable carbon assessment tool (e.g. OneClick LCA) should be used to conduct the carbon assessment. RICS also provides guidance on appropriate emission factors to use during different design stages and how to account for uncertainty when some design data may not be available. Energy modelling data for operation should also be included within the carbon assessment model to ensure WLC is accounted for.

[1] https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf
[2] https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment

6.2.4. Preferably, the embodied carbon assessment should be based on the Cost Plan/Bill of Quantities (BoQ) produced at the appropriate design stage. This ensures a correlation between cost and carbon. Other information that will be required by the Carbon Lead include:

- Structural take offs and Façade information;
- Schedules of equipment – MEP, fittings and finishes etc.; and
- Drawings – general arrangements, elevations and plans.

6.2.5. There will be slight differences between the buildings and infrastructure assessments, for example the temporal scope of the assessment, and the reporting categories. However, the general principal for the assessment will be the same.

6.2.6. Aligned to this (and as described in Section 5.3) it is recognised that there are some elements (e.g. rides and attractions) for which there will be minimal scope to consider carbon emissions due to limits of the supply chain, safety etc. It is recommended that these elements do not fall under the scope of the carbon assessment.

6.3. 'AS BUILT' CARBON ASSESSMENT IN CONSTRUCTION

6.3.1. Carbon assessments conducted during RIBA 5 (Manufacturing and Construction) should be used to confirm and verify the actual quantified carbon emissions associated with the Proposed Development. The 'as built' assessment should use the final embodied carbon assessment from RIBA 4 as the assessment to compare to. If a tool like OneClick LCA is used, then the carbon assessment can be updated by editing the material quantities and emissions factors to reflect the final amounts used.

6.3.2. The as built carbon assessment at RIBA 5 should be based on actual material quantities, and the distances the materials have been sourced from. Environmental Product Declarations (EPDs) from material suppliers should be used as a source of emissions factors to confirm the actual carbon emissions. Other information from site, including fuel use, water and energy consumption should be tracked and used to support the as built assessment. This should be collated on a quarterly basis (or as a minimum every six months) through construction to ensure that all data is captured and not lost after certain supply chain members have moved on from the Proposed Development.

6.3.3. During RIBA 5, progress should be reported every 3-6 months with variations to the RIBA 4 assessment noted. The benefit of this is that it means data is collated throughout the stage and makes the final 'as built' report easier to collate.

6.4. CARBON REDUCTION OPPORTUNITIES

6.4.1. As described in Section 4, during RIBA 3 and 4, carbon workshops will be planned to look at opportunities to reduce carbon through both design and construction. These should seek opportunities to reduce carbon emissions from construction but also ensuring that consideration is given to reducing energy demand through operation. Supported by information from the carbon assessments, these workshops will target hotspots to see if opportunities to minimise emissions through efficient design, low carbon materials and innovative construction methods can be achieved.

6.4.2. All carbon reduction opportunities will be captured in the Carbon Opportunities Register (**Annex 2)** which will describe the opportunities, state the potential for carbon reduction, discuss any implications on cost, risk, programme etc., and state any next steps.

6.4.3. It is important that this register is kept up to date, and if opportunities cannot be taken forward (e.g. a certain option would not be cost-effective), that this is noted as to help inform decisions later in the Proposed Development.

6.4.4. Opportunities may be discussed outside of the carbon workshops and the Carbon Lead will be the conduit for ideas outside of this forum, ensuring they are collated within the opportunities register.

7. CARBON BASELINE AND REDUCTION TARGETS

7.1. INTRODUCTION

7.1.1. The Proposed Development encompasses civil infrastructure works and buildings. This makes the Proposed Development different to most other projects so different approaches to carbon reduction targets and benchmarking will need to be considered.

7.1.2. The NPPF states that new developments should be planned in ways to help reduce greenhouse gas emissions. The implementation of PAS 2080 and following a PAS 2080 aligned carbon management process to manage and minimise carbon emissions will enable this to be achieved. To support this, PAS 2080 recommends that carbon reduction targets are set for projects.

7.1.3. At this stage, a carbon reduction target has not been set but it is recommended that this is developed as soon as the first detailed carbon assessment has been conducted. Whilst a high-level WLC assessment has been conducted proportionality to the level of design data there is (summarised in **Chapter 14: Greenhouse Gases (Volume 1)**), this cannot be used to set reduction targets through design and construction. A carbon reduction target should be agreed between UDX as the Asset Owner and the designers and contractors to discuss what appropriate carbon reduction targets should be through design and delivery.

7.1.4. As mentioned in Section 5.3, some elements of the scheme (e.g. rides and attractions) will not have relevant benchmark data so it is proposed that they are not included within the targets which should focus on the civil infrastructure and buildings where there is likely to be greater scope to minimise carbon emissions.

7.2. INCORPORATING CARBON REDUCTION TARGETS

INFRASTRUCTURE

7.2.1. LEED does not have a specific carbon reduction target for projects but it strongly encourages and provides frameworks for reducing carbon emissions in projects. Most infrastructure projects will set a carbon reduction target based on the carbon baseline for the project once the first 'bottom-up' carbon assessment is completed. It is recommended that for each part of the Proposed Development, once the first cost plan or BoQ based on a design is complete during RIBA 3 and a carbon assessment has been conducted (as described in Section 6), that this becomes the carbon baseline for the scheme. A carbon reduction target should then be set as a percentage reduction from the baseline. This percentage reduction should be set by UDX in collaboration with the project team to determine a challenging, but achievable carbon reduction target.

7.2.2. It is likely that any carbon reduction targets set should be for A1-5 (before use emissions). Whilst it is important to conduct a WLC assessment, the target should be verifiable at the end of construction.

BUILDINGS

7.2.3. Whilst most infrastructure projects seek to achieve a percentage reduction from a baseline, building projects use the functional unit of carbon emissions per square metre ($kgCO_2e/m^2$) of gross internal area. This makes comparison with others similar buildings possible.

7.2.4. Several industry benchmarks exist such as the LETI Climate Emergency Design Guide (2020) and the RIBA 2030 Climate Challenge (2021) which set embodied carbon targets for measuring performance for buildings in 2030. **Image 7-1** shows the alignment between the LETI and RIBA benchmarks for 2030.

RIBA 2030 Build Target

Life Cycle Embodied Carbon, A1-5, B1-5, C1-4

Band	Office	Residential (6+ storeys)	Education	Retail
A++	<150	<150	<125	<125
A+	<345	<300	<260	<250
A	<530	<450	<400	<380
B	<750	<625	<540	<535
C	<970	<800	<675	<690
D	<1180	<1000	<835	<870
E	<1400	<1200	<1000	<1050
F	<1625	<1400	<1175	<1250
G	<1900	<1600	<1350	<1450

Image 7-1 - Alignment of LETI and RIBA whole life embodied carbon benchmarks (Source: LETI Embodied Carbon Alignment)

7.2.5. More recently, the UK Net Zero Carbon Buildings Standard was introduced. This provides a more holistic approach to demonstrate level of effort required to enable the project to be classed as a 'net zero building' – this recommends targets that would be aligned to science-based targets and a future net zero society. This is still in a pilot stage so it is named here for information rather than something to specifically align to.

7.2.6. It is recommended that early in the development of the Proposed Development, appropriate carbon reduction benchmarks are agreed and shared with the Project Delivery Team – this would ensure that all buildings are working to achieve appropriate agreed targets. These targets could be for the main buildings (e.g. over 1,000 m^2) as they may not be appropriate for all smaller buildings. However, in this instance, there may still be opportunities to reduce the impact of smaller buildings which should be considered (e.g. timber frames rather than steel), even if targets are not placed specifically on them.

7.3. TRACKING PROGRESS AGAINST PROJECT TARGETS

7.3.1. After each design stage, a carbon assessment will be undertaken to document progress that has been achieved. The reporting of this is discussed in Section 8.

7.3.2. KPIs will be set for carbon reduction targets and this should be reported on as with all other KPIs. During construction, as built data should be captured to demonstrate how progress is being made compared to the final design assessment.

8. MONITORING AND REPORTING

8.1. THROUGH DESIGN

8.1.1. A Carbon Management Report must be prepared at the end of RIBA 3 and 4. As with the WLC assessment, it is recommended that this aligns to the reporting requirements specified in RICS Professional Standard, but as a minimum this must provide:

- An overview of the Proposed Development, and scope and boundary of assessment;
- Detail of the methodology followed to quantify WLC;
- A presentation of the results of the assessment at that work stage and identify carbon hotspots – this should be linked to the lifecycle modules scoped into the assessment as described above, and have a comparison of results to previous work stages;
- List of EPDs that have been used in the assessment; and
- A link to the Carbon Opportunities Register and highlight areas that will be explored and reviewed at the workshop early in the next project stage as set out in Section 4.2.

8.1.2. This reporting is not just a PAS 2080 requirement but will align with LEED to ensure appropriate points can be achieved.

8.1.3. The Carbon Opportunities Register (**Annex 2**) will be developed prior to the initial carbon management workshop with the project team and updated at each stage of the project. Any updates at the end of each stage will be noted down in the carbon register. The carbon intensity of the scheme will be reviewed in the progress meetings. The carbon register will be distributed to all relevant parties to aid the visual communication to the wider team.

8.1.4. The relevant carbon emissions data will be stored by the Carbon Lead. Upon completion of each phase of the Proposed Development, there will be a review of the carbon measurement process to establish effectiveness of the process and potential improvements that can be made going forward. This overview will provide guidance for the remaining works, as well as future UDX projects, providing a carbon reduction legacy from the Proposed Development.

8.2. THROUGH CONSTRUCTION

8.2.1. The final WLC assessment during RIBA 4 will be used as the baseline to monitor carbon emissions through delivery. It will be the responsibility of the chosen Contractor to report progress to this through RIBA 5. The chosen Contractor must monitor and report carbon emissions in construction and, where appropriate, commissioning and decommissioning activities, during the relevant delivery stages and identify and report where the greatest carbon emissions are expected to occur or have occurred, and where future reductions can be made. With this, product/material suppliers shall put systems in place in their own organisation to monitor and share carbon emissions of their product/material carbon data so that such data is made available to Contractors and Designers.

8.2.2. Reporting through construction should be on a six-monthly reporting cycle as a minimum.

8.2.3. As the Proposed Development has not yet commenced construction, there is no as built information available. As construction commences, as built data will need to be captured by the Contractor(s) and be transferred to be include in updates to the WLC assessment. At present there is not sufficient maturity in development, so an interim process is outlined in **Table 8-1**.

Table 8-1 - Information requirements for collating as built carbon assessment

Process	Details
Recording as-built carbon data for site emissions	Electricity, fuel and water use will need to be measured by the supply chain and managed/stored using a digital tool (TBC) and updated monthly. Materials quantities will also need to be logged by sub-contractors and stored in a digital tool (TBC) with associated delivery notes provided as evidence. Vehicle types, loads and journey distances will also need to be logged by sub-contractors and stored using a digital tool (TBC). The data provided will need to include descriptive labels which allow the data to be associated with construction month (e.g. energy use) or asset (e.g. materials quantities).
Recording which assets have been constructed	TBC
Collecting, accepting, and storing EPDs	EPDs will need to be collected from suppliers and contractors. These will need to be collated and accepted by UDX.
Storing as-built carbon data	The principal contractors will be responsible for obtaining and storing all as-built data relating to carbon. This data will need to be provided at frequencies to be determined to the Carbon Lead for the purpose of updating the LCA.

9. PROCUREMENT AND COLLABORATION

9.1. INTRODUCTION

9.1.1. Procurement is a key element to continue the reduction of carbon emissions following design and moving into delivery. A comprehensive plan will be developed for this but key areas to consider include contractual requirements, early contractor involvement and engaging with material suppliers.

9.2. CONTRACTUAL REQUIREMENTS

9.2.1. Contracts ensure commitments to carbon reduction are met to support the drive to reduce carbon emissions on the project. Language in the contract should be along the lines of secondary option X29 Climate Change[3] within the NEC4 contract. If used, this would include climate change requirements in the scope and setting contract specific climate-change targets via a performance table.

9.3. ENGAGING WITH SUPPLIERS

9.3.1. In accordance with PAS2080 principles, early contractor involvement is important to ensure carbon minimisation opportunities identified as part of design are effectively realised during design and construction of the scheme. To the extent practicable the project delivery team will engage with contractors who are likely working on the biggest carbon areas so that their early involvement can also identify and facilitate carbon minimisation opportunities.

9.3.2. Principal Contractors tendering should be required to complete a question on Environment, and once in contract will be required to comply with requirements around carbon reduction. This could include:

- Meeting a contractual carbon limit (budget);
- Demonstrating their commitment to carbon reduction, with corporate plans setting out how they will reach a position that aligns with the 1.5°C reduction of the Paris Agreement (United Nations, 2015) and contribute towards the UK' trajectory to net zero by 2050;
- Providing a CMP including a science-based target for emissions reduction, detailing the actions they will take to ensure they do not exceed their carbon limit, and the further technologies and measures they will deploy during the construction phase to reduce emissions below this maximum level;

9.3.3. Requirements to collaborate with other contractors, designers and UDX through formal regular carbon workshops to support the sharing of:

- Opportunities for collaboration;
- Proposals for innovations or low carbon investments;
- Current best practices; and
- Potential issues and opportunities for improvement.

[3] https://www.neccontract.com/resources/x29-climate-change-working-group

9.3.4. In alignment with PAS2080 principles, the project delivery team needs to engage with potential material suppliers and initiate discussions to examine the feasibility of low carbon solutions and the role of low carbon materials. The delivery team should engage with material suppliers to pursue these opportunities throughout the detailed design stage.

10. TRAINING AND CONTINUAL IMPROVEMENT

10.1. GENERAL

10.1.1. Continual improvement is a key aspect of the management process, enshrined in management system standards such as ISO14001 and ISO9001, allowing lessons learned to improve delivery of both the UDX UK Project and future projects for UDX and others. This will enable all Value Chain Members to mature their carbon management experience and target Net-Zero objectives. Continual improvement also facilitates the effective approaches and required innovation to achieve the end goal of decarbonisation. Any opportunities identified for this Proposed Development in the Carbon Opportunities Register will be shared with the delivery teams to encourage these measures to be incorporated as 'business as usual' on follow up projects. The Carbon Lead will ensure this is disseminated around the broader project team.

10.1.2. To ensure the delivery of the Proposed Development includes the most effective decarbonisation solutions, project team members with key roles and responsibilities should be given training covering topics or elements identified as a key component to actioning positive carbon outcomes. These training sessions can include, but are not limited to, workshops, briefings, and training sessions delivered by the Carbon Lead, with the aim of prompting discussions around carbon reduction solutions during the option identification, design, and construction of the Proposed Development. This is part of the UDX UK Project 's learning legacy, improving and maturing collective experience of carbon management through working on a nationally significant infrastructure project with strong commitments to reducing carbon emissions.

10.2. REQUIREMENTS FOR ALL VALUE CHAIN MEMBERS

10.2.1. Everyone working on the UDX UK Project has a responsibility to seek continual improvements to reduce carbon emissions to the extent of their ability to influence and improve outcomes of the Proposed Development. This is as important as factors such as time, cost, quality and health and safety.

10.2.2. It is important for all value chain members to identify, capture and share information on carbon emissions and carbon reduction solutions, maintaining ongoing collaboration and engagement with others to facilitate continual improvement in future and to inform development and implementation of best practices.

Annex 1

RECOMMENDED CARBON REDUCTION MEASURES

Item	Measure	Responsibility	Stage
1	Detailed design optimisation to reflect the PAS 2080:2023 carbon reduction hierarchy, covering: ▪ Avoid: align the outcomes of the project and/or programme of work with the UK's trajectory towards net zero at the system level and evaluate the basic need at the asset and/or network level; ▪ Switch: assess alternative solutions and then adopt one that reduces whole life emissions through alternative scope, design approach, materials, technologies for operational carbon reduction, among others, while satisfying the whole life performance requirements; and ▪ Improve: identify and adopt solutions and techniques that improve the use of resources and design life of an asset/network, including applying circular economy principles to assess materials/products in terms of their potential for reuse or recycling after end of life.	Asset Owner Designer Contractors Suppliers	Incorporate at the detailed design stage and to be confirmed prior to construction. Also to be considered along the entire project life cycle.
2	In accordance with LEED certification criteria confirm how carbon management has been integrated into the vision, mission, goals, and objectives as part of the planning and design process for the Proposed Development. Develop processes and policies to integrate whole life carbon management into day-to-day systems for operation of the Proposed Development, including identifying responsibilities for carbon management.	Asset Owner Designer	Incorporate at the detailed design stage and to be confirmed prior to construction. Also to be considered along the entire project life cycle.
3	In accordance with LEED certification criteria establish carbon related metrics and targets for relevant aspects of the Proposed Development, including a GHG per capita metric, an annual Municipal Solid Waste (MSW) metric, targets for recycling of construction and operational waste, and provision for electric vehicle charging infrastructure. Establish additional carbon metrics and targets linked to specific aspects of the Proposed Development (e.g. visitor travel, heating and cooling, procurement of goods and services, and the various buildings/use areas), to enable targeted carbon management, considering relevant industry benchmarks and national and sector-level targets/budgets.	Asset Owner Designer Contractors Suppliers	Incorporate at the detailed design stage and to be confirmed prior to construction. Also to be considered along the entire project life cycle.
4	Continuously assess and monitor emission hotspots to gather information on the key areas for carbon management, and to track progress in carbon reduction throughout development of the Proposed Development and its operation. This may include use of a central Building Management System (BMS) for monitoring.	Asset Owner Contractors Suppliers	To be completed along project lifecycle.

Item	Measure	Responsibility	Stage
5	Adopt continuous improvement processes by feeding back data to inform future baselines, which, in turn, will inform future decision-making. This could be undertaken by publishing an updated set of operational benchmarks focused on various aspects of the Proposed Development (noted under Item 3).	Asset Owner Contractors Suppliers	To be completed along project lifecycle.
6	In accordance with LEED certification criteria review the feasibility and confirm how the design of relevant aspects of the Proposed Development will reduce GHG emissions associated with the use of fossil fuel energy and improve the operational efficiency of the energy system, such as for heating and cooling requirements. Make use of a central BMS for monitoring and for optimisation of conditions to improve energy efficiency.	Asset Owner Designer	Incorporate at the detailed design stage and to be confirmed prior to construction. Also to be considered along the entire project life cycle.
7	Use procurement mechanisms to include carbon management as a differentiating factor for the supply chain. Consider specifying requirements for potential suppliers and contractors to identify carbon reduction plans and commitments to specific measures that contribute towards the UK's trajectory towards Net Zero in the procurement bidding process.	Asset Owner Contractor Suppliers	Prior to construction and throughout operation.
8	In accordance with LEED certification criteria consider opportunities to encourage the use of products and materials for which life cycle information is available and that have been extracted and sourced in a responsible manner. Minimise embodied carbon in the supply chain by considering opportunities to specify materials and products with reduced embodied GHG emissions. This would include using material substitution, recycled or secondary content, and renewable sources.	Asset Owner Designer Contractor Suppliers	Incorporate at the detailed design stage. and to be confirmed prior to construction.
9	Selection and engagement of materials suppliers and construction contractors considering their proximity to the Proposed Development, as well as policies and commitments to reduction of GHG emissions, including embodied emission in materials.	Asset Owner Contractor Suppliers	Incorporate at the detailed design stage and to be confirmed prior to construction.

Item	Measure	Responsibility	Stage
10	In accordance with LEED certification, confirm how relevant aspects of the Proposed Development will encourage the use of diverse transportation modes in order to reduce the reliance on personal vehicles and promotes alternatives to fossil fuel vehicles. Consider opportunities to introduce incentives for staff and visitors to use public transport or electric vehicles for visits to the Proposed Development and maximise use of electric/low carbon fuel fleet vehicles.	Asset Owner Designer	Incorporate at the detailed design stage and to be confirmed prior to construction. Also to be considered along the entire project life cycle.
11	In accordance with LEED certification criteria recycle or reuse construction and operational waste where practicable to avoid disposal to landfill, including the reuse of excavated arisings during the construction where suitable.	Asset Owner Designer Contractor	Incorporate at the detailed design stage and to be confirmed prior to construction. Also to be considered along the entire project life cycle
12	Design, specify and construct the Proposed Development to maximise the operational lifespan of equipment, minimise the need for maintenance and repair/refurbishment, and consider options for reuse of components being replaced in other applications (in the Proposed Development or alternative developments where appropriate), to avoid loss of material resources and embodied carbon.	Designer Contractor	Incorporate at the detailed design stage and to be confirmed prior to construction.
13	In accordance with LEED certification criteria consider how the provision of greenspace and conservation of natural resources could be used to enhance environmental quality. Consider the potential for minimising and offsetting carbon emissions within the design of the Proposed Development through optimisation of greenspace and natural habitats for carbon sequestration.	Asset Owner Designer Contractor	Incorporate at the detailed design stage and to be confirmed prior to construction. Also to be considered along the entire project life cycle.
14	Develop and implement a planned and preventative maintenance and replacement regime to make sure of efficient operation of the Proposed Development and reduced associated GHG emissions.	Asset Owner Designer	Incorporate at the detailed design stage. Also to be completed along project lifecycle.

Item	Measure	Responsibility	Stage
15	Consider where use of refrigerants is required for the applicable components of the Proposed Development for which UDX is the relevant Undertaker, specify equipment using low global warming potential (GWP) refrigerants when available.	Asset Owner Designer	Incorporate at the detailed design stage.
16	Identify in procurement documentation, that operational consumables for the applicable components of the Proposed Development for which UDX is the relevant Undertaker (i.e. food, chemicals, hospitality/office supplies etc) with reduced embodied carbon emissions and recycled content are preferred where practicable.	Asset Owner	Incorporate at the detailed design stage.

Annex 2

DRAFT CARBON OPPORTUNITIES REGISTER

Annex 1 provides recommended reduction measures to investigate, but as the Proposed Development develops it is important to capture more specific opportunities related to the design, materials, construction processes etc. An example Carbon Opportunities Register is provided below for information. Although this can be project specific, the key elements to be included are the details of the opportunity, potential carbon saving, feasibility, ownership of the opportunity and any follow up actions required.

High (>1,000 tCO_2)	Not Challenging	Cost Saving	Going Ahead
Med (500-1,000 tCO_2)	Challenging	Cost Neutral	Further Investigation
Low (<500tCO_2)	Very Challenging	Increase Cost	Not Feasible

<SCHEME NAME>

Reference	Date	Source	Lifestyle Stage	Discipline	Discipline Lead / Responsible for Inclusion	Opportunity	Carbon Reduction Hierarchy	Carbon Saving Estimate	Feasibility to Implement	Cost Effectiveness	RAG	Comments	Actions	Carbon Lead Actions
xx	*xx/yy/zz*	*Meeting, workshop, report etc.*	*Design/ Construction/ Operation*	*Design Discipline Name*	*In Charge of the Action*	*Details of Opportunity*	*Avoid/Switch/Improve*	*H/M/L*	*See Above*	*See Above*	*See Above*	*Notes on Implementation*	*Actions to be Taken*	*Actions for the Carbon Lead*

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