12 Materials

12.1 Scope of the Assessment

12.1.1 The use of energy and materials can give rise to significant impacts. The draft DMRB Volume 11, Section 3, Part 6 HD212/11 Materials Chapter (HD212/11) provides guidance for the assessment and management of the impacts arising from the use and consumption of materials and the production and management of waste associated with roads projects.

12.1.2 An assessment of the impact of the construction and maintenance of the Proposed Scheme on materials has been undertaken. The assessment has primarily focused on environmental impacts from construction in the form of: embodied energy associated with the production of materials; the generation, management of waste on site; and potential impact on waste policies and available waste management facilities.

12.1.3 Transport Scotland's Carbon Management System (CMS) Project Tool has been used to estimate embedded carbon equivalent (CO_2e) associated with the construction of the Proposed Scheme. Population of the CMS provides a systematic approach to ensure that all facets of the design are considered during the assessment. Furthermore, by applying the CMS to the project it is possible to screen which components of the design are likely to cause the greatest carbon emissions in terms of their material resource and to estimate this quantitatively.

12.1.4 Impacts associated with construction materials (imported and site won) and waste production will be derived from the CMS Project Tool and considered at the different stages of construction. The impacts will be summarised in the chapter and included in the Detailed Assessment Reporting Matrix (HD212/11). The proposed construction stages are as follows:

- Site clearance.
- Offline construction, including structures and accesses.
- Online construction.
- Maintenance.

12.1.5 It is expected that most of the waste generated on site would be Construction and Demolition (C and D). Therefore, the assessment has considered the waste facilities within North Ayrshire that may have the capacity to process or dispose of C and D waste.

12.1.6 With regards to mitigation, it is an objective of this assessment to improve the sustainability in design and construction and to address this from an early stage in the detailed design of the Proposed Scheme. Sustainability relates to the efficient use of resources (energy, water, materials). Implementing materials resource efficiency at the design stage is commonly referred to as 'Designing out Waste'. The Waste Hierarchy[1] would be applied to form priority order in recommendations regarding material procurement and site won materials and waste generation, treatment and disposal associated with the Proposed Scheme; and is as follows:

[1] The Waste Hierarchy is defined in the Article 4 of the Revised Waste Framework Directive (2008/98/EC)

- prevention;
- preparing for re-use;
- recycling;
- other recovery, e.g. energy recovery,; and
- disposal.

12.1.7 The use of materials and the management and transportation of waste during construction could also give rise to other adverse environmental effects such as air quality and noise impacts however this chapter does not consider these impacts. The respective specialist topic areas include an assessment of impacts during construction and are not repeated in this chapter. Please see Chapter 7, 8, 9, 10 and 13 for the assessment of the Proposed Scheme on Air Quality, Cultural Heritage, Landscape Effects, Nature Conservation and Noise and Vibration respectively.

12.2 Legislative, Regulatory and Planning Context

European Legislation

12.2.1 There is a range of legislation that is applicable to the management of waste from European Directives through to a national Acts and Regulations. This includes but is not limited to the following:

Directive on Waste (2008/98/EC)

12.2.2 Known as the Waste Framework Directive (WFD), the Directive establishes a framework for the management of waste across the European Community. It requires Member States to give priority to waste prevention and encourage reuse and recovery of waste Article 28 of the WFD requires EU Member States to prepare a national waste management plan. In response the Scottish Government has implemented 'The Zero Waste Plan'.

National Legislation

Environmental Protection Act 1990, Part II

12.2.3 This Act provides the basis for licensing controls and other provisions aimed at ensuring that waste handling, disposal and recovery options do not harm the environment

Environmental Protection (Duty of Care) Regulations 1991, as amended

12.2.4 These regulations impose a duty of care on anyone who imports, produces, carries, keeps, treats or disposes of controlled waste to ensure it is not unauthorised or harmfully deposited, treated or disposed of; and if transferred, is only given to an authorised person.

Landfill (Scotland) Regulations 2003

12.2.5 The Landfill (Scotland) Regulations transposes the requirements of the Landfill directive (Council Directive 1999/31/EC), which aims to prevent, or to reduce as far as possible, the negative environmental effects of landfill.

Waste (Scotland) Regulations 2011

12.2.6 These regulations which came into force on 27 March 2011 implement the remaining parts of the Waste Framework Directive 2008 that are not covered by the Waste Management Licensing (Scotland) Regulations 2011. A number of amendments to related legislation are included, such as the Environmental Protection Act 1990, the Environment Act 1995 and the National Waste Management Plan for Scotland Regulations 2007 amongst others.

Climate Change (Scotland) Act

12.2.7 The Act is key commitment of the Scottish Government to address climate change by reducing greenhouse gas emissions and transitioning to a low carbon economy. Part 1 of the Act, creates the statutory framework for greenhouse gas emissions reductions in Scotland by setting an interim 42 per cent reduction target for 2020, with the power for this to be varied based on expert advice, and an 80 per cent reduction target for 2050.

12.2.8 Part 4 of the Act places duties on public bodies relating to climate change These duties require that a public body must, in exercising its functions, act in the way best calculated to contribute to the delivery of emissions reduction targets (known as 'mitigation'), in the way best calculated to help deliver any statutory climate change adaptation programme, and in a way that it considers is most sustainable.

Transport Scotland Corporate Plan (2012-2015)

12.2.9 The Corporate Plan sets out the role Transport Scotland the period 2012-2015 to deliver increased sustainable economic growth, set in the context of the Government Economic Strategy's (GES) five strategic priorities which are critical to economic growth. Transport Scotland will continue its efforts to deliver a single integrated focus for developing national transport projects / policies and the low carbon economy.

12.2.10 Of particular relevance to this Materials assessment are commitment to:

- fully integrate the Carbon Management System (CMS) to influence and support low-carbon decision-making across the design and delivery of transport infrastructure projects and network maintenance;
- utilise the CMS - in tandem with the Carbon Management Plan - to facilitate annual sustainability reporting;
- embed resource efficiency into practices and adopt the next generation of Waste & Resources Action Programme (WRAP) Construction Commitments; and
- support sustainable design, construction, maintenance and operations through the adoption of infrastructure assessment schemes.

Local Policy

North Ayrshire Local Development Plan (NALDP) (Modified 2012)

12.2.11 The NALDP acknowledges the important role that the planning system has in delivery of a waste management network capable of processing waste arisings from all sectors including construction and demolition.

12.2.12 The NALDP also indicates that the Council are signed up to the Zero Waste Plan which sets a target of 70% recycling for all waste arisings in Scotland, restrictions on inputs to energy from waste plants, as well as progressive bans on the types of material

permitted for landfill, will also be introduced. The waste plan also sets targets, using the waste hierarchy of prevention, reduction, recycling, other recovery (e.g. energy recovery) and finally disposal, which is endorsed by the NALDP.

12.3 Methods of Assessment

12.3.1 The Highways Agency (HA) is currently modernising Volume 11 (Environmental Assessment) of the Design Manual for Roads and Bridges (DMRB). The Aims and Objectives of Environmental Assessment (DMRB, Vol.11, Part1: HA 200/08) identifies in Table 1.1 the Environmental Impact Assessment topics. One of the topics identified here is Materials for which no previous guidance has been available. Draft guidance has been published for Materials - DMRB Volume 11 – Environmental Assessment – Section 6, Part 6 (HD 212/11).

12.3.2 The draft guidance identifies two levels of assessment that may be undertaken, a simple and detailed assessment. The methodology used to assess both materials and waste associated with the Proposed Scheme follows that for a detailed level assessment. This was deemed appropriate given the availability of the CMS tool and the information that was available regarding the Proposed Scheme.

Materials Resource Assessment

12.3.3 Construction elements were identified using Volume 1 of the Manual of Contract Documents for Highway Works (MCHW) - Specification for Highway Works (SHW). This guidance contains the material specifications required in all components of the construction, improvement or maintenance of the Trunk Road network. The CMS Project Tool provides a CO_2e of the construction materials for a road by calculating the potential embedded carbon associated with the components and their constituent materials detailed in the SHW series.

12.3.4 The quantities of materials required to complete construction of the Proposed Scheme were entered into the CMS which then calculates the CO_2e of each material used. The combination of the above and the addition of the CO_2e for each material provides an overall figure which then be used to derive the magnitude of impact.

12.3.5 The scale of the magnitude of impact for materials is ranked according to scale, as summarised in Table 12.1 below:

Table 12.1 Scale of impact magnitude

Scale of Impact Magnitude	Total CO_2e of materials (tonnes)
No change	<1,000
Negligible	1,000 – 5,000
Minor	5,000 – 20,000
Moderate	20,000 – 40,000
Major	> 40,000

Waste Assessment

12.3.6 The waste assessment will identify and estimate the likely waste arisings as a result of the Proposed Scheme for the construction stages identified in Paragraph 12.1.4.

12.3.7 The assessment also considers the potential for onsite / offsite reuse of site won materials. These figures are derived from the cut and fill balance calculated for the Proposed Scheme specimen design. All material that did not qualify for re-use on site by virtue of the type of material or there being no capacity within the design for re-use was recorded.

12.3.8 The type and number of each type of waste facility within North Ayrshire was identified from the SEPA Waste Infrastructure Maps[2].

12.3.9 The sensitivity of the waste capacity and therefore sensitive receptors within North Ayrshire is determined by using the following terminology:

Table 12.2 Sensitivity of receptor(s)

Sensitivity	Description
Very High	There is no available waste management capacity for any waste arising from the project.
High	There is limited waste management capacity in relation to the forecast waste arising from the project.
Medium	There is adequate waste management capacity for the majority of wastes arising from the project.
Low	There is adequate available waste management capacity for all wastes arising from the project.

12.3.10 The nature of the impact was established to determine the magnitude of impact by utilising the scale indicated in Table 12.3 below.

Table 12.3 Magnitude of impact

Magnitude	Description
Major	Waste is predominantly disposed of to landfill or to incineration without energy recovery with little or no prior segregation.
Moderate	Wastes are predominantly disposed of to incineration with energy recovery.
Minor	Wastes are predominantly segregated and sent for composting, recycling or for further segregation and sorting at a materials recovery facility.
Negligible	Wastes are predominantly re-used on site or at an appropriately licensed or registered exempt site elsewhere.

12.3.11 The nature of each impact is classified as being:

- Adverse – Detrimental or negative impact to an environmental resource or receptor; or
- Beneficial – Advantageous or positive impact to an environmental resource or receptor.

12.3.12 The assessment of significance is based on the characteristics of the impact and the sensitivity of the receptor. By establishing the sensitivity / value of the receptor and the magnitude / nature of the impact in Table 12.4 below is used to determine the significance level of the environmental effect.

[2] SEPA Waste Infrastructure Maps: http://www.sepa.org.uk/waste/waste_infrastructure_maps.aspx

Table 12.4 Significance of waste effects matrix

Magnitude / Nature of Impact	Sensitivity of Receptor			
	Very High	High	Medium	Low
Major	Very Large	Large / Very Large	Moderate / Large	Slight Moderate
Moderate	Large / Very Large	Moderate / Large	Moderate	Slight
Minor	Moderate / Large	Moderate / Slight	Slight	Neutral / Slight
Negligible	Slight	Slight	Neutral / Slight	Neutral

12.3.13 The results of the impact assessment have been described below and reported in the 'Detailed Reporting Matrices'.

Mitigation

12.3.14 Mitigation measures are proposed in the form of measures to minimise the impacts associated with material need and waste generation and reported in Mitigation Measures Reporting Matrix (HD212/11).

12.4 Baseline Conditions

12.4.1 An estimate of the quantity of the materials was derived from the outline design of the scheme and Interpretive Ground Investigation Reports; details of which can be found in the following chapters and appendices:

- Chapter 4 Project Description, Figure 1.2 General Arrangement Overview and Figures 4.1a-e General Arrangement give an indication of the potential materials and construction techniques required to build the Proposed Scheme.
- Chapter 11: Geology and Soils describes the existing ground conditions an indication for site won materials.

12.4.2 Table 12.5 below is a summary of the potential materials required for construction of the Proposed Scheme based on the current Proposed Scheme Design and estimated quantities.

Table 12.5 An estimate of the quantity of materials required for the scheme.

Material Resource	Approximate Material Quantity
Series 0300: Fencing	
Timber	209.27 tonnes
Chain link fence mesh	26.40 tonnes
Series 0400: Road Restraint System	
N2 Safety Barrier	115.3 tonnes
Series 0500: Drainage	
Filter Material	7581.6 tonnes

UPVC pipe	28.9 tonnes
Chamber	696.6 tonnes
Series 0600: Earthworks	
Excavated Materials (Acceptable Cut)	459,615.1 tonnes
Imported Fill	120,376.2 tonnes
Topsoil (Re-used on site)	59,759.93 tonnes
Series 0700: Road Pavements	
Sub-base	145,808.3 tonnes
Base	37,428.5 tonnes
Binder	22,457.1 tonnes
Surfacing	7,485.7 tonnes
Series 1100: Kerbs, Footways and Paved Areas	
Concrete	6639 tonnes
Aggregate	4157 tonnes
Asphalt	800 tonnes
Series 1200: Traffic Signs and Road Markings	
Steel	308.07 tonnes
Series 1600: Piling	
Augured piles (Concrete)	1885.0 tonnes
Augured piles (Steel reinforcement)	78.5 tonnes
Series 1700: Structural Concrete	
Concrete	12304.8 tonnes
Steel	935.5 tonnes
Form Work (Timber)	183.3 tonnes
Series 1800: Steelwork for Structures	
Steel Plate	1473.3 tonnes
Series 1900 / 2000: Protection of Steelwork and Waterproofing for Concrete Structures	
Bitumen Emulsion	5520m^2
Series 2100 / 2300: Bridge Bearings and Bridge Expansion Joints and Sealing of Gaps	
Expansion Joint	41.5m^2

Local Waste Infrastructure

12.4.3 The local waste infrastructure and the potential waste management capacity have been identified. The total quantities of materials required for the construction of the Proposed Scheme are indicated in Table 12.5. **Error! Reference source not found.**

Construction and Demolition Waste

12.4.4 This assessment defines C and D wastes as waste materials arising from UK commercial C and D sites. This type of waste comprises, but is not limited to:

- off-cuts and waste timber
- plastics (such as uPVC & HDPE)
- glass (such as windows)
- packaging waste materials (for example card, wood and plastic film)
- inert materials such as soils, and
- aggregate materials (such as masonry, brick and block, paving, tiles and ceramics) and plasterboard in mixed waste.

12.4.5 SEPA produce data sheets, the latest in 2009, which indicate the quantities of C and D produced and treated in each Local Authority area[3]. The total quantity of C&D wastes managed in the North Ayrshire amounted to 220,433 tonnes and comprised the following:

Table 12.6 Quantity of Construction and Demolition Waste treated in North Ayrshire in 2009

Waste Type	Amount (tonnes)
Contaminated Soils	290
Metals	13,113
Mineral Waste	125,292
Mixed C and D Waste	78,487
Wood	3249

12.4.6 The different methods of managing the C&D wastes in the North Ayrshire comprised the following:

- Landfill Site
- Metal Recycler
- Transfer Station
- Multiple Activity Site
- Treatment Plant
- Incineration

12.4.7 The amount of C and D waste produced within North Ayrshire in 2009 was 149,878 tonnes[3].

12.4.8 It is clear from the SEPA map of Waste Management Facilities in North Ayrshire[2] and the breakdown of waste treatment in North Ayrshire that facilities exist in the local area for both disposal and recycling of construction and demolition waste.

[3] SEPA: C and D data Sheets 2009

12.5 Predicted Impacts

Material Resource Assessment

12.5.1 The Transport Scotland (TS) CMS Road Tool was utilised to assess the total embodied carbon emissions. Assumptions have been made in relation to types of materials required and the distance materials would have to travel from the site; for details of these assumptions please refer notes section of each Construction Series in Appendix 12.1 Transport Scotland CMS Toolkit.

12.5.2 The carbon emissions associated with the materials as detailed in Table 12.7 have been split into the embodied carbon and the transport associated emissions. Table 12.7 shows the embodied carbon which is the total primary energy consumed during resource extraction, transportation, manufacturing and fabrication of a material.

Table 12.7 The total embodied carbon contained within each SHW Series component

Material Resource	Embodied Carbon Emissions (tCO_2)
Series 0300: Fencing	2.3
Series 0400: Road Restraint System	347
Series 0500: Drainage	421.8
Series 0600: Earthworks	0
Series 0700: Road Pavements	6,623.5
Series 1100: Kerbs Footways Paved Areas	152.7
Series 1200: Traffic Signs and Road Markings	29.8
Series 1300: Road Lighting Columns, CCTV Masts and Cantilever Masts	63.4
Series 1400: Electrical Work for Road Lighting and Traffic Signs	22.1
Series 1600: Piling	622.2
Series 1700: Structural Concrete	2,402.6
Series 1800: Steelwork for Structures	2,445.7
Series 1900 / 2000	58.8
Series 2100 / 2300	11.0
Total Embodied Carbon Emissions (tCO_2)	16091

12.5.3 Table 12.8 indicated the transportation emissions of the materials from their manufacturing plant to the construction site.

Table 12.8 The total transport emissions contained within each SHW Series component

Material Resource	Transport Emissions (tCO_2)
Series 0300: Fencing	0.93
Series 0400: Road Restraint System	0.5
Series 0500: Drainage	148.3
Series 0600: Earthworks	0

Material Resource	Transport Emissions (tCO_2)
Series 0700: Road Pavements	1,268.7
Series 1100: Kerbs Footways Paved Areas	4.6
Series 1200: Traffic Signs and Road Markings	4.2
Series 1300: Road Lighting Columns, CCTV Masts and Cantilever Masts	0.1
Series 1400: Electrical Work for Road Lighting and Traffic Signs	0.14
Series 1600: Piling	50.5
Series 1700: Structural Concrete	84.4
Series 1800: Steelwork for Structures	112.3
Series 1900 / 2000	N/A
Series 2100 / 2300	N/A
Total Embodied Carbon Emissions (tCO_2)	2152.4

12.5.4 Table 12.9 the total amount of emissions within each design component based on the quantities detailed in Table 12.7 and Table 12.8.

Table 12.9 The total emissions summary contained within each SHW Series component

Material Resource	Total Emissions (tCO_2)
Series 0300: Fencing	4.13
Series 0400: Road Restraint System	347.5
Series 0500: Drainage	570.2
Series 0600: Earthworks	0
Series 0700: Road Pavements	9,161.0
Series 1100: Kerbs Footways Paved Areas	157.3
Series 1200: Traffic Signs and Road Markings	31
Series 1300: Road Lighting Columns, CCTV Masts and Cantilever Masts	63.5
Series 1400: Electrical Work for Road Lighting and Traffic Signs	22.24
Series 1600: Piling	6,51.6
Series 1700: Structural Concrete	2,484.4
Series 1800: Steelwork for Structures	2,558.0
Series 1900 / 2000	58.8
Series 2100 / 2300	11.0
Total Embodied Carbon Emissions (tCO_2)	16,974.4

Likely waste arisings

12.5.5 The main waste arisings due to the construction the Proposed Scheme is indicated in Table 12.10 below. Earthworks and pavement are the two main components considered to create waste during construction.

12.5.6 Cuttings which are unacceptable for re-use as part of the Proposed Scheme would require off site treatment, this is included in the 0600 Earthworks figure.

Table 12.10 The likely waste arisings

Material Resource	Waste Summary (tonnes)
Series 0600: Earthworks (Re-used on site)	519,375.03
Total Waste (tonnes)	

Summary of Materials Assessment

12.5.7 Table 12.9 indicates that the tCO_2 for the project is 16,974.4. Therefore, the impact would be adverse and permanent and the scale of magnitude Minor.

Summary of Waste Assessment

12.5.8 Table 12.10 indicates that 519,375.03 tonnes of Excavated Materials (either general fill or topsoil) would be re-used on site. As a result there would be no excavated material exported from site for disposal or waste treatment. There is potential for residual waste from the construction process but these are expected to be minimal. Therefore, the significance of the likely waste arisings is expected to be Neutral.

Policy Assessment

12.5.9 Table 12.11 provides a summary of the 'impacts' of the Proposed Scheme on policies indicated in Section 12.2 Legislative, Regulatory and Planning Context. The assessment indicates the interaction and compliance to relevant legislation and policies.

Table 12.11 Compliance of the scheme with relevant policies

Legislation / Policy	Description of interaction	Compliance
Directive on Waste (2008/98/EC)	The management of waste throughout the project would follow prioritise waste prevention and encourage reuse and recovery on site before considering treatment or disposal options.	Y
Environmental Protection Act 1990, Part II	The promoter of the Proposed Scheme would ensure that excess materials produce during construction would be handled, disposed or recovered without harming the environment.	Y
Environmental Protection (Duty of Care) Regulations 1991, as amended	The promoter of the Proposed Scheme would ensure that anyone who imports, produces, carries, keeps, treats or disposes of controlled waste on site would ensure it is not harmfully deposited, treated or disposed of. If waste is transferred it would only given to an authorised person.	Y
Landfill (Scotland) Regulations 2003	Mitigation measures aim to prevent or to reduce as far as possible, the negative environmental effects of landfill.	Y
Waste (Scotland) Regulations 2011	Please refer to the above.	Y
Climate Change (Scotland) Act	With reference solely to materials (tCO_2) minor impact the Proposed Scheme does not contribute to the commitment of the Scottish Government to address climate change by reducing greenhouse gas emissions and transitioning to a low carbon economy.	N
Transport Scotland Corporate Plan (2012-2015)	The Proposed Scheme would utilise the CMS to report the total carbon load. Through the implementation of Materials and Waste Management Strategy (M&WMS), SWMP and Waste and Resources Action Programme (WRAP) Construction Commitments, would reconcile the specific commitments relating to materials.	Y
North Ayrshire Local Development Plan (NALDP) (Modified 2012)	Using the waste hierarchy of prevention, which is endorsed by the NALDP, the promoter would set targets to encourage the contractor to divert at least 70% of excess materials from landfill.	Y

12.6 Mitigation

12.6.1 The following mitigation measures would be adhered to:

- A Materials and Waste Management Strategy (M&WMS) would be developed and implemented by the contractor for both material procurement and waste management.
- As part of the M&WMS a Site Waste Management Plan (SWMP) would be produced and adhered to.
- Embedding the next generation of Waste & Resources Action Programme (WRAP) into Construction Commitments.
- Based on the assessment, the following would be taken forward for treatment of materials:
    1. Any existing road pavement would be recycled for use; and
    2. Soft material from excavated cut would be reused on site.

12.6.2 A number of further mitigation measures are recommended to enhance the above commitments:

- Minimising the total material demand of the design by ensuring that material inputs match demand as closely as possible;
- Minimise waste by matching material demand with material supply. Material supply can be met from the following prioritised sources:
    1. On site reuse / recycled;
    2. Off site reuse / recycled/ secondary materials/ sustainable sources;
    3. Offsite primary material;

12.6.3 The efficacy of the above committed and recommended mitigation measures would be driven by the following:

- ensuring that targets for reporting SWMP progress are included in the Employers Requirements; and
- that a contractual obligation is put upon the contractor to achieve specific levels of performance relating to waste management – these should be reflected through key performance indicators set out in the M&WMS, SWMP and reported through the WRAP Construction Commitments.

12.6.4 Through a combination of statutory obligation and stringent target setting the mitigation measures indicated above would result in the majority of waste being diverted from landfill.

12.7 Material Resource

12.7.1 The following recommendations would result in a reduction in tCO_2 / waste material produced and should be given consideration for inclusion in the Employers Requirements:

- Materials could be ordered to arrive when required for construction and the quantities would be accurately predetermined.

- Damage during receiving and storage could be minimised by ensuring storage in accordance with manufacturers' guidelines and in designated areas with offloading supervised by competent personnel using appropriate equipment.
- Use of renewable materials from legal and sustainable sources (such as timber with appropriate certification).
- Make use of existing waste management infrastructure for sourcing non-virgin and recycled materials.

12.7.2 The baseline section identified a range of waste management facilities within the area. These facilities are also a source for recycled construction materials in Scotland in addition to accepting C&D waste for recycling. Sourcing materials as locally as possible would reduce impacts associated with transportation, and the identification of these sites in the locale confirm that recycled construction materials are readily available.

12.8 Summary

12.8.1 A summary of impacts and mitigation is proposed in Table 12.12 below.

Table 12.12 Detailed Assessment Reporting Matrix

Project Activity	Potential impacts associated with material use/ waste production	Description of the impacts	Brief description of mitigating measures (including where known the scale of the mitigating effect)	A description of how the measures would be implemented, measured and monitored
Site Preparation	Impacts associated with Site Clearance – production of inert waste.	Re-used on site and minimal waste from construction activities, Adequate waste capacity, Impact: negligible, low sensitivity of waste site. Significance: **Neutral**.	A Materials and Waste Management Strategy (M&WMS) shall be put in place to address the likely waste arising. A Site Waste Management Plan (SWMP) shall also be produced.	These measures would be reviewed regularly. A Materials and Waste Management Strategy (M&WMS) and a Site Waste Management Plan (SWMP) shall be put in place and adhered to by the contractor. All waste should be managed by following the waste hierarchy: 'reduce, reuse, and recycle' The Contractor shall carry out the Works in such a way to minimise the amount construction activity waste requiring disposal. The Contractor shall identify the waste category, quantities, opportunities for recycling and or reuse, disposal routes and licensing requirements for all waste through the implementation of the SWMP.
Demolition	N/A	N/A	N/A	N/A
Site construction	Embedded Carbon Emissions	Between 5000-20000 tCO_2, impact would be **adverse** and **permanent** and the scale of magnitude **Minor.**	Based on the assessment, the following would be taken forward for treatment of materials: 1.Any existing road pavement would be recycled for use; and 2. Soft material from excavated cut would be reused on site. A number of further mitigation measures are recommended to enhance the above commitments: •Minimising the total material demand of the design by ensuring that material inputs match demand as closely as possible; The following recommendations should be taken into account: •Materials could be ordered to arrive when required for construction and the quantities would be accurately predetermined. •Damage during receiving and storage could be minimised by ensuring storage in accordance with manufacturers' guidelines and in designated areas with offloading supervised by competent personnel using appropriate equipment. •Use of renewable materials from legal and sustainable sources (such as timber with appropriate certification). •Make use of existing waste management infrastructure for sourcing non-virgin and recycled materials.	A Materials and Waste Management Strategy (M&WMS) and a Site Waste Management Plan (SWMP) shall be put in place and adhered to by the contractor. The Contractor shall carry out the Works in such a way to minimise the amount materials required through design, cost benefit and risk iterations.

Project Activity	Potential impacts associated with material use/ waste production	Description of the impacts	Brief description of mitigating measures (including where known the scale of the mitigating effect)	A description of how the measures would be implemented, measured and monitored
	Production of inert waste.	Re-used on site and minimal waste from construction activities, Adequate waste capacity, Impact: negligible, low sensitivity of waste site. Significance: **Neutral**.	A Materials and Waste Management Strategy (M&WMS) shall be put in place to address the likely waste arising. A Site Waste Management Plan (SWMP) shall also be produced.	These measures would be reviewed regularly. A Materials and Waste Management Strategy (M&WMS) and a Site Waste Management Plan (SWMP) shall be put in place and adhered to by the contractor. All waste should be managed by following the waste hierarchy: 'reduce, reuse, and recycle' The Contractor shall carry out the Works in such a way to minimise the amount construction activity waste requiring disposal. The Contractor shall identify the waste category, quantities, opportunities for recycling and or reuse, disposal routes and licensing requirements for all waste through the implementation of the SWMP.
Site Operation	N/A	N/A	N/A	N/A