Norfolk Vanguard Offshore Wind Farm

Chapter 24

Traffic and Transport

Environmental Statement

Volume 1

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Environmental Impact Assessment
Environmental Statement

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For and on behalf of Norfolk Vanguard Limited

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Glossary

AADF	Annual Average Daily Flows
AADT	Annual Average Daily Traffic
AILs	Abnormal Indivisible Loads
AMP	Access Management Plan
ATC	Automated Traffic Counts
CBS	Cement Bound Sand
CIA	Cumulative Impact Assessment
CRS	Cable Relay Station
CTMP	Construction Traffic Management Plan
DCO	Development Consent Order
DfT	Department for Transport
DoS	Degree of Saturation
DMRB	Design Manual for Roads and Bridges
ECR	Export Cable Route
EIA	Environment Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
GEART	Guidelines for the Environmental Assessment of Road Traffic
GTA	Guidance on Transport Assessments
HDD	Horizontal Directional Drilling
HGV	Heavy Goods Vehicle
LTP	Local Transport Plan
MA	Mobilisation Area
MCTC	Manual Classified Turning Count
MMQ	Mean Max Queue
NCC	Norfolk County Council
NNDR	Norwich Northern Distributor Road
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Projects
NV	Norfolk Vanguard
PCU	Passenger Car Units
PDS	Project Design Statement
PEIR	Preliminary Environmental Information Report
PIC	Personal Injury Collision
PPG	Planning Policy Guidance
PRC	Practical Reserve Capacity
RFC	Ratio to Flow Capacity
RIS	Road Investment strategy
SRN	Strategic Road Network
TEMPro	Trip End Model Presentation Programme
TMA	Traffic Management Act
TMP	Traffic Management Plan
TP	Travel Plan

WCS	Worst Case Scenario

Terminology

Cable Relay Station	Primarily comprised of an outdoor compound containing reactors (also called inductors, or coils) and switchgear to increase the power transfer capability of the cables under the HVAC technology scenario as considered in the PEIR. This is no longer required for the project as the HVDC technology has been selected.
Control Point	A location that provides the checks and controls for the movement of HGVs and employees.
Delivery	A delivery is the process of transporting goods from a source location to a predefined destination. A delivery will generate two vehicle movements (an arrival and departure)
Jointing pit	Underground structures constructed at regular intervals along the cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	Where the offshore cables come ashore at Happisburgh South
Landfall compound	Compound at landfall within which HDD drilling would take place
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing low voltage electrical earthing links.
Mobilisation area	Areas approximately 100 x 100m used as access points to the running track for duct installation. Required to store equipment and provide welfare facilities. Located adjacent to the onshore cable route, accessible from local highways network and suitable for the delivery of heavy and oversized materials and equipment.
National Grid new / replacement overhead line tower	New overhead line towers to be installed at the Necton National Grid substation.
National Grid overhead line modifications	The works to be undertaken to complete the necessary modification to the existing 400kV overhead lines
National Grid substation extension	The permanent footprint of the National Grid substation extension
National Grid temporary works area	Land adjacent to the Necton National Grid substation which would be temporarily required during construction of the National Grid substation extension.
Necton National Grid substation	The existing 400kV substation at Necton, which will be the grid connection location for Norfolk Vanguard
Onshore 400kV cable route	Buried high-voltage cables linking the onshore project substation to the Necton National Grid substation
Onshore cable route	The 45m easement which will contain the buried export cables as well as the temporary running track, topsoil storage and excavated material during construction.
Onshore cables	The cables which take the electricity from landfall to the onshore project substation.
Onshore infrastructure	The combined name for all onshore infrastructure associated with the project from landfall to grid connection.

Onshore project area	All onshore electrical infrastructure (landfall; onshore cable route, accesses, trenchless crossing technique (e.g. Horizontal Directional Drilling (HDD)) zones and mobilisation areas; onshore project substation and extension to the Necton National Grid substation and overhead line modification)
Onshore project substation	A compound containing electrical equipment to enable connection to the National Grid. The substation will convert the exported power from HVDC to HVAC, to 400kV (grid voltage). This also contains equipment to help maintain stable grid voltage.
Running track	The track along the onshore cable route which the construction traffic would use to access workfronts.
The Applicant	Norfolk Vanguard Limited
The project	Norfolk Vanguard Offshore Wind Farm, including the onshore and offshore infrastructure.
Transition pit	Underground structures that house the joints between the offshore export cables and the onshore cables.
Trenchless crossing zone (e.g. HDD)	Temporary areas required for trenchless crossing works.
Vehicle movement	A single trip (i.e. either an arrival to, or departure from site) for the transfer of employees or goods.
Workfront	The 150m length of onshore cable route within which duct installation would occur

24 TRAFFIC AND TRANSPORT

24.1 Introduction

1. This chapter of the Environment Statement (ES) considers the potential traffic and transport impacts of the Norfolk Vanguard project (hereafter 'the project') in relation to the onshore project area.

2. This chapter provides an overview of the existing conditions and environment with regard to traffic and transport matters and assesses potential impacts and associated mitigation on sensitive receptors during the construction, operation and decommissioning phases of the project. The proposed methodology adhered to for the Environmental Impact Assessment (EIA) and Cumulative Impact Assessment (CIA) is discussed in section 24.4.

3. In accordance with the Overarching National Policy Statement (NPS) for Energy EN-1, this chapter contains a 'Transport Assessment' to determine the significance of the project in the context of its traffic and transport effects.

4. Figures which accompany the text in this chapter are provided in Volume 2 Figures.

5. It should be noted that the project's traffic and transport effects have the potential to impact on environmental receptors discussed in other chapters within the ES. The relevant chapters to consider are:

   - Chapter 25 Noise and Vibration;
   - Chapter 26 Air Quality;
   - Chapter 27 Human Health; and
   - Chapter 31 Socio-economics.

24.2 Legislation, Guidance and Policy

24.2.1 Legislation and Policy

6. There are a number of pieces of legislation, policy and guidance applicable to traffic and transport. The following sections provide detail on key pieces of international and UK legislation, policy and guidance which are relevant to this chapter.

24.2.2 National Policy Statements

7. The assessment of potential traffic and transport impacts has been made with specific reference to the NPSs. NPS set out policies or circumstances that the UK Government consider should be taken into account when making decisions on Nationally Significant Infrastructure Projects (NSIP). All six energy NPS received designation by the Secretary of State (SoS) for Energy and Climate Change on 19 July

2011. Those relevant to the project are:

- Overarching NPS for Energy (EN-1) (DECC, 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2011c).

8. For the specific assessment requirements for traffic and transport, only EN-1 is applicable. This is summarised in Table 24.1, together with an indication of where each stipulation is addressed.

Table 24.1 NPS assessment requirements

NPS requirement	NPS reference	ES Response
EN-1 Overarching NPS for Energy		
If a project is likely to have significant transport implications, the applicant's ES should include a Transport Assessment, using the NATA/ WebTAG methodology stipulated in Department for Transport (DfT) guidance, or any successor to such methodology.	Section 5.13.3	The chapter has been produced in accordance with current transport guidance (referenced later within sections 24.2.4 to 24.2.7) and this is evidenced throughout this document.
Where appropriate, the applicant should prepare a Travel Plan including demand management measures to mitigate transport impacts. The applicant should also provide details of proposed measures to improve access by public transport, walking and cycling, to reduce the need for car parking associated with the proposal and to mitigate transport impacts.	Section 5.13.4	Section 24.7.4 outlines the mitigation measures for construction, such as car-share and Heavy Goods Vehicle (HGV) controls. These parameters have also been captured in an Outline Travel Plan (OTP) (document reference 8.9) and an Outline Traffic Management Plan (OTMP) (document reference 8.8) which is submitted as part of the DCO application.

24.2.3 Local Planning Policy

9. EN-1 states that the Planning Inspectorate will also consider Development Plan Documents or other documents in the Local Development Framework relevant to its decision making.

10. The traffic and transport study area falls under the jurisdiction of Norfolk County Council and Suffolk County Council and would potentially include the following local planning authorities:

- North Norfolk District Council;
- South Norfolk District Council;
- Breckland Council;
- Broadlands District Council;

- Waveney District Council; and
- Norwich City Council.

11. North Norfolk District Council have produced a Local Plan which includes the Core Strategy and Site Allocation Plans setting out detailed, site specific policies (North Norfolk District Council, 2008) providing the context for development across North Norfolk. North Norfolk District Council is currently working on an Emerging Local Plan 2016-2036.

12. South Norfolk District Council, Broadland District Council and Norwich City Council each use an individual adopted Local Plan, which includes the Joint Core Strategy (a partnership between Broadland, Norwich and South Norfolk Councils) (Greater Norwich Development Partnership, 2014). All three authorities supplement the Local Plan via individual Development Management Policies Documents.

13. Breckland Council are currently updating an Emerging Single Local Plan 2011-2036 (Breckland Council, 2017). This plan sets out strategic planning policies within Breckland which will replace the Core Strategy and suite of documents that make up the adopted Local Plan (Breckland Council, 2009).

14. Waveney District Council falls within the county of Suffolk and provides a Core Strategy Development Plan Document (Waveney District Council, 2009) and a number of policies within the adopted Development Management Policies Documents (Waveney Disctrict Council, 2011).

15. Table 24.2 provides details of the local planning policy documents and the policies contained within these which are relevant to traffic and transport.

Table 24.2 Relevant local planning policies

Document	Policy/guidance	Policy/guidance purpose
Norfolk County Council		
Local Transport Plan 3 adopted April 2011.	Policy 4: Protecting the Environment	Transport decisions should take account of the character of the historic environment, landscape and local biodiversity. In particular: • Negative impacts should be mitigated; • Reasonable opportunities for creating habitats taken; • Due regard should be given to ecological networks and European designated sites; • Impact assessments should be undertaken where necessary.
North Norfolk District Council		
Local Development Framework – Core Strategy adopted September 2008.	Policy SS 2: Development in the Countryside	In areas designated as Countryside development will be limited to that which requires a rural location and can include the following: • Renewable energy projects • Transport
	CT5: The Transport	Development will be designed to reduce the need to travel and to maximise the use of sustainable forms of transport appropriate to its

Document	Policy/guidance	Policy/guidance purpose
	Impact of New Development	particular location. Development proposals will be considered against the following criteria; • The proposal provides for safe and convenient access on foot, cycle, public and private transport addressing the needs of all, including those with a disability; • The proposal is capable of being served by safe access to the highway network without detriment to the amenity or character of the locality; • Outside designated settlement boundaries the proposal does not involve direct access on to a principal route, unless the type of development requires a principal route location. • The expected nature and volume of traffic generated by the proposal could be accommodated by the existing road network without detriment to the amenity or character of the surrounding area or highway safety; and • If the proposal would have significant transport implications, it is accompanied by a transport assessment, the coverage and detail of which reflects the scale of development and the extent of the transport implications, and also, for non-residential schemes, a travel plan.
South Norfolk District Council		
Development Management Policies Document. **(South Norfolk District Council, 2015)**	Policy DM 3.11 Road Safety and the Free Flow of Traffic	On all sites development will not be permitted that endangers highway safety or the satisfactory functioning of the highway network. Planning permission will be granted for development involving the formation or intensified use of a direct access onto a Corridor of Movement providing it would not: • Prejudice the safe and free flow of traffic or planned proposals for sustainable transport initiatives along the Corridor of Movement; • Be practical to gain access from the site to the Corridor of Movement via a secondary road; and • Facilitate the use of the Corridor of Movement for short local journeys.
Joint Core Strategy (Broadland, Norwich and South Norfolk) adopted January 2014.	Policy 6: Access and Transportation.	The Transportation system will be enhanced to develop the role of Norwich as a Regional Transport Node. This will be achieved by a number of factors including; • Implementation of the Norwich Area Transportation Strategy (NATS) including construction of the Northern Distributor road; • Promoting improvements to the A11 and A47; and • Continuing to recognise that in the most rural areas the private car will remain an important means of travel.
Breckland Council		
Breckland Local Plan - Core Strategy and Development Control Policies Document adopted	Policy CP13: Accessibility	Travel Plans should be submitted for major schemes or those schemes where there are significant transport implications, such as those where a Transport Assessment is required.
	Policy DC 15: Renewable energy	Proposals for renewable energy development will be supported in principle. Permission will be granted for these developments unless it, or any related infrastructure such as power lines or access roads etc, has a significant detrimental impact or a cumulative detrimental

Document	Policy/guidance	Policy/guidance purpose
December 2009		impact upon: • Sites of international, national or local nature and heritage conservation importance; • The surrounding landscape and townscape; • Local amenity as a result of noise, fumes, electronic interference or outlook through unacceptable visual intrusion; and • Highway safety. Where development is permitted, mitigation measures will be required as appropriate to minimise any environmental impacts, such measures will be secured via condition or legal agreement. All development proposals for a renewable energy generation scheme should, as far as is practicable, provide for the site to be reinstated to its former condition should the development cease to be operational.
Emerging Single Local Plan Pre-Submission Publication August 2017	Policy TR01: Sustainable Transport Network	Major development proposals should include an assessment of the impacts of new development on the existing transport network. Where potential transport impacts are identified, developers will be expected to produce Transport Assessments to assess the impacts and identify appropriate mitigation, together with Travel Plans where appropriate.
	Policy TR02: Transport Requirements	Development proposals that are likely to generate a significant number of heavy goods vehicle movements will be required to demonstrate by way of a Routing Management Plan that no severe impacts will be caused to the efficient and safe operation of the road network and no material harm caused to the living conditions of residents.
Broadland District Council		
Joint Core Strategy (Broadland, Norwich and South Norfolk) adopted January 2014.	Policy 6: Access and Transportation.	The Transportation system will be enhanced to develop the role of Norwich as a Regional Transport Node. This will be achieved by a number of factors including; • Implementation of the Norwich Area Transportation Strategy (NATS) including construction of the Northern Distributor road; • Promoting improvements to the A11 and A47; and • Continuing to recognise that in the most rural areas the private car will remain an important means of travel.
Development Management Policies Document. **(Broadland District Council, 2015)**	Policy GC5: Renewable Energy	Proposals for renewable energy technology, associated infrastructure and integration of renewable energy technology will be encouraged where its impacts are (or can be made) acceptable.
	Policy TS2 – Travel Plans and Transport Assessments	In the case of major development, or where a particular need is identified, a Transport Assessment and/or Travel Plan will be required. Developers will need to include proposals to deal with any consequences of their development in terms of maximising access by foot, cycle and public transport and the means by which this will be secured in perpetuity.
	Policy TS3: Highway Safety	Development will not be permitted where it would result in any significant adverse impact upon the satisfactory functioning or safety of the highway network.
Waveney District Council		
Waveney Local Plan - Core	Policy CS15: Sustainable	Development that could generate significant traffic, including goods vehicles, will only be acceptable in the most accessible locations

Document	Policy/guidance	Policy/guidance purpose
Strategy Development Plan Document adopted January 2009	Transport	where there are opportunities to reduce the need to travel. Development proposals that will have significant transport implications will need to be accompanied by a transport assessment and travel plan showing how car based travel to the site can be minimised.
Development Management Policies Document.	Policy DM02 – Design Principles	Ensure access to the site that does not compromise highway safety and the traffic generated by the development is capable of being accommodated on the surrounding transport network.
Norwich City Council		
Joint Core Strategy (Broadland, Norwich and South Norfolk) adopted January 2014.	Policy 6: Access and Transportation.	The Transportation system will be enhanced to develop the role of Norwich as a Regional Transport Node. This will be achieved by a number of factors including; • Implementation of the Norwich Area Transportation Strategy (NATS) including construction of the Northern Distributor road; • Promoting improvements to the A11 and A47; and • Continuing to recognise that in the most rural areas the private car will remain an important means of travel.
Development Management Policies Document. adopted January 2011.	Policy DM30: Access and Highway Safety	Development must seek opportunities to remove unnecessary access points onto the principal or main distributor routes (as defined in the NATS route hierarchy). New vehicular accesses onto these routes will only be permitted where there is no practical alternative from a more minor route and (where adjacent to an existing or proposed bus rapid transit corridor) they would not prevent or restrict the implementation of necessary highway or junction improvement works associated with the transit corridor. Any new access point must allow for access and egress in a forward gear.

24.2.4 Traffic Management Act

16. The Traffic Management Act (TMA) was introduced in 2004 to deal with congestion and disruption on the road network. The TMA places a duty on local traffic authorities to ensure the expeditious movement of traffic on their road network and those networks of surrounding authorities.

17. The TMA directs effective communication between highway authorities and parties interested in carrying out street work. The TMA encourages a disciplined approach and advance communication to plan the street works.

24.2.5 The Strategic Road Network and the Delivery of Sustainable Development Guidance

18. The Department for Transport (DfT) Circular 02/2013 entitled 'The Strategic Road Network and the Delivery of Sustainable Development' sets out the ways in which the Highways Agency [now Highways England] will engage with communities and developers to deliver sustainable development and thus economic growth, whilst

safeguarding the primary function and purpose of the Strategic Road Network.

19. Under the heading of 'Environmental Impact' Circular 02/2013 notes that:

- "…developers must ensure all environmental implications associated with their proposals, are adequately assessed and reported so as to ensure that the mitigation of any impact is compliant with prevailing policies and standards. This requirement applies in respect of the environmental impacts arising from the temporary construction works and the permanent transport solution associated with the development, as well as the environmental impact of the existing trunk road upon the development itself".

20. The Circular 02/2013 details access requirements specifically for wind turbines and states that:

- "The promoter of a wind farm should prepare a report covering the construction, operation and de-commissioning stages of the development. From this, the acceptability of the proposal should be determined and any mitigating measures should be identified"
- Access to the site for construction, maintenance and de-commissioning should be obtained via the local road network and, normally, there should be no direct connection to the strategic road network"
- Swept path analyses should be provided by the developer for the abnormal load deliveries to the site."

21. Under the heading of '*Access, The Strategic Road Network'* Circular 02/2013 notes that:

- "The creation of new accesses to the strategic road network can impact on its ability to fulfil the function of facilitating the safe and effective movement of goods and people in support of economic growth by compromising traffic movement and flow"
- "The Highways Agency will adopt a graduated and less restrictive approach to the formation or intensification of use of access [to the presumption against for motorway access] to the remainder of the strategic road network. However, the preference will always be that new development should make use of existing junctions. Where a new junction or direct means of access is agreed, the promoter will be expected to secure all necessary consents, and to fund all related design and construction works"

24.2.6 Guidelines for the Environmental Assessment of Road Traffic

22. The Guidelines for the Environmental Assessment of Road Traffic (GEART) (Institute

of Environmental Assessment, 1993) relate to the assessment of the environmental impacts of road traffic associated with new developments, irrespective of whether the developments are to be subject to formal Environmental Impact Assessments (EIAs).

23. The purpose of the guidelines is to provide the basis for systematic, consistent and comprehensive coverage for the appraisal of traffic impacts arising from development projects. Impacts that may arise include: pedestrian severance and amenity, driver delay, accidents and safety and noise, vibration and air quality. Further details on the assessment methodology undertaken for the project in relation to traffic and transport can be found in section 24.4.

24.2.7 DfT Transport Assessment Guidance and Successors

24. The DfT Transport Assessment guidance referred to in NPS EN-1, was withdrawn in October 2014 and was replaced with DCLG Planning Practice Guidance (PPG). For the purpose of assessing the project's impact the relevant PPG is 'Travel Plans, Transport Assessment and Statements' (henceforth referred to as the Transport PPG).

25. The Transport PPG sets out the key principles to be adopted when developing a Transport Assessment as follows:

- Proportionate to the size and scope of the proposed development to which they relate and build on existing information wherever possible;
- Established at the earliest practicable possible stage of a development proposal;
- Be tailored to particular local circumstances (other locally-determined factors and information beyond those which are set out in this guidance may need to be considered in these studies provided there is robust evidence for doing so locally);
- Be brought forward through collaborative ongoing working between the local planning authority/transport authority, transport operators, rail network operators, Highways Agency (now Highways England) where there may be implications for the strategic road network and other relevant bodies.

26. The Transport PPG key principles have shaped the development of the ES and can be seen throughout the document.

24.3 Consultation

27. Consultation is a key driver of the EIA and ES, and is an ongoing process throughout the lifecycle of the project, from the initial stages through to consent and post-consent. To date, consultation regarding traffic and transport has been conducted

through transport Expert Topic Group (ETG) meetings in January 2016, July 2017 and January 2018 to review and agree methodologies for the assessments, the Scoping Report (Royal HaskoningDHV, 2016) and the Preliminary Environmental Information Report (PEIR) (Norfolk Vanguard Limited, 2017). The ETG included transportation professionals from Norfolk County Council, Highways England and Norfolk Vanguard Limited. Whilst not a member of the Group, Suffolk County Council were kept informed of developments, noting that the south east tip of the traffic and transport study area encompassed two roads within their administration area.

28. Further details of the project consultation process are presented within Chapter 7 Technical Consultation.

29. A summary of the consultation that has been undertaken to date and has driven forward the development of this traffic and transport assessment is provided in Table 24.3.

Table 24.3 Consultation responses

Consultee	Document / date received	Comment	Response / where addressed in the ES
Norfolk County Council	25th January 2017 First Expert Topic Group Meeting	Requirement for an Access Management Plan (AMP) and Traffic Management Plan (TMP) was identified.	An outline AMP (OAMP) (document reference 8.10) and outline TMP (OTMP) (document reference 8.8) have been provided as part of the DCO application.
		Trenchless methods (e.g. HDD) to cross the A47, A140, A149. Open cut to be considered for other routes on a site by site basis and agreed with NCC.	Commitment has been made to cross the A47, A140 and A149 via trenchless methods through the Outline Code of Construction Practice (Document ref.8.1)
		NCC advised that extended morning peaks (7:30am – 9am) may require traffic management restrictions.	This has been identified and considered in detailed peak hour capacity assessments as detailed in section 24.7.7.4.

Consultee	Document / date received	Comment	Response / where addressed in the ES
		NCC advised of their preference of routes not via local village centres.	Figure 24.9 details HGV routes within the traffic and transport study area. The strategy has taken account of local village centres and has routed construction traffic away from these locations where practical.
Highways England	27th February 2017 ETG meeting.	Traffic Distribution – a realistic worst case assessment that assumes that all onshore cable route sections will be active at the same time was outlined.	Stakeholders requested more detail on traffic derivation which informed the second meeting of the ETG. This information formed the basis of agreement of the derivation of project traffic demand by all highway stakeholders.
		Study Area – The study area was presented with an expected reduction in size once delivery routes had been agreed and traffic significance screening was finalised.	Updated traffic and transport study area contained within Figure 24.1.
		Access – Proposed existing access to the substation via Necton was presented. It was agreed that a review of the accident record would be undertaken if this facility was to be relied upon. Highways England explained that current policy does not prevent a new access from the A47 from being created, however, preference was for an existing access point to be utilised.	Following consultation with highway stakeholders, a technical note was produced which identified preferred access options based on an evaluation of road safety and environmental impact. The note was circulated to stakeholders and is presented in Appendix 24.21.
		Highways England noted that if the base port for [onshore] construction is to be Gt. Yarmouth, then assessments need to take account of Road Investment Strategy (RIS) schemes.	A sensitivity test of RIS schemes was subsequently agreed with Highways England as set out in section 24.7.7.4.
		Highways England stated that they do not accept Guidelines for the Environmental Assessment of Road Traffic (GEART) significance thresholds for assessing road safety and capacity.	GEART thresholds have not been applied to the effects of road safety and capacity.

Consultee	Document / date received	Comment	Response / where addressed in the ES
Highways England	7th March 2017 EIA Traffic & Transport Method Statement Response (Ref: 60506522 / DN052.002 BN01)	Impact on A47 at Necton issue raised requiring detailed analysis of traffic generation and a review of historic collisions.	Following consultation with highway stakeholders, a technical note was produced which identified preferred access options based on an evaluation of road safety and environmental impact. The note was circulated to stakeholders and is presented in Appendix 24.21.
		Impacts of HGVs on wider network (origin and destination) including a number of sensitive junction locations to be assessed.	Section 24.6.6 provides full HGV derivation, including demand, distribution and assignment. Table 24.35 details sensitive junctions that have been subject to a detailed capacity assessment.
		Highway authorities to seek a formal commitment to use Horizontal Directional Drilling (HDD) method under the A47 and a review required for HGV access to the HDD site off the A47	An OAMP (document reference 8.10) has been submitted with the DCO application which provides details of the proposed access arrangements.
Highways England and Norfolk County Council	17th July 2017 ETG Meeting	NCC / HE provided details of the sensitive junctions that would require further consideration of Driver Delay impacts.	Table 24.35 details sensitive junctions that have been subject to a detailed capacity assessment.
		NCC / HE raised concerns over potential cumulative effects resultant from Norfolk Vanguard construction traffic and proposed A47 Corridor Improvement Programme schemes.	The scope of the cumulative assessment has been agreed with Highways England and NCC and is set out in section 24.8.
		HE raised concern that HGVs originate from Kings Lynn and Lowestoft. However, the flows would be assigned slightly differently if Great Yarmouth was selected as a	Section 24.6.6 provides updated HGV derivation data, including that relating to Great Yarmouth assessed as an additional potential

Consultee	Document / date received	Comment	Response / where addressed in the ES
		source port.	source port.
		HE requested further clarity on employee distribution for PEIR, specifically for distribution from the south of the study area.	Figures 24.10, 24.11 and 24.12 clarify distribution south of the traffic and transport study area with further points of access.
		NCC suggested indicating 'red routes' that would ban HGVs from utilising the route.	The assessment identifies routes that would be unsuitable for project related HGV traffic.
		NCC / HE provided details of sensitive junctions that would require further consideration of Driver Delay impacts.	Table 24.35 details sensitive junctions which have been subject to a capacity assessment.
		Queries raised relating to the existing National Grid substation extension site access and potential for a new access north of the site.	Following consultation with highway stakeholders, a technical note was produced which identified preferred access options based on an evaluation of road safety and environmental impact. The note was circulated to stakeholders and is presented in Appendix 24.21.
		Concerns raised for access off the A47 at the trenchless crossing location.	An OAMP (document reference 8.10) has been submitted with the DCO application which provides details of the proposed access arrangements.
Highways England	4th December 2017 PEIR Response	Link Sensitivity – concerns raised for the sensitivity of Links 64 and 65 in which it is proposed that they are to be taken forward for further assessment.	Links 64 and 65 have now been assessed as 'medium' sensitivity in Table 24.9. Both links taken forward for further assessment in section 24.7.
		Trip Estimation - HE suggested the adoption of the latest version of TEMPro in the estimation of the background flows.	TEMpro (version 7.2) utilised to derive growth factors.
		Road Safety - HE recommended a contingency for mitigation at collision cluster site 12 should be	Section 24.7.7.3.3 discusses mitigation proposals for cluster 12 in the event that

Consultee	Document / date received	Comment	Response / where addressed in the ES
		considered in the event of the A47 Blofield to North Burlingham RIS scheme being delayed.	the proposed Road Investment Strategy (RIS) scheme is delayed.
		Junction Capacity – It is advised that junction capacity assessments may be considered for Junctions 1 (Gapton) and 2 (Vauxhall) in the event of the RIS construction programme being delayed.	Section 24.7.7.4.1 and 24.7.7.4.2 details a proportional approach to assessing capacity on Junction 1 and 2 in the event that the RIS schemes are delayed.
		Concerns raised relating to the substation access and cable crossing on the A47.	An OAMP (document reference 8.10) has been submitted with the DCO application which provides details of the proposed access arrangements.
Highways England and Norfolk County Council	25th January 2018 Traffic and Transport Expert Topic Group Meeting	NCC requested clarification in regard to the DCO transport documents.	An OAMP (document reference 8.10) and OTMP (document reference 8.8) have been provided in support of the DCO application.
		NCC identified concerns regarding the A47 highway access.	Following consultation with highway stakeholders, a technical note was produced which identified preferred access options based on an evaluation of road safety and environmental impact. The note was circulated to stakeholders and is presented in Appendix 24.21.
		HE requested that junction sensitivity tests be undertaken if RIS scheme is not put forward or delayed.	Section 24.7.7.4.1 and 24.7.7.4.2 detail a proportional approach to assessing capacity for impacted junctions in the event that the RIS schemes are delayed.
Norfolk County Council	November 2017 PEIR Response	The formal planning application, when submitted, must be accompanied by a Transport Assessment (TA). The TA will assess the effects of the anticipated traffic upon driver delay; severance; pedestrian delay; pedestrian	The Transport Assessment is contained within the ES. An OAMP (document reference 8.10) and OTMP (document reference 8.8) have been provided in support of the

Consultee	Document / date received	Comment	Response / where addressed in the ES
		amenity; accidents; road safety; and impact from abnormal loads. Development Consent Order (DCO) requirements will also have commitments to agree a Traffic Management Plan (TMP), which will initially be submitted in outline, then completed and agreed when the contractor is appointed.	DCO application.
		An onshore substation will be required. The intention is to extend the Necton substation in an east west direction with vehicular access provided from the A47(T). Traffic assessments for the A47(T) are issues for Highways England to comment upon and not the County Council. Nevertheless, the County Council has expressed concern with regard to the proposed access arrangements and has suggested that as a minimum, a full right turn lane be provided from the A47(T). An alternative access strategy from the A47(T) has also been proposed by the applicant, however the County Council has again raised safety concerns. Ultimately, access to the A47(T) for the proposed new substation is a matter for Highways England to assess and the County Council can only inform them of our concerns.	Following consultation with highway stakeholders, a technical note was produced which identified preferred access options based on an evaluation of road safety and environmental impact. The note was circulated to stakeholders and is presented in Appendix 24.21.
		Vattenfall should work closely with Highways England and Norfolk County Council (Highway Authority) to ensure the proposed cable route does not fetter any future plans for the dualling of the A47(T)	Norfolk Vanguard Limited will work with HE and NCC Highways to ensure that the proposed cable works include suitable provision for existing or approved road developments.
		Vattenfall should ensure that the proposed underground cable route does not fetter any future highway improvement schemes in Norfolk and that where any reinforcement or diversion is needed to the cable route as a result of such highway	Norfolk Vanguard Limited will work with HE and NCC Highways to ensure that the proposed cable works include suitable provision for existing or approved road developments.

Consultee	Document / date received	Comment	Response / where addressed in the ES
		works, that Vattenfall will be responsible for any upgrades or diversion of the cables and will fully meet the costs of these works.	
Breckland Council	November 2017 PEIR Response	The prolonged period of construction will have the biggest impact in terms of the local road network. This will be created by the movements of vehicles transporting materials and removing spoil for the trenches. A fully detailed Transport Assessment and a Construction Traffic Management Plan must clarify the precise implications of the development and propose an appropriate package of management and mitigation measures together with improvements to be made to the local road network at the Applicant's expense.	The Transport Assessment is contained within the ES including proposals for any required mitigations. An OAMP (document reference 8.10) and OTMP (document reference 8.8) have been provided in support of the DCO application.
		Breckland Council fully supports the highway views set out by Norfolk County Council in the response to this consultation. The request for a full right turn lane to be provided from the A47(T) into the area of the extended Necton substation is hereby reiterated. The District Council also shares the view that all major road scheme possibilities, including dualling of the A47, should remain unfettered. Highways England must be fully consulted and have no objections to the development.	Following consultation with highway stakeholders, a technical note was produced which identified preferred access options based on an evaluation of road safety and environmental impact. The note was circulated to stakeholders and is presented in Appendix 24.21.
North Norfolk District Council	November 2017 PEIR Response	The District Council recognises that the majority of traffic movements associated with the proposal will occur during the construction phase and would expect Vattenfall to work with the District Council, the Highway Authority and local communities affected to seek to minimise any adverse impacts through appropriate mitigation strategies.	Traffic derivation is discussed in section 24.6.6 including any proposed mitigation strategies.

Consultee	Document / date received	Comment	Response / where addressed in the ES
Necton Parish Council	November 2017 PEIR Response	Whilst the PEIR identifies entrances to the proposed sites further east of the Necton junction, the consequential impact of increased traffic, wide-load maneuverers and traffic-flow restrictions for proposed new right-hand filter lanes will cause long-term disruption for residents and local businesses.	Following consultation with highway stakeholders, a technical note was produced which identified preferred access options based on an evaluation of road safety and environmental impact. The note was circulated to stakeholders and is presented in Appendix 24.21.
		There is insufficient analysis of the potential impact of traffic to inform our view on this proposal at present. A Transport Assessment and a Construction Traffic Management Plan will form part of the application. The PINS Scoping Opinion (para 3.169) has highlighted our comments with regard to a TMP. Given the impact poor traffic management along the A47 would have on residents of Necton, we would expect to be invited by Vattenfall to form part of a consultation group focusing on this subject.	The Transport Assessment is contained within the ES including proposals for any required mitigations. An OAMP (document reference 8.10) and OTMP (document reference 8.8) have been provided in association with the DCO application. Norfolk Vanguard Limited will work with Necton Parish Council post-consent, to set up a suitably constituted 'advisory group' or similar. This group will enable the views, concerns and ideas of local residents to be fed into Norfolk Vanguard Limited ongoing planning activities, and into effective management processes during the construction phase. A Communications Plan will be produced and included within the Code of Construction Practice (DCO requirement 19)
		With regard to the strategic development plan for the A47 Necton area, this Council has commenced discussions with Highways England on safety improvement measures. Highways England has commissioned a survey that is expected to be complete by summer 2018. Vattenfall accepted an invitation to engage in these discussions, which commenced in	See above response.

Consultee	Document / date received	Comment	Response / where addressed in the ES
		September 2017 and we would expect they would continue to contribute to this process.	
Suffield Parish Council	November 2017 PEIR Response	Assurance required that site vehicles would adhere to proposed trackway.	The OTMP (document reference 8.8) that supports the DCO application contains a commitment to monitoring and enforcing HGV movements
		The proposed mobilisation zone on land between Rectory Road and Felmingham Road. In all literature from Vattenfall it is stated that their aim is the least possible environmental impact from their scheme. Putting a mobilisation zone in Suffield would be totally against this stated aim. The area of Suffield is a deeply rural one with a narrow single track road with blind bends, no street lights and very little traffic…. There are two zones earmarked, one on the A140 and one in North Walsham both of which are in 'blighted' areas with traffic, lighting etc. It is therefore quite unnecessary to inflict such a heavy toll on such a rural area.	Revised project proposals do not include the requirement for a mobilisation area in the vicinity of Suffield.
Colby and Banningham Parish Council	November 2017 PEIR Response	The Primary Mobilisation Area proposed for Rectory Road, Suffield. It is noted that this will be a congregation area for HGV's, contractor vehicles and personal vehicles, with 240 people working there each day. With no restrictions on hours of operation, and peak hours from 7a.m. to 7p.m. 7 days a week, there will not only be significant adverse implications on our residents in respect of noise and air quality, but the area of major concern is the traffic movements. There is not precise data included in the PEIR as to what this will mean for Colby and Banningham, but according to the proposals in the	Revised project proposals do not include the requirement for a mobilisation area in the vicinity of Suffield.

Consultee	Document / date received	Comment	Response / where addressed in the ES
		documents 80% of construction movements will be along unclassified roads and 20% along specially constructed new routes. In our villages with narrow roads, no footpaths and a great deal of –necessary –agricultural vehicle movements, this will be totally unacceptable bearing in mind the nature of the plant, equipment and materials that will need to be transported. The access routes via Highbury Farm and Banningham Hall will create additional pressures for Colby Road and Church Road, the former especially narrow and on a bend at this point. Bridge Road and Colby Corner should be avoided altogether due to its insufficient width for heavy vehicles – it is already signed as "unsuitable for HGV's" and the proximity of Colby Primary School and the traffic generated at the start and end of the school day.	
		Similar comments apply to the Primary Mobilisation Area, at the junction of the A140/B1145. However, the parish council's main comment on this area is that the site is totally unsuited to this use. The junction has been a cause of concern to both our council and Aylsham Town Council for a number of years, it has a bad accident record and the approach off the A140 is narrow and dangerous. The B1134 at this point is not technically wide enough for white lines along the middle of the road, although these do exist. Heavy vehicles turning off the A140 have to use the whole width of the road –if there is approaching traffic, the vehicles are forced to wait, sometimes with the rear sticking out on to the A140.	An OAMP (document reference 8.10) and OTMP (document reference 8.8) have been provided in support of the DCO application. These documents contain a commitment to assessing the manoeuvrability of the types of vehicle that would utilise the A140/B1145 junction and to mitigate this as appropriate.

Consultee	Document / date received	Comment	Response / where addressed in the ES
Oulton Parish Council	November 2017 PEIR Response	Consideration should be made regarding whether access to the site [MA7] is suitable, as it would require HGV's to negotiate narrow country lanes with informal passing places. Possible conflict with year round use by agricultural vehicles, residents and other vehicles plus the possibility of cumulative impact from HGV's from Dong/Ørsted Hornsea 3 project also accessing another potential compound on the old airfield at Oulton Street.	All routes proposed have been subject to a detailed desktop assessment augmented by site visits to validate OS data. An OAMP (document reference 8.10) and OTMP (document reference 8.8) have been provided in support of the DCO application which contains more detail of the measures proposed to manage access via narrow routes. Norfolk Vanguard Limited is in dialogue with Ørsted with regard to coordinating traffic demand.
East Ruston Parish Council	November 2017 PEIR Response	The proposed development site at 6a is over 600metres away from any usable road (B1159) extending to 700 metres to reach the temporary compound (and eventually the Boreas site) and beyond to follow the cable route. Development at this site will therefore necessitate additional road building, creating noise and disruption –as well as further permanent loss of valued countryside. At present the location of this new road is unclear and we do not feel in a position to fully understand the likely impact or comment thereon.	Norfolk Vanguard Limited has reviewed consultation received and revised proposals to now commit and deploy High Voltage Direct Current (HVDC) cable technology to the UK's National Grid and this removes the need for a Cable Relay Station (CRS) (all options including at site 6a) from the project.
		Presence would increase local traffic in the area to unacceptable levels which would subsequently impact surrounding villages and towns and cause diversion into quiet lanes which are not suitable for heavy or high volume traffic.	
Public Health	November 2017 PEIR Response	We note that the submitted reports do not identify any significant risks to public health. However, traffic movements associated with the onshore activities (construction) of the development may generate localised dust emissions leading to	An OTMP (document reference 8.8) has been provided in support of the DCO application. This document contains the measures for the day to day management of the project's

Consultee	Document / date received	Comment	Response / where addressed in the ES
		potential complaints. Any issues raised by local communities need efficient management during the development phase.	HGV traffic including dust suppression. Public health is considered within Chapter 27 Human Health. Dust emissions are considered within Chapter 26 Air Quality.
Royal Mail	November 2017 PEIR Response	Royal Mail requests that the ES to be submitted with Vattenfall's DCO application includes information on the needs of major road users (such as Royal Mail) and acknowledges the requirement to ensure that major road users are not disrupted though full consultation at the appropriate time in the DCO and development process.	An OTMP (document reference 8.8) has been provided in support of the DCO application. This document contains the measures for the day to day management of the project's HGV traffic to minimise the impact on all highway users.
Aylsham Town Council	November 2017 PEIR Response	The areas that concern the Town Council most are where it crosses the A140 and Blickling Road. These are very important and busy roads for Aylsham, especially the A140. Any mitigation of road disturbance would be welcomed.	An OTMP (document reference 8.8) has been provided in support of the DCO application. This document contains the measures for the day to day management of the project's HGV traffic to minimise the impact on all highway users
No to Relay Stations (N2RS)	November 2017 PEIR Response	Massive increase in road traffic, disrupting daily life and forcing traffic into single track lanes.	Norfolk Vanguard Limited has reviewed consultation received and revised proposals to now commit and deploy High Voltage Direct Current (HVDC) cable technology to the UK's National Grid and this removes the need for a Cable Relay Station from the project, thus significantly reducing traffic movement in this locality.
		Access issues	

24.4 Assessment Methodology

30. This section describes the methodology and impact assessment criteria used in the traffic and transport assessment, as consulted on and agreed via Expert Topic Group meetings, the Scoping Report, (Royal HaskoningDHV, 2016) the Method Statement (Royal HaskoningDHV, 2017) and the Preliminary Environmental Report (PEIR) (Norfolk Vanguard Limited, 2017).

31. The traffic and transport assessment methodology follows the principles set out in Chapter 6 (EIA Methodology) and adopts the 'project wide' significance evaluation. However, these principles have been augmented by traffic and transport specific methodologies (as prescribed in GEART) to inform a significance evaluation.

24.4.1 Scale of Assessment

32. Having identified the traffic and transport study area, GEART suggests application of the following rules to define the extent and scale of the assessment required:

    a. Rule 1: Include highway links where traffic flows are predicted to increase by more than 30% (or where the number of Heavy Goods Vehicles (HGVs) is predicted to increase by more than 30%); and

    b. Rule 2: Include any other specifically sensitive areas where traffic flows (or HGV component) are predicted to increase by 10% or more.

33. In justifying these rules GEART examines the science of traffic forecasting and states:

    - "It is generally accepted that accuracies greater than 10% are not achievable. It should also be noted that the day to day variation of traffic on a road is frequently at least some + or -10%. At a basic level, it should therefore be assumed that projected changes in traffic of less than 10% create no discernible environmental impact.
    - …a 30% change in traffic flow represents a reasonable threshold for including a highway link within the assessment."

34. Changes in traffic flows below the GEART rules (thresholds) are assumed to result in no discernible or negligible environmental effects and have therefore not been assessed further as part of this study.

35. The exception to the GEART Rule 1 and 2 is the consideration of the effects of driver delay and road safety. These effects can be potentially significant when high baseline traffic flows are evident, and a lower change in traffic flow can be potentially significant. Full details of the methodology adopted for these effects are set out in section 24.6.

36. GEART sets out consideration and, in some cases, thresholds in respect of changes in the volume and composition of traffic to facilitate a subjective judgement of traffic impact and significance.

37. The following environmental effects have been identified as being susceptible to changes in traffic flow and are appropriate to the local area.

24.4.1.1 Severance

38. Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. The term is used to describe a complex series of factors that separate people from both places and other people. Severance may result from the difficulty of crossing a heavily trafficked road or a physical barrier created by the road itself. It can also relate to relatively minor traffic flows if they impede pedestrian access to essential facilities. Severance effects could equally be applied to residents, motorists, cyclists or pedestrians.

39. GEART suggests that changes in total traffic flow of 30%, 60% and 90% are considered to be 'slight', 'moderate' and 'substantial' respectively.

24.4.1.2 Pedestrian amenity

40. Pedestrian amenity is broadly defined as the relative pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width and separation from traffic. The definition of amenity also takes into consideration pedestrian fear and intimidation, consideration of the exposure to noise and air pollution, and the overall relationship between pedestrians and traffic.

41. GEART suggests that a threshold of a doubling of total traffic flow or the HGV component may lead to a negative impact upon pedestrian amenity.

24.4.1.3 Road safety

42. The salient GEART guidance on road safety is as follows:

- "Where a development is expected to produce a change in the character of traffic (e.g. HGV movements on rural roads), then data on existing accidents levels may not be sufficient. Professional judgement will be needed to assess the implications of local circumstances, or factors which may elevate or lessen the risk of accidents, e.g. junction conflicts."

24.4.1.4 Driver delay

43. GEART recommends the use of proprietary software packages to model junction delay and hence increased vehicle delays. However, it is noted that vehicle delays are only likely to be significant when the surrounding highway network is at, or close to, capacity.

44. The ETG has identified sensitive junctions that require an assessment of potential delays for drivers during peak hours.

45. The assessment therefore seeks to disaggregate the peak hour traffic movements on to these junctions to facilitate a judgement of the potential significance of the driver delay effects.

24.4.1.5 Abnormal indivisible loads

46. The importing of large Abnormal Indivisible Loads (AILs) may lead to delays on the highway network. The construction of the onshore project substation is likely to require the delivery of up to eight supergrid transformers to the onshore project substation. A Route Access Study has been undertaken by Collet and Sons Ltd to inform the management measures required to deliver AILs to the onshore project substation which will be accessed off the A47. Appendix 2 of the OTMP (document reference 8.8) contains the Route Access Study and the details of the management measures to be employed to minimise the disruption to baseline traffic.

24.4.1.6 Other impacts

47. Traffic-borne noise and vibration effects and air quality effects will be informed by the traffic data outlined in this chapter. These impacts are assessed in Chapter 25 Noise and Vibration and Chapter 26 Air Quality, respectively.

24.4.2 Magnitude

48. Table 24.4 details the assessment framework for magnitude thresholds adapted from GEART. These thresholds are guidance only and provide a starting point by which transport data will inform a local analysis of the impact magnitude.

Table 24.4 Traffic and transport assessment framework

Effect	Magnitude of effect			
	Very low	**Low**	**Medium**	**High**
Severance	Changes in total traffic flows of less than 30%	Changes in total traffic flows of 30 to 60%	Changes in total traffic flows of 60 to 90%	Changes in total traffic flows of over 90%
Pedestrian amenity	Change in traffic flows (or HGV component) less than 100%	Greater than 100% increase in traffic (or HGV component) and a review based upon the quantum of vehicles, vehicle speed and pedestrian footfall		
Highway safety	Informed by a review of existing collisions patterns and trends based upon the existing personal injury collision records and the forecast increase in traffic			
Driver delay	Informed by projected traffic increases through sensitive junctions within the traffic and transport study area			

24.4.3 Highway Traffic Sensitive Receptors

49. The sensitivity of a road (link) can be defined by the type of user groups who may use it. A sensitive area may for example be a village environment or where pedestrian or cyclist activity may be high, for example in the vicinity of a school. Table 24.5 provides broad definitions of the different sensitivity levels which have been applied to the assessment.

Table 24.5 Example definitions of the different sensitivity levels for a highway link

Sensitivity	Definition
Low	Few sensitive receptors and / or highway environment can accommodate changes in volumes of traffic
Medium	A low concentration of sensitive receptors (e.g. residential dwellings, pedestrian desire lines, etc.) and limited separation from traffic provided by the highway environment
High *	High concentrations of sensitive receptors (e.g. hospitals, schools, areas with high tourist footfall etc.) and limited separation provided by the highway environment
Negligible	Routes of no importance to the assessment not included in the traffic and transport study area.

*High sensitivity links are considered to be 'specifically sensitive areas' for the purposes of GEART Rule 2

24.4.4 Other Receptors

50. To consider the effects on road safety and driver delay, areas with evidenced road safety patterns and congested junctions have been assigned an appropriate level of sensitivity informed by a detailed review of the baseline characteristics.

51. With respect to driver delay, the ETG has identified four junctions within the traffic and transport study area which are considered to be highly sensitive to changes in traffic.

- A12 Gapton Hall Roundabout;
- A47 Vauxhall Roundabout;
- A149 Fuller's Hill Roundabout; and
- Junction of the A47 and the A1064.

52. The location of these junctions is shown in Figure 24.2 and the assessment discussed further in paragraph 24.7.7.3.9.

24.4.5 Impact Significance

53. Table 24.6 sets out the significance matrix which combines the initial impact assessment derived from the assessment framework presented in Table 24.4 with the sensitive receptor value for the purpose of determining the 'magnitude of impact'.

Table 24.6 Impact significance matrix*

		Negative magnitude				Beneficial magnitude			
		High	Medium	Low	Very low	Very low	Low	Medium	High
Sensitivity	High	*Major*	*Major*	*Moderate*	*Minor*	*Minor*	*Moderate*	*Major*	*Major*
	Medium	*Major*	*Moderate*	*Minor*	*Minor*	*Minor*	*Minor*	*Moderate*	*Major*
	Low	*Moderate*	*Minor*	*Minor*	*Negligible*	*Negligible*	*Minor*	*Minor*	*Moderate*
	Negligible	*Minor*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Minor*

*Beneficial magnitude matrix has been included for completeness, although it is not anticipated for traffic and transport impacts.

54. Note that for the purposes of this ES, major and moderate impacts are deemed to be 'significant'. In addition, whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

55. Embedded mitigation and existing commitments to good practice are included in the initial assessment of impact and is detailed in section 24.7.5. If the impact does not require mitigation (or none is possible) the residual impact will remain the same. If additional mitigation is required there will be an assessment of the post-mitigation residual impact.

24.4.6 Cumulative Impact Assessment

56. Chapter 6 EIA Methodology provides a general methodology with regards to the Cumulative Impact Assessment (CIA).

57. The potential for cumulative effects has been considered for the construction, operation and decommissioning of the project cumulatively with other relevant projects.

58. Cumulative impacts are discussed where the onshore project area has the potential to overlap with similar impacts arising from:

- Recent development, either built or under construction (which is not considered as part of the baseline);
- Approved development, awaiting implementation; and
- Proposals awaiting determination within the planning process with design information in the public domain.

59. The CIA involves consideration of whether impacts on a receptor can occur on a cumulative basis between the project and other activities, projects and plans for which sufficient information regarding location and scale exist.

60. For further details of the methods used for the CIA for traffic and transport, see section 24.8.

24.4.7 Transboundary Impact Assessment

61. There are no transboundary impacts with regard to traffic and transport as the onshore project area is entirely within the UK and would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of the assessment and are not considered further.

24.5 Scope

24.5.1 Study Area

62. The onshore project study area includes the following elements:

- Landfall;
- Onshore cable route, accesses, trenchless crossing (e.g. Horizontal Directional Drilling (HDD)) zones and mobilisation areas;
- Onshore project substation; and
- Extension to the Necton National Grid substation and overhead line modification.

63. The traffic and transport study area has been informed by determining the most probable routes for traffic, for both the movement of materials and employees, and during construction, operational and decommissioning phases of the project. The study area has been determined with reference to the Norfolk Road Hierarchy and assigns trip origins on the A class road network and trip ends at the components of the onshore project area which serve the onshore cable route.

64. Routes that extend outside of the onshore traffic and transport study area are routes where construction traffic has dissipated and/ or include roads with negligible sensitive receptors. These parameters combine and do not represent significant impacts on the highway network.

65. The traffic and transport study area is illustrated in Figure 24.1 and covers the majority of north and east Norfolk, extending to both Kings Lynn to the west and Great Yarmouth to the east. The traffic and transport study area is divided into 86 separate highway sections known as links, which can be defined as sections of road with similar characteristics and traffic flows.

24.5.2 Data Sources

66. Existing traffic flow data for all the key links within the traffic and transport study area have been captured from a number of primary and secondary sources. The datasets used in the assessment are summarised in Table 24.7 and are presented in Figure 24.3.

Table 24.7 Data sources

Data	Year	Link coverage	Confidence	Notes
Classified Annual Average Daily Traffic (AADT) counts	2015	1a, 1b, 2-4, 6-12, 13a, 13b, 14, 18, 19, 24, 26, 27, 29, 30, 40a, 40b, 44a, 44b, 45, 50, 53-57, 64 and 65.	High	Data sourced from the DfT which provides classified AADT traffic count data.
Classified Automatic Traffic Counts (ATC)	2017	15-17, 20-23, 25, 32-37, 41-43, 46-49, 52 and 61.	High	Traffic counts commissioned by Norfolk Vanguard Limited which provide classified hourly and daily traffic count data.
AADT Traffic Flows	2012, 2017 and 2032	5, 28, 31, 38, 39, 51, 58-60, 62 and 63.	High	Data sourced and interpolated from the Norfolk County Council (Norwich Northern Distributor Road (A1067 to A47(T))) DCO Application*
Estimated Traffic Flow	2017	66-79	Medium	For links with limited project traffic demand flows have been estimated based on data sources for similar links within the traffic and transport study area.

* Document 5.6 NNDR Traffic Forecasting Report: Volume 3 – Appendices H to K

67. A DCO application for the Norwich Northern Distributor Road (NNDR) was submitted on 7th January 2014. The SoS granted development consent on 2nd June 2015.

68. The NNDR completed construction and fully opened to traffic in May 2018. As such, the NNDR (recently renamed to the A1270 - Broadland Northway) has been included as part of the Norfolk Vanguard traffic and transport study area.

69. As part of the NNDR DCO application, Document 5.6 - Traffic Forecasting Report was

produced. The report describes the changes in traffic and network performance that are expected to occur with the implementation of the NNDR and the proposed transport interventions in the area.

70. Table 24.7 demonstrates that baseline traffic flow data for 65 links within the study area have been captured. The remaining 14 links are based on estimated data as detailed within paragraph 76.

71. In addition to the data sources listed in Table 24.7, a desktop assessment was undertaken which included consideration of Personal Injury Collision (PIC) data utilising street view and mapping data.

72. High level open source PIC data for the most recent five year period (01.01.2012 to 31.12.2016) was obtained for the study area from the website Crashmap (Crashmap, 2017).

73. Full PIC data has been obtained from Norfolk County Council and Suffolk County Council for collision clusters identified by the high level Crashmap search.

24.5.3 Assumptions and Limitations

74. The traffic data has been collected from a combination of sources which include the DfT Traffic counts. However, DfT's traffic counts for individual road links are estimates, as they are not always based on up-to-date counts made at these locations. Where other more up-to-date sources of traffic data have been available, such as the commissioned classified ATCs, these have been used instead.

75. The DfT data utilised for the baseflows were taken from the 2015 counts which at the time of project inception was the latest available data. The traffic counts have been through a series of consultations, review and extensively agreed through the ETG. It is considered impractical to periodically update to the latest data and repeat the consultations and reviews.

76. The baseflows for 14 links have been estimated based on their location, characteristics and compared with adjacent link base flows which are of similar nature. There are a number of limitations when using estimated data such as over/under estimating the baseflows. Notwithstanding, it should be noted that all new links are of a minor status and thus have been predicted with low baseflows.

77. The Crashmap website utilises data approved by the National Statistics Authority and reported on by the DfT each year. Incidents are plotted to within 10 metres of their location and as such, can sometimes appear to be off the carriageway when interrogated in detail.

24.6 Existing Environment

78. Characterisation of the existing environment has been informed through a number of sources, including:

- Traffic count data from the DfT;
- Desktop studies and site visits;
- Personal injury collision data sourced utilising open source data;
- Traffic surveys commissioned by Norfolk Vanguard Limited; and
- Traffic count data from the Norfolk County Council, NNDR DCO application.

24.6.1 Highway Network

79. The road network in the vicinity of the onshore project study area is illustrated on Figure 24.4. Within the onshore study area, the principal highway network (managed by Norfolk County Council Highways) includes the A149, A140, and the A1067 whilst the A47 and A12 form part of the Strategic Road (Trunk Road) Network managed by Highways England. Management and maintenance of the road network within Norwich is undertaken by Norwich City Council.

80. A route hierarchy for the whole of Norfolk has been developed by Norfolk County Council (Norfolk County Council, 2017) to encourage drivers to use the most appropriate route according to their destination and vehicle type. These routes have been classified by the following categories and are shown in Appendix 24.1.

- Trunk Roads;
- Principal routes;
- Main Distributor routes;
- HGV routes;
- Local Access routes;
- Special routes; and
- Tourist routes.

24.6.1.1 A-roads (Trunk Roads and Principal Routes)

81. The A47 trunk route is identified in the Norfolk County Council Local Transport Plan (Norfolk County Council, 2011) as one of Norfolk's key strategic connections, forming part of the Trans-European Transport Network. The A47 provides the main east-west road connection and routes from Great Yarmouth to the Midlands and the north of England. Local to the study area, the A47 provides a key link between King's Lynn, Norwich and Lowestoft. The A47 is predominately a single carriageway road, widening to dual carriageway around the major urban areas (Norwich, Dereham, Swaffham and King's Lynn).

82. Six improvement schemes are proposed along the A47 corridor with an expected start date of 2019/2020. These improvements comprise of:

- A47 Wansford to Sutton dualling;
- A47/A141 Guyhirn junction improvement;
- A47 North Tuddenham to Easton dualling;
- A47 Blofield to North Burlingham dualling;
- A47/A11 Thickthorn junction improvement; and
- A47 Great Yarmouth junction improvements including reconstruction of the Vauxhall Roundabout.

83. The A146 is a principal rural single carriageway road that connects the A47 south of Norwich, with the A1145 at Lowestoft. This link joins to Lowestoft and onwards to Great Yarmouth, with both towns containing an operational port.

84. Diverging off the A146 is the A1145, a single carriageway road that leads into Lowestoft and terminates at its junction with the A12.

85. The A12 trunk road operates between Lowestoft and areas to the south including Ipswich. The route connects to other Principal A class roads including the A146, A143 and A1145, as well as the A47 trunk road which allows travel to the north and to Great Yarmouth.

86. Leading north out of Great Yarmouth is the principal road A149, a single carriageway road that widens to dual carriageway along the Caister-on-Sea by-pass. This road continues to Stalham, connecting to the A1151 and B1159.

87. The A1151 is a major road within the site study area, providing links between Norwich, Hoveton and Stalham, as well as the A149.

88. The A1067 provides direct links with Norwich and Fakenham. The rural single carriageway road also offers connecting links to the B1145 and other minor roads.

89. The A1065 is a single carriageway road which connects the A47 at Swaffham to the A148 at Fakenham to the north.

90. Bounding the northern extent of the study area is the A148, a rural single carriageway that extends from Fakenham, through Holt and connects to Cromer. Links to the A1065, A1067, B1149 and A140 are all present along this route.

91. Heading north out of Norwich is the A140, a single carriageway A class road that by-passes Aylsham and connects to Roughton. Links to the A148 and A149 are present along this route allowing connection to the wider study area.

24.6.1.2 B-roads

92. A number of strategically important B class roads are located within, or offer access to, the wider study area. These main roads offer access to minor roads and lanes located along the onshore cable route.

93. The B1145 is a single carriageway road that provides a link from Kings Lynn to Mundesley on the Norfolk coast. The B1145 crosses a number of A roads (A140, A149, A1065 and A1067) and runs through a number of small towns such as Reepham, Cawston, Aylsham and North Walsham.

94. Within the study area, the B1149 provides a direct link between Norwich and Holt. This single carriageway leads out of the City's outskirts through Horsford, providing a link with the town of Cawston.

95. The B1354 connects with the B1149 and routes southeast towards Aylsham. It is a single carriageway road and passes by the Blickling Estate.

96. Deviating off the A149 into Broomholm is the B1159, a single carriageway B class road located within the study area.

97. The B1147, accessible off the A47, is a single carriageway road located to the east of Dereham that offers connection to Dereham Road.

98. The B1436 is a single carriage way that offers a link to Roughton via the A140 and A149.

99. The B1147 is a single carriageway that links the A1067 through Swanton Morley and onwards to Dereham.

24.6.1.3 Other roads

100. Cromer Road, located off the A140 is a rural single carriageway that passes through Ingworth, a town north of Aylsham.

101. Located adjacent to the B1159 is Mill Common Road, a minor rural road located within the study area.

102. There are a total of 15 unclassified links which serve the final part of the journey to the onshore cable route (Local Access routes). These links typically have narrow carriageways and are subject to very low baseline traffic flows.

24.6.2 Traffic Flow Data

103. The baseline traffic flow data are summarised in Table 24.8 which includes the date and type of survey from which the data has been derived. The sources that have provided the data are as discussed in section 24.5.2.

Table 24.8 Existing daily traffic flows and associated data sources

Link ID	Link description	Total vehicles (24Hr AADT*)	Total HGVs (24Hr AADT*)	Data source, type and date
1a	A47	15,380	1,546	2015 DfT AADF
1b	A47	15,380	1,546	2015 DfT AADF
2	A47	20,675	2,038	2015 DfT AADF
3	A47	36,940	2,751	2015 DfT AADF
4	A47	42,551	2,916	2015 DfT AADF
5	A47	40,800	2,050	NDR Data
6	A47	18,349	1,108	2015 DfT AADF
7	A47	13,339	1,222	2015 DfT AADF
8	A146	11,947	645	2015 DfT AADF
9	A47	33,788	1,029	2015 DfT AADF
10	A47	23,061	596	2015 DfT AADF
11	A1065	6,754	536	2015 DfT AADF
12	A1065	4,866	463	2015 DfT AADF
13a	A148	12,886	733	2015 DfT AADF
13b	A148	9,297	549	2015 DfT AADF
14	A148	10,873	502	2015 DfT AADF
15	B1145 - Litcham	1,725	35	April 2017 ATC
16	B1110/B1146 - Holt Road	7,344	83	April 2017 ATC
17	B1145 - Billingford Road	2,803	46	April 2017 ATC
18	A1067	7,698	551	2015 DfT AADF
19	A148	11,404	978	2015 DfT AADF
20	Mill Common Road	271	6	April 2017 ATC
21	B1147 - Etling Green	1,391	15	April 2017 ATC
22	B1147 - Dereham Road	2,137	20	April 2017 ATC
23	Northgate - from junction with B1146	1,725	35	Aug 2017 ATC
24	A1067	9,140	461	2015 DfT AADF
25	Elsing Lane	495	5	April 2017 ATC
26	A1074	21,564	1,026	2015 DfT AADF
27	A140	29,064	1,949	2015 DfT AADF
28	A140	23,060	1,370	NDR Data
29	A1067	11,562	782	2015 DfT AADF

Link ID	Link description	Total vehicles (24Hr AADT*)	Total HGVs (24Hr AADT*)	Data source, type and date
30	A1067	10,130	640	2015 DfT AADF
31	A1067	19,080	609	NDR Data
32	B1149 - Norwich road	4,043	75	April 2017 ATC
33	B1149 - Holt Road	5,274	162	April 2017 ATC
34	B1145 - west of Cawston	2,648	26	April 2017 ATC
35a	B1159	3,236	29	April 2017 ATC
35b	B1159	3,236	29	April 2017 ATC
36	B1149 - Holt Road	7,553	145	April 2017 ATC
37	B1145 - Cawston road	3,816	49	April 2017 ATC
38	A140 - Cromer Road	21,280	832	NDR Data
39	A140 - Hevingham	12,420	413	NDR Data
40a	A140 - Roughton	8,754	183	2015 DfT AADF
40b	A140 - Aylsham	11,725	526	2015 DfT AADF
41	B1436 - Felbrigg	6,372	144	April 2017 ATC
42	B1145 - Reepham Road	2,265	18	April 2017 ATC
43	Cromer Road - Ingworth	983	3	April 2017 ATC
44a	A149 - Thorpe Market	8,190	424	2015 DfT AADF
44b	A149 - North Walsham	8,190	424	2015 DfT AADF
45	A149	6,276	326	2015 DfT AADF
46	B1145 - Lyngate Road	5,530	90	April 2017 ATC
47a	Bacton Road - North Walsham	1,949	16	April 2017 ATC
47b	North Walsham Road - Edingthorpe Green	1,949	16	April 2017 ATC
47c	Bloodslat Lane - Broomholm	1,949	16	April 2017 ATC
48	B1159 - Bacton Road	2,394	45	April 2017 ATC
49	B1159 – Coast Road	3,469	64	April 2017 ATC
50	A1151	9,148	339	2015 DfT AADF
51	A1151	12,100	515	NDR Data
52	A149 - Wayford Road	12,850	175	April 2017 ATC
53	A149	34,323	1,326	2015 DfT AADF
54	A149	26,345	765	2015 DfT AADF
55	A149	21,454	467	2015 DfT AADF
56	A149	8,125	329	2015 DfT AADF

Link ID	Link description	Total vehicles (24Hr AADT*)	Total HGVs (24Hr AADT*)	Data source, type and date
57	A149	8,256	456	2015 DfT AADF
58	NDR - Link a	n/a	n/a	NDR Data
59	NDR - Link b	n/a	n/a	NDR Data
60	NDR - Link c	n/a	n/a	NDR Data
61	B1436 - Roughton Road	4,451	103	April 2017 ATC
62	A1042	27,073	1,099	NDR Data
63	A1151	15,140	633	NDR Data
64	A12	9,413	548	2015 DfT AADF
65	A47	14,909	504	2015 DfT AADF
66	Wendling – Dereham Road	1,300	50	Estimated
67	North Walsham Road / Happisburgh Road	1,000	40	Estimated
68	The Street / Heydon Road	1,000	40	Estimated
69	Little London Road	500	20	Estimated
70	Plantation Road	1,000	40	Estimated
71	Vicarage Road / Whimpwell Street	2,000	70	Estimated
72	Dereham Road / Longham Road - Dillington	1,000	40	Estimated
73	Hoe Road South	800	30	Estimated
74	Mill Street, Elsing Road – Swanton Morley	800	30	Estimated
75	B1354 - Blickling	2,000	70	Estimated
76	High Noon Road / Church Road	500	20	Estimated
77	Hall Lane – North Walsham	500	20	Estimated
78	Bylaugh	500	20	Estimated
79	B1145 / Suffield Road	2,000	70	Estimated

* Annual Average Daily Traffic

24.6.3 Link Based Sensitive Receptors

104. All 86 highway links within the traffic and transport study area have been assessed and assigned sensitivity. Table 24.9 summarises the links and the rationale for the applied link sensitivity whilst Appendix 24.2 provides a full detailed breakdown per link. Figure 24.5 illustrates these routes graphically.

Table 24.9 Link based sensitive receptors

Link sensitivity	Link ID	Rational
Low	1a, 1b, 2-7, 8-a, 8-c, 9, 10-a, 10-c, 11, 12-b, 12-d, 12-f, 13a, 13b-a, 13b-c, 14-b, 14-d, 15-a, 15-c, 15-e, 15-g, 16, 18-a, 18-c, 18-e, 20-25, 29-a, 30, 32-a, 32-c, 33, 35a, 35b, 36-a, 37, 39-a, 39-c, 40a, 40b, 41, 44a-a, 44a-c, 45-a, 46, 47b, 49-b, 51-b, 52, 55, 56-a, 56-c, 56-e, 57-60, 67, 68, 70, 73, 76, 77 and 78.	An A-road, B-road or minor road that can accommodate a high volume of traffic and / or has limited sensitive receptors. There is minimal, including sporadic, frontage development and footways are wide and / or buffered.
Medium	8-b, 10-b, 12-a, 12-c, 12-e, 13b-b, 14-a,14-c, 17, 18-d, 19, 26-28, 29-b, 32-b, 34, 38, 39-b, 42, 43, 44a-b, 44b, 45-b, 50, 51-a, 53, 56-b, 56-d, 61-66, 72, 74, 75 and 79.	A-roads, B-roads or minor roads that can accommodate high volumes of traffic. Direct frontage development will be present along these links with increases in sensitive receptors including schools, hospitals, churches, pubs and local shops.
High	13b-d, 15-b, 15-d, 15-f, 18-b, 31, 36-b, 47a, 47c, 48, 49-a, 54, 69 and 71.	A mixture of A-roads, B-roads and minor roads that will pass through built up areas. These areas will have significant frontage development and multiple sensitive receptors throughout, and/or pedestrianised areas.

24.6.4 Road Safety

105. To assess whether the project will have an adverse road safety impact it is necessary to establish a baseline and identify any inherent road safety issues within the traffic and transport study area.

106. Recognising the sizeable extent of the traffic and transport study area, a proportional approach has been adopted in defining the road safety baseline involving the following stages:

- Stage 1: A high-level search of the traffic and transport study area utilising open source data[1] covering the most recent three year period of 2014 – 2016 to identify collision clusters. The collision cluster criteria has been based on Norfolk County Council's definition of *"five personal injury collisions occurring within a three year period in a 50 metre radius for built up areas and a 100 metre radius in non-built up areas."*[2]
- Stage 2: Further detailed STATS19[3] data have been obtained from Norfolk County Council for the five year period, 01.05.12 to 30.04.17 and Suffolk County Council for the five year period, 01.04.12 to 01.04.17. These datasets provide

[1] http://www.crashmap.co.uk/
[2] Community and Environmental Services, Norfolk County Council
[3] Accidents on the public highway that are reported to the police and which involve injury or death are recorded by the police on a STATS19 form. The form collects a wide variety of information about the accident (such as time, date, location, road conditions).

further information relevant to the collisions including information relating to the highway environment allowing more detailed assessment to be undertaken.

107. Table 24.10 provides a summary of all identified collision clusters within the traffic and transport study area; these are also shown graphically in Figure 24.6. These cluster sites are considered potentially sensitive to changes in traffic flow and are therefore assessed further in section 24.6.6.

Table 24.10 Crashmap collision cluster information

Link	Collision ref no.	Description	No. of collisions			
			Total	Fatal	Serious	Slight
2	1	A47 at the junction of Woodlane and Berrys Lane	**5**	0	0	5
3	14	A146 (Loddon Road) junction with slip road off A47	**6**	0	0	6
5	12	A47 Junction with the B1140 (Acle Road)	**5**	0	2	3
8	13	A146 (Loddon Road) junction with slip road onto A47	**5**	0	0	5
8	15	A146 (Beccles Road) at the junction of B1136 (Yarmouth Road)	**6**	0	0	6
8	16	A146 (Beccles Road)	**5**	0	1	4
12	17	A1065 junction with Gogg's Mill Road	**5**	0	1	4
26	2	Dereham Road (A1074) within the vicinity of the Norwich Road junction	**10**	0	0	10
26	4	Dereham Road (A1074) at the junction of Larkman Lane and Marl Pit Lane	**7**	0	0	7
26/27	3	A140, A1074 and Dereham Road (A1074) roundabout	**12**	0	0	12
27	5	A140 at the junction of Hellesdon Hall Road	**5**	0	1	4
28	6	A140 (Sweet Briar Road) at the junction of Drayton high Road, Drayton Road and Boundary Road	**9**	0	1	8
28/38/62	7	A1402 (Boundary Road and Mile Cross Lane) at the junction of A140, Cromer Road and Aylsham Road	**7**	0	2	5
38/38/39	18	A140 (Holt Road) roundabout with B1149	**5**	0	1	4
55	11	A149 (Norwich Road) roundabout with the Caister-on-Sea bypass	**6**	0	0	6
55/56	10	A149 (Norwich Road roundabout with the A1064 (Main Road) and Castle Lane	**5**	0	0	5
62	8	A1042 (Mile Cross Lane) at the junction of Vulcan Road and Weston Road	**8**	0	2	6
62/63	9	A1052 (Chartwell Road) Roundabout with the A1151 (Wroxham Road and Sprowston Road) and Mousehold Lane	**10**	0	1	9
65	19	A47 roundabout, Horn Hill with Belvere Road	**5**	0	0	5

24.6.5 Sensitive Junctions

108. During extensive consultation with Norfolk County Council and Highways England as part of the ETG meetings, the junctions that are potentially sensitive to the changes in traffic have been identified as those junctions presented within Table 24.11 and as detailed on Figure 24.2.

Table 24.11 Junctions identified as sensitive to changes in traffic

Junction notation	Location	Junction description	Junction type
Junction 1	Great Yarmouth	Junction of the A47 and Gapton Hall 'Gapton Roundabout'	Four arm roundabout with partial signal control
Junction 2	Great Yarmouth	Junction of the A47 and the A149 'Vauxhall Roundabout'	Four arm roundabout
Junction 3	Great Yarmouth	Junction of the B1141 and the A149 'Fuller's Hill Roundabout'	Four arm roundabout
Junction 4	Acle	Junction of the A47 and A1064	Four arm roundabout

109. Junctions 1, 2, and 4 form part of the Strategic Road Network (SRN) along the A47 and A12 and are maintained by Highways England. Junction 3 falls under Norfolk County Council jurisdiction.

110. Junctions 1 and 2 are currently included within the A47 corridor improvement programme as part of the Road Improvement Schemes (RIS) announced in 2014. Further discussion on the RIS schemes is contained in section 24.7.7.4.

111. The A47 corridor improvement programme is classed as a Nationally Significant Infrastructure Project and would be required to make a DCO application. Current timescales estimate that the DCO for this scheme will be submitted in summer 2018, with construction commencing in spring 2020.

24.6.6 Anticipated Trends in Baseline Conditions - Future Year Traffic Flows

112. To take account of sub-regional growth in housing and employment, vehicle flows have been factored to the future year baseline traffic demand using the DfTTrip End Model Presentation Programme (TEMPro) Version 7.2 with data set 7.0 for Norfolk geographical areas. Background traffic flows for 2022 are presented in Appendix 24.3.

24.7 Potential Impacts

113. The assessment for traffic and transport identifies the period when the maximum traffic will be generated, i.e. the Worst Case Scenario (WCS).

114. During the operational phase, traffic movements would be limited to those generated by the daily operation and periodic maintenance at the onshore project substation and at link boxes/test pits along the onshore cable route. No significant traffic impacts are anticipated during the operational phase therefore an operational traffic and transport assessment is screened out.

115. The WCS traffic demand scenarios have been developed by examining:

- The likely minimum construction programme;
- The earliest commencement date;
- Demand for materials and personnel;
- Likely shift patterns;
- Likely delivery windows; and
- The distribution of traffic.

116. The following sections sets out the parameters and assumptions that together form the WCS.

24.7.1 Construction Programme

117. Table 24.12 details the onshore project construction programme. It can be noted that a sequential approach has been adopted for construction stages with the duct installation/ primary works period representing the maximum construction intensity period in terms of traffic and therefore informing the WCS.

Table 24.12 Indicative project construction programme (HVDC Two Phase)

Activity	Year					
	2020	2021	2022	2023	2024	2025
Landfall						
Duct Installation						
Cable Pull, Joint and Commission						
Phase 1						
Phase 2						
Onshore cable route						
Preconstruction works						
Duct installation works						
Cable pull, joint and commission						
Phase 1						
Phase 2						

Activity	Year					
	2020	2021	2022	2023	2024	2025
Onshore project substation						
Preconstruction works						
Primary works						
Electrical plant installation and commission						
Phase 1						
Phase 2						

118. The duct installation works are programmed for a two year period (2022-2023). The construction traffic derivation for the duct installation includes a three month break where traffic movements are significantly reduced during the winter period. The reduction in traffic movements informs the WCS by condensing traffic movements into a shorter construction time period and thereby increasing daily movements. In real terms, a three month break is unlikely, however, the traffic derivation serves to simulate the accelerated working required to ensure construction keeps to the two year programme in the event of prolonged inclement weather.

119. It is considered that the earliest date that the duct installation/ primary works period could commence would be 2022; as such a baseline year for background traffic of 2022 has been derived for the purpose of the assessment.

120. The nature of construction works typically requires that employees work longer hours in the summer and shorter hours in the winter to take advantage of the available daylight. There is a possibility that a proportion of employee arrival/ departures may overlap with the network peaks.

121. Therefore, to inform the WCS it is assumed that all employee trips would overlap with the network peak hour.

122. The delivery of materials and plant to the mobilisation areas could occur between a typical 7am to 7pm delivery window. To account for breaks in deliveries such as lunch breaks and rest breaks, the HGV construction traffic would be profiled over a 10 hour period resulting in a worst case higher hourly HGV flows.

123. To further inform the WCS, it is proposed that a five day working week would be employed with the potential to extend to a seven day working week during specific periods of the installation. Seven day working would occur for example, following periods of poor weather, but will be reserved for where programme acceleration is required.

24.7.2 Worst Case Scenario

124. Norfolk Vanguard Limited has committed to using an HVDC solution to reduce the footprint of the onshore infrastructure. Thus, the ES traffic assessment is based on the HVDC scheme and its specific requirements.

125. Chapter 5 Project Description sets out the strategy for Norfolk Vanguard to install cable ducts along the onshore cable route for Norfolk Boreas (the sister project to Norfolk Vanguard). It is anticipated that these will be constructed and installed simultaneously for both projects within a single onshore cable route. Therefore, this scenario is considered within this ES as associated development as part of the DCO application.

126. The Norfolk Boreas onshore cable installation and construction of the onshore project substation are considered within Norfolk Vanguard's CIA which is detailed in section 24.8.

127. In summary, the maximum traffic generation would result from the construction of the following project onshore infrastructure components.

1. Norfolk Vanguard HVDC landfall HDD drilling;
2. Norfolk Vanguard and Norfolk Boreas HVDC onshore cable route duct installation;
3. Norfolk Vanguard HVDC onshore project substation; and
4. National Grid substation extension and overhead line modification.

128. The onshore duct installation /primary works are serviced by 14 mobilisation areas. The main function of the mobilisation areas is to provide a control point for HGVs delivering to the onshore cable route, as well as providing welfare facilities, parking for staff and storage areas for materials, plant and equipment.

129. The onshore cable route has been separated into 20 cable route sections (detailed in Figure 24.7) to inform the likely distribution of HGVs and employees on the highway network. The HGV routes are graphically depicted on Figure 24.9.

24.7.2.1 Onshore infrastructure parameters – cable pull, joint and commission

130. The cable pull stage for the project represents a lower construction intensity than that of the duct installation/primary works stages and therefore does not form part of the assessment worst case traffic scenario. The derivation of cable pull traffic demand is as follows:

131. It is assumed that all cable pull and jointing activities would be concentrated within a single year (2024). A total of sixteen work gangs will construct 96 joint pits evenly

spaced approximately 800m apart over 16 equidistant (3.8km) onshore cable route sections. An additional 20% contingency has been added to bolster the worst case scenario. Each work gang would complete 6 joint pits in series with each jointing pit constructed within an indicative five week construction window with the worst case traffic demand occurring in week one.

132. It is calculated that 80% of the onshore cable route will be accessed via unclassified roads/farm tracks (minor links) for the cable pulling and jointing process. The remaining 20% of the onshore cable route will require the worst case installation of a stone running track to gain access to the jointing pits which will generate additional traffic demand.

133. During week one of the five-week construction window, typical daily forecast HGV movements for the minor links that serve the onshore cable route are 24 for accessible joint pit locations (no running track) and 68 for an inaccessible location requiring a running track.

134. To contextualise the difference between the (cable pull and primary works) stages in terms of HGV quantum, a route section comparison of total HGV demand is presented in Table 24.13 and Table 24.14.

Table 24.13 Duct installation and primary works

Cable section: Mobilisation Area	Total vehicles
Section 0: MA1a-W	23,762
Section 1: MA1a-E (or MA1b-W)	13,660
Section 2: MA2-E	9,393
Section 3: MA3-W	5,018
Section 4: MA3-E	3,055
Section 5: MA4-W	5,503
Section 6: MA4-E	8,018
Section 7: MA5a-W	7,472
Section 8 & 8a: MA5b-E	14,223
Section 9 & 9a: MA6-W	7,472
Section 10: MA6-E	5,948
Section 11: MA7-W	5,402
Section 12: MA7-E	9,855
Section 13: MA8-E	8,853
Section 14: MA9-W	10,250
Section 15: MA10-W	5,018
Section 16 & 16a: MA10-E	6,590
Section 17a: MA10a-W	6,415
Section 17: MA11-W	8,936
Section 19: MA11-E	10,355

Cable section: Mobilisation Area	Total vehicles
Duct Installation Totals	**175,198**

Table 24.14: Cable pull, joint and commission

Cable section	Total vehicles
Section 1	3,114
Section 2	3,126
Section 3	3,126
Section 4	1,810
Section 5	2,002
Section 6	2,922
Section 7	4,526
Section 8	2,506
Section 9	1,714
Section 10	3,658
Section 11	2,938
Section 12	2,378
Section 13	3,778
Section 14	2,114
Section 15	2,818
Section 16	2,306
Cable Pull Totals	**44,830**

135. It is forecast that the traffic demand for the cable pull stage is not significant relative to the worst case scenario presented for the duct installation/primary works stage. It is therefore intrinsic that the assessment of the potential traffic impacts of the cable pull stage will be subsumed in the assessment of the duct installation/primary works stage for the 86 highway links identified in the traffic and transport study area.

136. The cable pull stage introduces low traffic demand on minor links to gain access to cable route sections. Details of the proposed cable pull minor access routes and associated traffic derivation are contained in Appendix 24.4.

137. Given the low volumes of project/baseline traffic, the potential traffic impact on the minor routes is unlikely to be significant and would be limited to access constraints (i.e. ensuring that HGVs can deliver without obstructing or damaging the highway). Details of the mitigation measures and detailed route assessments are contained in the Outline Traffic Management Plan (OTMP) submitted in support of the DCO application (DCO Ref. 8.8).

24.7.2.2 HGV traffic demand

138. Details of materials, plant, and timescales for the project have been informed by work undertaken by the engineering consultants. Appendix 24.5 details the forecasts associated with the expected quantity of materials, plant and total HGV deliveries for each of the components of the onshore project area associated with the WCS.

139. Appendix 24.6 details the indicative maximum traffic generation forecasts for each component of the onshore project area.

24.7.2.2.1 Peak HGV construction demand

140. Appendix 24.7 shows the disaggregation of components of the onshore project area traffic demand (contained within Appendix 24.5 and 24.6) by activity over time. This exercise allows derivation of total deliveries and HGV movements per day.

141. To meet the two year duct installation/ primary works period, 15 onshore cable route sections of a total of 20 would be close to or at peak activity at any one time for the duration of the project.

142. To ensure the assessment considers the maximum impacts in the traffic and transport study area, it is necessary to assign the traffic demand for a total of 20 onshore cable route sections to the network. This method has the advantage of ensuring the peak impact on all minor links is assessed and is therefore appropriate for screening traffic and transport effects.

143. There is a drawback in application of peak impact on all links, in that potential in-combination traffic flows on the Strategic/ Principal road network are over estimated by assigning traffic flows for all 20 onshore cable route sections (noting 15 onshore cable route sections would be active at any one time).

144. To address this overestimate, it has been agreed by the ETG that a 'primary route reduction factor' of 0.75 (a multiple of 15/20) can be applied to the project traffic flows assigned to the Strategic/ Principal road network. This reduction factor is not applied to the local road network as traffic would be assigned to discrete onshore cable route sections and is less influenced by multiple onshore cable route section activity.

145. If the assessment predicts significant impacts, the level of overestimation on the minor roads can be re-evaluated on a link and junction basis.

146. The trenchless crossing (TC) zones[4] traffic demand departs from the above

[4] Trenchless crossing zones (e.g. HDD) are areas within the onshore cable route which will house trenchless crossing entry or exit points. The 17 TC zones do not include the landfall.

methodology. The 17 TC zones will be split into three groups based on their geographic location and then assigned a TC work gang as detailed:

- Gang 1 will construct TC1, TC2, TC3a, TC3b, TC4 and TC5;
- Gang 2 will construct TC6, TC7, TC8, TC9, TC10 and TC11; and
- Gang 3 will construct TC12, TC13, TC14, TC15 & TC16.

147. Each work gang will construct TCs consecutively within their TC geographic location. This constrains traffic demand to a level that would be generated by three trenchless crossing zones active at any point within the construction programme (a traffic demand 'cap').

148. The total traffic demand for each crossing can be split up to 75% drive side and 25% at the reception side. As a worst case scenario, each side of a TC has had 75% of the total traffic demand assigned to allow flexibility in construction.

24.7.2.2.2 Contingencies

149. An appropriate level of contingency has been applied to the following onshore infrastructure HGV flows:

- 10% for landfall and trenchless crossing zones (e.g. HDD); and
- 20% for duct installation, cable pull and jointing, onshore project substation and National Grid substation extension.

24.7.2.3 Employee traffic demand

150. It is estimated that a workforce of 300 employees will be required during construction peaks, serving 15 onshore cable route sections as set out in Appendix 24.7.

151. Applying the same approach to construction workforce intensity as that adopted for HGV construction demand (i.e. assigning traffic to all 20 onshore cable route sections consecutively), a total of 400 employees over 20 onshore cable route sections has been assigned.

152. However, in contrast to the HGV derivation, no reduction factor has been applied to the workforce (recognising the total workforce number as finite).

153. Table 24.15 summarises the total onshore infrastructure component's employee demand to be assessed.

Table 24.15 Employee summary

Infrastructure component	Realistic programme	ES assessed employees	Notes
Duct	300	400	

Infrastructure component	Realistic programme	ES assessed employees	Notes
installation			
Landfall	10	20	
Trenchless crossings	30	30	3 gangs of 10 employees each.
Onshore project substation	50	50	
NG Substation Extension	50	50	
Totals	440	550	

154. In recognition of the large geographical area and rural nature of the traffic and transport study area it has been assumed, as a worst case, that all construction employees travel by car. No allowance has been made for the opportunities for employees to car share, walk and cycle or use public transport.

24.7.2.4 Summary of worst case scenario assumptions

155. The key assumptions that have informed the construction traffic demand WCS are summarised in Table 24.16.

Table 24.16 WCS traffic demand assumptions

Construction parameters
The duct installation activity (programmed for 2022-2023) would generate the highest construction intensity with the maximum project demand for delivery of materials and transportation of personnel anticipated during this period.
The duct installation activity would be subject to a three-month winter break, thereby condensing project traffic movements into a shorter period.
Earliest start of construction 2022.
7am to 7pm working day with a reduced 10 hour delivery window.
Five day working week (Monday – Friday).
Maximum demand for mobilisation areas, landfall, onshore project substation and National Grid substation extension occurs concurrently.
Three trenchless crossings out of a total of 17 planned trenchless crossings would be under construction at any one time.
An appropriate level of contingency (20%) reflecting the uncertainties in the design has been applied to all duct installation, cable pull and jointing and substation material quantities.
An appropriate level of contingency (10%) reflecting the uncertainties in the design has been applied to all trenchless crossing material quantities.

Construction parameters Traffic derivation
A 'Primary Route' reduction factor (0.75) to be applied to the project HGV traffic flows along the Strategic/ Principal road network to reflect a maximum realistic cumulative project traffic demand from 15 cable sections.
A maximum of 70% of the project traffic demand would be generated from a single port location to reflect the 'distance deterrent' for supply to the extreme east of the onshore cable route from a western supply chain origin and vice versa.
HGV traffic demand for each TC can be split up to 75% drive side and 25% at the reception side. Each side of a TC has had 75% of the total traffic demand assigned to allow flexibility in construction methodology.
No reduction to project traffic applied for construction workers to allow for travel by non-car modes (e.g. bus, rail, walking and cycling) or travel. Sustainable Travel mode share will be determined by the Project Travel Plan.
The nature of construction works typically requires that employees work longer hours in the summer and shorter hours in the winter to take advantage of the available daylight. To assess the worst case highway capacity impacts, workers are assumed to arrive /depart during the network peak hours.

24.7.2.5 Traffic distribution

156. At present, the supply chain for materials cannot be described as this will depend on the contractor employed. Therefore, the following sections describe the assumptions that have been adopted to inform the distribution of HGV and construction employee traffic.

24.7.2.5.1 HGV distribution

157. Trips associated with bulk materials such as aggregate and Cement Bound Sand (CBS) would make up the majority of the total HGV movements for the project.

158. The economics of transporting large quantities of bulk materials from outside of the local area are likely to be prohibitive. A review of the potential supply chain within the traffic and transport study area indicates that while there are a number of local suppliers that may meet some of Norfolk Vanguard's demand, they are unlikely to meet the substantive material demands required of the project.

159. A viable alternative would be to import materials from the ports local to the project. Kings Lynn Port to the west and Lowestoft/ Great Yarmouth Ports to the east are considered to be the most likely source for all materials and, as such, it is assumed that all HGV movements would have an origin and destination in these regions (noting that in practice that some of the demand could be met by local supply chain). The relevant port locations are presented graphically in relation to all onshore infrastructure locations in Figure 24.7.

160. A single port could have the capacity to provide all required materials for the project, however, it is unlikely that HGVs would travel long distances to service the furthest

onshore infrastructure site from a single port as the economics would be a 'distance deterrent'. Rather, it is considered reasonable to assume that two ports (one from the east, and one from the west) would be utilised for importing materials. Each port would generate the maximum traffic demand on the highway links which serve the closest onshore infrastructure locations.

24.7.2.5.2 Delivery locations

161. Figure 24.7 details the onshore project area. The site delivery strategy is as follows:

- Landfall: deliveries would be made directly to the landfall south of Happisburgh with construction traffic using the B1159 to access the local routes leading to the landfall compound at the landfall.
- Onshore cable route: Delivery of plant and materials would be direct to each of the 14 mobilisation areas. The mobilisation areas serve discrete lengths of the onshore cable route and are positioned to maximise construction productivity. They are sited at suitable locations close to public highways and are required to store equipment and provide welfare facilities.
- The 14 mobilisation areas serve a total of 20 cable route sections which typically head east and west from each mobilisation area.
- Trenchless crossing zones: Materials and plant are assumed to be delivered directly to the 17 TC locations.
- Onshore project substation: Deliveries would occur directly to the onshore project substation mobilisation area.
- National Grid substation extension and overhead line modification: Deliveries would occur directly to the National Grid overhead line temporary works area.

24.7.2.5.3 Employee distribution

162. The availability of local labour and rented accommodation has been reviewed as part of the socio economics study (as detailed in Chapter 31 Socio-economics) to inform the potential construction employee distribution.

163. The types of specialist skills required for the project mean that construction personnel will have to be drawn from across the UK since contractors will be unable to rely solely on local labour sources. Socio economic data has informed a worse case forecasts that 30% of the workforce would be drawn from the local area (resident) and 70% would be beyond a daily commute (in-migrant).

164. In-migrant personnel i.e. who reside beyond a reasonable daily commute (defined as up to a 45 minute drive to the onshore infrastructure sites) are likely to base themselves within local rented accommodation. To inform the distribution of labour from outside Norfolk, the availability of local rented accommodation within commuting distances of the project has been captured.

165. In acknowledgement of the large geographical study area, three destination locations have been proposed for specific components of the onshore project area and are listed below:

- Origin Data Set A – based on a 45 minute and 90 minute drive time to the onshore project substation location in the vicinity of Necton.
- Origin Data Set B – based on a 45 minute and 90 minute drive time to a central point along the onshore cable route in the vicinity of Cawston.
- Origin Data Set C – based on a 45 minute and 90 minute drive time to the landfall in the vicinity of Happisburgh.

166. The distribution of local rented accommodation per postcode cluster is outlined within Appendix 24.8. The distribution of bed spaces per postcode cluster has been factored using a gravity model approach, whereby the number of bed spaces is divided by the journey time (taken from a route planner) from the centre of the postcode cluster to either Origin Data Set A, B or C.

167. Appendix 24.8 also assigns each postcode cluster a point of entry on to the highway network to inform the distribution of employees from outside Norfolk.

168. In informing the distribution of the employees who potentially could be drawn from the local area (resident workers), the socio economics study has examined the distribution of residents within the local area (defined as a 90 minute drive to the onshore infrastructure sites) with the relevant skill sets.

169. The distribution of local employees per postcode cluster is outlined within Appendix 24.9. This has been factored using a gravity model approach, whereby the number of employees is divided by the journey time (taken from a route planner) from the centre of the postcode cluster to either Origin Data Set A, B or C.

170. Appendix 24.9 also assigns each postcode cluster a point of entry on to the highway network to inform the distribution of local employees.

171. Appendix 24.10 provides a summary of the traffic and transport study area point of entry links and their corresponding percentage distribution for resident and employees from outside Norfolk.

172. Figures 24.10, 24.11 and 24.12 graphically depict the percentage distribution for resident and non-local employees point of entry onto the highway network for Destinations A, B and C respectively.

24.7.2.6 Construction traffic assignment

24.7.2.6.1 HGV traffic assignment

173. The assignment of traffic flows for a large linear project is very complex in nature. A proportionate approach has been agreed by the ETG which seeks to minimise the number of data sets by consolidating traffic demand data for cable route sections and port locations, ensuring that flows are not over-estimated cumulatively on the Strategic/ Principal Road highway network.

174. To meet the proportional approach objectives a two stage process has been developed to consolidate traffic assignments.

- Stage 1 (Classify): Classifying all links within the traffic and transport study area according to their project function.
- Stage 2 (categorise): Identify and categorise links based on distance between the port origin and final onshore infrastructure destination, applying a 'distance deterrent' factor to traffic flows.

Stage 1 (Classify)

175. As discussed in paragraphs 142 to 144, a Primary Route reduction factor is applied to the Strategic/ Principal highway network to address the over estimation of cumulative project traffic flows from maximum cable route intensity.

176. All links within the traffic and transport study area have been classified according to their interaction with the project traffic demand. Table 24.17 details the link classifications and road function of the links. The reduction factor has been applied to links identified as 'Primary Collector Routes'.

Table 24.17 Primary Route Classifications

Link Classification	Road function/ characteristics	Links
Primary Collector Route	Trunk and principal roads. Connecting primary destinations such as major urban areas.	1a, 1b, 2-12, 13a, 13b, 14, 19, 53-57, 64 and 65
Secondary Collector Route	Major urban road networks and inter-primary links between the primary collector routes and the minor local routes.	18, 24, 26-33, 36, 38, 39, 40a, 40b, 44a, 44b, 45, 46, 50-52, 58, 60, 62 and 63
Minor Local Routes	Distributor roads and local access routes usually Classified B and C class roads including some unclassified roads.	15-17, 20-23, 25, 3435a, 35b37, 41-43, 47a, 47b, 47c, 48, 49, 61 and 66-79

177. The classification of links is presented graphically in Figure 24.8.

Stage 2 (Categorise)

178. Utilising two port locations (Kings Lynn to the west and either Lowestoft or Great Yarmouth to the east), Stage 2 categorises the links using distance deterrent to forecast the maximum traffic assignment on each link.

- Category 1 Links – A discrete port location would serve the demand for all onshore infrastructure locations with distance deterrent applied. Rather than apply a notional 50/50 east /west origin split, it has been assumed up to a maximum of 70% of traffic could be generated from either port location.
- Category 2 Links – Regardless of origin, traffic converges on links local to the respective onshore infrastructure locations to complete the 'last leg' of the journey. These links are not subject to distance deterrent and have 100% of the required traffic demand assigned.

179. The maximum traffic demand per week for each onshore infrastructure site location is contained within Appendix 24.7. The following steps detailed in Table 24.18 summarise the traffic assignment methodology.

Table 24.18 HGV assignment methodology

Steps	Description	Reference	Appendix Tables
Step 1	Assigns the peak construction HGV traffic deliveries travelling to each individual onshore infrastructure site location according to their assumed origin	Appendix 24.11 (Kings Lynn) Appendix 24.12 (Lowestoft) Appendix 24.13 (Great Yarmouth)	Tables 1, 4, 5 & 6
Step 2	Primary route reduction factor (0.75) applied to Total Daily HGV Deliveries (gross) for all identified Primary Collector Roads as classified in Table 24.16.	Appendix 24.11 (Kings Lynn) Appendix 24.12 (Lowestoft) Appendix 24.13 (Great Yarmouth)	Table 2
Step 3	TC deliveries for both drive and reception sides assigned to links.	Appendix 24.11 (Kings Lynn) Appendix 24.12 (Lowestoft) Appendix 24.13 (Great Yarmouth)	Table 3
Step 4	The sum HGV deliveries per link for each port location.	Appendix 24.11 (Kings Lynn) Appendix 24.12 (Lowestoft) Appendix 24.13 (Great Yarmouth)	Table 7
Step 5	Presenting 100% assignment and then applying a 70% distance deterrent. Summarises and colour codes each port assignment link flows.	Appendix 24.14 (HGV Assignment)	Kings Lynn (green) Table 1a (100% assignment) Table 1b (70% assignment). Lowestoft (blue) Table 2a (100% assignment) Table 2b (70% assignment). Great Yarmouth (purple) Table 3a (100% assignment) Table 3b (70% assignment).

Steps	Description	Reference	Appendix Tables
Step 7	Table 5 represents the final consolidated HGV traffic deliveries and movements associated with each link within the traffic and transport study area made up of the following composition. • Green – Kings Lynn origin – Category 1 link • Blue – Lowestoft origin – Category 1 link • Purple – Great Yarmouth origin – Category 1 link • Orange – All three port origins – Category 2 link	Appendix 24.14 (HGV Assignment)	Table 5 (Final assignment)

180. Table 24.19 below summarises the links that have had 70% or 100% HGV traffic flows assigned according to link category. The information is shown graphically in Figure 24.13.

Table 24.19 Link summary

Link category	Links affected
Category 1 Links with 70% flow assignments applied	2, 3, 4-10, 13a, 13b, 14, 18, 19, 29, 30, 32, 33, 36, 39, 40a, 41, 44a, 44b, 45, 52-60, 64 and 65.
Category 2 Links with 100% flow assignments applied.	1a, 1b, 16, 17, 21, 22, 24, 25, 34, 35a, 35b, 37, 40b, 42, 46, 47b, 47c, 49 and 66-79.

24.7.2.6.2 Employee traffic assignment

181. It is assumed all employees working on each of the onshore infrastructure sites would travel directly to each respective site.

182. Utilising the maximum employee numbers per week for each of the onshore infrastructure sites as contained within Appendix 24.7, the following six steps outlined in Table 24.20 assign traffic to the highway network:

Table 24.20 Employee assignment methodology

Steps	Description	Reference	Appendix Tables
Step 1	Assigns the peak employee traffic to the onshore project substation and National Grid substation extension utilising 'Origin Data Set A' and according to their assumed origin link	Appendix 24.15 (onshore project substations and National Grid substation extension)	Table 1 and 2
Step 2	Assigns the peak employee traffic to the 14 mobilisation areas utilising 'Origin Data Set B' and according to their assumed origin link	Appendix 24.16 (mobilisation areas)	Tables 1 to 13
Step 3	Assigns the peak employee traffic to the 17 trenchless crossing zones utilising 'Origin Data Set B'	Appendix 24.16 (TCs)	Tables 1 to 13
Step 4	The sum employee one-way trips per link applying a maximum 'cap' at three TCs per link.	Appendix 24.16 (TCs)	Table 14
Step 5	Assigns the peak employee traffic to the landfall zone utilising 'Origin Data Set C' and according to their assumed origin link	Appendix 24.16	Table 1
Step 6	Provides a cumulative summation of the movement to all employee traffic movements	Appendix 24.18 (Employee assignment summary)	Table 1

24.7.3 Traffic Impact Screening

183. With reference to the GEART (Rule 1 and Rule 2)[5], a screening process has been undertaken for the traffic and transport study area to identify routes that are likely to have an increase in traffic flows that would require further impact assessment.

184. Table 24.21 summarises the total daily peak vehicle movements (i.e. arrivals and departures) of all materials, personnel and plant. The table also provides a comparison of the peak daily construction flows with the forecast background daily traffic flows in 2022 (assumed worst case realistic start of construction). Cells highlighted blue indicate GEART Rule 1 or Rule 2 screening thresholds have been met. Appendix 24.19 graphically depicts this demand on the highway network.

Table 24.21 Existing and proposed daily traffic flows

Link	Description	Link sensitivity	Background 2022 flows (24hr AADT*)		2022 construction vehicle movements		Percentage increase	
			All vehicles	HGVs	All vehicles	HGVs	All vehicles	HGVs
1a	A47	Low	17,379	1,747	571	445	3.3%	25.5%
1b	A47	Low	17,379	1,747	737	377	4.2%	21.6%
2	A47	Low	23,363	2,303	693	312	3.0%	13.5%
3	A47	Low	41,742	3,109	527	312	1.3%	10.0%
4	A47	Low	48,083	3,295	394	312	0.8%	9.5%
5	A47	Low	45,233	2,273	704	639	1.6%	28.1%
6	A47	Low	20,734	1,252	679	639	3.3%	51.0%
7	A47	Low	15,073	1,381	373	312	2.5%	22.6%
8	A146	Medium	13,500	729	340	312	2.5%	42.7%
9	A47	Low	38,180	1,163	732	721	1.9%	62.0%
10	A47	Medium	26,059	673	725	721	2.8%	107.1%
11	A1065	Low	7,632	606	69	0	0.9%	0.0%
12	A1065	Medium	5,499	523	38	0	0.7%	0.0%
13a	A148	Low	14,561	828	747	671	5.1%	81.0%
13b	A148	High	10,506	620	569	520	5.4%	83.9%
14	A148	Medium	12,286	567	491	420	4.0%	74.0%
15	B1145 - Litcham	High	1,893	38	13	0	0.7%	0.0%
16	B1110/B1146 - Holt Road	Low	8,058	91	361	240	4.5%	263.0%
17	B1145 - Billingford Road	Medium	3,075	50	326	240	10.6%	474.5%
18	A1067	High	8,699	623	401	335	4.6%	53.9%
19	A148	Medium	12,887	1,105	756	721	5.9%	65.3%

[5] Rule 1: Include highway links where traffic flows are predicted to increase by more than 30% (or where the number of HGVs is predicted to increase by more than 30%); and Rule 2: Include any other specifically sensitive areas where traffic flows (or HGV component) are predicted to increase by 10% or more.

Link	Description	Link sensitivity	Background 2022 flows (24hr AADT*)		2022 construction vehicle movements		Percentage increase	
			All vehicles	HGVs	All vehicles	HGVs	All vehicles	HGVs
20	Mill Common Road	Low	297	7	0	0	0.0%	0.0%
21	B1147 - Etling Green	Low	1,526	16	304	240	19.9%	1455.3%
22	B1147 - Dereham Road	Low	2,345	22	328	240	14.0%	1091.4%
23	Northgate - from junction with B1146	Low	1,893	38	4	0	0.2%	0.0%
24	A1067	Low	10,328	521	579	431	5.6%	82.8%
25	Elsing Lane	Low	543	5	92	72	16.9%	1309.6%
26	A1074	Medium	24,367	1,159	117	0	0.5%	0.0%
27	A140	Medium	32,842	2,202	121	0	0.4%	0.0%
28	A140	Medium	22,300	1,325	138	0	0.6%	0.0%
29	A1067	Medium	13,065	884	450	335	3.4%	37.9%
30	A1067	Low	11,447	723	447	335	3.9%	46.4%
31	A1067	High	18,200	581	110	0	0.6%	0.0%
32	B1149 - Edgefield	Medium	4,436	82	275	235	6.2%	285.2%
33	B1149 - Holly road	Low	5,787	178	390	235	6.7%	132.1%
34	B1145 - west of Cawston	Medium	2,905	29	394	240	13.5%	839.6%
35a	B1159	Low	3,551	32	494	348	13.9%	1093.4%
35b	B1159	Low	3,551	32	350	287	9.9%	903.3%
36	B1149 - Horsford	High	8,287	159	347	235	4.2%	147.5%
37	B1145 - Cawston road	Low	4,187	54	180	96	4.3%	178.2%
38	A140 - Cromer Road	Medium	20,150	788	237	0	1.2%	0.0%
39	A140 - Hevingham	Medium	14,967	498	364	134	2.4%	26.9%
40a	A140 - Roughton	Low	9,892	207	356	344	3.6%	166.4%
40b	A140 - Roughton	Low	13,249	594	374	192	2.8%	32.2%
41	B1436 - Felbrigg	Low	6,991	158	542	478	7.7%	302.7%
42	B1145 - Reepham Road	Medium	2,485	20	306	192	12.3%	970.1%
43	Cromer Road - Ingworth	Medium	1,079	3	25	0	2.3%	0.0%
44a	A149	Medium	9,255	479	438	344	4.7%	71.8%
44b	A149	Medium	9,255	479	468	311	5.1%	64.8%
45	A149	Medium	7,092	368	358	244	5.0%	66.1%
46	B1145	Low	6,068	99	485	240	8.0%	242.5%
47a	North Walsham Road - Edingthorpe Green	High	2,138	18	151	0	7.1%	0.0%

Link	Description	Link sensitivity	Background 2022 flows (24hr AADT*)		2022 construction vehicle movements		Percentage increase	
			All vehicles	HGVs	All vehicles	HGVs	All vehicles	HGVs
47b	North Walsham Road - Edingthorpe Green	Low	2,138	18	209	72	9.8%	409.2%
47c	North Walsham Road - Edingthorpe Green	High	2,138	18	220	192	10.3%	1091.4%
48	B1159 - Bacton Road	High	2,627	49	0	0	0.0%	0.0%
49	B1159	High	3,806	70	232	192	6.1%	272.8%
50	A1151	Medium	10,337	383	186	0	1.8%	0.0%
51	A1151	Medium	20,467	872	114	0	0.6%	0.0%
52	A149 - Wayford Road	Low	14,099	192	363	244	2.6%	126.8%
53	A149	Medium	38,785	1,498	938	932	2.4%	62.2%
54	A149	High	29,770	864	300	294	1.0%	34.0%
55	A149	Low	24,243	528	300	294	1.2%	55.7%
56	A149	Medium	9,181	372	338	294	3.7%	79.0%
57	A149	Low	9,329	515	340	294	3.6%	57.0%
58	NDR - Link a	Low	37,050	1,570	536	503	1.4%	32.0%
59	NDR - Link b	Low	25,656	1,087	521	503	2.0%	46.3%
60	NDR - Link c	Low	19,142	811	402	335	2.1%	41.3%
61	B1436 - Thorpe Market Road	Medium	4,884	113	71	0	1.5%	0.0%
62	A1042	Medium	24,378	990	145	0	0.6%	0.0%
63	A1151	Medium	13,933	583	81	0	0.6%	0.0%
64	A12	Medium	10,637	619	319	312	3.0%	50.3%
65	A47	Medium	16,847	570	723	721	4.3%	126.7%
66	Wendling – Dereham Road	Medium	1426	55	136	96	9.5%	174.7%
67	North Walsham Road / Happisburgh Road	Low	1097	44	175	96	15.9%	218.3%
68	The Street / Heydon Road	Low	1097	44	176	96	16.0%	218.3%
69	Little London Road	High	549	22	260	**240	47.3%	1092.3%
70	Plantation Road	Low	1097	44	292	192	26.6%	436.6%
71	Vicarage Road / Whimpwell Street	High	2194	77	144	61	6.6%	78.8%
72	Dereham Road / Longham Road - Dillington	Medium	1097	44	184	144	16.7%	327.4%
73	Hoe Road South	Low	878	33	158	144	18.0%	436.5%

Link	Description	Link sensitivity	Background 2022 flows (24hr AADT*)		2022 construction vehicle movements		Percentage increase	
			All vehicles	HGVs	All vehicles	HGVs	All vehicles	HGVs
74	Mill Street, Elsing Road – Swanton Morley	Medium	878	33	103	72	11.7%	218.3%
75	B1354 - Blickling	Medium	2194	77	72	72	3.3%	93.5%
76	High Noon Road / Church Road	Low	549	22	92	72	16.7%	327.4%
77	Hall Lane – North Walsham	Low	549	22	92	72	16.7%	327.4%
78	Bylaugh	Low	549	22	92	72	16.7%	327.4%
79	B1145 / Suffield Road	Medium	2194	77	92	72	4.2%	93.5%
*	AADT – Annual Average Daily Traffic							
**	Links with traffic deliveries utilising smaller vehicles							
%	Exceeds GEART screening thresholds							

185. In accordance with GEART, only those sensitive links that show greater than 10% increase in total traffic flows (or HGV component) or, for all other links, a greater than 30% increase in total traffic or the HGV component are considered when assessing the traffic effect of severance and pedestrian amenity upon receptors.

186. It is noted from Table 24.21 that 60 of the 86 links are above the GEART screening thresholds. Table 24.22 provides a summary of those links that will be taken forward for further assessment and those that are screened out.

Table 24.22 Link screening summary

	Further assessment	No further assessment
Link	6, 8, 9, 10, 13a, 13b, 14, 16, 17, 18, 19, 21, 22, 24, 25, 29, 30, 32, 33, 34, 35a, 35b, 36, 37, 40a, 40b, 41, 42, 44a, 44b, 45, 46, 47b, 47c, 49, 52, 53, 54, 55, 56, 57, 58, 59, 60, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79.	1a, 1b, 2, 3, 4, 5, 7, 11, 12, 15, 20, 23, 26, 27, 28, 31, 38, 39, 43, 47a, 48, 50, 51, 61, 62, 63.

24.7.4 Assessment Scenarios

187. Chapter 5 Project Description outlines the scenarios to be assessed in relation to the phasing of the works. The phasing of the construction works is as follows:

- The offshore project may be constructed as one or two phases and elements of the onshore construction would also be phased to reflect this;
- Pre-construction works (e.g. hedgerow clearance) for the onshore cable route to be conducted over a two year period, prior to duct installation;
- Cable ducts would be installed in one operation over two years, regardless of the

offshore strategy;

- Cable pull through would be done in either one or two phases;
- The onshore project substation ground preparation and enabling works would be done in one phase, anticipated to take two years for pre-construction works and two years for primary works;
- The required electrical infrastructure and plant within the onshore project substation would then be installed as required for each phase if the one or two phase options were adopted for offshore construction; and
- Total construction window for the one phase scenario is anticipated to be five years, and six years for the two phase scenario.

24.7.5 Embedded mitigation

188. Norfolk Vanguard Limited has committed to a number of techniques and engineering designs/modifications inherent as part of the project, during the pre-application phase, in order to avoid a number of impacts or reduce impacts as far as possible. Embedding mitigation into the project design is a type of primary mitigation and is an inherent aspect of the EIA process.

189. A range of different information sources has been considered as part of embedding mitigation into the design of the project; for further details see Chapter 5 Project Description, Chapter 4 Site Selection and Assessment of Alternatives and the Consultation Report (Document reference 5.1) including engineering requirements, feedback from communities and landowners, ongoing discussions with stakeholders and regulators, commercial considerations and environmental best practice.

190. The following sections outline the key embedded mitigation measures relevant for this assessment.

191. With specific regard to traffic and transport, the final assessment has been a culmination of an interactive process with the project engineering consultants. This involved developing construction methodologies, undertaking a preliminary impact assessment and revising as necessary to minimise the potential impacts. This has led to a comprehensive suite of 'designed in' mitigation measures to addresses potential significant traffic and transport impact before it can manifest.

192. Table 24.23 sets out the designed in (embedded) mitigation measures that have been applied to the traffic forecasts contained in this chapter.

193. Where embedded mitigation measures have been developed into the design of the project with specific regard to traffic and transport, these are described in Table 24.24.

Table 24.23 Embedded mitigation

Parameter	Mitigation measures embedded into the project design	Notes
Strategic approach to delivering Norfolk Vanguard and Norfolk Boreas	Subject to both Norfolk Vanguard and Norfolk Boreas receiving development consent and progressing to construction, onshore ducts will be installed for both projects at the same time, as part of the Norfolk Vanguard construction works. This would allow the main civil works for the cable route to be completed in one construction period and in advance of cable delivery, preventing the requirement to reopen the land in order to minimise disruption. Onshore cables would then be pulled through the pre-installed ducts in a phased approach at later stages. In accordance with the Horlock Rules, the co-location of Norfolk Vanguard and Norfolk Boreas onshore project substations will keep these developments contained within a localised area and, in so doing, will contain the extent of potential impacts.	The strategic approach to delivering Norfolk Vanguard and Norfolk Boreas has been a consideration from the outset.
Commitment to HVDC technology	Commitment to HVDC technology minimises environmental impacts through the following design considerations; • HVDC requires fewer cables than the HVAC solution. During the duct installation phase this reduces the cable route working width (for Norfolk Vanguard and Norfolk Boreas combined) to 45m from the previously identified worst case of 100m. As a result, the overall footprint of the onshore cable route required for the duct installation phase is reduced from approx. 600ha to 270ha; • The width of permanent cable easement is also reduced from 54m to 20m; • Removes the requirement for a CRS; • Reduces the maximum duration of the cable pull phase from three years down to two years; • Reduces the total number of jointing bays for Norfolk Vanguard from 450 to 150; and • Reduces the number of drills needed at trenchless crossings (including landfall).	Norfolk Vanguard Limited has reviewed consultation received and in light of the feedback, has made a number of decisions in relation to the project design. One of these decisions is to deploy HVDC technology as the export system.
Site Selection	The project has undergone an extensive site selection process which has involved incorporating environmental considerations in collaboration with the engineering design requirements. Considerations include (but are not limited to) adhering to the Horlock Rules for onshore project substations and National Grid infrastructure, a preference for the shortest route length (where practical) and developing construction methodologies to minimise potential impacts. Key design principles from the outset were followed	Constraints mapping and sensitive site selection to avoid a number of impacts, or to reduce impacts as far as possible, is a type of primary mitigation and is an inherent aspect of the EIA process. Norfolk Vanguard Limited has reviewed consultation received to

Parameter	Mitigation measures embedded into the project design	Notes
	(wherever practical) and further refined during the EIA process, including; • Avoiding proximity to residential dwellings; • Avoiding proximity to historic buildings; • Avoiding designated sites; • Minimising impacts to local residents in relation to access to services and road usage, including footpath closures; • Utilising open agricultural land, therefore reducing road carriageway works; • Minimising requirement for complex crossing arrangements, e.g. road, river and rail crossings; • Avoiding areas of important habitat, trees, ponds and agricultural ditches; • Installing cables in flat terrain maintaining a straight route where possible for ease of pulling cables through ducts; • Avoiding other services (e.g. gas pipelines) but aiming to cross at close to right angles where crossings are required; • Minimising the number of hedgerow crossings, utilising existing gaps in field boundaries; • Avoiding rendering parcels of agricultural land inaccessible; and • Utilising and upgrading existing accesses where possible to avoid impacting undisturbed ground.	inform the site selection process (including local communities, landowners and regulators) and in response to feedback, has made a number of decisions in relation to the siting of project infrastructure. The site selection process is set out in Chapter 4 Site Selection and Assessment of Alternatives.
Duct Installation Strategy	The onshore cable duct installation strategy is proposed to be conducted in a sectionalised approach in order to minimise impacts. Construction teams would work on a short length (approximately 150m section) and once the cable ducts have been installed, the section would be back filled and the top soil replaced before moving onto the next section. This would minimise the amount of land being worked on at any one time and would also minimise the duration of works on any given section of the route.	This has been a project commitment from the outset in response to lessons learnt on other similar NSIPs. Chapter 5 Project Description provides a detailed description of the process.
Long HDD at landfall	Use of long HDD at landfall to avoid restrictions or closures to Happisburgh beach and retain open access to the beach during construction. Norfolk Vanguard Limited have also agreed to not use the beach car park at Happisburgh South.	Norfolk Vanguard Limited has reviewed consultation received and in response to feedback, has made a number of decisions in relation to the project design. One of those decisions is to use long HDD at landfall.

Parameter	Mitigation measures embedded into the project design	Notes
Trenchless Crossings	Commitment to trenchless crossing techniques to minimise impacts to the following specific features; • Wendling Carr County Wildlife Site; • Little Wood County Wildlife Site; • Land South of Dillington Carr County Wildlife Site; • Kerdiston proposed County Wildlife Site; • Marriott's Way County Wildlife Site / Public Right of Way (PRoW); • Paston Way and Knapton Cutting County Wildlife Site; • Norfolk Coast Path; • Witton Hall Plantation along Old Hall Road; • King's Beck; • River Wensum; • River Bure; • Wendling Beck; • Wendling Carr; • North Walsham and Dilham Canal; • Network Rail line at North Walsham that runs from Norwich to Cromer; • Mid-Norfolk Railway line at Dereham that runs from Wymondham to North Elmham; and • Trunk Roads including A47, A140, A149.	A commitment to a number of trenchless crossings at certain sensitive locations was identified at the outset. However, Norfolk Vanguard Limited has committed to certain additional trenchless crossings as a direct response to stakeholder requests.

Table 24.24 Embedded mitigation for traffic and transport

Parameter	Embedded mitigation for traffic and transport	Notes
Mobilisation Areas	Mobilisation areas would be located close to main A-roads minimising impacts upon local communities and utilising the most suitable roads. Mobilisation areas located away from population centres where practical to reduce impact on local communities and population centres.	
Duct Installation	Suitable access points and identification of optimum routes for construction traffic to use. This minimises impacts on sensitive receptors.	Details contained in the OAMP (document reference 8.10)
Cable Pull and Jointing Stage access	Suitable side accesses and road crossing locations reviewed from initial schedule of 200+ access points to 70+ realistic potential access points to minimise local route impacts.	Details contained in the OAMP (document reference 8.10)
Vehicle Movement	Construction of an (up to) 6m wide running track with an approximate length of 60km. This would reduce the number of access points required and HGV movements on the local road network. Consolidating HGVs at mobilisation areas to reduce vehicle movements along more sensitive local routes.	Details contained in the OTMP (document reference 8.8)

Parameter	Embedded mitigation for traffic and transport	Notes
	Carefully selected delivery routes acknowledging the sensitive receptors within the traffic and transport study area Management measures to control timing of deliveries	
Onshore Cable Route Site Selection	Consolidating onshore cable route section construction employee movements at mobilisation areas. Onward travel along the running track to place of work reducing vehicle movements along local routes.	Details contained in the OTP (document reference 8.9)

24.7.6 Monitoring

194. An OTMP (document reference 8.8) and OTP (document reference 8.9) are submitted in support of the DCO application for the project.

195. The OTMP (document reference 8.8) sets out the standards and procedures for managing the impact of HGV traffic during the construction period, including localised road improvements necessary to facilitate the safe use of the existing road network.

196. The OTP (document reference 8.9)sets out how construction employee traffic would be managed and controlled.

197. Both documents contain a commitment to monitoring and enforcement measures to ensure the project's HGV and employee traffic is within the bounds of the worst case impacts assessed.

198. Final plans which accord with these outline documents must be submitted to and approved by the relevant local planning authority (in consultation with the relevant highway authority) prior to commencement of relevant works, as per Requirement 25 of the DCO.

24.7.7 Potential Impacts during Construction

24.7.7.1 Impact 1: Severance

199. With reference to Table 24.21 it is noted the forecast peak daily change in total traffic flow for link 69 is greater than the 30% change in total traffic threshold whereby GEART suggests negative impacts may be experienced.

200. The remaining links all experience traffic flows significantly below the 30% thresholds and the magnitude of effect on low to high sensitivity links is assessed as very low, giving impact significance on all links of **negligible** to **minor adverse**.

201. Link 69 (shown on Figure 24.1) is Little London Road from the B1145 Lyngate Road junction to an access point approximately 210m east.

202. Link 69 is a narrow lane lined with no footway. The lane is lined with established hedgerows, walls and a number of private residential accesses. The route is assessed as unsuitable for conventional (20t payload) tipper trucks and therefore in order to safely traverse along the narrow lane, mitigation is proposed in the form of splitting HGV payload into smaller 10t vehicles at mobilisation area (MA)10.

203. By halving the size of vehicles, this in effect doubles the daily number of HGVs (from 120 to 240 movements) therefore giving rise to severance traffic effects

204. The increase of 240 HGV movements on link 69; represents a high magnitude of effect on a high value receptor; resulting in the prediction of a **major adverse** impact.

205. The 240 HGV movements represents the worst case scenario, where construction of all infrastructure components are undertaken concurrently and assigned to link 69. Table 24.25 breaks down the worst case scenario into the separate infrastructure components and their programmed date of works, as detailed within Appendix 24.7.

Table 24.25 Link 69 Traffic Derivation

Infrastructure component	Programmed date of infrastructure component	**Work Gang**	Peak construction vehicle deliveries	Peak construction vehicle movements	Indicative peak construction duration
Section 16a: MA10	24.03.2023 – 10.07.2023	Duct Installation Gang	48	96	9 weeks
TC 14 – Paston Way CWS (East)	27.06.2022 – 15.08.2022	TC Gang 3*	72	144	2 weeks
TC 15 – North Walsham and Dilham Canal (West)	22.08.2022 – 10.10.2022	TC Gang 3*	72	144	2 weeks
*	TC gang 3 would only work on one TC at any one time during the construction programme.				

206. It can be noted from Table 24.25 that the construction programme presented is sufficient to also allow sequential construction of the three components.

207. Notwithstanding, a sequential peak of 144 daily movements would still represent an increase of 76% for all vehicles and 654% for HGVs; therefore mitigation is considered.

208. As detailed in the construction programme (Appendix 24.7), section 16a of the duct installation is predicted to last a total of 12 weeks during year 2 (2023). The greatest opportunity to reduce the effects of severance upon Link 69 would be to focus on elongating the currently defined construction programme.

209. For example, an increase in total construction programme from 12 weeks to 24 weeks would see a reduction from 96 peak daily movements to 48.

210. Furthermore, the locations of the drive and reception side of the TC zone have not been selected at this time. Therefore 75% of the traffic (required at the drive) has been assigned to each side.

211. There is therefore an opportunity to further reduce the TC traffic demand by placing both TC 14 and TC 15 reception sides to the area which link 69 serves. This would reduce the 144 daily movements to 48 (25%).

212. In summary, mitigation for link 69 would be agreed as part of the TMP and may comprise one or more of the following mitigation measures:

1. Extend construction programme for section 16a of the duct installation;
2. Locate the reception sides of TC 14 and TC 15 to the area which link 69 serves; and
3. Sequential planning of construction activities to reduce peak HGV demand.

213. Table 24.26 contains forecast daily traffic demand with the implementation of mitigation measures.

Table 24.26 Resultant link 69 traffic demand

Infrastructure component	Work Gang	Peak daily construction vehicle deliveries	Peak daily construction vehicle movements	Peak construction duration
Section 16a:MA10	Duct Installation Gang	24	48	24 weeks
TC 14 – Paston Way CWS (East)	TC Gang 3	24	48	2 weeks
TC 15 – North Walsham and Dilham Canal (West)	TC Gang 3	24	48	2 weeks

214. 48 daily HGV movements is assessed as an achievable peak. With this much reduced demand the effect is considered to be of low magnitude. However, noting the high sensitivity of the receptor it is expected that the residual impact significance

would be marginally **moderate adverse**.

215. The assessed impact is very localised (impacting on a small number of dwellings) and is for a relative short duration of time. It is considered community engagement to establish clear lines of communication to the appointed contractor would serve to identify periods that are particular sensitive to HGV movements and that could further mitigate this impact.

216. The OTMP (document reference 8.8) contains a specific commitment to managing the HGV movements on link 69 and notes the need for community engagement.

24.7.7.2 Impact 2: Pedestrian amenity

217. It can be noted from Table 24.21 that the peak daily change in total flows or HGV component for links 10, 16, 17, 21, 22, 25, 32, 33, 34, 35a, 35b, 36, 37, 40a, 41, 42, 46, 47b, 47c, 49, 52, 65-70, 72, 73, 74,77 and 78 are greater than the 100% GEART impact threshold whereby GEART suggests negative impacts may be experienced (Paragraph 40).

218. In addition, links 75, 76 and 79 experience increases close to the 100% threshold. These links are also considered further noting that a small change in demand could result in potentially significant impacts.

219. The remaining links all experience traffic flows significantly below the 100% thresholds and the magnitude of effect is assessed as very low on low to high sensitivity links giving impact significance on all links of **negligible** to **minor adverse**.

220. Table 24.27 presents the impact assessment for each identified link. To establish the context for the impact assessment reference is made to Norfolk County Council's route hierarchy plan (Appendix 24.1).

Table 24.27 Pedestrian amenity assessment

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
10	A47	Strategic Road Network	673	1,395	107.1%	Part of Highways England A47 Strategic Road Network; designed for high vehicle capacity and has adequate separation from pedestrian activity.	Low	Medium	**Minor Adverse**
16	B1110/B1146 - Holt Road	Main Distributor Others – 3A2	91	331	263.0%	Receptors currently experience 1 HGV every 6 minutes 40 seconds. This would increase to 1 HGV every 1 minute 48 seconds during construction. Sporadic settlements with no footways provided, indicating minimal requirement to walk along the link.	Medium	Low	**Minor Adverse**
17	B1145 - Billingford Road	Main Distributor Others – 3A2	50	290	474.5%	Receptors currently experience 1 HGV every 12 minutes during peak hour. This would increase to 1 HGV every 2 minutes 4 seconds during construction. The majority of the route has no footways indicating minimal pedestrian movement. Where the link passes through the villages of Billingford a footway is provided and a 30mph speed limit is in force.	Medium	Medium	**Moderate Adverse**
21	B1147 - Etling Green	Local Access – 3B2	16	256	1455.3%	Classified as a 'Local Access' route within NCC Route Hierarchy plan. The link serves a Mobilisation area and one side of a TC zone resulting in a large increase in HGV flows over baseline flows. No footways provided along entire link indicating minimal pedestrian footfall predicted.	High	Low	**Moderate Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
22	B1147 - Dereham Road	Local Access – 3B2	22	261	1091.4%	Classified as 'Local Access' route within NCC Route Hierarchy plan. The link serves a mobilisation area and 1 TC zone resulting in a large increase in HGV flows over baseline flows.	High	Low	**Moderate Adverse**
25	Elsing Lane	Local Access – 3B2	5	77	1309.6%	Classified as 'Local Access' route within NCC Route Hierarchy plan. The link serves a single TC zone. Minimal HGV base flows increasing to one HGV every 7 minutes 48 seconds during construction period.	Medium	Low	**Minor Adverse**
32	B1149 - Edgefield	Main Distributor Others – 3A2	82	317	285.2%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan. The link serves access to 2 mobilisation areas and 3 TC zones. A low increase in HGV relative to baseline HGV movements. Majority of route has no footways, indicating minimal pedestrian movement. Link 32 routes through the villages of Holt and Edgefield where at least one footway is provided adjacent to the road. A speed limit of 30mph is in force in throughout the village extents.	Low	Medium	**Minor Adverse**
33	B1149 -Holt Road	Main Distributor Others – 3A2	178	412	132.1%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan. The link serves access to 2 mobilisation areas and 2 TC zones. Receptors currently experience 1 HGV every 3 minutes 22 seconds during peak hour. Likely to increase to 1 HGV every 1 minute 27 seconds during construction.	Medium	Low	**Minor Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
						Majority of route has no footways, indicating minimal pedestrian movement.			
34	B1145 – west of Cawston	Main Distributor Others – 3A2	29	268	839.6%	Receptors currently experience 1 HGV every 20 minutes. This would increase to 1 HGV every 2 minute 14 seconds during construction. However, evidence of existing industrial park and HGV movements routing through Cawston identified indicating the Highway has been adapted to accommodate HGV demand.	Medium	Medium	**Moderate Adverse**
35a	B1159	Main Distributor Others – 3A2	32	380	1093.4%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan. The link serves access to the landfall site, 2 mobilisation areas and 2 TC zones resulting in a large increase in HGV flows over baseline flows.	High	Low	**Moderate Adverse**
35b	B1159	Main Distributor Others – 3A2	32	319	903.3%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan. The link provides access to the landfall site, 2 mobilisation areas and 2 TC zones resulting in a large increase in HGV flows over baseline flows.	High	Low	**Moderate Adverse**
36	B1149 – Holt Road	Main Distributor Others – 3A2	159	384	147.5%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan. The link provides access to 2 mobilisation areas and 2 TC zones. Receptors currently experience 1 HGV every 3 minutes 46 seconds. This would increase to 1 HGV every 1 minute 33 seconds during construction. Majority of route has no footways indicating minimal	Low	High	**Moderate Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
						pedestrian movement. Link 36 routes through the village of Horsford where a footway is provided. A 30mph speed limit is in force which would reduce the speed of HGVs.			
37	B1145 – Cawston Road	Main Distributor Others – 3A2	54	150	178.2%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan. Receptors currently experience 1 HGV every 11 minutes 6 seconds. This would increase to 1 HGV every 4 minutes during construction. No footways provided along entire link indicating minimal pedestrian footfall predicted.	Low	Low	**Minor Adverse**
40a	A140 - Roughton	Primary Route – 2B	207	551	166.4%	Receptors currently experience 1 HGV every 2 minutes and 53 seconds. This would increase to 1 HGV every 1 minute 5 seconds during construction.	Medium	Low	**Minor Adverse**
41	B1436 - Felbrigg	Main Distributor Others – 3A2	158	636	302.7%	Receptors currently experience 1 HGV every 3 minutes and 48 seconds. This would increase to 1 HGV every 57 seconds during construction.	High	Low	**Moderate Adverse**
42	B1145 – Reepham Road	Main Distributor Others – 3A2	20	211	970.1%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan. The link serves two TC zones resulting in a large increase in HGV flows over baseline flows.	High	Medium	**Major Adverse**
46	B1145	Main Distributor	99	338	242.5%	The link serves access to a mobilisation area and 2 TC zones which result in a large increase in HGV flows over baseflows	Low	Low	**Minor Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
		Others – 3A2				during the construction period. However, the road is classified as a 'Main Distributor Others' route which serves existing industrial estates and commercial properties. The B1145 does not provide for pedestrian access along its length and a designated walking route on an adjacent side road and an underpass is provided to the residential areas to the east.			
47b	North Walsham Road - Edingthorpe Green	Special Access – 3B3	18	89	409.2%	Classified as a 'Special Access' route within the NCC Route hierarchy plan. The link provides access to 1 TC zone. During the construction period the link would experience 1 HGV every six minutes and 44 seconds.	Medium	Low	**Minor Adverse**
47c	North Walsham Road - Edingthorpe Green	Special Access – 3B3	18	209	1091.4%	Classified as a 'Special Access' route within the NCC Route hierarchy plan. The link provides access to 1 mobilisation area and 2 TC zones. A number of route constraints exist for a large increase in HGV flows including poor geometry and surface level footpaths with on street parking. During the construction period the link would experience 1 HGV every 2 minutes and 52 seconds.	High	High	**Major Adverse**
49	B1159	Main Distributor Others – 3A2	70	262	272.8%	Classified as a 'Main Distributor Other' route within the NCC Route hierarchy plan. The link routes through the villages of Walcott, Keswick and Broomholm. The link provides access to one mobilisation area and two TC zones. Evidence of direct residential frontage and on street parking exist on the route. Bacton primary school exists adjacent to the B1159.	Medium	High	**Major Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
						However, this is set against a relatively low HGV baseline and Bacton Gas Terminal HGV route. During the construction period the link would experience 1 HGV every 2 minutes and 17 seconds.			
65	A47	Strategic Lorry route*	570	1,291	126.7%	Classified as a Strategic Lorry Route as defined by Suffolk County Council and is designed for high vehicle capacity and has adequate separation from pedestrian activity.	Low	Medium	**Minor Adverse**
66	Wendling – Dereham Road	Minor local - 4A	55	151	174.7%	Classified as a 'Minor Local 4a' route within the NCC Route hierarchy plan. The link provides access to one mobilisation area. A low increase in HGV relative to baseline HGV movements. A single footway is provided sporadically along the northern verge linking bus stops to local residential dwellings indicating minimal pedestrian movement.	Low	Medium	**Minor Adverse**
67	North Walsham Road / Happisburgh Road	Minor local - 4A	44	140	218.3%	Classified as a 'Minor Local 4a' route within the NCC Route hierarchy plan. The link serves 1 mobilisation area located approximately 800m from the junction with the B1159. No sensitive receptors are identified along the route, indicating minimal pedestrian movement.	Low	Low	**Minor Adverse**
68	The Street / Heydon Road	Local Access – 3B2	44	140	218.3%	A low increase in HGVs relative to baseline movements. The link provides access to 1 mobilisation area. The road is classified as a 'Local Access' route which serves existing agricultural estates and an airfield. The route does not provide for pedestrian access along its length.	Medium	Low	**Minor Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
69	Little London Road	Minor local - 4A	22	262	1092.3%	Classified as a 'Minor Local 4a' route within the NCC Route hierarchy plan. From the B1145 Lyngate Road Junction to an access point approximately 210m east. The link would serve cable section 16a and 2 TC zones. The link is a narrow lane lined with no footway. The lane is lined with established hedgerows, walls and a number of private residential accesses.	High	High	**Major Adverse**
70	Plantation Road	Main Distributor Others – 3A2	44	235	436.6%	The link provides access to a mobilisation area and a TC zone which result in a large increase in HGV flows over baseflows during the construction period. The B1145 does not provide for pedestrian access along its length and there are a handful of agricultural properties accessed off the link.	Medium	Low	**Minor Adverse**
71	Vicarage Road / Whimpwell Street	Minor local - 4A	77	137	78.8%	Classified as a 'Minor Local 4a' route within the NCC Route hierarchy plan. The link serves the landfall and routes through Happisburgh Common which comprises of a number of sensitive receptors that front the road.	Low	High	**Moderate Adverse**
72	Dereham Road / Longham Road - Dillington	Minor local - 4A	44	188	327.4%	Classified as a 'Minor Local 4a' route within the NCC Route hierarchy plan. The link serves 2 TC zones and comprises of a rural narrow lane with sporadic frontage development. No footways are provided along the route indicating minimal pedestrian activity.	Medium	Medium	**Moderate Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
73	Hoe Road South	Minor local - 4A	33	177	436.5%	Classified as a 'Minor Local 4a' route within the NCC Route hierarchy plan The link provides access to 1 TC zone and comprises of a rural narrow lane. Minimal frontage access is located at its junction with the B1147. No footways are provided along the route indicating minimal pedestrian activity.	Medium	Low	**Minor Adverse**
74	Mill Street, Elsing Road – Swanton Morley	Local Access – 3B2	33	105	218.3%	The road is classified as a 'Local Access' route which routes through the village of Swanton Morley. Frontage development and footway provision is evident within Swanton Morley. A low increase in HGV relative to baseline HGV movements. The link serves 1 side of a TC zone. During the construction period the link would experience 1 HGV every 5 minutes and 42 seconds.	Low	Medium	**Minor Adverse**
75	B1354	Tourist Access - 3B4	77	149	93.5%	Part classified as a 'Tourist Access' route within the NCC Route hierarchy plan east of New Road as this routes past the Blickling Estate (National Trust) site. No footways are provided along the route indicating minimal pedestrian activity. The link serves 1 side of a TC zone and during the construction period the link would experience 1 HGV every 4 minutes.	Low	Medium	**Minor Adverse**
76	Hall Lane – North	Local Access –	22	94	327.4%	A low increase in HGVs relative to baseline HGV movements. The link provides access to 1 side of a TC zone.	Low	Low	**Minor Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
	Walsham	3B2				The road is classified as a 'Minor Local 4a' route and is signed as a designated route for HGVs to an existing agricultural property. No footways are provided along the route indicating minimal pedestrian activity.			
77	Bylaugh	Minor local - 4A	22	94	327.4%	A low increase in HGV relative to baseline HGV movements. The link provides access to 1 side of a TC zone. The road is classified as a 'Minor Local 4a' route and extends approximately 260m from its junction with North Walsham Road to the side access proposed. No footways are provided along the route indicating minimal pedestrian activity.	Medium	Low	**Minor Adverse**
78	B1145 / Suffield Road	Minor local - 4A	22	94	327.4%	A low increase in HGV relative to baseline HGV movements. The link provides access to 1 side of a TC zone. The road is classified as a 'Minor Local 4a' route and extends approximately 450m from its junction with North Walsham Road to the side access proposed. No footways are provided along the route indicating minimal pedestrian activity.	Medium	Low	**Minor Adverse**
79	High Noon Road / Church Road	Main Distributor Others – 3A2	77	149	93.5%	Classified as 'Main Distributor Others' route within NCC Route Hierarchy plan from its junction with the A140 and Suffield Road Receptors currently experience 1 HGV every 7 minutes 47 seconds during peak hour. Likely to increase to 1 HGV every 4 minutes and one seconds during construction.	Low	Medium	**Minor Adverse**

Link	Link description	NCC route hierarchy	2022 HGV base flows	2022 HGV const' flows	HGV flow increase	Assessment	Magnitude of effect	Link sensitivity	Impact significance
						No footways provided along entire link indicating minimal pedestrian footfall predicted.			

* Taken from Suffolk's Lorry Route Network Plan

221. With reference to Table 24.27, the links initially assessed as having potentially significant adverse pedestrian amenity impacts (**moderate** and **major adverse**) are considered in more detail.

24.7.7.2.1 Moderate adverse impacts

222. It is proposed to provide a series of 'enhanced' mitigation measures to be contained within the finalised TMP as outlined in Table 24.28. These measures detailed are additional to those contained in a 'typical' TMP and are included to minimise impacts and enable construction vehicle drivers to understand the policies, procedures and regulations proposed for the safe and efficient movement of plant, materials and employees.

Table 24.28 Enhanced TMP measures

Enhanced TMP Measures
Driver training and toolbox talks
Driver information packs to include: • Delivery timing constraints (e.g. school arrival/departure times); • HGV delivery routes; • Diversion routes; and • Identify safe areas to pull over to reduce the effect of slow moving platoons of vehicles
Safety Awareness – Educate drivers to report 'near misses'
Engagement structure – to provide clear governance and reporting (stakeholders) structure
Monitoring and Reporting – To monitor traffic flows at mobilisation areas and the onshore project substation
Contact information at all roadwork sites and robust complaint response standards (7 days)

223. The measures are designed to familiarise drivers with the identified sensitivities within the traffic and transport study area delivery routes. The 'enhanced' measures will help to mitigate the effects of pedestrian severance and amenity (and associated fear and intimidation factors) and are expected to reduce the potential for road safety impacts associated with the increase of HGV movements within the area.

224. It can be noted from Table 24.27 that links 17, 21, 22, 34, 35a, 35b, 36, 41, 71 and 72 would experience potentially **moderate adverse** impacts.

225. The adoption of the proposed mitigation measures of an enhanced TMP would serve to address the underlining issues that manifest in adverse pedestrian amenity effects (reducing the magnitude of this potential effect), and therefore, the residual impacts on links 17, 21, 22, 34, 35a, 35b, 36, 41, 71 and 72 are expected to be no greater than **minor adverse**.

24.7.7.2.2 Major adverse impacts

226. Table 24.27 demonstrates that links 42, 47c, 49 and 69 all experience **major adverse** impacts. The following section provides a more comprehensive description of these impacts and details specific mitigation measures in addition to the enhanced TMP

discussed at paragraph 222.

24.7.7.2.3 Link 42

227. Link 42 is the B1145 road linking the village of Bawdeswell from the A1067 and on to the village of Reepham. This link is used to access two TC zones (TC 6 and TC 7). The link is considered a medium sensitive route containing direct frontage development and an entrance to a garden centre.

228. The worst case traffic demand has been developed assuming construction of all infrastructure components being undertaken concurrently. With respect to link 42 this approach results in 192 construction vehicle movements on the link. Table 24.29 breaks down the worst case scenario for link 42 into the separate infrastructure components and their programmed date of works as detailed within Appendix 24.7.

Table 24.29 Link 42 Traffic Derivation

Activity	Programmed date of infrastructure component	Work Gang	Peak daily construction vehicle deliveries	Peak daily construction vehicle movements	Peak construction duration
Section 8a: MA5b	27.02.2023 – 12.06.2023	Duct Installation Gang	24	48	16 weeks
TC 6 – Marriott's Way (north and south side)	27.06.2022 – 15.08.2022	TC Gang 2*	72	144	2 weeks
TC 7 – Marriott's Way North and Kerdiston CWS (south side)	22.08.2022 – 10.10.2022	TC Gang 2*	36	72	2 weeks

* TC gang 2 would only work on one TC at any one time during the construction programme.

229. As can be seen from Table 24.29 and Table 24.25, (which are based on the construction programme presented), all three infrastructure components would not occur at the same time.

230. Notwithstanding, a peak of 144 daily movements would still represent an increase of 12.3% for all vehicles and 720% for HGVs

231. An alternative strategy would be to extend weeks 1 and 8 of the construction programme. Week 1 of the construction programme includes the mobilisation and delivery of stone for the construction of the TC compound, week 8 then demobilises

and removes the stone. Increasing each peak period to two weeks would ultimately reduce the traffic movements by 50%.

232. The proposed mitigation and breakdown of the infrastructure components programme would result in the following reduced construction traffic demand as presented in Table 24.30.

Table 24.30 Resultant link 42 traffic demand

Activity	Work Gang	Peak daily construction vehicle deliveries	Peak daily construction vehicle movements	Peak construction duration
Section 8a: MA5b	Duct Installation Gang	24	48	16 weeks
TC 6 – Marriott's Way (north and south side)	TC Gang 2*	36	72	4 weeks
TC 7 – Marriott's Way North and Kerdiston CWS (south side)	TC Gang 2*	36	72	2 weeks

*TC gang 2 would only work on one TC at any one time during the construction programme.

233. The implementation of the proposed programme changes would substantially reduce the number of HGV traffic movements to 72 per day.

234. Therefore, the magnitude of effect is predicted to reduce to low on a medium value sensitive receptor; resulting in a **minor adverse** residual impact.

235. The OTMP (document reference 8.8) contains a specific commitment to managing the HGV movements for link 42.

24.7.7.2.4 Link 47c and Link 49

236. Link 47c is the road from the B1145 through a residential area of North Walsham and on to the villages of Bacton and Broomholm. The link is used to access MA10a and two TC zones (TC15 and TC16). The link is considered a high sensitivity route and contains several constraints including poor geometry, surface level footpaths and on street parking. This link would not be suitable for the forecast increase in construction traffic.

237. Link 49 comprises the B1159 road from its junction with North Walsham Road (west of Happisburgh) north to its junction with Coast Road. The link passes through the villages of Walcott, Bacton and Broomholm.

238. The link is used to access MA-10a and two TC zones (TC15 and TC16). The cable route is considered a high sensitivity route and contains several constraints including

poor geometry, on street parking and a primary school immediately adjacent to the B1159.

239. It is worth noting that link 49 follows the agreed HGV routes associated with the nearby Bacton Gas Terminals, where HGV traffic is directed north on the B1159 (links 35 and 49), continuing north onto the B1159 – Coast Road.

240. The worst case scenario assumes construction of all infrastructure components being undertaken concurrently. This methodology assigns 192 construction vehicle movements onto links 47c and 49. Table 24.31 breaks down the worst case scenario for links 47c and 49 into the separate infrastructure components and their programmed date of works as detailed within Appendix 24.7.

Table 24.31 Links 47c and 49 traffic derivation

Activity	Programmed date of infrastructure component	**Work Gang**	Peak daily construction vehicle deliveries	Peak daily construction vehicle movements	Peak construction duration
Section 17a: MA10a	24.04.2023 – 31.07.2023	Duct Installation Gang	24	48	15 weeks
TC 15 – North Walsham and Dilham Canal (East side)	22.08.2022 – 10.10.2022	TC Gang 3*	36	72	2 weeks
TC 16 – Bacton Woodland (West and East side)	22.08.2022 – 10.10.2022	TC Gang 3*	72	144	2 weeks

*TC gang 3 would only work on one TC at any one time during the construction programme.

241. As can be seen from Table 24.31 (based on the construction programme presented) all three infrastructure components would not occur at the same time.

242. Notwithstanding, a sequential peak of 144 daily movements would still represent an increase of 800% for HGVs on link 47c and 205% on link 49.

243. An alternative strategy would be to extend weeks 1 and 8 of the construction programme for TC 16. Week 1 includes the mobilisation and delivery of stone activities for the construction of the TC compound, week 8 then demobilises and removes the stone. Increasing each peak period to two weeks would ultimately reduce the traffic movements by 50%.

244. It is further proposed that deliveries along links 47c and 49 are restricted so that no

HGV movements occur within the village during school drop off (8am to 9am) and pick up times (3pm to 4pm).

245. The breakdown of infrastructure component programme would result in the following forecast reduced construction traffic demand as presented in Table 24.32.

Table 24.32 Resultant link 47c and 49 traffic demand

Activity	Work Gang	Peak daily construction vehicle deliveries	Peak daily construction vehicle movements	Peak construction duration
Section 17a: MA10a	Duct Installation Gang	24	48	18 weeks
TC 15 – North Walsham and Dilham Canal (East side)	TC Gang 3	36	72	2 weeks
TC 16 – Bacton Woodland (West and East side)	TC Gang 3	36	72	4 weeks

246. With the introduction of the programme changes the peak number of vehicle movements is forecast to reduce to 72 per day.

247. Therefore, the magnitude of effect is predicted to reduce to very low on a high value sensitive receptor; resulting in a **minor adverse** residual impact.

248. The OTMP (document reference 8.8) contains a specific commitment to managing the HGV movements on link 47c and 49.

24.7.7.2.5 Link 69

249. Link 69 has been considered for mitigation during Impact 1: Severance assessment. The mitigation proposals discussed in section 24.7.7.1 would equally apply to Impact 2: Amenity and would reduce the forecast traffic demand to 48 daily HGV movements.

250. With this much reduced demand the effect is considered to be of low magnitude. However, noting the high sensitivity of the receptor it is expected that the residual impact significance would be marginally **moderate adverse**.

251. The assessed impact is very localised (impacting on a small number of dwellings) and is for a relative short duration of time. It is considered community engagement to establish clear lines of communication to the appointed contractor would serve to identify periods that are particularly sensitive to HGV movements and that could further mitigate this impact.

252. The OTMP (document reference 8.8) contains a specific commitment to managing the HGV movements on link 69 and notes the need for community engagement.

24.7.7.2.6 Summary

253. Table 24.33 provides a summary of the potential pedestrian amenity impacts and the expected resultant residual impacts following application of the proposed mitigation.

Table 24.33 Pedestrian amenity summary

Link	Link description	Initial impact assessment	Residual impact assessment	Mitigation measures (additional to Outline TMP)
10	A47	Minor adverse	n/a	n/a
16	B1110/B1146 – Holt Road	Minor adverse	n/a	n/a
17	B1145 - Billingford Road	Moderate adverse	Minor adverse	• Enhanced TMP measures.
21	B1147 – Etling Green	Moderate adverse	Minor adverse	• Enhanced TMP measures.
22	B1147 – Dereham Road	Moderate adverse	Minor adverse	• Enhanced TMP measures.
25	Elsing Lane	Minor adverse	n/a	n/a
32	B1149 - Edgefield	Minor adverse	n/a	n/a
33	B1149 -Holt Road	Minor adverse	n/a	n/a
34	B1145 – west of Cawston	Moderate adverse	Minor adverse	• Enhanced TMP measures.
35a	B1159	Moderate adverse	Minor adverse	• Enhanced TMP measures.
35b	B1159	Moderate adverse	Minor adverse	• Enhanced TMP measures.
36	B1149 – Holt Road	Moderate adverse	Minor adverse	• Enhanced TMP measures.
37	B1145 - Cawston Road	Minor adverse	n/a	• n/a
40a	A140 - Roughton	Minor adverse	n/a	• n/a
41	B1436 - Felbrigg	Moderate adverse	Minor adverse	• Enhanced TMP measures.
42	B1145 – Reepham Road	Major adverse	Minor adverse	• Enhanced TMP measures. • No concurrent Infrastructure components construction. • Extend TC 6 peak construction period.
46	B1145	Minor adverse	n/a	n/a
47b	North Walsham Road - Edingthorpe Green	Minor adverse	n/a	n/a
47c	North Walsham Road - Edingthorpe Green	Major adverse	Minor adverse	• Enhanced TMP measures. • No concurrent Infrastructure component construction. • Extend TC 16 Peak construction period. • Restrict delivery window to outside of school pick up and drop off times.

Link	Link description	Initial impact assessment	Residual impact assessment	Mitigation measures (additional to Outline TMP)
49	B1159	Major adverse	Minor adverse	• Enhanced TMP measures; • No concurrent Infrastructure component construction. • Extend TC 16 Peak construction period. • Restrict delivery window to outside of school pick up and drop off times.
65	A47	Minor adverse	n/a	n/a
66	Wendling – Dereham Road	Minor adverse	n/a	n/a
67	North Walsham Road / Happisburgh Road	Minor adverse	n/a	n/a
68	The Street / Heydon Road	Minor adverse	n/a	n/a
69	Little London Road	Major adverse	Moderate adverse	• Enhanced TMP measures; • No concurrent Infrastructure component construction. • Increase construction programme for section 16a of duct installation. • Locate reception sides of TCs to area served by link 69. • Consolidate TC Employees at MA10 to transfer via multi-occupancy vehicles.
70	Plantation Road	Minor adverse	n/a	n/a
71	Vicarage Road / Whimpwell Street	Moderate adverse	Minor adverse	Enhanced TMP measures.
72	Dereham Road / Longham Road - Dillington	Moderate adverse	Minor adverse	Enhanced TMP measures.
73	Hoe Road South	Minor adverse	n/a	n/a
74	Mill Street, Elsing Road – Swanton Morley	Minor adverse	n/a	n/a
75	B1354	Minor adverse	n/a	n/a
76	Hall Lane – North Walsham	Minor adverse	n/a	n/a
77	Bylaugh	Minor adverse	n/a	n/a
78	B1145 / Suffield Road	Minor adverse	n/a	n/a
79	High Noon Road / Church Road	Minor adverse	n/a	n/a

24.7.7.3 Impact 3: Road safety

254. During stakeholder engagement, Highways England stated that they *'do not recognise GEART significance thresholds for assessing road safety (and capacity)'*. Therefore, as a 'first pass' only those links that exhibit a 'negligible' increase in total

traffic or HGV component have been screened out.

255. Table 24.34 provides a summary of the collision clusters identified in Table 24.10 and includes details of the peak increase in daily construction flows in comparison to the forecast background daily traffic flows in 2022.

Table 24.34 Crashmap collision cluster information

Link	Cluster Ref No.	Description	% increase		Summary
			All vehicles	HGVs	
2	1	A47 at the junction of Woodlane and Berrys Lane	3.3%	25.5%	It is considered that a peak change in total traffic of 3% and HGV traffic of 25.5% represents a very low magnitude of effect on a potentially high sensitive receptor. Therefore, the impact is assessed as **minor adverse**.
3	14	A146 (Loddon Road) junction with slip road off A47	1.3%	10.0%	It is considered that a peak change in total traffic of 1.3% and HGV traffic of 10% represents a very low magnitude of effect on a potentially high sensitive receptor. Therefore, the impact is assessed as **minor adverse**.
5	12	A47 Junction with the B1140 (Acle Road)	1.6%	28.1%	It is considered that the change in HGV traffic could lead to potentially significant impacts.
8	13	A146 (Loddon Road) junction with slip road onto A47	2.5%	42.7%	
8	15	A146 (Beccles Road) at the junction of B1136 (Yarmouth Road)			
8	16	A146 (Beccles Road)			
12	17	A1065 junction with Gogg's Mill Road	0.7%	0.0%	It is considered that a peak change in total traffic of 0.7% represents a very low magnitude of effect on a potentially high sensitive receptor. Therefore, the significance impact is assessed as **minor adverse**.
26	2	Dereham Road (A1074) within the vicinity of the Norwich Road junction	0.5%	0.0%	It is considered that a peak change in total traffic of 0.5% represents a very low magnitude of effect on a potentially high sensitive receptor. Therefore, the magnitude of impact is assessed as **minor adverse**.
26	4	Dereham Road (A1074) at the junction of Larkman Lane and Marl Pit Lane			
26/27	3	A140, A1074 and Dereham Road (A1074) roundabout	0.4%	0.0%	It is considered that a peak change in total traffic of 0.4% represents a very low magnitude of change on a potentially high sensitive receptor. Therefore, the magnitude of impact is assessed as **minor adverse**.
27	5	A140 at the junction of Hellesdon Hall Road	0.4%	0.0%	

Link	Cluster Ref No.	Description	% increase		Summary
			All vehicles	HGVs	
28	6	A140 (Sweet Briar Road) at the junction of Drayton high Road, Drayton Road and Boundary Road	0.6%	0.0%	It is considered that a peak change in total traffic of 0.6% represents a very low magnitude of effect on a potentially high sensitive receptor. Therefore, the magnitude of impact is assessed as **minor adverse**.
28/38/62	7	A1402 (Boundary Road and Mile Cross Lane) at the junction of A140, Cromer Road and Aylsham Road	0.6% - 1.2%	0.0%	It is considered that a peak change in total traffic of up to 1.2% represents a very low magnitude of effect on a potentially high sensitive receptor. Therefore, the magnitude of impact is assessed as **minor adverse**.
36/38/39	18	A140 (Holt Road) roundabout with B1149	1.2% - 4.2%	0.0% - 147.5%	It is considered that the change in HGV traffic could lead to potentially significant impacts.
55	11	A149 (Norwich Road) roundabout with the Caister By Pass	1.2%	55.7%	
55/56	10	A149 (Norwich Road roundabout with the A1064 (Main Road) and Castle Lane	1.2% - 3.7%	55.7% - 79.0%	
62	8	A1042 (Mile Cross Lane) at the junction of Vulcan Road and Weston Road	0.6%	0.0%	It is considered that a peak change in total traffic of 0.6% represents a very low magnitude of effect on a potentially high sensitive receptor. Therefore, the magnitude of impact is assessed as **minor adverse**.
62/63	9	A1052 (Chartwell Road) Roundabout with the A1151 (Wroxham Road and Sprowston Road) and Mousehold Lane	0.6% - 0.6%	0.0%	
64	19	A47 roundabout, Horn Hill with Belvere Road	3.0%	50.3%	It is considered that the change in HGV traffic could lead to potentially significant impacts.

256. Table 24.34 identifies that of the 19 collision clusters within the traffic and transport study area, 10 would experience very low magnitude of effect resulting in a **minor adverse** impact. The remaining six sites would experience increases in HGV traffic which could potentially result in significant impacts and are therefore considered further.

257. To inform the further review of the above identified junctions, detailed collision data (known as STATS19[6]) has been obtained from Norfolk County Council and Suffolk

[6] Accidents on the public highway that are reported to the police and which involve injury or death are recorded by the police on a STATS19 form. The form collects a wide variety of information about the accident (such as time, date, location, road conditions).

County Council for the most recently available five year period (01.05.12 to 30.04.17 and 01.04.12 to 01.04.17 respectively).

258. The STATS19 collision data has been examined to identify any emerging patterns or factors that could be exacerbated by the project's traffic generation. The review is summarised below with full details included as Appendix 24.20.

24.7.7.3.1 Cluster site 10

259. Cluster site 10 is situated at a four arm roundabout to the west of Caister-on-Sea. The A149 approaches from the east as a dual carriageway and north as a single carriageway road. The A1064 heads west of the roundabout with Castle Lane leading south, both of which are single carriageway roads.

260. The junction has experienced nine collisions within the last five years. A review of the collisions at site 10 has indicated that four were single vehicle loss of control collisions; three were rear end shunts and two were collisions between vehicles and pedal cycles. However, there is no pattern to the location of the collisions with the collisions spread around the junction.

261. A review of the baseline highway environment at and on the approach to the roundabout has identified that the junction is of a modern standard and accommodates road safety measures, including advanced warning and direction signing on the A149 and A1064 approaches. The junction is also lit.

262. It is noted that whilst there is a pattern of collision types, the collisions are of a type that would be typical for this form of junction and are not concentrated at any particular location. Therefore, the junction is considered a low sensitivity receptor.

263. Cluster 10 is located at the intersection of links 55 and 56 which are projected to experience an increase of HGV traffic of up to 79%. This is considered to represent a medium magnitude of effect on a low sensitivity receptor resulting in a **minor adverse** impact.

24.7.7.3.2 Cluster site 11

264. Cluster site 11 is situated approximately 1.2km south west of Cluster 10 at a four arm roundabout to the west of Caister-on-Sea. The dual carriageway A149 approaches from the west and south. The Caister By-Pass approach from the north and Norwich Road from the east are both single carriageway roads.

265. The junction has experienced nine collisions within the last five years. A review of the collisions at site 11 has indicated that four were rear end shunts and four were single vehicle loss of control collisions. However, there is no pattern to the location of the collisions with rear end shunts occurring on three out of four junction arms

and loss of control incidents occurring away from the roundabout on the exit and approach arms.

266. A review of the baseline highway environment at and on the approaches to the roundabout has identified that the junction is of a modern standard and incorporates road safety measures, including advanced warning and direction signing on the A149 approaches. Street lighting is also present.

267. It is noted that whilst there is a pattern of collision types at cluster site 11, the collisions are of a type that would be typical for this form of junction and are not concentrated at any particular arm. In addition, the junction is of a modern standard and benefits from existing targeted road safety measures. Therefore, the junction is considered a low sensitivity receptor.

268. Cluster 11 is located on link 55 that is projected to experience an increase of HGV traffic of up to 55.7%. This is considered to represent a medium magnitude of effect on a low sensitivity receptor resulting in a **minor adverse** impact.

24.7.7.3.3 Cluster site 12

269. Cluster site 12 is located on the A47, between the priority junction with Lingwood Lane and the staggered priority junction with the B1140 north and south.

270. Cluster 12 is located along a section of the A47 which would form part of Highways England's Blofield to North Burlingham A47 corridor improvement RIS scheme.

271. Highway England identify that the corridor acts as a bottleneck creating congestion and as a result, a poor safety record. A preferred route announcement (option 4) has been made by Highways England which would involve dualling a new section of the A47 south of the existing Lingwood Lane junctions and constructing a new junction at the B1140.

272. The construction of the proposed improvements is projected to start in spring 2020 and should be complete by the start of the project construction programme in 2022.

273. It is considered that the proposed corridor improvement programme would be appropriate to mitigate the traffic impact of the project and therefore both discrete cluster locations are considered as a low sensitivity receptor.

274. This is considered to represent a low magnitude of effect on a low sensitivity receptor resulting in a **minor adverse** residual impact.

275. Notwithstanding, during consultation, Highways England requested that a contingency mitigation plan for cluster 12 was considered in the event that the corridor improvement programme is delayed.

276. In response, an investigation into collision patterns at cluster 12 has been undertaken. This review has established that cluster site 12 has experienced 25 collisions within the last five years. In total, of these 25 collisions, 8 are located at the eastbound start of the dualling and junction within Lingwood Lane and 16 at the staggered crossing with the B1140. These two discrete patterns are considered further.

277. The first pattern is comprised of eight collisions of which four were rear end shunts associated with vehicles turning right at the junction of Lingwood Lane and four involved rear end shunts where the A47 transitions between single and dual carriageway.

278. A review of the baseline highway environment at, and on the approaches to the B1140 staggered junction has identified that the junctions are of a modern standard and incorporate road safety measures, including advanced warning and direction signing on the A47 approaches. A reduced speed limit of 50mph is maintained throughout the staggered junction layout and street lighting is also present.

279. The second pattern is associated with vehicles turning from the A47 on to the B1140 (South Walsham Road and Acle Road). In total there were 16 collisions of which five were rear end shunts and 11 involved drivers turning across the path of an oncoming vehicle.

280. To mitigate the potential for construction traffic to escalate the identified pattern of rear end shunts it is proposed to provide a 'Queuing Ahead' sign. This sign would provide advance warning of potential queuing at the staggered B1140 junction reducing the potential for rear end shunts. This commitment is contained in the OTMP (document reference 8.8)

281. No construction traffic is projected to turn from the A47 into the B1140 north or south. Therefore, it is considered that the increase in traffic through this junction will not exacerbate the existing pattern of collisions.

282. It is considered that the proposed signage would be appropriate to mitigate the impact of the development traffic if the RIS schemes are not completed on time and therefore the magnitude of effect would be reduced to very low on a high sensitive receptor resulting in a **minor adverse** residual impact.

24.7.7.3.4 Cluster site 13

283. Cluster site 13 is located in the vicinity of the grade separated signalised junctions between the A47 and A146.

284. There have been 26 collisions within the last five years of which 13 are located at the

northbound off-slip from the A47 with the A146 and eight are located at the southbound off-slip from the A47 with the A146.

285. In total, approximately nine collisions were rear end shunt type collisions and 14 were vehicles turning across the path of an oncoming vehicle. It is therefore concluded that there is a pattern of rear end shunts and non-compliance with the traffic signals.

286. A review of the baseline highway environment has identified that the junctions are signalised and include advanced warning and direction signs with evidence of high friction surfacing on the approaches.

287. It is noted that whist there is a pattern of collision types, the junctions are of a modern standard and benefit from existing targeted road safety measures. Therefore, the junction is considered a low sensitivity receptor.

288. Cluster 13 is located on link 8 that is projected to experience an increase in HGV traffic of up to 42.7%. This is considered to represent a low magnitude of effect on a low sensitivity receptor resulting in a **minor adverse** impact.

24.7.7.3.5 Cluster site 15

289. Cluster site 15 is located at the priority junction of the A146 and B1136. The junction also includes a left turn deceleration lane from the A146 to B1136. The A146 is a single carriageway road with the traffic lanes separated by a narrow hatched central area. The B1136 is a single carriageway road which approaches the A146 from the village of Hales from the east immediately after a sharp bend in the road.

290. The junction has experienced 12 collisions within the last five years. A review of these 12 collisions has identified that three involve vehicles turning off the A146 being struck from behind and eight collisions involve vehicles right turning from the B1136 colliding with oncoming vehicles. It is therefore considered that there is a pattern of right turn collisions.

291. A review of the baseline highway environment in the locality of the junction has identified that there is good visibility from the B1136 of oncoming vehicles. However, vehicles using the off-slip from the A146 to B1136 could mask oncoming vehicles reducing the forward visibility of oncoming vehicles.

292. Cluster 15 is located on link 8 that is projected to experience an increase in HGV traffic of up to 42.7%; however, no traffic is projected to turn from the A146 into the B1136. Therefore, it is considered that the increase in traffic through this junction will not exacerbate the existing pattern of collisions.

293. In view of the above, the magnitude of effect is assessed as low on a medium

sensitivity receptor resulting in a **minor adverse** impact.

24.7.7.3.6 Cluster site 16

294. Cluster site 16 is located on the A146 (Beccles Road) at a priority junction with a hand car wash / dealership.

295. The junction has experienced six collisions within the last five year period. All recorded collisions occurred on the eastbound carriageway with traffic waiting to turn right being hit from the rear.

296. Whilst there is a pattern of collisions, a review of the baseline highway environment in the locality of the junction has identified that there is sufficient forward visibility of stationary right turning vehicles. It is therefore considered that driver inattention is the most likely cause of collisions at this junction. Therefore, the junction is considered to be of medium sensitivity.

297. Cluster 16 is located on link 8 that is projected to experience an increase in HGV traffic of up to 42.7%. This is considered to represent a low magnitude of effect on a medium sensitivity receptor resulting in a **minor adverse** impact.

24.7.7.3.7 Cluster site 18

298. Cluster site 18 is located at the four arm roundabout of the A140 and B1149 and the priority junction of the B1149 and Holly Lane immediately to the north of the roundabout.

299. Cluster site 18 has experienced 12 collisions within the last five years. These 12 collisions form two discrete clusters, with five centred around the junction of the B1149 and Holly Lane and seven at the roundabout junction of the A140 and B1149.

300. Cluster 18 is located at the intersection of links 36, 38 and 39 and would therefore experience an increase in HGV traffic of up to 147.5%.

301. However, both of the considered junctions are located adjacent to the recently completed NNDR and are subject to a number of highway layout revisions. These revisions include:

- The stopping up of Holly Lane to create a 3m wide 'private means of access' with combined cycle track; and
- Conversion of the current roundabout to a five arm roundabout which includes an on and off slip road connecting to the NNDR and additional footway/ cycleway facilities.

302. It is considered that the recently completed NNDR improvements would remove the conflict at the junction of the B1149 and Holly Lane and would be appropriate to

mitigate the existing road safety issues at the roundabout junction. Therefore, the cluster is assessed as a very low sensitivity receptor on a high magnitude of effect resulting in a **minor adverse** impact.

24.7.7.3.8 Cluster site 19

303. Cluster site 19 is located between the two roundabout junctions of the A12 within Lowestoft town centre south of the A12 Bascule Bridge.

304. There have been 17 collisions within the last five years at cluster site 19. A review of the incidents indicates that:

- Six involve collisions between vehicles and pedestrians/ cyclists;
- Five are rear end shunt type collisions;
- Four are collisions between vehicles negotiating the eastern roundabout; and
- The remaining two collisions include a motorcycle losing control and a collision between a cyclist and pedestrian off road on the shared use cycleway.

305. Based on the above assessment, it is considered that there may be an emerging pattern of rear end shunt type collisions, collisions involving pedestrians and cyclists and collisions between vehicles negotiating the eastern roundabout. The following paragraphs therefore provide a further review of these collisions. For these particular collision types, five occurred at the toucan crossing between the two roundabouts and eight occurred at the eastern ASDA roundabout.

306. The five collisions at the toucan crossing between the two roundabouts resulted in two rear end shunts and three collisions between vehicles and pedestrians/ cyclist. As such, it is considered that there is a pattern where drivers fail to stop in time for the crossing or have to break sharply resulting in rear end shunts.

307. A review of the baseline highway environment in this location identifies that the crossing is within a section of road that is street lit and subject to a 30mph speed limit. Furthermore, there is good forward visibility to the signal heads, including secondary high mounted signals and high friction surfacing on the approaches. It is therefore reasoned that the collisions at this location are more likely attributable to inattention rather than issue with the highway layout.

308. The eight collisions at the ASDA roundabout included three rear end shunt type collisions, four collisions between vehicles negotiating the roundabout and one collision between a car and cycle crossing the roundabout. As such, it is considered that there is a pattern of drivers failing to appreciate the intended direction of travel of another road user and having to take evasive action including heavy breaking.

309. A review of the baseline highway environment in this location identifies that the

roundabout is of a modern standard, with good visibility on all approach and within the circulatory area of the roundabout. In addition, the roundabout is street lit, subject to a 30mph speed limit and benefits from direction signing on the main approaches, supported by clearly defined lanes within the roundabout. It is therefore reasoned that the collisions at this location are more likely attributable to poor position and driver inattention rather than issue with the highway layout.

310. It is considered that the likely causes of collisions at this cluster are attributable to driver inattention and poor position rather than issues with the highway layout. Noting this juxtaposition (i.e. the highway complies with modern safety standards but behaviour is resulting in collisions), cluster 19 is assessed as a medium sensitivity receptor.

311. Cluster 19 is located on link 64 that is projected to experience an increase of HGV traffic of up to 50.3%. This quantum is considered to represent a medium magnitude of effect on a medium sensitivity receptor resulting in an impact of **moderate adverse**.

312. The mitigation strategy for cluster 19 reflects the need to raise awareness of the types of collision occurring at this location and introduce techniques to address inattentiveness. In this regard, it is considered that 'enhanced' TMP measures are provided in additional to those contained in a 'typical' TMP to minimise road safety impacts through measures such as driver training and toolbox talks.

313. Further details with regards to the enhanced mitigation measures to be contained within the finalised TMP are outlined in Table 24.28.

314. It is considered that the enhance TMP would be appropriate to mitigate the impact of the development traffic and therefore the magnitude of effect would be reduced to low on a medium sensitive receptor resulting in a **minor adverse** residual impact.

24.7.7.3.9 Other points of access

Onshore project substation access

315. An A47 Access Technical note provided to stakeholders details a number of access options for the onshore project substation and National Grid substation extension access off the A47. The technical note has been provided as Appendix 24.21.

316. The note details three access options as follows;

- Access A: Existing Necton National Grid Substation access utilising a U-turn strategy at Dereham to remove right turn access off the A47;
- Access A1: Upgrading the existing Necton National Grid Substation access to a DMRB compliant access; and

- Access B: Construction of a new DMRB compliant access opposite 'Spicers Corner' junction.

317. Based on an evaluation of road safety and environmental impact, the technical note concludes there are no overriding reasons to reject any of these three access options.

318. The technical note further concluded, there are no overriding technical/policy constraints preventing A or A1 being utilised concurrently with B. Rather, there are potential road safety benefits to be achieved by removing vehicle conflicts between the onshore project substation and National Grid substation traffic.

319. The Outline AMP (document reference 8.10) commits to further consultation post-consent with highway stakeholders to finalise the onshore project substation access strategy.

Road crossings and side accesses

320. A number of proposed (new) access points will be utilised on the highway network to access the onshore cable route infrastructure components. The accesses would introduce slow moving HGV traffic with the potential to lead to adverse road safety impacts.

321. In order to manage the potential impacts at the new accesses, each access would be designed in accordance with the relevant standards providing appropriate geometry and visibility splays. In addition, advanced warning signing and temporary speed limits would also be provided as required.

322. The exact design of each access would be developed and agreed post-consent with Norfolk County Council and Highways England and presented within the final AMP. Generic designs are included in the Outline AMP (document reference 8.10).

323. All new access points will be subject to an independent road safety audit.

24.7.7.4 Impact 4: Driver delay

324. The GEART screening thresholds do not apply to this effect as the potential impact is defined as significant when the traffic system surrounding the proposed project under consideration is at or close to capacity.

325. To facilitate the assessment of driver delay, Norfolk County Council and Highways England have identified four junctions that they consider most sensitive (section 24.6.5).

326. The project's peak hour traffic demand has been assigned to the sensitive junctions to facilitate an assessment of impact significance. Table 24.35 details the resultant

traffic flows at the junctions during the network peak hours.

Table 24.35 Peak hour traffic flows through sensitive junctions

Junction	Junction arm	Arrivals per arm	
		Light vehicles	HGVs
Junction 1: **Roundabout junction of the A47 / Gapton Hall** Network peak hours 08:00-09:00 and **16:30-17:30**	A47 (north)	0	37
	Pasteur Road	0	0
	A47 (south)	5.5	37
	Gapton Hall Road	0	0
Total arrivals		79.5	
Junction 2: Scenario 1 - Great Yarmouth origin port **Roundabout junction of the A47 'Vauxhall roundabout'** Network peak hours 07:45-08:45 and **17:00-18:00**	A47 (north)	3	32
	Runham Road	0	0
	A149 (southeast)	1	32
	A47 (southwest)	1	0
Total arrivals		69	
Junction 2: Scenario 2 - Lowestoft origin port **Roundabout junction of the A47 'Vauxhall roundabout'** Network peak hours 07:45-08:45 and **17:00-18:00**	A47 (north)	3	22
	Runham Road	0	0
	A149 (southeast)	1	15
	A47 (southwest)	1	16
Total arrivals		79	
Junction 3: **Roundabout junction of the B1141 and A149** **'Fuller's Hill Roundabout'** Network peak hours 07:45-08:45 and **16:15-17:15**	A149 – Lawn Avenue	2	15
	Fuller's Hill	0	0
	North Quay	0	47
	A149 – Acle New Road	0	32
Total arrivals		96	
Junction 4: **Roundabout junction of the A47 and A1064 at Acle** Network peak hours **07:00-08:00** and 16:45-17:45	A1064	0	0
	A47 (east)	0	32
	A47 (west)	5	32
	New Road	0	0
Total arrivals		65	
Notes The network peak hour with the highest traffic flows per junction is displayed in **bold**			

327. As detailed in paragraph 110, Junctions 1 (Gapton Hall Roundabout) and 2 (Vauxhall Roundabout) form part of the proposed A47 corridor improvement RIS scheme due to commence construction in 2020, with a likely completion by 2022, (the same year when the project's peak construction is due to start).

328. The Highways England RIS scheme has been proposed to tackle increasing congestion and capacity issues at junction 1 and 2 which are causing significant queuing and driver delay.

329. The RIS scheme has announced its preferred option however no technical data of the final layout of junction 1 and 2 are available at this time. During consultation with Highways England, it was noted that an assessment of the likely traffic impacts of Norfolk Vanguard would be required on the existing junction layout in the event that the RIS scheme was to be delayed.

330. A proportional approach for assessing the congested junctions was agreed during consultation with Highways England. A comparison of capacity results between the 2022 future year forecast flows against the 2022 future year plus development flows has determined the impact of development traffic on the junctions.

331. An assessment of daily peak hour total vehicle fluctuations on the Trunk Road junction arms has served to quantify the magnitude of impact.

332. Junction 3 at Fuller's Hill Roundabout falls under Norfolk County Council's jurisdiction and has recently (March 2017) completed a junction improvement scheme to mitigate current and future capacity issues. Norfolk County Council has provided a layout plan for the purpose of the assessment.

333. Junction 4 at Acle is an unchanged junction and standard methods of assessing driver delay and capacity were agreed.

24.7.7.4.1 Junction 1 Roundabout junction of the A47 'Gapton Hall roundabout'

334. Junction 1 forms the roundabout junction of the A47, Gapton Hall Road and Pasteur Road to the west of Great Yarmouth town centre.

335. MCTC data for this junction has been taken from traffic counts provided by Norfolk County Council which were undertaken on the 23rd October 2012, Appendix 24.22 shows the surveyed traffic flows. These data have been factored from vehicles to Passenger Car Units (PCUs) and factored from 2012 to 2022, Appendix 24.23 shows the peak hour flow matrices including growth factors.

336. Table 24.36 summarises the modelled RFC, queuing and delay for junction 1 between 16:30-17:30 for the forecast year of 2022 with and without development. Full junction model outputs can be found within Appendix 24.24.

Table 24.36 Junction 1 modelling results summary

Arm	2022 forecast baseflows 16:30 – 17:30			2022 forecast baseflows plus development traffic 16:30 – 17:30		
	DoS (Degree of Saturation)	Delay (s)	MMQ (pcu)	DoS	Delay (s)	MMQ (pcu)
A47 North - Ahead	78.9%	24.5	13.7	83.5	27.1	16.5
A47 South - Ahead	154.7%	719.7	184.8	162.4%	781	207
Practical Reserve Capacity over all lanes	-71.9%			-80.5%		

337. As shown in Table 24.36, Junction 1 operates over capacity at -71.9% Practical Reserve Capacity (PRC) for the 2022 forecast year. The addition of 80 vehicles in the peak hour increases capacity issues to -80.5% PRC. There are also increases in Degree of Saturation (DoS), delay and queuing on the trunk road arm approaches.

338. The peak hour daily traffic flow fluctuations for junction 1 was derived for the northern A47 approach arm from traffic data sourced from TRADS. A neutral month (June) in 2017 has been selected and the daily peak hour flows averaged over the month to culminate in a fluctuation of flows in the order of 181 vehicles. The daily fluctuation calculations for junction 1 can be found in Appendix 24.25.

339. A proportional approach has been undertaken to compare fluctuation in daily peak hour traffic flows on the northern A47 approach arm against development traffic entering the junction on the same arm. When compared with the development flows of 37 HGVS entering the junction it is considered that the development flows at peak hour would be indiscernible from day to day traffic fluctuations. Therefore, the junction is assessed as a high sensitivity receptor on a very low magnitude of effect resulting in a **minor adverse** impact.

24.7.7.4.2 Junction 2 Roundabout junction of the A47 'Vauxhall roundabout'

340. Junction 2 forms the roundabout junction of the A47, A149 to the northwest of Great Yarmouth town centre.

341. MCTC data for this junction has been taken from traffic counts provided by Norfolk County Council which were undertaken on the 23rd October 2012, Appendix 24.26 shows the surveyed traffic flows. These data have been factored from vehicles to PCUs and factored from 2012 to 2022, Appendix 24.27 shows the peak hour flow matrices and growth factors.

342. Two scenarios are presented for junction 2 which assesses the different construction traffic assignment at the junction based on the two port origins of Great Yarmouth

and Lowestoft.

Junction 2: Scenario 1 - Great Yarmouth port origin results

343. Table 24.37 summarises the modelled RFC, queuing and delay for junction 2 (Scenario 1) between 17:00-18:00 for the forecast year of 2022 with and without development. Full junction model outputs can be found within Appendix 24.28.

Table 24.37 Junction 2 modelling results summary – Scenario 1 - Great Yarmouth port origin

Arm	2022 forecast baseflows 17:00 – 18:00			2022 forecast baseflows plus development traffic 17:00 – 18:00		
	RFC	Delay (s)	MMQ (pcu)	RFC	Delay (s)	MMQ (pcu)
A47 North	0.81	13.17	4.26	0.86	17.37	5.93
Runham Road	1.89	768.32	37.46	3.27	3108.22	54.42
A149	1.07	118.94	79.61	1.1	156.1	109.18
A47 South	1.21	410.07	160.23	1.24	480.65	185.54

Junction 2: Scenario 2 - Lowestoft port origin results

344. Table 24.38 summarises the modelled RFC, queuing and delay for junction 2 (scenario 2) between 17:00-18:00 for the forecast year of 2022 with and without development. Full junction model outputs can be found within Appendix 24.29.

Table 24.38 Junction 2 modelling results summary – Scenario 2 - Lowestoft port origin

Arm	2022 forecast baseflows 17:00 – 18:00			2022 forecast baseflows plus development traffic 17:00 – 18:00		
	RFC	Delay (s)	MMQ (pcu)	RFC	Delay (s)	MMQ (pcu)
A47 North	0.81	13.17	4.26	0.85	16.39	5.5
Runham Road	1.89	768.32	37.46	3.01	2777.07	52.62
A149	1.07	118.94	79.61	1.1	160.03	109.74
A47 South	1.21	410.07	160.23	1.26	529.09	214.51

345. As shown in Table 24.36 and Table 24.38, Junction 2 operates significantly over capacity for the 2022 forecast year with three arms showing RFC significantly above the 0.85 recognised threshold for RFC.

346. With the additional 69 development vehicles from the origin port assignment to Great Yarmouth, and the 79 development vehicles from Lowestoft origin port assignments in addition to the 2022 forecast flows shows the junctions experiences further deterioration in RFC, queues and delays.

347. Runham Road in particular experiences an exponential growth in RFC and delays for both scenario 1 and 2.

348. The peak hour daily traffic flow fluctuations for junction 2 has been derived for the northern A47 approach arm from traffic data sourced from TRADS. A neutral month (June) in 2017 was selected and the daily peak hour flows were averaged over the month culminating in a fluctuation of flows in the order of 158 vehicles. The daily fluctuation calculations for junction 2 can be found in Appendix 24.30.

349. A proportional approach has been undertaken to compare fluctuation in daily peak hour traffic flows on the northern A47 approach arm against development traffic entering the junction on the same arm. When compared with the development flows of 32 HGVS entering the junction it is considered that the development flows at peak hour would be indiscernible from day to day traffic fluctuations. Therefore, the junction is assessed as a high sensitivity receptor on a very low magnitude of effect resulting in a **minor adverse** impact.

24.7.7.4.3 Junction 3 – Junction of the B1141 and A149 'Fuller's Hill Roundabout'

350. Junction 3 forms the roundabout junction of the B1141, A149 and North Quay to the northwest of Great Yarmouth town centre.

351. MCTC data for this junction has been taken from traffic counts provided by Norfolk County Council which were undertaken on the 15th October 2015, Appendix 24.31 shows the surveyed traffic flows. These data have been factored from vehicles to PCUs and factored from 2015 to 2022, Appendix 24.32 shows the peak hour flow matrices and growth factors.

352. Fuller's Hill roundabout has recently completed a junction improvement scheme to increase capacity of the roundabout and reduce congestion particularly on the North Quay approach where significant queuing was experienced. The improved layout scheme can be found in Appendix 24.33.

353. Classified turning count survey data for 2015 was provided by NCC. The flows have been factored up to the future year of 2022 by a weekday PM factor of 1.1197.

354. Table 24.39 summarises the modelled RFC, queuing and delay for junction 3 between 16:15-17:15 for the forecast year of 2022 with and without development. Full junction model outputs can be found within Appendix 24.34.

Table 24.39 Junction 3 modelling results summary

Arm	2022 forecast baseflows 16:15 – 17:15			2022 forecast baseflows plus development traffic 16:15 – 17:15		
	RFC	Delay (s)	Queue (pcu)	RFC	Delay (s)	Queue (pcu)
North Quay (north)	0.56	3.94	1.24	0.59	4.4	1.43
Fuller's Hill	0.35	4.11	0.53	0.37	4.56	0.59
North Quay (south)	0.84	17.31	5.09	0.94	35.18	11.19
Acle New Road	0.93	26.27	10.4	0.99	54.81	24.19

355. Table 24.39 shows that without the development traffic the junction exhibits one arm exceeding the recognised 0.85 threshold for RFC with queues up to 11 PCUs. Due to this baseline condition the introduction of relatively modest flows (less than a 3% increase in total traffic), of 96 vehicle movements (94 HGVs and two cars) the junction performance deteriorates further, with queues exceeding 24 PCUs.

356. For Junction 3 the magnitude of effect is therefore assessed as very low on a high sensitivity receptor and the impact is predicted to be **minor adverse**.

24.7.7.4.4 Junction 4 – Junction of the A1064 and A47

357. Junction 4 forms the roundabout junction of the A1064, A47 and New Road east of Acle.

358. MCTC data for this junction has been taken from traffic counts commissioned by Norfolk Vanguard Limited on the 8th February 2018. Appendix 24.35 shows the surveyed traffic flows. These data have been factored from vehicles to PCUs. Appendix 36 shows the surveyed traffic flows from February 2018 and Appendix 24.37 shows the peak hour flow matrices.

359. Table 24.39 summarises the modelled RFC, queuing and delay for junction 4 between 07:00-08:00 for the forecast year of 2022 with and without development. Full junction model outputs can be found within Appendix 24.38.

Table 24.40 Junction 4 modelling results summary

Arm	2022 forecast baseflows 07:00-08:00			2022 forecast baseflows plus development traffic 07:00-08:00		
	RFC	Delay (s)	Queue (pcu)	RFC	Delay	Queue (pcu)
A1064	0.82	21.1	4.32	0.86	28.41	5.74
A47 (east)	1	67.88	24.58	1.07	127.32	54.24
A47 (west)	0.56	3	1.24	0.58	3.2	1.4
New Road	0.55	11.79	1.22	0.59	13.65	1.41

360. Table 24.40 shows that without the development traffic the junction exhibits one arm exceeding the recognised 0.85 threshold for RFC with queues up to 25 PCUs. With the addition of the proposed development traffic (less than a 3% increase in total traffic), of 69 vehicle movements (64 HGVs and five cars) there would be a slight increase in RFC with an associated increase to 55 PCU queues.

361. For Junction 4 the magnitude of effect is therefore assessed as very low on a high sensitivity receptor and the impact is predicted to be **minor adverse**.

24.7.8 Potential Impacts during Operation

362. During the operational phase, traffic movements would be limited to those generated by the daily operation and periodic maintenance at the onshore project substation and National Grid substation and at link boxes/test pits along the onshore cable route.

363. Along the onshore cable route, periodic access to installed link boxes and test pits may be required for inspection, (estimated to be annually). These test pits will be accessible from ground level and will be located close to existing access routes where possible. Access to the cable easement will be required to conduct emergency repairs if necessary.

364. The onshore project substation will not be manned; however, access will be required periodically for routine maintenance activities, estimated at an average of one visit per week for each of the onshore project substation and National Grid substation extension.

365. Considering the activities listed above, no significant traffic impacts are anticipated during the operational phase.

24.7.9 Potential Impacts during Decommissioning

366. This section describes the potential impacts of the decommissioning of the onshore infrastructure with regards to impacts on traffic and transport. Further details are provided in Chapter 5 Project Description.

367. No decision has been made regarding the final decommissioning policy for the onshore cables, as it is recognised that industry best practice, rules and legislation change over time. It is likely the cables would be pulled through the ducts and removed, with the ducts themselves left in situ.

368. In relation to the onshore project substation the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology would be determined later within the project lifetime, but are expected to include:

- Dismantling and removal of outside electrical equipment from site located outside of the onshore project substation buildings;
- Removal of cabling from site;
- Dismantling and removal of electrical equipment from within the onshore project substation buildings;
- Removal of main onshore project substation buildings and minor services equipment;
- Demolition of the support buildings and removal of fencing;
- Landscaping and reinstatement of the site (including land drainage); and
- Removal of areas of hard standing.

369. Whilst details regarding the decommissioning of the onshore project substation are currently unknown, considering the worst case scenario which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would no worse than those during construction.

370. The decommissioning methodology would need to be finalised nearer to the end of the lifetime of the project so as to be in line with current guidance, policy and legislation at that point. Any such methodology would be agreed with the relevant authorities and statutory consultees. The decommissioning works could be subject to a separate licencing and consenting approach.

24.8 Cumulative Impacts

371. The assessment of cumulative impact has been undertaken as a two stage process. Firstly, all the impacts from previous sections have been assessed for potential to act cumulatively with other projects. This summary assessment is set out in Table 24.41.

Table 24.41 Potential cumulative impacts

Impact		Potential for cumulative impact	Rationale
Construction			
1	Severance	Yes	Cumulative impacts arising from two or more projects are possible due to the increase in traffic from the projects.
2	Pedestrian amenity	Yes	Cumulative impacts arising from two or more projects are possible due to the increase in traffic from the projects.
3	Road safety	Yes	Cumulative impacts arising from two or more projects are possible due to the increase in traffic from the projects.
4	Driver delay	Yes	Cumulative impacts arising from two or more projects are possible due to the increase in traffic from the projects.
Operation			
No cumulative impacts are anticipated as there are no operational impacts associated with Norfolk Vanguard.			
Decommissioning			
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.			

372. The second stage of the CIA is an assessment of the onshore project area and the potential effects of other projects scoped into the CIA upon the same receptors. To identify whether this may occur, the potential nature and extent of effects arising from all projects scoped into the CIA have been identified.

373. The projects identified for potential cumulative impacts with Norfolk Vanguard have been discussed during ETG meetings with stakeholders and the full list has been agreed in consultation with local authorities.

374. Table 24.42 summarises those projects which have been scoped into the CIA due to their temporal or spatial overlap with the potential effects arising from the project. The remainder of the section details the nature of the cumulative impacts against all those receptors scoped in for cumulative assessment.

Table 24.42 Summary of projects considered for the CIA in relation to traffic and transport

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Site location / rationale
National Infrastructure Planning							
Norfolk Boreas Offshore Wind Farm	Pre-Application	Expected construction date 2026	0 – projects are co-located	Pre-application outline only	High	Yes	Overlapping proposed project boundaries may result in impacts of a direct and / or indirect nature during construction.
Hornsea Project Three Offshore Wind Farm	Pre-Application	Expected construction date 2021	0 – cable intersects project	Full PEIR available: http://hornseaproject3.co.uk/Documents-library/PEIR-Documents	High	Yes	Overlapping proposed project boundaries may result in impacts of a direct and / or indirect nature during construction.
Dudgeon Offshore Wind Farm	Commissioned	Constructed	0	http://dudgeonoffshorewind.co.uk/	High	No	Construction complete, minimal operational traffic demand.
A47/A12 Junction enhancements to the following junctions and roundabouts: Vauxhall, Gapton Hall, Harfreys, Bridge	Pre-application	Starts 2019/2020 with projected finish year of 2022	26.7km	https://infrastructure.planninginspectorate.gov.uk/projects/eastern/a47-north-tuddenham-to-easton/	Medium	Yes	Insufficient information in the public domain with regards to final scheme proposal. However, Norfolk Vanguard Limited have liaised with Highways England to establish a suitable 'reference case' for highway capacity assessments, therefore it is taken forward into the CIA

[7] Shortest distance between the considered project and Norfolk Vanguard – unless specified otherwise.

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Site location / rationale
Road and James Paget Hospital.							
A47 corridor improvement programme – A47 Blofield to North Burlingham	Pre-application	Expected construction date 2021-22	25	https://infrastructure.planninginspectorate.gov.uk/projects/eastern/a47-blofield-to-north-burlingham/	Medium	Yes	
A47 corridor improvement programme – A47 / A11 Thickthorn	Pre-application	Expected construction date 2020-21	18	https://infrastructure.planninginspectorate.gov.uk/projects/eastern/a47a11-thickthorn-junction/	Medium	Yes	
Norwich Western Link	Pre-application	2022	2.8	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/norwich/norwich-western-link/timeline	Medium	No	If consent is granted, Norfolk Vanguard Limited and its contractors would engage stakeholders to try and establish opportunities to co-ordinate activities and avoid peak traffic impacts.
Third River Crossing (Great Yarmouth)	Pre-application	Expected to start in 2020	28	https://www.norfolk.gov.uk/roads-and-transport/major-	Medium	No	

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Site location / rationale
				projects-and-improvement-plans/great-yarmouth/third-river-crossing			
King's Lynn B Power Station amendments	Pre-application	Construction expected 2018-2021	28	https://www.kingslynnbccgt.co.uk/	Medium	No	The King's Lynn B Power Station site is located west of the project's traffic study area. The traffic and transport study area has been carefully screened by assigning traffic demand to the network and determining the scope and scale of the project's potential traffic impact. Traffic impacts outside of the traffic and transport study area are deemed to be 'insignificant' it therefore follows that there would not be a significant cumulative impact associated with King's Lynn B Power Station.

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Site location / rationale
NNDC							
PF/17/1951 Erection of 43 dwellings and new access with associated landscaping, highways and external works	Awaiting decision	Anticipated Q2 2018	0.7	https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_92323	High	Yes	Sub-regional growth in housing as adopted by the region's Local Plans has been captured within TEMPro future year growth factors for 2022. Therefore, the cumulative effect of housing projects is inherent in the traffic and transport impact assessments.
Bacton Gas Terminal Extension	Approved	Approved 20/09/2016. Expires 20/09/2019	3.0	Approved PDS available https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_88689	Medium	No	Project would not result in an increase in traffic movements, therefore not taken forward into CIA.
Bacton Gas Terminal Coastal Protection	Approved	Approved 18/11/2016. Expires 18/11/2019	2.5	Approved PDS available	Medium	No	Project would not result in an increase in traffic movements.

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Site location / rationale
Bacton and Walcott Coastal Management Scheme	Approved	Expected construction date 2018	1.0	Public information leaflets available: https://www.north-norfolk.gov.uk/media/3371/bacton-to-walcott-public-information-booklet-july-2017.pdf	Medium	No	Project would not result in an increase in traffic movements.
Breckland Council							
21-31 new dwellings in Necton (BLR/2017/0001/PIP)	Awaiting decision	Not known. Application submitted November 2017.	1.0	http://planning.breckland.gov.uk/OcellaWeb/showDocuments?reference=BLR/2017/0001/PIP&module=pl	Medium	Yes	Sub-regional growth in housing as adopted by the region's Local Plans has been captured within TEMPro future year growth factors for 2022. Therefore, the cumulative effect of housing projects is inherent in the traffic and transport impact assessments.
4-8 new dwellings in Necton (BLR/2017/0002/PIP)	Awaiting decision	Not known. Application submitted November 2017.	1.0	http://planning.breckland.gov.uk/OcellaWeb/showDocuments?reference=BLR/2017/0002/PIP&module=pl	Medium	Yes	

Project	Status	Development period	[7]Distance from Norfolk Vanguard site (km)	Project definition	Project data status	Included in CIA	Site location / rationale
70 dwellings (3PL/2016/0298/D) (Phase 2 of 3PL/2012/0576/O)	Approved (21/09/16)	Not known. Application submitted March 2016.	6.4	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2016/0298/D&from=planningSearch	Medium	Yes	Sub-regional growth in housing as adopted by the region's Local Plans has been captured within TEMPro future year growth factors for 2022. Therefore the cumulative effect of housing projects is inherent in the traffic and transport impact assessments.
98 dwellings at Swans Nest with access from Brandon Road (3PL/2017/1351/F) (Phase 3 of 3PL/2012/0576/O)	Awaiting decision (due 30/03/2018)	Not known. Application submitted Jan 2016.	6.4	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2017/1351/F&from=planningSearch	Medium	Yes	
175 dwellings with access at land to west of Watton Road, Swaffham (3PL/2016/0068/O) (Swans Nest Phase B)	Awaiting decision (due 13/10/2017)	Not known. Application submitted Jan 2016.	6.4	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2016/0068/O	Medium	Yes	

375. With reference to paragraph 112, the Department for Transport Trip End Model Presentation Programme (TEMPro) has been used to calculate future year baseline traffic flows. This has captured sub-regional growth in housing and employment as adopted by the region's Local Plans. This information has been taken into account when undertaking the CIA.

24.8.1 Cumulative Impacts during Construction

24.8.1.1 Norfolk Boreas Offshore Wind Farm

376. As identified in Table 24.42, through one of its subsidiaries, Vattenfall Wind Power Ltd is developing the Norfolk Boreas Offshore Wind Farm (herein the 'Norfolk Boreas project') (sister project to Norfolk Vanguard) located to the north of NV East, with the DCO application for Norfolk Boreas following approximately one year behind the Norfolk Vanguard DCO submission. The development of Norfolk Boreas will use the same onshore cable route as Norfolk Vanguard with the addition of a spur to the Norfolk Boreas onshore project substation.

377. The latest indicative programme of onshore activities relating to Norfolk Boreas has been provided by Norfolk Boreas Limited and is provided below:

- Main works for onshore project substation infrastructure - 2024 to 2025;
- Installation of cables and onshore project substation plant for phase 1 – 2026; and
- Installation of cables and onshore project substation plant for phase 2 – 2027.

378. It can therefore be noted that in 2024 and 2025 there could be an overlap between the construction of the Norfolk Boreas project substation and the Norfolk Vanguard cable pull, joint and commissioning phase.

379. It can be noted from Table 24.12 the worst case assessment for Norfolk Vanguard includes the overlap of onshore project substation and duct installation activities along the onshore cable route. This scenario generates greater traffic demand and associated impact than that of a Boreas onshore project substation and Norfolk Vanguard cable pull, joint and commissioning cumulative activities. It is therefore concluded that any potential cumulative impacts associated with Norfolk Boreas have been adequately assessed within the Norfolk Vanguard (worst case) impact assessment.

24.8.1.2 Hornsea Project Three Offshore Wind Farm

380. Ørsted is proposing to develop an offshore wind farm located in the southern North Sea, with a total generating capacity of up to 2,400MW.

381. The outline Export Cable Route (ECR) of the Hornsea project will make landfall at a location between Sheringham and Cley next the Sea. From the landfall location, the ECR heads approximately 55km south to connect to the Norwich Main National Grid Substation.

382. A high level construction programme indicates that onshore construction is currently planned to commence in 2021 and last for a period of six years. The key onshore infrastructure indicative construction durations are:

- Onshore project substation: Q3 2021 – Q3 2024; and
- Onshore cable route: Q1 2023 – Q1 2025.

383. From the above indicative programme, Hornsea Project Three construction will likely coincide with Norfolk Vanguard's duct installation and onshore project substation construction works period.

384. Ørsted has submitted a Hornsea Project Three PEIR in July 2017 and an investigation into the traffic demand set out in Chapter 7 Traffic and Transport of the Hornsea Project Three PEIR has been undertaken.

385. The Hornsea Project Three study area has been segregated into 183 highway links. The onshore cable route has been split into 34 sections which are served by 75 potential access points. Total HGV traffic demand has been presented for each of the 34 onshore cable route sections with an associated maximum daily HGV movement per section. Crucially, the Hornsea Project Three PEIR does not include an assignment of daily HGV movements to the 183 highway links.

386. The Hornsea Project Three application for development consent was submitted in May 2018 and therefore the pre-application stage is running almost concurrently with Norfolk Vanguard. At the time of writing, the data necessary for Norfolk Vanguard to undertake a full CIA taking into account Hornsea Project Three was not publicly available. However, Norfolk Vanguard Limited and Ørsted are in regular and on-going dialogue and Norfolk Vanguard Limited will seek to continue working closely with Ørsted, and with statutory consultees to assess potential cumulative impacts. This approach complies with the relevant EIA Regulations and is consistent with that taken for other applications, where relevant environmental information has become available after the point of the DCO application submission.

24.8.1.3 A47 Corridor improvement programme

387. Highways England has proposed six improvement schemes for the A47 as part of the Roads Investment Strategy announced in 2014. The schemes have been identified as congestion hotspots and significant growth has been predicted in the areas which the proposed improvements will help to support.

388. The A47 corridor improvement programme is classed as a NSIP and would be required to make a DCO application. Current timescales estimate that the DCO will be submitted in summer 2018, with construction commencing in spring 2020.

389. Four of the six schemes that could potentially impact on the project include:

- North Tuddenham to Eastern dualling;
- A47 / A11 Thickthorn Junction;
- A47 Blofield to North Burlingham dualling; and
- Great Yarmouth junction enhancements.

390. The programme of construction works for the schemes is due to start in 2020 and predicted to end in 2022. The works are likely to finish before the main construction works of the project, however this does not allow for slippage in the programme.

391. At this stage, three of the four identified schemes have announced their preferred scheme options and further consultation is ongoing. The full DCO planning process has not yet begun.

392. With regards to highway capacity assessment, it has been agreed with Highways England that a suitable 'reference case' would be to assume no improvements are in place. This reference case forms the basis of the highway capacity assessments set out within section 24.7.7.4.

393. With regards to the potential for cumulative impacts associated with the potential overlap of construction traffic, noting the lack of information available at this stage, it is not possible to provide a meaningful assessment of cumulative impacts.

394. It is therefore proposed that, if approved, through the development of the TMP, Norfolk Vanguard Limited and its contractors would engage Highway England to establish opportunities to co-ordinate activities and avoid peak traffic impacts.

24.8.2 Cumulative Impacts during Operation

395. No cumulative impacts are anticipated as there are no operational impacts associated with Norfolk Vanguard.

24.8.3 Cumulative Impacts during Decommissioning

396. Decommissioning of Norfolk Boreas and Hornsea Project Three may potentially take place at the same time as the Norfolk Vanguard project. The detail and scope of the decommissioning works for the Norfolk Vanguard project will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those

identified during the construction stage.

24.9 Inter-relationships

397. In order to address the environmental impact of the proposed project as a whole, this section establishes the inter-relationships between traffic and transport and other physical, environmental and human receptors. The objective is to identify where the accumulation of impacts on a single receptor, and the relationship between those impacts, may give rise to a need for additional mitigation. Table 24.43 summarises the inter-relationships that are considered of relevance to traffic and transport and identifies where they have been considered within the ES.

Table 24.43 Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter	Rationale
The relationship between traffic delay and traffic noise upon local residents.	Chapter 25 Noise and Vibration	Traffic data included in the assessment is presented in Chapter 25 Noise and Vibration.	Increased traffic has the potential to increase noise disturbance temporarily.
The relationship between traffic delay and traffic related air quality upon local residents.	Chapter 26 Air Quality	Traffic data included in the assessment is presented in Chapter 26 Air Quality.	Traffic has the potential to temporarily affect air quality.
The relationship between traffic delay and traffic related emissions upon the health of local residents.	Chapter 27 Human Health	Traffic data included in the assessment is presented in Chapter 26 Air Quality and Chapter 27 Human Heath.	Traffic movements associated with construction may generate localised dust emissions leading to potential complaints.

398. The potential for inter-relationship impacts on a link by link basis has been identified and is set out in Appendix 24.38, which sets out a link by link analysis of the accumulation of effects and reviews the mitigation proposed.

24.10 Interactions

399. The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. The worst case impacts assessed within the chapter take these interactions into account and for the impact assessments are considered conservative and robust. For clarity the areas of interaction between impacts are presented in Table 24.44 along with an indication as to whether the interaction may give rise to synergistic impacts.

Table 24.44 Interactions between impacts

Potential interaction between impacts				
Construction				
	1. Severance	**2. Pedestrian Amenity**	**3. Highway Safety**	**4. Driver Delay**
1. Severance	-	Yes	Yes	No
2. Pedestrian Amenity	Yes	-	Yes	No
3. Highway Safety	Yes	Yes	-	Yes
4. Driver Delay	No	Yes	Yes	-
Operation				
No significant impacts.				
Decommissioning				
It is anticipated that the decommissioning impacts will be no worse than those of construction.				

24.11 Summary

400. This chapter of the ES has assessed the potential impacts of the onshore element of the Norfolk Vanguard project on the surrounding traffic sensitive receptors.

401. This chapter has been developed with regards to the legislative and policy framework outlined in section 24.2.1 and further informed by consultation with Highways England and Norfolk County Council.

402. Traffic demand has been calculated with regards to an access strategy that has been adopted for the project and is secured through an OTMP (document reference 8.8) an OTP (document reference 8.9) and an OAMP (document reference 8.10).

403. In accordance with national guidance (GEART) a traffic and transport study area was identified, baseline conditions established and sensitive receptors identified. The traffic and transport study area was screened to identify routes that could be potentially impacted by the projects' traffic generation.

404. A total of 86 highway links within the traffic and transport study area have been assessed for the effects of severance, pedestrian amenity, road safety and driver delay. With the application of mitigation measures (as appropriate) the residual impact for all highway links (bar link 69) was assessed to be not significant.

405. Link 69 has a mitigated traffic demand of 48 daily HGV movements and the effect is considered to be of low magnitude. However, noting the high sensitivity of the receptor it is expected that the residual impact significance would be marginally **moderate adverse**.

406. The assessed impact is very localised (impacting on a small number of dwellings) and is for a relative short duration. It is considered community engagement to establish clear lines of communication to the appointed contractor would serve to identify periods that are particularly sensitive to HGV movements and that could further mitigate this impact.

407. The OTMP (document reference 8.8) contains a specific commitment to managing the HGV movements on link 69 and notes the need for community engagement.

408. Table 24.45.summarises the traffic and transport impact assessment.

Table 24.45 Potential impacts identified for traffic and transport

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Construction						
Impact 1: Pedestrian Severance	Links: 6, 8, 9, 10, 13a, 13b, 14, 16, 17, 18, 19, 21, 22, 24, 25, 29, 30, 32, 33, 34, 35a, 35b, 36, 37, 40a, 40b, 41, 42, 44a, 44b, 45, 46, 47b, 47c, 49, 52, 53, 54, 55, 56, 57, 58, 59, 60, 64, 65, 66, 67, 68, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79.	Low – High	Very Low -	Negligible - Minor	N/A	Negligible – Minor
	69	High	High	Major	Specific targeted TMP measures.	Moderate
Impact 2: Pedestrian Amenity	Links: 6, 8, 9, 10, 13a, 13b, 14, 16, 17, 18, 19, 21, 22, 24, 25, 29, 30, 32, 33, 34, 35a, 35b, 36, 37, 40a, 40b, 41, 42, 44a, 44b,	Low – High	Low – High	Minor – Major	Specific targeted TMP measures.	Minor

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
	45, 46, 47b, 47c, 49, 52, 53, 54, 55, 56, 57, 58, 59, 60, 64, 65, 66, 67, 68, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79.					
	69	High	High	Major	Specific targeted TMP measures.	Moderate adverse
Impact 3: Road Safety	Clusters: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19	Negligible - Medium	Low - Medium	Minor - Moderate	Specific targeted TMP measures.	Minor adverse
Impact 4: Driver Delay	Junctions: 1, 2, 3, 4	High	Low - Very Low	Minor	n/a	Minor adverse
Operation						
All impacts	All links	Low - High	Very Low	Negligible, or up to localised minor adverse	n/a	Negligible, or up to localised minor adverse
Decommissioning						
Impacts upon those links serving the cable route works would be significantly less than the construction phase whilst impacts upon those links primarily serving the onshore project substation (link 1) would be no worse than construction. Therefore, the overall magnitude of effect would be negligible to minor adverse and where appropriate similar mitigation strategies as presented for construction would be valid.						
Cumulative during construction						
Norfolk Boreas Offshore Wind Farm	As per construction.					
Hornsea Project Three Offshore Wind Farm	Refer to section 24.8.1.2					

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
Dudgeon Offshore Wind Farm	As per construction.					
Bacton Gas Terminal Extension	As per construction.					
Bacton Gas Terminal Coastal Protection						
Bacton and Walcott Coastal Management Scheme						
A47 Improvement Corridor Programme	As per construction.					
A47/A12 Junction enhancements to the following junctions and roundabouts: Vauxhall, Gapton Hall, Harfreys, Bridge Road and James Paget Hospital.	As per construction.					
Norwich Western Link	As per construction.					
Third River Crossing (Great Yarmouth)	As per construction.					
King's Lynn B Power Station amendments	As per construction.					

Potential impact	Receptor	Value/ sensitivity	Magnitude	Significance	Mitigation	Residual impact
PF/17/1951 Erection of 43 dwellings and new access with associated landscaping, highways and external works, and amendments to substation)	As per construction.					
Cumulative during operation						
No cumulative impacts are anticipated as there are no operational impacts associated with Norfolk Vanguard.						
Cumulative during decommissioning						
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.						

24.12 References

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