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From: Faulkner, Stephen
To: Norfolk Vanquard
Subject: RE: Norfolk Vanguard - Secretary of State Consultation
Date: }17\mathrm{ December 2019 10:47:05
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FAO Gareth Leigh
Norfolk Vanguard Project Case Team

Thank you for your email below and attached letter dated 6 December 2019.

Norfolk County Council will fully respond to the queries raised in the letter in due course.

In the meantime I would like to clarify that with regard to: Appearance of Electrical Equipment (paragraphs 17 -19); and Control of Noise During Operational Phase (Paragraphs 26 and 27) these are matters for the respective District Councils to consider and respond to accordingly in their Local Planning and Environmental Health roles.

I note that Breckland District Council has not been sent a copy of the letter referred to above and as such I have forwarded it to the District Council's Planning Department for information

Kind regards

Stephen

## Stephen Faulkner MRTPI

Principal Planner
Community and Environmental Services
Telephone: 01603222752


From: Norfolk Vanguard [NorfolkVanguard@planninginspectorate.gov.uk](mailto:NorfolkVanguard@planninginspectorate.gov.uk)
Sent: 06 December 2019 16:22
Cc: Norfolk Vanguard [NorfolkVanguard@planninginspectorate.gov.uk](mailto:NorfolkVanguard@planninginspectorate.gov.uk)
Subject: Norfolk Vanguard - Secretary of State Consultation

WARNING: External email, think before you click!.

Dear Sir / Madam,
Please find attached a letter from the Secretary of State.

Kind regards,
Norfolk Vanguard Project Case Team

To see our email disclaimer click here http://www.norfolk.gov.uk/emaildisclaimer

Community and Environmental Services
County Hall Martineau Lane Norwich
NR1 2SG
Department for Business, Energy \& Industrial Strategy
1 Victoria Street
LONDON
SW1H 0ET


Thank you for your letter of 6 December 2019 requesting additional information from Norfolk County Council to which we would like to respond as follows:-

Traffic Movements at Cawston - paragraph number 11 to 16
Norfolk County Council still believes a suitable access strategy can be produced that mitigates the impact to highway users sufficient to offset potential harm from in-combination traffic effects arising from the proposed Norfolk Vanguard project and H3 in the event that both are granted development consent. However:-

1. As Highway Authority we make no assessment relating to residential amenity. Our remit is confined to assessing impact upon highway users and we leave it for Broadland District Council to respond to you on amenity issues.
2. Whilst we have now received revised drawings, which are broadly in line with our expectations, we only received an updated road safety audit (RSA) from the applicants today and accordingly we have not yet had the opportunity to review the contents. Until such time as a RSA is agreed, which overcomes the safety concerns previously raised by the external auditors, we cannot agree that a suitable mitigation scheme exists.

We note from your letter that further comments will be invited from interested parties within 28 days (if appropriate) and believe we will be able to provide a firm view on the acceptability of the RSA by that date.

In the circumstances, given the fact a mitigation scheme has not yet been agreed, Norfolk County Council can see the merit in the revised text to requirement 21 as suggested by the Secretary of State. In the event of the scheme failing to pass the safety audit, a revised scheme of traffic mitigation will need to be submitted. Accordingly we have no objection to the proposed amendment.

As the Secretary of State may be aware, the mitigation scheme for Cawston is also being considered as part of the examination for the Norfolk Boreas NSIP. Given the close relationship between Norfolk Vanguard and Boreas, with Vanguard delivering essential infrastructure for Boreas, we are unclear what would happen if the Boreas Inspector finds the mitigation scheme proposed by Norfolk Vanguard is unacceptable and finds in favour of a different solution.

## Additions to Trenchless Crossings paragraphs 20-21

Norfolk County Council remains firmly of the view that trenchless crossing needs to be undertaken for the B1149 and that the B1149 needs to be included within the list of trenchless crossing locations contained within Requirement 16.

Whilst the applicants have addressed our previous safety concerns within a clarification note on trenchless crossings (copy appended to this letter) the applicants solution simply raises other problems. In short resolving one issue simply creates a different problem. A copy of our response to the applicants clarification note is also appended to this letter.

In summary:-

- This specific proposal would now require the construction of a new diversion lane (shaded pink on drawing numbers TP-PB4476-DR033 and TP-PB4476-DR036 attached to the applicants trenchless crossing clarification note). The disruption to road users for this specific proposal will be significant and last for weeks and not days as implied.
- We are not convinced by the applicants argument that open cut trenching will extend their works programme for this crossing by 8 to 9 weeks. However, even if there is some inconvenience to Norfolk Vanguard (a private company undertaking these works), we do not believe that should be at the expense of the entire public using this highway, given a reasonable alternative exists.
- The applicants imply night time working would only be required for trenchless crossing. However, their Outline Traffic Management Plan indicates it could also be required for open cut trenching. It is clear that night time working could be used for either open cut or trenchless crossings in equal measure, there is little difference.
- The proposal for the B1149 will require a deep excavation and the provision of a new diversion lane. Accordingly, open cut trenching for this specific proposal will require traffic lights to be fully operational 24 hours per day, 7 days per week. In sharp contrast to trenchless crossing, which may or may not have a night time impact - the applicants proposal for open cut trenching to the B1149 will cause disruption throughout the night.
- The assessment of noise falls outside our remit and accordingly it is not an issue for the Highway Authority to assess. However open cut trenching at this specific location will require traffic signals 24 hours per day, 7 days per week with vehicles stopping and starting at the traffic signals together with associated noise.
- Open cut trenching for this specific location will not only require the road to be dug up but also requires the highway verges and adjacent hedges (together with any trees) to be dug up and removed to accommodate a diversion lane.
- The applicants indicate a typical worst case scenario of an additional 450 HGVs per trenchless crossing. However, this is not a typical crossing and the applicants do not appear to have taken into account the movements associated with the construction of the new diversion lane attributable to this specific proposal.
- The issue of long term maintenance liability is also a concern, particularly given the potential for other future large scale projects and their associated HGV load movements. Rural road structure can vary greatly, and with an increasing volume of base level traffic, notwithstanding the additional loading from these HGV movements any weakening of the surface construction derived from breaking open the bound and subgrade layers, will greatly increase the risk of carriageway failure in years to come when it has reverted to local authority responsibility.

In short to enable an open cut method would require extensive temporary carriageway widening to give adequate sideways clearance to permit through traffic whilst the road was crossed half at a time. This widening would involve the removal of mature hedgerow, and the construction of a suitable running lane in virgin verge. The nature of the verge and traffic levels at this point requires a full depth construction to enable adequate lateral restraint. We fully understand that Norfolk County Councils laboratory has provided a suitable construction specification. However, Construction would involve importing much aggregate and bituminous bound material to a rural environment, only for it to be removed again once the crossing was completed. This is not environmentally sound practice and goes against the applicants very reasons (environmental) for using open cut trenching.

## Timing of Traffic Management Measures - Paragraphs 24 and 25

These are active measures that will be implemented during the works and accordingly we believe the original text is more accurate and should be re-instated.

If further clarification is required, then please let me know.

Yours sincerely

Senior Engineer - Highways Development Manager for Executive Director for Community and Environmental Services

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Services
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Dear Sir/ Madam

NCC contact number: 03448008020
Text Relay - 1800103448008020

## Application by Norfolk Boreas Limited for the Norfolk Boreas Offshore Windfarm. Response to the applicants clarification note on trenchless crossings.

Please accept this letter as Norfolk County Councils written submissions in its capacity as local highway authority in response to documentation submitted into the examination at Deadline 4.

## 1. Introduction

The ExA will recall that Norfolk County Council has raised serious ongoing concerns regarding the applicant's proposal to use open cut trenching for the B1149 road crossing. During Issue Specific Hearing 3, the applicants indicated their reasons for selecting this method of working relate solely to environmental impact. The applicants written summary of their oral case submitted at deadline 4 also confirms this as follows: -
"The Applicant can also confirm that the decision whether or not to use trenchless installation is not primarily based on financial imperative or implication for the Applicant. The decision to use trenchless techniques is based on thorough investigation and assessments relating to environmental considerations."

To support of the applicants position, the ExA asked the applicants to submit a clarification note to set out the reasons for and against trenchless crossings for the B1149 and also Church Road, Colby. It is the County Councils contention that the applicants have produced a set of generalities that could be used for any crossing point and have not taken into account the local context of the B1149 at this specific location.

In response to the applicants clarification note we wish to comment as set out overleaf:-

## 2. Comparison of open cut trenching and trenchless crossing of highways

## Impacts to road users

The applicants state - Open cut trenching is temporary typically lasting less than 1 week.
In response - The whole point of the County Councils concern is that the B1149 is not a typical crossing. We have not objected to other "B class" roads along the cable route being crossed by open cut trenching but we do have concerns with this specific crossing.

This specific proposal requires the construction of a new diversion lane as shaded pink on drawing numbers TP-PB4476-DR033 and TP-PB4476-DR036 attached to the applicants trenchless crossing clarification note. The disruption to road users for this specific proposal will be significant and last for weeks (see also our detailed comments under the heading timescale below).

## Working hours

The applicants - indicate night time working may be needed for trenchless crossings but imply it will not be required with open cut trenching.

In response - The applicants Outline Traffic Management Plan for open cut trenching states at para 113 that "...To minimise the impact of closures or diversions, night working could be employed." Accordingly it is clear that night time working could be used for either open cut trenching or trenchless crossings in equal measure, there is no difference. The Outline Traffic Management Plan is clearly at variance with the clarification note on Trenchless Crossings, they cannot both be right. We are of the view that it is the applicants trenchless crossing clarification note that gives a false impression.

The applicants - State that for "technical reasons", night time working may be necessary with trenchless crossing but give no such indication for open cut trenching.

In response - The applicants do not provide any indication as what those "technical" reasons may be. It is equally clear from the Outline Traffic Management Plan that "technical" reasons could require night time working with both methods.

The proposal for the B1149 will require a deep excavation and the provision of a new diversion lane. For these reasons, open cut trenching for this specific proposal will require traffic lights to be fully operational 24 hours per day, 7 days per week. In sharp contrast to trenchless crossing, which may or may not have a night time impact - the applicants proposal for open cut trenching to the B1149 will cause disruption throughout the entire working period both day and night.

Given the status of the B1149 as a "band 4" traffic sensitive street, the traffic lights will also need to be under manual control at peak times.

## Works footprint

The applicants indicate - Additional temporary land requirements for laydown areas and facilities will be required for trenchless crossings.

In response - The Outline Traffic Management Plan clearly indicates at para 45 that open cut trenching also requires a running track to deliver equipment to the installation site from mobilisation areas and will also require separate storage areas for topsoil and subsoil.

Open cut trenching for this specific proposal to the B1149 will not only require the road to be dug up but also requires the highway verges and adjacent hedges (together with any trees) to be dug up and removed to accommodate a diversion lane (see area shaded pink on drawing numbers TP-PB4476-DR033 and TP-PB4476-DR036 attached to the applicants clarification note).

## Timescale

The applicants state - Open cut trenching is typically likely to be completed in days, but trenchless crossing will take up to 6 weeks as there is a requirement to "...conduct the crossing, allowing for setup of temporary areas and additional equipment, period of drilling and subsequent demobilisation and removal of equipment and materials".

In response - The whole point of the County Councils concern is that this is not a typical crossing. We have not objected to other "-class" Broads along the cable route being crossed by open cut trenching but we do have concerns with the specific proposal to the B1149.

This specific proposal requires:-

- Installation of traffic lights
- Creation of storage areas for the materials excavated from the verges to be kept.
- Excavation and removal of the existing verges and hedges.
- Construction of a new diversion lane over the former verge - including the importation of raw materials.
- New road marking to be painted on the carriageway surface
- Saw cut and remove one side of the existing carriageway - with removal of materials from site.
- Import new granular back-fill material to infill the excavation.
- Reinstate the original road.
- Remove and dispose of the temporary running surface material from the diversion lane
- Relocate the traffic signals and signs.
- Repeat the whole process all over again on the opposite side of the road.
- Reinstate the verges and plant new hedges.
- Demobilisation

The disruption to road users will be significant and last for weeks.

## Materials and Transport

The applicants state - Negligible additional materials will be required for open cut trenching compared to trenchless crossing in agricultural land, with exception to some minor traffic management and resurfacing materials, however this is offset by no running track material requirements.

In response - this proposal does not simply involve negligible resurfacing of the existing road but:-

- Requires the highway verges and adjacent hedges and part of the field to be dug up and removed to accommodate a diversion lane. (see area shaded pink on drawing numbers TP-PB4476-DR033 and TP-PB4476-DR036 attached to the applicants clarifiacation note).
- Importing new raw materials to construct the diversion lane.
- Importation of granular back-fill for the deep excavation.
- The Outline Traffic Management Plan clearly indicates at para 45 that open cut trenching would require a running track to deliver equipment to the installation site from mobilisation areas and will require separate storage areas for topsoil and subsoil.

The applicants state - state that approximately 8 HGV deliveries will be required per notional 15 m highways open cut trenched crossing.

In response - The applicants do not give a total number of movements or the calculation of how many m 2 of excavation there will be, but simply say 8 movements per 15 m 2 of excavation. One thing is clear, there will be a lot more than 15 m 2 of excavation to construct the new diversion lanes and a lot more than 8 movements.

The applicants state - With reference to Appendix 24.20 [APP-635], worst case additional deliveries of 450 HGVs per trenchless crossing.

In response - This is not a typical crossing and it is very clear the applicants have not taken into account the movements associated with the construction of the new diversion lane attributable to this specific proposal and the calculations to show how the 450 movements have been derived are not substantive.

## Equipment / plant and associated noise levels

The assessment of noise falls outside our remit and accordingly it is not an issue for the Highway Authority to assess. However we would like to make the following comments:-

- As with working hours mentioned above - the applicants Outline Traffic Management Plan for open cut trenching states at para 113 that "To minimise the impact of closures or diversions, night working could be employed. Accordingly it is clear that night time working could be used for either open cut trenching or trenchless crossings, there is no difference.
- In contrast, open cut trenching at this specific location will require traffic signals 24 hours per day, 7 days per week with vehicles stopping and starting at the traffic signals together with associated noise.

In summary, we are having difficulty reconciling the applicants claim that their proposal for open cut trenching is based on a "...thorough investigation and assessments relating to environmental considerations" as claimed within their clarification note.

In addition, we do not understand the applicants statement within their EIA that they will use "...trenchless crossing techniques at key sensitive environmental features, including but not limited to; waterways, protected wildlife sites, woodlands, long distance cycle route/footpaths, and major transport corridors to avoid significant environmental disturbance" and yet they are now saying that trenchless crossing (rather than open cut trenching) would actually cause significant environmental disturbance!

## 3. Considerations for the Proposed Open Cut Method at the B1149

## Road Network Disruption Review

We agree with the applicants that "...open cut trenching for the B1149 project would need to be carried out by closing a lane of the carriageway and providing traffic signal control to safely introduce single file traffic (known as 'one-way working').

## Traffic Flow Data

We have no issue with the traffic flow data.

## Network Disruption Conclusion

We disagree with the applicants claim that these works are capable of being undertaken outside of the periods of 7:30am to 9 am and 4 pm to 7 pm with the road being open to two-way traffic thereafter.

Department for Transport Chapter 8 states that if it is not possible to maintain adequate sideways clearance for 2 way traffic to be facilitated, then the carriageway must be reduced to single carriageway width and traffic management deployed. Given the use of the B1149 by HGV's; PSV's etc, the width required is 6.75 m to maintain 2 way traffic. The width cannot be maintained and accordingly traffic lights will be required throughout the entire working period, both day and night.

Irrespective of the above, this project involves a deep excavation and the construction of a new diversion lane. The scale and nature of the works is such that it would not be feasible to open the road to two way running during construction. This proposal will require traffic lights to be fully operational 24 hours per day, 7 days per week. Even if it were possible for the applicants to open the road to two way running each day (which it isn't) it would simply extend the timescale and cause additional disruption to highway use for a longer period. The disruption will already last weeks and not days as indicated by the applicants.

Given the status of the road as a "band 4 " traffic sensitive street, the traffic lights will need to be under manual control at peak times.

## Long-Term Maintenance Liability Review

The issue of long term maintenance liability remains a concern, particularly given the potential for other future large scale projects and their associated HGV load movements. Rural road structure can vary greatly and with an increasing volume of base level traffic, notwithstanding the additional loading from these HGV movements. Any weakening of the surface construction derived from breaking open the bound and subgrade layers will
greatly increase the risk of carriageway failure in years to come when it has reverted to local authority responsibility.

## Cumulative Traffic Management

The County Council agrees the proposed diversion lane is technically feasible, but the solution offered for the B1149 is not a typical open cut trench and the applicants claim under their heading of timescale that this can all be provided and completed in days is not realistic.

The scale and nature of the works is such that this proposal will require traffic lights to be fully operational 24 hours per day, 7 days per week. In addition, the disruption will last weeks and not days as indicated by the applicants.

Given the status of the road as a "band 4" traffic sensitive street, the traffic lights will need to be under manual control at peak times.

## Conclusions

We do not agree with the applicants conclusions.
The County Council is of the opinion that an open cut method of duct installation at this specific point on the B1149, whilst not impossible, is impractical. We still wish to see a trenchless method used similar to that at other points on this cable route.

The road width and scale of the works is such that traffic signal control would be necessary 24 hours per day, 7 days per week. This would need manual control consideration at peak traffic times due to the roads' Traffic Sensitive designation (Band 4 0730 - 0900 and 1600 - 1900). The crossing point whilst having reasonable forward visibility would benefit from additional signage to alert approaching traffic particularly from the north approach. This traffic management would need to be in place for the full duration of the crossing works on a $24 / 7$ basis. Trenchless methods require no carriageway incursion of works or traffic management.

To enable an open cut method would require extensive temporary carriageway widening to give adequate sideways clearance to permit through traffic whilst the road was crossed half at a time. This widening would involve the removal of mature hedgerow, and the construction of a suitable running lane in virgin verge. The nature of the verge and traffic levels at this point requires a full depth construction to enable adequate lateral restraint. We fully understand that Norfolk County Councils laboratory has provided a suitable construction specification. Construction would involve the importion of much aggregate and bituminous bound material to a rural environment, only for it to be removed again once the crossing was completed. This is not environmentally sound practice and goes against the applicants very reasons (environmental) for using this crossing methodology.

The issue of long term maintenance liability is also a concern, particularly given the potential for other future large scale projects and their associated HGV load movements. Rural road structure can vary greatly, and with an increasing volume of base level traffic, notwithstanding the additional loading from these HGV movements any weakening of the surface construction derived from breaking open the bound and subgrade layers will greatly increase the risk of carriageway failure in years to come when it has reverted to local authority responsibility.

We remain firmly of the view that trenchless crossing methods need to be employed for this crossing.

We have not undertaken any assessment in relation to the acceptability of removing the hedgerow and/or trees as required for the construction of the proposed diversion lane as this falls outside our remit and rests with Broadland District Council.
4. Considerations for the Proposed Open Cut Method at Church Road, Colby

We understand this is an issue that has been raised by North Norfolk District Council.
Whilst the County Council has not insisted on trenchless crossing for this particular road, we would have no objection to the use of this method.

Yours sincerely


Senior Engineer - Highways Development Manager for Executive Director for Community and Environmental Services

# Norfolk Boreas Offshore Wind Farm Clarification Note Trenchless Crossings B1149 and Church Road, Colby 

| Date | Issue No. | Remarks / Reason for Issue | Author | Checked | Approved |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $28 / 01 / 2020$ | 01D | First draft for Internal Review | AH/RE/AR | $\mathrm{CD} / \mathrm{VR}$ | JL |
| $30 / 01 / 2020$ | 01F | Final for Deadline 4 submission | AH/RE/AR | CD | JL |

## Table of Contents

1 Introduction ..... 4
2 Comparison of open cut trenching and trenchless crossing of highways ..... 4
3 Considerations for the Proposed Open Cut Method at the B1149 ..... 6
4 Considerations for the Proposed Open Cut Method at Church Road, Colby ..... 10
5 References ..... 15
Table of Tables
Table 2.1 Comparison of open cut trench and trenchless crossing methods ..... 4
Table 3.1 Traffic Flow Data (two-way flows) ..... 8
Table of Appendices
Appendix 1 B1149 Automatic Traffic Counters Data
Appendix $2 \quad$ B1149 Pavement Testing Results
Appendix $3 \quad$ B1149 Traffic Management Plans
Appendix 4 Church Road, Colby Access Layout
Appendix 5 Church Road, Colby Access Aerial Image

## Glossary of Acronyms

| AAWT | Annual Average Weekly Traffic |
| :--- | :--- |
| ATC | Automatic Traffic Count |
| dDCO | Draft Development Consent Order |
| DMRB | Design Manual for Roads and Bridges |
| ES | Environmental Statement |
| HGV | Heavy Goods Vehicle |
| LWA db(A) | A-weighted sound power level in decibels |
| M | Metres |
| Mph | Miles per hour |
| NPL | Norfolk Partnership Laboratory |
| OLEMS | Outline Landscape and Ecological Management Strategy |
| TC | Trenchless Crossing Point |
| TEMPro | Trip End Model Presentation Programme |

## 1 Introduction

1. Following Issue Specific Hearing 3 on Onshore Effects including the draft Development Consent Order held on Tuesday 21 ${ }^{\text {st }}$ January 2020, an action was identified by the Examining Authority for the Applicant to produce a Clarification Note to set out the reasons for and against trenchless crossings at B1149 and at Church Road, Colby, to include plans to an appropriate scale. This clarification note has been produced to address the request from the Examining Authority.

## 2 Comparison of open cut trenching and trenchless crossing of highways

2. Open cut trenching and trenchless crossing duct installation methods for the crossing of highways are detailed within Section 5.7.2.3.3 and Section 5.7.2.4 of Environmental Statement Chapter 5 Project Description [APP-218] respectively.
3. Crossing of highways for duct installation is required only in Scenario 2.
4. A comparison of open cut trenching and trenchless crossing methods is provided in Table 2.1 based on a range of parameters and with reference to the application documents.

Table 2.1 Comparison of open cut trench and trenchless crossing methods
$\left.\begin{array}{|l|l|l|}\hline \text { Parameter } & \text { Open Cut Trench Crossing } \\ \text { Impacts to } \\ \text { road users }\end{array} \begin{array}{l}\text { Temporary (typically less than 1 week) } \\ \text { impacts to road users which may include } \\ \text { traffic management measures such as single } \\ \text { lane closure or road closure or diversion. }\end{array} \quad \begin{array}{l}\text { No direct impacts to road users } \\ \text { Working } \\ \text { hours }\end{array} \begin{array}{l}\text { Consented construction hours: } \\ 07.00-19.00 \text { Monday to Friday } \\ 07.00-13.00 \text { Saturday } \\ \text { No work on Sundays or public holidays. } \\ \text { As set out in Requirement 26. }\end{array} \quad \begin{array}{l}\text { Consented construction hours: } \\ 07.00-19.00 \text { Monday to Friday } \\ 07.00-13.00 \text { Saturday } \\ \text { Trenchless crossings may require works to } \\ \text { extend outside of the consented hours (for } \\ \text { technical reasons following commencement } \\ \text { of drilling), i.e. works may extend into the } \\ \text { evening or night time. } \\ \text { Should works be required to extend beyond } \\ \text { the consented hours then prior approval } \\ \text { would be required from the relevant planning } \\ \text { authority as set out in Requirement 26. }\end{array}\right\}$

| Parameter | Open Cut Trench Crossing |  |  | Trenchless Crossing |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Materials and Transport | Negligible additional materials required to be delivered compared to open cut trenching in agricultural land, with exception to some minor traffic management and resurfacing materials, however this is offset by no running track material requirements. With reference to Appendix 24.20 [APP-635], approximately 8 HGV deliveries per notional 15 m highways open cut trenched crossing. |  |  | Significant additional materials and associated traffic movements to establish and remove additional temporary works areas and drilling equipment to the location. With reference to Appendix 24.20 [APP-635], worst case additional deliveries of 450 HGVs per trenchless crossing. |  |  |
| Equipment <br> / plant <br> and associated noise levels | Negligible add trench cros trenching in <br> Noise level equipment | itional equi g compared gricultural <br> rovided fo | uipment for open cut d to open cut land. <br> associated | Additional equi required with a <br> Noise levels pro equipment. <br> Trenchless cros | ment for tre sociated nois <br> vided for ass <br> ing (daytime | chless crossings <br> ciated |
|  | Duct installation (daytime) |  |  | Name | LwA$\mathrm{dB}(\mathrm{~A})^{*}$ | On time Correction** |
|  | Name | LwA $\mathrm{dB}(\mathrm{A})^{*}$ | On time Correction** |  |  |  |
|  | Bulldozer | 108 | $75 \%$ | Tracked Excavator | 107 | 50\% |
|  | Dump <br> Truck | 107 | 75\% | Backhoe Loader | 96 | 50\% |
|  | Tracked Excavator | 107 | 75\% | Bulldozer | 108 | 50\% |
|  | Generator 105 100\% |  |  | Dumper | 101 | 50\% |
|  | Water <br> Pump | 93 | 75\% | Mobile Crane | 106 | 25\% |
|  |  |  |  | Cement Mixer | 103 | 25\% |
|  | Dump Truck | 115 | 15km/h |  |  |  |
|  |  |  |  | Concrete <br> Pump | 108 | 25\% |
|  | Lorry | 108 | 15km/h |  |  |  |
|  | Evening / night-time activities None |  |  | Piling | 118 | 10\% |
|  |  |  |  | Drilling Rig | 105 | 75\% |
|  |  |  |  | Water Pump | 93 | 75\% |
|  |  |  |  | Generator | 105 | 100\% |
|  |  |  |  | Trenchless crossing (evening / night-time) |  |  |
|  |  |  |  | Name | LwA dB(A)* | On time Correction** |
|  |  |  |  | Backhoe Loader | 96 | 50\% |
|  |  |  |  | Dumper | 101 | 50\% |
|  |  |  |  | Drilling Rig | 105 | 75\% |


| Parameter | Open Cut Trench Crossing | Trenchless Crossing |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  | Water Pump | 93 | $75 \%$ |
|  |  | Generator | 105 | $100 \%$ |

* A-weighted sound power level in decibels
** Percentage of assessment period that plant is expected to be in operation

5. In summary, trenchless crossing methods mitigate direct impacts to the highway and highway users. However, the additional trenchless crossing equipment, associated materials and methodology requirements results in a number of additional wider impacts including an extended installation timescale, notable additional HGV deliveries of materials and additional temporary land requirements.
6. Conversely, open cut trench crossing methods do not require notable additional materials or equipment as the duct installation method is similar to that employed through the majority of the onshore cable route, including in agricultural land either side of the crossing. During the crossing works, impacts to highway users can be mitigated through the use of traffic management measures for the short installation period (typically less than 1 week) and additional impacts associated with trenchless crossing methods (e.g. additional equipment, materials, temporary land, HGV deliveries etc.) are fully mitigated.
7. The application of open cut trenching or trenchless crossing methods at highways crossings has been carefully considered, in consultation with the Highways Authority, acknowledging the benefits and drawbacks of each methodology. Where justification has been provided through an evidential basis that impacts to road users would be significant through the use of open cut trenching, the use of trenchless crossing methods has been committed to (and secured in Requirement 16 of the dDCO ). Where assessments have illustrated that traffic management measures are sufficient to mitigate impacts to road users, the use of open cut trenching is proposed to limit additional indirect impacts associated with the onshore duct installation.

3 Considerations for the Proposed Open Cut Method at the B1149
8. Norfolk County Council raised concerns with the use of open cut trenching on the B1149 and an investigation was undertaken in response to the concerns raised, further details are provided below.

### 3.1 Road Network Disruption Review

9. The principal guidance for temporary traffic management situations in the UK is Chapter 8 of the Traffic Signs Manual (Department for Transport, 2009¹) ('Chapter

[^0]$8^{\prime}$ ). Chapter 8 gives detailed specification for roadworks for a wide range of traffic situations.
10. Open cut trenching for the Project would be carried out by closing a lane of the carriageway and providing traffic signal control to safely introduce single file traffic (known as 'one-way working'). Paragraph D5.1.6 of Chapter 8 details the maximum vehicle flows at which significant delays would be experienced by traffic subjected to one-way working as follows:
'On roads where flows are very high, overload of the controlled area is possible and exceptional delays may result. This can occur with two-way flows as low as 1,300 vehicles per hour (for sites about 50m long)....' (Department for Transport, 2009)
11. Thus, the 1,300 vehicle per hour is adopted as the 'Chapter 8 thresholds' to determine if the open cut method would lead to significant network disruption at the B1149.

### 3.1.1 Traffic Flow Data

12. Baseline traffic flow data for the B1149 was captured via seven-day Automatic Traffic Counters (ATC) commissioned by Norfolk Vanguard Limited at a location approximately 65 m north of the crossing point. Original ATC were captured as part of Chapter 24 of the Environmental Statement (ES), undertaken on the $19^{\text {th }}$ April 2017 to $25^{\text {th }}$ April 2017, and this data is provided in Appendix 1. The traffic count data is summarised in Table 3.1.
13. A review of the surveyed traffic data identifies network peak hours of 7:30am to 8:30am and 4:30pm to 5:30pm.
14. Within Table 3.1, the surveyed flows have been growthed to the forecast year of 2023 (the earliest start of construction for Norfolk Boreas - Scenario 2). Annual Average Weekly Traffic (AAWT) has been derived to reflect the Project's predominate weekday traffic demand. The growth factors for AAWT peak hours have been derived from the Department for Transport Trip End Model Presentation Programme (TEMPro2) Version 7.2 with data set 72 for the Broadland (B1149) geographical area.
15. To account for daily fluctuations in traffic flows a $10 \%(-5 \% /+5 \%)$ daily fluctuation factor has been applied to the 2023 forecast flows.
16. In addition, the daily development flows (employees and HGVs) for both Norfolk Boreas and Hornsea Project Three have been taken from the respective examination documentation (and as presented in the cumulative impact assessment section 24.8 of ES Chapter 24 [APP-237] and added to the maximum (+5\%) 2023 forecast flows.
17. The final 2023 forecast flows presented in Table 3.1 are considered to be the maximum worst case flows that the B1149 would experience during open cut trenching.

Table 3.1 Traffic Flow Data (two-way flows)

| Time Periods |  | Surveyed <br> Flows | TEMPro <br> Growth <br> Factors | $2023$ <br> Daily <br> Forecast <br> Flows | 2023 <br> Forecast <br> Daily <br> Fluctuations |  | Norfolk Boreas <br> 2023 Daily <br> Development <br> Flows |  | Hornsea Project 3 <br> Daily <br> Development <br> Flows |  | Total 2023 <br> Daily Forecast <br> Flows with Developments Total Vehicles |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | $\begin{gathered} \text { Min } \\ (-5 \%) \end{gathered}$ | $\begin{aligned} & \text { Max } \\ & (-5 \%) \end{aligned}$ | Employee Vehicles | HGVs | Employee Vehicles | HGVs |  |
| B1149 |  |  |  |  |  |  |  |  |  |  |  |
| 24hr AAWT ${ }^{1}$ | 24hrs | 5,645 | 1.1324 | 6,292 | 6,072 | 6,712 | 173 | 212 | 232 | 162 | 7,491 |
| Weekday am Peak | $\begin{aligned} & \text { 7:30am } \\ & \text { to } \\ & \text { 8:30am } \end{aligned}$ | 513 | 1.1234 | 547 | 540 | 605 | 87 | 21.2 | 116 | 17 | 846 |
| Weekday pm Peak | $\begin{aligned} & 4: 30 \mathrm{am} \\ & \text { to } \\ & 5: 30 \mathrm{pm} \end{aligned}$ | 561 | 1.1261 | 631 | 600 | 663 | 87 | 21.2 | 116 | 17 | 904 |
| 1 | Annual Average Weekly Traffic |  |  |  |  |  |  |  |  |  |  |

### 3.1.2 Network Disruption Conclusion

18. As can be seen by Table 3.1, both the forecast 2023 AM (846) and PM (904) peak flows (for both Project alone and cumulative traffic flows) are well below the Chapter 8 thresholds of 1,300 two-way vehicle flows for one-way working.
19. Therefore, it is considered that one-way working remains appropriate for the B1149 and will not result in significant network disruption. It is noted that the B1149 is defined by Norfolk County Council as a traffic sensitive route and in accordance with this stipulation, all roadworks will be undertaken outside of the periods of 7:30am to 9 am and 4 pm to 7 pm and the road would be open to two-way traffic thereafter.
20. With the combination of the identified low traffic flows and previously identified traffic mitigation measures in place, no more than a minor adverse residual impact would be experienced on the B1149 during the open cut trench crossing works, which is not significant in Environmental Impact Assessment terms.

### 3.2 Long-Term Maintenance Liability Review

21. Norfolk County Council's concern was that the trench reinstatement would become a long term maintenance liability (after the mandatory 3 year maintenance period).
22. In response, Norfolk Vanguard Ltd. commissioned local pavement specialists, the Norfolk Partnership Laboratory (NPL) to investigate ground conditions at the B1149 and ascertain if an appropriate road reinstatement specification is feasible. NPL
undertook four core sample ground investigations in the approximate location of the proposed open cut trench crossings on the B1149.
23. Appendix 2 contains the core testing results. In summary, the testing indicates that there is good load bearing subgrade (known as the California Bearing Ratio test) and accordingly the road can be suitably reinstated. A specification has been developed for the reinstatements to minimise the potential for future maintenance liability by minimising the risk of differential settlement and reflective cracking. Appendix 2 also contains the recommended pavement specification for each trench location. The specification uses readily available material and established trenching techniques and would be adopted by a suitably accredited contractor.
24. Based on the findings of the laboratory tests and the recommended reinstatement specification, it is concluded that adverse maintenance liability can be mitigated and therefore open cut trenching remains an appropriate method. The specification will be secured in an update to the Outline Traffic Management Plan to be submitted at Deadline 5.

### 3.3 Cumulative Traffic Management

25. Norfolk County Council has raised specific concerns relating to the cumulative interaction of the Project's and Hornsea Project Three's traffic. With regard to oneway working the specific concerns are:
1) Accommodating the large volume of abnormal loads delivering cable drums to the Hornsea Project Three main compound at Oulton; and
2) Ensuring the roadworks do not lead to 'blocking back' of the B1149/The Street, Oulton junction; or vehicles do not approach the back of a queue unsighted from the B1149 south, hump back bridge; and
3) The need for a 1.2 m wide safety zone.
26. Appendix 3 sets out the proposed one-way traffic management concept design for the B1149 (to be included in the updated Outline Traffic Management Plan to be submitted at Deadline 5). The roadworks design incorporates a wide one way lane $(4.5 \mathrm{~m})$ to accommodate the Hornsea Project Three abnormal loads and a 1.5 m wide safety zone within the current Order limits for Norfolk Boreas. It can also be observed from Appendix 3 that the road works terminate some 210 m southeast of the B1149/The Street, Oulton junction ensuring that the risk of traffic blocking back to the B1149/The Street junction would be minimised. Furthermore, the roadworks terminate some 430 m northwest of the hump back bridge ensuring the risk of queue length collision is minimised. The updated traffic management design was shared with Norfolk County Council at a meeting on the 15th January 2020 and it was confirmed that officers had "no technical objection" to the proposal.
27. The traffic management methodology employs single lane working controlled by traffic signals to enable the trench to be cut and reinstated in sections whilst maintaining the flow of traffic. In order to accommodate the required AIL and safety zone widths it is necessary to widen the carriageway to provide the requisite clearance. This widening will be temporary and will be reinstated following trench reinstatement, however to accommodate the traffic outlined it will be of robust construction and require some additional HGV movements. It is noted that the B1149 is designated a traffic sensitive route and therefore there may be restrictions on working during the hours of 07:30 to 09:00 and 16:00 to 19:00, Monday to Friday
28. It is concluded that the specific cumulative traffic concerns have been designed out at the B1149 crossing.

### 3.4 Conclusion

29. An open cut trench crossing is deemed appropriate as there is no evidence to suggest that this form of crossing will cause significant adverse impacts or present a maintenance liability.
30. Conversely, the use of a trenchless crossing method would introduce alternate impacts, including up to 450 additional HGV deliveries to support the method, extended installation timescales and the requirement for additional temporary land.
31. It should be noted that there are currently no temporary works areas in proximity to the B1149. As such it would not be possible to undertake a trenchless crossing in this location without additional land outside of the current Order limits. However, the evidence presented within this note demonstrates that that an open cut trench solution is appropriate for the B1149.

## 4 Considerations for the Proposed Open Cut Method at Church Road, Colby

32. The Environmental Statement Chapter 29 identifies that at Church Road, Colby localised trees are susceptible to significant effects. In these locations open trenching would be carefully sited so as to minimise the number of trees to be removed, targeting poorer condition specimens or by using existing gaps in the tree line. However, restrictions applied to planting over cable easements prevents trees from being replanted over the 13 m easement and immediately either side. Therefore, a significant effect would occur in relation to the removal of trees owing to their good condition and that direct replacement planting would not possible.
33. North Norfolk District Council identified in their Local Impact Report [REP2-087] that they believe that at this location the duct should be installed via a trenchless crossing technique so as to avoid the loss of trees at this location. As detailed above the ES considered the potential for localised tree loss at this location.

### 4.1 Additional Requirements

34. As detailed in section 2, the inclusion of a trenchless crossing of Church Road, Colby would require;

- Additional laydown areas and facilities associated with additional trenchless crossing equipment not currently secured within the Order Limits;
- Additional HGV movements;
- Longer duration for duct installation; and
- Additional equipment for trenchless crossings required with associated noise.

35. The prolonged works period and alternate construction methodology (compared to trenched installation) would result in additional construction impacts including noise, light, traffic, dust, vibration and land use which have not been assessed within the Environmental Statement.

### 4.2 Access Layout

36. At this location an access is required directly from the road to the cable route, in order to access works from MA8 (to the south-west) to TC11 (to the north-east). This is because TC11 is committed as a 'stop end' to mitigate direct impacts to Kings Beck (which is a sensitive watercourse), see ES Figure 5.4 Map 3 [APP-268]. Therefore, access either side of Church Road would be required to access the trenchless crossing at this location.
37. Appendix 4 details the general arrangement of the proposed access (AC58) and for context, Appendix 5 details the access layout overlaid on aerial photography.
38. It can be noted that (in accordance with HGV routing embedded mitigation) AC58 has been designed to accommodate HGV access from the north only. An assumed 30mph speed limit is applied (enforced by temporary traffic management) to minimise the required visibility splays and associated clearance of vegetation.
39. Notwithstanding these design relaxations, a significant area vegetation removal is required to implement safe access. As such, a trenchless crossing here would not remove the necessity to open a notable gap in the hedgerow and removal of any associated trees.

### 4.3 HGV Traffic Management

40. Noting the width of Church Road (single lane carriageway) a road closure may be required to implement an open cut trench. This would be a temporary closure lasting a few days during which traffic would be diverted round via the A140.
41. As set out in Table 2.1, a trenchless crossing generates in excess of 400+ HGVs above the relatively low demand generated by open cut trenching. For this volume of HGV
traffic, mobile traffic management on Church Road would cause notable delays, frequently necessitating temporarily halting traffic and escorting HGVs to and from site. This would introduce disruption for the entire periods of drilling, lasting six weeks.

### 4.4 Conclusion

42. Considering the access layout and visibility splay for construction accessibility through the hedgerow/trees will be required for a trenchless crossing of Church Road, Colby the benefits of a trenchless crossing at this location are not realised.
43. Furthermore, HGV movements for trenchless crossing techniques will introduce disruption to the travelling public for a period of up to six weeks.
44. In comparison, the Applicant's use of a trenched method will minimise construction impacts, land requirements and timescales and will look to microsite so far as possible to minimise impacts to trees. The Applicant has committed to replacing trees as close as practicable to the location where they were removed, outside of the permanent operational easement and subject to landowner agreements [OLEMS, Version 2, REP1-020]. This commitment to replace trees as close as possible to the location where they are removed, combined with reinstatement of the hedgerow, will assist in minimising the identified impact.

## Norfolk Boreas Offshore Wind Farm <br> Appendix 1 - <br> B1149

## Automatic Traffic

## Counters Data

[^1]Applicant: Norfolk Boreas Limited
Document Reference: ExA.AS-3.D4.V1



| Time |  | 21 April 2017 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Total | Classification |  |  |  |  |  |  |  |  |  |  |  | $\begin{gathered} \text { >PSL } \\ 60 \end{gathered}$ | $\begin{gathered} \text { >PSL\% } \\ 60 \end{gathered}$ | $\begin{gathered} >\mathrm{SL1} \\ 68 \\ \mathrm{ACPO} \\ \hline \end{gathered}$ | $\begin{gathered} >S L 1 \% \\ 68 \\ \text { ACPO } \\ \hline \end{gathered}$ | $\begin{gathered} \hline \text { SL2 } \\ 75 \\ \text { Dft } \\ \hline \end{gathered}$ | $\begin{array}{\|c\|} \hline>\text { SL2\% } \\ 75 \\ \text { Dft } \\ \hline \end{array}$ | Mean | $\begin{gathered} \text { Vpp } \\ 85 \end{gathered}$ |
|  |  | $\begin{gathered} 1 \\ \mathrm{MCL} \end{gathered}$ | $\begin{gathered} 2 \\ \text { SV } \end{gathered}$ | $\begin{gathered} 3 \\ \text { SVT } \end{gathered}$ | $\begin{gathered} 4 \\ \text { TB2 } \end{gathered}$ | $\begin{gathered} 5 \\ \text { TB3 } \end{gathered}$ | $\begin{gathered} 6 \\ 14 \end{gathered}$ | $7$ | $\begin{gathered} 8 \\ \text { ART4 } \end{gathered}$ | $\begin{gathered} 9 \\ \text { ART5 } \end{gathered}$ | $10$ | $\begin{aligned} & 11 \\ & \text { BD } \end{aligned}$ | $12$ DRT |  |  |  |  |  |  |  |  |
| 0000 | \| 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 42.9 | ? | 28.6 | 0 | 0 | 55.1 | - |
| 0015 | 113 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 66.7 | 2 | 66.7 |  | 33.3 | 62.3 | - |
| 0030 | 4 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45.7 | - |
| 0045 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35.2 | - |
| 0100 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 50 | 1 | 50 | 1 | 50 | 73.5 | - |
| 0115 | 14 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 50 | , | 25 | 1 | 25 | 60.6 | - |
| 0130 | 4 | 0 | 3 | 0 | I | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43.3 | - |
| 0145 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 50 | , | 50 | 1 | 50 | 59.1 | - |
| 0200 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43.9 | - |
| 0215 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 100 | 0 | 0 | 0 | 0 | 67 | - |
| 0230 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42.6 | - |
| 0245 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 59.9 | - |
| 0300 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55.1 | - |
| 0315 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47.3 | - |
| 0330 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | - |
| 0345 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 25 | 0 | 0 | 0 | 0 | 55.9 | - |
| 0400 | 12 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50.5 | - |
| 0415 | 13 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43.4 | - |
| 0430 | $1{ }^{1} 4$ | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 25 | 0 | 0 | 0 | 0 | 51.5 | - |
| 0445 | 17 | 0 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47.1 | - |
| 0500 | 17 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 42.9 | I | 14.3 | 0 | 0 | 49.5 | - |
| 0515 | 23 | 1 | 17 | 0 | 2 | 0 | 0 | 0 |  | 1 | 1 | 0 | 0 | 5 | 21.7 | 1 | 4.3 | 1 | 4.3 | 51 | 62.9 |
| 0530 | 18 | 0 | 15 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 16.7 | 1 | 5.6 | 0 | 0 | 52.3 | 59.1 |
| 0545 | - 17 | 0 | 13 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 7 | 41.2 | 0 | 0 | 0 | 0 | 56.3 | 62.2 |
| 0600 | $\underline{27}$ | 0 | 19 | 0 | 1 | 0 | 3 | 0 | 1 | 0 | 3 | 0 | 0 | 2 | 7.4 | 0 | 0 | 0 | 0 | 48.3 | 56.8 |
| 0615 | 37 | 0 | 32 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 10 | 27 | 0 | 0 | 0 | 0 | 51.3 | 62.9 |
| 0630 | 48 | 0 | 43 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 11 | 22.9 | 4 | 8.3 | 0 | 0 | 53.8 | 63.1 |
| 0645 | 59 | 1 | 52 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 13 | 22 | 6 | 10.2 | 2 | 3.4 | 53.7 | 63.5 |
| 0700 | 88 | 0 | 72 | 1 | 11 | 0 | 0 |  | 0 | 0 | 3 | 0 | 0 | 7 | 8 | 1 | 1.1 | 1 | 1.1 | 49.8 | 57.5 |
| 0715 | 117 | 1 | 98 | 4 | 12 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 8 | 6.8 | 3 | 2.6 | 0 | 0 | 48.1 | 55.7 |
| 0730 | 124 | 0 | 107 | 4 | 8 | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 2 | 1.6 | 0 | 0 | 0 | 0 | 45.7 | 52.8 |
| 0745 | 121 | 1 | 102 | 3 | 8 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 2 | 1.7 | 0 | 0 | 0 | 0 | 45.5 | 53.2 |
| 0800 | 112 | 2 | 85 | 5 | 13 | 2 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 2.7 | 1 | 0.9 | 0 | 0 | 45.4 | 52.3 |
| 0815 | 140 | 2 | 118 | 5 | 13 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 1.4 | 2 | 1.4 | 0 | 0 | 45.3 | 52.1 |
| 0830 | 115 | 0 | 101 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 4 | 3.5 | 0 | 0 | 0 | 0 | 45.5 | 52.1 |
| 0845 | 98 | 1 | 84 | 0 | 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | 4.1 | 1 | 1 | 0 | 0 | 46.7 | 53.7 |
| 0900 | 87 | 0 | 72 | 2 | 8 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 1.1 | 0 | 0 | 0 | 0 | 45.8 | 51.9 |
| 0915 | 107 | 0 | 86 | 1 | 15 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45.2 | 50.8 |
| 0930 | 93 | 0 | 79 | 1 | 6 | 2 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 1.1 | 0 | 0 | 0 | 0 | 45 | 52.1 |
| 0945 | 119 | 0 | 101 | 2 | 7 | 3 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 48.8 |
| 1000 | 93 | 0 | 73 | 2 | 13 | 0 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45.6 | 50.8 |
| 1015 | 94 | 0 | 78 | 2 | 9 | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41.8 | 48.5 |
| 1030 | 113 | 2 | 88 | , | 13 | 2 | 2 | 1 | 1 | 2 | 1 | 0 | 0 | 1 | 0.9 | 0 | 0 | 0 | 0 | 43.3 | 49.4 |
| 1045 | 97 | 0 | 80 | 2 | 9 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42.9 | 49 |
| 1100 | 94 | 0 | 76 | 1 | 13 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 2 | 2.1 | 1 | 1.1 | 0 | 0 | 45.9 | 49.9 |
| 1115 | 114 | 0 | 95 | 2 | 10 | 1 | 4 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41.1 | 48.5 |
| 1130 | 93 | 0 | 81 | 1 | 8 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 2.2 | 0 | 0 | 0 | 0 | 38.7 | 48.8 |
| 1145 | 96 | 1 | 74 | , | 14 | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 44.6 | 49.7 |
| 1200 | 84 | 1 | 71 | 4 | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46.6 | 52.6 |
| 1215 | 89 | 0 | 75 | 0 | 7 | 2 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 3 | 3.4 | 1 | 1.1 | 0 | 0 | 46.3 | 52.3 |
| 1230 | 103 | 0 | 90 | 1 | 10 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44.4 | 49.2 |
| 1245 | 88 | 0 | 79 | , | 7 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.1 | 0 | 0 | 0 | 0 | 45.7 | 53.2 |
| 1300 | 79 | 0 | 66 | 1 | 8 | 0 | , | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46.1 | 51.9 |
| 1315 | 105 | 1 | 90 | 2 | 10 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 44.3 | 50.3 |
| 1330 | 82 | 1 | 71 | 1 | 7 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 2.4 | 0 | 0 | 0 | 0 | 45.1 | 50.3 |
| 1345 | 83 | 0 | 70 | 1 | 8 | 0 | , | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1.2 | 0 | 0 | 0 | 0 | 45.8 | 51.2 |
| 1400 | 106 | 0 | 85 | 3 | 15 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44.2 | 50.1 |
| 1415 | 93 | 1 | 81 | 0 | 6 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2.2 | 0 | 0 | 0 | 0 | 44.4 | 51.7 |
| 1430 | 110 | 0 | 95 | 1 | 6 | 0 | 0 | 0 | 2 | 1 | 4 | 0 | 1 | 6 | 5.5 | 1 | 0.9 | 0 | 0 | 45.9 | 53.5 |
| 1445 | 109 | 0 | 89 | 3 | 12 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0.9 | 0 | 0 | 0 | 0 | 43.5 | 48.5 |
| 1500 | 86 | 1 | 80 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2.3 | 0 | 0 | 0 | 0 | 49.5 | 56.4 |
| 1515 | 102 | 1 | 93 | 1 | 6 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 3.9 | 1 | 1 | 0 | 0 | 47.6 | 51.9 |
| 1530 | 103 | 1 | 79 | 6 | 15 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1.9 | 0 | 0 | 0 | 0 | 46.9 | 53.5 |
| 1545 | 110 | 1 | 98 | 3 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1.8 | 1 | 0.9 | 1 | 0.9 | 46.5 | 51.9 |
| 1600 | 101 | 1 | 92 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 1 | 1 | 47.2 | 53.2 |
| 1615 | 139 | 1 | 122 | 2 | 12 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1.4 | 0 | 0 | 0 | 0 | 46 | 51 |
| 1630 | 149 | 1 | 133 | 2 | 11 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2 | 1 | 0.7 | 0 | 0 | 47.9 | 54.4 |
| 1645 | 121 | 0 | 109 | 0 | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 2.5 | 0 | 0 | 0 | 0 | 46.6 | 52.6 |
| 1700 | 141 | 2 | 129 | 1 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 3.5 | 2 | 1.4 | 0 | 0 | 48.2 | 54.8 |
| 1715 | 142 | 2 | 131 | 1 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 4.2 | 3 | 2.1 | 1 | 0.7 | 48.6 | 53 |
| 1730 | 148 | 1 | 141 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 6.8 | 4 | 2.7 | 0 | 0 | 47.9 | 53.2 |
| 1745 | 111 | 1 | 108 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 1.8 | 0 | 0 | 0 | 0 | 48.5 | 54.8 |
| 1800 | 117 | 0 | 112 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 2.6 | , | 0.9 | 1 | 0.9 | 45 | 53.2 |
| 1815 | 116 | 2 | 108 | 1 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2.6 | 0 | 0 | 0 | 0 | 49 | 53.7 |
| 1830 | 92 | 1 | 90 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3.3 | 0 | 0 | 0 | 0 | 43.1 | 51.9 |
| 1845 | 83 | 0 | 79 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 7.2 | 1 | 1.2 | 0 | 0 | 47.1 | 53 |
| 1900 | 51 | 0 | 48 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 7 | 13.7 | 1 | 2 | 0 | 0 | 49.6 | 59.3 |
| 1915 | 54 | 0 | 51 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7.4 | 1 | 1.9 | 1 | 1.9 | 48 | 56.4 |
| 1930 | 36 | 0 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8.3 | 0 | 0 | 0 | 0 | 51.2 | 57.3 |
| 1945 | 46 | 1 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6.5 | 1 | 2.2 | 1 | 2.2 | 49 | 55.7 |
| 2000 | 32 | 0 | 31 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 12.5 | 0 | 0 | 0 | 0 | 49.7 | 57 |
| 2015 | 34 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 14.7 | 3 | 8.8 | 1 | 2.9 | 51.6 | 59.9 |
| 2030 | 29 | 1 | 27 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 13.8 | 1 | 3.4 | 0 | 0 | 51.7 | 59.5 |
| 2045 | 26 | 0 | 25 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3.8 |  | 3.8 | 0 | 0 | 49.1 | 52.3 |
| 2100 | 26 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 15.4 | 0 | 0 | 0 | 0 | 51.2 | 58.2 |
| 2115 | 20 | 0 | 19 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 | 1 | 5 | 0 | 0 | 51.4 | 59.1 |
| 2130 | -19 | 0 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5.3 | 0 | 0 | 0 | 0 | 47.7 | 51 |
| 2145 | $\underline{20}$ | 0 | 19 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 15 |  | 5 | 0 | 0 | 51 | 59.5 |
| 2200 | $\underline{34}$ | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 11.8 | 0 | 0 | 0 | 0 | 47.4 | 54.1 |
| 2215 | 48 | 0 | 47 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 10.4 | 0 | 0 | 0 | 0 | 48.9 | 58.2 |
| 2230 | 42 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2.4 | 0 | 0 | 0 | 0 | 47.1 | 54.1 |
| 2245 | 40 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 47 | 54.4 |
| 2300 | 19 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 10.5 | 0 | 0 | 0 | 0 | 49.6 | 56.4 |
| 2315 | -12 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8.3 | 0 | 0 | 0 | 0 | 52.9 | 57.9 |
| 2330 | \| 12 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 16.7 | 0 | 0 | 0 | 0 | 48.3 | 56.1 |
| 2345 | $\underline{6}$ | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 33.3 | 0 | 0 | 0 | 0 | 58.7 | - |
| 07-19 | 5107 | 30 | 4416 | 79 | 423 | 29 | 34 | 5 | 24 | 19 | 42 | 2 | 4 | 115 | 2.3 | 26 | 0.5 | 5 | 0.1 | 45.7 | 52.6 |
| 06-22 | 5671 | 33 | 4941 | 83 | 442 | 30 | 37 | 5 | 25 | 21 | 48 | 2 |  | 193 | 3.4 | 46 | 0.8 | 10 | 0.2 | 46.2 | 53.2 |
| 06-00 | 5884 | 33 | 5152 | 83 | 443 | 30 | 37 | 5 | 26 | 21 | 48 | 2 | 4 | 214 | 3.6 | 46 | 0.8 | 10 | 0.2 | 46.3 | 53.2 |
| 00-00 | 6005 | 35 | 5253 | 83 | 452 | 30 | 38 | 5 | 28 | 24 | 51 | 2 | 4 | 244 | 4.1 | 56 | 0.9 | 15 | 0.2 | 46.4 | 53.5 |







## Norfolk Boreas Offshore Wind Farm <br> Appendix 2 - <br> B1149 Pavement

## Testing Results

[^2]Applicant: Norfolk Boreas Limited
Document Reference: ExA.AS-3.D4.V1






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| ---: | :--- |
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| Your Sample Ref | 4029 |
| Your Project or Order No. |  |
| Date Tested | $09 / 04 / 2019$ |
| Date Report Issued | 23-Apr-19 |

Page 1 of 1

## Particle Size Distribution to BS 1377 : Part 2 :1990 Section 9




[^3]
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Your Sample Ref
40210
Your Project or Order No.

| Date Tested | $03 / 04 / 2019$ |
| ---: | :--- |
| Date Report Issued | $23-A p r-19$ |

Page 1 of 1
Particle Size Distribution to BS 1377 : Part 2 :1990 Section 9


| Sieving |  | Specification for Highway Works Classification Table 6/2 | Sample Proportions |  |
| :---: | :---: | :---: | :---: | :---: |
| Particle Size |  |  | BOULDERS | 0 |
| mm | \% Passing |  | COBBLES | 0 |
| 125 | 100 | This material complies with the following material classes 1B, 6E/6R, 6M. | Coarse GRAVEL | 6 |
| 90 | 100 |  | Medium GRAVEL | 12 |
| 75 | 100 |  | Fine GRAVEL | 8 |
| 63 | 100 |  | Coarse SAND | 20 |
| 37.5 | 100 |  | Medium SAND | 45 |
| 20 | 94 |  | Fine SAND | 4 |
| 14 | 93 |  | Silt \& Clay | 5 |
| 10 | 88 |  |  |  |
| 6.3 | 82 |  | Grading |  |
| 5 | 81 |  | D100 | 20 |
| 2 | 74 |  | D60 | 0.81 |
| 1.18 | 71 |  | D10 | 0.23 |
| 0.600 | 54 |  | Uniformity Coefficient | 4 |
| 0.425 | 30 |  |  |  |
| 0.300 | 13 |  | Desc |  |
| 0.212 | 9 |  | Light brown and orangey | ry gravelly, |
| 0.063 | 5 |  | medium and coarse SA medium and coarse, su | is fine, lint. |
|  | Moisture content \% 5 |  |  |  |

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40211
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| Date Tested | $05 / 04 / 2019$ |
| ---: | :--- |
| Date Report Issued | 23-Apr-19 |

Page 1 of 1

## Particle Size Distribution to BS 1377 : Part 2 :1990 Section 9



| Sieving |  | Specification for Highway Works Classification Table 6/2 | Sample Proportions |  |
| :---: | :---: | :---: | :---: | :---: |
| Particle Size |  |  | BOULDERS | 0 |
| mm | \% Passing |  | COBBLES | 0 |
| 125 | 100 | This material complies with the following material classes 1B, 6E/6R, 6M. | Coarse GRAVEL | 0 |
| 90 | 100 |  | Medium GRAVEL | 3 |
| 75 | 100 |  | Fine GRAVEL | 2 |
| 63 | 100 |  | Coarse SAND | 7 |
| 37.5 | 100 |  | Medium SAND | 40 |
| 20 | 100 |  | Fine SAND | 38 |
| 14 | 100 |  | Silt \& Clay | 10 |
| 10 | 97 |  |  |  |
| 6.3 | 97 |  | Grading |  |
| 5 | 97 |  | D100 | 10 |
| 2 | 94 |  | D60 | 0.28 |
| 1.18 | 93 |  | D10 | 0.06 |
| 0.600 | 88 |  | Uniformity Coefficient | 4 |
| 0.425 | 79 |  |  |  |
| 0.300 | 63 |  | Desc |  |
| 0.212 | 47 |  | Light brown and orangey | ightly gravelly, |
| 0.063 | 10 |  | fine and medium SAND. medium, sub-angular flin | fine and |
|  | Moisture content \% 10 |  |  |  |

[^4]
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40212
Your Project or Order No.

| Date Tested | $05 / 04 / 2019$ |
| ---: | :--- |
| Date Report Issued | $23-A p r-19$ |

Page 1 of 1
Particle Size Distribution to BS 1377: Part 2 :1990 Section 9


| Sieving |  | Specification for Highway Works Classification Table 6/2 | Sample Proportions |  |
| :---: | :---: | :---: | :---: | :---: |
| Particle Size |  |  | BOULDERS | 0 |
| mm | \% Passing |  | COBBLES | 0 |
| 125 | 100 | This material complies with the following material classes 1B, 6E/6R, 6M. | Coarse GRAVEL | 0 |
| 90 | 100 |  | Medium GRAVEL | 0 |
| 75 | 100 |  | Fine GRAVEL | 6 |
| 63 | 100 |  | Coarse SAND | 30 |
| 37.5 | 100 |  | Medium SAND | 61 |
| 20 | 100 |  | Fine SAND | 2 |
| 14 | 100 |  | Silt \& Clay | 2 |
| 10 | 100 |  |  |  |
| 6.3 | 100 |  | Grading |  |
| 5 | 98 |  | D100 | 5 |
| 2 | 94 |  | D60 | 0.58 |
| 1.18 | 90 |  | D10 | 0.31 |
| 0.600 | 64 |  | Uniformity Coefficient | 2 |
| 0.425 | 33 |  |  |  |
| 0.300 | 7 |  | Desc |  |
| 0.212 | 4 |  | Orangey brown and yell | n, slightly |
| 0.063 | 2 |  | gravelly, medium to coar sub-angular flint. | Gravel is fine, |
|  | Moisture content \% 5 |  |  |  |

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| Your Sample Ref | B4029 |
| Your Project or Order No |  |
| Date Report Issued | $23-A p r-19$ |
| Date Tested | 08-Apr-19 |

ROHA0001
NCCL201904029-642
34029

23-Apr-19
08-Apr-19

Page 1 of 1

## Determination of the California Bearing Ratio to BS 1377 : PART 4 : 1990

| Scheme | Norfolk Vanguard and Boreas |  |  |
| :--- | :--- | :--- | :--- |
| Location | CBR $1 @ 0.7 \mathrm{~m}$ |  | $29-M a r-19$ |
| Date sampled | $27-M a r-19$ | Date received | 18.955 kg |
| Sample type | Bulk Disturbed | Sample Mass |  |

If a sample certificate was provided it is available for inspection.
The accuracy of information provided by third parties cannot be guaranteed.

| Material | Soil |
| :--- | :--- |
| Description | Dark yellowish brown, slightly gravelly, medium SAND. Gravel is fine and medium, sub-angular flint. |

Supplier Not applicable Source Ex site

|  |  | Test Specimen |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Location |  | Not applicable |  |  |  |
| Orientation |  | Not applicable |  |  |  |
|  |  | Prep |  |  |  |
| Method of Division |  | Quartering |  |  |  |
| Preparation Method |  | Sieving, Natural Moisture Content |  |  |  |
| Condition |  | Unsoaked |  |  |  |
| Retained 37.5mm | \% | 1 |  |  |  |
| Retained 20mm | \% | 2.1 |  |  |  |
| Number of layers |  | 3 | CBR Value Top | \% | 43.0 |
| Blows per layer |  | N/A | CBR Value Bottom | \% | 104.0 |
| BS Method |  | 3.7, Vib.Hammer |  |  |  |
| Bulk Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 2.07 | Moisture Content Top | \% | 7.0 |
| Dry Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 1.94 | Moisture Cont. Bottom | \% | 7.0 |
| Initial Moisture Content | \% | 6.6 | Moisture Content Method |  | Oven dried @ $105-110^{\circ} \mathrm{C}$ |

## Remarks



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| Date Report Issued | $23-A p r-19$ |
| Date Tested | 08-Apr-19 |

ROHA0001
NCCL2019040210-642
B40210

23-Apr-19
08-Apr-19

Page 1 of 1

## Determination of the California Bearing Ratio to BS 1377 : PART 4 : 1990

| Scheme | Norfolk Vanguard and Boreas |  |  |
| :--- | :--- | :--- | :--- |
| Location | CBR 2 @ 0.2m |  |  |
| Date sampled | $27-M a r-19$ | Date received | $29-M a r-19$ |
| Sample type | Bulk Disturbed | Sample Mass | 22.35 kg |

If a sample certificate was provided it is available for inspection.
The accuracy of information provided by third parties cannot be guaranteed.

| Material | Soil |  |  |
| :--- | :--- | :--- | :--- |
| Description | Light brown and orangey brown, very gravelly, medium and coarse SAND. Gravel is fine, medium and coarse, <br> sub-angular flint. |  |  |
| Supplier | Not applicable | Source | Ex site |


|  |  | Test Specimen |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Location |  | Not applicable |  |  |  |
| Orientation |  | Not applicable |  |  |  |
|  |  | Prep |  |  |  |
| Method of Division |  | Quartering |  |  |  |
| Preparation Method |  | Sieving, Natural Moisture Content |  |  |  |
| Condition |  | Unsoaked |  |  |  |
| Retained 37.5mm | \% | 3 |  |  |  |
| Retained 20mm | \% | 7.2 |  |  |  |
| Number of layers |  | 3 | CBR Value Top | \% | 46.0 |
| Blows per layer |  | N/A | CBR Value Bottom | \% | 133.0 |
| BS Method |  | 3.7, Vib.Hammer |  |  |  |
| Bulk Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 2.10 | Moisture Content Top | \% | 5.3 |
| Dry Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 2.00 | Moisture Cont. Bottom | \% | 5.5 |
| Initial Moisture Content | \% | 5.4 | Moisture Content Meth |  | Oven dried @ $105-110^{\circ} \mathrm{C}$ |

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| Your Sample Ref | B40211 |
| Your Project or Order No |  |
| Date Report Issued | $23-A p r-19$ |
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ROHA0001
NCCL2019040211-642
B40211

23-Apr-19
08-Apr-19

## Determination of the California Bearing Ratio to BS 1377 : PART 4 : 1990

| Scheme | Norfolk Vanguard and Boreas |  |  |
| :--- | :--- | :--- | :--- |
| Location | CBR 3 @ 0.2m |  | $29-M a r-19$ |
| Date sampled | $27-M a r-19$ | Date received | Sample Mass |

If a sample certificate was provided it is available for inspection.
The accuracy of information provided by third parties cannot be guaranteed.

| Material | Soil |  |  |
| :--- | :--- | :--- | :--- |
| Description | Light brown and orangey brown, slightly gravelly, fine and medium SAND. Gravel is fine and medium, sub- <br> angular flint. |  |  |
| Supplier | Not applicable | Source | Ex site |


|  |  | Test Specimen |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Location |  | Not applicable |  |  |  |
| Orientation |  | Not applicable |  |  |  |
|  |  | Prep |  |  |  |
| Method of Division |  | Quartering |  |  |  |
| Preparation Method |  | Sieving, Natural Moisture Content |  |  |  |
| Condition |  | Unsoaked |  |  |  |
| Retained 37.5mm | \% | 0 |  |  |  |
| Retained 20mm | \% | 0.6 |  |  |  |
| Number of layers |  | 3 | CBR Value Top | \% | 15.0 |
| Blows per layer |  | N/A | CBR Value Bottom | \% | 12.0 |
| BS Method |  | 3.7, Vib.Hammer |  |  |  |
| Bulk Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 2.22 | Moisture Content Top | \% | 11.0 |
| Dry Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 2.01 | Moisture Cont. Bottom | \% | 9.7 |
| Initial Moisture Content | \% | 11.0 | Moisture Content Meth |  | Oven dried @ 105-110 ${ }^{\circ} \mathrm{C}$ |

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| Your Sample Ref | B40212 |
| Your Project or Order No |  |
| Date Report Issued | $23-A p r-19$ |
| Date Tested | 08-Apr-19 |

ROHA0001
NCCL2019040212-642
B40212

23-Apr-19
08-Apr-19

## Determination of the California Bearing Ratio to BS 1377 : PART 4 : 1990

| Scheme | Norfolk Vanguard and Boreas |  |  |
| :--- | :--- | :--- | :--- |
| Location | CBR 4 @ 0.2m |  | $29-M a r-19$ |
| Date sampled | $27-M a r-19$ | Date received | Sample Mass |

If a sample certificate was provided it is available for inspection.
The accuracy of information provided by third parties cannot be guaranteed.

| Material | Soil |  |
| :--- | :--- | :--- |
| Description | Orangey brown and yellowish brown, slightly gravelly, medium to coarse SAND. Gravel is fine, sub-angular <br> flint. |  |
| Supplier | Not applicable | Source |


|  |  | Test Specimen |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Location |  | Not applicable |  |  |  |
| Orientation |  | Not applicable |  |  |  |
|  |  | Prep |  |  |  |
| Method of Division |  | Quartering |  |  |  |
| Preparation Method |  | Sieving, Natural Moisture Content |  |  |  |
| Condition |  | Unsoaked |  |  |  |
| Retained 37.5mm | \% | 0 |  |  |  |
| Retained 20mm | \% | 1.1 |  |  |  |
| Number of layers |  | 3 | CBR Value Top | \% | 32.0 |
| Blows per layer |  | N/A | CBR Value Bottom | \% | 64.0 |
| BS Method |  | 3.7, Vib.Hammer |  |  |  |
| Bulk Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 1.90 | Moisture Content Top | \% | 5.4 |
| Dry Density | $\mathrm{Mg} / \mathrm{m}^{3}$ | 1.80 | Moisture Cont. Bottom | \% | 5.5 |
| Initial Moisture Content | \% | 5.5 | Moisture Content Meth |  | Oven dried @ 105-110 ${ }^{\circ} \mathrm{C}$ |

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## Norfolk Boreas Offshore Wind Farm <br> Appendix 3-B1149 <br> Traffic

## Management Plans

[^5]






## Norfolk Boreas Offshore Wind Farm Appendix 4 - <br> Church Road, Colby <br> Access Layout

## Applicant: Norfolk Boreas Limited

Document Reference: ExA.AS-3.D4.V1
Deadline 4
Date: January 2020
Revision: Version 1


## Norfolk Boreas Offshore Wind Farm <br> Appendix 5 - <br> Church Road, Colby <br> Access Aerial Image




[^0]:    ${ }^{1}$ Department for Transport, 2009. Traffic and Signs Manual, Chapter 8.

[^1]:    Deadline 4
    Date: January 2020
    Revision: Version 1

[^2]:    Deadline 4
    Date: January 2020
    Revision: Version 1

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[^5]:    Applicant: Norfolk Boreas Limited
    Document Reference: ExA.AS-3.D4.V1
    Deadline 4
    Date: January 2020
    Revision: Version 1

