Abnormal Loads Risk Assessment
HARRYBURN WIND FARM

ABNORMAL LOAD ACCESS ROUTE REPORT
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1 INTRODUCTION

1.1 Project Summary

COWI UK has been commissioned by Innogy Renewables UK Ltd (Innogy) to prepare an Abnormal Load Access Route report for inclusion within the Environmental Statement. The initial report reference JU099-R002 considered a full range of options for proposed abnormal load access routes for wind turbine component delivery vehicles. This report summarises the preferred access route with updated plans based upon the current site layout.

The site is located approximately 70km southeast of Glasgow and approximately 1km southwest of Junction 14 on the A74(M) Motorway. The approximate centre of the site (Leadhills village) can be identified at Ordnance Survey (OS) National Grid Reference (NGR) NS 886 150.

A route location plan is attached (Drawing J1479-DRG-C01-050) in Appendix A.
1.2 Information Sources

The following information sources have been used in compiling this report:

Table 1 – Information Sources

<table>
<thead>
<tr>
<th>Source of Information</th>
<th>Details</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordex Energy</td>
<td>Transport, access roads and crane requirements Nordex N100 Delta (via Innogy)</td>
<td>22nd January 2013</td>
</tr>
<tr>
<td>Vestas Wind Systems</td>
<td>Weight, Dimensions and Centre of Gravity of 55m Blade Vestas V112-3.3 (via Innogy)</td>
<td>2nd September 2013</td>
</tr>
<tr>
<td>Ordnance Survey digital mapping and contours</td>
<td>OS Mastermap and 5m Contours</td>
<td>February 2015</td>
</tr>
<tr>
<td>Site Walkover Survey</td>
<td>Walkover survey and route assessment survey.</td>
<td>29th September to 1st October 2014</td>
</tr>
<tr>
<td>Aerial and Satellite Photography</td>
<td>Web based satellite imagery</td>
<td>2015</td>
</tr>
</tbody>
</table>

1.3 Methodology

1.3.1 Base Mapping

The swept path analysis that has been undertaken is based on digital Ordnance Survey mapping. COWI accepts no responsibility or liability as to the accuracy or content of the data. It is recommended that as the development progresses, detailed topographical surveys are commissioned at key/critical locations identified by this study.

Details of the public highway boundary have not been obtained from South Lanarkshire Council at this stage. In order to determine the impact on third party land, it has been assumed that fence lines, walls and hedgerows define this boundary.
1.3.2 Candidate Turbine

A single candidate turbine has not yet been established. Innogy provided the list of candidate turbines being considered.

A wind turbine comprises the following component parts:

- Nacelle;
- Blades; and
- Tower sections.

Due to the large size of the parts, all turbine components are delivered to site separately. The nacelle generally represents the heaviest load, the blades the longest and the tower sections the widest. Innogy advised by email dated 27th January 2015 that the following components were to be used. These are detailed in the table below:

**Table 2 – Candidate Turbine Details**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Turbine</th>
<th>Largest Component</th>
<th>Component Length</th>
<th>Component Width</th>
<th>Vehicle Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordex</td>
<td>N100 Delta</td>
<td>Tower Section</td>
<td>29.800m</td>
<td>4.30m</td>
<td>50.361m</td>
</tr>
<tr>
<td>Vestas</td>
<td>V112-3.3</td>
<td>Rotor Blade</td>
<td>54.673m</td>
<td>4.13m</td>
<td>55.315m</td>
</tr>
</tbody>
</table>

It is assumed that in addition to the turbine delivery vehicles (TDVs), at least one heavy lift crane (400-800T) and one smaller crane will require access to the site. These are commonly used for turbine erection. The specification of cranes used on site will be confirmed by the contractor, however the TDV represent the worst-case from a highway geometry point of view and are therefore the focus of this study.

1.3.3 Swept Path Analysis

These components and the delivery vehicles used to transport them have been modelled using the swept path analysis software, Autotrack. A copy of the vehicle details can be seen in Appendix C. Two TDVs have been built up, the first transporting the Nordex N100 Delta tower component, and the second transporting the Vestas V112-3.3 rotor blade.

These vehicles have been used in Autotrack to model the swept path to determine the critical junctions/sections of the road network, and hence the suitability of the proposed route.

The study considers only the travel direction to the Development at this stage. After delivering the components the vehicles and their trailers will be empty and will be reconfigured accordingly. During maintenance and demolition, any components leaving the site can be broken up and transported on standard road
using vehicles. If any components need to be replaced during the lifetime of the wind farm then they will be delivered to the development in the same route as is being considered in this study.

Vertical alignment has not been considered at this stage.

Automatic rear wheel steering of the vehicle trailers is the preferred method of operation as it reduces delays both to the TDV journey and other road users. However, at a number of locations the use of manual rear wheel steering has been necessary where automatic steering does not allow the passage of the vehicle or where there is substantial impact on the surrounding land and infrastructure.
2 ROUTE ASSESSMENT

2.1 Site Entrance

The proposed entrance to the site is located off the A702 to the north of Elvanfoot at OS GR 295129, 617670 as indicated in Figure 1 below.

**Figure 1 – Site Entrance**

OS Licence Number 100019980
2.2 Proposed Access Route

This report only considers access from the A74(M) to the development, it is assumed that there are already suitable access routes from delivery ports to the A74(M), based upon similar developments in the local area.

The initial study highlighted difficulties in accessing the site from the north (travelling south) due to restricted access under the A74(M) bridge a Junction 14. At this stage it is assumed that the TDV will access the site from the south (traveling north). Therefore Route D from the initial report represents the preferred option for TDV’s.

2.2.1 Route D

Route D leaves the A74(M) motorway at Junction 14 (northbound) and heads along the exit slip road to the reach the roundabout. Taking the first exit, the TDVs follow the A702 crossing a bridge over the Carstairs to Lockerbie railway line before arriving at the site entrance.

Figure 2 - Overview of Route D

OS Licence Number 100019980
3 SWEEP PATH ANALYSIS

3.1 Key Locations

The route identified in Section 2 was reviewed for possible constraints which may require further investigation and a number of key locations were identified. These are shown on Drawing J1479-DRG-C01-050 (which is included within Appendix A). It should be noted that the original reference numbers have been retained for consistency.

In addition to the specific locations raised the following points are also applicable:

> The strength of below ground structures and culverts along the route will need to be assessed.

> Overhead power lines and telephone cables which pass over the proposed access carriageway are at risk of strikes. A survey should be undertaken to determine which cables will need to be temporarily increased in height.

> Buried services, including manholes and chambers, along the route will need to be identified and if necessary covers assessed for load capacity.

> Vegetation and tree trimming will be required along the route to ensure a minimum access envelope of 5m x 5m is maintained.
4 SWEPT PATH ANALYSIS OF ROUTE D

4.1 Location 05 (A74(M) Junction 14 (northbound) Slip Road & Roundabout)

For the swept path analysis and the mitigation actions required see drawings J1479-DRG-C01-051&052 included within Appendix B.

Minor widening works will be required between the A74(M) entrance and exit slip roads to the north and along the splitter island towards the A702. More detailed swept path analysis will be required following detailed topographical survey of the area to ascertain the required 'land take' for widening and required removal of road signs and lighting columns. Discussions with Transport Scotland and the local highways authority will also be required.

This junction is deemed at this stage to be low risk. Widening within the highway boundary is necessary so approval will be required of these works by Transport Scotland and local highways authority.

4.2 Location 06 (A702 Railway Overbridge)

For the swept path analysis and the identified constraints see drawings J1479-DRG-C01-053&054 included within Appendix B.

Minor widening works will be required on the outside of the bend following the railway bridge (see Photograph 1). More detailed swept path analysis will be required following detailed topographical survey of the area to ascertain the detailed bridge dimensions (see Photograph 2), the required 'land take' for widening and required removal of road signs and lighting columns. Discussions with the local highways authority will also be required.

Discussions will need to be made with Network Rail to determine the capacity of the existing railway bridge (structure reference WCM1/B/282) to carry the TDVs.
Network Rail approval will be required following bridge capacity assessments. Widening within the highway boundary is necessary so approval will be required of these works by local highways authority.

**Photograph 1 - A702 west of the railway bridge looking south**

**Photograph 2 - A702 across the railway bridge looking northeast**
5 CONCLUSIONS & RECOMMENDATIONS

5.1 Conclusions

For the purpose of this study, two candidate turbines have been utilised, as advised by Innogy in email dated 27th January 2015. The blade (Vestas V112-3.3) and lower tower section (Nordex N100 Delta) represent the longest and widest loads and as such it is these components which have been used to model the swept path analysis.

Swept path analysis has been based on digital Ordnance Survey mapping. Details of the public highway boundary have not been obtained from South Lanarkshire Council at this stage. In order to determine the impact on third party land, it has been assumed that fence lines, walls and hedgerows define the highway boundary.

At each key location, swept path analysis was undertaken with the tower delivery vehicle and the blade delivery vehicle, activating manual rear steering on the blade vehicle where required.

The study considers only the travel direction to the Development at this stage. The initial study highlighted difficulties in accessing the site from the north (travelling south) due to restricted access under the A74(M) bridge a Junction 14. At this stage it is assumed that the TDV will access the site from the south (traveling north).

Key Locations 05 and 06 were deemed critical to determining the viability of the proposed access routes and gaining access from the motorway network.

Transport Scotland, the local highways authority and Network Rail should be contacted during the next stage of investigation to provide any comments and feedback on the preferred route.
5.2  Recommendations

5.2.1  Primary Recommendations

It is recommended that a detailed study of Location 05 be commissioned, including the following:

- Detailed topographical survey,
- Consultation with Transport Scotland and the local highways authority regarding their land boundaries,
- Swept Path Analysis, and
- Vertical alignment checks.

This will be with the aim to determine the extents of widening and 3rd Party involvements required.

It is also recommended that the railway overbridge at Location 06 be investigated further, including:

- Consultation with Network Rail to determine the current load capacity,
- Consultation with Specialist Haulage Contractors to determine the likely axel loads and dimensions,
- Detailed topographical survey, and
- Swept Path Analysis.

This will be with the aim to confirm the viability of the bridge to carry the TDVs.

This report has only considered TDV access from the south (travelling north on A74(M)). Should TDV access be required from the north (travelling south on A74(M)) it is recommended that further detailed assessments are undertaken to identify feasible route options.
5.2.2 Secondary Recommendations

It is recommended that a single preferred candidate turbine is agreed for use on all future swept path analysis.

Highway boundary drawings and detailed topographical surveys should be undertaken at all key risk areas, allowing detailed horizontal and vertical alignment assessments to be undertaken. Topographical surveys at pinch points will be required to achieve a higher degree of certainty on road widening/re-alignment and land-take issues.

Utilities searches should be commissioned to detail the nature and location of all services which would be affected by the proposed access routes.

Pavement load capacity checks should be discussed with Transport Scotland and the local highway authority, as appropriate.

Transport Scotland and the local highways authority should be engaged in future discussions of the proposed route options.
Appendix A  Route and Key Location Plan
1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES UNLESS SHOWN OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM UNLESS STATED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING. DO NOT TAKE DIGITAL DIMENSIONS OFF THIS DRAWING. WORK TO FIGURED DIMENSIONS ONLY - IF IN DOUBT ASK.
4. THIS DRAWING TO BE READ IN CONJUNCTION WITH J1477-R001-ABNORMAL LOAD ACCESS ROUTE REPORT.

NOTES

LEGEND

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Appendix B  Swept Path Analysis Drawings
1. All dimensions in millimetres and all levels in metres unless shown otherwise.
2. All levels are in metres and relate to Ordnance Datum unless stated otherwise.
3. Do not scale from this drawing. Do not take digital dimensions off this drawing. Work to figured dimensions only - if in doubt ask.
4. This drawing to be read in conjunction with:
   J1475-DRG-C01-050 - ROUTE OPTIONS & KEY LOCATION PLAN
   J1475-DRG-C01-052 - IDENTIFIED CONSTRAINTS PLAN

**NOTES**

**CURRENT VERSION INFORMATION**

**OVERVIEW**

**SCALE**

**KEY**

**DELIVERY VEHICLE**

**LOAD OVERSAIL**

**BLADE VEHICLE SWEPT PATH ANALYSIS**

**TOWER VEHICLE SWEPT PATH ANALYSIS**

**DELIVERY VEHICLE BODY ENVELOPE**

**DELIVERY VEHICLE WHEEL EXTENT**

**PROJECT**

**HARRYBURN WIND FARM**

**ABNORMAL LOAD ACCESS ROUTE**

**LOCATION PLAN ROUTE D**

**SWEPT PATH ANALYSIS**

**DRAWING**

**J1479-DRG-C01-051**

**SCHEDULE**

**COWI UK LTD**

This drawing is the property of COWI UK Limited and must not be copied or used for any purpose other than that for which it is supplied.
1. All dimensions in millimetres and all levels in metres unless shown otherwise.
2. All levels are in metres and relate to Ordnance Datum unless stated otherwise.
3. Do not scale from this drawing. Do not take digital dimensions off this drawing. Work to figured dimensions only - if in doubt ask.
4. All street furniture positions are approximate and need to be confirmed by detailed topographical survey.
5. Details of the public highway have not been obtained from South Lanarkshire Council at this stage. In order to determine impact on 3rd party land, it has been assumed that fence lines, walls and hedgerows define this boundary.
6. Existing services are not shown. Services search and detailed topographical survey to be carried out at a later date.
7. This drawing to be read in conjunction with:
   J1477-R001-ABNORMAL LOAD ACCESS ROUTE
   J1479-DRG-C01-050 - ROUTE OPTIONS & KEY LOCATION PLAN
   J1479-DRG-C01-051 - SWEPT PATH ANALYSIS
8. Swept path analysis shown is merged external envelope of the two vehicles (blade and tower) used in drawing J1479-DRG-C01-051.

KEY
- Delivery vehicle body envelope
- Delivery vehicle wheel extent
- Load overrun

KEY - DELIVERY VEHICLE
SWEEP PATH
N.T.S

AREA SUBJECT TO OVERSAIL IN 3RD PARTY LAND
- 0.5m buffer of swept path analysis

AREA SUBJECT TO OVERSAIL IN HIGHWAY LAND
AREA SUBJECT TO OVERSAIL WITHIN 3RD PARTY LAND
AREA SUBJECT TO OVERSAIL WITHIN HIGHWAY LAND

DELIVERY VEHICLE
BODY ENVELOPE
DELIVERY VEHICLE
WHEEL EXTENT

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES UNLESS SHOWN OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO ORDNANCE DATUM UNLESS STATED OTHERWISE.
3. DO NOT SCALE FROM THIS DRAWING. WORK TO FIGURED DIMENSIONS ONLY.
4. ALL STREET FURNITURE POSITIONS ARE APPROXIMATE AND NEED TO BE CONFIRMED BY DETAILED TOPOGRAPHICAL SURVEY.
5. DETAILS OF THE PUBLIC HIGHWAY HAVE NOT BEEN OBTAINED FROM SOUTH LANARKSHIRE COUNCIL AT THIS STAGE. IN ORDER TO DETERMINE IMPACT ON 3RD PARTY LAND, IT HAS BEEN ASSUMED THAT FENCE LINES, WALLS AND HEDGEROWS DEFINE THIS BOUNDARY.
6. EXISTING SERVICES ARE NOT SHOWN. SERVICES SEARCH AND DETAILED TOPOGRAPHICAL SURVEY TO BE CARRIED OUT AT A LATER DATE.
7. THIS DRAWING TO BE READ IN CONJUNCTION WITH:
   J1477-R001-ABNORMAL LOAD ACCESS ROUTE REPORT
   J1479-DRG-C01-050 - ROUTE OPTIONS & KEY LOCATION PLAN
   J1479-DRG-C01-053 - SWEPT PATH ANALYSIS
8. SWEPT PATH ANALYSIS SHOWN IS MERGED EXTERNAL ENVELOPE OF THE TWO VEHICLES (BLADE AND TOWER) USED IN DRAWING J1479-DRG-C01-053.

KEY:
- AREA SUBJECT TO OVERRUN WITHIN HIGHWAY LAND
- AREA SUBJECT TO OVERSAIL IN HIGHWAY LAND
- AREA SUBJECT TO OVERRUN WITHIN 3RD PARTY LAND
- AREA SUBJECT TO OVERSAIL IN 3RD PARTY LAND
- 0.5m BUFFER OF SWEPT PATH ANALYSIS

KEY - DELIVERY VEHICLE
- BODY ENVELOPE
- DELIVERY VEHICLE WHEEL EXTENT

LOAD OVERSAIL
DELIVERY VEHICLE

SCALE 1:500

NOTES
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Appendix C  Swept Path Analysis Vehicle Models
### V112-3.3 55m Blade UNAPPROVED

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<th>Specification</th>
<th>Measurement</th>
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<td>Overall Length</td>
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<tr>
<td>Overall Width</td>
<td>2.650m</td>
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<tr>
<td>Overall Body Height</td>
<td>4.800m</td>
</tr>
<tr>
<td>Min Body Ground Clearance</td>
<td>0.375m</td>
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<tr>
<td>Track Width</td>
<td>2.600m</td>
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<tr>
<td>Look to Look Time</td>
<td>6.00s</td>
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<tr>
<td>Wall to Wall Turning Radius</td>
<td>9.600m</td>
</tr>
</tbody>
</table>
JUG99-Nordex N100 Delta Top Tower UNAPPROVED

Overall Length 60.361m
Overall Width 2.280m
Overall Body Height 4.900m
Min Body Ground Clearance 0.156m
Max Track Width 2.400m
Lock to Lock Time 6.00s
Wall to Wall Turning Radius 9.500m