

Rigged Hill Windfarm Repowering

Technical Appendix A12.1: Abnormal Load Assessment

Volume 3 – Technical Appendix July 2019





RIGGED HILL WIND FARM REPOWERING

ABNORMAL LOAD ROUTE ASSESSMENT

MARCH 2019



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1 INTRODUCTION

Rigged Hill Wind Farm is an operational wind farm of ten wind turbines located near Limavady in Derry / Londonderry, Northern Ireland. This Abnormal Load Route Assessment (ALRA) provides an assessment of land based routes to the existing wind farm site for the delivery of new wind turbine components to enable repowering of the wind farm.

2 METHODOLOGY

This ALRA is a desk based study which uses publically available Ordinance Survey Northern Ireland (OSNI) mapping to conduct swept path analysis of pinch points on the proposed delivery routes. Swept path analysis is conducted in AutoCAD using the Vehicle Tracking software and a bespoke set of delivery vehicles developed for this ALRA.

2.1 Mapping

OSNI Vector Mapping was used to conduct swept path analysis along the proposed delivery route. This mapping is two-dimensional and therefore the assessment only considers the horizontal geometry of pinch points on the route. Topographical surveys may be required in order to undertake an assessment of vertical constraints.

The OSNI mapping used during this assessment was the most up to date mapping available at the time the assessment was undertaken, however a number of locations where this appeared to be out of date were identified. At one location where recent junction improvement works have been undertaken, preliminary design drawings of a new roundabout were acquired from the Department for Infrastructure and are used in this ALRA.

In other locations inaccuracies in mapping have been identified and noted, however no alternative mapping was available. In general the extents of road and verges are noted as being inaccurate. Topographical surveys are recommended to be used as the basis for detailed design of all improvements works.

2.2 Site Visit

A site visit and route drive over was undertaken in October 2017 by an Arcus Engineer in order to verify results of an initial swept path analysis. During this drive over the locations of identified constraints were confirmed in order to verify the accuracy of the OS mapping. A number of additional points of constraint (PCs), and locations where OS mapping was out of date or inaccurate, were identified during this drive over.

2.3 Delivery Vehicle Specifications

Several candidate wind turbines are being considered for repowering the wind farm. In order to provide a robust assessment this ALRA considered the worst case wind turbine blade and the worst case tower section dimensions from the candidate turbines.

Vehicle data sheets are included in Appendix A. Dimensions of the worst case turbine components and corresponding delivery vehicle specifications are provided in the following tables.

Table 2.1: Candidate Turbine Data

	Data Us
Blade	Length 5



ed in Assessment

58.7m

	Data Used in Assessment
Tower Section	Length 22.6m Diameter 4.5m

Table 2.2: Assumed delivery vehicles for Candidate Turbine

	Data	Source
Blade Trailer	Vehicle length – 63.5m Blade overhang – 10.5m	Volvo Cab / TSR Trailer
Tower	Total vehicle length – 40.3m Vehicle width - 4.5m	Volvo Cab / Tower Clamp & Nooteboom

2.4 Route to Site

Routes to site were considered from Belfast and Larne in the east and from Foyle Port, Derry / Londonderry in the West. Figure 1 included in appendix B shows the assessed routes to site and location of PCs, and overview of each route is provided below.

Route A:

- Foyle Port;
- Port Road;
- Haw Road;
- Maydown Road;
- A2;
- A37;
- Ringsend Road;
- Terrydoo Road; and
- Site Entrance

Route B:

- Belfast Harbour;
- Airport Road West;
- A2;
- M3;
- M2;
- A26;
- M2;
- A26;
- A37;
- A29;
- Craigmore Road;
- Ringsend Road;
- Terrydoo Road; and
- Site Entrance.

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Route C:

- Larne Harbour;
- A8;
- A36;
- M2;
- A26;
- A37;
- A29;
- Craigmore Road;
- Ringsend Road;
- Terrydoo Road; and
- Site Entrance.

2.5 Assumptions

In order to keep the results of assessment as concise as possible the following assumptions have been made at each PC:

During transit, delivery vehicles will be accompanied by an escort vehicle and a police escort if required;

At all locations where the delivery vehicle occupies the full road width, or is required to contraflow a junction, appropriate traffic management procedures will be implemented by the escort. This will usually involve temporary closure of the road or junction whilst the vehicle passes;

A detailed traffic management plan will be prepared prior to delivery to inform all relevant stakeholders of road closures and other procedures to be implemented during delivery; and

Topographical surveys will be undertaken and used as a basis for detailed design of any required improvement works.

3 RESULTS OF ASSESSMENT

Based on swept path analysis of all PCs identified on the proposed delivery routes, outcomes and mitigation requirements have been defined and are summarised in Table 3.1.

At each PC both the wind turbine blade vehicle and tower section vehicle were tracked. Swept path analysis drawings for each pinch point are included in Appendix C. At each PC the vehicle shown is the one with the most severe mitigation requirements.



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Tabi	le 3.1: Assessment of Con	nstraints				
Ref	Location	Assessment Outcome	Mitigation	Risk	Notes	
PC/00 - PC/1	10 Refer to Route A from Foyle P	ort				
PC/00	Bend on exit from Foyle Port over railway bridge, Port Road	Blade tip to oversail pedestrian footway on outside of bend.	Topographical survey or dry run recommended to confirm bridge parapet clearance	Low	Sheet 1 of 38	
PC/01	Haw Road/Maydown Road Junction	Blade tip to oversail pedestrian footway on outside bend, north of Haw Road. Centre of load to oversail hardstanding area on inside bend and conflict with fence in additional land. Vehicle to overrun verge east of Maydown Road. Central island indicated on mapping is not present, confirmed during site visit.	Fence to be relocated behind oversail area in additional land. Load bearing surface to be laid in overrun area east of Maydown Road.	High	Sheet 2 of 38	
PC/02	Maydown Roundabout, A2	Roadsign on approach arm central island conflicts with blade tip oversail. Central island to be overrun by trailer.	Roadsign on approach arm central island to be mounted on demountable supports and temporarily removed during delivery. Load bearing surface to be laid on central island overrun area, steel plating and kerb protection likely to be sufficient.	Medium	Sheet 3 of 38	
PC/03	Campsey Roundabout, A2	Blade tip to oversail central barrier on approach arm. Roundabout central island to be overrun. Trailer oversail may conflict with chevron signpost in central island.	Height of blade tip and central barrier to be checked to ensure it can be safely oversailed. Load bearing surface to be laid in central island to permit overrun. Topographical survey recommended to establish clearance to chevron sign.	Medium	Sheet 4 of 38	
PC/04	Broadbridge Roundabout, A2	Blade tip to oversail central barrier. Blade tip to oversail barrier on inside bend of approach arm. Load to oversail roundabout central island.	Height of blade tip to be checked against barrier height to ensure clearance.	Low	Sheet 5 of 38	

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Notes		Sheet 6 of 38	Sheet 7 of 38	Sheet 8 of 38	Sheet 9 of 38	
	Risk	Low	Medium	Medium	Medium	
	Mitigation	Clearance height of approach arm barrier and inside bend barrier to be checked against clearance of blade tip to ensure safe passage.	Load bearing surface to be laid on approach arm central island to permit overrun, steel plating may be sufficient bollards to be mounted on demountable supports. Topographical survey will be required to establish level of roundabout central island, this is likely to require reduction to permit trailer oversail. Chevron signpost to be mounted on demountable supports.	Directional sign on approach arm central island and plastic bollards to be mounted on demountable supports and removed during delivery. Load bearing surface to be laid in overrun area of exit arm central island, steel plating should be sufficient. Lighting column on exit arm central island to be relocated. Clearance height of blade tip above roundabout central island to be checked.	Topographical information of actual roundabout will be required to allow robust assessment. Chevron signpost to be mounted on demountable supports and removed during delivery. Level of roundabout central island to be lowered to accommodate overrun.	
	Assessment Outcome	Blade tip to oversail approach arm central island barrier. Blade tip to oversail inside bend of approach arm. Trailer to oversail roundabout central island.	Vehicle to overrun approach arm central island and conflict with plastic bollards. Blade tip to oversail verge on inside bend of approach arm. Trailer to oversail roundabout central island and conflict with chevron signpost. Central island is built up above road level and may conflict with trailer oversail.	Roundabout to be contra-flowed. Blade tip to oversail approach arm central island and will conflict with directional sign. Vehicle to overrun exit arm central island and to conflict with lighting column and bollards.	Assessment based on scaled PDF of preliminary design drawings as mapping did not include roundabout. Blade tip to oversail entry arm inside bend. Trailer to overrun roundabout central island and conflict with chevron signpost. Central island is built up above road level and may conflict with trailer oversail.	
	Location	Longfield Roundabout, A2	Lisnakilly Roundabout, A2	Killane Roundabout, A2/ A37	A37/Greystone Road Roundabout	
	Ref 1 PC/05		PC/06	PC/07	PC/08	

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Assessment	Repowering
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Mitigation	Signpost and markers to be mounted on demountable supports and lowered during delivery.	Option 1 : Load bearing surface to be laid in overrun area north of Ringsend Road in additional land. Telegraph pole and fence to be relocated. Option 2 : Load bearing surface to be laid in overrun area. Chevron signposts and directional signage to be mounted on demountable supports and removed during delivery. Fence to be relocated behind overrun area. Chevron signs must be present at all times when road is open to public to ensure safety.		Load bearing surface to be laid in overrun area. Road sign to be mounted on demountable support.	No further mitigation required	Load bearing surfaces to be laid in overrun areas. Blade height to be considered against pedestrian guard rail height. Road sign to be mounted on demountable support. Topographic survey recommended to confirm extent of central island hedge
Assessment Outcome	Blade tip to oversail outside bend, north of Broad Road. Trailer to oversail inside bend and conflict with signpost and markers.	Option 1: Vehicle to overrun area north of Ringsend Road in additional land and conflict with telegraph pole and fence on field boundary. Option 2: Vehicle to overrun area south of Ringsend Road in additional land and conflict with chevron signposts, directional signage and fence.	larbour to PC/19 Lame Road Roundabout / M2	Trailer to overrun outside bend of roundabout within verge. Blade tip to oversail roundabout outside bend and island. Trailer to oversail island and conflict with road sign.	Vehicle can negotiate junction with no conflict.	Blade tip to oversail northern footway and central reservation. Potential conflict with pedestrian guard rail on A8/Ballymena Rd. Blade tip to oversail roundabout outside bend. Trailer to overrun A8 central reservation and roundabout central island.
Location	Broad Road/Ringsend Road Junction, A37	Ringsend Road/Terrydoo Road Junction	9 Refer to Route B from Larne H	Larne Harbour Roundabout	The Harbour Hwy Roundabout	Milbrook Roundabout
Ref	PC/09	PC/10	PC/11 - PC/1	PC/11	PC/12	PC/13

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Ref	Location	Assessment Outcome	Mitigation	Risk	Notes	
PC/14	A8/Shanes Roundabout	Vehicle required to contraflow roundabout. Blade tip to oversail approach arm outside bend. Trailer to oversail roundabout central island and conflict with road sign (north of Browndod Rd). Blade tip to oversail the roundabout. Trailer to oversail the roundabout. Trailer to oversail roundabout central island and conflict with lamp post (south of Drumahoe Rd). Trailer to oversail western pavement on Drumahoe Rd.	Load bearing surfaces to be laid in overrun areas. Topographic survey recommended to establish conflict with lamp post. Road sign/eastern lamp post to be removed. Roundabout to be contraflowed.	Medium	Sheet 16 of 38	
PC/15	A36/Shanes Hill Rd	Vehicle can negotiate junction with no conflict.	No further mitigation required	Low	Sheet 17 of 38	
PC/16	A36/Shanes Hill Rd	Vehicle can negotiate junction with no conflict.	No further mitigation required	Low	Sheet 18 of 38	
PC/17	Shanes Hill Rd	Vehicle can negotiate junction with no conflict.	No further mitigation required	Low	Sheet 19 of 38	
PC/18	A36/Moorfields Rd	Vehicle can negotiate junction with no conflict.	No further mitigation required	Low	Sheet 20 of 38	
PC/19	Larne Rd Roundabout / M2	Vehicle can negotiate junction with no conflict.	No further mitigation required	Low	Sheet 21 of 38	
PC/20 - PC/;	34 Refer to Route C from the Por	t of Belfast				
PC/20	Airport Rd W Unnamed Roundabout	Vehicle to overrun roundabout central island within existing overrun area.	No further mitigation required	Low	Sheet 22 of 38	
PC/21	Airport Rd W Unnamed Roundabout	Trailer to overrun approach arm central island and conflict with road sign. Load to oversail inside bend with no conflict identified.	Load bearing surfaces to be laid in overrun area, steel plating may be sufficient. Road sign to be mounted on demountable supports.	Medium	Sheet 23 of 38	



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Ref	Location	Assessment Outcome	Mitigation	Risk	Notes
PC/22	Airport Rd/A2 On-Slip	Blade tip to oversail outside bend over bollard and conflict with lighting columns and vegetation. Trailer to overrun inside bend within verge.	Load bearing surfaces to be laid in overrun areas. Clearance height of blade above bollard to be checked. Lighting columns to be relocated as required. Signposts to be relocated or mounted on demountable supports. Vegetation to be suitably cut back.	Medium	Sheet 24 of 38
PC/ 23	M2/ Lisnevanagh Road Roundabout	Blade tip to oversail on the outside bend on approach arm and over roundabout central island, no conflict identified. Trailer to oversail inside bend above roundabout central island, no conflict identified.	No further mitigation required.	Low	Sheet 25 of 38
PC/24	Ballee Roundabout	Blade tip to oversail, and trailer to overrun, approach arm outside bend and conflict with lighting column. Trailer to oversail approach arm inside bend. Blade tip to oversail approach of roundabout. Trailer to oversail exit arm inside edge. Potential conflict with lighting column.	Load bearing surface to be laid in overrun area within verge. Lighting columns to be relocated.	Medium	Sheet 26 of 38
PC/25	A26/A44 Roundabout	Assessment based on scaled PDF of preliminary design drawings as mapping did not include rounabout. Vehicle to overrun roundabout central island and approach arm inside bend and potentially conflict with chevron signpost on central island. Blade tip to oversail A26 central reservation.	Topographical information of actual roundabout will be required to allow robust assessment. Load bearing surface to be laid in overrun area in roundabout central island and approach arm inside bend. Clearance height of blade tip above barrier in central reservation to be checked.	Medium	Sheet 27 of 38

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Ref	Location	Assessment Outcome	Mitigation	Risk	Notes
PC/26	Kilraughts Road Roundabout, A26	Vehicle to overrun roundabout central island. Trailer to oversail roundabout central island and approach and exit arm inside bends. Conflict with chevron signpost on roundabout central island and lighting column on approach arm.	Load bearing surface to be laid in roundabout central island. Central island level may need to be lowered. Chevron signpost to be mounted on demountable supports and lowered during delivery. Lighting column on inside bend of approach arm will require relocation.	Medium	Sheet 28 of 38
PC/27	Portrush Road Roundabout, A26	Roundabout central island to be overrun and conflict with chevron signpost. Blade tip to oversail inside bend of approach arm, no conflict identified.	Roundabout central island is raised and may need to be lowered to accommodate vehicle overrun. Chevron signpost to be mounted on demountable supports.	Medium	Sheet 29 of 38
PC/28	Wattstown Roundabout, A26	Blade tip to conflict with lighting column on approach arm inside bend. Roundabout central island level is raised and may conflict with trailer oversail, conflict with chevron signpost.	Lighting column on approach arm inside bend to be relocated. Level of roundabout central island to be established to check for conflict with trailer oversail, chevron signpost to be mounted on demountable supports.	Medium	Sheet 30 of 38
PC/29	Lodge Road Roundabout, A26/A29	Trailer to oversail approach arm central reservation and outside of roundabout, no conflict identified.	No further action required.	Low	Sheet 31 of 38
PC/30	Strand Road Roundabout, A29	Rear of trailer to oversail approach arm central divider and conflict with signpost. Vehicle to overrun roundabout central island. Trailer to oversail approach arm inside bend. Trailer to oversail roundabout central island and conflict with chevron and directional signs.	Load bearing surface to be laid on approach arm central divider and roundabout central island, steel plating may be sufficient. Signpost on approach arm central divider, and on roundabout central island to be mounted on demountable supports and removed during delivery.	Medium	Sheet 32 of 38
PC/31	Greenmount Roundabout, A29	Trailer to oversail approach arm inside bend, roundabout central island and exit arm inside bend.	Locations of approach arm inside bend lighting column and central island chevron sign should be confirmed to check clearance, likely to be ok.	Low	Sheet 33 of 38



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e Assessment n Repowering	
r	Assessment Outcome
on Road	Vehicle to overrun minor sections of

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Ref Lo	cation	Assessment Outcome	Mitigation	Risk	Notes
PC/32 Dr	umcroon Road undabout, A29	Vehicle to overrun minor sections of approach and exit arm islands.	Load bearing surfaces to be laid in overrun areas. Steel plating and kerb protection likely to be sufficient. Topographical survey or dry run recommended to establish clearance to signs.	Low	Sheet 34 of 38
PC/33 Dri Ro	umcroon Road/Craigmore ad Junction	Blade tip to oversail verge on outside bend of Drumcroon Road. Trailer to overrun inside bend of junction and conflict with give way sign. Blade tip to oversail verge on south verge of Craigmore road.	Give way sign to be mounted on demountable supports and lowered during delivery. Load bearing surface to be laid in overrun area on inside bend.	Medium	Sheet 35 of 38
PC/34 Ve Ro	rtical Crests on Craigmore ad	During site observations it was noted that crests on the stretch of Craigmore Road east of Ringsend could have the potential to result in the blade trailer grounding out.	Dry run to investigate the severity of vertical crests on this stretch of road.	Low	
PC/10 Rin Ro	gsend Road/Terrydoo ad Junction	Option 3: Vehicle to overrun additional land north of Ringsend Road and conflict with telegraph pole. Option 4: Vehicle to overrun additional land west of Terrydoo Road and conflict with give way and chevron signposts.	Option 3: Load bearing surface to be laid in overrun area within additional land. Telegraph pole to be relocated. Option 4: Load bearing surface to be laid in overrun area within additional land. Chevron and give way signposts to be mounted on demountable supports and lowered during delivery. <u>Signs must be</u> present at all times when road is open to public to ensure safety.	High	Sheet 36 of 38 Sheet 37 of 38
Site Te Entrance Junction	rrydoo Road	New access junction to be constructed.	Temporary overrun area required to accommodate ALV.	N/A	Sheet 38 of 38

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4 CONCLUSION

Summary 4.1

Three delivery routes were assessed for the candidate wind turbine blade and tower section vehicles. Thirty five pinch points were identified and swept path analysis was conducted at each.

Whilst the majority of each route requires only minor or no mitigation there are a number of junctions where more significant improvement works will be required to permit delivery. Additionally there are two roundabouts where the OSNI mapping is not up to date and scaled PDFs of preliminary design drawings were used as a basis for assessment. This will provide a general indication of required works, however more accurate mapping will be required to assess this proposal in detail.

4.2 **Recommendations for Further Work**

Two roundabouts at PC/08 and PC/25 will require a topographical survey, or the acquisition of as built drawings, issued in digital format, in order to allow a detailed assessment to be undertaken.

At a number of PCs clearance height of the blade tip and or trailer has been identified as a constraint. At these locations clearance heights need to be confirmed in order to establish if the manoeuvre can be performed, this will require a topographical survey to be undertaken in order to ascertain the level of the roundabout or other obstruction.

Structural surveys may need to be undertaken at structures along the route in order to establish weight limits. An abnormal indivisible loads application should be submitted to the relevant authority which will initiate consultations with all relevant parties and identify areas where further review is required.

A dry run should be considered to confirm the viability of improvement works once undertaken.



APPENDIX A – VEHICLE DATA SHEET



APPENDIX B – ROUTE TO SITE



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Figure 12.1.1

APPENDIX C – SWEPT PATH ANALYSIS DRAWINGS

LEGEND:						1
VEHICLE VEHICLE WHEEL TRACK VEHICLE OVERHANG LOAD						z
						\geq
EXTENT OF VEHICLE OVER-RUN						
NOTES:						
MANUAL REAR STEERING HAS BEEN UTILISED FOR THIS SWEPT PATH ANALYSIS. ANALYSIS HAS NOT CONSIDERED VERTICAL GROUND CLEARANCE OF THE VEHICLE AND						
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WIDENING, EARTHWORKS, DRAINAGE, SERVICES, PEDESTRIAN FACILITIES AND TRAFFIC MANAGEMENT. 4. ANALYSIS BASED ON 58.7m BLADE DELIVERY VEHICLE.						
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