DART+ Coastal North

Public Consultation No.2

Annex 3.2 E1: Option Selection OBB39 report

NTA Údarás Náisiúnta Iompair National Transport Authority

Rialtas na hÉireann Government of Ireland | Tionscadal Éireann Project Ireland 2040

Iarnród Éireann Irish Rail

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1. INTRODUCTION

This report documents the optioneering assessment for the vehicular bridge (IÉ reference OBB39) to enable the electrification of the railway line beneath this bridge. The existing vertical clearance beneath this structure is insufficient to accommodate electrical wiring without a derogation or some form of physical intervention (to either the track below or the bridge itself). This report documents the various options considered and recommends a preferred option for progressing to the next stage of the design process.

2. SITE AND LOCATION

2.1 Location

The vehicular bridge (IÉ reference OBB 39) is located in Rush & Lusk Station and carries the R128 Road over the Northern Line at approximate chainage 13 mi 1644 yds. This is an important access route between the towns of Lusk and Rush.

Figure 1: Bridge location (Map data © OpenStreetMap contributors, Map layer by Esri)

2.2 Existing structure

The existing structure is a single span (9.16m skew span) reinforced concrete bridge with precast concrete parapets and precast concrete beams on masonry abutments with a reinforced concrete extension. A principal inspection was carried out on all elements of the structure above ground by IÉ on 19/07/2019 and the overall condition was deemed good.

Figure 2: Bridge elevation looking towards Belfast (source: Iarnród Éireann)

Figure 3: View of western bridge abutment (source: Iarnród Éireann)

3. DESIGN REQUIREMENTS

An assessment of bridge clearances required for electrification of the Northern line has been carried out at this location based on the topographical survey of the existing rail and bridge arrangement. This assessment has found that the existing clearance from the rails to the underside of the bridge (~4776mm) is sufficient to cater for a case 14 electrical solution (derogation required). The table below shows the additional clearances required to achieve an electrical solution based on the hierarchical cases outlined in the project's functional specification. A contact wire height (CWH) of less than 4.400m will require a derogation. To achieve a CWH greater than 4.400m (no derogation required) min. 4710mm clearance is required.

Table 1: Electrical case hierarchy at OBB 39

Electrical Case	Nominal CW height (mm)	Minimum soffit height for case (mm)	Additional clearance required at structure (mm)
1	4700	5620	964
2	4700	5420	764
3	4700	5220	564
4	4700	5080	424
5	4600	5295	639
6	4600	5095	439
7	4600	4955	299
8	4500	5170	514
9	4500	4970	314
10	4500	4830	174
11	4400	5070	414
12	4400	4870	214
13	4400	4710	54
14	4350	4640	none
14_OBB39	-	-	-
15	4270	4490	none

4. OPTIONS CONSIDERED

A number of options have been considered to enable the electrification of the track beneath this bridge. These options generally consider electrical solutions which would require a derogation, the modification or replacement of the bridge structure and the lowering of the track.

4.1 Electrical solution requiring a derogation

This option involves track lowering via tamping to allow for a bespoke electrical solution which retains the existing rail and bridge soffit levels. This requires a reduction of some design tolerances to achieve an electrical solution with a nominal contact wire height of 4370mm (approximately equivalent to a hierarchy case 14); further details of this are provided below. This option would require a derogation.

Table 2: Potential electrical solution parameters with CWH < 4400 mm (Derogation required)

Potential OHLE solution	Contenary with zero encumbrance
OHLE Arrangement	Fitted with Elastic Bridge Arms
Static Clearance (Csc) - 1500Vdc	100mm
Dynamic Clearance (Cdc) - 1500Vdc	80mm
Minimum Position of the Contact Wire (considering tamping)	4245mm
Actual Design Contact Wire Height (Cdcl) (After Tamping)	4370mm
Maximum Design Contact Wire Height [Pre-Tamping]	4420mm
OHLE System Depth (Csd)	0mm
OHLE Uplift (Cwu)	50mm
OHLE Construction/Installation (Cct) + Maintenance Tolerance (Cmt)	50mm
Structure Construction Tolerance (St)	0mm
Track Maintenance Tamping Allowance (Tla)	50mm
Track Construction Tolerance (Tct)	0mm
Track Maintenance Tolerance (Tmt)	25mm
Considered OHLE span through the overbridge (as per hierarchy cases)	12m
Sag and Ice Load	25mm
Survey Tolerance	5mm
Loading Gauge	4064mm
Mechanical Clearance	201mm
Speed through the structure	160km/h - 100mph
Acceptance - CCE	TMTA 50mm
Acceptance - SET	CW<4700mm
Derogation - SET	CWH – 4370mm Post tamping

Table 3: Potential electrical solution parameters with CWH = 4500mm based on design proposal

Potential OHLE solution	Contenary with zero encumbrance
OHLE Arrangement	Free Running
Static Clearance (Csc) - 1500Vdc	150mm
Dynamic Clearance (Cdc) - 1500Vdc	100mm
Minimum Position of the Contact Wire (considering tamping)	4336mm
Actual Design Contact Wire Height (Cdcl) (After Tamping)	4500mm
Maximum Design Contact Wire Height [Pre-Tamping]	4575mm
OHLE System Depth (Csd)	0mm
OHLE Uplift (Cwu)	70mm
OHLE Construction/Installation (Cct) + Maintenance Tolerance (Cmt)	50mm
Structure Construction Tolerance (St)	0mm
Track Maintenance Tamping Allowance (Tla)	75mm
Track Construction Tolerance (Tct)	5mm
Track Maintenance Tolerance (Tmt)	25mm
Considered OHLE span through the overbridge (as per hierarchy cases)	15m
Sag and Ice Load	39mm
Survey Tolerance	5mm
Loading Gauge	4064mm
Mechanical Clearance	107mm
Speed through the structure	160km/h - 100mph
Acceptance - CCE	TMTA 75mm Mech. clearance 107mm
Acceptance - SET	CW<4700mm
Derogation - SET	No

4.2 Track lowering

This option involves lowering of the tracks to allow for a more favourable electrical solution whilst retaining the existing bridge levels. This requires the removal of tracks and ballast, lowering of the formation and reinstatement of the tracks at a lower level. The existing platform has a precast concrete coping. No further details are available at the time of writing this report with respect to the as-built nature of the platform structure, however from visual inspection it appears to have a front wall construction consisting of a mixture of concrete and granite setts.

Based on the topographical survey carried out by Murphy Geospatial in August 2021, the maximum track lowering of 74mm is required approximately 30m north of OBB39, reducing to approximately 60mm in the immediate vicinity of OBB39.

The extent of the lowering through the platform is limited to the first 19m of the, of which 14m forms the platform ramp. Approximately 5m of the existing operational length of the platform structure needs to be lowered, with a maximum reduction of 11mm required.

On this basis, given the maximum lowering of 11mm occurs at the top of ramp location reducing to 0mm within 5m of this location, intervention with respect to lowering the copings may not be required as these values would in in the upper limits of typical construction tolerance. However, should the coping require lowering in this location by 11mm this could prove problematic due to the presence of granite setts in the wall construction. It should be expected that a partial closure of the platform would be required while these works are being undertaken. Relocation of stop boards may also be required.

It should be noted that subsequent to the aforementioned survey being carried out and used for the basis of the design, routine maintenance works have been undertaken in the form of tamping the alignment. Whist the clearances required to accommodate the OHLE are maintained, there will be a marginal impact with respect to the length and the depth of lowering required, based off the assumption the tamping operation is in the order of 25mm. Prior to commencement of both preliminary and detailed design, revised level information should be considered and values revised accordingly.

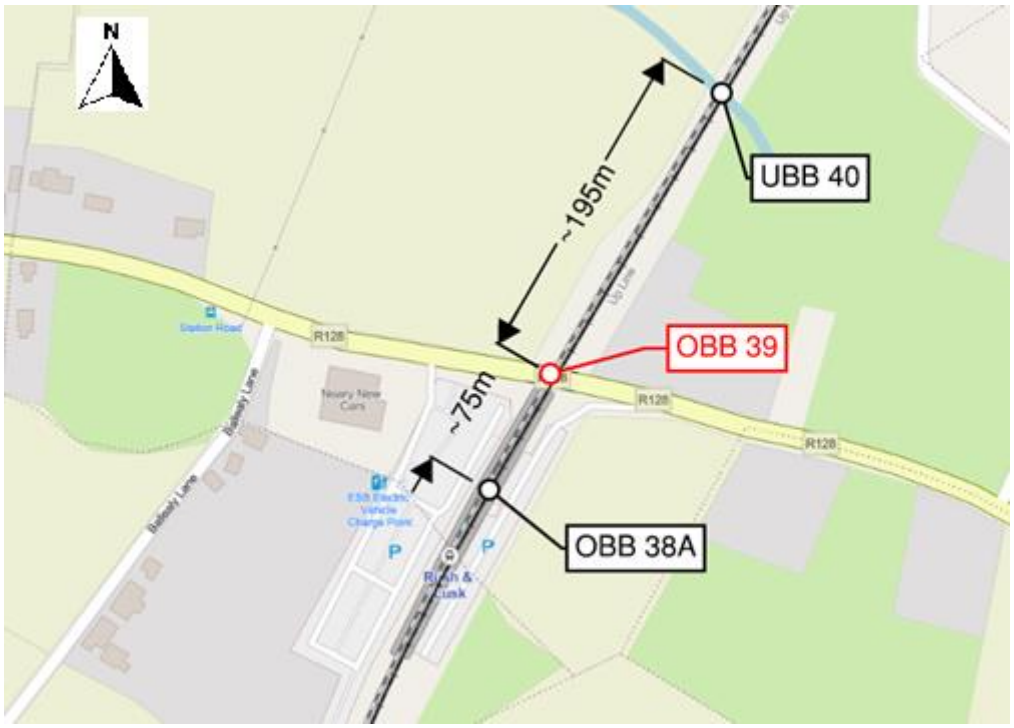

Figure 4: Crossings up line and down line of bridge (Map data © OpenStreetMap contributors, Map layer by Esri)

4.3 Bridge Modification (Raise Superstructure or Demolish and Reconstruct Bridge)

This option involves raising of the existing bridge soffit levels. This can be done by extending the abutment heights and jacking or replacing the bridge deck, or by demolishing and reconstructing the bridge entirely. Based on the information available, it is difficult to raise the bridge soffit levels to achieve a more favourable electrical solution.

Raising of bridge levels will require road closures during the works. The existing road is an important access route between Lusk and Rush. There are several alternative routes which can be used to access these services, the most suitable of which appears to be via OBB46 which carries the L1285 over the Northern Line. This would only add an additional 4mins to the journey time. Bus routes 33 and 33A currently cross this bridge.

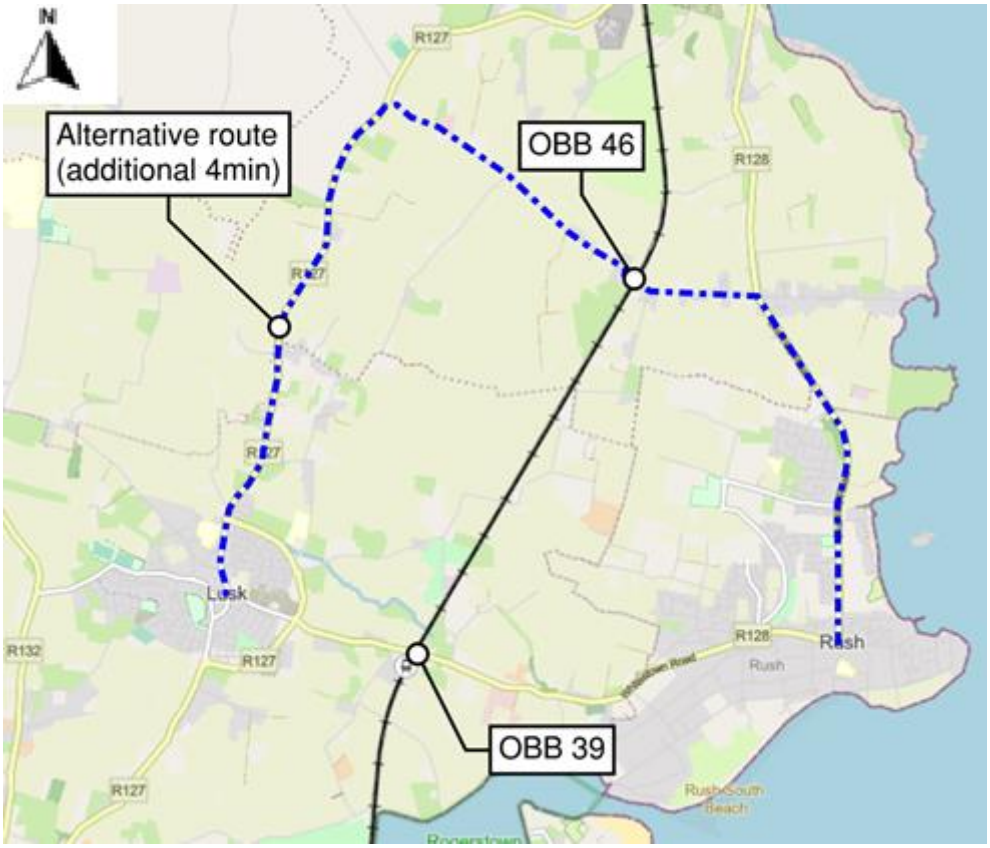

Figure 5: Road diversion option (Map data © OpenStreetMap contributors, Map layer by Esri)

Raising of bridge levels will also require raising of road levels on approaches to the bridges. The bridge is situated on a significant vertical crest with poor inter-visibility on approach. The closest road interface is approximately ~35m to the east. Tie-in to the existing road levels is possible if the bridge deck is raised, however this would further impact on the vertical alignment and visibility over the bridge.

The current highway geometry is considered non-compliant with current standards. In order to bring the current highway to the minimum standards with respect to vertical curvature and forward and safe stopping distances on the approach to the station, installation of approximately 250m of new retaining structures will be required to each side of the carriageway to a maximum height of 2.3m to both sides of the over bridge.

Reconfiguration of the existing station entrance, junctions and carparking will be required with modification to the existing walking routes and surface water drainage system to accommodate the new final levels.

Significant amendments shall be required to existing local accesses to dwellings and businesses in the vicinity, with due care and consideration given to the intervisibility at the junction splays with vulnerable road users and vehicles wishing to egress from these junctions. Given the proposed level difference in this area, additional cut off drainage will need to be provided to prevent excess surface water runoff from the carriageway surfacing.

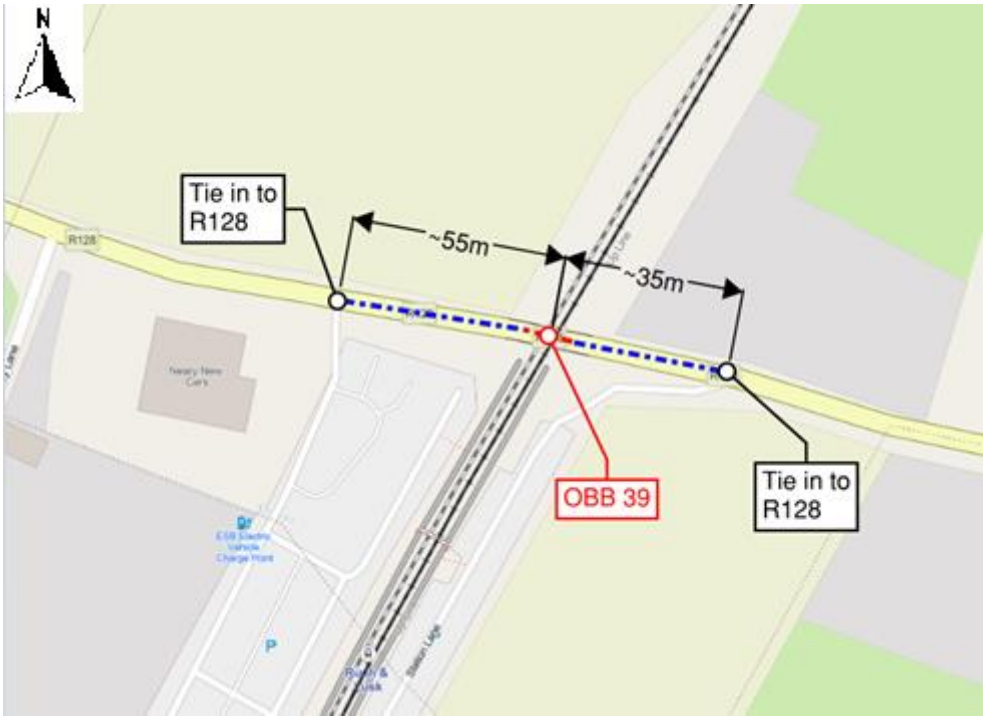

Figure 6: OBB 39 approach road tie ins (Map data © OpenStreetMap contributors, Map layer by Esri)

Figure 7: Approach to OBB 39 from the East (source: Iarnród Éireann)

5. CONCLUSIONS AND RECOMMENDATIONS

Track lowering should be considered as the appropriate solution in this instance, given the short length of the operation platform impacted.

However, it should be noted that a reduced wire height derogation should be sought for the platform area, as the rising gradient of the wire in this location will not fulfil the requirements with respect to touch potential.

Raising of bridge levels will cause significant disruption given the importance of this route, thus temporary closure will impact on the local road networks as diversionary routes will need to be presented and approved by the local authority. The physical works themselves will be expensive and have a significant impact on the station car park and adjacent business in order to tie in the raised highway levels associated with the new bridge.

APPENDIX A

Drawings