DART+ Coastal North

Public Consultation No.2

Annex 3.2 E3: Option Selection OBB55 Report

NTA
Údarás Náisiúnta Iompair
National Transport Authority

Rialtas na hÉireann
Government of Ireland

Tionscadal Éireann
Project Ireland
2040

Iarnród Éireann
Irish Rail

CONTENTS

TABLES

FIGURES

1. INTRODUCTION

This report documents the optioneering assessment for the vehicular bridge (IÉ reference OBB 55) 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 55) is located in Balbriggan, south of Balbriggan Station and carries the R127 over the Northern Line at approximate chainage 21 mi 304 yds. This is an important access road for a large residential area from the east of the town to the town on the west.

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

2.2 Existing structure

The existing structure is a single span (9.144m span) reinforced concrete bridge with precast concrete portal units on masonry abutments. A principal inspection was carried out on all elements of the structure above ground by IÉ on 13/08/2013 and the overall condition was deemed good.

Figure 2: Bridge elevation towards Dublin (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 (~4590mm) is insufficient to cater for an electrical solution 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 55

Electrical Case	Nominal CW height (mm)	Minimum soffit height for case (mm)	Additional clearance required at structure (mm)
1	4700	5620	1150
2	4700	5420	950
3	4700	5220	750
4	4700	5080	610
5	4600	5295	825
6	4600	5095	625
7	4600	4955	485
8	4500	5170	700
9	4500	4970	500
10	4500	4830	360
11	4400	5070	600
12	4400	4870	400
13	4400	4710	240
14	4350	4640	170
14_OBB55	-	-	-
15	4270	4490	20

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 providing a slab track to allow for a bespoke electrical solution which retains the existing rail and bridge soffit levels. This requires the removal of tracks and ballast, construction of a concrete slab and reinstatement of the tracks on the new slab. This allows a reduction of some design tolerances to achieve an electrical solution with a nominal contact wire height of 4270mm (hierarchy case 15); further details of this are provided below. This option would require a derogation.

Table 2: Potential electrical solution parameters with CWH < 4400mm (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)	4215mm
Actual Design Contact Wire Height (Cdcl) (After Tamping)	4270mm
Maximum Design Contact Wire Height [Pre-Tamping]	4270mm
OHLE System Depth (Csd)	0mm
OHLE Uplift (Cwu)	50mm
OHLE Construction/Installation (Cct) + Maintenance Tolerance (Cmt)	30mm
Structure Construction Tolerance (St)	0mm
Track Maintenance Tamping Allowance (Tla)	0mm
Track Construction Tolerance (Tct)	5mm
Track Maintenance Tolerance (Tmt)	5mm
Considered OHLE span through the overbridge (as per hierarchy cases)	12m
Sag and Ice Load	25mm
Survey Tolerance	5mm
Loading Gauge	4064mm
Mechanical Clearance	205mm
Speed through the structure	160km/h - 100mph
Acceptance - CCE	Slab track
Acceptance - SET	CW<4700mm Reduced electrical clearances

Potential OHLE solution	Contenary with zero encumbrance
	OHLE construction + maintenance tolerance 30mm
Derogation - SET	CWH -4270mm

Table 3: Potential electrical solution parameters with CWH 4400mm based on design proposal

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)	4275mm
Actual Design Contact Wire Height (Cdcl) (After Tamping)	4400mm
Maximum Design Contact Wire Height [Pre-Tamping]	4450mm
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)	5mm
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	215mm
Speed through the structure	160km/h - 100mph
Acceptance - CCE	TMTA 50mm
Acceptance - SET	CW<4700mm Reduced electrical clearances OHLE Uplift 50mm
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.

Based on the information available, it is considered feasible to lower the track to achieve a more favourable electrical solution. The railway line is straight at this location with the nearest crossing located ~200m from the structure. It is assumed that the bridge foundation is at least 200mm below ballast formation level.

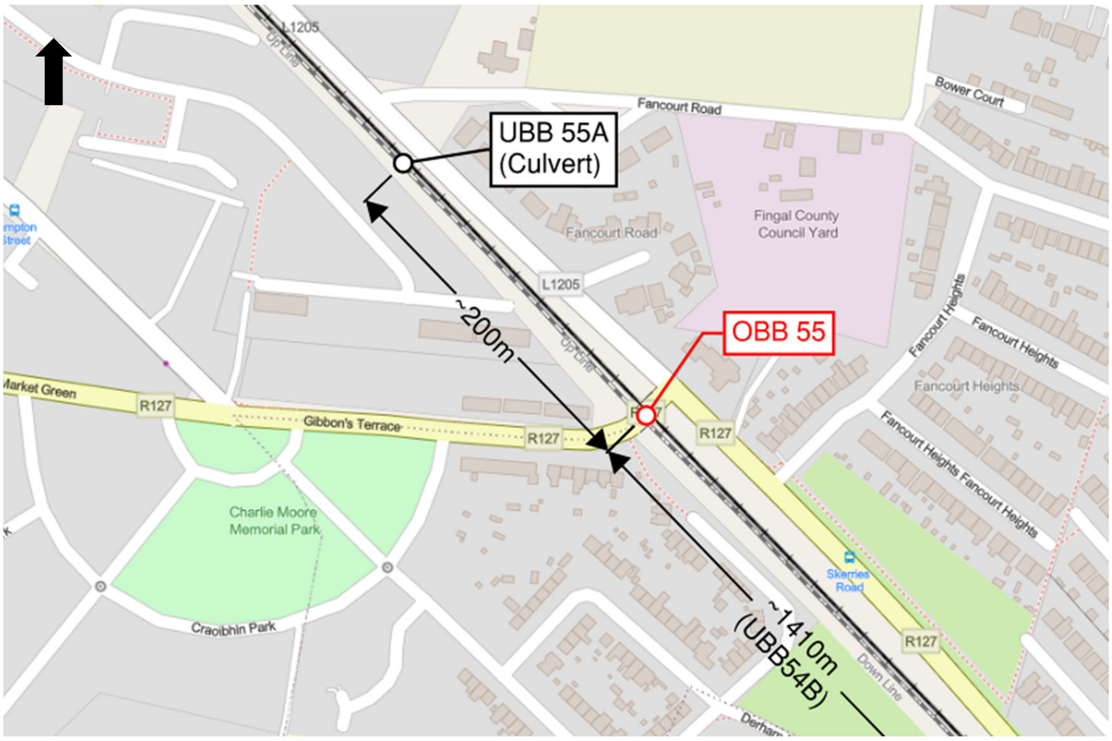

Figure 4: Crossings up line and down line of bridge (Map data © OpenStreetMap contributors, Map layer by Esri)

The existing grade of the railway falls on an east to west axis (east high). On this basis the vertical gradient needs to be increased to provide the additional clearance from the top of rail to the soffit of the structure.

The introduction of a vertical curve located directly underneath the structure has been considered in this instance to minimise any additional works to the east or the west of the structure given the tight physical constraints in the locality. The proposed maximum lowering in the area of the railway line affected is approximately 193mm directly under the structure, which is then graded out to each side. The maximum lowering required beyond the structure occurs approximately 60m to the west requiring the track to be lowered by 284mm at the bottom of the proposed sag curve. Whilst reducing the radius of this curve does present an opportunity to reduce the dig required, the radius would not be deemed appropriate given the current existing line speed, this impact would be further exacerbated should the line speed be increased in the further.

In reducing the rail level by this value, reprofiling of the existing formation will be required. Records of the existing drainage in this area show only natural as opposed to engineered drainage is present in this locality. Whilst lowering the track may pose issues with respect to pooling of water and an increased risk of wet bed occurring if it is found the imperviable material lays within the area of the cutting, an existing continuous downward gradient is provided throughout, thus eliminating creation of a low point. However, on this basis consideration may need to be given to providing a positive drainage solution. This will likely be over a 200m length.

Given the railway line is located in an open cutting, it is considered that minor localised reprofiling of the existing cut slopes to the eastern side of the structure will be required over approximately 140m.

With a reduction of the rail level of 200mm in close proximity to the abutment wall, further investigations with respect to the foundation level on OB55 needs to be made, as the need may arise for the existing foundations to be strengthened or underpinned. To mitigate against disruption to the existing cut slope, consideration of a small dwarf retaining structure, for a 50m length, 60m to the east of the overbridge should still be considered.

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

This option involves the 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 for a large residential area from the east to the town on the west. Alternative routes can be used (with an additional 8 minute journey time), however these routes may not be suitable for some vehicles such as buses with restricted headroom at bridges and narrow roads. Several bus routes cross this bridge including routes 33 and 33A. The underbridge at Quay Street has restricted headroom of 3.82m. The underbridge on Harbour Road has no such restrictions on headroom, however the road linking this on Seapoint Lane appears to be very narrow and may not be accessible to larger vehicles.

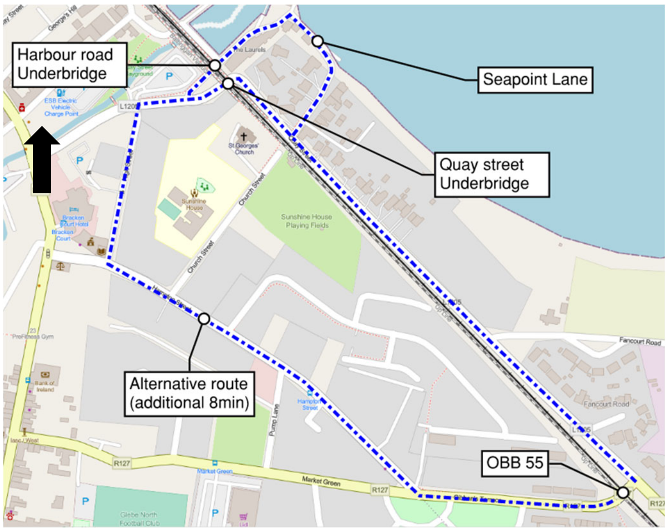

Figure 5: Road diversion options with restricted headroom (Map data © OpenStreetMap contributors, Map layer by Esri)

A route with unrestricted headroom is available via OBB46 to the south, however this is a significantly longer route with an additional 27 minute journey time.

Figure 6: Road diversion options with unrestricted headroom (Map data © OpenStreetMap contributors, Map layer by Esri)

Raising of bridge levels will also require raising of road levels on approaches to the bridges. This may lead to issues with tie in levels to the adjacent roads Gibbon's Terrace and Skerries Road. The junction with Skerries Road is already on a substandard vertical curve with poor intervisibility.

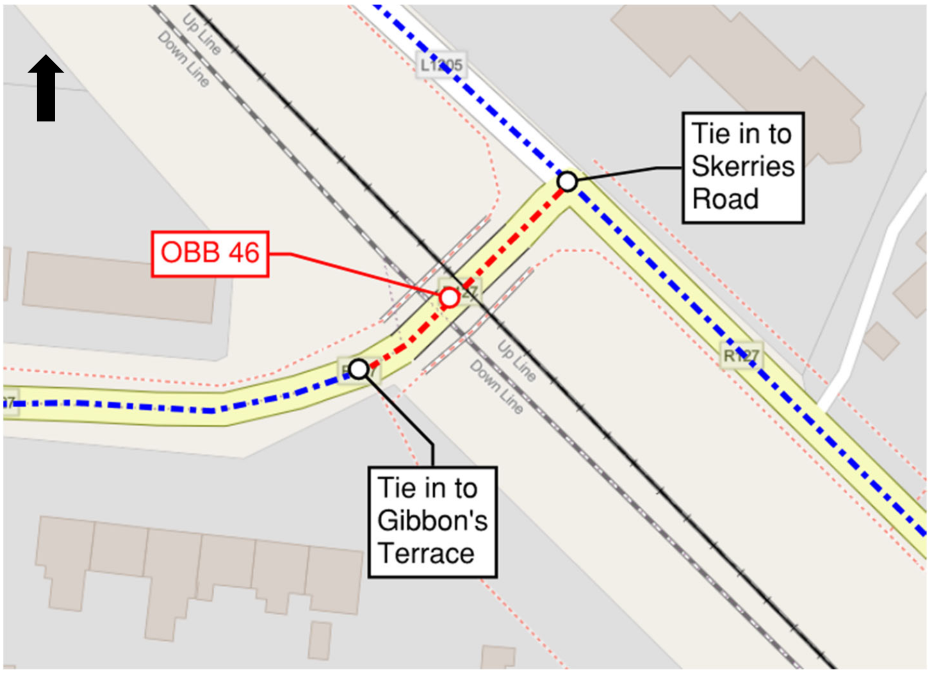

Figure 7: OBB 46 approach road tie ins (Map data © OpenStreetMap contributors, Map layer by Esri)

Raising the road level in this area will impact heavily on local residential properties with approximately 60 properties requiring their existing drives and access to be regraded. Installation of cut off drainage will also be required in the vicinity due to the adjacent highway being raised, with surface water run off likely to adversely impact on these dwellings.

Road restraint systems associated with any replacement bridge works will comply with DN-REQ-03034 (The design of road restraint systems for roads and bridges). The implementation of any road restraint system would need to take into account the need to maintain access to properties in close proximity of the bridge.

New retaining walls will be required to each side of the highway to facilitate the raised bridge structure, with approximately 500m in total required to a height of 1.5m; installation of these retaining structures will cause potential inter-visibility issues from those egressing driveways joining the main carriageway. The existing highways drainage will need to be modified with 8 existing manholes to be raised and all channel line drainage reconnected from the new finished road level to the existing main carrier drain.

Due to the proximity of the existing T-junction with Skerries Road, significant works will be required in a similar manner, including substantial utility diversions. It should be noted that due to the rising gradient and proposed crest curve in this locality, a departure from standard will be required pertaining to the visibility sightlines on the approach to the Stop line. Advance warning signage should be considered with raised height STOP signs provided.

Figure 8: Approach to OBB 55 from the West (source: Iarnród Éireann)

5. CONCLUSIONS AND RECOMMENDATIONS

As detailed in Appendix A, lowering of the track is a feasible option - although with the potential for some impact to the existing infrastructure.

Raising of bridge levels will cause significant disruption given the importance of this route. Temporary closure will impact on the local road networks as diversionary routes will be required to be presented and approved by the local authority. The capital costs for the installation of a raised bridge deck and associated retaining structures are substantially more expensive that the track lowering solution, whilst offering no comparative advantage in terms of function. The impacts on surrounding residents' properties further deter the pursuit of any bridge raising solution.

If a derogation is not an accepting solution, a track lowering in this location is recommended.

APPENDIX A

Drawings