DART+ West

Iarnród Éireann

Option Selection Report Volume 4: Annex_6.2 Bridge Interventions Assessment

MAY-MDC-GEN-ROUT-RP-Y-0002 Annex 6.2

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DART+ West

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Glossary

Abbreviation	Meaning
BRT	Bus Rapid Transit
CIÉ	Córas Iompair Éireann
CRR	Commission for Railway Regulation
DART	Dublin Area Rapid Transit (IÉ's Electrified Network)
DCDP	Dublin City Development Plan
DTTAS	Department of Transport, Tourism and Sport
DU	DART Underground
EMRA	Eastern and Midland Regional Assembly
GDA	Greater Dublin Area
GHG	Greenhouse gas
GSWR	Great Southern & Western Railway
IÉ / IR	Iarnród Éireann / Irish Rail
KCDP	Kildare County Development Plan
LAP	Local Area Plan
MASP	Metropolitan Area Strategic Plan
MCA	Multi-Criteria Analysis
MDC	Multi-Disciplinary Consultant (i.e. IDOM)
MGWR	Midlands Great Western Railway
NAPSI	National Action Plan for Social Inclusion
NDP	National Development Plan 2018–2027
NHA	Natural Heritage Area
NIAH	National Inventory of Architectural Heritage
NMI	National Museum of Ireland
NPF	National Planning Framework
NSO	National Strategic Outcomes
NTA	National Transport Authority
PLUTO	Planning Land Use and Transport Outlook 2040
pNHA	proposed Natural Heritage Area
PPT	Phoenix Park Tunnel
QBC	Quality Bus Corridor
RO	Railway Order
RPG	Regional Planning Guidelines
RPS	Record of Protected Structures
RRV	Rail Road Vehicles
RSES	Regional Spatial and Economic Strategy
SDRA	Strategic Development and Regeneration Area

Abbreviation	Meaning
SDZ	Strategic Development Zone
SIFLT	Strategic Investment Framework for Land Transport
SMR	Sites and Monuments Record
SPA	Special Protection Area
TII	Transport Infrastructure Ireland
TOD	Transit Oriented Development
WHO	World Health Organisation

1. Clearance at Bridges

1.1 Introduction

Electrifying a railway usually means there needs to be a greater distance between the Top of Rail (TOR) and any bridges/structures above it, to ensure that the Overhead Line Equipment (OHLE) fits beneath the bridges.

Analysing all overbridges on the Maynooth Line has identified potentially challenging bridges that do not allow standard OHLE solutions or which may present a challenge for the DART+ West Project. These structures are classified as challenging structures requiring further assessment.

Existing Iarnród Éireann infrastructure has several categories of electrical clearances based on the minimum maintenance parameters which includes Enhanced, Normal, Special Reduced, in order of decreasing heights. Clearance categories are outlined in Table 1-1:

Table 1-1 IÉ electrical clearance categories

Clearance Category	Clearance TOR to Soffit (mm)	Categorisation	Considerations
Enhanced	≥ 5620		Standard contact wire height of 4700 mm and system height and a minimum current carrying dropper of 500 mm.
Minimum Normal	5619 – 5080		Allows contact wire height of 4700 mm but reduced system height.
Minimum Normal	5079 - 4710		Requires contact wire below 4700 mm up to 4400 mm and risk assessment. Requires MCA to explore how to gain clearance.
Special Reduced	4709 - 4495		Requires contact wire height below 4400 mm including risk assessment and standard derogation. Requires MCA to explore how to gain clearance.
Black Structure	< 4495		There is no solution with the current clearance. It requires Permanent Way or Structural intervention to gain clearance. Requires MCA to explore the solution.

Challenging structures, i.e. those with less that 'Enhanced' clearance as defined in Table 1-1, are shown in Figure 1-1. The figure indicates the bridge codes only rather than the common names for the bridges for the purposes of clarity of the figure, however the common names for the bridges are also indicated in the sections of this Chapter where the individual bridges are discussed.

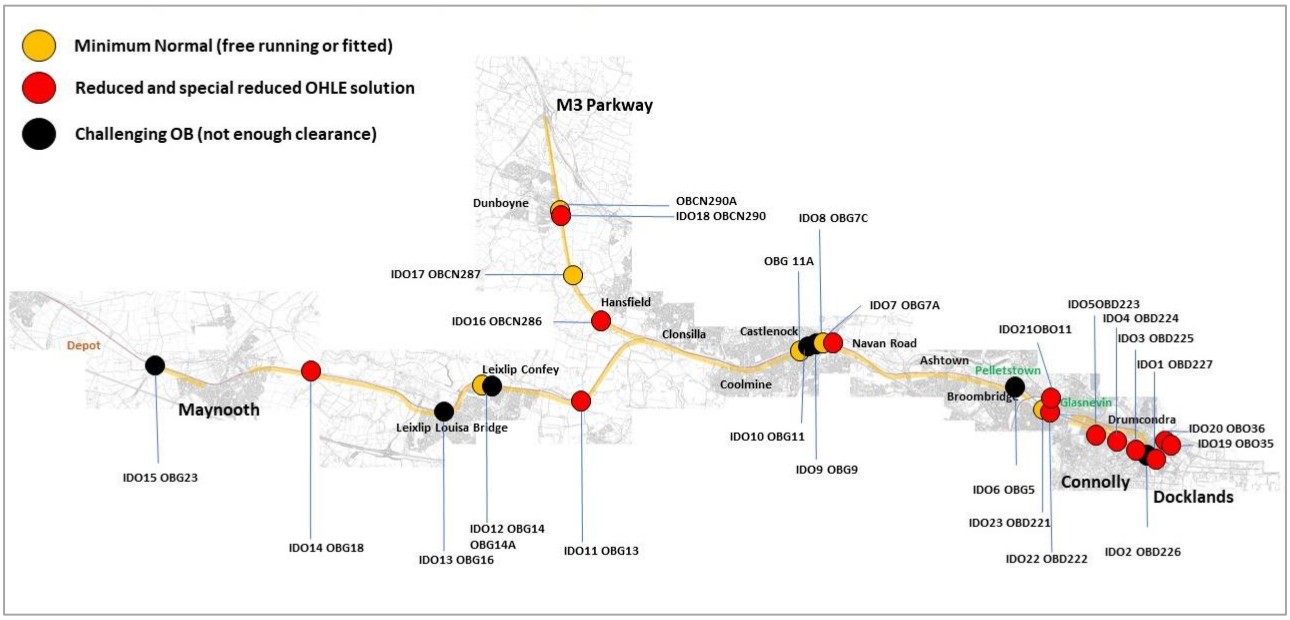

Figure 1-1 Overbridges with less than 'Enhanced' clearance

1.1.1 Description of options

An option selection process has been performed for existing structures along DART+ West that have less than 'Enhanced' clearance, with the following potential solutions analysed depending on each case. These solutions are visited for each structure, starting from the first (optimal solution). Only feasible technical options are analysed in the subsequent option selection process.

- Vertical track lowering to allow an OHLE with contact wire height at 4700 mm.
- Vertical track lowering to allow an OHLE with contact wire height at 4400 mm.
- Bridge modifications or reconstructions to allow an OHLE with contact wire height at 4700 mm.
- Bridge modifications or reconstructions to allow an OHLE with contact wire height at 4400 mm.
- Horizontal realignment to avoid passing below the overbridge.
- Other options or mixed solutions.
- Vertical track lowering to allow an OHLE with contact wire height at 4200 mm (only in Black Structures).
- Bridge modifications or reconstructions to allow an OHLE with contact wire height at 4200 mm (only in Black Structures).
- Special reduced OHLE solution from 4400 mm to 4200 mm (in Red and Black Structures).

1.1.2 OHLE solutions

The structure classification is described in Section 1.1.

Green Structures

1. Contact wire height of 4700 mm, nominal system height of 1300 mm, current carrying dropper of 500 mm and enhanced electrical clearances.

Amber Structures

Where it is not possible to provide the standard OHLE solution due to mechanical or electrical clearance, the following 'Options' hierarchy has been followed for Amber structures to maintain nominal contact wire height:

2. Maintain contact wire height of 4700 mm. Reduced system height, minimum current carrying dropper of 300 mm and enhanced electrical clearances.

3. Maintain contact wire height of 4700 mm. Reduced system height, non-current carrying dropper of 100 mm and enhanced electrical clearances.

4. Maintain contact wire height of 4700 mm. Reduce system height to zero and replace catenary with contenary (twin contact wire). If the bridge width is equal or less than 8 to 9 m free running solution under the bridge shall be used, if the bridge width is greater than 8 – 9 m width fitted solution with bridge/elastic arms shall be applied. Enhanced electrical clearances. Limit uplift to 70 mm.

When the above options are not possible, the following hierarchy has been followed, required in this case risk assessment if it is the final solution to adopt:

5. Reduce contact wire height to 4600 mm. Reduced system height, minimum current carrying dropper of 300 mm and enhanced electrical clearances. Reduce tamping allowance to 75 mm. Maximum OHLE Span 55 m unless reduction in tamping or OHLE tolerance is agreed with relevant Iarnród Éireann stakeholders.

6. Reduce contact wire height to 4600 mm. Reduced system height, non-current carrying dropper of 100 mm and enhanced electrical clearances. Reduce tamping allowance to 75 mm. Maximum OHLE Span 55 m unless reduction in tamping or OHLE tolerance is agreed with relevant Iarnród Éireann stakeholders.

7. Reduce contact wire height to 4600 mm. Reduce system height to zero and replace catenary with contenary (twin contact wire). If the bridge width is equal or less than 8 to 9 m free running solution under the bridge shall be used, if the bridge width is greater than 8 – 9 m width fitted solution with bridge/elastic arms shall be applied. Enhanced electrical clearances. Reduce tamping allowance to 75 mm and limit uplift to 70 mm.

8. Reduce contact wire height to 4500 mm. Reduced system height, minimum current carrying dropper of 300 mm and enhanced electrical clearances. Reduce tamping allowance to 50 mm. Maximum OHLE Span 45 m unless reduction in tamping or OHLE tolerance is agreed with relevant Iarnród Éireann stakeholders.

9. Reduce contact wire height to 4500 mm. Reduced system height, non-current carrying dropper of 100 mm and enhanced electrical clearances. Reduce tamping allowance to 50 mm. Maximum OHLE Span 45 m unless reduction in tamping or OHLE tolerance is agreed with relevant Iarnród Éireann stakeholders.

10. Reduce contact wire height to 4500 mm. Reduce system height to zero and replace catenary with contenary (twin contact wire). If the bridge width is equal or less than 8 to 9 m free running solution under the bridge shall be used, if the bridge width is greater than 8 – 9 m width fitted solution with bridge/elastic arms shall be applied. Enhanced electrical clearances. Reduce tamping allowance to 50 mm and limit uplift to 70 mm.

11. Reduce contact wire height to 4400 mm. Reduced system height, reduced current carrying dropper of 300 mm, enhanced electrical clearances. Reduce tamping allowance to 50 mm. Requires a maximum span of 30 m to infringe the minimum contact wire position over the vehicle of 4190 mm unless reduction in tamping or OHLE tolerance is agreed with relevant Iarnród Éireann stakeholders.

12. Reduce contact wire height to 4400 mm. Reduced system height, non-current carrying dropper of 100 mm, enhanced electrical clearances. Reduce tamping allowance to 50 mm. Requires a maximum span of 30 m to infringe the minimum contact wire position over the vehicle of 4190 mm unless reduction in tamping or OHLE tolerance is agreed with relevant Iarnród Éireann stakeholders.

13. Reduce contact wire height to 4400 mm. Reduce system height to zero and replace catenary with contenary (twin contact wire). If the bridge width is equal or less than 8 to 9 m free running solution under the bridge shall be used, if the bridge width is greater than 8 to 9 m width fitted solution with bridge/elastic arms shall be applied. Reduced electrical clearances. Reduce tamping allowance to 50 mm and limit uplift to 70 mm. Maximum span between bridge arms of 12 m.

Red Structures

14. Reduce contact wire height to 4350 mm. Reduce system height to zero and replace catenary with contenary (twin contact wire). If the bridge width is equal or less than 8 to 9 m free running solution under the bridge shall be used, if the bridge width is greater than 8 to 9 m width fitted solution with bridge/elastic arms shall be applied. Reduced electrical clearances. Reduce tamping allowance to 50 mm and limit uplift to 50 mm. Maximum span between bridge arms of 12 m.

15. Reduce contact wire height to 4270 mm. Reduce system height to zero and replace catenary with contenary (twin contact wire). If the bridge width is equal or less than 8 to 9 m free running solution under the bridge shall be used, if the bridge width is greater than 8 – 9 m width fitted solution with bridge/elastic arms shall be applied. Reduced electrical clearances. Slab track required to reduce tamping allowance to 0 mm and track maintenance tolerance to 5 mm. Limit uplift to 50 mm. Maximum span between bridge arms of 9 m.

1.1.3 Track lowering

This solution consists of a track lowering the existing track levels to achieve the necessary clearance for the OHLE beneath the existing bridge. That means that in some cases, to reach the required contact wire height, this intervention must be undertaken two or three times.

The total length depends on the height to be lowered and the longitudinal slope of the tracks.

These works require possession time throughout weekend periods (achievable on single night possession).

The main problems associated with this type of intervention are:

1.1.3.1 Flooding

Lowering the tracks level can cause or compound flooding issues in specific areas with the consequent risk of service disruption.

In those cases, mitigations measures consist basically in flood water removal from tracks and provision of floodplains to store stormwater runoff.

1.1.3.2 Drainage

At 15 OB's (all OB except OB7A, 7C and OBG11) the train tracks have a low point in the longitudinal profile. Generally, this low point is relative and is due to the need to achieve clearance of the tracks to the overbridge.

A further lowering of the tracks accentuates this low point and requires lineside drainage implementation. Where a gravity system is not possible, a pumped drainage system has been considered and costed.

1.1.3.3 Impact on stations

Lowering the tracks on overbridges that are located close to stations potentially impacts upon existing infrastructure within the station.

The railway platforms provide convenient access to trains, for which they must maintain a standard height to the rails.

Track lowering near stations where ethe alignment cannot recover the standard height requires actions to adapt the platform levels to the tracks.

This can be eliminated either by lowering all platforms levels or displacing them until the tracks reach their original level and the platforms are back to the standard height.

In both cases, it requires works at platforms and around the station to adapt to the new levels and may necessitate amendment to footbridges, accesses, buildings, and facilities.

This is the case at OBG5 (Broombridge Station), OBG11 (Castleknock Station), OBG14 (Leixlip Confey Station), OBG16 (Leixlip Louisa Station) and OBCN290 Dunboyne Station.

In the MCA assessment of the overbridges in the previous paragraph, none of the selected options will affect station platform.

1.1.3.4 Structure safety

Due to insufficient vertical clearance for the catenary equipment under bridges, there are several existing bridges requiring track lowering to increase the vertical clearance. These are listed below:

- OBO36 (Ossory Road Bridge).
- OBD227/227A/227B, railway bridge.
- OBD226 Newcomen Bridge.
- OBD225 Clarke's Bridge.
- OBD224 Clonliffe Bridge.
- OBD223 Binn's Bridge.
- OBD222 (Cross Guns / Westmorland Br).
- OBD221 (Near Cross Guns / Westmorland Br).
- OBG7A (West M50 Roundabout / Navan Road).
- OBG13, adjacent to Collins Bridge.
- OBG18 Pike Bridge.
- OBCN286 Barnhill Bridge.

- OBCN290/290A Dunboyne Bridge.
- OBO11 Cross Guns (on Prospect Road).

Track lowering at overbridges requires the verification that the overbridge structure, mainly its foundations, is not impacted or compromised.

For OBO36, it is only required to lower the track by approximately 20 mm, which will not have a significant impact on the existing foundation.

For the remainder of the overbridges, it is proposed to lower the track by at least 250 mm to 700 mm or more. Therefore, a structural verification of the existing foundations, including geotechnical surveys to obtain the existing foundation details (i.e. foundation geometry and depth), is required. For those structures at which the foundations will be exposed due to the track lowering, a solution will be designed to maintain the safety of the structures.

1.1.4 Bridge deck reconstruction

1.1.4.1 Arch bridges

To increase the vertical clearance on protected bridges, the following three solutions have been studied:

- Structural solution A: Precast arch deck.
- Structural solution B: Precast frame deck.
- Structural solution C: Arch lifting.

1.1.4.1.1 Structural solution A: Precast arch deck

The construction phase of this solution is as follows.

- Traffic diversion.
- Soil improvement behind the existing wall.
- Demolition of the upper part of the existing arch bridge, and maintain the vertical walls.
- Place the precast concrete wall blocks and anchor them to the existing walls.
- Place the precast concrete arch deck.
- Make right stonework along the deck to integrate aesthetically with the arch bridge and backfill to a new level.
- Repair and restoration work
  - Displacement of the existing masonry
  - Repair the parapets (to be aesthetically pleasing).
- Reconstruction of the road.

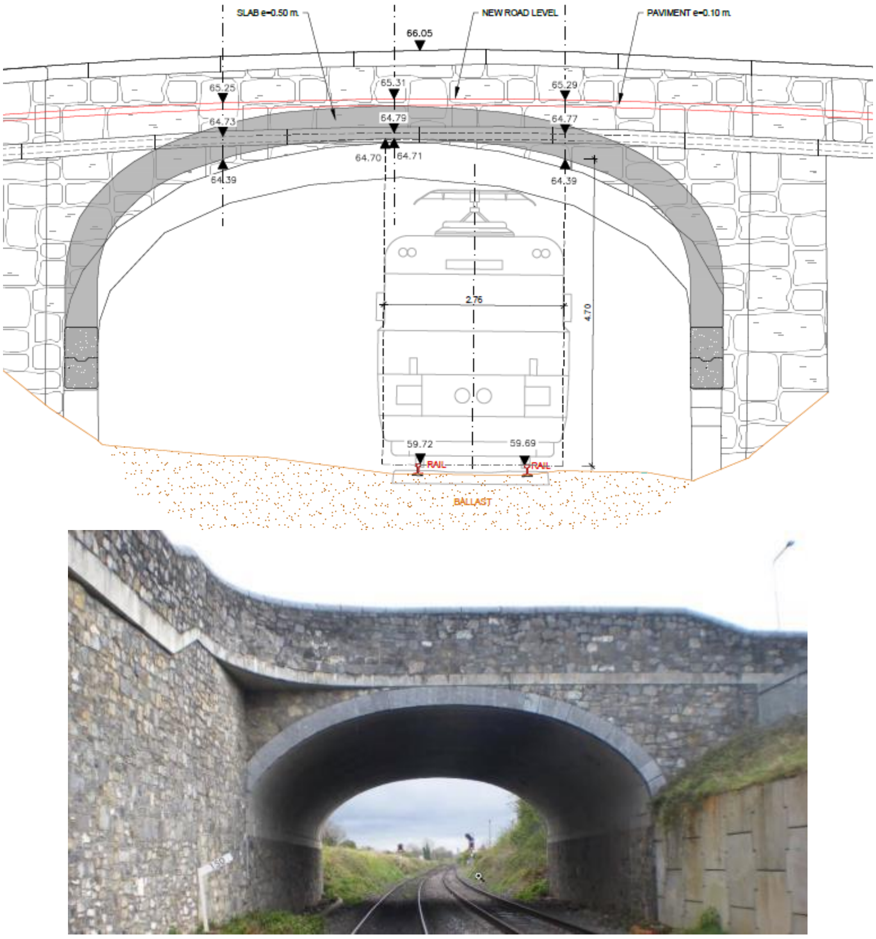

Figure 1-2 Solution A: Precast arch deck

1.1.4.1.2 Structural solution B: Precast frame deck

The construction phase of this solution is as follows.

- Traffic diversion.
- Soil Improvement behind the existing wall.
- Demolition of the upper part of the existing arch bridge, and maintain the vertical walls.
- Place the precast concrete wall blocks and anchor them to the existing walls.
- Place the precast concrete frame deck.
- Make right stonework along the deck to integrate aesthetically with the arch bridge and backfill to a new level.
- Repair and restoration work
  - Displacement of the existing masonry
  - Repair the parapets (to be aesthetically pleasing).
- Reconstruction of the road.

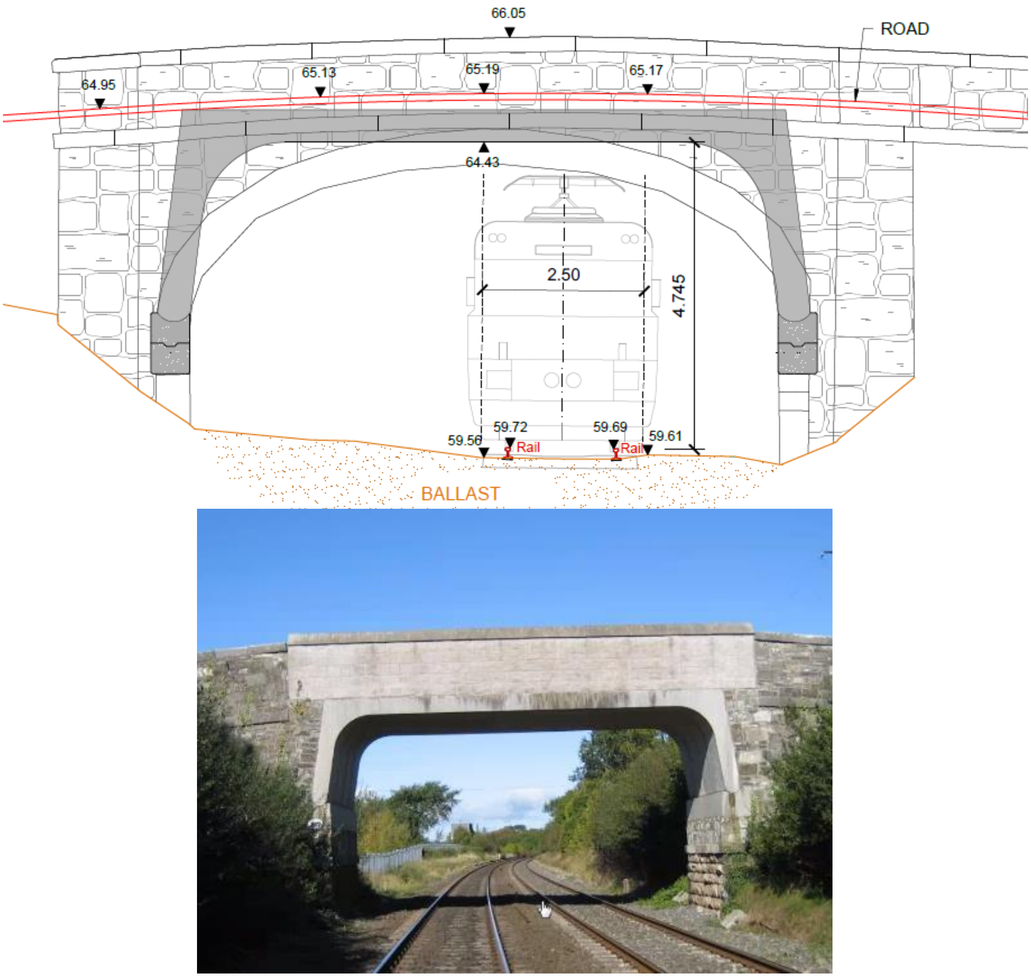

Figure 1-3 Solution B: Precast frame deck

1.1.4.1.3 Structural solution C: Arch Lifting

The construction phase of this solution is as follows.

- Traffic diversion.
- Remove the pavement and infill (if required).
- Install anchor bars around the area where the jacks will be inserted.
- Vertical cut and horizontal cut just below the springing.
- Vertical slip bearing in slots down the back to prevent the arch from spreading horizontally.
- Jacks underneath to pick it up and put a hinge at each end (a two-hinged arch) to retain stability.
- Insert jacks, and jack up.
- Insert and fill grout bags and remove jacks.
- Make good restoration work and backfill the roads to the new level.
- Reconstruction of the road.

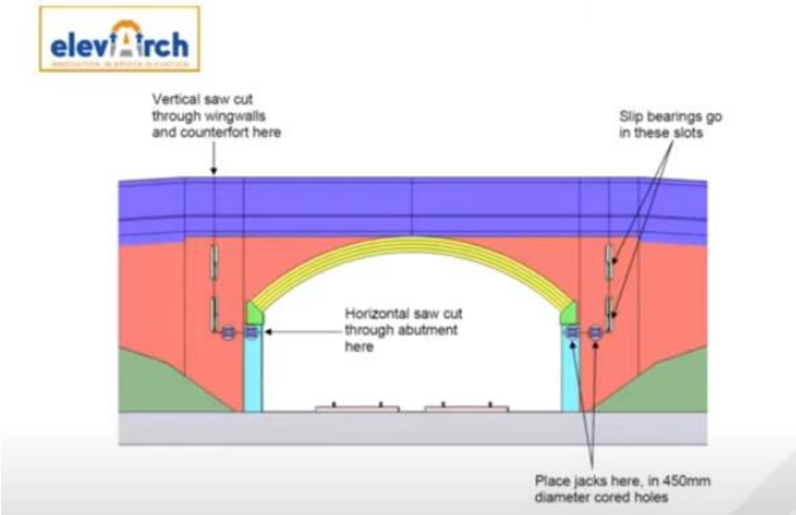

Figure 1-4 Solution C: Arch Lifting

The solution 3C is the most sympathetic alteration. Nevertheless, it has a higher risk compared to solutions 3A & 3B, for being an innovative solution with limited experience.

The differences between the solutions 3A & 3B are the deck shape and the required lift height. Solution 3A, the precast arch shape is maintaining the geometry of the current stone arch with a less negative aesthetic impact compared to the precast frame shape solution.

Although the solution 3B of the precast frame shape allows the height of the bridge arch to reduce its shape slightly has a very significant negative visual impact.

Therefore, the solutions 3A has been considered as the best solution in terms of arch deck bridges structural modification (OBG5 adjacent to Broombridge, OBG11 adjacent to Granard Bridge and OBG14 adjacent to Cope Bridge).

1.1.4.2 Flat deck bridges

To increase the vertical clearance on the flat deck bridges, a heavy lifting solution or deck renewal has been proposed.

1.1.4.2.1 Structural solution D: Heavy lifting

The construction phase and construction duration of this solution are similar to the arch lifting solution.

The construction phase for this solution is as follows.

- Traffic diversion.
- Remove the pavement and infill to reduce the dead load (optional).
- Vertical cut in the edges of the structural deck and horizontal cut between the piers/abutments and the deck.
- Insert jacks and jack up.
- Insert and fill grout bags and remove jacks.
- Repair the parapets, pavements and infill.
- Road modification to a new level.
- Reconstruction of the road.

1.1.4.2.2 Structural solution E: Deck renewal

The construction phase of this solution is as follows.

- Traffic diversion.
- Soil Improvement behind the existing wall.
- Demolition of the upper part of the existing flat deck, and maintain existing abutments and piers.
- Increase the elevation of the existing abutments/piers. The connection area between the existing abutments/piers and the new increased sections must be connected with steel bars, and concrete should be poured to the new elevation.
- Place the precast concrete beam deck.
- Backfill to a new level.
- Repair and restoration work
  - Repair the parapets (aesthetically pleasing)
  - Repair the pavement.
- Reconstruction of the road.

1.1.4.2.3 New track alignment

This solution consists of a diversion of the track layout that avoids passing beneath the existing overbridge and thus manages to avoid the clearance issue caused by the OHLE implementation.

Given that this solution involves a high cost of construction and land acquisition, it is only proposed in the four overbridges categorised as Black (OBD226, OBG5, OBG11 and OBG23) that have no possible catenary solution.

This option was eliminated for OBG226, OBG5, and OBG11 as they are located in urban environments where a diversion option would require a considerable investment and result in severe social impact.

1.1.5 Hierarchy of options

A number of structures along the route have clearances which result in the need to propose one of the options described above (i.e. OHLE solution, track lowering or structural intervention) to achieve an acceptable outcome. These are discussed later in this Chapter.

Each structure must be carefully examined to ensure that only solutions that are technically feasible for that particular location are proposed.

Firstly, possible options involving non-standard OHLE solutions are identified. If the most appropriate OHLE solution proves to be acceptable, taking factors such as safety and maintenance into account, then this will be the proposed option as these solutions would generally result in less disruption to the public and to IÉ, and would generally be relatively cost effective. However achieving a suitable OHLE solution is not always possible.

The second option would be the consideration of track lowering. Again however, there are some locations where such options cannot be proposed for technical reasons such as, for example, flooding issues, lowering resulting in steep gradients, or proximity to existing stations.

Where no suitable OHLE or track lowering option can be identified, then the final options would be structural interventions such as deck construction or raising, construction of a new bridge or realignment of the track. These solutions are generally the most expensive of the options available and are the most disruptive to the public and the rail operator. In addition, there are a number of heritage bridges along the route, and any structural work that affects these bridges must be undertaken in a manner so as to eliminate or at least minimise the impact. Therefore, these solutions are only proposed where no suitable alternative that meets all the technical requirements and requirements of the stakeholders have been identified.

1.2 OBD227, 227A, 227B – Railway Bridges

1.2.1 Introduction

These three overbridges are located on the MGWR line, at 2 miles 665 yards mileage, inside Dublin city.

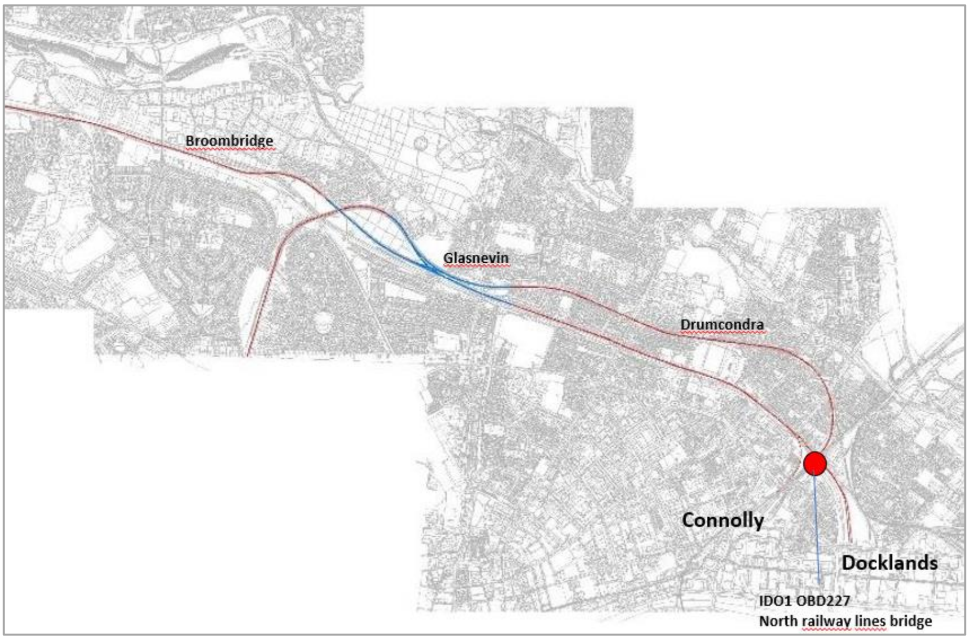

Figure 1-5 OBD227 Location Plan

The three structures lie next to each other and support the north railway lines exiting/entering Connolly Station and the GSWR (North Strand Junction).

The three structures are flat deck but of different types:

- OBD227 (also UB7 N. Strand – Connolly) is a typical steel railway bridge, registered at the National Inventory of Architectural Heritage (NIAH) (Reg No. 50060481)

- OBD227A (also named UBB1B Belfast line) is a wrought iron bridge with stone abutments, registered at the National Inventory of Architectural Heritage (NIAH) (Reg No. 50060481)
- OBD227B (named UBB1H Connolly Wash Road). It is a concrete bridge (precast beams).

Figure 1-6 OBD227 – Railway Bridges

For this option, the three structures have been considered as a unique structure for two reasons:

Firstly, the currently available data of the TOR to soffit distances at both ends of these three structures are similar:

- OBD227 West TOR to soffit clearance: 4430 mm.
- OBD227B East TOR to soffit clearance: 4480 mm.

Secondly, the solution chosen for one influences the rest:

- Lowering of the track cannot be considered for only one structure. Given the proximity of the structures, lowering the tracks at one structure inevitably means that tracks are lowered under the other two structures.
- An OHLE reduced solution in one structure, with contact wire height bellow 4400 mm, implies again that, due to proximity, a greater contact wire height is not achievable in the other structures.

The current bridges are already flat deck structures (metallic and concrete bridges). Flat deck is the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.

These overbridges support the north railway lines exiting/entering Connolly Station and GSWR line, so the modification of their structures would have a significative impact on railway operation.

The bridges have others spans over Royal Canal and Ossory Road, so modification on the span over MGWR also implies modifications to the others spans.

1.2.2 Proposed option

For the reasons mentioned above, the option proposed is a **track lowering solution**.

1.3 OBD226, OBD226A and UBD233 – Newcomen Bridge

1.3.1 Introduction

The OBD226 is located on the MGWR line, at 2 miles 558 yards mileage, inside Dublin city.

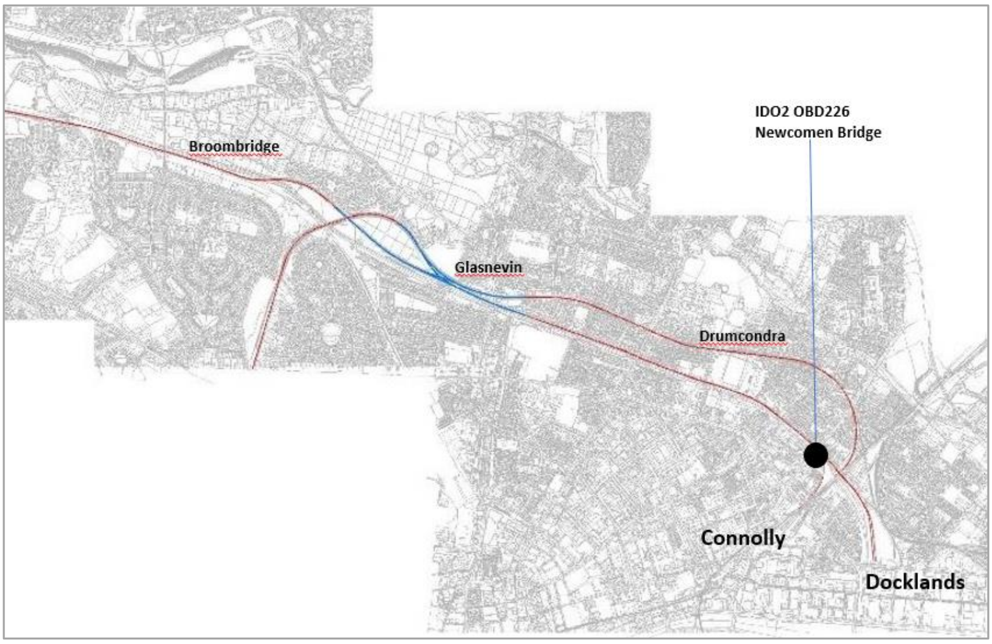

Figure 1-7 OBD226 Location Plan

The bridge is early 20th-century concrete rail bridge, however it is adjacent to the Royal Canal bridge, an RPS (Nº 911) granite structure built c. 1790.

The structural bridge modifications on the railway bridge have to consider the implications for the protected canal bridge.

Figure 1-8 OBD226 and OBD226A – Newcomen Bridge

Recently two new pedestrian overbridges have been constructed in this area, OBD226A and OBD223A.

OBD226A is a pedestrian bridge that crosses over the MGWR line parallel to Newcomen Bridge (OBD226) on its eastern side.

Figure 1-9 OBD226A – Newcomen Bridge

It has been verified that this new structure does not present a more significant challenge than OBG226 itself, and therefore does not influence the options studied in this section for OBG226.

OBD226A is a pedestrian bridge that crosses over the MGWR line in parallel at Newcomen Bridge (OBD226) at its eastern side.

Figure 1-10 UBD233 – Crossing Over Connolly Chord Line

1.3.2 Options assessed

OBD226, Newcomen Bridge represents a significant challenge for the OHLE since there is insufficient clearance above the Down track (i.e. the track carrying trains travelling away from Dublin).

The Up track (i.e. track carrying trains travelling towards Dublin) has a TOR to soffit clearance of 4.46 m that allows OHLE solutions but, the Down track has a TOR to soffit clearance of 4.24 m that do not allow any OHLE solution. It requires Permanent Way or Structural intervention to gain clearance

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.3.2.1 Track lowering

- The Royal Canal Bridge (protected) UBD233. This underbridge is located circa 20 m from the overbridge, and a lifting bridge over Royal Canal. This underbridge limits the Down track lowering starting point.
- Turnout. Under the bridge, there is a turnout on the Down track for the chord coming from Connolly Station that needs to be located on a constant gradient.
- Drainage issue. The track alignment longitudinal profile in the Up track presents a low point under the bridge.

1.3.2.2 Bridge reconstruction

- Bridge typology. The current bridge already has a flat deck, the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.
- This overbridge is located within the city of Dublin, and the modification of its structure would have a significant impact on urban mobility.
- Utilities: the services crossing over the train tracks, through Newcomen Bridge, need to be diverted if the bridge is modified.

1.3.3 Proposed option

For the above mentioned reasons, the option proposed is a **minimum track lowering** at the Down Track combined with a **Reduce height OHLE Solution at Up and Down track.**

1.4 OBD225 – Clarke’s Bridge

1.4.1 Introduction

The OBD225 is located on the MGWR line, at 2 miles 380 yards mileage, inside Dublin city.

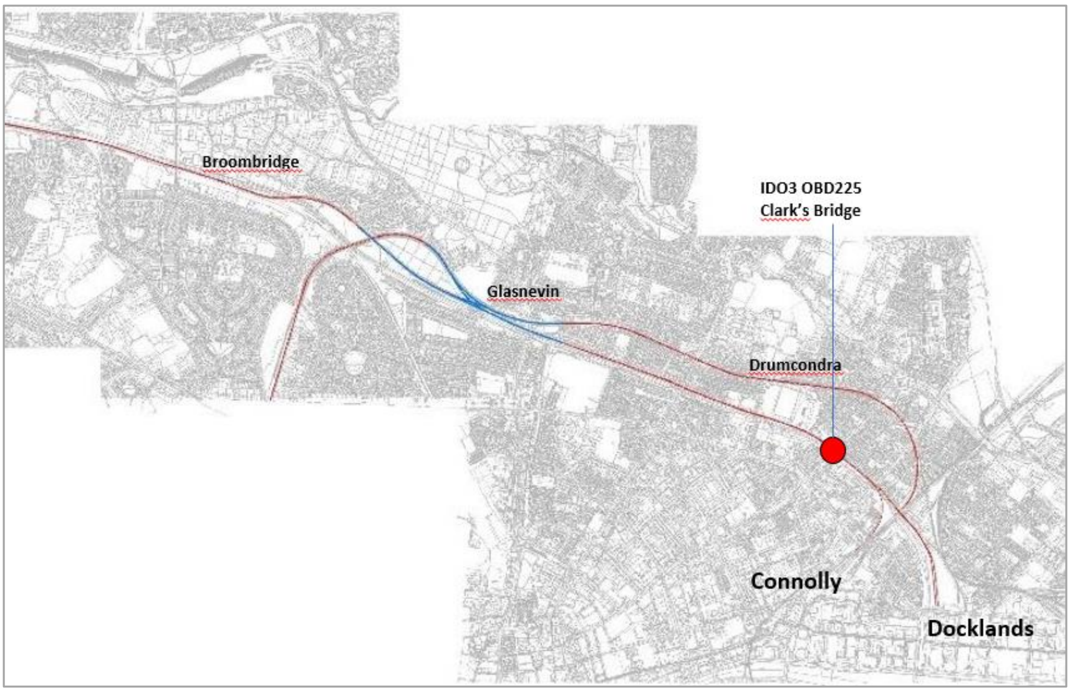

Figure 1-11 OBD225 Location Plan

The railway bridge is next to the Royal Canal Bridge, an RPS (Nº 910) granite structure built c. 1790.

The structural bridge modifications on the railway bridge have to consider the implications for the protected canal bridge.

Figure 1-12 OBD225 – Clarke's Bridge

The main constraints identified for the proposed solutions to obtain an enhanced OHLE clearance are:

- Utilities: through Clarke's Bridge the services crossing over the train tracks need to be diverted if the bridge deck is lifted.

The main constraints identified for the proposed solutions to obtain an enhanced OHLE clearance are:

- Bridge typology. The current bridge already has a flat deck, the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.
- This overbridge is located within the city of Dublin, and the modification of its structure would have a significant impact on urban mobility.
- The Royal Canal Bridge (protected).

1.4.2 Proposed option

For the reasons mentioned above, the option proposed is a **Track lowering Solution.**

1.5 OBD224 – Clonliffe Bridge

1.5.1 Introduction

The OBD224 is located on the MGWR line, at 1 mile 1710 yards mileage, inside Dublin city.

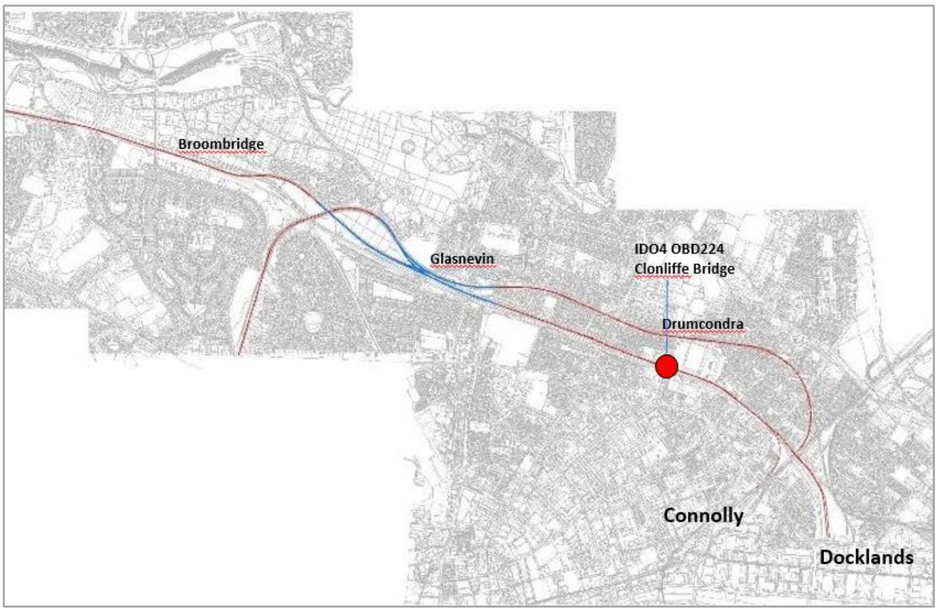

Figure 1-13 OBD224 Location Plan

Figure 1-14 OBD224 – Clonliffe Bridge

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

- Bridge typology. The current bridge already has a flat deck, the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.
- This overbridge is located within the city of Dublin, and the modification of its structure would have a significant impact on urban mobility.

1.5.2 Proposed option

For the reasons mentioned above, the option proposed is a **Track lowering Solution.**

1.6 OBD223 – Binns Bridge

1.6.1 Introduction

The OBD223 is located on the MGWR line, at 1 mile 1019 yards mileage, already inside Dublin city.

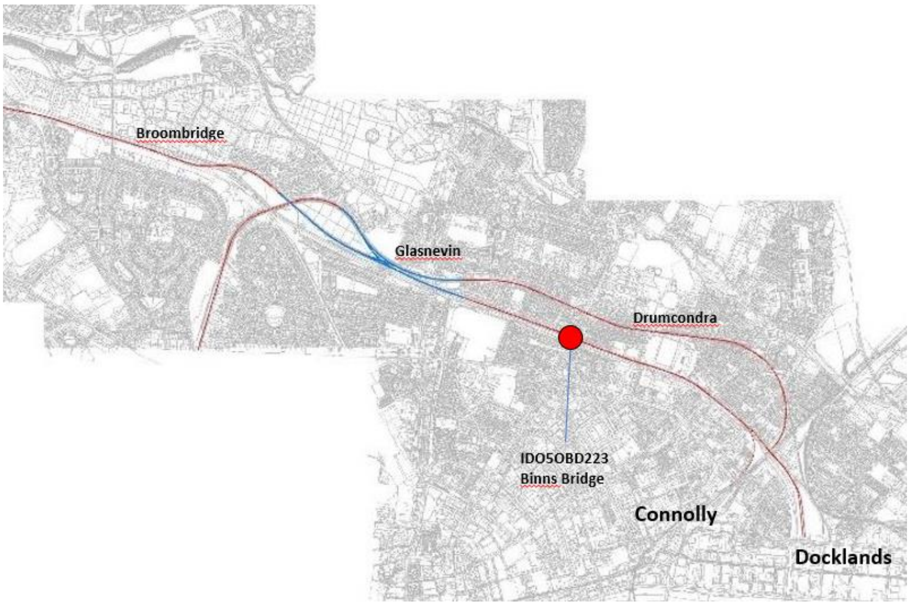

Figure 1-15 OBD223 Location Plan

The double-arch stone bridge, erected 1864, carrying the road over the railway line is an RPS structure (no. 908).

Figure 1-16 OBD223 – Binns Bridge

The main constraints identified for the proposed solutions to obtain an enhanced OHLE clearance are:

- Currently, the longitudinal profile of the tracks has a low point in the passage through the overbridge, so reducing the level of the track at this point can introduce track drainage issues.
- Flooding issues. There is a flooding area at OBD223 (ID66), so lowering the tracks at this point would compound flooding issues.
- The structure is protected (RPS nº 908).

- Bridge typology. Although the overbridge is an arch type structure, the clearance issue does not occur at the arch's sides, but at its high point, so bridge modification is a challenging issue to achieve the required catenary clearance.
- This overbridge is located within the city of Dublin, and the modification of its structure would have a significant impact on urban mobility.
- Utilities: through Binns Bridge the services crossing over the train tracks need to be diverted if the bridge deck is modified.

1.6.2 Proposed Option

For the reasons mentioned above, the option proposed is a **Track Lowering Solution.**

1.7 OBG5 – Adjacent to Broombridge

1.7.1 Introduction

The OBG5 is located on the Maynooth line, at 1 mile 1305 yards mileage, at Broombridge Station exit towards Maynooth.

The railway arch is located next to the Royal Canal arch that is national rating protection (Categories of Special Interest: Architectural Historical Social Technical). The bridge (over the Royal Canal) and the Royal Canal drop are dated from 1790.

Figure 1-17 OBG5 – Broombridge

1.7.2 Options Assessed

OBG5 Broombridge represents a significant challenge for the OHLE since there is insufficient clearance for any OHLE solution. It requires Permanent Way or Structural intervention to gain clearance

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.7.2.1 Track Lowering

- Broombridge Station. Lowering the tracks requires station modifications (platforms, accesses, footbridge, utilities, fences, etc.).

- Royal Canal. The water level of the Royal Canal is similar to the level of the tracks, so lowering the tracks would cause flooding issues.
- Flooding issues. There is a flooding area at Broombridge station exit towards Maynooth, so lowering the tracks at this point would compound flooding issues.

1.7.2.2 Bridge Reconstruction

- Bridge impacted as structural alterations are required. Since the arch of the Royal Canal is a protected bridge, any bridge modification must take this protection into account.
- Utilities: through Broombridge, the services crossing over the train tracks need to be diverted if the bridge deck is modified.

1.7.3 Proposed Option

The option proposed is a **Bridge deck reconstruction (precast arch deck).**

1.8 OBG7A – M50 Roundabout / Navan Road

1.8.1 Introduction

The OBG7A is located on the Maynooth line, at 4 miles 804 yards mileage, at the roundabout connecting Navan Road to the M50.

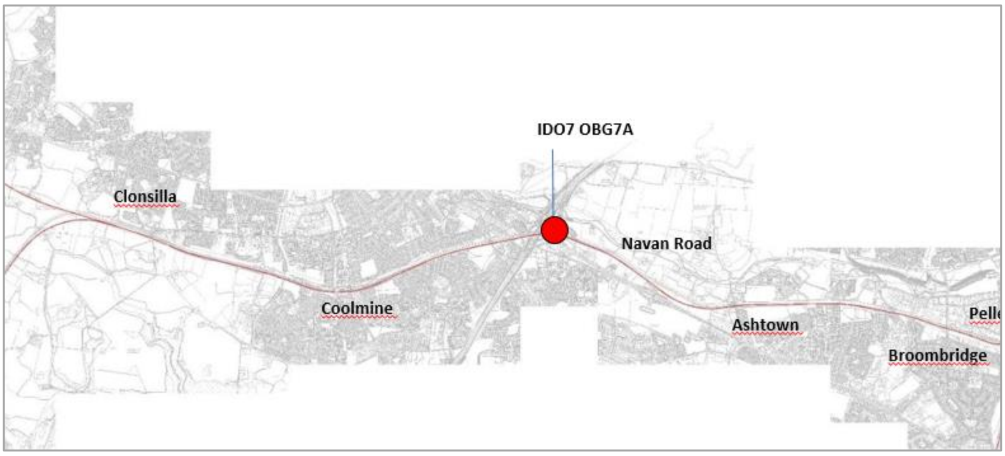

Figure 1-18 OBG7A Location Plan

Figure 1-19 OBG7A – West M50 Roundabout / Navan Road

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

- Bridge typology: The current bridge already has a flat deck, the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.
- Any intervention in the bridge would have a significant impact on M50 motorway access roundabout.
- UBG7B (M50 motorway). There is a short distance between OBG7A and UBG7B, so this limits track lowering.

1.8.2 Proposed Option

For the reasons mentioned above, the option proposed is the **minimum track lowering** without impacting UBG7B (M50 motorway) structure.

1.9 OBG7C – M50 Roundabout

1.9.1 Introduction

The OBG7C is located on the Maynooth line, at 4 miles 993 yards mileage, at the roundabout connecting Navan Road to the M50.

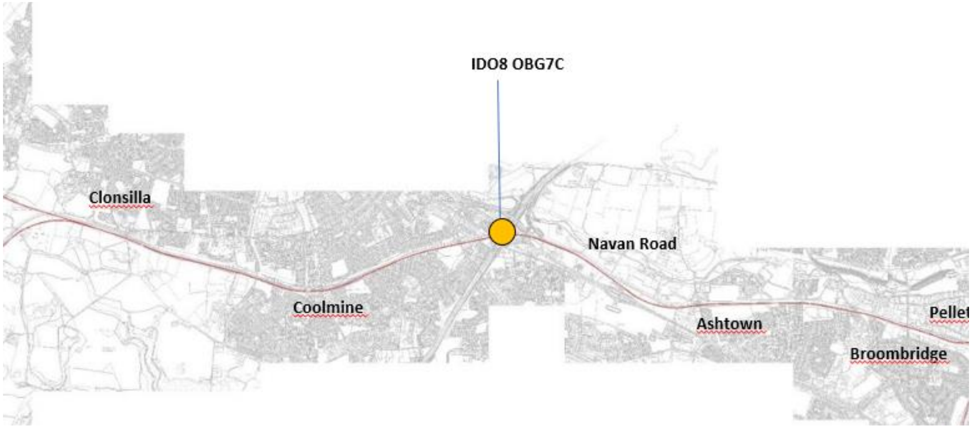

Figure 1-20 OBG7C Location Plan

Figure 1-21 OBG7C – East M50 Roundabout Bridge

1.9.2 Options assessed

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.9.2.1 Track lowering

- UBG7B (M50 motorway). There is a short distance between OB7C and UBG7B, so track lowering is limited by this UB.
- Drainage issue. Between OBG9 and OBG7C there is a longitudinal profile flat slope, so lowering the track generates a low point at the track profile.

1.9.2.2 Bridge deck heavy jacking

- Bridge typology. The current bridge already has a flat deck, the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.
- Any intervention to the bridge would have a significant impact on M50 motorway access roundabout.

1.9.3 Proposed option

For the reasons mentioned above, the option proposed is a **Reduced height OHLE Solution.**

1.10 OBG9 – Old Navan Road Bridge

1.10.1 Introduction

The OBG9 is located on the Maynooth line, at 4 miles 1086 yards mileage, 360 m from Castleknock Station towards Dublin.

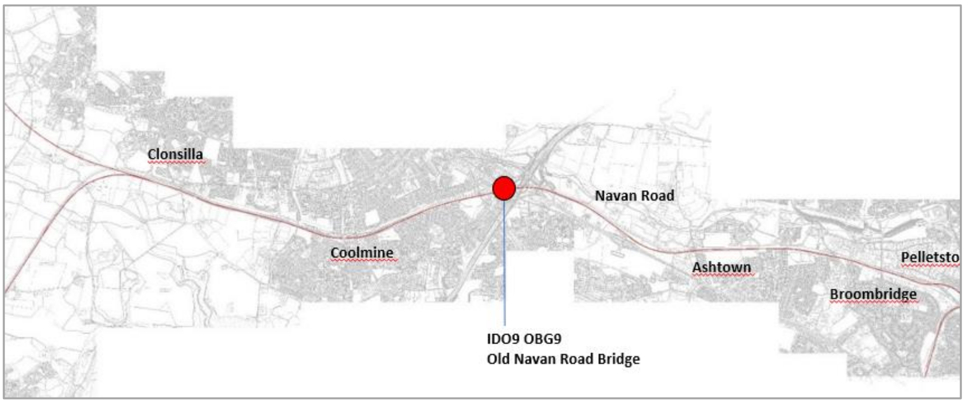

Figure 1-22 OBG9 Location Plan

Figure 1-23 OBG9 – Old Navan Road Bridge

1.10.2 Options assessed

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.10.2.1 Track lowering

- UBG10. This culvert is located at 40 m to the OBG9 towards Maynooth. It is a stone arch stream of 0.93 m span length with a cover depth of 1.0 m. Lowering the track would impact this culvert.

- Drainage issue. Between OBG9 and OBG7C there is a longitudinal profile flat slope, so lowering the track generates a low point at the track profile.

1.10.2.2 Bridge reconstruction

- Bridge typology. The current bridge already has a flat deck, the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.
- Utilities: through Old Navan Road Bridge the services crossing over the train tracks need to be diverted if the bridge deck is modified

1.10.3 Proposed option

For the reasons mentioned above, the option proposed is a **Bridge deck heavy lifting**.

1.11 OBG11 – adjacent to Granard Bridge

1.11.1 Introduction

The OBG11 is located on the Maynooth line at 4 miles 1428 yards mileage, at Castleknock Station exit towards Dublin.

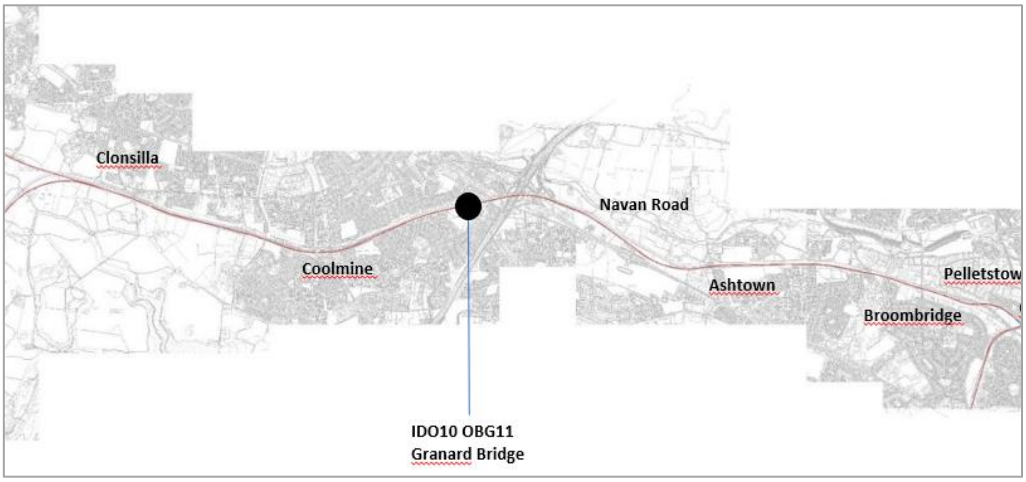

Figure 1-24 OBG11 Location Plan

Granard Bridge is a structure registered at the National Inventory of Architectural Heritage (NIAH), Reg No. 11354002.

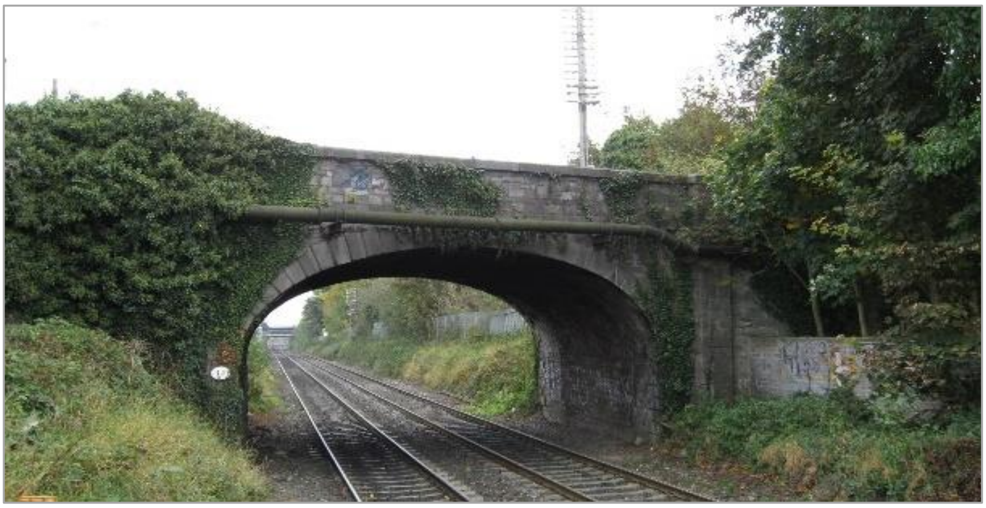

Figure 1-25 OBG11 – Granard Bridge

1.11.2 Options assessed

OBG11 represents a significant challenge for the OHLE since there is insufficient clearance for any OHLE solution. It requires Permanent Way or Structural intervention to gain clearance

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.11.2.1 Track lowering

- Castleknock Station. Lowering the tracks require station modifications (platforms, accesses, footbridge, utilities, fences, etc.).
- Royal Canal is very close to the tracks, so lowering option would compound flooding issues.

1.11.2.2 Bridge reconstruction

- Bridge impacted as structural alterations are required
- Utilities: through Granard Bridge, services are crossing over the tracks that would need to be diverted if the bridge deck is reconstructed.

1.11.3 Proposed option

The option proposed is a **Bridge deck reconstruction (precast arch deck).**

1.12 OBG13 – Adjacent to Collins Bridge

1.12.1 Introduction

The OBG13 is located on the Maynooth line at 8 miles 1674 yards mileage, between Leixlip Confey and Clonsilla stations.

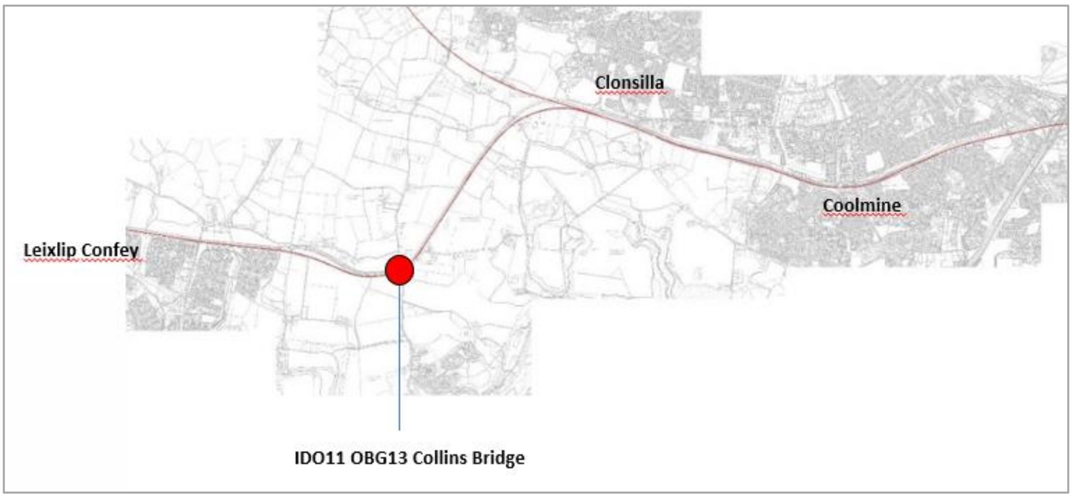

Figure 1-26 OBG13 Location Plan

Collins Bridge is a structure registered at the National Inventory of Architectural Heritage (NIAH), Reg No. 11360002.

Figure 1-27 OBG13 – Collins Bridge

1.12.2 Proposed option

A **track lowering** is proposed to obtain an enhanced OHLE clearance.

1.13 OBG14 – Adjacent to Cope Bridge

1.13.1 Introduction

The OBG14 is located on the Maynooth line at 10 miles 264 yards mileage, at Leixlip Confey Station exit towards Dublin.

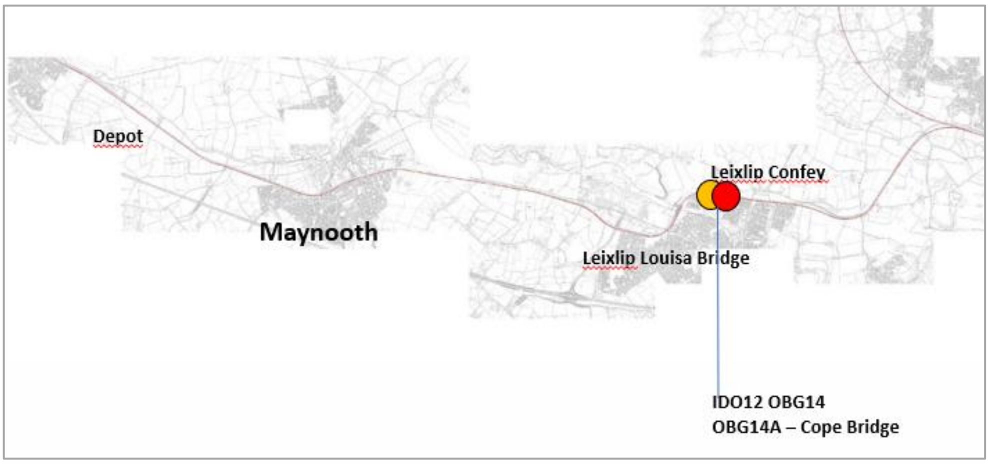

Figure 1-28 OBG14 Location Plan

Figure 1-29 OBG14 – Cope Bridge

1.13.2 Options assessed

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.13.2.1 Track lowering

- Leixlip Confey Station. Lowering the tracks requires station modifications (platforms, accesses, footbridge, utilities, fences, etc.).
- Royal Canal. The water level of the Royal Canal is almost the same as the level of the tracks, so lowering the tracks would compound flooding issues.

1.13.2.2 Bridge reconstruction

- Bridge impacted as structural alterations are required
- Utilities: through Cope Bridge, the services crossing over the train tracks need to be diverted if the bridge deck is modified.

1.13.3 Proposed option

The option proposed is a **Bridge deck reconstruction (precast arch deck)**.

1.14 OBG16 – Louisa Bridge

1.14.1 Introduction

The OBG16 is located on the Maynooth line at 11 miles 503 yards mileage, at Leixlip Louisa Bridge Station exit towards Maynooth.

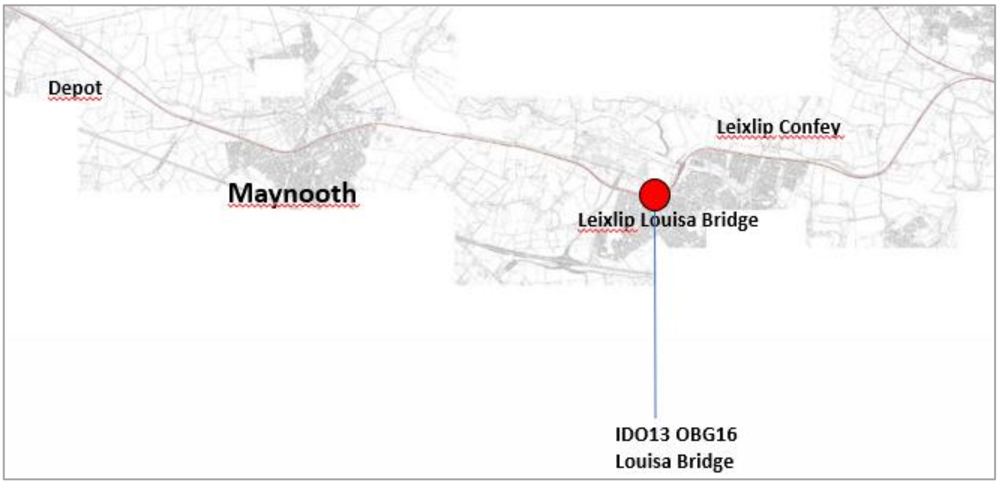

Figure 1-30 OBG16 Location Plan

Figure 1-31 OBG16 – Louisa Bridge

- Bridge typology. The current bridge already has a flat deck, the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.

1.14.2 Options assessed

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.14.2.1 Track lowering

- Leixlip Louisa Bridge Station. Lowering the tracks requires station modifications (platforms, accesses, footbridge, utilities, fences, etc.).
- Royal Canal. The water level of the Royal Canal is almost the same as the level of the tracks, so lowering the tracks would compound flooding issues.
- Flooding issues. Louisa Bridge Station is in a flooding area due to poor drainage. Currently, the longitudinal profile of the tracks has a low point in the passage through the overbridge, so reducing the level of the track at this point would compound flooding issues.

1.14.2.2 Bridge deck heavy lifting

- Impacts on R148 road during the works
- Utilities: through Louisa Bridge, the services crossing over the train tracks need to be diverted if the bridge deck is lifted.

1.14.3 Proposed option

The option proposed is a **Bridge deck heavy lifting**.

1.15 OBG18 – Pike Bridge

1.15.1 Introduction

The OBG18 is located 2.2 km from the Maynooth Station towards Dublin, at line mileage 13 miles 793 yards.

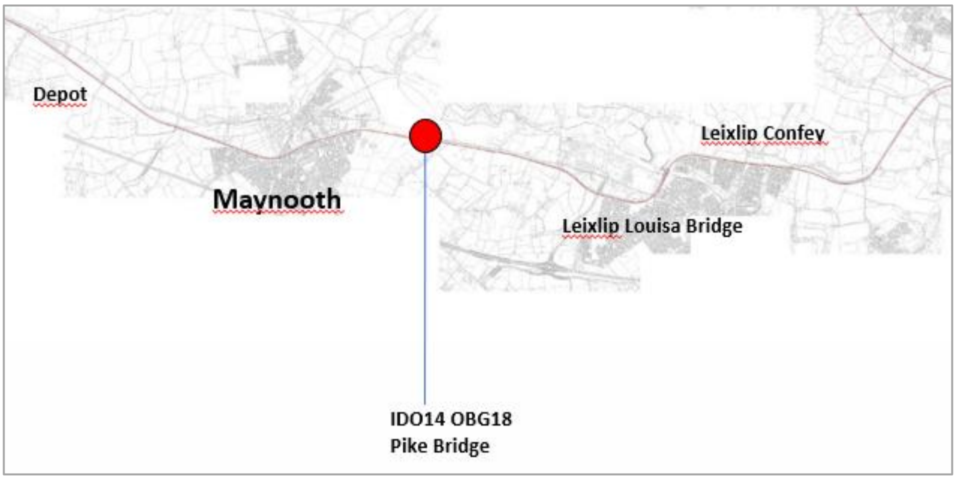

Figure 1-32 OBG18 Location Plan

Pike Bridge it is a protected structure RPS B06-13. The bridge (over the Royal Canal) and the Royal Canal drop are dated from 1793.

Figure 1-33 OBG18 – Pike Bridge

1.15.2 Proposed option

A **track lowering** is proposed to obtain an enhanced OHLE clearance.

1.16 OBG23 – Jackson's Bridge

1.16.1 Introduction

The OBG23 is located on the Maynooth to Sligo line at 16 miles 1055 yards mileage, between Maynooth Station and the future DART Depot.

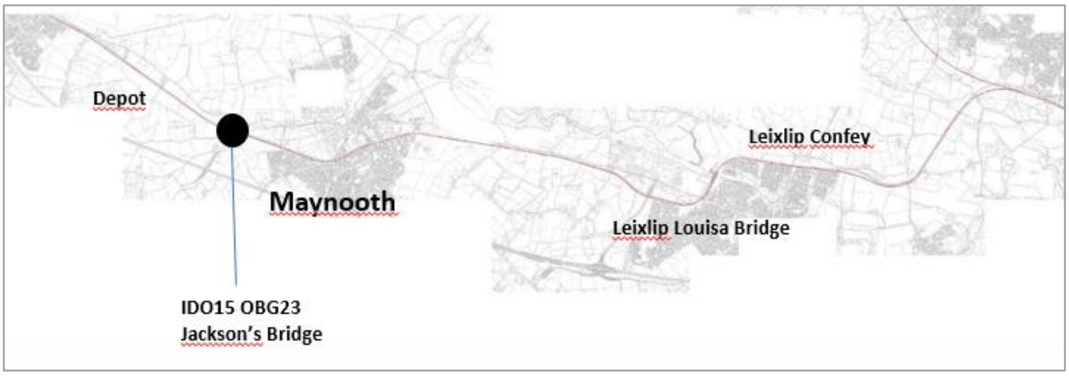

Figure 1-34 OBG23 Location Plan

Figure 1-35 OBG23 – Jackson´s Bridge site

Jackson´s Bridge is protected RPS B05-36. The bridge (over the Royal Canal) and the Royal Canal drop are dated 1793.

Jackson’s Bridge comprises five arches carrying a local road, the L5401. Any works to the railway bridge due to insufficient vertical clearance under the bridge, whether raising or rebuilding the arch or merely raising the parapet level, will have implications for the character and setting of the canal bridge and the five-arched bridge as a whole and must be treated with great care and with the agreement of Kildare County Council and all Iarnród Éireann departments.

Refer to Section 8.17 of this report for further background and details of the development of the design at Jacksons Bridge

The arch of the canal bridge is a shallow segmental arch with a low ratio of rise to span. The arch ring is parallel, and the voussoirs are of hammer-dressed limestone. The abutments of the canal bridge are constructed in limestone ashlar. The barrel of the arch is formed with small, squared limestone rubble. The parapet and spandrels are of squared limestone rubble.

Figure 1-36 Eastern Face of Canal Bridge

The railway bridge carries the road over the railway in a single elliptical arch. The arch ring is parallel and is comprised of chamfered dressed limestone voussoirs with tooled margins. Above the arch ring is a projecting string course of dressed limestone. The arch is flanked on either side by projecting piers or pilasters of limestone ashlar. The spandrels and parapets are of limestone ashlar. The string course and the ashlar masonry continue to the south of the southern pilaster into the southern two arches, while to the north the string course and ashlar do not run beyond the pilaster into the canal bridge.

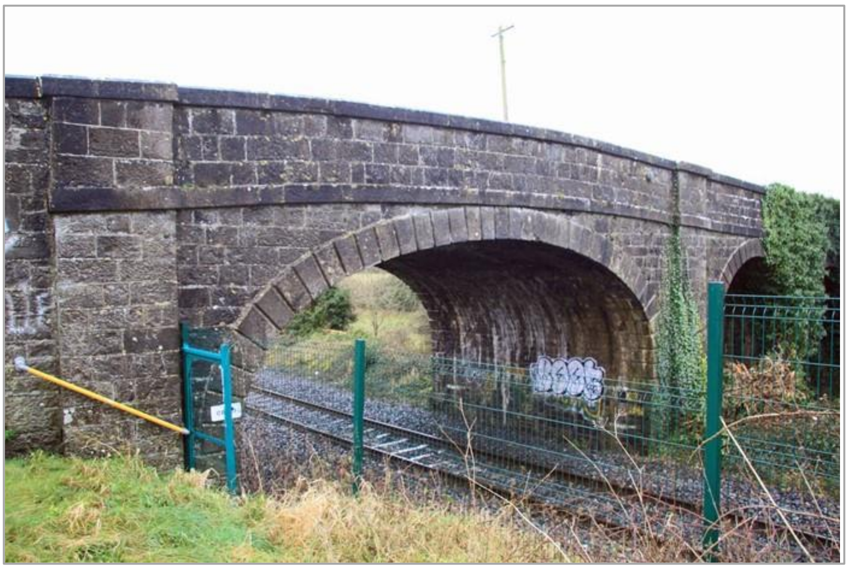

Figure 1-37 Western face of the railway bridge

The worst clearance from TOR to soffit is 4.18 m, and it does represent a major challenge for the OHLE since there is insufficient clearance for any OHLE solution as the clearance is less than the minimum contact wire height allowed, to which needs to be added 150 mm for electrical clearance.

Figure 1-38 OBG23 view from Maynooth

In this section of single track from Maynooth to Kilcock, an electrified double-track is the preliminary requirement to connect the terminal stop of DART services at Maynooth Station with the new Depot.

The main requirements and restraints found for the proposed solutions to obtain an enhanced OHLE clearance are:

1.16.2 Depot operational functionality

Jackson's Bridge is located west of Maynooth, a short distance from the new Depot, serving the entire new fleet of the DART+ Project.

In order to deliver this service, the project must electrify the single track as well as provide an additional track from Maynooth to the new Depot, including Jackson's Bridge overbridge.

The options studied should consider the east entrance of the Depot, closest to Jackson's Bridge. The report analyses the impact of these alternatives on the functionality of the Depot.

The construction methodology of each option and its impact on the operation of the line has been analysed

1.16.3 Flooding area

The outcomes of the Flood Risk Assessment undertaken to date (i.e. Stage 1 & 2) indicate that the area in the vicinity of Jackson's Bridge (OBG23) has a significant history of flooding. This catchment was analysed as part of the OPW Eastern CFRAM Study. An extract of the flood mapping produced as part of this assessment showing the 10%,1% & 0.1% AEP flood extents (current climate scenario) are shown in Figure 1-39. Presently, it appears that the railway line is at risk of overtopping in the 10% AEP fluvial flood event.

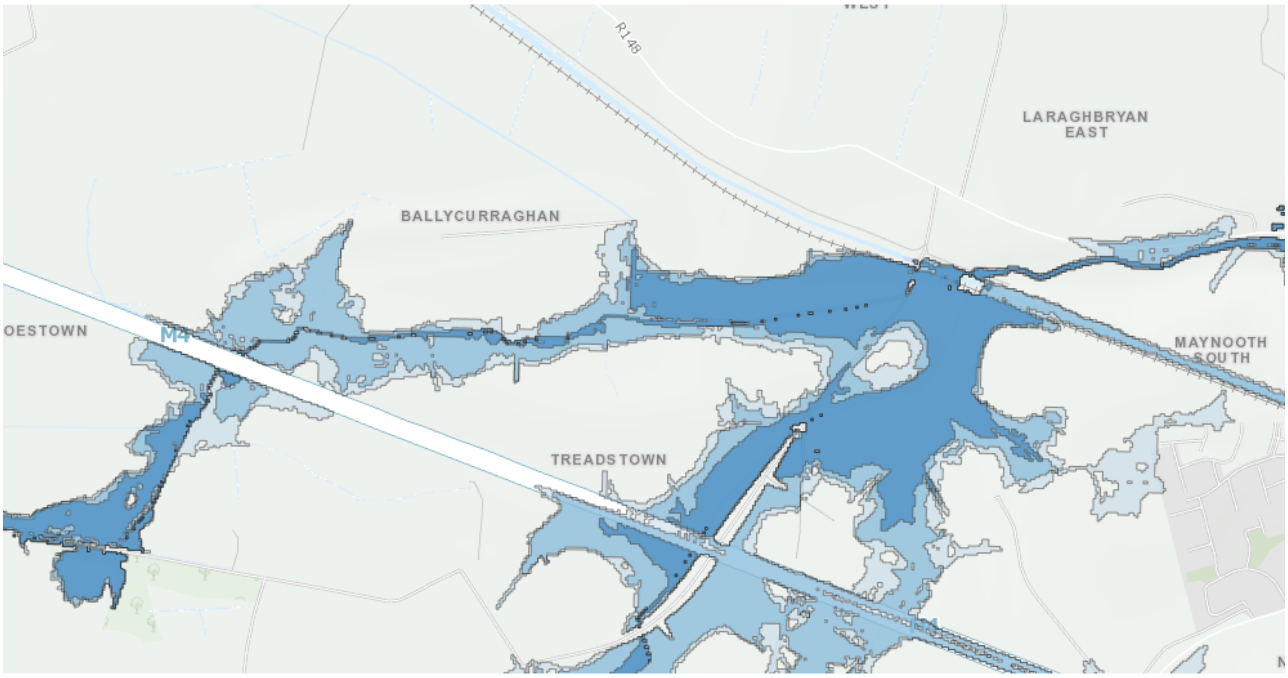

Figure 1-39 Flooding Area Upstream UBG22. Low to High-Risk Areas. Source: OPW Flood Maps

The preliminary hydraulic analysis indicates that the 0.1%AEP flood level (plus a suitable climate change factor) at Jackson's Bridge (OBG23) is 60.361 mOD. With the inclusion of an appropriate freeboard (to account for modelling uncertainties and settlement as per OPW guidance) of 500 mm, the preliminary design flood level required to meet the 0.1%AEP standard of protection at OBG23 is 60.861 m OD. The minimum existing track level is approximately 59.74 mOD, at Jackson's Bridge, 1.121 m below the design flood level.

The preliminary hydraulic assessment considered the impact of the proposed options

1.16.4 Jackson's Bridge protected structure

Jackson's Bridge is a protected structure and is included in the record of protected structures for Kildare County Council along with the adjacent canal lock. The description is "Jackson's Bridge (and Lock)".

The National Inventory of Architectural Heritage has included the bridge and lock; they have been assigned a Regional significance for their architectural, historical, social and technical interest. The Bridge (over the Royal Canal) dated from 1793 and the canal lock from 1795.

Jackson's Bridge is comprised of five arches. The original bridge had a single arch, carrying the road over the Royal Canal. In the 1840s the bridge was extended to take the road over the Midland Great Western Railway line and as the embankment leading to the bridge was to cross a watercourse two further arches were built to bring water through and to provide an accommodation arch for access between fields. A further arch was added at the northern end to allow those using the canal towpath to cross beneath the road.

The "protected" status of the structure implies that works that would materially affect the character of the structure require planning permission.

1.16.5 ESB overhead 220 kV

The options assessed has considered the presence of ESB overhead lines.

At the 91+750 chainage, 30 m before Lyreen river (UBG22), a 220 kV ESB line crosses over the railway line. Because of the flood protection level required for the track, some options do not achieve enough vertical clearance to the line that requires its diversion. For that reason, at MCA2, Option 5 has been split into two options, 5A and 5B.

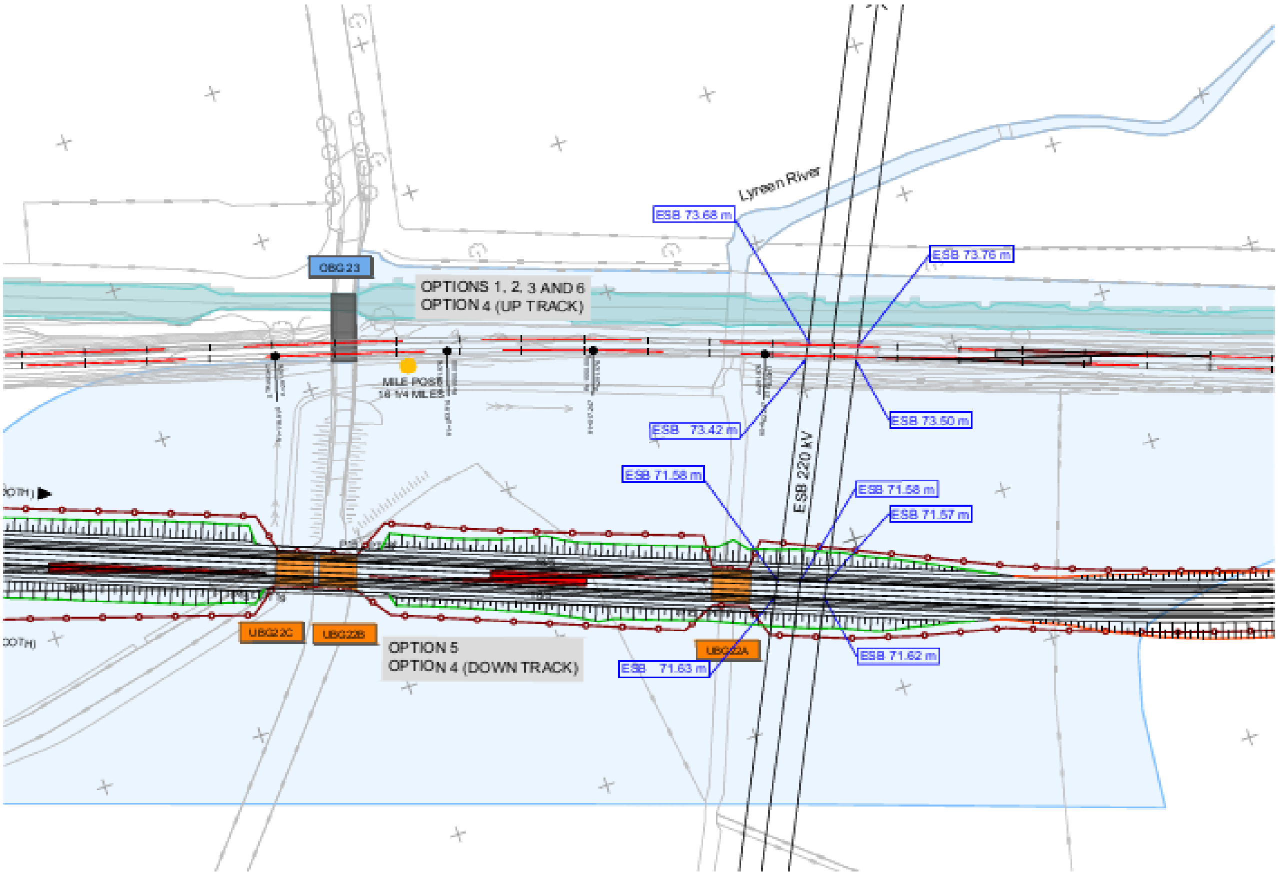

Figure 1-40 ESB 220 kV cables high over the six assessed options

1.16.6 Description of Options

The options assessment must take into account all these requirements and constraints. Furthermore, it is relevant to deem that the assessment should consider future scenarios of double track beyond Kilcock.

Considering the constraints in this section, the options identified are shown in Table 1-2.

Table 1-2 MCA 1 IDO15 options

Options	Description
IDO15 – 1	One Online track electrified
IDO15 – 2	Double Online track. Vertical track lowering
IDO15 – 3	Double Online track. Bridge deck reconstruction and retaining wall to prevent flooding
IDO15 – 4	Double track. New alignment for one Offline track
IDO15 - 5	Double Offline track. New alignment for both tracks
IDO15 - 6	Double Online track. Bridge deck reconstruction. (3 arches reconstruction)

The full Stage 1 and 2 MCA's and included in Annex 08.1 of this report.

1.16.7 Description of Preferred Option 5A Double Track Offline

Preferred option 5A consist of a double-track alignment offline of Jackson's Bridge (i.e. to the south of existing), avoiding the clearance issue at the bridge and avoiding direct negative impacts to Jackson's Bridge.

It is proposed that the existing L5041 will be diverted to the west of its current location where it crosses over Jackson's Bridge. The road will link to the new access road for the proposed depot at a roundabout south the proposed depot before bridging over the proposed depot, rail line and canal. The new road will tie in with a junction along the R148 approximately 1 km west of the current L5041/R148 junction. Pedestrian and cycle traffic will be accommodated via access under the proposed new rail line and over the existing Jackson's Bridge, which will be closed to vehicular traffic other than for maintenance purposes. Pedestrians and cyclists will continue to access the greenway and other roads as they currently do.

The junction with the R148 and the roundabout south of this junction with the depot will both be modelled and sized to accommodate the predicted traffic flows at these junctions as part of the design development. Vehicular traffic currently utilising the L5041 and the R148 will be able to utilise this diverted road albeit with a diversion of approximately 2 km for traffic accessing Maynooth and the east while traffic accessing Kilcock and the west will face similar trip distances to what is currently experienced.

The new alignment begins at 91+000 chainage, just outside the Maynooth urban area, and ends at 92+500 chainage, past the east entrance to the Depot. The length of this new alignment is 1.5 km.

This option has the least impact on the existing flood regime compared to the other options while providing sufficient flood protection to rail services.

It is highlighted that this option does not directly impact Jackson's Bridge.

At the 91+770 chainage, 150 m East of Jackson's Bridge, the proposed offline tracks crosses under ESB 220 kV electric lines. Because of the flood track protection level required at the minimum **61.06 m** level, there is not enough clearance from the track to the electric line that has to be diverted.

The new track alignment requires L5041 road diversion though the new OBG23A located west of Jackson's Bridge, which also provides Depot access from R-148 road.

1.17 OBCN286 – Barnhill Bridge

1.17.1 Introduction

The OBCN286 is located on the Clonsilla – M3 Parkway, at 8 miles 513 yards mileage, at 1.85 km from Clonsilla Station towards M3 Parkway.

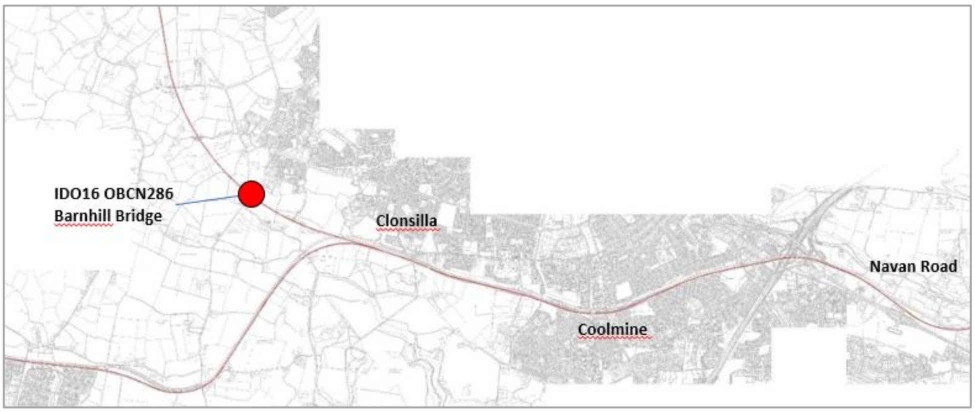

Figure 1-41 OBCN286 Location Plan

Barnhill Bridge is registered at the National Inventory of Architectural Heritage (NIAH), register No. 11352001.

Figure 1-42 OBCN286 – Barnhill Bridge

1.17.2 Proposed option

A **track lowering** is proposed to obtain an enhanced OHLE clearance.

1.18 OBCN287 – Stirling Road Bridge

1.18.1 Introduction

The OBCN287 is located on the Clonsilla – M3 Parkway, at 9 miles 247 yards mileage, at 1.9 km from Dunboyne Station towards Clonsilla.

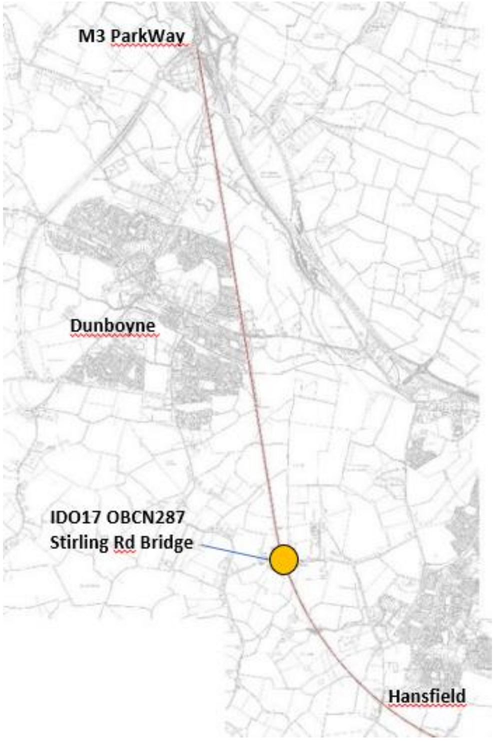

Figure 1-43 OBCN287 Location Plan

Figure 1-44 OBCN287 – Stirling Road Bridge

1.18.2 Proposed option

The option proposed is an **OHLE solution**.

1.19 OBCN290 – Dunboyne Bridge

1.19.1 Introduction

The OBCN290 is located on the Clonsilla – M3 Parkway, at 10 miles 493 yards mileage, at Dunboyne Station exit towards Clonsilla.

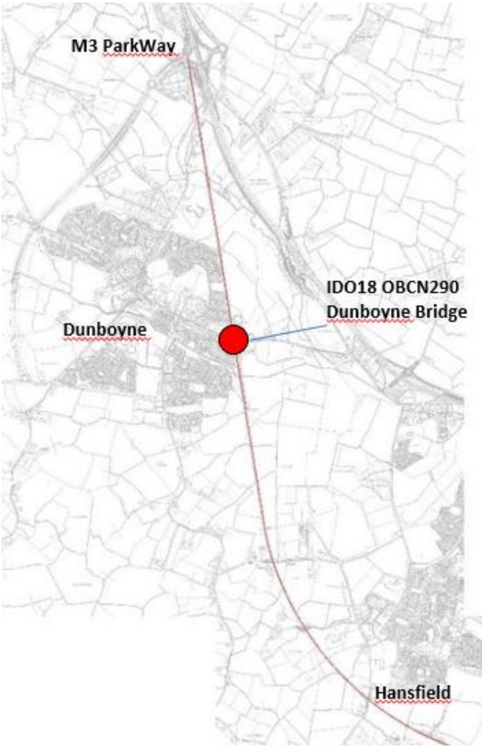

Figure 1-45 OBCN290 Location plan

Dunboyne Bridge is registered at the National Inventory of Architectural Heritage (NIAH), register No. 14341002.

Figure 1-46 OBCN290 – Dunboyne Bridge

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

- Dunboyne Station. Lowering the tracks requires station modifications (platforms, accesses, footbridge, utilities, fences, etc.).
- Drainage issues. Tracks and station are in a longitudinal profile low point, so reducing the level of the track at this point can cause drainage issues.
- Utilities: through Dunboyne Bridge the services crossing over the train tracks need to be diverted if the bridge deck is modified.

1.19.2 Proposed option

For the reasons mentioned above, the option proposed is the **minimum track lowering** without impacting Dunboyne Station.

1.20 OBO35/35A – railway bridges

1.20.1 Introduction

These 2 overbridges are located on the GSWR line, at 4 miles 583 yards mileage, inside Dublin city.

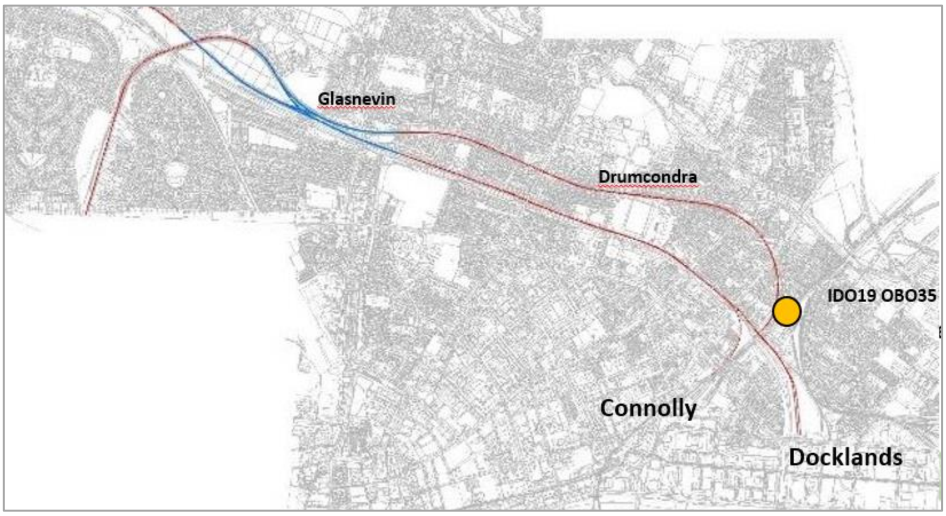

Figure 1-47 OBO35/35A Location Plan

This stretch of track, towards the port (East Wall) once North Strand Junction is passed, is currently only used by freight trains.

The two structures lie next to each other and support the north railway lines exiting/entering Connolly Station and the GSWR (North Strand Junction).

The two structures are flat deck but of different types:

- OBO35 (also UBB1J and UBB2A) is a typical steel railway bridge of 8.53 m of span length.
- OBO35A is a concrete bridge.

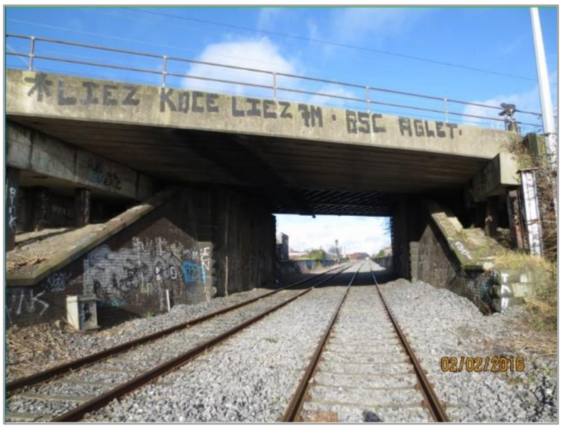

Figure 1-48 OBO35 and 35A – Railway Bridges (at the left OBO35 and the right OBO35A)

1.20.2 Options assessed

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

1.20.2.1 Track lowering

- Railway gradients. Between North Strand Junction and OBO35, the railway gradient is over 1 in 50 (2%). Lowering the track implies increasing this value that is already over the standard value. By contrast, lowering the tracks would improve the gradient between OBO35/35A and OBO36 that is over 1:40.

1.20.2.2 Bridge reconstruction

- Bridge typology.
- The current bridges are already flat deck structures (metallic and concrete bridges). Flat deck is the most advantageous geometry, so a change of typology cannot be used to provide the required catenary clearance.
- These overbridges support the north railway lines exiting/entering the Connolly Station and GSWR line, so the modification of their structures would significantly impact railway lines operation.

1.20.3 Proposed option

For the reasons mentioned above, the option proposed is a **Reduced height OHLE solution**.

1.21 OBO36 – Ossory Road Bridge

1.21.1 Introduction

The OBO36 is located on the GSWR line, at 4 miles 784 yards mileage, inside Dublin city.

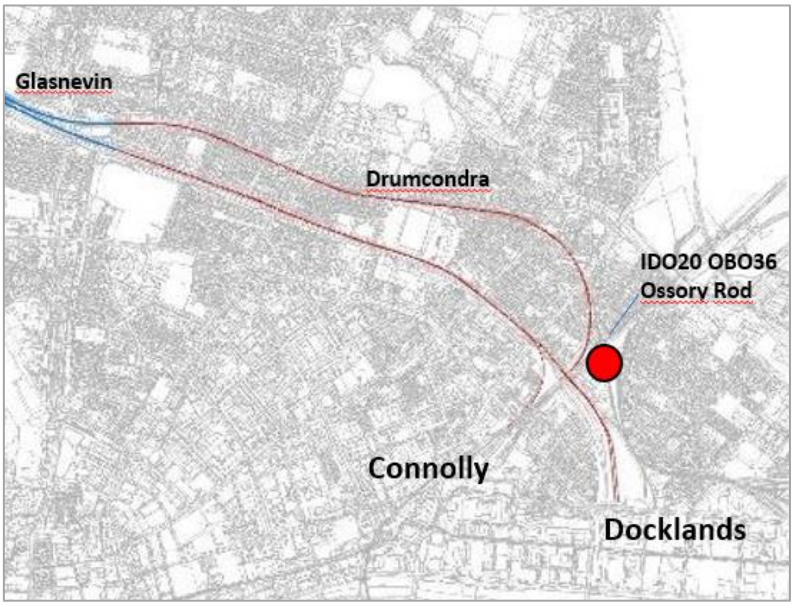

Figure 1-49 OBO36 Location Plan

As with the previously discussed OBO35/35A the tracks on this stretch are currently only used by freight trains.

.

Figure 1-50 OBO36 – Ossory Road

1.21.2 Proposed option

The option proposed is a **Track lowering to allow a 4400 mm contact wire height**.

1.22 OBO11 – Cross Guns (on Prospect Road)

1.22.1 Introduction

The OBO11 is located on the GSWR line, at 2 miles 1459 yards mileage, inside Dublin city (Glasnevin area).

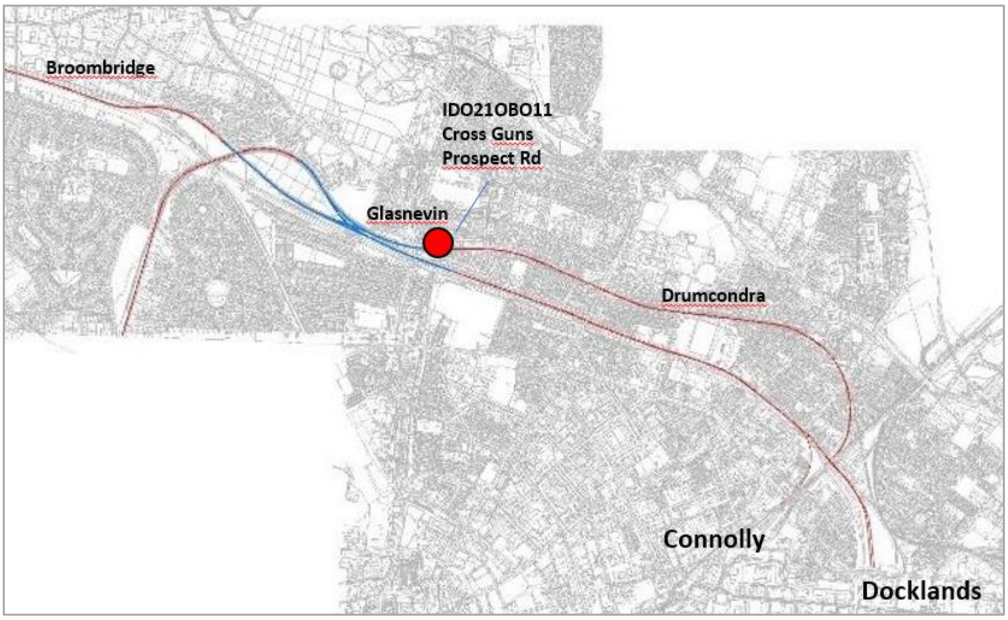

Figure 1-51 OBO11 Location Plan

Figure 1-52 OBO11 – Cross Guns on Prospect Road

1.22.2 Proposed option

The option proposed is a **track lowering to allow a 4400 mm contact wire height**.

1.23 OBD222 – Cross Guns (Westmorland Bridge)

1.23.1 Introduction

The OBD222 is located on the MGWR line, at 0 mile 1598 yards mileage, inside Dublin city. This is a 171 m length overbridge/tunnel.

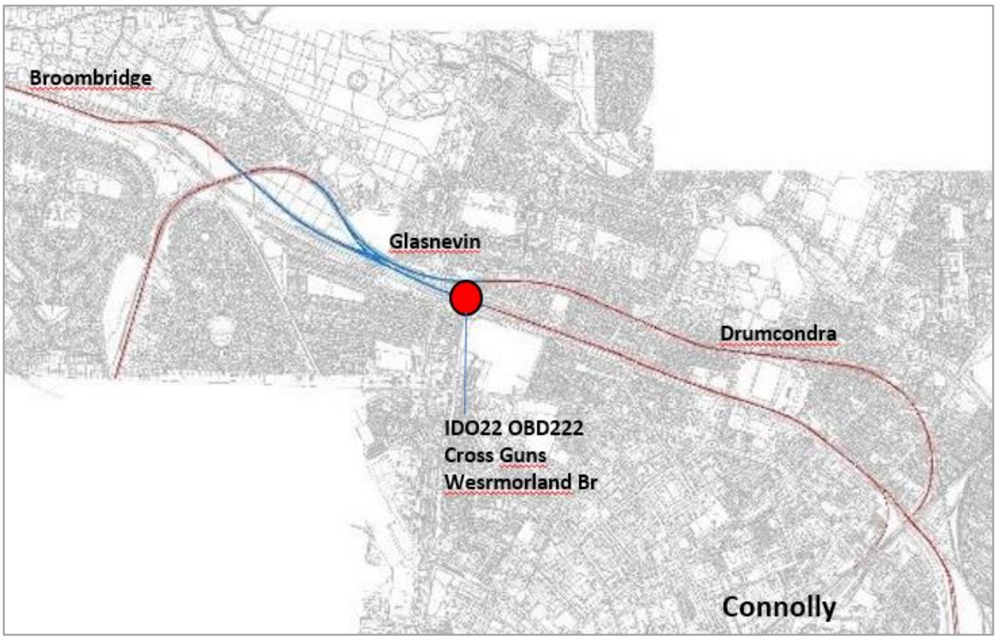

Figure 1-53 OBD222 Location Plan

Cross Guns Bridge is registered at the National Inventory of Architectural Heritage (NIAH), register No. 5006112.

Figure 1-54 OBD222 – Cross Guns Bridge (Westmorland Br)

The main constraints for the proposed solutions to obtain an enhanced OHLE clearance are:

- Bridge typology. Although the overbridge is an arch type structure, its length, about 170 m, means that it is considered more a tunnel than an overbridge.
- Industrial buildings are located on the tunnel which makes the modification of the overbridge structure unworkable.

- MGWR 1.67% gradient from the East (Dublin Centre) towards West (Glasnevin Junction).
- OBD222 is registered at the National Inventory of Architectural Heritage (NIAH).
- OBD222 is located within the city of Dublin, and the modification of its structure would have a significant impact on urban mobility.
- Utilities diversions.

1.23.2 Proposed option

The option proposed is a **track lowering to allow a 4250-4300 mm contact wire height**.

1.24 OBD221 – Maintenance Bridge at Glasnevin

1.24.1 Introduction

The OBD221 is located on the MGWR line, at 0 mile 1598 yards mileage, inside Dublin city (Glasnevin area).

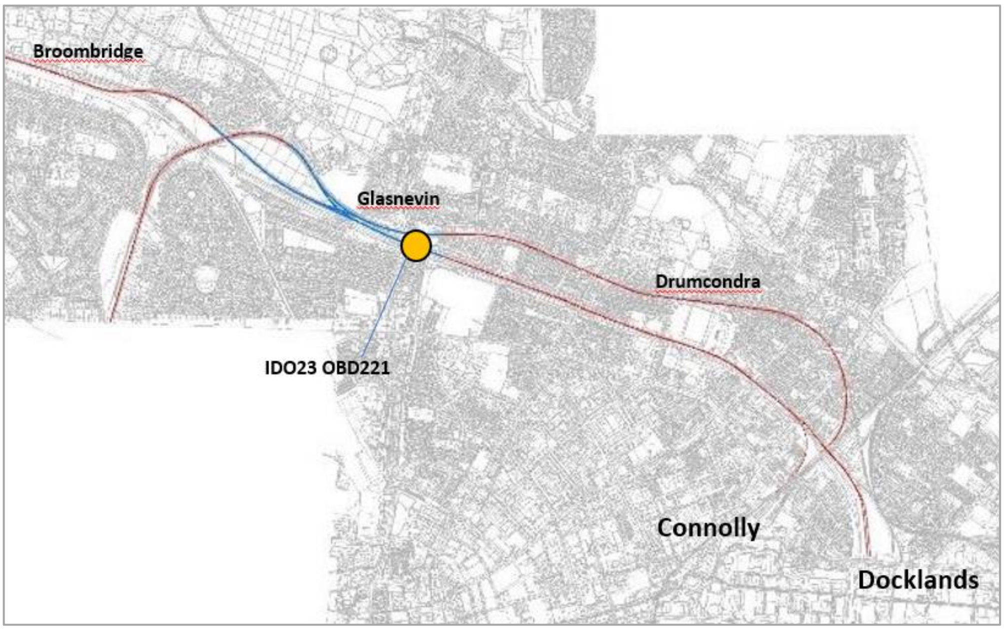

Figure 1-55 OBD221 Location Plan

Figure 1-56 OBD221 – Maintenance Bridge in Glasnevin Area

The main inputs for the proposed solutions to obtain an enhanced OHLE clearance are:

- OBD222 preferred option. OBD221 is so close to OBD222 that the track lowering solutions of OBD222 reach OBD221 area, so track lowering is required in any case at this overbridge.
- MGWR 1.67% gradient from the East (Dublin Centre) towards West (Glasnevin Junction).
- Glasnevin Junction is located circa 100 m from OBD221.
- Access Point: This bridge is the access point (available for crane) to the Glasnevin Junction area.
- Metrolink project: this structure would be demolished during implementation of the Metrolink project; solutions have to be assessed taking into account that they may only be temporary.

1.24.2 Proposed option

The option proposed is the **minimum track lowering** because of OBD222 track lowering.