Chapter 03

Alternatives Considered

N25 Little Island Pedestrian and Cyclist Bridge
Environmental Impact Assessment Report

Appendix 3.1
Feasibility Report

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1 Introduction

Cork County Council (CCC), the National Transport Authority (NTA) and Arup have identified the benefits associated with the provision of a new pedestrian and cycle bridge. The proposed bridge will cross the N25 and connect the Little Island Train Station, the Glounthaune Road and future greenway to the Eastgate Business Park in Little Island, Cork. Eastgate is a relatively dense employment zone within Little Island and the provision of a new bridge providing access to this area from the Train Station and greenway will strongly encourage an increase in trips via sustainable modes.

The project location lies approximately 10km east of Cork City on the N25 Cork to Waterford primary route as shown in Figure 1 below.

The proposal is to undertake a feasibility and constraints assessment for the proposed project in relation to structural, geotechnical, environmental and cost. The constraints assessment informed the selection of potential design options for the proposed bridge.

The objective of the proposed bridge is to provide efficient pedestrian and cycle connectivity between the Little Island Train Station and the Eastgate Business Park and to promote sustainable transport modes while minimising impacts on the surrounding area and environment.

While options of extension of the existing R623 Little Island Bridge/N25 Overbridge (additional traffic lanes installed in 2019) have been considered, the focus of this report is on the area west of the R623, which will directly connect the Little Island Train Station to proposed pedestrian, cycle and bus network improvements in the Eastgate area which are proposed as part of the Little Island Sustainable Transport Interventions Project (LISTI).

Figure 1: General Location of Project (Red Marker) © Bing Maps

2 Background Information

The report builds on work carried out by Arup as part of LISTI project where the benefits of a new pedestrian and cycle bridge were identified as part of the design interventions recommended on the existing public road network and East Gate Business Park. These recommendations were to deliver enhanced access for public transport and pedestrians/cyclists to and within Little Island and between Little Island and the Little Island Railway Station.

The LISTI Design Options Assessment Report provides the basis for the identification of the need for the proposed pedestrian and cycle bridge and the possible locations.

Previous work was also undertaken in relation to a new bridge proposal in a nearby location completed by RPS Consultant Engineers (RPS) referred to as “Little Island Pedestrian / Cycle Bridge - High Level Feasibility Study” - December 2016. The RPS report was assessed for any information that could aid in the identification of constraints for this feasibility study. It was noted that the recommended option proposed by RPS would not meet the design brief of this project as outlined in section 5 of this report, due to the bridge only including pedestrian steps and elevators. No ramps were included in that option and therefore the bridge would not accommodate cyclists unless cyclists dismounted and utilised the proposed elevators or stairs.

3 Methodology

The aim of this report is to identify the key constraints associated with the development of a pedestrian bridge in this location and determine if a potential bridge is likely to be feasible based on specific criteria including:

- Environmental;
- Construction;
- Planning;
- Construction Cost;
- Programme.

The feasibility study is based on a desktop review of publicly available information.

Design options for the bridge have included consideration, on a preliminary basis, of aspects such as aesthetic form, constructability, cost, and landing options.

4 Previous Considerations

There are several potential options to facilitate pedestrian and cyclist movements to Little Island and Eastgate Business Park from the train station and surrounding network.

As part of the LISTI project, an initial examination of 4 potential bridge landing locations were identified and examined. These 4 locations are identified in Figure 2 below.

Figure 2: Potential New Bridge Landing Points Considered

Initial examination based on walking catchment and location resulted in two of these options to be removed at an early stage, namely locations 1 and 4. In order for either of these locations to be viable, it was determined that it would require a relocation of the Little Island Train Station. Cork County Council held initial discussions with Iarnród Éireann (IÉ), during which the feasibility of relocating the station was discussed. IÉ indicated that it could be feasible to relocate the station, hence options 1 and 4 were considered. However, when comparing the pros and cons of relocating the train station against retaining its current location, it was considered that a relocation of the station would not provide sufficient benefits to justify the capital expenditure at this time. Therefore, Options 1 and 4 have not been considered further in this feasibility report.

In addition to the landing options identified in Figure 2, consideration was also given to providing a new bridge immediately adjacent to, or an extension of, the existing An Crompan Bridge. This option would provide a pedestrian and cycle route connecting the Glounthaune Road, Little Island Train Station and Little Island along the existing road network. However, as this option would either require the widening of two existing bridges or the construction of two new bridges, this option did not provide any reduction in capital costs relative to the other landing options considered. Furthermore, as a pedestrian route currently exists between the train station and Little Island, it is not anticipated that a new bridge in this location would attract a similar level of modal shift to the train station as a new connection into the Eastgate area. In addition, the provision of a new bridge connection to the west of the train station provides a significantly better opportunity to connect the bridge and wider Little Island area to the proposed Bury's Bridge to Carrigtwohill greenway, ensuring cyclists have a fully segregated cycle network from the surrounding areas directly into Eastgate.

From a constructability perspective, it should be noted that widening the existing bridges over the N25 and the railway is a more complex process than providing a new standalone structure due to the requirements necessary to tie-in the new and old structures. These bridges would likely require significant traffic management measures for a considerably longer duration on the N25 and potentially on the railway. While this would not by itself rule out the feasibility of a new bridge in this location, when compared to alternative options, it makes for a less desirable outcome.

As a result of the sifting process which eliminated a number of potential landing points for further consideration, Locations 2 and 3 as presented in Figure 2 above remained and these shall be further assessed in this feasibility study.

5 Preliminary Options Assessment

5.1 Design Brief

The proposed bridge structure could potentially have an approximate span in excess of 90m, which is the distance between the park on the northern side of the N25 road and the Eastgate Business Park. The bridge will need an additional 130m - 140m of ramps either side to facilitate tie into existing infrastructure.

In accordance with TII Design Criteria for Footbridges document DN-STR-03005 the soffit of the proposed bridge will need to be a minimum 5.7m above the level of the existing N25 carriageway.

A combined pedestrian/cyclist bridge usually has a strict minimum width of 2.0m, with 2.7m if pedestrians and cyclists are segregated. Pedestrian bridge widths between 2.5 and 4 m are the most common widths in structures of combined traffic.

At this stage of the study and as agreed with the NTA, widths of 4 and 5 metres have been considered. These widths appear achievable at this stage but will be subject to verification pending a more detailed analysis.

The bridge is proposed to facilitate all pedestrians and cyclist traffic using approach ramps with a maximum gradient of 1:20 as requested by the NTA. As a result, the proposed structure should not have access elevators or stairs.

Splitting of the park with the proposed bridge structure is also to be avoided. Therefore, the approach ramps will be supported on columns spaced apart to allow the amenity of the park to be retained.

5.2 Design Parameters Structural

The proposed structure shall be designed in accordance with Eurocodes and the TII Design Manual for Roads and Bridges (DMRB), which both specify a design life of 120 years. It will be designed for pedestrian loading in accordance with IS EN 1991-2, load model LM4.

All pedestrian bridges should be categorized into bridge classes by their usage to determine the appropriate dynamic actions to be considered due to pedestrians. The bridge class has been identified as Class C in accordance with Cl.NA.2.46.2 of IS EN 1991-2:2003 (National Annex).

This class is suitable for urban routes subject to significant variation in daily usage (e.g. structures serving access to offices or schools). The number and nature of pedestrian users on a bridge results in the bridge becoming ‘excited’, the scale of the excitations is a function of the type of bridge, span, structural depth (inertia), materials and nature of the pedestrian usage i.e. groups of people jogging/running etc.

Generally, the intent is to have minimal or no perceptible dynamic response. However, in longer span bridges where the intent is to provide a slender solution with aesthetic merit, a balance between acceptable dynamic behaviour and the slenderness of the structure is required.

As the proposed structure will form a pedestrian and cyclist link, the parapet height shall be a minimum of 1.2m high for pedestrians and an additional rail for cyclists will be at a height of 1.4m minimum in accordance with TII DMRB requirements.

5.3 Bridge Alignments

As mentioned previously, the LISTI options assessment has identified landing points 2 and 3 as being optimal for maximising the number of pedestrians and cyclists that would use the bridge. These landing points have identified potential alignments for the bridge, resulting in three options; Bridge Alignment Option 1, Bridge Alignment Option 2 and Bridge Alignment Option 3. Bridge Alignment Options 2 and 3 are essentially very similar but an opportunity arose to improve connectivity for cyclists from the greenway by avoiding sharp turns on the approach ramps, hence both options have been examined.

These alignment options consider the bridge spanning the existing N25 dual carriageway and existing Cork to Midleton railway with connectivity to the Little Island Train Station via ramped access west of the station and the Eastgate Business Park as per the LISTI options assessment landing points.

The alignment options are discussed in further detail below as well as identifying advantages and disadvantages for each. These alignments have been compared and Bridge Alignment Option 3 has been chosen as the preferred alignment. This alignment will be used to complete the constraints study.

5.3.1 Bridge Alignment Option 1

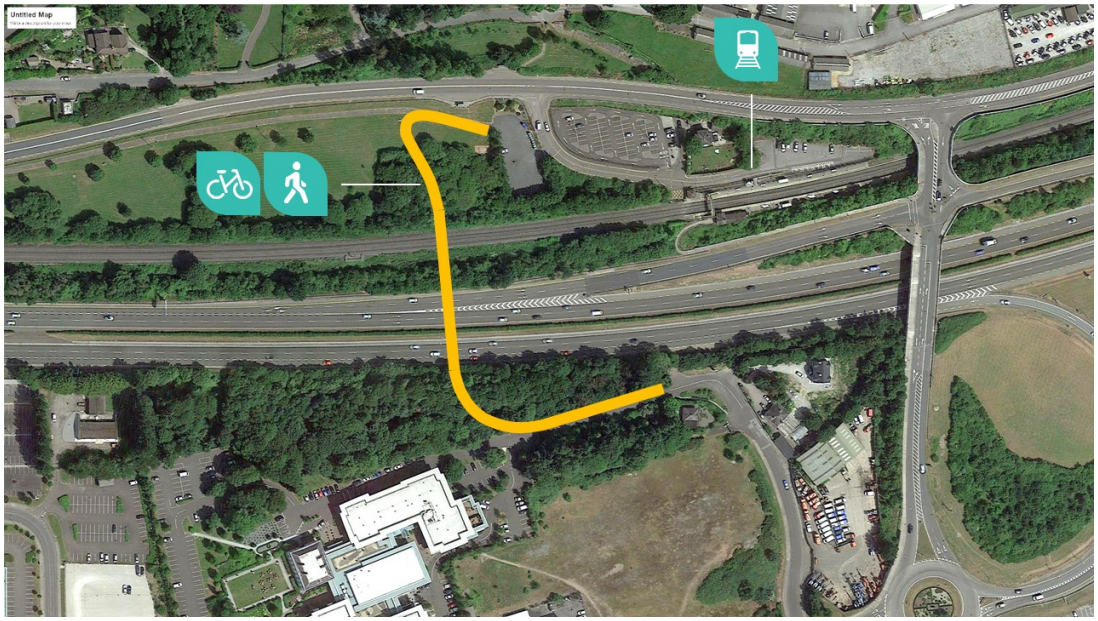

Figure 3: Bridge Alignment Option 1

Advantages

- Approach ramps much closer to train station;
- At grade connection to Bury's Bridge Greenway;
- Closest bridge to Little Island Train Station;
- Provides multi-modal interchange (rail, bus, cycling, pedestrian connectivity).

Disadvantages

- Impact on third party landowner (Radisson Blu Hotel);
- Sharp bend in alignment is not preferred for cyclists;
- Longer span over N25;
- Does not have the same pedestrian/cyclist catchment;
- Poor tie in locations at the Eastgate Business Park side;
- Additional tree felling/site clearance to facilitate both approach ramps.

5.3.2 Bridge Alignment Option 2

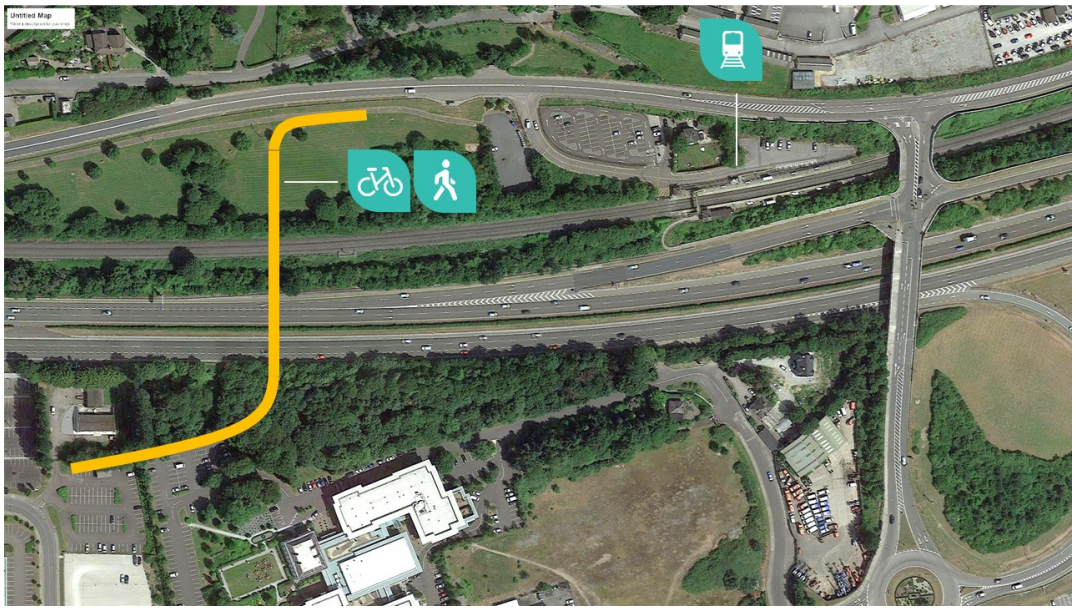

Figure 4: Bridge Alignment Option 2

Advantages

- Landing point within Eastgate (Highest Catchment);
- High quality connection between Tivoli and Bury's Bridge greenways;
- Provides multi-modal interchange (rail, bus, cycling, pedestrian connectivity);
- Shorter span over N25;
- Lower structure relative to Option 1 due to avoidance of rising carriageway levels at eastbound merge lane.

Disadvantages

- Enhanced connectivity with Euro Business Park will be necessary;
- Utility diversions necessary;

5.3.3 Bridge Alignment Option 3

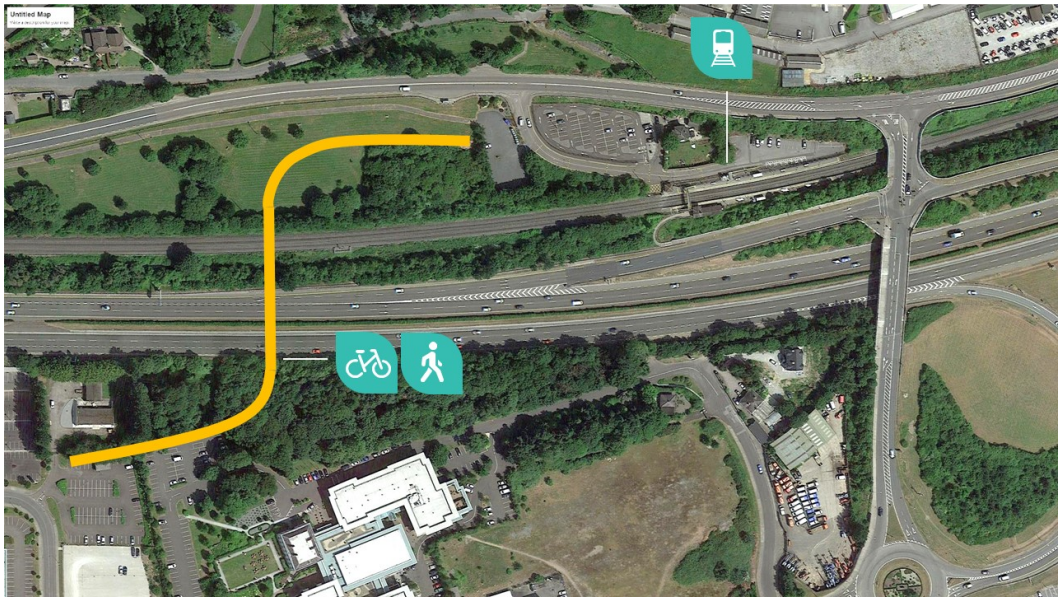

Figure 5: Bridge Alignment Option 3

Advantages

- Curved ramps reduce harsh angles for cyclists;
- Landing point within Eastgate (Highest Catchment);
- High quality connection between Tivoli and Bury's Bridge greenways;
- Provides multi-modal interchange (rail, bus, cycling, pedestrian connectivity);
- Shorter span over N25;
- Lower structure relative to Option 1 due to avoidance of rising carriageway levels at eastbound merge lane.

Disadvantages

- Enhanced connectivity with Euro Business Park will be necessary;
- Utility diversions necessary;
- Increased approach ramp length;

6 Constraints Analysis

6.1 Study Area

The feasibility study area for the proposed bridge crossing is illustrated in Figure 6 below. This area encompasses landing points 2 and 3 as discussed in Section 4 and the three alignment options presented in Section 5.3.

Figure 6: Feasibility Study Area © Bing Maps

The study area is bounded by the Glounthaune Road (former N25) to the north of the existing train station and extends between the train station to the east and a petrol filling station to the west on the northern side of the N25 road and existing Cork to Midleton railway.

To the south of the N25 road, the boundary extends to where it meets the perimeter of Zu Cars and traces the property boundary of an existing pumping station on the western side. The boundary extends to the east onto the Radisson Blu Hotel lands and continues until it meets the edge of a wooded area bordering the N25 road. The study area is bisected by the National Primary N25 road which is a high-quality dual carriageway with a speed limit of 120 km/h.

The study area for each constraint type may extend beyond or remain within the feasibility study area depending on the range and extent of potential impacts (both direct and indirect) from the proposed development.

6.2 Environmental Constraints

6.2.1 Biodiversity and Fisheries

Designated Sites

The closest Natura 2000 sites to the study area are the Cork Harbour Special Protection Area (SPA) site code 004030 and the Great Island Channel Special Area of Conservation (SAC) site code 001058. The Great Island Channel is also designated as a proposed Natural Heritage Area (pNHA) 001058. The boundary of Great Island Channel pNHA lies circa 250m to the east of the study area. The closest point of the Cork Harbour SPA is approximately 600m to the east and circa 2km to the southwest and west. The closest point of the Great Island Channel SAC lies approximately 1km to the east. The Dunkettle Shore pNHA site code 001082 is located circa 1km to the west. The Rock Farm Quarry pNHA site code 001074 is located circa 1.25km to the south. Refer to Designated Sites, below.

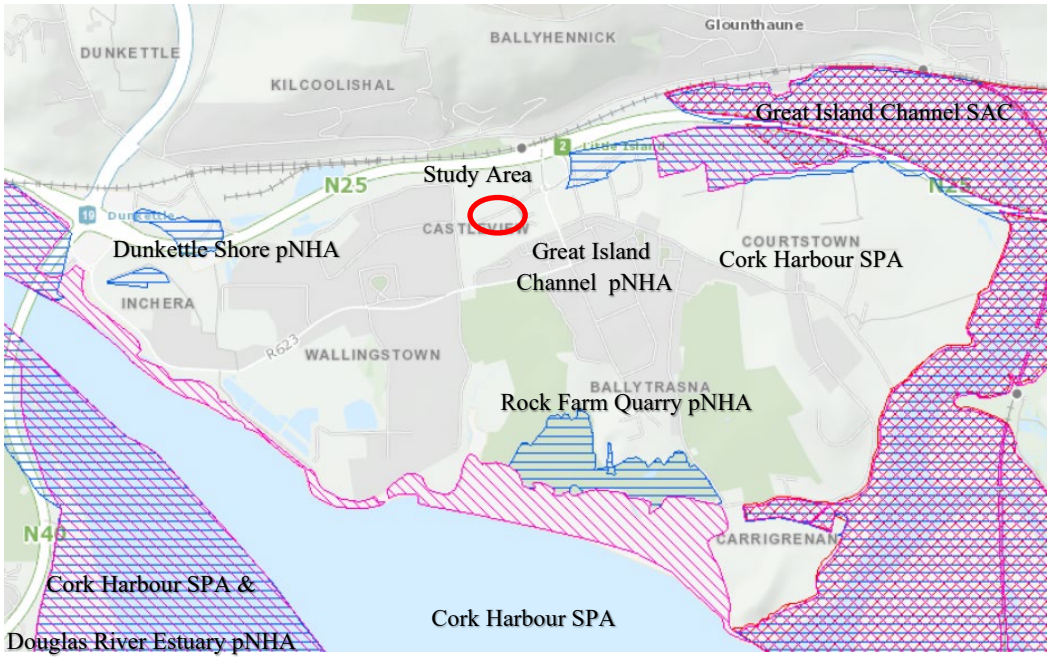

Figure 7 Designated Sites (source: NPWS [1]website, accessed December 2020)

For each of the SACs and SPAs, the National Parks and Wildlife Service (NPWS) publishes a site synopsis and conservation objectives and other data on its website[2] The site synopsis lists the species and habitats for which the site is designated. Table 1 summarises the significant features of the designated sites in the vicinity of the study area. It would be necessary to demonstrate that construction and operation of the proposed bridge would not have a significant negative effect on the species for which these sites are designated.

[1]https://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=8f7060450de3485fa1c1085536d477ba

[2] https://www.npws.ie/protected-sites accessed December 2020

Table 1 Summary of Significant features of Designated Sites

Designated Site	Site Code	Summary of site significance
Great Island Channel SAC	001058	Tidal Mudflats and Sandflats; Atlantic Salt Meadows; the site is a wetland of international importance for the birds
Cork Harbour SPA	004030	Cork Harbour is an internationally important wetland site, regularly supporting in excess of 20,000 wintering waterfowl
Great Island Channel pNHA	001058	Same as for Great Island Channel SAC
Dunkettle Shore pNHA	001082	No information on NPWS website
Rock Farm Quarry pNHA	001074	The area is of considerable interest botanically because of its species diversity and the presence of 'rarities' for the region, such as Dense-flowered Orchid and Portland Spurge.

Other Biodiversity

The study area contains wooded areas to the south of the N25 and on both sides of the railway, particularly on its northern side. These wooded areas may be suitable habitat for bats, a species protected under the Habitats Directive. It would be necessary to assess the importance of the study area for bats and breeding birds.

Fisheries

The nearest fishery river is the Glashaboy River, the estuary of which is located 2.5km to the west of the study area. There is sea angling from the harbourside towns, of which Passage West, 4km to the south of the site, is the closest. The proposed project is unlikely to have any effect on fisheries. There are some small watercourses/drains in the vicinity of the existing N25. Evidence of otters has been recorded in these areas previously.

6.2.2 Archaeological, Architectural and Cultural Heritage

Cultural heritage features in the vicinity of the study area are shown in Figure 8. There are a number of cultural heritage features in the general area, including the Little Island Railway Station, Register No. 20907528, the station master's house, Register No. 20907529, and the foot bridge at Little Island Railway Station, Register No. 20907530, in the National Inventory of Archaeological Heritage. The Radisson Blu Hotel, Register No. 20907527, is also in the Inventory. Excavation of undeveloped land has the potential to uncover unknown cultural heritage features.

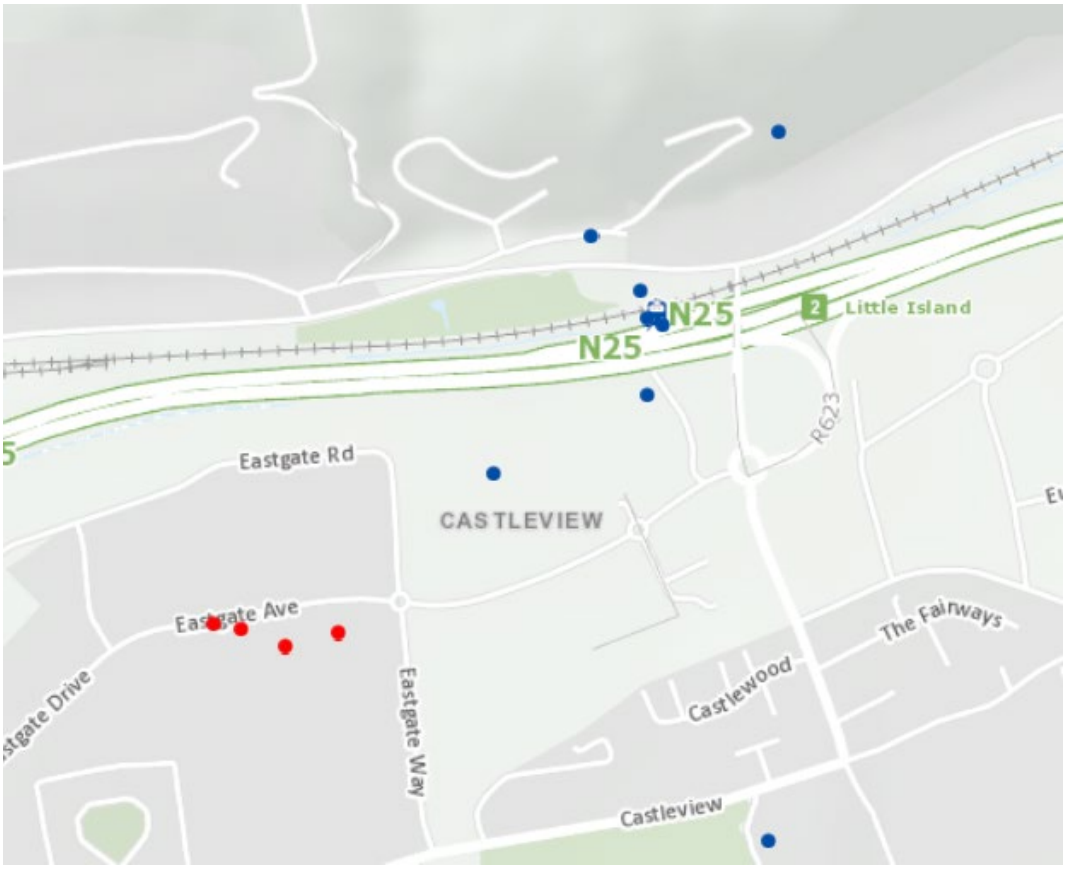

Figure 8 Cultural Heritage Features in Study Area (source: https://maps.archaeology.ie/HistoricEnvironment/ accessed December 2020)

The red dots are records held by the National Monuments Service and have identified fulacht fia and kilns. Blue dots are records held in the National Inventory of Architectural Heritage and are identifying buildings and structures. There is no known site of archaeological significance within the study area.

Two protected structures in close proximity to the study area are listed in the Cork County Development Plan 2014 - 2020. These are Ditchley House, RPS ID 00502, in the area marked Castleview on Figure 8 and Rockgrove House, RPS – 00490, to the north of the Railway Station.

There are no architectural conservation areas in the vicinity of the study area.

6.2.3 Geological and Hydrogeological

Ground conditions in this area were inferred from online maps provided by the Geological Society of Ireland (GSI), online maps provided by Ordnance Survey Ireland (OSI) and historic ground investigations. The information gathered from these sources indicate that ground conditions primarily consist of alluvial deposits underlain by glacial till or gravels, which rest on sandstone and siltstone bedrock.

A review of historic maps from OSI indicates that the site is bisected by the historic watercourse separating Little Island and Caharlag, which accounts for the presence of alluvial deposits in this area. It should also be noted that bedrock maps from GSI indicate the presence of faulting between the Gyleen Formation (siltstone) and Cuskinny Member (sandstone).

There are no geological heritage areas of significant importance in the proximity of the proposed bridge and it is unlikely that there are any public or private water supply sources. The groundwater at the site is designated as high vulnerability aquifer and described as a high permeability subsoil, sand and gravels overlain by poorly drained soil. Given the proximity to the estuary there is likelihood of brackish water in the area. This designation of vulnerability has the potential to be further reduced based on site specific risk assessments and investigations.

The groundwater level is unknown, but likely to be close to the ground surface.

Ground investigation data in this area were obtained from three historic projects: (i) Gas Pipeline Route from Powerhead Bay to Cork, Aghada and Marino Point, undertaken in 1976; (ii) Little Island Bridge, undertaken in 1994; and (iii) Little Island Bridge Widening, undertaken in 2018. The 1976 investigation works contain 2 no. boreholes in the western part of the site, which recorded soft organic clay and silt to depths of 6.5m and 7.5m. The 1994 investigation works contain 2 no. boreholes, located c. 100m west of the site and recorded rock fill to a depth of 1.2–2m, underlain by firm sandy gravelly clay to a depth of 3.5m, which rests on soft organic silt to a depth of 9.5–10m, underlain by compact sandy gravels. The boreholes terminated at depth of 13–14m and did not confirm bedrock. The most recent investigation works comprised 2 no. boreholes, 4 no. trial pits and 12 no. slit trenches, located c. 250m southwest of the site. The ground conditions in this location consist of made ground (similar to a Class 1 / Class 2 material) to a depth of 2–4.5 m, underlain by medium dense gravel and firm to stiff glacial till. The boreholes terminated at depths of 15 m and did not confirm bedrock.

The ground conditions are likely to consist of soft alluvial or organic soils overlying glacial till or gravels, overlying rock. The depth and extent of soft soils are variable in the area, and hence may vary at the bridge foundation locations.

Available ground investigation data in the area suggests it may vary from 3.5m to 10m in depth. It is recommended that piled foundations extending to the gravels, till, or rock are used to support the bridge abutments. The potential for differential settlement due to varying ground conditions at the foundations should also be considered in the design. If piles are founded in rock, the risk of fracturing due to faulting should be considered. A detailed site investigation is required to confirm the foundation conditions of the proposed bridge abutments and approach ramp supports/embankments.

6.2.4 Hydrology and Water Quality

Hydrology

The website https://www.floodinfo.ie/map/floodmaps/ provides information on past flood events and current flood risk. Figure 9 shows an extract from this website for the study area. The low-lying land to the north of the railway is currently at risk to flooding. The closest recorded past flood event, indicated by the yellow triangle on Figure 9, was to the east of the study area.

The M25 and railway corridor are indicated as at risk of flooding in the Mid-Range Future Scenario (assumes a sea level rise of 0.5m) in the Irish Coastal Protection Strategy Study 2011. Refer to Figure 10 below, which is an extract from map 33, in that study, and which shows the flood extent in the Mid-Range Future Scenario.

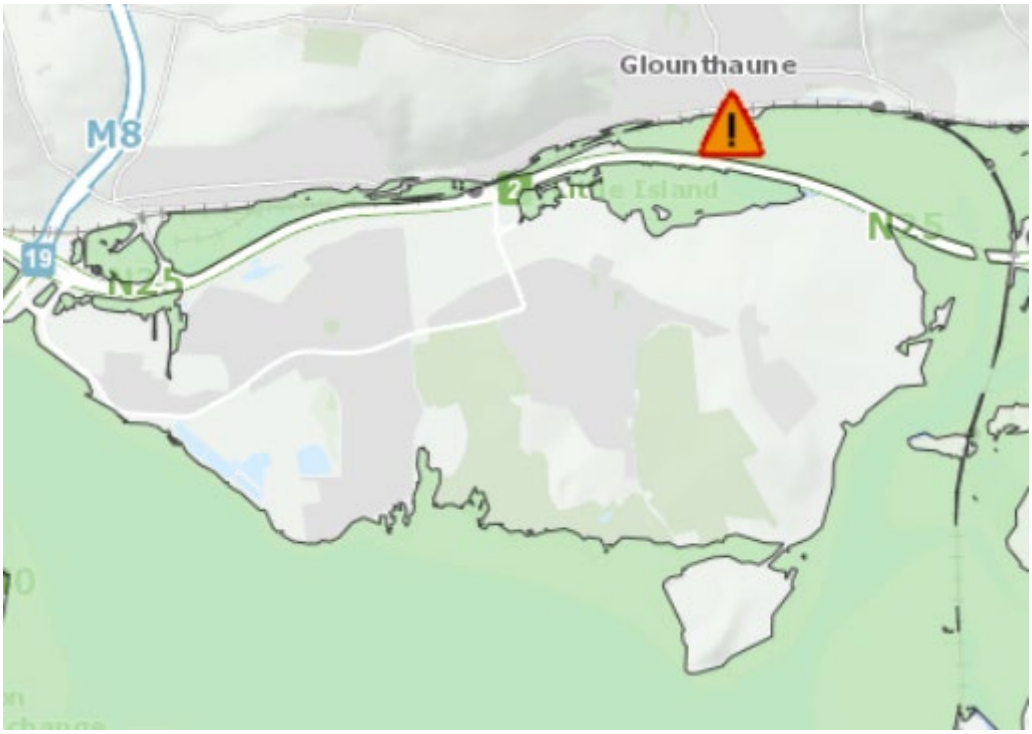

Figure 9 Current Flood Risk Extent and Past Flood Events (Source: https://www.floodinfo.ie/map/floodmaps/ accessed December 2020)

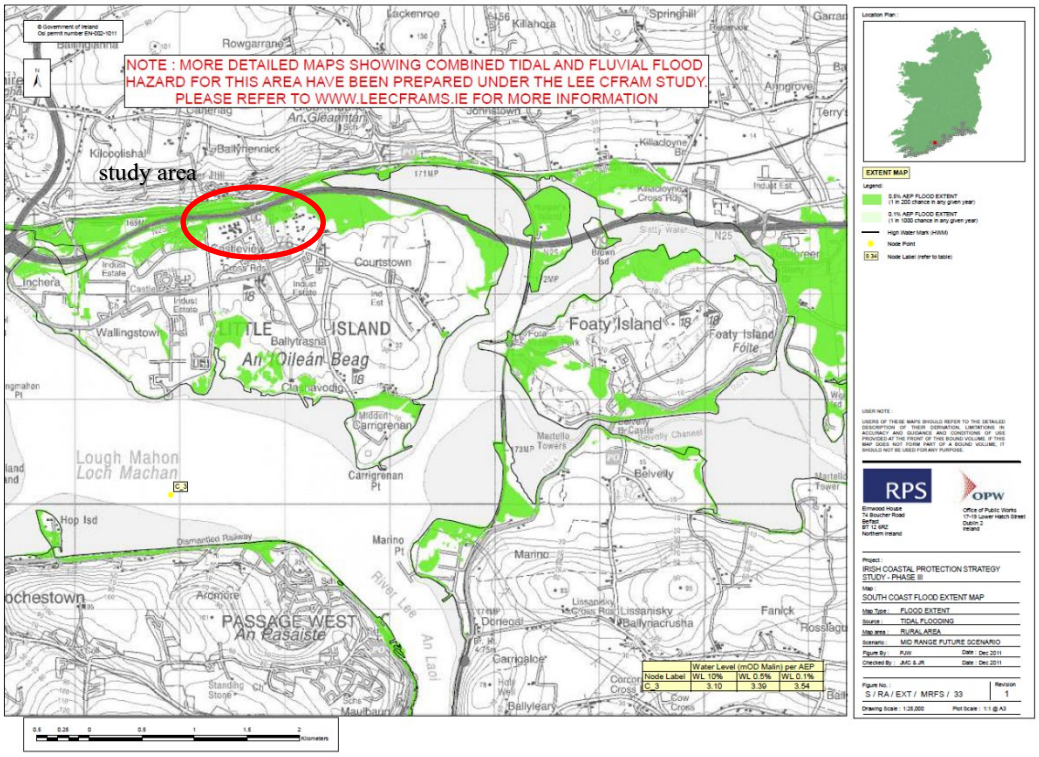

Figure 10 Extract from ICPSS Map 33 showing Mid-Range Future Scenario (Source: https://www.gov.ie/en/collection/be54a0-irish-coastal-protection-strategy-study-phase-3-south-coast/ accessed December 2020.)

It should be noted that these flood risk maps are for guidance only. A site-specific flood risk assessment should be carried out to determine the flood risk in the study area.

Water Quality

Lough Mahon to the south, North Channel Great Island to the east and Glashaboy Estuary to the west are the nearest water bodies to the study area. These water bodies are classified as "transitional and coastal". In the EPA report[3] chapter 2, Section 2.1.2, summarises the surface water ecological status of water bodies in the River Lee catchment.

> "*Three have deteriorated, including Glashaboy Estuary which has declined from Good in 2007-09 to Poor in 2010-15. Lough Mahon and Owennacurra Estuary both declined from Good to Moderate status. Three have improved, two coastal Outer Cork and Cork Harbour and one transitional North Channel Great Island have improved from Moderate in 2007-09 to Good in 2010-15*."

Lough Mahon is indicated as at risk of not meeting surface water environmental objectives, in Section 2.3.2 of the Report.

[3] EPA, Lee-Cork Harbour Catchment Assessment 2010 – 2015 (HA 19), 2018, Version no. 3

6.2.5 Landscape and Visual

The entire area surrounding the study area, from the western limits of Cork City to just east of Midleton and from the top of the ridgeline to the north, in the townland of Knockraha, to the mouth of Cork Harbour, is designated a High Value Scenic Landscape in the Cork County Development Plan 2014 - 2020. In relation to High Value Landscapes, the Plan states:

> *" 13.6.9 Within these High Value Landscapes considerable care will be needed to successfully locate large scale developments without them becoming unduly obtrusive. Therefore, the location, siting and design of large scale developments within these areas will need careful consideration and any such developments should generally be supported by an assessment including a visual impact assessment which would involve an evaluation of visibility and prominence of the proposed development in its immediate environs and in the wider landscape*."

The landscape character from the Glashaboy River valley in the west to east of Midleton, and from the top of the ridgeline to the north, in the townland of Knockraha, to the mouth of Cork Harbour, is type "City Harbour and Estuary".

The road from Dunkettle to Glanmire and eastwards to Caherlag and Glounthaune is designated scenic route S41. The road from Caherlag eastwards to Cashnagarriffe, northwest of Carrigtwohill, is designated scenic route S42. The proposed development is likely to be visible from parts of these routes. There are scenic routes on Great Island and from Passage West to Monkstown and further southwards, from which the proposed development is unlikely to be visible. The policies and objectives of the County Development Plan in relation to scenic routes is as follows:

> *"13.7.2 Each of the scenic routes was examined individually and their location related to the landscape character type traversed and some of the features lending themselves to the attractive nature of these particular routes identified. Scenic routes highlight the quality of the overall environment and landscape experienced within Cork County. It is important to protect the character and quality of those particular stretches of scenic routes that have special views and prospects particularly those associated with High Value Landscapes.*
>
> *"13.7.3 Whilst advocating the protection of such scenic resources the plan also recognises the fact that all landscapes are living and changing, and therefore in principle it is not proposed that this should give rise to the prohibition of development along these routes, but development, where permitted, should not hinder or obstruct these views and prospects and should be designed and located to minimise their impact. This principle will encourage appropriate landscaping and screen planting of developments along scenic routes."*
>
> *"**County Development Plan Objective GI 7-2: Scenic Routes***
>
> *Protect the character of those views and prospects obtainable from scenic routes and in particular stretches of scenic routes that have very special views and prospects identified in this plan. The scenic routes identified in*

this plan are shown on the scenic amenity maps in the CDP Map Browser and are listed in Volume 2 Chapter 5 Scenic Routes of this plan."

The County Development Plan 2014 – 2020 Volume 2: Heritage and Amenity, Chapter 5[4], *Scenic Routes – Views and Prospects & Scenic Route Profiles* provides a description of the views and prospects from the scenic routes which are protected.

S41 Description and General Views Being Protected:

"R639 regional road and local road from Dunkettle to Glanmire and eastwards to Caherlag and Glounthaune; Views of the Estuary and Harbour, wooded landscape, open countryside and hillsides"

S42 Description and General Views Being Protected:

"Local road at Forest-town, NW. Carrigtwohill and westwards to Caherlag; Views of the Harbour, wooded landscape, open countryside and hillsides"

6.2.6 Noise and Vibration

There is a significant number of dwellings located on Factory Hill and Tower Hill, the hillside to the north and northwest of the study area. The Radisson Blu Hotel is located on the southern boundary. These are the closest noise sensitive receptors.

The existing noise environment of the area is that of one near an industrial estate, a dual carriageway with a speed limit of 120 km/h and a train station. The main noise and vibration impact of the proposed development will relate primarily to the construction stage and the significance of the impact will depend on the construction methodology, such as the use of piling for foundations. The noise and vibration of these activities is considered to be short term.

6.2.7 Air Quality and Climate

There is a significant number of dwellings located on Factory Hill and Tower Hill, the hillside to the north and northwest of the study area. The Radisson Blu Hotel is located on the southern boundary. These are the closest receptors sensitive to air quality impacts.

As with noise and vibration, the existing air quality in the study area is typical of similar urban settings. Little Island is designated as Zone B under the Air Quality Standards Regulations, 2011. The air quality index for Little Island, according to the EPA, is good, with the nearest monitoring stations located in Cobh and the South Link Road in Cork City.

There are likely to be temporary impacts on air quality during construction of the pedestrian/cyclist bridge, which can be controlled by the implementation of standard best construction measures.

In terms of climate change, the construction of a new pedestrian bridge, is seen as a positive measure, encouraging a modal shift from other forms of transport.

[4] https://epublishbyus.com/volume_two_heritage_and_amenity/10039836#

6.3 Little Island Train Station and Railway

The Little Island train station is on the Cork to Cobh/Midleton commuter service and is located to the north of the N25 National Primary Road at the off ramp to Little Island. Entrance to the train station is made via a regional road to the north of the train station. A separate pedestrian access from the N25 eastbound off ramp is also present with a footpath connecting the train station to the An Crompan overbridge. The railway itself follows roughly parallel to the Glounthaune road in both the eastern and western directions from the train station.

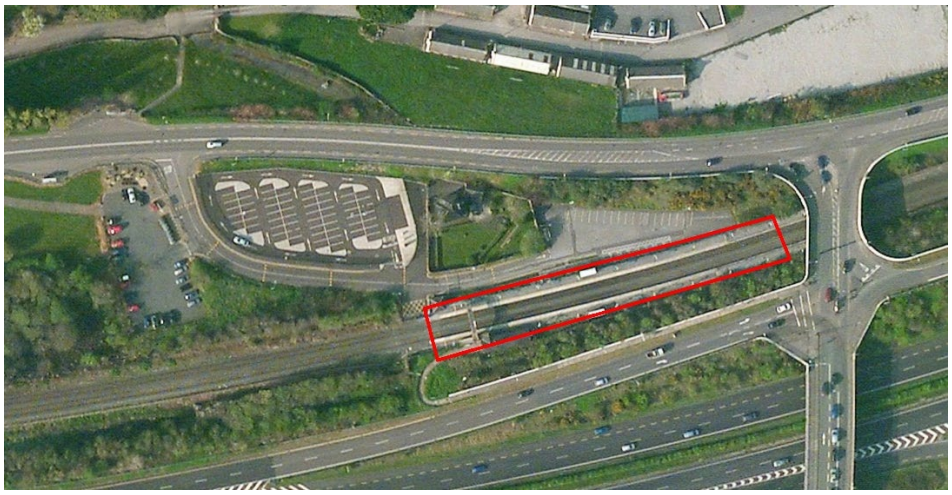

Figure 11: Little Island Train Station

The proposed bridge will need to adhere to any design constraints imposed by Iarnród Éireann (IÉ). It should be noted that at the time of writing this report, initial discussions between Cork County Council and IÉ have been held and all parties have indicated that they consider the provision of a new bridge to be feasible.

6.4 National Primary Road N25

The N25 road is a national primary road forming part of the route from Cork to Rosslare Europort via Waterford City. The road is part of the E30 European route and a short section is also part of the E01 European route. It forms part of the proposed Atlantic Corridor.

At the point of interest for the proposed pedestrian bridge, nearest the Little Island Train Station, the national primary road consists of six lanes. There are two lanes each for eastbound and westbound traffic as well as slipways to the north of the main N25 that provide access to/from Little Island. The proposed bridge will need to adhere to any design constraints imposed by Transport Infrastructure Ireland (TII).

6.5 Utilities

The following utility companies have been contacted in relation to the location of their assets within the feasibility study area. The results of which are summarised below in Table 2.

Table 2: Utilities found within study area

Utility Provider	Asset
Virgin Media	No services present
BT	Cable duct running from train station, along off ramp to Little Island and across existing bridge and into Eastgate Business Park
Gas Networks Ireland	600mm 19 bar transmission pipeline crosses through park under N25 to Eastgate Business Park 180mm 4 bar PE distribution pipe crosses the N25 between the train station and Eastgate Business Park
Aurora	Duct running parallel to the railway on area in between the railway and N25 road.
Electricity Supply Board	Buried and overhead services in vicinity 10kV overhead cable crosses through the park on the northern side of the N25, spans over the N25 before going underground and distributed through the Eastgate Business Park.
Irish Water/CCC (Foul and Water)	Gravity Foul main crosses the N25 through the park to a pumping station within the Eastgate Business Park 750mm Asbestos watermain running East-West across the existing park and then under the N25 to the Eastgate Business Park
E-net	Duct running through median of N25 road and into Eastgate Business Park
Eir	Several buried 50-100mm ducts Ducts cross under N25 road between the train station and Eastgate Business Park

It is proposed that further investigation be completed during design phases to verify with utilities companies their asset locations and to confirm these with trial pit/slit trenches as part of any site investigation works.

6.6 Foundation Construction and Ramps

The foundations for the bridge and approach ramps will be a key consideration for the success of the project. With a height constraint between the carriageway/railway and the soffit of the bridge of 5.7m in accordance with TII Design Criteria for Footbridges document DN-STR-03005, there will be a significant height difference between any proposed start/end points to the bridge itself.

Given the relatively flat level difference between both sides and the existing carriageway there is very little opportunity to incorporate this level change into the existing landscape. As a result, the level difference will need to be achieved through stairs, ramps, lifts or a combination of all three. DN-STR-03005 recommends that access to the deck of the footbridge should be provided by both ramps and stairs where access by stairs alone only be considered in exceptional circumstances and in consultation with the overseeing organisation for disability groups.

As a result, the access to the bridge is likely to be provided by ramps as opposed to stairs. A proposed maximum gradient of 1:20 as requested by the NTA or shallower could be utilised to facilitate pedestrians and cyclists. Given the height difference between existing ground levels and the deck level of the proposed bridge and requirements for landings, the ramps are likely to be approximately 130m long. Further analysis would need to be completed during the design phase to accurately measure the length of the approach ramps, minimise their footprint and adhere to requirements for pedestrians and cyclists.

The support structure for these ramps will need to be minimal in size to mitigate the effect on the surrounding environment and animal habitats and be aesthetically pleasing to minimise visual impact of the structure. See Figure 12 and Figure 13 below comparing an elegant approach ramp to a standard approach ramp.

Figure 12 Example Elegant Bridge Ramp Design

Figure 13: Standard Approach Ramp Design - Hermitage Bridge Ramps Design © Google

The ability to construct a foundation on the land located between the N25 primary road and existing railway will also be a significant factor on the bridge form. Figure 14 shows the area of land that is potentially available for the construction of an intermediate pier based on the preferred bridge alignment option.

The ability to construct in this area will turn a single span bridge into a bridge composed of two segments of shorter spans. These shorter spans involve less construction materials being used for the bridge superstructure and therefore are slenderer than the single span option. This will aid in all bridge options but more so the below deck structures as a shallower superstructure will reduce the height of the approach ramps.

Figure 14: Land between Railway and N25 Road

As identified previously, there are currently utilities in this area that would likely need to be relocated. The area is also heavily wooded and is likely to contain some animal habitats which will need to be considered further.

6.7 Landownership

A cursory inspection of the available landowner information in the vicinity of the proposal was completed to identify key landowners for the successful delivery of the project. The owners of the train station, railway and the N25 dual carriageway have been identified as being affected by the proposed project.

The inspection is not considered to be exhaustive and any doubt in ownership and further investigation will be required if the project should progress.

7 Potential Bridge Options

7.1 Structural Span Options Overview

The total length between the park on the northern side of the N25 and the Eastgate Business Park boundary on the southern side is approximately 85m.

A number of different span arrangement options exist by using the land between the existing railway and the N25 for locations of supports. Locating foundations within these lands will allow two span bridge options to be considered as well as the single span option.

The single span option would potentially be a 90-95m span crossing over the existing railway, the N25 eastbound diverge lane and the N25 dual carriageway.

For the double span option, any bridge spanning the proposed alignment could potentially have a main span of 60m depending on where the bridge supports are and the degree of skew. The piece of land between the railway and the N25 is approximately 22.5m wide. If this land can be used for an intermediate support then it would allow a two-span bridge to be constructed consisting of a span of approximately 35m crossing the railway and a 60m span crossing the N25 road.

This results in span options as follows:

- Span Option 1 – 95m Bridge Length
- Span Option 2 – 95m Bridge length comprising a span of 60m over the N25 road and 35m over the IÉ railway

Spans in the order of magnitude quoted above do not present significant structural problems and can be achieved using a range of bridge options outlined below.

7.2 Bridge Options Overview

Given the constraints indicated in the previous section and the potential span of the bridge, six potential bridge options have been identified.

The evaluation of options is limited to the main bridge span only with consideration of the approach spans considered separately. A significant constraint is the constructability of the bridge and the need to construct the bridge quickly avoiding major traffic disruption. As a result, all options considered are assumed to be constructed off-site and installed over a weekend overnight road closure.

The potential bridge options are listed below and summarised in the following sections. It should be noted that all figures and diagrams are indicative at this stage and may not represent the final design.

- Bridge Option 1 – Double Span Through Girder;
- Bridge Option 2 – Single Span Half Through Truss;
- Bridge Option 3 – Double Span Half Through Truss;
- Bridge Option 4 – Single Span Tied Arch;

- Bridge Option 5 – Double Span Tied Arch;
- Bridge Option 6 – Double Span Cable Stay;

7.2.1 Option 1 – Double Span Through Girder

Figure 15: Double Span Through Girder

The supporting structure of a through girder bridge consists of a steel or concrete girder supporting the deck. The girders themselves are the primary support for the deck and are responsible for transferring the load down to the foundations. Material type, shape, and weight all affect how much weight a beam can hold and the depth of the girder itself.

With concrete girder options, they can either be pretensioned precast beams or post tensioned precast beams although it is extremely unlikely that a precast concrete span could be fabricated offsite and transported to site with a span of 60m. In addition, a 90m single span through girder is likely to be in the region of 3.5m deep which would make this option extremely challenging given the height requirements over the existing dual carriageway. As a result, both single span through girders and concrete double span girders are not considered further.

The steel girder option can incorporate a composite concrete deck which, while adding additional weight, can increase the stiffness of the system resulting in a shallower section. The advantage of the double span through girder is the provision of the back span over the existing railway helps to reduce the depth of the main span through the provision of a monolithic pier between the existing railway and the eastbound diverge ramp. The benefit of this will be limited due to the relative stiffness of this pier due to the height of the deck above the ground.

The advantage of the through girder option is that it comprises of relatively simple construction which can be fabricated offsite and lifted into position in a single lift during an overnight road closure.

The disadvantages of the through girder option is the depth required for the support structure and the limitation to efficiently achieve spans of this length. At 60m span a though girder would need to be in the region of 2.5m to 3m deep as a continuous double span. This combined with the depth of handrailing results in a very deep structure which will have a negative aesthetic impact on the surrounding environment. In addition, the depth of the girder below the walking level sets the walking level higher above the roadway requiring longer ramps to achieve a tie in with the existing levels.

7.2.2 Option 2 – Single Span Half Through Truss

Figure 16: Single Span Through Girder – A2 Midhurst Warren Truss, UK

Half-through steel bridges are a common solution for pedestrian and cycleway bridges. The footway/cycleway is relatively narrow and a stiffened steel plate deck can easily span between the main beams on each side.

There are two options for the open web girders – a triangulated truss (usually Warren type) and a Vierendeel girder. In the latter case, the parapet is often incorporated into the edge beams, with handrails within each panel. In both cases, the deck is usually a thin steel plate with transverse and longitudinal stiffeners.

A positive attribute of this type of bridge is that it does not depend on horizontal compression forces for its integrity which allows them to be built off-site and then transported into place and nearly all the superstructure is above deck which aids with clearances for highways and railways reducing the length of ramps.

For the single span option, a truss depth in the region of 2.5m to 3m is feasible with all of the structure above deck and the handrail incorporated into the structure itself as shown in Figure 16.

7.2.3 Option 3 – Double Span Through Truss

The advantage of the double span through truss is the ability to reduce the overall depth of the truss by utilising the reduced main span moment provided by the presence of a back span and the continuous truss over the intermediate support.

Another positive attribute of this option is the ability to fabricate each span off site and transport to site in more manageable lengths.

The disadvantage of this option is the construction of the intermediate pier in close proximity to the existing railway line and N25 dual carriageway.

7.2.4 Option 4 – Single Span Tied Arch

Figure 17: Shouldered Tied Arch Bridge Example – N19 Co. Clare

A tied arch bridge (also called bowstring-arch) is a type of bridge that has an arch on each side of the deck of which its outward direction horizontal forces are tied together by a chord tying the arch ends, usually the deck itself. The deck itself is then hung by vertical tie beams connected to the arches support the deck from above.

A positive attribute of this type of bridge is that all the superstructure is above deck which aids with clearances for highways and railways reducing the length of ramps.

The structural system allows for a very slender deck and can form a very aesthetically pleasing structure through the provision of tubular arches and vertical or crisscross cable arrangements.

Although transportation of a 90m long single span arch is unlikely given the existing constraints on the existing N25, it could be assembled north of the existing railway and push launched or craned into position. This will require further

investigations into the available lands for assembly and launching but is seen as a viable option at this stage.

7.2.5 Option 5 – Double Span Tied Arch

Figure 18: Double Span Tied Arch Bridge Example – Infinity Footbridge, Stockton-on-Tees, UK

Multi-span continuous tied arches are also a potential option with the 30m – 65m span ratios supported by two arches of varying span and height. In this example the continuous deck spans over the support tying the arches together.

The advantage of this option over Option 4 is that the spans can be reduced giving more flexibility in terms of assembly and erection however it is still unlikely that these spans could be transported to site and would require assembly north of the existing railway.

The disadvantage of this option over Option 4 is the construction of the intermediate pier in close proximity to the existing railway line and N25 dual carriageway.

7.2.6 Option 6 – Double Span Cable Stayed

Figure 19 Cable Stayed Bridge Example

A cable-stayed bridge has one or more towers from which cables support the bridge deck. A distinctive feature are the cables or stays, which run directly from the tower to the deck, normally forming a fan-like pattern or a series of parallel lines.

The tower of a cable-stayed bridge is responsible for absorbing and dealing with compressional forces and the cables attach to both the deck and the tower at several separate points. This offers the advantage of keeping the supporting structure all above the deck level which aids with clearances for highways and railways reducing the length of approach ramps.

In the case of this proposed bridge the 30m – 65m span ratio suits the cable stayed bridge system with a single tower located on the land between the existing railway line and the N25 eastbound diverge. The back span could span over the existing railway line with modest foundations at the interface with both on the north and south ramps.

The disadvantage of the cable stayed option is the requirement for a temporary support within the central verge of the dual carriageway to facilitate construction. This constraint would not rule out this option but would require acceptance from TII.

8 Construction Methodology

This section outlines the proposed method for construction for each bridge option with similarities present for most options. The purpose of this section is to identify differences in how each bridge option is constructed which is a primary constraint for the project and is influential on the cost of the structure and likely disruption to the existing traffic network during construction.

8.1 Span Construction and Installation

It is envisaged that all options are fabricated off site with large sections of the span transported to site via road during overnight transportation operations. Given the length of the spans, it is not possible to transport the spans in their entirety so it will be necessary to procure a nearby offsite assembly area to facilitate final fabrication/assembly. There appears to be a number of areas in the vicinity of the proposed bridge that would be suitable.

A potential alternative option for assembly and installation of Bridge Options 4 and 5 is to assemble the bridge in the public park north of the existing bridge and launch the bridge over the existing railway and over the existing N25 dual carriageway. A full assessment of the area and its ground levels to the north will need to be completed before this can be confirmed as viable.

For Options 1, 2, 3, 4 and potentially Option 5 final erection would be carried out using one or two large mobile cranes during a night time road closure as shown in Figure 20.

Figure 20: Bridge Erection during Road Closure

Installation of Option 6 would not be possible in a single lift and would require either launching of the deck from the north with a temporary pier in the central median or a segment by segment erection with the main span temporarily supported using that same temporary pier. There appears to be adequate space in the region to perform this.

8.2 Abutments and Piers

It is envisaged that due to the ground conditions in the area, all abutments and piers would need to have a piled foundation. Access appears to be possible to all locations required for foundations for a piling rig. For the two span options, where an intermediate pier would be required, the construction of a foundation/pier in the land between the existing railway and N25 dual carriageway would be more complex. However, it is not deemed unachievable at this stage with the necessary design development and engagement with TII and IÉ.

9 Statutory Consent Processes

9.1 Environmental Impact Assessment (EIA) Screening Process

The competent authority, in considering a decision to grant permission for the proposed bridge may be required to carry out an environmental impact assessment, in compliance with the EIA Directive (2011/92/EU), as amended by Directive 2014/52/EC. An EIA screening assessment should be carried out, in compliance with EU and Irish EIA legislation, to determine if an EIA is required.

Article 8 of the Roads Regulations 1994 (Road development prescribed for the purposes of Section 50(1)(a) of the Roads Act, 1993 (as amended) specifies the classes of development which require an EIA, including:

'The construction of a new bridge or tunnel which would be 100 metres or more in length'

If the ramps are deemed to be integral to the main span, the proposed bridge is likely to exceed this threshold, Section 50(1)(a) of the Roads Act, 1993, as amended, provides that an EIA will be required.

In addition, Section 50(1)(c) of the Roads Act, 1993 (as amended) specifies the following:

'Where a road authority considers that any proposed road development (other than development to which paragraph (a) applies) .....would be likely to have significant effects on the environment…'

Cork County Council will determine whether an EIA is required. This will also determine the statutory consent route. It is possible, given the length of the proposed bridge, that an EIAR will be required in accordance with Section 50(1)(a).

9.2 Appropriate Assessment Screening Process

Articles 6(3) and 6(4) of the Habitats Directive set out the requirement for an assessment of proposed plans and projects, which are not directly connected with the management of a Natura 2000 site, and which are likely to have a negative effect on Natura 2000 sites.

Article 6(3) establishes the requirement to screen all plans and projects and to carry out a further assessment if required.

The Appropriate Assessment (AA) screening assessment will consider whether the proposed development has the potential to have a significant impact on the conservation objectives of any relevant Natura 2000 sites. The screening assessment must be in accordance with the relevant EU and Irish legislation and best practice guidance.

While the proposed bridge is not located in close proximity a Natura 2000 site, there are two Natura 2000 sites in the vicinity. There may be a hydrological pathway from the proposed bridge to the Natura 2000 sites. However, an Appropriate

Assessment will be required given the potential impact of the southern approach ramps on the woodland habitats and hydrological pathways to the Natura 2000 sites.

The ecological and habitat surveys will be required to ascertain the sensitivity of the biodiversity of the area to the proposed bridge and construction works.

9.3 Transport Infrastructure Ireland (DN-STR-03001)

All structures built within the footprint of motorways and national roads are subject to Technical Acceptance by TII. As the proposed bridge will cross the N25 national primary road, the bridge design and approval will need to comply with TII's standard "Technical Acceptance of Road Structures on Motorways and Other National Roads" DN-STR-03001.

This will be an ongoing interaction with TII seeking approval of the structure at various stages of the design. No construction can begin before technical acceptance is issued by TII.

It is deemed at this stage that Technical Acceptance by TII is achievable subject to due process, further design development and further engagement.

9.4 Iarnród Éireann (CCE-TMS-310)

The proposed bridge will also need to cross the existing railway. In a similar fashion as engaging with TII, IÉ will need to be consulted in relation to the bridge crossing their asset. The design of the bridge should be in compliance with "Guidance on Third Part Works" CCE -TMS-310.

This will be an ongoing interaction with IÉ seeking approval of the structure at various stages of the design.

Like TII Technical Acceptance, it is deemed at this stage that technical acceptance from IÉ is achievable subject to due process, design development and further engagement.

In addition to technical acceptance it will also be necessary to acquire the air rights above the railway by agreement with IÉ.

10 Cost

The construction cost estimate at this stage is a high-level cost estimate based on industry experience.

A more detailed cost estimate should be carried out on the emerging preferred option for a more accurate reflection of the construction costs. To account for the high-level nature of the cost estimate a +/- 30% factor was applied to get an appropriate cost range for this stage of the assessment.

The construction cost estimate is based on rates per m^2 for both the main span and approach ramps from industry experience and previous projects of a similar nature. Two options are considered in the cost estimate for different widths of ramps and bridges. Option A outlines a cost estimate for a 4m wide bridge and ramps while Option B is for a 5m wide bridge and ramps. Similarly, a cost per unit was assigned to the foundation costs. It is noted that foundation construction adjacent to the existing rail line will be significantly more than the other foundations and this has been accounted for in the cost estimate.

It is noted that a cost per m^2 for the approach ramps of €1,500 was used which is high however this was selected to account for the higher than normal architectural requirement of the approach ramps to minimise the impact both on the existing park to the north and the existing wooded area to the south.

An allowance has also been made for contractor preliminaries, relocation of the existing services and road and rail possessions for final installation.

An indicative cost estimate for the two width options (Option A and B) are provided in Table 3 and Table 4 below.

Table 3: Estimate Costs – Option A (4m Deck Width)

Option A - 4m Deck Width														
Opt	**Deck Area (m^2)**	**Rate/m^2 Main Span**	**Cost of Main Span**	**Found-ations**	**Found-ation Costs/unit**	**Found-ation Costs**	**Ramp Length (m)**	**Deck Area (m^2)**	**Rate/m^2 Ramps**	**Cost of Ramps**	**Prelims, Service Diversions & Possessions**	**Provisional Cost**	**Total Cost**	
	A (95*4)	B	C (A*B)	D	E	F (D*E)	G	H (G*4)	I	J	K	L (C+F+J+K)	- 30% (L*0.7)	+ 30% (L*1.3)
1	380	€3,500	€1,330,000	3	€100,000	€300,000	260	1,040	€1,500	€1,560,000	€450,000	€3,640,000	€2,548,000	€4,732,000
2	380	€4,500	€1,710,000	2	€100,000	€200,000	260	1,040	€1,500	€1,560,000	€450,000	€3,920,000	€2,744,000	€5,096,000
3	380	€4,000	€1,520,000	3	€100,000	€300,000	260	1,040	€1,500	€1,560,000	€450,000	€3,830,000	€2,681,000	€4,979,000
4	380	€5,000	€1,900,000	2	€100,000	€200,000	260	1,040	€1,500	€1,560,000	€450,000	€4,110,000	€2,877,000	€5,343,000
5	380	€5,000	€1,900,000	3	€150,000	€450,000	260	1,040	€1,500	€1,560,000	€450,000	€4,360,000	€3,052,000	€5,668,000
6	380	€4,500	€1,710,000	3	€125,000	€375,000	260	1,040	€1,500	€1,560,000	€450,000	€4,095,000	€2,866,500	€5,323,500

Table 4: Estimate Costs – Option B (5m Deck Width)

Option B - 5m Deck Width														
Opt	**Deck Area (m^2)**	**Rate/m^2 Main Span**	**Cost of Main Span**	**Found-ations (no.)**	**Found-ation Costs/unit**	**Found-ation Costs**	**Ramp Length (m)**	**Deck Area (m^2)**	**Rate/m^2 Ramps**	**Cost of Ramps**	**Prelims, Service Diversions & Possessions**	**Provisional Cost**	**Total Cost**	
	A (95*5)	B	C (A*B)	D	E	F (D*E)	G	H (G*5)	I	J	K	L (C+F+J+K)	- 30% (L*0.7)	+ 30% (L*1.3)
1	475	€3,500	€1,662,500	3	€100,000	€300,000	260	1,300	€1,500	€1,950,000	€450,000	€4,362,500	€3,053,750	€5,671,250
2	475	€4,500	€2,137,500	2	€100,000	€200,000	260	1,300	€1,500	€1,950,000	€450,000	€4,737,500	€3,316,250	€6,158,750
3	475	€4,000	€1,900,000	3	€100,000	€300,000	260	1,300	€1,500	€1,950,000	€450,000	€4,600,000	€3,220,000	€5,980,000
4	475	€5,000	€2,375,000	2	€100,000	€200,000	260	1,300	€1,500	€1,950,000	€450,000	€4,975,000	€3,482,500	€6,467,500
5	475	€5,000	€2,375,000	3	€150,000	€450,000	260	1,300	€1,500	€1,950,000	€450,000	€5,225,000	€3,657,500	€6,792,500
6	475	€4,500	€2,137,500	3	€125,000	€375,000	260	1,300	€1,500	€1,950,000	€450,000	€4,912,500	€3,438,750	€6,386,250

11 Project Timescales

The approach outlined in Figure 21 represents a reasonable scenario as to how the proposed bridge may be delivered in terms of design, statutory consent, construction tendering, sequencing and duration.

Whilst the general requirements detailed will be followed, the Contractor, when appointed, will ultimately be responsible for the sequencing and implementation of the works in a safe and secure manner and in accordance with all statutory requirements.

Construction works such as removal of trees and vegetation will be restricted to winter months from October to February so the schedule would need to be adjusted to reflect these seasonal requirements depending on the likely construction start date.

Figure 21 provides an estimated design, statutory planning process, tender and construction programme with durations for each of the main elements of the project delivery outlined resulting in a total project duration of 32 months.

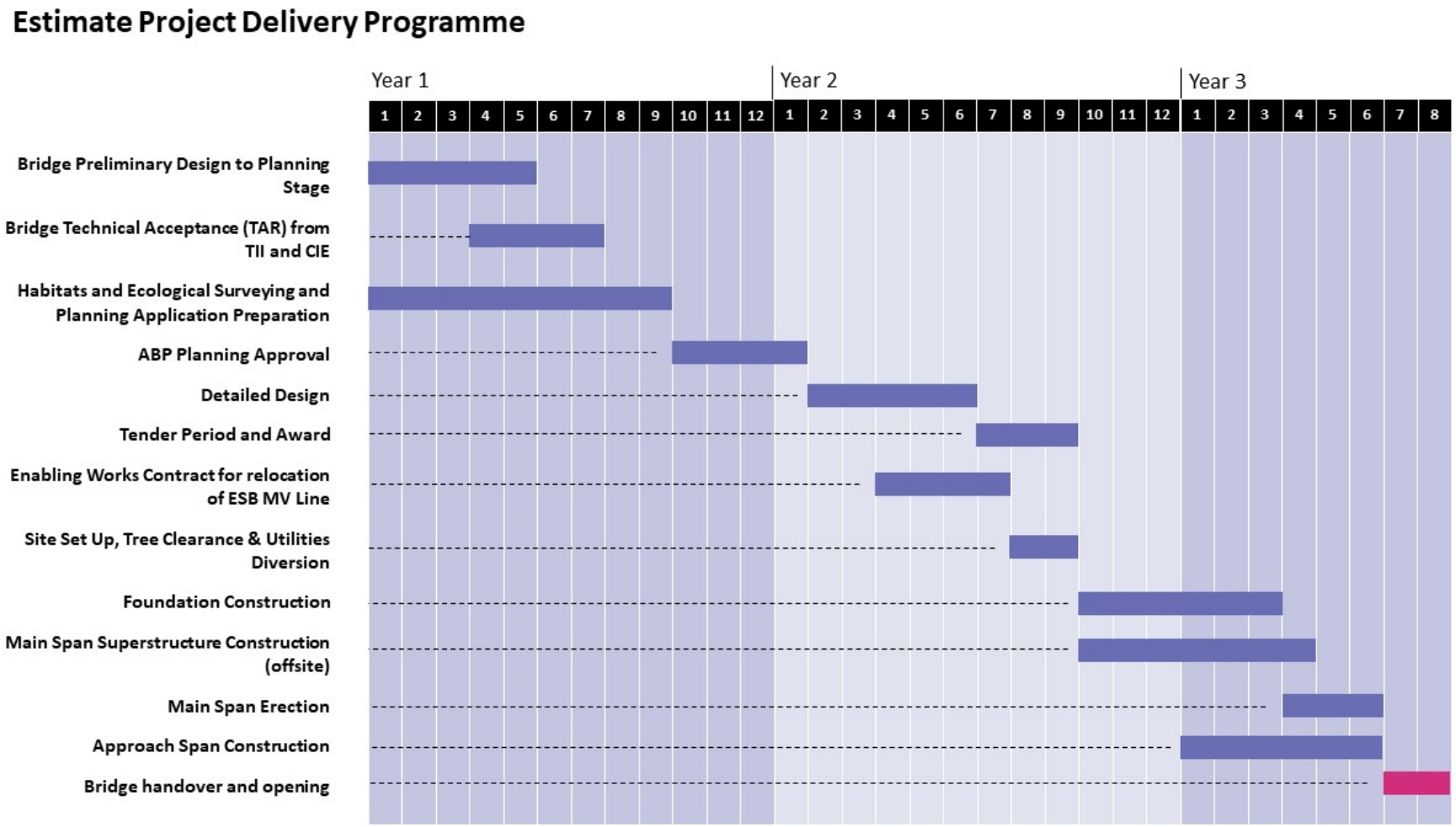

Figure 21: Estimate Project Delivery Programme

12 Conclusions

This report has assessed the feasibility of constructing a new pedestrian/cycle bridge with the chosen alignment under the criteria outlined in the report. It has concluded that the construction of the proposed bridge is feasible. The project should proceed to the next stage and recommendations have been given below which suggest the next steps for successful delivery of the project.

This report also outlines the key considerations which should be used when completing the next stages of the project. Further consideration should be given to include environmental, stakeholder and constructability aspects of the project.

The proposed alignment has been assessed with several potential bridge types and construction options for the bridge and has demonstrated that they are possible for this alignment.

13 Recommendations

It is recommended that a more detailed bridge options assessment be conducted to provide greater certainty on the alignment, landowners, structure types and cost.

It is also recommended that once this detailed assessment has been conducted and a bridge option chosen that draft reports on EIA Screening and AA Screening are prepared. This will allow the competent authority to undertake an assessment and determine whether either an EIAR or NIS, or both, is required for the proposed development and hence determine the route for statutory consent.

Engaging with TII and IÉ at an early stage will be critical to the project's success and it is recommended that these stakeholders be consulted at the onset of the project commencement.

Given the relatively flat terrain, an above deck structure appears to be most advantageous in limiting the extent of ramping. Therefore, it is recommended that the through girder option (Option 1) is not considered further.

The double span options reduce the complexity of the final bridge lift and offer the option to provide a third access point to Little Island Train Station south of the existing railway. However, it adds complexity to the foundation construction in relation to the constraints previously outlined and will impact on the delivery of this option. It is therefore recommended that further analysis be completed in advance of selecting a preferred bridge type option.