Appendix J.2

Preliminary Design Report

ST02 - Naas Road

Pedestrian and Cycle Bridge

CBC008-ST02 Naas Road Pedestrian/Cycle Bridge Preliminary Design Report

Clondalkin to Drimnagh Core Bus Corridor
BCIDA-ACM-STR_ZZ-0008_XX_00-RP-CB-0003

Client – National Transport Authority
Stage – Stage

Project Reference: BusConnects Package A
Project Number: 60599123
BCIDA–ACM–STR_ZZ-0008_XX_00-RP-CB-0003

Date (8th June 2021)

Quality information

Prepared by	Checked by	Verified by	Approved by
Callum Moloney Graduate Engineer	Arthur Costello Principal Engineer	Niamh Rodgers Structural Design Lead	Joe Seymour Project Director

Revision History

Revision	Revision date	Details	Authorized	Name	Position
L01	08/06/2021	Issue for Comment	NR	Niamh Rodgers	Structural Design Lead

Distribution List

# Hard Copies	PDF Required	Association / Company Name
0	1	NTA
0	1	TII

Prepared for:

National Transport Authority

Prepared by:

AECOM Ireland Limited in association with Mott MacDonald
24 Lower Hatch Street
Dublin 2 D02 TY88
Ireland

Prepared in association with:

MOTT MACDONALD

Table of Contents

1. Introduction 6
1.1 Brief 6
1.2 Background information covering origins for the need for the structure 6
1.3 Previous studies and their recommendations 7
2. Site & Function 8
2.1 Site location 8
2.2 Function of the structure and obstacles crossed 8
2.3 Choice of location 8
2.4 Site description and topography 8
2.5 Vertical and horizontal alignment 9
2.6 Cross sectional dimensions on the alignments 9
2.7 Existing underground and overground services 9
2.8 Geotechnical summary 11
2.8.1 Ground Investigation 11
2.8.2 Ground Summary 11
2.8.3 Groundwater Summary 13
2.9 Hydrology and hydraulic summary 13
2.10 Archaeological summary 13
2.11 Environmental summary 13
3. Structure & Aesthetics 14
3.1 General description of recommended structure or family of structures and design working life 14
3.2 Aesthetic considerations 14
3.3 Proposals for the recommended structure or family of structures 15
3.3.1 Proposed Category 15
3.3.2 Span Arrangements 15
3.3.3 Minimum headroom provided 15
3.3.4 Approaches including run-on arrangements 15
3.3.5 Foundation type 15
3.3.6 Substructure 16
3.3.7 Superstructure 16
3.3.8 Articulation arrangements, joints and bearings 16
3.3.9 Vehicle Restraint System 16
3.3.10 Drainage 16
3.3.11 Durability 16
3.3.12 Sustainability 17
3.3.13 Inspection and maintenance 17
4. Safety 18
4.1 Traffic management during construction including land for temporary diversions 18
4.2 Safety during construction 18
4.3 Safety in use 18
4.4 Lighting 19
5. Cost 20
5.1 Budget Estimate in current year, including whole life cost 20
6. Design Assessment Criteria 21
6.1 Actions 21
6.1.1 Permanent Actions 21
6.1.2 Snow, Wind and Thermal Actions 21
6.1.3 Actions relating to normal traffic 21
6.1.4 Actions relating to abnormal traffic 21

6.1.5 Footway or footbridge live loading....21
6.1.6 Provision for exceptional abnormal loads....21
6.1.7 Accidental actions....21
6.1.8 Actions during construction....22
6.1.9 Any special loading not covered above....22
6.2 Authorities consulted and any special conditions required....22
6.3 Proposed departures from standards....22
6.4 Proposed methods of dealing with aspects not covered by Standards....22
7. Ground Conditions....23
7.1 Geotechnical Classification....23
7.2 Description of the ground conditions and compatibility with proposed foundation design....23
8. Drawings and Documents....24
8.1 List of all documents accompanying the submission....24
Appendix A Photographs and Photomontages....25
Appendix B Drawings....29
Appendix C Utility Drawings....30
Appendix D Designers Risk Assessment....31

Figures

Figure 2.1 Site Location....8
Figure 2.2 Borehole Locations....11
Figure 2.3 Geotechnical Longitudinal section....12
Figure 3.1 Painted Steel Colour Card in accordance with DN-STR-03007 & BS4800....15

Tables

Table 1.1 Previous Studies....7
Table 2.1 Naas Road Pedestrian/Cycle Bridge Central Span Cross-Section....9
Table 2.2 Naas Road Pedestrian/Cycle Bridge Arterial Span Cross-Section....9
Table 2.3 List of Relevant Services....10
Table 2.4 List of Service Diversion....10
Table 2.5 Ground Summary....12
Table 2.6 Groundwater Monitoring....13
Table 3.1 Minimum Design Life for Structural Elements....14
Table 5.1 Budget Estimate in the current year....20
Table 6.1 Material Densities for Design....21
Table 8.1 Naas Road Pedestrian/Cycle Bridge Drawing List....24

1. Introduction

1.1 Brief

The BusConnects Dublin – Core Bus Corridor (CBC) Infrastructure Works (herein after called the CBC Infrastructure Works) involves the development of continuous bus priority infrastructure and improved pedestrian and cycling facilities on sixteen radial core corridors in the Greater Dublin Area.

The National Transport Authority (NTA) have appointed AECOM in a joint venture with Mott MacDonald to undertake the design of the infrastructure works for Package A of the BusConnects Programme. Package A includes the following four CBC routes:

Clongriffin to City Centre CBC;

Lucan to City Centre CBC;

Clondalkin to Drimnagh CBC; and

Tallaght to City Centre CBC.

As part of the project scope AECOM have agreed to prepare bridge options and preliminary designs for all new structures within the package. The Preliminary Design Report (PDR) presented here has been developed in accordance with the Transport Infrastructure Ireland (TII) Technical Acceptance of Road Structures on Motorways

This PDR will focus on CBC008-ST02, a new pedestrian/cycle bridge located on the Clondalkin to Drimnagh CBC at the Naas Road, Long Mile Road and New Nangor Road junction. The bridge also spans the Luas Red Line at this location. The bridge shall be henceforth known as the Naas Road Pedestrian/Cycle Bridge. The PDR is a deliverable at Phase 4 of the Technical Acceptance process.

1.2 Background information covering origins for the need for the structure

BusConnects includes the development of sixteen radial CBCs and a number of orbital bus routes that will service the wider Dublin area. The new bridge will be constructed as part of the Clondalkin to Drimnagh Core Bus Corridor (CBC). The Clondalkin to Drimnagh CBC commences on the R134 New Nangor Road at the junction with Woodford Walk and progresses east via the R134. The CBC continues along New Nangor Road until reaching the proposed location of the Naas Road Pedestrian/Cycle Bridge at the Naas Road, Long Mile Road and New Nangor Road junction. The CBC is then routed north east along Naas Road to the junction with Walkinstown Avenue. The CBC departs Naas Road and continues south along Walkinstown Avenue and onto the Long Mile Road where it connects to the Tallaght to City Centre CBC.

The new bridge will provide improved pedestrian and cyclist crossing facilities between the four corners of the junction. Resulting in increased safety across the highly trafficked junction and helping to encourage a modal shift from private vehicle use to public transport and cycling. The existing pedestrian and cyclist facilities around and through the junction currently lack continuity and connectivity. There are numerous pedestrian crossings at the junction; however, they do not provide direct connectivity to all corners of the junction. For example, no pedestrian crossings are present on the western side of the Naas Road. All pedestrians wishing to travel from the westbound footpath of the Long Mile Road to the westbound footpath of New Nangor Road would need to pass through nine individual pedestrian crossings. In addition, the priority order at the junction is given to the LUAS Red Line, followed by traffic with pedestrians given the least priority, this results in excessive wait times at each crossing, encourages cyclists to merge with live traffic through the junction rather than use the pedestrian crossings and provides a poor standard of service for users.

The new bridge will provide a continuous and direct connection between the four corners of the junction, reducing wait times at crossings, discouraging cyclists to merge with live traffic at the congested junction and improve the safety of all commuters.

1.3 Previous studies and their recommendations

The following table is a list of documents as part of previous studies for the development of the proposed bridge:

Table 1.1 Previous Studies

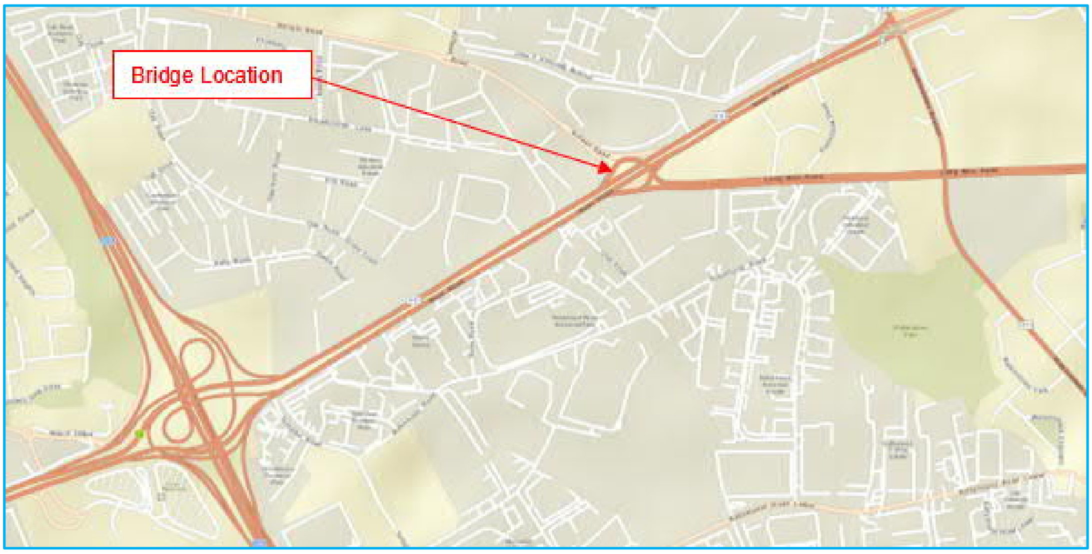
Year	Document Reference	Report Title	Author
2020	BCIDA-ACM-STR_ZZ-0008_XX_00-RP-CB-0002	CBC008-ST01 Naas Road Pedestrian/Cycle Bridge Structures Options Report	AECOM
2021	BCIDA-ACM-PRW_ZZ-0008_XX_00-RP-ZZ-0001	CBC008 Second and Third Public Consultation Summary Report	AECOM
2021	BCIDA-ACM-PRG_ZZ-0008_XX_00-RP-ZZ-0005	CBC008 Preferred Route Option Report	AECOM

The Structures Options Report (SOR) assessed three different bridge options for the Naas Road Pedestrian/Cycle Bridge. The report assessed each option based on a Multi Criteria Assessment (MCA) and recommended that Option 2 Steel Through Warren Truss should be taken forward to preliminary design as the emerging preferred bridge option.

2. Site & Function

2.1 Site location

The Naas Road Pedestrian/Cycle Bridge will be constructed over the Naas Road, Long Mile Road and New Nangor Road junction. The co-ordinates of the bridge are 709761.958 (E), 731648.402 (N) (ITM).



© 2021 OpenStreetMap Contributors

Figure 2.1 Site Location

2.2 Function of the structure and obstacles crossed

The bridge will provide a direct and continuous crossing for pedestrians and cyclists between the four corners of the junction over Naas Road, New Nangor Road, Long Mile Road and the Luas Red Line.

2.3 Choice of location

The bridge location and articulation has been developed with the aim of providing the optimal pedestrian link between the four corners of the junction. The central span has been designed as single span over the main carriageways of the Naas Road and the Luas Red Line. The arterial link spans have also been designed as single spans to each corner of the junction. The support location have been chosen with consideration of the sightlines of vehicles on approach and through the junction. The impact on traffic in an already congested junction during construction was also a factor in determining the optimum support locations.

2.4 Site description and topography

The existing junction is highly trafficked and one of the busiest junctions in Dublin City with a large amount of street furniture, lighting posts and signage gantries positioned throughout the junction. The junction currently offers a link between New Nangor Road, Long Mile Road to the Naas Road which has priority through the centre of the junction providing a direct link to the M50 motorway and N7 primary road to the west and city centre to the east. The Luas adds additional complexity travelling between the eastbound and westbound carriageways of Naas Road.

There are two industrial units with associated car parks located to the north and west of the junction. To the east there is an existing petrol station and forecourt area including access points to and from Naas Road and Long Mile Road. These areas will provide a constraint to the location, articulation and length of any approach ramps and steps to the bridge. In addition, land take will likely be required for a small portion of land from each unit.

A review of topographical information and site visits have revealed that the industrial units and carparks to the north and west of the bridge location are situated at a significantly lower level to the junction and footpaths. Retaining walls are currently provided in these locations to retain fill between the junction and the industrial. Where widening of the junction is required to accommodate the bridge new retaining walls will be constructed.

2.5 Vertical and horizontal alignment

The bridge has a total of five spans including one central span and four arterial spans linking the central span to tie-in points at each of the four corners of the junction. To the north of Naas Road the arterial spans extend from the north support of the central span, located within an existing concrete traffic island, to two tie-in points located in the north and west corners of the junction. Similarly, to the south of Naas Road the arterial spans extend from the south support of the central span, located within an existing concrete traffic island, to two tie-in points located in the south and east corners of the junction.

The vertical alignment of the bridge has been detailed to ensure a minimum vertical clearance of 5.7m to all carriageways and a minimum clearance of 6m provided to the Luas tracks. To meet this minimum requirement a longitudinal fall of 1.45% from north west to south east has been incorporated over the central span. Similarly, a longitudinal fall has also been incorporated to all arterial spans varying to a maximum of 5%. The alignment crossfall will be a standard 2.5% either side of the centre line over all spans.

2.6 Cross sectional dimensions on the alignments

Table 2.1 Naas Road Pedestrian/Cycle Bridge Central Span Cross-Section

Section	Width (m)
Pedestrian/Cyclist Parapet	0.30
Footway	2.50
Cycleway	2.50
Inside Edge Offset	0.65
Pedestrian/Cyclist Parapet	0.30
Total	**6.25**

Table 2.2 Naas Road Pedestrian/Cycle Bridge Arterial Span Cross-Section

Section	Width (m)
Pedestrian/Cyclist Parapet	0.30
Footway	2.00
Cycleway	2.00
Inside Edge Offset	0.65
Pedestrian/Cyclist Parapet	0.30
Total	**5.25**

2.7 Existing underground and overground services

The bridge location is in a built-up urban environment and there are numerous existing underground utilities ranging from telecommunication services to gas and drainage utilities. Utility diversions may be required as part of the bridge construction, where possible these diversions will be minimised. Service providers have been contacted regarding information on their type and location of any underground and overground services through the junction. The following table summarises the available existing services information.

Table 2.3 List of Relevant Services

Service Provider	Services	Location
EIR	EIR Duct	Long Mile Road eastbound & westbound verges
		New Nangor Road eastbound & westbound verges
		Naas Road northbound and southbound verge southwest side of junction
ESB	LV UG ESB Line Existing Duct	Pedestrian footpath at Maxol petrol station
	MV OH ESB Line Existing Poles	Long Mile Road westbound verge
Virgin Media	Virgin Media Duct	Naas Road northbound verge
		New Nangor Road eastbound verge
Gas Networks Ireland	GNI TELCO	Naas Road northbound verge through junction
		Naas Road southbound verge at Luas line through junction
		New Nangor Road eastbound to centre of junction
	GNI HP	Naas Road southbound verge through junction
	GNI LP	Naas Road northbound verge through junction
	ENET	Naas Road northbound verge through junction
		New Nangor Road eastbound to centre of junction
SDCC	Foul Water Drain	Naas Road northbound verge through junction
	Storm Water Drain	Naas Road northbound & southbound verge through junction
		Long Mile Road westbound verge
	Clear Water Drain	Naas Road northbound verge through junction
		Naas Road northbound to Long Mile Road eastbound

Further slit trenches and site investigation will be required at detailed design stage to determine the exact location of the services. In addition, at detailed design stage further discussions will be required with Gas Network Ireland to identify suitable offsets from the high-pressure and low-pressure gas lines located within the site extent for all construction works which may result in excessive vibration to the pipelines.

As part of the preliminary design the following table of diversions maybe required to maintain services following construction. Drawings of the existing services and proposed diversions are included in Appendix C.

Table 2.4 List of Service Diversion

Service Provider	Services	Diversion Location
Gas Networks Ireland	GNI HP	Central span, south support foundation
	GNI TELCO	Central span, north support foundation
	GNI LP	
	ENET	
Virgin Media	Virgin Media Duct	
SDCC	Storm Water Drain	Central span, south support foundation
	Clear Water Drain	Central span, north support foundation
	Foul Water Drain	
EIR	EIR duct	Central span, north support foundation

The junction has a large variety of street furniture installations including traffic signals, CCTV, lighting posts, minor signage gantries and electrical cabinets. In addition, there is an existing portal traffic signal gantry over the R134 New Nangor Road on approach to the junction.

The Luas Red Line and its associated infrastructure such as overhead power cables are continuous through the centre of the junction, separating the Naas Road east and westbound carriageways. The petrol station to the east has associated underground petrol tanks which will be high risk during any excavation or vibratory works in the immediate area.

2.8 Geotechnical summary

2.8.1 Ground Investigation

Four boreholes (R8-CPGS01 to R8-CPGS04) were carried out as part of the ground investigation to inform the preliminary design. The locations are shown in the figure below.

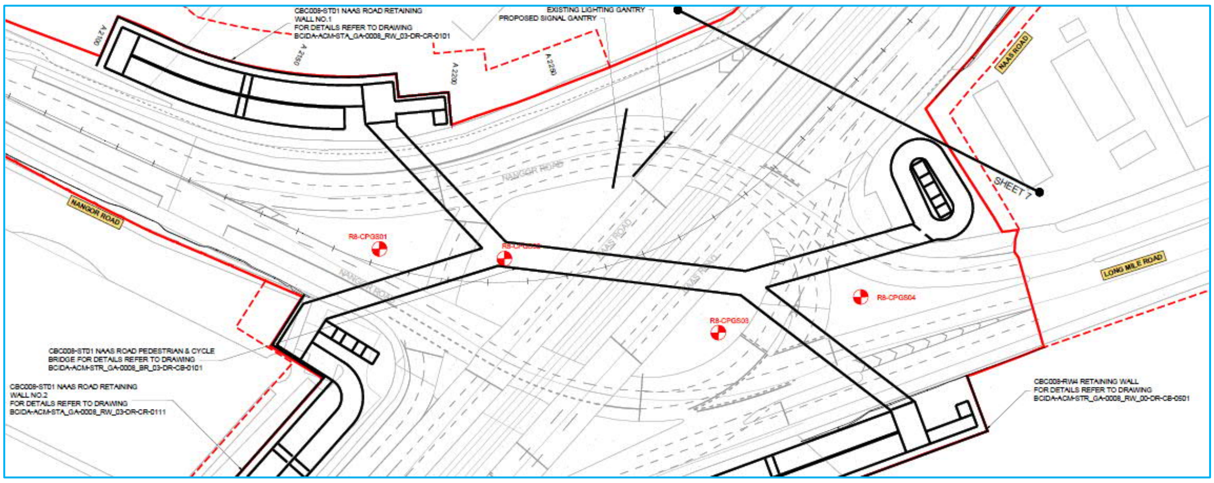


Figure 2.2 Borehole Locations

Site operations, which were conducted between 13th and 22nd October 2020, comprised:

- Four boreholes (R8-CPGS01-R8-CPGS04) put down by a combination of light cable percussion boring, using a Dando 2000 rig, and rotary follow-on drilling techniques with core recovery in bedrock using a truck mounted Berretta T44 rotary drilling rig.
- A groundwater monitoring standpipe was installed in R8-CPGS02 and R8-CPGS04.

2.8.2 Ground Summary

The following lists the sequence of ground conditions recorded at the site in approximate stratigraphic order.

- Paving brick at ground level. Beneath this were both bitmac and concrete of varying thickness likely representing old road surfaces; overlying
- Sub-base comprising of crushed rock aggregate fill; overlying
- Glacial Till consisting of sandy gravelly silt/clay with low to medium cobble content;
  - typically, firm to maximum of 2 to 2.5 m (**brown Dublin boulder clay**); generally underlain by
  - stiff / very stiff / hard soil with high cobble content and occasional boulders typical below 2.0 to 2.4m bgl. (**black Dublin boulder clay)**; overlying
- Limestone Bedrock.

An interpreted geotechnical longitudinal section is shown, and a summary of the available ground investigation data is recorded, in the figure and table below, respectively:

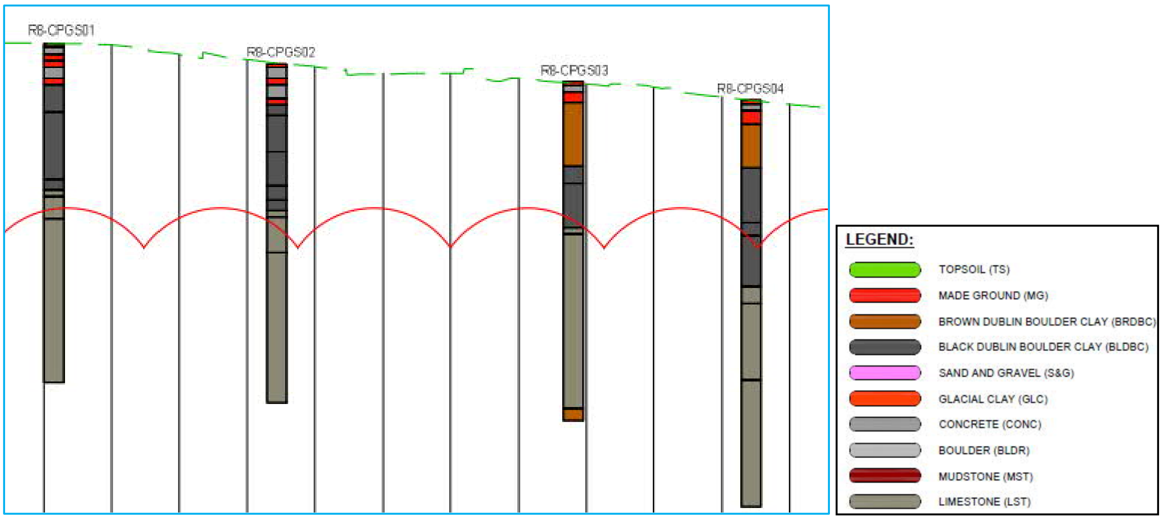


Figure 2.3 Geotechnical Longitudinal section

Table 2.5 Ground Summary

Stratum	Typical Stratum Description	Depth at Top of Stratum (*mbgl)	Level at Top of Stratum (m AOD)	Thickness Range (m)	Occurrence
Paving brick overlying Bitmac/Concrete	Paving brick overlying both Bitmac and concrete of varying thickness likely representing old road surfaces.	0	48.19 to 46.53	0.6 to 1	Typically, all boreholes; however, no Bitmac encountered in R8-CPGS03 and R8-CPGS04
Engineered Fill - Subbase	Sub-base, comprising approximately 200 to 300mm of crushed rock aggregate fill, was encountered beneath old road make up	0.3 to 1	46.23 to 47.69	0.2 to 0.4	All boreholes. Two 0.2 m thick layers encountered in R8-CPGS01
Glacial Till - Brown Dublin Boulder Clay	firm brown sandy gravelly CLAY	0.6 to 0.7	45.83 to 46.48	1.3 to 1.9	R8-CPGS03 and R8-CPGS04
Glacial Till - Black Dublin Boulder Clay	Stiff to very Stiff dark grey to black sandy gravelly CLAY	1.2 to 2.5	46.99 to 44.53	1.8 to 3.5	All boreholes.
Limestone	Typically, medium strong dark grey Limestone. Full descriptions available in Logs.	4.3 to 5.5	43.89 to 41.03	5.35 to 6.5**	All boreholes. Soft becoming Firm Clay infill noted at R8-CPSGS03 from 9.65 m to 10 m (target depth)

*mbgl = metres below ground level
**base not proven

2.8.3 Groundwater Summary

The results of groundwater monitoring are as follows:

Table 2.6 Groundwater Monitoring

Testhole	Standpipe Depth	Slotted Screen Range (m bgl*)	Response Zone	Water Level (mbgl) 19-11-2020	Water Level (mbgl) 19-01-2021	Water Level (mbgl) 12-12-2021	Water Level (mbgl) 12-03-2021
R8-CPGS02	4.5	1 - 4.5	Glacial Till to 4.3 Limestone 4.3 to 4.5	3.29	3.1	3.26	3.24
R8-CPGS04	5.16	1 - 5.5	Glacial Till	2.53	2.33	2.51	2.5

*mbgl = metres below ground level

2.9 Hydrology and hydraulic summary

The main hydrological feature in the surrounding area is the Grand Canal which is located approximately 800m to the north of the bridge. In addition, the Cammock river runs approximately 100m to the east of the bridge location.

A review of the OPW flood mapping (www.floodinfo.ie) shows that there are no historical events related to flooding at the immediate bridge location as of 29th of March 2021. Recurring flooding events have occurred to the north east of the bridge location, along the Old Naas Road due to the Camac Culvert. Additionally, flooding events have been recorded to the south east at Robinhood Stream in Walkinstown.

A review of CFRAMS model output for fluvial flooding for the present day predicts that there is no risk of flooding pertaining to the junction. CFRAMS modelling indicates that the industrial area to the north is located within the flood zone of the River Camac for the 1% Annual Exceedance Probability (AEP). The impact, due to construction of the access ramps, on future flooding within this area will need to be considered at detailed design.

2.10 Archaeological summary

No sites of major archaeological importance were identified at the bridge location during the EIA stage of the project. Based on the South Dublin County Councils (SDCC) “2016-2022 Development Plan” maps and schedule there are no protected structures or monuments in the surrounding area.

2.11 Environmental summary

The EIAR carried out during the preliminary design stage noted the following environmental findings:

- Potential for construction activities to result in adverse noise impacts at properties in the surrounding area (awaiting further detail as noise impact assessment is still to be completed).
- No appreciable alteration to townscape and streetscape character in construction or operational phase due to new cycle and pedestrian overbridge.
- No protected structures in the area of the proposed bridge construction.

In addition, the location of any underground petrol tanks linked to the adjacent petrol station east of the junction should be determined prior to any construction works. Mitigation procedures must be established against damage to the tanks potentially causing leakage into and contamination of the surrounding soil.

3. Structure & Aesthetics

3.1 General description of recommended structure or family of structures and design working life

The bridge will be a five-span fully through warren truss structure. The bridge is formed of a central span (55.5m) over the Naas Road and Red Line Luas and four arterial spans (ranging from 42.115m to 46.125m) spanning the outer corners of the junction. The bridge will be formed in painted structural steel, supported on braced steel supports located in the concrete islands to the north and south of the Naas Road. All spans will be fully articulated on a combination of pot, guided and fixed bearings allowing for expansion and contraction and mitigating against excessive stresses in the supports. The truss will be designed with full-through construction where the superstructure is built up around the deck. Where required, a steel mesh will be fitted to the vertical and horizontal bracing to create a fully enclosed superstructure.

The north and south supports of the central span will consist of three steel piers in a triangular arrangement, diagonally braced for lateral stiffness and supported on insitu concrete piled foundations. The arterial spans will be supported at these central supports and span to end supports formed from a pair of braced steel columns.

Painted steel access ramps and stairs will be supported off landing structures at the end supports of each arterial span. The ramps will be formed of a ladder beam structures and will vary in overall length from 119m to 136.1m. The ramps will be designed in accordance with the requirements set out in DN-STR-03005. Thus, landings of 2m in length will be provided at equal intervals along the length of the ramp and at maximum vertical rises of 2.5m. The ramps will also incorporate a 1-in-20 fall from the proposed bridge deck level to proposed finished footpath levels. Approach steps shall also be provided to arterial structure; these steps shall be formed in painted structural steel. The stairs shall be detailed in accordance with DN-STR-03005 to ensure that 2.5m long landings shall be provided at a maximum spacing of every 13 risers. The riser height will be a maximum of 150mm with a tread length of between 300mm and 350mm.

The design working life of the bridge will be a minimum of 120 years as defined in the TII publication, DN-STR-03012 - Design for Durability. Maintainable elements and components listed below are subject to greater wear and will require replacement within the design life. Careful design and detailing combined with thorough routine inspections, quality control and supervision on site will help achieve the minimum expected design life listed in the below table:

Table 3.1 Minimum Design Life for Structural Elements

Component	Years
Bridge Bearings	50
Expansion Joints	50
Parapets	50
Drainage Systems	50
Deck Waterproofing	50
Steelwork Paint Systems	20

3.2 Aesthetic considerations

The bridge design has been developed to take account of the basic principles of aesthetics and to respect the surrounding urban environment. The bridge form will be as simple as possible to ensure the bridge does not detract from the overriding function. The bridge function has been emphasized through careful consideration of the positioning of the bridge spans, tie-in points, and articulation of the ramps and arterial spans to satisfy the desired movement lines of the end user.

The form of the bridge will be consistent over all five spans, with similar proportions, structural depths, parapets, and finishes. The bridge will be constructed in painted steel, with the choice of paint colour to be determined at detailed design. The choice of colour will be in accordance with DN-STR-03007 and BS4800.

Figure 3.1 Painted Steel Colour Card in accordance with DN-STR-03007 & BS4800

The bridge aesthetics should be considered in depth during detailed design with the CIRIA C543 Bridge Detailing Guide used to determine a number of aesthetic requirements thus ensuring consistency across the bridge.

3.3 Proposals for the recommended structure or family of structures

3.3.1 Proposed Category

The bridge will be a Category 3 structure as the central span is greater than 50m in accordance with TII publication DN-STR-03001 - Technical Acceptance of Road Structures on Motorways and Other National Roads.

3.3.2 Span Arrangements

The bridge is formed of a central span (55.5m) over the Naas Road and Luas Red Line and four arterial spans (ranging from 42.115m to 46.125m) spanning the outer corners of the junction. The central span extends from an existing concrete island to the north west of the Naas Road to the existing concrete island to the south east of the Naas Road.

3.3.3 Minimum headroom provided

A minimum vertical clearance of 5.7m will be provided to all carriageways in accordance with DN-GEO-03036 – Cross Section and Headroom. A minimum vertical clearance of 6m will be provided from the top of rail level of the Luas tracks in accordance with TII's "Code of Engineering Practice for Works on, near or adjacent to the LUAS Light Rail System".

The bridge will have a fully enclosed superstructure with a minimum internal headroom of 2.7m above finished surface level in accordance with TII publications DN-GEO-03036 and DN-GEO-03040 - Subways for Pedestrians and Pedal Cyclists Layout and Dimensions.

3.3.4 Approaches including run-on arrangements

Approach ramps and stairs accommodating segregated pedestrian and cycle use will be provided at each of the four corners of the junction.

The approach ramps will be formed of a ladder beam structure on steel piers supported on pad foundations. The ramps will be designed in accordance with DN-STR-03005 and DMURS provided with a 1-in-20 gradient from finished deck level to finished footpath level. Access ramps will have 2m landings provided at equal intervals along the length of the ramps. In the north and west corners, where the boundaries between the junction and respective industrial areas show significant level differences, the access structures will be supported at the tie-in point by a retained earthworks solution.

3.3.5 Foundation type

Reinforced concrete end-bearing piled foundations will be provided to the bridge piers. The length of the piles will be confirmed during the detailed design stage and are dependent on the depth to bedrock at the support locations.

3.3.6 Substructure

The central span will be supported on a group of three braced vertical steel columns to the north and south of the Naas Road respectively. The arterial spans will span from these central supports to end supports formed of pairs of braced steel columns located in each corner of the junction. The access ramps and stairs will be supported on steel columns located at regular intervals over their length.

3.3.7 Superstructure

The superstructure will be a fully through warren-truss structure. The central and arterial spans will be supported on a combination of pot, guided and fixed bearings at the support locations. The full-through truss arrangement has the advantage of reducing the construction depth and ease at which the clearance envelope over the junction's associated carriageways and Luas tracks. Structural steel hollow sections will form the main top and bottom longitudinal chord members. Diagonal bracing between the top and bottom chords will stiffen the superstructure against deflection. Horizontal bracing will be provided between the top chords adding lateral stability. A solid steel deck with a combined waterproofing and surfacing layer shall also be provided to form the finished surface level of the bridge. Where required, a steel mesh will be attached to the vertical and horizontal bracing creating a fully enclosed superstructure.

3.3.8 Articulation arrangements, joints and bearings

The central and arterial spans will be fully articulated, supported on a combination of pot, guided and fixed bearings allowing for longitudinal and transverse expansion and contraction. The design of the bearings will be in accordance with DN-STR-03004 Bridge Bearings, use of BS 5400: Part 9. The types of bearings will be determined at detailed design based on design movements.

Expansion joints will be provided at the end of each span to ensure a continuous surface for user. The joints will be designed in accordance with DN-STR-03006 – Expansion Joints for use in Highway Bridge Decks. The joints will be continuous across the bridge deck including the bottom chords of the truss.

3.3.9 Vehicle Restraint System

No vehicle restraint system is provided on the bridge. In accordance with DN-STR-03005 – Design Criteria for Footbridges. The northern central span support location has been designed to ensure a minimum of 4.5m clear zone offset from the adjacent carriageways and as a result so no vehicle restraint system is required to protect accidental impact of the piers. The southern central span support is located within the 4.5m clear zone therefore insitu concrete safety barriers will be provided to protect the piers from accidental impact. At detailed design an assessment of the junction will need to be undertaken to inform the appropriate VRS design. Flared/curved safety barriers requiring a Departure from Standards in accordance with DN-REQ-03034 may be the most appropriate form.

A delineation kerb will be installed longitudinally along the length of the bridge separating the pedestrian and cyclist area. These kerbs will be formed of a prefabricated rubber kerbing unit connected to the bridge deck.

3.3.10Drainage

The design shall incorporate a longitudinal fall of minimum 0.05% over all spans of the bridge and standard cross-fall of 2.5% over the bridge deck to ensure water drains from the surface mitigating the slip hazard of standing water and ice. Longitudinal and transverse drainage systems will be considered as part of the detailed design based on the expected and allowable conveyance of surface water over the bridge deck and to prevent the free fall of water from the bridge deck. Access and rodding points for drainage systems will need to be considered at detailed design.

3.3.11Durability

The bridge will be designed in accordance with the TII publication DN-STR-03012 - Design for Durability with a design life of 120 years. The design life for replaceable parts such as bearings, expansion joints and waterproofing systems will be 50 years in accordance with DN-STR-03012. All exposed structural steelwork will have a protective paint system applied such that no maintenance shall be required up to 12 years and no major maintenance before 20 years. The steelwork will be designed so that it discourages the accumulation of water, dirt and debris and minimises the risk of rusting or deterioration. Intermittent welds should be avoided where possible, simple connections and welds should be preferred.

All buried concrete surfaces will be treated with two coats of epoxy resin waterproofing in accordance with DN-STR-03012 – Design for Durability and CC-SPW-02000 Specification for Road Works Series 2000 – Waterproofing for Concrete Structures.

All exposed concrete surfaces will receive a hydrophobic pore lining impregnation in accordance with DN-STR-03012 – Design for Durability and CC-SPW-02000 Specification for Road Works Series 2000 – Waterproofing for Concrete Structures.

The design working life of the bridge will be working life category 5 and of the replaceable parts will be working life category 2 in accordance with GE-POL-01008 - Interim Requirements for the Use of Eurocodes for the Design of Road Structures.

3.3.12 Sustainability

Structural steel members will be fabricated in a factory with high precision and efficiency. This reduces the material waste and waste disposal requirements thus reducing the environmental impacts and harmful emissions created in production.

The use of cement replacement products, such as Ground Granulated Blast Slag (GGBS) will be maximised in the foundation design, reducing the environmental impacts of concrete production. The replacement levels will be in accordance with the levels specified within IS EN 206.

At the end of the bridge service life a large percentage of structural steel can be recycled or reused on other projects. This recycled steel is in huge demand due to its ability to be reused in rolled steel sections. Members of the bridge subject to fatigue loading will not be suitable for recycle or reuse into structural steel.

3.3.13 Inspection and maintenance

Throughout its design life inspection and maintenance of the bridge will be required. The inspections will be carried out in line with the TII EIRSPAN Bridge Management System. The EIRSPAN system was introduced in 2001 to provide an integrated management system for the bridges in Ireland. The system coordinates activities such as inspection, repairs and maintenance work to ensure optimal management of the bridge stock. As a minimum the following inspection regime should be implemented:

- Routine Inspection – every year;
- Principal Inspection - every six years.

The full-through structural form enables inspection and minor maintenance of the top of deck, top chord, vertical and horizontal bracing and mesh to be carried out from the deck level. Inspection and maintenance of the bridge soffit will require access from the carriageways and Luas tracks under temporary carriageway and track closures. The soffit of the bridge can be designed to incorporate details allowing rope inspections which eliminates the need for MEWP access. All lane carriageway and track closures should be programmed for night-time and weekend works.

4. Safety

4.1 Traffic management during construction including land for temporary diversions

The bridge will be constructed over the highly congested junction of Naas Road, Long Mile Road, New Nangor Road and the Luas Red Line. The construction sequence will need to minimise disruption to Luas, vehicle, cyclist and pedestrian traffic through the junction and limit subsequent effects on traffic in the surrounding areas.

Construction and erection of each span of the bridge will require temporary lane closures and diversions. It should be carried out outside of peak times during night-time and weekend possessions. The construction sequence should prioritise construction of the arterial spans and central span sequentially rather than simultaneously. This will minimise the lane closures required at any one-time during construction. Construction time over the carriageways and Luas tracks and the extent of lane possessions and traffic management will be minimised through assembly of each span off-line within the main construction compound located within the brown field site to the south of the bridge location. Once assembled, each span will be manoeuvred into position by crawler cranes and Self Propeller Modular Transporters (SPMTs). Localised traffic management will be required throughout construction, where possible the effects of localised traffic management on the flow of traffic within the junction should be minimised. During construction the minimum vertical clearances of 5.7m over the carriageways in accordance with DN-GEO-03036 and 6m over the Luas tracks in accordance with TII's "Code of Engineering Practice for Works on, near or adjacent to the LUAS Light Rail System". will be maintained.

Current pedestrian crossings may be temporarily obstructed due to construction of the bridge supports and erection of temporary compound hoarding. Alternative temporary pedestrian and cyclist facilities and crossings will need to be established to discourage the use of current facilities near the active construction areas and to maintain pedestrian and cyclist safety while navigating the junction.

The use of the junction by construction traffic and personnel should be limited and transport plans for navigating around the site should be created and include safe turning locations away from the junction. Off-line delivery routes to the main site compounds should be established to prevent additional traffic in an already congested area.

4.2 Safety during construction

As part of the design development, a Designer's Risk Assessment (DRA) has been prepared in accordance with the Safety, Health and Welfare at Work (Construction) Regulations 2013 and the amendments of 2019 and 2020. The DRA shall be viewed as a working document to be developed further as the design develops. The DRA has been included in Appendix D and includes all risks identified and the resulting mitigation measures or alterations incorporated within the design. Where no mitigation is possible the DRA will be used to communicate the risks to the Contractor and site personnel.

Where possible, the hierarchy of risk control will be implemented within the design and construction, with the Designer and Contractor aiming to control all risks through elimination. Where this is not possible, reduction, isolation or mitigation controls will be incorporated to ensure safety during construction.

A site compound will be established within a brownfield site to the south of the proposed bridge location. This will allow for storage, assembly and deliveries to be carried out away from the congested junction. Temporary site compounds will be set-up at the bridge support locations i.e. at the four corners of the junction and within the existing concrete islands north and south of Naas Road. Hoarding, fencing and secure compound entrance locations will need to be established to prevent access from the public potentially leading to injury and mitigate the risk of vandalism and theft of construction equipment. Any hoarding or fencing around the supports of the central span, within the existing traffic islands, will need to consider the sightlines of the traffic travelling on and the traffic approaching the junction. Assembly of the superstructure within the main site compound will be maximised to mitigate the construction risks associated with work around live traffic and at height.

4.3 Safety in use

Safety of the end user has been considered as part of the Designer's Risk Assessment. A routine inspection will be carried out at least once a year or after any significant event in line with the recommendations contained within the EIRSPAN Bridge Management System, as defined by TII. The routine inspection will take account of any defects and establish whether the bridge requires a Principal Inspection to be carried out or if routine maintenance will suffice. Routine maintenance consists of simple remedial works to maintain the safety of the day to day pedestrian/cycle traffic on the bridge. A Principal Inspection can only be carried out by an approved Principal Inspection Team Leader according to the TII Bridge Management Section. The Principal Inspection shall record all findings from the bridge on the EIRSPAN database for future reference.

Pedestrian bridges in the past have been susceptible to dynamic excitation, due to the frequency of pedestrian movements and wind loading. Depending on the conditions, if the frequency of the loading approaches the natural frequency of the bridge it can result in excessive vibrations causing discomfort to the user. A dynamic analysis will be carried out to determine the natural frequency and response of the bridge to movement. This analysis will allow the designers to make adjustments to the bridge such as increasing the dead load to move the natural frequency of the bridge away from the expected range of frequencies from the live loading and improve the comfort of the user.

The bridge will incorporate a long fall and cross-fall across the deck to mitigate the slip hazard of standing water and ice on the surface. The access ramps will have a constant gradient of 1-in-20 in line with DMURS recommendations. All bridge spans will be fully enclosed superstructure reducing the risk of anti-social behaviour, objects being dropped onto vehicles passing beneath the bridge and users falling or jumping from the bridge deck.

A delineation kerb will be installed longitudinally along the length of the bridge separating the pedestrian and cyclist area, this will help to avoid conflicts between pedestrians and cyclists in the segregated area. These kerbs will be formed of a prefabricated rubber kerbing unit connected to the bridge deck.

The northern central span support has been situated with sufficient set back from the carriageway edge and outside of the relevant clear zone as defined by TII Publication DN-GEO-03036 - Cross Sections and Headroom to mitigate against the risk of impact from an errant vehicle. A concrete safety barrier will be provided to the southern supports as these are located within the carriageway clear zones.

Construction of the bridge has the potential to restrict sightlines from vehicles as they approach or depart the junction. The pier type and form have been developed with consideration for sightlines and preserving visual envelopes and the proposed location has been determined based on the minimal impact to vehicle safety on the junction.

4.4 Lighting

Where required, public lighting will be installed along the length of the bridge to improve visibility and reduce the risk of anti-social behaviour. The detailed lighting design will ensure that the lighting is vandal proof and easily maintained.

5. Cost

5.1 Budget Estimate in current year, including whole life cost

The construction costs provided below have been based on quantities calculated from the preliminary bridge design and 3D model. Major elements associated with the bridge and ramps such as earthworks, piling, concrete, reinforcement, structural steelwork and waterproofing have been included. Rates have been based on AECOM's internal cost database or based on Spon's Civil Engineering and Highway Works Price Book 2021 as required. It should be noted that costs are indicative only and may vary depending on the detailed design and the Contractor's methodology.

During the preliminary design stage, Thompsons of Carlow Ltd. have been engaged to provide current Structural Steelwork rates (2021). The steel tonnage quantities were based on the preliminary design drawings provided in Appendix B. The rates provided include supply, fabrication, painting, installation and all associated quality assurance for all structural steel elements including bridge parapets.

Allowances have been made for preliminaries, consultancy fees and contingency. A budget of 30% of the construction cost has been provided for preliminaries to cover traffic management, PSCS, temporary accommodation etc. The contingency is 30% of the construction cost and will cover minor elements such as drainage, fencing, landscaping works and any unforeseen unknowns. Finally, an allowance of 15% of the construction cost has been provided for professional fees to deliver the bridge from detailed design to handover. These fees will include detailed design, CAT III checks, construction supervision and handover.

The rates used to calculate the amounts presented below are exclusive of VAT. No allowance has been made for land acquisition within the costs provided below. The cost of land acquisition will be covered under the construction costs for the entire BusConnects CBC08 Tallaght/Clondalkin to City Centre scheme.

Table 5.1 Budget Estimate in the current year

Series	Amount (€)
CC-SPW-00600 - Earthworks	48,532.60
CC-SPW-01600 - Piling and Embedded Retaining Walls	376,894.21
CC-SPW-01700 - Structural Concrete	236,274.00
CC-SPW-01800 - Structural Steelwork	5,892,689.21
CC-SPW-02000 - Waterproofing of Structures	412,668.90
CC-SPW-02100 - Bridge Bearings	60,000.00
Construction Cost	**7,027,058.92**
Preliminaries (30% of Construction Cost)	2,108,117.68
Contingency (30% of Construction Cost)	2,108,117.68
Professional Fees (15% of Construction Cost)	1,054,058.84
Total Cost	**12,297,353.11**

6. Design Assessment Criteria

6.1 Actions

6.1.1 Permanent Actions

Permanent actions and material densities will be in accordance with IS EN 1991-1-1 and the Irish National Annex. Material/partial factors will be as detailed in IS EN 1990 and the Irish National Annex. The accepted densities for principal construction materials are as follows:

Table 6.1 Material Densities for Design

Material	Density
Reinforced Concrete	25 kN/m^3
Structural Steelwork	78.5 kN/m^3
6N/6P backfill to structures	21 kN/m^3

6.1.2 Snow, Wind and Thermal Actions

Snow loads are not deemed a critical load case and will not be considered in accordance with the National Annex to IS EN 1991-1-3.

Wind loading will be considered in accordance with IS EN 1991-1-4 and the Irish National Annex. Wind loads will be taken to act simultaneously with other loads in accordance with the National Annex to IS EN 1990. Wind loads will not be considered in combination with thermal loading in accordance with A2.2.2 (6) of the NA to IS EN 1990.

Thermal loading will be considered in accordance with IS EN 1991-1-5 and the Irish National Annex. The combination of thermal and wind loading will not be considered for the footbridge in accordance with the National Annex to IS EN 1990.

6.1.3 Actions relating to normal traffic

Not applicable.

6.1.4 Actions relating to abnormal traffic

Not applicable.

6.1.5 Footway or footbridge live loading

Actions on the bridge will be considered in accordance with IS EN 1991-2 and the Irish National Annex. The bridge will be designed for a uniformly distributed pedestrian loading of 5kN/m^2. In addition, the bridge will also be designed for a concentrated load of 20kN acting on a square surface area 0.2m by 0.2m.

No service vehicle loading will be considered as part of the design as service vehicles will be excluded from crossing the bridge through the introduction of suitable bollards on approach to the bridge.

6.1.6 Provision for exceptional abnormal loads

Not applicable.

6.1.7 Accidental actions

Not applicable. The bridge will be designed to provide a minimum of 5.7m clearance above the Naas Road, Long Mile Road and New Nangor Road carriageways and 6m clearance over the Luas tracks avoiding impact on the superstructure. The supports will be set-back sufficiently outside of the clear zone or protected by concrete safety barriers avoiding accidental impact on the substructure.

6.1.8 Actions during construction

Actions arising during construction will be considered in accordance with IS EN 1991-1-6 and the Irish National Annex.

6.1.9 Any special loading not covered above

Due to pedestrian bridges having slender profiles and lighter spans they are more susceptible to vibrate significantly under pedestrian traffic. Detailed design of the bridge should include a dynamic analysis determining the natural frequency of the bridge and ensuring it does not coincide with the frequency range of human-induced vibrations.

6.2 Authorities consulted and any special conditions required

The following authorities have been consulted as part of the development of the scheme:

- South Dublin County Council
- Transport Infrastructure Ireland
- National Transport Authority

6.3 Proposed departures from standards

No departures from standards are envisaged for the bridge.

6.4 Proposed methods of dealing with aspects not covered by Standards

Not applicable.

7. Ground Conditions

7.1 Geotechnical Classification

Considering the guidance in IS EN 1997-1, it is considered that Geotechnical Category 2 is currently the most appropriate for the proposed bridge.

Geotechnical Category 2 applies to conventional types of structure and foundations with no exceptional risk or difficult loading conditions. This includes spread footing, raft foundations, piled foundations, walls or other structures retaining or supporting water, excavations, bridge piers and abutments, embankments and earthworks, ground anchors and other systems and tunnels in hard, non-fractured rock and not subjected to special water tightness or other requirements.

7.2 Description of the ground conditions and compatibility with proposed foundation design

Preliminary geotechnical analysis of the foundation options found that provided the foundations are adequately sized during the detailed design phase, shallow pad foundations founded on the stiff to very stiff Glacial Till (black Dublin boulder clay) could achieve Serviceability Limit State settlements of less than 25 mm.

However, to avoid large excavations and temporary works adjacent to the busy carriageways and hamburger junction, a piled foundation solution, with the piles generating the majority of their geotechnical capacity from end bearing in the underlying bedrock, is being progressed as part of the preliminary design. A piled solution will reduce the temporary works requirements, excavation intrusion and service diversion extents within the junction. Piled foundations will be assumed for all support locations to limit the risk of differential settlement between the supports.

8. Drawings and Documents

8.1 List of all documents accompanying the submission

The following table lists the drawings accompanying this submission. The drawings are contained within Appendix B:

Table 8.1 Naas Road Pedestrian/Cycle Bridge Drawing List

Drawing Number	Revision	Drawing Title
BCIDA-ACM-STR_GA-0008_BR_03-DR-CB-0101	L02	ST02 – Naas Road Pedestrian & Cycle Bridge Plan
BCIDA-ACM-STR_GA-0006_BR_03-DR-CB-0102	L02	ST02 – Naas Road Pedestrian & Cycle Bridge Details

Appendix A Photographs and Photomontages

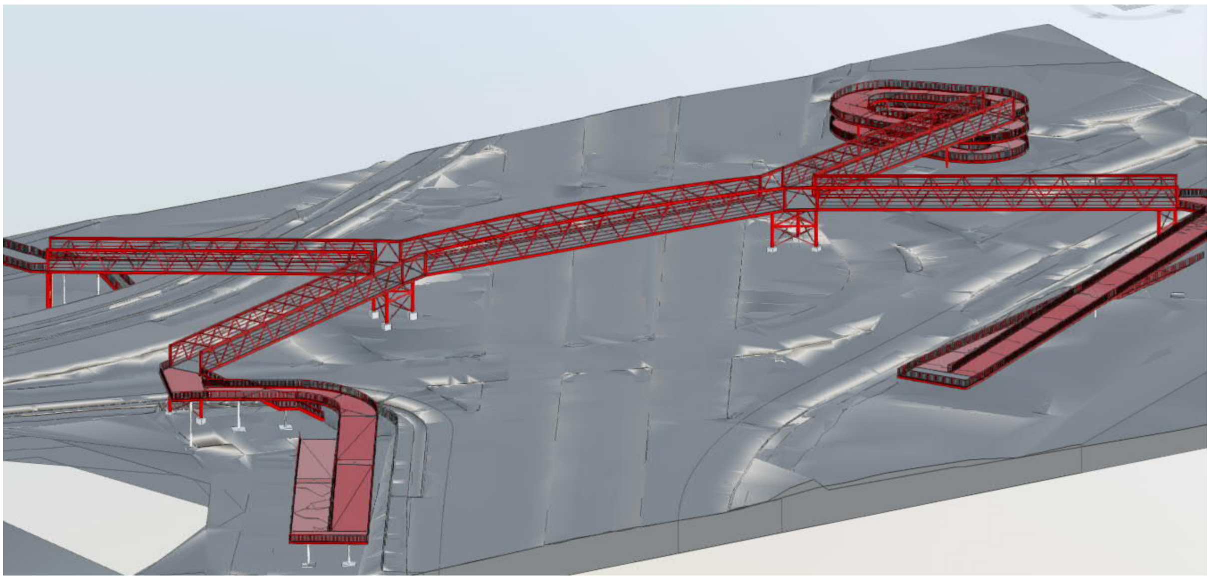


Figure A.1 Naas Road Pedestrian and Cycle Bridge 3D Model looking eastwards from Naas Road

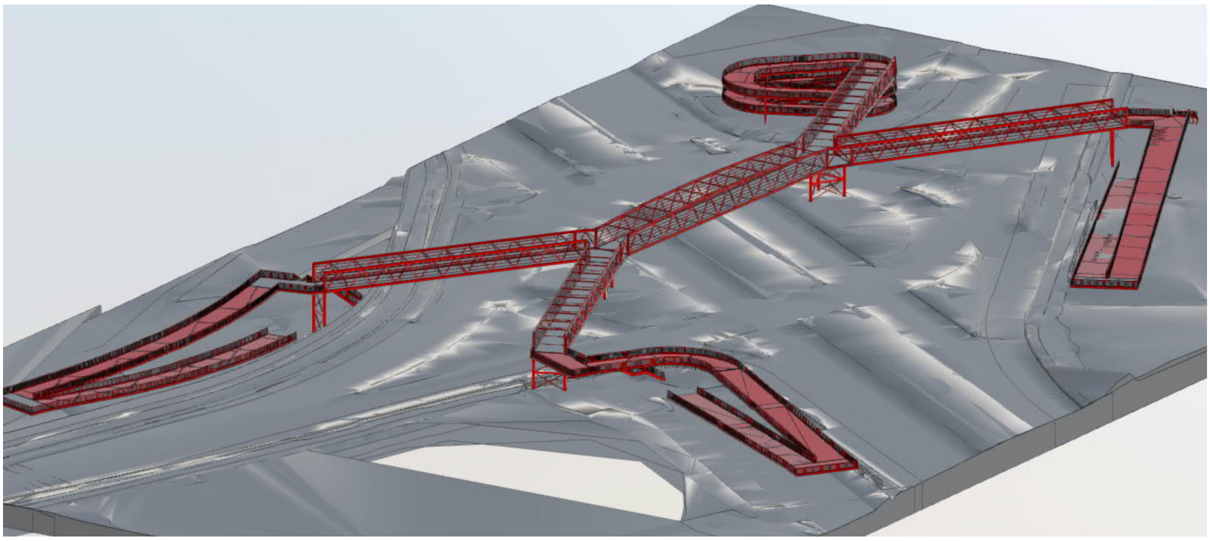


Figure A.2 Naas Road Pedestrian and Cycle Bridge 3D Model looking southwards

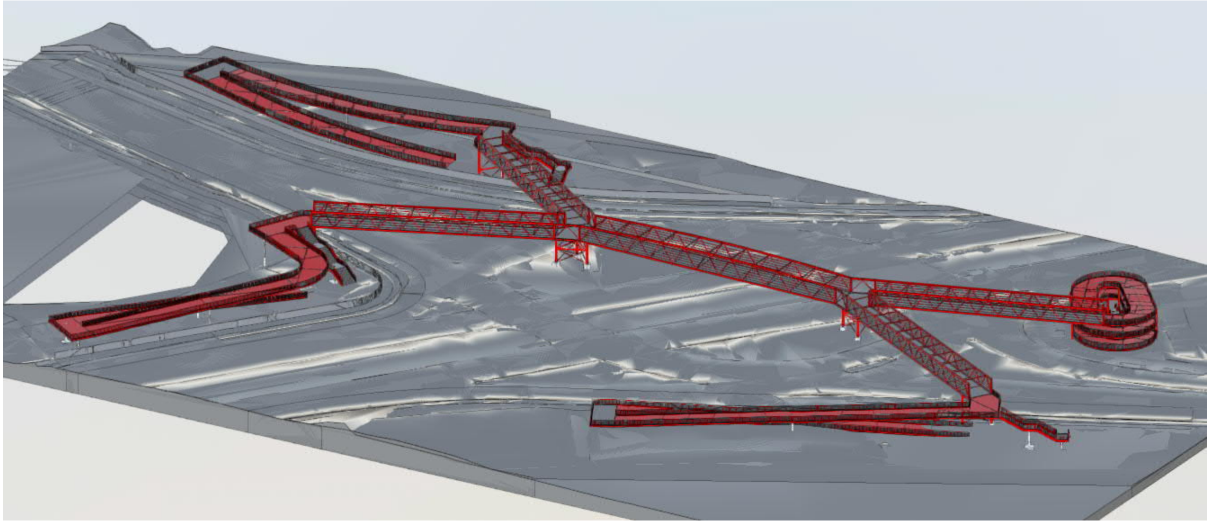


Figure A.3 Naas Road Pedestrian and Cycle Bridge 3D Model looking northwards

Photo A.1 Proposed Bridge Location looking north west

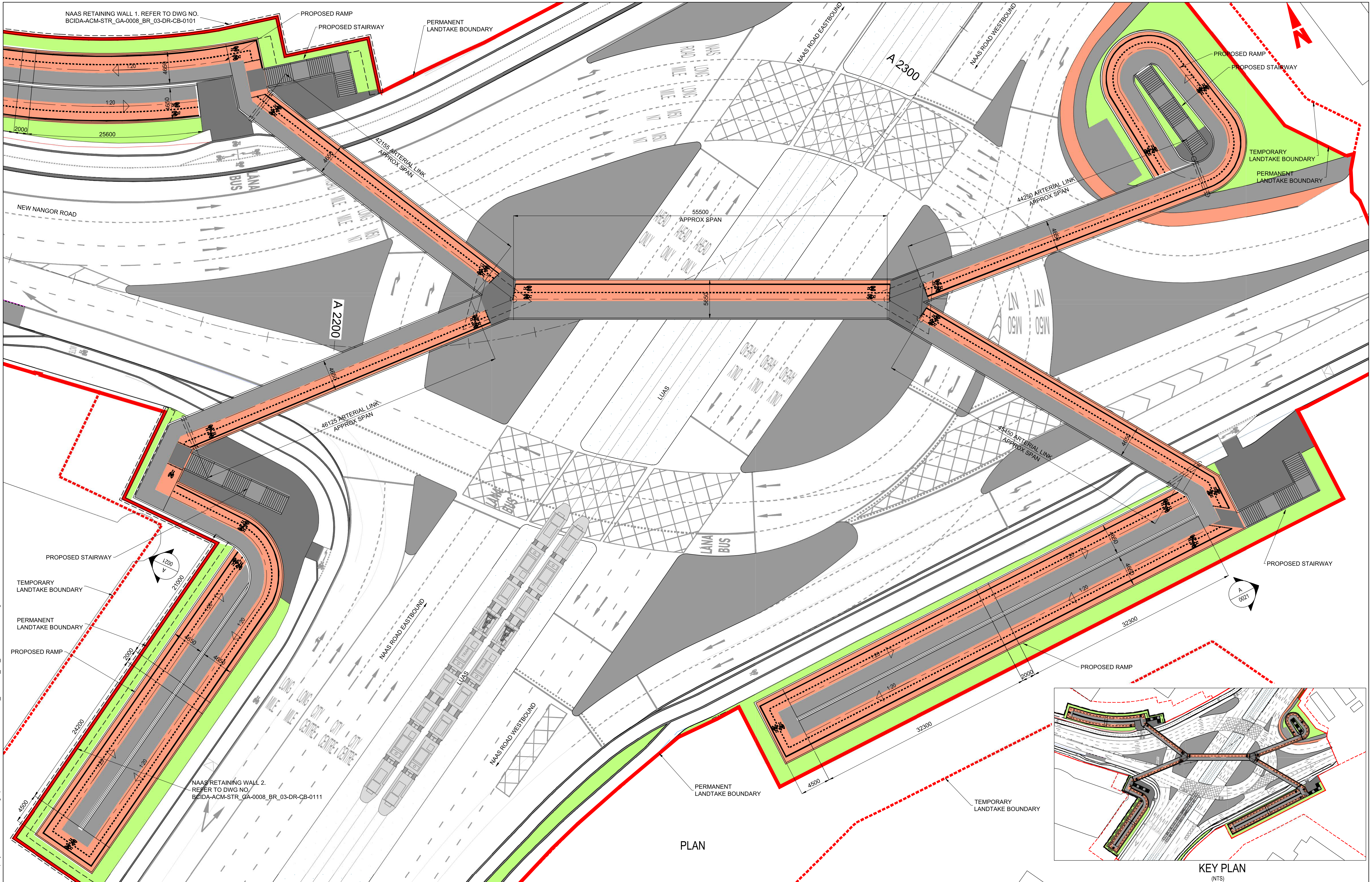
Photo A.2 Proposed Bridge Location looking north west

Photo A.3 Proposed Bridge Location looking south east

Photo A.4 Proposed Northern Central Support Location

Photo A.5 Proposed Southern Central Support Location

Appendix B Drawings



PLAN

KEY PLAN
(NTS)

Disclaimer

a. © National Transport Authority (NTA) 2021. This drawing is confidential and the copyright in it is owned by NTA. This drawing must not be either loaned, copied or otherwise reproduced in whole or in part or used for any purpose without the prior permission of NTA.
b. This drawing is to be used for the design element identified in the titlebox. Other information shown is to be considered indicative only. The drawing is to be read in conjunction with all other relevant design drawings.
c. O.S. data used for plans are printed under © Ordnance Survey Ireland Government of Ireland. All rights reserved. Licence Number 2021/OSi_NMA_180 National Transport Authority. All elevations are in metres and relate to OSi Geoid Model (OSGM15) Malin Head. All Co-ordinates are in Irish Transverse Mercator Grid (ITM) as defined by OSi active local GPS station.
d. Information concerning the position of apparatus shown on this drawing is based on drawings supplied by the utility owners and/or the utility works contractor, whilst every care has been taken in the preparation of this drawing, positions should be taken as approximate and are intended for general guidance only and no representation is made by the NTA as to the accuracy, completeness, sufficiency or otherwise of this drawing and the position of the apparatus.The information contained herein does not purport to be comprehensive or final as the apparatus is subject to being altered and/or superceded. Recipients should not rely on this information. Any liabilities are hereby expressly disclaimed.
e. The information contained herein has been provided by the NTA but does not purport to be comprehensive or final. Recipients should not rely on the information. Neither the NTA nor any of its directors, officers, employees, agents, stakeholders or advisers make any representation or warranty as to, or accept any liability or responsibility in relation to, the adequacy, accuracy, reasonableness or completeness of the information provided as part of this document or any matter on which the information is based (including but not limited to loss or damage arising as a result of reliance by recipients on the information or any part of it). Any liabilities are hereby expressly disclaimed.

Rev	Date	Drn	Chk'd	App'd	Description
L02.1	19/01/21	DH	AD	JS	ISSUE FOR PEER REVIEW
L01	08/12/20	DH	AD	JS	STAGE B1 - PEER REVIEW

Project Ireland 2040
Building Ireland's Future

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: AECOM / Mott MacDonald

Programme Title: BUSCONNECTS DUBLIN CORE BUS CORRIDORS INFRASTRUCTURE WORKS

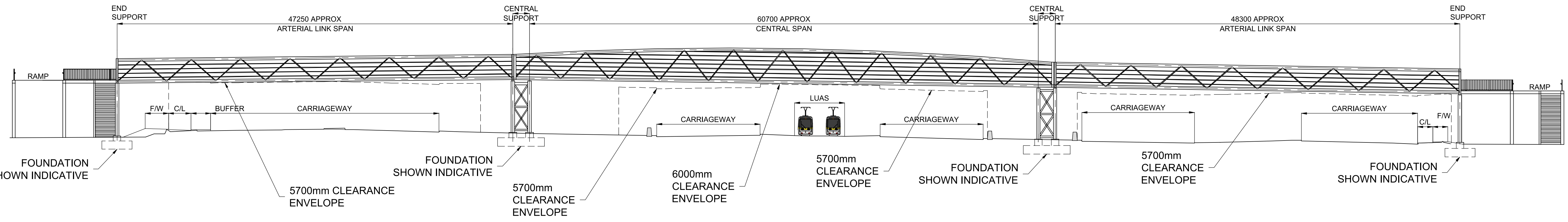
Drawing Title: CBC08 TALLAGHT/CLONDALKIN TO CITY CENTRE ST02 NAAS ROAD PEDESTRIAN & CYCLE BRIDGE PLAN

Date	Scale	Drawn	Checked	Approved
19/01/21	1:250 @ A1 1:500 @ A3	---	---	---

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
BCIDA	ACM		BCIDA-ACM-STR_GA-0008_BR_03-DR-CB-0101	1 of 1		L02.1

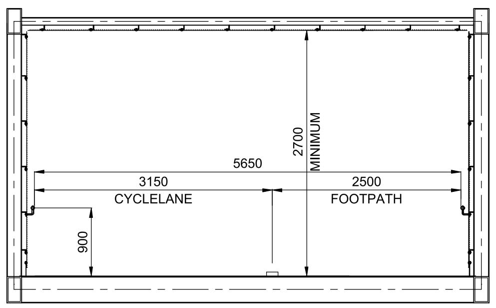
DO NOT SCALE USE FIGURED DIMENSIONS ONLY

C:\users\callum.moloney\appdata\local\projectwise\workdir\mott-gb-pw-03\d0252893\BCIDA-ACM-STR_GA-0008_BR_03-DR-CB-0101.dwg



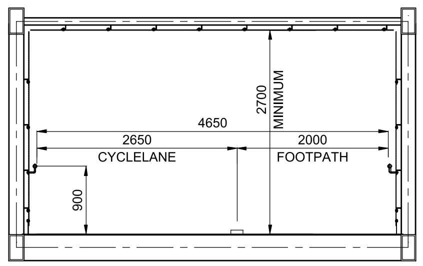
DEVELOPED ELEVATION A-A

1:250 @ A1
1:500 @ A3



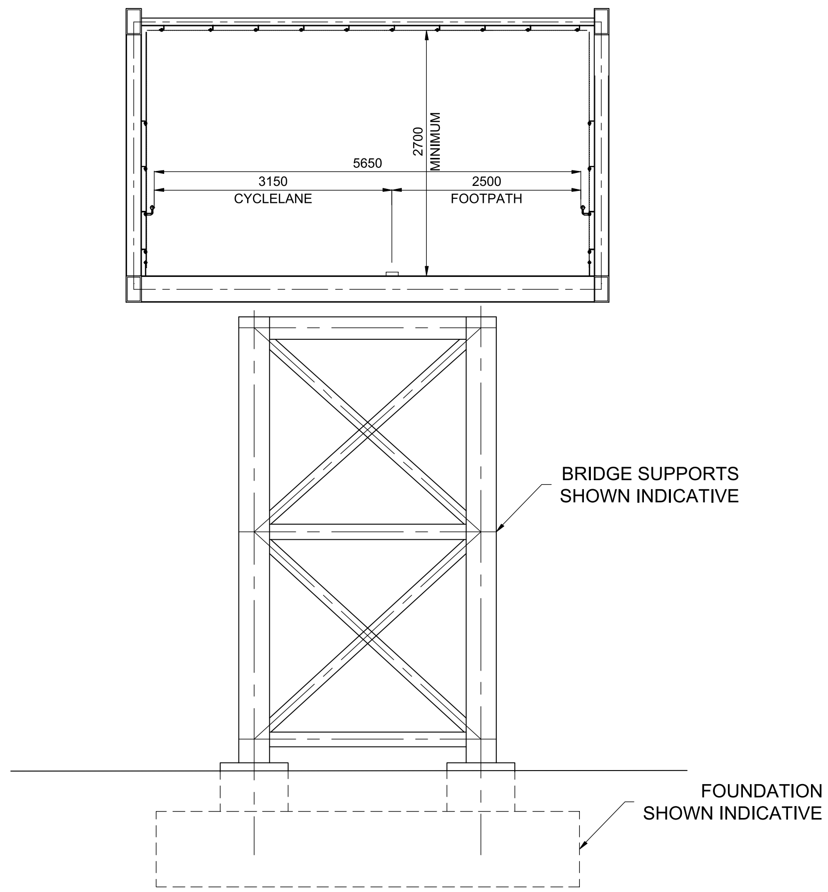
TYPICAL SECTION THROUGH CENTRAL SPAN

1:50 @ A1
1:100 @ A3



TYPICAL SECTION THROUGH ARTERIAL LINK SPAN

1:50 @ A1
1:100 @ A3



TYPICAL SECTION THROUGH MAIN FOOTBRIDGE SUPPORT

1:50 @ A1
1:100 @ A3

Project Ireland 2040
Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
L02	28/04/21	DH	AD	JS	ISSUE FOR PEER REVIEW
L01	08/12/20	DH	AD	JS	STAGE B1 - PEER REVIEW

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: AECOM / MOTT MACDONALD

Programme Title: **BUSCONNECTS DUBLIN CORE BUS CORRIDORS INFRASTRUCTURE WORKS**

Drawing Title: CBC08 TALLAGHT/CLONDALKIN TO CITY CENTRE ST02 NAAS ROAD PEDESTRIAN & CYCLE BRIDGE DETAILS

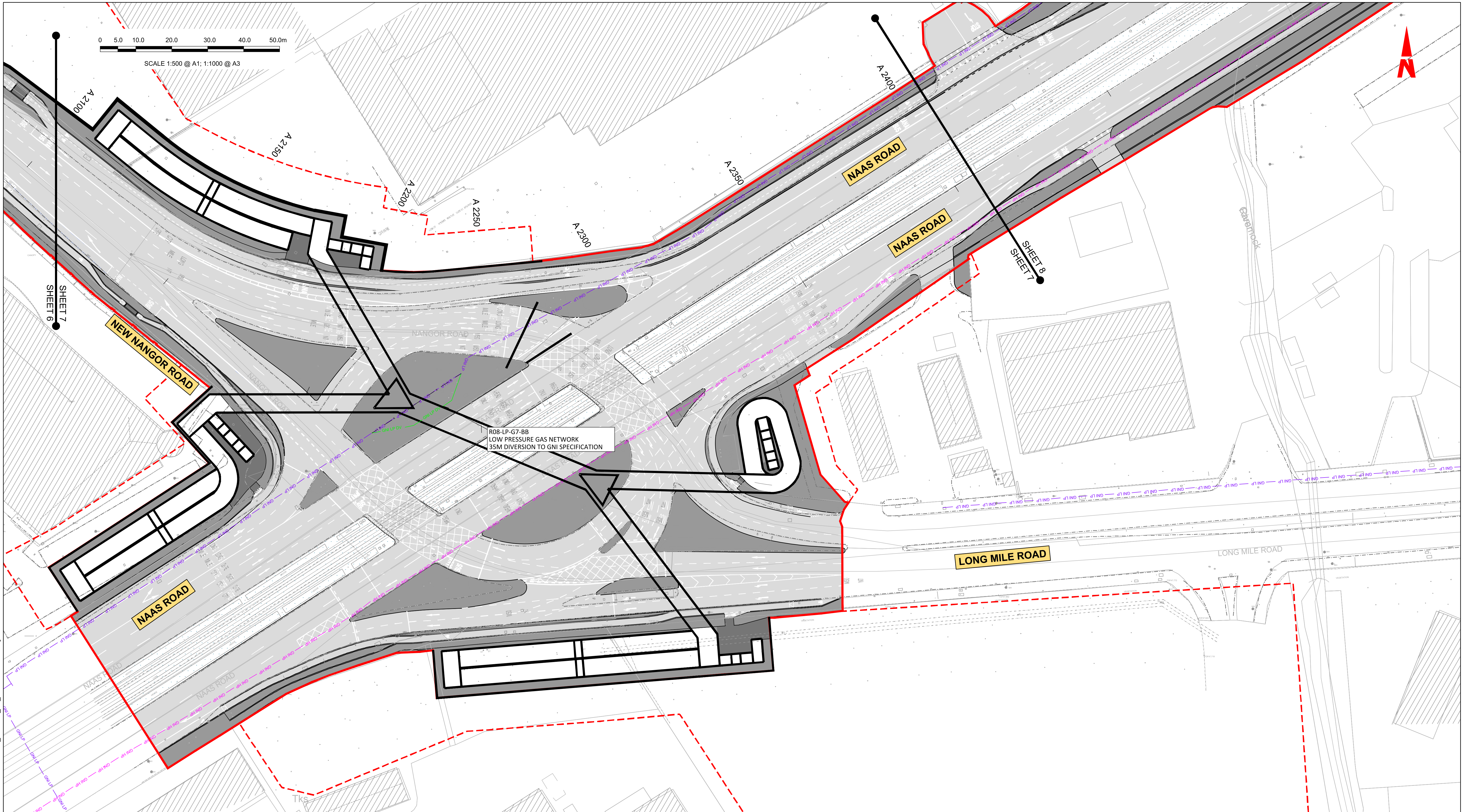
Date	Scale	Drawn	Checked	Approved
28/04/21	AS SHOWN @ A1 AS SHOWN @ A3	D.HAMILTON	A.DUGGAN	J.SEYMOUR

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
BCIDA	ACM		BCIDA-ACM-STR_GA-0008_BR_03-DR-CB-0102	1 of 1	S3	L02

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

C:\users\costelloa\appdata\local\projectwise\workdir\mott-gb-pw-03\d0252893\BCIDA-ACM-STR_GA-0008_BR_03-DR-CB-0102.dwg

Appendix C Utility Drawings



LEGEND:

EXISTING KERB LINE	PROPOSED KERB LINE
GAS NETWORKS IRELAND - EXISTING HIGH PRESSURE GAS NETWORK	GAS NETWORKS IRELAND - HIGH PRESSURE - PROPOSED UNDERGROUND DIVERSION
GAS NETWORKS IRELAND - EXISTING MEDIUM PRESSURE GAS NETWORK	GAS NETWORKS IRELAND - MEDIUM PRESSURE - PROPOSED UNDERGROUND DIVERSION
GAS NETWORKS IRELAND - EXISTING LOW PRESSURE GAS NETWORK	GAS NETWORKS IRELAND - LOW PRESSURE - PROPOSED UNDERGROUND DIVERSION
SITE BOUNDARY LINE	TEMPORARY LAND TAKE
EXISTING NETWORK TO BE DECOMMISSIONED	

NOTES:

1. UTILITY LOCATIONS ARE INDICATIVE ONLY AND BASED ON UTILITY PROVIDER RECORDS
2. ROAD LAYOUT IS PRELIMINARY ONLY AND IS SUBJECT TO CHANGE

Project Ireland 2040
Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
L03	28/04/21	PZ	AD	JS	ISSUED FOR PEER REVIEW
L02	01/02/21	PZ	CA	JS	PRE-PLANNING ISSUE FOR INFORMATION
L01	10/12/20	PZ	AD	JS	STAGE B1 - PEER REVIEW

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: AECOM / MOTT MACDONALD

Programme Title: BUSCONNECTS DUBLIN CORE BUS CORRIDORS INFRASTRUCTURE WORKS

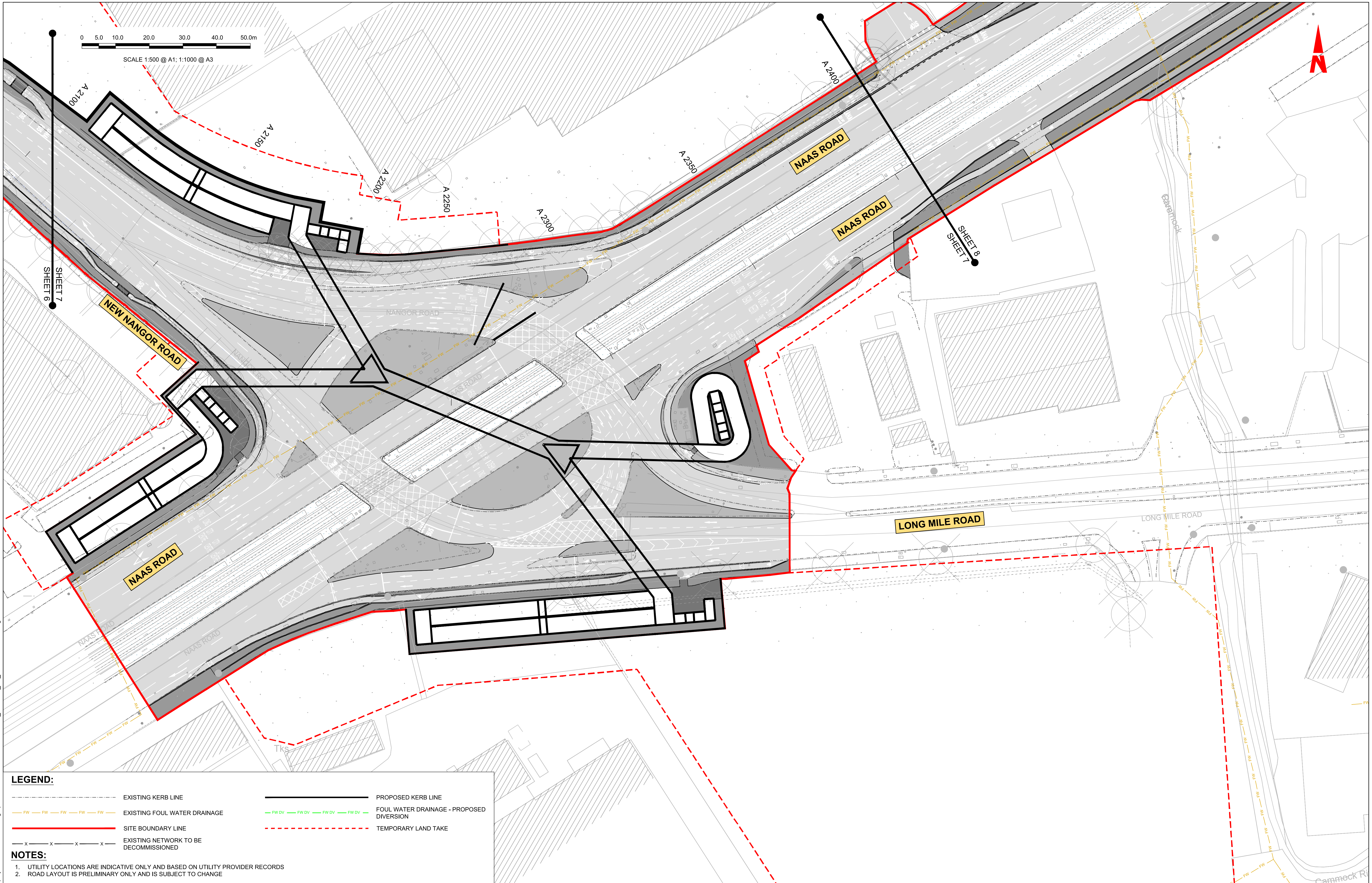
Drawing Title: CBC08 TALLAGHT/CLONDALKIN TO CITY CENTRE GAS UTILITY ASSETS, RECORDS AND PROPOSED WORKS

Date	Scale	Drawn	Checked	Approved
28/04/21	1:500 @ A1 1:1000 @ A3	P.ZAJAC	A.DUGGAN	J.SEYMOUR

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
BCIDA	ACM		BCIDA-ACM-UTL_UG-0008_XX_00-DR-CU-0007	07 of 12	S3	L03

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

C:\Users\ZAJ91828\Desktop\L03_UTILITY DIVERSIONS\ROAD 08\UTHORISED\GAS\BCIDA-ACM-UTL_UG-0008_XX_00-DR-CU-0007.dwg



LEGEND:

EXISTING KERB LINE	PROPOSED KERB LINE
EXISTING FOUL WATER DRAINAGE	FOUL WATER DRAINAGE - PROPOSED DIVERSION
SITE BOUNDARY LINE	TEMPORARY LAND TAKE
EXISTING NETWORK TO BE DECOMMISSIONED	

NOTES:

1. UTILITY LOCATIONS ARE INDICATIVE ONLY AND BASED ON UTILITY PROVIDER RECORDS
2. ROAD LAYOUT IS PRELIMINARY ONLY AND IS SUBJECT TO CHANGE

Project Ireland 2040
Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
L03	28/04/21	PZ	AD	JS	ISSUED FOR PEER REVIEW
L02	01/02/21	PZ	CA	JS	PRE-PLANNING ISSUE FOR INFORMATION
L01	10/12/20	PZ	AD	JS	STAGE B1 - PEER REVIEW

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: AECOM, MOTT MACDONALD

Programme Title: **BUSCONNECTS DUBLIN CORE BUS CORRIDORS INFRASTRUCTURE WORKS**

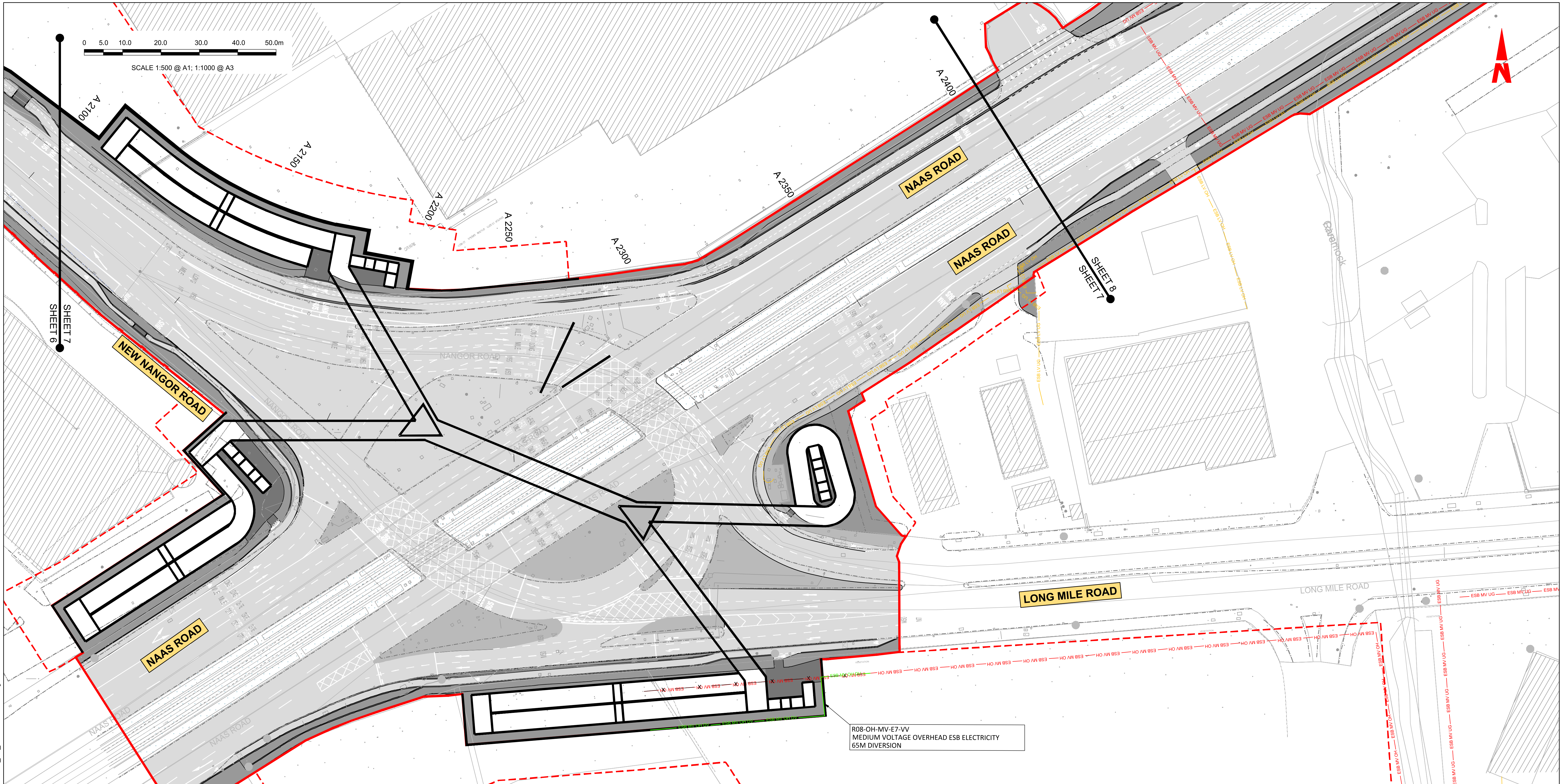
Drawing Title: CBC08 TALLAGHT/CLONDALKIN TO CITY CENTRE FOUL SEWER UTILITY ASSETS. RECORDS AND PROPOSED WORKS

Date	Scale	Drawn	Checked	Approved
28/04/21	1:500 @ A1 1:1000 @ A3	P.ZAJAC	A.DUGGAN	J.SEYMOUR

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
BCIDA	ACM		BCIDA-ACM-UTL_UD-0008_XX_00-DR-CU-0007	07 of 12	S3	L03

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

C:\users\poc83666\appdata\local\projectwise\workdir\mott-gb-pw-04\d0252975\BCIDA-ACM-UTL_UD-0008_XX_00-DR-CU-0007.dwg



LEGEND:

EXISTING KERB LINE	PROPOSED KERB LINE
ESB - HIGH VOLTAGE - EXISTING UNDERGROUND	ESB - HIGH VOLTAGE - PROPOSED UNDERGROUND DIVERSION
ESB - HIGH VOLTAGE - EXISTING OVERHEAD	ESB - HIGH VOLTAGE - PROPOSED OVERHEAD DIVERSION
ESB - MEDIUM VOLTAGE - EXISTING UNDERGROUND	ESB - MEDIUM VOLTAGE - PROPOSED UNDERGROUND DIVERSION
ESB - MEDIUM VOLTAGE - EXISTING OVERHEAD	ESB - MEDIUM VOLTAGE - PROPOSED OVERHEAD DIVERSION
ESB - LOW VOLTAGE - EXISTING UNDERGROUND	ESB - LOW VOLTAGE - PROPOSED UNDERGROUND DIVERSION
ESB - LOW VOLTAGE - EXISTING OVERHEAD	ESB - LOW VOLTAGE - PROPOSED OVERHEAD DIVERSION
SITE BOUNDARY LINE	TEMPORARY LAND TAKE
EXISTING NETWORK TO BE DECOMMISSIONED	

NOTES:

1. UTILITY LOCATIONS ARE INDICATIVE ONLY AND BASED ON UTILITY PROVIDER RECORDS
2. ROAD LAYOUT IS PRELIMINARY ONLY AND IS SUBJECT TO CHANGE

Project Ireland 2040
Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
L03	28/04/21	PZ	AD	JS	ISSUED FOR PEER REVIEW
L02	29/01/21	PZ	CA	JS	PRE-PLANNING ISSUE FOR INFORMATION
L01	10/12/20	PZ	AD	JS	STAGE B1 - PEER REVIEW

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: AECOM / MOTT MACDONALD

Programme Title: **BUSCONNECTS DUBLIN CORE BUS CORRIDORS INFRASTRUCTURE WORKS**

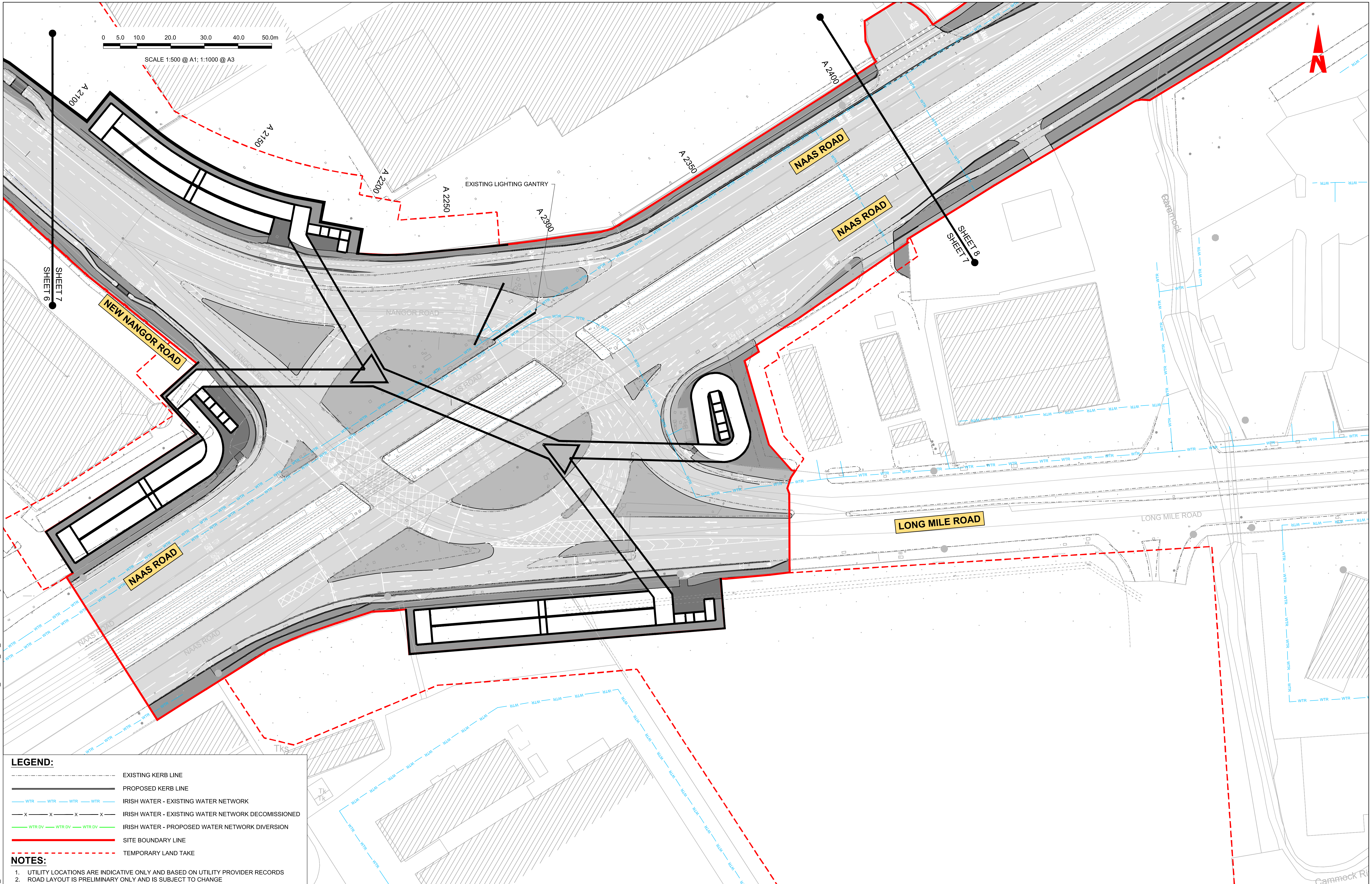
Drawing Title: CBC08 TALLAGHT/CLONDALKIN TO CITY CENTRE ELECTRICITY UTILITY ASSETS. RECORDS AND PROPOSED WORKS

Date	Scale	Drawn	Checked	Approved
28/04/21	1:500 @ A1; 1:1000 @ A3	P.ZAJAC	A.DUGGAN	J.SEYMOUR

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
BCIDA	ACM		BCIDA-ACM-UTL_UE-0008_XX_00-DR-CU-0007	07 of 12	S3	L03

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

C:\Users\ZAJ91828\Desktop\L03_UTILITY DIVERSIONS\ROAD 08\UTHORISED\ESB\BCIDA-ACM-UTL_UE-0008_XX_00-DR-CU-0007.dwg



LEGEND:

— · — · —	EXISTING KERB LINE
———	PROPOSED KERB LINE
— WTR — WTR —	IRISH WATER - EXISTING WATER NETWORK
—x— x —x—	IRISH WATER - EXISTING WATER NETWORK DECOMISSIONED
— WTR DV — WTR DV —	IRISH WATER - PROPOSED WATER NETWORK DIVERSION
———	SITE BOUNDARY LINE
- - - - -	TEMPORARY LAND TAKE

NOTES:

1. UTILITY LOCATIONS ARE INDICATIVE ONLY AND BASED ON UTILITY PROVIDER RECORDS
2. ROAD LAYOUT IS PRELIMINARY ONLY AND IS SUBJECT TO CHANGE

Project Ireland 2040
Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
L03	28/04/21	PZ	AD	JS	ISSUED FOR PEER REVIEW
L02	01/02/21	PZ	CA	JS	PRE-PLANNING ISSUE FOR INFORMATION
L01	10/12/20	PZ	AD	JS	STAGE B1 - PEER REVIEW

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: AECOM / MOTT MACDONALD

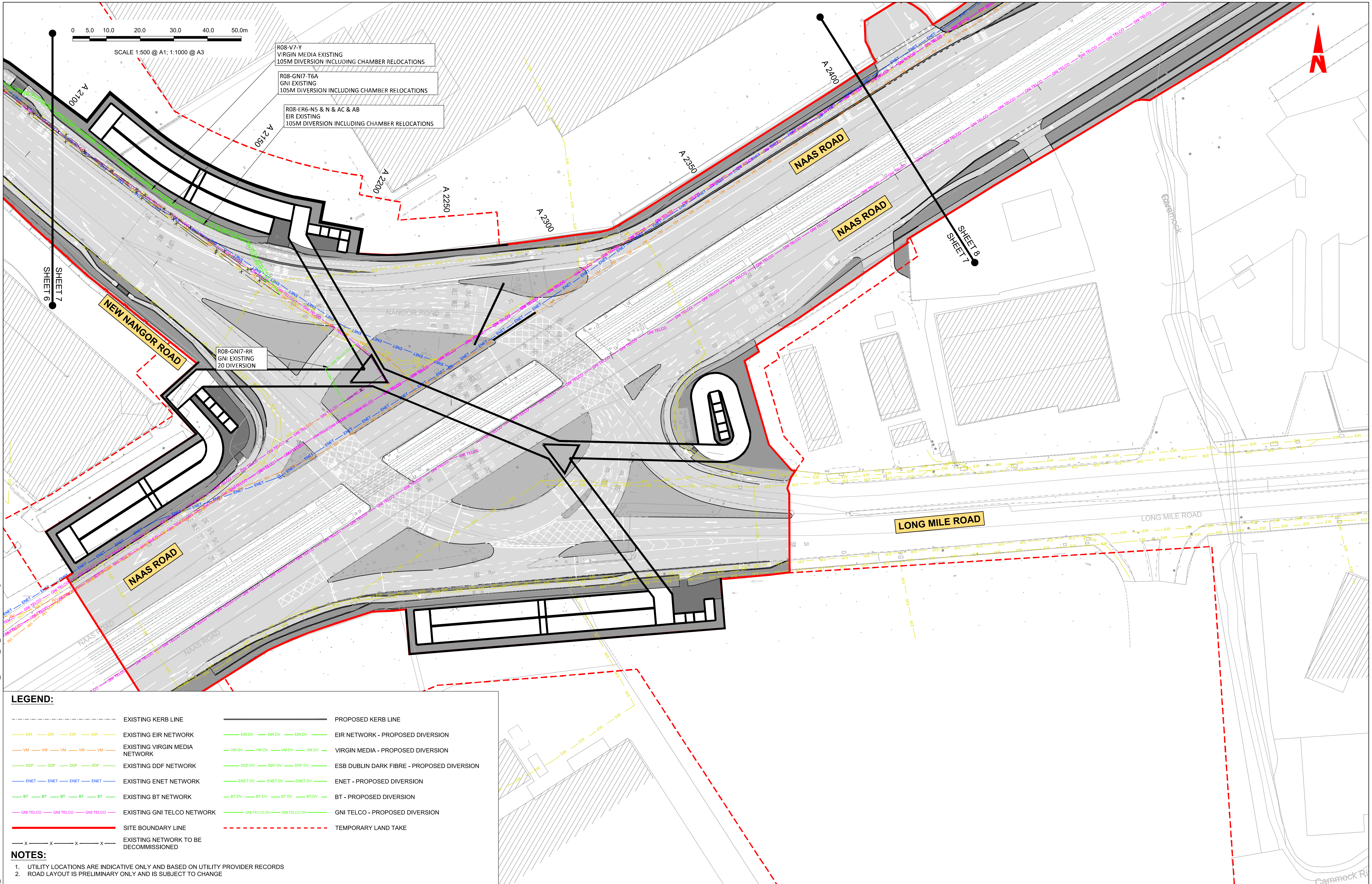
Programme Title: **BUSCONNECTS DUBLIN CORE BUS CORRIDORS INFRASTRUCTURE WORKS**

Drawing Title: CBC08 TALLAGHT/CLONDALKIN TO CITY CENTRE WATER UTILITY ASSETS. RECORDS AND PROPOSED WORKS

Date	Scale	Drawn	Checked	Approved
28/04/21	1:500 @ A1 1:1000 @ A3	P.ZAJAC	A.DUGGAN	J.SEYMOUR

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
BCIDA	ACM		BCIDA-ACM-UTL_UW-0008_XX_00-DR-CU-0007	07 of 12	S3	L03

DO NOT SCALE USE FIGURED DIMENSIONS ONLY



LEGEND:

EXISTING KERB LINE	PROPOSED KERB LINE
EXISTING EIR NETWORK	EIR NETWORK - PROPOSED DIVERSION
EXISTING VIRGIN MEDIA NETWORK	VIRGIN MEDIA - PROPOSED DIVERSION
EXISTING DDF NETWORK	ESB DUBLIN DARK FIBRE - PROPOSED DIVERSION
EXISTING ENET NETWORK	ENET - PROPOSED DIVERSION
EXISTING BT NETWORK	BT - PROPOSED DIVERSION
EXISTING GNI TELCO NETWORK	GNI TELCO - PROPOSED DIVERSION
SITE BOUNDARY LINE	TEMPORARY LAND TAKE
EXISTING NETWORK TO BE DECOMMISSIONED	

NOTES:

1. UTILITY LOCATIONS ARE INDICATIVE ONLY AND BASED ON UTILITY PROVIDER RECORDS
2. ROAD LAYOUT IS PRELIMINARY ONLY AND IS SUBJECT TO CHANGE

Project Ireland 2040
Building Ireland's Future

Rev	Date	Drn	Chk'd	App'd	Description
L03	28/04/21	PZ	AD	JS	ISSUED FOR PEER REVIEW
L02	01/02/21	PZ	CA	JS	PRE-PLANNING ISSUE FOR INFORMATION
L01	10/12/20	PZ	AD	JS	STAGE B1 - PEER REVIEW

Client: NTA Údarás Náisiúnta Iompair National Transport Authority

Engineering Designer: AECOM, MOTT MACDONALD

Programme Title: BUSCONNECTS DUBLIN CORE BUS CORRIDORS INFRASTRUCTURE WORKS

Drawing Title: CBC08 TALLAGHT/CLONDALKIN TO CITY CENTRE TELECOM UTILITY ASSETS, RECORDS AND PROPOSED WORKS

Date	Scale	Drawn	Checked	Approved
28/04/21	1:500 @ A1 1:1000 @ A3	P.ZAJAC	A.DUGGAN	J.SEYMOUR

Project Code	Originator Code	QMS Code	Drawing File Name	Sheet Number	Status	Rev
BCIDA	ACM		BCIDA-ACM-UTL_UL-0008_XX_00-DR-CU-0007	07 of 12	S3	L03

DO NOT SCALE USE FIGURED DIMENSIONS ONLY

C:\Users\ZAJ91828\Desktop\L03_UTILITY DIVERSIONS\ROAD 08\UTHORISED\TELECOM\BCIDA-ACM-UTL_UL-0008_XX_00-DR-CU-0007.dwg

Appendix D Designers Risk Assessment

BusConnects Package A – CBC008 Clondalkin to Drimnagh
CBC08-ST02 Naas Road Pedestrian/Cycle Bridge
Designers Risk Assessment

Project Number:	60599126	**Revision**							
Client:	National Transport Authority	**Rev**	01	02	03	04	05	06	07
Designer:	AECOM	**Date**	26/03/21						
Contractor:	Not applicable	**Client**	✓						
Prepared by:	Rionach Murphy	**Designer**	✓						
Checked by:	Arthur Costello	**Main Contractor**	-						
Approved by:	Niamh Rodgers	**Sub-Contractors**	-						
		Other	-						

Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
1	Live Carriageways	Site is on the Naas Road and Long Mile Road Junction. The road will be live during some of the construction.	High	Bridge has been designed with a main span over all lanes of the Naas Road. All traffic lanes to be closed during lifting of bridge superstructures Traffic management to be implemented to ensure that safe working zones are provided to any works near live carriageways.	Live traffic with traffic management zones	Medium	Traffic Management will be required for bridge lifts and any construction works on or near live carriageways. All traffic management plans to be developed in accordance with Chapter 8 of the Traffic Signs Manual. Contractor is to ensure that all staff are aware of the risks of working near a live road.
2	Access and egress to the site and compound	Access and egress to site.	High	Design of the overall CBC08 Clondalkin to Drimnagh route has ensured that sufficient lands are made available within the temporary CPO area.	N/A	Low	Contractor to be made aware of temporary CPO area and to ensure that construction works are carried out within this area.
3	Site security	Unauthorised access by members of the public to the works areas	High	Sufficient space has been provided within the Temporary CPO area to allow suitable hoarding/fencing to be erected to prevent unauthorised access to the works areas		Low	Contractor to ensure that fencing is erected and maintained throughout the construction works.

Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
4	Plant movements	Insufficient ground bearing pressure for site works.	Medium	Preliminary Ground investigations have been carried out to determine if there are potential risks of low ground bearing pressures.		Low	Further Ground Investigations to be carried out as part of Detailed Design to determine any further areas of low ground bearing pressures. Appropriate hoarding to be provided at construction stage to separate works from areas of adverse ground conditions.
5	Multiple Site Activities	Numerous concurrent construction projects are expected to take place at different locations along the Clondalkin to Drimnagh Route	Medium	Phasing of the construction works has been considered to avoid works being carried out in parallel on CBC08		Low	Contractor to discuss sequencing and construction programme with the client and CBC08 Design team. On-site personnel to be aware of ongoing site activities and follow any appropriate safety requirements. Barriers and hoarding to be put in place as appropriate to protect on-site personnel and segregate different site activities.
6	Underground services	Potential for unknown and/or undocumented services in the vicinity of the proposed structure.	Medium	Desk top study of available utility information has been carried out and all known services in the vicinity of the proposed structure have been shown on preliminary design drawings.		Low	Further desk top study to be carried out at Detailed Design stage to identify any additional services which have been constructed in the interim. At construction stage full CAT scan site survey to be carried out prior to commencement. Any services identified should be located by hand excavation, marked and protected or re-routed before commencement of works.
7	Excavation adjacent to a live carriageway	Excavations required to construct the bridge run the risk of undermining the live carriageways.	High	The bridge supports have been set back from the edge of carriageways to ensure safe working zones can be achieved with minimal traffic management required.		Low	The contractor is to be aware of the risk of undermining existing road. As part of the detailed design the construction methodology should consider if sheet piling is required to avoid undermining. The contractor is to ensure that vibration levels from excavation are limited and that safe working limits are developed prior to works.

Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
8	Structural Instability	Instability of structural elements during construction	High	The preliminary design has been developed for a fully through truss construction with a braced pair of truss chords to ensure stability during construction		Medium	Where required the Contractor shall ensure that temporary works are provided on site to ensure structural stability during construction. All temporary works required are to be designed by a temporary works designer.
9	Bridge Superstructure Construction	Risks to operatives during cutting & welding of steel members	High	The preliminary design has ensured that the bridge superstructure can be fabricated off site in a controlled environment and assembled on site limiting the amount of on-site works required		Low	Contractor is to ensure that assembly of the bridge superstructure is carried out by suitably qualified steel workers
10	Bridge Superstructure Construction	Transportation and delivery of bridge superstructure	High	The preliminary design has ensured that the bridge superstructure can be fabricated off site and assembled within the site compound. The bridge will be delivered to site in sections to avoid major logistical issues with delivery of the a fully assembled superstructure		Low	Contractor and detailed designer to liaise with the steel work fabricator to ensure that transportation and delivery of the bridge can be successfully achieved.
11	Working at Height	Risk of fall of plant, materials and people.	High	The bridge design has been developed to ensure the main bridge span can be lifted into position fully assembled avoiding the need for works from height over live carriageways of Naas Road. Th bridge has been designed to require minimum construction on site with most elements being prefabricated.		Medium	The Contractor shall ensure appropriate guard rails and netting provided to the structure to prevent falling objects. Contractor to ensure suitable fall restraint systems/harnesses to be used when working at height.
12	Night-time Working	Reduced visibility and fatigue caused by night-time working poses the risk of slips, trips, falls and unsafe working practices being incorporated.	High	The preliminary design has assumed that main span of the bridge will be lifted during night-time works and closure of the Naas Road. The design has been developed to ensure the lifting can be carried in a single night limiting the requirements for night-time working.		Low	The Detailed Designer and Contractor will need to consider the construction methodology and sequencing to limit night-time working. Where night works are required the Contractor must ensure that all staff are briefed on the dangers of night-time work and that site personnel are not overworked and remain vigilant.

Ref.	Feature, element, process or work activity	Constraints and significant hazards identified	Risk Rating before Intervention	Designers interventions to eliminate or reduce hazards	Significant residual hazards remaining	Residual Risk Rating	Information to be provided to enable project partners to manage hazards
13	Anti-Social Behaviour (as built)	Risk to the site from anti-social behaviour and vandalism	Medium	The design has ensured that full enclosure of the main warren truss span is provided to avoid the risk of anti-social behaviour and items being thrown from the bridge on the live carriageways of the N4 below.		Low	The Detailed Designer and Contractor are to ensure that full enclosure is achieved through correct detailing and construction.