

The background of the page is a vibrant red. It is decorated with several abstract geometric shapes in blue, green, and white. In the top right, there is a blue shape with a white circle inside, and a dark blue shape below it. In the top left, there is a green shape with a white circle inside. In the bottom left, there is a blue shape with a white circle inside, and a dark blue shape below it. In the bottom right, there is a large green shape with a white circle inside, and a red shape below it. The text is positioned in the upper left quadrant of the red background.

Appendix J.7
Preliminary Design Report
Gantries



Gantries

Preliminary Design Report

Lucan to City Centre Core Bus Corridor
BCIDA-ACM-STR_ZZ-0006_XX_00-RP-CB-0016

Client – National Transport Authority
Stage – Stage 2

Project Reference: BusConnects Package A
Project Number: 60599123
BCIDA-ACM-STR_ZZ-0006_XX_00-RP-CB-0016

Date (21st June 2022)

Preliminary Design Report – Consultation

STA-1b

Categories 1, 2 & 3

Scheme

Name and Location BusConnects – CBC0006 Lucan to City Centre Core Bus Corridor

Structures(s)

Name and nature of the Structure(s) CBC0006-GY01 & GY02 Gantries


Structures Options Report

Reference BCIDA-ACM-STR_ZZ-0006_XX_00-RP-CB-0016

Revision L01

Date 21 / 06 / 2022

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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 twelve 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 three CBC schemes:

Clongriffin to City Centre Core Bus Corridor Scheme;

Lucan to City Centre Core Bus Corridor Scheme; and

Tallaght/Clondalkin to City Centre Core Bus Corridor Scheme.

Each scheme contains several bridge structures, retaining walls and ancillary structures with various structural forms. As part of the scope AECOM have agreed to take all structures through the *Technical Acceptance of Road Structures on Motorways and Other National Roads* procedure as outlined in DN-STR-03001.

This Preliminary Design Report (PDR) will focus on the gantries GY01 and GY02 located along the N4 at Junction 2 and Junction 1 respectively. The PDR is a deliverable at Phase 4 of the Technical Acceptance process.

The Preliminary Design Report refers to the following gantries:

GY01 Cantilever Gantry

GY02 Portal Gantry

These gantries are required due to proposed changes to the existing road along the N4 to meet the project objectives of CBC Infrastructure Works.

1.2 Background Information

BusConnects plans to transform Dublin’s bus and cycle network, with an aim of increasing the attractiveness of public transport and cycling encouraging a modal shift from private car. The scheme consists of twelve radial Core Bus Corridor’s (CBC), which will be supplemented at a later stage with a network of orbital corridors. The scheme will provide 230kms of continuous bus priority lanes and 200kms of cycle tracks/lanes throughout Dublin. The Lucan to City Centre CBC has been identified as one of the twelve routes proposed along the Core Bus Network.

The proposed gantries will be located along the eastbound carriageway of the N4 and are required to replace and supplement existing gantries on the route.

1.3 Previous Studies and their recommendations

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

Date	Document Reference	Report Title	Author
2020	RPT-16_080-004 (DRAFT)	Lucan to City Centre Core Bus Corridor Options Study – Feasibility Report	AECOM
2020	BCIDA-ACM-PMG_PD-0006_XX_00-RP-ZZ-0001 (DRAFT)	CBC06 Preferred Route Options Report	AECOM

Table 1-1 Previous Studies

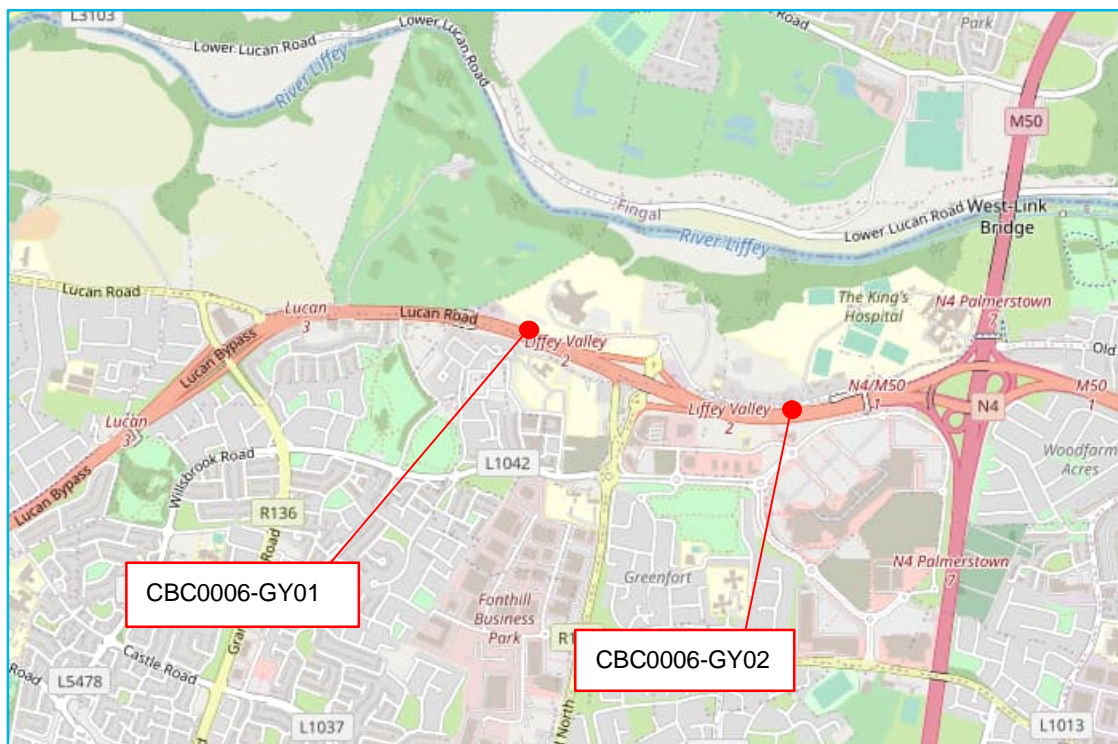
2. Site and Location

2.1 Introduction

The gantries are located along the N4 at Junction 2 and Junction 1. The ITM coordinates are as follows:

GY01 – 706,013.836 (N), 735,401.864 (E)

GY02 – 706,962.977 (N), 735,172.247 (E)



©OpenStreetMap contributors

Figure 2-1 Location Plan

2.2 Function of the structure and obstacles crossed

GY01 is required due to additional cross-sectional width being provided along the N4 creating sufficient space for a two-way cycle track. GY01 will be a cantilever gantry spanning both eastbound diverge lanes for Junction 2.

GY02 is required due to the proposed N4 Pedestrian Bridge which creates reduced visibility of the existing portal gantry to the east of the bridge. The new gantry will be a portal gantry spanning the eastbound lanes of the N4 including bus lane, three eastbound carriageways and the eastbound Junction 1 diverge lane.

2.3 Choice of location

The proposed gantries will be located along the eastbound carriageway of the N4 replacing and supplementing existing gantries. The location for each gantry has been determined based on the required distances for advanced directional signage from the respective junction.

2.4 Site description topography

Both gantries are located in a busy urban environment with a number of busy roads, commercial, amenity and healthcare units and other infrastructure. GY01 will be located within the proposed raised verge/footpath parallel to the N4 within a widening of the existing embankment. A number of mature trees are located within this widening.

GY02 will be positioned on the western side of the proposed N4 Pedestrian Bridge and will be supported within the eastbound footpath and existing N4 median.

2.5 Vertical and horizontal alignment

The existing N4 alignment is on a maximum longitudinal fall of 5% from east to west at both gantry locations. The alignment is on a standard cross fall of 2.5% either side of the centre line at both locations.

2.6 Cross sectional dimensions on the alignments

The proposed N4 cross section at GY01 and GY02 is as follows:

Section	Width (m)
Two-Way Cycle Lane	3.65
Footpath	4.44
Eastbound Bus Lane	3.50
Eastbound Traffic Lane	17.30
Central Reserve	0.54
Westbound Traffic Lane	11.20
Westbound Bus Lane	3.50
Cycle Lane	3.25
Total	47.38

Table 2-1 GY01 N4 Cross Section

Section	Width (m)
Footpath	3.50
Eastbound Bus Lane	3.50
Raised Island	1.00
Eastbound Traffic Lane	11.97
Central Reserve	4.61
Westbound Traffic Lane	11.91
Westbound Bus Lane	3.80
Total	40.29

Table 2-2 GY02 N4 Cross Section

2.7 Existing underground and overground services

A number of existing services have been recorded in the area surrounding the proposed gantries. The following table summarises the service providers and their utilities.

Gantry	Service Provider	Services	Location
GY01	EIR	Existing EIR Network	Along Eastbound Pathway adjacent to N4
	Irish Water	Existing Storm Water Drainage	Along Eastbound Pathway adjacent to N4
GY02	EIR	Existing EIR Network	Along Eastbound Pathway adjacent to N4 and across N4
	Irish Water	Existing Storm Water Drainage	Along Eastbound Pathway adjacent to N4
		Existing Water Network	Along Eastbound Pathway adjacent to N4 and across N4

Table 2-3 List of Service Providers

Rerouting and diversion of any of the existing underground and overground services to facilitate construction of each structure will be carried out as required as part of the overall BusConnects scheme.

2.8 Geotechnical

A Preliminary Sources Study Report (PSSR) for the BusConnects Lucan to City Centre CBC was prepared in accordance with Managing Geotechnical Risk DN-ERW-03083 (October 2019), Section 6.1, specifically Appendix C. It addressed the geological, geotechnical, geomorphological, hydrogeological and geo-environmental aspects of the BusConnects CBC.

The preliminary investigation comprised of a number of boreholes which provide geotechnical information at the proposed gantries. The results of this investigation are summarised below.

2.8.1 GY01 Ground Summary

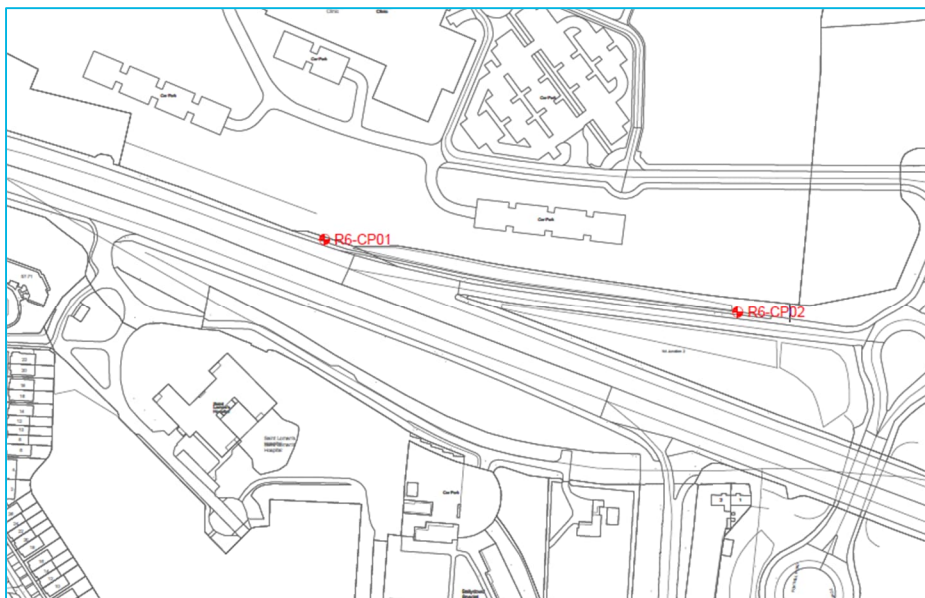


Figure 2-2 GY01 Borehole Locations

R6-CP01 recorded TOPSOIL of 0.1m depth followed by soft sandy gravelly CLAY to a depth of 1.0m. This was then followed with firm sandy gravelly CLAY down to 4.7m, and sandy coarse GRAVEL down to 5m. Here at 5m the borehole was terminated as an SPT blow count of 50 was recorded.

R6-CP02 recorded TOPSOIL of 0.2m depth followed by fine to coarse GRAVEL to a depth of 0.7m. This was then followed with stiff gravelly CLAY to 1.2m, and stiff gravelly sandy silty CLAY down to 1.9m. Here at 1.9m the borehole was terminated as an SPT blow count of 38 was recorded.

Stratum	Typical Stratum Description	Depth at Top of Stratum (m bgl)	Level at Top of Stratum (m AOD)	Thickness Range (m)	Occurrence
Topsoil	-	0	60.52 – 52.79	0.1 – 0.2	R6CP01, R6CP02
Clay	Sandy gravelly	0.1 – 0.2	60.42 – 52.09	1.2 – 4.6	R6CP01, R6CP02
Gravel	Fine to course	0.2 – 4.7	55.92 – 52.59	0.3 – 0.5	R6CP01, R6CP02

Table 2-4 GY01 Ground Summary

2.8.2 GY02 Ground Summary

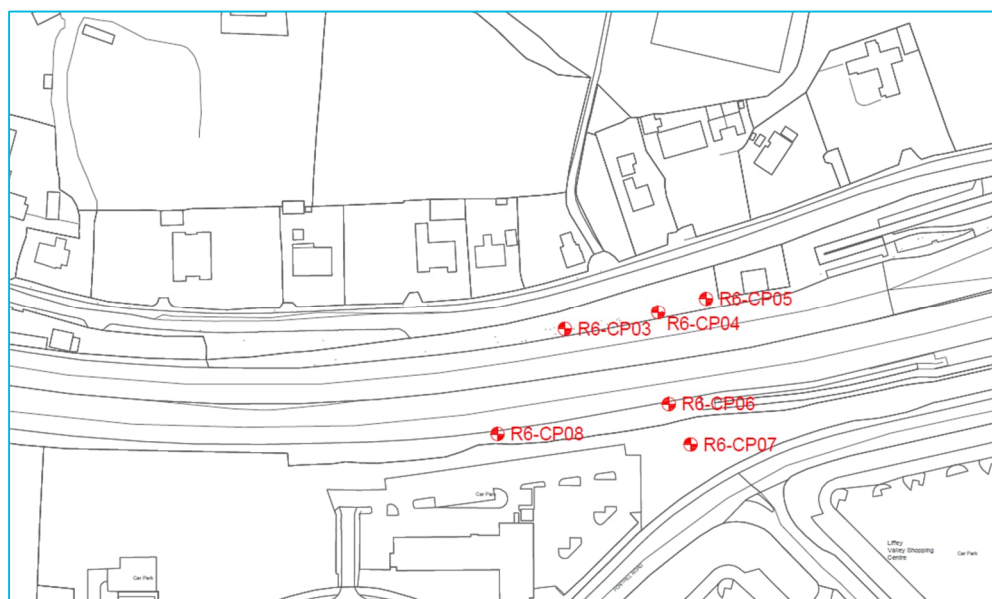


Figure 2-3 GY02 Borehole Locations

R6-CP03 recorded TOPSOIL of 0.1m depth followed by sandy gravelly CLAY at 0.4m depth and sandy GRAVEL at 0.6m depth. Below this layer was sandy CLAY to 1m, followed by SAND to 1.2m and gravelly sandy CLAY to 3.7m. The final layer was COBBLES, possibly bedrock, at 4m where the borehole was terminated as an SPT blow count of 50 was recorded.

Stratum	Typical Stratum Description	Depth at Top of Stratum (m bgl)	Level at Top of Stratum (m AOD)	Thickness Range (m)	Occurrence
Topsoil	-	0	50.76	0.1	R6CP03
Clay	Sandy gravelly	0.1 – 1.2	50.66 – 49.66	0.3 – 2.5	R6CP03
Gravel	Sandy subrounded	0.4	50.46	0.2	R6CP03
Sand	Fine to coarse	1	49.86	0.2	R6CP03
Cobbles	Angular to subangular	3.7	47.16	0.3	R6CP03

Table 2-5 GY02 Ground Summary

2.9 Hydrology and hydraulic summary

The River Liffey forms the main hydraulic feature in the surrounding area. The River Liffey is located approximately 500m to the north of the gantry locations with no other major waterways or distributary stream in the immediate surrounding area.

A review of the OPW flood mapping (www.floodinfo.ie) shows that there are no historical events pertaining to flooding in the area surrounding the gantries as of 21st June 2022. A review of CFRAMS model output for fluvial flooding for the present day shows that the gantries are located outside of the River Liffey's flood zone for the 0.1% Annual Exceedance Probability (AEP). It is unlikely that construction will impact this flood zone, however review of the flood mapping in the area should be revisited in the detailed design stage to review any possible updates of the flood record.

2.10 Archaeological summary

No sites of major archaeological importance were identified at the proposed retaining gantry locations.

2.11 Environmental summary

The EIAR prepared as part of the preliminary design did not identify any particular major environmental impacts associated with the construction of the gantries.

3. Structure and Aesthetics

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

GY01 proposes the use of a painted steel cantilever structure supported on an in-situ concrete foundation. The foundation will be located within the proposed footpath and designed to include a minimum 750mm concrete upstand above finished ground level.

The steel cantilever will be designed in accordance with gantry Group 5 as specified by TII. The gantry will be formed of two large, welded steel box beams with an end plate and a stiffener plate to provide added rigidity. The gantry will be designed to support to two directional signs denoting the eastbound bus lane and eastbound Junction 2 diverge lane.

The proposed dimensions of GY02 are as follows:

Parameter	Dimension
Column Height	8.45m
Span Length	11.97m

Table 3-1 GY01 Gantry Geometry

GY02 proposes the use of a painted steel portal frame structure supported on two in-situ concrete foundations with a minimum 750mm upstand above finished ground level. The foundations will be located in the footpath and within the central reserve of the N4. The existing concrete safety barrier will provide sufficient protection to the gantry from vehicle impact. The support location within the footpath has been sufficiently set back from the edge of bus lane avoiding the need for a safety barrier in this location.

The steel portal frame will be designed in accordance with Gantry Group 6 as specified by TII. The gantry will be formed of a large Vierendeel truss supported on braced vertical steel supports. All sections will be formed of steel box sections of varying sizes. The connection details between the various steel sections vary between bolted and welded across the structure. The portal gantry will support directional signage for the M50 Northbound, M50 Southbound and R148 City Centre lanes on the eastbound approach to N4 Junction 1.

The proposed dimensions of GY02 are as follows:

Parameter	Dimension
Column Height	7.28m
Span Length	23.08m

Table 3-2 GY02 Gantry Geometry

The design working life of the gantries will be a minimum of 120 years as defined in the TII publication, DN-STR-03012 - Design for Durability. Maintainable elements 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.

3.2 Aesthetic considerations

The gantry design incorporates the basic principles of structures aesthetics which respects the surrounding landscape and minimises the environmental intrusion. The structural form of the gantries has been developed to match the existing gantries on site ensuring a consistency of form across the N4 at this location.

3.3 Proposals for the recommended structure or family of structures

3.3.1 Proposed Category

Both GY01 and GY02 will be classified as Category 2 structures due to their span lengths being in excess of 9m and 20m respectively in accordance with DN-STR-03001. Category 2 structures require a check by a different design team to the lead designer.

3.3.2 Span Arrangements

The required spans of GY01 and GY02 will be approximately 10m and 22m respectively.

3.3.3 Minimum headroom provided

The minimum headroom at both gantries will be 5.7m in accordance with DN-GEO-03036 Cross Sections and Headroom.

3.3.4 Approaches including run-on arrangements

Not applicable.

3.3.5 Foundation type

Both gantries will be supported on reinforced cast in-situ concrete foundations. The foundations of both gantries will be detailed with a minimum 750mm concrete upstand above finished ground level providing protection the steel superstructure. The final foundation sizing will be confirmed during the detailed design stage and will be dependent on the soil parameters and predicted loading.

3.3.6 Substructure

Not applicable.

3.3.7 Superstructure

GY01 cantilever will be designed in accordance with Gantry Group 5 as specified by TII. The gantry will be formed of two large, welded steel box beams with an end plate and a stiffener plate to provide added rigidity.

GY02 portal frame will be designed in accordance with gantry Group 6 as specified by TII. The gantry will be formed of a large Vierendeel truss supported on braced vertical steel supports. All sections will be formed of steel box sections of varying sizes. The connection details between the various steel sections vary between bolted and welded across the structure.

3.3.8 Articulation arrangements, joints, and bearings

Not applicable.

3.3.9 Vehicle Restraint System

No vehicle restraint barrier will be provided to GY01 as the bus lane as this location is segregated from the main N4 traffic lanes (with 60 km/h design speed) by a raised concrete island limiting the risk from of accidental impact with the gantry supports.

GY02 will be supported within the footpath and central reserve of the N4. Within the central reserve the existing concrete safety barrier will be reinstated following construction to provide sufficient protection to the gantry from vehicle impact. The northern support will be located 3.85m from the edge of carriageway. No safety barrier will be provided on approach to this support as the design speed for the proposed bus lane will be 50 km/h with a clear zone requirement of 3.0m in accordance with DN-GEO-03036 Cross Sections and Headroom. At the gantry location the proposed bus lane will also be segregated from the main N4 traffic lanes (with 60 km/h design speed) by a raised concrete island limiting the risk from of accidental impact with the gantry supports.

3.3.10 Drainage

Not applicable.

3.3.11 Durability

The gantries will be designed in accordance with the TII publication DN-STR-03012 - Design for Durability with a minimum design life of 120 years. The design life for replaceable parts will be 50 years in accordance with DN-STR-03012. The design working life of the gantry will be working life category 5 while replaceable parts will be working life category 2 in accordance with GE-POL-01008.

All buried concrete surfaces of the foundations 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.

3.3.12 Sustainability

Steel use in the superstructure is a much more environmentally friendly solution than concrete, as it has a lower carbon impact and less general waste.

For the concrete footings, the use of Ground Granulated Blast Slag (GGBS) will be maximised to reduce the cement usage and reduce the environmental impact of the concrete production. These replacement levels will be in accordance with the levels specified within IS EN 206:2013.

At the end of the service life a large proportion of the concrete of the foundation can be recycled and reused as aggregate material or hard core for road construction.

3.3.13 Inspection and maintenance

Maintenance and inspection of the gantries will be required throughout the service life. 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 and structures 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.

Routine inspections will be carried out from the finished ground level, however for principal inspections and possibly maintenance will require an appropriate method of working from height such as an MEWP. These inspections should check for deterioration in the members and joints, or any movements of the structure out of plane since the previous inspection.

4. Safety

4.1 Traffic management during construction including land for temporary diversions

The gantries will be constructed parallel to the highly congested N4 road. It is assumed that all carriageways will be required to remain live during works with only temporary closures permitted. The construction sequence will need to minimise the affect construction will have on the live carriageways. Where lane closures are required during construction suitable traffic management in accordance with Chapter 8 of the Traffic Signs Manual will need to be installed.

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, 2020 and 2021. The DRA shall be viewed as a working document to be developed further as the design develops. The DRA 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.

The following list of particular risks has been identified for the gantries:

- Traffic around Dublin can be very busy, particularly for the N4 which experiences heavy congestion. It is important that it is clearly communicated how workers will access the site, in order to avoid any possible conflicts with traffic.
- Any temporary slopes required as part of construction should be constructed with suitable benching to minimise the risk of earth falls. Sheet piling shall be considered where benching is not possible due to constraints within the lands made available.
- Considerations should be made regarding cyclists and pedestrians during construction with possible alternate routes clearly communicated to ensure that safety is maintained.
- The risk of working near live services should be considered. Where possible all services should be diverted in advance of construction. Where this is not possible a health and safety plan should be prepared to determine the correct procedures for working near live services.
- The risk of working from a height should be considered during construction and any safety equipment required for this shall be worn at all times.

4.3 Safety in use

Safety of the end user will be 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 gantries require a Principal Inspection to be carried out or if routine maintenance consisting of simple remedial works is sufficient to maintain the safety. 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 on the EIRSPAN database for future reference.

4.4 Lighting

No public lighting is proposed as part of the gantries design.

5. Cost

5.1 Budget estimate in current year

The construction costs provided below have been based on quantities calculated from the preliminary gantry design. Major elements associated with gantries such as earthworks, concrete, reinforcement, and steel 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 2022 as required. It should be noted that costs are indicative only and may vary depending on the detailed design and the Contractor's methodology.

Allowances have been made for preliminaries, consultancy fees and contingency. A budget of 10% of the construction cost has been provided for preliminaries to cover traffic management, PSCS, temporary accommodation etc. The contingency is 15% of the construction cost and will cover minor elements such as drainage, fencing, landscaping works and any unforeseen unknowns. Finally, an allowance of 10% of the construction cost has been provided for professional fees to deliver the retaining wall through detailed design and handover. These fees will include detailed design, CAT I checks, construction supervision and handover.

The rates used to calculate the amounts presented below are all 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 Lucan to City Centre route

Series	Amount (€)
CC-SPW-00600 – Earthworks	€531.30
CC-SPW-01700 – Structural Concrete	€14,227.23
CC-SPW-01800 – Steelwork for Structures	€43,661.70
CC-SPW-02000 – Waterproofing	€4,982.89
Construction Cost	€63,403.11
Preliminaries (10% of Construction Cost)	€6,340.32
Contingency (15% of Construction Cost)	€9,510.47
Professional Fees (10% of Construction Cost)	€6,340.32
Total Cost	€85,594.20

Table 5-1 GY01 Estimated Cost

Series	Amount (€)
CC-SPW-00600 – Earthworks	€1,103.90
CC-SPW-01700 – Structural Concrete	€12,427.24
CC-SPW-01800 – Steelwork for Structures	€193,316.90
CC-SPW-02000 – Waterproofing	€5,095.21
Construction Cost	€11,942.24
Preliminaries (10% of Construction Cost)	€21,194.33
Contingency (15% of Construction Cost)	€31,791.49
Professional Fees (10% of Construction Cost)	€21,194.33
Total Cost	€86,123.37

Table 5-2 GY02 Estimated Cost

6. Design Assessment Criteria

6.1 Actions

6.1.1 Permanent Actions

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

Material	Density
Reinforced Concrete	25.0 kN/m ³
Steel	78.5 kN/m ³

Table 6-1 Materials Densities for Design

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 NA to IS EN 1990. Wind loads will not be considered in combination with thermal loading in accordance with clause 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 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

Not applicable.

6.1.6 Provision for exceptional abnormal loads

Not applicable.

6.1.7 Accidental actions

Not applicable.

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

Not applicable.

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
- National Transport Authority
- Transport Infrastructure Ireland

6.3 Proposed departures from standards

No departures from standards are envisaged for the design and construction of the gantries.

6.4 Proposed methods of dealing with aspects not covered by standards

Not applicable.

7. Ground Conditions

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

Geotechnical Category 2 applies to conventional types of structures 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.

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

7.1.1 GY01 Spread Footing

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 (Dublin Boulder Clay) could achieve Serviceability Limit State of less than 25mm.

7.1.2 GY02 Spread Footing

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 (Dublin Boulder Clay) could achieve Serviceability Limit State of less than 25mm.

8. Drawings and Documents

8.1 List of all documents accompanying the submissions

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

Drawing Number	Revision	Drawing Title
BCIDA-ACM-STR_GA-0006_GY_01-DR-CB-0001	L01	GY01 Cantilever Gantry
BCIDA-ACM-STR_GA-0006_GY_01-DR-CB-0001	L01	GY02 Portal Gantry

Table 8-1 Drawing List

Appendix A Photographs and Photomontages



Figure 8-1 GY01 Cantilever Gantry

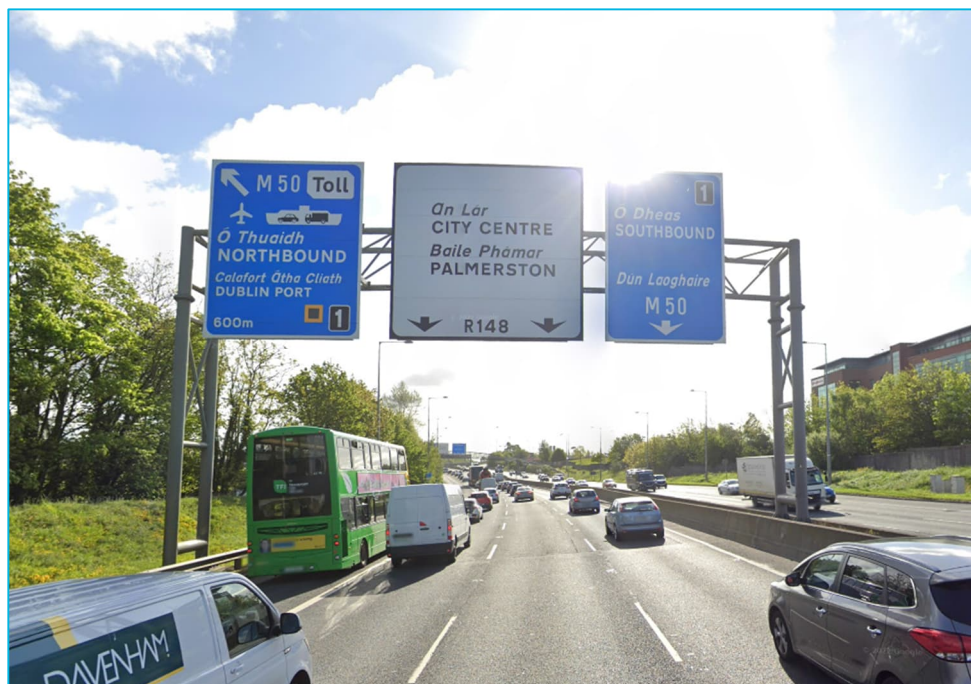
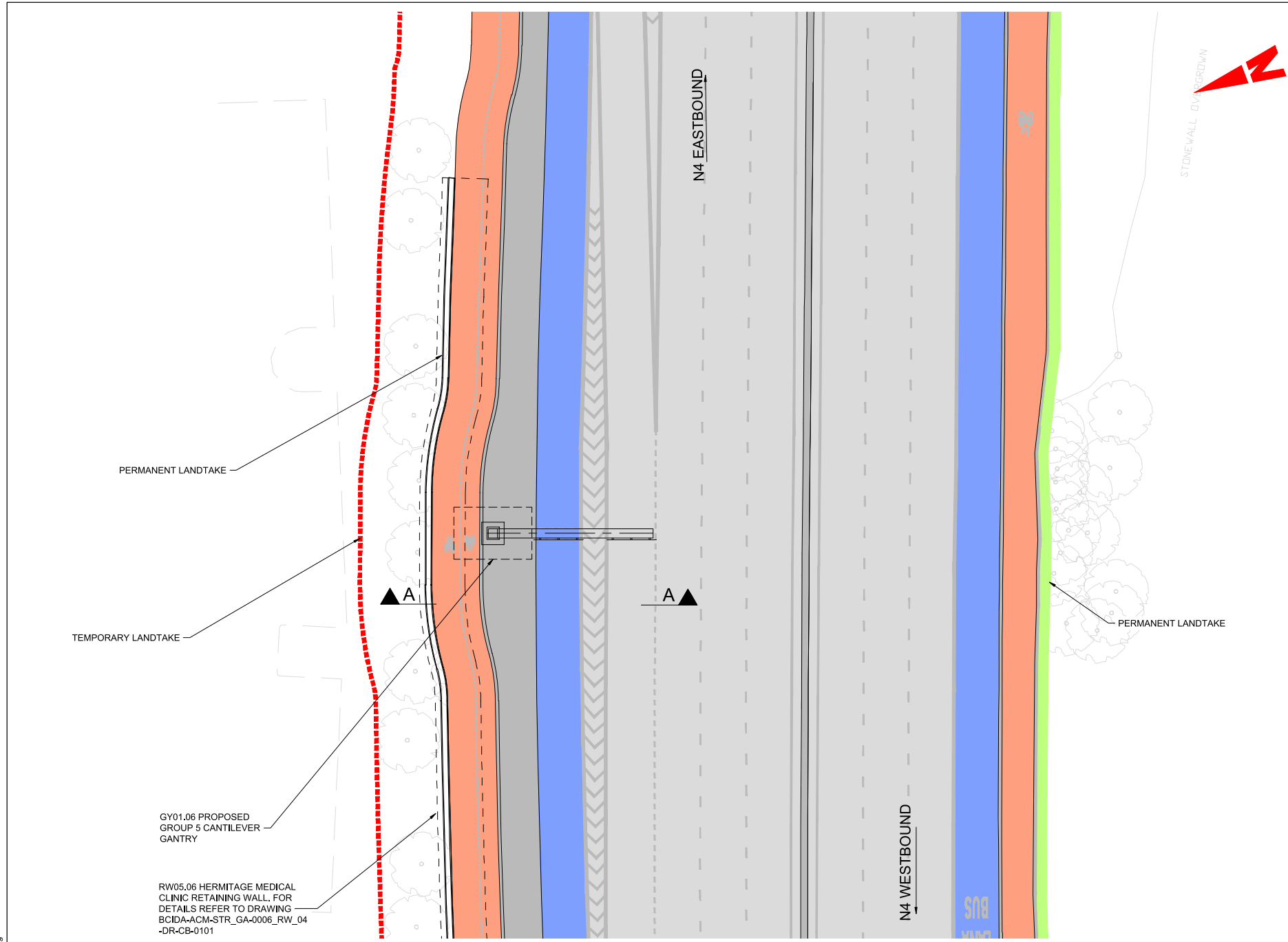
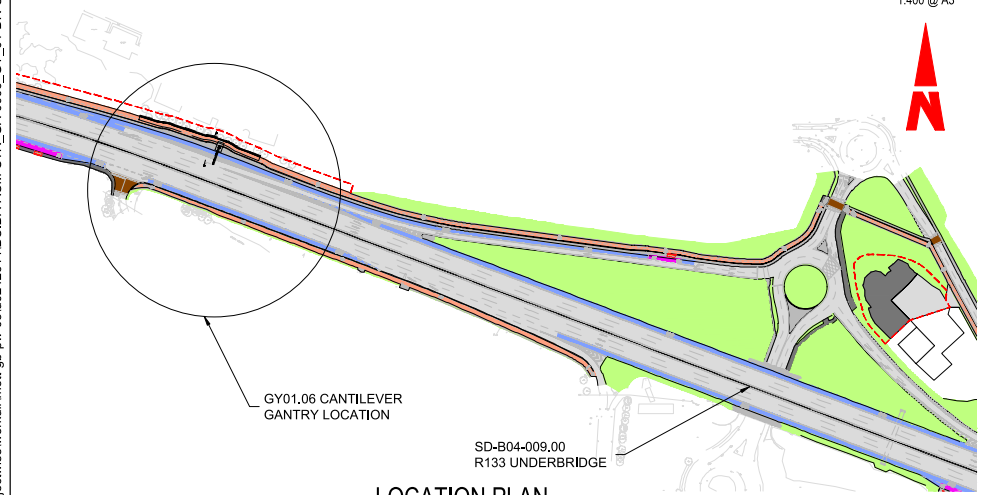


Figure 8-2 GY02 Portal Gantry

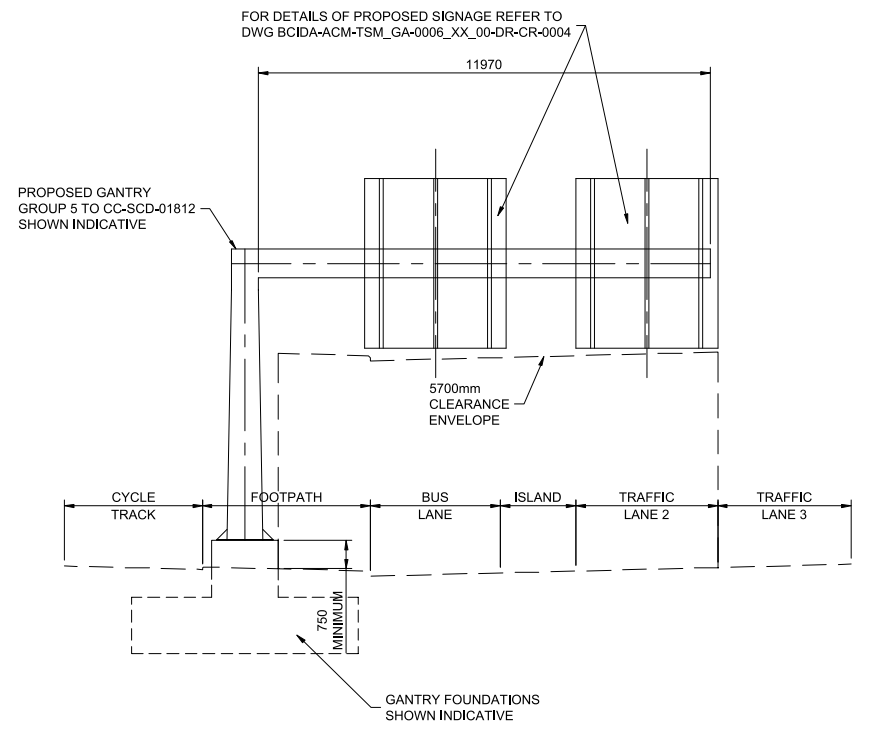
Appendix B Drawings



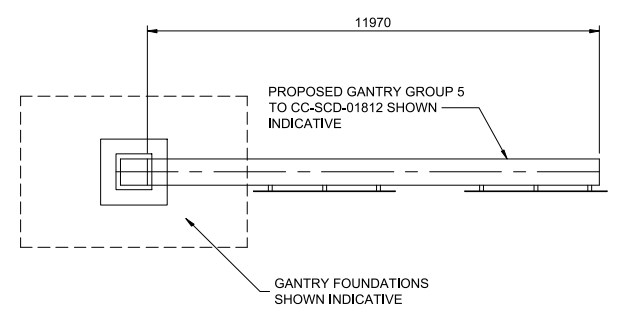
LOCATION PLAN
1:200 @ A1
1:400 @ A3



LOCATION PLAN
1:5000 @ A1
1:10000 @ A3



ELEVATION A-A
1:100 @ A1
1:200 @ A3



PLAN ON GANTRY
1:100 @ A1
1:200 @ A3

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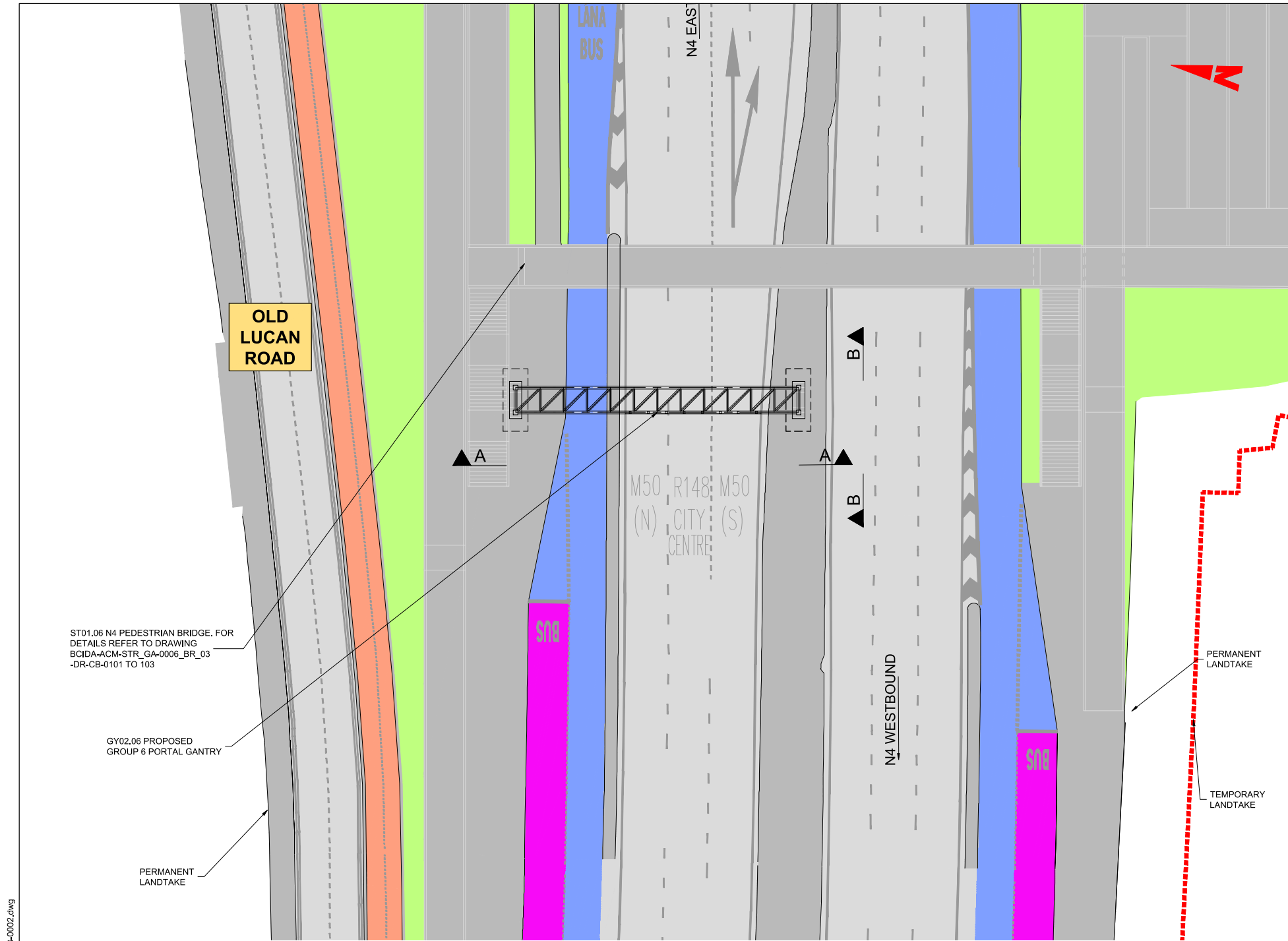
Rev	Date	Drn	Chk'd	App'd	Description
L02	21/01/22	DH	AD	CA	ISSUE FOR PHASE 3: PRELIMINARY DESIGN
L01	04/08/21	AC	CA	JS	ISSUED FOR APPROVAL

NTA Údarás Náisiúnta Iompair National Transport Authority		Engineering Designer AECOM M MOTT MACDONALD							
Date	21/01/22	Scale	AS SHOWN @ A1 1:1000 @ A3	Drawn	D.HAMILTON	Checked	A.T.DALE	Approved	C.ACTON
Project Code	BCIDA	Originator Code	ACM	OMS Code					

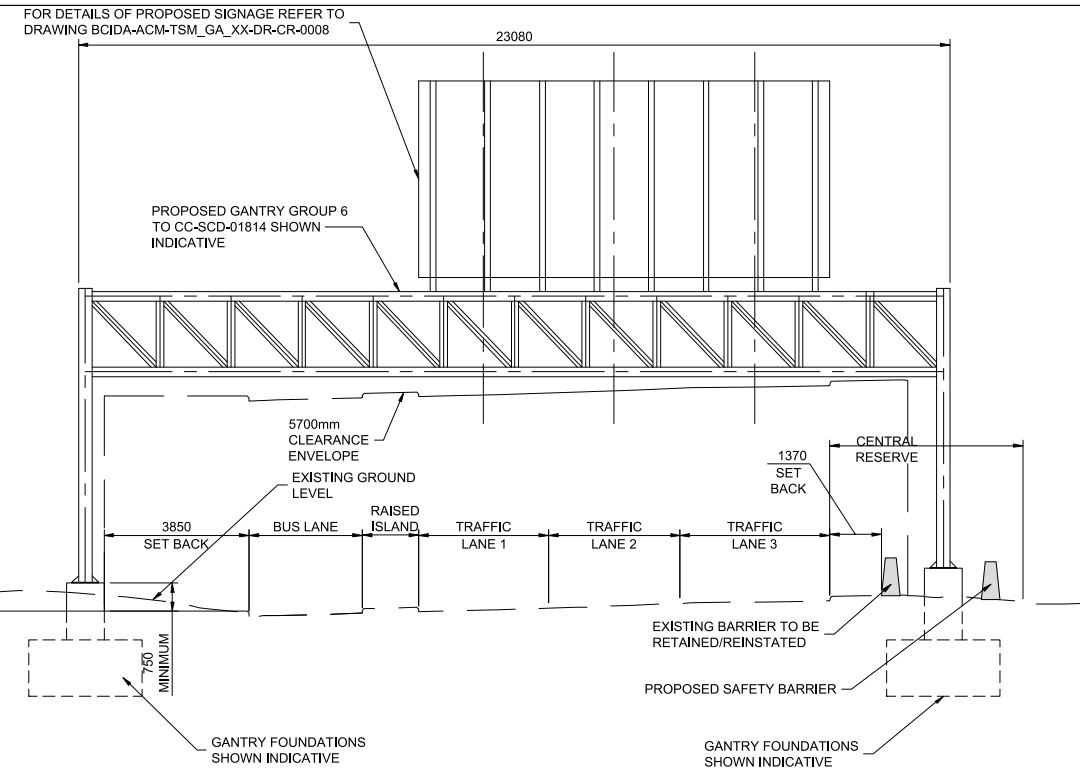
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Drawing Title LUCAN TO CITY CENTRE CORE BUS CORRIDOR SCHEME GY01.06 CANTILEVER GANTRY GENERAL ARRANGEMENT			
Drawing File Name	BCIDA-ACM-STR_GA-0006_GY_01-DR-CB-0001	Sheet Number	01 of 01
Status	A	Rev	L02

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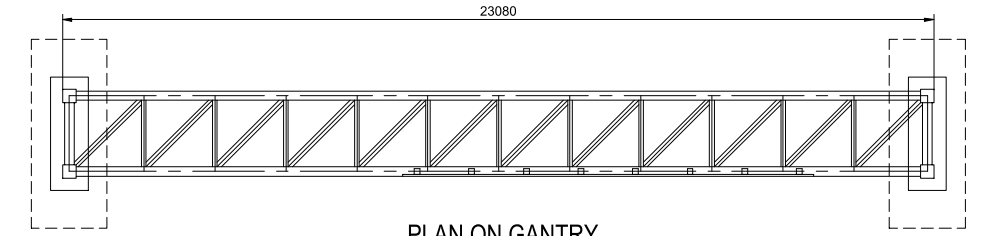
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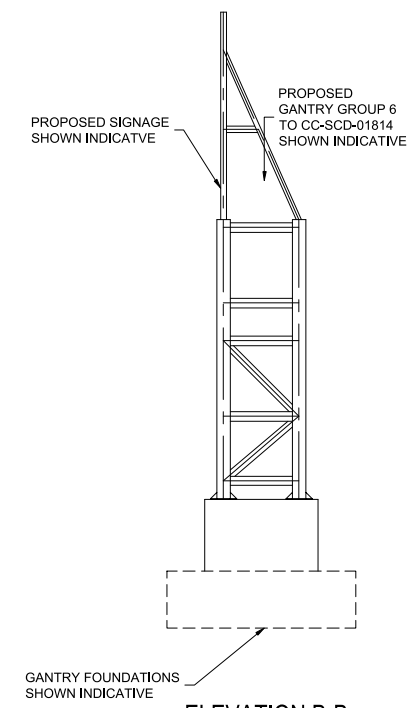
LOCATION PLAN
1:200 @ A1
1:400 @ A3



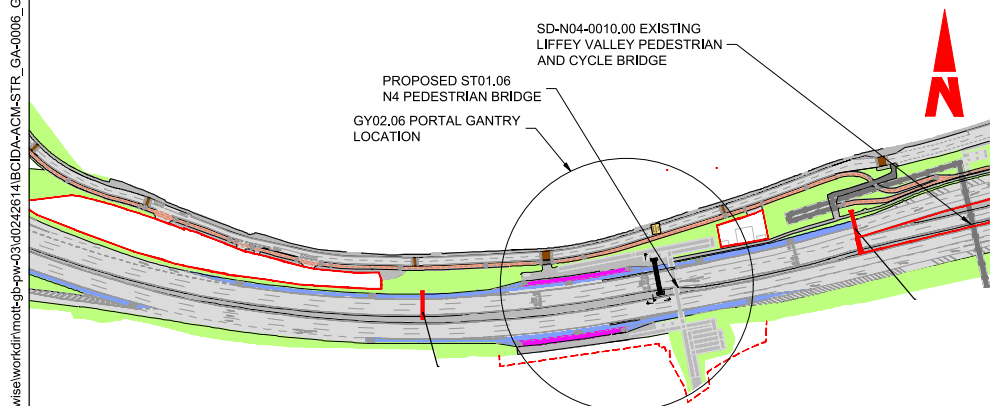
ELEVATION A-A
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1:200 @ A3



PLAN ON GANTRY
1:100 @ A1
1:200 @ A3



ELEVATION B-B
1:100 @ A1
1:200 @ A3



LOCATION PLAN
1:5000 @ A1
1:10000 @ A3

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Rev	Date	Drn	Chk'd	App'd	Description
L02	21/01/22	DH	AD	CA	ISSUE FOR PHASE 3: PRELIMINARY DESIGN
L01	04/08/21	AC	CA	JS	ISSUED FOR APPROVAL

Client NTA Údarás Náisiúnta Iompair National Transport Authority		Engineering Designer AECOM M MOTT MACDONALD		
Date 21/01/22	Scale AS SHOWN @ A1 AS SHOWN @ A3	Drawn D.HAMILTON	Checked A.T.DALE	Approved C.ACTON
Project Code BCIDA	Originator Code ACM	QMS Code		

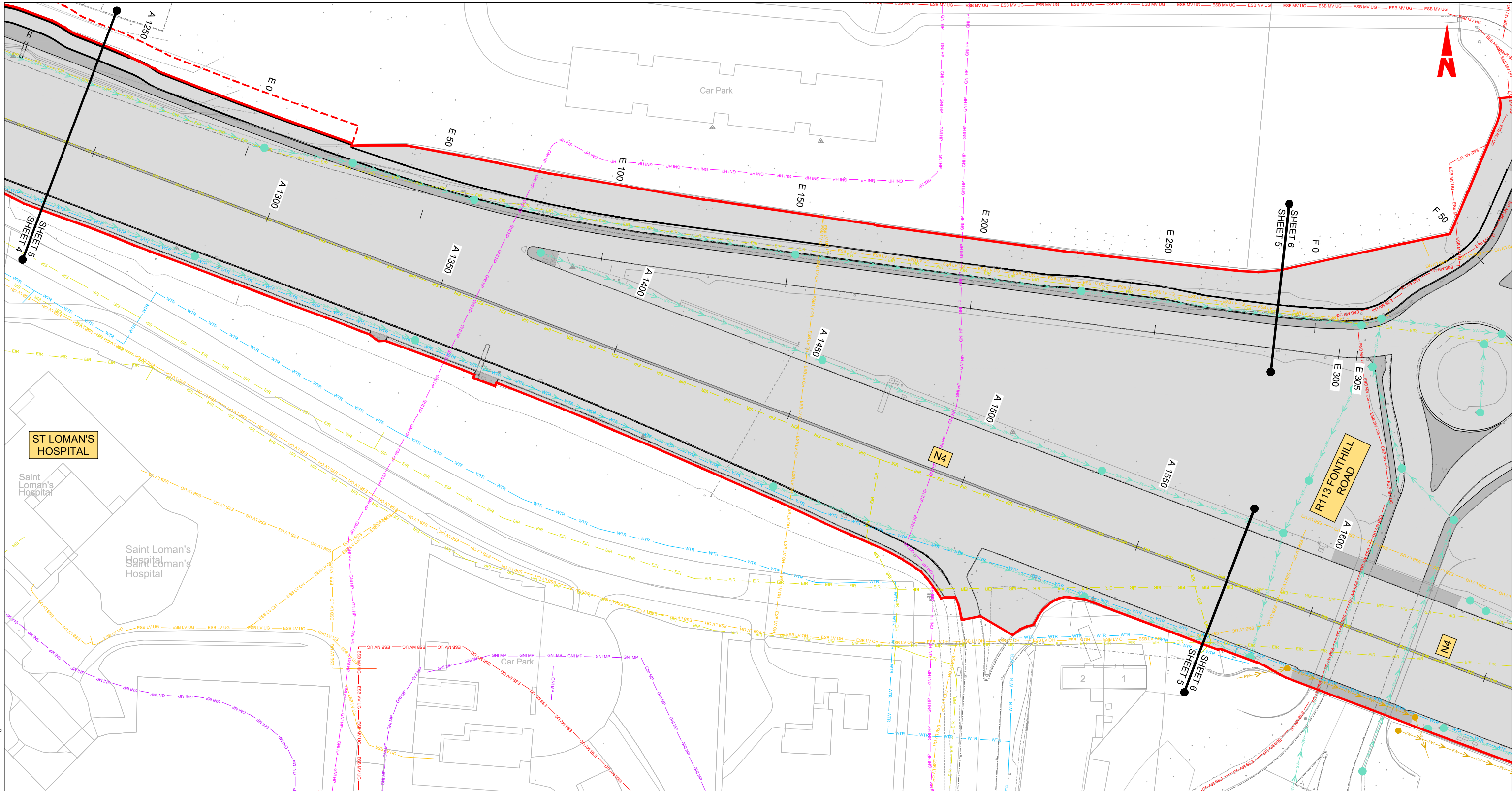
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Drawing Title LUCAN TO CITY CENTRE CORE BUS CORRIDOR SCHEME GY02.06 PORTAL GANTRY GENERAL ARRANGEMENT			
Drawing File Name BCIDA-ACM-STR_GA-0006_GY_01-DR-CB-0002	Sheet Number 01 of 01	Status A	Rev L02

W.I.P.

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Appendix C Utility Drawings

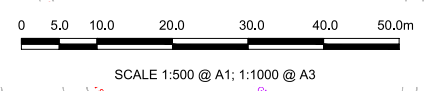


LEGEND:

- EXISTING KERB LINE
- EXISTING HV ELECTRICITY (UNDERGROUND)
- EXISTING HV ELECTRICITY (OVERHEAD)
- EXISTING MV ELECTRICITY (UNDERGROUND)
- EXISTING MV ELECTRICITY (OVERHEAD)
- EXISTING LV ELECTRICITY (UNDERGROUND)
- EXISTING LV ELECTRICITY (OVERHEAD)
- EXISTING LP GAS NETWORK
- EXISTING MP GAS NETWORK
- EXISTING HP GAS NETWORK
- EXISTING STORM WATER DRAINAGE
- EXISTING FOUL WATER DRAINAGE

NOTE: UTILITY LOCATIONS ARE INDICATIVE ONLY AND BASED ON UTILITY PROVIDER RECORDS

- PROPOSED KERB LINE
- EXISTING COMBINED DRAINAGE NETWORK
- EXISTING WATER NETWORK
- EXISTING VIRGIN MEDIA NETWORK
- EXISTING ESB DUBLIN DARK FIBRE
- EXISTING TELCO DUCT
- EXISTING ENET NETWORK
- EXISTING EIR NETWORK
- EXISTING FIBRE DUBLIN CITY COUNCIL NETWORK
- SITE BOUNDARY LINE
- TEMPORARY LAND ACQUISITION



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Rev	Date	Drn	Chk'd	App'd	Description
L04	11/02/22	PP	AD	CA	ISSUE FOR PHASE 3: PRELIMINARY DESIGN
L03	30/06/21	PZ	NS	JS	ISSUE FOR APPROVAL
L02	22/04/21	PZ	AD	JS	ISSUED FOR PEER REVIEW
L01	23/10/20	PZ	AD	JS	STAGE A - PEER REVIEW

W.I.P.

Client: **NTA**
Údarás Náisiúnta Iompair
National Transport Authority

Engineering Designer: **AECOM** **MOTT MACDONALD**

Date: 11/02/22
Scale: 1:500 @ A1, 1:1000 @ A3
Project Code: BCIDA
Originator Code: ACM

Drawn: P.POCZATKO
Checked: A.T.DALE
Approved: C.ACTON

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

Drawing Title: **LUCAN TO CITY CENTRE CORE BUS CORRIDOR SCHEME COMBINED EXISTING UTILITY RECORDS**

Drawing File Name	Sheet Number	Status	Rev
BCIDA-ACM-UTL_UC-0006_XX_00-DR-CU-0005	05 of 31	A	L04

Appendix D Designers Risk Assessment

BUSCONNECTS – Lucan to City Centre Route 0006
 CBC006-GY01 & GY02
 Designers Risk Assessment



Project Number:	60599126	Revision							
Client:	National Transport Authority	Rev	01	02	03	04	05	06	07
Designer:	AECOM	Date	21/06/22						
Contractor:	Not applicable	Client	✓						
Prepared by:	Adam Power	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	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.	N/A	Low	Contractor to ensure that fencing is erected and maintained throughout the construction works.
2	Access and egress to the site and compound	Access and egress to site and compound from busy urban area.	High	Traffic management to be implemented to ensure that safe access and egress is achieved	N/A	Low	The contractor is to ensure that suitable traffic management is implemented on site which includes appropriately designed and identified access points for site vehicles.
3	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.	N/A	Low	Appropriate hoarding to be provided at construction stage to separate works from areas of adverse ground conditions.
4	Underground services	Potential for unknown and/or undocumented services in the vicinity of the proposed structure.	Medium	Desk top study of available utility information carried out and all known services in the vicinity of the proposed structure have been shown on preliminary design drawings. Any additional services after the PDR have been identified in the detailed design.	In correctly utility locations provided in information received from utility providers. Changes to utilities in the period before construction.	Low	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.

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
5	Working at a Height	Risk of fall of plant, materials and people.	High	The gantry design has been developed to ensure the main structure can be lifted into position as a single unit. Simple connection details such as bolting have been considered as part of the preliminary design to provide an efficient assembly.	N/A	Medium	Detailed Design and Contractor to consider construction methodology of the main gantry overhead span.
6	Poor weather conditions	On days where weather conditions are poor, extra care must be maintained	High		N/A		Contractor must ensure workers are following health and safety regulations and must cease work if weather conditions escalate.
7	Substances hazardous to health	Risk of chemical exposure from construction materials such as waterproofing and silane.	High	Project Specific Specifications have been prepared to identify a number of likely substances to be used in the construction which is hazardous to health.	N/A	Medium	Contractor to refer to project specification for further information. All substances to be applied in line with manufacturers recommendations.
8	Manual handling	Injury to staff, possible back injury and/or crushing toes, caused by manual handling, lifting tools and equipment, moving materials, and/or hand digging.	High	Consideration of method of construction has been made during detailed design. Elements have been sized such that they can be easily fabricated of site and transported.	Appropriate location for crane to be determined.	Low	Contractor to develop method statements and ensure manual handling training is undertaken prior to manual handling activities. Only trained personnel to use tools. Only use the appropriate tool for each activity. Specialised equipment or mechanical hoist equipment to be used where appropriate.
19	Power Tools	Risk of clothing becoming entangled in moving parts; possibility of eye injuries from dust or other airborne fragments, when using power tools. Also, risk of wrist and/or hand injuries, due to power tools jamming or binding. Hand/Arm Vibration Syndrome (HAVS) from over use of power tools.	High	Consideration has been made during the design to maximise the use of prefabricated components to reduce the requirements for power tools on site.	N/A	Low	The contractor is to ensure safe systems of work are in place and followed at all times. Protective PPE including eye protection and safety footwear (laced) provided and all staff must have received manual handling training. Inspect all tools before use for damage/wear, do not use if damaged. Hydraulic tools to be used in accordance with manufacturer's procedures and safety procedures and serviced to the manufacturer's specification.

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
9	Repetitive tasks	Long term risk, due to repetitive use of vibratory equipment (compaction tools, breakers etc.), of vibration white finger, carpal tunnel syndrome, permanent and painful numbness and tingling in the hands and arms, due to the use of vibratory equipment.	High	Consideration of method of construction has been made during detailed design to ensure that the areas of compaction are kept to a minimum and where possible larger machine compactors will be used.	N/A	Medium	Operators to minimise the time spent during shift operating vibratory tools. Select power tools with the lowest vibration level. All operators to undergo regular HAVS assessments.
10	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	Site personnel should receive the required safety induction training. Appropriate signage should be erected to make site personnel aware of the potential hazards across the site. This is an important note as assembly of the gantry may require temporary lane closure, which would likely be during the quieter late hours.	N/A	Low	The contractor must ensure that all site personnel wear the required PPE at all times when on site. It is also the contractor's responsibility to ensure site personnel are not overworked and remain vigilant.
11	Live National Primary Road	Site is immediately adjacent to the N4. The road will be live during majority of construction	High	Traffic management to be implemented to ensure that safe working strips are provided to work areas.	Live traffic with traffic management zones	Medium	Traffic Management controls to be implemented on site during construction works. Contractor is to ensure that appropriate PPE is worn at all times and that all staff are aware of the risks of working near a live road.
12	Site security	Unauthorised access by members of the public to the works areas	High	Suitable hoarding/fencing to be erected to prevent unauthorised access to the works areas	N/A	Low	Contractor to ensure that fencing is erected and maintained throughout the construction works.
13	Slope/ground stability	Risk of embankment failure during construction	High	Embankments have been designed to ensure stability during temporary construction stages as well as the final construction. The depth of embankments has been limited where possible to reduce the risk of collapse.	N/A	Low	Stability of constructed embankments to be checked on a regular basis, surcharging with heavy plant to be avoided on embankments, if movement of heavy plant on embankments is required the embankment should be monitored.

