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Blessington eGreenway

Design Statement

Wicklow County Council

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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1. Introduction

The report provides details in relation to the design of the Blessington eGreenway. The scheme is proposed to travel around the Poulaphouca Reservoir in Blessington, County Wicklow. The scheme has been designed with reference to:

- Rural Cycleway Design (DN-GEO-03047-02) published by Transport Infrastructure Ireland.
- Greenways and Cycle Routes Ancillary Infrastructure Guidelines published by the Department of Transport Tourism and Sport.
- National Cycle Manual published by the National Transport Authority.

1.1 Project Description

The scheme is proposed to provide a predominately off-road shared use path for pedestrians and cyclists. The scheme will cover approximately 33km and involve the provision and upgrading of a greenway mostly through forest and woodlands adjacent to the shoreline of the Blessington Lake/Poulaphouca Reservoir SPA.

Traffic lights are proposed at three existing bridge crossings (Knockiernan Bridge, Baltyboys Bridge and Valleymount Bridge) to manage a new shuttle system for vehicular traffic. This will create space within the existing bridge cross section for the provision of a shared use path to accommodate users of the eGreenway.

The greenway surface construction is proposed to consist of a machine laid, bound pavement. A 20mm surface course is proposed to be laid on a 40 mm to 55 mm base course on 150mm Clause 804 subbase on a geotextile layer as required. Construction works will require shallow excavation (maximum depth of 200 mm - 300 mm), tree removal and replacement, placement of culverts, single span bridges over larger streams, fencing and minor landscaping.

The project involves the following (as shown in Figure 1):

1. Blessington – The Blessington section of the Proposed Development extends from the Wicklow County Council boundary at Russellstown to Blessington. The section comprises 9.2km in length. This section is proposed to consist of new greenway and the upgrade of existing sections along the route with a connection to Russborough House via an existing underpass of the N81. It is proposed to extend the capacity of the Russellstown car park with an additional 50 car spaces. Works to both the Russellstown Car Park and the Blessington eGreenway Hub and Car Park will provide electric vehicle charging points, bicycle parking, bins, seating areas, drinking water stations and CCTV. There is 1 no. new watercourse crossing included in this section while several existing crossings are to be retained.
2. Baltyboys – The Baltyboys section of the Proposed Development extends from the Blessington section to the Valleymount section. This section comprises 5.3km in length. Works to the Valleymount West Car Park and Baltyboys car park will provide electric vehicle charging points, bike parking, bins, seating, drinking water stations and CCTV. Precast box culverts and gabion retaining walls will be required within this section to construct the Proposed Development. There are approximately 5 no. small watercourses/ditches crossings along this section.
3. Tulfarris – The Tulfarris section of the Proposed Development connects the Baltyboys section to Tulfarris via the R758. This section comprises 3.7km in length. This section is proposed to consist of new greenway and share the existing road to connect with the Tulfarris Hotel & Golf Resort. There are approximately 2 no. new small watercourse/ditch crossings along its length.
4. Valleymount – The Valleymount section of the Proposed Development extends from Baltyboys to Ballyknockan. This section comprises 5.2km in length commencing at the Valleymount carpark, which is located adjacent to Valleymount GAA Club. Works to the two carparks in Valleymount East and West will provide electric vehicle charging points, bicycle parking, bins, seating areas, drinking water stations, and CCTV. Precast box culverts and gabion retaining walls will be required within this section. There are approximately 3 no. small watercourses/ditches crossed by the Proposed Development in this section as well as a crossing of the Annacarney Stream.

5. Ballyknockan – The Ballyknockan section of the Proposed Development extends from Ballyknockan to Lacken. This section comprises 4.3km in length. Gabion retaining walls will be required within this section. Due to the high ground to the east there are a few small tributaries on this section with approximately 13 no. small watercourses/ditches requiring to be accommodated by the Proposed Development.

6. Lacken – The Lacken section of the Proposed Development extends from Lacken to Knockiernan Bridge. This section comprises 5.6km in length. The section involves new greenway construction. Precast box culverts, concrete underpasses, and gabion retaining walls will be required within this section. It is proposed to extend the capacity of the Knockiernan car park with an additional 50 car spaces. Works to both Knockiernan and Lacken car park will provide electric vehicle charging points, bicycle parking, bins, seating areas, drinking water stations, and CCTV. The eastern side of the lake has many small tributaries which will require the Proposed Development to accommodate approximately 7 no. small watercourses/ditches.

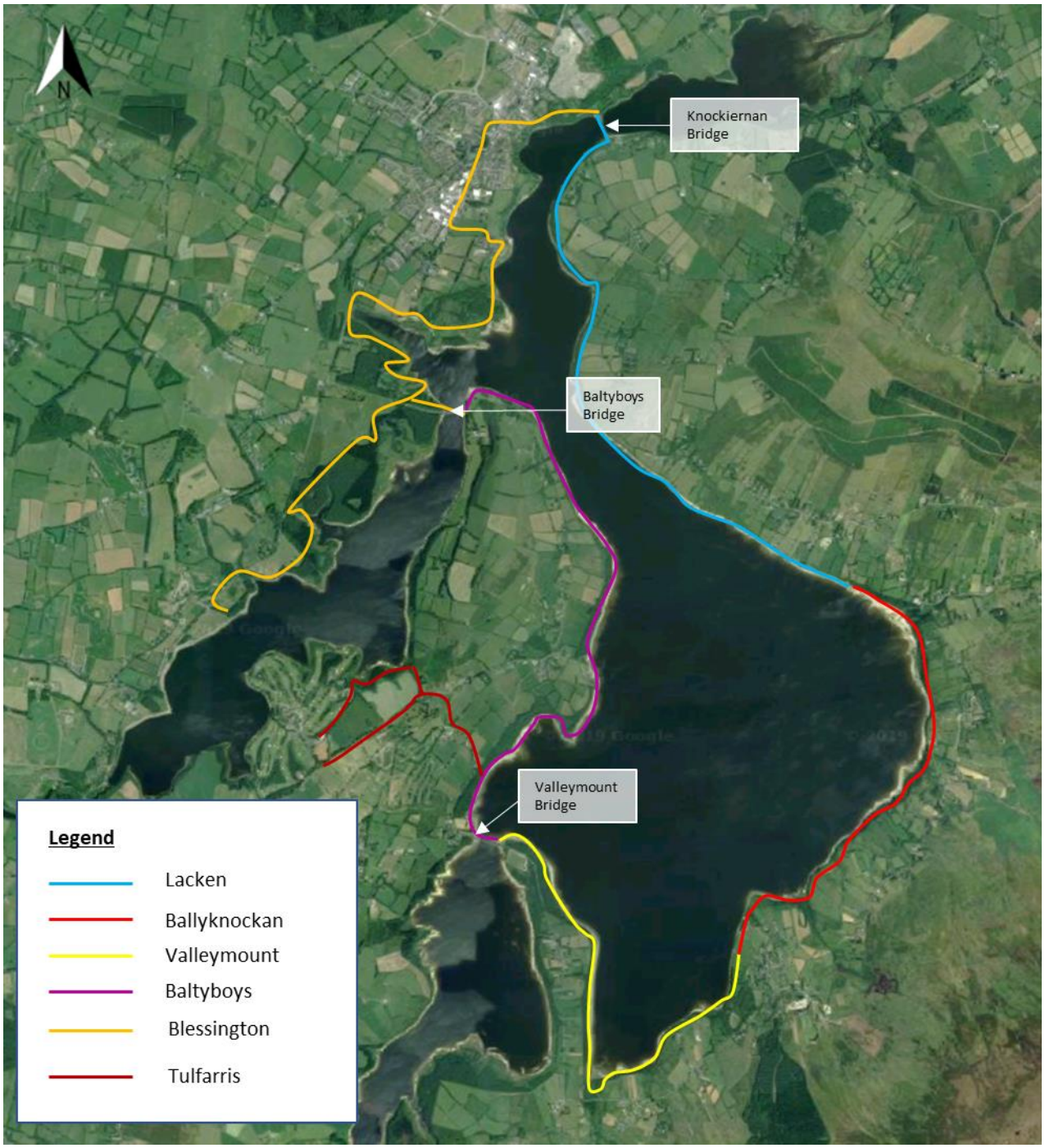

Figure 1 Blessington eGreenway Routing

1.2 Blessington eGreenway Concept

The proposed Blessington eGreenway is a predominantly traffic free path, designated for use by pedestrians, cyclists, and other non-motorised users such as wheelchair users, and will travel along the shore of Blessington Lake. The Blessington eGreenway will be Ireland's first eGreenway with electric bike and car charging facilities and is proposed on lands predominately within the ownership of the ESB. This Greenway will be a signature Ireland's Ancient East visitor experience, and it will add value to existing venues in the surrounding counties and provide a West Wicklow 'bookend' to the East Wicklow Glendalough experience.

The eGreenway vision for the Greenway comprises the following elements:

- Sustainable **Energy**: the Greenway encircles the water used to generate hydroelectricity, and this sustainable energy theme is replicated on the Greenway through the provision of electric bike and electric car-charging.
- **Exercise**: The Greenway provides a self-led facility for sport and exercise as well as a resource for group and commercial exercise activities.
- **Eco-Tourism**: The Blessington E-Greenway concept supports environmentally sustainable travel in a natural area through a variety of means, bike, walk, sail, kayak, row, equestrian, while also supporting the local economy and the well-being of the host community. As part of this approach, supporting facilities such as a native woodland planting programme, bird hides and outdoor classrooms will be developed while interpretation/education resources will be provided at each car park.
- **Events**: a variety of directly organised and supported events will form part of the ongoing animation of the Greenway. These events will include recreation, environmental and sports competitions.
- **Epicurean**: local dining providers are supporting the Blessington area as a good-food location with an emphasis on locally grown quality dining experiences.

1.3 Code of Conduct

Signage will be provided at trailhead car parks to make users aware that they share the facility with others and that they need to respect the needs of these other users. Effective sharing is more likely if the user is presented with a standard Code of Conduct, and encounters simple awareness raising information at all access points to the Greenway, especially where new users might commence their journey or where others may first encounter the facility. It is intended that a code of conduct will be developed and displayed at key locations along the facility.

1.4 Universal Accessibility

It is intended that the design and management of the Greenways will provide a safe, attractive, accessible, coherent experience and provide users with the opportunity to engage with the natural and built heritage of an area. Universal accessibility has been considered through the provision of appropriate car parking spaces, and the technical aspects of the facility such as width, and gradient.

1.5 Landownership

It is intended that the Blessington eGreenway will be delivered on lands owned predominately by the Electricity Supply Board (ESB). Approximately 600m of the Proposed Development travels adjacent to the N81 which is in Co. Kildare. An agreement is in place with Kildare County Council in accordance with Section 85 of the Local Government Act 2001 (as amended).

Figure 2 Existing Blessington eGreenway at The Avon

2 Greenway Design

2.1 Cross Section

The minimum width of the greenway will be 3m. This will widen to 4m in the vicinity of the trailhead car parks where the volume of pedestrians and cyclists is anticipated to be higher. This will provide safety and comfort to both the cyclists and pedestrians on the greenway.

Objects such as trees and fences are likely to be adjacent to the scheme. It is necessary to provide a buffer between the object and the cycleway to avoid limiting the effective capacity. Where possible a minimum verge width of 1.0m will be provided on either side of the greenway.

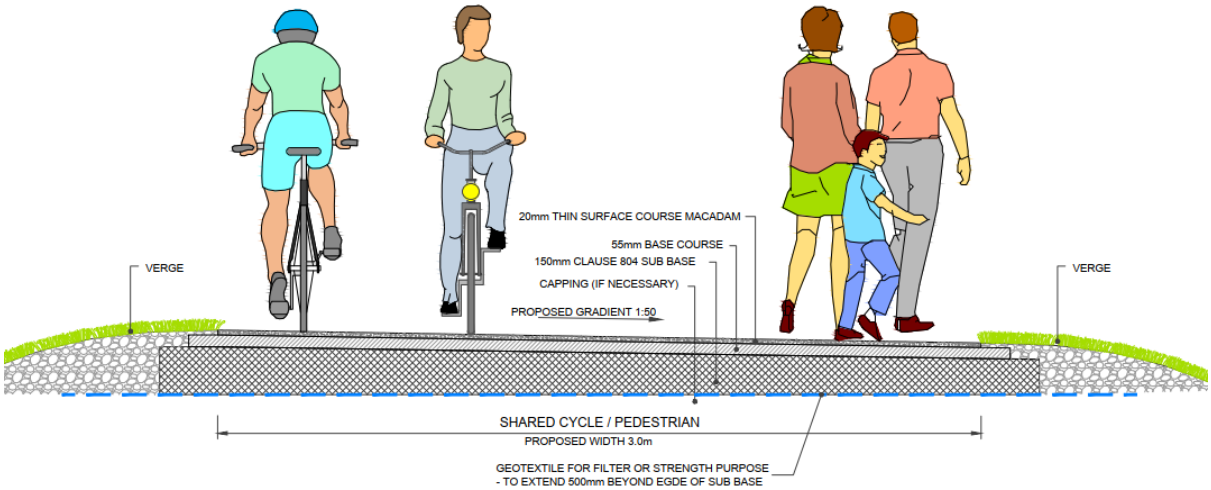

Figure 3 Typical cross section

2.2 Horizontal Alignment

To provide good forward visibility and deliver a safe and comfortable level of cycling, sufficient horizontal radii are required where constraints allow a minimum horizontal radius of 25m will be provided.

2.3 Cross Falls

The proposed cross fall for this project is 2.5% which fall towards the reservoir which allows surface water to naturally drain towards the reservoir. This also matches the natural topography of the land making the drainage easier to manage. This will ensure the Greenway is adequately drained and reduces the potential for standing water and ice on the greenway

2.4 Vertical Alignment

The vertical alignment will be less than 5% where possible. Should a higher gradient be required it will be kept to short distances, preferably less than 100m in length. This is a key issue for universal accessibility. A gradual vertical alignment positively affects the comfort and attractiveness of the scheme. It also reduces the potential for steep downhill speeds which leads to higher speeds and a requirement for longer stopping distances.

2.5 Road Crossings

The interactions between the cycleways and the public road is an important component of the design of the greenway. Motorists need to understand where to expect interactions with pedestrians and cyclists on the public road. Pedestrians and cyclists need to understand the control measures in place when interacting with vehicles travelling on the public road. Crossing facilities will include signage in respect to which user has priority. Approaches to crossings and junctions will be at right angles and adequate advance warning signage will be provided in line with the Traffic Signs Manual (TSM). Road crossings provide accessibility to the facility.

Table 1. Road Crossings

Sections	Number	Road Crossings
Blessington	3	N81, R758, Kilbride Road
Baltyboys	4	R758 (3 No. Crossings), Blessington Sailing Club access
Tulfarris	0	On road
Valleymount	1	R758
Ballyknockan	0	-
Lackan	0	Underpass to Lake Drive

Figure 4 below shows the typical layout at road crossings.

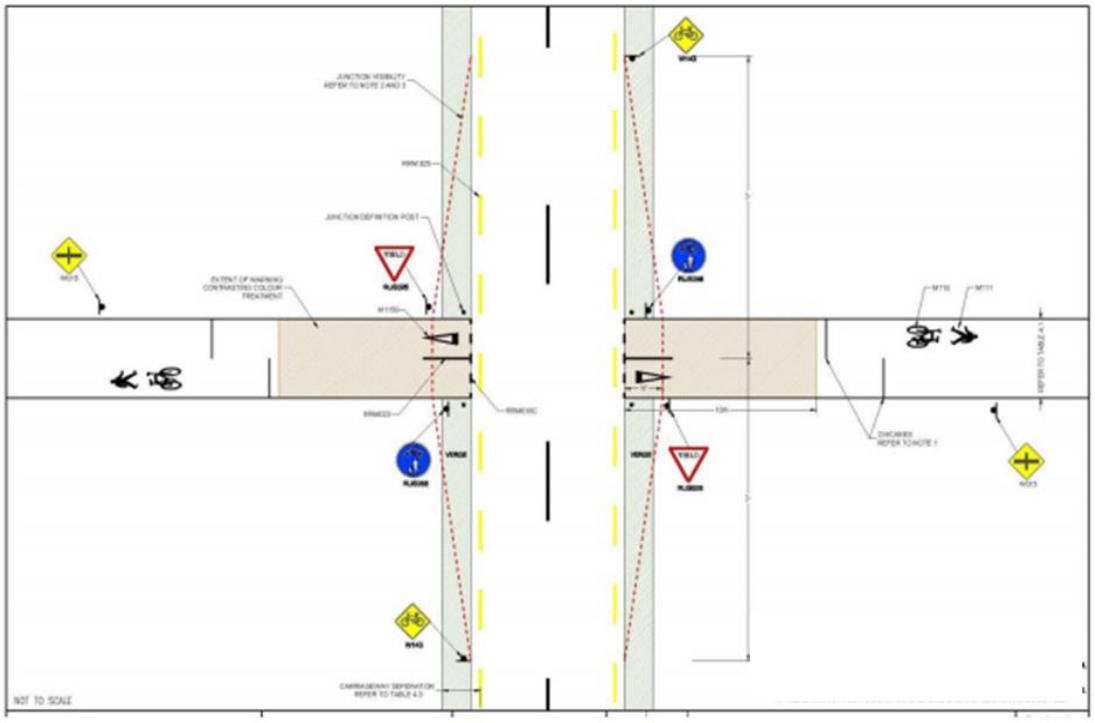

Figure 4 Road Crossing Layout

To ensure the appropriate use of the Greenway it is proposed to provide barriers as indicated in the layout shown in Figure 5. Access control features will be designed to facilitate access for prams, wheelchairs, and bike types such as cargo bikes and bikes with panniers.

Traffic lights are proposed at three existing bridge crossings (Knockiernan Bridge, Baltyboys Bridge and Valleymount Bridge) to manage a new shuttle system for vehicular traffic. This will create space within the existing bridge cross section for the provision of a shared use path to accommodate users of the eGreenway (Refer to Appendix A for Bridge Shuttle Study).

Figure 5 Bollard Access Control

2.6 Drainage

Rainwater that falls onto the greenway will run over the edge towards the reservoir. This should not be any significant change to the current situation. Suitable crossfalls between 1% and 3% will be chosen where possible with a 2% cross fall anticipated for much of the route.

The proposed route interacts with several drainage ditches. These drainage ditches collect surface water from the neighbouring fields and bring the water into the reservoir. Appropriately sized drainage pipes or culverts will be provided to allow for the water to flow into the reservoir as it currently does.

Drainage pipes will also be used beneath the greenway in locations where fill earthworks have the potential of causing ponding for surface water runoff. The purpose of these drainage pipes will be to bring the surface water beneath the greenway so that it can continue to flow into the reservoir.

For the sections of the project between The Avon and Blessington Town where existing kerbs are to be relocated for footpath widening, and the cycle paths, new gullies and connections will be provided to maintain the existing drainage system.

2.7 Pavement

A bound pavement is proposed consisting of the following:

- 20mm surface course.
- 40mm to 55mm base course.
- 150 Clause 804 sub-base.
- Geotextile layer (where necessary).
- Capping (where necessary).

A machine laid sub-base is proposed as this will provide a much more even surface with better ride comfort and better drainage than using a hand laid approach. An elevated boardwalk over short sections may be required where ground conditions do not facilitate the application of capping and sub-base material.

2.8 Structures

Traffic lights are proposed at the three existing bridge crossings (Knockiernan Bridge, Baltyboys Bridge and Valleymount Bridge) to manage a new shuttle system for vehicular traffic. This will create space within the existing bridge cross section for the provision of a shared use path to accommodate users of the eGreenway. Appendix A contains a report titled 'Bridge Shuttle Study'. This provides an assessment of the operation of the traffic light shuttle system at the existing bridge crossings. It is proposed to allocate the traffic lane closest to the existing footway for the Greenway to maximise the use of the available space allocated to pedestrians and cyclists. From a structural perspective if is desired to upgrade the facility to a raised adjacent in the future, then this is easier to accommodate on this side.

Several new structures will be required throughout the scheme to facilitate the construction of the greenway within the available lands. A combination of culverts and bridges are required for the river crossings, depending on the length and elevation of crossing required. A Section 50 application will be required for a number of these crossings and this will be submitted to the Office of Public Works if planning permission has been obtained.

Table 2. Structural Elements

Section	Scheme Provision
Blessington	Rock armour - 367 m, retaining structure (gabions or similar) 44m
Baltyboys	Rock armour – 1614m
Tulffarris	none
Valleymount	Rock armour – 310m, Annacarney bridge structure
Ballyknockan	Rock armour – 278m
Lacken	Rock armour - 942m, Underpass to local road to connect to Knockiernan car park

To cross the Annacarney stream in the Valleymount section it is proposed to provide a new bridge structure. Currently the L4365 Lake Drive crosses Annacarney stream using a 3 span insitu concrete bridge constructed circa 1939. The existing Annacarney Bridge cross section accommodates two 2.1m wide carriageways with minimal verges over the stream and as a result there is insufficient space to accommodate the proposed greenway. Therefore, it is proposed that a new greenway structure be constructed at the toe of the existing bridge embankment. This is proposed to comprise of longitudinal and transverse deck members and provide a slender structure. It will require the construction of two full height cast insitu concrete abutments to support the bridge. The abutments will allow the steel beam to span the stream with the potential added advantage of larger span capabilities to that of a precast concrete box and arch.

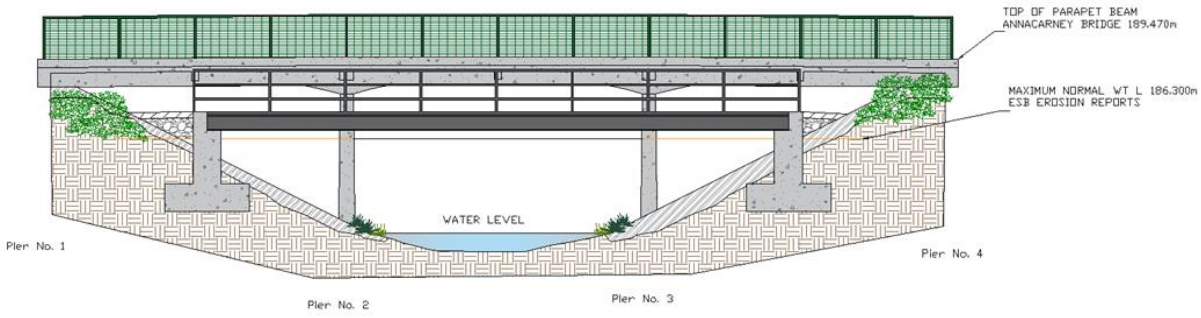

Figure 6 Section showing proposed new greenway bridge with existing Annacarney road bridge in background (Subject to separate Section 50 approval process)

Elsewhere the scheme will provide facilities to facilitate water flow towards the lake. A variety of piped crossings and precast box culverts will be involved. A Section 50 application will be required for a number of these crossings and this will be submitted to the Office of Public Works. Bridges and culverts will be subject to hydraulic design.

2.9 Erosion Protection Measures

Rock armour has been placed in various locations along the shoreline by the ESB to manage the impact of coastal erosion on the land. Figure 7 shows existing rock armour at Lacken. Similar erosion protection measures are proposed to protect the Greenway as outlined in Table 1 above.

Figure 7 Existing Rock Armour at Lacken

2.10 Car Parking Facilities

It is proposed to upgrade the car parking facilities. Table 3 below provides details as to the proposals:

Table 3. Upgrade to Car Parking Facilities

Location	Upgrades
Knockerinan	Extension of existing car park by 50 spaces. Provision of drinking water stations, electric vehicle and bike charging points, bicycle parking, bins, seating, information signage and CCTV.
Lacken	Provision of drinking water stations, electric vehicle and bike charging points, bicycle parking, bins, seating, information signage and CCTV.
Valleymount (East)	Provision of drinking water stations, electric vehicle and bike charging points, bicycle parking, bins, seating, information signage and CCTV.
Valleymount (West)	Provision of drinking water stations, electric vehicle and bike charging points, bicycle parking, bins, seating, information signage and CCTV.
Baltyboys	Provision of drinking water stations, electric vehicle and bike charging points, bicycle parking, bins, seating, information signage and CCTV.
Russellstown	Extension of existing car park by 50 spaces. Provision of drinking water stations, electric vehicle and bike charging points, bicycle parking, bins, seating, information signage and CCTV.
Blessington eGreen way Hub	Provision of drinking water stations, electric vehicle and bike charging points, bicycle parking, bins, seating, information signage and CCTV.

2.11 Access to Shoreline

There a small number of slips (Lacken & Ballyknockan) that provide access to the lake from the shoreline. It is intended these access points will be provided with gated crossings of the Greenway to ensure access to the shoreline is retained. Priority is proposed to be provided to Greenway users.

2.12 Trees

An Arboricultural Survey and Assessment (ASA) prepared by Flynn Furney Environmental Consultants concludes that c. 7,265 trees will be required to be removed to facilitate the scheme.

Tree management activities undertaken on behalf of the ESB typically involve the clear felling of between 1,750 and 2,500 trees every 2/3 years. The ESB also conducts thinning activities which typically involves the removal of 75 to 225 trees every 2/3 years. Thus, tree felling occurs in this area as part of routine tree management activities.

The project will replace the c.7,265 trees that will be required to be felled to facilitate the scheme. This will involve planting new native species tree along the route in ESB lands (approx. 2,300 trees at 10m centres over approx. 23km), and lands adjacent to scheme owned by Wicklow County Council (at Knockieran Car Park, Burgage area and the Avon area) which will accommodate 4,965 trees.

2.13 Flooding

A Flood Risk Assessment of the proposed Blessington eGreenway has been developed. This assessment concludes the Greenway facility is classified a ‘Water-Compatible Development’ and therefore its construction is appropriate subject to suitable mitigation measures.

The vertical design of the greenway takes into consideration the historic water levels reached in the reservoir and the possible levels that could be reached in very extreme situations along with mitigation measures such as access control for events above such a level. Access and egress during flood events are of critical importance and is a key consideration in the design, particularly given how rapidly the water level in the reservoir can rise. Flood forecasting will be used to ensure Health and Safety remains a key priority in terms of management and operation of the greenway.

3 Appendix A: Bridge Shuttle Study

Blessington eGreenway

Bridge Shuttle Study

Wicklow County Council

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
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Figures

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1. Executive Summary

This document examines the feasibility of a shared use path being incorporated onto the existing bridge locations on the proposed eGreenway route. Each bridge design has a Toucan crossing setback approximately 30m to link the eGreenway route into the shared use across the bridges.

The document outlines the shuttle working designs that have been created and the operational impact at the three bridge locations:

1. Knockieran Bridge
2. Baltyboys Bridge and
3. Valleymount Bridge.

Traffic modelling was undertaken to assess the shuttle working designs of three existing bridges. This assessment concludes that the shuttle working on the three bridges can be satisfactorily accommodated and will not result in traffic congestion.

2. Introduction

Background

2.1 This technical note has been prepared for the Blessington eGreenway around the Poulaphouca Reservoir, Blessington County Wicklow.

2.2 The provision of this scheme is central to realising the tourism potential of the Blessington Lakes and will contribute to meeting the objectives of the Wicklow County Council (WCC) County Development Plan 2016-2022 in relation to tourism and recreation.

2.3 The indicative route is outlined in **Figure 1** below.

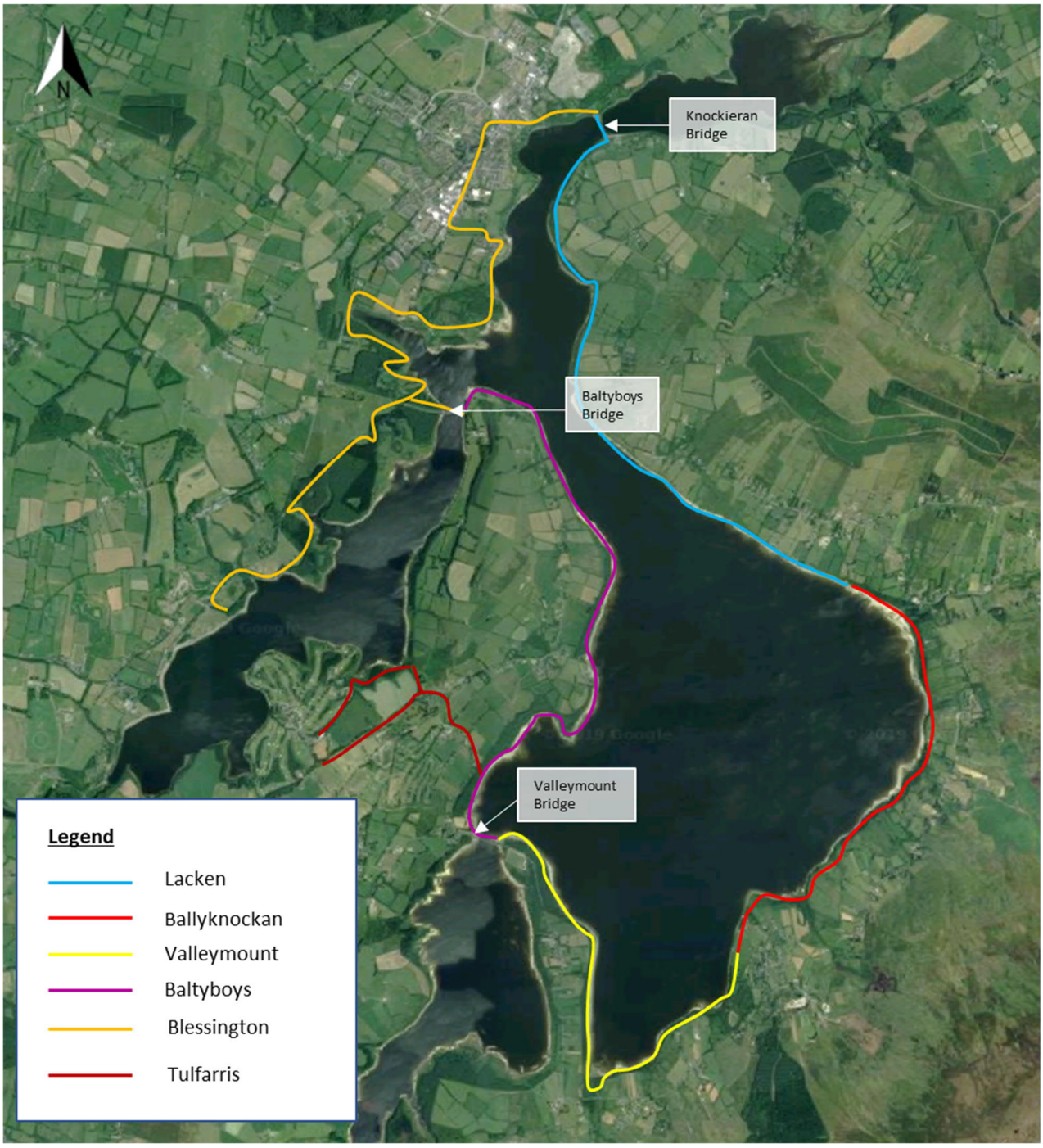


Figure 1 – Blessington eGreenway Routing

Study Objectives

2.4 This document examines the feasibility of a shared use pedestrian and cycle path being incorporated into the existing bridge locations, whilst maintaining a single bi-directional traffic lane; this document outlines the shuttle working designs that have been created and their operational impact at the following bridge locations:

1. Knockieran Bridge;
2. Baltyboys Bridge; and
3. Valleymount Bridge.

2.5 The existing bridges allow two-way traffic with no traffic signal control; traffic demands are low throughout the day. There are no segregated cycle facilities at any of the sites and cyclists are assumed to use the carriageway as there are narrow pedestrian footways across all the bridges.

2.6 The objectives and deliverables of the study are to provide:

- a design drawing identifying a shuttle working traffic management arrangement for each bridge; and
- a traffic modelling assessment for each bridge to establish the requirement for traffic signal operation.

2.7 Traffic modelling software (LinSig version 3) was used in this assessment.

Document Structure

2.8 In the following chapters, the report outlines the design and site-specific considerations required for shuttle working on the E-Greenway and explores in more detail the designs developed per bridge and the assumptions made throughout:

Chapter 2 – Data Availability

Chapter 3 – Shuttle Working Methodology

Chapter 4 – Knockieran Bridge

Chapter 5 – Baltyboys Bridge

Chapter 6 – Valleymount Bridge

Chapter 7 – Conclusion and Next Steps

3. Data Availability

3.1 Traffic counts were obtained from Tuesday 4th May – Wednesday 19th May 2021. Raw data provided was directional and classified.

3.2 AECOM selected the peak period by assessing the max total volume at a count site per hour from a mid-weekday. The highest flow periods were variable in the AM and PM peaks; the highest flow peak hours were chosen per site to assume worst-case flow proportion scenarios. The highest flow periods only show assumed tidal behaviour at Knockieran Bridge.

3.3 Flows were classified as 5 separated vehicle types: Two-Wheelers, Cars, Vans, Trucks and Semi-Trucks. LinSig only accepts flows in a standardised lengths of Passenger Car Units (PCUs) where 1 PCU = 5.75m. The flows provided by the survey company were not standardised to a PCU class, therefore AECOM have converted the flows using assumed PCU factors as below:

Table 1 – PCU Conversion Factors

Vehicle Type	Two-wheelers	Car	Vans	Trucks	Semi-Truck
PCU Factor	0.5	1	1	1.5	2.3

3.4 The model assesses the 2021 base year only with no growth assumptions made for forecast design years. Similarly, there are no committed developments assumptions for the network.

4. Shuttle Working Methodology

Overview

4.1 The scheme concentrates on improving walking and cycling facilities around Blessington Lake whilst understanding the impact on the junction capacity at the three key bridges when signalising and allowing shuttle behaviour across the bridge for motorised traffic only. The modelling results will be reviewed from a traffic capacity perspective to assess if there are any capacity concerns by implementing the proposed schemes.

Design Considerations

4.2 In order to include a shared footway and cycleway across each of the three bridges, the carriageway needs to be narrowed to a single traffic lane to be used in turn for each direction to cross the bridge.

4.3 Entry onto the bridge is proposed to be signalised to control when traffic can cross without conflicting with opposing traffic. Adjacent Toucan crossing facilities are also proposed to allow crossing of the carriageway prior to the bridge entries to then join the uncontrolled shared path and cross the length of the bridge.

4.4 Designing the shared path on the side of the existing narrow footpath is considered to be structurally appropriate as the existing kerbs form part of the existing structure. It is assumed for this concept design that the shared path will be protected from the traffic lane by using containment kerbs instead of a vehicle restraint system which would require a working width and set back which would limit the width given to the shared footpath and carriageway. A vehicle restraint system is proposed to remain between the carriageway and bridge parapet.

Operational Considerations

Operation

4.5 All schemes have a shuttle working design whereby traffic is given right-of-way across the bridge with the opposing movement held. When a phase loses right-of-way, an all-red stage will be active and extended based on detection of vehicles remaining on the bridge. Once the vehicles have cleared the bridge the previously opposing phase will be called to cross the bridge.

4.6 A toucan crossing is proposed to connect with the pedestrian and cycle paths adjacent to the bridges.

4.7 The Toucan crossing traffic signals will be coordinated with the shuttle working to ensure traffic is not stopped when exiting the bridge.

4.8 For the shuttle working system, it is proposed that two traffic phases, A and B, and two extendable dummy ‘clearance’ phases, C and D, are used.

4.9 The dummy extendable all red phases, C and D, are extendable by traffic detection in reality; within LinSig there is no variability for these all red stages and therefore the longest expected all red time has been modelled.

4.10 The following outlines an example of the stage sequence proposed and operating within the LinSig models, where:

- Stage 1 – Traffic Stage (single direction);
- Stage 2 – All Red bridge clearance from Stage 1;
- Stage 3 – Traffic Stage (single direction); and
- Stage 4 – All Red bridge clearance from Stage 3.

4.11 A phase delay is proposed to hold the bridge entry green following the termination of the traffic signals at the upstream Toucan crossing.

Modelling

4.12 In LinSig, each stage is assumed to be demanded once per cycle over an hour-long period. In reality, the pedestrian crossing may not be demanded in every cycle or an all-red stage may be longer or shorter than modelled.

4.13 The all-red stages were modelled to replicate on-site signalisation where the all-red could be extendable on-site dependent on detection, however the LinSig model cannot replicate this as outlined in **Section 4.9**.

4.14 Lane lengths on approach have been modelled as the length to the preceding junction. Where the preceding junction is beyond the default lane length (60 PCUs/365m), the lane length remains unaltered. Custom lane lengths have been entered based on the appropriate full movement from stopline to stopline; it is assumed that cruise speed for movements preceding the bridge are 45kph and movements on the bridges are assumed to have a cruise speed of 32kph.

4.15 Saturation flows for signalised stoplines were assumed to be 1800 (PCU/hr) which equates to 1 vehicle every 2 seconds, the default value within LinSig. The RR67 formula in-built within LinSig was not used to calculate the saturation flows, as this can generally be observed to overestimate saturation flows compared to onsite conditions. The bridge is narrow and may have more cautious drivers, so it is more robust to assume a conservative saturation flow.

4.16 When reviewing modelling results in LinSig in the following section, the key outputs to consider are Practical Reserve Capacity (PRC %), Delay (PCUs per hour) and Mean Max Queues (MMQ):

- The PRC is a measure of how much additional traffic could pass through a junction whilst maintaining a maximum Degree of Saturation (DoS %) of 90% on all Lanes, where the PRC is calculated from the maximum DoS of all lanes. It is therefore pertinent to consider the maximum DoS to outline which lane(s) are causing capacity constraints at the junction. Degree of Saturation is defined as the ratio of flow to capacity for the lane, where 90% is considered the maximum acceptable degree of saturation.
- Delay (pcu/hr) highlights the total aggregate delay on all lanes for the modelled peak hour.
- The Mean Maximum Queue (MMQ) represents the maximum queue within a typical cycle averaged over all the cycles within the modelled time period. When a lane is oversaturated the maximum queue within each cycle will grow progressively over the modelled time period.

5. Knockieran Bridge

Bridge Design

5.1 Knockieran Bridge is the northernmost bridge within the study, connecting Killbride Road and Lake Drive. The existing bridge features a narrow pedestrian footway on the northern side.

5.2 Outlined in **Figure 2** is the proposed design linking the Blessington eGreenway into the bridge. The design includes a Toucan crossing on the northern side of the bridge, including the creation of a shared use pedestrian and cycle path by reducing the width of the carriageway to a single bi-directional traffic lane. The concept Knockieran Bridge design is in **Appendix A**.

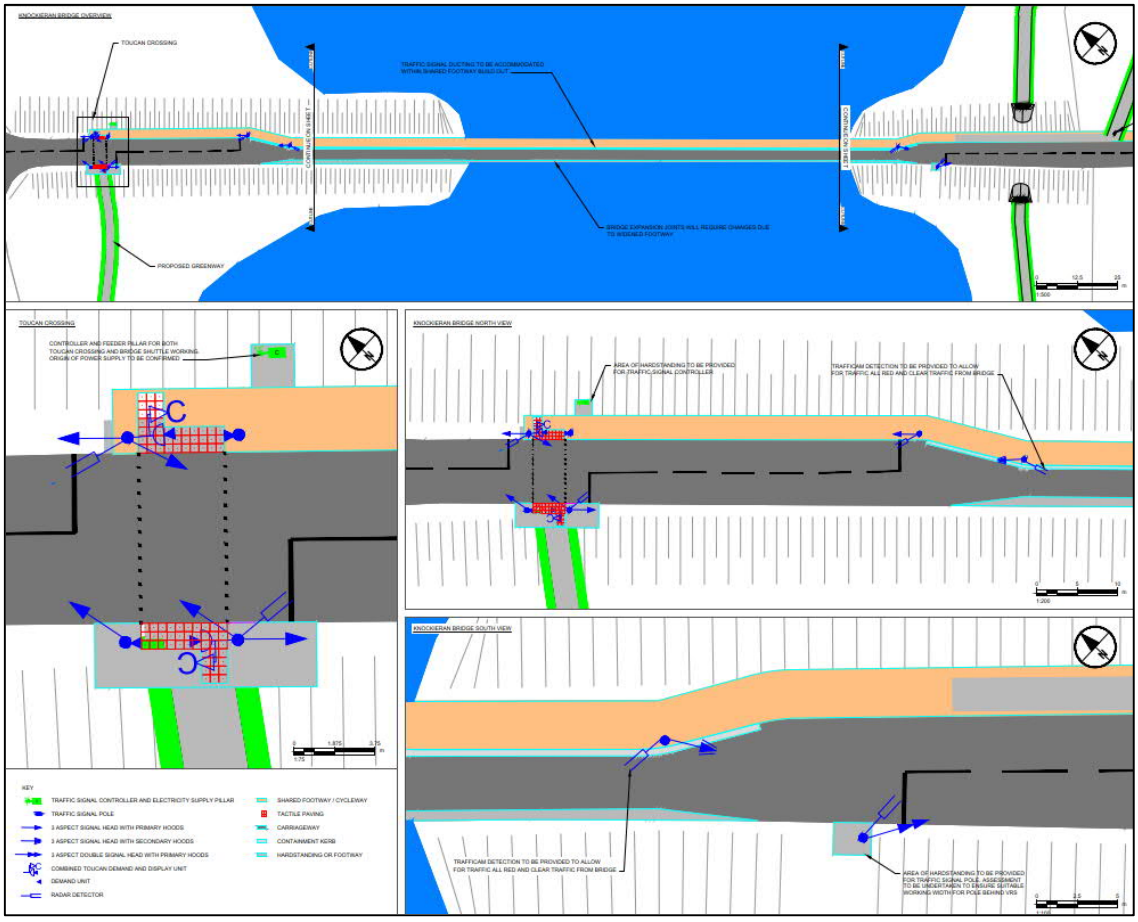


Figure 2 – Proposed Shuttle Working Design, Knockieran Bridge

Bridge Operation

5.3 Traffic flows were standardised to Passenger Car Units (PCUs) for modelling in LinSig as outlined in **Chapter 3**.

5.4 Traffic flows used in the AM (09:00-10:00) peak and PM (17:00-18:00) peak are outlined in **Table 2** below.

Table 2 – Traffic Flows (PCUs), Knockieran Bridge

	To Blessington	From Blessington
AM	131	64
PM	91	108

5.5 The model operates a 4-stage sequence as outlined in **Figure 3** below.

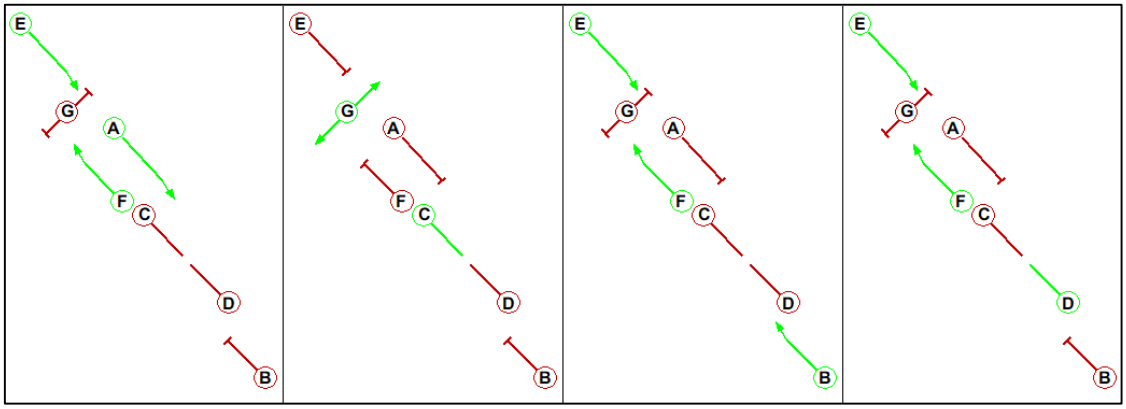


Figure 3 – Stage Sequence, Knockieran Bridge

5.6 The modelled all-red time for Stage 2 and Stage 4 is 22s. As highlighted within **Table 3** below, using the minimum cycle time to facilitate all-red time and giving Phases A and B minimum green time shows that the network has reserve capacity.

Table 3 – Network Results, Knockieran Bridge

	AM	PM
	Minimum Green Time	Minimum Green Time
Cycle Time (seconds)	71	71
Total Delay (Pcu/Hr)	2.9	2.5
PRC (%)	39.3 %	100.6%

5.7 Full LinSig model results for Knockieran Bridge are outlined in **Appendix D** of the report.

5.8 The model results, with DoS less than 70% in AM and PM scenarios and minimal MMQs within the capacity of all lanes, shows that the bridge has no capacity concerns with the introduction of the shuttle working.

6. Baltyboys Bridge

Bridge Design

6.1 Baltyboys Bridge is the middle bridge between Blessington and Humphrystown Bridges; it connects Blessington town with Baltyboys via the R758. The existing bridge features a narrow pedestrian footway on the southern side.

6.2 Outlined in **Figure 4** is the proposed design linking Blessington eGreenways into the bridge. The design includes Toucan crossings on both sides of the bridge, including widening the shared use pedestrian/cycle pathway and reducing the width of the roadway to facilitate bi-directional controlled traffic streams. The concept Baltyboys Bridge design is outlined in **Appendix B**.

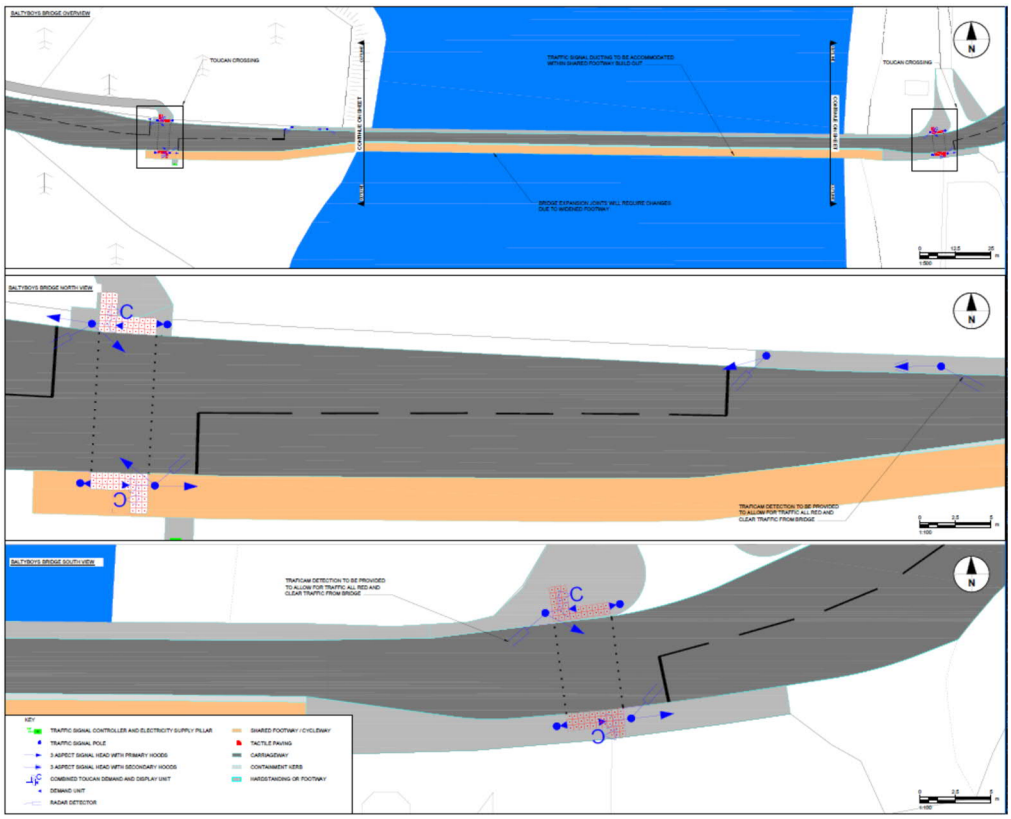


Figure 4 – Proposed Shuttle Working Design, Baltyboys Bridge

Bridge Operation

6.3 Traffic flows were standardised to PCUs for modelling in LinSig as outlined in **Chapter 3**.

6.4 Traffic flows used in the AM (09:00-10:00) peak and PM (17:00-18:00) peaks are outlined in **Table 4** below.

Table 4 – Traffic Flows (PCUs), Baltyboys Bridge

	To Russellstown	From Russellstown
AM	80	82
PM	67	114

6.5 The model operates a 4-stage sequence as outlined in **Figure 5** below.

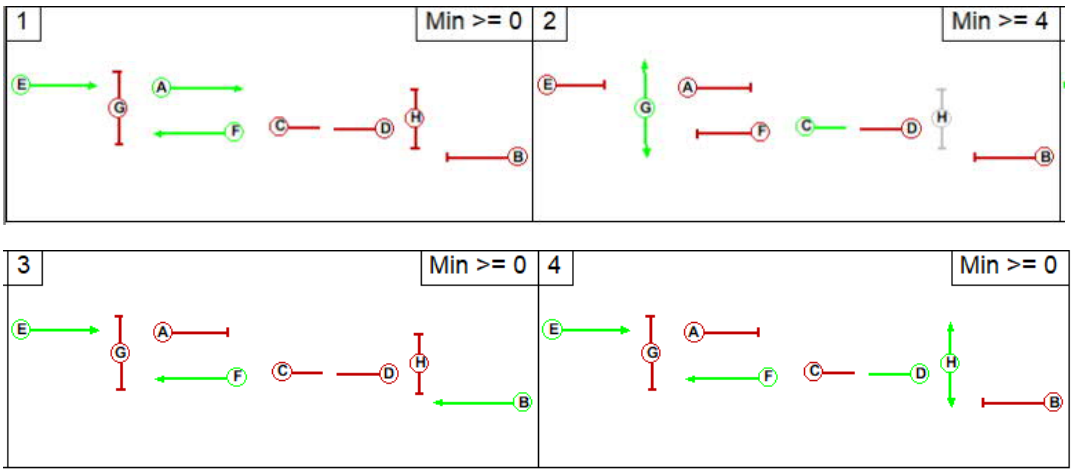


Figure 5 – Stage Sequence, Baltyboys Bridge

6.6 The modelled all-red time for Stage 2 and Stage 4, allow the pedestrian phases G and H to run whilst the all-red is extended for vehicles present on the bridge.

6.7 The Toucan crossing on the eastern side of the bridge, providing access to and from the car park, is designed closer to the edge of the bridge compared to the western side and there is no second stopline before entering onto the bridge westbound nor a second stop line leaving the bridge and preceding the toucan eastbound. The bridge effectively acts as an extended signalised crossing with a large intergreen between phases A & H.

6.8 As highlighted within **Table 5** below, using the minimum cycle time to facilitate all-red time and giving Phases A and B minimum green time also shows that the network has reserve capacity.

Table 5 – Network Results, Baltyboys Bridge

	AM	PM
	Minimum Green Time	Minimum Green Time
Cycle Time (seconds)	78	78
Total Delay (Pcu/Hr)	2.13	2.39
PRC (%)	133.7%	100.4%

6.9 Full LinSig model results for Baltyboys Bridge are outlined in **Appendix E** of the report.

6.10 The model results, with DoS less than 45% in AM and PM scenarios and minimal MMQs within the capacity of all lanes, shows that the bridge has no capacity concerns with the introduction of the shuttle working.

7. Valleymount Bridge

Bridge Design

7.1 Valleymount Bridge is the southernmost bridge within the scheme consideration which connects Humphreystown and Valleymount via the R758. The existing bridge features a narrow pedestrian footway on the southern side.

7.2 Outlined in **Figure 6** is the proposed design linking Blessington eGreenways into the bridge. The design includes Toucan crossings on both sides of the bridge, including widening the shared use pedestrian/cycle pathway and reducing the width of the roadway to facilitate uni-directional controlled traffic streams. The concept Baltyboys Bridge design is outlined in **Appendix C**.

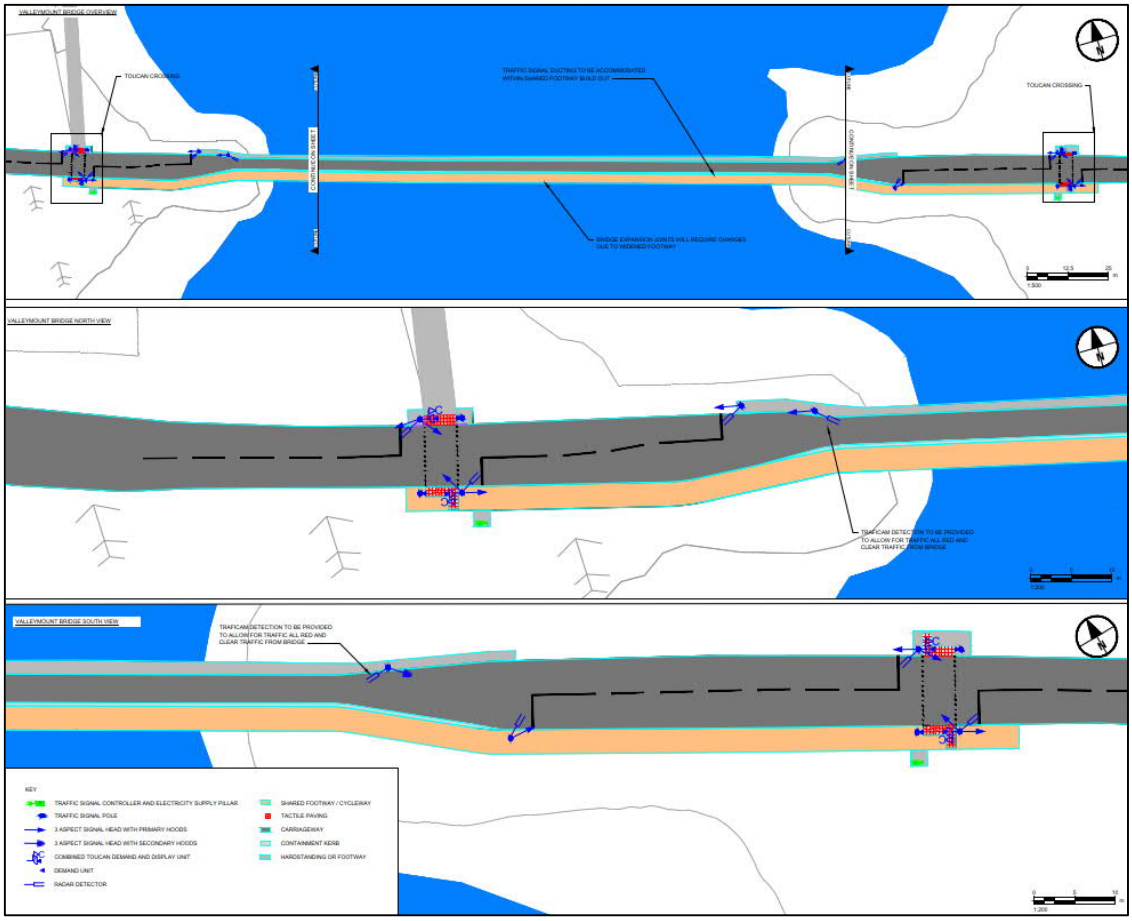


Figure 6 – Proposed Shuttle Working Design, Valleymount Bridge

Bridge Operation

7.3 Traffic flows were standardised to PCUs for modelling in LinSig as outlined in **Chapter 3**.

7.4 Traffic flows used in the AM (09:00-10:00) peak and PM (17:00-18:00) peaks are outlined in **Table 6** below:

Table 6 – Traffic Flows (PCUs), Valleymount Bridge

	To Humphreystown	From Humphreystown
AM	80	60
PM	75	62

7.5 The model operates a 4-stage sequence as shown in **Figure 7** below.

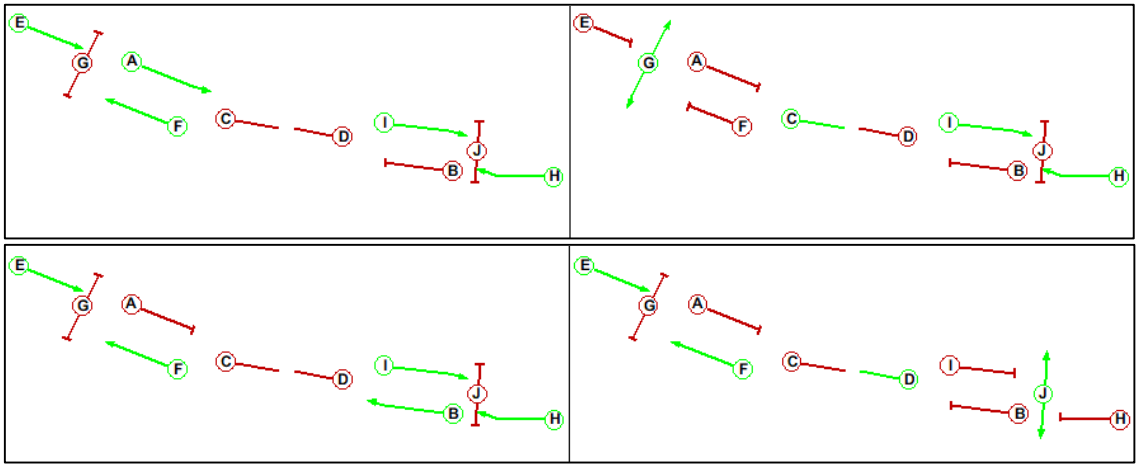


Figure 7 – Stage Sequence, Valleymount Bridge

7.6 The modelled all-red time for Stage 2 and Stage 4 is 25s. As highlighted within **Table 7** below, using the minimum cycle time to facilitate all-red time and giving Phases A and B minimum green time also shows that the network has reserve capacity.

Table 7 – Network Results, Valleymount Bridge

	AM	PM
	Minimum Green Time	Minimum Green Time
Cycle Time (seconds)	80	80
Total Delay (Pcu/Hr)	1.8	1.8
PRC (%)	178.4%	197.0%

7.7 Full LinSig model results for Valleymount Bridge are outlined in **Appendix F** of the report.

7.8 The model results, with DoS less than 33% in AM and PM scenarios and minimal MMQs within the capacity of all lanes, shows that the bridge has no capacity concerns with the introduction of the shuttle working.

8. Conclusion

8.1 This technical note has been prepared for the Blessington eGreenway.

8.2 This document examines the feasibility of widened shared-use paths being incorporated onto the existing bridge locations on the proposed eGreenway route. The document outlines the shuttle working designs that have been created and their operational impact at the three bridge locations:

1. Knockieran Bridge;
2. Baltyboys Bridge; and
3. Valleymount Bridge.

8.3 The objectives and deliverables of the study are to provide (per bridge):

- a design drawing identifying a shuttle working traffic management arrangement.
- a traffic modelling assessment to establish the requirement for traffic signals.

8.4 Design drawings are provided in **Figures 2, 4 and 6** outlining the provision for and considerations of implementing a shuttle working arrangement on the bridges.

8.5 LinSig modelling results testing the designs show that the bridges have minimal capacity constraints with the introduction of shuttle working:

- Knockieran Bridge DoS % results on all lanes are lower than 70% in both AM and PM peaks with none of the MMQ results exceeding the length of the lane;
- Baltyboys Bridge DoS % results on all lanes are lower than 45% in both AM and PM peaks with none of the MMQ results exceeding the length of the lane; and
- Valleymount Bridge DoS % results on all lanes are lower than 33% in both AM and PM peaks with none of the MMQ results exceeding the length of the lane.

8.6 Results, based on the designs created, conclude that shuttle working on the three bridges would not cause congestion and can be satisfactorily accommodated.

Appendix A

Knockieran Bridge Concept Design

ISO A1 594mm x 841mm

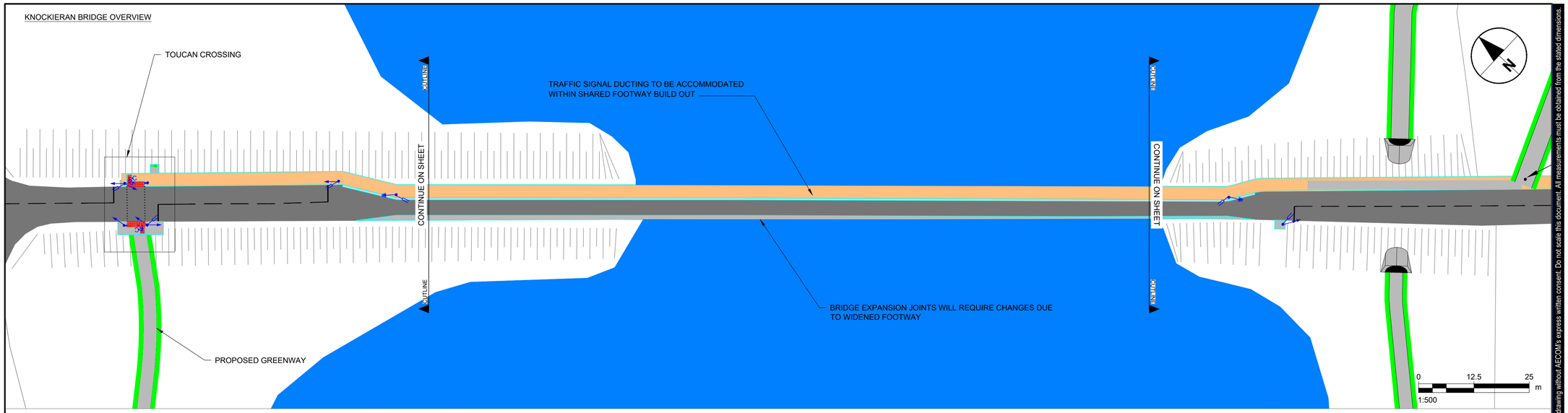
Approved: NW

Checked: ER

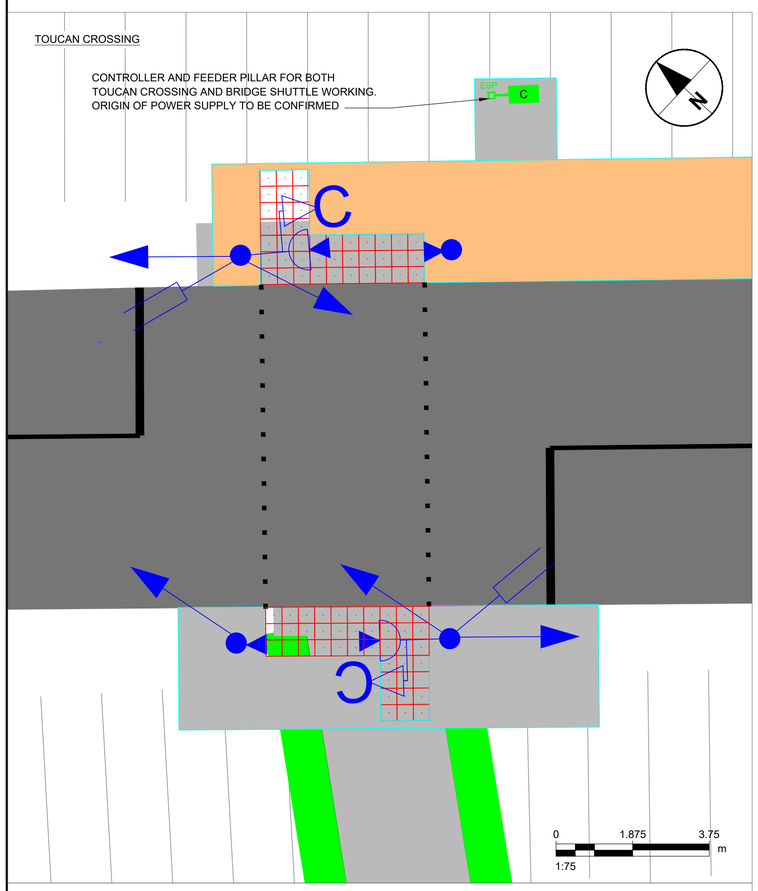
Designer: MB

Project Management Initials:

KNOCKIERAN BRIDGE OVERVIEW



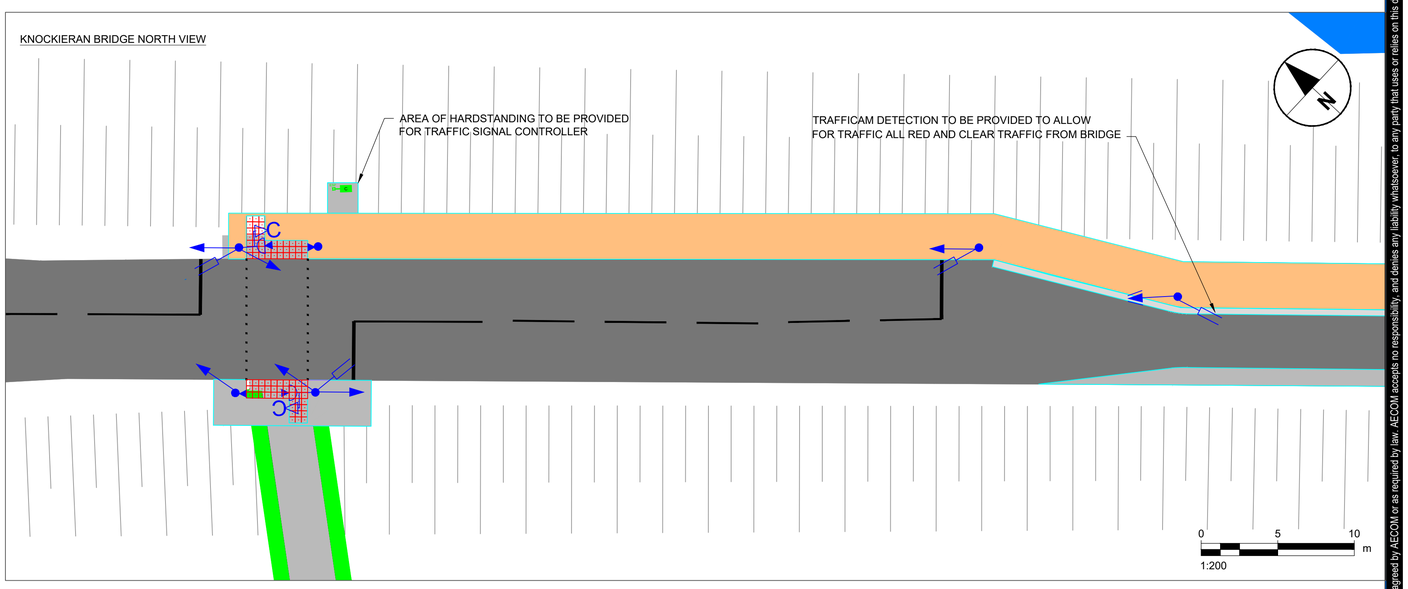
TOUCAN CROSSING



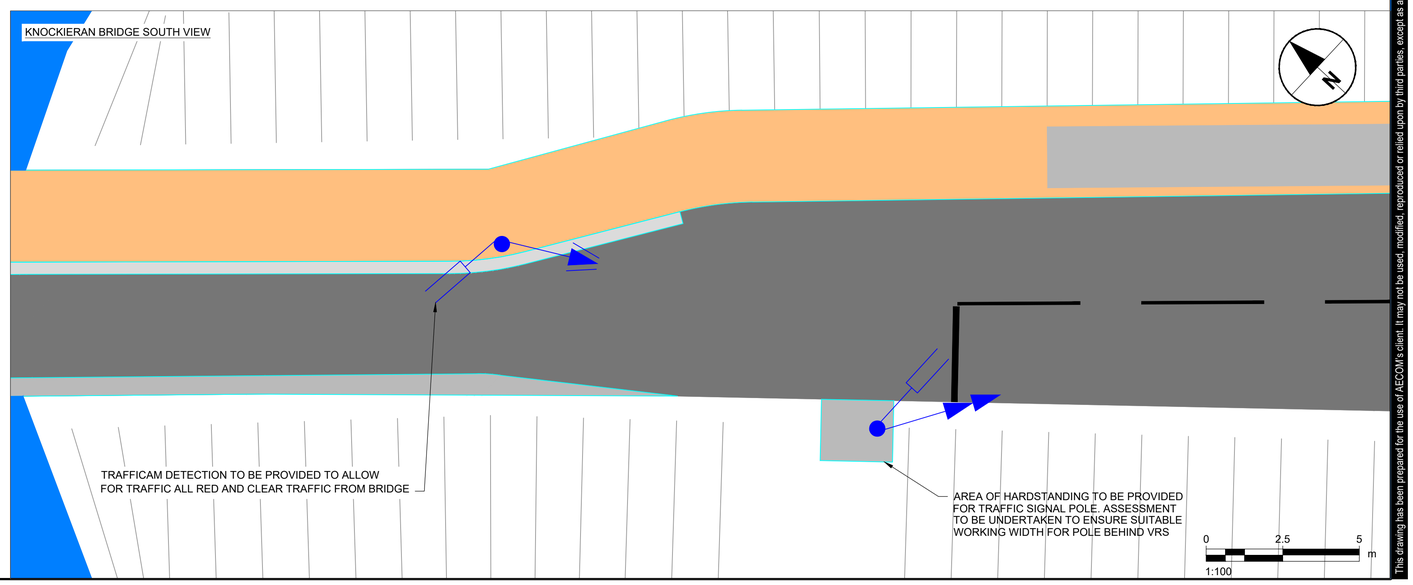
KEY

- TRAFFIC SIGNAL CONTROLLER AND ELECTRICITY SUPPLY PILLAR
- TRAFFIC SIGNAL POLE
- 3 ASPECT SIGNAL HEAD WITH PRIMARY HOODS
- 3 ASPECT SIGNAL HEAD WITH SECONDARY HOODS
- 3 ASPECT DOUBLE SIGNAL HEAD WITH PRIMARY HOODS
- COMBINED TOUCAN DEMAND AND DISPLAY UNIT
- DEMAND UNIT
- RADAR DETECTOR
- SHARED FOOTWAY / CYCLEWAY
- TACTILE PAVING
- CARRIAGEWAY
- CONTAINMENT KERB
- HARDSTANDING OR FOOTWAY

KNOCKIERAN BRIDGE NORTH VIEW



KNOCKIERAN BRIDGE SOUTH VIEW



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A	13/08/2021	FIRST ISSUE

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PROJECT NUMBER

60617025

SHEET TITLE

KNOCKIERAN BRIDGE
SHUTTLE WORKING
CONCEPT DESIGN

SHEET NUMBER

60617025_SHT_DD_BLGWY_1201

Appendix B

Baltyboys Bridge Concept Design

ISO A1 594mm x 841mm

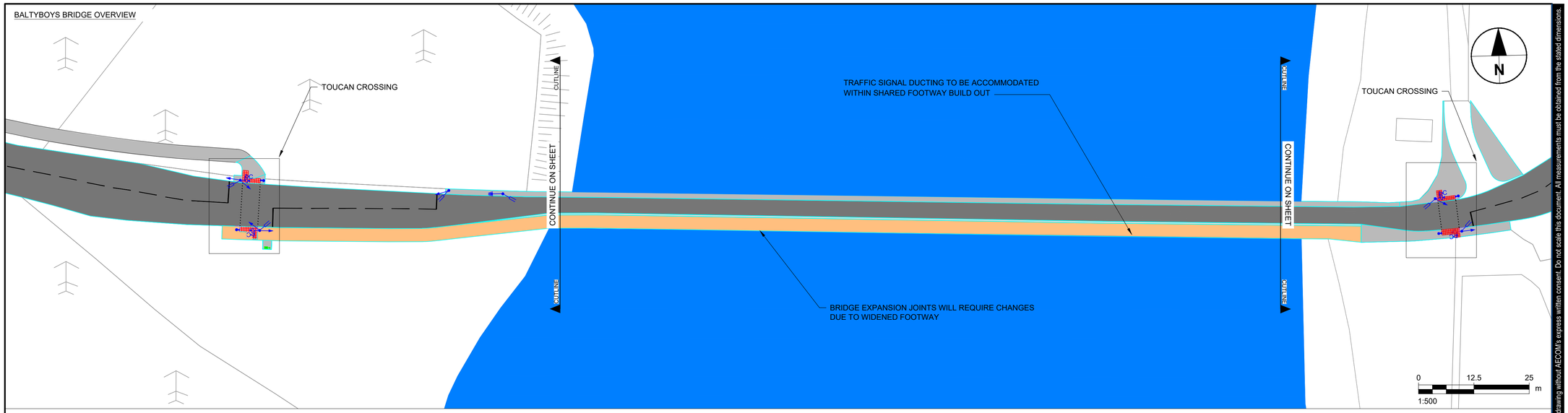
Approved: NW

Checked: ER

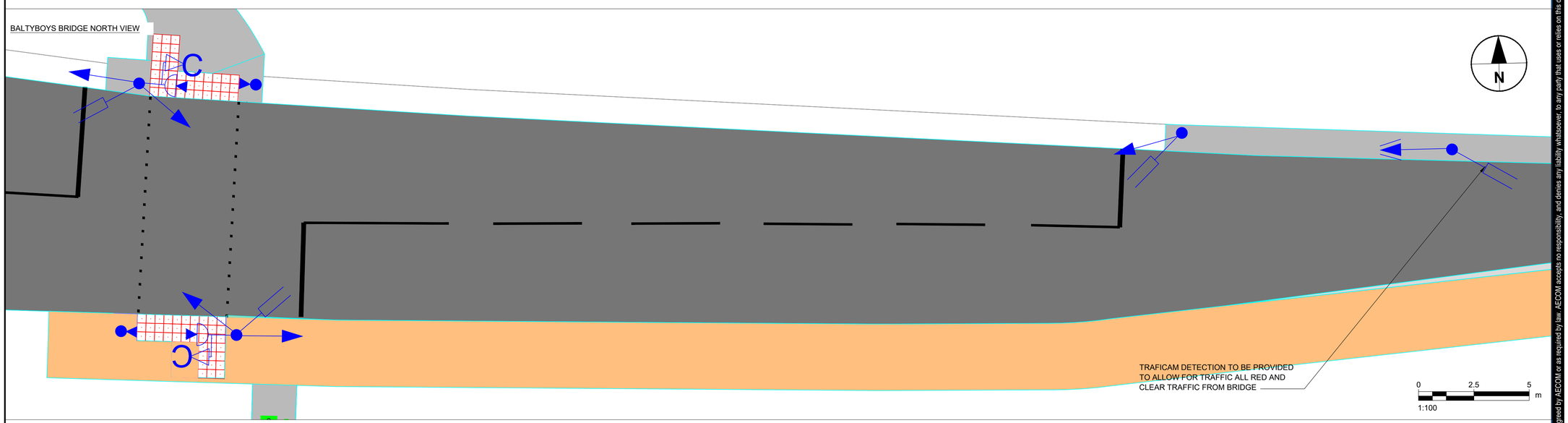
Designer: MB

Project Management Initials:

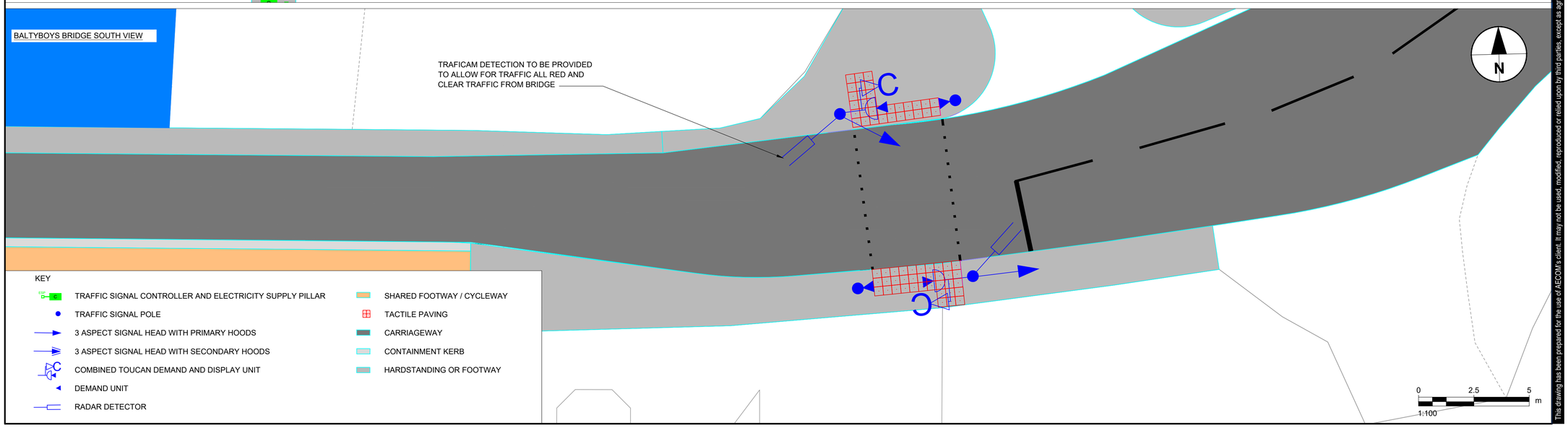
BALTYBOYS BRIDGE OVERVIEW



BALTYBOYS BRIDGE NORTH VIEW



BALTYBOYS BRIDGE SOUTH VIEW



KEY

- TRAFFIC SIGNAL CONTROLLER AND ELECTRICITY SUPPLY PILLAR
- TRAFFIC SIGNAL POLE
- 3 ASPECT SIGNAL HEAD WITH PRIMARY HOODS
- 3 ASPECT SIGNAL HEAD WITH SECONDARY HOODS
- COMBINED TOUCAN DEMAND AND DISPLAY UNIT
- DEMAND UNIT
- RADAR DETECTOR
- SHARED FOOTWAY / CYCLEWAY
- TACTILE PAVING
- CARRIAGEWAY
- CONTAINMENT KERB
- HARDSTANDING OR FOOTWAY

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PROJECT NUMBER

60617025

SHEET TITLE

BALTYBOYS BRIDGE
SHUTTLE WORKING
CONCEPT DESIGN

SHEET NUMBER

60617025_SHT_DD_BLGWY_1202

Appendix C

Valleymount Bridge Concept Design

ISO A1 594mm x 841mm

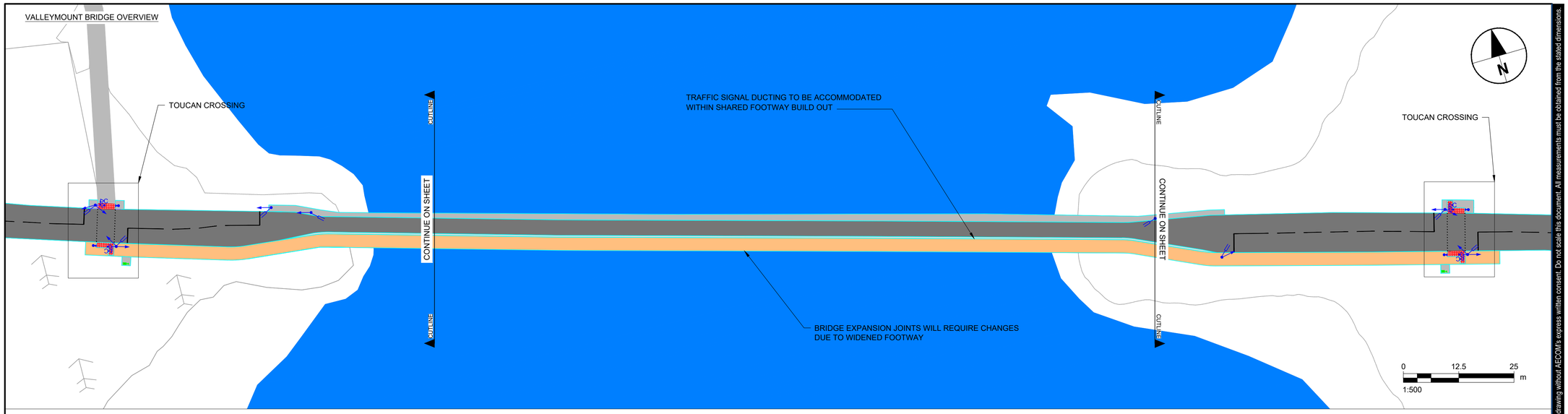
Approved: NW

Checked: ER

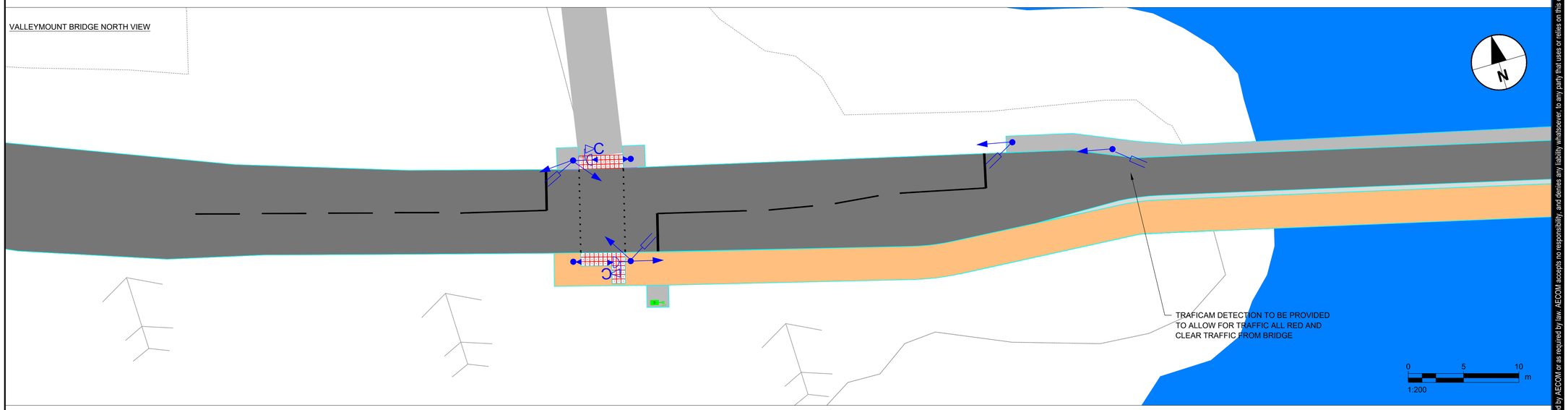
Designer: MB

Project Management Initials:

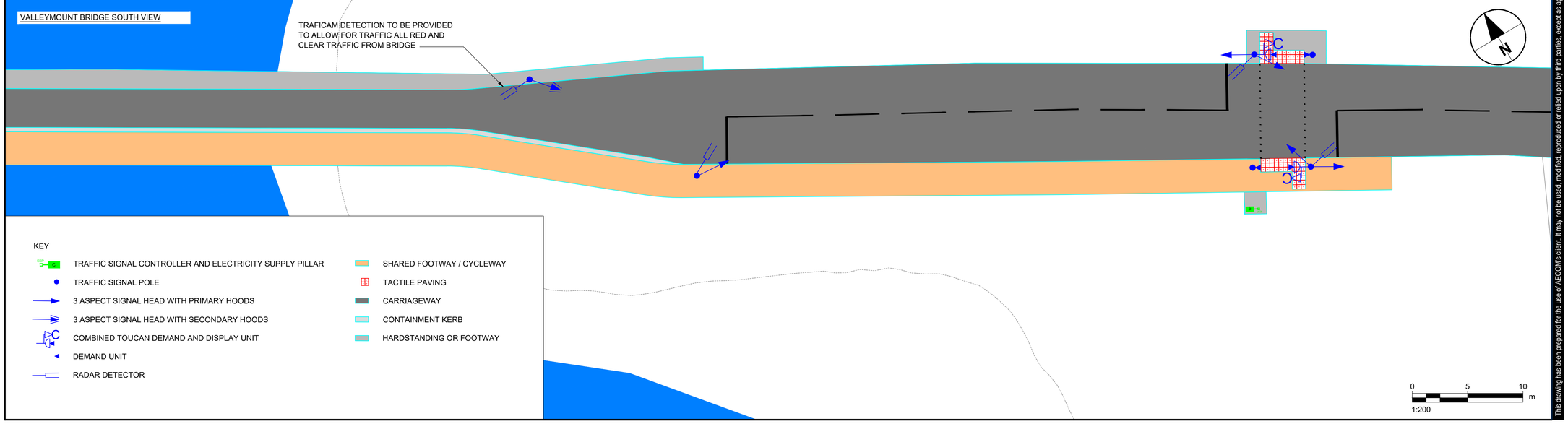
VALLEYMOUNT BRIDGE OVERVIEW



VALLEYMOUNT BRIDGE NORTH VIEW



VALLEYMOUNT BRIDGE SOUTH VIEW



KEY

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- TRAFFIC SIGNAL POLE
- 3 ASPECT SIGNAL HEAD WITH PRIMARY HOODS
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PROJECT NUMBER

60617025

SHEET TITLE

VALLEYMOUNT BRIDGE
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CONCEPT DESIGN

SHEET NUMBER

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Appendix D

Knockieran Bridge LinSig Model Results

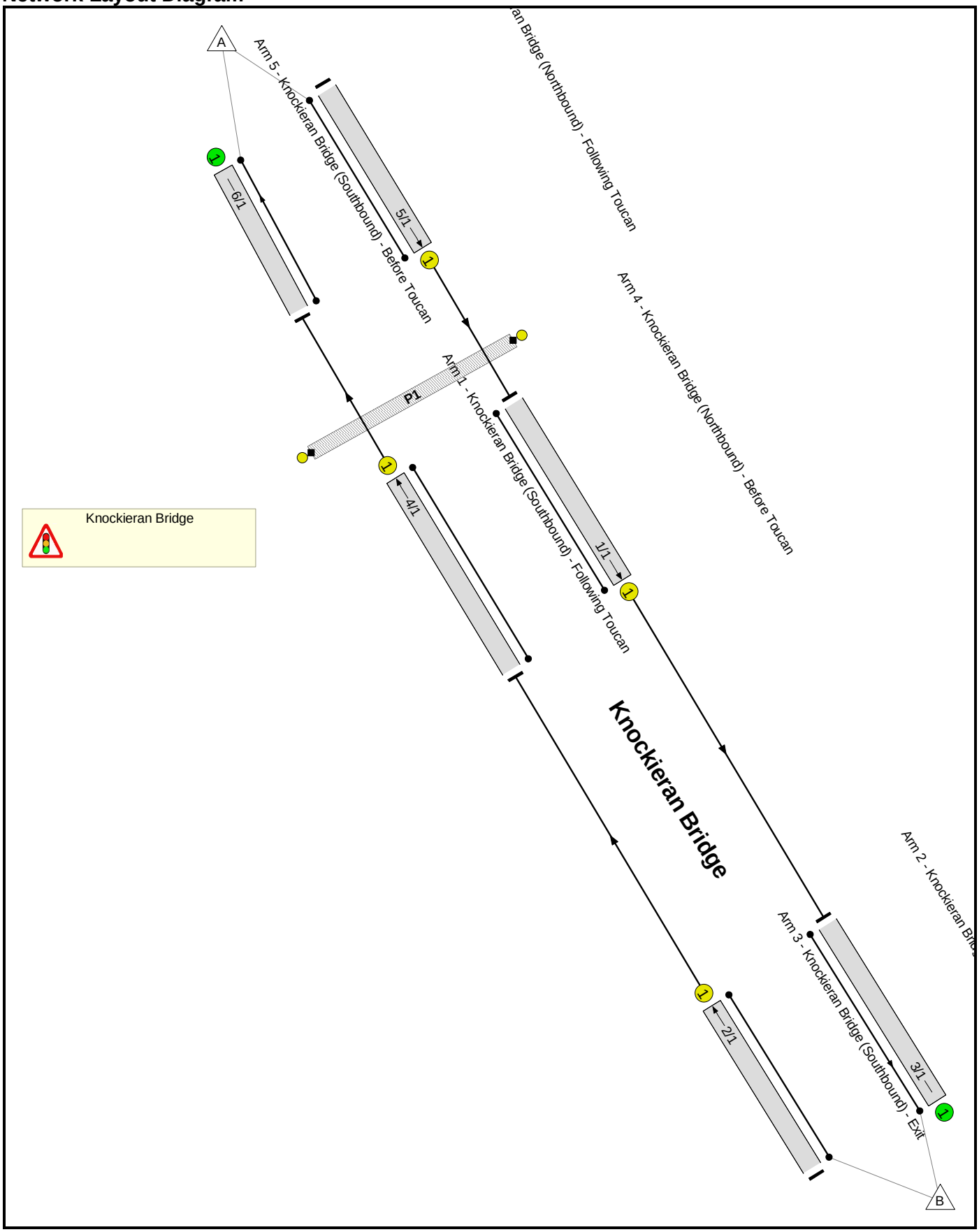
Full Input Data And Results

User and Project Details

Project:	**Blessington Greenways**
Title:	**Knockieran Bridge**
Location:	Knockieran Bridge
Client:	Wicklow County Council
Date Started:	27/08/21
Additional detail:	
File name:	1_Knockieran Bridge_1Toucan.lsg3x
Author:	Jacob Hughes
Company:	AECOM
Address:	

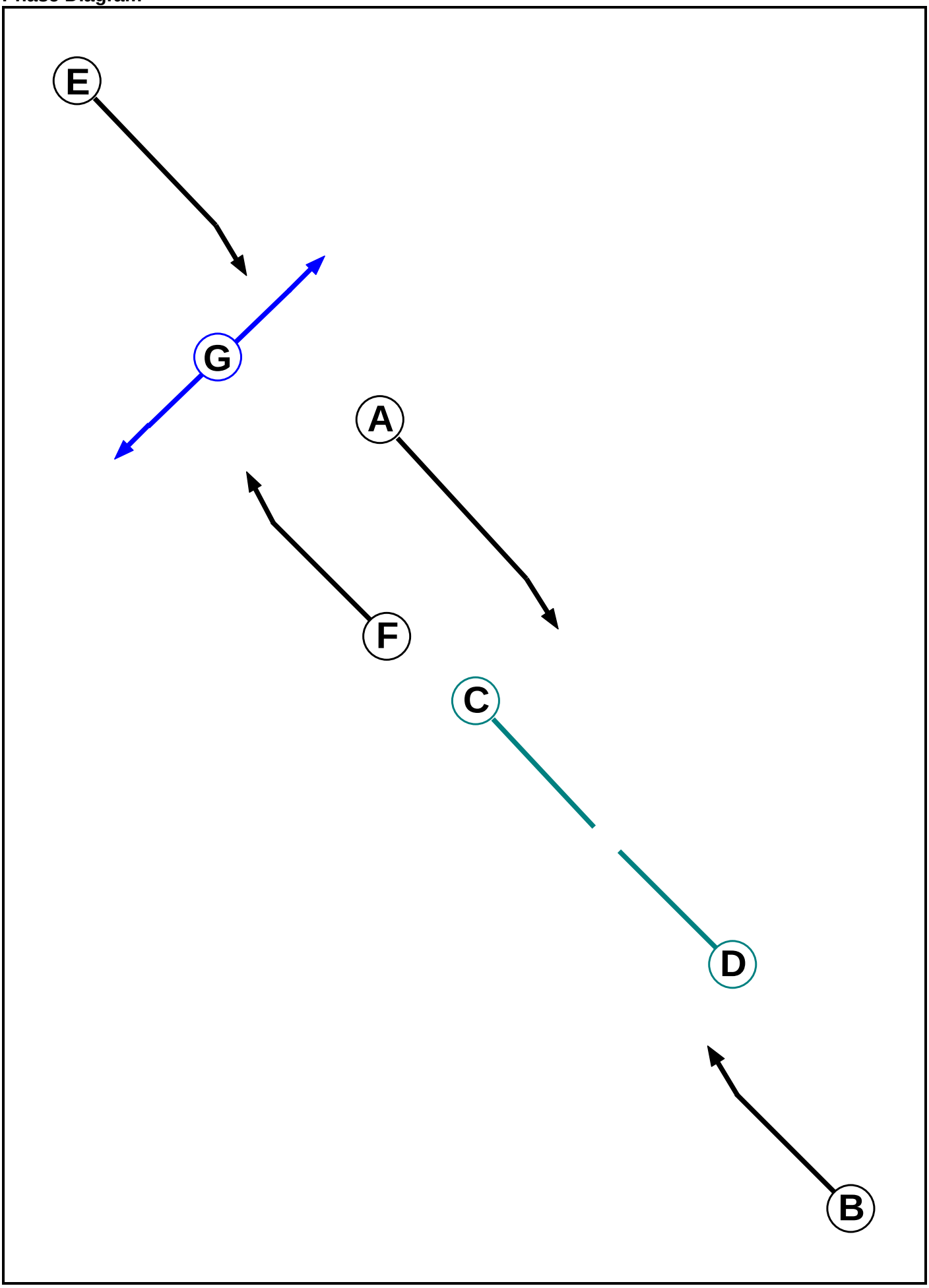
Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Phase Diagram



Full Input Data And Results

Phase Input Data

Phase Name	Phase Type	Assoc. Phase	Street Min	Cont Min
A	Traffic		-9999	7
B	Traffic		-9999	7
C	Dummy		-9999	4
D	Dummy		-9999	4
E	Traffic		-9999	7
F	Traffic		-9999	7
G	Pedestrian		-9999	5

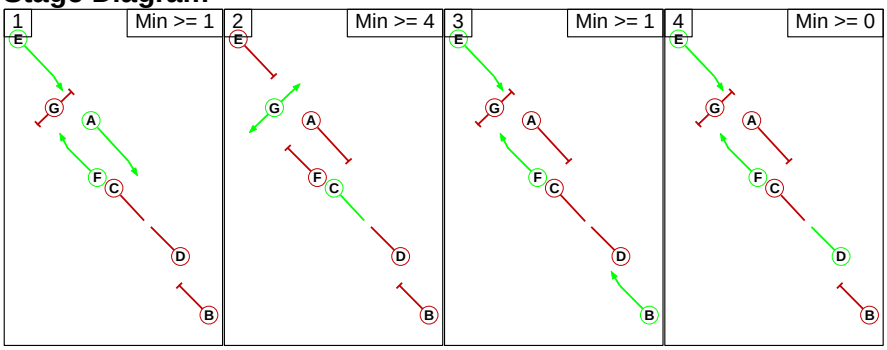
Phase Intergreens Matrix

		Starting Phase						
		A	B	C	D	E	F	G
Terminating Phase	A		5	3	3	-	-	-
	B	5		3	3	-	-	-
	C	2	2		1	-	-	-
	D	2	2	1		-	-	-
	E	-	-	-	-		-	5
	F	-	-	-	-	-		5
	G	-	-	-	-	8	8	

Phases in Stage

Stage No.	Phases in Stage
1	A E F
2	C G
3	B E F
4	D E F

Stage Diagram



Phase Delays

Term. Stage	Start Stage	Phase	Type	Value	Cont value
1	2	A	Losing	3	3

Full Input Data And Results

Lane Input Data

Junction: Knockieran Bridge												
Lane	**Lane Type**	**Phases**	**Start Disp.**	**End Disp.**	**Physical Length (PCU)**	**Sat Flow Type**	**Def User Saturation Flow (PCU/Hr)**	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Turns**	**Turning Radius (m)**
1/1 (Knockieran Bridge (Southbound) - Following Toucan)	U	A	2	3	6.6	User	1800	-	-	-	-	-
2/1 (Knockieran Bridge (Northbound) - Entry)	U	B	2	3	15.0	User	1800	-	-	-	-	-
3/1 (Knockieran Bridge (Southbound) - Exit)	U		2	3	60.0	Inf	-	-	-	-	-	-
4/1 (Knockieran Bridge (Northbound) - Before Toucan)	U	F	2	3	7.0	User	1800	-	-	-	-	-
5/1 (Knockieran Bridge (Southbound) - Before Toucan)	U	E	2	3	5.0	User	1800	-	-	-	-	-
6/1 (Knockieran Bridge (Northbound) - Following Toucan)	U		2	3	60.0	Inf	-	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: 'AM'	08:00	09:00	01:00	
2: 'PM'	17:00	18:00	01:00	

Traffic Flows, Desired

Scenario 1: 'AM (9-10) ' (FG1: 'AM', Plan 1: 'Network Control Plan 1')
Desired Flow :

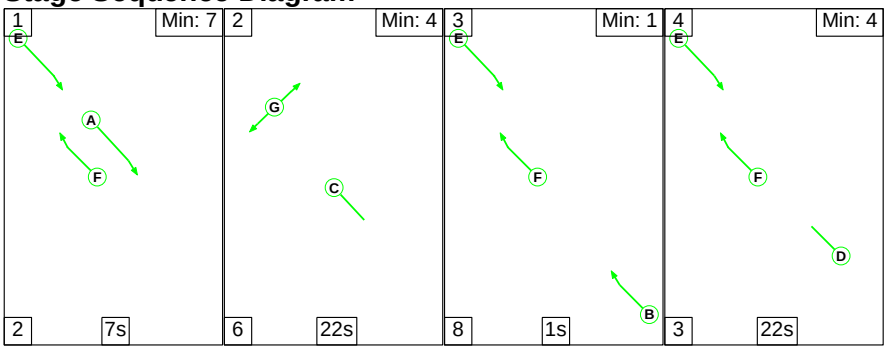
		Destination		
		A	B	Tot.
Origin	A	0	64	64
	B	131	0	131
	Tot.	131	64	195

Full Input Data And Results

Scenario 2: 'PM (17-18) ' (FG2: 'PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

		Destination		
		A	B	Tot.
Origin	A	0	108	108
	B	91	0	91
	Tot.	91	108	199

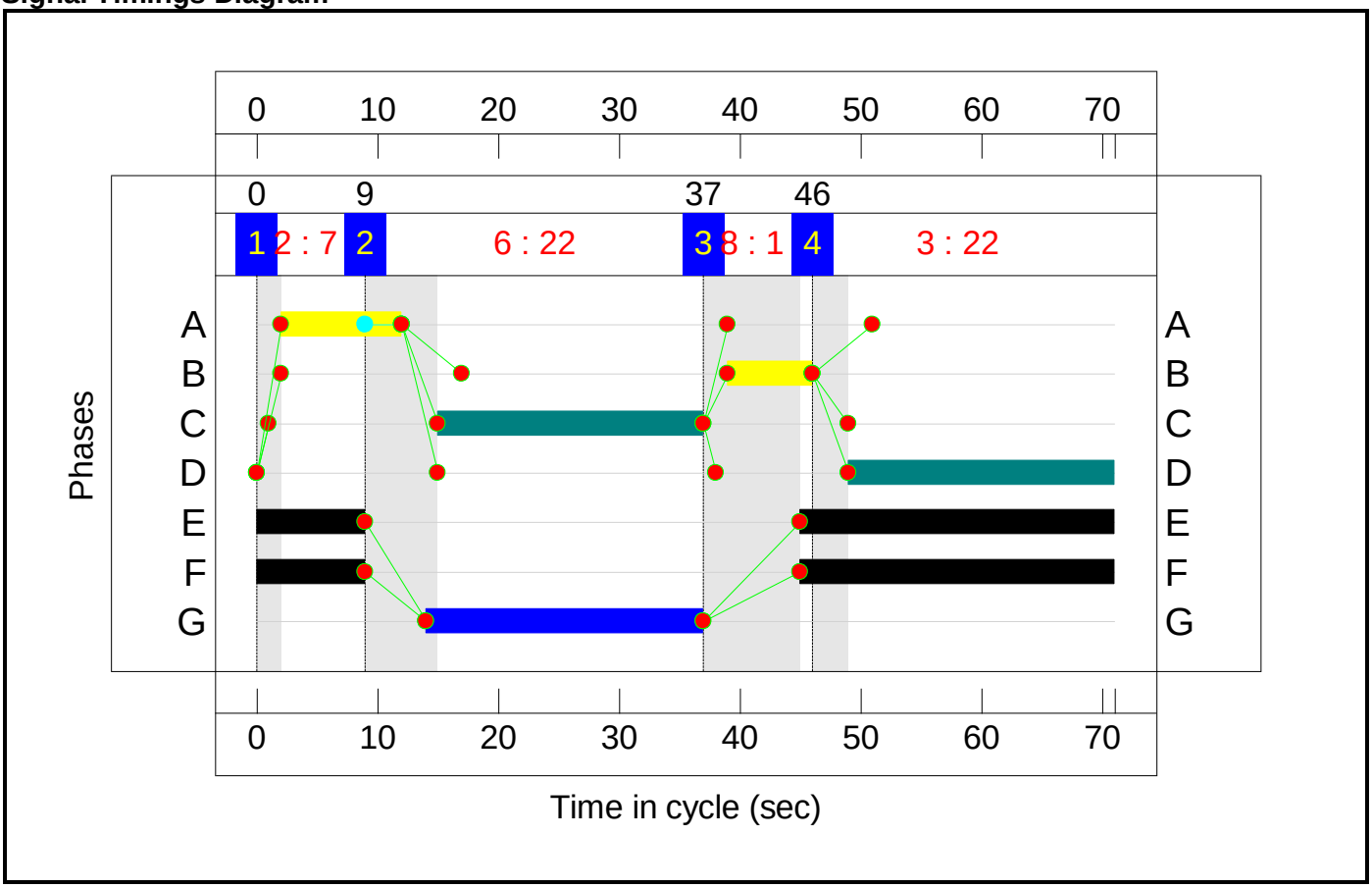
Scenario 1: 'AM (9-10) ' (FG1: 'AM', Plan 1: 'Network Control Plan 1')
Stage Sequence Diagram



Stage Timings

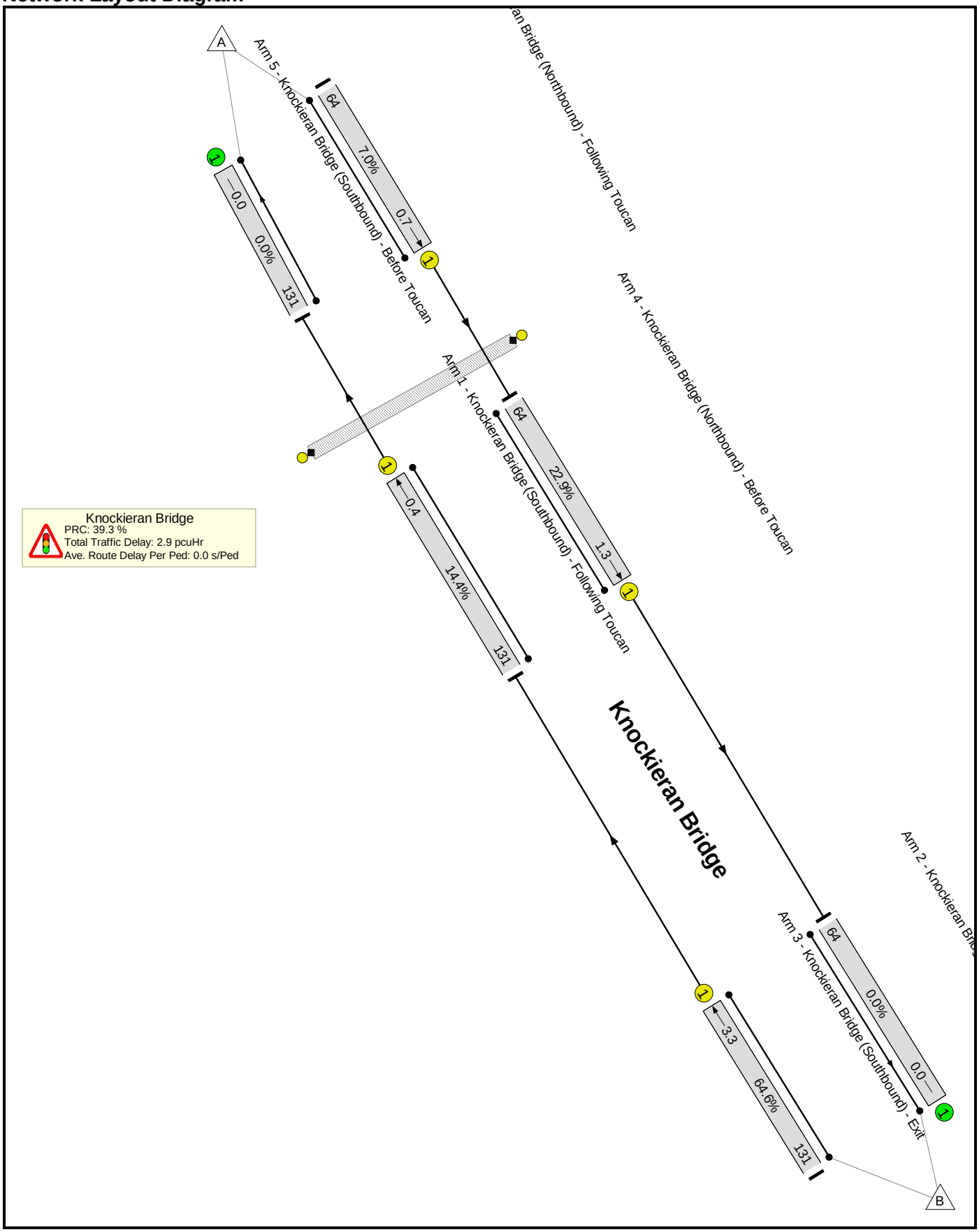
Stage	1	2	3	4
Duration	7	22	1	22
Change Point	0	9	37	46

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Knockieran Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**64.6%**
Knockieran Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**64.6%**
1/1	Knockieran Bridge (Southbound) - Following Toucan Ahead	U	N/A	N/A	A		1	10	-	64	1800	279	22.9%
2/1	Knockieran Bridge (Northbound) - Entry Ahead	U	N/A	N/A	B		1	7	-	131	1800	203	64.6%
3/1	Knockieran Bridge (Southbound) - Exit	U	N/A	N/A	-		-	-	-	64	Inf	Inf	0.0%
4/1	Knockieran Bridge (Northbound) - Before Toucan Ahead	U	N/A	N/A	F		1	35	-	131	1800	913	14.4%
5/1	Knockieran Bridge (Southbound) - Before Toucan Ahead	U	N/A	N/A	E		1	35	-	64	1800	913	7.0%
6/1	Knockieran Bridge (Northbound) - Following Toucan	U	N/A	N/A	-		-	-	-	131	Inf	Inf	0.0%
Ped Link: P1	Unnamed Ped Link	-	N/A	-	G		1	23	-	0	-	0	0.0%

Full Input Data And Results

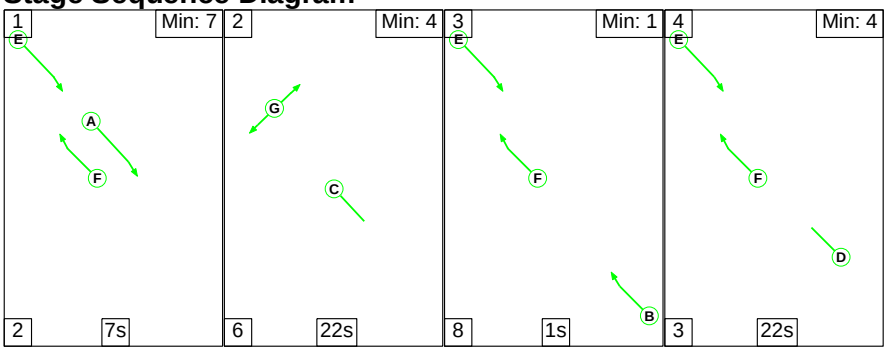
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Knockieran Bridge	**-**	**-**	**0**	**0**	**0**	**1.7**	**1.2**	**0.0**	**2.9**	**-**	**-**	**-**	**-**
Knockieran Bridge	**-**	**-**	**0**	**0**	**0**	**1.7**	**1.2**	**0.0**	**2.9**	**-**	**-**	**-**	**-**
1/1	64	64	-	-	-	0.3	0.1	-	0.5	25.7	1.1	0.1	1.3
2/1	131	131	-	-	-	1.1	0.9	-	2.0	54.6	2.4	0.9	3.3
3/1	64	64	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/1	131	131	-	-	-	0.1	0.1	-	0.2	6.1	0.4	0.1	0.4
5/1	64	64	-	-	-	0.2	0.0	-	0.2	11.1	0.6	0.0	0.7
6/1	131	131	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
Ped Link: P1	0	0	-	-	-	-	-	-	-	-	-	-	-

C1 PRC for Signalled Lanes (%): 39.3 Total Delay for Signalled Lanes (pcuHr): 2.86 Cycle Time (s): 71
PRC Over All Lanes (%): 39.3 Total Delay Over All Lanes(pcuHr): 2.86

Full Input Data And Results

Scenario 2: 'PM (17-18) ' (FG2: 'PM', Plan 1: 'Network Control Plan 1')

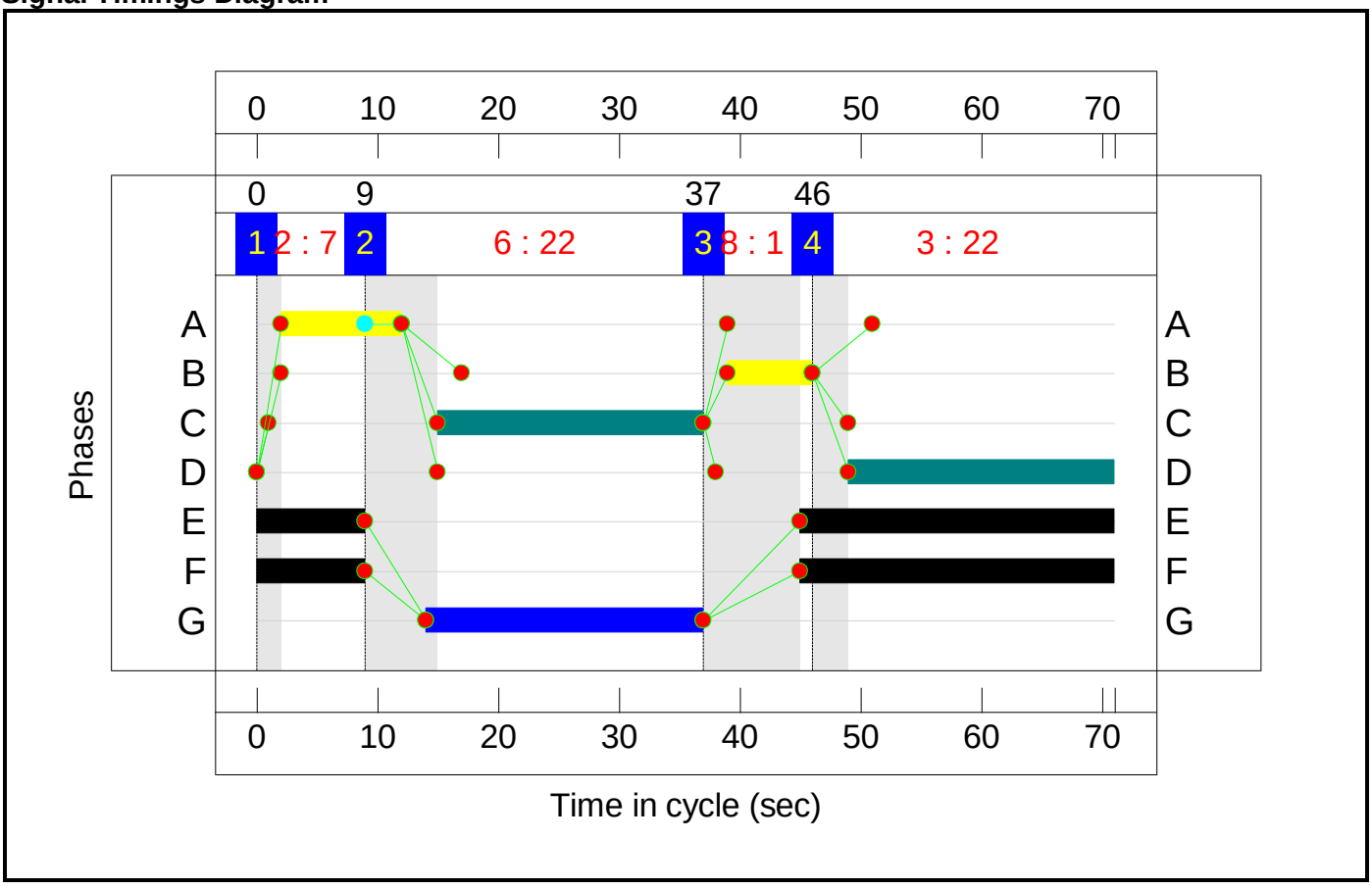
Stage Sequence Diagram



Stage Timings

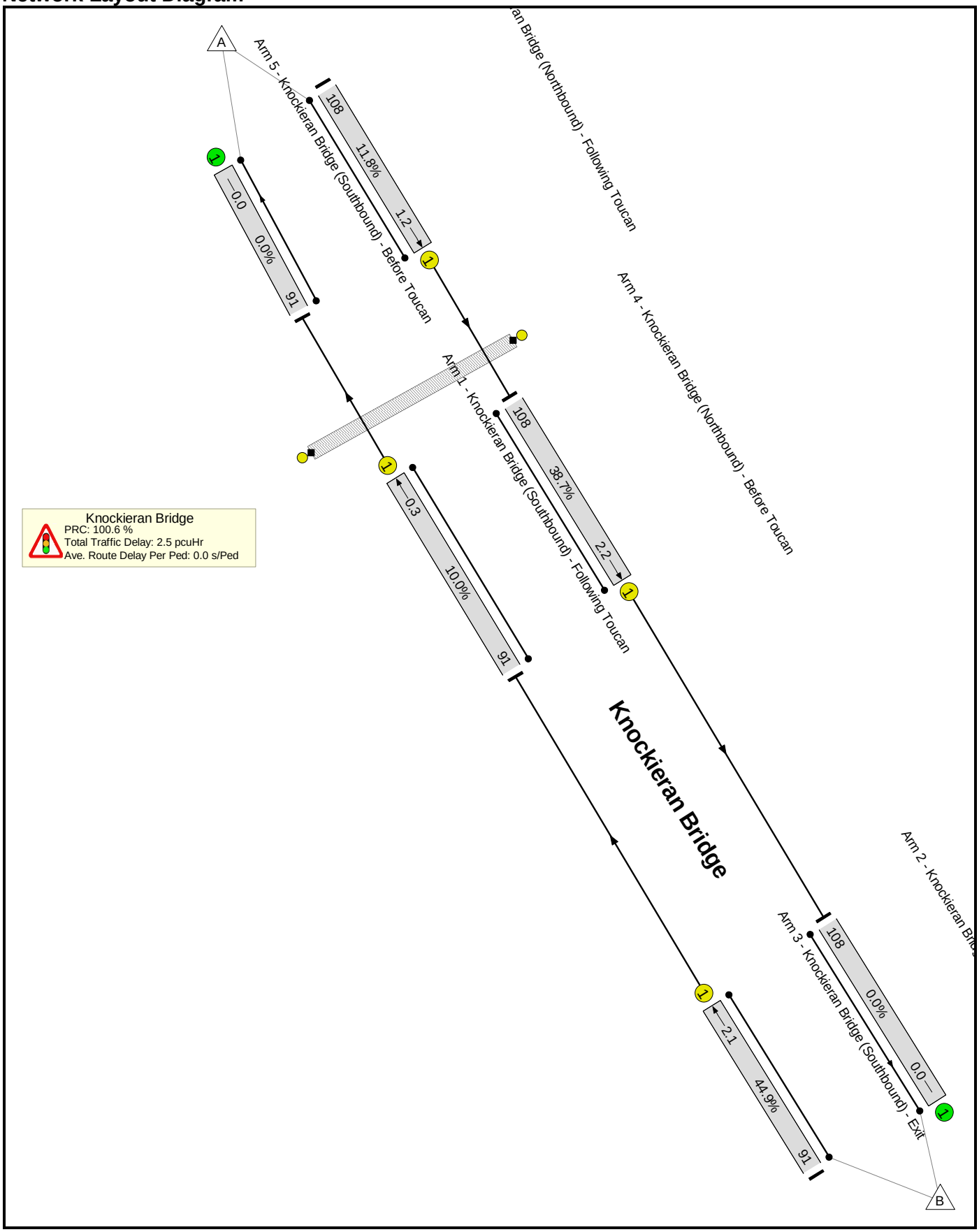
Stage	1	2	3	4
Duration	7	22	1	22
Change Point	0	9	37	46

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Knockieran Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**44.9%**
Knockieran Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**44.9%**
1/1	Knockieran Bridge (Southbound) - Following Toucan Ahead	U	N/A	N/A	A		1	10	-	108	1800	279	38.7%
2/1	Knockieran Bridge (Northbound) - Entry Ahead	U	N/A	N/A	B		1	7	-	91	1800	203	44.9%
3/1	Knockieran Bridge (Southbound) - Exit	U	N/A	N/A	-		-	-	-	108	Inf	Inf	0.0%
4/1	Knockieran Bridge (Northbound) - Before Toucan Ahead	U	N/A	N/A	F		1	35	-	91	1800	913	10.0%
5/1	Knockieran Bridge (Southbound) - Before Toucan Ahead	U	N/A	N/A	E		1	35	-	108	1800	913	11.8%
6/1	Knockieran Bridge (Northbound) - Following Toucan	U	N/A	N/A	-		-	-	-	91	Inf	Inf	0.0%
Ped Link: P1	Unnamed Ped Link	-	N/A	-	G		1	23	-	0	-	0	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Knockieran Bridge	**-**	**-**	**0**	**0**	**0**	**1.6**	**0.8**	**0.0**	**2.5**	**-**	**-**	**-**	**-**
Knockieran Bridge	**-**	**-**	**0**	**0**	**0**	**1.6**	**0.8**	**0.0**	**2.5**	**-**	**-**	**-**	**-**
1/1	108	108	-	-	-	0.5	0.3	-	0.8	28.3	1.9	0.3	2.2
2/1	91	91	-	-	-	0.7	0.4	-	1.1	45.5	1.7	0.4	2.1
3/1	108	108	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/1	91	91	-	-	-	0.1	0.1	-	0.1	5.7	0.2	0.1	0.3
5/1	108	108	-	-	-	0.3	0.1	-	0.3	11.4	1.1	0.1	1.2
6/1	91	91	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
Ped Link: P1	0	0	-	-	-	-	-	-	-	-	-	-	-

C1 PRC for Signalled Lanes (%): 100.6 Total Delay for Signalled Lanes (pcuHr): 2.49 Cycle Time (s): 71
PRC Over All Lanes (%): 100.6 Total Delay Over All Lanes(pcuHr): 2.49

Appendix E

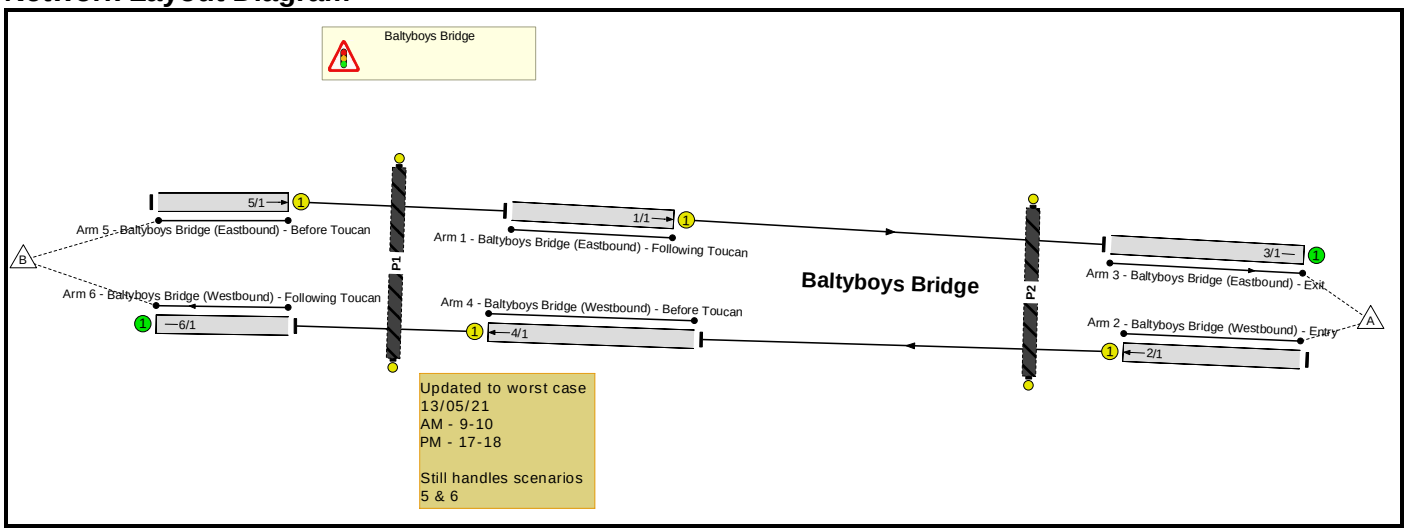
Baltyboys Bridge LinSig Model Results

Full Input Data And Results

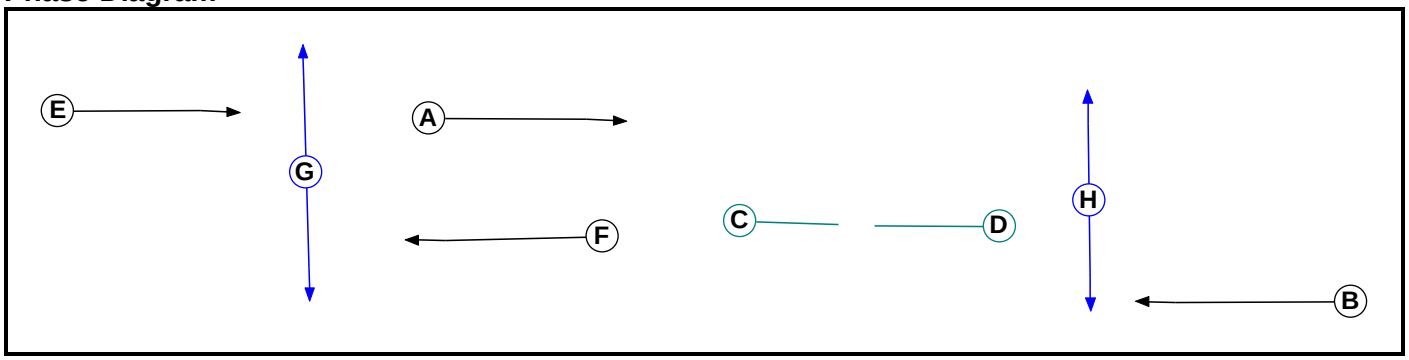
User and Project Details

Project:	**Blessington Greenways**
Title:	**Baltyboys Bridge**
Location:	Baltyboys Bridge
Client:	Wicklow County Council
Date Started:	27/08/21
Additional detail:	
File name:	2_Baltyboys Bridge_2Toucan_2.lsg3x
Author:	Jacob Hughes
Company:	AECOM
Address:	

Network Layout Diagram



Phase Diagram



Full Input Data And Results

Phase Input Data

Phase Name	Phase Type	Assoc. Phase	Street Min	Cont Min
A	Traffic		-9999	7
B	Traffic		-9999	7
C	Dummy		-9999	4
D	Dummy		-9999	4
E	Traffic		-9999	7
F	Traffic		-9999	7
G	Pedestrian		-9999	5
H	Pedestrian		-9999	5

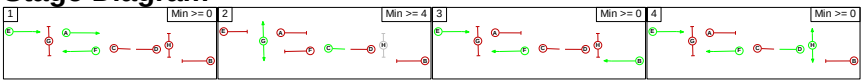
Phase Intergreens Matrix

Terminating Phase \ Starting Phase	A	B	C	D	E	F	G	H
A		5	3	3	-	-	-	30
B	5		3	3	-	-	-	5
C	2	2		1	-	-	-	-
D	2	2	1		-	-	-	-
E	-	-	-	-		-	5	-
F	-	-	-	-	-		5	-
G	-	-	-	-	10	10		-
H	10	10	-	-	-	-	-	

Phases in Stage

Stage No.	Phases in Stage
1	A E F
2	C G
3	B E F
4	D E F H

Stage Diagram



Phase Delays

Term. Stage	Start Stage	Phase	Type	Value	Cont value
1	2	A	Losing	3	3

Full Input Data And Results

Lane Input Data

Junction: Baltyboys Bridge												
Lane	**Lane Type**	**Phases**	**Start Disp.**	**End Disp.**	**Physical Length (PCU)**	**Sat Flow Type**	**Def User Saturation Flow (PCU/Hr)**	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Turns**	**Turning Radius (m)**
1/1 (Baltyboys Bridge (Eastbound) - Following Toucan)	U	A	2	3	6.6	User	1800	-	-	-	-	-
2/1 (Baltyboys Bridge (Westbound) - Entry)	U	B	2	3	60.0	User	1800	-	-	-	-	-
3/1 (Baltyboys Bridge (Eastbound) - Exit)	U		2	3	60.0	Inf	-	-	-	-	-	-
4/1 (Baltyboys Bridge (Westbound) - Before Toucan)	U	F	2	3	6.6	User	1800	-	-	-	-	-
5/1 (Baltyboys Bridge (Eastbound) - Before Toucan)	U	E	2	3	60.0	User	1800	-	-	-	-	-
6/1 (Baltyboys Bridge (Westbound) - Following Toucan)	U		2	3	60.0	Inf	-	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: 'AM'	09:00	10:00	01:00	
2: 'PM'	16:00	17:00	01:00	

Traffic Flows, Desired

Scenario 3: 'AM (9-10) - Min' (FG1: 'AM', Plan 1: 'Network Control Plan 1')

Desired Flow :

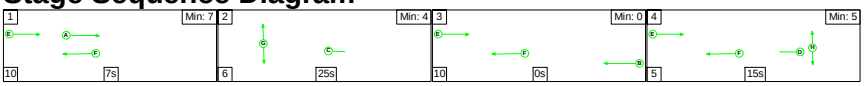
		Destination		
		A	B	Tot.
Origin	A	0	80	80
	B	82	0	82
	Tot.	82	80	162

Full Input Data And Results

Scenario 4: 'PM (17-18) - Min' (FG2: 'PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

		Destination		
		A	B	Tot.
Origin	A	0	67	67
	B	114	0	114
	Tot.	114	67	181

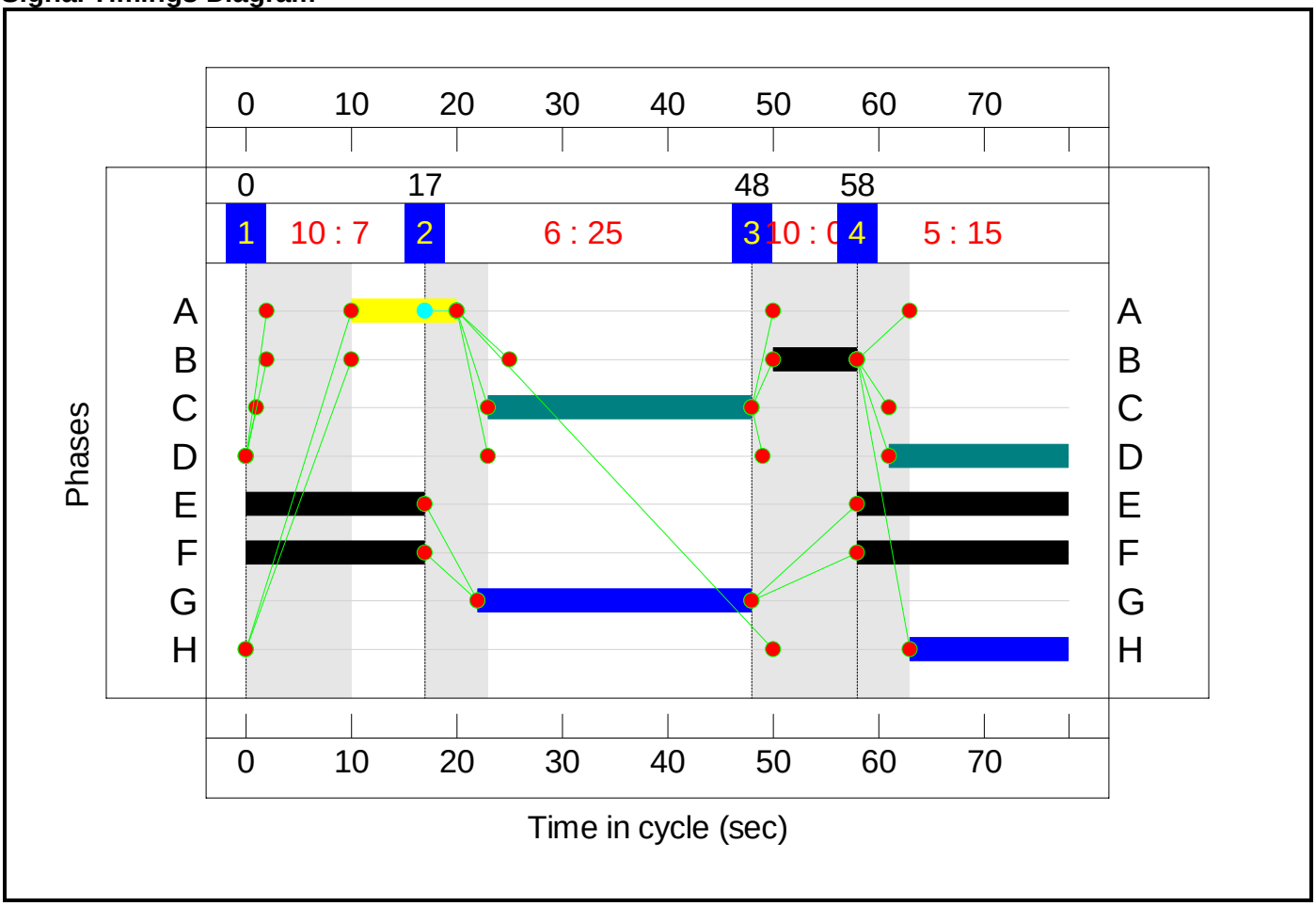
Scenario 3: 'AM (9-10) - Min' (FG1: 'AM', Plan 1: 'Network Control Plan 1')
Stage Sequence Diagram



Stage Timings

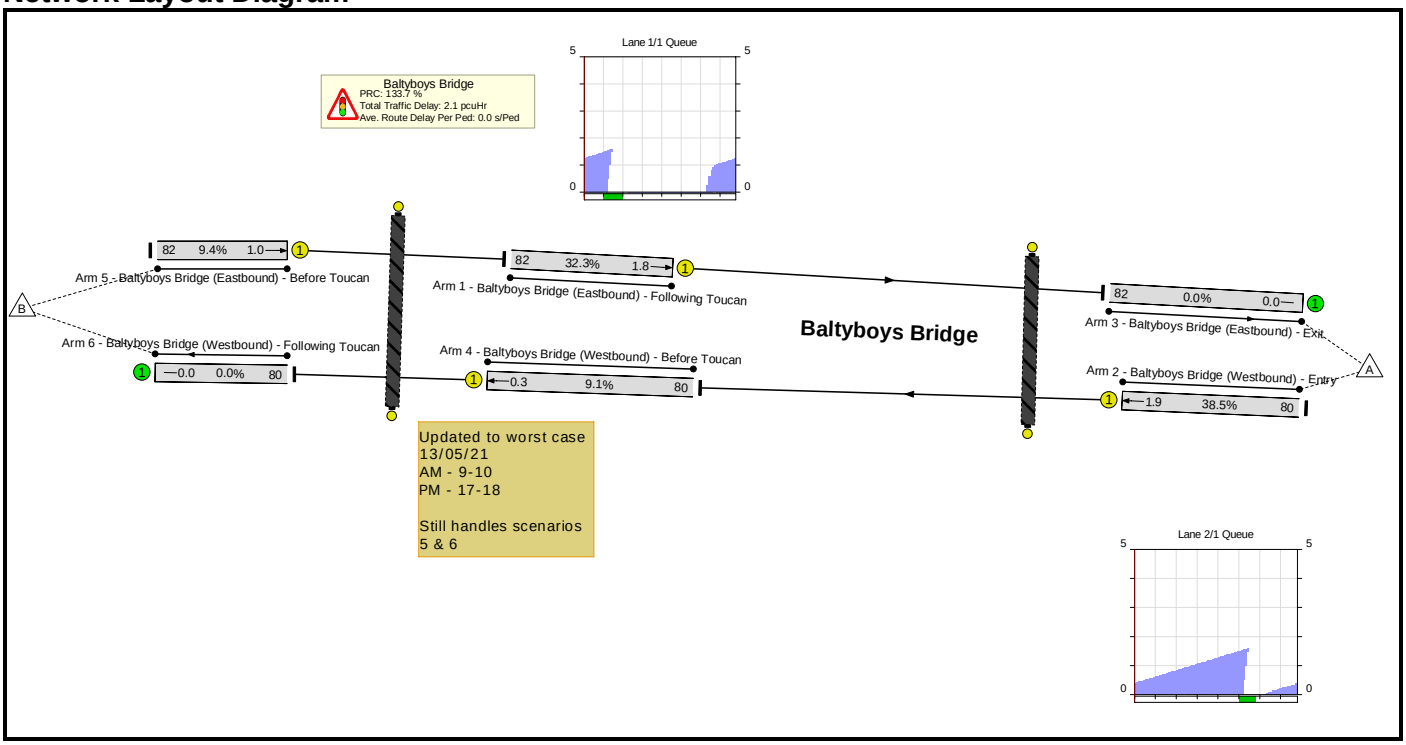
Stage	1	2	3	4
Duration	7	25	0	15
Change Point	0	17	48	58

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Baltyboys Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**38.5%**
Baltyboys Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**38.5%**
1/1	Baltyboys Bridge (Eastbound) - Following Toucan Ahead	U	N/A	N/A	A		1	10	-	82	1800	254	32.3%
2/1	Baltyboys Bridge (Westbound) - Entry Ahead	U	N/A	N/A	B		1	8	-	80	1800	208	38.5%
3/1	Baltyboys Bridge (Eastbound) - Exit	U	N/A	N/A	-		-	-	-	82	Inf	Inf	0.0%
4/1	Baltyboys Bridge (Westbound) - Before Toucan Ahead	U	N/A	N/A	F		1	37	-	80	1800	877	9.1%
5/1	Baltyboys Bridge (Eastbound) - Before Toucan Ahead	U	N/A	N/A	E		1	37	-	82	1800	877	9.4%
6/1	Baltyboys Bridge (Westbound) - Following Toucan	U	N/A	N/A	-		-	-	-	80	Inf	Inf	0.0%
Ped Link: P1	Unnamed Ped Link	-	N/A	-	G		1	26	-	0	-	0	0.0%
Ped Link: P2	Unnamed Ped Link	-	N/A	-	H		1	15	-	0	-	0	0.0%

Full Input Data And Results

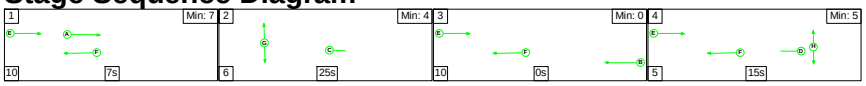
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Baltyboys Bridge	**-**	**-**	**0**	**0**	**0**	**1.5**	**0.7**	**0.0**	**2.1**	**-**	**-**	**-**	**-**
Baltyboys Bridge	**-**	**-**	**0**	**0**	**0**	**1.5**	**0.7**	**0.0**	**2.1**	**-**	**-**	**-**	**-**
1/1	82	82	-	-	-	0.4	0.2	-	0.7	29.9	1.6	0.2	1.8
2/1	80	80	-	-	-	0.7	0.3	-	1.0	46.0	1.6	0.3	1.9
3/1	82	82	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/1	80	80	-	-	-	0.1	0.1	-	0.1	6.1	0.2	0.1	0.3
5/1	82	82	-	-	-	0.2	0.1	-	0.3	13.0	0.9	0.1	1.0
6/1	80	80	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
Ped Link: P1	0	0	-	-	-	-	-	-	-	-	-	-	-
Ped Link: P2	0	0	-	-	-	-	-	-	-	-	-	-	-

C1 PRC for Signalled Lanes (%): 133.7 Total Delay for Signalled Lanes (pcuHr): 2.13 Cycle Time (s): 78
PRC Over All Lanes (%): 133.7 Total Delay Over All Lanes(pcuHr): 2.13

Full Input Data And Results

Scenario 4: 'PM (17-18) - Min' (FG2: 'PM', Plan 1: 'Network Control Plan 1')

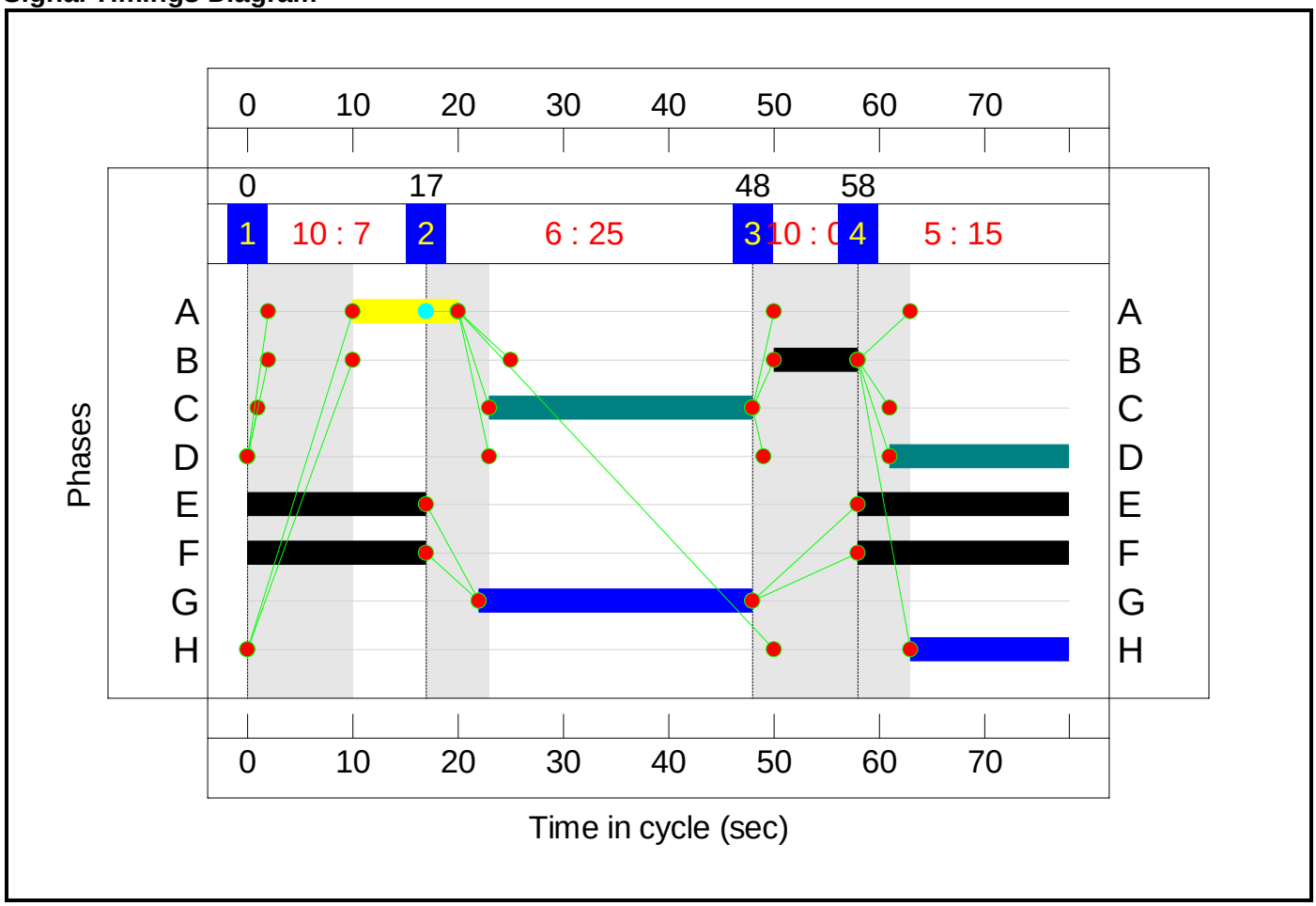
Stage Sequence Diagram



Stage Timings

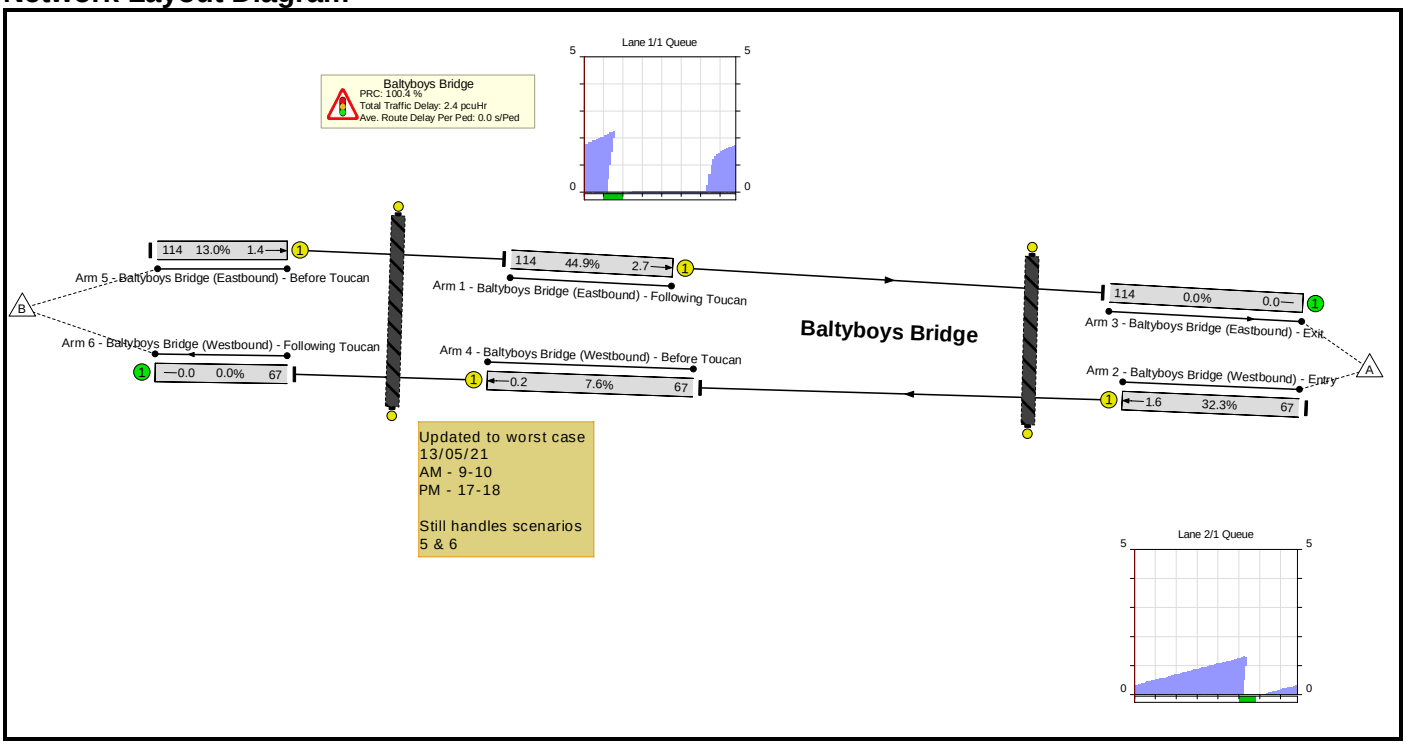
Stage	1	2	3	4
Duration	7	25	0	15
Change Point	0	17	48	58

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Baltyboys Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**44.9%**
Baltyboys Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**44.9%**
1/1	Baltyboys Bridge (Eastbound) - Following Toucan Ahead	U	N/A	N/A	A		1	10	-	114	1800	254	44.9%
2/1	Baltyboys Bridge (Westbound) - Entry Ahead	U	N/A	N/A	B		1	8	-	67	1800	208	32.3%
3/1	Baltyboys Bridge (Eastbound) - Exit	U	N/A	N/A	-		-	-	-	114	Inf	Inf	0.0%
4/1	Baltyboys Bridge (Westbound) - Before Toucan Ahead	U	N/A	N/A	F		1	37	-	67	1800	877	7.6%
5/1	Baltyboys Bridge (Eastbound) - Before Toucan Ahead	U	N/A	N/A	E		1	37	-	114	1800	877	13.0%
6/1	Baltyboys Bridge (Westbound) - Following Toucan	U	N/A	N/A	-		-	-	-	67	Inf	Inf	0.0%
Ped Link: P1	Unnamed Ped Link	-	N/A	-	G		1	26	-	0	-	0	0.0%
Ped Link: P2	Unnamed Ped Link	-	N/A	-	H		1	15	-	0	-	0	0.0%

Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Baltyboys Bridge	**-**	**-**	**0**	**0**	**0**	**1.6**	**0.8**	**0.0**	**2.4**	**-**	**-**	**-**	**-**
Baltyboys Bridge	**-**	**-**	**0**	**0**	**0**	**1.6**	**0.8**	**0.0**	**2.4**	**-**	**-**	**-**	**-**
1/1	114	114	-	-	-	0.6	0.4	-	1.0	32.6	2.2	0.4	2.7
2/1	67	67	-	-	-	0.6	0.2	-	0.8	44.5	1.3	0.2	1.6
3/1	114	114	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/1	67	67	-	-	-	0.1	0.0	-	0.1	6.0	0.2	0.0	0.2
5/1	114	114	-	-	-	0.3	0.1	-	0.4	13.3	1.3	0.1	1.4
6/1	67	67	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
Ped Link: P1	0	0	-	-	-	-	-	-	-	-	-	-	-
Ped Link: P2	0	0	-	-	-	-	-	-	-	-	-	-	-

C1 PRC for Signalled Lanes (%): 100.4 Total Delay for Signalled Lanes (pcuHr): 2.39 Cycle Time (s): 78

PRC Over All Lanes (%): 100.4 Total Delay Over All Lanes(pcuHr): 2.39

Appendix F

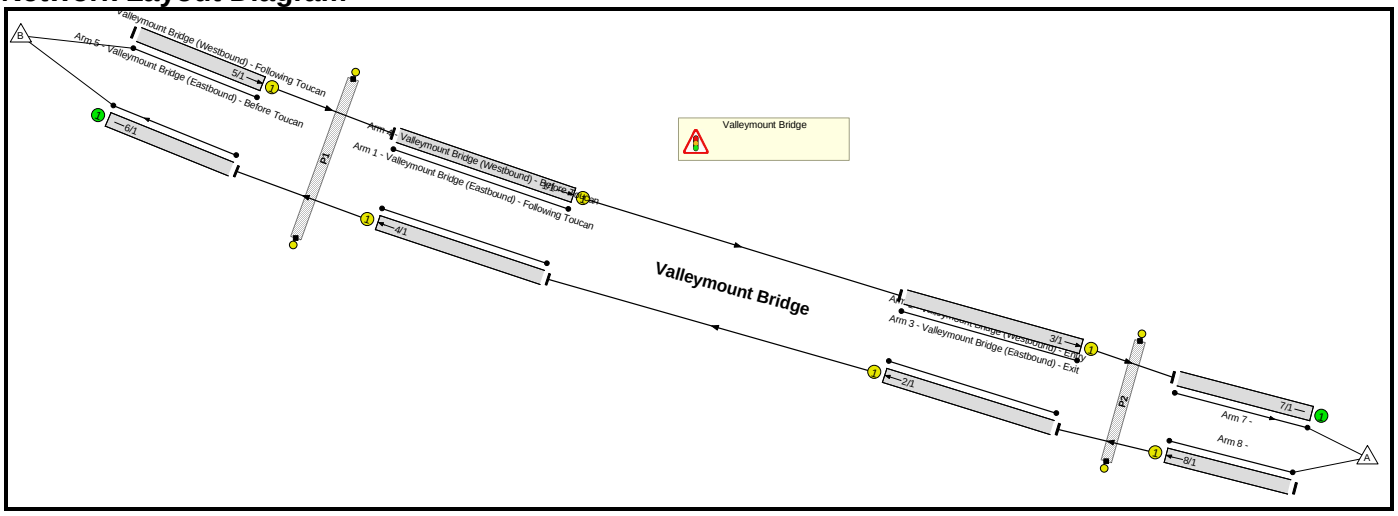
Valleymount Bridge LinSig Model Results

Full Input Data And Results

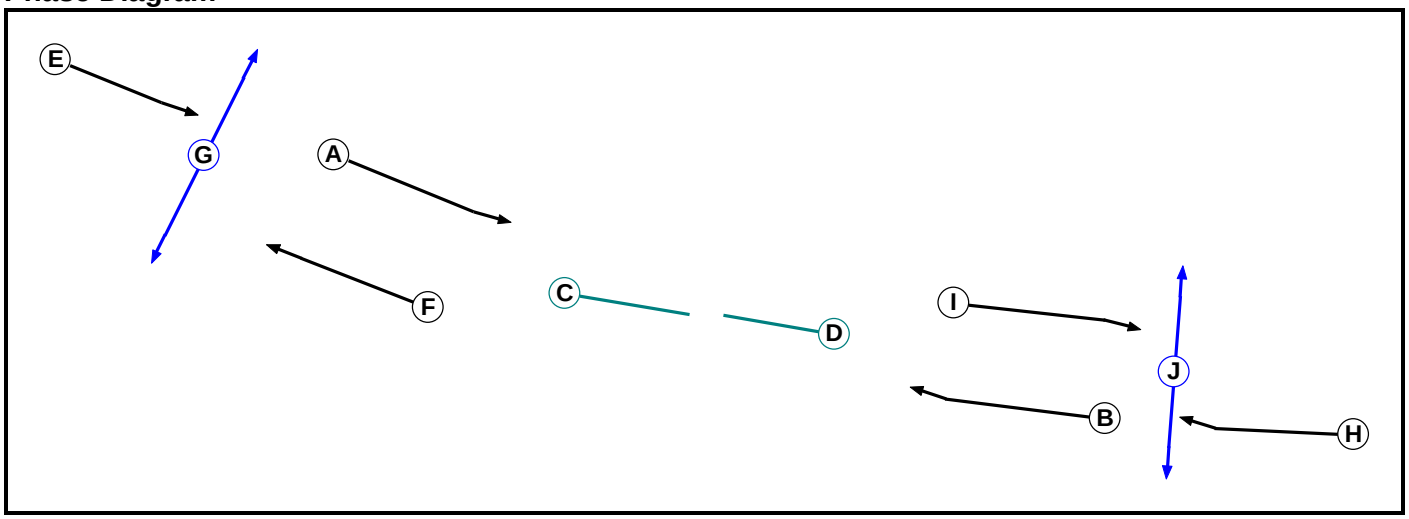
User and Project Details

Project:	**Blessington Greenways**
Title:	**Valleymount Bridge**
Location:	Valleymount Bridge
Client:	Wicklow County Council
Date Started:	27/08/21
Additional detail:	
File name:	3_Valleymount Bridge_2Toucan.lsg3x
Author:	Jacob Hughes
Company:	AECOM
Address:	

Network Layout Diagram



Phase Diagram



Full Input Data And Results

Phase Input Data

Phase Name	Phase Type	Assoc. Phase	Street Min	Cont Min
A	Traffic		-9999	7
B	Traffic		-9999	7
C	Dummy		-9999	4
D	Dummy		-9999	4
E	Traffic		-9999	7
F	Traffic		-9999	7
G	Pedestrian		-9999	5
H	Traffic		-9999	7
I	Traffic		-9999	7
J	Pedestrian		-9999	5

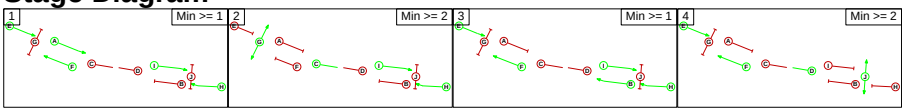
Phase Intergreens Matrix

Terminating Phase \ Starting Phase	A	B	C	D	E	F	G	H	I	J
A		5	3	3	-	-	-	-	-	-
B	5		3	3	-	-	-	-	-	-
C	2	2		1	-	-	-	-	-	-
D	2	2	1		-	-	-	-	-	-
E	-	-	-	-		-	5	-	-	-
F	-	-	-	-	-		5	-	-	-
G	-	-	-	-	8	8		-	-	-
H	-	-	-	-	-	-	-		-	5
I	-	-	-	-	-	-	-	-		5
J	-	-	-	-	-	-	-	8	8	

Phases in Stage

Stage No.	Phases in Stage
1	A E F H I
2	C G H I
3	B E F H I
4	D E F J

Stage Diagram



Phase Delays

Term. Stage	Start Stage	Phase	Type	Value	Cont value
1	2	A	Losing	3	3
3	4	B	Losing	3	3

Full Input Data And Results

Lane Input Data

Junction: Valleymount Bridge												
Lane	**Lane Type**	**Phases**	**Start Disp.**	**End Disp.**	**Physical Length (PCU)**	**Sat Flow Type**	**Def User Saturation Flow (PCU/Hr)**	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Turns**	**Turning Radius (m)**
1/1 (Valleymount Bridge (Eastbound) - Following Toucan)	U	A	2	3	5.2	User	1800	-	-	-	-	-
2/1 (Valleymount Bridge (Westbound) - Entry)	U	B	2	3	5.2	User	1800	-	-	-	-	-
3/1 (Valleymount Bridge (Eastbound) - Exit)	U	I	2	3	43.5	User	1800	-	-	-	-	-
4/1 (Valleymount Bridge (Westbound) - Before Toucan)	U	F	2	3	43.5	User	1800	-	-	-	-	-
5/1 (Valleymount Bridge (Eastbound) - Before Toucan)	U	E	2	3	19.3	User	1800	-	-	-	-	-
6/1 (Valleymount Bridge (Westbound) - Following Toucan)	U		2	3	60.0	Inf	-	-	-	-	-	-
7/1	U		2	3	60.0	Inf	-	-	-	-	-	-
8/1	U	H	2	3	60.0	User	1800	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: 'AM'	09:00	10:00	01:00	
2: 'PM'	17:00	18:00	01:00	

Traffic Flows, Desired

Scenario 1: 'AM (9-10)' (FG1: 'AM', Plan 1: 'Network Control Plan 1')

Desired Flow :

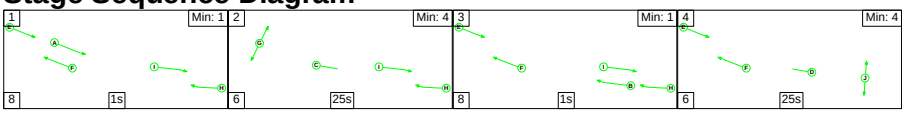
	Destination			
		A	B	Tot.
Origin	A	0	80	80
	B	60	0	60
	Tot.	60	80	140

Full Input Data And Results

Scenario 2: 'PM (17-18)' (FG2: 'PM', Plan 1: 'Network Control Plan 1')
Desired Flow :

Origin	Destination		
	A	B	Tot.
A	0	75	75
B	62	0	62
Tot.	62	75	137

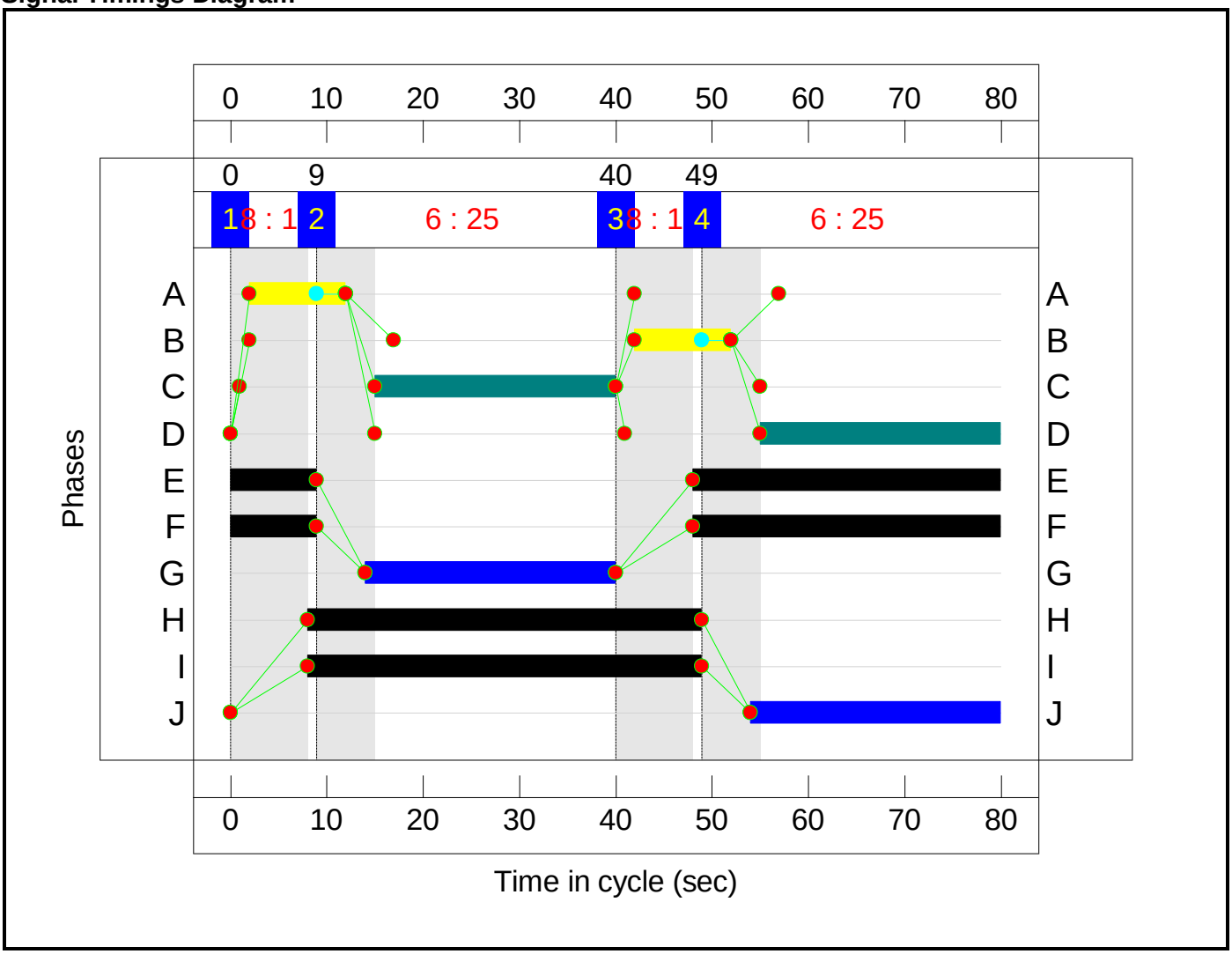
Scenario 1: 'AM (9-10)' (FG1: 'AM', Plan 1: 'Network Control Plan 1')
Stage Sequence Diagram



Stage Timings

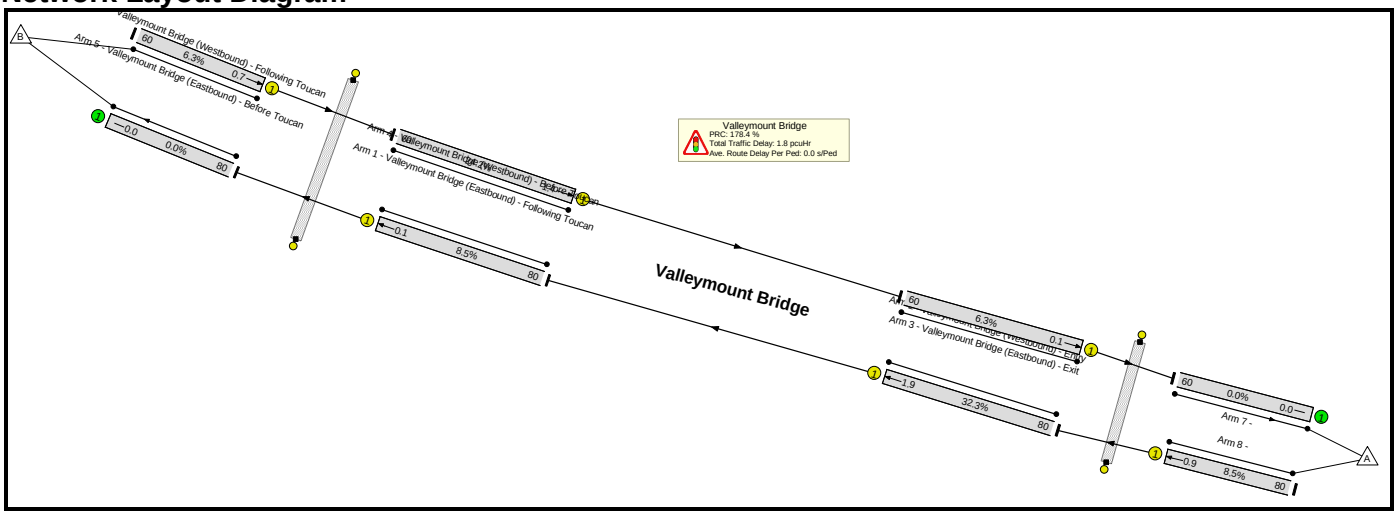
Stage	1	2	3	4
Duration	1	25	1	25
Change Point	0	9	40	49

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Valleymount Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**32.3%**
Valleymount Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**32.3%**
1/1	Valleymount Bridge (Eastbound) - Following Toucan Ahead	U	N/A	N/A	A		1	10	-	60	1800	248	24.2%
2/1	Valleymount Bridge (Westbound) - Entry Ahead	U	N/A	N/A	B		1	10	-	80	1800	248	32.3%
3/1	Valleymount Bridge (Eastbound) - Exit Ahead	U	N/A	N/A	I		1	41	-	60	1800	945	6.3%
4/1	Valleymount Bridge (Westbound) - Before Toucan Ahead	U	N/A	N/A	F		1	41	-	80	1800	945	8.5%
5/1	Valleymount Bridge (Eastbound) - Before Toucan Ahead	U	N/A	N/A	E		1	41	-	60	1800	945	6.3%
6/1	Valleymount Bridge (Westbound) - Following Toucan	U	N/A	N/A	-		-	-	-	80	Inf	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	60	Inf	Inf	0.0%
8/1	Ahead	U	N/A	N/A	H		1	41	-	80	1800	945	8.5%
Ped Link: P1	Unnamed Ped Link	-	N/A	-	G		1	26	-	0	-	0	0.0%
Ped Link: P2	Unnamed Ped Link	-	N/A	-	J		1	26	-	0	-	0	0.0%

Full Input Data And Results

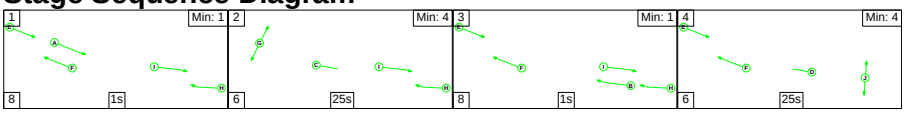
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Valleymount Bridge	**-**	**-**	**0**	**0**	**0**	**1.3**	**0.6**	**0.0**	**1.8**	**-**	**-**	**-**	**-**
Valleymount Bridge	**-**	**-**	**0**	**0**	**0**	**1.3**	**0.6**	**0.0**	**1.8**	**-**	**-**	**-**	**-**
1/1	60	60	-	-	-	0.4	0.2	-	0.5	31.6	1.2	0.2	1.4
2/1	80	80	-	-	-	0.5	0.2	-	0.7	32.9	1.6	0.2	1.9
3/1	60	60	-	-	-	0.0	0.0	-	0.0	2.9	0.0	0.0	0.1
4/1	80	80	-	-	-	0.0	0.0	-	0.1	3.7	0.1	0.0	0.1
5/1	60	60	-	-	-	0.2	0.0	-	0.2	11.4	0.7	0.0	0.7
6/1	80	80	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	60	60	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	80	80	-	-	-	0.2	0.0	-	0.3	11.5	0.9	0.0	0.9
Ped Link: P1	0	0	-	-	-	-	-	-	-	-	-	-	-
Ped Link: P2	0	0	-	-	-	-	-	-	-	-	-	-	-

C1 PRC for Signalled Lanes (%): 178.4 Total Delay for Signalled Lanes (pcuHr): 1.84 Cycle Time (s): 80
PRC Over All Lanes (%): 178.4 Total Delay Over All Lanes(pcuHr): 1.84

Full Input Data And Results

Scenario 2: 'PM (17-18)' (FG2: 'PM', Plan 1: 'Network Control Plan 1')

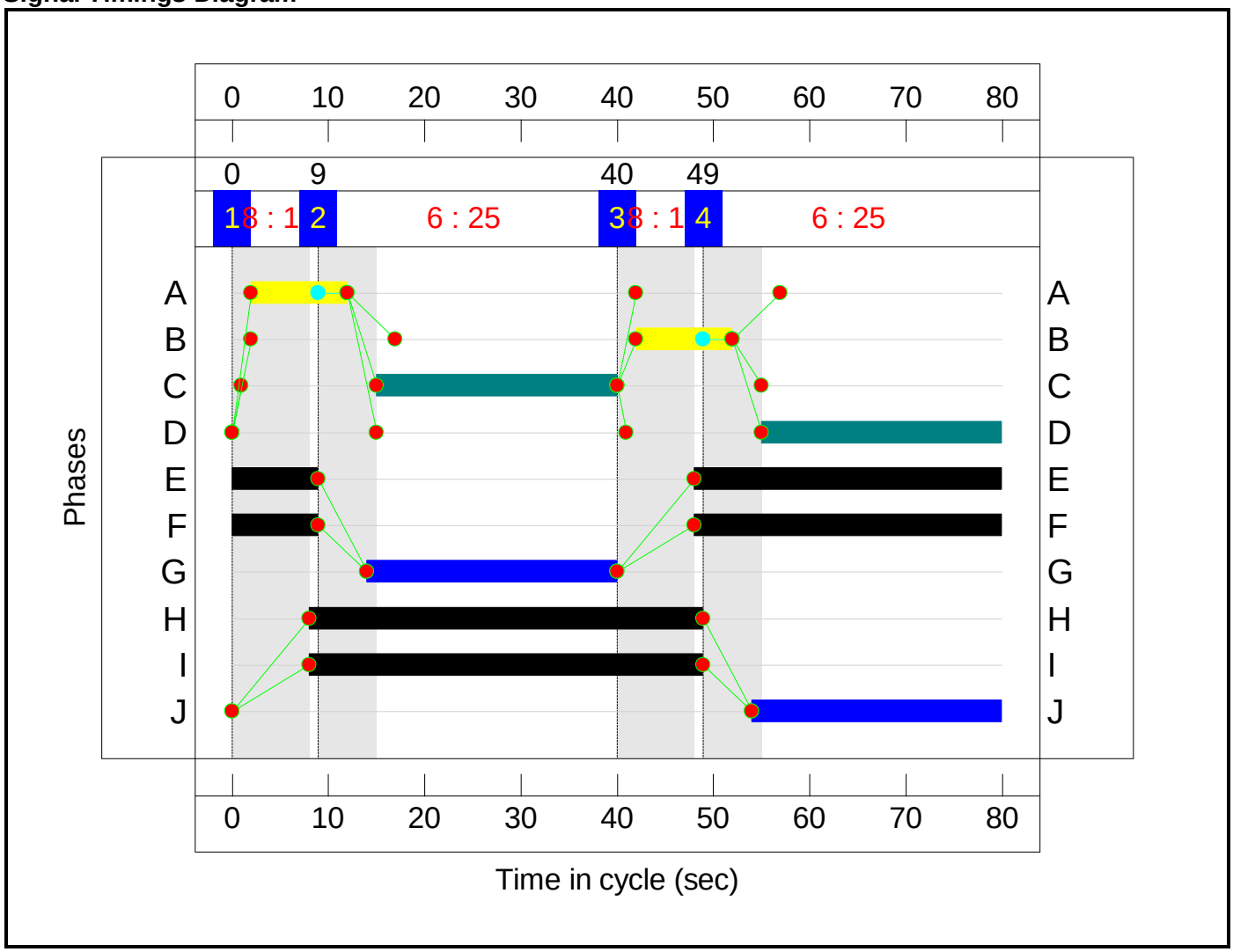
Stage Sequence Diagram



Stage Timings

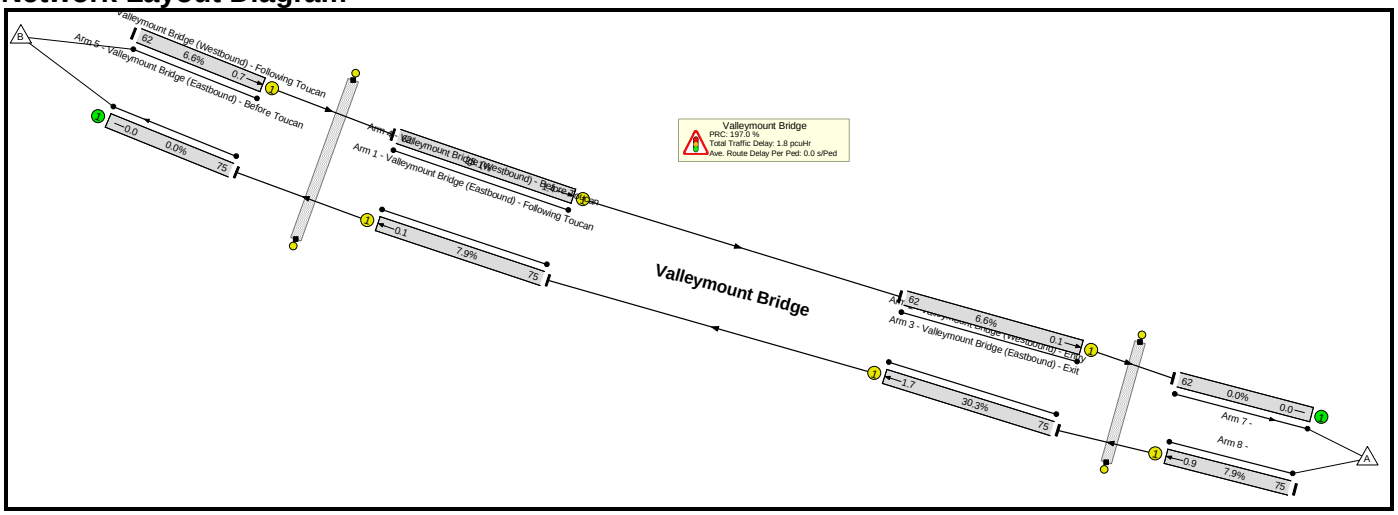
Stage	1	2	3	4
Duration	1	25	1	25
Change Point	0	9	40	49

Signal Timings Diagram



Full Input Data And Results

Network Layout Diagram



Full Input Data And Results

Network Results

Item	Lane Description	Lane Type	Controller Stream	Position In Filtered Route	Full Phase	Arrow Phase	Num Greens	Total Green (s)	Arrow Green (s)	Demand Flow (pcu)	Sat Flow (pcu/Hr)	Capacity (pcu)	Deg Sat (%)
Network: Valleymount Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**30.3%**
Valleymount Bridge	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**30.3%**
1/1	Valleymount Bridge (Eastbound) - Following Toucan Ahead	U	N/A	N/A	A		1	10	-	62	1800	248	25.1%
2/1	Valleymount Bridge (Westbound) - Entry Ahead	U	N/A	N/A	B		1	10	-	75	1800	248	30.3%
3/1	Valleymount Bridge (Eastbound) - Exit Ahead	U	N/A	N/A	I		1	41	-	62	1800	945	6.6%
4/1	Valleymount Bridge (Westbound) - Before Toucan Ahead	U	N/A	N/A	F		1	41	-	75	1800	945	7.9%
5/1	Valleymount Bridge (Eastbound) - Before Toucan Ahead	U	N/A	N/A	E		1	41	-	62	1800	945	6.6%
6/1	Valleymount Bridge (Westbound) - Following Toucan	U	N/A	N/A	-		-	-	-	75	Inf	Inf	0.0%
7/1		U	N/A	N/A	-		-	-	-	62	Inf	Inf	0.0%
8/1	Ahead	U	N/A	N/A	H		1	41	-	75	1800	945	7.9%
Ped Link: P1	Unnamed Ped Link	-	N/A	-	G		1	26	-	0	-	0	0.0%
Ped Link: P2	Unnamed Ped Link	-	N/A	-	J		1	26	-	0	-	0	0.0%

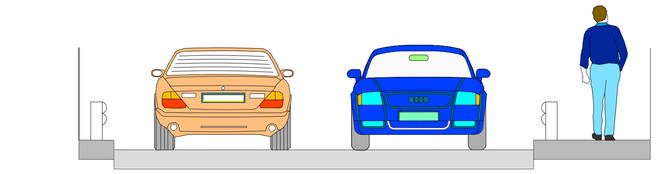
Full Input Data And Results

Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Valleymount Bridge	**-**	**-**	**0**	**0**	**0**	**1.2**	**0.5**	**0.0**	**1.8**	**-**	**-**	**-**	**-**
Valleymount Bridge	**-**	**-**	**0**	**0**	**0**	**1.2**	**0.5**	**0.0**	**1.8**	**-**	**-**	**-**	**-**
1/1	62	62	-	-	-	0.4	0.2	-	0.5	31.7	1.2	0.2	1.4
2/1	75	75	-	-	-	0.5	0.2	-	0.7	32.5	1.5	0.2	1.7
3/1	62	62	-	-	-	0.0	0.0	-	0.1	3.0	0.0	0.0	0.1
4/1	75	75	-	-	-	0.0	0.0	-	0.1	3.6	0.1	0.0	0.1
5/1	62	62	-	-	-	0.2	0.0	-	0.2	11.4	0.7	0.0	0.7
6/1	75	75	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
7/1	62	62	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
8/1	75	75	-	-	-	0.2	0.0	-	0.2	11.5	0.8	0.0	0.9
Ped Link: P1	0	0	-	-	-	-	-	-	-	-	-	-	-
Ped Link: P2	0	0	-	-	-	-	-	-	-	-	-	-	-

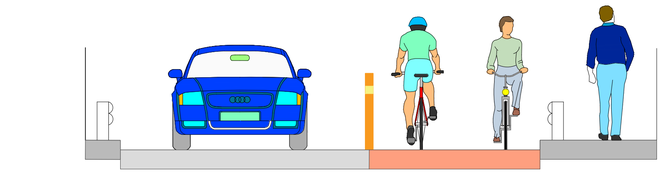
C1 PRC for Signalled Lanes (%): 197.0 Total Delay for Signalled Lanes (pcuHr): 1.79 Cycle Time (s): 80
PRC Over All Lanes (%): 197.0 Total Delay Over All Lanes(pcuHr): 1.79

Appendix G

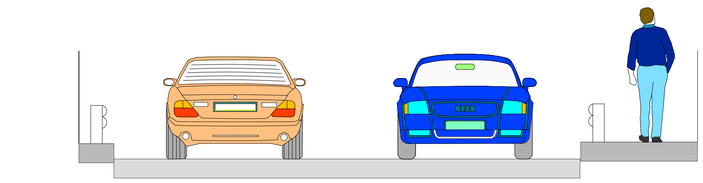
Bridge Cross-sections Concept Design



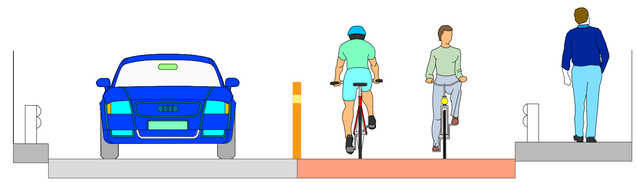
KNOCKIERAN BRIDGE EXISTING CROSS-SECTION



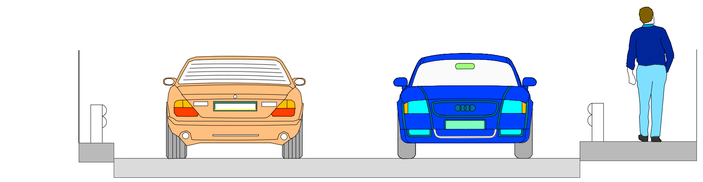
KNOCKIERAN BRIDGE PROPOSED CROSS-SECTION



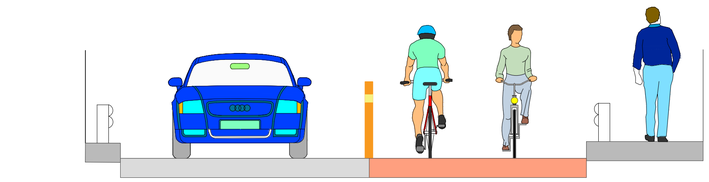
BALTYBOYS BRIDGE EXISTING CROSS-SECTION



BALTYBOYS BRIDGE PROPOSED CROSS-SECTION



VALLEYMOUNT BRIDGE EXISTING CROSS-SECTION



VALLEYMOUNT BRIDGE PROPOSED CROSS-SECTION

AECOM

PROJECT

BLESSINGTON
eGREENWAY

CLIENT

WICKLOW
ENDLESS OPPORTUNITIES

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NOTES

ISSUE/REVISION

C	13/12/2021	ISSUE FOR PLANNING
B	23/09/2021	SECOND ISSUE
A	13/08/2021	FIRST ISSUE
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60617025

SHEET TITLE

CROSS SECTIONS
SHUTTLE WORKING
CONCEPT DESIGN

SHEET NUMBER

60617025_SHT_DD_BLGWY_1204

Project Management Initials: Designer: EB Checked: ER Approved: NW ISO A1 594mm x 841mm

Filename: Z:\UK\IEDBL2\JOBS\PR-447455_BLESSINGTON_GREENWAY\900_CAD_GIS\910_CAD\05-MODELS\SHUTTLE WORKING STUDY\60617025_SHT_DD_BLGWY_1204.DWG
Last saved by: LUTTRELLC Last Plotted: 2021-12-13

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