REPORT

Holyhead Breakwater Environmental Impact Assessment Report

Appendices

Client: Isle of Anglesey County Council

Reference: PB9014-RHD-BW-XX-RP-C-0214

Status: Final/P01

Date: 14 May 2021

CYNGOR SIR YNYS MÔN ISLE OF ANGLESEY COUNTY COUNCIL

Stena Line

Llywodraeth Cymru Welsh Government

Royal HaskoningDHV

Enhancing Society Together

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Checked by: Jamie Gardiner

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Approved by: Jamie Gardiner

Date: 28/05/2021

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Project related

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1.1 NRW Screening Opinion

Cyfoeth Naturiol Cymru
Natural Resources Wales

Ein cyf/Our ref: SC1903

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Sent by e mail

Date 01 October 2019

Dear Sarah

SCREENING OPINION UNDER THE MARINE WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2007 (as amended)

HOLYHEAD BREAKWATER REFURBISHMENT

I am writing further to your request for a screening opinion, dated 13 August 2019, made in accordance with The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) ("The Regulations").

The purpose of the Environmental Impact Assessment (EIA) screening procedure is to determine whether the proposed works require an Environmental Impact Assessment and submission of an Environmental Statement (ES).

In reaching our Screening Opinion we have considered the proposed works against Schedule A1 and A2 of the above regulations. We have also consulted with the bodies that we consider have an interest in the project by reason of their environmental responsibilities, or local or regional competences, as required by the above regulations.

Screening Opinion

It is our opinion that the works fall within the categories of project listed within Schedule A2, paragraph 69 of the above regulations, and therefore must be considered in terms of its size, nature and location having regard to the relevant criteria listed in Schedule 1 of the above regulations.

"69. Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works".

We have carefully considered the views of the consultation bodies alongside the criteria as set out in Schedule 1 of the Regulations, and have determined, based on the information provided; that the project **does not** require a statutory Environmental Impact Assessment.

The Conservation of Habitats and Species Regulations 2017

As part of the screening exercise, we have also considered whether the proposed project, either alone or in combination with other plans or projects, is likely to have a significant effect on any site designated as a European site of conservation importance under the above Regulations. To assist in making this judgement of likely significant effect, we have sought advice from our statutory nature conversation advisor.

It is our initial view that the following sites could be impacted by the proposal:

- North Anglesey Marine SAC
- Anglesey Terns SPA

We would encourage you to contact Natural Resources Wales to receive further pre-application advice on this product.

This Screening Opinion will be provided to all those bodies that were consulted and will be publicised on our website and on our Public Register.

If the UK leaves the EU - either with or without a deal - the legal obligations relating to compliance with environmental permits and legislation will continue to apply. NRW on behalf of Welsh Ministers will continue to issue licenses in line with our current practice. If you have any questions about your permits or licenses, please contact our Customer Care Centre on 03000 653 000.

Yours sincerely

Marine Licensing Team
Natural Resources Wales

Cc: All Consultation Bodies

Annex 1 – Comments by Consultation Bodies

To be read in conjunction with Screening Opinion SC1903

1. **Summary of Proposal Considered –** Holyhead Breakwater Refurbishment

2. **Location –** Holyhead Harbour, Anglesey

3. **Issues for Consideration**

Although it was concluded a statutory Environmental Impact Assessment was not required the following advice has been provided regarding the proposal.

Noise Disturbance / Marine Mammals

As the rock and concrete will be placed along the breakwater, and no other construction is proposed – Our internal NRW advisors don't foresee any likely significant effect on any marine mammal features of the adjacent designated sites. Underwater noise will be minimal and for a short duration, and they don't anticipate it to be of a level to cause any significant disturbance or injury.

Coastal Processes

Our internal advisors agree that hydrodynamic and sediment dispersion modelling is not appropriate for the scale of this development. However, they recommend that an overview of the potential local and regional scale changes to coastal processes be presented in the final application.

Archaeology

The scope of work relating to archaeology and cultural heritage reflects previous pre-application discussions with the Welsh Archaeological Trust and is still considered to be appropriate.

Habitats Regulations Assessment (HRA)

At this stage it is not possible to state whether an appropriate assessment will be required. Following the European Court of Justice ruling in the case of 'People over Wind and Sweetman v Coillte Teoranta (Case C-323/17)' it is no longer appropriate to consider mitigation measures when screening a plan or project to determine whether it is necessary to carry out an appropriate assessment of the implications for a European site. Rather, mitigation measures should only be considered at the appropriate assessment stage. Therefore, it is highly likely that any HRA for this project would have to go to appropriate

assessment. This does not mean to say that any potential impact pathways from the proposed development cannot be mitigated.

Navigational Safety

The Marine and Coastguard Agency (MCA) would expect the safety of navigation to be considered, with any predicted impact on shipping and navigation to be suitably mitigated. The MCA note that the site falls within the jurisdiction of Stena Line in their capacity of Statutory Harbour Authority, who would be expected to maintain safety within their waters in line with the Port Marine Safety Code, and it's Guide to Good Practice.

1.2 IoACC Screening Opinion

CYNGOR SIR
YNYS MÔN
ISLE OF ANGLESEY
COUNTY COUNCIL

DEWI FRANCIS JONES MSc, M.R.T.P.I
Prif Swyddog Cynllunio – Rheoleiddio a Datblygu Economaidd
Chief Planning Officer – Regulation and Economic Development

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Cais Rhif / App. No. **SCR/2019/50**

Ms. Sarah Marjoram
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DEDDF CYNLLUNIO GWLAD A THREF 1990 / TOWN AND COUNTRY PLANNING ACT 1990

RHEOLIADAU CYNLLUNIO GWLAD A THREF (ASESIAD AR YR EFFAITH AMGYLCHEDDOL) (CYMRU) 2017 / TOWN AND COUNTRY PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) (WALES) REGULATIONS 2017

Barn sgrinio ar gyfer atgyweirio yn / Screening opinion for the refurbishment at Morglawdd, Caergybi / Breakwater, Holyhead

RHYBUDD PENDERFYNIAD

Ceisiwyd barn sgrinio ymhellach i'r datblygiad arfaethedig uchod ar.

Wrth ffurfio barn sgrinio ar effaith sylweddol tebygol o ddatblygiad arfaethedig, rhaid rhoi sylw i Rhestr 3 o'r Rheoliadau Gwlad a Thref (Asesiad ar yr Effaith Amgylcheddol) (AEA) 2017 sydd yn nodi meini prawf dethol i'w hystyried. Nodir tri maen prawf bras:

- nodweddion y datblygiad;
- sensitifrwydd amgylcheddol y lleoliadau daearyddol sy'n debygol o gael eu heffeithio gan y datblygiad; a
- math a nodweddion yr effaith bosib.

Fel arfer bydd angen asesiad ar gyfer datblygiad os yw'n:

- ddatblygiad pwysig sydd a phwysigrwydd y tu i'r lleol;
- ddatyblygiad mewn lleoliad amgylcheddol sensitive iawn; a'n
- ddatblygiad sy'n cael effaith anarferol o gymhleth ac o bosib bergylus ar yr amgylchedd.

Wedi ystyried y datblygiad arfaethedig, a chadw mewn cof y wybodaeth a gyflwynwyd a'r meini prawf dethol Rhestr 3 o'r Rheoliadau yn fy marn i bydd y datblygiad yn cael effaith sylweddol ar yr ymgylchedd ac yn hyn o beth **BYDD ANGEN AEA.**

NOTICE OF DECISION

A request for a screening opinion in respect of the above proposed development was made on.

In formulating a screening opinion on the likely significant effects on the environment of a proposed development, regard is to be had to Schedule 3 of the Town and Country Planning (Environmental Impact Assessment) (EIA) Regulations 2017 which sets out the selection criteria to be taken into account. Three broad criteria are identified:

- the characteristics of the development;
- The environmental sensitivity of geographical areas likely to be affected by development; and
- the types and characteristics of the potential impact

EIA will generally be needed for development if:

- they are major developments of more than local importance;
- they are developments in particularly sensitive or vulnerable locations; or
- they are developments with unusually complex and potentially hazardous environmental effects.

Having considered the proposed development taking into account the information submitted and the selection criteria contained in Schedule 3 of the Regulations, my judgment is that the proposed development is likely to have significant effects on the environment and that **EIA IS** required.

DYDDIAD Y PENDERFYNIAD **01/10/2019** DATE OF DECISION

DEWI FRANCIS JONES
PRIF SWYDDOG CYNLLUNIO / CHIEF PLANNING OFFICER

Croeso i chi ddelio gyda'r Cyngor yn Gymraeg neu'n Saesneg. Cewch yr un safon o wasanaeth yn y ddwy iaith. You are welcome to deal with the Council in Welsh or English. You will receive the same standard of service in both languages.

1.3 Further Information to IoACC

Note

HaskoningDHV UK Ltd.
Industry & Buildings

To:	Emma Collett, Rowland Thomas
From:	Sarah Marjoram
Date:	Tuesday, 19 November 2019
Copy:	Jamie Gardiner, Neil Chamberlain, Simon Lewis
Our reference:	PB9014-RHD-ZZ-XX-MS-Z-0108
Classification:	Project related

Subject: **Holyhead Breakwater – Further Information for IoACC to inform an EIA screening request**

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1 Introduction

This note has been prepared to provide the Isle of Anglesey County Council (IoACC) with further information on elements of the proposed Holyhead Breakwater refurbishment scheme (the proposed scheme) which have resulted in the proposed scheme being considered an EIA Development. Its purpose is to provide further justification as to why the proposed scheme is not considered to have the potential to result in significant environmental impacts and therefore is not considered to be an EIA Development.

The IoACC raised comments on the following topics:

- Details and location of the concrete batching plant and further information to determine the potential effects (addressed in **Section 2.1** of this note);
- Inclusion of the Chwarel Morglawdd Caergybi Local Wildlife Site (LWS) (addressed in **Section 2.2**);
- An in-combination assessment with other plans and projects (addressed in **Section 2.3**); and,
- Details of 'best practice' mitigation measures (addressed in **Section 3**).

Please note, the information provided in this note is additional to that provided in the Screening Report (PB9014-RHD-ZZ-XX-RP-C-0062) and therefore the two documents should be read in conjunction.

Since the Screening Report was produced, there have been some minor amendments to the proposed scheme, as follows (see also **Drawing PB9014-RHD-BW-XX-DR-C-0066** at the end of this note):

- In addition to the use of Tetrapods, rock is now also being proposed to be placed at Soldiers Point, and around the nose and along a section of the leeward side of the breakwater;
- The Tetrapods will now extend around the nose of the breakwater to approximate 100m along the leeward side; and,
- It is proposed that the turning point, located approx. 100m from the end of the breakwater on the leeward side is removed.

These changes are presented in more detail in **Section 4**, along with an assessment of their potential to effect on the screening exercise.

2 Provision of Further Information

2.1 Concrete Batching Plant

The concrete batching plant is proposed to be located at one of two locations – within Holyhead Port on Salt Island or adjacent to the Breakwater on Soldiers Point. Regardless of the location chosen, clear constraints will be given to the contractor defining the area they can occupy. This will also define the programme of works to ensure there is sufficient space.

2.1.1 Salt Island

Stena Line has confirmed that there is sufficient space on Salt Island for a concrete batching plant, should it be located here (see **Figure 2.1**). Material would be delivered to Terminal 2 by sea for the manufacturing of concrete and casting of Tetrapods. There is also sufficient space to allow the Tetrapods to cure and dry before these would be transported to Soldiers Point by barge prior to placement along the seaward side of the Breakwater. The screening report for the Holyhead Breakwater refurbishment concluded that the operation of the batching plant would not have a significant impact on human or ecological receptors.

This conclusion was based on the information available within the Environmental Statement (ES) of the Holyhead Port Expansion (HPE) project (I&BPB6108R006F0.1)[1], which was not presented within the screening report. As such, relevant information from the ES is presented below to confirm that a concrete batching plant located on Salt Island is not anticipated to result in significant environmental effects to human and ecological receptors.

Potential significant environmental impacts from a concrete batching plant can arise from impacts to air quality, noise and water quality. As such, an assessment of these parameters was carried out and presented within the HPE ES. The HPE project proposes the use of a concrete batching plant to be located on Admiralty Pier, on the south side of Salt Island. A summary of the assessment is provided below.

Air Quality

The assessment of potential impacts to air quality on human receptors was carried out for the construction phase of the HPE project. There are no ecological receptors sensitive to dust on or near Salt Island.

The HPE project proposed the use of a concrete batching plant on Salt Island to support the construction of the reclamation areas. Human receptors (i.e. residents and businesses) are located within 350m of Salt Island and as such under Institute of Air Quality Management (IAQM) guidance a detailed assessment was required.

A concrete batching plant is considered to be a dusty activity and as such was assigned a Dust Magnitude of Large. The sensitivity of people to dust soiling was considered to be low, and the sensitivity of people to the health effects of PM_{10} was also considered to be low as the annual background PM_{10} concentration at the site is less than 24µg.m^{-3}.

[1] Royal HaskoningDHV, 2019. Holyhead Port Expansion Environmental Statement.

Legend:

- Salt Island Batching Plant
- Human Receptor

Client:	Project:
IOACC	Holyhead Breakwater Refurbishment

Title:

Salt Island concrete batching plant and human receptors

Figure:	Drawing No:
2.1	PB9014-001-001

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
01	05/11/19	AB	SM	A3	1:3,000

Co-ordinate system: British National Grid

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Therefore, the assessment determined that there was a **medium risk** of potential impacts to human receptors resulting from construction activities without the implementation of mitigation measures. Recommended measures in the HPE ES included:

- Develop and implement a Dust Management Plan (DMP)
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results and make an inspection log.
- Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- Erect solid screens or barriers, around the site boundary.
- Take measures to control site runoff of water.
- Produce a Construction Logistics Plan to manage the delivery of materials, thereby avoiding/minimising the time materials are stockpiled on site.
- Use enclosed chutes and conveyors and covered skips.
- Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

The implementation of these measures was considered to ensure that the residual impact to human receptors arising from potential impacts from dust would not be significant.

With regards to the proposed scheme, the measures outlined above would also be put in place to reduce any potential air quality impacts to human receptors. Any risk to human health would therefore be not significant, as concluded for the HPE scheme.

Noise

Noise modelling was also undertaken as part of the EIA for the HPE project. This included the operation of a concrete batching plant on Salt Island that would operate 24/7. Noise sensitive receptor locations were chosen to represent the closest residential housing and businesses to the HPE project. The operation of the concrete batching plant was assessed as part of the Week 37 activities which included drilling and driving piles, filling piles with concrete, installation of anchor walls and tie rods and the placement of material within the reclamation areas by excavators. The modelling determined that these activities would have no impact on nearby human receptors (see **Figures 2.2** and **2.3** below extracted from the HPE ES – the concrete batching plant is located adjacent to Terminal 2 on Admiralty Pier, indicated by the red arrow).

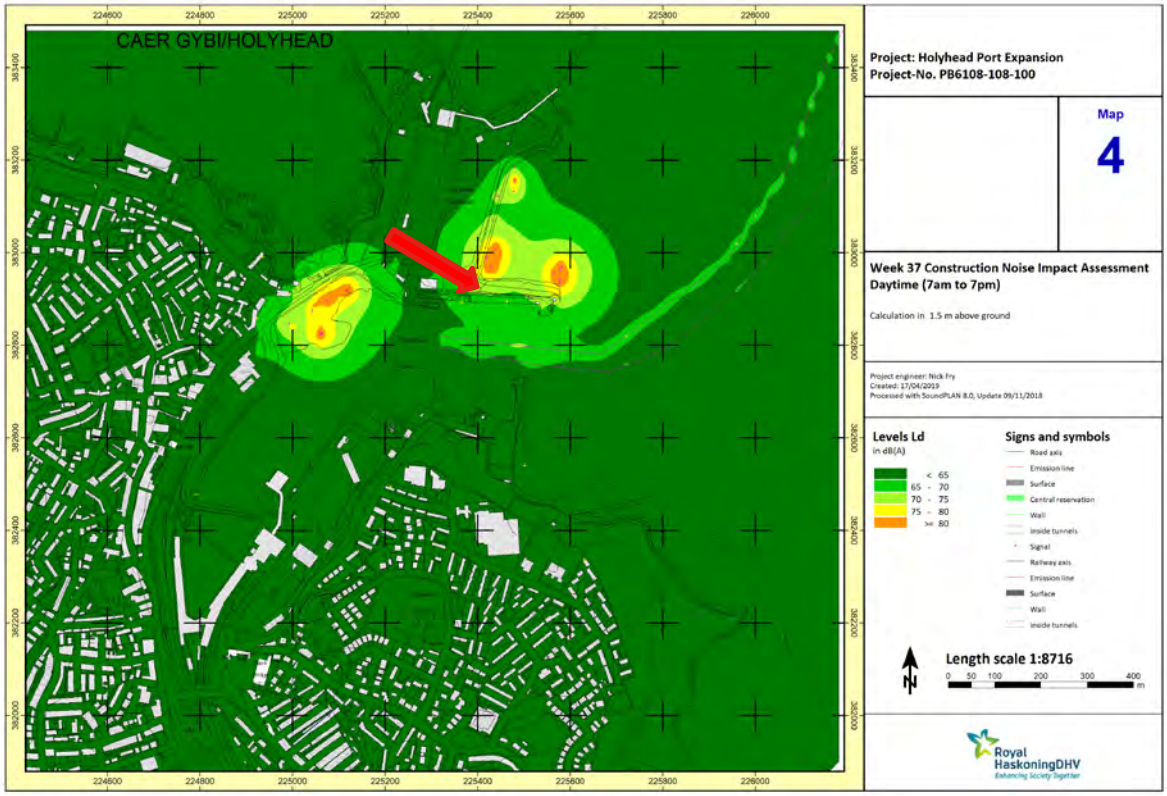

Figure 2.2 Construction Noise Impact Assessment (daytime - 7am to 7pm) (Source: Royal HaskoningDHV, 2019)

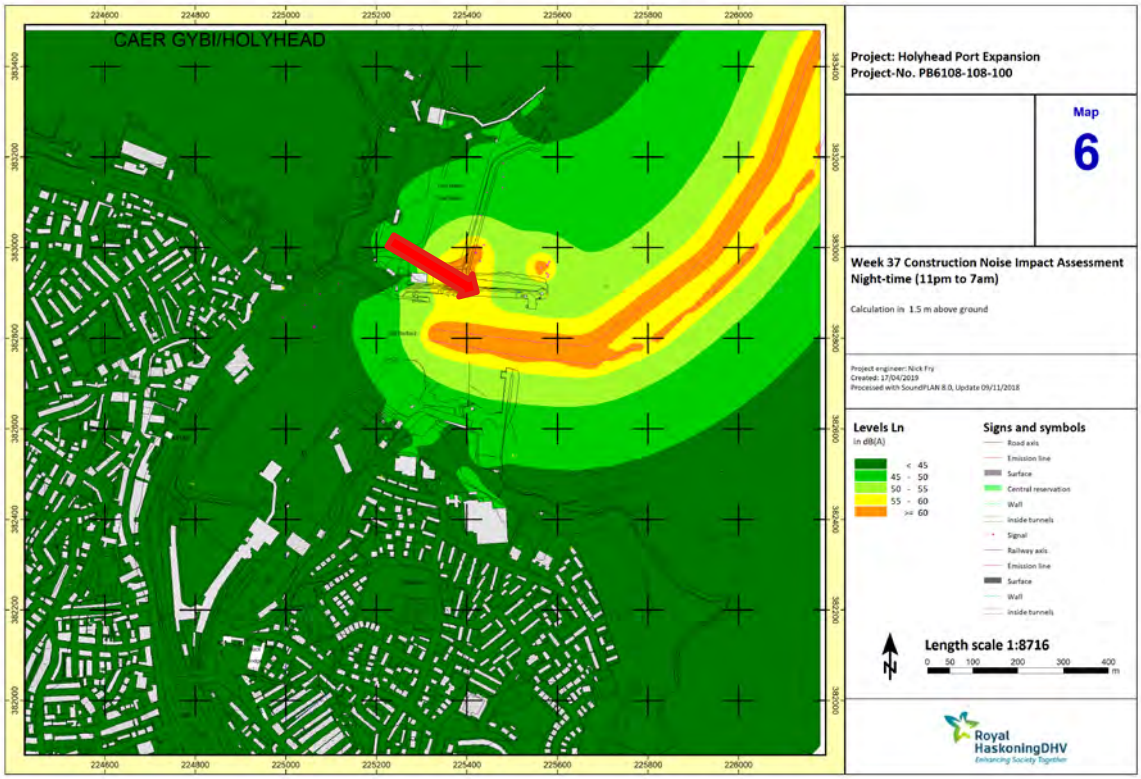

Figure 2.3 Construction Noise Impact Assessment (night-time - 11pm to 7am) (Source: Royal HaskoningDHV, 2019)

The above assessment also applies to the proposed scheme. As such it can be inferred that no impact to human receptors will arise from this activity.

There are a number of 'best practice' measures that should always be implemented on construction sites so as to be a "good neighbour" and protect the amenity of nearby human receptors. These include:

- switching off equipment when not required;
- minimising the drop height of materials;
- starting up plant sequentially rather than all together;
- increasing the distance between plant and noise sensitive receptors is the most effective method of controlling noise; and,
- on sites where it is not possible to reduce noise by increasing the distance between source and receptor, screening may be considered.

These measures would be implemented as part of the proposed scheme and as such impacts to human receptors arising from noise are considered to be **negligible**.

Water quality

Potential risks to water quality arising from the operation of a concrete batching plant arise from any run-off of water that has been contaminated with cement or other chemicals. The risk of this arising can be minimised by following standard good practice with regard to pollution prevention guidance. Construction works will be undertaken in accordance with NRW's Guidelines for Pollution Prevention No. 5 (GPP5) on works in, near and liable to affect watercourses. In addition, it will be ensured that following mitigation measures are put in place:

- concrete and cement mixing and washing areas are situated at least 10m away from the nearest watercourse,
- a settlement and recirculation system should be incorporated to allow water to be re-used;
- all washing out of equipment should occur in a contained area; and,
- all water should be collected for off-site disposal.

These measures will be put in place for the proposed scheme and would adequately mitigate any potential adverse impacts to water quality arising from the operation of the concrete batching plant.

2.1.2 Soldiers Point

Should the concrete batching plant be located on Soldiers Point, it would be located at the northern most end, closest to the Breakwater (**Figure 2.4**). As such the nearest human receptor would be located over 350m away and as such potential impacts arising from air quality and noise would not be significant. However, the mitigation measures set out above will be put in place regardless to comply with best practice and standard industry practices.

The mitigation measures set out above for water quality will also be put in place, thus ensuring that the marine environment is protected.

223525 223800 224075

384125 383850 383575

N

200m

Chwarel Morglawdd, Caergybi LWS

0 50 100 Metres

Legend:

- Soldiers Point Working Area
- Potential Location of Batching Plant
- Human Receptor
- Local Wildlife Site
- Local Wildlife Site 20m Buffer

Client:	Project:
IOACC	Holyhead Breakwater Refurbishment

Title:

Soldiers Point - Location of concrete batching plant and LWS

Figure:	Drawing No:
2.4	PB9014-001-002

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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2.2 LWS Chwarel Morglawdd Caergybi

A small outlier area of the LWS Chwarel Morglawdd Caergybi is located directly at the landward end of Soldiers Point (see **Figure 2.4**). This area is an important feeding and nesting area for birds. Species recorded include shelduck, oystercatcher, red-breasted merganser and ringed plover.

The LWS would be approximately 200m from the location of the concrete batching plant at the northern end of Soldiers Point. Using the findings of the air quality and noise assessments carried out to inform the HPE ES, and with adherence to the mitigation measures, no significant impacts to the site from air quality and noise are anticipated.

In order to prevent any direct damage to the LWS a buffer of 20m will be established around the boundary of the LWS to prevent any direct damage to the site during the construction phase.

2.3 Other Projects

A Habitats Regulations Assessment will be undertaken in support of the Marine Licence Application to NRW. As such potential in-combination effects on European designated sites with the plans and projects listed by the IoACC will be fully assessed.

3 Mitigation Measures for the Proposed Scheme

The following mitigation and best practice measures, as described in the sections above, will be adhered to as part of the construction of the proposed scheme.

Table 2.1 Mitigation measures that will be put in place for the proposed scheme

Topic	Mitigation Measure
Air Quality	Development and implementation of a DMP.
	Regular site inspections will be carried out to monitor compliance with the DMP, inspection results will be recorded in an inspection log.
	Site layout planned so that machinery and dust causing activities are located away from receptors, as far as is practicable.
	Where it is not possible to reduce dust by increasing the distance between source and receptors, solid screens or barriers around the site boundary will be considered.
	Take measures to control site runoff of water. (See water quality section below).
	Produce a Construction Logistics Plan to manage the delivery of materials, thereby avoiding/minimising the time materials are stockpiled on site.
	Enclosed chutes and conveyors and covered skips will be used.
	Equipment will be readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
	Sand and other aggregates will be stored in bunded areas and will not be allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
	Bulk cement and other fine powder materials will be delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
Noise	Switch off equipment when not required.
	Minimise the drop height of materials.

Topic	Mitigation Measure
	Start up plant sequentially rather than all together.
	Increase the distance between plant and noise sensitive receptors is the most effective method of controlling noise.
	Where it is not possible to reduce noise by increasing the distance between source and receptor, screening may be considered.
Water Quality	Construction works will be undertaken in accordance with NRW's Guidelines for Pollution Prevention No. 5 (GPP5) on works in, near and liable to affect watercourses.
	Concrete and cement mixing and washing areas will be situated at least 10m away from the nearest watercourse.
	A settlement and recirculation system will be incorporated to allow water to be re-used.
	All washing out of equipment should occur in a contained area.
	All water will be collected for off-site disposal.
LWS	A 20m buffer will be established around the boundary of the LWS to prevent any machinery or Tetrapods being placed within the site.

A will be produced prior to construction commencing and will be adhered to throughout the construction activities. The CEMP will include all the mitigation measures and best practice set out in **Table 2.1** above and will also include other standard mitigation measures such as tool-box talks with contractors to raise ecological awareness whilst on site.

4 Changes to the Proposed Scheme

Since the Screening Report was submitted, in August 2019, a number of minor changes to the proposed scheme have been made as the design works have progressed. These are summarised in **Table 3.1** and illustrated in **Drawing PB9014-RHD-BW-XX-DR-C-0066**, at the end of this note.

Table 3.1 Changes to the proposed scheme

	Original Design	Updated Design
1	Only concrete armouring will be used for the refurbishment	The engineering design has confirmed that quarried rock will be required to repair the rubble mound at the lighthouse end of the Breakwater. It is anticipated that approximately 80,000m^3 of rock will be required which will vary in size from 0.001 tonne to 15 tonnes. A small section (up to 20m) along the seaward side of the breakwater will need to be infilled with rock, in order to act as an interface between the land and rubble mound at Solders Point. This will require approximately 5,000m^3 of rock. A section of the rubble mound along the leeward side of the Breakwater is too steep for the placement of ACBM. Therefore, rock will need to be placed along this length to repair the rubble mound. This will require approximately 20,000m^3 of rock. Rock will be placed below low water. In summary, an approximate total of 105,000m^3 of quarried rock will be required as part of the refurbishment of the Breakwater. All rock would be delivered by sea.
2	Articulated Concrete Block Mattress (ACBM) will be used to refurbish the leeward side of the Breakwater	A short length (approximately 120m) of concrete armouring (Tetrapods and Chevrons) will be required to refurbish a section of the leeward side of the Breakwater, from the lighthouse end, to prevent the rubble mound in this area from being eroded further. A 450m length of the leeward side from Soldier's Quay will no longer have ACBM placed along it as no refurbishment is required along this section.
3		The turning point, located approximately 100m from the lighthouse on the leeward side of the Breakwater will need to be removed as part of the proposed refurbishment.

4.1 Potential Impacts of the Changes to the Proposed Scheme

The potential impacts of the changes outlined in **Table 3.1** above on the environment are presented below:

1. The rock required for the refurbishment of the Breakwater will be suitable for placement within the marine environment.

   As with the materials required for the Tetrapod and chevron units, the rock will be delivered by sea to either Holyhead Port or Soldiers Quay for storage until it is required. It will then be transported to the construction area by barge and lifted into place by a long reach excavator which will likely be positioned on a jack-up barge or similar, as per the Tetrapods and chevrons.

   As such the use of rock within the refurbishment does not represent a material change to the methodology assessed within the Screening report and therefore the conclusions within the report would not change.

2. The use of Tetrapods and chevron units along a short section of the leeward side of the Breakwater would mean that part of the refurbishment along the leeward side of the Breakwater would be visible above mean low water spring. The potential visual impact of this will be assessed within the Visual Assessment. The potential impact of this on the setting of heritage assets will be discussed with Cadw, GAPS and the IoACC's conservation officer as part of the Listed Building Consent application.

   The removal of the ACBM from a ~450m section of the leeward side of the Breakwater, from Soldiers Quay, is considered to be beneficial in reducing the overall potential impacts of the proposed scheme.

3. The turning point is a recent addition (according to Stena this is thought to have been added around the 1970's / 80's) to the Breakwater and not part of the original structure. It is considered therefore to have no heritage importance that its removal could be seen as beneficial due to the restoration of the Breakwater to its original state.

   This will be considered further as part of the Listed Building Consent application, including consultation with Cadw, GAPS and the IoACC's conservation officer to agree how the turning point should be removed and the details of any restoration works.

4.2 Effect on Screening Conclusion

In light of the above, the minor changes to the proposed scheme are not considered to affect the conclusion of the Screening Report submitted in August 2019, and the proposed refurbishment scheme is still considered to not be an EIA Development.

1.4 IoACC Second Screening Opinion

DEWI FRANCIS JONES MSc, M.R.T.P.I
Prif Swyddog Cynllunio – Rheoleiddio a Datblygu Economaidd
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Cais Rhif / App. No. **SCR/2019/69**

Ms. Sarah Marjoram
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DEDDF CYNLLUNIO GWLAD A THREF 1990 / TOWN AND COUNTRY PLANNING ACT 1990

RHEOLIADAU CYNLLUNIO GWLAD A THREF (ASESIAD AR YR EFFAITH AMGYLCHEDDOL) (CYMRU) 2017 / TOWN AND COUNTRY PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) (WALES) REGULATIONS 2017

Barn sgrinio ar gyfer atgyweirio yn / Screening opinion for the refurbishment at Morglawdd, Caergybi / Breakwater, Holyhead

RHYBUDD PENDERFYNIAD

Ceisiwyd barn sgrinio ymhellach i'r datblygiad arfaethedig uchod ar.

Wrth ffurfio barn sgrinio ar effaith sylweddol tebygol o ddatblygiad arfaethedig, rhaid rhoi sylw i Rhestr 3 o'r Rheoliadau Gwlad a Thref (Asesiad ar yr Effaith Amgylcheddol) (AEA) 2017 sydd yn nodi meini prawf dethol i'w hystyried. Nodir tri maen prawf bras:

- nodweddion y datblygiad;
- sensitifrwydd amgylcheddol y lleoliadau daearyddol sy'n debygol o gael eu heffeithio gan y datblygiad; a
- math a nodweddion yr effaith bosib.

Fel arfer bydd angen asesiad ar gyfer datblygiad os yw'n:

- ddatblygiad pwysig sydd a phwysigrwydd y tu i'r lleol;
- ddatyblygiad mewn lleoliad amgylcheddol sensitive iawn; a'n
- ddatblygiad sy'n cael effaith anarferol o gymhleth ac o bosib bergylus ar yr amgylchedd.

Wedi ystyried y datblygiad arfaethedig, a chadw mewn cof y wybodaeth a gyflwynwyd a'r meini prawf dethol Rhestr 3 o'r Rheoliadau yn fy marn i bydd y datblygiad yn cael effaith sylweddol ar yr ymgylchedd ac yn hyn o beth **BYDD ANGEN AEA.**

NOTICE OF DECISION

A request for a screening opinion in respect of the above proposed development was made on.

In formulating a screening opinion on the likely significant effects on the environment of a proposed development, regard is to be had to Schedule 3 of the Town and Country Planning (Environmental Impact Assessment) (EIA) Regulations 2017 which sets out the selection criteria to be taken into account. Three broad criteria are identified:

- the characteristics of the development;
- The environmental sensitivity of geographical areas likely to be affected by development; and
- the types and characteristics of the potential impact

EIA will generally be needed for development if:

- they are major developments of more than local importance;
- they are developments in particularly sensitive or vulnerable locations; or
- they are developments with unusually complex and potentially hazardous environmental effects.

Having considered the proposed development taking into account the information submitted and the selection criteria contained in Schedule 3 of the Regulations, my judgment is that the proposed development is likely to have significant effects on the environment and that **EIA IS** required.

DYDDIAD Y PENDERFYNIAD **13/02/2020** DATE OF DECISION

DEWI FRANCIS JONES
PRIF SWYDDOG CYNLLUNIO / CHIEF PLANNING OFFICER

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Appendix 6

Scoping Opinions and Consultation Responses

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6.1 IoACC Scoping Opinion

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Regulation & Economic Development Service

EIA Scoping Opinion

Refurbishment/repair of Breakwater structure together with formation of concrete batching plant for the fabrication, curing and storage of concrete armour units

Holyhead Breakwater

Application No. SCO/2020/1

Holyhead Breakwater Refurbishment Scoping Opinion (SCO/2020/1)

EIA Scoping Request under Regulation 14 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017, for the re-furbishment of Holyhead Breakwater together with the formation of a concrete batching plant for the fabrication, curing and storage of concrete armour units.

Introduction

On 21 April 2020, the applicant Sealink Stena Ltd. submitted a Scoping Request to the Isle of Anglesey County Council (IACC) for the proposed refurbishment of Holyhead Breakwater which included the establishment of a concrete batching plant either at the southern point of the Breakwater at Soldier's Quay or on land within the Holyhead Port complex. The Scoping Request was accompanied by an Environmental Scoping Report (dated 3 April 2020), prepared by their consultants Royal Haskoning DHV (RHDHV).

Following e-mail correspondence on the 26 May 2020, the applicant agreed to an extension of time for the IACC to respond to the Scoping Request. This was in order to receive outstanding consultation responses to ensure that a comprehensive response could be provided by IACC.

The IACC provided a screening opinion for the proposal on 13 February 2020 (reference SCR/2019/69). The scoping opinion provided by the IACC remains relevant and has been utilised to inform this Scoping Opinion.

Context

Constructed between 1848 and 1873, the Holyhead Breakwater provides an area of sheltered water for the Port of Holyhead and the New Harbour, and provides protection to the surrounding coastline from coastal erosion and flooding. The structure is Grade II* listed and reaches a total length of 2.4km, which is the longest Breakwater in the UK.

Holyhead Port is a strategically important international ferry port, providing the main link between the Republic of Ireland and mainland UK. The Breakwater forms part of the essential infrastructure for the operation of the Port, providing shelter from a more extreme wave climate to the berthing ferries and other vessels. Without the Breakwater, it is likely that the wave conditions would increase to the point that the operation of the ferries is no longer viable, resulting in the closure of the Port and the loss of the international link to Ireland for Wales and England.

In addition to the ferries, the Port also supports a flourishing cruise industry. A total of 52 cruise ships arrived the port in 2018, bringing in 32,700 passengers and generating a cruise tourism impact of in excess of £2.5M. Ensuring that wave conditions are favourable and that cruise ships are able to dock is therefore vitally important. According to the Cruise Lines International Association (CLIA), it is estimated that the average spend for a cruise passenger and crew is £115 and £50 respectively. The importance therefore of being able to dock in all weather conditions and the benefit this has to the local economy is evident.

According to the Applicant's supporting documentation, "the Breakwater is formed by a wide rubble mound with a crest around the waterline, with a vertical blockwork-walled superstructure on top." Since its construction, the Breakwater has been subject to considerable wave action, which has led to the movement of the rock blocks that make up the rubble mound and erosion of the rubble mound itself. As a result, the rubble mound has been subject to regular, expensive, maintenance through the partial replacement of lost material. The vertical blockwork wall structure is also subject to periodic damage which is repaired on an ongoing basis. However, to ensure the survival of the Great Breakwater, a long term and sustainable solution is now required to protect and maintain the integrity of the structure.

The refurbishment proposed in this scheme seeks a more substantial solution that will safeguard the Breakwater over a considerably longer time period than the current maintenance programme provides. Estimates suggest that if nothing is done, the Breakwater would be breached within 15 years, threatening the viability of the Port and the ferry services that operate out of it. This could have severe implications for the economy of Anglesey and the wider North Wales economy.

In order to address the erosion of the rubble mound and thereby extend the life of the Breakwater, the applicant suggests the following works be undertaken:

- On the seaward side, constructing an armoured slope of rock or purpose-made concrete armour units (tetrapods) to restore the rubble mound and protect the face of the superstructure by reducing wave impact forces and wave overtopping; and
- On the leeward side, restoring the rubble mound to its original levels using an articulated concrete block mattress.

Production of the tetrapods would require a dedicated space, either within the Port itself or at the southern part of the Breakwater at Soldiers' Point. This would accommodate a concrete batching plant and provide storage space for raw materials and for curing the tetrapods.

The proposed development therefore consists of refurbishing the Breakwater together with forming a concrete batching plant and storage/curing area for cast tetrapods and raw materials (aggregate/cement/chemicals/water).

IACC Response to EIA Scoping

General

The uncertainty relating to the proposed location of the concrete batching plant for the fabrication, curing and storage of the concrete armour units proposed to be used in the project is an issue that any formal submission should fully address as the areas proposed vary in their environmental value. Where the Port is an already industrialised setting, albeit being within the setting of several listed buildings, the proposed area at Soldier's Point is sensitively located being adjacent/within to areas designated for their ecological/landscape value in addition to being located on part of the Breakwater structure itself which is Grade II* listed.

Greater clarity is required regarding the project description. The Scoping Report would benefit from a concise summary of what the proposal entails. There needs to be reference to the concrete batching plant and curing and storage areas. The study area is not clearly defined for the various assessments and the IACC would recommend this is addressed by the applicant.

For the purposes of Regulation 14(2)(a) of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017, the Scoping Report does meet the minimum requirements for the IACC to issue a Scoping Opinion. However, given the lack of detail and uncertainty on the location of the proposed batching plant, IACC would strongly encourage the applicant to work with the IACC in the preparation of the EIA including the scope of the assessment (and any other relevant studies) prior to the submission of the application. This will ensure that sufficient detail is contained within the Environmental Statement (ES) and may reduce the need for the IACC to request further information under Regulation 24.

Planning Policy

The IACC would expect the ES to include a summary of all the relevant national and local planning policies, including an assessment of how the proposed development complies with, or meets the policy objectives. A summary of the relevant national and local planning policies is provided below.

National Planning Policy - Planning Policy Wales (Edition 10)

Section 5.3 of Planning Policy Wales provides further guidance in relation to harbour developments:-

"5.3.14 Functional and attractive ports, harbours, marinas and inland waterways, which meet current and future demand, make Wales an attractive location for businesses, visitors and freight transportation. Support and investment in these facilities unlocks potential to boost the economy both directly, from the greater use of the facilities, and indirectly through the opportunities that improved maritime transport infrastructure provide for other sectors (both nationally and internationally)."

It continues in paragraph 5.3.16:

"5.3.16 Planning authorities should seek to promote the use of ports, harbours, marinas and inland waterways by the protection or provision of access to them and by the retention or provision of appropriate wharf, dock, harbour and rail transfer facilities to support economic activities in a way that minimises any adverse impacts on the environment."

Further guidance relating to the role of harbours and their current and future operations, including options for expansion and diversification is provided within the Wales National Marine Plan.

Wales National Marine Plan

The Plan was adopted in October 2019 and is a material consideration in terms of planning decision-making. The following policies are considered relevant to the proposed development:

ENV_01: Resilient marine ecosystems
Proposals should demonstrate how potential impacts on marine ecosystems have been taken into consideration and should, in order of preference:

a. avoid adverse impacts; and/or

b. minimise impacts where they cannot be avoided; and/or

c. mitigate impacts where they cannot be minimised.

If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.

Proposals that contribute to the protection, restoration and/or enhancement of marine ecosystems are encouraged.

P&S_01: Ports and Shipping (supporting)

P&S_01 a: Proposals for ports, harbours and shipping activities will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.

P&S_01 b: Relevant public authorities and the sector are encouraged, in liaison with other interested parties, to collaborate to understand opportunities to support the sustainable development of the ports and shipping sector through marine planning.

Policy P&S_02: Ports and Shipping (supporting)
Proposals that provide for the maintenance for the maintenance, repair, development and diversification of port and harbour facilities will be supported where they contribute to the objectives of this plan. Proposals should comply with the relevant general policies and sector safeguarding policies of this plan and any other relevant considerations.

Anglesey and Gwynedd Joint Local Development Plan (2016)

The following table provides a brief overview of the relevant local plan policies, which are of relevance to the proposed development:-

Policy	**Explanation**
PS 1: Welsh Language and Culture	Policy states the requirement to promote and support the Welsh language. Guidance is provided within the policy relating to the requirement to submit a Welsh Language Statement/Impact Assessment for various types of development. Further, the expectation relating to a bilingual signage scheme and the expectation that Welsh names will be used for new

	developments is also highlighted within the policy. Should it be confirmed that the number of construction workers exceeds 50 workers; the ES will need to include a Welsh Language Impact Assessment. Further guidance on the preparation of such an assessment can be found in the adopted Supplementary Planning Guidance (SPG) Maintaining and Creating Distinctive and Sustainable Communities.
PS 5: Sustainable Development	All proposals should demonstrate how they are consistent with the principle of sustainable development.
PCYFF 2: Development Criteria	Provides guidance as to how proposals should demonstrate compliance with relevant plan policies, National Planning policies and guidance. Further guidance is also provided relating to the general principle of development.
PCYFF 3: Design and Place Shaping	Requirement for all proposals to demonstrate a high quality Design which fully takes into account the natural, historic and built environment.
PCYFF 4: Design and Landscaping	All proposals should demonstrate how consideration has been given to their surroundings, including due consideration to the Landscape Character Assessment /Seascape Character assessment.
PS 13: Providing opportunity for a Flourishing Economy	Promotes facilitating economic growth whilst seeking to protect and enhance the natural and built environment.
CYF 8: Holyhead Regeneration Area	Supports proposals located within the 'Holyhead Regeneration Area' which would aid the transformational change by encouraging Holyhead to become a more attractive location to live, work, visit and enjoy.
PS 19: Conserving and where appropriate enhancing the natural environment	Proposal is located within a sensitive area due to its natural beauty and proximity to nature conservation designations. It is adjacent to, if not within, a Special Protection Area and Special Area of Conservation whereas a Site

	of Special Scientific Interest is within 130m and a Local Wildlife Site is within close proximity of the site. In accordance with Strategic Policy PS19, measures should be undertaken to ensure that the proposal conserves and where appropriate enhances the Plan area's distinctive natural environment and coastline.
AMG 3: Protecting and enhancing features and qualities that are distinctive to the local landscape character	Consideration should be given to protecting and enhancing features and qualities that are distinctive to the local landscape character
AMG 4: Coastal protection	Measures should be taken to ensure that the Proposal doesn't cause unacceptable harm to:- ▪ Water quality ▪ Public Access consideration ▪ The built environment, landscape and seascape character; ▪ The area's biodiversity interest.
AMG 5: Local Biodiversity Conservation	Proposals must protect and where appropriate enhance biodiversity that has been identified as being important to the local area, through avoiding significant harm and considering opportunities to create and improve and manage wildlife habitats and natural landscape. A Proposal which affects sites of local biodiversity importance will be refused unless they can conform with the criteria as listed within the policy.
PS 20: Preserving and where appropriate enhancing heritage assets	Whilst seeking to support the wider economic and social needs of the Plan area, the LPA will preserve and where appropriate enhance its unique heritage assets.

Legislative Framework in Wales

In addition to the national and local policy framework, the applicant should also include an assessment against the relevant legislative framework in Wales. In particular regard should be had to the Wellbeing of Future Generations Act 2015.

The Well-being of Future Generations Act requires public bodies in Wales to think about the long-term impact of their decisions, to work better with people, communities and each other, and to prevent persistent problems such as poverty, health inequalities and climate change. The Act requires public bodies (including the IACC) to carry out sustainable development and places a legal duty on them to do so.

Part 2 of the Act defines sustainable development as *"the process of improving the economic, social, environmental and cultural well-being of Wales by taking action, in accordance with the sustainable development principle, aimed at achieving the well-being goals*". In this context, the sustainable development principle means that public bodies "*must act in a manner which seeks to ensure that the needs of the present are met without compromising the ability of future generations to meet their own need".*

The Planning (Wales) Act 2015 requires that any statutory body carrying out a planning function must exercise those functions in accordance with the principles of sustainable development as set out in the Wellbeing of Future Generations Act 2015. Any planning decision made by the IACC therefore must be made against the legislative framework as outlined in the Act. The ES should therefore include reference to how the proposed developments meets the 7 wellbeing goals as defined in the Act in order to allow the IACC to carry out its own assessment.

Regard should also be had to other relevant legislation such as the Environment (Wales) Act 2016 and Historic Environment (Wales) Act 2016.

Built/Historic Environment

The Scoping Report chapter that considers Cultural Heritage is reasonably short and makes a significant omission in terms of guidance that should be considered when assessing the impact of the proposed works upon the setting of the heritage assets, including the Breakwater itself, in the immediate area of the proposal site. Given the historic significance of the Breakwater and other heritage assets within the immediate area, the impact of the proposed development on the setting of the designated heritage assets should be undertaken in accordance with Welsh Government published guidance 'The Setting of Historic Assets in Wales (2017)'. This guidance does not appear to be referenced in the Scoping Report but it should provide the basis for assessing the impact of the proposed works on the heritage assets' setting. The Level 4 Building Record of the Holyhead Breakwater prepared by GAT is a comprehensive and helpful document and should provide a useful input into assessing impacts upon the structure and surrounding area.

The study area proposed for the assessment in regard to designated heritage assets is considered too small and should be increased to 3km to include the assets listed below and it would be expected that a stage 1 assessment be carried out for all of the

following designated heritage assets, which will determine the location of any viewpoints that will be required if it is necessary for stages 2 to 4 to be carried out for specific heritage assets. The following historic assets are potentially affected by the proposal.

Scheduled Ancient Monuments
AN019 Caer y Twr

Listed Buildings
5743 HOLYHEAD BREAKWATER, SOLDIER'S POINT II*
5744 LIGHTHOUSE ON HOLYHEAD BREAKWATER II
5771 CUSTOMS HOUSE, SALT ISLAND II
5772 HARBOUR OFFICE, SALT ISLAND II*
5773 GEORGE IV ARCH, SALT ISLAND II*
14729 ZODIAC RESTAURANT, BEACH ROAD (N SIDE) II
14730 TRINITY HOUSE OFFICE, BEACH ROAD (N SIDE) II
14731 TRINITY YARD LARGE WORKSHOP, BEACH ROAD (N SIDE) II
14732 TRINITY YARD SMALL WORKSHOP, BEACH ROAD (N SIDE) II
14755 GUNPOWDER MAGAZINE, BREAKWATER QUARRY II
14756 COTTAGE ON CORNER OF PENTRE PELLA (INCLUDING FOREGARDEN WALL),
14759 PORTHYFELIN HOUSE, SOLDIER'S POINT II
14760 SOLDIER'S POINT HOUSE, SOLIDER'S POINT II
14761 SCREEN WALL TO SOLDIER'S POINT HOUSE, SOLDIER'S POINT II

Conservation Areas
Holyhead Beach

The scale of the proposed works has the potential to impact the setting of designated heritage assets both during the construction stage, which may be over a considerable time period, and as a result of the physical appearance of the completed works.

Continuing uncertainty as to the location of the proposed batching/curing/storage area where the armour units are to be fabricated and stored present very different challenges in terms of mitigating impact on nearby designated heritage assets as well as nearby important ecological sites. The proposed location near Soldier’s Point is an extremely sensitive site both in historic environment and ecological terms. It will be necessary that the ES provides a final location for the batching plant.

The refurbishment works to the Breakwater will require Listed Building Consent and an application for such consent must be supported by a detailed Heritage Impact Statement and accompanying Method Statement.

From an archaeological perspective, the submitted documents present an accurate reflection of the discussions between the applicant and the Gwynedd Archaeological Planning Service (GAPS) as the project has developed. The proposed scope of

Cultural Heritage Assessment (section 8.6 of the scoping report) is generally satisfactory but evidence-gathering should include a site visit and the subsequent assessment should include consideration of ancillary activities, specifically the proposed concrete batching plant location, since both the Salt Island and Soldier's Point options would have cultural heritage implications.

Landscape and Visual

The Landscape and Seascape baseline is considered in chapter 8.5 of the Scoping report.

We would agree that the operational effects would not give rise to significant effects (8.5.2). Although temporary in nature, the extent to which construction effects might affect landscape and seascape character will depend on the duration of the works and associated matters noted in 8.5.2. Provided that the duration of the work proposed can be regarded as temporary, it is appropriate that construction and operational effects are scoped out of the ES with regard to landscape and seascape.

8.5.3 (5.2.2 and Appendix B4 - indexed in report as B5) notes that the viewpoints for a visual assessment have been discussed with GAPS, RCAHMW, IACC and NRW and are related to the appearance of the listed structure. VP 1 and 4 are close views, VP 2 and 3 are longer views). This is detailed in B4 section 3 (now includes an addition VP 4). The methodology for the production of the images appears appropriate (baseline, construction and residual/post completion). However, as colouration of the tetrapods and the probable rate and degree of discolouration/weathering are considerations, the assessment could be enhanced by e.g., a year 10 image based on similar armour/sites (or images of the tetrapods at installation and after a number of years).

Therefore, we would agree that a full Landscape/Seascape and Visual Impact Assessment is not required but that visual effects are assessed as proposed in the Scoping Report (subject to the above considerations) and these images used to inform possible mitigation for both heritage and amenity.

The submission of photographs has helped to provide useful context and understanding of the Breakwater's general visibility from the AONB coastline. We agree that wire frame images would not be necessary, however images submitted as part of the environmental statement should be of better quality and include pictures of the development area at low tide in order to understand the full magnitude of change. We note that a Landscape Consultant will walk the Coastal Path and paths on Holyhead Mountain in order to choose the most appropriate location for a 'worst-case' viewpoint and subsequent photomontage. A description of the development's likely zone of visual influence is commonly set out in the introduction of visual effects assessment. An assessment of sequential views would not be necessary. However we would expect a general description to confirm locations within the AONB and lengths of the Anglesey Coastal Path (locations accessed by sensitive visual receptors) that would have views of the Breakwater.

Ecology

We are in basic agreement with the proposed approach in terms of assessing impacts on ecology. The following covers specific subject areas.

Section 7.4 (Terrestrial Ecology) of the Scoping Report notes the potential for a site compound and concrete batching plant on Soldier's Point, in an area of mainly low ecological value. It is stated that a walkover survey ahead of works would be used to ensure protected species such as reptiles would not be affected during works.

It is also stated that a 20m buffer will be established around the local Wildlife Site boundary. The Report proposes scoping out terrestrial ecology from EIA, apart from potential indirect impacts on the LWS in the air quality assessment (the approach to which is covered in Section 8.3).

We would comment that the methodology referred to will need to be clearly covered through the main application. If there is any likelihood at all that areas of habitat suitable for protected species may indeed be used in works, then the EIA itself should include this, even where basic, to avoid doubt and ensure full coverage.

Section 10 covers Habitat Regulations Assessment (HRA), and at the end of the section it is stated that a HRA will be undertaken, with the information for an HRA presented as a chapter in the ES. Provision of HRA information will be useful for whichever body undertakes the actual, formal assessment. Whilst it appears that HRA will be required for the refurbishment proposal and the developers are indeed required to provide the necessary data and information to carry this out, the HRA itself will be undertaken by the competent authority for relevant permissions which is best placed to do so.

The 2km buffer area for designated sites is currently unclear – we would expect to see a 2km buffer radius from the scheme. We agree that North Anglesey Marine SAC should be considered in the HRA.

It is unclear which other plans and projects will be screened into the assessment. There is currently a lot of planning and marine activity in the area that should also be considered. The list of projects included later in this document should assist in that regard.

Please note that should mitigation via a CEMP be considered the appropriate route to control possible pollution, this cannot be considered for HRA purposes until the Appropriate Assessment stage due to the People over Wind ruling and therefore potential spills should be scoped in to the HRA.

Benthic ecology

Section 2.25
We welcome the consideration of the Stena Line Biosecurity Plan as part of the current proposal to minimise the risks associated with marine invasive non-native species (INNS). However, in order for this document to be fully incorporated we advise that it is included with the current application and made specific to the proposed development.

We also request clarification as to whether the proposal has assessed the risks associated to the introduction of large amounts of new artificial structures (e.g. concrete tetrapod units) and the potential for increased colonisation of marine INNS considering that Holyhead Marina is a known marine INNS hotspot, particularly for the Carpet Sea Squirt *Didemnum vexillum*. See also comments on Section 8: Scoping of Environmental Effects.

Section 2.3: Alternatives
It is not clear from this section whether the use of natural rock has been considered and assessed as one of the options for the breakwater refurbishment, as this option would significantly reduce the risks associated to the colonisation of marine INNS. See also comments on Section 8: Scoping of Environmental Effects.

Section 3.1: EIA Screening Exercise
It appears that there has been a variation in scheme design since we were first consulted. Initial advice on the requirements for specific modelling related to physical processes may no longer apply given the design change (see physical process comments). In line with this advice, and until the results of the numerical modelling have been assessed, it is not possible to comment on the range of potential benthic habitat receptors as part of the current scheme.

Section 7: Topics Scoped out of the EIA
As per previous comments, the current proposal has not included provision for a Coastal Processes and Geomorphology assessment, therefore it is not possible to fully assess the potential impacts on benthic ecology receptors as a result of the proposed scheme. We advise that a robust physical processes and geomorphology assessment should be undertaken to evaluate fully the potential impacts on benthic ecology receptors.

Section 8: Scoping of Environmental Effects
We note that section 8.1.2 refers to the rapid colonisation ‘by similar species to that already present on the rubble mound’, but given it is well documented that new artificial structures are more readily colonised by marine INNS than natural rock habitat (Airoldi et al., 2015), we require clarification over how the applicant can be certain that the breakwater refurbishment will not aid facilitation of the spread of marine INNS in this area. In particular, we seek clarification on whether the use of natural rock as part of the breakwater refurbishment has been ruled out and the rationale for the use of concrete over natural rock.

Economy

From an economic perspective, this response focuses on the following sections/chapters:

- 7.11 Tourism and Recreation;
- 7.14 Socio-Economics; and
- 9.1 Cumulative Impact Assessment

Tourism & Recreation

Tourism and Recreation has been scoped out of the EIA as it is deemed that the proposed refurbishment will not have any significant impacts on tourism. Whilst it is agreed that the proposed refurbishment will not have a direct impact on tourism, it is nevertheless important to highlight the significant indirect impacts on tourism if the Breakwater fell into a state of disrepair. For example, the impact on the ferries, cruise ships, Holyhead Marina, Holyhead Waterfront etc. which are worth millions to the local economy each year.

Tourism is the largest economic sector on the Island generating £311M per annum to its economy. On average, the sector supports approximately 4,000 jobs and the importance of the visitor economy to Anglesey, its residents and its future cannot be over emphasised (STEAM Report 2018).

The Island attracts 1.70 million visitors per annum (STEAM Report 2018) and has a high number of repeat visitors at over 85%. The tourism sector has transformed itself over the past 10 years. This is demonstrated in increased visitor numbers (from 1.39M in 2006 to 1.70M in 2018) and in the value of tourism to the economy (£186M in 2006, £304M in 2017 to £311M in 2018). This is a significant growth market that needs to be protected.

In addition to its 1.70 million visitors, Holyhead is the UK's second busiest port processing two million annual visitors travelling between the UK and the Republic of Ireland, further boosting Anglesey's tourism sector. More recently, Holyhead has emerged as Wales' premier cruise port. In 2018, 52 cruise ships arrived at the port, bringing in 32,700 passengers and generating a cruise tourism impact of in excess of £2.5M.

Visitors come to Anglesey to experience its unique character and very special sense of place, peaceful and tranquil setting, its beaches, seascapes and its dramatic landscapes. In 2016, Anglesey was named the second-best UK holiday destination. Its greatest tourism assets lie in its natural and historic environment, which have been acknowledged and designated nationally and internationally. Most (95%) of Anglesey's 201km coastline and coastal habitat is a designated AONB and it attracts a large and growing number of visitors to its beaches and 125 miles of Coastal Path. The Isle of Anglesey AONB has 'one of the most distinctive, attractive and varied landscapes in the British Isles.'

Growth in Anglesey's economy has been led by its visitor economy and the Island 'depends on a thriving, innovative and profitable tourism sector.' It is the UK's most tourist-dependant local authority with one of the highest percentages of employment in the tourism sector as a percentage of total employment.

The importance of Holyhead Port for both ferry passengers and the cruise ship industry is vital to the Anglesey and North Wales economy. The development of Holyhead Marina and Holyhead Waterfront (subject to planning permission) are also important to the local economy and the regeneration of Holyhead.

Whilst we are not stating that tourism should be scoped into the EIA, we believe that recognition should be given to the importance of the Breakwater to the wider tourism

economy. This should be included in the context/background section of the EIA for completeness.

Socio-economics
The applicant states that the proposed scheme is considered to have a beneficial impact on the socio-economics of Holyhead by ensuring the continued protection of the town and Port. As such, the applicant states that no further assessment is considered necessary. Socio-economics has therefore been scoped out the EIA.

Again, whilst we agree that no further assessment is required, we would be looking for commitments by the applicant to the use of local employment and supply chain opportunities where possible. Recognising that the refurbishment is a specialised construction, there may be opportunities for local people in supporting roles and this should be actively encouraged and promoted by the applicant.

Flood risk

With regard to flood risk, we appreciate the benefit afforded by the Breakwater to reduce wave impacts in the Harbour and areas of land around the Harbour area in Holyhead. As such we are generally satisfied with the engineering works to refurbish the Breakwater.

Whilst table 7.2 identifies that flooding is to be screened out (as natural disasters) and suggests that the procedures which are to be put in place for mitigation/prevention would rely on NRW's flood warning service. Please be aware that the site/town does not benefit from a full flood warning service and only relies on a general flood alert service for the West Anglesey Coastline from Cemlyn Bay through to Llanddwyn Island. This flood alert is based on still water levels of 3.45m AOD or above for the class A gauge in Holyhead and does not include wave impacts. As can be appreciated the wave impacts would be a significant factor increasing the risks during the refurbishment works to the Breakwater.

We would therefore suggest that flood risk be scoped in or a suitable flood risk assessment be carried out to determine the impact flooding could have.

Coastal processes

Section 2.2 Description of the Operational Phase
Numerical modelling has shown that refurbishment of the seaward side of the Breakwater would reduce the volume of overtopping by around 30%. In order to confirm these results, and prior to the detailed design phase, 2D and 3D physical modelling will be undertaken on the design of the seaward option.

Initial modelling has shown a large reduction in overtopping. We require clarification about the redistribution of energy from the scheme. Modelling is going to be undertaken for design purposes and this should be shown in a representation of changes to wave and tidal energy and the surrounding environment.

Section 3.1 EIA Screening Exercise
Coastal Processes – We agree that numerical modelling is not required. It is recommended that an overview of the potential local and regional scale changes to coastal processes be presented in the final application.

NRW advises that their initial advice was that modelling bespoke to coastal processes was not required. However, they consider that the scheme described in the EIA Scoping report is larger than the original scheme and as modelling is to be carried out for design purposes, advise that this is used to describe any local and regional scale changes, as recommended previously.

Section 7 Topics Scoped out of the EIA
We do not agree that Coastal Processes and Geomorphology (Section 7.1) can be scoped out of EIA. The purpose of the scheme is to deflect, absorb and change the available energy; an appreciation of how this will work and what local and regional change will be is required to understand the fundamental changes to the environment. The coastal process and geomorphology assessment will aid interpretation of any associated benthic impacts, which are scoped in to the assessment.

Water Quality and Water Framework Directive

We agree that there are no Bathing Waters or Shellfish Waters within 2km of the works (sections 4.2.5 and 4.2.6). The 2km radius relates to the Water Framework Directive (WFD) compliance assessment, which is not mentioned in these sections.

We agree that Marine and Sediment Quality (section 7.2) can be scoped out of the EIA. However, the Developer should take note of the following guidance in the production of the Construction Environmental Management Plan (CEMP): GPP5 Work and Maintenance In or Near Water, which can be found on the Netregs website: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/.

We agree with the position set out in Section 11.2 of the report that a WFD compliance assessment will be required and is therefore scoped in. It should be noted that the WFD compliance assessment will draw upon assessments carried out as part of the wider EIA for relevant topic areas. Therefore, it is advised that the Coastal Processes and Geomorphology topic area is scoped in to EIA as this will underpin the assessment of potential effects to WFD hydromorphological elements and will be required to fully inform the assessment of potential effects to biological elements.

Following on from the above comment, the WFD compliance assessment should largely draw upon the assessments and information provided in the wider EIA where there are common topic areas. Therefore, we advise that a consistent approach should be taken to both EIA and WFD compliance assessment; this also applies to the scoping stage.

Minerals and Waste

It is noted within the documentation that the fabrication of concrete armour units for the refurbishment work will be undertaken from a concrete batching plant to be located at either:

- Salt Island;
- Soldier's Point; or
- Off-site.

From the information provided, it is not clear what is to be cast on site, the amount of units cast, the amount of raw material required and timescale. However, it is assumed that the following will be fabricated and cast on site:

- Tetrapod units @ 45 tonnes;
- Interlocking 60 ft concrete armour units;
- Block Mattress units; and
- Anchor block units.

A thumbnail assessment based solely on information previously provided relates to the tetrapod units only.

36 Tetrapods @ 45 tonnes each to be cast within 24 hour time frame. This will require circa 1,564 tonnes of aggregate, sand, cement, chemicals; 65 tonnes of rebar and in the region of 324,000 litres of water (1 tonne concrete@200 litres water).

Although not specified within the literature, it has been estimated that the development will require in the region of 12,500 Tetrapods. Based on this figure it is assumed that without taking the other concrete armour units into account; the following amount of material (approximately) will be required:

- 22,570 tonnes rebar
- 543,000 tonnes of aggregate, sand, cement, chemicals
- 108,600,000 litres of water

Such an activity will require 347 days to produce 12,500 units.

Environmental Impact Assessment (EIA) is the process of compiling, evaluating and presenting environmental information about the likely significant environmental effects, both adverse and beneficial, of a proposed project; in this case the proposed development. The assessment is designed to help produce an environmentally sympathetic project and to provide decision makers and statutory consultees with the environmental information they require during examination and determination of an application for consent. The early detection of potential significant adverse environmental effects enables appropriate mitigation measures (i.e. measures to avoid, reduce or offset significant adverse effects), to be identified and incorporated into the design of a scheme, or commitments to be made to environmentally sensitive construction methods and practices.

The Scoping Opinion seeks to ensure that any environmental statement (ES) submitted with respect to a planning application for the development proposal

described in the scoping request includes information that is reasonably required to assess the environmental effects, and allow a determination to take place. The ES must address the baseline conditions, likely significant impacts, the probability of effects and the proposed mitigation measures. The information provided should be that which is necessary to demonstrate the risks, likelihood of occurrence, likelihood of any significant impact and an outline of the main alternatives studied by the applicant.

Based on the above, the following baseline conditions need to be considered:

Transportation
It is noted that should a batching plant be located on site, it will be supplied by Sea. Such an arrangement needs to address the baseline conditions, likely significant impacts, the probability of effects and the proposed mitigation measures. The information provided should be that which is necessary to demonstrate the risks, likelihood of occurrence, likelihood of any significant impact and an outline of the main alternatives studied by the applicant .e.g. road.

Noise, dust and air quality
It is acknowledged that noise, dust and air quality are discussed within the Scoping submission and these are addressed elsewhere in this scoping opinion. It should be noted that the proposed sites for the batching plant are in a coastal location and pollution prevention measures must be fully considered within the requirements of EIA regulations.

Area of site
It appears that both Salt Island and Soldier's Point appear constrained in area. Such a facility will require a substantial storage area for different grades of aggregate materials, sand, silos for cement, other chemicals, rebar etc. There will need to be an operational area for concrete production where heavy plant, pumps and possibly concrete wagons will be operating. The site will need to be equipped with cranes and conveyors (within site and for offloading purposes), there will need to be a curing area for concrete units to harden prior to being moved into location (what is the timescale associated with curing?). As such, the information provided within the ES should be that which is necessary to demonstrate the risks, likelihood of occurrence, likelihood of any significant impact and an outline of the main alternatives studied by the applicant e.g. off-site casting and importation to site.

Water use
The sustainable use of water and its effect upon the environment must be fully considered within the requirements of EIA regulations.

Supply of aggregate/raw materials
It is noted that material will be imported to site by sea. With the majority of local quarries without the benefit of a direct port facility (with Raynes Quarry in Old Colwyn, Conwy being an exception) how is this to be sustainably achieved? The ES will need to incorporate a material management plan specifying how the project is to be achieved through the sustainable use of natural resources in line with European, National and Local Planning Policy.

Waste management
The ES must explain how waste generated on site is to be managed in accordance with the EU Waste Framework Directive and in line with European, National and Local Planning Policy and Targets

Amenity effects
The effects upon the amenity of local residents will also need to be fully considered within the requirements of EIA regulations.

Traffic and Transportation

Given that the materials required for the works will be delivered by sea, no significant highway impacts are forecast. However, should the Soldiers' Point location be selected for locating the concrete batching plant, this will be located near human receptors and a public right of way. As such, it will be necessary to prepare a detailed management plan which will identify and mitigate risks to the public using the public highway and rights of way.

Environmental Protection

The issues of light pollution, air quality (PM10 and PM2.5), dust, noise and vibration will all be issues in this development. No development shall take place until a site specific Construction Environmental Management Plan (CEMP) has been submitted to and approved in writing by the Council. The plan must demonstrate the adoption and use of the best practicable means to reduce the effects of noise, air quality, dust, vibration and site lighting.

Health & Safety

The development must comply with the requirements of the Health and Safety at Work Act 1974, and all regulations made under that Act.

Cumulative Impact Assessment (CIA)

Whilst the Scoping List names Holyhead Waterfront, Holyhead Marina and Holyhead Port Expansion as projects which should be considered cumulatively, for consistency and fairness with other projects which have recently been scoped for EIA, there are a number of other local projects which should be considered at this scoping stage. The most notable omission is the Morlais project.

The Morlais project manages a 35km^2 area of seabed near Holy Island, Anglesey. It has the potential to become one of the largest tidal stream energy sites in the world with a generating capacity of up to 240MW of electricity. The applicant (Menter Môn) has applied on the 16th September 2019 to Welsh Government under the Transport and Works Act 1992 for an order to develop and operate the Morlais demonstration zone. Menter Môn has also applied to Natural Resources Wales Marine Licensing

Team for a marine licence under the Marine and Coastal Access Act 2009. Both processes will run in parallel with each other.

Below is a list of projects that are being proposed in and around the Holyhead area, which the applicant should consider at this Scoping Stage. Whilst not stating that all should be included in the CIA, they should nevertheless be considered and an explanation provided why they have been scoped in/out.

Developer	Project Title & Description	Source of Information / Application Reference	Status
Conygar	***Holyhead Waterfront Development*** Outline application for a mixed-use development consisting of a new marina, residential properties, a hotel, commercial, leisure and retail uses together with associated land reclamation and service infrastructure.	Planning Application 19C1046A/EIA/ECON VAR/2020/20 currently being assessed by the IACC.	Consented
Stena Line	Marine License Application for Maintenance Dredging at Holyhead Port	Natural Resource Wales (NRW)	Consented
Stena Line	Harbour Revision Order for Holyhead Port Expansion	Planning Inspectorate	Consultation closed. Awaiting details from PINs
Conygar	***Parc Cybi Stage 2*** Mixed-use employment developments on the southern edge of Holyhead, close to the A55. Primarily distribution and warehousing space but also includes an 80-bed hotel.	Planning Application	Consented
Land and Lakes	***Penrhos Leisure Village*** A leisure village at Penrhos Coastal Park, Holyhead, with up to 500 new lodges and cottages and 315 new dwellings at Kingsland.	Planning Application 46C427K/TR/EIA/ECON	Consented
Orthios Group	***Anglesey Eco Park*** including: • a 299 megawatt electric (MWe) biomass power station within the existing consented scheme;	Planning Application (determined by DECC)	Consented

	• prawn-growing facility (aquaculture); • large soil-less indoor vegetable growing facility (hydroponics); • home compostable food packaging facility; • the compostable food packaging centre of excellence; • research and development; and • a deep water jetty for bulk import.		
Minesto	***Holyhead Deep*** 10MW (and phased development to 80MW) Tidal kite installation off the coast of Holyhead, plus on-land elements and grid connection.	Environmental Statement / NRW Scoping Opinion.	Consented.
Morlais	***West Anglesey Demonstration Zone*** Menter Môn has been awarded a long-term lease to manage an area of seabed off the west coast in order to develop the marine energy sector.	Pre-inquiry Hearing July 2020.	Reasonably foreseeable.
IACC	***Business units at Penrhos*** Full application for the erection of 10 flexible business units including associated parking and service yard, landscaping, vehicle charging points, solar panels and two bin / recycling storage and bike storage.	Planning Application 19LPA1023A/CC	Consented.
Anwyl Homes	***Residential development at South Stack Road (Phase 1)***, Holyhead Construction of 123 detached and	Planning Application 19C608F	Under construction.

	semidetached homes on an 11-acre site.		
Anwyl Homes	***Residential development at South Stack Road (Phase 2)*** Full application for the erection of 46 dwellings together with the creation of a new vehicular access on land adjacent to Parc Tyddyn Bach, Holyhead.	Planning Application FPL/2018/57	Application Submitted.
Huws Gray	***Builders Merchant Yard*** Full application for the erection of a building to be used as a builders merchant with warehouse and sales floor areas (sui generis use), construction of new vehicular site access, storage yard, loading areas together with soft and hard landscaping areas on land at Parc Cybi, Holyhead.	Planning Application FPL/2018/25	Consented.
Horizon Nuclear Power	***Wylfa Newydd New Nuclear Power Station***	DCO Application National Infrastructure Planning website	DCO Examination completed.

Conclusion

The IACC formally adopts this Scoping Opinion in accordance with Regulation 14 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. Whilst IACC recognises there are a number of gaps in the submitted Scoping Report, it is satisfied that the commitments made in the Scoping Report together with continued dialogue between the applicant and the IACC will result in a complete EIA being submitted in support of a planning application. IACC would in particular request the applicant to give further consideration to the need to address the following matters during the preparation of the ES:

i. Provide further detail on the proposed application – particularly confirmation and details in relation to the proposed batching plant and curing and storage arrangements for raw materials and fabricated armour units. This must be accompanied by an assessment of likely significant effects and proposed mitigation (including detail as to how the mitigation is to be secured).

ii. Planning Policy – need to ensure that the EIA contains the relevant local and national legislation and policy.

iii. Heritage Assets/Archaeology - The EIA will need to consider all heritage assets that will be affected by the proposed development and an initial list of these assets is provided.

iv. Landscape and Visual – we would agree that a full Landscape/Seascape and Visual Impact Assessment is not required but that visual effects are assessed as proposed in the Scoping Report (subject to the considerations referred to in this scoping opinion) and that these images used to inform possible mitigation for both heritage and amenity.

v. Ecology – the applicant must address all the issues raised in this scoping opinion. The applicant would also be reminded to include Local Wildlife Sites in their baseline assessments.

vi. Economy – whilst we agree that no further assessment is required, we would be looking for commitments by the applicant to the use of local employment and supply chain opportunities where possible. Additionally, recognition should be given to the importance of the Breakwater to the wider tourism economy. This should be included in the context/background section of the EIA for completeness.

vii. Flood Risk – We would suggest that flood risk be scoped in or a suitable flood risk assessment be carried out to determine the impact flooding could have.

viii. Coastal Processes – we do not agree that Coastal Processes and Geomorphology can be scoped out of EIA. The coastal process and geomorphology assessment will aid interpretation of any associated benthic impacts, which are scoped in to the assessment.

ix. Water Quality and Water Framework Directive – we agree that Marine and Sediment Quality can be scoped out of the EIA and that a WFD compliance assessment will be required and is therefore scoped in. The WFD compliance assessment should draw upon the assessments and information provided in the wider EIA, therefore, it is advised that a consistent approach be taken to both EIA and WFD compliance assessment.

x. Mineral and waste – clarity is required as to batching plant location, what exactly is to be cast on site and that sufficient fabrication, curing and storage areas can be provided in the locations referred to in the Scoping Report. Clarity is also required in terms of the amount of material needed to fabricate the units required and how/where this will be sustainably sourced if the intention is to transport the materials by sea. The probable effects and the proposed mitigation measures in relation to transport; noise, dust and air quality; water use; waste management and amenity effects must be fully considered within the requirements of the EIA Regulations.

xi. Traffic and Transport – should the Soldier's Point location be selected for locating the concrete batching plant, it will be necessary to prepare a detailed management plan which will identify and mitigate risks to the public using the public highway and rights of way.

xii. Environmental Protection - The issues of light pollution, air quality, dust, noise and vibration will all be issues in this development. A site specific Construction Environmental Management Plan (CEMP) must be agreed with the Council and implemented during the undertaking of the works. It must demonstrate the adoption and use of the best practicable means to reduce the effects of noise, air quality, dust, vibration and site lighting.

xiii. Cumulative impacts – A list of projects proposed in the area is provided in this scoping opinion. Whilst not stating that all should be included in the CIA, they should nevertheless be considered and an explanation provided why they have been scoped in/out.

6.2 NRW Screening and Scoping Opinion

Cyfoeth Naturiol Cymru
Natural Resources Wales

Ein cyf/Our ref: SC2002

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29 Heol Casnewydd / 29 Newport Road
Caerdydd / Cardiff

Ebost/Email:
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Ffôn/Phone: 0300 065 4790

Sent by email

Date 23 July 2020

Dear Mr Ben Hughes,

SCREENING AND SCOPING OPINION UNDER THE MARINE WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2007 (as amended)

HOLYHEAD BREAKWATER REFURBISHMENT

I am writing in response to your request for a Scoping Opinion dated 20 April 2020, made in accordance with the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) ("The Regulations").

The purpose of the Environmental Impact Assessment (EIA) screening procedure is to determine whether the proposed works require an EIA and submission of an Environmental Statement (ES). The purpose of the scoping procedure is to determine what information should be provided in the ES.

Screening Opinion

It is our opinion that the works fall within the categories of projects listed within Schedule A2, paragraph 69 of the above regulations and therefore, must be considered in terms of its size, nature and location having regard to the relevant criteria listed in Schedule 1 of the Regulations.

We have considered your correspondence dated 19 May 2020 and have determined that the project requires an EIA. We consider that this decision has been reached in agreement between NRW Permitting Service and Royal HaskoningDHV acting on behalf of the applicant which is the Isle of Anglesey County Council, in accordance with Regulation 5 of the Regulations.

Scoping Opinion

In reaching our Scoping Opinion, we have had regard to the information provided in the "Holyhead Breakwater Environmental Scoping Report", dated 03 April 2020 and considered the requirements of Schedule 3 of the Regulations. We have consulted with the bodies that we consider to have an interest in the project, by reason of their responsibilities or local/regional competences, as required by the Marine Works Regulations and had regard of their comments.

This letter sets out the additional information that we consider necessary to be included and/or assessed in the ES for this project.

Please note our Scoping Opinion is based on the information available to us at this time. The information provided is not a definitive list of the ES/EIA requirements and further information may be required following an application for this project, to ensure a full assessment is carried out.

Please also note that our scoping opinion will be provided to all those bodies that were consulted and will be published on our website and on our Public Register.

The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended)

Scoping Opinion (SC2002)

Summary of the proposal

Royal HaskoningDHV on behalf of the Isle of Anglesey County Council, has sought a Scoping Opinion from Natural Resources Wales Permitting Service (NRW PS) for the proposed Holyhead Breakwater refurbishment in Anglesey. The proposed works include the refurbishment of the seaward and leeward sides of Holyhead Breakwater.

The proposed works are required to repair damage caused by continuous wave exposure and erosion. The Isle of Anglesey County Council are seeking to identify a cost effective and long-term sustainable solution to the erosion of Holyhead Breakwater.

Location – Holyhead Port, Anglesey

The works are proposed on Holyhead Breakwater which forms part of the essential infrastructure of Holyhead port and the new harbour in Anglesey.

Consultation Responses Received

In considering the scoping report, the NRW PS consulted with various consultation bodies. The consultation bodies that responded are listed below:

- Natural Resources Wales Technical Experts (NRW TE);
- Ministry of Defence (MoD);
- Royal Yachting Association (RYA);
- Trinity House Lighthouse Service (THLS);
- Isle of Anglesey County Council Planning (IoACCP);
- Welsh Government Marine and Fisheries (WGMF);
- Welsh Archaeological Trust; and
- NERL Safeguarding.

0. General comments

0.1. Marine and coastal guidance produced by NRW that may provide useful information to help with your project is available here: https://naturalresources.wales/guidance-and-advice/business-sectors/marine/marine-and-coastal-guidance/?lang=en

0.2. The ES submitted must demonstrate consideration of the points raised in this scoping opinion. It is strongly recommended that a table is provided in the ES summarising the scoping opinion comments and how they are addressed in the ES.

0.3. The EIA must be undertaken by a competent person and the ES must include a competent expert statement.

0.4. The ES must include a Non-Technical Summary (NTS).

0.5. Throughout the ES robust evidence should be presented so that the potential environmental impacts can be properly understood and evaluated; and appropriate measures identified to avoid, reduce or where necessary compensate for those impacts.

0.6. The ES must include:

- A description of the likely significant effects of the project, whether direct, indirect, secondary, cumulative, transboundary, short-term, medium-term, long-term, permanent, temporary, positive and negative.
- A description of the methods used to make the assessment of the significant effects and difficulties encountered in compiling the information and uncertainties involved.
- A description of measures to avoid, prevent, reduce or offset identified significant adverse effects and proposed monitoring arrangements.
- A description of the expected significant adverse effects of the project on the environment resulting from the vulnerability of the project to risks of major accidents or disasters.

0.7. The UK left the EU on 31 January 2020 – all legal obligations relating to compliance with environmental licences/permits and legislation will continue to apply. NRW on behalf of Welsh Ministers will continue to issue licenses in line with our current practice.

0.8. Early engagement with relevant stakeholders is encouraged. You are able to obtain further advice from NRW TE through the NRW discretionary advice planning service, please see here: https://naturalresources.wales/guidance-and-advice/business-sectors/planning-and-development/advice-for-developers/our-service-to-developers/?lang=en

0.9. THLS noted that any marking requirements and/or alterations to existing Atons should be considered in consultation with the Local Lighthouse Authority once a formal application is made.

0.10. Uncertainty remains regarding the proposed location of the batching plant and possible storage/curing site. The two proposed sites present very different challenges in terms of mitigating the potential impacts on nearby designated heritage assets, as well as nearby important ecological sites. The proposed batching plant located near Soldier's Point is an extremely sensitive site. We recommend that you engage with the IoACCP to discuss the impacts on designated heritage assets.

0.11. Soldier's Point is located near human receptors and a public right of way. If Solider's Point is selected for the concrete batching plant, the IoACCP noted that a detailed management plan will need to be prepared which will identify and mitigate these risks to the public, using the public highway and rights of way.

0.12. The 2 km screening area used for designated sites is currently unclear. We recommend that a 2 km radius from the scheme is presented on a map.

1. Legislation and Consenting Requirements

1.1. The IoACCP confirmed that the proposed works to the Holyhead Breakwater must obtain Listed Building Consent, which should be supported by a detailed Heritage Impact Statement and an accompanying Method Statement.

1.2. You must ensure that reference is made to and consideration of compliance with the UK Marine Policy Statement and the now published Welsh National Marine Plan and its associated policies within the submitted ES, alongside any further regional planning documentation. The published Welsh National Marine Plan can be found here: https://gov.wales/welsh-national-marine-plan-document. Implementation guidance for the Welsh National Marine Plan can also be found here:

https://gov.wales/welsh-national-marine-plan-implementation-guidance.

1.3. Where possible, other environmental assessments should be coordinated with the EIA process. However, it is important to note that Habitat Regulation Assessment (HRA) and Water Framework Directive (WFD) assessment (and any other assessment) are separate processes to the EIA.

2. Topics Scoped out of the EIA

2.1. We received no comments from consultees on the following listed topics and we agree that they can be scoped out of the EIA. However, acknowledgement of each topic should still be made in the submitted ES:

- Commercial and Recreational Navigation;
- Traffic and Transport;
- Accidents and Natural Disasters;
- Population and Human Health;
- Existing Infrastructure and Other Users;
- Waste; and
- Marine Mammals.

2.2. We note that in Section 7.8 'Accidents and Natural Disasters', the potential for vessels to collide with Holyhead Breakwater either during the construction or operational phase due to failed steering or engine failure, has not been considered and should have been acknowledged in the Scoping Report.

2.3. We do not agree that Section 7.9 'Climate Change' can be scoped out of the EIA, as all projects are vulnerable to the impacts of climate change to some extent. In this case, the potential long-term impacts of sea level rise on the proposed scheme should have been addressed utilising a proportionate approach.

2.4. **Coastal Processes and Geomorphology**

2.4.1. We disagree that Section 7.1 'Coastal Processes and Geomorphology' can be scoped out of the EIA. The purpose of the scheme is to deflect, absorb and change the available energy. An appreciation of how this will work and what local and regional change there will be, is therefore required, to understand the fundamental changes to the environment.

2.4.2. As modelling is to be undertaken for design purposes, NRW TE recommended that this modelling is also used to describe any local and regional scale changes to coastal processes and the redistribution of wave and tidal energy from the scheme. Until this is undertaken, NRW TE noted that it is not possible to comment on the range of potential benthic habitat receptors as part of the current scheme. We therefore recommend that you engage with NRW TE regarding modelling outputs.

2.4.3. We recommend that a robust physical processes and geomorphology assessment should be undertaken to evaluate the potential impacts on benthic ecology receptors.

2.5. **Marine Water and Sediment Quality**

2.5.1. We agree that Section 7.2 'Marine Water and Sediment Quality' can be scoped out of the EIA. However, you should take note of the following guidance in the production of the Construction Environment Management Plan (CEMP): GPP5 Work and Maintenance In or Near Water. This can be found on the Netregs website: https://www.netregs.org.uk/environmental-topics/pollution-

prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/.

2.6. **Terrestrial Ecology**

2.6.1. The IoACCP noted that in Section 7.4 'Terrestrial Ecology' has been scoped out of the EIA, apart from potential indirect impacts on the Local Wildlife Site in the air quality assessment (the approach covered in Section 8.3 'Air Quality'). Not enough detail has been presented at this time to allow us to agree with this conclusion. If there is any likelihood that areas of habitat suitable for protected species may indeed be used in the proposed works, then the EIA itself should include this.

2.7. **Fish and Shellfish Resource and Commercial Fisheries**

2.7.1. WGMF noted that Holyhead Breakwater is popular with recreational anglers and both recreational and commercial lobster potting occurs in the vicinity of the breakwater. Therefore, the proposed refurbishment will have a short-term impact on this activity during the construction phase of the works. This should be acknowledged within the ES. It is anticipated however, that the completed refurbishment will provide new habitat for fish and shellfish. WGMF noted the following fish and shellfish species presence in Holyhead harbour and in area of the works:

All year round:

- European sea bass (*Dicentrarchus labrax*);
- Thick lipped grey mullet (*Chelon labrosus*);
- European plaice (*Pleuronectes platessa*);
- European flounder (*Platichthys flesus*);
- Common dab (*Limanda limanda*);
- Thornback ray (*Raja clavata*);
- Lesser spotted dogfish (*Scyliorhinus canicula*);
- Larger spotted dogfish (*Scyliorhinus stellaris*);
- Conger (*Conger conger*);
- Grey gurnard (*Eutrigla gurnardus*);
- European pollack (*Pollachius pollachius*);
- Saithe (*Pollachius virens*);
- Poor cod (*Trisopterus minutus*);
- Pouting (*Trisopterus luscus*);
- Multiple goby and wrasse species;
- Lobster (*Homarus gammarus*); and
- Edible crab (*Cancer pagurus*).

Seasonal:

- European spider crab (Maja squinado);
- Atlantic herring (*Clupea harengus*);
- Atlantic cod (*Gadus morhua*);
- Whiting (*Merlangius merlangus*); and
- Atlantic mackerel (*Scomber scombrus*).

2.8. **Tourism and Recreation**

2.8.1. In Section 7.11 'Tourism and Recreation', we agree that a detailed tourism and recreation section is not required. However, we recommend that recognition be given in the EIA to the importance of the breakwater to the wider tourism economy.

2.9. **Socio-economics**

2.9.1. In Section 7.14 'Socio-economics', we agree that Socio-economics can be scoped out of the EIA. Whilst the IoACCP agreed that no further assessment is required, they encouraged utilisation of local employment and supply chain opportunities where possible.

3. Scoping of Environmental Effects

3.1. **Marine and Coastal Ecology**

3.1.1. Consideration must be given in the assessment to the introduction of marine Invasive Non-Native Species (INNS) and any mitigation required.

3.1.2. NRW TE noted that in Section 8.1.2 'Marine and Coastal Ecology', it refers to the rapid colonisation "by similar species that are already present on the rubble mound". It is well documented that new artificial structures are more readily colonised by marine INNS than natural rock habitat (Airoldi *et al*., 2015; see link here: https://onlinelibrary.wiley.com/doi/full/10.1111/ddi.12301), therefore, you must provide evidence that the breakwater refurbishment will not aid facilitation of the spread of marine INNS in this area. We recommend you engage with NRW TE to discuss this matter further.

3.1.3. In Section 2.25 'Description of the Operational Phase', NRW TE agreed with the consideration of the Stena Line Biosecurity Plan as part of the current proposal to minimise the risks associated with marine INNS. However, for this document to be fully incorporated, it is recommended that it is included with the application and made specific to the proposed development. We consider that a biosecurity plan must be submitted with the application.

3.1.4. NRW TE has requested clarification on whether the proposal has assessed the risks associated with the introduction of large amounts of new artificial

structures (e.g. concrete tetrapod units) and the potential for increased colonisation of marine INNS; given that Holyhead marina is a known marine INNS hotspot particularly for the carpet sea squirt (*Didemnum vexillum*). We recommend that you engage with NRW TE regarding construction materials for the proposed project.

3.1.5. In Section 2.3 'Alternatives', NRW TE has requested clarification on whether the use of natural rock has been considered as one of the options for the breakwater refurbishment. This option would significantly reduce the risks associated with the colonisation of marine INNS. We recommend that you engage with NRW TE regarding construction materials for the proposed project.

3.2. **Ornithology**

3.2.1. In reference to Section 2.1.5 'Construction Programme', as the work will be taking place during the bird breeding season, the construction phase of the project has the potential to damage or destroy the nests or eggs of any birds that are nesting on the existing breakwater. There is currently no evidence to show that there are no birds nesting on the breakwater. NRW TE advised that a bird survey of the breakwater is carried out before works commence to ensure no bird nests or eggs are damaged or destroyed during construction. Under the Wildlife and Countryside Act 1981, all birds and their eggs are protected by law and makes it an offence to: a) intentionally kill, injure or take any wild bird; b) intentionally take, damage or destroy the nest of any wild bird while it is in use or being built; or c) intentionally take or destroy the egg of any wild bird. Impact on nesting birds must be considered within the assessment and relevant mitigation identified where required.

3.2.2. The Environment Wales Act (2016) Section 6 'Biodiversity and resilience of ecosystems duty', states that: 'A public authority must seek to maintain and enhance biodiversity in the exercise of functions in relation to Wales and in so doing, promote the resilience of ecosystems so far as consistent with the proper exercise of those functions'**.** NRW TE recommend that potential opportunities during refurbishment of the inner breakwater are taken to create habitat for nesting birds, namely black guillemots (*Cepphus grylle*), through the installation of nest boxes or nest cavities in the wall of the breakwater; as described here in Leonard *et al.* 2015, Nest for Black Guillemots, as part of the Northern Ireland Seabird Report 2014: https://www.bto.org/sites/default/files/u41/NI-Seabird-Report-2014-web-version.pdf#page=42

3.3. **Air Quality**

3.3.1. No comments were received from consultees in relation to Section 8.3 'Air Quality' and we have no comment to make on this section of the report. The ES should include an assessment of the impacts on air quality, as set out in the scoping report.

3.4. **Noise**

3.4.1. No comments were received from consultees in relation to Section 8.4 'Noise' and we have no comment to make on this section of the report. The ES should include an assessment of the impacts on noise, as set out in the scoping report.

3.5. **Landscape/Seascape and Visual Setting**

3.5.1. The extent to which construction might affect landscape and seascape character will depend on the duration of the works and associated matters noted in Section 8.5.2 'Landscape/Seascape and Visual Setting'. Provided that the duration of the work proposed can be regarded as temporary, it is appropriate that construction and operational effects on seascape and landscape are scoped out of the ES.

3.5.2. In Section 8.5.3 'Landscape/Seascape and Visual Setting' (5.2.2 and Appendix B4 - indexed in report as B5), it notes that the viewpoints for a visual assessment have been discussed with Gwynedd Archaeological Planning Service, Royal Commission on the Ancient and Historical Monuments of Wales, IoACC and NRW and are related to the appearance of the listed structure (VP 1 and 4 are close views, VP 2 and 3 are longer views). This is detailed in B4 Section 3 (now includes an addition VP 4). The methodology to produce images appears appropriate (baseline, construction and residual/post completion). However, as colouration of the tetrapods and the probable rate and degree of discolouration/weathering are considerations, the assessment could be enhanced by, for example, a Year 10 image, based on similar armour/sites or images of the tetrapods at installation and after several years. We agree that a full Seascape and Landscape Visual Impact Assessment is not required but that Visual Effects are assessed as proposed in the scoping report (subject to considerations above) and these images used to inform possible mitigation for both Heritage and amenity.

3.6. **Cultural Heritage**

3.6.1. Cadws' records show that the following historic assets are potentially affected by the proposal:

Listed Buildings:

- 5743 Holyhead Breakwater, Soldier's Point II*
- 5744 Lighthouse on Holyhead Breakwater II
- 5771 Customs House, Salt Island II
- 5772 Harbour Office, Salt Island II*
- 5773 George Iv Arch, Salt Island II*
- 14729 Zodiac Restaurant, Beach Road (N Side) II
- 14730 Trinity House Office, Beach Road (N Side) II

- 14731 Trinity Yard Large Workshop, Beach Road (N Side) II
- 14732 Trinity Yard Small Workshop, Beach Road (N Side) II
- 14755 Gunpowder Magazine, Breakwater Quarry II
- 14756 Cottage on corner of Pentre Pella (Including Foregarden Wall)
- 14759 Porthyfelin House, Soldier's Point II
- 14760 Soldier's Point House, Solider's Point II
- 14761 Screen Wall to Soldier's Point House, Soldier's Point II.

Scheduled Ancient Monuments**:**

- AN019 Caer y Twr Conservation Areas: Holyhead Beach.

3.6.2. We broadly agree with the scope of the assessment outlined in Section 8.6 'Cultural Heritage', although we consider that the study area proposed for the assessment of designated heritage assets should be increased to 3 km, to include the assets identified above. The impact of the proposed works on the settings of these designated heritage assets should be assessed in accordance with the Welsh Government guidance given in the document "The Setting of Historic Assets in Wales". Cadw recommended a stage 1 assessment to be carried out for all above designated heritage assets, which will determine the location of any viewpoints that will be required if it is necessary for stages 2 to 4 to be carried out for specific heritage assets.

3.6.3. Welsh Archaeological Trust recommended that the evidence gathering discussed in Section 8.6 'Cultural Heritage Assessment' should include a site visit and consideration of ancillary activities, specifically the proposed concrete batching plant location since both the Salt Island and Soldier's Point options would have cultural heritage implications.

4. Cumulative Impact Assessment

4.1. The ES must include an assessment of cumulative and in-combination effects. There are many projects either approved or being developed at present and therefore, caution will be needed with any in-combination assessment and baseline chosen.

4.2. The following data sources may provide useful information on other projects for the assessment of cumulative effects:

- The Nationally Significant Infrastructure Projects register:
  https://infrastructure.planninginspectorate.gov.uk/projects/register-of-applications/
- The Developments of National Significance Register:
  http://gov.wales/docs/desh/publications/180312-dns-register-en.pdf
- Planning Policy e.g. Local Development Plans, Transport Plans (National and Local) and National Policy Statements.

- An up to date list of marine licensable developments can be found at the following link: http://lle.gov.wales/catalogue/item/MarineLicences/?lang=en

IoACCP provided a table presented in Annex 1 of projects that as a should be considered.

5. Habitats Regulations Assessment (HRA)

5.1. The HRA assessment should draw upon the assessments and information provided in the wider EIA, where there are common topic areas.

5.2. We agree that North Anglesey Marine Special Area of Conservation (SAC) should be considered in the HRA.

6. Water Framework Directive (WFD)

6.1. We agree with Section 11.2 'The WFD Process', that a WFD assessment will be required. Note that the WFD assessment will draw upon assessments carried out as part of the wider EIA for relevant topic areas; including Coastal Processes and Geomorphology as this will underpin the assessment of potential effects to WFD hydro-morphological elements and will be required to fully inform the assessment of potential effects to biological elements.

6.2. The WFD assessment should draw upon the assessments and information provided in the wider EIA, where there are common topic areas.

Yours sincerely,

J. Ware

Jess Ware
Permitting Officer

Marine Licensing Team
Natural Resources Wales

Approved by:

Wendy Dodds
Marine Licensing Team Leader

Natural Resources Wales
Cc: Consultation Bodies.

Annex 1 – Projects that should be considered in the Cumulative Impact Assessment as suggested by Isle of Anglesey County Council Planning.

Developer	Project Title & Description	Source of Information/ Application Reference	Status
Conygar	*Holyhead Waterfront Development:* Outline application for a mixed-use development consisting of a new marina, residential properties, a hotel, commercial, leisure and retail uses together with associated land reclamation and service infrastructure.	Planning Application 19C1046A/EIA/ECON VAR/2020/20 currently being assessed by the IACC.	Consented
Stena Line	Marine Licence Application for Maintenance Dredging at Holyhead Port	Natural Resource Wales (NRW)	Consented
Stena Line	Harbour Revision Order for Holyhead Port Expansion	Planning Inspectorate	Consultation closed. Awaiting details from PINS
Conygar	*Parc Cybi Stage 2:* Mixed-use employment developments on the southern edge of Holyhead, close to the A55. Primarily distribution and warehousing space but also includes an 80-bed hotel.	Planning Application	Consented
Land and Lakes	*Penrhos Leisure Village:* A leisure village at Penrhos Coastal Park, Holyhead, with up to 500 new lodges and cottages and 315 new dwellings at Kingsland.	Planning Application 46C427K/TR/EIA/ECON	Consented
Orthios Group	*Anglesey Eco Park:* including: • a 299 megawatt electric (MWe) biomass power	Planning Application (determined by DECC)	Consented

	station within the existing consented scheme; • prawn-growing facility (aquaculture); • large soil-less indoor vegetable growing facility (hydroponics); • home compostable food packaging facility; • the compostable food packaging centre of excellence; • research and development; and • a deep water jetty for bulk import.		
Minesto	*Holyhead Deep:* 10MW (and phased development to 80MW) Tidal kite installation off the coast of Holyhead, plus on-land elements and grid connection.	Environmental Statement / NRW Scoping Opinion.	Consented.
Morlais	*West Anglesey Demonstration Zone:* Menter Môn has applied for a long-term lease to manage an area of seabed off the west coast in order to develop the marine energy sector.	Marine Licence application ORML1938 Transport & Works Act Order (to be determined by Planning Inspectorate Wales)	Reasonably foreseeable.
IACC	*Business units at Penrhos:* Full application for the erection of 10 flexible business units including associated parking and service yard, landscaping, vehicle charging points, solar panels and two bin / recycling storage and bike storage.	Planning Application 19LPA1023A/CC	Consented.

Anwyl Homes	*Residential development at South Stack Road (Phase 1)*, *Holyhead:* Construction of 123 detached and semidetached homes on an 11-acre site.	Planning Application 19C608F	Under construction.
Anwyl Homes	*Residential development at South Stack Road (Phase 2):* Full application for the erection of 46 dwellings together with the creation of a new vehicular access on land adjacent to Parc Tyddyn Bach, Holyhead.	Planning Application FPL/2018/57	Application Submitted.
Huws Gray	*Builders Merchant Yard:* Full application for the erection of a building to be used as a builders merchant with warehouse and sales floor areas (sui generis use), construction of new vehicular site access, storage yard, loading areas together with soft and hard landscaping areas on land at Parc Cybi, Holyhead.	Planning Application FPL/2018/25	Consented.
Horizon Nuclear Power	*Wylfa Newydd New Nuclear Power Station*	DCO Application National Infrastructure Planning website	DCO Examination completed.

6.3 GAPS Pre-application Consultation Responses

Holyhead Breakwater: Archaeology

From
Jenny Emmett
To
Sarah Marjoram; Neil Chamberlain; Simon Lewis; EmmaCollett@ynysmon.gov.uk; wyn.parry@stenaline.com; Keith Williams (KeithWilliams@ynysmon.gov.uk); John I. Williams (JohnWilliams2@ynysmon.gov.uk); Emma M. Collett (EmmaCollett@ynysmon.gov.uk)
Cc
deanna.groom@rcahmw.gov.uk; Nick.Davies@gov.wales; Jamie Gardiner; RowlandThomas@ynysmon.gov.uk
Recipients
Sarah.Marjoram@rhdhv.com; Neil.Chamberlain@rhdhv.com; Simon.Lewis@rhdhv.com; EmmaCollett@ynysmon.gov.uk; wyn.parry@stenaline.com; KeithWilliams@ynysmon.gov.uk; JohnWilliams2@ynysmon.gov.uk; EmmaCollett@ynysmon.gov.uk; deanna.groom@rcahmw.gov.uk; Nick.Davies@gov.wales; jamie.gardiner@rhdhv.com; RowlandThomas@ynysmon.gov.uk

Dear all,

Thank you for the informative presentation and overview of the project so far. I'm afraid for much of the meeting today it sounded as though you were holding it in an underwater cave, so I concluded it was sensible to email comments, with apologies if anything was covered today and I missed it. I don't have email addresses for Delyth (NRW) or Simon (RSPB) so please could you send this on, if you feel it appropriate to do so.

There are essentially three areas of potential archaeological impact for the proposed work:

i) physical impact to the breakwater itself

ii) visual impact, i.e. change in appearance of the breakwater

iii) impact on nearby archaeology during pre-construction investigations and construction works.

Item (i) has already been addressed through the completion of a comprehensive building record by Gwynedd Archaeological Trust in January 2017 (GAT report 1355). This was commissioned by RHDHV, so is presumably available to the project team for reference, e.g. in relation to historical evidence for its construction method and materials.

Both item (i) and (ii) will be addressed through the listed building consent application, and Keith and John's advice leading up to this. As the current form of the structure is already recorded, item (ii) is more a design issue that lies more in the remit of the built conservation officer than me.

Item (iii) mainly concerns the numerous wrecks and their shed cargo that are recorded around the breakwater. These sites are located with varying degrees of precision, and may be at risk from disturbance or damage either from construction activities (such as the placement of a jack-up barge / construction platform) or from any sediment-testing type investigations. I'm afraid I couldn't quite hear the response to this point over the phone, so to confirm, these will need to be identified as part of the archaeological section of your environmental report, or in a separate report if a combine environmental report isn't being produced, so that they can be avoided by construction activities. You should also consult Deanna, the RCAHMW maritime officer (I note that she sent apologies for this meeting) as she is the expert on this subject.

I would be interested to know what surveys are being undertaken to inform the scheme, as these can have incidental archaeological benefit as well as impact, in producing new information. I think I heard that GPR was planned to investigate voids in the breakwater?

Based on the current information, archaeology appears to be a relatively minor topic area that can be dealt with through the various consultation stages. I would be grateful to be kept in the loop, but probably don't need to attend further workshops.

Thank you for including us at this early stage, and apologies for the inconvenience of not being able to attend in person today.

Regards

Jenny

Jenny Emmett

Uwch Archaeolegydd Cynllunio - Senior Planning Archaeologist

6.4 NRW Pre-application Consultation Responses

Cyfoeth Naturiol Cymru
Natural Resources Wales

Ein cyf/Our ref: CAS-85309-C7N2

Ebost/Email: northplanning@cyfoethnaturiolcymru.gov.uk
Ffôn/Phone: 03000 65 5265

BY EMAIL ONLY
FAO: SARAH MARJORAM

15th May 2019

Dear Sarah,

PRELIMINARY PRE-APPLICATION ADVICE

PROPOSED HOLYHEAD BREAKWATER REFURBISHMENT

As you are aware NRW recently attended a stakeholder workshop held by Royal Haskoning to introduce new proposals to refurbish Holyhead breakwater. In the meeting we agreed that we would send you some initial comments on the proposal under our Free Preliminary Advice service.

We have considered the information received regarding the proposal in relation to our Development Planning checklist. We advise that the following matters are relevant to your site / proposed development and suggest you consider these further prior to the submission of any planning application / marine licence application required:

Flood Risk Management

- For information the area of coast from Soldier's Point, along Newry beach and further east is located within Zone C2 as defined by the Development Advice Map (DAM) referred to under Technical Advice Note 15: Development and Flood Risk (TAN15) (July 2004). The breakwater affords a degree of protection from wave action / storm conditions. Our flood maps/zones are based on extreme sea levels (0.5% & 0.1%) which do account for surges but not wave action. As such we advise that any works undertaken are unlikely to change NRW's flood maps. Can you confirm whether maps will be developed in support of the proposed scheme showing which areas of the town benefit from the breakwater.
- What breach lengths are going to be modelled and how many model runs will be carried out? We would be grateful if you could advise and agree these parameters. NRW does have breach and blockage guidance but these are for formal linear defences rather than breakwaters and as such may not be applicable.
- What are the impacts of a total breach on any development proposal along Newry beach? It is understood that at the time, the proposed waterfront development relied on the breakwater.
- What would be the lifetime of the proposed development in years?
- Which Climate change allowance is proposed for use? For information, climate change allowances for planning applications in Wales require compliance with Climate change allowances and flood consequence assessments (CL-03-16)

Further advice on development flood risk can be found on our website.

Landscape
The proposal is located just over 1km away from the Anglesey / Ynys Môn Area of Outstanding Natural Beauty (AONB). Given the scale of the proposal we would advise you to consult with the Local Planning Authority and consider the need for Landscape Assessments in accordance with published best practice guidance. We refer you to our website for further advice.

European Protected Species (EPS)
Whales, dolphins and porpoises (cetaceans) are European Protected Species (EPS). It is against the law to deliberately capture, kill, injure or disturb a cetacean. Given the proximity of the proposed development to the North Anglesey Marine / Gogledd Môn Forol Special Area of Conservation (SAC), we advise that any future planning / marine licence applications should consider impacts to harbour porpoise as an EPS. Please see our website for further advice.

Protected Sites
The proposal is located within / immediately adjacent to the Anglesey Terns / Morwenoliaid Ynys Môn Special Protection Area (SPA) and the North Anglesey Marine / Gogledd Môn Forol SAC.

The proposal is located within about 150m of the Glannau Ynys Gybi : Holy Island Coast SAC, SPA and Site of Special Scientific Interest (SSSI).

Should the proposal be subject to planning and/or a marine licence the Local Planning Authority and/or NRW will be a competent authority for the purposes of the Conservation of habitats and Species Regulations 2017. As such they must not agree to any plan or project unless they are certain that it will not adversely affect the integrity of the SACs and SPAs listed above.

The competent authorities will need to carry out a test of likely significant effects (TLSE) for the SACs and SPAs, as required under Regulation 63 of the Conservation of Habitats and Species Regulations 2017. This test applies to impacts on the SACs and SPAs from the proposed works alone and in-combination with other plans and projects.

If the test concludes there is likely to be a significant effect then an appropriate assessment of the impacts on the SAC from the proposed works, either alone or in combination with other plans and projects, will be required. We would be able to assist with that assessment in our role as the statutory nature conservation body under the above Regulations.

The Wildlife and Countryside Act 1981 (as amended) places a duty on public authorities in exercising their functions, so far as this is likely to affect the flora, fauna, geological or physiographical features of a SSSI, to take reasonable steps consistent with the proper exercise of their functions to further the conservation and enhancement of those features. We refer you to our website for further advice.

Section 7 Marine Species and Habitats
We advise that any future planning and/or marine licence application made should consider marine priority species and habitats listed on section 7 of the Environment (Wales) Act 2016. The following guidance note provides information on how to access marine ecology datasets for marine developments and activities.

Water Framework Directive
Should the proposed development require a marine licence, it is likely that any application made will need to be accompanied by a Water Framework Directive (WFD) Assessment. Further information can be found on our website and the following guidance note

Invasive Non-Native Species
Reducing the risk of the spread of invasive non-native species is an important consideration for any proposed development, particularly so at this location in Holyhead which is close by to a known location of the highly invasive non-native sea squirt *Didemnum vexillum*. We would expect any planning and/or marine licence application to be accompanied by a biosecurity risk assessment detailing measures designed to reduce the risk of spread of invasive non-natives as a result of the proposed works. We can provide further advice on this issue if required.

Please note the view expressed in this letter is a response to a pre-planning enquiry only. We trust these comments will prove helpful but they should not set a precedent for any future Natural Resources Wales' response to any formal application for planning permission or other legal consent. Such applications shall be assessed on the information submitted and regulations of relevance at that time. The details contained in this letter are based on the information available to date.

Please do not hesitate to contact us should you require further information regarding the contents of this letter.

Yours sincerely,

Delyth W Rowlands

Delyth Wyn Rowlands
Cynghorydd Cynllunio Datblygu / Development Planning Advisor
Cyfoeth Naturiol Cymru / Natural Resources Wales

6.5 Holyhead Breakwater Consultation Log

Comment Number	What are your key interests in Holyhead Breakwater?	What are your key concerns relating to its refurbishment?	Do you have any relevant information you can share to inform the development of the proposed scheme?	Any other comments
1	Yatching and boating, Using the Marina and facilitating lifeboat services	The loss of the breakwater would be catastrophic for the port and the town of Holyhead	I was under the belive that when the harbour was sold out of public ownership that all rights and obligations were transferred, did this not include the mainting the breakwater ?	
2	Historic and iconic structure such as this should be more when marketing tourism on Anglesey, such as South Stack and the Church in the Sea. We should be proud of our past achievments and maintain them. It is one of the longest beakwaters in the world, a fact that is sadly forgotten. Stella Line should be in the strongest possible terms to allow the condition to deteriioate by carrying out virtually no maintenance. Do something "Seaward Side"	I have no concerns regarding refurbishment (The channel tunnel was built in the 90s) All environmental issues, both environmental, technical and social would be addressed during the various "impact" processes which are statuory before such work commences. Surely the cost of repair is much less that construction of a new structure.	I'm sure that many find difficulty in interpretating the three questions on this paper. If you wish to bring people on board, ask questions that they understand and can answer. Look to the past work carried out that maintain the structure, neglect has brought us to where we are , thanks to Stenna	
3	Resident Marina user ?	My concerns are the impact on the local economy if the breakwater is to fall into disrepair. What would the result be to the coastline and marine life. I think strengthening the seaward side and the groynes on the Leeward side would be the best way forward.		
4	Resident Marina user ?	Social - historic importance and contempory local icon, well used locally. Technical - Maximum maintenance more effective long term.		
5	We have a home in Tam y Bryn Rd.- We use the breakwater for recreational purposes. - We feel the breakwater is integral to the identity of Holyhead port and town	Essential to the protection of HH sea front. - It is important national monument. - It is a structure of architectural and historic importance. - It allows for safe recreational environment (dinghy sailing).	It is essential to existing and future commercial development: marina, restaurants, museum, lifeboat station, housing….	
6	To maintain a "safe haven" for locals and visiting sailors (for which Stena receive payment)	My concerns are all costs should be bourne by the owners - to maintain their operation in a safe manner.	Stena Conygar Planning App to , IOACC included "Environmental Impact Statements" which stated Stena reported the breakwater would require no work for 100 years ? IOACC Planning accepted this ?.	
7	That the public once again have vehicular access for disabled to go fishing.	That public monies are used then Stena Line who have not done any serious maintenance but whose ships have caused major wave damage to the structure, take oover the running of it. Stena Line sold it to Conegar for £1.00 ! Sealink and British rail spent millions on Rock Armour, Stena NONE !!		
8	Part of my life and my upbringing. It defends us. As sailors we knew the safety of the harbour and its history. Shelter and beauty. Bolsach and Salt Island have been ruined, ugly, station ugly	Needs sensitive restoration - not cost to wild life. Has to be in keeping with design. Its historic and we should be proud, caretake the project.	Not a development expert but please don't let it ruin any further. Don't need any more fancy developments, do not need a safe haven.	
9	Enjoy fishing especially in the summer. Also walking along the breakwater.Amount of time it will take. Realise it needs to be done			
10	Having lived all my life(72 years) in Holyhead, I have seen many changes to the buildings and structures which have been detrimental to our local history, (eg St Seriols Church, Railhoose,Convent) Please find the resources to save our breakwater for the generations which will follow to walk, run, fish and just enjoy it.	If nothing is done the breakwater will eventuall breach and there will be nothing left only a pile of stone ! Our local history will be consigned to the text books (or these days on line !)	No information, but would hope that the breakwater would remain a public acsess structure and not made a private concern	
11	Keeping structurally sound and important transportation hub operational. It makes good business sense for Wales.	Done properly, the social and environmental benefits could be long lasting and inumerable. Repair the inside of the structure wall so that erosion is halted - but without decreasing harbour area. Do major structural repair and support the outer wall - there's more room.	Never neglect the sea. The stongest and most beneficial force on earth. The potential for wave energy is there, transport and food is there, think futuristically- population growths , industrial needs, DO NOT THINK SMALL	
12	The port needs to carry on the service to Ireland. Tourism – beautiful location for walks and fishing	It needs refurbishing, at the minute it is untidy and a bit of work on it would improve the environment	Only what I see while appreciating the Holyhead area	
13	It was constructed to provide a refuge for ships during severe gales and should be maintained to offer protection for yatchs now moored there.	That it should not be closed to the public for a long period of time		
14	As a resident of the town for 80 years. As the wife of a seafarer for 58 years, as someone who lives close to the structure and sees it every morning from my bedroom window, and as a resident who wishes to ensure that its refurbishment and ongoing upkeep is funded for the long term.	My key concerns are that the refurbishment offers a long term improvement to the structure and that any refurbishment includes the walkways.	Having travelled to Dunlaoghaire regularly for a number of years, I have always noticed that the seaward side of their breakwater has a curve. This allows the waves to travel up the curve and flow back on itself into the sea. You describe your option as a 'slope', this would mean that at the top of the slope the sea would come over the top of the breakwater, I assume. Would it not be better to provide a 'buffer' rather than a 'slope'? On the issue of the 'mound', you say that you will be restoring it. If this is the case will it not suffer from the same issue on the leeward side over the years to come? I have no technical knowledge, just the power of observation!	
15	I live within 100 metres of the shoreline in Newry Beach	My main concern is that Stena Line own the Breakwater and they should maintain it. It is in their interests to maintain a safe harbour and port as they are the owners of the Port and a substantial amount of and close to the surrounding shoreline. I am not in favour of scarce public funds being allocated to the repair of the Breakwater bearing in mind who the owners of the Breakwater are. If Stena Line are stating they don't have sufficient funds to pay for the repair they should consider introducing a levy on all ferry passengers using the port to pay for the upkeep of the Breakwater. It must be remembered that Stena had a very favourable deal when they acquired the Port but with this deal came some responsibilities – which includes maintaining the Breakwater.	Nothing in particular other than one from a personal perspective in that should the breakwater fail I shall have constant wet feet as the sea/tide will be lapping at my front door!	
16	Emerging marine planning documents in Wales advise that marine developments should seek to enhance biodiversity, not only to minimise environmental harm. As part of the Ecostructure project (www.ecostructureproject.eu) we are investigating ways of enhancing biodiversity on artificial structures in the marine environment. We are trialling eco-engineering designs in the Irish Sea and collating a catalogue of evidence to support decision-making for ecologically-sensitive design in marine development projects. As such we are very interested in options for refurbishing Holyhead Breakwater.	Our key interests are maximising biodiversity benefits and minimising environmental impacts in marine development projects.	As part of a previous project we surveyed portions of the breakwater wall and rubble and can share biological information if of interest. When outputs from the Ecostructure project become available we will be able to share findings about what is likely to colonise different structures and how eco-engineering biodiversity enhancement interventions are likely to perform.	
17	I enjoy walking outdoors and a love of the sea, the breakwater is a fantastic example of maritime engineering which should be preserved for all to enjoy.	Access should be maintained for all to walk and fish from the breakwater, is is a magnet for marine life and above all else protects Holyhead port and the marina from on shore winds.	unsure of what you are asking here	
18	I write with regards to your consultation on the maintenance and upkeep of the Iconic Breakwater here at Holyhead, which has afforded a safe haven in the harbour area since 1873, and allowed continued development along the Newry Beach, Bolsach and Victoria Road areas, which would disappear without the protection afforded by this unique structure, a feat of engineering which is still to be admired to this day.	I am at present the Mayor of Holyhead, and as part of my role I have had the honour of meeting and talking to many dignitaries who have visited Holyhead during the last year, as well as the many visitors from all over the World, who visit on one of the many Cruise Ships that have Wales, and Holyhead, as an important part of their itineraries when visiting Great Britain and Ireland, holidaymakers and tourists from all parts of the Country, and they all say the same thing, how wonderful it is to be able to enjoy the Newry Beach area, protected by this amazing structure, and even walk its length to admire it for what it is, a structure affording protection to so many areas of our Town against the ever increasing storms that blow in from the Irish Sea.	I am hoping that a new marina or possibly even two marinas are to be constructed in the near future to replace the one that was totally destroyed here last year, the results of which have been felt hard by the Restaurant, Bars, Chandlers and the Sailing Club during the summer, with significant decrease in the numbers of boats and craft moorings, resulting in a big decrease in people coming to Holyhead during the Sailing season, and my fear would be that if the continued deterioration in the structure of the Breakwater, would over time, put any further developments that happen in this area in jeopardy. In conclusion, I would fully support any application for funding to start the work of securing the future of the Breakwater from a structural point view, for the reasons stated above, that is to secure the long term sustainability of the areas protected by the Breakwater since the 1800s, and secondly to allow further developments planned within this area in future, which will in my opinion, add to the economic growth of Holyhead and Ynys Môn well into the future, with the possibility of attracting further exiting new projects into the area, which will not be possible if the Breakwater were ever lost.	
19	The Breakwater is essential for the protection of the port and town of Holyhead. Newry Beach and the outer harbour owes its existence to the shelter that the Breakwater has provided for more than 150 years. The Museum is located in the old Lifeboat House positioned at the water's edge at Newry Beach. It was built there as the Breakwater was being constructed. It is beyond doubt that this Grade II listed building, home to the town's collection of unique maritime artefacts, would be at serious risk of damage from the unfettered Irish Sea, should the Breakwater be breached. In addition, a very popular tourist attraction (over 5,000 visitors each Summer) could no longer operate.	The Trustees urge those now responsible for the maintenance and survival of the Breakwater do all it can to ensure that it remains in place. It would be false economy to turn backs on this magnificent structure and leave it to the mercy of the sea. All should be done to shore up and protect the seaward side of the structure. So much time has been lost since regular maintenance of the rubble base was abandoned. This surely must be the first priority. Among the Museum Trustees are two Master Mariners with extensive seagoing experience. One of the suggestions they make, seen in ports elsewhere, is the use of Tetrapods - preformed concrete shapes - to protect the seaward side of the Breakwater from wave action - see photo.		
20	My main interest is fishing. I often visit to fish from there either alone or with my daughter. I fish for pleasure and also take part in various species hunt competitions where we have to try and catch as many species as possible. My results are shared with both The Angling Trust as well as CEFAS. The breakwater is home to many species of fish, which either live their permanently around it's structures or else visit at stages of the tide or season. I also take part in competitions on the breakwater. When I visit my daughter and I support the local businesses by purchasing goods as well as consumables.	From a social point of view it would affect my fishing as well as other anglers and boat owners, depending on which side is refurbished and any restrictions this will impose for access and for how long.The environmental impact again depends on which side repairs are done. Both sides are home to fish and various sea life, including crustaceans, other species, seaweeds etc. Wrasse can be caught on either side but more over on the back wall as the rocky environment provides an ideal habitat. Wrasse are territorial and are likely to remain close to where they like to breed, hunt or have hiding areas in times of danger. Last summer I caught a 3lb Ballan Wrasse there. Conger, pollack and bull Huss are also to be found in this area. On the inner area close to the wall resides smaller species of fish including the long spined sea scorpion, rockling, wrasse, tompot blennies etc. It is also visited by whiting, dog fish, bull Huss, pouting, poor cod, shannies and various Goby species. There are Off the walls near the light house there are octopus. There is also a seal which frequents the waters to hunt. also numerous prawns and shrimp which are a valuable food source. Crabs including the edible and velvet swimming crab along with lobsters are crustaceans which are in the inner area and I presume live amongst the rocks off the back wall too. There are also numerous prawns and shrimp which are a valuable food source. Crabs including the edible and velvet swimming crab along with lobsters are crustaceans which are in the inner area and I presume live amongst the rocks off the back wall too. There is also a seal which frequents the waters to hunt. Various species of seabird also visit. My concerns for the environment is the disruption that the refurbishment will cause, mostly at and below sea level. How long this disruption will be, the use of boats (adding to pollution levels) and machinery. Any damage to habitats caused by vibration, any contaminants entering the water and the dropping of rocks/concrete. Although I would rather the outer wall be strengthened by increasing the rocks or concete slabs than actual rebuilding of the wall at sea level as the latter would likely cause more habitat destruction. From an economic point of view should fishing be restricted or banned during repair work this would affect the businesses in Holyhead whereby people visit in order to fish the breakwater and they come from far and wide. In particular an Angling shop called Winnie's Worms would be very affected by it because a large part of his business especially during summer relies on not only locals that fish but moreover visitors.	Only as already listed above that careful consideration of the environment needs to be made before the final choice. Also to consider how this will affect anglers and in particular Angling businesses at Holyhead. My own preference would be to top up the rocks seaward side and to strengthen the wall only where it is absolutely necessary to repair. Otherwise the topping of the rocks would further act as a barrier to the waves and incoming tide.On the inner side I would prefer it if rocks/concrete was not dropped as it would destroy habitats and make changes to the sea bed which would alter the eco system and which creatures lived there, particularly close in. The water has only come over the bottom wall on inner during storms. Could there not be a provision to build a small wall along near the outer edge of the lower level? One which would help prevent the tide coming over? Stones or bricks which are used could have holes placed at the bottom in certain areas so if water did come over it could seep back into the sea. If the pot holes were filled in along the lower level this would help with standing water and if the whole lower level was raised slightly a slight camber could be installed towards the sea to help with water drainage. Even if this camber was only a few feet away from the edge. This would help to direct sea water away from the wall that divides the two levels and thus reduce erosion of the wall. Sadly I am unable to attend the public meeting but I wanted to express my interest in this matter and raise the concerns I have.	
21	The economy of the area has been severely disrupted by the loss of the marina just over a year ago and it is essential that we retain the drive to reignite the growth of water-sports and commercial marine industries to draw people in and to support the fragile economy of the area.		Apologies for the late submission but in my opinion options 3 and 4, i.e. significant repairs to both sides of this historic monument, must be put in hand as the eventual failure of the breakwater would render the harbour lost as a port of refuge.	
22	As a former "Holyheadian" I often return to visit my mum who still lives in the town. I was sad to hear about the poor state of the breakwater. I will not sadly be able to make the meeting on the 29th bur would love to hear more about the plans to look after this historic engineering project. Too many of the town's historic buildings have been pulled down or left to rot and it would be catastrophic if the same fate befell the breakwater.			
23	This is one of the best venues for any disabled angler and is a key reason for visiting Holyhead. When planning a fishing trip to Holyhead I would normally spend at least £100 a trip with local businesses for the likes of bait, food and tackle. If this was multiplied by the number of people using the breakwater then I feel that would be a considerable amount. If the breakwater was not maintained and lost to angling then alot of local businesses would suffer.		No sorry	
24	History:(an) historic landmark. Leisure:walking/running/fishing Protection: protects port/harbour	To Keep the Breakwater the same aesthetically ,using the same materials as the original construction -Something must be done imminently as the minimum has been done over recent years	Aggregate being placed on the lower 'deck' is recyclable material which contains clays and soils which is totally unsuitable because:a)clays and soils can be washed away I.e.environmentally undesirable b)will encourage growth of vegetation on the breakwater,leading to structural damage long-term.Recycled aggregate is a cheap alternative,but totally unsuitable for the running surface of the lower layer	I WOULD like to be kept informed as the project develops.Thankyou.
25			Do nothing you don't own it! If you own it and get payed port tax then yes maintain your investment.	
26	My history in the Breakwater is of a historical/cultural one. I am from Holyhead and also a local amateur historian (past-time) and Fisherman who frequently uses the Breakwater. I am well aware of the importance of the Breakwater to the History of Holyhead and Western Anglesey. The construction of the Breakwater in the 19th Century and developing a link between London to Dublin was one of the major factors why Holyhead and Western Anglesey developed and the population significantly grew.	Undoubtedly the Breakwater has not been maintained over the years which is disappointing. However my key concerns are that the original historical construct of the Breakwater may be destroyed during technical refurbishment works.	At the time of its construction in the 19th Century the Breakwater was using quite advanced construction techniques - the fact its also one of the longest breakwaters in the world is often overlooked. As part of the development of the proposed scheme I think consideration needs to be given to protecting the historical construct of the Breakwater as much as possible and also installing a new commemorative plaque once the new works have been completed.	Please can you also add my email address to your distribution list so I can be kept informed of the latest project news on the refurbishment:
27				I note that erosion is being cited as a problem with the breakwater. I would to point out that in the 1980s when the port was run by the railways they would annually purchase from Penrhyn Quarries, 3000 ton of stone blocks in the size range of 8 to 10tonnes. The size of the blocks had been determined as being of sufficient mass to resist movement by the sea. These blocks were placed as and where needed using a large mobile crane over the course of the year These actions were I believe successfull in stabilising the breakwater. Regrettably when Stena took over the port this prudent maintenance work with these very large blocks of stone was discontinued.To me for Stena to now claim that the breakwater is at risk after their neglect and to request welsh government support is greed in the extreme when viewed against the profits the port has generated and the fact that it was known and quantified liability from the start
28				I first became familiar with the Breakwater when I started working as a firefighter at Holyhead Fire Station in 1967, and through a friend started sea angling. I became a member of the local Holyhead and District Angling Club, and over the years up to present day I have served as the Secretary, Chairman, President. I was nvolved with organising the Holyhead Open Sea Angling Festival for over 35 yrs and have walked up and down that breakwater thousands of times. For many years there was a full time maintain acne squad that kept up a constant program of protection and maintain acne of the breakwater. A large mobile crane ran on rails along the whole length of the breakwater. Large rocks were constantly dumped over the back of the structure, and the maintain acne team knew exactly where the most vulnerable areas were. After each storm the team would be down there to check and strengthen any area weakened by the storm. Everyone that know the breakwater know, of the neglect that started to happen as on as the then Thacher government sold Sealink to American, James Blair Sherwood who Imeediately started stripping al the assets of Sealink nationwide. The maintainance of the breakwater diminished from then on, and when Stena took ove the port, ships and responsibility for the breakwater, it all went down hill after that. It was obvious to everyone that ey had no intention of running a proper on going maintainance program for the breakwaer and reluctantly carried out repairs only "if and when" required after a storm, and only carrying out the minimum work. The did not have a maintainance crew edification for the breakwater, and often they sub contracted the work. Some of the blocks they dumped over the back were huge blocks of slate, and not the heavy granite used in the past, and as everyone knows, slate is much less heavy and dense than rock, and they would only last one good blow and they were gone.I remember talking to a person in Stena House many many years ago, and he showed me proposals that were on the cards then by Stena, of allowing the breakwater to collapse into a mound, which could then be covered in tangle concrete units, much cheaper than all the maintainance needed. I could go on and on about the total deliberate neglect that has taken place in regards the breakwater, and now we are at the stage I believe, that if nothing is done, this unique and very well known landmark, that is a historical feat of engineering, will be lost. I served for many years on the Anglesey County Councilor as a Councilor for Holyhead's! And as far back as I can remember, no one has been willing to grab the mettle and insist on Sealink and now Stena should be made to fulfill their responsibility for the breakwater and the port of Holyhead. They make very large profits from their operation in Holyhead, which they acquired for a give away price, but show no responsibility at all for the future of the port, they are playing a very dangerous game I feel in their neglect of the breakwater, deliberately so as to put pressure on others, to bail them out of their responsibility. The port of Holyhead should have been taken over by our local authority when te wholly of Sealink ports were given away cheaply by Mergaret Thatchers Government, but no one had the courage to go for it. Anglesey and Holyhead would by now would be reaping the benefit. All agencies must now pull together to protect this wonderfull structure that admired world wide, but it still sticks in my throat when I think that Stena are going to be bailed out. The old Breakwater Gang will be turning in their graves.
29		I think regardless of cost the breakwater should be re stored to its original state To let it deteriate will cause problems and drastic results and much more costly if it had ti be re paired then		
30	local resident, active in leisure boating. Mooring holder and member of Holyhead Sailing Club. Walking along the Breakwater. Protection and preservation of an iconic landmark and symbol of Holyhead's historic, current and future as the principal strategic sea bridge to and from Ireland.	gradual breaches leading to total failure would be a catastrophe for Holyhead directly and North Wales generally in terms of economic loss, loss of employment, social consequences of loss of tourism. Loss to seafarers of one of the only ports of refuge along the North West coast. It is difficult to imagine how Holyhead could survive as a cross-Irish Sea ferry hub without the protection of the Breakwater.	I am not an expert. However as a sailor I would expect that the only feasible and long term solution is to strengthen and protect the Seaward side. This might be done with the use of very large interlocking pre-cast concrete Tetra-Pods. The strategic importance of the Breakwater cannot be overstated and as such I believe its refurbishment should be treated as a major national infrastructure project funded through taxation.	
31	That it's restored and looked after thereafter and accessible for walks/bike rides/etc.	Local people and resources used first if available. No pollution made whilst work is ongoing.	Yes It's a local icon prevalent in most of my childhood memories. Let's not have it deteriorate due to usual issues/corruption/lack of appreciation within the council and stena or whoever else is key to getting this remarkable piece of local history maintained well.	I grew up at Hibernia row and therefore looked out at the breakwater every day of my life there. And still do when we visit family often throughout every year.
32	I feel very strongly about the preservation on this historical monument and everything possible should be done to preserve it. Whilst under the care of British rail it was always maintained with large stones being placed over the back of the structure into the Irish Sea - that should continue.	The environmental impact on just letting it deteriorate is not an option with more frequent extreme weather, rising seas due to climate change, ETC Failure in the breakwater would result in damage along the sea front of Newry beach and the salt island complex, causing further sea erosion, which in turn adds costs to the local economy putting people , premises and businesses at risk, it would also hamper the Port for vessels requiring refuge and the sea's waves would also impact on the Penrhos beach area causing further coastal erosion. The World economic forum global risk report identifies the above impact as one of the economic risks to face us in 2019. Anglesey in the last couple of years has seen an expansion in the tourism industry, the breakwater is only one of the very few places if interest in the area for people to see and is disabled access friendly on the upper level.		
33				Further to my earlier e mail. Have a look on your Face book stream for Anglesey Council, contributor "Beth Owen" I notice she stated that the annual replacement of the rock armour policy stopped some 20 years ago!! No wonder there is a problem today !!
34				I was involved in the maintenance of the breakwater for a short time as a Sealink Ports Engineer and Procurement Manager some 30 years ago, at that time the seaward side was subject to stiorm wave erosion of the facing rock armour and every year the maintenance programme replaced lost material with imported rock armour which I would not define as "rubble". The size of rock armour used required a significant size long reach crane and each individual rock was placed carefully one rock at a time. I know that the previous Port Engineer now retired now still lives in the Area and his Name is John Marchbanks, I think it worthwhile taking his advice on the maintenance strategy as given the wave power in any gale,rubble would be washed away in no time. I also recall one particular storm exposed some timber so the existing breakwater may not be Block on block construction throughout. There used to be some superb cross sectional drawings of the breakwater in the Port Engineers Office all hand drawn at the time of construction.
35	I live opposite it in the old coastguard houses	The disgusting state of what should be a tourist attraction, get a railway running alomg it. What a waste !	Stena are a disgrace they have done nothing to improve the new harbour (outer harbour) or inner one	Why have these pamphlets not been distibuted to people who live along Newry and waterside areas . I got mine from a third party!
36	I have keen interests in the holyhead breakwater as a keen angler who has fished this venue very frequently for the last 45 years. I also I'm the chairman of the holyhead and district angling club angling club which I've been a member for 35years. We hold our annual open competition on the every year for many years sponsored by stena we also hold many club matches on the breakwater. I also walk this venue often.when I was younger the breakwater was constantly maintained by crane dropping big bolders of the seaward side of the breakwater witch fid the trick but this practice stopped Many years ago to slow the sea to pound the main structure .if this method would of continued the breakwater would be in better condition.			
37	Fishing and walking	During proposed refurbishment access would be restricted? Would the refurb affect the fish stocks? If funding was provided by Welsh office then as it is public money access for cars would be guaranteed?	The massive apertures on seaward side of the Breakwater are constantly being concrete filled is this process not working or cost efficient?	
38	To see the town of Holyhead protected from the sea	to have the town benefit from the Breakwater also being used as a tourist attraction.	Once refurbished, it should remain open and accessible for the public to enjoy.	
39				can you please tell me who is paying for the consultants royal haskoning dhv to fix the holyhead breakwater, also where are stena going to get the money to fix the breakwater will the Anglesey rate payers. or the Welsh assembly pick up the tabs?.
40	Cymell is a day centre for people with learning disabilities. We used to be able to go fishing every Friday onto the breakwater. We felt safe and used to meet a lot of people there to socialise	That we will not be able to go fishing and walking on the breakwater where it is a safe place for us. We also have wheelchair users who used to enjoy the opportunity to go on the breakwater	We would like the breakwater to remain open so that we can continue to go there on our fishing club day, walking and cycling.	

6.6 Visual impact and heritage assessment correspondence

Note

HaskoningDHV UK Ltd.
Industry & Buildings

To:	Cadw, Gwynedd Archaeological Planning Service (GAPS), Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW), Isle of Anglesey County Council (IoACC) and Natural Resources Wales (NRW)
From:	Sarah Marjoram
Date:	Friday, 20 September 2019
Copy:	Emma Collett, Rowland Thomas, Steven Edwards, Jamie Gardiner and Neil Chamberlain
Our reference:	PB9014-RHD-BW-XX-CO-YE-0103
Classification:	Project related
Subject:	**Holyhead Breakwater Refurbishment Scheme – Proposed Scope of the Visual and Heritage Setting Assessments**

1 Introduction

Stena Line and the IoACC are proposing the refurbishment of Holyhead Breakwater. The rubble mound which supports the Breakwater superstructure is subject to movement and erosion by wave action and currents, which over the years has resulted in undermining the superstructure. The rubble mound extends approximately 120m from the seaward side of the Breakwater superstructure, and approximately 40m from the leeward side.

The refurbishment would involve the placement of concrete armour units (Tetrapods) along the length of the seaward side of the superstructure, around the lighthouse end and along the leeward side of the breakwater for approximately 100m. Chevron units would be placed at the toe of the Tetrapods to prevent these being moved by the physical force of water movement. The Tetrapods would extend approximately 30m seawards from the superstructure and would have a crest height of +6.7mCD (see **Plate 1** below). The finished design has a 50-year design life to a 100-year design standard, taking into account 1 in 100-year wave height combined with a 1 in 100-year storm surge and 50 years of sea level rise. In order to meet these standards, the design height of the seaward option is required to be 1.1m above Mean High Water Spring (MHWS) level which is +5.6mCD and would therefore be visible throughout the tidal cycle. At high tide, between eight and 15m width of Tetrapods would be visible along the length of the Breakwater.

An Articulated Concrete Block Mattress (ACBM) would be installed along the leeward side of the Breakwater, which would not be visible at any state of the tide (see **Plate 2** below). This would halt the ongoing movement of the rubble mound, providing a long-term solution to the ongoing erosion.

The construction of the refurbishment works would be undertaken entirely by marine-based plant. A jack-up or floating barge with spud legs, or an alternative form of anchoring system, would be required as a platform for a long-reach excavator.

A suitable method of anchoring the barge has yet to be confirmed; however, it could involve a series of anchor points installed on the Breakwater superstructure, or a series of concrete anchor blocks placed seaward of the rubble mound which can be used to hold the barge in place. A vessel would be used to

transport the concrete armour and mattress to the jack-up/floating barge, which would then take the material and place this onto the existing rubble mound foundation.

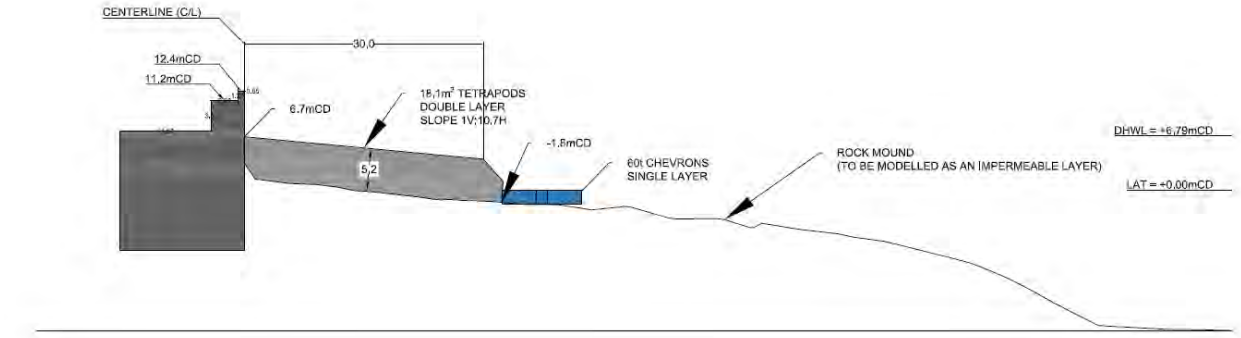

Plate 1 Proposed refurbishment of the seaward side of the Breakwater (LAT – Lowest Astronomical Tide; DHWL – Design High Water Level)

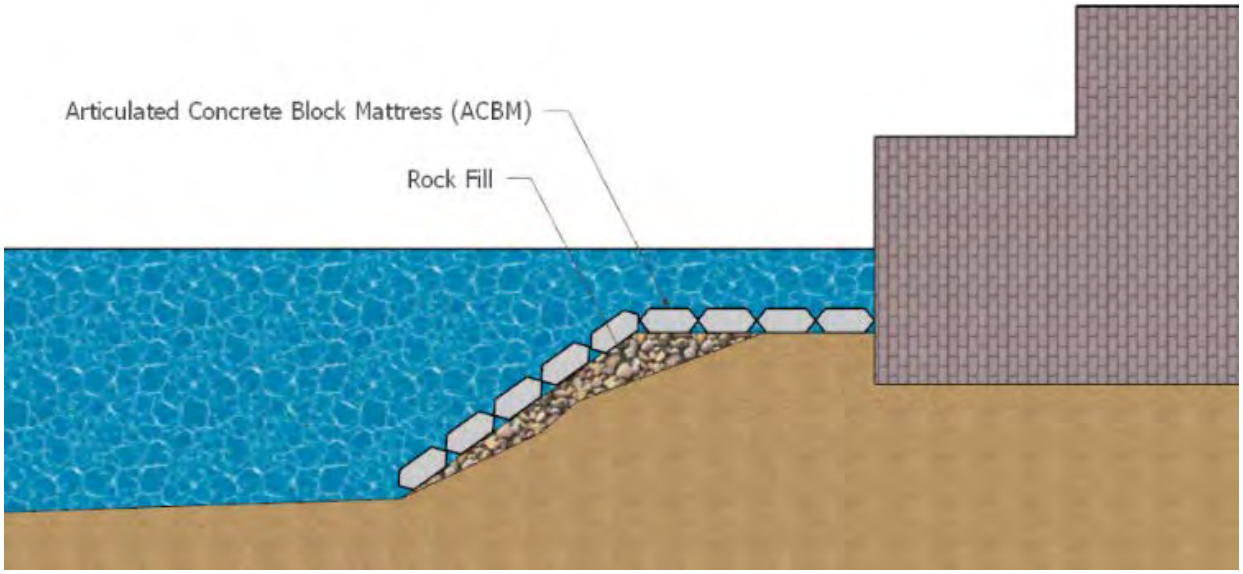

Plate 2 Proposed refurbishment of the leeward side of the Breakwater

2 Purpose of This Note

This note presents the proposed methodology and viewpoint locations for undertaking a visual assessment and heritage settings assessment of the proposed refurbishment works for agreement with GAPS, Cadw, RCAHMW, IoACC and NRW.

3 Proposed Approach

The visual assessment would comprise photomontages of the proposed scheme, which would be used to assess the potential impacts of the proposed scheme on the local visual and heritage setting. Given the nature of the proposed works being concrete armour in front of an existing structure that are only partly visible at high water, no impact on the local seascape/landscape character is anticipated and a full Landscape and Visual Impact Assessment is not considered necessary.

3.1 Viewpoints

Three viewpoints are proposed from which photomontage images of the proposed refurbishment works would be produced (see **Figure 1** at the end of this note), as follows:

- **View 1** – looking south west along the seaward side of the breakwater from the lighthouse. This would consider views from the Grade II listed lighthouse;
- **View 2** – the nearest view from the coastal path and within the Anglesey Area of Outstanding Natural Beauty (AONB) looking north east along the seaward side of the breakwater; and,
- **View 3** – an elevated view of the breakwater looking north east from Holyhead Mountain and the AONB.

These viewpoints have been chosen as they are considered to represent the most appropriate views of the breakwater from visually sensitive locations. Viewpoints from other locations have been considered, such as Newry Beach and across the bay from Penrhyn Bay Caravan Park, however the proposed refurbishment works would either not be visible (from Newry Beach) or the distance is such that the refurbishment works would not be visible (Penrhyn Bay Caravan Park) and as such these locations have been discounted.

3.2 Assessment methodology

3.2.1 Visual assessment

The assessment would be undertaken following standard industry guidance (such as the 'Guidelines for Landscape and Visual Impact Assessment', 3rd Edition) to summarise the key predicted issues and effects of the scheme.

A 3D model would be produced using Civil 3D for the purpose of depicting how the proposed refurbishment works would look like once completed. This would then be used in the production of photomontage images. Photomontage images would be produced for daytime only, given the refurbishment works would not be visible at night time. They will provide a realistic representation of what the proposed refurbishment works would look like once completed.

The following stages of development would be assessed from the agreed viewpoints:

- existing baseline condition;
- construction stage effects; and,
- visual effects once completed.

3.2.2 Heritage setting assessment

The results of the visual assessment will be used to inform a heritage settings assessment of the breakwater and lighthouse. Assessing the setting of a heritage asset and how that setting contributes to its significance follows the methodology recommended in the Setting of Heritage Assets: Historic Environment Good Practice Advice in planning Note 3 (Historic England, 2017).

This guidance document recommends a stage-based approach for assessing the implications of development proposals, as follows:

- Step 1: identify those heritage assets whose settings might be affected;
- Step 2: assess whether, how and to what degree setting makes a positive contribution to the value of those heritage assets;
- Step 3: assess the effect of the proposed development on the significance of those assets as a result of changes to setting;
- Step 4: maximise enhancement and minimise harm; and,
- Step 5: make and document decisions and monitor outcomes.

The first four steps of this process would be undertaken as part of the assessment. Given the localised nature of the proposed refurbishment works, only the breakwater and lighthouse are proposed to be included in the heritage setting assessment.

Figure 1 Proposed viewpoints

Minutes

HaskoningDHV UK Ltd.
Maritime & Aviation

Present:	Wyn Parry (WP) - Stena Rowland Thomas (RT) - IoACC Steve Edwards (SE) - Stena Keith Williams (KW) - IoACC Gareth Edwards (GE) - RCAHMW Jenny Emmett (JE) – GAPS Neil Maylan (NM) - Cadw Simon Lewis (SL) - RHDHV Neil Chamberlain (NC) - RHDHV Vic Cooper (VC) - RHDHV Anna Sweeney (AS) - RHDHV
Apologies:	Emma Collett - IoACC
From:	Click to enter "Sender"
Date:	25 March 2020
Location:	Telecom
Copy:	
Our reference:	PB9014-RHD-BW-XX-MI-C-0140
Classification:	Project related
Enclosures:	See below

Subject: **Holyhead Breakwater Refurbishment – Heritage Stakeholder Meeting**

Number	Details	Action
1	**Introductions** All member introduced them self's and the organisations they represent.	
2	**Background and Maintenance Requirements – NC** Rock replenishment unsustainable; Armoured slope on seaward side was required but attempting to keep the profile as low as possible; Articulated concrete block mattresses for the leeward side; No questions.	
3	**Potential Heritage Impacts – VC** Turning circle highlight as modern addition, regarding of mound clarified as addition of material to allow a stable platform for the addition of the armour units; Desk based assessment for the presence of wrecks and underwater archaeological features to assess placement of anchor blocks – GIS layer offered by **GE** to help assist with identification of areas of importance to avoid for anchoring blocks. Leeward side below water level so no visual impact; Seaward side potential visual impacts, predominantly close to the breakwater – views from historical monuments not impacted; Use of rock in places were possible.	VC to supply outline of proposed working and anchoring area to RCAHMW for assessing the presence of marine arachnological features.

Number	Details	Action
4	**Thoughts and questions** – **All** **WP** – Why are rocks unsustainable and how have we ended up with armoured units? **NC** reply – due to high wave action size of rock required is not available locally and only sourced from Norway which is financially viable	
5	**KW** - Textured finished to reduce visual impact and colour to ensure it blend with background. And chance of an application to promote marine growth? **NC –** Some form of tetrapod's will be viable; level of tetrapod's will be the same as the historical height of the rouble mound when it was constructed; Due to the uneven level of the rouble mound the layout of the tetrapod's will be less uniform than depicted in the visual montages. Change of colour is possible, the scheme is already expensive and additional texturing and colouring may be prohibitively expensive. **KW** - Visibility of ACBM on Leeward side - View point 9 section on leeward side backfilled with rock due to the mound too steep and narrow for concrete mattresses (NC).	Look into colour options for the tetrapod's and the options for texturing
6	**JE** - happy with comments raised by KW, visual montages useful and showing a lesser impact than expected.	
7	**NM** - Cadw no change to the experience from the monument's views	
8	**SL** & **WP** - worst case issued for impact assessment range of images to show High water and with marine growth maybe show in 10 years' time for contrast.	Project team to consider further montages for lower impact levels for comparison – for 2nd public consultation

Holyhead Breakwater Refurbishment Scheme

Refurbishment Options and Potential Impacts to Heritage Significance

25 March 2020

Project related

Reference: PB9014-RHD-BW-XX-PP-C-0139

Agenda

1. Welcome and introductions
2. Background and Maintenance Requirements
3. Selecting a Preferred Management Option
4. Potential Heritage Impacts
5. Discussion

6.7 Marine and coastal ecology survey scope

Note

HaskoningDHV UK Ltd.
Industry & Buildings

To:	Natural Resources Wales and the Isle of Anglesey County Council
From:	Sarah Marjoram
Date:	30/08/2019
Copy:	
Our reference:	PB9014-RHD-BW-XX-CO-YE-0100
Classification:	Project related

Subject: **Proposed Scope Marine Ecology Survey of Holyhead Breakwater**

---

1 Introduction

Stena Line and the Isle of Anglesey County Council are proposing the refurbishment of Holyhead Breakwater. The rubble mound which supports the Breakwater superstructure is subject to movement and erosion by wave action and currents, which over the years has resulted in undermining the superstructure. The rubble mound extends approximately 120m from the seaward side of the Breakwater superstructure, and approximately 40m from the leeward side.

The refurbishment would involve the placement of concrete armour units (Tetrapods) along the length of the seaward side of the superstructure. These would extend approximately 30 m seawards from the superstructure (see **Plate 1** below) and between 8 and 15 m depth of tetrapod would be visible above Mean High Water Spring (MHWS) level along the length of the Breakwater. A concrete mattress will be installed along the leeward side of the Breakwater, which would not be visible at any state of the tide (see **Plate 2** below). This would halt the ongoing movement of the rubble mound, providing a long-term solution to the ongoing erosion.

The construction of the refurbishment would be undertaken entirely by marine-based plant. A jack-up or floating barge with spud legs, or an alternative form of anchoring system, would be required as a platform for a long-reach excavator.

A suitable method of anchoring the barge has yet to be confirmed; however, it could involve a series of anchor points installed on the Breakwater superstructure, or a series of concrete anchor blocks placed seaward of the rubble mound which can be used to hold the barge in place. A vessel would be used to transport the concrete armour and mattress to the jack-up/floating barge, which would then take the refurbishment material and place this onto the existing rubble mound foundation.

1.1 Purpose of this note

This note outlines the proposed methodology for undertaking a marine ecology survey of the rubble mound for agreement with Natural Resources Wales and the Isle of Anglesey County Council. The results of the survey will be used to inform the environmental reporting which will be required to support the appropriate consent applications for the proposed refurbishment.

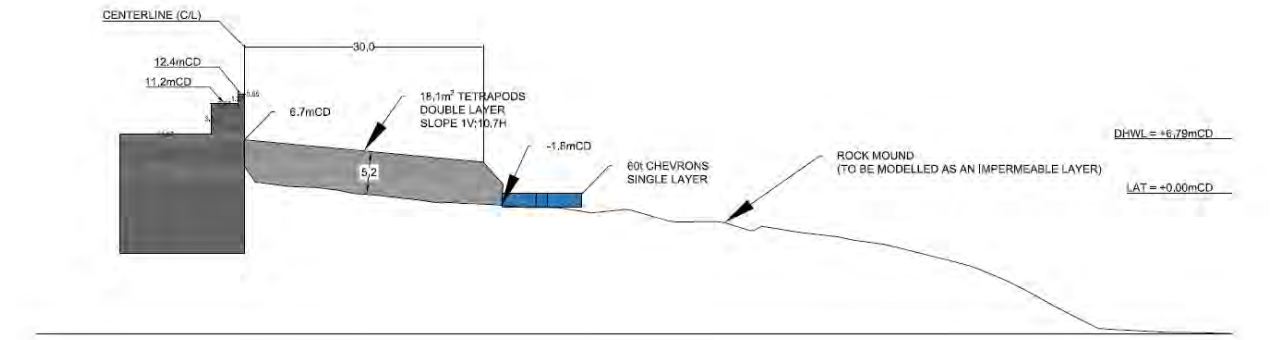

Plate 1 Proposed refurbishment of the seaward side of the Breakwater

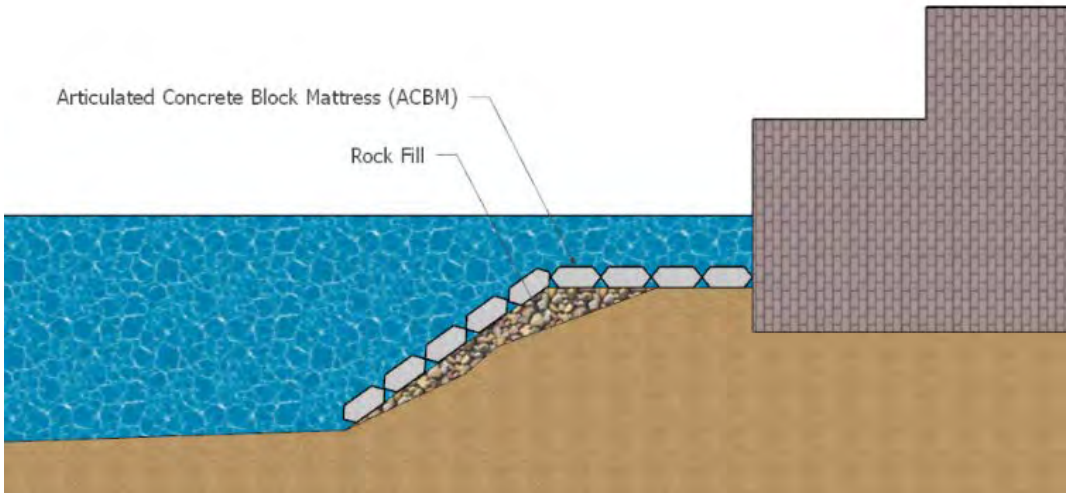

Plate 2 Proposed refurbishment of the leeward side of the Breakwater

2 Survey Objectives

The objective of the survey will be to characterise the intertidal and subtidal habitats and species present on the rubble mound and a proportion of the surrounding sea bed. As well as identifying habitats and species, a targeted review of the survey data for the invasive carpet sea squirt (*Didemnum vexillum*) will also be undertaken.

2.1 Survey approach

The rubble mound comprises rock of various sizes and therefore it is not possible to carry out a grab survey to collect samples, nor are samples for infaunal analysis required. It is therefore proposed that digital imaging techniques, using a vessel or Remotely Operated Vehicle (ROV), are used to carry out the survey.

Given the length of the Breakwater (approximately 2.4 km, totalling 4.8 km survey length), it is proposed that a transect approach will be adopted, with transects taken at 300m intervals running perpendicular to the Breakwater. In order to survey the width of the rubble mound, the transects will run from the MHWS level for 200m on the seaward side of the Breakwater and 50 m on the leeward side. This will include approximately 80 m of surrounding seabed on the seaward side and 10 m of seabed on the leeward side.

A total of eight transects would be undertaken on both the leeward and seaward sides, with the final transect located at the head of the Breakwater, running in towards the lighthouse. It is considered that given the uniformity of the rubble mound (in terms of consistency of substrate), this approach will provide sufficient data coverage to characterise the ecology of the Breakwater and the associated rubble mound, including the surrounding seabed.

The seaward transects would be undertaken at high water to ensure there is enough water coverage of the rubble mound at the base of the wall to survey the intertidal area.

The invasive species *D. vexillum* will be targeted when reviewing the video footage of the transects. Should an ascidian be identified as potentially *D. vexillum* the location will be noted, and samples collected where possible for identification purposes.

Following completion of the survey, a detailed technical report will be compiled outlining specifications, positioning, survey methodologies, significant survey events, together with a photographic sample log of all samples collected. The report will present the combined results of the seabed characterisation, assessment of the seawall and *D. vexillum* assessment.

2.2 Survey timings

It is anticipated that the survey will be undertaken within the next four to six weeks over a three- to five-day period, subject to weather conditions.

2.3 Navigational safety

Onsite operations will require a Notice to Mariners (NtM) to be issued and close liaison with Holyhead Port to mitigate any potential risk from incoming/outgoing ferries and cargo vessels. The chosen contractor will produce the NtM and will issue to Holyhead Harbour Master in advance of the survey.

From:	Moon, James
To:	Sarah Marjoram
Cc:	Neil Chamberlain; Jamie Gardiner; North Planning
Subject:	RE: Holyhead Breakwater - Marine Ecology Survey Scope NRW:03561074
Date:	08 October 2019 12:57:56
Attachments:	image001.jpg image002.jpg

Dear Sarah,
Thank you for providing the comments below in response to our queries. I can confirm that we are now happy with the responses detailed below in green and have no further comments or objections to the proposed survey.
Kind Regards
James

James Moon

Uwch Gynghorydd Morol / Senior Marine Advisor

Cyngor Morol Ardal a Rheoli / Marine Area Advice and Management

Cyfoeth Naturiol Cymru / Natural Resources Wales
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james.moon@naturalresourceswales.gov.uk

Gwefan / Website:
www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

Ein diben yw sicrhau bod adnoddau naturiol Cymru yn cael eu cynnal, eu gwella a'u defnyddio yn gynaliadwy, yn awr ac yn y dyfodol.
Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

From: Sarah Marjoram <Sarah.Marjoram@rhdhv.com>
Sent: 07 October 2019 13:19
To: Moon, James <James.Moon@cyfoethnaturiolcymru.gov.uk>
Cc: Neil Chamberlain <Neil.Chamberlain@rhdhv.com>; Jamie Gardiner <jamie.gardiner@rhdhv.com>; North Planning <NorthPlanning@cyfoethnaturiolcymru.gov.uk>; Wray, Ben <Ben.Wray@cyfoethnaturiolcymru.gov.uk>; Egerton, Jack <jack.egerton@cyfoethnaturiolcymru.gov.uk>
Subject: RE: Holyhead Breakwater - Marine Ecology Survey Scope NRW:03561074
Hi James,
Please see below our response.
If you cold let us know that your specialists agree by the end of the week I would be grateful. The survey is on the critical path for the project and we would like to give the contractors the green light to start ASAP.
Many thanks
Sarah

From: Moon, James <James.Moon@cyfoethnaturiolcymru.gov.uk>
Sent: 26 September 2019 08:36
To: Sarah Marjoram <Sarah.Marjoram@rhdhv.com>
Cc: Neil Chamberlain <Neil.Chamberlain@rhdhv.com>; Jamie Gardiner <jamie.gardiner@rhdhv.com>; North Planning <NorthPlanning@cyfoethnaturiolcymru.gov.uk>;

Wray, Ben <Ben.Wray@cyfoethnaturiolcymru.gov.uk>; Egerton, Jack <jack.egerton@cyfoethnaturiolcymru.gov.uk>
Subject: RE: Holyhead Breakwater - Marine Ecology Survey Scope NRW:03561074
Dear Sarah,
Thank you for providing clarification on the points we raised below. Following review of the information we are happy with the survey scope and for you to proceed with ROV surveys. However our benthic ecologist has asked for a few points of clarification if possible:

- How will samples be taken if suspected D.Vex is seen on the ROV? We assume with a dive team?
- All video acquired via the ROV will be carefully reviewed post survey, utilising in-house video editing and viewing software to enable a detailed inspection of any specimens with potential to be D. vex. The video is recorded at 60 frames per second (fps) and typically reviewed at 30 FPS to enable better ID, along with freezing and extraction of still images. Should D. vex be identified and identification cannot be confirmed, a follow up dive survey would be undertaken to either confirm presence in-situ or collect samples for subsequent analyses.
- We also consider that it would be beneficial to have a backup plan in case there are any issues with ROV survey.
- Noted
- Would it be possible to extend the ROV transects to 20m (from 10m) beyond the rubble heap on the landward side to cover the footprint of any ancillary construction equipment such as jack-up barge etc.
- Yes, this will be added.
- "A total of 8 transects would be undertaken on both the landward and seaward side..." could you please confirm that this is 8 transects per side?
- Yes, 8 transects per side will be undertaken.

If you could provide some clarification on the points raised above that would be really helpful.
For your information I have not put together a charging agreement for this advice as I have considered it as a free preliminary opinion under our discretionary advice service (DAS) as detailed in my previous email. Any further requests for advice will have to be charged for.
If you have any questions please don't hesitate to get in touch.
Kind Regards
James

James Moon

Uwch Gynghorydd Morol / Senior Marine Advisor

Cyngor Morol Ardal a Rheoli / Marine Area Advice and Management

Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/Tel: 03000653348

E-bost/E-mail:
james.moon@cyfoethnaturiolcymru.gov.uk
james.moon@naturalresourceswales.gov.uk

Gwefan / Website:
www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

and used, now and in the future.

From: Sarah Marjoram <Sarah.Marjoram@rhdhv.com>
Sent: 18 September 2019 16:26
To: Moon, James <James.Moon@cyfoethnaturiolcymru.gov.uk>
Cc: Griffiths, Bryn <Bryn.Griffiths@cyfoethnaturiolcymru.gov.uk>; Neil Chamberlain <Neil.Chamberlain@rhdhv.com>; Jamie Gardiner <jamie.gardiner@rhdhv.com>; North Planning <NorthPlanning@cyfoethnaturiolcymru.gov.uk>; Wray, Ben <Ben.Wray@cyfoethnaturiolcymru.gov.uk>
Subject: RE: Holyhead Breakwater - Marine Ecology Survey Scope NRW:03561074

Hi James,
Thank you for providing the initial comments on the proposed marine ecology survey scope of the Breakwater.
We have prepared responses to the queries from your benthic ecologist and would appreciate if you could forward these on and confirm whether these would allow your specialist to agree with the survey scope?

- The main question is whether the equipment to be used and the conditions on the day are good enough to characterise the intertidal and subtidal environment.
    - **RHDHV response:** The ROV is subject to very similar restrictions as the other possible survey options (limited to divers or drop-down video (DDV)), however, the ROV has the following advantages:
        - Less restricted in terms of access than the DDV because a vessel is not required
        - Ability to hold station, move laterally and reverse, this is near impossible with a DDV
        - Much safer than diver options
        - Just as constrained as any of the other options in terms of visibility, however with the advantage of being able to hold station for the best image acquisition.
    - The selection of survey window will need to consider current and antecedent weather conditions to avoid periods when swell will have increase water turbidity and reduced visibility. In addition, the surveys will focus on periods of slack water, thus further reducing the effects of poor visibility. Whilst good visibility cannot be guaranteed, and no method could, the best possible conditions will be targeted to obtain the best possible data possible. We do not consider that any other survey method would provide a better option.
- For example, can this methodology differentiate between habitat types and effectively describe what habitats will potentially be impacted? Also can it detect any habitats/species of principle importance that we may be concerned about.
    - **RHDHV response:** Subject to the restriction of visibility and options to reduce risk highlighted above, a benthic ecologist experienced in still image and video analysis will be able to differentiate and describe habitats and important species from the acquired UHD and HD video / stills – this is common practice and doesn't differ from that used extensively for DDV surveys.
    - The proposed ROV is a Class I ROV within the JNCC ROV guidance (http://archive.jncc.gov.uk/page-7612) although significantly advanced compared to some within the example list, with capability to cover the first two columns of Table 1. This is a standard and recognised method for marine benthic ecology studies.
- There is also a potential concern around invasive non-native species and *Didemnum vexillum* in Holyhead and whether the use of an ROV would be able to identify the presence or absence of the species. It may be difficult to do this using ROVs and therefore the use of dive surveys may be more appropriate.
    - **RHDHV response:** The methodology proposed (i.e. the initial ROV survey and follow up sampling should any *D. vex* be identified) was used to carry out a survey for *D. vex*

related to the EIA for the Expansion of Holyhead Port project. This was approved in advance by NRW (CAS-40640-C5P9).

- To ensure this element is as robust as possible, we would obtain ultra-high resolution (4k video) – at a higher resolution than is normally obtained during dropdown video (normally only 1080 HD at maximum), thus enabling the ability to closely examine imagery to determine the identification. In addition, the video would be reviewed live during surveys, and should potential *D. vex* be seen, a closer examination would be undertaken with the ROV – i.e., piloted closer to the potential specimen and additional footage taken.
- It is acknowledged that the ID of *D. vex* can be challenging and can be quite difficult to identify with certainty by visual means, however there are a number of identifying traits to look out for:
  - *D. vex* can range in colour from light grey/off white to a bright orange; and
  - *D. vex* will often have quite marked dark veins running through the mat, especially as the colony gets larger.
- There are a few species that it can be confused for (e.g. other *Didemnum* species, *Lissoclinum* spp, *Tridemnum* spp, some sponges. The clearest identifying feature of *D. vex* being how it grows, often forming large mat like colonies and also form long pendulous colonies which 'drip' from the main mat, often on overhangs / undercuts and vertical surfaces – these features can only be seen from a side on angle that is only possible with an ROV and not normally possible with drop camera systems. The proposed team have previously undertaken surveys looking for *D. vex* specifically and have identified it in the past. Looking for *D. vex* is also a common part of much of the DDV and ROV image analysis the team undertakes. Onboard ecologists will be prepared with targeted custom made field keys to assist with in-field ID.
- **It should be noted that the proposed scheme would not result in any material being removed from the footprint of the breakwater. Only regrading of existing material would be carried out within the footprint of the rubble mound. As a result there is actually no risk of spreading *D. vex* through the removal of material.**

As requested I have attached a completed DAS request form, along with correspondence received from Anglesey County Council on the methodology.
I realise that the timescale within which we require your response is quite tight. Carrying out this survey is on the critical path for the project and we would appreciate your efforts to respond to us as quickly as possible on this.
We look forward to receiving your response.
Many thanks,
Sarah

From: Moon, James <James.Moon@cyfoethnaturiolcymru.gov.uk>
Sent: 10 September 2019 13:51
To: Sarah Marjoram <Sarah.Marjoram@rhdhv.com>
Cc: Griffiths, Bryn <Bryn.Griffiths@cyfoethnaturiolcymru.gov.uk>; Neil Chamberlain <Neil.Chamberlain@rhdhv.com>; Jamie Gardiner <jamie.gardiner@rhdhv.com>; North Planning <NorthPlanning@cyfoethnaturiolcymru.gov.uk>; Wray, Ben <Ben.Wray@cyfoethnaturiolcymru.gov.uk>
Subject: RE: Holyhead Breakwater - Marine Ecology Survey Scope NRW:03561074
Dear Sarah,

Thank you for contacting us with regards to the Holyhead breakwater survey scope. Your email below was forwarded on to be my by our planning team. For any future queries regarding your project please contact the NRW marine area advice and management team in the first instance (marine.area.advice@cyfoethnaturiolcymru.gov.uk).

Firstly I want to make you aware of some guidance that we have recently produced which can be found here . Specifically GN030 “Assessment guidance for marine developments and activities” that covers benthic survey specification amongst others. Not all will be relevant to your project but the technical introductory chapter will provide a useful overview. We also have a useful piece of guidance on scoping for marine developments which can be found here which may be useful.

In addition we have a discretionary advice service in place to charge for pre-application advice. Details of this service can be found on our website here. As part of this service we can provide up to 3 hours of free preliminary advice to a developer following which we will have to put an agreement in place for charged advice. I have passed your email and report on to our benthic ecologist to get the ball rolling. They made the following comments regarding your proposed methodology:

- The main question is whether the equipment to be used and the conditions on the day are good enough to characterise the intertidal and subtidal environment.
- For example, can this methodology differentiate between habitat types and effectively describe what habitats will potentially be impacted? Also can it detect any habitats/species of principle importance that we may be concerned about.
- There is also a potential concern around invasive non-native species and *Didemnum vexillum* in Holyhead and whether the use of an ROV would be able to identify the presence or absence of the species. It may be difficult to do this using ROVs and therefore the use of dive surveys may be more appropriate.

These comments are based on a very quick review of the proposals. If you would like to request further pre-application advice please complete a “Request for charged advice” form at the bottom of the DAS page of our website.

Kind Regards

James

James Moon

Uwch Gynghorydd Morol / Senior Marine Advisor

Cyngor Morol Ardal a Rheoli / Marine Area Advice and Management

Cyfoeth Naturiol Cymru / Natural Resources Wales
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Gwefan / Website:
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Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

---------- Original Message ----------
From: Sarah Marjoram;
Received: Fri Aug 30 2019 14:20:47 GMT+0100 (GMT Summer Time)
To: North planning; North Planning Mailbox Queue; North Planning ;
Cc: Jamie Gardiner; jamie.gardiner@rhdhv.com; Jamie Gardiner; Neil.Chamberlain@rhdhv.com;
Subject: Holyhead Breakwater - Marine Ecology Survey Scope

Good afternoon,
Please see attached the proposed scope for a survey of Holyhead Breakwater to characterise the intertidal and subtidal marine ecology.
As discussed in the note, due to the substrate it is proposed that the survey be undertaken using an ROV, and due to the length of the Breakwater the survey effort is broken down into a number of transects running perpendicular to the Breakwater.
We would be grateful if you could review the attached and confirm whether NRW agree with the proposed scope.
If you have any questions please give me a call.
Kind regards,
Sarah

Sarah Marjoram BSc (Hons), MRes, AMIMarEST
Environmental Consultant - Marine
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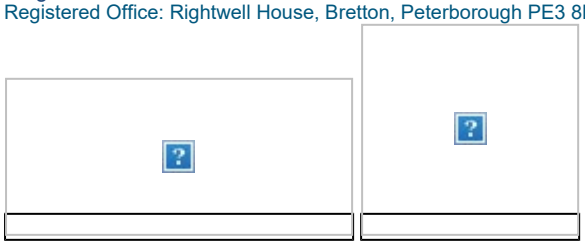

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6.8 Modelling approach correspondence

Note / Memo

HaskoningDHV UK Ltd.
Industry & Buildings

To:	NRW
From:	David Brew
Date:	03 December 2020
Copy:	Anna Sweeney, Jamie Gardiner
Our reference:	PB9014-RHD-BW-XX-FN-C-0187
Classification:	Project related
Checked by:	Jamie Gardiner

Subject: **Coastal Processes Modelling Consultation**

---

1 Introduction

1.1 Environmental Scoping Report

On 20th April 2020, Isle of Anglesey County Council published the Environmental Scoping Report for refurbishment of Holyhead Breakwater (Royal HaskoningDHV, 2020). The scoping concluded that the potential effects on coastal processes and geomorphology of the proposed scheme would be negligible or less. For this reason, it was considered that hydrodynamic and sediment dispersion modelling would not be necessary to understand the proposed scheme's effects on coastal processes. The scoping recommended that coastal processes and geomorphology could be screened out of the Environmental Impact Assessment.

1.2 Natural Resources Wales Screening and Scoping Opinion

Natural Resources Wales (NRW) published its screening and scoping opinion on 23rd July 2020 (NRW, 2020). In the coastal processes and geomorphology section of this opinion, NRW recommended the following:

- 2.4.1. We disagree that Section 7.1 'Coastal Processes and Geomorphology' can be scoped out of the EIA. The purpose of the scheme is to deflect, absorb and change the available energy. An appreciation of how this will work and what local and regional change there will be, is therefore required, to understand the fundamental changes to the environment.
- 2.4.2. As modelling is to be undertaken for design purposes, NRW TE recommended that this modelling is also used to describe any local and regional scale changes to coastal processes and the redistribution of wave and tidal energy from the scheme. Until this is undertaken, NRW TE noted that it is not possible to comment on the range of potential benthic habitat receptors as part of the current scheme. We therefore recommend that you engage with NRW TE regarding modelling outputs.
- 2.4.3. We recommend that a robust physical processes and geomorphology assessment should be undertaken to evaluate the potential impacts on benthic ecology receptors.

1.3 Purpose of this Note

The purpose of this note is to address the comments of Natural Resources Wales for further consultation on a potential way forward for the coastal processes and geomorphology assessment. The note provides justification for an approach to assessment of coastal processes and geomorphology that does not require new hydrodynamic and/or wave modelling.

2 Design

2.1 Design Basis

The existing breakwater is formed by a rubble mound which is largely submerged topped by a vertical wall. Over the decades, the existing rubble mound has lowered, due primarily to attrition under wave action. In its current condition, the rubble mound is “tripping-up” approaching waves, which break/slam into the front face of the vertical wall. The structure is at risk of breaching due to undermining of the vertical walls and/or impulsive wave loading on the vertical wall. The primary aim of the refurbishment is to mitigate these threats and extend the working life of the breakwater.

In the design, the seaward-facing side and roundhead of the breakwater would be protected by concrete armour units. The lee side would be protected with concrete mattresses/thin rock revetment. The footprint of the rubble mound refurbishment is almost entirely inside the footprint of the existing breakwater. The breakwater superstructure will remain the same length as the existing breakwater. There would be a small extension of the rubble mound at the roundhead (10-30m beyond the existing rubble mound) to re-instate the rubble mound profile as close as possible to the as-built footprint from the 1800’s. The main changes to the geometry of the breakwater would be:

- to replace substantial volumes of rock that have been lost due to erosion with a 5.2m thick layer of concrete armour units on the seaward side, and
- to replace a less substantial volume of rock on the leeside with a 220mm thick concrete mattress.

2.2 Completed Physical Modelling for Waves and Design Purposes

A set of 2D and 3D small-scale physical models have been completed for the breakwater to assess the concrete armour stability and the effect of the refurbishment on wave overtopping and wave loads on the vertical wall:

- 2D tests to decide between XBloc and Tetrapod (DHI, 2019a);
- 2D tests to establish a stable toe detail (DHI, 2019b); and
- 3D tests to check the roundhead stability (HR Wallingford, 2020).

The models were built based on the initial results of a wave overtopping analysis carried out using a numerical modelling tool called AMAZON. Previous baseline tidal current model shows that currents are weak and have a negligible influence on the design of the coastal defences.

The conclusions from these models are that the concrete armour would reduce the wave energy approaching the vertical wall and would reduce the degree of overtopping. This reduction is caused by the breaking up of wave energy within the concrete armour layer, rather than any increase in reflected wave energy (which might be expected from a vertical seawall, for example). The 3D physical model also showed that waves reflecting from the superstructure would pass back over the armour layer, thereby losing further energy.

These results can be used to inform the coastal processes and geomorphology environmental assessment, but only from the perspective of waves. A baseline model was constructed for the 2D tests, which allows comparison between the existing case and the post-construction case. The introduction of the Tetrapod concrete armour units reduced overtopping ten-fold, as well as reducing the height of waves reflected from the breakwater.

2.3 Completed Wave Modelling for the Baseline Conditions

Royal HaskoningDHV has completed runs of a MIKE21-SW model representing the baseline wave conditions at the breakwater. A suite of scenarios was completed for four return period events; 1 in 1 year for typical conditions, and 1 in 100 year, 1 in 200 year and 1 in 1,000 year for extreme storm events. The wave model has not been run for the breakwater refurbishment in place. Hence, the results can be used to inform the baseline of the coastal processes and geomorphology assessment, but not for the assessment of impacts.

2.4 Need for Numerical Modelling for Impact Assessment

2.4.1 Waves

The results of the physical modelling tests show that there would be:

- a local reduction in wave energy over the breakwater mound due to turbulence between the concrete armour units; and
- a small reduction in reflected wave energy local to the structure, resulting in marginally calmer conditions further to the west.

The area of coast to the west of the breakwater will still be exposed to the full force of storms approaching from the Irish Sea, and therefore the effect of a small reduction in reflected wave energy from the breakwater will be negligible. The effect will be so slight that it is very unlikely that this will be visible in numerical model output plots if they were run with and without the refurbishment in place. Also, given that the surrounding seabed and coast is dominated by rock with a thin layer of sediment (0-2m), the marginal reduction in reflected wave energy would have no noticeable effect on the distribution of sediments.

2.4.2 Tidal Currents

Ambient tidal current flows in the region are weak due to the open, exposed nature of the coast. Admiralty Chart No.2011 “Holyhead Harbour” notes a maximum velocity of 1.4 knots (0.7m/s). RHDHV have an existing MIKE21-FMHD model and ran a baseline scenario for tidal currents using water levels and tidal current velocities over one month to cover two spring-neap cycles. This shows that the worst-case currents would occur locally at the head of the breakwater, where water flows in and out of the constrained harbour area. The results align with the 1.4 knots (0.7m/s) recorded on the Admiralty Charts. The maximum increase in length of the breakwater will be 30m, which is only about 1.5% of the total length of the superstructure (2,150m) and the width of the entrance of Holyhead Harbour (2,300m from the tip of the breakwater to Twyn Cliperau). Hence, the impact of placing rock and concrete armour at the head of the breakwater will have a highly localised and small impact on tidal current flows. Therefore, there is no benefit in undertaking tidal modelling of the refurbishment in place, as the changes predicted in the model outputs due to the slight change in geometry of the structure would be so small, they would be difficult to identify in model outputs.

2.4.3 Conclusions and Proposed Way Forward

The proposed refurbishment of the breakwater would have very limited impact on the redistribution of waves and currents, and hence, sediments. The order of magnitude would be too small to identify in numerical model outputs and so the use of numerical modelling in the assessment would be disproportionate to the magnitude of potential impact. Also, the additional time and cost associated with

preparing wave and tidal current models would be of no benefit in understanding the impact on coastal processes.

With respect to the three main recommendations made by NRW, we propose that:

- 2.4.1. Coastal processes and geomorphology is scoped into the EIA.
- 2.4.2. Existing models and information will be used to describe any local and regional scale changes to coastal processes and the redistribution of wave and tidal energy from the proposed scheme. They show that there would be very little change to the physical environment.
- 2.4.3. A robust and proportionate physical processes and geomorphology assessment to evaluate the potential impacts on benthic ecology receptors, would be to use expert geomorphological assessment without numerical modelling of impacts (as that would be disproportionate to the potential scale of the impacts).

2.5 References

DHI. 2019. Holyhead Breakwater. 2D Physical Model Tests. Report to HaskoningDHV UK Ltd, August 2019.

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Royal HaskoningDHV. 2020. Environmental Scoping Report. Holyhead Breakwater Refurbishment Scheme. Report to Isle of Anglesey County Council, April 2020.

Jamie Gardiner

From: Griffith, Katherine <Katherine.Griffith@cyfoethnaturiolcymru.gov.uk>
Sent: 21 December 2020 15:11
To: Anna Sweeney
Cc: Jamie Gardiner
Subject: RE: SC2002 Holyhead Breakwater Scoping Response - Coastal Processes Consultation

Hi Anna,

Hope you are well, regarding the advice you requested in the Memo titled; 'Coastal Processes Modelling Consultation' dated 3rd December 2020, Reference: PB9014-RHD-BW-XX-FN-C-0187 please see our response below.

NRW advisory can confirm we agree with the proposed way forward namely:
2.4.1. Coastal processes and geomorphology is scoped into the EIA.
2.4.2. Existing models and information will be used to describe any local and regional scale changes to coastal processes and the redistribution of wave and tidal energy from the proposed scheme. They show that there would be very little change to the physical environment.
2.4.3. A robust and proportionate physical processes and geomorphology assessment to evaluate the potential impacts on benthic ecology receptors, would be to use expert geomorphological assessment without numerical modelling of impacts (as that would be disproportionate to the potential scale of the impacts).

We would advise a visual representation be included of any changes expected, even though these will be based on expert geomorphological assessment and be more qualitative in nature. An appreciation of confidence will also aid assessment.

If you have any queries please do get in touch,
Many thanks and wishing you a merry Christmas
Kate

Dr Kate Griffith

Uwch-ymgynghorydd Morol (Gogledd-Orllewin) / Senior Marine Advisor (North West)

Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/ Phone: 03000 65 4990

Maes y Ffynnon

Siaradwr Cymraeg

From: Anna Sweeney <anna.sweeney@rhdhv.com>
Sent: 11 December 2020 10:00
To: Griffith, Katherine <Katherine.Griffith@cyfoethnaturiolcymru.gov.uk>
Cc: Jamie Gardiner <jamie.gardiner@rhdhv.com>; David Brew <david.brew@rhdhv.com>
Subject: RE: SC2002 Holyhead Breakwater Scoping Response - Coastal Processes Consultation

Hi Kate,

Thank you very much for the update and we look forward to hearing from you soon.

All the best, Anna

Anna Sweeney BSc (Hons), MRes
Senior Marine Mammal Consultant
Environment Team

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From: Griffith, Katherine <Katherine.Griffith@cyfoethnaturiolcymru.gov.uk>
Sent: 11 December 2020 09:56
To: Anna Sweeney <anna.sweeney@rhdhv.com>
Cc: Jamie Gardiner <jamie.gardiner@rhdhv.com>
Subject: RE: SC2002 Holyhead Breakwater Scoping Response - Coastal Processes Consultation

Hi Anna,

Hope you are well, just to let you know that I have heard back from our technical specialist and it's estimated that this work can be covered within the free 3 hours that we can give (so no need for a DAS as mentioned in my earlier email). We will aim to get this response to you on the 23rd of December – if becomes apparent that this timescale is not possible I will let you know as soon as possible.

I will also get in touch if need any further details/info for your advice request.
Please get in touch if you have any questions.
Thanks
Kate

Dr Kate Griffith

Uwch-ymgynghorydd Morol (Gogledd-Orllewin) / Senior Marine Advisor (North West)

Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/ Phone: 03000 65 4990

Maes y Ffynnon

Siaradwr Cymraeg

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From: Griffith, Katherine
Sent: 10 December 2020 13:36
To: anna.sweeney@rhdhv.com
Cc: jamie.gardiner@rhdhv.com
Subject: RE: SC2002 Holyhead Breakwater Scoping Response - Coastal Processes Consultation

Hi Anna,

Thank you for your email. Providing advice on your specification may need to come under our Discretionary Advice Service (DAS), there is more information and guidance about the DAS here on our website, there is a link at the bottom of the page which is a guide for the DAS, which I have included here. However, we can give 3 hours of our time for free before needing to use the DAS, so I have asked our coastal processes specialist for an estimate of how long it may take to review and give an opinion on the proposed approach – that way we will know if we will need to set the DAS up or not.

I understand that it may be useful for an opinion prior to the Christmas break. However, it may not be possible due to the current workloads but I will let you know if this is at all possible. If we do need to use the DAS I'm afraid it's unlikely we would be able to keep to that kind of timescale due to the processes involved in setting up such an agreement.

Many thanks
Kate

Dr Kate Griffith

Uwch-ymgynghorydd Morol (Gogledd-Orllewin) / Senior Marine Advisor (North West)

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From: North Planning <NorthPlanning@cyfoethnaturiolcymru.gov.uk>
Sent: 08 December 2020 10:12
To: Marine Area Advice and Management Team <marine.area.advice@cyfoethnaturiolcymru.gov.uk>
Cc: Sharp, Rowland <Rowland.Sharp@cyfoethnaturiolcymru.gov.uk>; Griffith, Katherine <Katherine.Griffith@cyfoethnaturiolcymru.gov.uk>
Subject: FW: SC2002 Holyhead Breakwater Scoping Response - Coastal Processes Consultation

Hi,

We've received the email below ref SC2002 Holyhead Breakwater Scoping Response, we believe this is one for your team

Thanks,
Victoria Taylor
Cynorthwyydd Cynllunio Datblygiad / Development Planning Assistant
Cyfoeth Naturiol Cymru / Natural Resources Wales
Maes y Ffynnon, Bangor

Siaradwr Cymraeg

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Croesewir gohebiaeth yn y Gymraeg a'r Saesneg / Correspondence welcomed in both Welsh and English.
Ffoniwch ni ar **03000 65 3000** (24-awr) i roi gwybod am ddigwyddiadau amgylcheddol / Call us on **03000 65 3000** (24-hour) to report environmental incidents

---

From: Anna Sweeney <anna.sweeney@rhdhv.com>
Sent: 04 December 2020 10:53
To: North Planning <NorthPlanning@cyfoethnaturiolcymru.gov.uk>
Cc: Jamie Gardiner <jamie.gardiner@rhdhv.com>
Subject: FW: SC2002 Holyhead Breakwater Scoping Response - Coastal Processes Consultation

Good Morning,

Further to the scoping response received from you on the 23rd July we would like to confirm our approach to the coastal processes in the EIA report as outlined in the attached note.

We would appreciate your opinion on our approach before the Christmas shutdown.

All the best, Anna Sweeney

Anna Sweeney BSc (Hons), MRes
Senior Marine Mammal Consultant
Environment Team

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Appendix 8

Traffic and Transport

Contents	
8.1	Traffic and Transport Environmental Statement Scoping Note
8.2	Daily Background Reference Flows
8.3	Peak Daily Construction Flows
8.4	Junction 1 and 4 Model Outputs
8.5	Junction 2 Model Outputs
8.6	Junction 3 Model Outputs

8.1 Traffic and Transport Environmental Statement Scoping Note

REPORT

Holyhead Breakwater Refurbishment Scheme

Environmental Statement Scoping - Traffic and Transport

Client: Isle of Anglesey County Council

Reference: PB9014-RHD-ZZ-XX-RP-Z-0050

Status: S0/P01.01

Date: 11 February 2021

Royal HaskoningDHV

Enhancing Society Together

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Document title: Holyhead Breakwater Refurbishment Scheme

Document short title:
Reference: PB9014-RHD-ZZ-XX-RP-Z-0050
Status: P01.01/S0
Date: 11 February 2021
Project name: Holyhead Breakwater
Project number: PB9014
Author(s): Elizabeth Merrick

Drafted by: Elizabeth Merrick

Checked by: Ryan Eldon

Date: 10th February 2021

Approved by: Phil Marshall

Date: 11th February 2021

Classification
Project related

Royal HaskoningDHV

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1 Introduction

1.1 Background

Constructed between 1848 and 1873, Holyhead Breakwater ("the Breakwater") provides an area of sheltered water for the Port of Holyhead and Holyhead New Harbour and provides protection to the surrounding coastline from coastal erosion and flooding (see Figure 1.1). The Breakwater is a Grade II* listed Victorian structure and, at a total length of 2.4km, is the longest breakwater in the UK. At the end of the Breakwater (the roundhead) sits the Grade II-listed Holyhead Breakwater Lighthouse. The Breakwater is formed by a wide rubble mound with a crest around the waterline and a vertical blockwork-walled superstructure on top (see Figure 1.2).

Over time the Breakwater has been subject to considerable wave action, which has led to the displacement and erosion of the rock that makes up the rubble mound and, consequently, a loss of integrity of the rubble mound itself (Plate 1-1). As a result, the rubble mound has been subject to regular, expensive maintenance through the partial replacement of lost material. The vertical blockwork wall superstructure is subject to periodic damage, which is repaired on an ongoing basis.

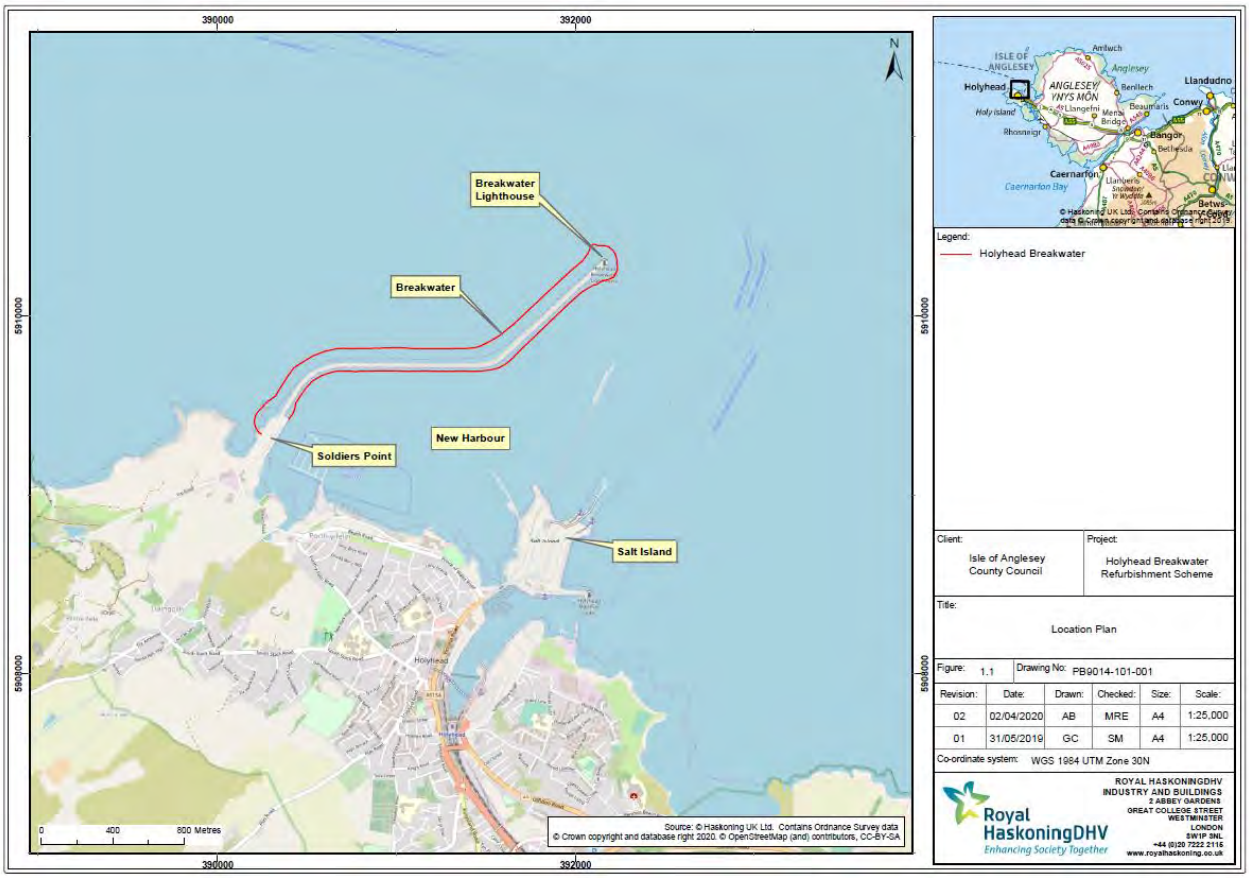


Figure 1—1 Location Plan

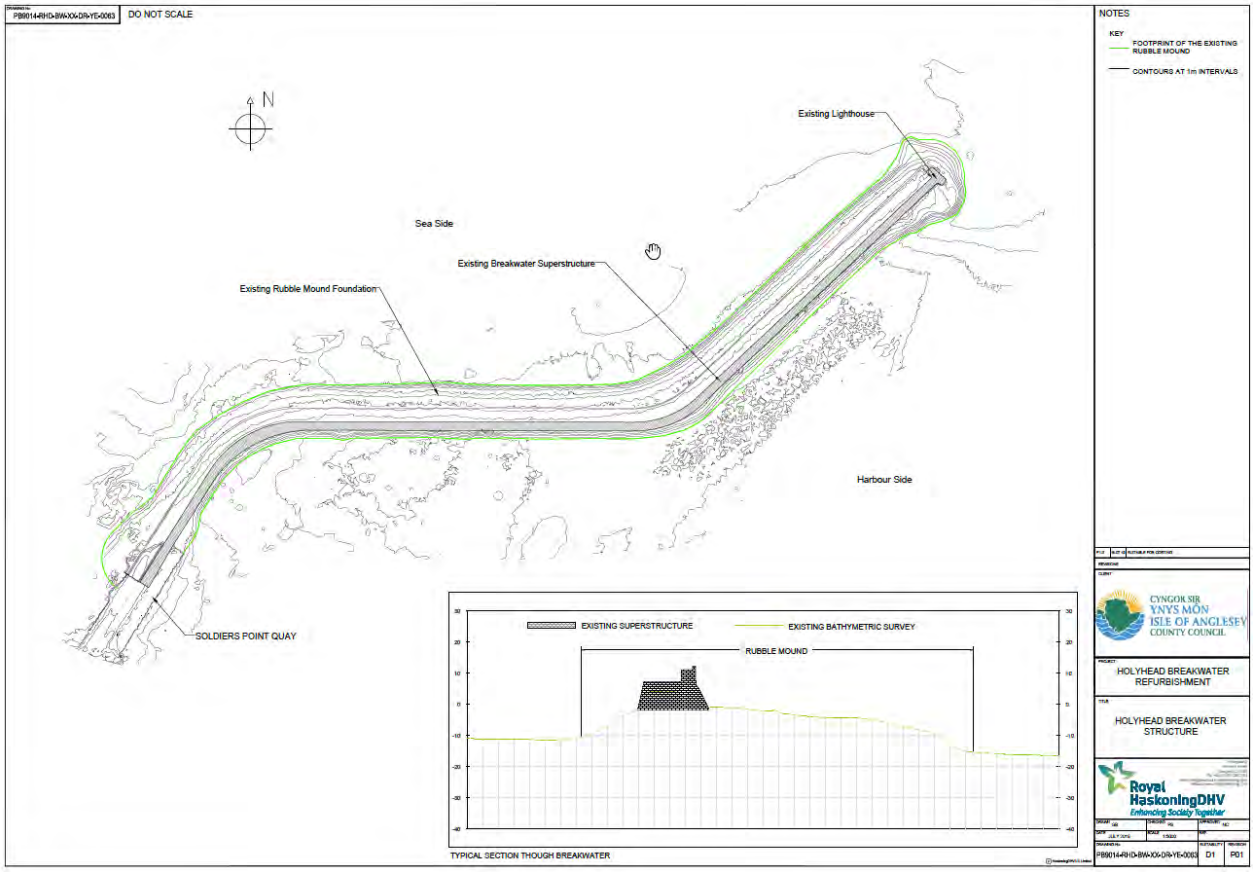


Figure 1—2 Holyhead Breakwater Structure

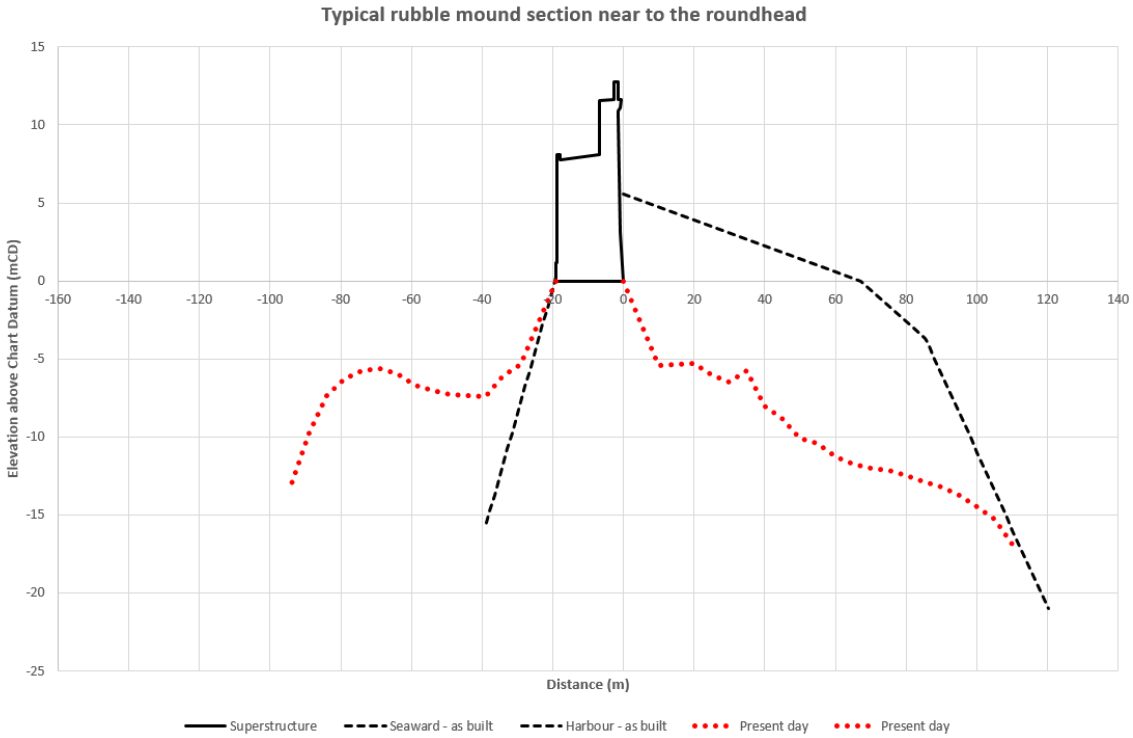


Plate 1-1 Cross-section of the Breakwater structure showing erosion of the rubble mound

Royal HaskoningDHV was commissioned to produce an Outline Business Case (OBC) by the Isle of Anglesey County Council (IoACC) with the aim to identify a cost-effective, long-term and sustainable solution to the erosion of the rubble mould to continue to provide a stable foundation for the breakwater.

Subsequent to the OBC and further work on refining a suitable solution, a preferred refurbishment scheme has been devised. Given the scale of the proposed works, these will require an Environmental Statement (ES) to summarise the Environmental Impact Assessment (EIA).

Initial scoping of the ES was based on all refurbishment materials being constructed off site and being transported and placed from the sea. This remains the preferred and most likely construction strategy and would minimise local transport impacts. As the construction methodology has evolved, the need to consider a worst case scenario has arisen, whereby construction materials (primarily concrete) are bought to the port by road, constructed and cured on site before being placed by sea.

A full description of the refurbishment scheme is provided in Section **Error! Reference source not found.**.

1.2 Purpose of this report

This document proposes the scope for the traffic and transport chapter of the Environmental Statement (ES) for the refurbishment scheme. The assessment considers a “worst-case scenario” noting that a reduced traffic demand scenario is likely to occur when construction begins.

1.3 Report structure

Following this introduction, Section 2 considers the relevant legislative and regulatory regime, Section 3 provides a description of the proposed scheme and Section 4 presents an overview of the baseline environment and receptors. Section 5 identifies the potential environmental impacts associated with the relevant environmental topics and considers how these are proposed to be assessed and/or could be mitigated, and Section 6 presents the proposed approach to the Environmental Impact Assessment.

2 Policy

2.1 National Planning Policy

The assessment of potential traffic and transport impacts has been made with specific reference to the National Policy Statements (NPS) for England and Wales. The NPS for Ports was prepared by the Department for Transport (DfT) and received designation by the Secretary of State on the 26th of January 2012. For development in Wales, the principal policy documents are the Planning Policy Wales (PPW) and the associated Technical Advice Note (TAN) suite of documents. The PPW was published in November 2016 and sets out the land use planning policies of the Welsh Government. Section 8 of the PPW sets out the transport-related planning policies.

The Technical Advice Note (TAN) is a series of documents that supplement the PPW by providing detailed planning advice. This was first published in November 1996 and was last updated in October 2017. TAN 18: Transport (2007) gives a description of how to integrate land use, transport planning and details how transport impacts should be assessed and mitigated.

2.2 Regional and Local Planning Policy

Regional and local planning policy’s and Regional Transport Plans relevant to the proposed scheme are the North Wales Joint Local Transport Plan (2015) and the Anglesey and Gwynedd Joint Local Development Plan (2011 - 2026).

2.3 The Guidelines for the Environmental Assessment of Road Traffic

The guidelines for the Environmental Assessment of Road Traffic (GEART) (published January 1993 by the Institute of Environmental Assessment) are guidelines for the assessment of the environmental impacts of road traffic associated with new developments, irrespective of whether the developments are to be subject to formal EIAs. The purpose of the guidelines is to provide the basis for systematic, consistent and comprehensive coverage for the appraisal of traffic impacts arising from development projects.

3 Description of the Proposed Scheme

The refurbishment of the Breakwater comprises the following:

- Seaward side – installation of concrete armour onto the existing rubble mound along the length of the Breakwater, in the form of 18.1m^2 Tetrapod units and reinforcing 120-tonne Z-shaped concrete units to prevent displacement;
- Breakwater roundhead (i.e. the terminal section of the Breakwater on which the lighthouse stands) – rock placement to widen the existing rubble mound, with the installation of Tetrapod units and reinforcing Z-shaped blocks on top;
- Leeward side – the restoration of the existing rubble mound along sections of the Breakwater through the installation of an articulated concrete block mattress (ACBM), and a rock revetment where the existing rubble mound is too steep to accommodate the ACBM.

The refurbishment scheme could be undertaken over the course of a single construction phase of around 2 years, or over three phases, each lasting approximately nine months with two-year intervals.

The preferred scenario would see all manufacturing of concrete undertaken off site at a local manufacturing facility. The concrete units would be brought to site and placed by barge, which would require a limited workforce on site, and therefore create no material impact on the local highway network. Once the breakwater is operational the site would be maintained and inspected by staff occasionally, consistent with the existing situation. Therefore the operational phase would also have no material impact on the local highway network. As a consequence it was previously agreed that this scenario would not require an assessment of transport impacts.

It is possible that the Tetrapod units and Z-shaped concrete units could be constructed and cured at the Port of Holyhead. At any given point a maximum of 2520 Tetrapod units and 744 Z-shape units will be stored on site. Whilst materials for the units could be imported by barge, and concrete mixed on site, a “worst-case scenario” could see HGVs being used to import the concrete from off site concrete plants, which would likely have an impact of the local highway network. Therefore an assessment of transport impacts in the “worst-case scenario” is required.

4 Overview of baseline environment and receptors

4.1 Study area

The traffic and transport study area has been informed by the most probable routes for traffic, for the movement of materials during the construction phase of the proposed scheme. The study area is based on the premise that HGV trips will have a local origin. Therefore the study area will focus on the immediate area surrounding the Port of Holyhead and only include links one to four shown in Figure 4—1.

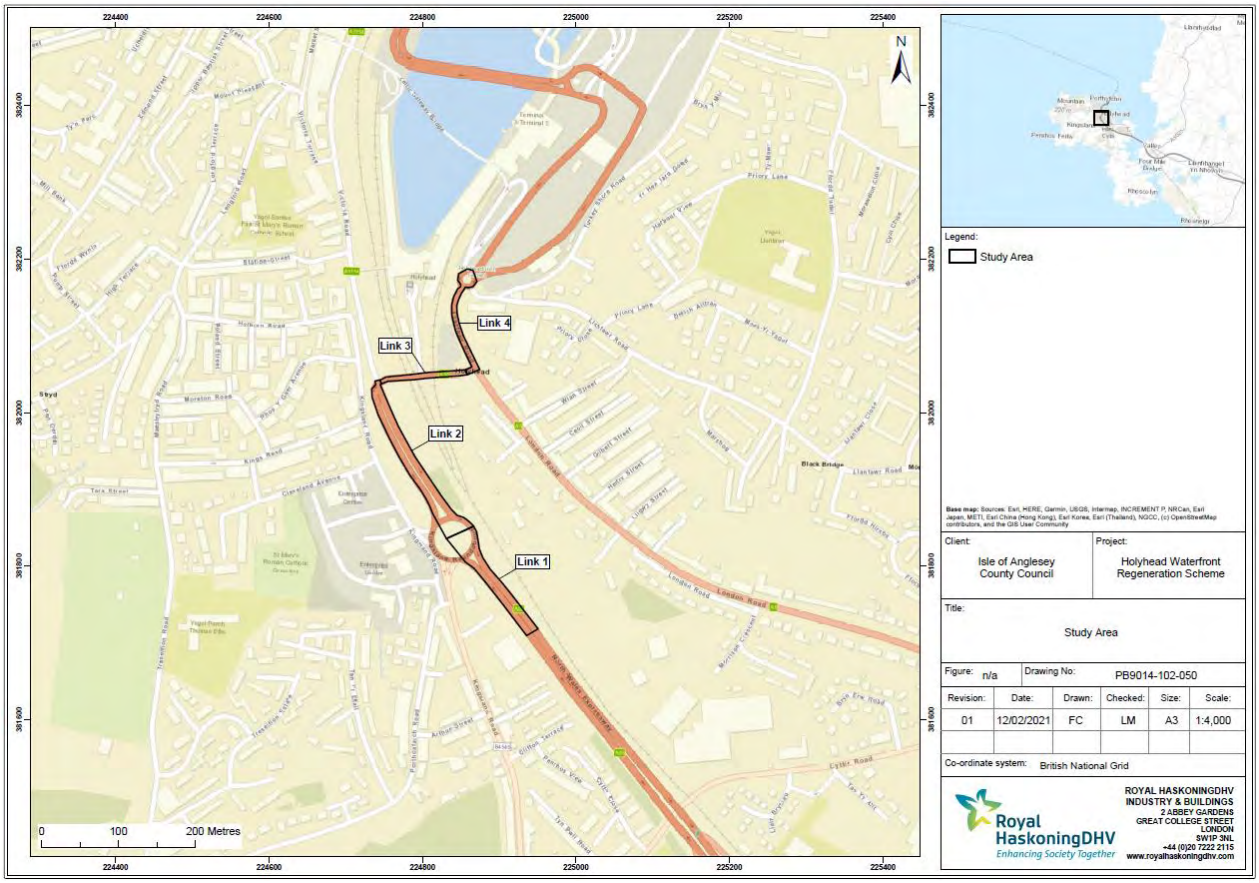


Figure 4—1 Study Area

The following data sources contained within Table 4-1 to be used to inform the assessment.

Table 4-1 Data Sources

Data	Date	Coverage	Confidence	Notes
7-Day Classified Automatic Traffic Counts	October 2018	1 link within the traffic and transport study area.	High	Traffic count commissioned by Stena Line Ports Limited[1] which provides classified hourly and daily count and speed data (over 7 days).
Signal Information	Latest Available	Signalised junction	High	To be provided by highway authority
24-Hour Manually Classified Turning Count	14:00hrs to 14:00hrs 3rd/4th October 2018	Railway Station/Ferry Access/Llanfawr Road/A55 roundabout A55/A5 junction A5154/A55 junction Kingsland Roundabout	High	Traffic counts commissioned by Stena Line Ports Limited[1] which provide classified hourly turning count data.
Personal Injury Collision Data	Latest five-year period available,	All links within the traffic and transport study area	High	

[1] *Traffic data supplied by Stena Line Ports Limited as undertaken for the Holyhead Port Expansion Environmental Statement (Royal HaskoningDHV, 2018)*

Data	Date	Coverage	Confidence	Notes
	January 2015 to December 2019			
Sensitive Receptors	Latest Available	All links within the study area.	High	Desktop studies

At present, the Welsh Government have enforced a national lockdown and Stay At Home orders. Therefore traffic flows are not expected to be representative as the number of vehicles on the road is likely to be lower than usual. To produce a robust methodology, it is proposed to use data from surveys completed in 2018 to inform the baseline. The AADT figures present below are derived from a 24hr (Wednesday) Manual Classified Turning Count surveys factored utilising a seven-day ATC located on the A55 – Victoria Road.

The A55 North Wales Expressway (Link 1) is a two-lane dual carriageway road that runs north to a roundabout junction with the B4545 and Kingsland Road. The road has lighting present and is subject to a 30mph speed limit, there are no footways or frontage developments along the link. The derived 2018 AADT traffic flows totalled 11,557 vehicles of which 1,513 were HGVs on the A55 North Wales Expressway.

The A55 Victoria Road (Link 2) continues north for a further 200 metres to a signalised junction with the A5154 and the A55 (London Road). The road consists of two-lane dual carriageway subject to a 30mph speed limit with street lighting present. No footways or frontage developments are present along the road. The derived 2018 AADT traffic flows totalled 12,501 vehicles of which 1,517 were HGVs on the A55 - Victoria Road.

The A55 London Road (Link 3) is a three-lane single carriage road that runs 110m east of its junction with A55 Victoria to the signalised junction with the A5 London Road. The road is subject to a speed limit of 30mph with footways and street lights provided on both sides of the road. Vehicular access to Holyhead Rail Station is located on the A55 London Road. The derived 2018 AADT traffic flows totalled 10,254 vehicles of which 1,526 were HGVs on the A55 London Road.

The A55 London Road (Link 4) is also the terminal section of the A55 before entering the Holyhead Port. It consists of a three-lane single carriageway road with a single lane heading north from the junction with the A5 London Road to a roundabout junction serving Holyhead train station the Port access road and LLanfawr Road. Two lanes (ahead only and dedicated right turn lane) head south to exit the port area. The road is subject to a 30mph speed limit with continuous footways and street lighting on both sides. The derived 2018 AADT traffic flows totalled 7,504 vehicles of which 1,429 were HGVs on the A55 London Road.

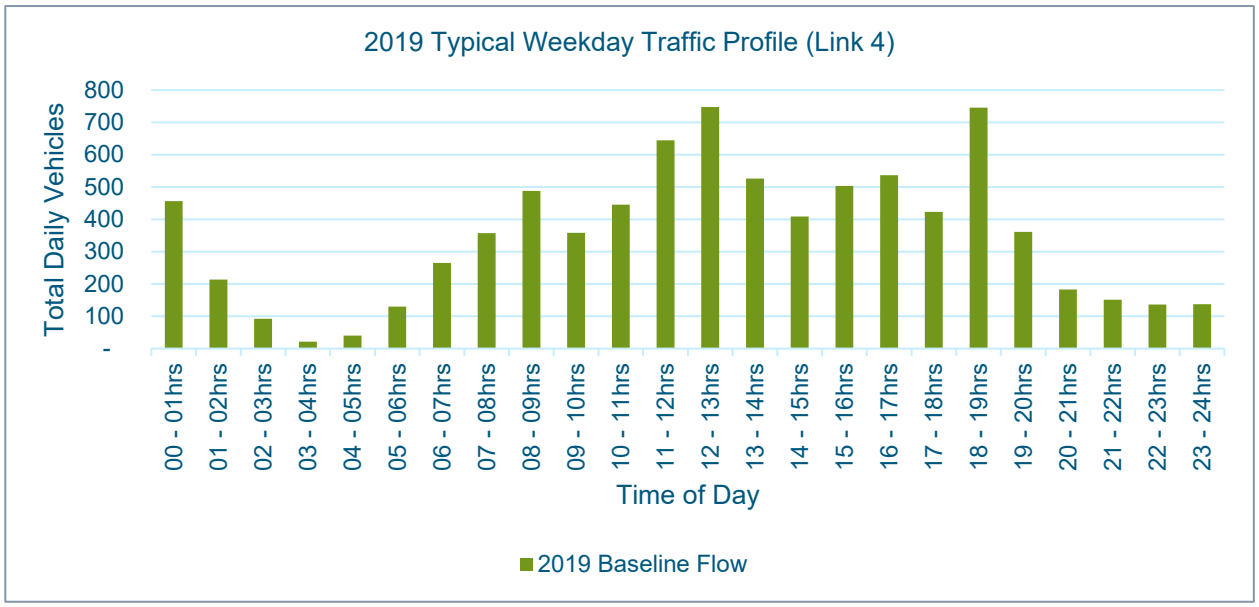
National Cycle Route 8 (NCR8) links Holyhead to Cardiff and begins at Holyhead Port. The NCR8 crosses the A55 roundabout junction with the B4545 and Kingsland Road and continues on-road along Llanfawr Road.

The majority of vehicular access to the port is routed through link 4 (A55) thus, a typical daily traffic profile of link 4 would best represent the network peak hours within the study area.

Data from the commissioned MCC surveys[2] at the railway Station/ Ferry Access / Llanfawr Road/ A55 roundabout and the A55 / A5 junction has been used to derive a daily traffic profile for link 4 and is shown in Plate 4-1.

[2] *Traffic data supplied by Stena Line Ports Limited as undertaken for the Holyhead Port Expansion Environmental Statement (Royal HaskoningDHV, 2018)*

Plate 4-1 2018 Typical Weekday Traffic Profile (Link 4)



As shown in Plate 4-1, peak traffic movements occur between 12:00 to 13:00 at 748 movements and between 18:00 to 19:00 at 746 vehicle movements which coincide with the arrival and departure of the RoPax ferries at the port.

5 Identification of key issues

5.1 Potential impacts during construction

The construction phase of the refurbishment of Holyhead Breakwater is expected to last for a total of two years with the earliest realistic start of construction in quarter two of 2022. The programme is constrained by the fact that materials can only be placed during the spring and summer.

A maximum of 30 staff would be expected to work on the project per day. It is expected these staff would be based locally and have limited impact on the highway network.

The preferred option for delivery of materials to site would be by sea. In the “worst-case scenario” the delivery method would be by road from an off site concrete batching plant to the Port of Holyhead. In this situation the delivery of concrete and moulds, for the construction of the Tetrapods units and Z-shaped units on-site, via HGVs would be expected to occur over a 10-hour period per day. Based on a maximum rate of unit production per day equates to approximately 204 concrete lorries. This is a maximum total of 408 HGV movements per day. It is noted that a daily average of 102 concrete lorries would be required for production of the units.

To ensure the assessment considers the maximum impacts in the traffic and transport study area, a worst case peak traffic demand scenario of 408 daily HGV movements is to be assessed.

5.2 Potential impacts during operation

Once the construction works are complete, operational traffic would primarily be limited to maintenance trips and therefore no significant traffic impacts are anticipated during the operational phase. Therefore, no assessment of operation impacts in relation to traffic and transport is to be assessed in the EIA.

5.3 Summary of potential impacts

A review of the baseline situation outlined in Section 4 indicates potential significant impacts on sensitive receptors resulting from additional construction traffic are summarised in Table 5-1.

Table 5-1 Key issues in relation to traffic and transport due to the proposed scheme

Potential Effects	Potential impact significance	Comment
Severance and Amenity	Impact unknown or has the potential to be significant	The increase in traffic during construction may lead to severance and impacts upon the amenity value of cyclists along NCR8 and pedestrians between the A55 and the site access.
Road safety	Impact unknown or has the potential to be significant	The increase in traffic during construction may lead to adverse highway safety impacts upon users travelling along the A55.
Driver delay	Impact unknown or has the potential to be significant	The increase in traffic during construction may lead to delays for traffic travelling west and east along the A55, and vehicles attempting to access Holyhead Rail Station.

6 Proposed approach to the EIA

6.1 Determining impact significance

The principle guidelines for the assessment of the environmental impacts of road traffic associated with new developments are the 'Guidelines for the Environmental Assessment of Road Traffic' (GEART) published by the Institute of Environmental Assessment in January 1993. The guidance provides a framework for the assessment of traffic borne environmental impacts, such as pedestrian severance and amenity, driver delay and road safety.

GEART suggests the following rules to define the extent and scale of the assessment required:

- Rule 1: Include highway links where total traffic flows (or HGV component) are predicted to increase by more than 30%.
- Rule 2: Include any other specifically sensitive areas where total traffic flows (of HGV component) are predicted to increase by 10% or more.

The above criteria will be applied to the proposed schemes construction traffic demand which will dictate the extent of the study area and the scale of the impact assessment.

Further details on the approach to the identified environmental effects to be assessed are detailed below.

6.1.1 Severance

Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. The term is used to describe a complex series of factors that separate people from places and other people. Severance may result from the difficulty of crossing a heavily trafficked road or a physical barrier created by the road itself. It can also relate to relatively minor traffic flows if they impede pedestrian access to essential facilities.

GEART suggests that changes in total traffic flow of 30%, 60% and 90% are considered to be slight, moderate and substantial respectively. However, GEART notes that these figures should be used cautiously, and the assessment should pay full regard to specific local conditions.

6.1.2 Amenity

Amenity is broadly defined as the relative pleasantness of a journey, and is considered to be affected by traffic flow, traffic composition and pavement width and separation from traffic. It can impact a range of non-motorised users such as pedestrians, cyclists and equestrians.

GEART suggests that a threshold of a doubling of total traffic flow or the HGV component may lead to a negative impact upon pedestrian amenity.

6.1.3 Road Safety

GEART guidance on road safety is as follows:

> *"Where a development is expected to produce a change in the character of traffic (e.g. HGV movements on rural roads), then data on existing accidents levels may not be sufficient. Professional judgement will be needed to assess the implications of local circumstances, or factors which may elevate or lessen the risk of accidents, e.g. junction conflicts."*

In this context, an examination of the baseline collisions occurring within the traffic and transport study area will be undertaken to identify any collision clusters. These locations are considered to be sensitive to changes in traffic flows and therefore a more detailed analysis of the types of collisions will be undertaken.

6.1.4 Driver Delay

As identified in Section 5, traffic flows are forecast to be above 30 two-way vehicle movements per hour where impacts could be significant. A total of 41 HGVs per hour are predicted based on 408 daily HGV flows profiled over a 10 hour delivery window. Thus, further assessment in the form of junction modelling is proposed in accordance with GEART recommendations.

GEART recommends the use of proprietary software packages to model junction delay and hence increased vehicle delays. However, it is noted that vehicle delays are only likely to be significant when the surrounding highway network is at, or close to, capacity. It is proposed to assess the following junctions;

- Railway Station/ Ferry Access/ Llanfawr Road/ A55 roundabout
- A55/A5 junction
- A5154/A55 junction
- A55/B4545 - Kingsland Roundabout

Due to the daily traffic profiles experienced within Holyhead as detailed in Section 4, the following junction assessment scenarios are proposed to be undertaken for the reference baseline year of 2020 and a forecast construction year of 2022.

1. Traditional network peak hour of (8am to 9am); and
2. Port related network peak hour of 12pm to 1pm.

Industry standard junction modelling software such as Junctions 9 and Linsig will be used to determine the likely impacts of additional construction traffic on the highway network.

6.1.5 Sensitivity

The sensitivity of a road (link) can be defined by the type of user groups who may use it, e.g. elderly people or children. A sensitive area may be a village environment or where pedestrian or cyclist activity

may be high, for example in the vicinity of a school. Taking into consideration the nature of the proposed development (the port) and local amenities within proximity of the development, sensitive user groups include and are not limited to:

- ferry passengers;
- local pedestrians and cyclists;
- Holyhead railway station users; and,
- Residents of Holyhead.

Table 6-1 provides broad definitions of the different sensitivity levels which are proposed to be for the assessment.

Table 6-1 Example Definitions of the Different Sensitivity Levels for a Highway Link

Sensitivity	Definition
High*	High concentrations of sensitive receptors (e.g. ferry passengers, local pedestrians, cyclists, railway users and residents) and limited separation provided by the highway environment. Defined Collision Clusters Junctions with negative spare capacity.
Medium	A low concentration of sensitive receptors (e.g. residential dwellings, pedestrian desire lines, etc.) and limited separation from traffic provided by the highway environment. Junctions approaching or at capacity
Low	Few sensitive receptors and / or highway environment that can accommodate changes in volumes of traffic.
Negligible	Links that fall below GEART Rule 1 and 2 screening thresholds.
* High sensitivity links are considered to be 'specifically sensitive areas' for the purpose of GEART Rule 2	

6.1.6 Magnitude

The project's traffic demand would be assigned to the highway links within the study area and the increase in traffic flow to baseline conditions determined. This would facilitate an assessment of the magnitude of effect as set out in Table 6-2.

Table 6-2 Definitions of the magnitude of effect for the traffic and transport assessment

Effect	Negligible	Low	Medium	High
Severance	Change in total traffic flow of less than 30%	Change in total traffic flow of 30-60%	Change in total traffic flow of 60-90%	Change in total traffic flows of over 90%
Pedestrian and Cycle Amenity	Change in traffic flow (or HGV component less than 100%)	Greater than 100% increase in traffic (or HGV component) and a review based upon the quantum of vehicles, and vehicle speed		
Road Safety	Informed by a review of collision patterns and trends based upon the existing personal injury collision records and the forecast increase in traffic.			
Driver Delay	Increases in peak hour traffic flows less than 30 vehicles per hour	Informed by projected traffic increases through sensitive junctions within the study area.		

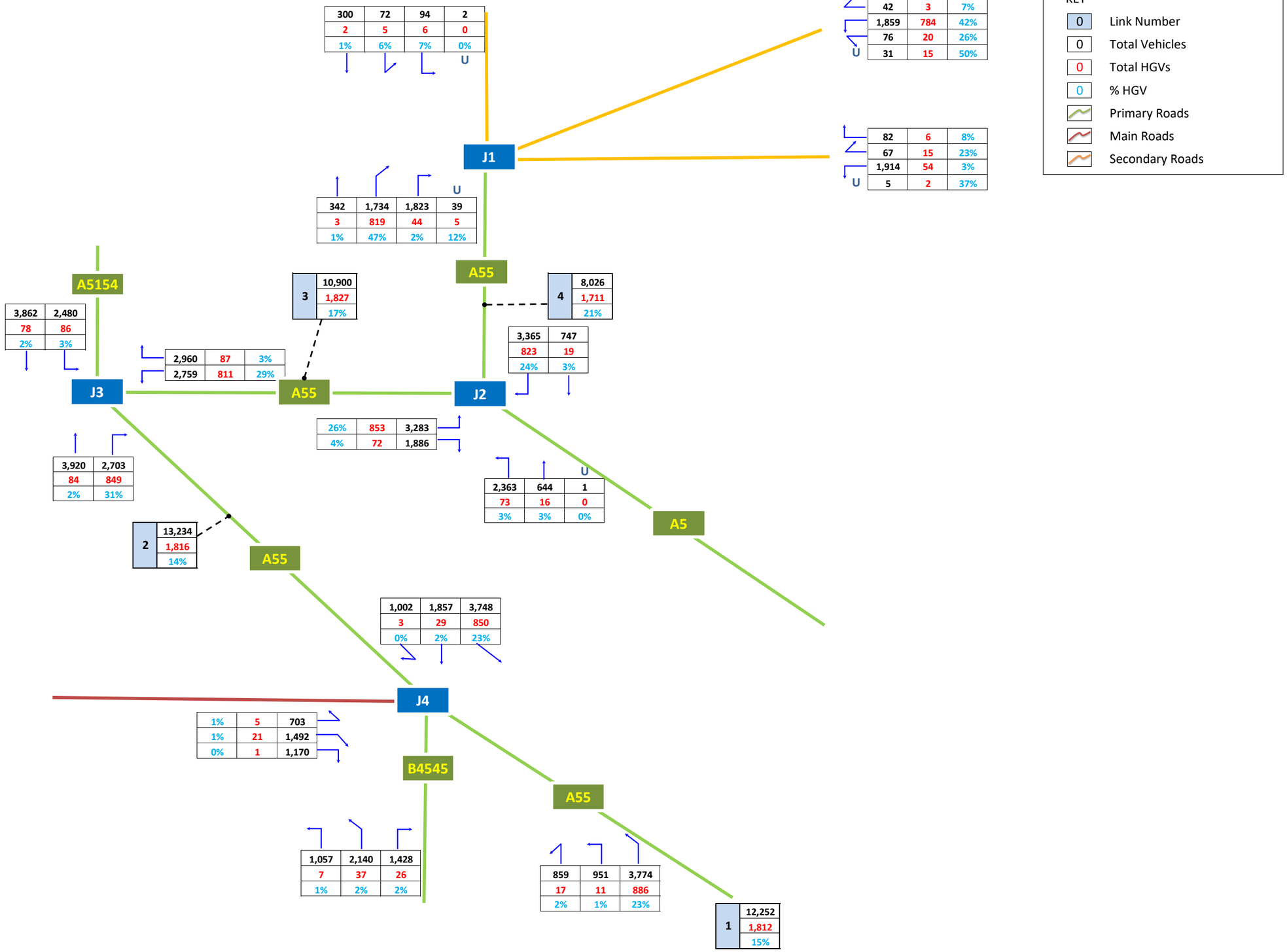
The magnitude of the effect would be combined with the sensitivity of each discrete highway link within the study area to determine the overall impact of the proposed construction traffic demand.

Table 6-3 summarises the potential impacts for both construction and operation of the proposed development.

Table 6-3 Summary of Potential Impacts

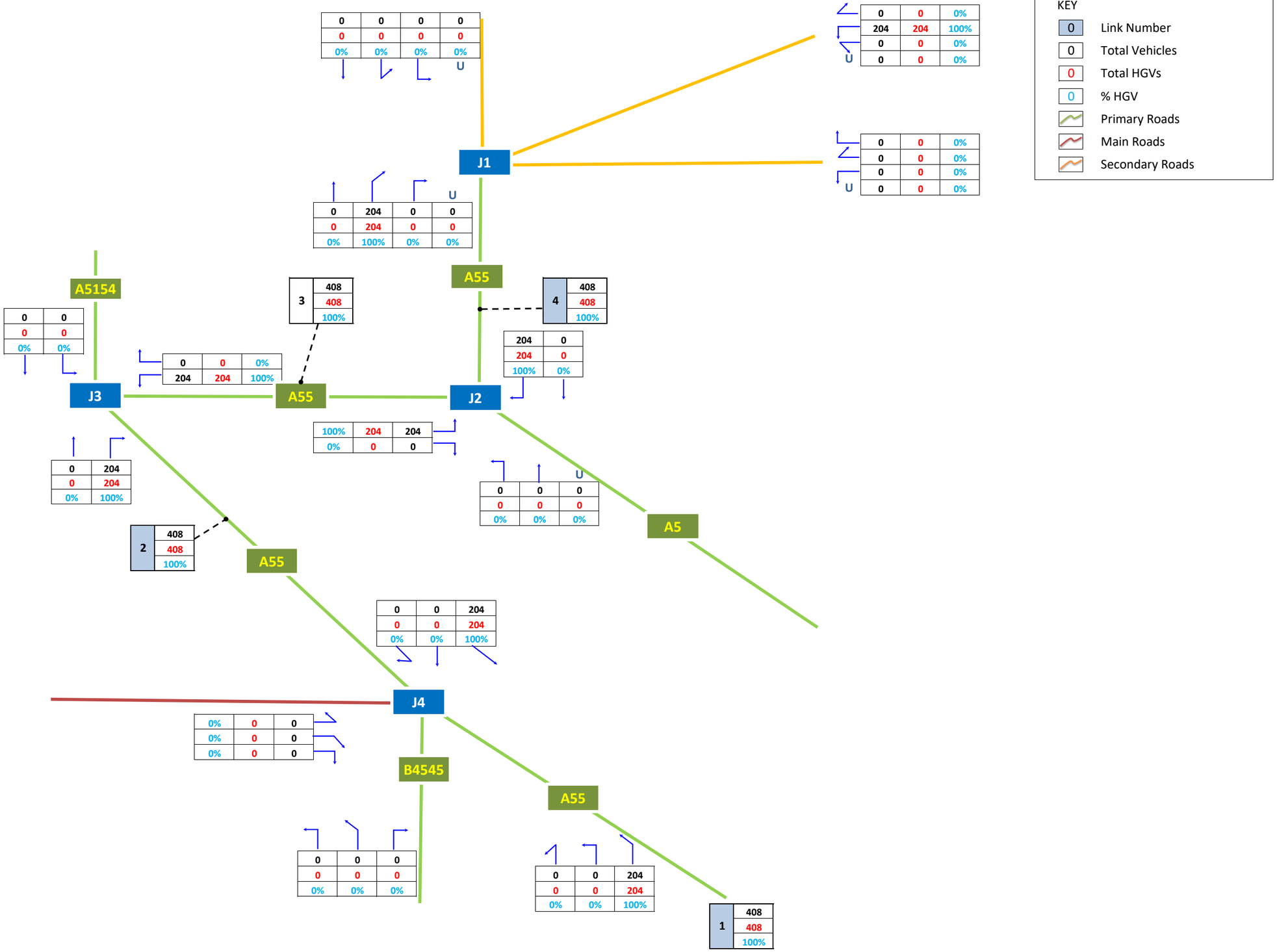
Effect	Construction	Operation
Severance	Yes	No
Pedestrian and Cycle Amenity	Yes	No
Highway Safety	Yes	No
Driver delay	Yes	No
Notes: Scoped in (Yes) and scoped out (No)		

8.2 Daily Background Reference Flows



	Project Title Holyhead Breakwater Refurbishment Scheme ES Traffic and Transport Chapter	**Appendix Title** 2022 24hr AADT Forecast Flows	**Appendix No** 8.2
	Job Number PB9014	**Date** Mar-21	

8.3 Peak Daily Construction Flows



	Project Title Holyhead Breakwater Refurbishment Scheme ES Traffic and Transport Chapter	**Appendix Title** 2022 Peak Daily Constuction Flows	**Appendix No** 8.3
	Job Number PB9014	**Date** Mar-21	

8.4 Junction 1 and 4 Model Outputs

Junctions 9

ARCADY 9 - Roundabout Module

Version: 9.5.1.7462

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Filename: Junction 1 and 4 - Existing and Construction Flows.j9
Path: C:\Users\304111\Box\PB9014 Holyhead Breakwater\1. WIP\Technical\101\STAGE B\12. EIA Report\Transport\Technical Data\Modelling\Junctions9
Report generation date: 01/04/2021 16:13:33

Summary of junction performance

	AM Peak							Port Peak					
	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS	Set ID	Queue (PCU)	Delay (s)	RFC	LOS	Junction Delay
Existing Flows (Peak Period) - 2018 Base													
Kingsland Road Roundabout - A55 Victoria Road		0.2	2.00	0.14	A				0.9	3.22	0.41	A	
Kingsland Road Roundabout - A55 North Wales Expressway		0.4	2.87	0.23	A				0.7	3.66	0.36	A	
Kingsland Road Roundabout - B4545 Kingsland Road (South)		0.2	2.89	0.18	A	2.89	A		0.4	3.50	0.28	A	3.65
Kingsland Road Roundabout - Holyhead Fire Station		0.0	0.00	0.00	A				0.0	2.38	0.00	A	
Kingsland Road Roundabout - B4545 Kingsland Road (North)	D1	0.3	4.23	0.21	A			D2	0.4	5.05	0.29	A	
A55/Llanfawr Rd Roundabout - Railway Station Access		0.0	3.42	0.04	A				0.1	3.84	0.07	A	
A55/Llanfawr Rd Roundabout - Ferry Access		0.1	6.76	0.09	A	4.87	A		3.2	17.87	0.71	C	10.3
A55/Llanfawr Rd Roundabout - Llanfawr Road		0.2	4.04	0.17	A				0.2	5.31	0.18	A	
A55/Llanfawr Rd Roundabout - A55		0.5	5.13	0.28	A				1.2	7.30	0.47	A	
Existing Flows (Peak Period) - 2022 Future Base + HGV Growth													
Kingsland Road Roundabout - A55 Victoria Road		0.4	2.32	0.25	A				1.0	3.51	0.45	A	
Kingsland Road Roundabout - A55 North Wales Expressway		0.5	3.23	0.29	A				0.9	3.98	0.39	A	
Kingsland Road Roundabout - B4545 Kingsland Road (South)		0.9	4.52	0.46	A	3.83	A		0.4	3.69	0.30	A	3.93
Kingsland Road Roundabout - Holyhead Fire Station		0.0	4.50	0.00	A				0.0	2.44	0.00	A	
Kingsland Road Roundabout - B4545 Kingsland Road (North)	D3	0.7	5.99	0.42	A			D4	0.5	5.37	0.32	A	
A55/Llanfawr Rd Roundabout - Railway Station Access		0.0	3.47	0.04	A				0.1	3.95	0.07	A	
A55/Llanfawr Rd Roundabout - Ferry Access		0.3	8.46	0.14	A	5.42	A		4.7	23.33	0.78	C	12.8
A55/Llanfawr Rd Roundabout - Llanfawr Road		0.3	4.35	0.23	A				0.2	5.61	0.20	A	
A55/Llanfawr Rd Roundabout - A55		0.6	5.41	0.31	A				1.5	8.36	0.52	A	
Existing Flows (Peak Period) - 2022 Future Base + HGV Growth + Developm													
Kingsland Road Roundabout - A55 Victoria Road		0.4	2.49	0.27	A				1.2	3.76	0.48	A	
Kingsland Road Roundabout - A55 North Wales Expressway		0.6	3.50	0.32	A				1.0	4.24	0.42	A	
Kingsland Road Roundabout - B4545 Kingsland Road (South)		0.9	4.66	0.47	A	3.98	A		0.5	3.78	0.30	A	4.14
Kingsland Road Roundabout - Holyhead Fire Station		0.0	4.57	0.01	A				0.0	0.00	0.00	A	
Kingsland Road Roundabout - B4545 Kingsland Road (North)	D5	0.7	6.22	0.43	A			D6	0.5	5.54	0.33	A	
A55/Llanfawr Rd Roundabout - Railway Station Access		0.1	3.54	0.04	A				0.1	4.04	0.08	A	
A55/Llanfawr Rd Roundabout - Ferry Access		0.4	9.07	0.19	A	6.04	A		6.5	29.37	0.84	D	15.6
A55/Llanfawr Rd Roundabout - Llanfawr Road		0.3	4.46	0.23	A				0.3	5.78	0.20	A	
A55/Llanfawr Rd Roundabout - A55		0.7	6.02	0.35	A				1.8	9.30	0.56	A	

There are warnings associated with one or more model runs - see the 'Data Errors and Warnings' tables for each Analysis or Demand Set.

Values shown are the highest values encountered over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

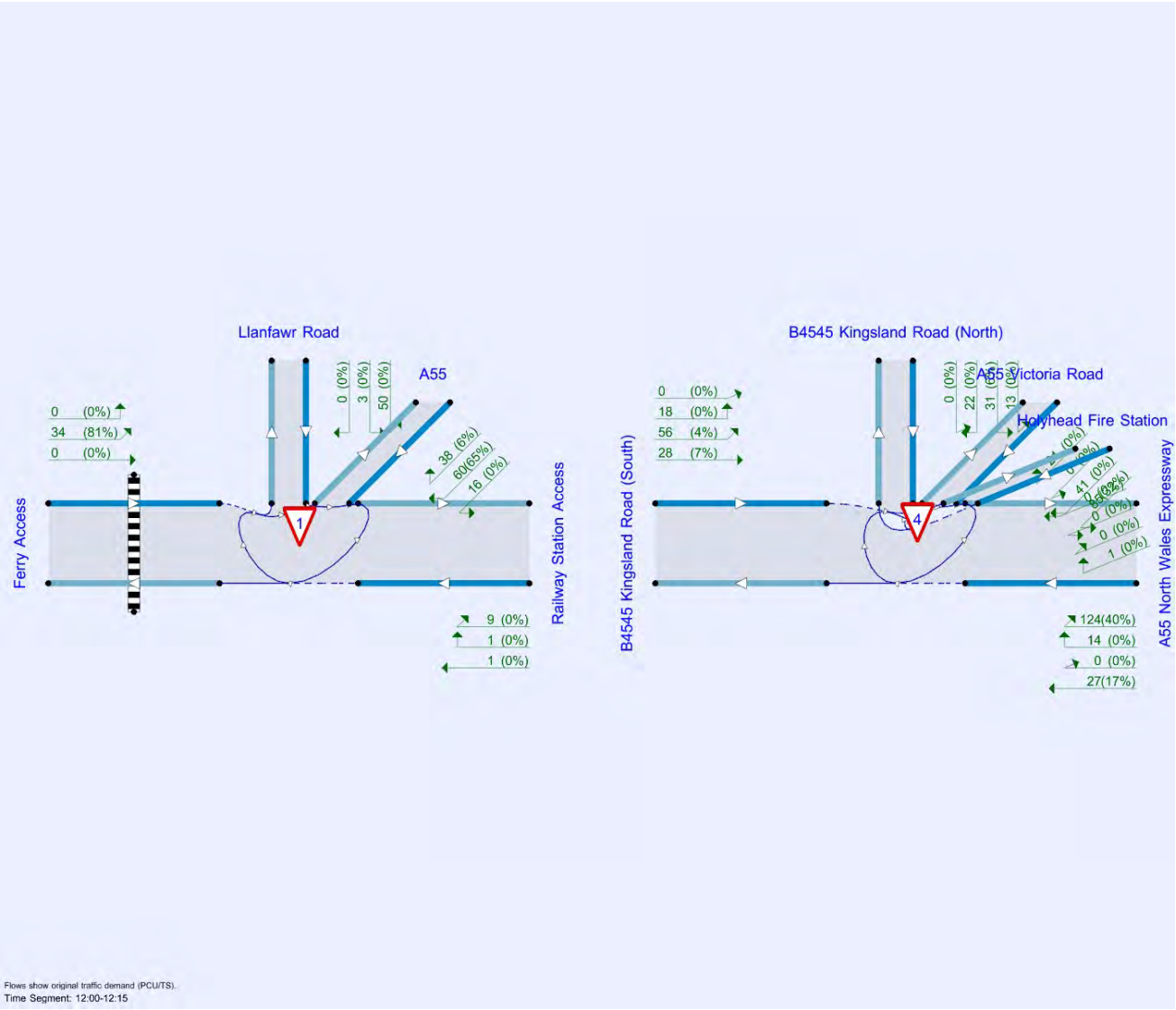
File summary

File Description

Title	Existing Flows - Holyhead Reclamation
Location	Holyhead
Site number	NA
Date	16/02/2021
Version	1
Status	Existing
Identifier	
Client	IACC
Jobnumber	PB9014-102-135
Enumerator	CORPORATEROOT\305248
Description	

Units

Distance units	Speed units	Traffic units input	Traffic units results	Flow units	Average delay units	Total delay units	Rate of delay units
m	mph	PCU	PCU	perTimeSegment	s	-Min	perMin



The junction diagram reflects the last run of Junctions.

Analysis Options

Vehicle length (m)	Calculate Queue Percentiles	Calculate detailed queueing delay	Calculate residual capacity	RFC Threshold	Average Delay threshold (s)	Queue threshold (PCU)
5.75				0.85	36.00	20.00

Analysis Set Details

ID	Name	Description	Include in report	Network flow scaling factor (%)	Network capacity scaling factor (%)
A1	Existing Flows (Peak Period)	Base + HGV Growth + with Dev Flows at A55/Llanfawr Road Roundabout (1) and Kingsland Road Roundabout (4), at Peak Period	✓	100.000	100.000

Demand Set Details

ID	Scenario name	Time Period name	Traffic profile type	Start time (HH:mm)	Finish time (HH:mm)	Time period length (min)	Time segment length (min)	Run automatically
D2	2018 Base	Port Peak	DIRECT	12:00	13:00	60	15	✓

Existing Flows (Peak Period) - 2018 Base, Port Peak

Data Errors and Warnings

No errors or warnings

Junction Network

Junctions

Junction	Name	Junction type	Use circulating lanes	Arm order	Junction Delay (s)	Junction LOS
4	Kingsland Road Roundabout	Standard Roundabout		A55N, A55S, KINGS, FIRE, KINGN	3.65	A
1	A55/Llanfawr Rd Roundabout	Standard Roundabout		RAIL, FERRY, LLANF, A55	10.33	B

Junction Network Options

Driving side	Lighting
Left	Normal/unknown

Arms

Arms

Junction	Arm	Name	Description
Kingsland Road Roundabout	A55N	A55 Victoria Road	
	A55S	A55 North Wales Expressway	
	KINGS	B4545 Kingsland Road (South)	
	FIRE	Holyhead Fire Station	
	KINGN	B4545 Kingsland Road (North)	
A55/Llanfawr Rd Roundabout	RAIL	Railway Station Access	
	FERRY	Ferry Access	
	LLANF	Llanfawr Road	
	A55	A55	

Roundabout Geometry

Junction	Arm	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit only
Kingsland Road Roundabout	A55 Victoria Road	7.30	9.03	8.3	26.5	69.0	18.0	
	A55 North Wales Expressway	7.28	7.28	0.0	12.4	69.0	24.5	
	B4545 Kingsland Road (South)	5.80	6.70	4.0	7.9	69.0	26.0	
	Holyhead Fire Station	8.78	11.97	4.6	3.0	69.0	41.5	
	B4545 Kingsland Road (North)	3.31	6.10	8.8	13.0	69.0	24.5	
A55/Llanfawr Rd Roundabout	Railway Station Access	5.75	7.49	3.2	3.0	32.2	29.0	
	Ferry Access	7.38	7.38	0.0	6.0	32.2	35.5	
	Llanfawr Road	3.98	5.95	5.7	4.7	32.2	30.5	
	A55	3.47	4.28	3.5	16.9	32.2	8.0	

Zebra Crossings

Junction	Arm	Space between crossing and junction entry (Zebra) (PCU)	Vehicles queueing on exit (Zebra) (PCU)	Central Refuge	Crossing data type	Crossing length (m)	Crossing time (s)
A55/Llanfawr Rd Roundabout	Ferry Access	15.00	1.00		Distance	6.00	4.29

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Junction	Arm	Final slope	Final intercept (PCU/TS)
Kingsland Road Roundabout	A55 Victoria Road	0.676	665.423
	A55 North Wales Expressway	0.584	545.457
	B4545 Kingsland Road (South)	0.511	449.760
	Holyhead Fire Station	0.485	505.748
	B4545 Kingsland Road (North)	0.463	353.064
A55/Llanfawr Rd Roundabout	Railway Station Access	0.511	350.972
	Ferry Access	0.663	484.580
	Llanfawr Road	0.513	312.096
	A55	0.589	317.946

The slope and intercept shown above include any corrections and adjustments.

Arm Capacity Adjustments

Junction	Arm	Type	Reason	Percentage capacity adjustment (%)
A55/Llanfawr Rd Roundabout	Ferry Access	Percentage		50.00

Traffic Demand

Vehicle mix varies over time	Vehicle mix varies over turn	Vehicle mix varies over entry	Vehicle mix source	PCU Factor for a HV (PCU)	O-D data varies over time
✓	✓	✓	HV Percentages	2.00	✓

Demand overview (Traffic)

Junction	Arm	Linked arm	Profile type	Use O-D data	Scaling Factor (%)
Kingsland Road Roundabout	A55 Victoria Road		DIRECT	✓	100.000
	A55 North Wales Expressway		DIRECT	✓	100.000
	B4545 Kingsland Road (South)		DIRECT	✓	100.000
	Holyhead Fire Station		DIRECT	✓	100.000
	B4545 Kingsland Road (North)		DIRECT	✓	100.000
A55/Llanfawr Rd Roundabout	Railway Station Access		DIRECT	✓	100.000
	Ferry Access		DIRECT	✓	100.000
	Llanfawr Road		DIRECT	✓	100.000
	A55		DIRECT	✓	100.000

Demand overview (Pedestrians)

Junction	Arm	Profile type
Kingsland Road Roundabout	A55 Victoria Road	
	A55 North Wales Expressway	
	B4545 Kingsland Road (South)	
	Holyhead Fire Station	
	B4545 Kingsland Road (North)	
A55/Llanfawr Rd Roundabout	Railway Station Access	
	Ferry Access	[DIRECT]
	Llanfawr Road	
	A55	

Origin-Destination Data

A55/Llanfawr Rd Roundabout 12:00 - 12:15

Demand (PCU/TS)

		To			
		Railway Station Access	Ferry Access	Llanfawr Road	A55
From	Railway Station Access	3.00	1.00	1.00	9.00
	Ferry Access	0.00	3.00	0.00	34.00
	Llanfawr Road	3.00	0.00	0.00	50.00
	A55	16.00	60.00	38.00	0.00

Proportions

		To		
		Railway Station Access	Ferry Access	Ll
From	Railway Station Access	0.21	0.07	
	Ferry Access	0.00	0.08	
	Llanfawr Road	0.06	0.00	
	A55	0.14	0.53	

A55/Llanfawr Rd Roundabout 12:15 - 12:30

Demand (PCU/TS)

		To			
		Railway Station Access	Ferry Access	Llanfawr Road	A55
From	Railway Station Access	0.00	1.00	5.00	12.00
	Ferry Access	1.00	0.00	2.00	155.00
	Llanfawr Road	1.00	2.00	0.00	33.00
	A55	7.00	62.00	37.00	1.00

Proportions

		To		
		Railway Station Access	Ferry Access	L
From	Railway Station Access	0.00	0.06	
	Ferry Access	0.01	0.00	
	Llanfawr Road	0.03	0.06	
	A55	0.07	0.58	

A55/Llanfawr Rd Roundabout 12:30 - 12:45

Demand (PCU/TS)

		To			
		Railway Station Access	Ferry Access	Llanfawr Road	A55
From	Railway Station Access	0.00	2.00	4.00	4.00
	Ferry Access	0.00	0.00	3.00	110.00
	Llanfawr Road	4.00	3.00	0.00	33.00
	A55	8.00	66.00	43.00	2.00

Proportions

		To		
		Railway Station Access	Ferry Access	L
From	Railway Station Access	0.00	0.20	
	Ferry Access	0.00	0.00	
	Llanfawr Road	0.10	0.08	
	A55	0.07	0.55	

A55/Llanfawr Rd Roundabout 12:45 - 13:00

Demand (PCU/TS)

		To			
		Railway Station Access	Ferry Access	Llanfawr Road	A55
From	Railway Station Access	0.00	6.00	4.00	9.00
	Ferry Access	1.00	0.00	2.00	55.00
	Llanfawr Road	2.00	0.00	0.00	45.00
	A55	6.00	108.00	33.00	1.00

Proportions

		To		
		Railway Station Access	Ferry Access	Ll
From	Railway Station Access	0.00	0.32	
	Ferry Access	0.02	0.00	
	Llanfawr Road	0.04	0.00	
	A55	0.04	0.73	

Kingsland Road Roundabout 12:00 - 12:15

Demand (PCU/TS)

		To				
		A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
From	A55 Victoria Road	0.00	85.00	41.00	0.00	21.00
	A55 North Wales Expressway	124.00	0.00	27.00	0.00	14.00
	B4545 Kingsland Road (South)	56.00	28.00	0.00	0.00	18.00
	Holyhead Fire Station	0.00	0.00	0.00	0.00	1.00
	B4545 Kingsland Road (North)	13.00	31.00	22.00	0.00	0.00

Proportions

From	A55 Victoria Road	
	A55 North Wales	
	B4545 Kingsland	
	Holyhead Fire Sta	
	B4545 Kingsland	

Kingsland Road Roundabout 12:15 - 12:30

Demand (PCU/TS)

		To				
		A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
From	A55 Victoria Road	0.00	188.00	40.00	0.00	24.00
	A55 North Wales Expressway	93.00	0.00	15.00	0.00	11.00
	B4545 Kingsland Road (South)	45.00	21.00	0.00	0.00	22.00
	Holyhead Fire Station	0.00	0.00	0.00	0.00	0.00
	B4545 Kingsland Road (North)	16.00	29.00	22.00	0.00	0.00

Proportions

From	A55 Victoria Road	
	A55 North Wales	
	B4545 Kingsland	
	Holyhead Fire Sta	
	B4545 Kingsland	

Kingsland Road Roundabout 12:30 - 12:45

Demand (PCU/TS)

		To				
		A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
From	A55 Victoria Road	0.00	157.00	49.00	0.00	16.00
	A55 North Wales Expressway	102.00	0.00	19.00	0.00	18.00
	B4545 Kingsland Road (South)	44.00	35.00	0.00	0.00	15.00
	Holyhead Fire Station	0.00	0.00	0.00	0.00	0.00
	B4545 Kingsland Road (North)	14.00	33.00	22.00	0.00	0.00

Proportions

From	A55 Victoria Road	
	A55 North Wales	
	B4545 Kingsland	
	Holyhead Fire Sta	
	B4545 Kingsland	

Kingsland Road Roundabout 12:45 - 13:00

Demand (PCU/TS)

		To				
		A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
From	A55 Victoria Road	0.00	101.00	35.00	0.00	16.00
	A55 North Wales Expressway	136.00	0.00	15.00	1.00	28.00
	B4545 Kingsland Road (South)	40.00	30.00	0.00	0.00	16.00
	Holyhead Fire Station	0.00	0.00	0.00	0.00	0.00
	B4545 Kingsland Road (North)	16.00	37.00	23.00	0.00	0.00

Proportions

From	A55 Victoria Road	
	A55 North Wales	
	B4545 Kingsland	
	Holyhead Fire Sta	
	B4545 Kingsland	

Vehicle Mix

A55/Llanfawr Rd Roundabout 12:00 - 12:15

Heavy Vehicle Percentages

		To			
		Railway Station Access	Ferry Access	Llanfawr Road	A55
From	Railway Station Access	0	0	0	0
	Ferry Access	0	70	0	81
	Llanfawr Road	0	0	0	0
	A55	0	65	6	0

Average PCU Per Veh

		To		
		Railway Station Access	Ferry Access	Ll R
From	Railway Station Access	1.000	1.000	1
	Ferry Access	1.000	1.700	1
	Llanfawr Road	1.000	1.000	1
	A55	1.000	1.650	1

A55/Llanfawr Rd Roundabout 12:15 - 12:30

Heavy Vehicle Percentages

		To			
		Railway Station Access	Ferry Access	Llanfawr Road	A55
From	Railway Station Access	0	0	0	19
	Ferry Access	0	0	0	43
	Llanfawr Road	0	0	0	14
	A55	32	73	0	0

Average PCU Per Veh

		To		
		Railway Station Access	Ferry Access	Ll R
From	Railway Station Access	1.000	1.000	1
	Ferry Access	1.000	1.000	1
	Llanfawr Road	1.000	1.000	1
	A55	1.320	1.730	1

A55/Llanfawr Rd Roundabout 12:30 - 12:45

Heavy Vehicle Percentages

From \ To	Railway Station Access	Ferry Access	Llanfawr Road	A55
Railway Station Access	0	0	0	0
Ferry Access	0	0	85	80
Llanfawr Road	0	0	0	0
A55	25	66	5	0

Average PCU Per Veh

From \ To	Railway Station Access	Ferry Access	Ll R
Railway Station Access	1.000	1.000	1
Ferry Access	1.000	1.000	1
Llanfawr Road	1.000	1.000	1
A55	1.250	1.660	1

A55/Llanfawr Rd Roundabout 12:45 - 13:00

Heavy Vehicle Percentages

From \ To	Railway Station Access	Ferry Access	Llanfawr Road	A55
Railway Station Access	0	0	0	22
Ferry Access	0	0	0	67
Llanfawr Road	0	0	0	10
A55	0	59	0	0

Average PCU Per Veh

From \ To	Railway Station Access	Ferry Access	Ll R
Railway Station Access	1.000	1.000	1
Ferry Access	1.000	1.000	1
Llanfawr Road	1.000	1.000	1
A55	1.000	1.590	1

Kingsland Road Roundabout 12:00 - 12:15

Heavy Vehicle Percentages

From \ To	A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
A55 Victoria Road	0	32	0	0	0
A55 North Wales Expressway	40	0	17	0	0
B4545 Kingsland Road (South)	4	7	0	0	0
Holyhead Fire Station	0	0	0	0	0
B4545 Kingsland Road (North)	0	6	0	0	0

Average PCU Per Veh

From \ To	
A55 Victoria Road	
A55 North Wales	
B4545 Kingsland	
Holyhead Fire Sta	
B4545 Kingsland	

Kingsland Road Roundabout 12:15 - 12:30

Heavy Vehicle Percentages

From \ To	A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
A55 Victoria Road	0	37	0	0	19
A55 North Wales Expressway	42	0	0	0	0
B4545 Kingsland Road (South)	5	0	0	0	10
Holyhead Fire Station	0	0	0	0	0
B4545 Kingsland Road (North)	0	0	0	0	0

Average PCU Per Veh

From \ To	
A55 Victoria Road	
A55 North Wales	
B4545 Kingsland	
Holyhead Fire Sta	
B4545 Kingsland	

Kingsland Road Roundabout 12:30 - 12:45

Heavy Vehicle Percentages

From \ To	A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
A55 Victoria Road	0	53	12	0	0
A55 North Wales Expressway	49	0	0	0	13
B4545 Kingsland Road (South)	5	13	0	0	0
Holyhead Fire Station	0	0	0	0	0
B4545 Kingsland Road (North)	16	21	0	0	0

Average PCU Per Veh

From \ To	
A55 Victoria Road	
A55 North Wales	
B4545 Kingsland	
Holyhead Fire Sta	
B4545 Kingsland	

Kingsland Road Roundabout 12:45 - 13:00

Heavy Vehicle Percentages

	To					
From		A55 Victoria Road	A55 North Wales Expressway	B4545 Kingsland Road (South)	Holyhead Fire Station	B4545 Kingsland Road (North)
	A55 Victoria Road	0	41	7	0	0
	A55 North Wales Expressway	46	0	0	0	0
	B4545 Kingsland Road (South)	0	7	0	0	0
	Holyhead Fire Station	0	0	0	0	0
	B4545 Kingsland Road (North)	0	0	0	0	0

Average PCU Per Veh

From	A55 Victoria Road
	A55 North Wales
	B4545 Kingsland
	Holyhead Fire Sta
	B4545 Kingsland

Detailed Demand Data

Demand for each time segment

Time Segment	Junction	Arm	Demand (PCU/TS)	Demand in PCU (PCU/TS)	Pedestrian Demand (Ped/TS)
12:00-12:15	Kingsland Road Roundabout	A55 Victoria Road	147.00	147.00	
		A55 North Wales Expressway	165.00	165.00	
		B4545 Kingsland Road (South)	102.00	102.00	
		Holyhead Fire Station	1.00	1.00	
		B4545 Kingsland Road (North)	66.00	66.00	
	A55/Llanfawr Rd Roundabout	Railway Station Access	14.00	14.00	
		Ferry Access	37.00	37.00	0.00
		Llanfawr Road	53.00	53.00	
		A55	114.00	114.00	
12:15-12:30	Kingsland Road Roundabout	A55 Victoria Road	252.00	252.00	
		A55 North Wales Expressway	119.00	119.00	
		B4545 Kingsland Road (South)	88.00	88.00	
		Holyhead Fire Station	0.00	0.00	
		B4545 Kingsland Road (North)	67.00	67.00	
	A55/Llanfawr Rd Roundabout	Railway Station Access	18.00	18.00	
		Ferry Access	158.00	158.00	0.00
		Llanfawr Road	36.00	36.00	
		A55	107.00	107.00	
12:30-12:45	Kingsland Road Roundabout	A55 Victoria Road	222.00	222.00	
		A55 North Wales Expressway	139.00	139.00	
		B4545 Kingsland Road (South)	94.00	94.00	
		Holyhead Fire Station	0.00	0.00	
		B4545 Kingsland Road (North)	69.00	69.00	
	A55/Llanfawr Rd Roundabout	Railway Station Access	10.00	10.00	
		Ferry Access	113.00	113.00	0.02
		Llanfawr Road	40.00	40.00	
		A55	119.00	119.00	
12:45-13:00	Kingsland Road Roundabout	A55 Victoria Road	152.00	152.00	
		A55 North Wales Expressway	180.00	180.00	
		B4545 Kingsland Road (South)	86.00	86.00	
		Holyhead Fire Station	0.00	0.00	
		B4545 Kingsland Road (North)	76.00	76.00	
	A55/Llanfawr Rd Roundabout	Railway Station Access	19.00	19.00	
		Ferry Access	58.00	58.00	0.07
		Llanfawr Road	47.00	47.00	
		A55	148.00	148.00	

Results

Results Summary for whole modelled period

Junction	Arm	Max RFC	Max Delay (s)	Max Queue (PCU)	Max LOS	Average Demand (PCU/TS)	Total Junction Arrivals (PCU)
Kingsland Road Roundabout	A55 Victoria Road	0.41	3.22	0.9	A	193.25	773.00
	A55 North Wales Expressway	0.36	3.66	0.7	A	150.75	603.00
	B4545 Kingsland Road (South)	0.28	3.50	0.4	A	92.50	370.00
	Holyhead Fire Station	0.00	2.38	0.0	A	0.25	1.00
	B4545 Kingsland Road (North)	0.29	5.05	0.4	A	69.50	278.00
A55/Llanfawr Rd Roundabout	Railway Station Access	0.07	3.84	0.1	A	15.25	61.00
	Ferry Access	0.71	17.87	3.2	C	91.50	366.00
	Llanfawr Road	0.18	5.31	0.2	A	44.00	176.00
	A55	0.47	7.30	1.2	A	122.00	488.00

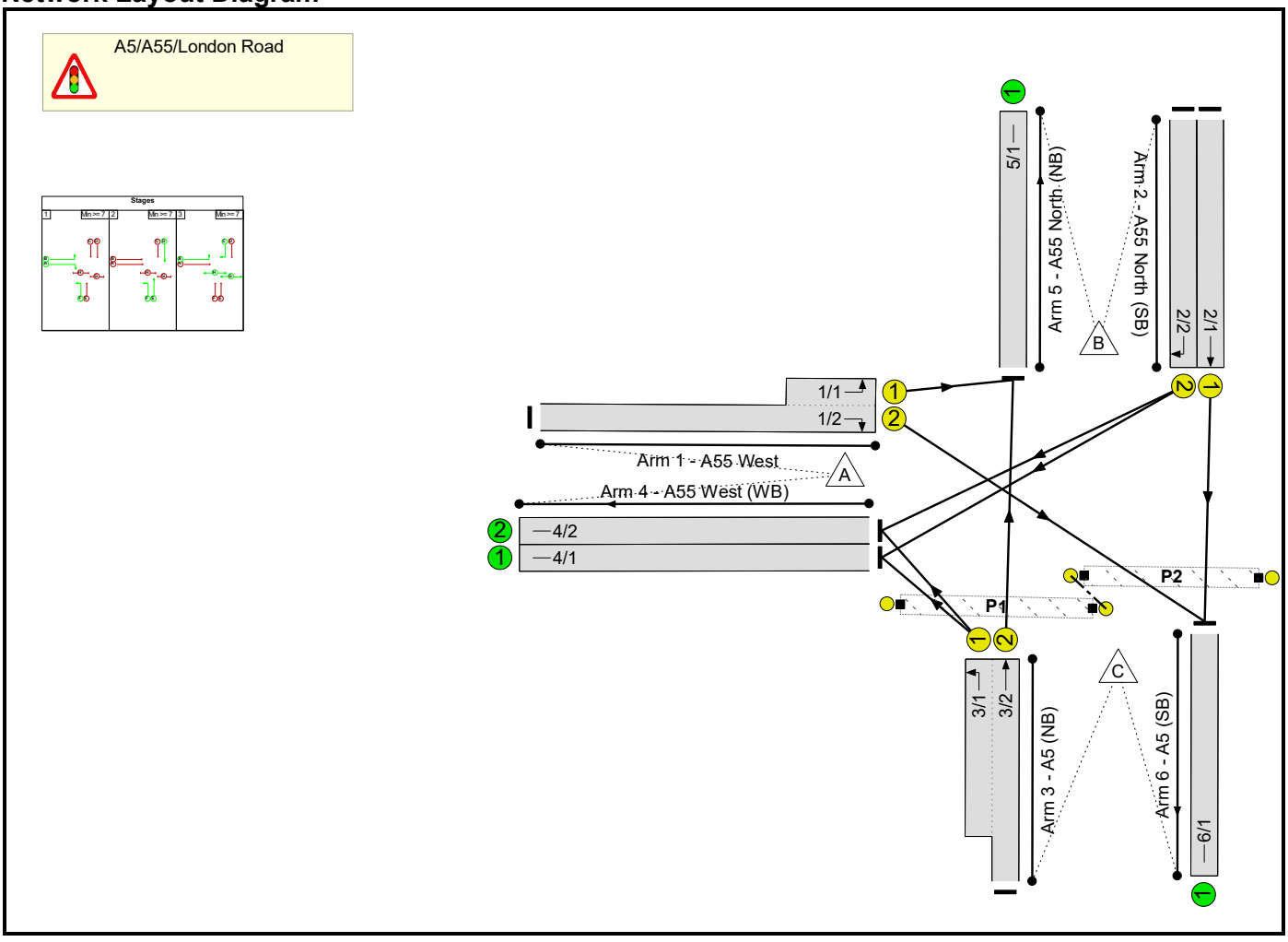
8.5 Junction 2 Model Outputs

Full Input Data And Results

User and Project Details

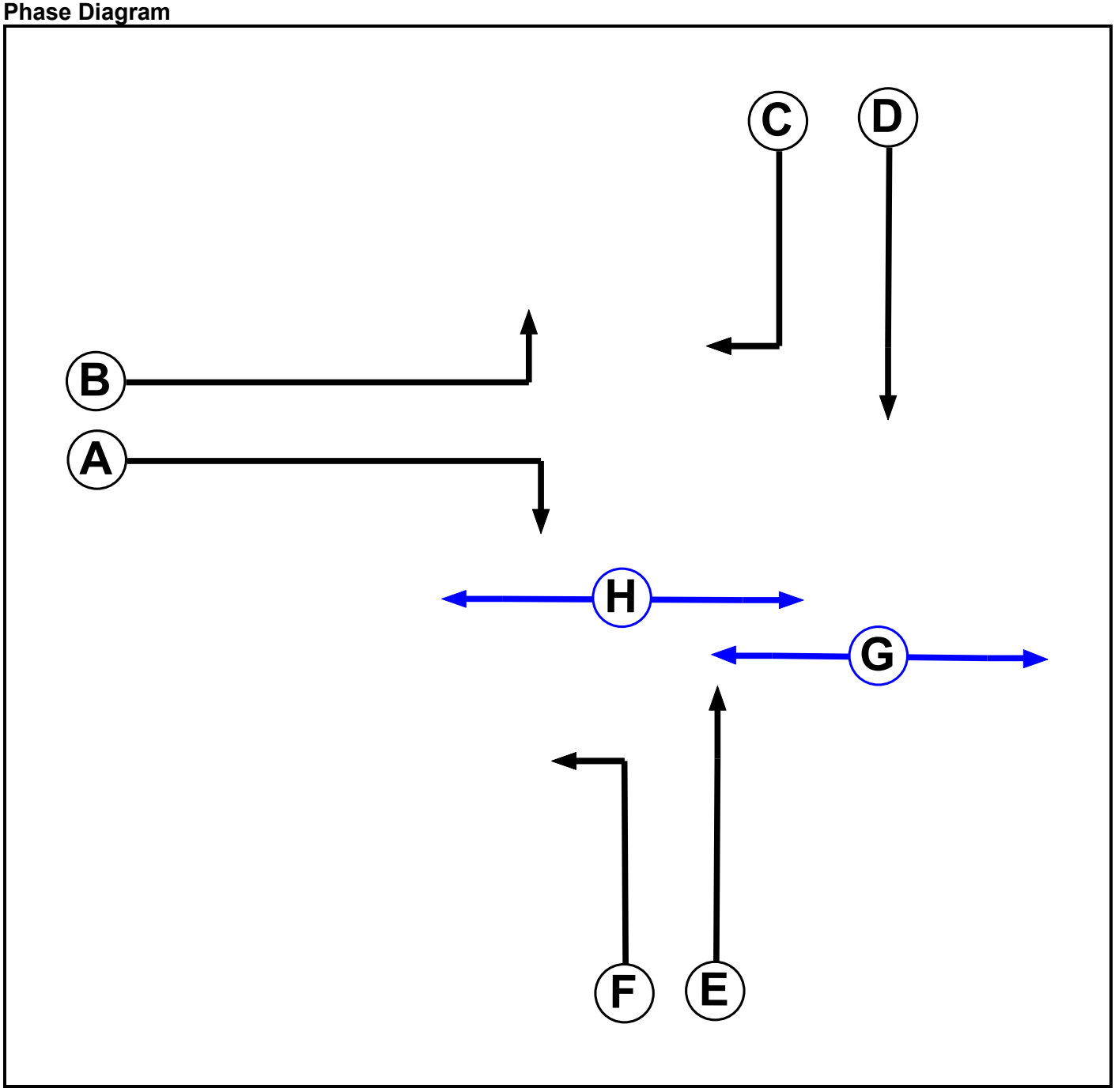
Project:	**101**
Title:	**Holyhead Breakwater Refurbishment Scheme**
Location:	Holyhead
Client:	Anglesey County Council
Site Ref(s):	Holyhead - London Road - East Sig Junction
Design Layout Ref:	Existing
Date Started:	21.03.2021
Date Completed:	28.03.2021
Checked By:	RNE
Checked By Date:	30.03.2021
Additional detail:	
File name:	LinSig Model - Junction 2 (London Road East) (Base + Future + Growth).lsg3x
Author:	Tom Hicks
Company:	Royal HaskoningDHV
Address:	London

Network Layout Diagram



Full Input Data And Results

Phase Diagram



Phase Input Data

Phase Name	Phase Type	Assoc. Phase	Street Min	Cont Min
A	Traffic		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Traffic		7	7
E	Traffic		7	7
F	Traffic		7	7
G	Pedestrian		7	7
H	Pedestrian		7	7

Full Input Data And Results

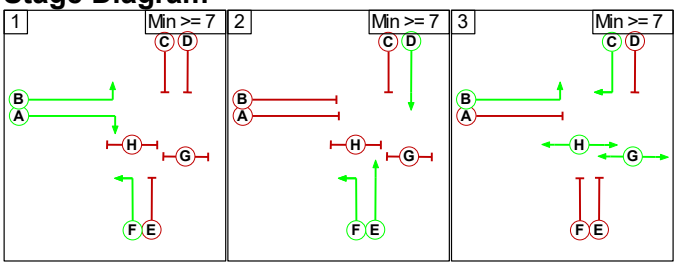
Phase Intergreens Matrix

Terminating Phase	Starting Phase							
	A	B	C	D	E	F	G	H
A		-	5	5	5	-	7	7
B	-		-	5	5	-	-	-
C	5	-		5	5	5	-	-
D	5	5	5		-	-	7	7
E	5	5	5	-		-	7	7
F	-	-	5	-	-		7	7
G	7	-	-	7	7	7		-
H	7	-	-	7	7	7	-	

Phases in Stage

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

Stage Diagram



Phase Delays

Term. Stage	Start Stage	Phase	Type	Value	Cont value
There are no Phase Delays defined					

Prohibited Stage Change

From Stage	To Stage		
	1	2	3
1		5	7
2	5		7
3	7	7	

Full Input Data And Results

Give-Way Lane Input Data

Junction: A5/A55/London Road
There are no Opposed Lanes in this Junction

Full Input Data And Results

Lane Input Data

Junction: A5/A55/London Road

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 (A55 West)	U	B	2	3	5.0	User	1800	-	-	-	-	-
1/2 (A55 West)	U	A	2	3	15.0	Geom	-	3.40	0.00	N	Arm 6 Right	Inf
2/1 (A55 North (SB))	U	D	2	3	13.9	Geom	-	3.40	0.00	Y	Arm 6 Ahead	Inf
2/2 (A55 North (SB))	U	C	2	3	14.8	Geom	-	3.40	0.00	N	Arm 4 Right	16.20
3/1 (A5 (NB))	U	F	2	3	12.2	User	1800	-	-	-	-	-
3/2 (A5 (NB))	U	E	2	3	9.0	Geom	-	3.50	0.00	N	Arm 5 Ahead	Inf
4/1 (A55 West (WB))	U		2	3	15.7	Inf	-	-	-	-	-	-
4/2 (A55 West (WB))	U		2	3	10.4	User	1800	-	-	-	-	-
5/1 (A55 North (NB))	U		2	3	16.5	User	1800	-	-	-	-	-
6/1 (A5 (SB))	U		2	3	60.0	User	1800	-	-	-	-	-

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: 'Base Peak'	11:45	12:45	01:00	
2: 'AM Peak (Base 2018)'	08:00	09:00	01:00	
3: 'Port Peak (2018)'	12:00	13:00	01:00	
4: 'AM Peak (Future Base 2022)'	08:00	09:00	01:00	
5: 'Port Peak (Future Base 2022)'	12:00	13:00	01:00	
6: 'AM Peak + HGV growth (2022)'	08:00	09:00	01:00	
7: 'Port Peak + HGV growth (2022)'	12:00	13:00	01:00	
8: 'AM Peak + HGV + Cons (2022)'	08:00	09:00	01:00	
9: 'Port Peak + HGV + Cons (2022)'	12:00	13:00	01:00	

Scenario 1: 'AM Peak (Base 2018)' (FG2: 'AM Peak (Base 2018)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	266	125	391
	B	228	0	52	280
	C	193	45	0	238
	Tot.	421	311	177	909

Traffic Lane Flows

Lane	Scenario 1: AM Peak (Base 2018)
Junction: A5/A55/London Road	
1/1 (short)	266
1/2 (with short)	391(In) 125(Out)
2/1	52
2/2	228
3/1 (short)	193
3/2 (with short)	238(In) 45(Out)
4/1	421
4/2	0
5/1	311
6/1	177

Full Input Data And Results

Lane Saturation Flows

Junction: A5/A55/London Road								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 West Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
1/2 (A55 West)	3.40	0.00	N	Arm 6 Right	Inf	100.0 %	2095	2095
2/1 (A55 North (SB))	3.40	0.00	Y	Arm 6 Ahead	Inf	100.0 %	1955	1955
2/2 (A55 North (SB))	3.40	0.00	N	Arm 4 Right	16.20	100.0 %	1917	1917
3/1 (A5 (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
3/2 (A5 (NB))	3.50	0.00	N	Arm 5 Ahead	Inf	100.0 %	2105	2105
4/1 (A55 West (WB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 West (WB) Lane 2)	This lane uses a directly entered Saturation Flow						1800	1800
5/1 (A55 North (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
6/1 (A5 (SB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800

Scenario 2: 'Port Peak (Base 2018)' (FG3: 'Port Peak (2018)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	416	162	578
	B	476	0	76	552
	C	152	66	0	218
	Tot.	628	482	238	1348

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 2: Port Peak (Base 2018)
Junction: A5/A55/London Road	
1/1 (short)	416
1/2 (with short)	578(In) 162(Out)
2/1	76
2/2	476
3/1 (short)	152
3/2 (with short)	218(In) 66(Out)
4/1	628
4/2	0
5/1	482
6/1	238

Lane Saturation Flows

Junction: A5/A55/London Road								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 West Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
1/2 (A55 West)	3.40	0.00	N	Arm 6 Right	Inf	100.0 %	2095	2095
2/1 (A55 North (SB))	3.40	0.00	Y	Arm 6 Ahead	Inf	100.0 %	1955	1955
2/2 (A55 North (SB))	3.40	0.00	N	Arm 4 Right	16.20	100.0 %	1917	1917
3/1 (A5 (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
3/2 (A5 (NB))	3.50	0.00	N	Arm 5 Ahead	Inf	100.0 %	2105	2105
4/1 (A55 West (WB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 West (WB) Lane 2)	This lane uses a directly entered Saturation Flow						1800	1800
5/1 (A55 North (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
6/1 (A5 (SB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800

Full Input Data And Results

Scenario 3: 'AM Peak + HGV growth (2022)' (FG6: 'AM Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	295	132	427
	B	252	0	55	307
	C	204	48	0	252
	Tot.	456	343	187	986

Traffic Lane Flows

Lane	Scenario 3: AM Peak + HGV growth (2022)
Junction: A5/A55/London Road	
1/1 (short)	295
1/2 (with short)	427(In) 132(Out)
2/1	55
2/2	252
3/1 (short)	204
3/2 (with short)	252(In) 48(Out)
4/1	456
4/2	0
5/1	343
6/1	187

Full Input Data And Results

Lane Saturation Flows

Junction: A5/A55/London Road								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 West Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
1/2 (A55 West)	3.40	0.00	N	Arm 6 Right	Inf	100.0 %	2095	2095
2/1 (A55 North (SB))	3.40	0.00	Y	Arm 6 Ahead	Inf	100.0 %	1955	1955
2/2 (A55 North (SB))	3.40	0.00	N	Arm 4 Right	16.20	100.0 %	1917	1917
3/1 (A5 (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
3/2 (A5 (NB))	3.50	0.00	N	Arm 5 Ahead	Inf	100.0 %	2105	2105
4/1 (A55 West (WB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 West (WB) Lane 2)	This lane uses a directly entered Saturation Flow						1800	1800
5/1 (A55 North (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
6/1 (A5 (SB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800

Scenario 4: 'Port Peak + HGV growth (2022)' (FG7: 'Port Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	479	171	650
	B	544	0	81	625
	C	161	70	0	231
	Tot.	705	549	252	1506

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 4: Port Peak + HGV growth (2022)
Junction: A5/A55/London Road	
1/1 (short)	479
1/2 (with short)	650(In) 171(Out)
2/1	81
2/2	544
3/1 (short)	161
3/2 (with short)	231(In) 70(Out)
4/1	705
4/2	0
5/1	549
6/1	252

Lane Saturation Flows

Junction: A5/A55/London Road								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 West Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
1/2 (A55 West)	3.40	0.00	N	Arm 6 Right	Inf	100.0 %	2095	2095
2/1 (A55 North (SB))	3.40	0.00	Y	Arm 6 Ahead	Inf	100.0 %	1955	1955
2/2 (A55 North (SB))	3.40	0.00	N	Arm 4 Right	16.20	100.0 %	1917	1917
3/1 (A5 (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
3/2 (A5 (NB))	3.50	0.00	N	Arm 5 Ahead	Inf	100.0 %	2105	2105
4/1 (A55 West (WB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 West (WB) Lane 2)	This lane uses a directly entered Saturation Flow						1800	1800
5/1 (A55 North (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
6/1 (A5 (SB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800

Full Input Data And Results

Scenario 5: 'AM Peak + HGV + Cons (2022)' (FG8: 'AM Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	343	132	475
	B	299	0	55	354
	C	204	48	0	252
	Tot.	503	391	187	1081

Traffic Lane Flows

Lane	Scenario 5: AM Peak + HGV + Cons (2022)
Junction: A5/A55/London Road	
1/1 (short)	343
1/2 (with short)	475(In) 132(Out)
2/1	55
2/2	299
3/1 (short)	204
3/2 (with short)	252(In) 48(Out)
4/1	503
4/2	0
5/1	391
6/1	187

Full Input Data And Results

Lane Saturation Flows

Junction: A5/A55/London Road								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 West Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
1/2 (A55 West)	3.40	0.00	N	Arm 6 Right	Inf	100.0 %	2095	2095
2/1 (A55 North (SB))	3.40	0.00	Y	Arm 6 Ahead	Inf	100.0 %	1955	1955
2/2 (A55 North (SB))	3.40	0.00	N	Arm 4 Right	16.20	100.0 %	1917	1917
3/1 (A5 (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
3/2 (A5 (NB))	3.50	0.00	N	Arm 5 Ahead	Inf	100.0 %	2105	2105
4/1 (A55 West (WB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 West (WB) Lane 2)	This lane uses a directly entered Saturation Flow						1800	1800
5/1 (A55 North (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
6/1 (A5 (SB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800

Scenario 6: 'Port Peak + HGV + Cons (2022)' (FG9: 'Port Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	526	171	697
	B	591	0	81	672
	C	161	70	0	231
	Tot.	752	596	252	1600

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 6: Port Peak + HGV + Cons (2022)
Junction: A5/A55/London Road	
1/1 (short)	526
1/2 (with short)	697(In) 171(Out)
2/1	81
2/2	591
3/1 (short)	161
3/2 (with short)	231(In) 70(Out)
4/1	752
4/2	0
5/1	596
6/1	252

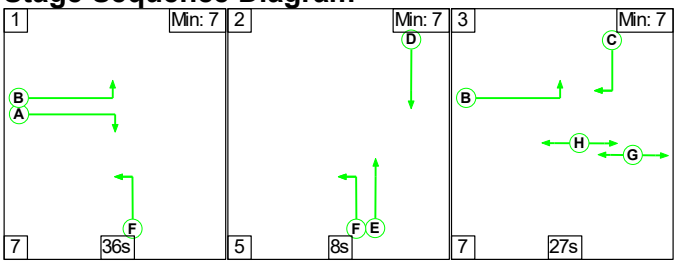
Lane Saturation Flows

Junction: A5/A55/London Road								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 West Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
1/2 (A55 West)	3.40	0.00	N	Arm 6 Right	Inf	100.0 %	2095	2095
2/1 (A55 North (SB))	3.40	0.00	Y	Arm 6 Ahead	Inf	100.0 %	1955	1955
2/2 (A55 North (SB))	3.40	0.00	N	Arm 4 Right	16.20	100.0 %	1917	1917
3/1 (A5 (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
3/2 (A5 (NB))	3.50	0.00	N	Arm 5 Ahead	Inf	100.0 %	2105	2105
4/1 (A55 West (WB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 West (WB) Lane 2)	This lane uses a directly entered Saturation Flow						1800	1800
5/1 (A55 North (NB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800
6/1 (A5 (SB) Lane 1)	This lane uses a directly entered Saturation Flow						1800	1800

Full Input Data And Results

Scenario 1: 'AM Peak (Base 2018)' (FG2: 'AM Peak (Base 2018)', Plan 1: 'Network Control Plan 1')

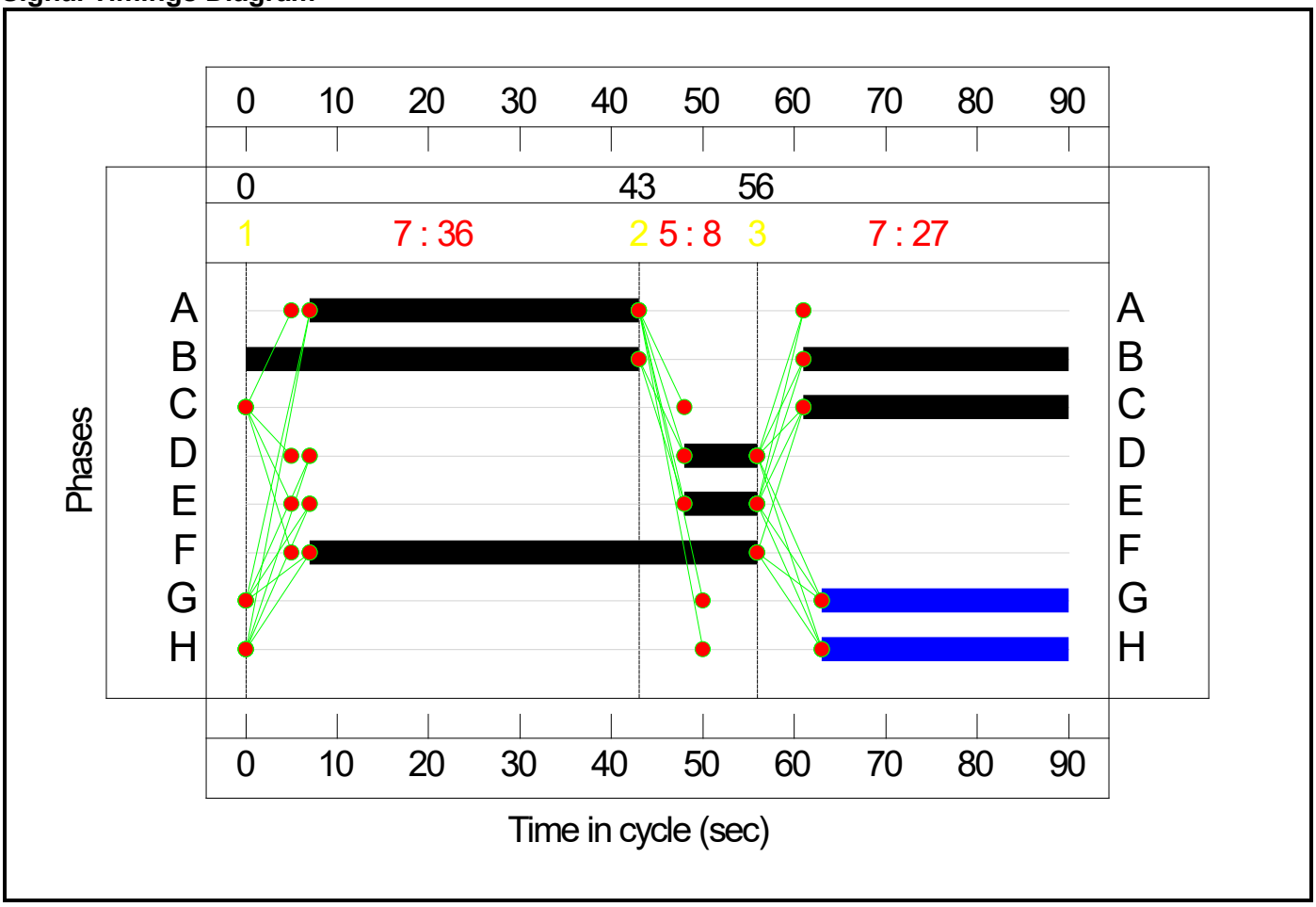
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	36	8	27
Change Point	0	43	56

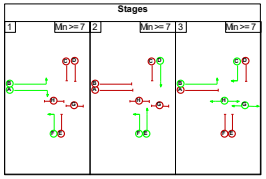
Signal Timings Diagram

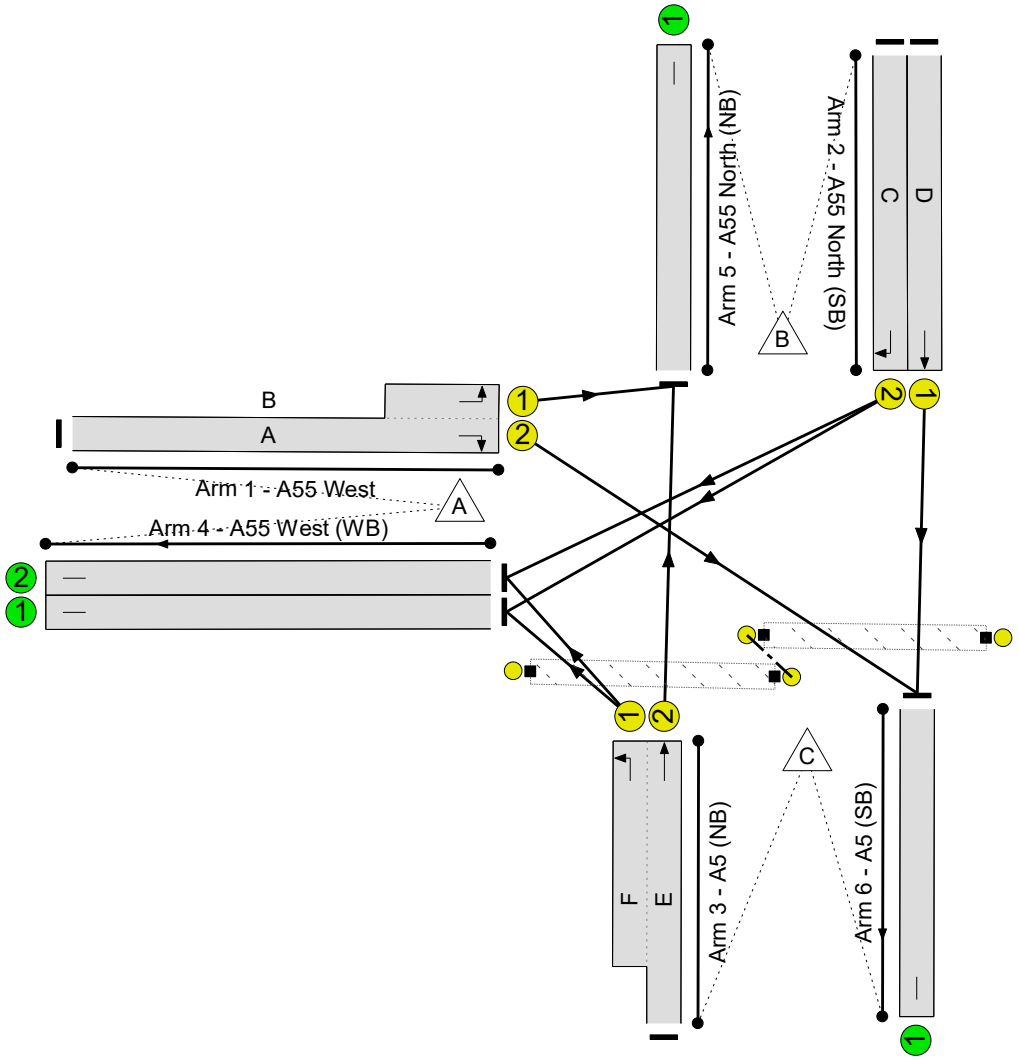


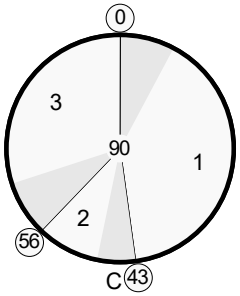
Full Input Data And Results

Network Layout Diagram

A5/A55/London Road
PRC: 152.2 %
Total Traffic Delay: 4.7 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped







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: Holyhead Breakwater Refurbishment Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**35.7%**
A5/A55/London Road	-	-	**N/A**	-	-		-	-	-	-	-	-	**35.7%**
1/2+1/1	A55 West Left Right	U	N/A	N/A	A B		1	36:72	-	391	2095:1800	387+825	32.3 : 32.3%
2/1	A55 North (SB) Ahead	U	N/A	N/A	D		1	8	-	52	1955	196	26.6%
2/2	A55 North (SB) Right	U	N/A	N/A	C		1	29	-	228	1917	639	35.7%
3/2+3/1	A5 (NB) Left Ahead	U	N/A	N/A	E F		1	8:49	-	238	2105:1800	210+919	21.4 : 21.0%
4/1	A55 West (WB)	U	N/A	N/A	-		-	-	-	421	Inf	Inf	0.0%
4/2	A55 West (WB)	U	N/A	N/A	-		-	-	-	0	1800	1800	0.0%
5/1	A55 North (NB)	U	N/A	N/A	-		-	-	-	311	1800	1800	17.3%
6/1	A5 (SB)	U	N/A	N/A	-		-	-	-	177	1800	1800	9.8%
Ped Link: P1	Western Crossing	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Eastern Crossing	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

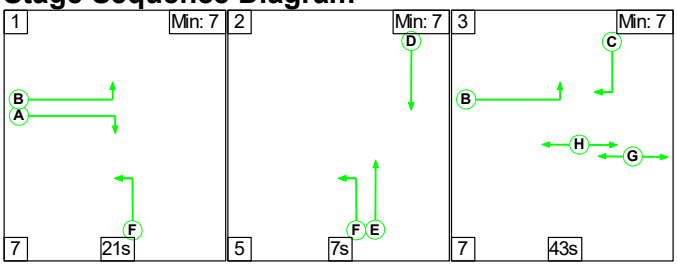
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Holyhead Breakwater Refurbishment Scheme	**-**	**-**	**0**	**0**	**0**	**3.7**	**1.0**	**0.0**	**4.7**	**-**	**-**	**-**	**-**
A5/A55/London Road	**-**	**-**	**0**	**0**	**0**	**3.7**	**1.0**	**0.0**	**4.7**	**-**	**-**	**-**	**-**
1/2+1/1	391	391	-	-	-	0.7	0.2	-	1.0	8.8	1.9	0.2	2.2
2/1	52	52	-	-	-	0.5	0.2	-	0.7	50.0	1.2	0.2	1.4
2/2	228	228	-	-	-	1.4	0.3	-	1.7	27.1	4.3	0.3	4.6
3/2+3/1	238	238	-	-	-	1.0	0.1	-	1.1	17.1	2.4	0.1	2.5
4/1	421	421	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	0	0	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	311	311	-	-	-	0.0	0.1	-	0.1	1.2	0.0	0.1	0.1
6/1	177	177	-	-	-	0.0	0.1	-	0.1	1.1	0.0	0.1	0.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 152.2 Total Delay for Signalled Lanes (pcuHr): 4.53 Cycle Time (s): 90
PRC Over All Lanes (%): 152.2 Total Delay Over All Lanes(pcuHr): 4.68

Full Input Data And Results

Scenario 2: 'Port Peak (Base 2018)' (FG3: 'Port Peak (2018)', Plan 1: 'Network Control Plan 1')

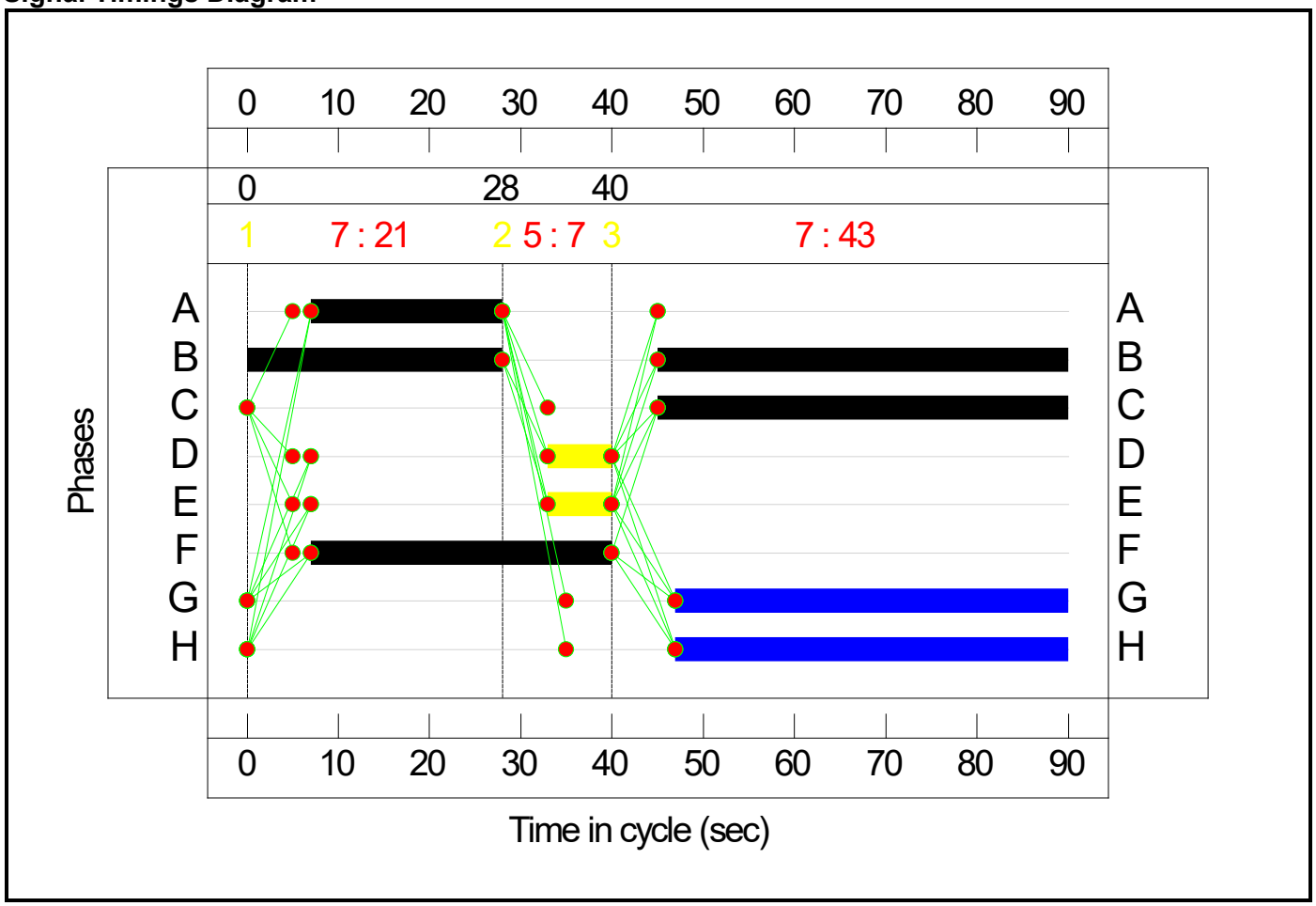
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	21	7	43
Change Point	0	28	40

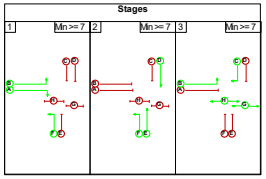
Signal Timings Diagram

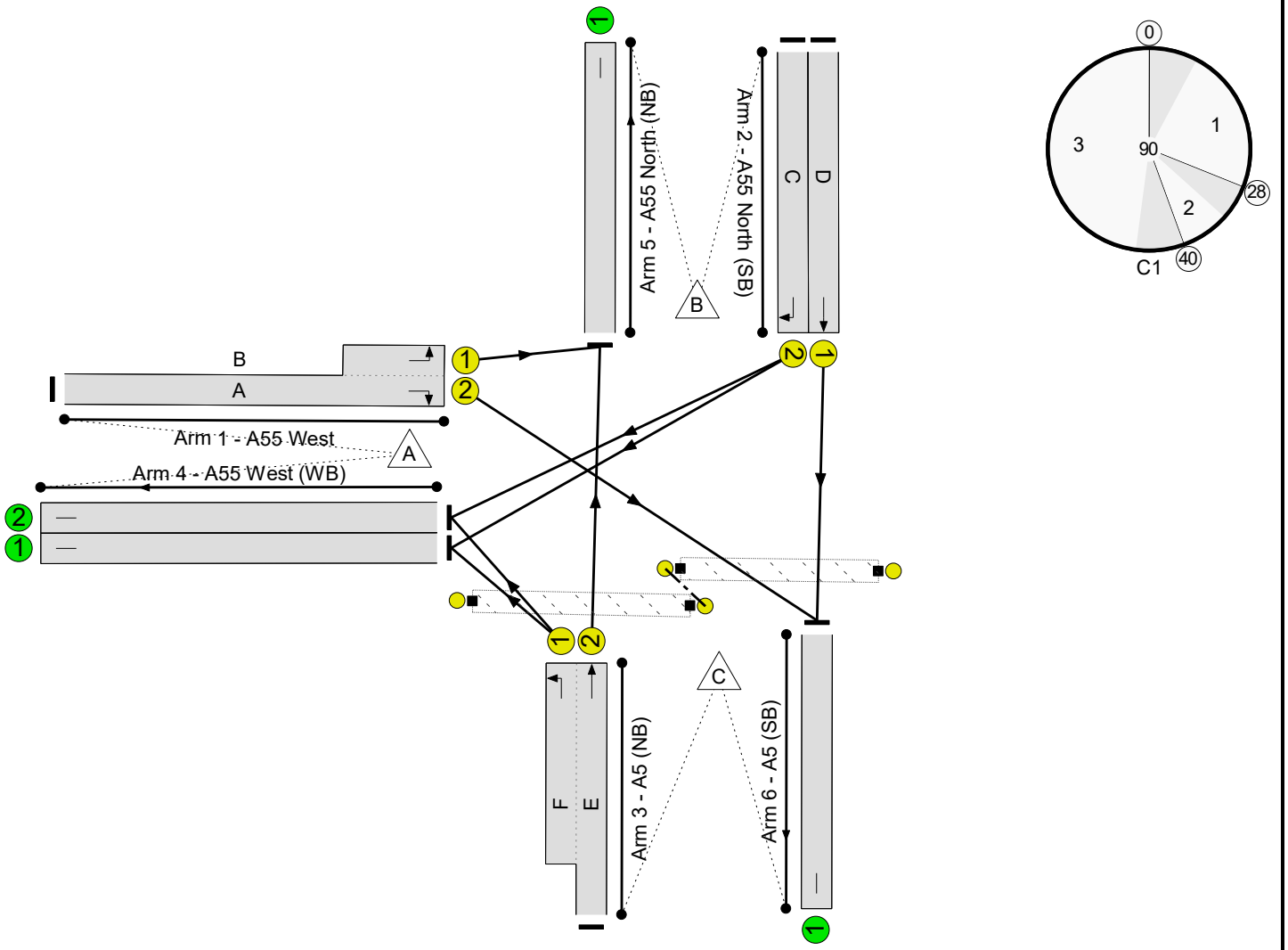


Full Input Data And Results

Network Layout Diagram

A5/A55/London Road
PRC: 53.3 %
Total Traffic Delay: 7.7 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped





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: Holyhead Breakwater Refurbishment Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**58.7%**
A5/A55/London Road	-	-	**N/A**	-	-		-	-	-	-	-	-	**58.7%**
1/2+1/1	A55 West Left Right	U	N/A	N/A	A B		1	21:73	-	578	2095:1800	276+708	58.7 : 58.7%
2/1	A55 North (SB) Ahead	U	N/A	N/A	D		1	7	-	76	1955	174	43.7%
2/2	A55 North (SB) Right	U	N/A	N/A	C		1	45	-	476	1917	980	48.6%
3/2+3/1	A5 (NB) Left Ahead	U	N/A	N/A	E F		1	7:33	-	218	2105:1800	187+632	35.3 : 24.1%
4/1	A55 West (WB)	U	N/A	N/A	-		-	-	-	628	Inf	Inf	0.0%
4/2	A55 West (WB)	U	N/A	N/A	-		-	-	-	0	1800	1800	0.0%
5/1	A55 North (NB)	U	N/A	N/A	-		-	-	-	482	1800	1800	26.8%
6/1	A5 (SB)	U	N/A	N/A	-		-	-	-	238	1800	1800	13.2%
Ped Link: P1	Western Crossing	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Eastern Crossing	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

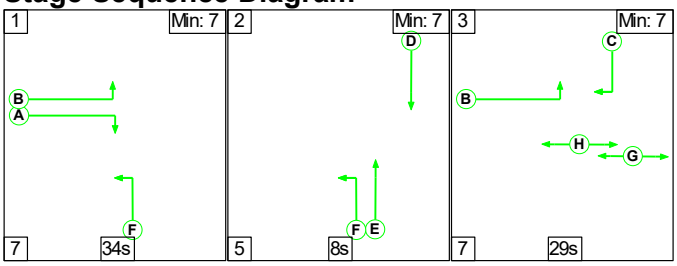
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Holyhead Breakwater Refurbishment Scheme	**-**	**-**	**0**	**0**	**0**	**5.7**	**2.0**	**0.0**	**7.7**	**-**	**-**	**-**	**-**
A5/A55/London Road	**-**	**-**	**0**	**0**	**0**	**5.7**	**2.0**	**0.0**	**7.7**	**-**	**-**	**-**	**-**
1/2+1/1	578	578	-	-	-	1.5	0.7	-	2.2	13.6	3.3	0.7	4.0
2/1	76	76	-	-	-	0.8	0.4	-	1.2	57.2	1.8	0.4	2.2
2/2	476	476	-	-	-	1.9	0.5	-	2.4	17.9	7.7	0.5	8.1
3/2+3/1	218	218	-	-	-	1.5	0.2	-	1.7	28.0	2.6	0.2	2.8
4/1	628	628	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	0	0	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	482	482	-	-	-	0.0	0.2	-	0.2	1.4	0.0	0.2	0.2
6/1	238	238	-	-	-	0.0	0.1	-	0.1	1.2	1.5	0.1	1.6
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 53.3 Total Delay for Signalled Lanes (pcuHr): 7.44 Cycle Time (s): 90
PRC Over All Lanes (%): 53.3 Total Delay Over All Lanes(pcuHr): 7.70

Full Input Data And Results

Scenario 3: 'AM Peak + HGV growth (2022)' (FG6: 'AM Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

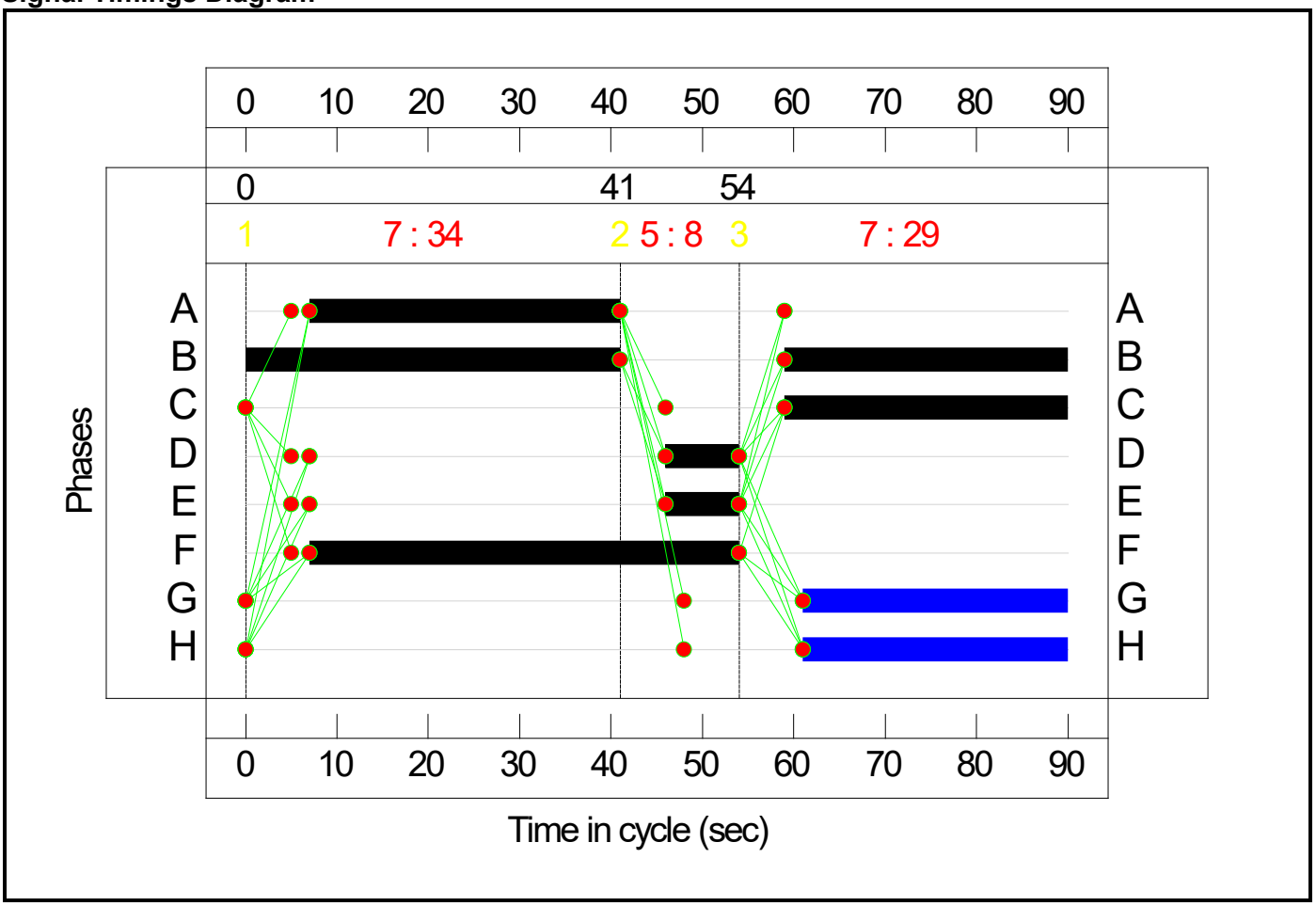
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	34	8	29
Change Point	0	41	54

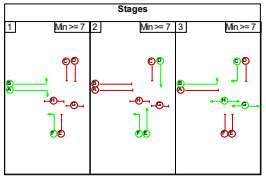
Signal Timings Diagram

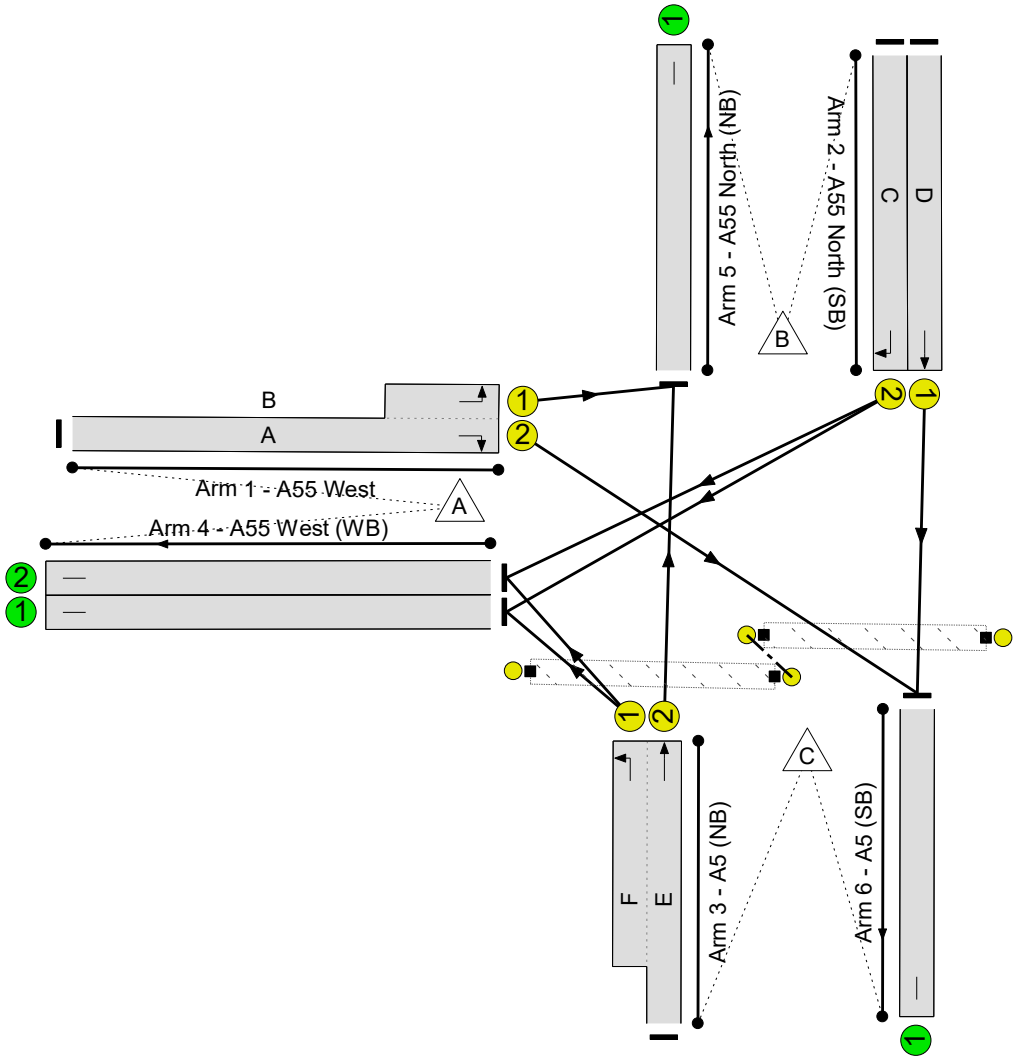


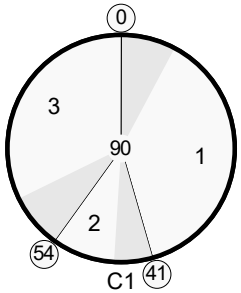
Full Input Data And Results

Network Layout Diagram

A5/A55/London Road
PRC: 143.4 %
Total Traffic Delay: 5.1 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped







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: Holyhead Breakwater Refurbishment Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**37.0%**
A5/A55/London Road	-	-	**N/A**	-	-		-	-	-	-	-	-	**37.0%**
1/2+1/1	A55 West Left Right	U	N/A	N/A	A B		1	34:72	-	427	2095:1800	368+823	35.9 : 35.9%
2/1	A55 North (SB) Ahead	U	N/A	N/A	D		1	8	-	55	1955	196	28.1%
2/2	A55 North (SB) Right	U	N/A	N/A	C		1	31	-	252	1917	682	37.0%
3/2+3/1	A5 (NB) Left Ahead	U	N/A	N/A	E F		1	8:47	-	252	2105:1800	208+885	23.1 : 23.1%
4/1	A55 West (WB)	U	N/A	N/A	-		-	-	-	456	Inf	Inf	0.0%
4/2	A55 West (WB)	U	N/A	N/A	-		-	-	-	0	1800	1800	0.0%
5/1	A55 North (NB)	U	N/A	N/A	-		-	-	-	343	1800	1800	19.1%
6/1	A5 (SB)	U	N/A	N/A	-		-	-	-	187	1800	1800	10.4%
Ped Link: P1	Western Crossing	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Eastern Crossing	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

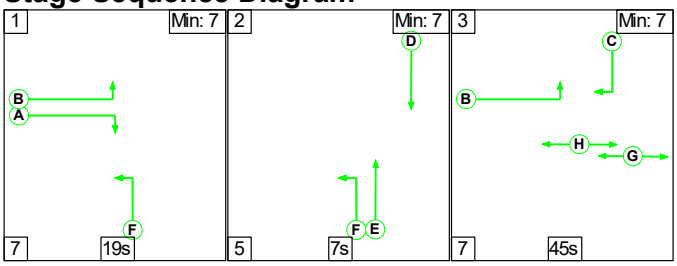
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Holyhead Breakwater Refurbishment Scheme	**-**	**-**	**0**	**0**	**0**	**4.0**	**1.1**	**0.0**	**5.1**	**-**	**-**	**-**	**-**
A5/A55/London Road	**-**	**-**	**0**	**0**	**0**	**4.0**	**1.1**	**0.0**	**5.1**	**-**	**-**	**-**	**-**
1/2+1/1	427	427	-	-	-	0.8	0.3	-	1.1	9.2	2.1	0.3	2.4
2/1	55	55	-	-	-	0.6	0.2	-	0.8	50.3	1.3	0.2	1.5
2/2	252	252	-	-	-	1.5	0.3	-	1.8	25.7	4.6	0.3	4.9
3/2+3/1	252	252	-	-	-	1.1	0.1	-	1.3	18.2	2.7	0.1	2.8
4/1	456	456	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	0	0	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	343	343	-	-	-	0.0	0.1	-	0.1	1.2	0.0	0.1	0.1
6/1	187	187	-	-	-	0.0	0.1	-	0.1	1.1	0.0	0.1	0.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 143.4 Total Delay for Signalled Lanes (pcuHr): 4.94 Cycle Time (s): 90
PRC Over All Lanes (%): 143.4 Total Delay Over All Lanes(pcuHr): 5.11

Full Input Data And Results

Scenario 4: 'Port Peak + HGV growth (2022)' (FG7: 'Port Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

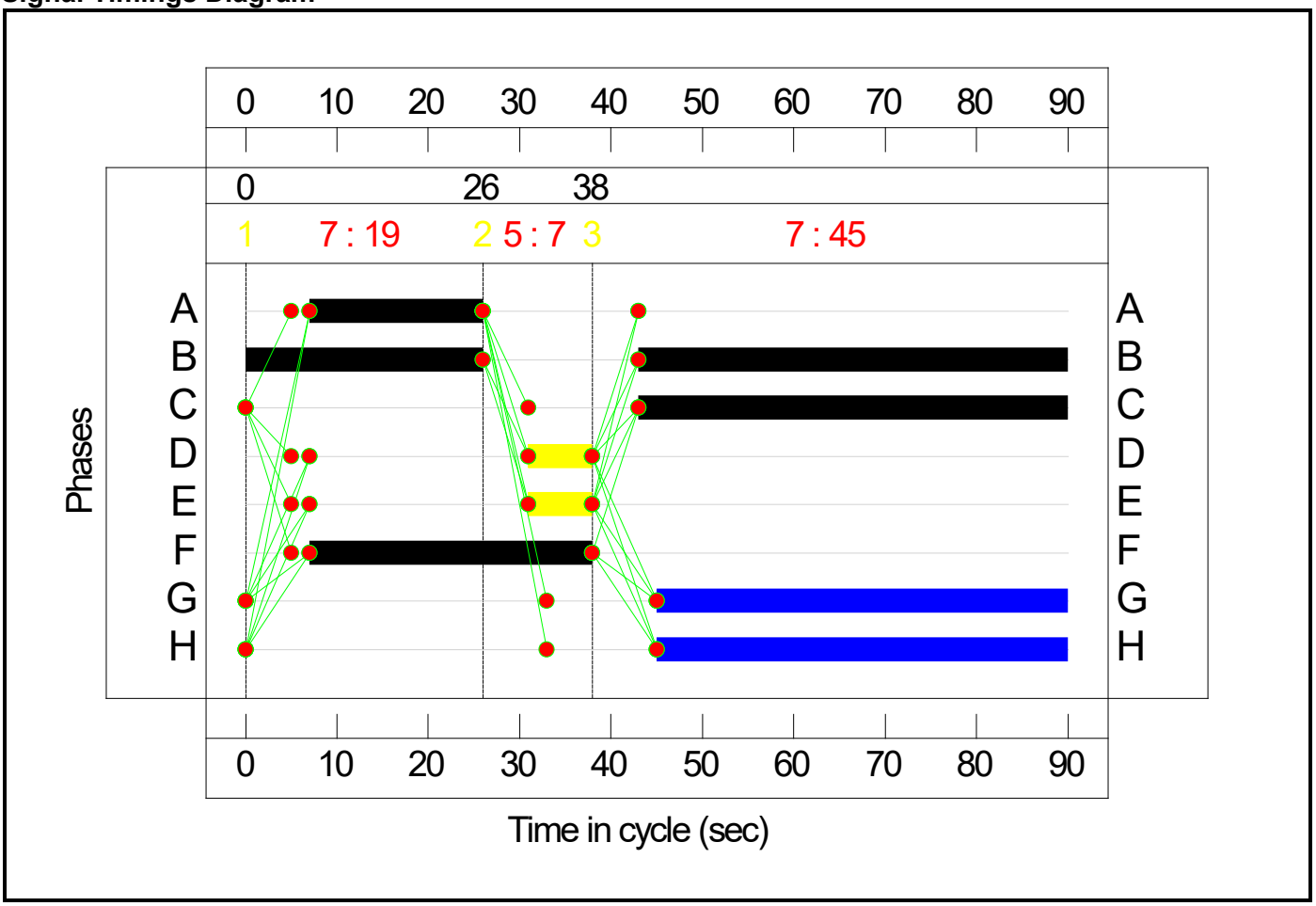
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	19	7	45
Change Point	0	26	38

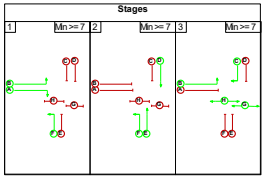
Signal Timings Diagram

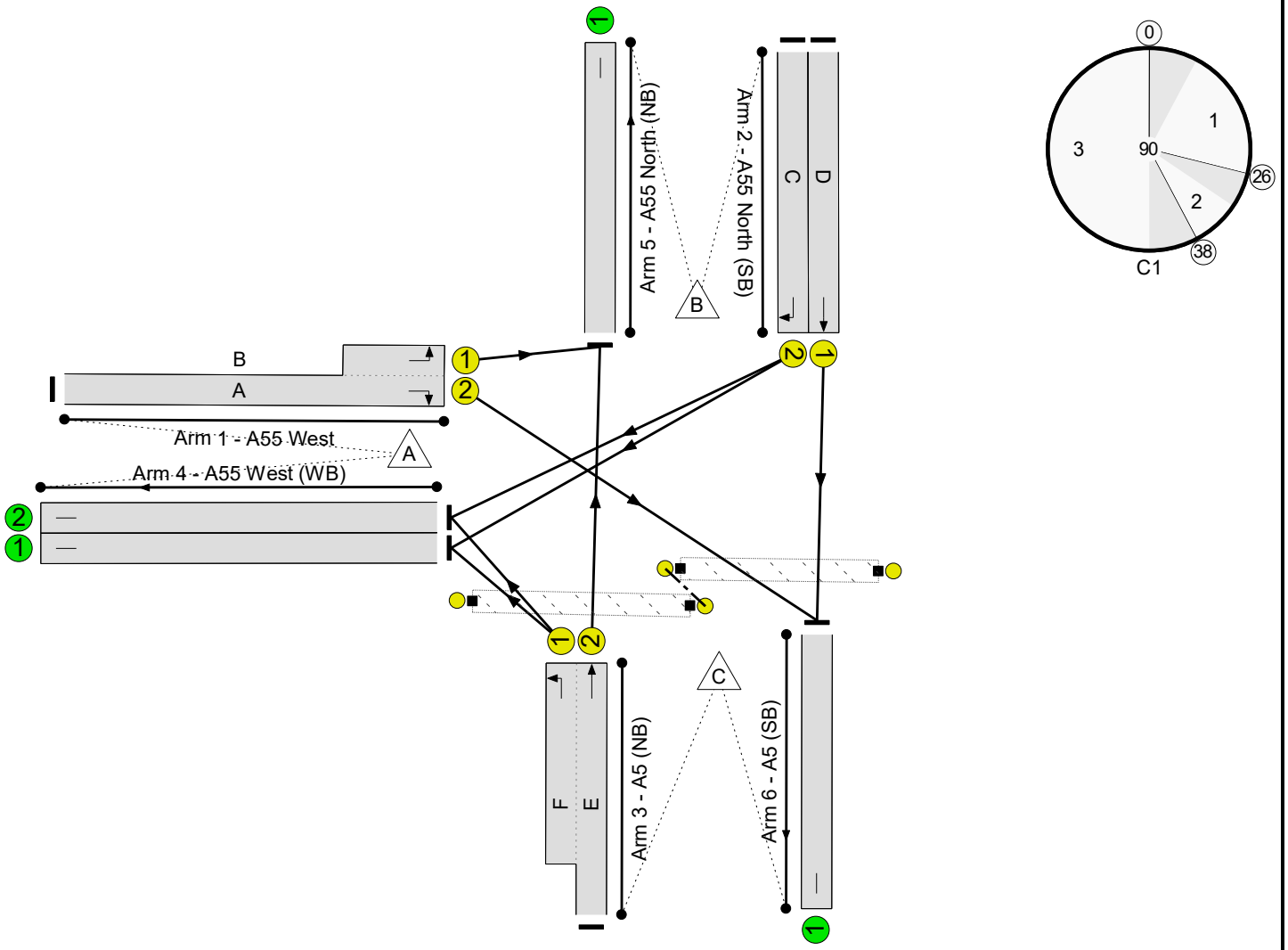


Full Input Data And Results

Network Layout Diagram

A5/A55/London Road
PRC: 36.9 %
Total Traffic Delay: 8.7 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped





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: Holyhead Breakwater Refurbishment Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**65.7%**
A5/A55/London Road	-	-	**N/A**	-	-		-	-	-	-	-	-	**65.7%**
1/2+1/1	A55 West Left Right	U	N/A	N/A	A B		1	19:73	-	650	2095:1800	260+729	65.7 : 65.7%
2/1	A55 North (SB) Ahead	U	N/A	N/A	D		1	7	-	81	1955	174	46.6%
2/2	A55 North (SB) Right	U	N/A	N/A	C		1	47	-	544	1917	1022	53.2%
3/2+3/1	A5 (NB) Left Ahead	U	N/A	N/A	E F		1	7:31	-	231	2105:1800	187+602	37.4 : 26.7%
4/1	A55 West (WB)	U	N/A	N/A	-		-	-	-	705	Inf	Inf	0.0%
4/2	A55 West (WB)	U	N/A	N/A	-		-	-	-	0	1800	1800	0.0%
5/1	A55 North (NB)	U	N/A	N/A	-		-	-	-	549	1800	1800	30.5%
6/1	A5 (SB)	U	N/A	N/A	-		-	-	-	252	1800	1800	14.0%
Ped Link: P1	Western Crossing	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Eastern Crossing	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

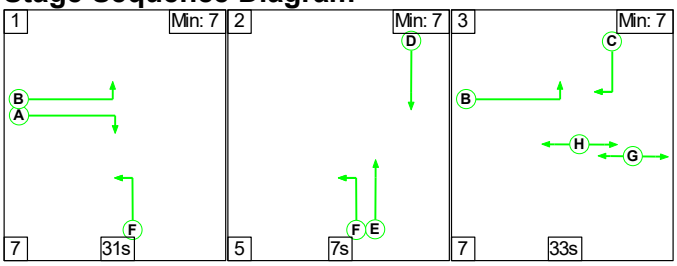
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Holyhead Breakwater Refurbishment Scheme	**-**	**-**	**0**	**0**	**0**	**6.3**	**2.5**	**0.0**	**8.7**	**-**	**-**	**-**	**-**
A5/A55/London Road	**-**	**-**	**0**	**0**	**0**	**6.3**	**2.5**	**0.0**	**8.7**	**-**	**-**	**-**	**-**
1/2+1/1	650	650	-	-	-	1.7	1.0	-	2.6	14.5	3.6	1.0	4.6
2/1	81	81	-	-	-	0.9	0.4	-	1.3	58.2	1.9	0.4	2.3
2/2	544	544	-	-	-	2.1	0.6	-	2.6	17.4	8.8	0.6	9.3
3/2+3/1	231	231	-	-	-	1.7	0.2	-	1.9	29.3	2.8	0.2	3.0
4/1	705	705	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	0	0	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	549	549	-	-	-	0.0	0.2	-	0.2	1.4	0.0	0.2	0.2
6/1	252	252	-	-	-	0.0	0.1	-	0.1	1.2	2.0	0.1	2.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 36.9 Total Delay for Signalled Lanes (pcuHr): 8.44 Cycle Time (s): 90
PRC Over All Lanes (%): 36.9 Total Delay Over All Lanes(pcuHr): 8.75

Full Input Data And Results

Scenario 5: 'AM Peak + HGV + Cons (2022)' (FG8: 'AM Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

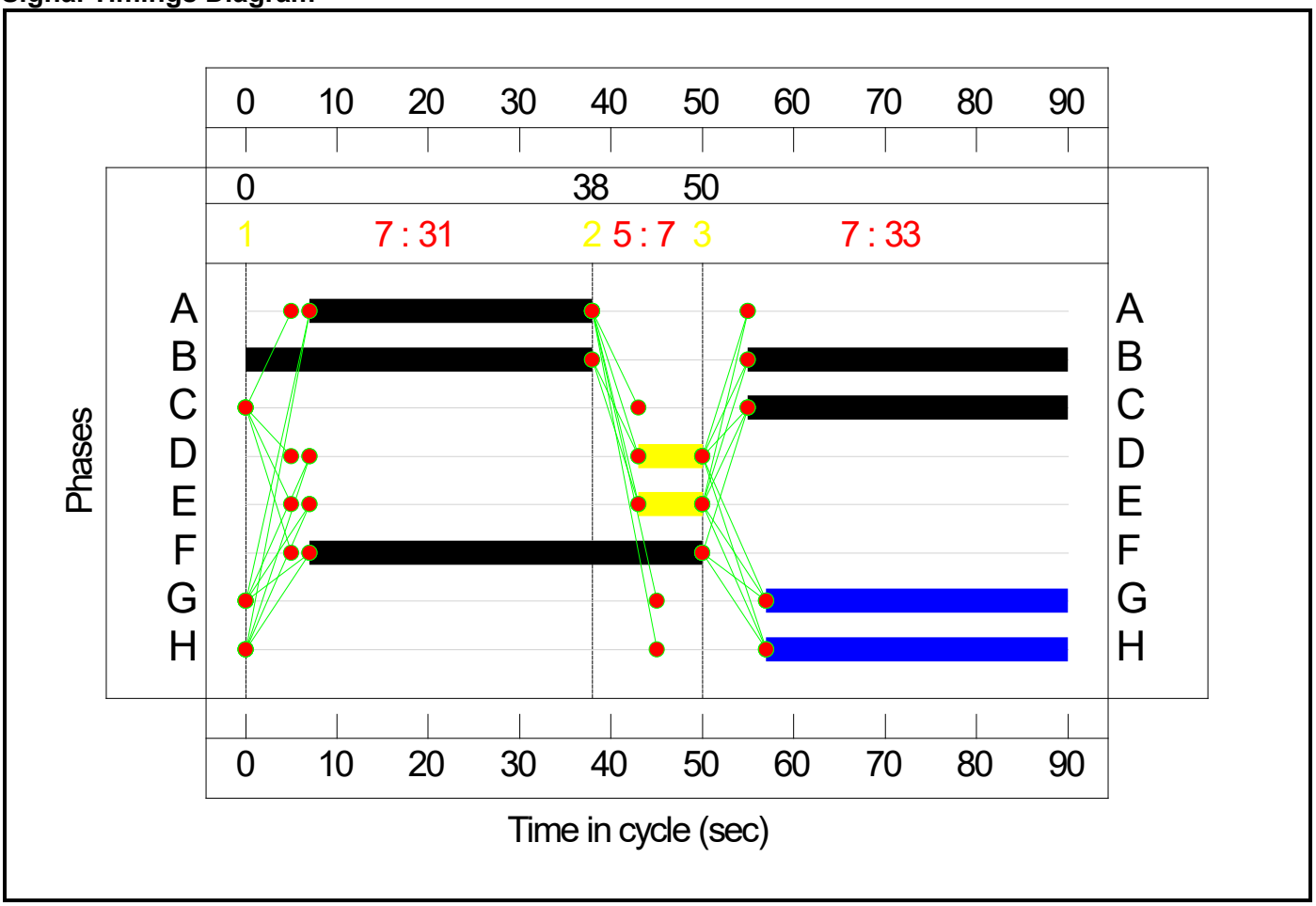
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	31	7	33
Change Point	0	38	50

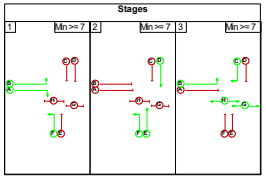
Signal Timings Diagram

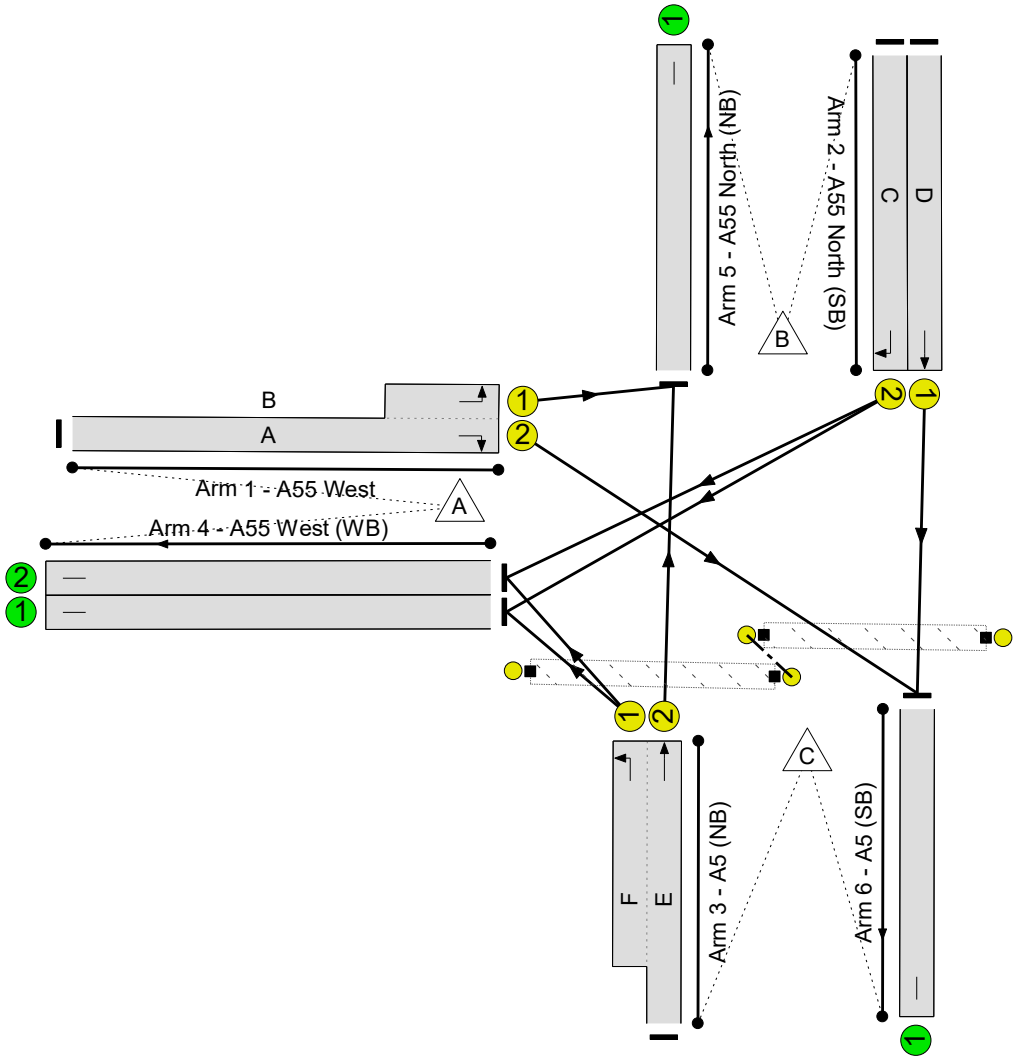


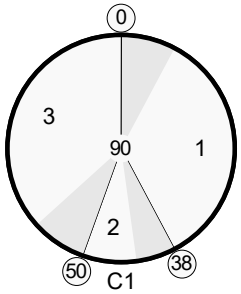
Full Input Data And Results

Network Layout Diagram

A5/A55/London Road
PRC: 127.1 %
Total Traffic Delay: 5.6 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped







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: Holyhead Breakwater Refurbishment Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**39.6%**
A5/A55/London Road	-	-	**N/A**	-	-		-	-	-	-	-	-	**39.6%**
1/2+1/1	A55 West Left Right	U	N/A	N/A	A B		1	31:73	-	475	2095:1800	333+865	39.6 : 39.6%
2/1	A55 North (SB) Ahead	U	N/A	N/A	D		1	7	-	55	1955	174	31.6%
2/2	A55 North (SB) Right	U	N/A	N/A	C		1	35	-	299	1917	767	39.0%
3/2+3/1	A5 (NB) Left Ahead	U	N/A	N/A	E F		1	7:43	-	252	2105:1800	187+818	25.7 : 24.9%
4/1	A55 West (WB)	U	N/A	N/A	-		-	-	-	503	Inf	Inf	0.0%
4/2	A55 West (WB)	U	N/A	N/A	-		-	-	-	0	1800	1800	0.0%
5/1	A55 North (NB)	U	N/A	N/A	-		-	-	-	391	1800	1800	21.7%
6/1	A5 (SB)	U	N/A	N/A	-		-	-	-	187	1800	1800	10.4%
Ped Link: P1	Western Crossing	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Eastern Crossing	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

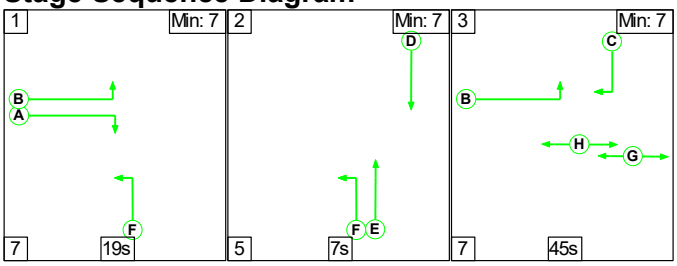
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network: Holyhead Breakwater Refurbishment Scheme	**-**	**-**	**0**	**0**	**0**	**4.3**	**1.2**	**0.0**	**5.6**	**-**	**-**	**-**	**-**
A5/A55/London Road	**-**	**-**	**0**	**0**	**0**	**4.3**	**1.2**	**0.0**	**5.6**	**-**	**-**	**-**	**-**
1/2+1/1	475	475	-	-	-	0.9	0.3	-	1.2	9.3	2.2	0.3	2.6
2/1	55	55	-	-	-	0.6	0.2	-	0.8	53.6	1.3	0.2	1.5
2/2	299	299	-	-	-	1.6	0.3	-	1.9	23.0	5.2	0.3	5.6
3/2+3/1	252	252	-	-	-	1.3	0.2	-	1.4	20.4	2.9	0.2	3.1
4/1	503	503	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	0	0	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	391	391	-	-	-	0.0	0.1	-	0.1	1.3	0.0	0.1	0.1
6/1	187	187	-	-	-	0.0	0.1	-	0.1	1.1	0.0	0.1	0.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 127.1 Total Delay for Signalled Lanes (pcuHr): 5.39 Cycle Time (s): 90
PRC Over All Lanes (%): 127.1 Total Delay Over All Lanes(pcuHr): 5.58

Full Input Data And Results

Scenario 6: 'Port Peak + HGV + Cons (2022)' (FG9: 'Port Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

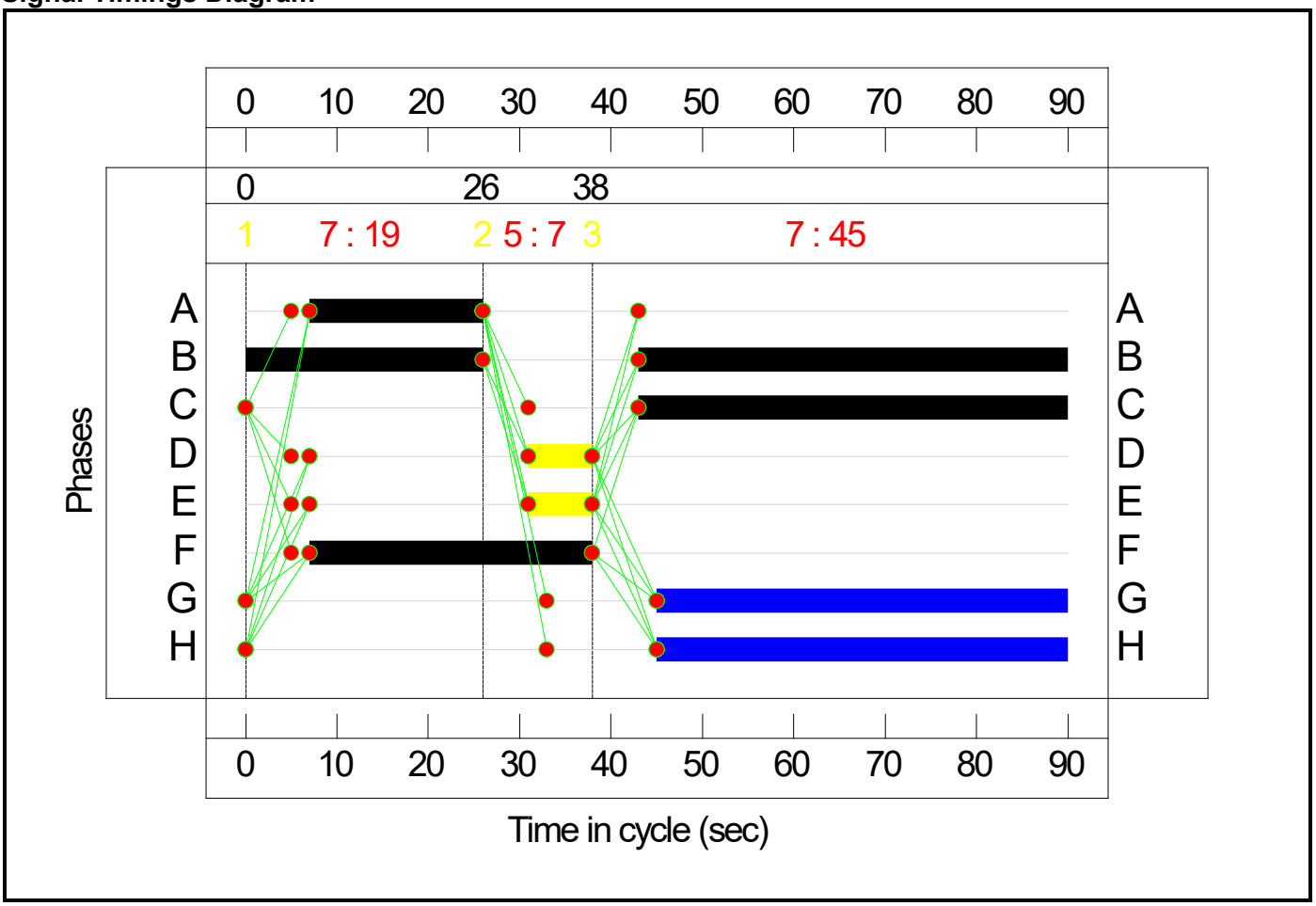
Stage Sequence Diagram



Stage Timings

Stage	1	2	3
Duration	19	7	45
Change Point	0	26	38

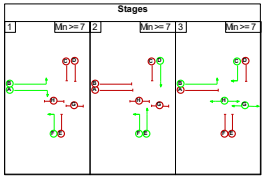
Signal Timings Diagram

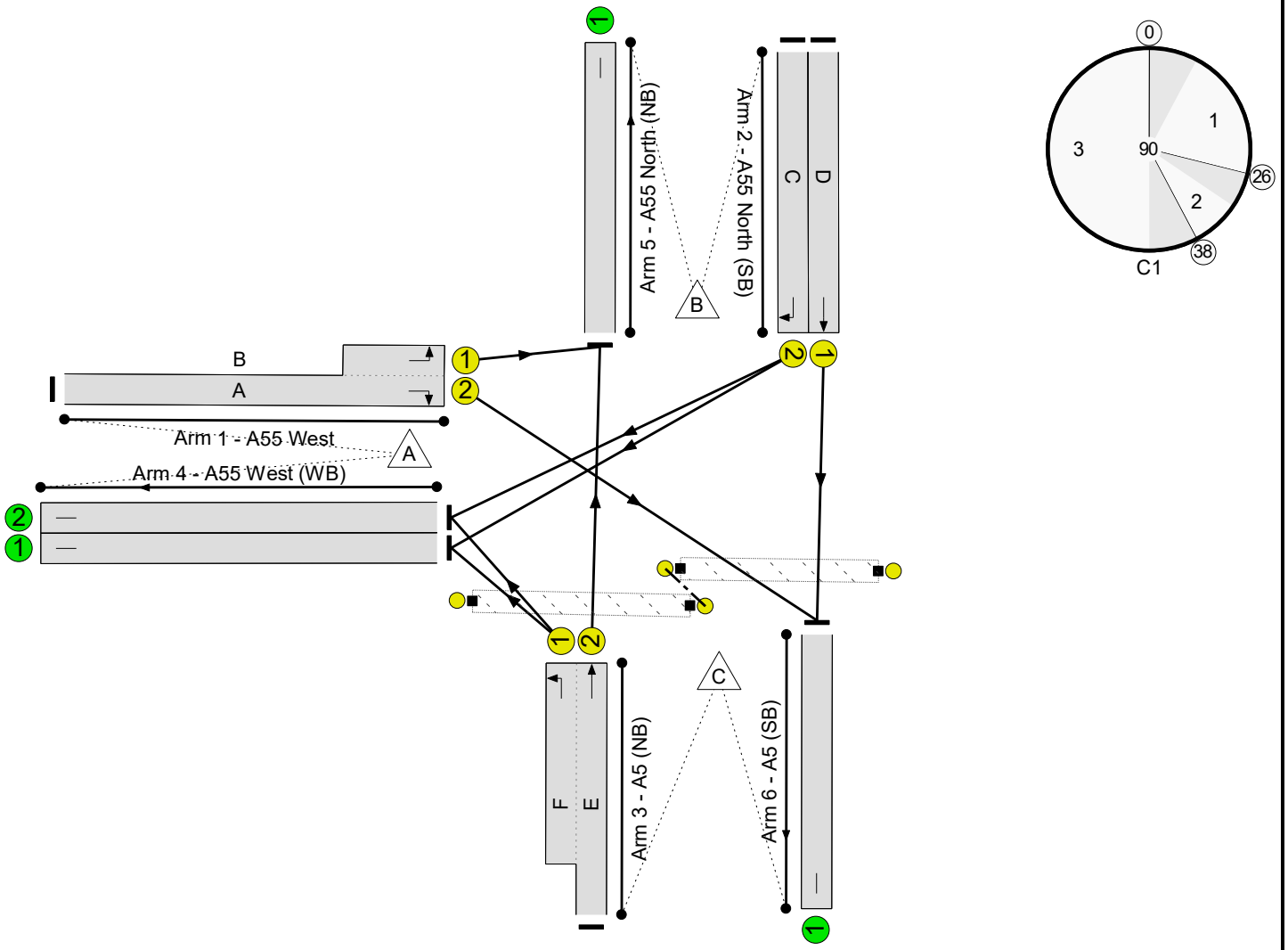


Full Input Data And Results

Network Layout Diagram

A5/A55/London Road
PRC: 34.7 %
Total Traffic Delay: 9.2 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped





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: Holyhead Breakwater Refurbishment Scheme	-	-	**N/A**	-	-		-	-	-	-	-	-	**66.8%**
A5/A55/London Road	-	-	**N/A**	-	-		-	-	-	-	-	-	**66.8%**
1/2+1/1	A55 West Left Right	U	N/A	N/A	A B		1	19:73	-	697	2095:1800	256+787	66.8 : 66.8%
2/1	A55 North (SB) Ahead	U	N/A	N/A	D		1	7	-	81	1955	174	46.6%
2/2	A55 North (SB) Right	U	N/A	N/A	C		1	47	-	591	1917	1022	57.8%
3/2+3/1	A5 (NB) Left Ahead	U	N/A	N/A	E F		1	7:31	-	231	2105:1800	187+602	37.4 : 26.7%
4/1	A55 West (WB)	U	N/A	N/A	-		-	-	-	752	Inf	Inf	0.0%
4/2	A55 West (WB)	U	N/A	N/A	-		-	-	-	0	1800	1800	0.0%
5/1	A55 North (NB)	U	N/A	N/A	-		-	-	-	596	1800	1800	33.1%
6/1	A5 (SB)	U	N/A	N/A	-		-	-	-	252	1800	1800	14.0%
Ped Link: P1	Western Crossing	-	-	-			0	0	-	0	-	0	0.0%
Ped Link: P2	Eastern Crossing	-	-	-			0	0	-	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: Holyhead Breakwater Refurbishment Scheme	**-**	**-**	**0**	**0**	**0**	**6.6**	**2.7**	**0.0**	**9.2**	**-**	**-**	**-**	**-**
A5/A55/London Road	**-**	**-**	**0**	**0**	**0**	**6.6**	**2.7**	**0.0**	**9.2**	**-**	**-**	**-**	**-**
1/2+1/1	697	697	-	-	-	1.7	1.0	-	2.7	14.0	3.6	1.0	4.6
2/1	81	81	-	-	-	0.9	0.4	-	1.3	58.2	1.9	0.4	2.3
2/2	591	591	-	-	-	2.3	0.7	-	3.0	18.3	9.9	0.7	10.5
3/2+3/1	231	231	-	-	-	1.7	0.2	-	1.9	29.3	2.8	0.2	3.0
4/1	752	752	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	0	0	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	596	596	-	-	-	0.0	0.2	-	0.2	1.5	0.0	0.2	0.2
6/1	252	252	-	-	-	0.0	0.1	-	0.1	1.2	2.0	0.1	2.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf
Ped Link: P2	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 34.7 Total Delay for Signalled Lanes (pcuHr): 8.90 Cycle Time (s): 90
PRC Over All Lanes (%): 34.7 Total Delay Over All Lanes(pcuHr): 9.23

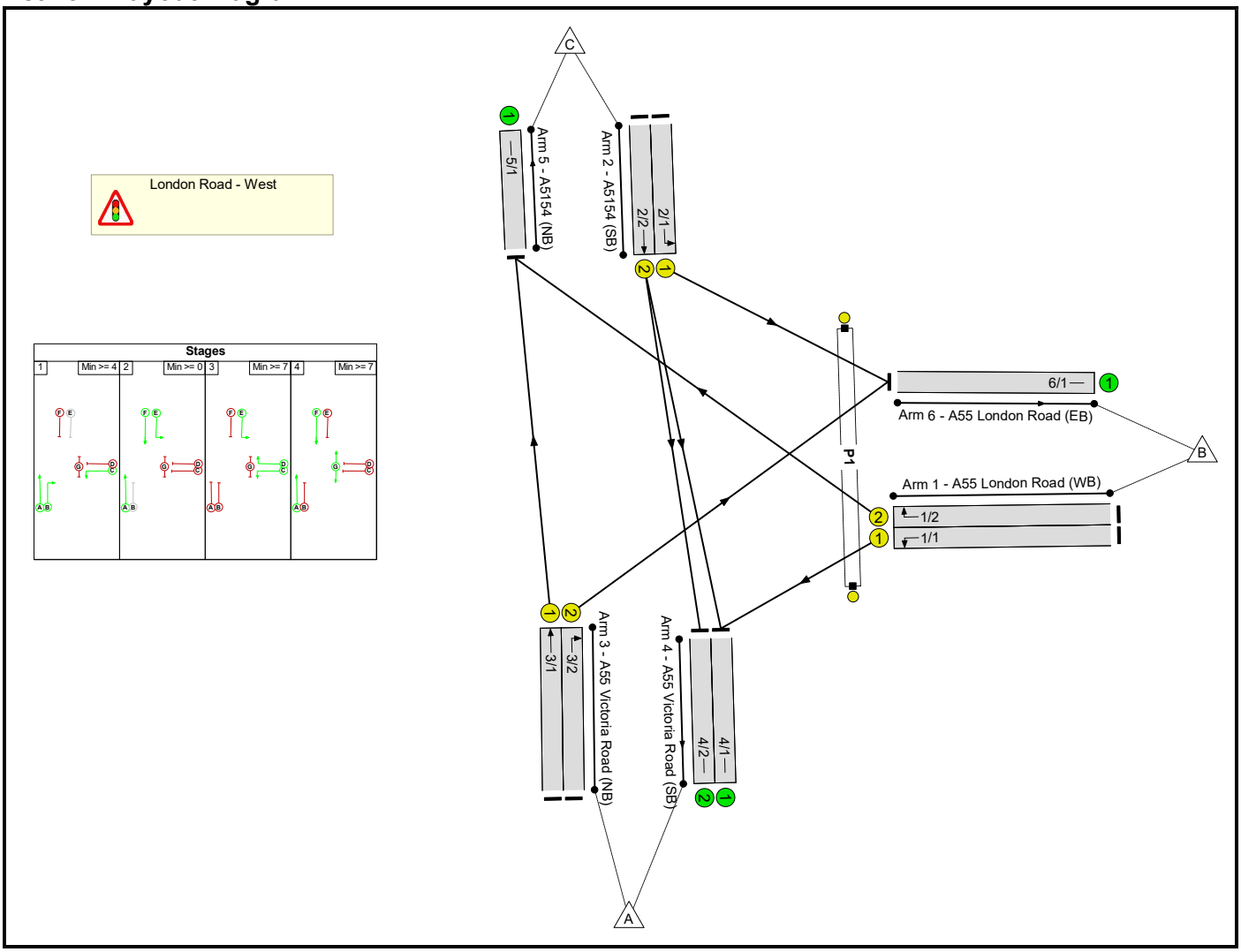
8.6 Junction 3 Model Outputs

Full Input Data And Results

User and Project Details

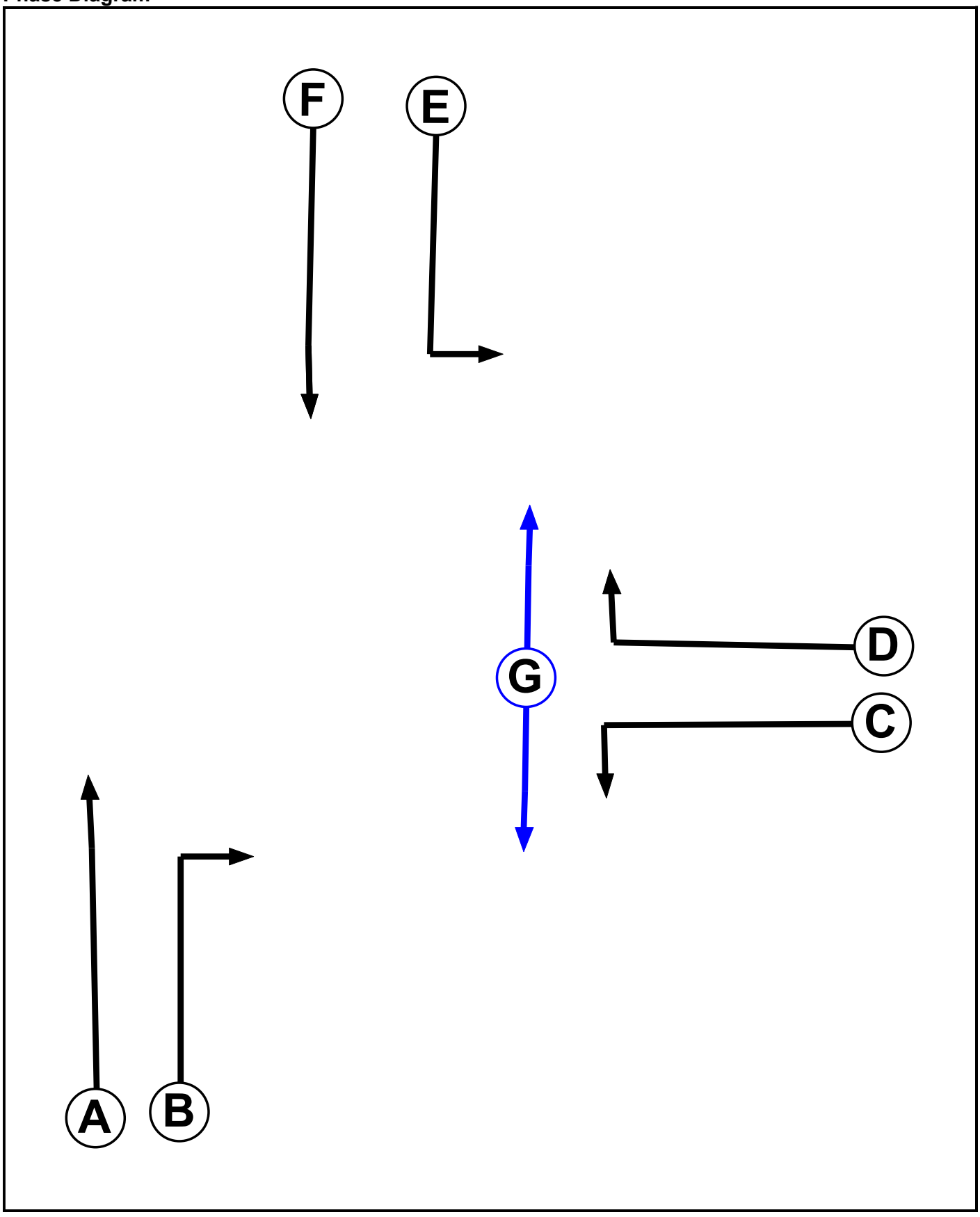
Project:	**101**
Title:	
Location:	
Site Ref(s):	Holyhead - London Road - West Sig Junction
Additional detail:	
File name:	LinSig Model - Junction 3 (London Road West)(Base + Future + Growth).lsg3x
Author:	
Company:	RHDHV
Address:	

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		7	7
B	Traffic		7	7
C	Traffic		7	7
D	Traffic		7	7
E	Traffic		7	7
F	Traffic		7	7
G	Pedestrian		7	7

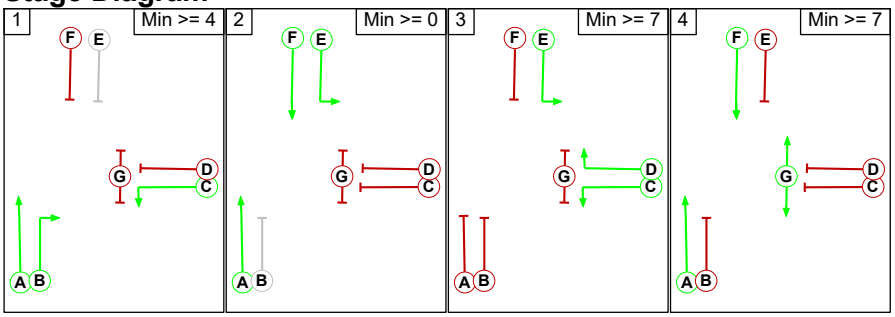
Phase Intergreens Matrix

		Starting Phase						
		A	B	C	D	E	F	G
Terminating Phase	A		-	-	5	-	-	-
	B	-		-	5	-	-	7
	C	-	-		-	-	5	7
	D	5	5	-		-	5	7
	E	-	-	-	-		-	7
	F	-	-	5	5	-		-
	G	-	7	7	7	7	-	

Phases in Stage

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

Stage Diagram



Phase Delays

Term. Stage	Start Stage	Phase	Type	Value	Cont value
There are no Phase Delays defined					

Full Input Data And Results

Prohibited Stage Change

	To Stage				
		1	2	3	4
From Stage	1		5	5	7
	2	5		5	7
	3	5	5		7
	4	7	7	7	

Full Input Data And Results

Give-Way Lane Input Data

Junction: London Road - West
There are no Opposed Lanes in this Junction

Full Input Data And Results

Lane Input Data

Junction: London Road - West												
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 (A55 London Road (WB))	U	C	2	3	10.4	Geom	-	3.30	0.00	Y	Arm 4 Left	Inf
1/2 (A55 London Road (WB))	U	D	2	3	8.9	Geom	-	3.40	0.00	N	Arm 5 Right	34.00
2/1 (A5154 (SB))	U	E	2	3	10.6	Geom	-	3.50	0.00	Y	Arm 6 Left	21.80
2/2 (A5154 (SB))	U	F	2	3	10.6	Geom	-	3.60	0.00	N	Arm 4 Ahead	Inf
3/1 (A55 Victoria Road (NB))	U	A	2	3	27.8	Geom	-	3.55	0.00	Y	Arm 5 Ahead	Inf
3/2 (A55 Victoria Road (NB))	U	B	2	3	28.7	Geom	-	3.40	0.00	N	Arm 6 Right	12.74
4/1 (A55 Victoria Road (SB))	U		2	3	60.0	Inf	-	-	-	-	-	-
4/2 (A55 Victoria Road (SB))	U		2	3	60.0	Inf	-	-	-	-	-	-
5/1 (A5154 (NB))	U		2	3	60.0	Inf	-	-	-	-	-	-
6/1 (A55 London Road (EB))	U		2	3	15.1	Geom	-	3.33	0.00	Y		

Traffic Flow Groups

Flow Group	Start Time	End Time	Duration	Formula
1: 'Base Peak'	15:45	16:45	01:00	
2: 'AM Peak (Base 2018)'	08:00	09:00	01:00	
3: 'Port Peak (Base 2018)'	12:00	13:00	01:00	
4: 'AM Peak (Future Base 2022)'	08:00	09:00	01:00	
5: 'Port Peak (Future Base 2022)'	12:00	13:00	01:00	
6: 'AM Peak + HGV growth (2022)'	08:00	09:00	01:00	
7: 'Port Peak + HGV growth (2022)'	12:00	13:00	01:00	
8: 'AM Peak + HGV + Cons (2022)'	08:00	09:00	01:00	
9: 'Port Peak + HGV + Cons (2022)'	12:00	13:00	01:00	

Scenario 1: 'AM Peak (Base 2018)' (FG2: 'AM Peak (Base 2018)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	213	354	567
	B	144	0	263	407
	C	320	184	0	504
	Tot.	464	397	617	1478

Traffic Lane Flows

Lane	Scenario 1: AM Peak (Base 2018)
Junction: London Road - West	
1/1	144
1/2	263
2/1	184
2/2	320
3/1	354
3/2	213
4/1	304
4/2	160
5/1	617
6/1	397

Full Input Data And Results

Lane Saturation Flows

Junction: London Road - West								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 London Road (WB))	3.30	0.00	Y	Arm 4 Left	Inf	100.0 %	1945	1945
1/2 (A55 London Road (WB))	3.40	0.00	N	Arm 5 Right	34.00	100.0 %	2006	2006
2/1 (A5154 (SB))	3.50	0.00	Y	Arm 6 Left	21.80	100.0 %	1838	1838
2/2 (A5154 (SB))	3.60	0.00	N	Arm 4 Ahead	Inf	100.0 %	2115	2115
3/1 (A55 Victoria Road (NB))	3.55	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1970	1970
3/2 (A55 Victoria Road (NB))	3.40	0.00	N	Arm 6 Right	12.74	100.0 %	1874	1874
4/1 (A55 Victoria Road (SB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 Victoria Road (SB) Lane 2)	Infinite Saturation Flow						Inf	Inf
5/1 (A5154 (NB) Lane 1)	Infinite Saturation Flow						Inf	Inf
6/1 (A55 London Road (EB))	3.33	0.00	Y				1948	1948

Scenario 2: 'Port Peak (Base 2018)' (FG3: 'Port Peak (Base 2018)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	368	331	699
	B	437	0	188	625
	C	320	184	0	504
	Tot.	757	552	519	1828

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 2: Port Peak (Base 2018)
Junction: London Road - West	
1/1	437
1/2	188
2/1	184
2/2	320
3/1	331
3/2	368
4/1	597
4/2	160
5/1	519
6/1	552

Lane Saturation Flows

Junction: London Road - West								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 London Road (WB))	3.30	0.00	Y	Arm 4 Left	Inf	100.0 %	1945	1945
1/2 (A55 London Road (WB))	3.40	0.00	N	Arm 5 Right	34.00	100.0 %	2006	2006
2/1 (A5154 (SB))	3.50	0.00	Y	Arm 6 Left	21.80	100.0 %	1838	1838
2/2 (A5154 (SB))	3.60	0.00	N	Arm 4 Ahead	Inf	100.0 %	2115	2115
3/1 (A55 Victoria Road (NB))	3.55	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1970	1970
3/2 (A55 Victoria Road (NB))	3.40	0.00	N	Arm 6 Right	12.74	100.0 %	1874	1874
4/1 (A55 Victoria Road (SB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 Victoria Road (SB) Lane 2)	Infinite Saturation Flow						Inf	Inf
5/1 (A5154 (NB) Lane 1)	Infinite Saturation Flow						Inf	Inf
6/1 (A55 London Road (EB))	3.33	0.00	Y				1948	1948

Full Input Data And Results

Scenario 3: 'AM Peak + HGV growth (2022)' (FG6: 'AM Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	239	375	614
	B	162	0	278	440
	C	338	195	0	533
	Tot.	500	434	653	1587

Traffic Lane Flows

Lane	Scenario 3: AM Peak + HGV growth (2022)
Junction: London Road - West	
1/1	162
1/2	278
2/1	195
2/2	338
3/1	375
3/2	239
4/1	331
4/2	169
5/1	653
6/1	434

Full Input Data And Results

Lane Saturation Flows

Junction: London Road - West								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 London Road (WB))	3.30	0.00	Y	Arm 4 Left	Inf	100.0 %	1945	1945
1/2 (A55 London Road (WB))	3.40	0.00	N	Arm 5 Right	34.00	100.0 %	2006	2006
2/1 (A5154 (SB))	3.50	0.00	Y	Arm 6 Left	21.80	100.0 %	1838	1838
2/2 (A5154 (SB))	3.60	0.00	N	Arm 4 Ahead	Inf	100.0 %	2115	2115
3/1 (A55 Victoria Road (NB))	3.55	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1970	1970
3/2 (A55 Victoria Road (NB))	3.40	0.00	N	Arm 6 Right	12.74	100.0 %	1874	1874
4/1 (A55 Victoria Road (SB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 Victoria Road (SB) Lane 2)	Infinite Saturation Flow						Inf	Inf
5/1 (A5154 (NB) Lane 1)	Infinite Saturation Flow						Inf	Inf
6/1 (A55 London Road (EB))	3.33	0.00	Y				1948	1948

Scenario 4: 'Port Peak + HGV growth (2022)' (FG7: 'Port Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	427	350	777
	B	503	0	199	702
	C	353	211	0	564
	Tot.	856	638	549	2043

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 4: Port Peak + HGV growth (2022)
Junction: London Road - West	
1/1	503
1/2	199
2/1	211
2/2	353
3/1	350
3/2	427
4/1	679
4/2	177
5/1	549
6/1	638

Lane Saturation Flows

Junction: London Road - West								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 London Road (WB))	3.30	0.00	Y	Arm 4 Left	Inf	100.0 %	1945	1945
1/2 (A55 London Road (WB))	3.40	0.00	N	Arm 5 Right	34.00	100.0 %	2006	2006
2/1 (A5154 (SB))	3.50	0.00	Y	Arm 6 Left	21.80	100.0 %	1838	1838
2/2 (A5154 (SB))	3.60	0.00	N	Arm 4 Ahead	Inf	100.0 %	2115	2115
3/1 (A55 Victoria Road (NB))	3.55	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1970	1970
3/2 (A55 Victoria Road (NB))	3.40	0.00	N	Arm 6 Right	12.74	100.0 %	1874	1874
4/1 (A55 Victoria Road (SB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 Victoria Road (SB) Lane 2)	Infinite Saturation Flow						Inf	Inf
5/1 (A5154 (NB) Lane 1)	Infinite Saturation Flow						Inf	Inf
6/1 (A55 London Road (EB))	3.33	0.00	Y				1948	1948

Full Input Data And Results

Scenario 5: 'AM Peak + HGV + Cons (2022)' (FG8: 'AM Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

	Destination				
		A	B	C	Tot.
Origin	A	0	286	375	661
	B	209	0	278	487
	C	338	195	0	533
	Tot.	547	481	653	1681

Traffic Lane Flows

Lane	Scenario 5: AM Peak + HGV + Cons (2022)
Junction: London Road - West	
1/1	209
1/2	278
2/1	195
2/2	338
3/1	375
3/2	286
4/1	378
4/2	169
5/1	653
6/1	481

Full Input Data And Results

Lane Saturation Flows

Junction: London Road - West								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 London Road (WB))	3.30	0.00	Y	Arm 4 Left	Inf	100.0 %	1945	1945
1/2 (A55 London Road (WB))	3.40	0.00	N	Arm 5 Right	34.00	100.0 %	2006	2006
2/1 (A5154 (SB))	3.50	0.00	Y	Arm 6 Left	21.80	100.0 %	1838	1838
2/2 (A5154 (SB))	3.60	0.00	N	Arm 4 Ahead	Inf	100.0 %	2115	2115
3/1 (A55 Victoria Road (NB))	3.55	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1970	1970
3/2 (A55 Victoria Road (NB))	3.40	0.00	N	Arm 6 Right	12.74	100.0 %	1874	1874
4/1 (A55 Victoria Road (SB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 Victoria Road (SB) Lane 2)	Infinite Saturation Flow						Inf	Inf
5/1 (A5154 (NB) Lane 1)	Infinite Saturation Flow						Inf	Inf
6/1 (A55 London Road (EB))	3.33	0.00	Y				1948	1948

Scenario 6: 'Port Peak + HGV + Cons (2022)' (FG9: 'Port Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

Traffic Flows, Desired

Desired Flow :

		Destination			
		A	B	C	Tot.
Origin	A	0	475	350	825
	B	550	0	199	749
	C	353	211	0	564
	Tot.	903	686	549	2138

Full Input Data And Results

Traffic Lane Flows

Lane	Scenario 6: Port Peak + HGV + Cons (2022)
Junction: London Road - West	
1/1	550
1/2	199
2/1	211
2/2	353
3/1	350
3/2	475
4/1	726
4/2	177
5/1	549
6/1	686

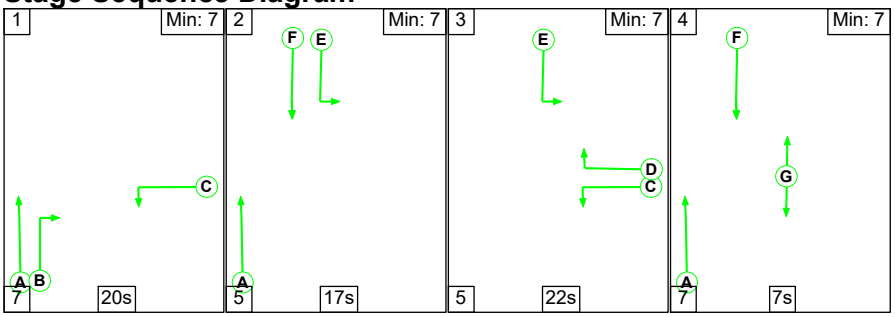
Lane Saturation Flows

Junction: London Road - West								
Lane	**Lane Width (m)**	**Gradient**	**Nearside Lane**	**Allowed Turns**	**Turning Radius (m)**	**Turning Prop.**	**Sat Flow (PCU/Hr)**	**Flared Sat Flow (PCU/Hr)**
1/1 (A55 London Road (WB))	3.30	0.00	Y	Arm 4 Left	Inf	100.0 %	1945	1945
1/2 (A55 London Road (WB))	3.40	0.00	N	Arm 5 Right	34.00	100.0 %	2006	2006
2/1 (A5154 (SB))	3.50	0.00	Y	Arm 6 Left	21.80	100.0 %	1838	1838
2/2 (A5154 (SB))	3.60	0.00	N	Arm 4 Ahead	Inf	100.0 %	2115	2115
3/1 (A55 Victoria Road (NB))	3.55	0.00	Y	Arm 5 Ahead	Inf	100.0 %	1970	1970
3/2 (A55 Victoria Road (NB))	3.40	0.00	N	Arm 6 Right	12.74	100.0 %	1874	1874
4/1 (A55 Victoria Road (SB) Lane 1)	Infinite Saturation Flow						Inf	Inf
4/2 (A55 Victoria Road (SB) Lane 2)	Infinite Saturation Flow						Inf	Inf
5/1 (A5154 (NB) Lane 1)	Infinite Saturation Flow						Inf	Inf
6/1 (A55 London Road (EB))	3.33	0.00	Y				1948	1948

Full Input Data And Results

Scenario 1: 'AM Peak (Base 2018)' (FG2: 'AM Peak (Base 2018)', Plan 1: 'Network Control Plan 1')

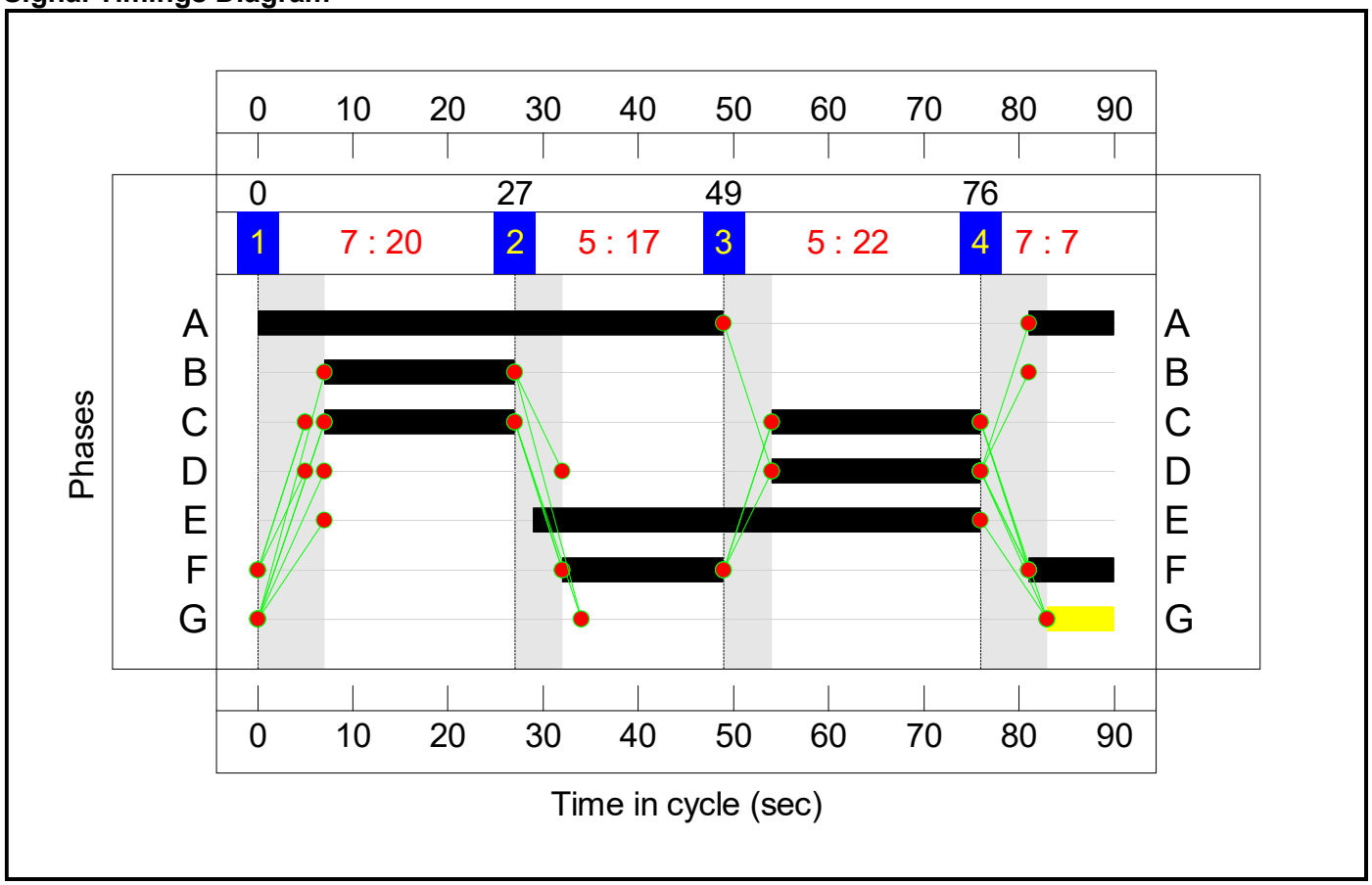
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	20	17	22	7
Change Point	0	27	49	76

Signal Timings Diagram

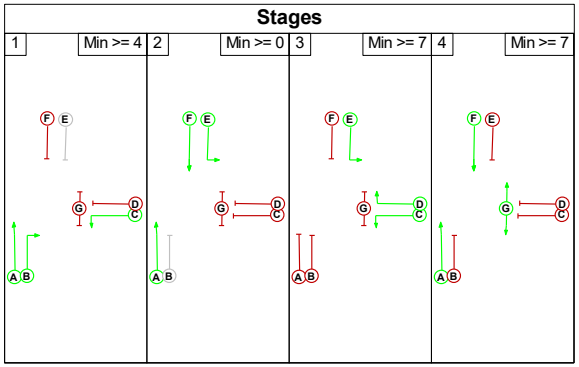


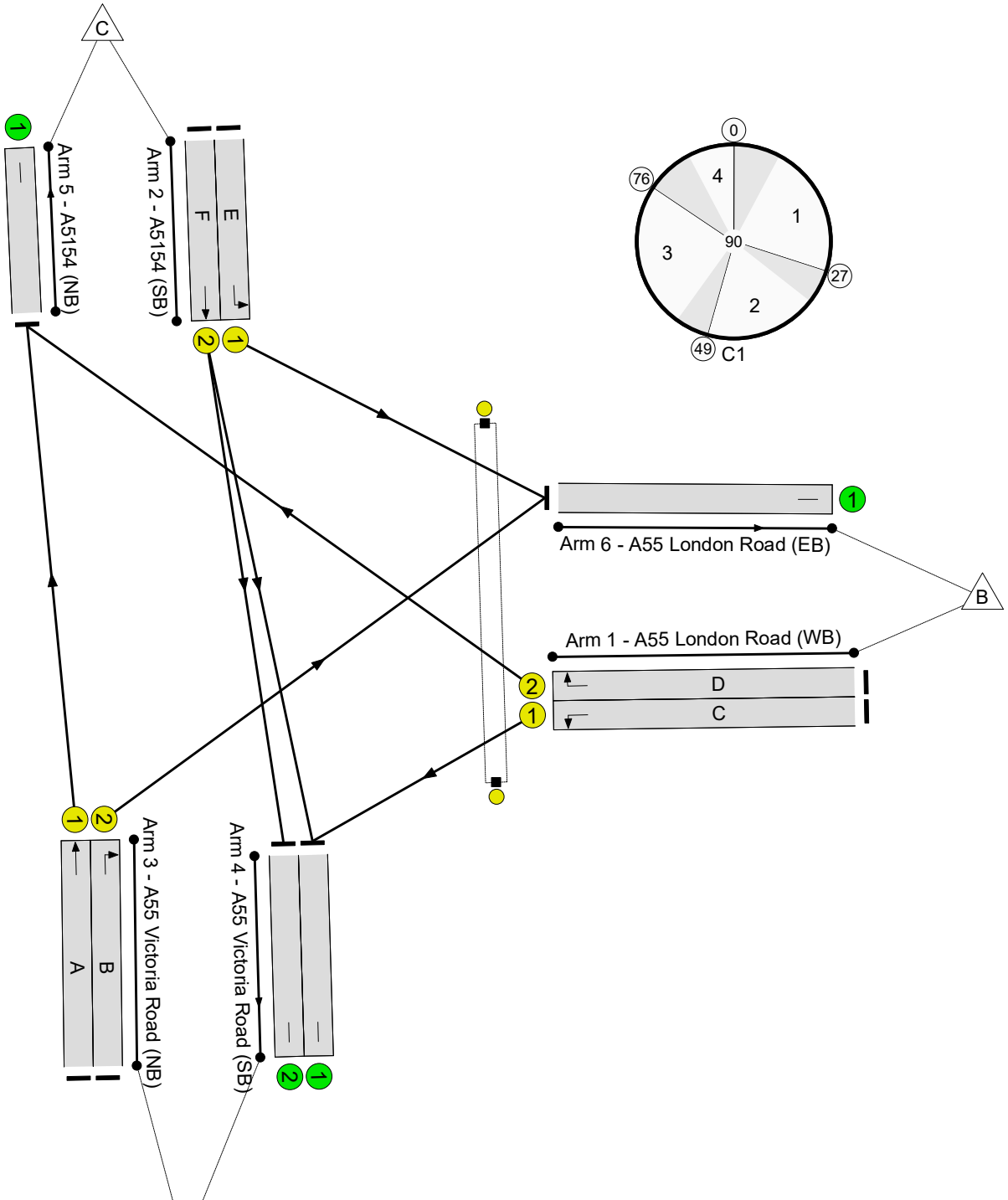
Full Input Data And Results

Network Layout Diagram

Full Input Data And Results

London Road - West
PRC: 75.4 %
Total Traffic Delay: 8.4 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped





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	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**51.3%**
London Road - West	**-**	**-**	**N/A**	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**51.3%**
1/1	A55 London Road (WB) Left	U	N/A	N/A	C		2	42	-	144	1945	951	15.1%
1/2	A55 London Road (WB) Right	U	N/A	N/A	D		1	22	-	263	2006	513	51.3%
2/1	A5154 (SB) Left	U	N/A	N/A	E		1	47	-	184	1838	980	18.8%
2/2	A5154 (SB) Ahead	U	N/A	N/A	F		2	26	-	320	2115	658	48.6%
3/1	A55 Victoria Road (NB) Ahead	U	N/A	N/A	A		1	58	-	354	1970	1291	27.4%
3/2	A55 Victoria Road (NB) Right	U	N/A	N/A	B		1	20	-	213	1874	437	48.7%
4/1	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	304	Inf	Inf	0.0%
4/2	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	160	Inf	Inf	0.0%
5/1	A5154 (NB)	U	N/A	N/A	-		-	-	-	617	Inf	Inf	0.0%
6/1	A55 London Road (EB)	U	N/A	N/A	-		-	-	-	397	1948	1948	20.4%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

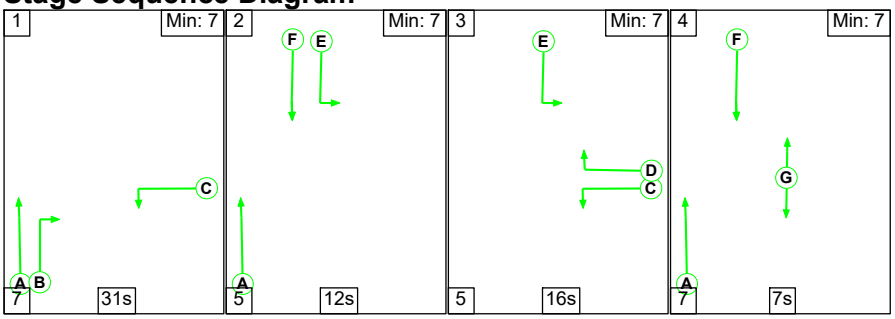
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**6.4**	**2.0**	**0.0**	**8.4**	**-**	**-**	**-**	**-**
London Road - West	**-**	**-**	**0**	**0**	**0**	**6.4**	**2.0**	**0.0**	**8.4**	**-**	**-**	**-**	**-**
1/1	144	144	-	-	-	0.3	0.1	-	0.3	8.7	1.1	0.1	1.2
1/2	263	263	-	-	-	2.1	0.5	-	2.6	35.9	5.6	0.5	6.1
2/1	184	184	-	-	-	0.6	0.1	-	0.7	13.2	2.4	0.1	2.5
2/2	320	320	-	-	-	1.1	0.5	-	1.6	17.9	3.2	0.5	3.7
3/1	354	354	-	-	-	0.6	0.2	-	0.8	8.4	3.6	0.2	3.8
3/2	213	213	-	-	-	1.8	0.5	-	2.2	37.8	4.6	0.5	5.0
4/1	304	304	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	160	160	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	617	617	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	397	397	-	-	-	0.0	0.1	-	0.1	1.2	0.0	0.1	0.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 75.4 Total Delay for Signalled Lanes (pcuHr): 8.30 Cycle Time (s): 90
PRC Over All Lanes (%): 75.4 Total Delay Over All Lanes(pcuHr): 8.43

Full Input Data And Results

Scenario 2: 'Port Peak (Base 2018)' (FG3: 'Port Peak (Base 2018)', Plan 1: 'Network Control Plan 1')

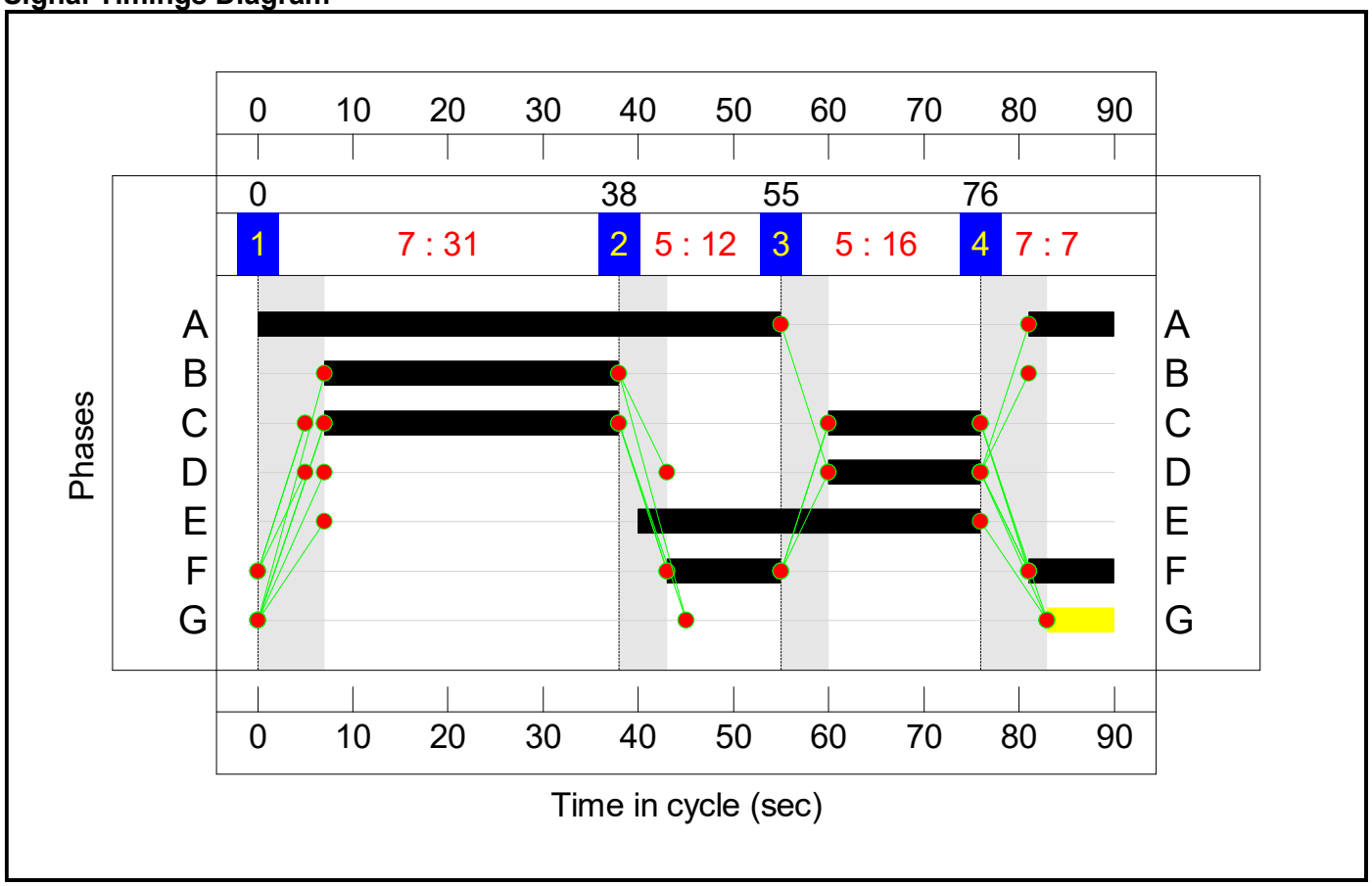
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	31	12	16	7
Change Point	0	38	55	76

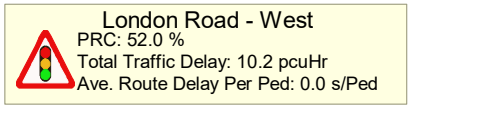
Signal Timings Diagram

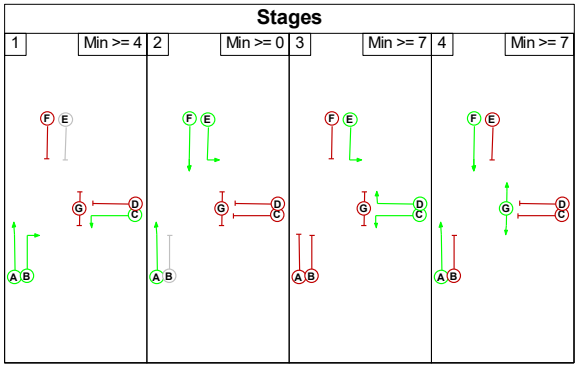


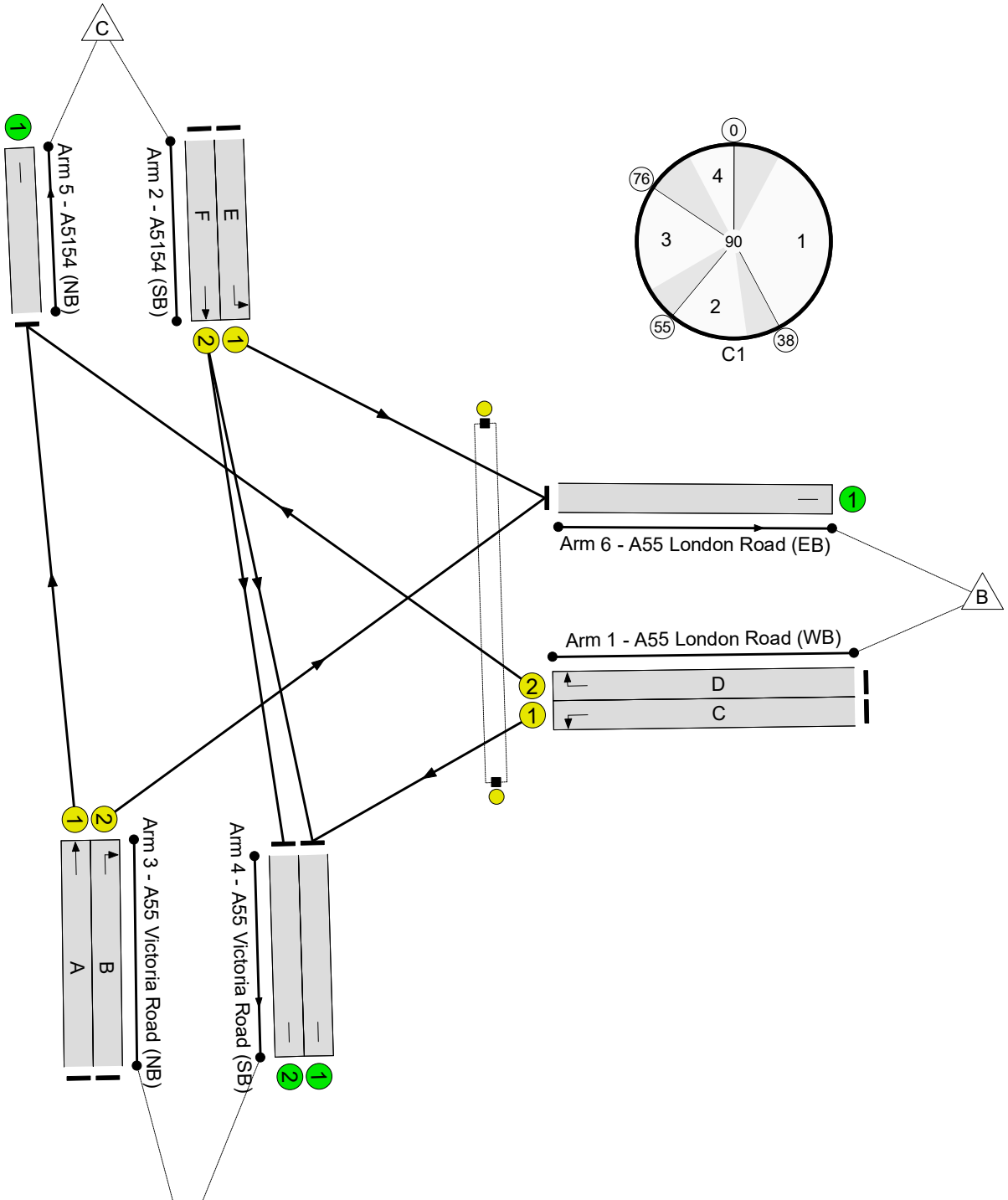
Full Input Data And Results

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	-	-	**N/A**	-	-		-	-	-	-	-	-	**59.2%**
London Road - West	-	-	**N/A**	-	-		-	-	-	-	-	-	**59.2%**
1/1	A55 London Road (WB) Left	U	N/A	N/A	C		2	47	-	437	1945	1059	41.3%
1/2	A55 London Road (WB) Right	U	N/A	N/A	D		1	16	-	188	2006	379	49.6%
2/1	A5154 (SB) Left	U	N/A	N/A	E		1	36	-	184	1838	756	24.4%
2/2	A5154 (SB) Ahead	U	N/A	N/A	F		2	21	-	320	2115	541	59.2%
3/1	A55 Victoria Road (NB) Ahead	U	N/A	N/A	A		1	64	-	331	1970	1423	23.3%
3/2	A55 Victoria Road (NB) Right	U	N/A	N/A	B		1	31	-	368	1874	666	55.2%
4/1	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	597	Inf	Inf	0.0%
4/2	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	160	Inf	Inf	0.0%
5/1	A5154 (NB)	U	N/A	N/A	-		-	-	-	519	Inf	Inf	0.0%
6/1	A55 London Road (EB)	U	N/A	N/A	-		-	-	-	552	1948	1948	28.3%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

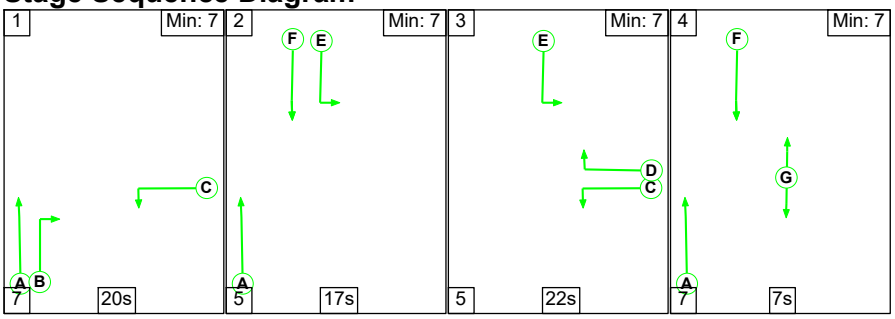
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**7.5**	**2.7**	**0.0**	**10.2**	**-**	**-**	**-**	**-**
London Road - West	**-**	**-**	**0**	**0**	**0**	**7.5**	**2.7**	**0.0**	**10.2**	**-**	**-**	**-**	**-**
1/1	437	437	-	-	-	0.7	0.4	-	1.1	8.9	3.3	0.4	3.6
1/2	188	188	-	-	-	1.7	0.5	-	2.2	42.1	4.2	0.5	4.7
2/1	184	184	-	-	-	0.9	0.2	-	1.0	20.5	3.0	0.2	3.1
2/2	320	320	-	-	-	1.4	0.7	-	2.1	23.8	4.4	0.7	5.1
3/1	331	331	-	-	-	0.4	0.2	-	0.5	5.8	2.8	0.2	2.9
3/2	368	368	-	-	-	2.4	0.6	-	3.0	29.3	7.4	0.6	8.0
4/1	597	597	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	160	160	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	519	519	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	552	552	-	-	-	0.0	0.2	-	0.2	1.3	0.0	0.2	0.2
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 52.0 Total Delay for Signalled Lanes (pcuHr): 9.97 Cycle Time (s): 90
PRC Over All Lanes (%): 52.0 Total Delay Over All Lanes(pcuHr): 10.16

Full Input Data And Results

Scenario 3: 'AM Peak + HGV growth (2022)' (FG6: 'AM Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

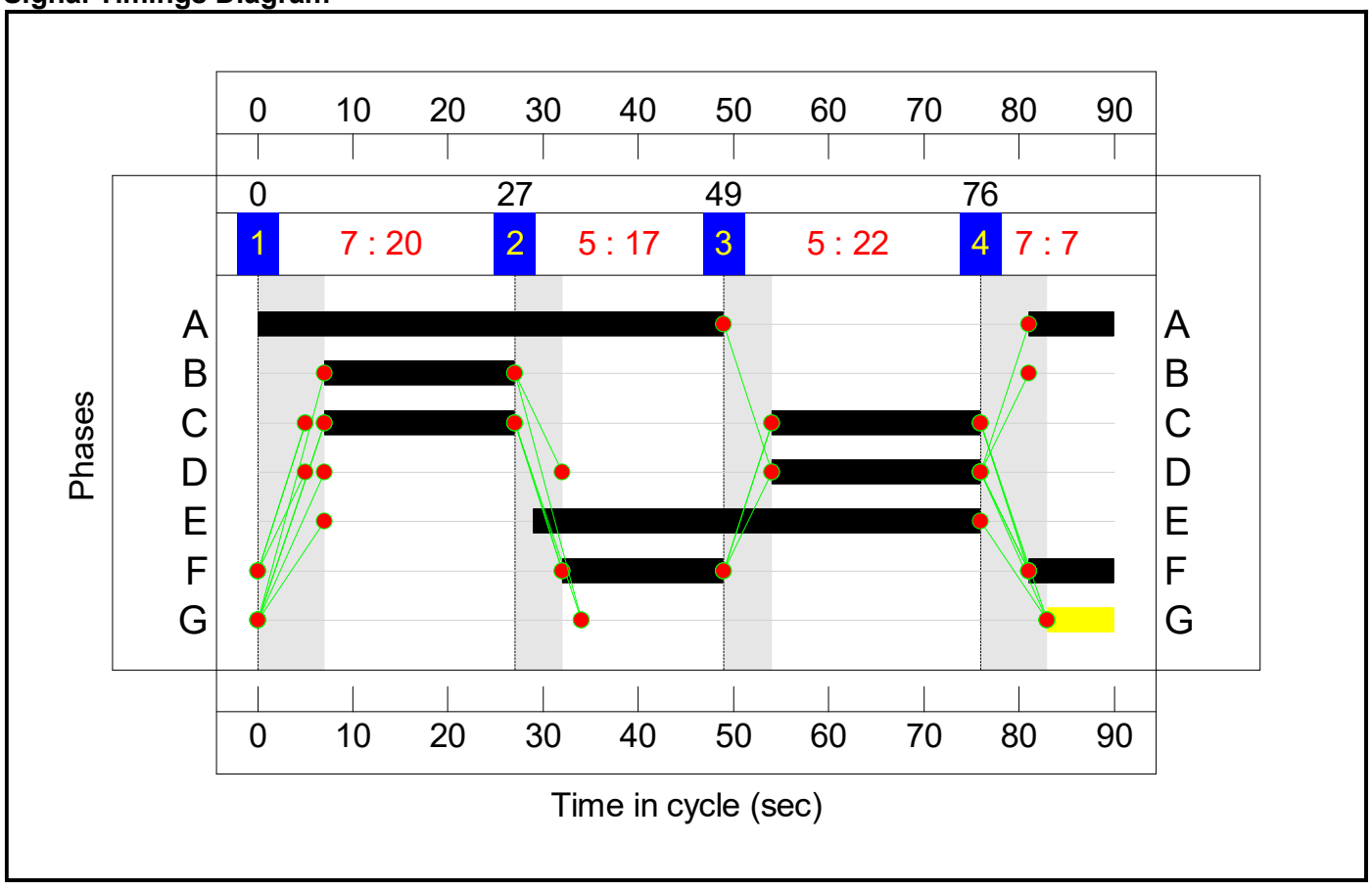
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	20	17	22	7
Change Point	0	27	49	76

Signal Timings Diagram

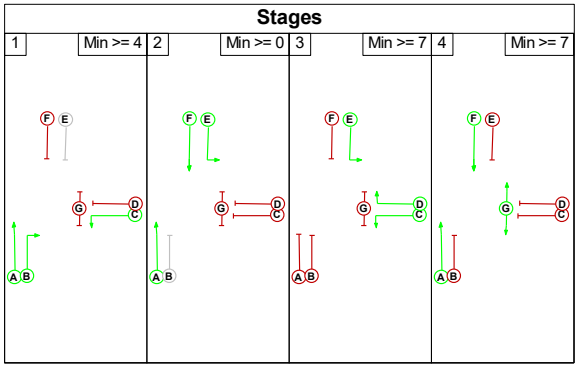


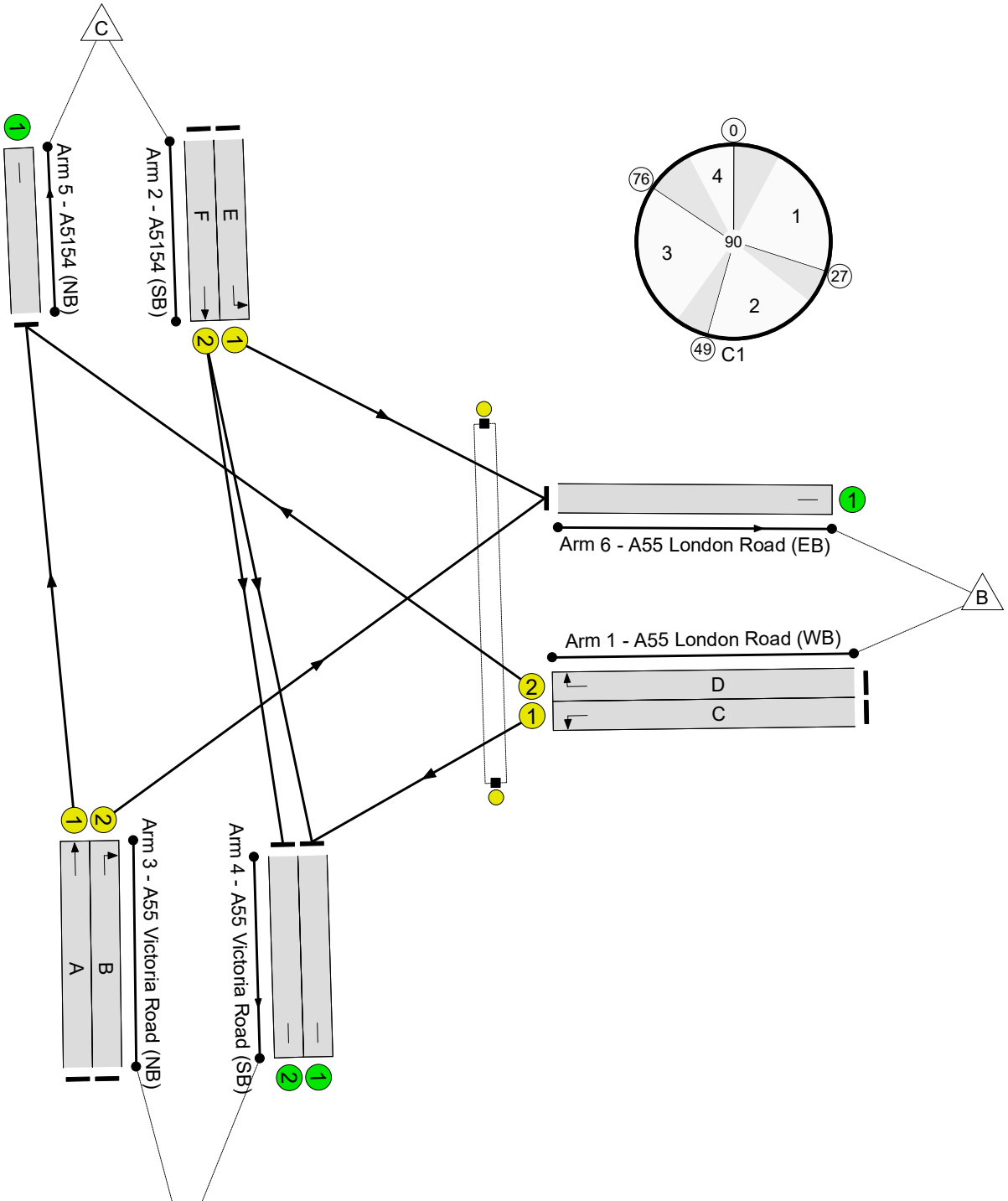
Full Input Data And Results

Network Layout Diagram

Full Input Data And Results

London Road - West
PRC: 64.7 %
Total Traffic Delay: 9.3 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped





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	-	-	**N/A**	-	-		-	-	-	-	-	-	**54.7%**
London Road - West	-	-	**N/A**	-	-		-	-	-	-	-	-	**54.7%**
1/1	A55 London Road (WB) Left	U	N/A	N/A	C		2	42	-	162	1945	951	17.0%
1/2	A55 London Road (WB) Right	U	N/A	N/A	D		1	22	-	278	2006	513	54.2%
2/1	A5154 (SB) Left	U	N/A	N/A	E		1	47	-	195	1838	980	19.9%
2/2	A5154 (SB) Ahead	U	N/A	N/A	F		2	26	-	338	2115	658	51.4%
3/1	A55 Victoria Road (NB) Ahead	U	N/A	N/A	A		1	58	-	375	1970	1291	29.0%
3/2	A55 Victoria Road (NB) Right	U	N/A	N/A	B		1	20	-	239	1874	437	54.7%
4/1	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	331	Inf	Inf	0.0%
4/2	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	169	Inf	Inf	0.0%
5/1	A5154 (NB)	U	N/A	N/A	-		-	-	-	653	Inf	Inf	0.0%
6/1	A55 London Road (EB)	U	N/A	N/A	-		-	-	-	434	1948	1948	22.3%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

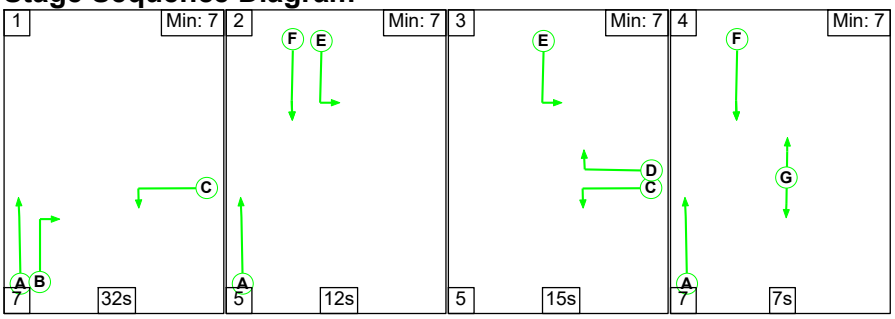
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**7.0**	**2.3**	**0.0**	**9.3**	**-**	**-**	**-**	**-**
London Road - West	**-**	**-**	**0**	**0**	**0**	**7.0**	**2.3**	**0.0**	**9.3**	**-**	**-**	**-**	**-**
1/1	162	162	-	-	-	0.3	0.1	-	0.4	8.8	1.3	0.1	1.4
1/2	278	278	-	-	-	2.2	0.6	-	2.8	36.6	5.9	0.6	6.5
2/1	195	195	-	-	-	0.6	0.1	-	0.7	13.3	2.5	0.1	2.6
2/2	338	338	-	-	-	1.2	0.5	-	1.7	18.3	3.4	0.5	3.9
3/1	375	375	-	-	-	0.7	0.2	-	0.9	8.6	4.0	0.2	4.2
3/2	239	239	-	-	-	2.0	0.6	-	2.6	39.3	5.2	0.6	5.8
4/1	331	331	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	169	169	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	653	653	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	434	434	-	-	-	0.0	0.1	-	0.1	1.2	0.0	0.1	0.1
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 64.7 Total Delay for Signalled Lanes (pcuHr): 9.16 Cycle Time (s): 90
PRC Over All Lanes (%): 64.7 Total Delay Over All Lanes(pcuHr): 9.31

Full Input Data And Results

Scenario 4: 'Port Peak + HGV growth (2022)' (FG7: 'Port Peak + HGV growth (2022)', Plan 1: 'Network Control Plan 1')

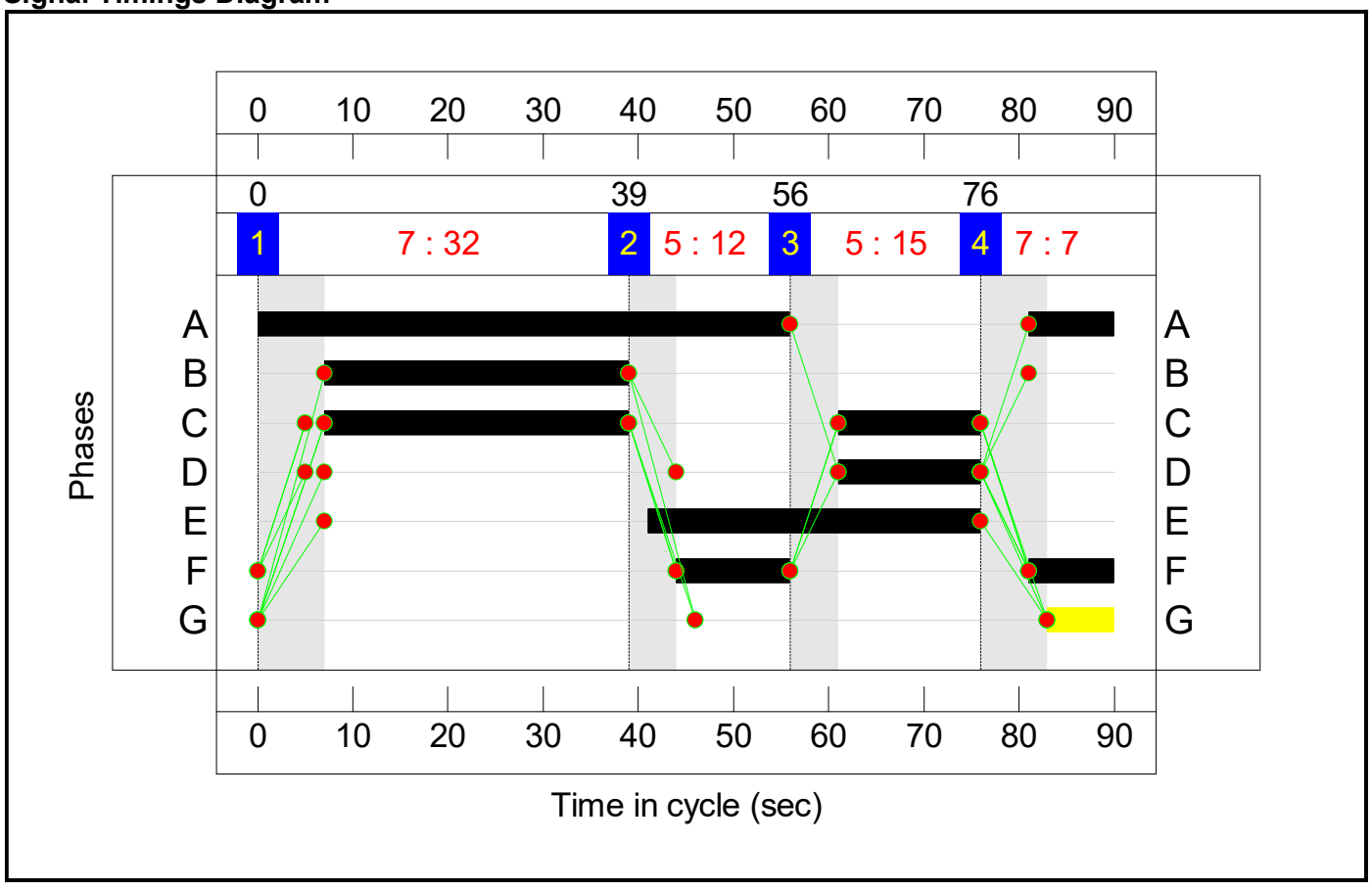
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	32	12	15	7
Change Point	0	39	56	76

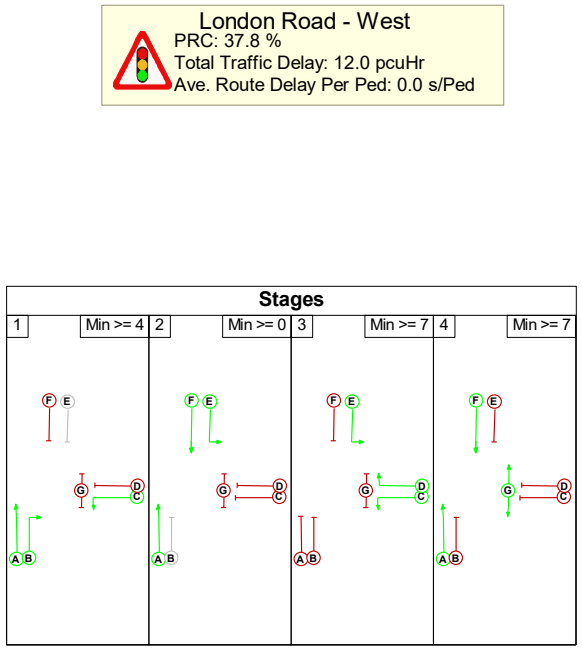
Signal Timings Diagram

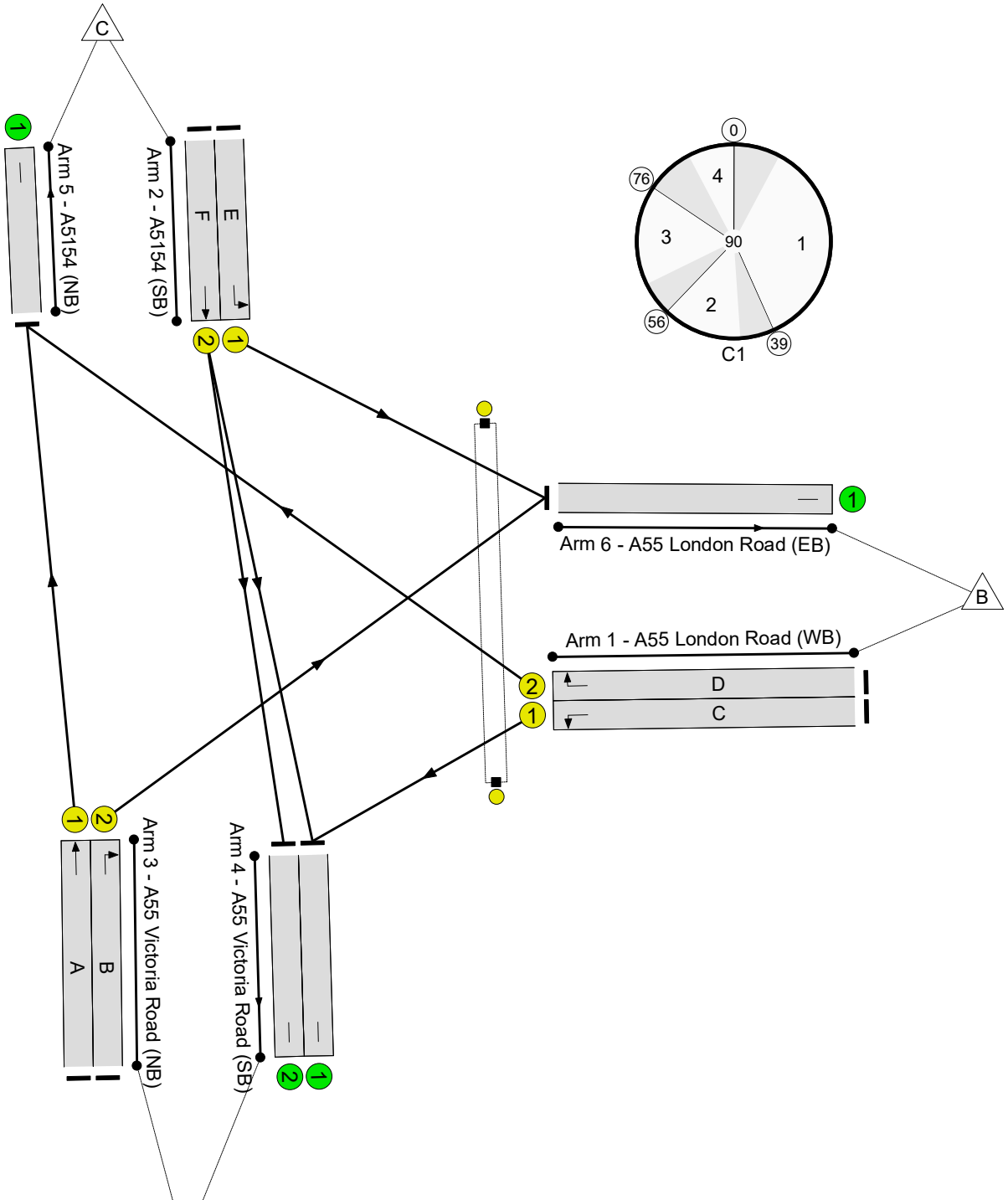


Full Input Data And Results

Network Layout Diagram

Full Input Data And Results





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	-	-	**N/A**	-	-		-	-	-	-	-	-	**65.3%**
London Road - West	-	-	**N/A**	-	-		-	-	-	-	-	-	**65.3%**
1/1	A55 London Road (WB) Left	U	N/A	N/A	C		2	47	-	503	1945	1059	47.5%
1/2	A55 London Road (WB) Right	U	N/A	N/A	D		1	15	-	199	2006	357	55.8%
2/1	A5154 (SB) Left	U	N/A	N/A	E		1	35	-	211	1838	735	28.7%
2/2	A5154 (SB) Ahead	U	N/A	N/A	F		2	21	-	353	2115	541	65.3%
3/1	A55 Victoria Road (NB) Ahead	U	N/A	N/A	A		1	65	-	350	1970	1445	24.2%
3/2	A55 Victoria Road (NB) Right	U	N/A	N/A	B		1	32	-	427	1874	687	62.1%
4/1	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	679	Inf	Inf	0.0%
4/2	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	177	Inf	Inf	0.0%
5/1	A5154 (NB)	U	N/A	N/A	-		-	-	-	549	Inf	Inf	0.0%
6/1	A55 London Road (EB)	U	N/A	N/A	-		-	-	-	638	1948	1948	32.8%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

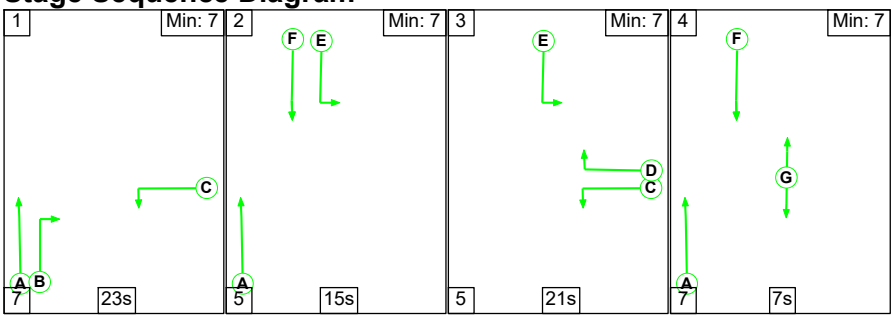
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**8.6**	**3.4**	**0.0**	**12.0**	**-**	**-**	**-**	**-**
London Road - West	**-**	**-**	**0**	**0**	**0**	**8.6**	**3.4**	**0.0**	**12.0**	**-**	**-**	**-**	**-**
1/1	503	503	-	-	-	0.9	0.5	-	1.3	9.5	3.9	0.5	4.4
1/2	199	199	-	-	-	1.9	0.6	-	2.5	45.1	4.5	0.6	5.2
2/1	211	211	-	-	-	1.1	0.2	-	1.3	21.7	3.6	0.2	3.8
2/2	353	353	-	-	-	1.6	0.9	-	2.5	25.7	5.0	0.9	5.9
3/1	350	350	-	-	-	0.4	0.2	-	0.5	5.5	2.8	0.2	3.0
3/2	427	427	-	-	-	2.8	0.8	-	3.6	30.3	8.7	0.8	9.5
4/1	679	679	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	177	177	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	549	549	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	638	638	-	-	-	0.0	0.2	-	0.2	1.4	0.0	0.2	0.2
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 37.8 Total Delay for Signalled Lanes (pcuHr): 11.75 Cycle Time (s): 90
PRC Over All Lanes (%): 37.8 Total Delay Over All Lanes(pcuHr): 11.99

Full Input Data And Results

Scenario 5: 'AM Peak + HGV + Cons (2022)' (FG8: 'AM Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

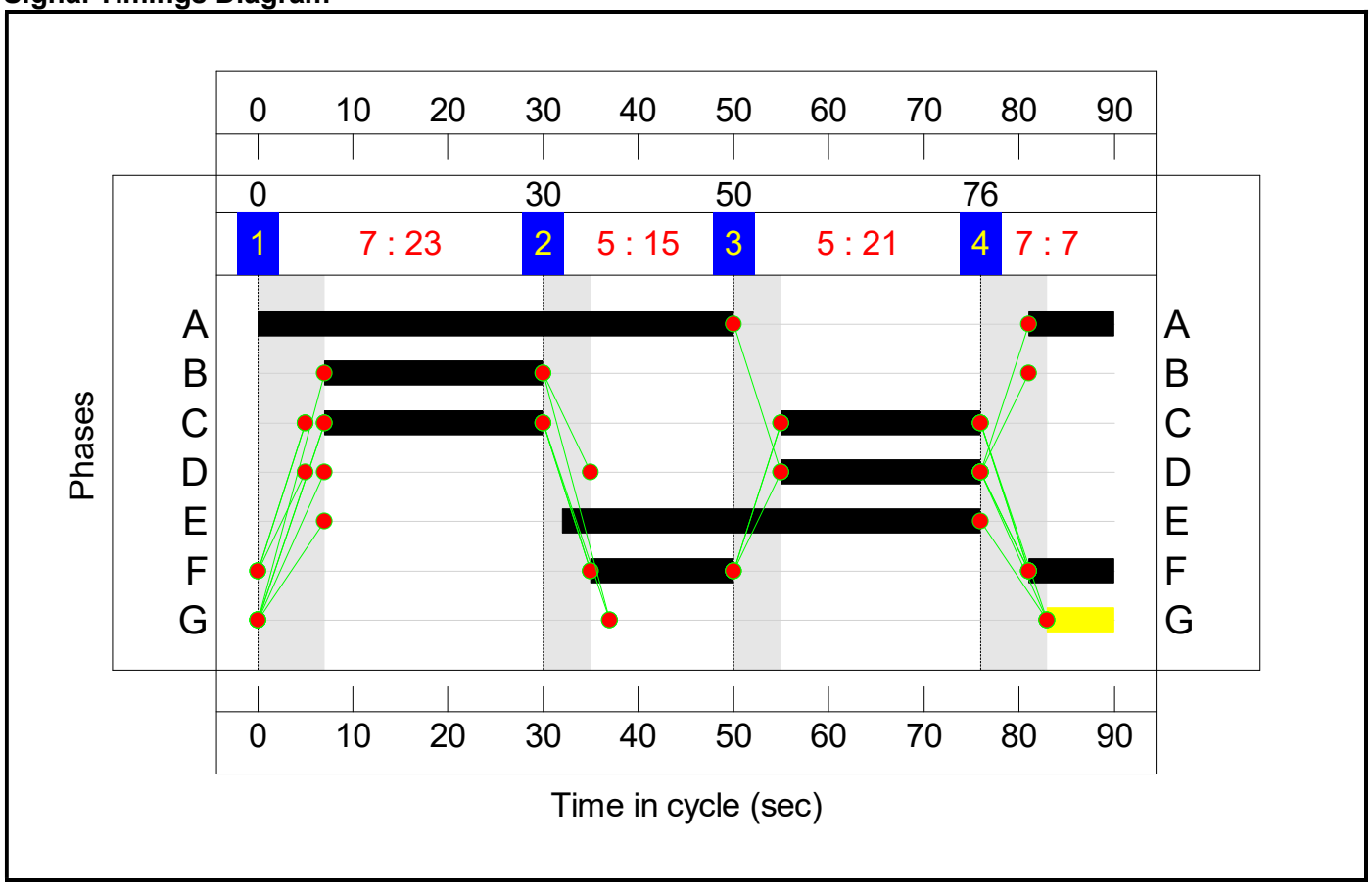
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	23	15	21	7
Change Point	0	30	50	76

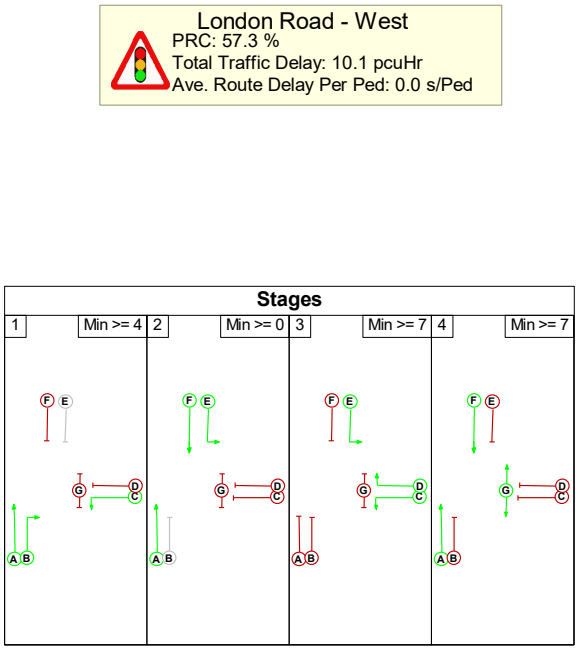
Signal Timings Diagram

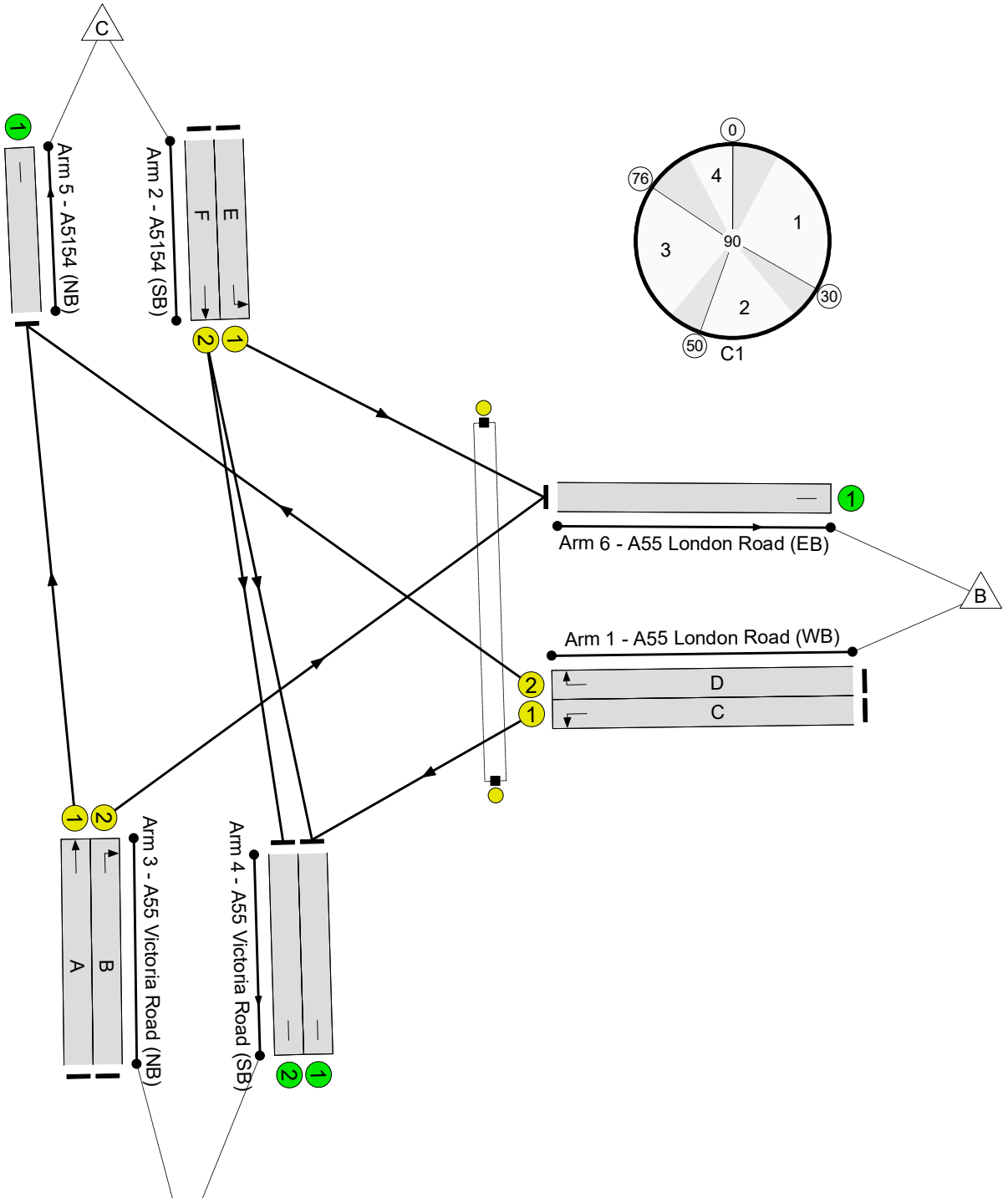


Full Input Data And Results

Network Layout Diagram

Full Input Data And Results





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	-	-	**N/A**	-	-		-	-	-	-	-	-	**57.2%**
London Road - West	-	-	**N/A**	-	-		-	-	-	-	-	-	**57.2%**
1/1	A55 London Road (WB) Left	U	N/A	N/A	C		2	44	-	209	1945	994	21.0%
1/2	A55 London Road (WB) Right	U	N/A	N/A	D		1	21	-	278	2006	490	56.7%
2/1	A5154 (SB) Left	U	N/A	N/A	E		1	44	-	195	1838	919	21.2%
2/2	A5154 (SB) Ahead	U	N/A	N/A	F		2	24	-	338	2115	611	55.3%
3/1	A55 Victoria Road (NB) Ahead	U	N/A	N/A	A		1	59	-	375	1970	1313	28.6%
3/2	A55 Victoria Road (NB) Right	U	N/A	N/A	B		1	23	-	286	1874	500	57.2%
4/1	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	378	Inf	Inf	0.0%
4/2	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	169	Inf	Inf	0.0%
5/1	A5154 (NB)	U	N/A	N/A	-		-	-	-	653	Inf	Inf	0.0%
6/1	A55 London Road (EB)	U	N/A	N/A	-		-	-	-	481	1948	1948	24.7%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	0	-	0	0.0%

Full Input Data And Results

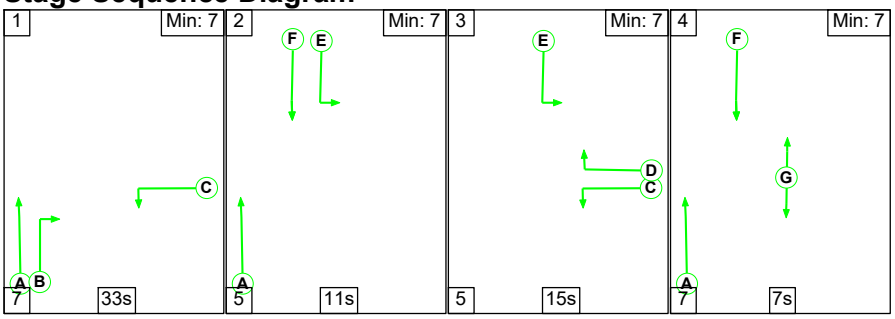
Item	Arriving (pcu)	Leaving (pcu)	Turners In Gaps (pcu)	Turners When Unopposed (pcu)	Turners In Intergreen (pcu)	Uniform Delay (pcuHr)	Rand + Oversat Delay (pcuHr)	Storage Area Uniform Delay (pcuHr)	Total Delay (pcuHr)	Av. Delay Per PCU (s/pcu)	Max. Back of Uniform Queue (pcu)	Rand + Oversat Queue (pcu)	Mean Max Queue (pcu)
Network	**-**	**-**	**0**	**0**	**0**	**7.5**	**2.6**	**0.0**	**10.1**	**-**	**-**	**-**	**-**
London Road - West	**-**	**-**	**0**	**0**	**0**	**7.5**	**2.6**	**0.0**	**10.1**	**-**	**-**	**-**	**-**
1/1	209	209	-	-	-	0.4	0.1	-	0.5	8.4	1.5	0.1	1.6
1/2	278	278	-	-	-	2.3	0.7	-	3.0	38.2	6.0	0.7	6.7
2/1	195	195	-	-	-	0.7	0.1	-	0.8	15.1	2.7	0.1	2.8
2/2	338	338	-	-	-	1.3	0.6	-	1.9	20.2	3.8	0.6	4.4
3/1	375	375	-	-	-	0.6	0.2	-	0.8	8.1	3.9	0.2	4.1
3/2	286	286	-	-	-	2.3	0.7	-	2.9	36.9	6.1	0.7	6.8
4/1	378	378	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	169	169	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	653	653	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	481	481	-	-	-	0.0	0.2	-	0.2	1.2	0.0	0.2	0.2
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1 PRC for Signalled Lanes (%): 57.3 Total Delay for Signalled Lanes (pcuHr): 9.93 Cycle Time (s): 90
PRC Over All Lanes (%): 57.3 Total Delay Over All Lanes(pcuHr): 10.09

Full Input Data And Results

Scenario 6: 'Port Peak + HGV + Cons (2022)' (FG9: 'Port Peak + HGV + Cons (2022)', Plan 1: 'Network Control Plan 1')

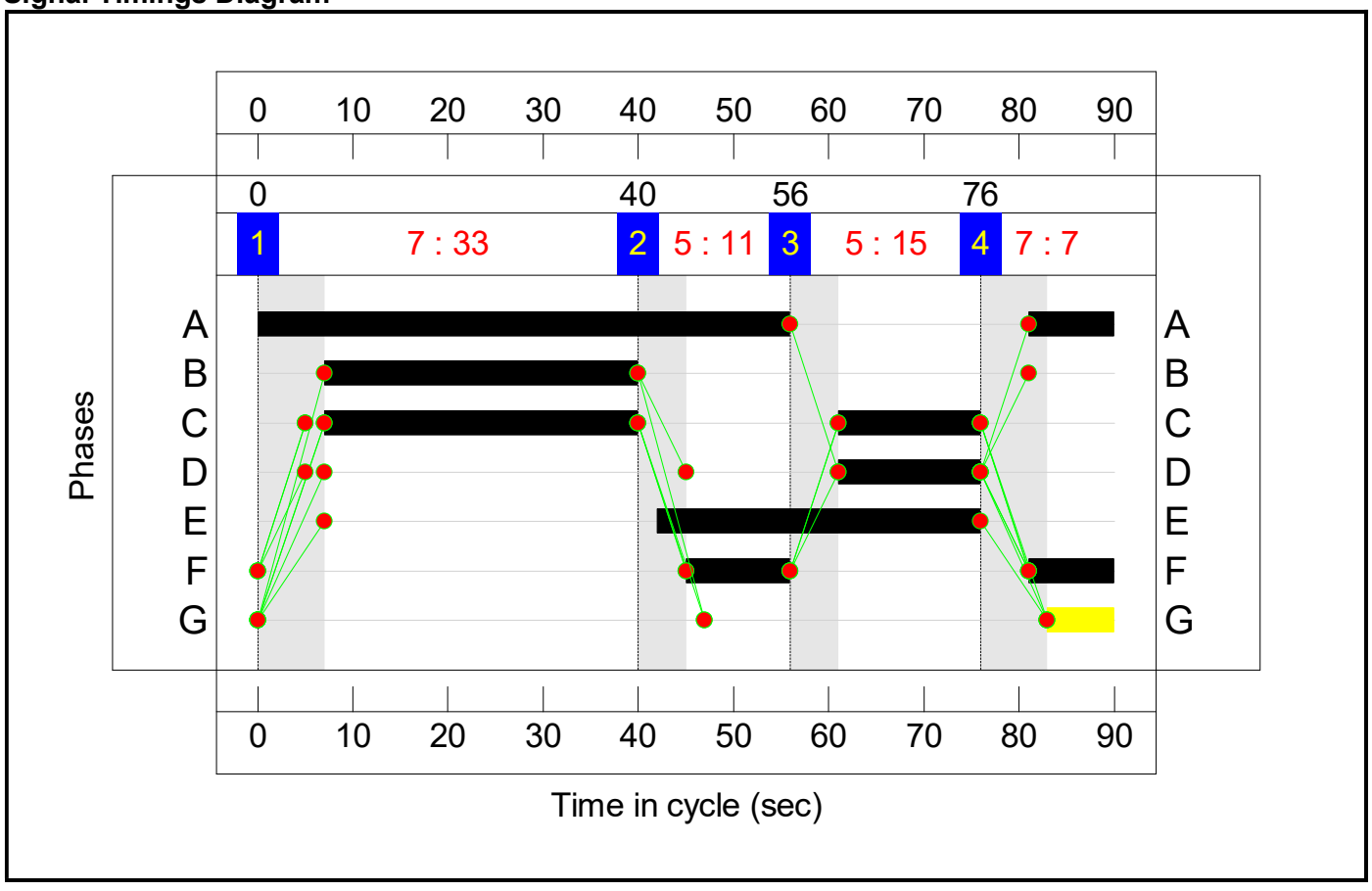
Stage Sequence Diagram



Stage Timings

Stage	1	2	3	4
Duration	33	11	15	7
Change Point	0	40	56	76

Signal Timings Diagram

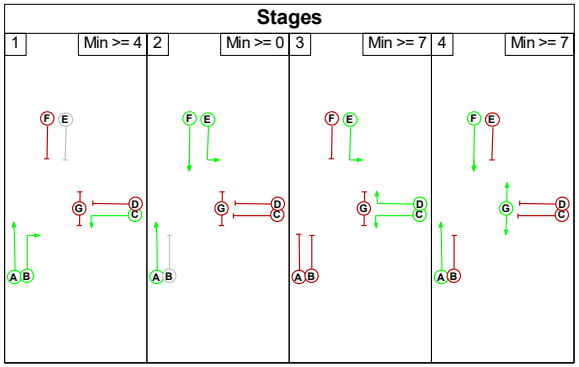


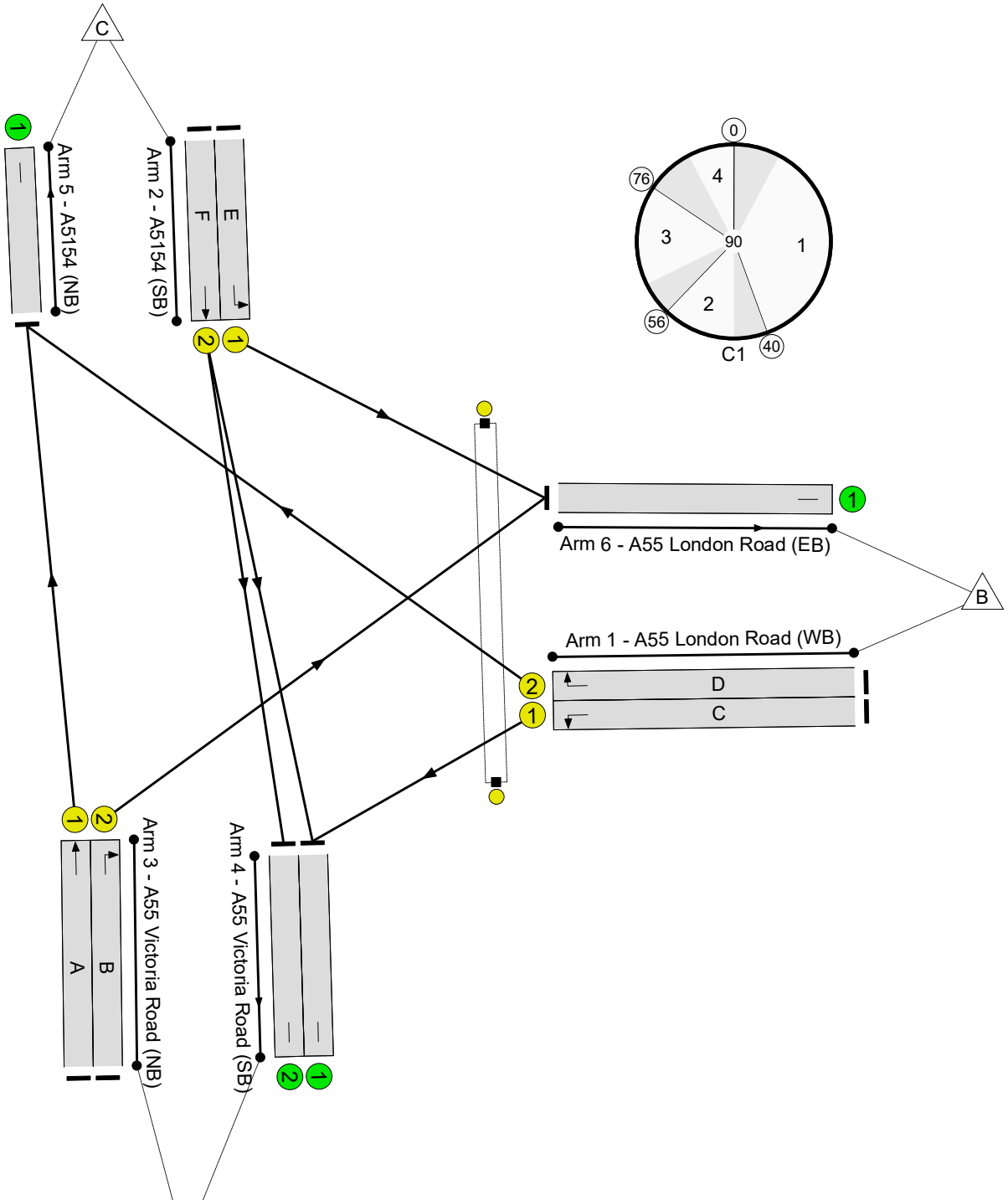
Full Input Data And Results

Network Layout Diagram

Full Input Data And Results

London Road - West
PRC: 31.8 %
Total Traffic Delay: 12.9 pcuHr
Ave. Route Delay Per Ped: 0.0 s/Ped





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	-	-	**N/A**	-	-		-	-	-	-	-	-	**68.3%**
London Road - West	-	-	**N/A**	-	-		-	-	-	-	-	-	**68.3%**
1/1	A55 London Road (WB) Left	U	N/A	N/A	C		2	48	-	550	1945	1081	50.9%
1/2	A55 London Road (WB) Right	U	N/A	N/A	D		1	15	-	199	2006	357	55.8%
2/1	A5154 (SB) Left	U	N/A	N/A	E		1	34	-	211	1838	715	29.5%
2/2	A5154 (SB) Ahead	U	N/A	N/A	F		2	20	-	353	2115	517	68.3%
3/1	A55 Victoria Road (NB) Ahead	U	N/A	N/A	A		1	65	-	350	1970	1445	24.2%
3/2	A55 Victoria Road (NB) Right	U	N/A	N/A	B		1	33	-	475	1874	708	67.1%
4/1	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	726	Inf	Inf	0.0%
4/2	A55 Victoria Road (SB)	U	N/A	N/A	-		-	-	-	177	Inf	Inf	0.0%
5/1	A5154 (NB)	U	N/A	N/A	-		-	-	-	549	Inf	Inf	0.0%
6/1	A55 London Road (EB)	U	N/A	N/A	-		-	-	-	686	1948	1948	35.2%
Ped Link: P1	Unnamed Ped Link	-	-	-			0	0	-	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	**-**	**-**	**0**	**0**	**0**	**9.0**	**3.9**	**0.0**	**12.9**	**-**	**-**	**-**	**-**
London Road - West	**-**	**-**	**0**	**0**	**0**	**9.0**	**3.9**	**0.0**	**12.9**	**-**	**-**	**-**	**-**
1/1	550	550	-	-	-	0.9	0.5	-	1.5	9.6	4.1	0.5	4.6
1/2	199	199	-	-	-	1.9	0.6	-	2.5	45.1	4.5	0.6	5.2
2/1	211	211	-	-	-	1.1	0.2	-	1.3	22.6	3.6	0.2	3.8
2/2	353	353	-	-	-	1.6	1.1	-	2.7	27.6	5.1	1.1	6.2
3/1	350	350	-	-	-	0.4	0.2	-	0.5	5.5	2.8	0.2	3.0
3/2	475	475	-	-	-	3.1	1.0	-	4.1	31.0	9.9	1.0	10.9
4/1	726	726	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
4/2	177	177	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
5/1	549	549	-	-	-	0.0	0.0	-	0.0	0.0	0.0	0.0	0.0
6/1	686	686	-	-	-	0.0	0.3	-	0.3	1.4	0.0	0.3	0.3
Ped Link: P1	0	0	-	-	-	-	-	-	Inf	Inf	-	-	Inf

C1

PRC for Signalled Lanes (%): 31.8
PRC Over All Lanes (%): 31.8

Total Delay for Signalled Lanes (pcuHr): 12.61
Total Delay Over All Lanes(pcuHr): 12.89

Cycle Time (s): 90

Appendix 9

Air Quality

Contents	
9.1	Construction Dust and Particulate Matter Assessment Methodology
9.2	Traffic Data used in the Air Quality Assessment
9.3	Valley Meteorological Station Wind Roses

9.1 Construction Dust and Particulate Matter Assessment Methodology

Appendix 9.1: Construction Phase Dust and Particulate Matter Assessment Methodology

The following section outlines criteria developed by the Institute of Air Quality Management (IAQM, 2016) for the assessment of air quality impacts arising from construction activities. The assessment procedure is divided into four steps and is summarised below:

Step 1: Screening the Need for a Detailed Assessment

An assessment will normally be required where there are human receptors within 350 m of the site boundary and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s). Internal guidance from Natural England recommends that ecological receptors within 200 m of a site should be considered in a construction dust and particulate matter assessment, as opposed to only those ecological sites within 50 m of a site (as stated in IAQM Guidance (IAQM, 2016)).

A designated ecological site refers to any sensitive habitat affected by dust soiling. For locations with a statutory designation, such as a Site of Specific Scientific Interest (SSSI), Special Area of Conservation (SACs) and Special Protection Areas (SPAs), consideration should be given as to whether the particular site is sensitive to dust. Some non-statutory sites may also be considered if appropriate.

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is 'negligible'.

There are a number of human receptors within 350 m of the concrete batching plant. The Anglesey Terns SPA and North Anglesey Marine SAC are within 200 m of the concrete batching plant; however, both are considered not sensitive to dust. A Detailed Assessment was therefore undertaken for human receptors only.

Step 2: Assess the Risk of Dust Impacts

A site is allocated to a risk category on the basis of the scale and nature of the works (Step 2A) and the sensitivity of the area to dust impacts (Step 2B). These two factors are combined in Step 2C to determine the risk of dust impacts before the implementation of mitigation measures. The assigned risk categories may be different for each of the construction activities outlined by the IAQM (demolition, construction, earthworks and trackout).

Step 2A: Define the Potential Dust Emission Magnitude

The IAQM guidance recommends that the dust emission magnitude is determined for demolition, earthworks, construction and trackout. As it is anticipated that no buildings will be demolished as part of the construction of the concrete batching plant and the concrete batching plant will be located on existing hardstanding, demolition and earthworks have been scoped out of the assessment. The dust emission magnitude is based on the scale of the anticipated works. **Table 9.1.1** describes the potential dust emission class criteria for each outlined construction activity.

Table 9.1.1 Criteria Used in the Determination of Dust Emission Class

Activity	Criteria used to Determine Dust Emission Class		
	Small	Medium	Large
Construction	• Total building volume <25,000 m^3; • Construction material with low potential for dust release.	• Total building volume 25,000 – 100,000 m^3; • Potentially dusty construction material (e.g. concrete).	• Total building volume >100,000 m^3; • On site concrete batching.
Trackout	• <10 outward HDV trips in any one day; • Unpaved road length <50 m.	• 10 – 50 outward HDV trips in any one day. • Unpaved road length 50 – 100 m.	• >50 outward HDV trips in any one day; • Unpaved road length >100 m.

Step 2B: Define the Sensitivity of the Area

The sensitivity of the area takes into account the following factors (**Table 9.1.2**):

- the specific sensitivities of receptors in the area;
- the proximity and number of receptors;
- the local background PM_{10} concentration; and,
- site-specific factors, such as the presence of natural shelters, such as trees, to reduce the risk of windblown dust.

Table 9.1.2 Criteria for Determining Sensitivity of Receptors

Sensitivity of Receptor	Criteria for Determining Sensitivity	
	Dust Soiling Effects	Health Effects of PM_{10}
High	Dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms	Residential properties, hospitals, schools and residential care homes
Medium	Parks, places of work	Office and shop workers not occupationally exposed to PM_{10}
Low	Playing fields, farmland, footpaths, short-term car parks and roads	Public footpaths, playing fields, parks and shopping streets

The criteria detailed in **Table 9.1.3** and **Table 9.1.4** were used to determine the sensitivity of the area to dust soiling effects and human health impacts.

Table 9.1.3 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<350
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 9.1.4 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentrations	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg.m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg.m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg.m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg.m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg.m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg.m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentrations	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
	<28 µg.m^3	≥1	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Step 2C: Define the Risk of Impacts

The dust emission magnitude and sensitivity of the area are combined and the risk of impacts from each activity (construction and trackout) before mitigation is applied should be determined using the criteria detailed in **Table 9.1.5** and **Table 9.1.6**.

Table 9.1.5 Risk of Dust Impacts – Construction

Potential Impact	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 9.1.6 Risk of Dust Impacts - Trackout

Potential Impact	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Step 3: Site-Specific Mitigation

Step three of the IAQM guidance identifies appropriate site-specific mitigation. These measures are related to whether the site is a low, medium or high-risk site. The highly recommended mitigation for the proposed scheme is detailed in the **Section 9.6.2** of **Chapter 9**.

Step 4: Determine Significant Effects

With the implementation of the mitigation measures detailed in **Section 9.6.2** of **Chapter 9**, the residual impacts from the construction are considered to be **not significant**, in accordance with IAQM guidance.

9.2 Traffic Data used in the Air Quality Assessment

Appendix 9.2: Traffic Data used in the Air Quality Assessment

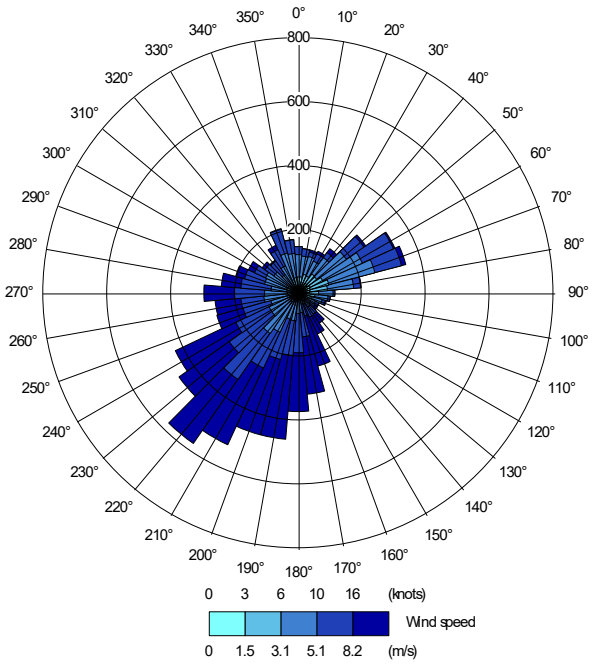
Road link	Link Name	Verification / base year (2018)		Year of peak construction 'without refurbishment scheme' (2022)		Year of peak construction 'with refurbishment scheme' (2022)		Speed
		AADT	HGV (%)	AADT	HGV (%)	AADT	HGV (%)	(mph)
1[A,B]	A55 - N Wales Expressway	11,557	13.7	12,820	17.1	13,228	19.6	30-70
2[A,B]	A55 - Victoria Road	12,501	12.7	13,759	15.8	14,167	18.2	30
3[A]	A55 - London Road	10,254	15.5	11,325	19.1	11,733	21.9	30
4[A]	A55 - North of A55/A5 Junction	7,504	19.9	8,458	24.2	8,866	27.7	30
5[A]	Port Access Road	3,523	41.1	4,098	48.7	4,506	53.3	20
6*	A5 Holyhead Road	7,156	2.9	7,439	2.9	7,439	2.9	30-60
7*	A5025	5,447	2.5	5,662	2.5	5,662	2.5	30-60
8*	A5154	3,268	2.2	3,370	2.2	3,370	2.2	20-30
9*	A5 London Road	6,536	2.2	6,794	2.2	6,794	2.2	30-60

[A]2022 flows include cumulative construction traffic from the Holyhead Port Expansion
[B]2022 flows include cumulative construction traffic from the Morlais (West Anglesey) Demonstration Zone
*Traffic data were obtained from the DfT Manual Count Point Data (Site numbers 77044, 50659, 77035 and 88024) for the A5 Holyhead Road, A5025, A5154 and A5 London Road respectively (DfT, 2021) as these links will not be used by refurbishment scheme construction traffic, but were included for model verification and to predict more representative pollutant concentrations at human and ecological receptors.

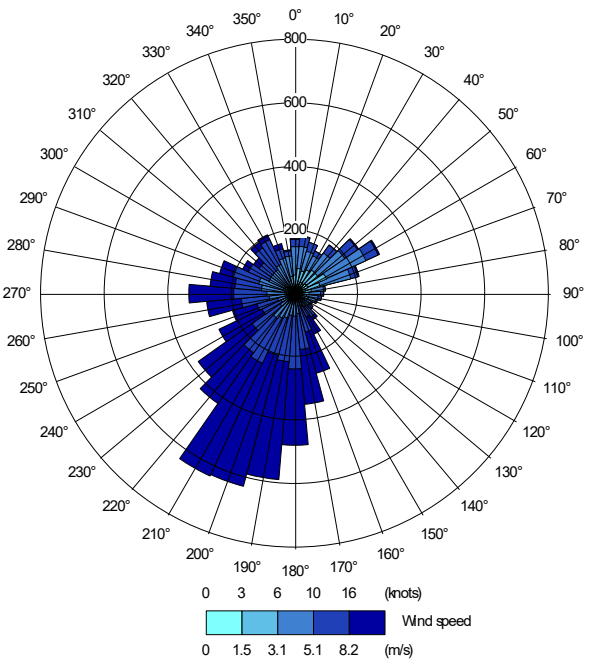
9.3 Valley Meteorological Station Wind Roses

Appendix 9.3: Valley Meteorological Station Wind Roses (2014 – 2019)

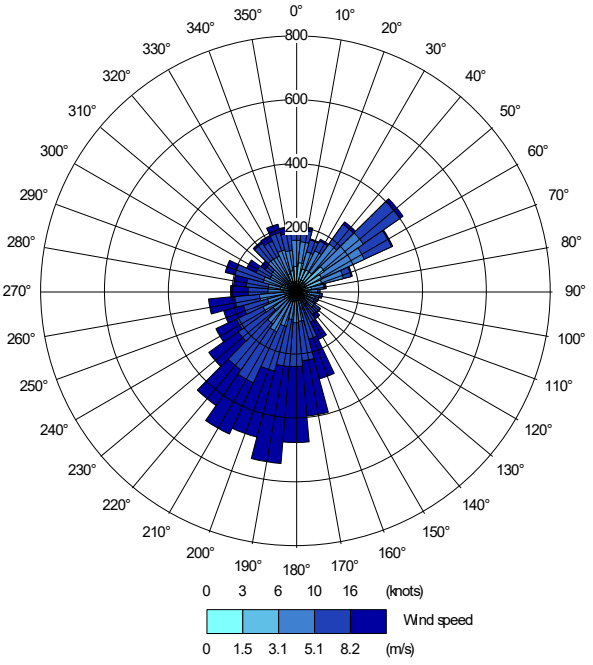
Valley Wind Rose 2014



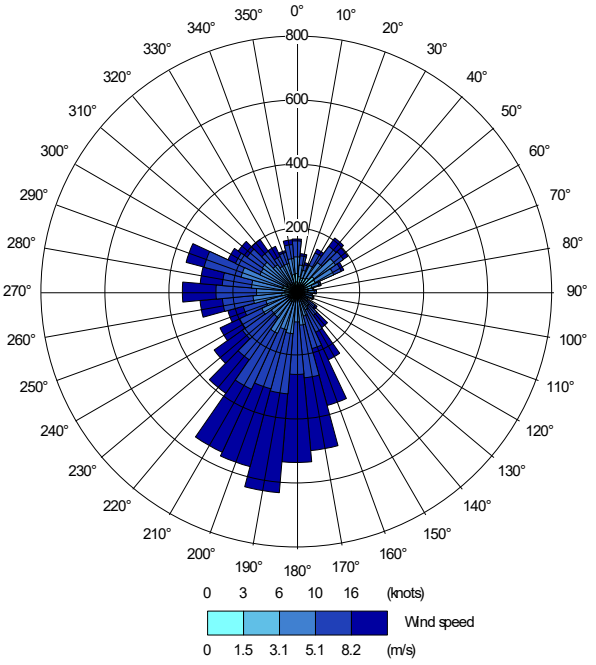
Valley Wind Rose 2015



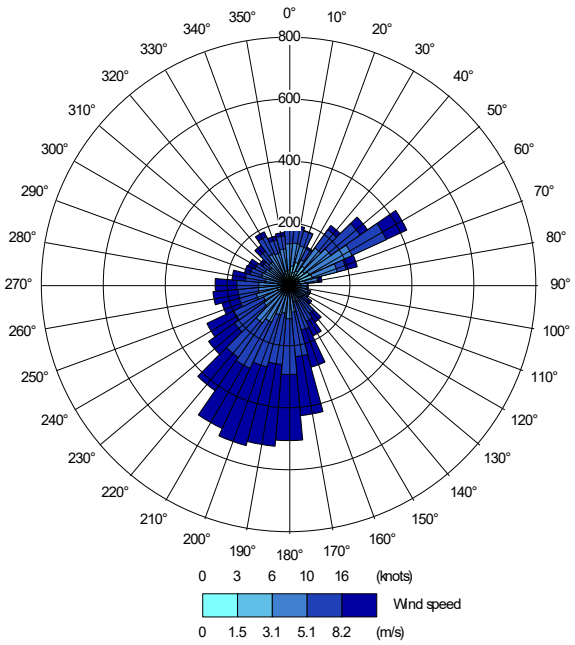
Valley Wind Rose 2016



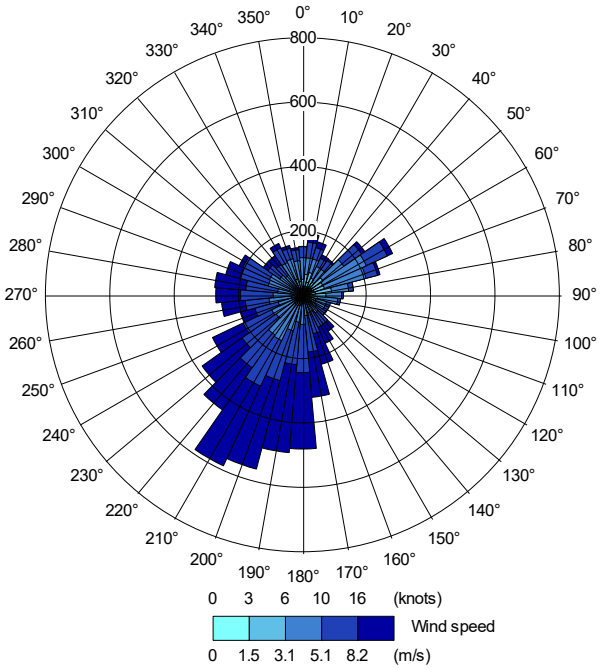
Valley Wind Rose 2017



Valley Wind Rose 2018



Valley Wind Rose 2019



Appendix 11

Marine Ecology

Contents	
11.1	Benthic Ecology Remotely Operated Vehicle (ROV) Survey Report
11.2	Drop Down Video Survey

11.1 Benthic Ecology Remotely Operated Vehicle (ROV) Survey Report

Royal HaskoningDHV

Benthic Ecology Remotely Operated Vehicle (ROV) Survey Report of the Breakwater at Holyhead

Carcinus Reference: J0578_200301

Date: 03 March 2020

Final

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Document Approval

	Name	Role	Date
Author	Matthew Crabb Elena Maher	Director Associate	24 February 2020
Checked	Despina Crabb Matthew Crabb	Quality Control Director	03 March 2020
Approved	Matthew Crabb	Director	03 March 2020

This report was produced by Carcinus Ltd (Carcinus) on behalf of Royal HaskoningDHV for the purposes of providing a benthic ecology report in relation to the proposed works within the vicinity of the Holyhead breakwater. Every effort has been made to ensure the information contained within is as complete and valid as possible at the time of writing. It should be noted that additional information may exist that was not available or identified at the time or has subsequently been published after the date of this report.

Carcinus accepts no liability for any costs, losses or liabilities arising from the reliance upon or use of the contents of this report other than by its client.

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Non-technical Summary

Carcinus Ltd (Carcinus) was commissioned by Royal HaskoningDHV to conduct a survey to acquire and analyse underwater video data from the area surrounding a breakwater structure at Holyhead. The data were collected using a remotely operated vehicle in December 2019. The aim was to characterise the seabed in the study area to allow an ecological characterisation of the breakwater wall, rubble mound and surrounding seabed, whilst noting the presence of any *Didemnum vexillum* or any other non-native species or those of conservation importance.

Footage was collected from eight transects using a remote operated vehicle (ROV) system. No sediment or faunal samples were collected.

The data collected has allowed identification of the existing habitats and features across the study area.

The key findings of this report are as follows:

- A total of eight biotopes representing a variety of faunal communities and seafloor environments were identified in footage collected from Holyhead in 2019. The most frequently observed biotope was: 'Kelp and red seaweeds (moderate energy infralittoral rock)'.
- The most abundant biotope was: '*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud'.
- A variety of faunal and algal taxa were identified in the ROV footage and stills. Particularly abundant fauna included the common dragonet (*Callionymus lyra*), small gobies, the sea-pen *Virgularia mirabilis,* the sea squirt *Ascidella aspersa* and brittle stars.
- The vertical breakwater surface was colonised by highly abundant barnacles (Cirripedia) and limpets (*Patella vulgata*) though diversity within the community here was generally low.
- Within the shallower waters near the breakwater where boulders and rocky surfaces were abundant, the kelp species *Saccharina latissima* and *Laminaria digitata* were both identified in dense bands as was the Fucoid *Fucus serratus.*
- A clear gradient in sediment and habitat types was apparent with depth and distance from the breakwater.
- A total of 42 fauna were identified in total, with 40 species being identified from video footage collected with the ROV, while a total of 16 fauna were identified from stills analysis, two of which were not identified from the video analysis. A total of 11 types seaweed (identified to differing of taxonomic level) were identified in stills extracted from video.
- The invasive sea squirt *D. vexillum* was not identified along any of the transects either on the seafloor or on the vertical surface of the breakwater. However, presence cannot be ruled out due to the transect nature of the survey.
- Reduced visibility was an occurrence at times during the survey, mostly limited to the softer sediment biotopes remote from the breakwater during initial ROV set down and manoeuvring. During these times, a reduction in faunal and algal species identification may have resulted.

1. Introduction

Royal HaskoningDHV (the 'Client') commissioned Carcinus Ltd (Carcinus) to undertake a Remotely Operated Vehicle (ROV) survey of the seabed within the vicinity of the Holyhead breakwater.

The client is working to refurbish the Holyhead Breakwater and a marine ecology survey of the breakwater and the associated rubble mound it sits on, plus an area of the adjacent seabed was required. The breakwater is approximately 2.4 km long with surveys required to extend approximately 200 m from the wall on the seaward side and 60 m on the leeward side. The substrate consists of mainly rubble (rock of various sizes), and as such needed to be surveyed using subsea digital imaging techniques rather than substrate / sediment collection methods.

A survey to assess the biotopes and principle species present along with determining if the carpet sea-squirt *Didemnum vexillum* was present within the areas surveyed was required.

The initial survey detailed within this report took place within the harbour on the leeward side of the breakwater. Weather conditions at the time prohibited survey operations on the seaward side of the breakwater.

1.1. Objectives

The specific objectives of this report are as follows:

- Provide detail of the survey operations associated with the data collection phase of the initial survey;
- Outline the methods and procedures used;
- Detail the results of the survey with specific reference to benthic ecology and *D. vexillum* within the survey area; and
- Highlight key species and features of conservation importance.

2. Methods

2.1. Planning & Preparation

Prior to the onset of survey, the Health, Safety and Environmental (HSE) aspects of the proposed works were fully considered and planned. As part of this process, a detailed Project Execution Plan (PEP) was compiled, which included emergency planning, consideration of environmental conditions on site and project specific tasks as well as outlining any vessel specific hazards. A project specific Risk Assessment (RA) detailing the likely risks was also be prepared.

A Notice to Mariners (NtM) was issued and close liaison with the Port of Holyhead was maintained to mitigate any potential risk from incoming / outgoing ferries.

2.2. Mobilisation / De-mobilisation

2.2.1. Mobilisation

Mobilisation took place from Amlwch which represented a close accessible port capable of accommodating the proposed survey vessel (see below). Every effort was made to mobilise during a period of settled weather to increase the chance of encountering good sampling conditions and minimise weather risks. Within the mobilisation schedule, allowance was made for a pre-mobilisation kick-off meeting to be held on-board the vessel prior to departure to inform all those involved in survey operations of the agreed scope, the PEP, method statements and the risks identified within the Health, Safety and Environmental (HSE) management plan.

Prior to leaving port, all equipment was checked to ensure it is functioning correctly and no damage has been sustained during transportation. This involved both dry and wet tests of the ROV control and camera systems to check functionality and fine tune any settings as well as measuring the distance between dual lasers to determine scaling. Following this, all deck equipment was lashed down ahead of transit to site.

2.2.2. De-mobilisation

Following completion of the survey, data including seabed video, stills images, positions, times and field recording sheets was backed-up onto separate duplicate hard-drives with appropriate shock-proof enclosures. All sampling equipment was secured on-deck during transit before disembarkation in port.

2.3. Survey Strategy

The survey strategy was devised by Royal Haskoning DHV and Carcinus in agreement with relevant Statutory Nature Conservation Bodies (SNCB's) prior to the commencement of fieldwork. This included all the necessary consents and permissions. The HSE aspects of the works were also considered and planned. As part of this process, a detailed PEP was compiled, which included emergency planning, consideration of environmental conditions and project specific tasks.

Survey transects were positioned along the length of the breakwater, running perpendicular to it, such that each linear transect would cover the area from 60 m distant from the leeward side to the wall itself (where accessible by ROV based on onsite conditions). Acceptable sampling accuracy was aimed to be within 10 m of the target location subject to onsite conditions and the health and safety criteria outlined in the separate project execution plan. The targeted transects are presented in Table 1 and Figure 1.

Table 1 Start and end positions for targeted survey transects (positions in WGS1984 Lat/Long).

	Start		End	
Transect	**Latitude**	**Longitude**	**Latitude**	**Longitude**
T1	53.32269	-4.64505	53.32292	-4.64573
T2	53.32455	-4.64276	53.32492	-4.64317
T3	53.32482	-4.6394	53.32531	-4.63944
T4	53.32487	-4.63521	53.32535	-4.63525
T5	53.32493	-4.63093	53.32541	-4.63096
T6	53.3261	-4.62611	53.32646	-4.62666
T7	53.32817	-4.62243	53.32853	-4.62302
T8	53.32994	-4.61785	53.33077	-4.61898

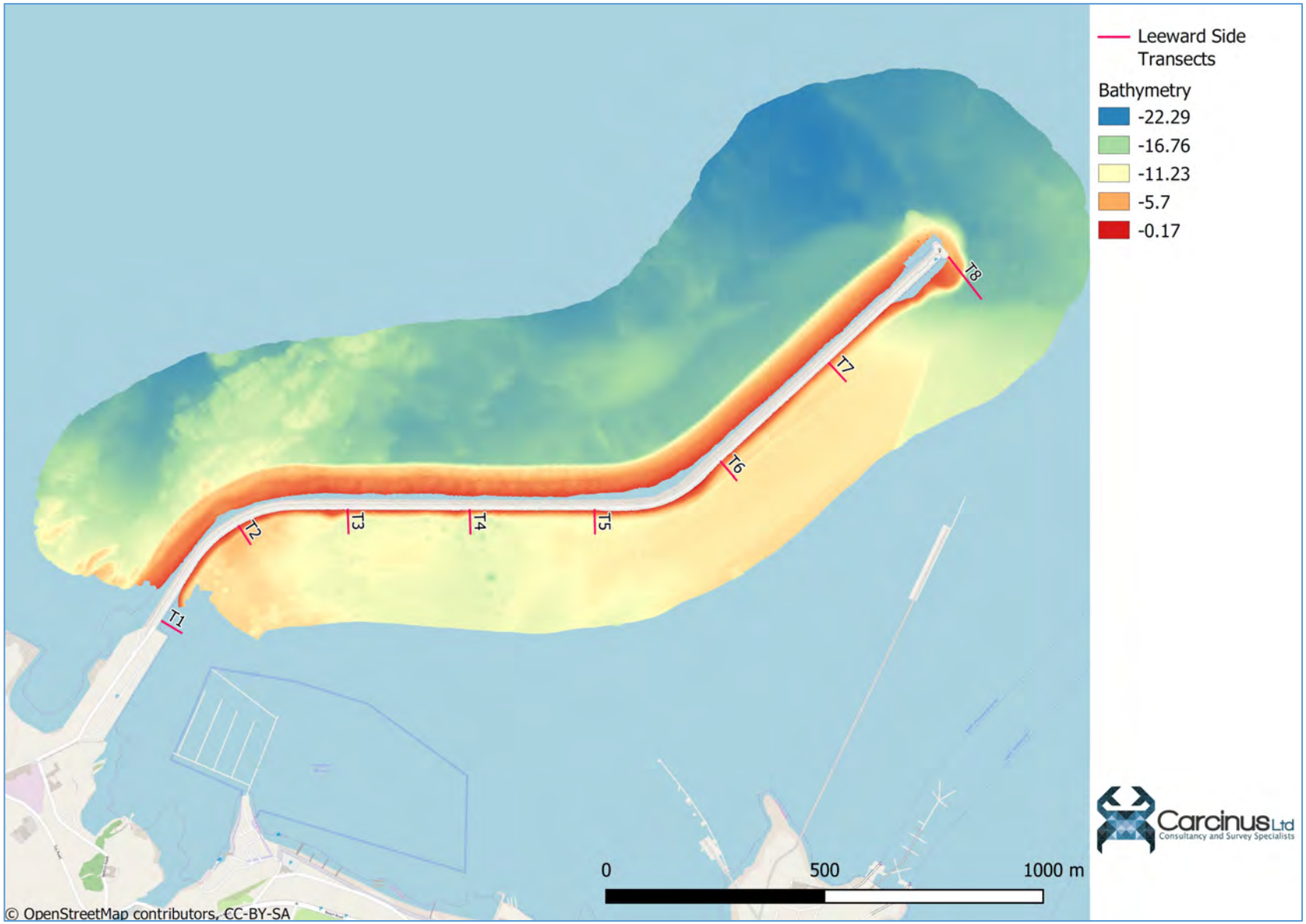

Figure 1 Targeted survey transects

2.4. Vessel Specifications and Positioning

The survey vessel, SeeKat 'C', was commissioned to undertake the above works, see Plate 1. The vessel is ideally suited for coastal and near shore survey operations and is based just 15 miles from Holyhead, at Amlwch. As such, it was possible to mobilise at relatively short notice to make use of a narrow window of favourable weather conditions.

Plate 1 Proposed survey vessel Seekat 'C'.

Site positioning was achieved using a differential GPS / GNSS system providing positional information to a computer running Trimble HYDROPro™ Navigation. Offset corrected positional information was applied to the video overlay for the ROV system. Noting that due to the presence of extensive pot deployments within the survey area, overlay positions were not obtainable for much of the transects, where the vessel was required to stand off to maintain a safe distance from the pot lines etc. All information was logged and appropriately stored in triplicate redundant storage and secured offsite after survey operations on each day. All coordinates were recorded in WGS1984 Lat / Long. Transects were 'flown' at a steady speed and where coordinates are not reliable due to the needs for vessel stand-off, time based measured have been utilised to correct biotope boundaries identified during video analysis.

2.5. Survey Techniques

Digital data was acquired via a camera mounted within a heavy configuration BlueROV2, comprising four vertical thrusters and 4 vectored thrusters giving six degrees of freedom and increased buoyancy for added control and the additional 4K camera payload. The ROV is a self-contained unit powered by high capacity lithium ion batteries. The system which is light weight was deployed and recovered by hand via its load bearing umbilical. The BlueROV2 heavy configuration was ideally suited to the requirements of this survey, with a max dive depth of 300 m, the survey area was well within its depth rating and its high degree of control and manoeuvrability ensured that substrates could be assessed, including large boulders, flat sands / muds and vertical services, all viewable from an oblique or perpendicular viewing angle that cannot be achieved via conventional drop down camera systems.

The BlueROV2 Heavy was equipped with a 1080p HD video camera with live feed to the surface and overlay and in addition an UHD 4K video camera was also added, enabling significantly higher image and video resolution to be obtained. The BlueROV2 Heavy was also equipped with 4 No. 1500 lumen

subsea lights with 10 levels of adjustable brightness, thus ensuring that the substrate could be adequately illuminated, whilst avoiding excessive back-scatter from water-born particulate matter and plankton. Scaling lasers were also added to assist with later image and video analysis.

The ROV operator acted as the pilot and monitored the live video feed. An additional team member was required to manage the tether. The on-board cameras were configured to record continuous video, with the 1080 HD video being streamed in real-time to the vessel. Footage was viewed in real-time on the surface by the pilot to provide a means of monitoring survey parameters e.g. visibility, camera angle, relative position etc.

The position of the ROV will be provided from a vessel mounted dGNSS (with layback / offset) augmented by the live camera feed and ROV telemetry (including, heading, depth, camera angle, roll, and pitch, battery condition and internal temperature).

The ROV was hand deployed from the vessel to the water surface upon which time it was armed and diving commenced. Deployment stopped at ~50 cm from the seabed with the vessel moving slow ahead. Recording will commence just prior to the start-of-line (SOL) and will end once the ROV has passed the end-of-line (EOL) with the ROV being 'flown' along the transect. On completion of a given transect or line segment, the ROV was surfaced and brought alongside the survey vessel. Once alongside and under the control of the deck crew, the ROV was disarmed and retrieved to deck.

Video data was downloaded from the onboard UHD 4K cameras and the ROV was checked for condition and operation before powering off. Batteries were changed, when required, in preparation for the next transect / dive.

2.6. Biosecurity

Prior to mobilisation to the survey site, all equipment was previously cleaned and dried. Acknowledging the potential for the presence of *D. vexillum* within the area, all survey equipment was thoroughly cleaned and dried following survey operations to ensure the species was not transferred to other locations.

2.7. Data Analysis

2.7.1. Seabed Images and Video

All ROV footage and image analysis has been undertaken in-line with JNCC guidance given in the Marine Monitoring Handbook (JNCC, 2001; JNCC, 2015), the JNCC guidance on assigning benthic biotopes (Parry, 2015) and the NMBAQC and JNCC epibiota interpretation guidelines (Turner *et al.,* 2016). Biotopes have been assigned along each transect within the study area using a standardised recording format. This enabled the identification of biotopes through record of substrate type, habitats and species present as well as the identification of energy regimes locally (through video footage). Note that incidental patches of habitat smaller than 5x5 m did not constitute biotopes following guidance by Connor *et al.* (2004).

Footage from the ROV transects was analysed to determine habitat types and their boundaries present across the site and notes were made of any obvious macrobenthic and epifaunal species present. The UHD 4k footage from individual transects was reviewed twice per transect at a quarter speed to allow the identification of fauna, algae and biotopes. Start and end points for each biotope type were noted. Rationale for biotope designations along each transect are given in Appendix 1.

A total of 42 images were extracted from the 4k footage collected along each of the biotope sections at each transect during the video analysis. Stills were extracted approximately halfway through each biotope section in the 4k footage. This approach ensured that every habitat section along each of the transects was subject to assessment. These stills were consequently analysed to determine the

SACFOR abundance of faunal and algal communities at a higher resolution not possible from video interrogation as per JNCC guidance (Parry, 2015). Unfortunately, due to the poor visibility at the time of survey, some of the stills are very unclear and it is likely that fauna and algae are underrepresented in the final dataset. Nonetheless, environmental conditions and conspicuous fauna were identified during the video identification stage and, where possible, SACFOR abundance scores were given (Appendix 3).

Two species matrices have been produced as a result of the ROV footage and image analysis; one for sections of video transects covering each habitat and one for stills. A presence/absence matrix has been compiled for sections of video covering single habitat types per transect while a SACFOR abundance matrix has been compiled for the stills given the high resolution of the images which allows for the identification of less conspicuous taxa. SACFOR abundance of epibiota within stills allows for quantitative analysis of identifiable organisms. Coverage of macroalgae has been recorded, where possible, to aid with the identification of biotopes. The species matrices for the footage and stills collected along each transect at Holyhead are given in full in Appendices 2 and 3 respectively.

Biotopes were assigned along each transect using the survey results and field notes. Information used to classify biotopes included biological zone, substrate, energy level, sediment mobility, salinity, depth and species composition as per JNCC guidelines (Parry, 2015).

3. Survey Operations

Survey operations took place between the 2nd and 4th of December 2019. There were no accidents or near misses to report with all survey activities adhereing to the health and safety plan and accompanying risk assessments. The weather window for survey operations was short and conditions on site restricted operations to the leeward side of the breakwater, due to large rolling swell running along the outside wall / rock armouring. Antecedal weather conditions had been reasonably unsettled and relatively high suspended sediments were encountered during the survey. Adjustments were made to ROV lighting to minimise backscatter. Due to the reduced visibility, the ROV was flown at a reduced distance from the substrate to maximise image quality.

Survey operations commenced from transects at the landward end of the breakwater, working towards the head of the breakwater as the time of highwater approached. Thus ensuring that operations near the head of the breakwater were undertaken as near to slack water as possible. Owing to swell, operations beyond the end of the breakwater were not possible. In addition, strong tidal flow was encountered near the head of the breakwater even over the predicted slackwater period.

A large number of fishing pots were deployed within close proximity of the breakwater, with each string marked at a single end. Bouyant rope was strung between pots resulting in a significant entanglement hazard to the ROV. On a number of occasions the ROV had passed under ropes and the entanglement only became apparent upon surfacing, resulting in a second dive to manuever the ROV back under the ropes to free the vehicle. The prescence of pot strings also restricted the vessels ability to follow the ROV along the transects and in most cases was required to stand off of the transects, whilst the ROV undertook survey operations. In addition to marked pot lines, the prescence of abandoned / lost posts and other debris in the form of sunken boats was also observed.

In total, 8 transects were successully completed to aquire digital video and stills images of the seabed on the leeward side of the breakwater.

4. Results

4.1. Substrates of Holyhead Breakwater

A variety of substrate types were identified during the analysis of footage collected during the survey at Holyhead. Mixed sediments composed of bedrock, boulders, cobbles and coarse gravel were dominant across the shallower portions of the site near to the breakwater while muddy sands and mixed sediments were dominant in the deeper waters and open areas of seafloor.

A gradient in sediment type and associated ecology was apparent along the transects running from shore to sea. Sediments observed were increasingly dominated by muddy sands and well-sorted missed sediments as distance from the shore increased.

The sediments at Holyhead appeared to be highly influential on the benthic and epibenthic communities identified across the site. Where boulders, cobbles and mixed sediments provided heterogeneity and stable surfaces more impervious to tidal action, macroalgae was abundant alongside epibiota. Where sediments were fine, tube forming, and burrowing taxa were mostly dominant and algae was very rare. The substrates present were important identifying factors for the biotopes present across the site and were a key guidance feature when determining suitable habitat descriptions. Rationale for biotope descriptions are outlined in Appendix 1 and discussed further in Section 4.6.

4.2. Anthropogenic Influences at Holyhead

Signs of anthropogenic disturbance were apparent at several locations at Holyhead. A notably large patch of litter including bottles, plastics and drink cans was recorded along Transect 2 near to the breakwater (Plate 2). Abandoned fishing pots colonised by encrusting fauna were also observed.

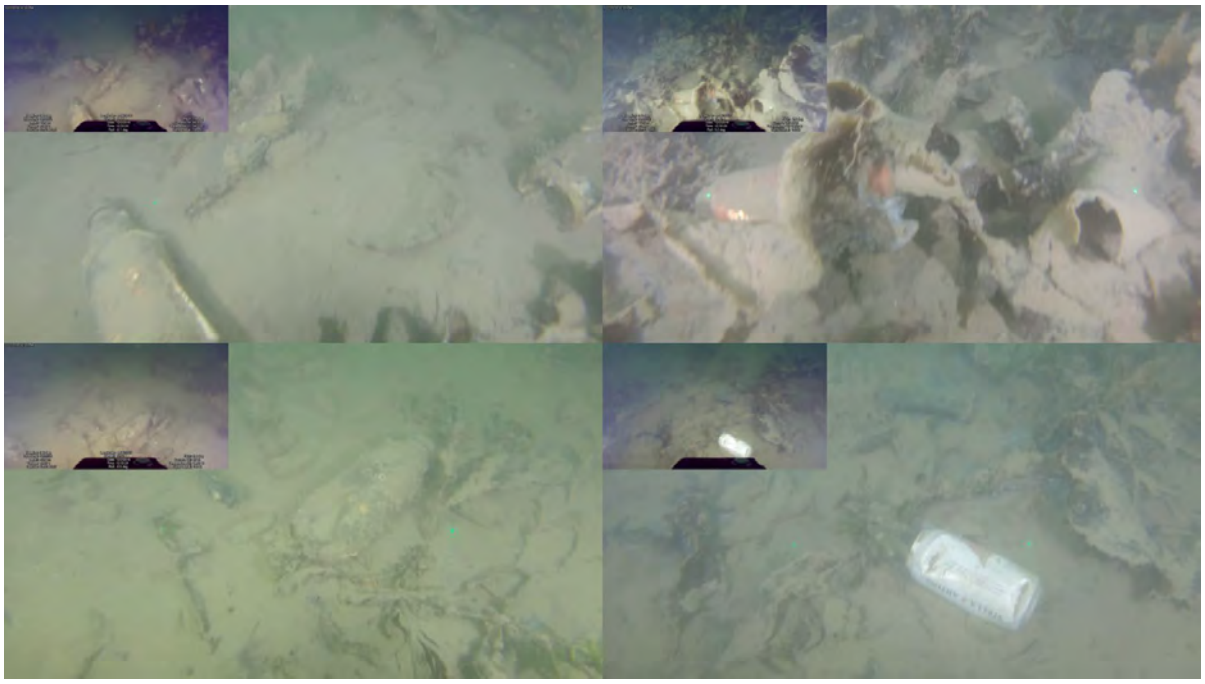

Plate 2 Anthropogenic litter identified along Transect 2 in the 2019 survey of Holyhead.

In addition to the discovery of litter items settled on the seafloor, a relatively recent shipwreck (Plate 3) was identified along Transect 8. There were no fouling communities present on the wreck and few fauna or algal species were identified in the vicinity of the wreck.

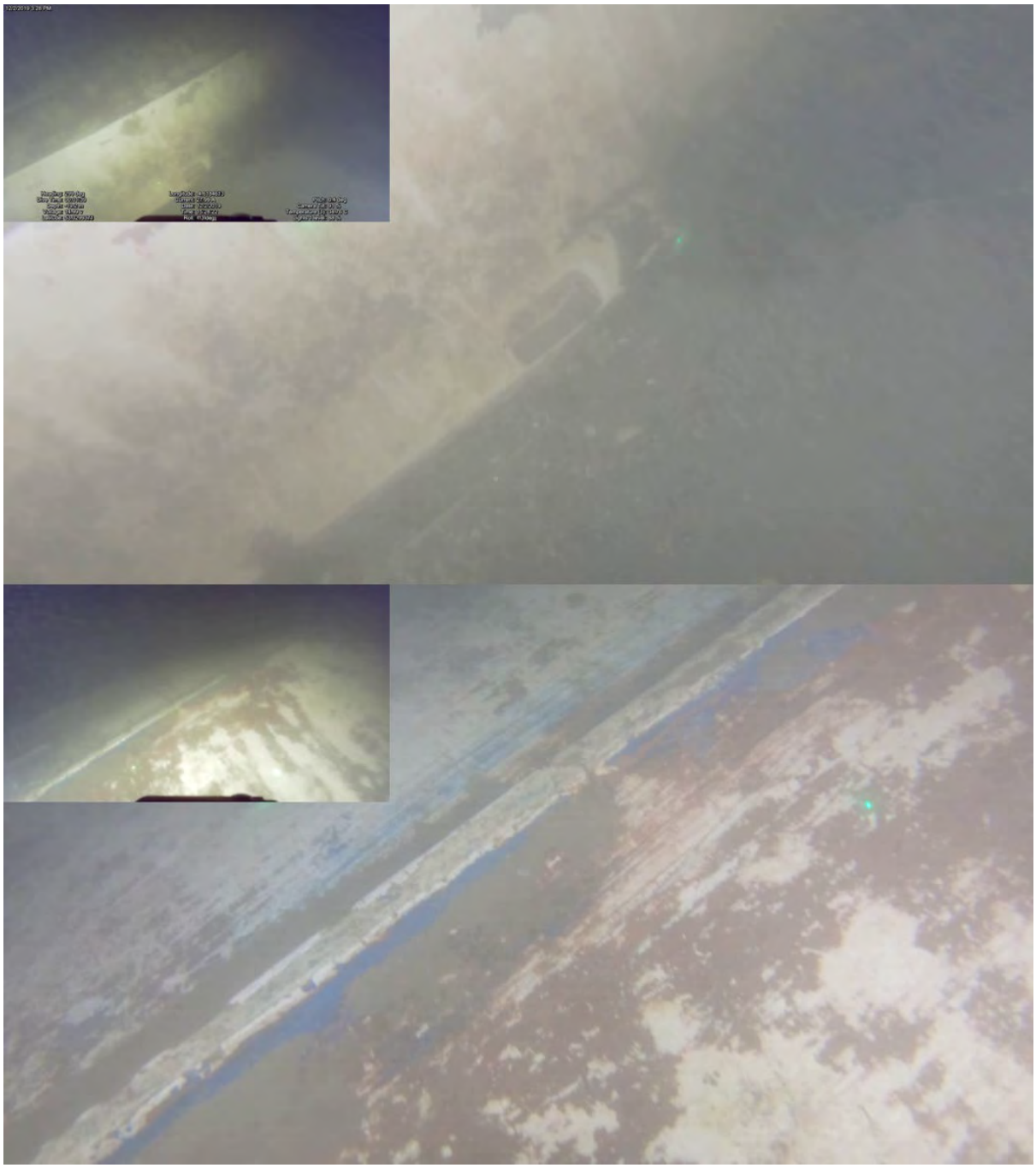

Plate 3 Small shipwreck identified along Transect 8 during the 2019 ROV survey of Holyhead.

4.3. Epibenthic Fauna of Holyhead Breakwater

A total of 40 fauna were identified from across a range of habitat types in the video analysis of footage collected using the ROV at Holyhead in 2019. A total of 16 taxa were recorded in the stills collected from along the same footage, the majority of which had been identified to the same or similar taxonomic level during the footage analysis process. A breakdown of the fauna presence and absence recorded in footage collected at Holyhead is given in Appendix 2, whist SACFOR abundance determined from stills can be located in Appendix 3. Note that due to issues with poor visibility resulting from poor survey conditions, some taxa (such as 'Cirripedia' which was most likely to be *Semibalanus* sp.) have been left at a low level of taxonomic level to increase confidence in the correct

designation. The identity and presence of encrusting ascidian, sponge and bryozoan taxa were especially challenging to verify due to their small size and lack of features identifiable. For example, small patches of inconspicuous, encrusting, orange fauna were observed along Transect 4; though identifying them as pigmented Bryozoa such as *Parasmittina trispinosa* or *Scizoporella japonica* or as a mat forming Ascidean such as *Didemnum* sp. was on occasion not possible.

The epibenthic fauna identified in both the video and stills gathered during the ROV survey were relatively diverse for a small area surveyed during winter months and indicative of a fairly complex community. Notable features included large expanses of fine muddy sands colonised by the sea pen *V. mirabilis*, ophiuroids and other burrowing species in the deeper waters as well as a relatively diverse population of macroalgae and invertebrate species nearer to the breakwater. Communities present on the vertical wall of the breakwater itself were characterised by low diversity but high abundance with Cirripedia and *Patella vulgata* frequently recorded as the only conspicuous fauna.

Fish identified across the site included juvenile wrasse (Labridae), common dragonets (*C. lyra*), Gobiidae, Pleuronecteformes and the lesser spotted dogfish (*Scyliorhinus canicula*). Several commercially valuable species including the European lobster (*Homarus gammarus*), and the Common spider crab (*Maja squinado*) were recorded in low abundance across the site. Anchored fishing pots were also observed at several locations within the site boundaries.

All of the fauna identified in footage collected at Holyhead were typical for the circalittoral and infralittoral habitats present and those distributed along the coast of north Wales. The majority of immobile taxa were represented by common Bryozoa, Hydrozoa and Porifera species as well as anemones including *Cerianthis lloydii* and *Urticina felina*. Signs of burrowing fauna and Annelida were also present across much of the site where soft sediments were present though burrow identification was not possible.

Video analysis revealed that the most frequently recorded taxon was the sea squirt *Ascidella aspersa* which was identified at 18 of the 42 habitat sections identified along the transects at Holyhead. Note that each section of transect where different biotopes/habitat types were recorded (including the breakwater wall) have been treated as separate 'samples' for the purpose of summarising biological data. Species were recorded on a presence/absence basis and not according to individual abundance due to MNCR SACFOR scoring. This species is common across the UK and though *A. aspersa* is a solitary colony, it is often present in high abundance in relatively shallow, sheltered sites (Curtis, 2005). A summary of the 10 most frequently observed faunal taxa (from ROV video analysis) is given in Table 2.

Table 2 The ten most frequently recorded taxa in footage collected by ROV at Holyhead in 2019.

Taxon Name	Frequency of identification
Ascidella aspersa	18
Gobiidae	12
Spiorbidae	11
Spironbranchus sp.	10
Cirripedia	9
Callionymus lyra	8
Patella vulgata	7
Hydrozoa	7

Taxon Name	Frequency of identification
Sertulariidae	7
Ophiuroidea	5

4.4. Rare & Invasive Species

The small spotted catshark *Scyliorhinus canicula* is listed on the IUCN Red List though is categorised as 'Least Concern' with the main threat considered to be fishing and harvesting of aquatic resources (Ellis *et al*., 2009). The population mature of *S. canicula* is considered to be stable and widespread across Europe.

No invasive non-native species (including *D. vexillum*) were identified in the footage and stills collected at Holyhead in 2019. However, their absence cannot be ruled out due to the transect design of the survey.

4.5. Macroalgae of Holyhead Breakwater

The seaweed (macroscopic marine algae) communities at Holyhead were sparse in the deeper waters where fine and mixed sediments dominated but well developed where suitable rock and boulder dominated substrate allowed nearer the breakwater wall. The presence of numerous seaweeds across the site had a palpable influence on the faunal communities present. A wide range of forms and species of algae were observed, offering multiple functions to the local ecosystem including habitat provision, food supply, shelter and protection. Though identification from stills and video was challenging (many algal species require microscopic inspection), some prominent species were identified.

A gradient in algal species and forms (zonation) was apparent between the shallow to deep subtidal regions of the site at Holyhead. Forms of attached algae were rare at the start of each transect where fine sediments were dominant and waters were deeper (~10-20m), though presence and diversity increased closer to the breakwater.

A green diatom film was present on the surface of sublittoral muddy sands at Transects 1 and 2. The kelp *Saccharina latissima* was regularly one of the first macroalgal species recorded in abundance as the transect approached the breakwater. The oar weed kelp species *Laminaria digitata* mixed with *S. latissima* were typically observed as the transect progressed towards the breakwater and the presence of red algae (rhodophytes) were increasingly present. In the band below the kelp forest along the edges of rocky outcrops were developed seaweed turfs. These were made up of tufts of foliose red, brown and green seaweeds, important for grazing gastropods and other herbivores. Encrusting Corallina species were common in the lower infralittoral zone alongside numerous foliose reds which were often present as an epiphyte on kelp stipes. Nearest to the breakwater where large boulders were more abundant and algal species were subject to increased tidal flow and internal wave action, the brown Fucoid *F. serratus* was present in dense carpets. The green algae *Ulva* sp. was identified very occasionally in small patches in the shallowest regions of the site, near to the breakwater.

Observations of algae near the breakwater at Holyhead were made during winter and some of the kelp species in particular appeared damaged and worn. Nonetheless, the macroalgae communities appeared generally healthy and provided habitat for a variety of mobile fauna including the European lobster *Homarus gammarus*, juvenile wrasse (Labridae), the grey topshell *Steromphala cineraria* as

well as encrusting fauna including Bryozoa (*Membranipora membranacea* and *Electra pilosa*) and Hydrozoa (*Obelia* sp.)

4.6. Biotope Designation within Holyhead Breakwater Survey Area

A total of eight infralittoral and circalittoral biotope complexes (JNCC, 2015) were identified following the 2019 survey suggesting a relatively diverse and ecologically heterogeneous site. Please note that following guidance given in Parry et al. (2015), any habitat covering an area of greater than 5 m^2 has been classified as a biotope to the highest possible level of certainty.

The locations of the biotopes have been identified from ROV footage analysis undertaken by experienced biologists. A total of eight infralittoral and circalittoral biotope complexes (JNCC, 2015) were identified following the 2019 survey suggesting a relatively diverse and ecologically heterogeneous site. These biotopes have been digitised to allow the visualisation of biotope distribution and are representative of EUNIS levels 3-6 (Figures 2 to 10). Please note that following guidance given in Parry *et al*. (2015), any habitat covering an area of greater than 5m^2 has been classified as a biotope to the highest possible level of certainty.

An example photograph of each biotope designation is given in Appendix Plate 1. Variation in biotopes across the site is apparent with infaunal communities transitioning along and between transects as environmental conditions transform.

The biotopes designated to the communities at Holyhead were generally typified by moderately sheltered conditions with relatively low energy regimes and ranged from the sublittoral to the shallow infralittoral zones. Low-moderate tidal flow was a defining environmental condition within the area of interest which was influential for the algal and faunal species identified across the site. As discussed in Section 4.1, bedrock, boulders, cobbles and mixed sediment appeared to be dominant near to the breakwater whereas fine sediments (muddy sands) dominated the deeper environments further from the breakwater. This resulted in a gradient of variation between habitat types and associated communities near to and further from the breakwater.

Variation in faunal assemblages was apparent along all transects in approach to the breakwater and were correlated with the habitat type and environmental conditions. Habitats transitioned from fine sediments at the start of each transect and were designated as biotopes such as 'Infralittoral muddy sand' and 'Virgularia mirabilis and Ophiura spp. with Pecten maximus on circalittoral sandy or shelly mud'. Fine muddy sands were gradually replaced by mixed sediments as the conditions became shallower in the approach to the breakwater ('Circalittoral mixed sediment'; 'Infralittoral mixed sediment'). Finally, mixed sediments gave way to sublittoral and fringe rock at the base of the breakwater. Biotopes here were dominated by kelps, Fucoids and red seaweeds and were classified as '*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock', 'Kelp and red seaweeds (moderate energy infralittoral rock)' or '*Laminaria digitata* on moderately exposed sublittoral fringe rock' depending largely on the dominant algal cover and formations.

Though the habitats dominated by fine sediments located in the deeper open-water sections appeared sparse due to a lack of algal cover, faunal communities were relatively abundant and demonstrated some diversity. Fish were present across all transects with flatfish (Pleuronecteformes) and Gobiidae occupying infralittoral muddy sands present in Transect 1 as well as the sea squirt A. aspersa which was present along all eight transects. From Transect 2 onwards the common dragonet (*C. lyra*) and Gobiidae were abundant where 'Infralittoral muddy sands' was the dominant biotope and continued to be identified along most transects. Further along the breakwater, further from the shore (Transects 3-7), the sea pen *V. mirabilis* and brittle stars (*Ophiura* spp.) were recorded frequently

which (alongside the presence of appropriate habitat conditions) resulted in the designation of the biotope '*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud' along large stretches of the site. Note, *P. maximus* was not identified in any of the footage or extracted stills collected at Holyhead though it is noted to only be present in low abundance for this biotope. The biotope '*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment' was recorded just once at the start of Transect 8 where the burrowing anemone *C. lloydii* was recorded alongside *Ophiura albida* and numerous tubes embedded into shelly muddy mixed sediments.

Habitats and communities established on the breakwater itself were not designated as biotopes as the species identified here were colonising an artificial structure, a suitable description for which was not accounted for by any of the existing biotope descriptions (though a description for 'Circalittoral fouling faunal communities' does exist). Encrusting faunal communities present were relatively consistent along the length of the breakwater and were dominated by barnacles (most likely *Semibalanus* sp.) and limpets (*Patella vulgata*) with the occasional presence of indeterminate encrusting sponges and *Littorina* sp. recorded. As such, the biotope considered to be most analogous for the faunal communities on the breakwater is '*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock' (LR.HLR.MusB.Sem) (Level 5).

Algal communities were most diverse in the areas nearest to the breakwater where hard substrates enabled colonisation by large algal species which in turn provided heterogeneity, shelter and food for epibenthos. Macroalgae was only present on the lower parts of the vertical breakwater wall where *F. serratus* and numerous rhodophytes were identified. Macroalgal films present on the mid and upper sections of the wall were not identifiable. Algal presence was influential on biotope designation as a number of the habitats identified using ROV footage were dominated by particular species that were characteristic for location and environmental conditions.

Figure 2 The distribution of biotopes assigned along the eight transects surveyed at Holyhead in 2019. Each colour represents a single biotope

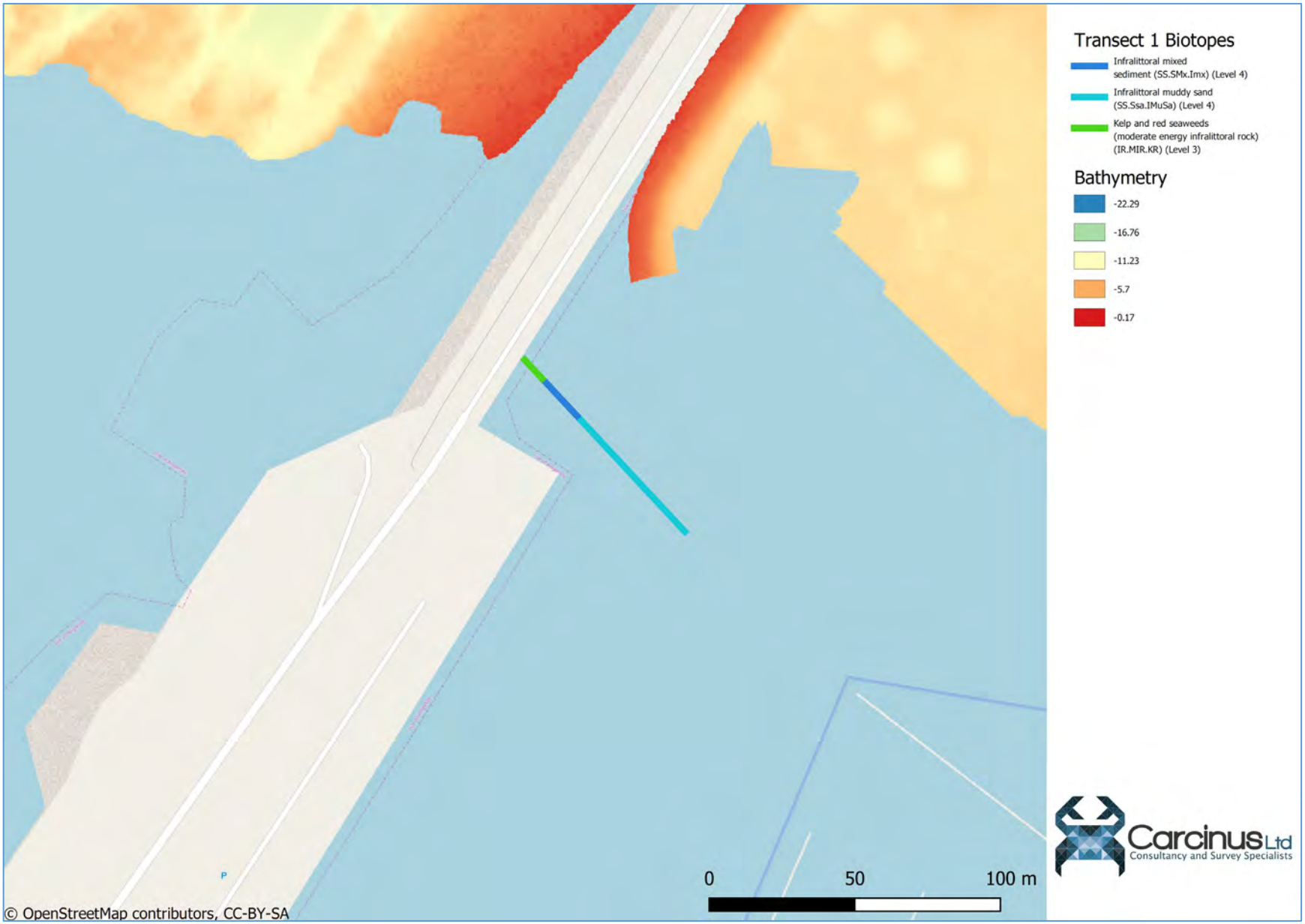

Figure 3 The distribution of biotopes assigned along transect 1 surveyed at Holyhead in 2019. Each colour represents a single biotope

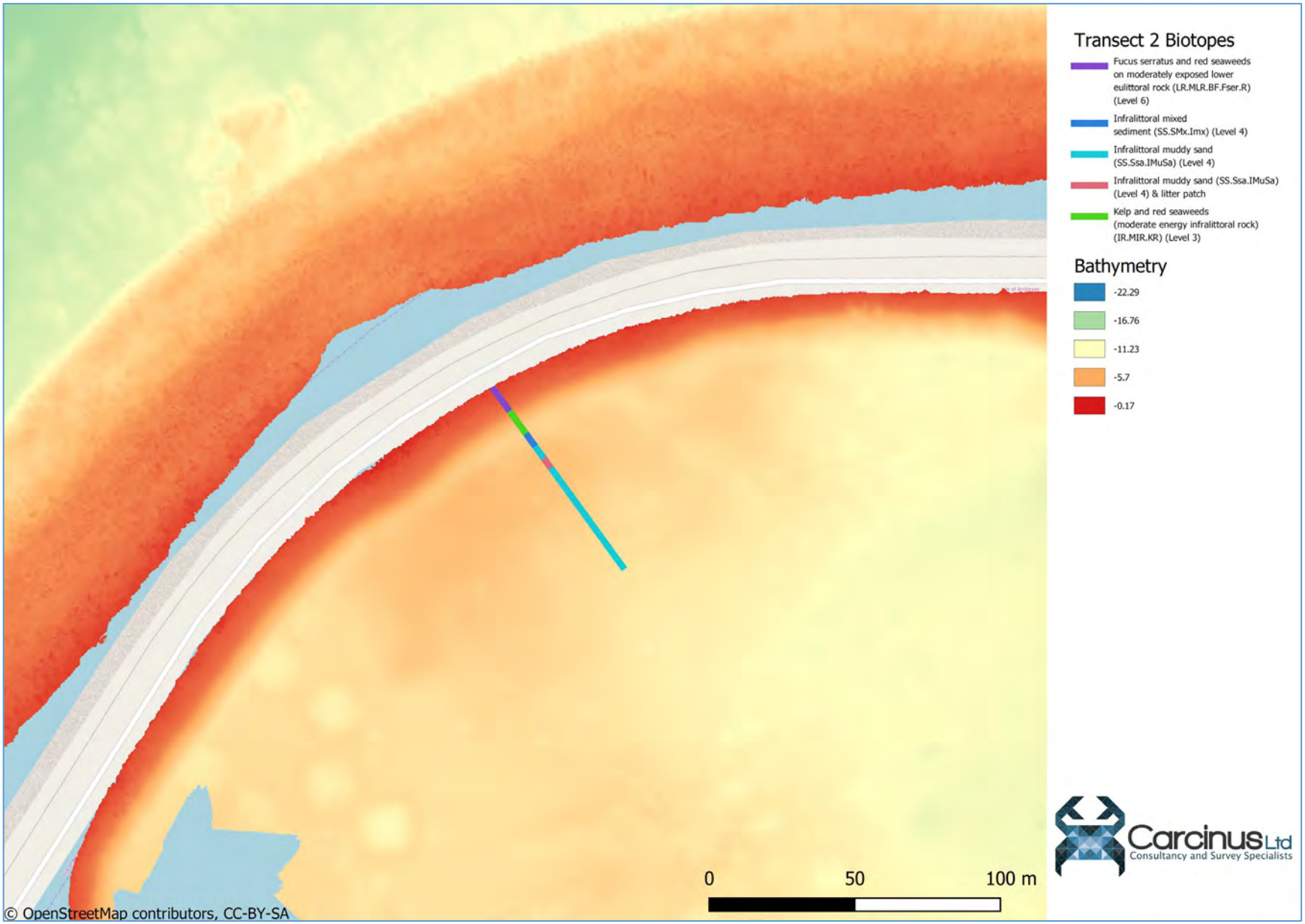

Figure 4 The distribution of biotopes assigned along transect 2 surveyed at Holyhead in 2019. Each colour represents a single biotope

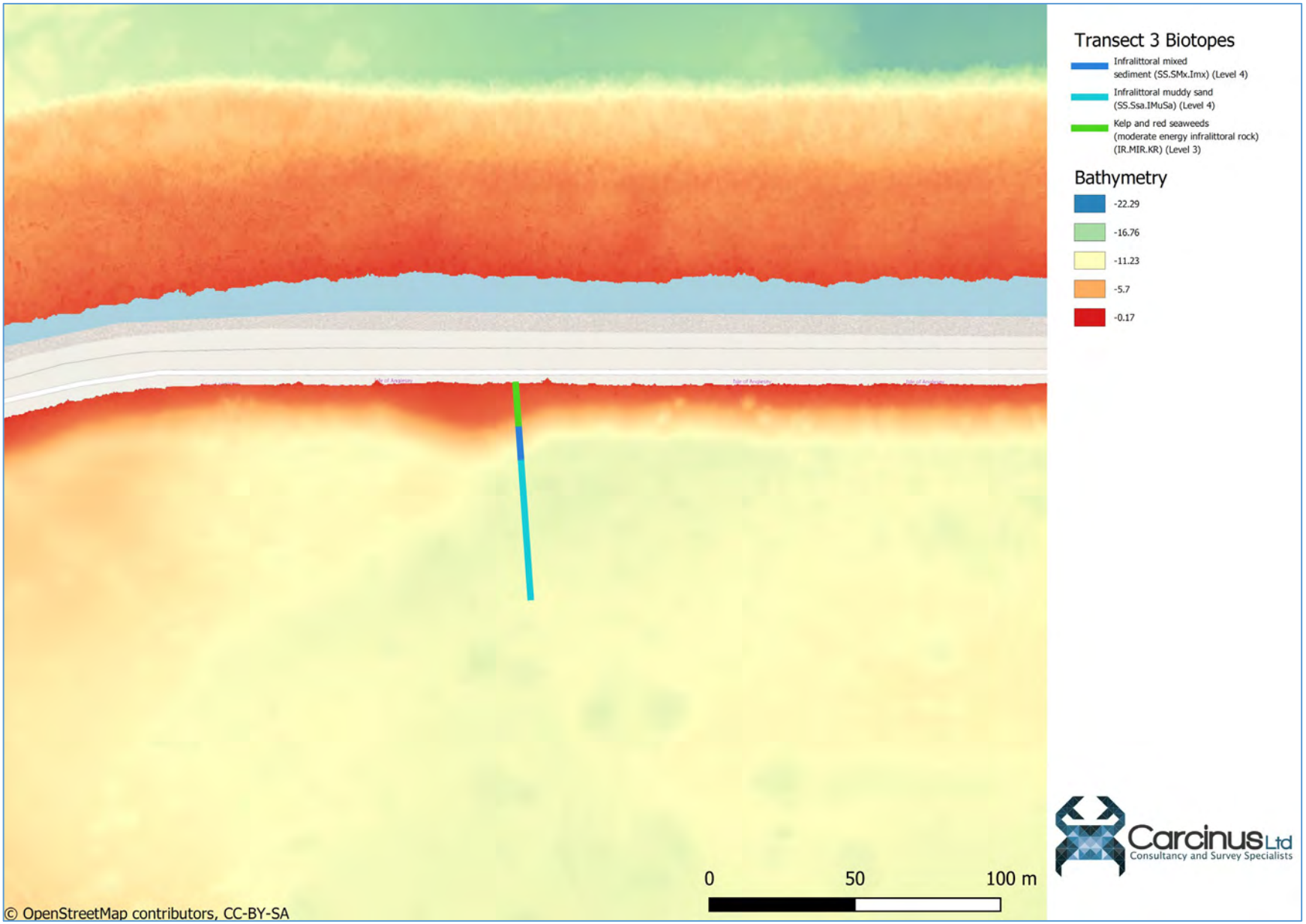

Figure 5 The distribution of biotopes assigned along transect 3 surveyed at Holyhead in 2019. Each colour represents a single biotope

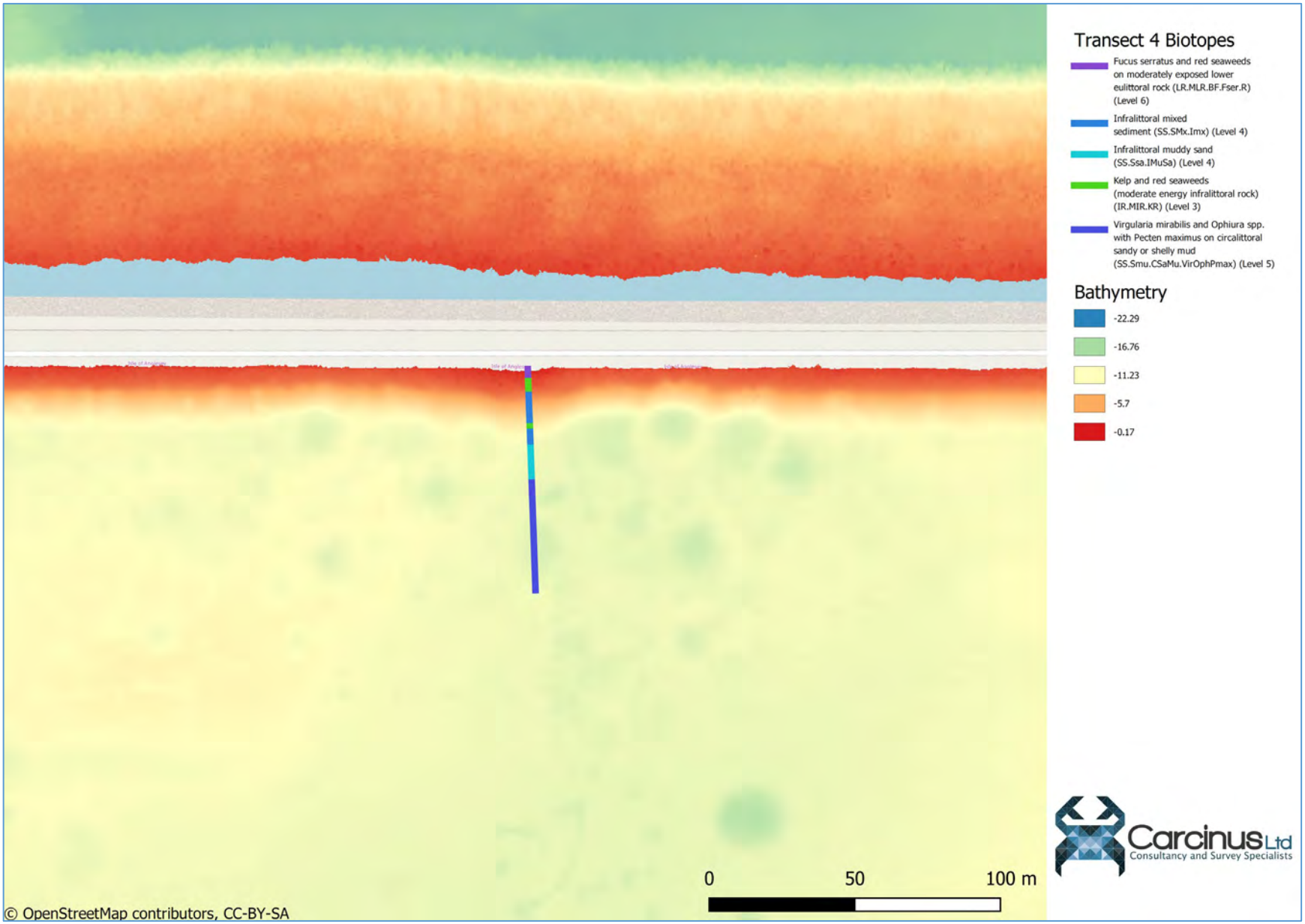

Figure 6 The distribution of biotopes assigned along transect 4 surveyed at Holyhead in 2019. Each colour represents a single biotope

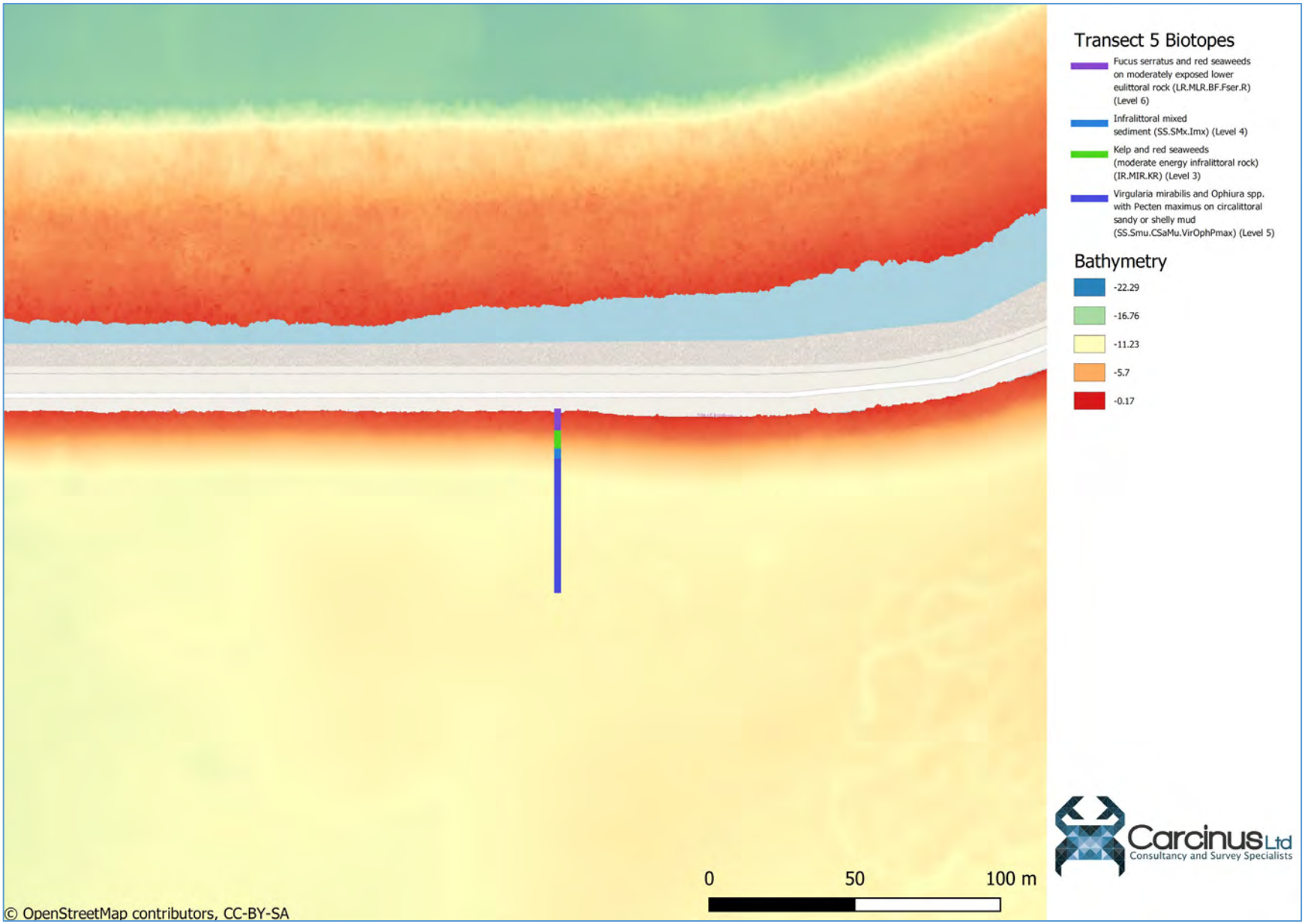

Figure 7 The distribution of biotopes assigned along transect 5 surveyed at Holyhead in 2019. Each colour represents a single biotope

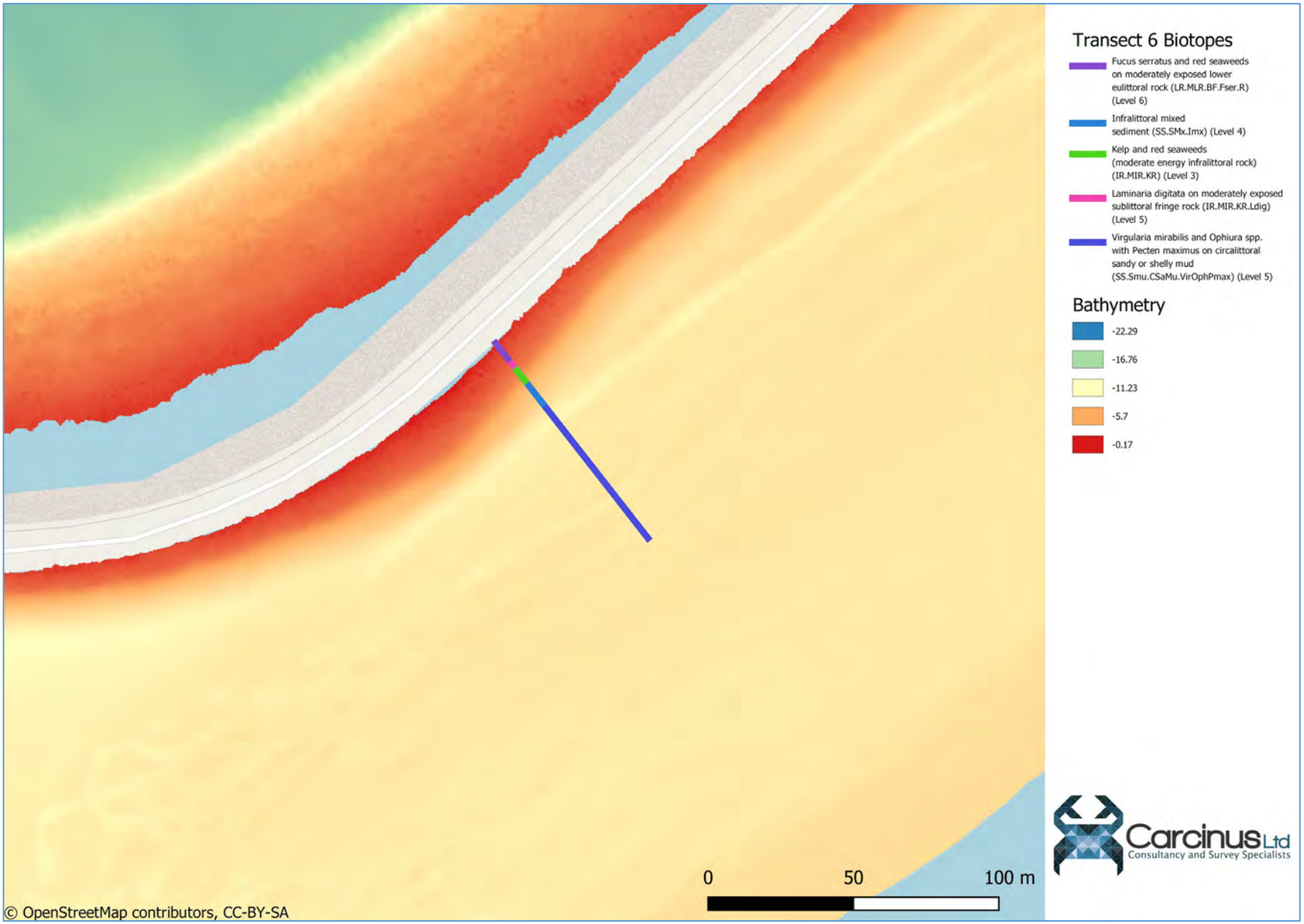

Figure 8 The distribution of biotopes assigned along transect 6 surveyed at Holyhead in 2019. Each colour represents a single biotope

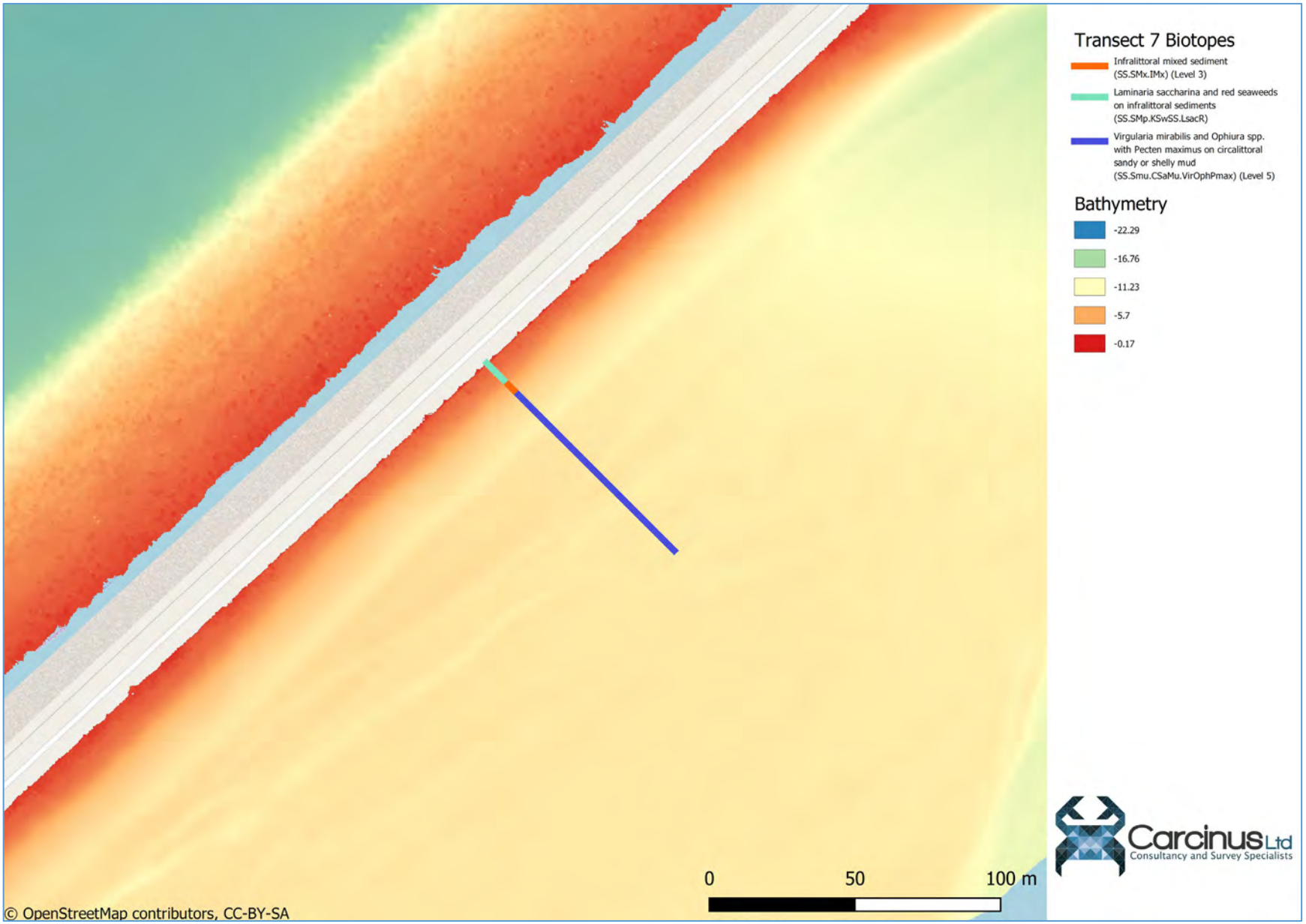

Figure 9 The distribution of biotopes assigned along transect 7 surveyed at Holyhead in 2019. Each colour represents a single biotope

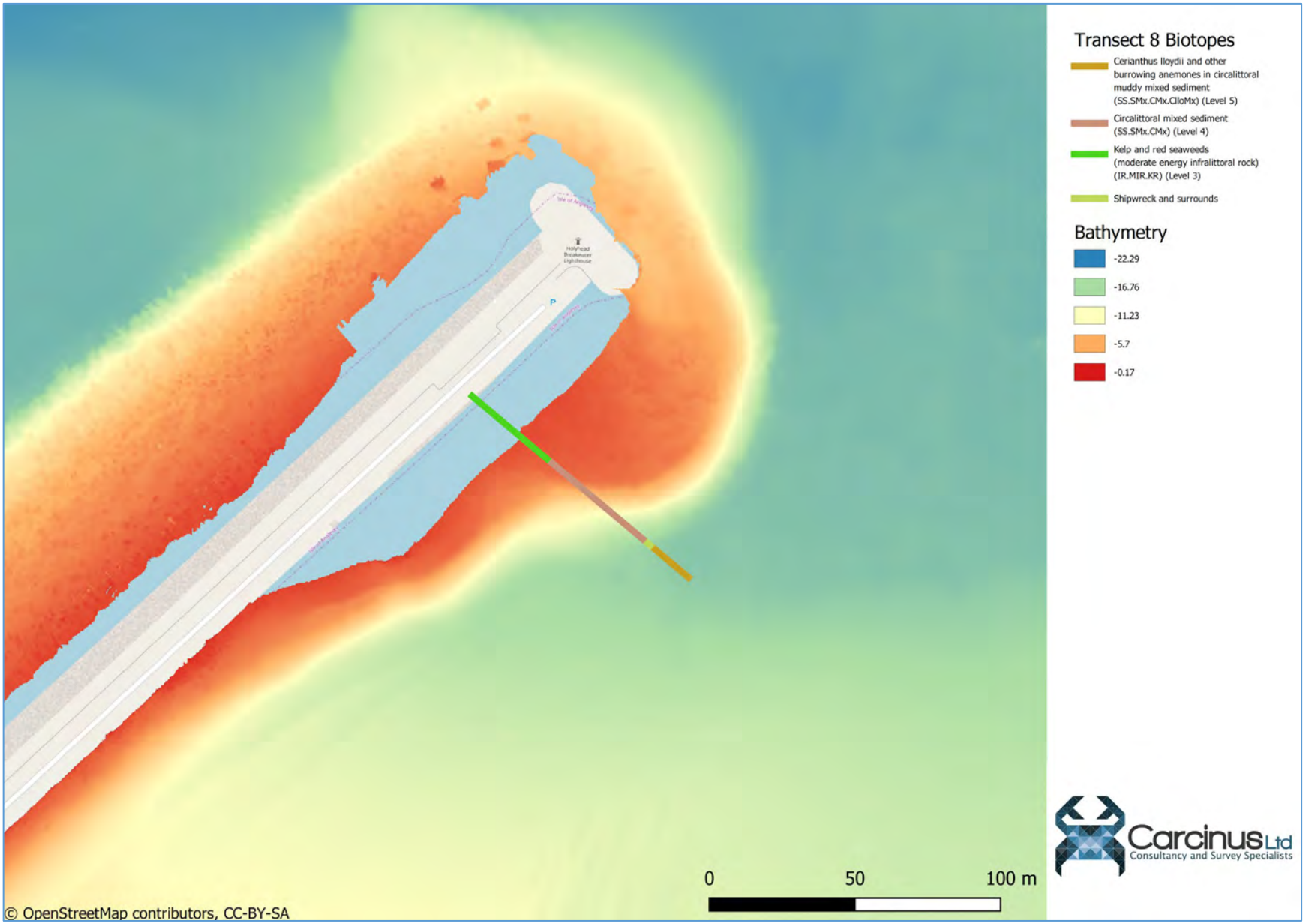

Figure 10 *The distribution of biotopes assigned along transect 8 surveyed at Holyhead in 2019. Each colour represents a single biotope*

A1.2141 (LR.MLR.BF.Fser.R)

The biotope '*Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock' was recorded near to the breakwater at Transects 2, 4, 5 and 6.

A3.123 (IR.MIR.KR)

The biotope 'Kelp and red seaweeds (moderate energy infralittoral rock)' was recorded nine times along the eight transects. This biotope was observed at all of the transects in the approach to the breakwater where the seafloor was dominated by bedrock, boulders and gravel.

A3.211 (IR.MIR.KR.Ldig)

The biotope '*Laminaria digitata on moderately exposed sublittoral fringe rock*' was identified just once along ~4 m of the nearshore half of Transect 6. This biotope was typified by a canopy of the kelp *Laminaria digitata* which while present elsewhere, was often found in combination with other algal groups.

Infralittoral muddy sand (SS.Ssa.IMuSa)

'Infralittoral muddy sand' was identified at six locations along the transects at Holyhead. This biotope was most often present at the start of the transects where fine sediments were dominant, waters were deeper than near the breakwater (~20 m) and benthos and macroalgae were not abundant.

A5.354 (SS.Smu.CSaMu.VirOphPmax)

The habitat classified as '*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud' was present at Transects 4–7 where muddy sands were dominant. This habitat covered more seafloor than any other identified at Holyhead in 2019. The sea pen *V. mirabilis* and *Ophiura* spp. were both frequently observed in sections designated as this biotope though *P. maximus* was not recorded. Previous studies undertaken in 2009 identified the biotope *Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud (Mercer, 2009). However, on careful consideration of the findings of this survey, '*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud' over '*Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud' for the following reasons:

- Firstly, sandy and shelly components were present within the substrate which were not accounted for in '*Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud'.
- Furthermore, *Ophiura* spp. were highly abundant. The '*Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud' biotope describes *Amphiura filiformis* as present but not *Ophiura* spp. and the presence of *Ophiura* spp. could not be ignored given its frequent occurrence.

A5.43 (SS.SMx.Imx)

'Infralittoral mixed sediment' was observed at Transects 1-7 in relatively small patches. Faunal abundance was generally low within areas designated as this habitat. This habitat was often a transition zone between the finer sediments at the deeper end of the transect and the rocky substrates found closer to the breakwater. Few algal species were recorded in this biotope.

A5.44 (SS.SMx.CMx)

The standalone biotope 'Circalittoral mixed sediment' was present within Transect 8. This biotope was similar to A5.43 but was located in deeper waters where sediments were more thoroughly mixed and better sorted at the surface. Few fauna or macroalgal species were recorded in this biotope which represented a transition between finer sediments near the start of the transect and more coarse, rocky sediments near the breakwater.

A5.441 (SS.SMx.CMx.ClloMx)

The biotope '*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment' was identified along the deepest section of Transect 8. A5.441 and shares numerous characteristics with A5.23 though the burrowing anemone *C. lloydii* was identified in the area designated as this biotope.

4.7. Notes on Biotope Designations

It should be noted that limited detail regarding the presence of some faunal and algal species identified from footage collected during the ROV survey were included in the biotope descriptions. Many of the most abundant taxa, including fish identified, were not mentioned in the most frequently occurring biotope descriptions though they were clearly important components of the community structure across the site. Additionally, many of the macrofauna mentioned in the JNCC habitat descriptions such as *Pecten maximus* as well as small invertebrates such as annelids and amphipods were not visible in some biotopes where descriptions suggest they are abundant. This may be a result of the complex ecological conditions present at Holyhead as well as the limited capacity to identify inconspicuous taxa using video and stills techniques.

5. Discussion

This report has been prepared to characterise the benthic ecology and environmental conditions on the leeward site of the Holyhead breakwater, north Wales.

Overall it can be said that faunal and algal communities observed at Holyhead in 2019 were relatively complex and reflected the environmental conditions including substrate type, depth and energy regime. The nature of the substrate across the proposed development site was variable over a small area, though this was characteristic of a dynamic coastline with increased complexity due to man-made structures such as the breakwater. The presence of bedrock, boulders and mixed sediments across the site added structural complexity that can be associated with a diverse ecosystem.

The following conclusions can be drawn from the monitoring investigation outlined in this report:

- A total of eight biotopes representing a variety of faunal communities and seafloor environments were identified in footage collected from Holyhead in 2019. The most frequently observed biotope was: 'Kelp and red seaweeds (moderate energy infralittoral rock)'.
- A variety of faunal and algal taxa were identified in the ROV footage and stills. Particularly abundant fauna included the common dragonet (*Callionymus lyra*), small Gobiidae, the sea-pen *Virgularia mirabilis,* the sea squirt *Ascidella aspersa* and brittle stars.
- The vertical breakwater surface was colonised by highly abundant barnacles (Cirripedia) and limpets (*Patella vulgata*) though diversity within the fouling community was generally low.
- Within the shallower waters near the break water where boulders and rocky surfaces were abundant, the kelp species *Saccharina latissima* and *Laminaria digitata* were both identified in

dense bands as was the Fucoid *Fucus serratus.* Kelp species were often accompanied by a diverse range of red algae. A green diatom film was present on muddy sands along Transects 1 and 2.

- A clear gradient in habitat types was apparent with distance from the breakwater and depth. Communities identified in more open, deeper waters (>10m) were notably different from those observed in more shallow environments close to man-made structures (0-10 m).
- Seafloor environments and communities observed along transects nearer to land demonstrated some distinction from those further along the breakwater where conditions were more exposed, and water was deeper.
- A total of 42 fauna were identified in total, with 40 species being identified from video footage collected with the ROV, while a total of 16 fauna were identified from stills analysis, two of which were not identified from the video analysis. A total of 11 types seaweed (identified to differing of taxonomic level) were identified in stills extracted from video.
- The invasive sea-squirt *D. vexillum* was not identified along any of the transects either on the seafloor or encrusting the breakwater wall. However, presence cannot be ruled out due to the survey design.
- Reduced visibility was an occurrence at times during the survey, mostly limited to the softer sediment biotopes remote from the breakwater during initial ROV set down and manoeuvring. During these times, a reduction in faunal and algal species identification may have resulted.

6. References

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Appendix 1 – Biotope designation rationale using ROV footage collected at Holyhead in 2019

Transect 1

1080p Video Rname	Combined Video Name	Video Length (combi)	Video Quality (combi)	Transect	Date	Designated Biotope	EUNIS Biotope	Start Time (24hr)	End Time (24hr)	Start Video Run Time	End Video Run Time	Still extraction	Start Depth (m)	End Depth (m)	Substrate Type	Fauna Present	Key Algae Present	Energy (high, med, low)	Notes
Transect_1_1080p_Only	Transect_1_Combined_Video.mp4 (start: 01:18, end: 04:26)	6:25:00	Good-poor	T1	02/12/2019	Infralittoral muddy sand (SS.Ssa.IMuSa) (Level 4)	A5.23	12:17:14	12:18:47	01:18	04:26	03:00	6.7	6.6	Sand	Ascidella aspersa (Frequent) Gobidae (Occasional), Brachyura (Occasional) (04:01), annelida/amphipod burrows, Paguridae (Occasional), Pleuronectiformes, Cerianthus tubes (Frequent)	Saccharina latissima, Fucus, Halidrys siliquosa, green diatom film overlaying much of the seafloor.	Low	Scallop and Cerastoderma shells. No ascideans in biotope descriptions. There are scars in the sand - from anchors or mooring or fishing (~3:40). Diatom film characteristic for biotope.
Transect_1_1080p_Only	Transect_1_Combined_Video.mp4	6:25:00	Poor	T1	02/12/2019	Infralittoral mixed sediment (SS.SMx.Imx) (Level 4)	A5.43	12:18:47	12:19:17	04:26	05:26	05:00	6.6	4	Sand and bedrock	Ascidiella aspersa (Frequent)	Indet. kelp, Fucus sp., Ulva sp., Halidrys siliquosa	Low	Sand dominant mixed sediemnt, relatively sparce, some occasional Ascideans but unable to identify
Transect_1_1080p_Only	Transect_1_Combined_Video.mp4	6:25:00		T1	02/12/2019	Kelp and red seaweeds (moderate energy infralittoral rock) (IR.MIR.KR) (Level 3)	A3.123	12:19:17	12:19:32	05:26	05:54	05:45	4	2.6	Pebbles, boulders		Saccharina latissima, Ulva sp., Chondrus crispus, Corallinaceae crusts	Low	Approach to the wall. Can't see any *Chorda filum* or *Desmarestia aculeata* though these are mentioned in the description.
Transect_1_1080p_Only	Transect_1_Combined_Video.mp4	6:25:00	Good-poor	T1	02/12/2019	Breakwater fouling community		12:19:32	12:19:44	05:54	6:20:00	06:10	2.6	1.2	Artificial structure (rock)	*Steromphala* sp. (Occasional), *Spironbranchus* (Occasional), *Patella vulgata* (Common) Cirripedia (Abundant)	Ulva sp., Chondrus crispus, Corallinaceae crusts, Laminaria sp. (base of structure)	Low	Some light orange encrusting feature on wall, sponge bor ascidean, possibly D. vexillum?