

## OPTIONS APPRAISAL

### Options Appraisal Introduction

This section demonstrates how options were identified, considered and comparatively evaluated assessing their potential contribution to the objectives and value for money criteria. The evaluation process included both technical assessment processes: review of strategy, policy, physical and environmental constraints, as well as transport modelling and consultation with stakeholders and the public.

The option appraisal process was undertaken through a gradually refined series of steps. Full details of the option appraisal process is described in the Part B Report<sup>1</sup>, compiled by the Lead Consultant. This entailed:

- i. High level identification of **Project Objectives**.
- ii. Consideration of **Range of Options** which may deliver the objectives set against identified constraints and opportunities.
- iii. Consideration and **Evaluation of Sifted Options** which would deliver objectives.
- iv. Consideration and **Evaluation of Refined Options**

The options considered were set against the need to address the area's development constraints and ranged from doing nothing through individual interventions which may facilitate some degree of change or unlock individual sites, to a full intervention with more radical infrastructure solutions (such as increasing connectivity through provision of a new bridge over the River Clyde).

### Project Objectives

As detailed in Section 3.4, all potential options for the CWRR project will be appraised against the following project specific and SMART objectives:

- Delivery of better cross river infrastructure to reduce the physical and psychological barrier created by the River Clyde, allowing for a greater flow of labour and general populations as well as opening opportunities for active travel between the north and south of the river.
- Deliver network infrastructure to unlock the development potential, enhance the attractiveness of and entice private investment into existing, vacant or derelict sites within the locality for employment and housing opportunities.
- Enabling the project to build on existing planned developments in a holistic manner to deliver further economic regeneration, by facilitating physical access opportunities to the core facilities at the Glasgow Airport Investment Area (GAIA) and the Advanced Manufacturing Innovation District Scotland (AMIDS) within Renfrewshire and the entire City Region.
- Create construction and operational jobs both during the infrastructure delivery and beyond.

### Range of Options Considered

The City Deal Agreement (signed 2015) followed detailed consideration by Scottish Government, UK Government and the eight member authorities within Glasgow City Region. This consideration examined opportunities to radically improve the economic conditions within GCR and options for interventions, programmes and procurement routes to achieve that end.

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<sup>1</sup> 'Clyde Waterfront and Renfrew Riverside Part B - Options Generation and Assessment' Report written by Sweco in October 2016.

The resulting City Deal programme includes an infrastructure programme, labour market programmes and an Innovation and Life Sciences programme.

The CWRR project was identified as one of 20 projects brought forward from a previous long list, which forms part of the Infrastructure Programme, following a review of the economic potential of each project. This analysis was carried out by external consultants on behalf of the member authorities. The projects were appraised primarily against the ability to unlock the area’s development potential and create GVA, with additional consideration given to potential wider regeneration benefits (further detail on this process is given in the Programme Business Case<sup>2</sup>). It is in this context that the specific options available to facilitate the Clyde Waterfront and Renfrew Riverside project have been considered.

Options were considered by a series of workshop sessions involving Renfrewshire Council officers, external stakeholders and professional advisers. Initially consideration of long list options was informed by a high level sifting against affordability, deliverability and value for money considerations to swiftly identify impractical options.

**Choices in the Strategic Options Framework Filter (Green Book):**

<b>Scope</b>	Geography: Renfrew North to address traffic congestion	Geography: Renfrew North and Clydebank to improve connectivity	Activity: <del>Non physical will not address the identified constraints</del>	Activity: Physical, wide range of options for road and river crossing
<b>Solution</b>	RC <del>direct build: possible issue with state aid and market competition</del>	RC procure individual contracts: market competition, but loss of efficiency	RC procure joint contract for all elements: market preference	Other <del>partner procures for RC: no clear benefit, increases management time</del>
<b>Delivery</b>	Direct build by RC: retain control	RC funds other party to build: loss of control	JV <del>with landowners: significantly increases time/risk, does not</del>	Other public lead: not obvious alternative to lead
<b>Implementation</b>	Single phase now: major disruption over a (relatively) short period but maximises economic benefits	Single phase but postpone: delays development and achievement of benefits	Phased but start now: <del>increase length of disruption, but some benefits from early activity, will increase cost to deliver</del>	Phased but postpone: <del>increases length of disruption from works, delays development activity and benefits, will increase delivery cost</del>
<b>Funding</b>	City Deal + RC: clear additionality and opportunity	All RC: substitution from other planned activity	Other public: no alternative source found	Private: won't fund infrastructure is a public good

Choices in the Strategic Options framework Filter (Green Book)

The long list of initial options considered for CWRR, are briefly outlined below. These were evaluated against the project objectives noted above using technical information gathered during the project progression and also feedback from stakeholders and the public.

**Long List of Options**

**Option 1 - Do nothing**

<sup>2</sup> 'Glasgow and Clyde Valley City Deal Programme Business Case' as approved by City Deal Cabinet in December 2015.

This option assumes no additional capital investment is available for infrastructure works aimed at projects which will tackle existing issues of accessibility and poor connectivity, which would have the potential to increase economic activity and increase GVA.

### Option 2 – Do Minimum

This option assumes minimal spend on existing infrastructure endeavouring to address some of the existing constraints to economic growth, while not increasing the availability of additional infrastructure to address accessibility and connectivity.

### Option 3 – Improved Ferry Link

This option would reintroduce the previously suspended vehicular ferry with a modern equivalent.

### Option 4 – Renfrew North Development Road Only

This option considers the impact of constructing the Renfrew North Development road only with no further capital investment for infrastructure works.

### Option 5 – River Clyde Crossing by way of a Tunnel Only

This option considers the potential for creating a north/south link across the River Clyde in the vicinity of Renfrew, Clydebank / Yoker by way of a tunnel.

### Option 6 – River Clyde Crossing by way of a Bridge Only

This option considers the impact of constructing a north / south connection across the River Clyde in the vicinity of Renfrew and Yoker by way of a bridge.

### Option 7: Renfrew North Development Road and River Clyde Bridge Crossing including other improvements to accessibility, walking, cycling and public transport links

This option considers the potential for addressing the significant connectivity issues between the north and south of the River Clyde between Renfrew, Clydebank and Yoker whilst addressing the current congestion issues in and around Renfrew Town Centre. The option includes improvements to walking, cycling and public transport aspects around the surrounding areas. The option therefore enhances accessibility to key development sites along both sides of the River Clyde.

### Option Costs

The table below shows the evaluation of the works costs for all works required to deliver each option, including allowance for land acquisition, fees, optimism bias, inflation etc.

OPTION	Option 1 - Do nothing	Option 2 - Do Minimum	Option 3 - Improved Ferry Link	Option 4 - Renfrew North Development Road Only	Option 5 - River Clyde Crossing by way of a Tunnel Only	Option 6 - River Clyde Crossing by way of a Bridge Only	Option 7 - Renfrew North Development Road and River Clyde Bridge Crossing including other improvements to accessibility, walking, cycling and public transport links
			Cost excl: vessel purchase est' @ £10,000,000				

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	£	£	£	£	£	£	£
<b>Total Project Costs</b>	-	677,977	4,487,551	29,067,398	412,652,710	97,327,300	90,680,225
<b>Revenue Assumptions</b>	-	-	£200,000	£15,000	£950,000	£108,000	£123,000
<b>Per annum</b>							
<b>Revenue assumptions</b>	No change	Intervention does not increase asset	24 hour operation additional cost for fuel.	Road / gully maintainace	Comparison with Clyde Tunnel published figs.	24 hour operation dedicated team	24 hour operation dedicated team

Evaluation of work costs

### Sifted Options

A first stage Sifting Process, involving qualitative assessment, consideration of the relative cost and benefit and a SWOT analysis (see Table below), was carried out on the long list of 7 options detailed within the section ‘range of options considered’, based on the criteria noted in the Objectives section. The specific benefits and disbenefits for each option are presented in this section Based on this analysis, the following options have been discounted:

#### Option 3 – Improved Ferry Link

This option assumes that the existing passenger ferry is enhanced to provide a vehicular ferry on frequent service across the River Clyde. A vehicular ferry previously operated on this route, however required significant public subsidy due to the operational and maintenance costs involved, compared to passenger numbers. The requirement for long term subsidy and ongoing maintenance and upgrade costs is little changed since the removal of the previously service. With other existing route options, the need to wait between ferries at peak times and the interruption to journey times makes this a lower choice option for commuters. The requirement for vehicle waiting areas in periods between ferry crossings also constrains the potential for development in the adjacent areas. Comparison of traffic flows for the bridge option indicates future potential of 800 cars per hour in each direction, when Local Development Plans for the three adjacent member authorities complete. It is unlikely that a ferry option could accommodate such a demand for the crossing and therefore outcomes would be limited. Based on historical information, the relative cost of this option is likely to be high, with constrained benefits, ineffective response to the project objectives relating primarily to an infrequent traffic link, and no additional contribution to opening up constrained land for development. This option is therefore discounted.

#### Option 5 – River Clyde Crossing by way of a Tunnel

Providing the transport link between the north and south areas of the River Clyde crossing by way of a tunnel has been considered. Technical evaluation of the vertical alignments required to gain access and egress from the tunnel identify considerable adverse effects within the areas local to the new tunnel and considerable difficulty in connecting to existing road network without major interventions (tunnel could not connect to RNDR). The significant areas sterilised by the tunnel construction and future maintenance requirements would impact on future development potential and conflict with aspects of the project objectives. Whole life costs, due to the significant long-term operation and maintenance requirements, make this option extremely unattractive. Technical evaluation also identified potentially unaffordable and significant irresolvable technical issues due to ground conditions and land constraints. Additionally, the detrimental effect on local residential housing and local communities make this option largely undeliverable. The relative capital and revenue cost of this Option are high at £412,652,710. While traffic connectivity across the Clyde will improve the detrimental impacts of the land sterilised

and environmental impacts will be significant. These aspects together with the high capital costs and future maintenance costs make this option unattractive. This option is therefore discounted.

### **Option 6 – River Clyde Crossing by way of a Bridge**

This option assumes only a Bridge is designed and constructed with limited improvements in roads infrastructure on either side of the crossing. To enable this to happen, the location of the bridge would require to be at Ferry Road, Renfrew in the south and Yoker Ferry Road in the north. In this location, and with the constraints imposed on the bridge design to allow continuing river navigation, an opening bridge would be required. The land availability constraints would also suggest a twin bascule bridge structure.

On the north of the river, the road levels required to meet the technical constraints would result in the bridge passing at 1<sup>st</sup> floor level of existing properties. In addition, the existing road junction at Kelso St / Dumbarton Road is already congested and modelling indicates that at peak periods, traffic may queue from the south and result in vehicles being stationary on the bridge. As the bridge will require to open, this design solution would raise complex traffic issues which need resolved and indeed it is unlikely that a workable solution could be found.

On the south of the river, the level of any road connection with existing infrastructure (Ferry Rd / Kings Inch Road, would result in the start of the bridge ramp sitting lower than the level of the Renfrew Flood Relief barrier. In effect, the bridge would be unable to operate in the event of tidal flooding which requires erection of the flood defence scheme.

As this bridge will significantly improve connectivity between the north and south of the River, the interaction with the road network on the south side of the river will result in the increased traffic adding to current traffic problems in and around Renfrew Town Centre. Transport modelling indicates traffic in the order of 800 movements in each direction, each hour, across the new bridge. Without the RNDR a large proportion of this traffic will seek to move through Renfrew Town Centre considerably exacerbating an already congested area, adding to existing air quality issues and further reducing public transport reliability.

The resulting adverse effect on the local area and its implications for businesses, air quality and environment make this option undesirable. In summary, the Transport and Environmental impact provided by a bridge crossing alone is unlikely to maximise the potential development of the area. This option is therefore discounted.

Option	Strength	Weakness	Opportunity	Threat	Relative Value for Money
<p><b>Option 1:</b> Do Nothing</p> <p>Benefits: Counterfactual economic benefits as per EIA</p> <p>Disbenefits: Fails to deliver net additional economic growth for city region; no improved cross-river connectivity for access to jobs/ education/ leisure</p>	Low cost / Low risk Option.	Targeted GVA growth unlikely to be delivered. Requires existing interventions to perform significantly better than any anticipated outcome.	Staff resource assigned to progressing CWRR project, could be directed to other interventions.	<p>Little improvement to economic conditions locally.</p> <p>Constrained opportunity in comparison to other areas exacerbates condition which results in declining condition, due to movement of business away from area.</p> <p>Potential diminution of economic potential within other areas of City Region, due to continuing constraint in connectivity.</p>	<p>Zero Cost, Very Low Benefit</p> <p>Relative VfM Ranking: 7</p>
<p><b>Option 2:</b> Do Minimum:</p> <p>Minor improvements to existing infrastructure (e.g. junction improvements, traffic regulation orders)</p> <p>Benefits: Counterfactual economic benefits;</p>	Low cost / minimal Risk Option.	Targeted GVA growth unlikely to be delivered. Requires existing interventions to perform significantly better than any anticipated outcome.	Staff resource assigned to progressing CWRR project, could be directed to other interventions.	<p>Minimal improvement to economic conditions locally.</p> <p>Constrained opportunity in comparison to other areas, exacerbates condition which results in declining condition, due to movement of business away from area.</p> <p>Potential diminution of economic potential within other areas, due to continuing constraint in connectivity.</p>	<p>Minimal Cost, Minimal benefit</p> <p>Relative VfM Ranking: 6</p>

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Option	Strength	Weakness	Opportunity	Threat	Relative Value for Money
<p>slightly improved roads</p> <p>Disbenefits: Fails to deliver net additional economic growth for city region; no improved cross-river connectivity</p>					
<p><b>Option 3:</b> Improved Ferry Link</p> <p>Benefits: Minimal increase in economic benefits; improved cross-river connectivity</p> <p>Disbenefits: Significant capital/revenue cost for limited economic return; likely to increase traffic congestion into road network</p>	<p>High Cost / High Risk Option</p>	<p>Targeted GVA growth unlikely to be delivered. Intervention is not significantly improved over existing situation, despite significant cost. Requires existing interventions to perform significantly better than any anticipated outcome.</p>	<p>Little interference with existing infrastructure and stakeholder operations.</p>	<p>Minimal improvement to economic conditions locally.</p> <p>Potential diminution of economic potential within other areas, due to continuing constraint in connectivity.</p> <p>Long term risk to viability of intervention as demonstrated previously.</p>	<p>High long term cost, Minimal Benefit.</p> <p>Relative VfM Ranking: 4</p>
<p><b>Option 4:</b> Renfrew North Development Road (RNDR).</p>	<p>Minimal risk option.</p> <p>Limited impact on neighbouring properties.</p>	<p>No improvement in connectivity across River Clyde.</p> <p>Limited increase in access to wider</p>	<p>Access increased for Transitional area on south of river.</p>	<p>Development opportunities created are seen as limited by market and take longer to achieve.</p> <p>Other areas with fewer constraints have accelerated growth,</p>	<p>Medium relative cost, Medium Benefits ( RC only &amp; constrained GVA)</p>

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Option	Strength	Weakness	Opportunity	Threat	Relative Value for Money
<p>Benefits: Increase in economic benefits in Renfrew; enhanced road network</p> <p>Disbenefits: Fails to deliver uplift in Clydebank; no improved cross-river connectivity</p>		<p>catchment for business opportunities either side of river.</p> <p>GVA in local and region area limited due to lack of wider connectivity.</p> <p>Potentially limited modal shift for areas beyond Renfrew.</p>	<p>Improved traffic within Renfrew TC.</p> <p>Improved link from Braehead to Airport Investment Area.</p>	<p>increasing differential in wealth and poverty.</p> <p>Areas north of River see limited growth due to continuing poor links and access to New hospital.</p> <p>RNDR in area of, or close to SINC.</p>	<p>Relative VfM Ranking: 2</p>
<p><b>Option 5:</b></p> <p>River Crossing by Tunnel.</p> <p>Benefits: Increase in economic benefits; improved cross-river connectivity; no traffic flow disruption</p> <p>Disbenefits: Significant up-front capital and long-term maintenance costs; likely to increase traffic congestion</p>	<p>Low visual impact (at river), post construction.</p> <p>River navigational aspects addressed without constraint to traffic.</p>	<p>High Risk solution.</p> <p>High long term cost option.</p> <p>Significant technical challenges to address.</p> <p>No improvement in local traffic distribution particularly in Renfrew TC (Tunnel could not connect to RNDR).</p> <p>Potentially limited modal shift for areas beyond Renfrew.</p>	<p>Existing Clyde crossing operational system could be extended.</p>	<p>Significant impact on land requirement.</p> <p>Detrimental Impact on future development opportunities, particularly residential.</p>	<p>Very High cost, Minimal Benefit.</p> <p>Relative VfM Ranking: 5</p>
<p><b>Option 6:</b></p> <p>River Crossing by Bridge</p>	<p>Significantly increased connectivity for</p>	<p>Increased traffic would increase issues in Renfrew and other areas.</p>	<p>Opening bridge would create focal point feature.</p>	<p>Flood levels on South of river may constrain bridge location, or usage.</p> <p>River navigational aspects require to be accommodated in structure</p>	<p>Medium relative Cost, Medium Benefit</p>

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Option	Strength	Weakness	Opportunity	Threat	Relative Value for Money
<p>Benefits: Increase in economic benefits; improved cross-river connectivity</p> <p>Disbenefits: Some disruption to cross-river traffic flow; likely to increase traffic congestion</p>	<p>catchments each side of River.</p> <p>Increased catchment for Braehead and development sites on North of River.</p>	<p>River Navigation would require to be maintained.</p> <p>Potentially limited modal shift for areas beyond Renfrew.</p>	<p>Operational control could use GCC Smart City System.</p>	<p>design. Potential impact on public transport operations.</p>	<p>Relative VfM Ranking: 3</p>
<p><b>Option 7:</b></p> <p>RNDR &amp; Bridge across Clyde, with improvements to active travel and environmental aspects.</p> <p>Benefits: Increase in economic benefits; improved cross-river connectivity; addresses traffic congestion</p> <p>Disbenefits: Some disruption to cross-river traffic flow</p>	<p>Significantly increased connectivity across River.</p> <p>Increased traffic flows managed.</p> <p>Improved connectivity to larger catchment for Airport, Clydebank, Yoker and Braehead.</p> <p>Transitional areas opened for development.</p> <p>Opportunity for modal shift in wider geographic area.</p>	<p>Largest number of stakeholders of any option.</p> <p>If Opening bridge option is selected, this is specialist (though not unfamiliar) structure.</p>	<p>Opening bridge would create focal point feature.</p> <p>Operational control could use GCC Smart City System.</p> <p>Link to RNDR would open development opportunities to larger catchment, maximising GVA potential.</p> <p>Improved recreational and active travel opportunities in wider area.</p>	<p>RNDR in area of, or close to SINC.</p> <p>Flood levels on South of river may constrain bridge location, or usage.</p> <p>River navigational aspects require to be accommodated in structure design. Potential impact on public transport operations.</p>	<p>Medium to High Relative Cost, Maximum Benefit.</p> <p>Relative VfM Ranking: 1</p>

## 1.1 Options Appraisal

### 1.1.1 Option 1 – Do Nothing (Counterfactual)

This option considers what will happen in the CWRR Study Area and Wider Area of Search in the absence of the CWRR project to meet the project objectives (including to increase GVA generated across the GCR). In other words, this option represents the counterfactual case and will form the basis of the assessment of Value for Money of other short-listed options.

Option 1 – Do Nothing comprises:

- The predicted evolution of current socio-economic and environmental baseline conditions within the Study Area and Wider Area of Search. This covers predicted changes in the characteristics and performance of the transport network, land and property development, existing retail and town centres, economic sectors, business interests, labour market supply and employment opportunities; combined with,
- The addition of committed projects/interventions within the Study Area and Wider Area of Search which are not presently fully operational but which are likely to occur in the absence of the CWRR project.

Each thematic element of Option 1 – Counterfactual is outlined below.

#### Transport Network

Under Option 1 - Counterfactual the following is expected to occur in relation to the local transport network:

- In accordance with existing LDPs and Local Transport Strategies, the following transport network improvements will be delivered by 2025 or earlier:
  - GAIA road infrastructure, comprising the Wright Street Link and Abbotsinch Road Realignment;
  - A82 Kilbowie Roundabout Improvements;
  - Proposed M8 Bishopton Junction;
  - Glasgow Airport Pick-Up/Drop-Off (PUDO) Improvements and full implementation of surface access strategy; and,
  - Implementation of the Renfrewshire Cycling Strategy (2016 – 2025).
- Levels of non-car ownership are expected to remain constant, with non-car ownership in North Renfrew and Clydebank & Yoker far above the national average, although slightly below that for Glasgow City<sup>3</sup>;
- In the absence of the CWRR project, no significant change in travel mode share is expected within the Study Area or Wider Area of Search<sup>4</sup>;
- Traffic levels are predicted to rise with the implementation of current and future planning permissions and LDP site allocations being built out. By 2020 there will be slight increases in traffic flows north and south of the River Clyde, although on the south side increases are only likely on King's Inch Road and Inchinnan Road. The only exception is Dock Street in Clydebank

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<sup>3</sup> The 2011 Census indicated that the Scottish figure for the number of households without access to a car or van was 30.5%. This compares to figures of 45.7% and 49.4% for households in Renfrew North and Clydebank & Yoker respectively.

<sup>4</sup> Under Option 1 – Counterfactual no westwards expansion of Clyde Fastlink beyond its current extent is expected due to feasibility considerations.

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where a significant increase is expected due to low existing base flows in combination with proposed new residential development;

- Accessibility software TRACC has been used to map existing journey times (2016) by car and public transport between various destinations such as health, education and transport hubs north and south of the River Clyde in the vicinity of the CWRR project. In the absence of the CWRR project, with the above noted infrastructure improvements, changes in traffic flows and queuing would mean that journey times along most key road corridors would either remain constant or increase slightly. However, journey times along the Abbotsinch Road corridor will increase by around one minute due to the realignment of Abbotsinch Road and additional junctions being developed to facilitate the development of allocated sites.

### Land and Property Development

Option 1 – Counterfactual assumes the full delivery of current (2017) planning permissions, LDP effective site allocations and other Council commitments by 2025, together with uptake of general industrial/employment land across the Wider Area of Search sustained at current rates (~4ha per annum) and the partial build out (60%) of employment land within the Glasgow Airport Investment Area (GAIA). This option is therefore underpinned by the following key assumptions:

- Implementation of the Renfrew Town Centre Simplified Planning Zone;
- Delivery of the consented extension to Braehead Shopping Centre.
- 29% of the current industrial land supply within the Wider Area of Search is expected to be developed by 2025 and 100% by 2037. However,
  - In the absence of the CWRR project, no industrial or employment development would occur within the Study Area due to known marketability, access, flood risk and contamination constraints; and,
  - Over and above the expected 329% land take-up, 60% of the employment floorspace predicted to be unlocked by the GAIA project is assumed to be delivered by 2025, with 100% delivered by 2037. The GAIA City Deal project, including NIMIS and AMIDS, would therefore be delivered as currently planned (i.e. the current phasing, extent and type of employment generating development) in the absence of the CWRR project.
- Demand for commercial land is anticipated to increase as a direct result of increased investment in GAIA and Westway Business Park. Overall, land values are expected to increase in the Wider Area of Search due to catalytic effects from the GAIA project resulting in increased take-up of presently derelict land.

The development and economic impacts of Option 1 – Counterfactual are presented in Section 5 – Economic Case. This provides a reference case to identify and assess the net benefits of implementing the preferred CWRR project option.

### Retail & Town Centres

The CWRR REIA (2017) identified four retail and town centres with the potential to be impacted by the CWRR, although after further analysis Paisley Town Centre was excluded from consideration in this OBC owing to the absence of any connectivity or economic relationship with the CWRR project. The three remaining centres of interest are:

- Braehead – defined as including Braehead Shopping Centre and Retail Park. Braehead is classified as a Strategic Commercial Centre (SCC) within the Clydeplan Network of Strategic Centres. Through case law it has been established that Braehead is not presently a Town Centre for planning purposes;

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<sup>5</sup> Based on approximately 21ha take-up of the industrial land supply within Renfrewshire between 2012 and 2017.



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- Clydebank – The town centre area is defined in accordance with the West Dunbartonshire LDP Proposed Plan (2016) and includes Clyde Shopping Centre, Clyde Retail Park and Kilbowie Retail Park. Clydebank is classified as a Strategic Town Centre (STC) within the Clydeplan Network of Strategic Centres; and,
- Renfrew – The town centre area is defined in accordance with the adopted Renfrewshire LDP (2014), which classifies Renfrew as a Core Town Centre (CTC). Renfrew CTC is not part of the Clydeplan Network of Strategic Centres.

The expected performance of each retail or town centre (except Paisley) under Option 1 – Counterfactual is outlined below.

### **Braehead SCC**

In the absence of the CWRR project there will be no change in the extent of the retail catchment area, although the catchment's population will steadily increase due to planned housing delivery across the Wider Area of Search and beyond. In the absence of other changes this would increase retail expenditure at the centre. The consented expansion of Braehead SCC is expected to be undertaken in order to maintain retail market share, particularly for comparison shopping and associated leisure activities, in the face of competition from other major retail centres (e.g. Glasgow City Centre).

### **Clydebank STC**

In line with current planning policies there will continue to be an emphasis on Class 1 (retail) uses in Clydebank STC and it is anticipated that the comparison/convenience split will remain the same. Some leisure uses will be delivered as part of the Queen's Quay redevelopment and the redevelopment of the former Playdrome site will deliver additional retail and leisure floorspace that will draw additional footfall into the Town Centre. No significant investment in additional floorspace is planned within Clyde Shopping Centre, although the owners will continue to reconfigure the existing space and introduce new formats in response to changing trends.

By 2025 the delivery of planned housing within the Study Area and Wider Area of Search, including at Queen's Quay, will increase total catchment shopper population, which in the absence of other changes would increase retail expenditure. This housing delivery will also alter the demographic characteristics of the catchment area, with increased purchasing power predicted to result. A slight fall in Clydebank STC's vacancy rates is expected by 2025, which coupled with the Town Centre First policy principle and planned developments including the redevelopment of the Playdrome site is likely to stimulate further development interest within the STC.

In the long term to 2037, the continued delivery of planned housing on the north side of the River Clyde within the Wider Area of Search will increase total catchment shopper population, which in the absence of other changes would increase retail expenditure. This housing delivery will also alter the demographic characteristics of the catchment area, with increased purchasing power predicted to result.

### **Renfrew CTC**

By 2025, delivery of planned housing in the Renfrew North area will have increased total catchment shopper population, which in the absence of other changes would increase retail expenditure. In addition, planned accessibility and public transport improvements within Renfrew CTC will deliver journey time savings. This will increase the penetration of the Town Centre to segments of the population within the centre's catchment area where journey time savings are realised, although any changes to the catchment area are expected to be negligible.

In the long term, continued delivery of planned housing in the Renfrew North area will increase total catchment shopper population, which in the absence of other changes would increase retail expenditure. Renfrew CTC will continue to focus on convenience retailing, services and lower order comparison retail. Overall there is limited scope for additionality given existing low availability/vacancy rates and little physical room for expansion in the Town Centre. No change to the retention rate is therefore predicted.



## **Labour Market**

In the absence of the CWRR project, the economic and employment opportunities presented by the GAIA City Deal Project (incorporating AMIDS and NMIS) would largely be confined to the labour market south of the River Clyde. This will result in distinct labour market trajectories north and south of the River Clyde.

### **North of River Clyde**

In the absence of the CWRR project it is anticipated that there will be only minor changes to the labour flows across the River as a result of the GAIA project. The occupational profile is likely to see minor beneficial changes as a result of the Golden Jubilee Hospital expansion, however the full impacts of this on the local labour force will be seen in the longer term.

By 2025, job and training opportunities created by major developments including the consented expansion of Braehead Shopping Centre will provide additional potential employment opportunities. However, the ability of Clydebank & Yoker workers to access employment opportunities created within the GAIA/AMIDS area will be limited owing to relatively low car ownership levels and limited options for crossing the River Clyde (i.e. Erskine Bridge, Clyde Tunnel, Yoker Ferry). In terms of occupational profile, the impacts of the Golden Jubilee Hospital Expansion are likely to include increased provision of specialist training opportunities, which is expected to raise the area's occupational profile.

### **South of River Clyde**

In the absence of the CWRR project, no major changes are anticipated to the prevailing labour flows over the River Clyde or to the occupation profile of the resident population of Renfrew North. Although the Golden Jubilee Hospital planned expansion will provide approximately 800 new jobs and training opportunities, the impact on the labour market in Renfrew North will be limited in scale due to the competing labour supply from Clydebank and Yoker, West Dunbartonshire more widely, and from neighbouring local authority areas.

By 2025 it is assumed that 60% of employment floorspace within the GAIA (i.e. including NIMIS and AMIDS) will be developed, with full development by 2037 or earlier. Inward investment linked to delivery of the GAIA and the Westway Business Park Masterplan, and development of the Hillington Business Park (supported by a Simplified Planning Zone) is likely to result in major job and training opportunities for residents in Renfrew North and other parts of the Wider Area of Search situated south of the River Clyde.

## **Economic Sectors and Business Interests**

As with the labour market, changes in economic activities north and south of the River Clyde would differ owing to the development of the GAIA City Deal project and the absence of cross-river connectivity.

### **North of River Clyde**

GVA, start-up rates and supply chain are expected to increase steadily up to 2037 in line with the major developments identified in the adopted Glasgow City LDP (2015) and the West Dunbartonshire LDP MIR (2017), including at the Carless, Exxon (Bowling) and Lomond Gate sites.

### **South of River Clyde**

By 2025, minor increases in GVA and business start-ups are anticipated in the segment of the Wider Area of Search situated south of the River Clyde, as the initial phase of the GAIA City Deal project and Westway Business Park Masterplan implementation will attract high value GVA businesses to the area. The resultant increased economic activity may have secondary minor positive impacts on the rate of start-up businesses across the segment of the Wider Area of Search located south of the River Clyde.

These effects are anticipated to continue and intensify up to 2037, at which point employment floorspace within the GAIA (including NIMIS and AMIDS) is expected to be fully operational. This will result in major increases in GVA, moderate increases in business start-up rates, and moderate



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improvements to supply chain linkages, as increased private industry investment is likely to attract supplier businesses to relocate closer to their customers.

### Summary

Drawing together the information presented above, high level economic effects from Option 1 - Counterfactual are expected to be as follows:

- Development of transport infrastructure and land in accordance with planning permissions and sites allocated with current and emerging LDPs covering the CWRR Study Area and Wider Area of Search, resulting in associated construction and operational expenditure and employment;
- Implementation of committed developments including Queens Quay (West Dunbartonshire), Jubilee Hospital Extension (West Dunbartonshire) and Braehead Extension (Renfrewshire), resulting in associated construction and operational expenditure and employment;
- Full implementation of the AMIDS / NMIS project facilitated by the GAIA City Deal infrastructure project ), with resultant employment and economic benefits for Renfrew North and the Wider Area of Search south of the River Clyde;
- Uptake of general industrial/employment land (excluding GAIA/AMIDS) within the Wider Area of Search at approximately 4ha per annum, resulting in associated construction and operational expenditure and employment.

### Option 2 – Do Minimum

Option 2 – Do Minimum comprises:

- The predicted evolution of current socio-economic and environmental baseline conditions within the Study Area and Wider Area of Search, with the additional minimum interventions into infrastructure costed at £677,977. This covers predicted changes in the characteristics and performance of the transport network, land and property development, existing retail and town centres, economic sectors, business interests, labour market supply and employment opportunities; combined with,
- The addition of committed projects/interventions within the Study Area and Wider Area of Search which are not presently fully operational, but which are likely to occur in the absence of the CWRR project.

This intervention is assumed to be completed by 2025, with the operation of all road infrastructure by 2020.

### Transport Network

As per Option 1 – Counterfactual, except that additional potential local transport interventions would result in minor improvements to traffic flows, increased junction capacity and reduced queuing at key junctions within the CWRR Study Area.

### Land and Property Development

As per Option 1 – Counterfactual (Option 2 – Do Minimum would have no additive effect on land or property development).

### Retail & Town Centres

As per Option 1 – Counterfactual, except that additional potential local transport interventions would result in minor improvements to traffic flows west of Renfrew Town Centre, which would in turn improve access to and the attractiveness of the Town Centre.



### **Labour Market**

As per Option 1 – Counterfactual (Option 2 – Do Minimum would have no additive effect on labour markets).

### **Economic Sectors and Business Interests**

As per Option 1 – Counterfactual (Option 2 – Do Minimum would have no additive effect on economic sectors or business interests).

### **Summary**

In summary, the only changes that would result from Option 2 – Counterfactual are minor improvements to traffic flows, increased junction capacity and reduced queuing at key junctions within the CWRR Study Area. This would have a minor beneficial effect on the performance of Renfrew Town Centre.

### **Option 3 – Renfrew North Development Road (RNDR)**

Option 3 – RNDR comprises:

- The predicted development of socio-economic and environmental baseline conditions within the Study Area and Wider Area of Search, with significant investment into the road infrastructure south of the River Clyde only, costed at £29,067,398.
- Predicted changes in the characteristics and performance of the transport network in Renfrewshire, land and property development, existing retail and town centres, economic sectors, business interests, labour market supply and employment opportunities; all south of the River.
- The RNDR will run between Ferry Road Renfrew and Argyll Avenue Renfrew to link with Inchinnan Road.

This intervention is assumed to be completed by 2025, with the operation of all road infrastructure by 2020.

### **Transport Network**

This option would alleviate existing and predicted future congestion to the west of Renfrew Town Centre, thereby resulting in major improvements to traffic flows and reduced queuing at key junctions within the Renfrew North segment of the CWRR Study Area. No other segment of the Study Area or Wider Area of Search would benefit from this option.

### **Land and Property Development**

This option would alleviate existing and predicted future congestion to the west of Renfrew Town Centre, which combined with the implementation of GAIA City Deal road infrastructure would improve access to and the attractiveness for inward investment of AMIDS, including both Inchinnan Business Park and the GAIA itself. A modest increase in the uptake of employment/industrial land at both locations is therefore predicted by 2025, with no further change from Option 1 – Counterfactual after this. No other segment of the Study Area or Wider Area of Search would benefit from this option.

### **Retail & Town Centres**

As per Option 1 – Counterfactual, except that the construction of the RNDR would result in major improvements in traffic flows to the west of Renfrew Town Centre. This would in turn improve access to and the attractiveness of the Town Centre.

### **Labour Market**

As per Option 1 – Counterfactual (Option 3 – RNDR would have no additive effect on labour markets).



## Economic Sectors and Business Interests

As per Option 1 – Counterfactual (Option 3 – RNDR would have no additive effect on economic sectors or business interests).

### Summary

In summary, the only changes that would result from Option 2 – Counterfactual are major improvements to traffic flows and reduced queuing west of Renfrew Town Centre. This would have a clear beneficial effect on the performance of Renfrew Town Centre and would increase the marketability of available employment land within the AMIDS area including Inchinnan Business Park and the GAIA.

## Option 7 - RNDR & Opening Bridge across Clyde, with improvements to active travel and environmental aspects

Option 7 – RNDR and Opening Bridge comprises the construction and operation of an opening vehicular bridge across the River Clyde, the development of the RNDR and associated improvements to public realm.

This intervention is assumed to be completed by 2025, with the operation of all road infrastructure by 2020.

### Transport Network

Option 7 considers the benefits of further linkages and accessibility to surrounding areas on both sides of the river crossing, including walking, cycling and public transport links along with other connectivity improvements to key sites. The potential for this project to link effectively with existing and planned active travel routes will provide greater potential outcomes. Links to National Cycle Route 7 at Yoker / Clydebank, existing core paths within Renfrew and the complementary Glasgow Airport Investment Area will enhance overall connectivity around the area, improve environmental aspects by improved travel choices and eased active and public transport options.

## Land and Property Development

### *North of the Clyde*

This option would lead to short and intermediate term acceleration in residential and commercial development, receiving greater market interest owing to the accessibility improvements delivered by CWRR infrastructure. Over and above Option 1- Counterfactual, this option is likely to unlock or accelerate the development of sites.

The presently localised property market catchment area will also be extended to the south side of the River Clyde. This will generate increased new build property sales rates and in consequence a degree of land value uplift. These trends will continue into the long term, although increases in site marketability will eventually taper off. To 2037, the viability of derelict land remediation will increase due to expected land value uplifts. The effects are likely to be similar in the absence of public transport.

### *South of the Clyde*

Effects are likely to be similar to those experienced North of the River Clyde. However, development of AMIDS including Netherton Farm and Inchinnan Business Park (as per Option 1- Counterfactual), in tandem with this option, is likely to increase the marketability of employment land at AMIDS including Netherton Farm and Inchinnan Business Park. This could result in faster buildout and either higher density or higher value employment development compared with the development of AMIDS including Netherton Farm and Inchinnan Business Park under Option 1-Counterfactual. Option 7 is predicted to result in 15% additional buildout at both AMIDS including Netherton Farm and Inchinnan Business Park by 2025. Reflecting increased market interest, 110% of currently proposed employment land at Netherton Farm and 90% at Inchinnan Business Park will be built out to 2037.

## Retail & Town Centres

## Braehead SCC

Compared to the Option 1, there will be a minor increase in penetration of the local catchment at Clydebank and Yoker given accessibility improvements resulting from the CWRR project in combination with public transport provision to 2025. This increase will not affect the centre's overall market share given the existing regional characteristics of the centre's catchment area and competition with other major retail centres. To 2037, there will be increases in the centre's penetration of the local catchment due to positive changes in the relative attractiveness of the centre compared with other centres, including Clydebank particularly in the absence of an investment response from the other centres.

Without public transport provision, Braehead will see a minor increase in catchment penetration in the short term compared with Option 1 given accessibility improvements, though less than with public transport provision.

## Clydebank STC

This Option will see the accelerated delivery of planned housing to 2025 which will increase total catchment shopper population for Clydebank STC, which in the absence of other changes would increase retail expenditure. Accessibility and public transport improvements under this scenario will affect the relative attractiveness of Clydebank STC and other nearby centres resulting in a likely net trade draw from Clydebank STC to Braehead SCC. Potential trade diversion effects will be limited by the differentiation in retail offers, although there may be limitations to the desire for multiple representation by retailers in the centres. If this results in an investment response it likely to lag behind the opening of the CWRR infrastructure in 2020. To 2037, Clydebank STC's catchment area will theoretically increase (south of the River Clyde) as a result of accessibility improvements resulting from the CWRR in combination with public transport provision, although given competition from other retail centres (e.g. Renfrew CTC) this change is likely to be negligible. The catchment area's population will also increase due to housing developments accelerated and/or facilitated by the CWRR project, which in the absence of other factors would increase retail expenditure.

The effects of Option 7 without public transport to 2025 will be of a similar nature to Option 7 with public transport, although trade draw will be lower given the absence of public transport and the relatively low car ownership levels in Clydebank and Yoker. To 2037, effects will be similar as if public transport was provided though the absence of public transport provision and competition from other retail centres will mean that an increase in Clydebank's catchment area will be negligible.

## **Renfrew CTC**

To 2025, Renfrew CTC's catchment area will increase slightly with improved local access to communities north of the River Clyde, the catchment area's population will also increase due to housing developments accelerated and/or facilitated by the CWRR project. However, trade diversion will not catalyse significant retail growth in Renfrew given spatial constraints. The centre's market share is expected to remain unchanged. Between 2025 and 2037, the catchment area's population will increase due to housing developments accelerated and/or facilitated by the CWRR project, though population growth will taper off. No further opportunities for growth of the retail centre area expected given spatial constraints

Compared to Option 7 with the public transport intervention, no provision of public transport will only increase Renfrew CTC's catchment area increase slightly to 2025 though to a lesser extent. To 2037, population growth due to housing delivery associated with the CWRR project will taper off. No further opportunities for growth of the retail centre area expected given spatial constraints.

### **1.1.1.1 Labour Market**

#### *North of River Clyde*

To 2037, moderate labour market and accessibility improvements will occur for Clydebank & Yoker residents who presently travel, or may in future travel, into Renfrewshire for work. This will apply to a greater extent to those without a car who rely on public transport, or those who have a restricted budget



for travelling to work. Additional labour market improvements will result from active travel links between residential and employment centres. Together these interventions will reduce journey times to places of employment and open up new employment opportunities, particularly to areas identified for development in Renfrew North. Major labour market accessibility improvements are anticipated from 2025 to 2037, leading to increased convergence of presently distinct labour markets in Renfrew North and Clydebank & Yoker. The CWRR project with public transport provision is expected to encourage and accelerate private investment for development on previously inaccessible derelict land. This is likely to improve accessibility to job and training opportunities for local residents, resulting in positive changes in the occupational profile of the area. These effects are likely to stimulate population growth over time. Given low levels of car ownership Clydebank & Yoker, the provision of public transport under this scenario will be required to maximise access to employment opportunities for Clydebank & Yoker residents. Owing to these effects, the CWRR will stimulate population growth and investment over time.

Without public transport provision, the impacts to 2037 will be smaller in scale. There will be positive effects relating to improved accessibility between local communities, for people already travelling across the river using the Erskine Bridge or Clyde Tunnel and a new river crossing opportunity for people who currently do not cross the River due to accessibility constraints. However, lower car ownership rates in Clydebank & Yoker will restrict the ability of local residents to access employment opportunities in Renfrewshire (including those arising from the GAIA City Deal project, Braehead expansion and upgrades to Hillington Business Park). Nonetheless, employment in Clydebank & Yoker will increase due to the Queen's Quay mixed use development, the redevelopment of the former Playdrome site and the expansion of the Golden Jubilee Hospital.

#### *South of River Clyde*

Impacts on the labour market to 2025 will be similar to Clydebank and Yoker though public transport will be less crucial to maximising employment opportunities for Renfrewshire residents. Without public transport intervention, the anticipated short term and long-term impacts as described under Option 7 with public transport will be smaller in scale in the absence of public transport. Accessibility to West Dunbartonshire will be influenced by improved accessibility between local communities, for people already travelling across the river using the Erskine Bridge or Clyde Tunnel and a new river crossing opportunity for people who currently do not cross the River due to accessibility constraints. The latter could improve access to employment opportunities at the expanding Golden Jubilee Hospital, though accessibility to employment opportunities on either side of the River Clyde for households without car ownership would remain limited.

#### **1.1.1.2 Economic Sectors and Business Interests**

##### *North of River Clyde*

To 2025, CWRR's impacts on GVA generation in the immediate vicinity of CWRR infrastructure are expected to be minor as private investment is likely to be focused on residential developments. Moderate increases in the business start-up rate and supply chain activity in the area are anticipated due to better labour market accessibility, extended catchment area and improved access to the strategic transport network i.e. M8 and Glasgow Airport, as a direct result of the CWRR project. These impacts are expected to continue to 2037.

Without public transport impacts to 2037 are expected to be like those described above. The delivery of waterfront sites (e.g. flexible space at Queen's Quay) and further accessibility and town centre improvements will increase the proportion of higher skilled jobs in the area. In the longer term, the CWRR project will improve access to highly skilled employment opportunities in the neighbouring local authorities, particularly for those with cars. This is likely to be smaller due to the lack of public transport, however the impacts are likely to be limited in scale as only a small proportion of Clydebank & Yoker labour force is assumed to be dependent on public transport.

##### *South of River Clyde*

By 2025, impacts of the CWRR project on GVA generation, business start-ups and the supply chain are expected to be moderate increased on the counterfactual scenario. This reflects anticipated

increased private investment in previously inaccessible sites and the associated network effects of the new agglomeration of economic activity in the area. These impacts are expected to continue to 2037.

Without public transport, the anticipated impacts to 2037 are expected to be similar to those under Option 7 with public transport. In the short term, impacts of the CWRR project on GVA generation, business start-ups and the supply chain are expected to be moderate increases on the counterfactual scenario. This reflects anticipated increased private investment in previously inaccessible sites and the associated network effects of the new agglomeration of economic activity in the area.

**1.1.1.3 Summary**

Drawing together the information presented above, high level economic effects from Option 7 are expected to be as follows:

- Development of transport infrastructure link providing enhanced connectivity, improved travel choices and active and public transport options.
- Accelerated development of land in accordance with planning permissions and sites allocated with current and emerging LDPs covering the CWRR Study Area and Wider Area of Search, resulting in associated construction and operational expenditure and employment;
- Implementation of committed developments including Queens Quay (West Dunbartonshire), Jubilee Hospital Extension (West Dunbartonshire) and Braehead Extension (Renfrewshire), resulting in associated construction and operational expenditure and employment;
- Accelerated implementation of AMIDS (including NIMIS), with resultant employment and economic benefits for Renfrew North and the Wider Area of Search south of the River Clyde;

**Evaluation of Sifted Options**

The contribution of the shortlisted option to project objectives and critical success factors is indicated below. Alongside the economic analysis in the next chapter, the results of this table have been used to inform our selection of the preferred option for the CWRR project investment.

Contribution to project objectives /CSFs

	Option 1	Option 2	Option 4	Option 7
<b>Contribution to project objectives</b>				
1. Improve cross-river infrastructure	XXX	XXX	XXX	√√√
2. Deliver network infra to unlock V+D sites	XXX	XX	√√√	√√√
3. Additional economic benefits from planned developments	XXX	XXX	√√	√√√
4. Create construction and operational jobs	XXX	XX	√√	√√√
<b>Contribution to Critical Success Factors</b>				
1. Strategic Fit	XXX	XXX	√	√√√
2. Value for Money	√	√	√√	√√√
3. Affordability	√	√√	√√√	√√√
4. Deliverability	√	√	√√√	√√√

While all four short-listed options are taken forward into the economic analysis to allow robust assessment of the value for money (see Chapter 5), based on the qualitative assessment of likely transport/ development/ economic effects generated by each as described earlier, Option 7 is identified as the preferred approach. Option 7 was subjected to further detailed consideration of sub-options to ensure that the most robust scenario (i.e. route/ corridor solution and bridge design) is taken forward

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for financial and economic analysis. The detailed evaluation process is described within the Part B report<sup>6</sup>.

This Sifting Process considered potential locations for the new bridge and roads and also considered differing bridge solutions which would meet the design constraints identified by stakeholders.

Design constraints for the new bridge, were identified by stakeholders to maintain the navigational rights of the River Clyde and recognise the economic contribution of the River. The resulting outcome table is shown below.

Route Selection

	Route A1	Route A2	Route B	Route C1	Route C2	Route X	Route Y
Policies and Plans	XX	XX	X	XX	XX	XX	0
Local Use and Communities	XX	XX	XX	XX	XX	X	✓
Geology, Soils and Contaminated Land	XXX	XXX	X	X	X	X	X
Water Quality, Drainage and Flooding	X	X	X	X	X	0	0
Landscape and Visual Effects	XX	XX	XX	X	X	XX	0
Ecology and Nature Conservation	XX	XX	XX	XXX	XXX	XXX	XX
Archaeology and Cultural Heritage	XX	XX	X	X	X	X	X
Noise and Vibration	XX	XX	XX	X	X	X	X
Air Quality	XX	XX	0	X	X	X	X
Sustainability	XX	XXX	XXX	X	0	XX	XX
Environment Summary	XX	XX	XX	X	X	X	X
Preferred Option (Environment)				✓	✓		✓

Transport / Economic Assessment

Transport Modelling was a key element of the project development involving close dialogue with key stakeholders, testing and scrutiny of potential options to assess the implications on the existing and future road network. To ensure that the testing of transport implications reflected the potential outcomes

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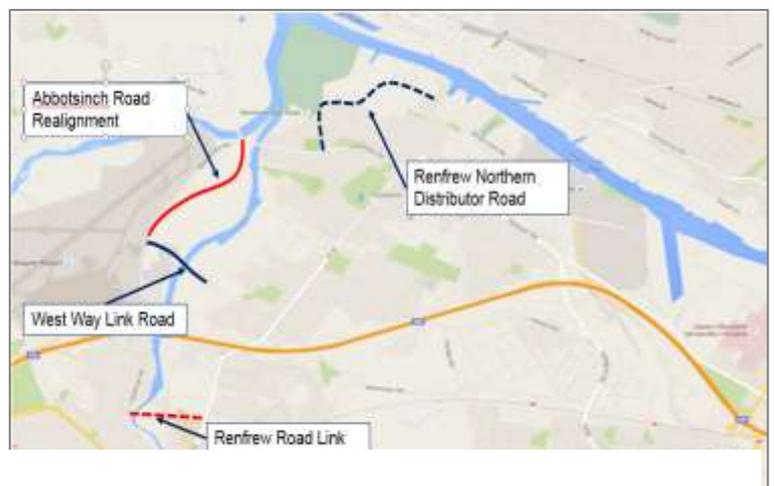
from the City Deal programme a range of tests were agreed and undertaken. This testing assessed the CWRR project individually and also collectively with the Glasgow Airport Investment Area project.

To assess the implications of all tested options against the do-minimum scenario a number of tests were completed.

- Traffic flows for the existing base condition (2015) were assessed.
- Flows generated in the road network based on development in line with the Local Development Plans of all three affected member authorities (2037) without the infrastructure created through City Deal.
- Flows generated in the road network based on development in line with the Local Development Plans of all three affected member authorities (2037) with the inclusion of the infrastructure created through City Deal. Each option for the infrastructure being tested separately.

As certain elements of the City Deal projects (both CWRR and the complementary Glasgow Airport Investment Area) are contained within the Renfrewshire Council LDP, that test assumed those infrastructure elements to be in place at that point in time (2037). The infrastructure elements included in the LDP model were:

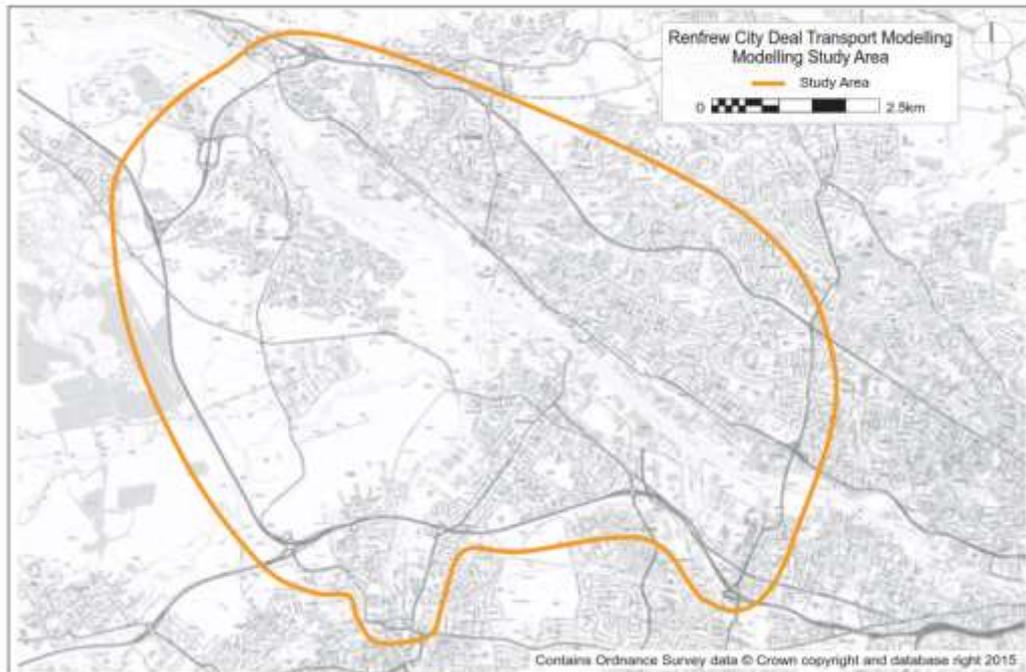
- proposed Renfrew North Development Road (Route Y alignment);
- the re-alignment of Abbotsinch Road east of the Glasgow Airport Boundary;
- Bridge and link road to Wright Street from Abbotsinch Road (West Way Link);
- Road link between Inchinnan Road, Paisley and Renfrew Road Paisley.



Elements included in the LDP model

A two tiered methodology approach was developed using the strategic model, Transport Model for Scotland (TMfS) and an operational model created in S-Paramics to assess traffic aspects and resulting economics. The operational model covers the areas of Renfrew, Paisley, Clydebank and Yoker, as shown in Figure below. To ensure that the transport modelling process allowed effective and accurate interpretation, close liaison was maintained between the project team and representatives from the three local roads authorities: Renfrewshire; Glasgow and West Dunbartonshire, with Transport Scotland representatives also given opportunity to input to the process. This liaison covered each key stage of the modelling process.

- The areal extent of the model was agreed at the outset.
- The “base model” created, was then assessed against existing conditions and agreed between all parties as reflecting conditions known to be present in the study area.
- The range of scenarios and outputs from studies of the various infrastructure options, were agreed, reviewed and discussed by all parties and agreed as appropriate outcomes for consideration in the detailed infrastructure design process.
- The preferred option outcomes were agreed to be the most effective solution for the project.



Areas covered by the operational model

A full report<sup>6</sup> on the modelling and outputs for the options testing was delivered by the specialist consultant who forms part of the Project team. The transport modelling process will continue during the detailed design stage to ensure that junction designs and road geometry provides the most effective outcomes.

A summary of the main traffic findings between the Base model and the LDP scenario are:

- Reduction in traffic flow on Inchinnan Road East between Argyll Avenue and Renfrew Cross as a result of the introduction of the Renfrew North Development Road.
- Renfrew North Development Road accounts for a significant increase in traffic flows during peak periods on Kings Inch Road.
- There is a reduction in southbound traffic flows on Hairst Street during the PM peak. This is largely due to the reassignment to the Renfrew North Development Road.
- Although there is an increase in peak period traffic flows on Dumbarton Road, no new infrastructure improvements are proposed in this area with the increase in flows being a function of general traffic growth.

A summary of the main traffic findings between the LDP scenario and the various corridor scenarios can be seen below (refer to App M for corridor locations):

- Increase in traffic volumes in the CWRR study area are associated with the increased traffic attracted to the new crossing.
- Corridor A (alignment further east in location of Ferry Road, Renfrew to Ferry Road Yoker): provides an alternative route for trips from the M8 eastbound to areas in Glasgow and Clydebank north of river. Of all bridge alignment locations tested, this one experiences the most trips which commence and finish outside the study area. In effect, the location of this option in relation to the Clyde tunnel makes it an alternative route choice for traffic which is not local in origin or destination.

<sup>6</sup> 'Part B: Option Testing Report' written by SIAS in June 2016

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- Corridor B (located near Neil Street on the south bank and Lasswade Street on the north) results in the lowest crossing flows. This is a consequence of the constrained junctions at the northern tie-in at Dumbarton Road and its proximity to the congested junction at Kelso Street.
- All location options indicate a significant increase in traffic flows on the Renfrew North Development Road and Kings Inch Road due to the flows attracted to the new River crossing.
- Options B and C indicate an increase in traffic flows to Dumbarton Road. Option C located near Lobnitz Dock on the south bank and Dock Street, Clydebank on the north) indicates a slight reduction as traffic moves south across the river rather than continuing on the congested Glasgow / Dumbarton Road route.
- All options indicate a slight increase in traffic flows on Inchinnan Road West

The detailed design and traffic modelling process will continue with development of proposals to manage and mitigate adverse effects in the existing road network resulting from the project. This work will continue in liaison with representatives of the member authorities.

Each of the crossing options carries a mixture of local (*internal* within the paramics model study area) and wider (*external* to the paramics model study area) trips. As the projects objectives are focused on providing local connectivity, a specific analysis was also produced to examine the effect of each option in attracting local trips (from or to internal locations) and wider journeys (from and to external locations) The results shown in Table below. demonstrate that Corridor C carries the lowest number of these wider trips due to its westerly location and lower attraction to traffic using the Clyde Tunnel route.

AM Peak		Northbound		Southbound		Northbound % trips			Southbound % Trips		
No. of Trips		Ext	Int	Ext	Int	Ext - Exl	Ext - Int / Int - Ext	Int - Int	Ext - Ext	Ext -Int / Int - Ext	Int - Int
Corridor A	External	534	545	267	395	31%	51%	17%	19%	56%	25%
	Internal	329	289	391	350						
Corridor B	External	383	451	251	384	30%	52%	18%	18%	57%	24%
	Internal	221	230	407	336						
Corridor C	External	381	516	242	344	28%	54%	17%	18%	57%	25%
	Internal	209	234	403	326						

Local & wider journey analysis

Analysis of traffic queuing during the peak periods, including on Ferry Road, Kings Inch Road and Dumbarton Road was appraised. Flows and queuing were also reviewed at the southern tie in of the Renfrew North Development Road at Inchinnan Road, for route options X and Y.

The study of traffic queuing indicated that options A and B resulted in significant queuing, primarily on the north bank, due to the congestion of junctions at Dumbarton Road, linked to the already busy junctions and Kelso Street and Ellerslie Road. Corridor C displayed the least amount of queuing and at levels which could be accommodated within junction designs.

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At the southern end of the Renfrew North Development Road, traffic flows indicated by the modelling are similar to the northern bank. However due to the constraints imposed by the existing junction at Inchinnan Road (The Bascule Bridge, and Abbotsinch Road/ Greenock Road junction), the queuing which results in this area would impact on the effective operation of a new road along route X. Route Y is therefore deemed the most effective and was taken forward for the project development.

Average Cross Clyde journey times between Renfrew, Clydebank and Yoker and from the extremities of the model north and south, were also investigated and compared as part of the assessment process. All routes demonstrated that savings were possible over the existing network conditions. The greatest journey time saving was associated with Corridor C. This is due in part to the reduced junction congestion in that option, as the links to existing road network are removed from existing constrained junctions (e.g. Dumbarton Road / Kelso Street, Glasgow and Inchinnan Road/ Greenock Road, Renfrew). The comparative journey times across the study area at peak periods are shown below.

From	To	Existing (from Google Maps)	Route A	Route B	Route C
Inchinnan Road	GWR East	18 mins	9 min	11 min	9 min
King's Inch Road	GWR West	18 mins	11 min	14 min	13 min
GWR West	King's Inch Road	18 mins	14 min	13 min	12 min
GWR East	Inchinnan Road	18 mins	15 min	13 min	12 min

AM Peak comparative journey times

From	To	Existing (from Google Maps)	Route A	Route B	Route C
Inchinnan Road	GWR East	20 mins	10 min	13 min	11 min
King's Inch Road	GWR West	22 mins	13 min	16 min	15 min
GWR West	King's Inch Road	18 mins	17 min	15 min	13 min
GWR East	Inchinnan Road	18 mins	20 min	19 min	17 min

PM Peak comparative journey times

An objective of the project is to encourage the increased use of active travel options. The influence of the project interventions were therefore examined for journey time differences which would be achieved by non-motorised users. The journey time benefits for non-motorised users for each of the corridor options can be seen in these tables. These journey times are based on isochronal data produced by the multi-modal accessibility tool, TRACC.



CLYDE WATERFRONT AND RENFREW RIVERSIDE PROJECT

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<b>Cycle from Renfrew Town Centre to:</b>	<b>Existing Journey Time</b>	<b>Corridor A</b>	<b>Corridor B</b>	<b>Corridor C</b>
Yoker Rail Station	Over 30 Mins	5 - 10 mins	10-15 mins	10-15 mins
Braehead Shopping Centre	5 - 10 mins	5 - 10 mins	5 - 10 mins	5 - 10 mins
Clyde Shopping Centre	Over 30 Mins	15-20 mins	15-20 mins	15-20 mins
QEU Hospital	15-20 mins	15-20 mins	15-20 mins	15-20 mins
GJN Hospital	Over 30 Mins	20-25 mins	20-25 mins	20-25 mins
WCS Clydebank	Over 30 Mins	10-15 mins	10-15 mins	10-15 mins
WCS Paisley	10-15 mins	10-15 mins	10-15 mins	10-15 mins
UWoS Paisley	15-20 mins	15-20 mins	15-20 mins	15-20 mins
Glasgow Airport	15-20 mins	15-20 mins	15-20 mins	15-20 mins
Westway Development	5 - 10 mins	5 - 10 mins	5 - 10 mins	5 - 10 mins
Scotstoun Sports Centre	25-30 mins	15-20 mins	15-20 mins	20-25 mins
Inchinnan Business Park	15-20 mins	15-20 mins	15-20 mins	15-20 mins
Netherton Farm	10-15 mins	10-15 mins	10-15 mins	10-15 mins
Junction 28	15-20 mins	15-20 mins	15-20 mins	15-20 mins
<b>Total Minutes Saved</b>		<b>-60</b>	<b>-55</b>	<b>-50</b>

Cycle times from Renfrew Town Centre

<b>Cycle times from Yoker Rail Station</b>	<b>Existing Journey Time</b>	<b>Corridor A</b>	<b>Corridor B</b>	<b>Corridor C</b>
Yoker Rail Station	N/A	N/A	N/A	N/A
Braehead Shopping Centre	Over 30 Mins	15-20 mins	15-20 mins	15-20 mins
Clyde Shopping Centre	5 - 10 mins	5 - 10 mins	5 - 10 mins	5 - 10 mins
QEU Hospital	25-30 mins	20-25 mins	20-25 mins	20-25 mins
GJN Hospital	10-15 mins	10-15 mins	10-15 mins	10-15 mins
WCS Clydebank	5 - 10 mins	5 - 10 mins	5 - 10 mins	5 - 10 mins
WCS Paisley	Over 30 Mins	20-25 mins	20-25 mins	20-25 mins
UWS Paisley	Over 30 Mins	25-30 mins	25-30 mins	25-30 mins
Glasgow Airport	Over 30 Mins	20-25 mins	20-25 mins	20-25 mins
Westway Development	Over 30 Mins	15-20 mins	15-20 mins	15-20 mins
Scotstoun Sports Centre	10-15 mins	10-15 mins	10-15 mins	10-15 mins
Inchinnan Business Park	Over 30 Mins	25-30 mins	20-25 mins	20-25 mins
Netherton Farm	Over 30 Mins	15-20 mins	15-20 mins	15-20 mins
Junction 28	Over 30 Mins	20-25 mins	20-25 mins	20-25 mins
<b>Total Minutes Saved</b>		<b>-90</b>	<b>-95</b>	<b>-95</b>

**Cycle times from Yoker Rail Station**

The information outputs show that the three corridor options produce significant cycling journey time savings when compared to the existing routes. Although similar in the total minutes saved, it is apparent that from Renfrew Town Centre to the chosen destinations, Route A is the preferred option. Whereas from Yoker train station Routes B and C reduce the collective journey times by the largest amount.

All corridors link effectively to existing core paths and cycle routes on the northern (National Cycle Route 7) and southern (Renfrewshire Core Paths REN/2/1) extremities of the project. The northern link of Corridor C is closest to Yoker station, however and as a link, by cycle or walking, this route would be preferable to encourage use of the rail network.

**Stakeholder and Public Feedback**

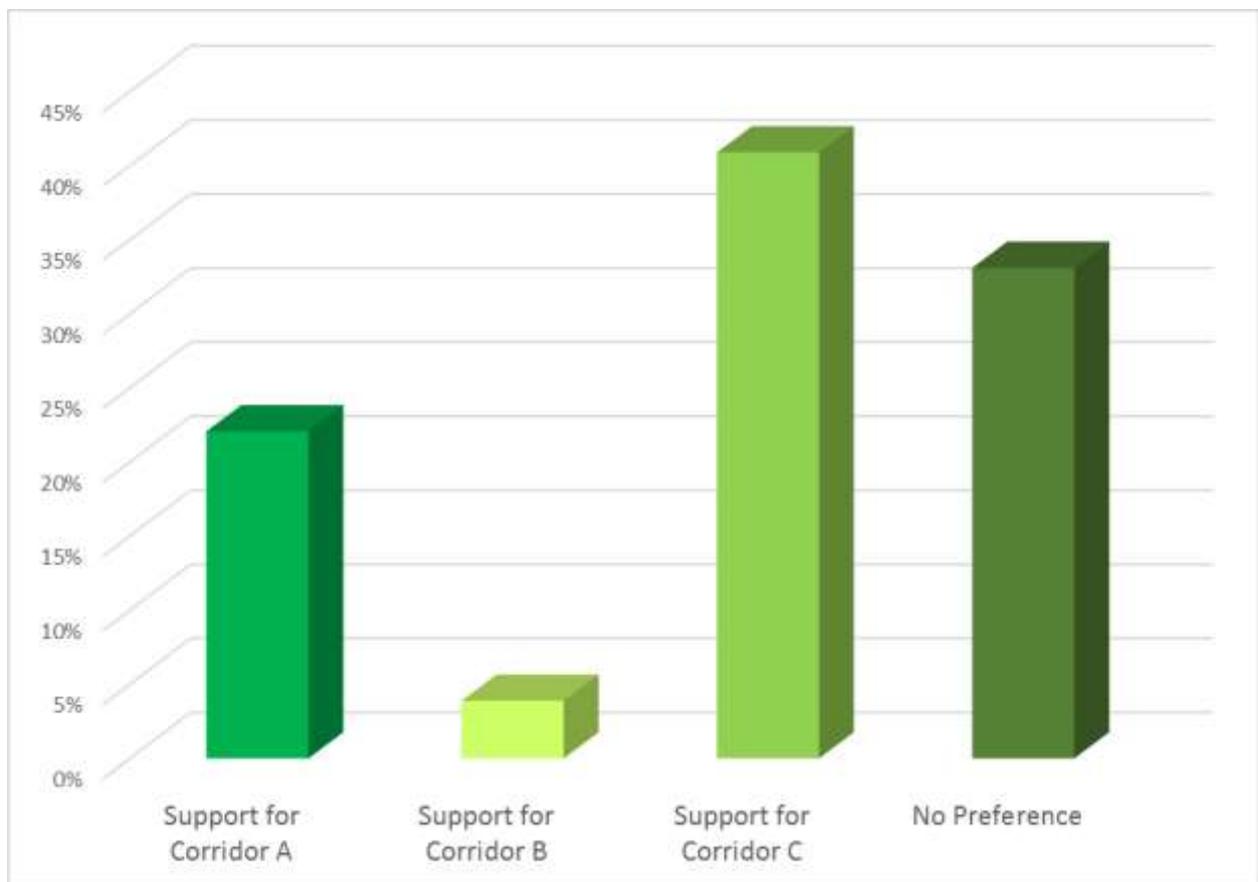
During development of the project and particularly during appraisal of the various design options, the project team undertook a range of workshops, meetings, presentations and exhibitions to enable stakeholders and the public to comment on the project outcomes and design principles. During May and June of 2016, a series of direct stakeholder and public engagement events were held, to enable opinions to be expressed on the options under consideration.

A further round of public consultation was undertaken during May 2017 in advance of the planning application for the project.

Attendance and information gathered at these engagement events was recorded<sup>7</sup>. Analysis of the records notes that throughout the development of the CWRR project, over 1500 people were directly engaged during the three rounds of events and 568 feedback forms were returned. The analysis records that 90% of those who expressed an opinion were in support of the new river crossing.

In the first two rounds of consultation, many of the respondents who expressed their support for the proposed bridge also took the opportunity to state a preferred location from the corridors under consideration. However, 33% of respondents did not express a preference for the location of the bridge. Corridor C was found to be the most popular corridor with 41% of respondents giving their support to this corridor. Figure below shows the views of respondents to the bridge location.

Respondents who expressed views on the link roads to the proposed bridge raised aspects such as



potential traffic routing along corridors already perceived to be busy (Inchinnan Road, Renfrew/ Dumbarton Road, Glasgow/ Yoker Mill Road, Clydebank). In relation to new routes for the Renfrew North Development Road, most respondents noted the potential adverse impact on the trees and

#### Preferences on the bridge location

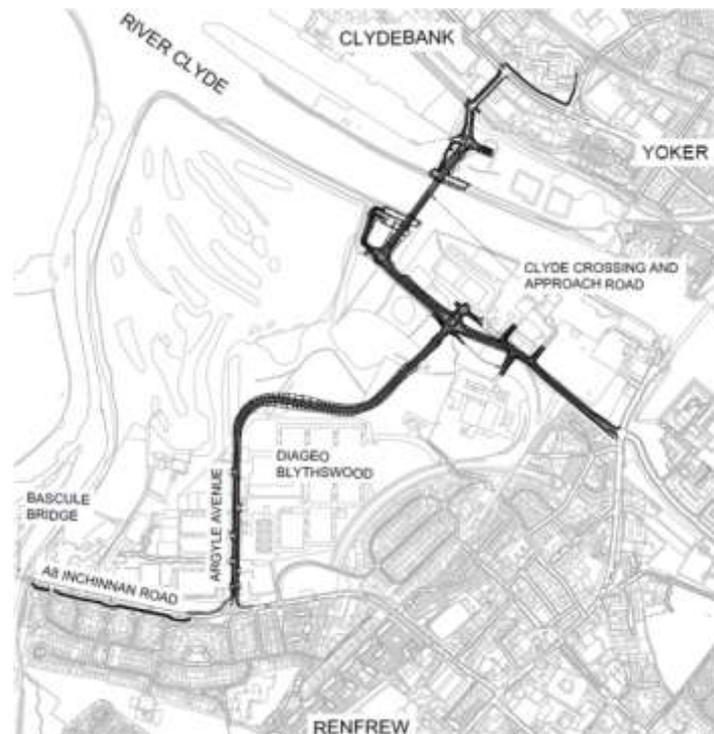
habitat within Blythswood, Renfrew.

<sup>7</sup> 'Clyde Waterfront and Renfrew Riverside - 2016 Public Exhibitions Report' written by Sweco, June 2016

## Preferred Option Alignment

The project team have undertaken detailed analysis, comparison and evaluation of the options generated at the outset of the project, using technical and analytical research of the physical, environmental and transport constraints, together with the views of public and stakeholders provided during the design development. This exercise (described within Section 0 of this OBC) has concluded that the most effective option, and therefore the preferred option is a bridge on Corridor C, linked to the new Renfrew North Development Road (RNDR), which will sit close to the existing Meadowside Street in this area, linking to the junction of Ferry Road / Kings Inch Road. The RNDR will then run south along the eastern edge of Blythswood (thereby minimising effects on trees and habitat in that area) and pass southwards along Argyll Avenue to the junction of Argyll Avenue and Inchinnan Road. On the north bank of the river, the road from the bridge head will link to Dock Street, Clydebank and continue to the junction of Dock Street / Glasgow.

Determination of the precise location of the bridge, resulted from evaluation of a range of influencing aspects and involved discussions with key landowners, the Harbour Authority and businesses potentially affected by the bridge. The evaluation also considered the need to: maximise development opportunity following completion of the project; minimise disruption to existing businesses; provide suitable processes for bridge maintenance, while not limiting river use. Consideration was also given to the options for construction of the bridge, while not adversely affecting river traffic or existing businesses in the area. The outcome of this evaluation process, resulted in a bridge location which is west of Lobnitz Dock on the south bank of the River Clyde and east of Rothesay Dock on the north bank.



Preferred alignment

## Bridge Form

The GCR City Deal and the CWRR project within it, is aimed at major regeneration and resulting economic growth throughout the City Region. While the improved connectivity of the new Clyde Bridge will provide the conditions for that growth, the potential to transform the local environment using the



## CLYDE WATERFRONT AND RENFREW RIVERSIDE PROJECT

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bridge form as a catalyst for a step change in physical environment must be explored. All of this of course while acknowledging the underlying finance available and need to ensure value for money.

## 1.1 Evaluation of Preferred Option

Following the initial Sifting Process involving identification, qualitative and SWOT analysis, the most effective option (*Option 8 - Renfrew North Development Road and River Clyde Bridge Crossing including other improvements to accessibility, walking, cycling and public transport links*), was subjected to further detailed consideration. This detailed consideration explored and assessed sub-options against the project objectives and the local Objectives and criteria as noted in the detailed evaluation process is described within the Part B report<sup>1</sup>.

This Sifting Process considered potential locations for the new bridge and roads and also considered differing bridge solutions which would meet the design constraints identified by stakeholders.

Design constraints for the new bridge, were identified by stakeholders to maintain the navigational rights of the River Clyde and recognise the economic contribution of the River. The design constraints and frequency of river traffic were researched and agreed as:

- Clear Span 90m
- Air Draft 47m
- Commercial Ship Frequency Average of 2 passes per day.
- Leisure Ship Frequency No records maintained (and can be intermittent)

The comparison of a high level fixed bridge against a lower level opening bridge examined potential locations for bridges, relative costs and impact on the potential to deliver the project outcomes. To link the areas of Renfrew to Yoker and Clydebank, only one location could be identified which might accommodate a fixed bridge of the required scale (Corridor D), without significant impact on existing residential and business locations. This location however crosses the “safeguarding zone” for aircraft landing and taking off from Glasgow Airport. To achieve the fixed bridge elevation required by the Harbour Authority, it is likely that the safeguarding zone would be breached. Three locations for a low level opening bridge were possible (Corridors A, B, C). These are shown on Figure 1.1.A below.

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<sup>1</sup> ‘Clyde Waterfront and Renfrew Riverside Part B - Options Generation and Assessment’ Report written by Sweco in October 2016.

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Figure 1.1.A - Potential bridge and road alignments

Evaluation of the bridge locations, design type and potential routes for the connecting Renfrew North Development Road involved an iterative process, considering many interrelated constraints. For the bridge these included:

- Land availability
- Commercial Ship Frequency - Average of 2 passes per day.
- Leisure Ship Frequency - No records maintained and can be intermittent
- Soffit level of Bridge in relation to vessel size, flood levels, opening frequency.
- Implications of an opening bridge on road traffic flows.
- Bridge Height in relation to Glasgow Airport Safeguarding Zones
- Potential for and impact on subsequent Development areas.
- Traffic flows on either side of the bridge
- Construction, operation and maintenance Costs
- Stakeholder and Public Opinion

For the Renfrew North Development Road these included:

- Traffic Flows following completion of the project, resulting from the improved connectivity;
- Traffic flows resulting from the development which would be generated by the improved accessibility;
- Traffic flows from growth as predicted by Local Development Plans (Renfrewshire, Glasgow City, West Dunbartonshire);
- Impact on Ecological habitats;
- Impact on existing properties;
- Ability to maximise economic outcomes through consideration of masterplanning options;
- Potential for and impact on subsequent development areas through masterplan consideration;
- Stakeholder needs and expressed views;
- Land availability;
- Potential to improve connections to existing and planned active travel routes;
- Public Opinion.

The approach road to the high level bridge would require passing through Renfrew Golf Course on the south bank and linking to Clydebank to the east of the Titan Crane. The height of the structure with its approach roads would adversely affect the environment on both sides of the river and impact on habitat on the south and the setting of the Grade A listed Titan Crane. The northern landing point would also be west of Rothsay Dock which is a busy freight and fuel dock. The bridge would potentially reduce pilot visibility to the dock on approach increasing navigational risks. In addition, the safeguarding zone for Glasgow Airport, which sets constraints on the heights of structures, would be compromised by the required scale of a fixed bridge. All of these aspects together with the relative costs resulted in the deletion of a high level bridge and the connecting roads (Corridor D) from the option evaluation process.

Road Route J (see Figure 1.1.A above) was found to impact adversely on existing residential properties, due to the narrow nature of the corridor available and the proximity to occupied homes. Route J was therefore discounted.

Having discounted a fixed bridge solution and Route J, the Refined Options, which included three potential opening bridge locations (corridors) and the various road connections which could deliver the project objectives, were examined further against a range of technical aspects. The process followed is described within the Part B report<sup>2</sup> and summarised in section 1.2 below.

## **1.2 Evaluation of Refined Options**

### **1.2.1 Refined Options**

At this stage, the refined options, shown on Figure 1.2.A below, were considered in greater detail using information revealed by research and physical investigation. Assessments were completed for each option in terms of a range of parameters as listed in Section 1.2.2 and 1.2.3 of this OBC. The

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<sup>2</sup> 'Clyde Waterfront and Renfrew Riverside Part B - Options Generation and Assessment' Report written by Sweco in October 2016.

impact of each option being determined using a seven point assessment scale (based on STAG guidance ranging from “Major Benefit” to “Major Cost or Negative Impact”. Detail of the evaluation process and each of the key parameters considered, is contained in the Part B report<sup>2</sup>.

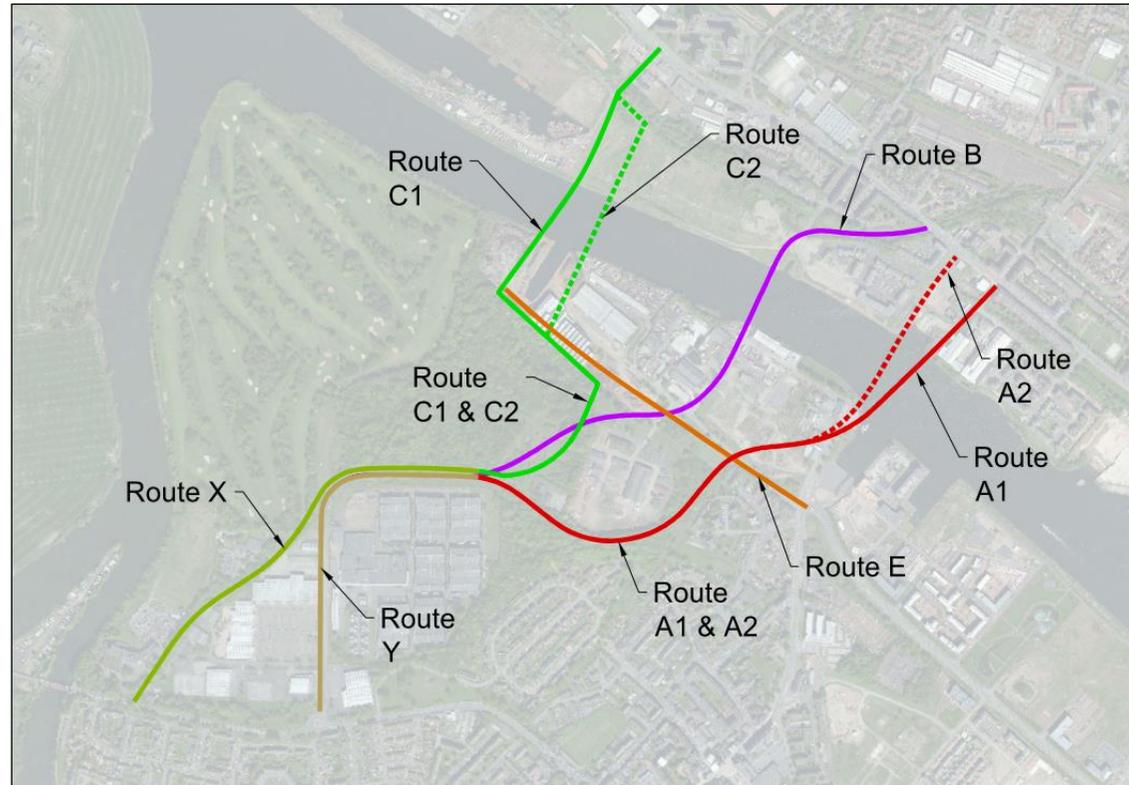


Figure 1.2.A - Refined options alignments

## 1.2.2 Environment

### 1.2.2.1 Policies and Plans

All bridge locations and road alignments were considered in relation to relevant policies in place within Renfrewshire, Glasgow City and West Dunbartonshire Councils. No discernible differences were encountered between the options in this regard, with only minor preference noted for Corridor B on the bridge and a road alignment which meets Inchinnan Road at Argyll Avenue.

### **1.2.2.2 Land Use and Communities**

The various options were considered in relation to existing and proposed land uses and the evolving masterplan potential. Consideration of adverse impacts on existing communities (residential and business) were also included. No clear differentiators were noted between the options in this measure.

### **1.2.2.3 Geology, Soils and Contaminated land**

A review of historical site investigation data and targeted exploratory site investigation confirmed that hydrocarbon contamination is present within a former oil refinery site that is considered to be a High potential risk and so it been classified as having a major negative impact on routes in Corridor A. Geology, mineral resource and soil conditions were found to be generally similar in all locations, with these aspects providing no influence on option selection. Consequently, routes in Corridors B and C are preferred on the basis of potential contamination.

### **1.2.2.4 Water Quality, Drainage and Flooding**

These aspects were considered for each option and proved not to be differentiators between design solutions.

### **1.2.2.5 Landscape and Visual Effect**

The relative impact and opportunities afforded by each option were considered. Corridor A was considered to have a relatively “moderately “negative adverse effect after mitigation on the townscape character on the south bank. Corridor B would result in a moderate negative visual impact due to the impacts on the residential properties in the Ellerslie residential zone and in front of properties along Lasswade Street, on the north bank, as the route meets Dumbarton Road along the old railway line.

The road route which uses the existing alignment of Argyll Avenue was also viewed as favourable to infringing on strong landscape edge adjacent to Renfrew Golf course and as such, Corridor C with a connecting road that fringes the tree line and meets Inchinnan Road at Argyll Ave is preferred.

### **1.2.2.6 Ecology and Nature Conservation**

The various options were assessed as having varying degrees of effect on non-statutory designated areas (comprising two areas of ancient woodland and one Site of Importance for Nature Conservation (SINC)). This assessment together with considered effects on Effects on terrestrial habitats and terrestrial and freshwater receptors, resulted in a road route through the western edge of Blythswood as being noted as least favoured.

### **1.2.2.7 Archaeology and Cultural Heritage**

While no areas were considered to be of significant importance within the study area, Corridor A has potential adverse effects on the Grade C listed Ferry Inn. While a road route that passes through Blythswood has potential to impact archaeological remains associated with the site of Renfield Mansion, a country house which was demolished in the early 19th century.

### **1.2.2.8 Noise and Vibration**

Route option C was identified as strong preferences, but would still require detailed consideration of noise and vibration, due to the low number of receptors within the potential works area. In comparison, route options A and B are likely to give rise to greater noise and vibration impacts, more so for A, due to the notably higher number of receptors within the 300m buffers. Corridor C is preferred.

### **1.2.2.9 Air Quality**

The completed project will lead to an increase in general traffic flows in Inchinnan Road and Dumbarton / Glasgow Road. Changes in traffic flow have a consequential effect on particulate emissions and potentially therefore, air quality. The changes were particularly considered in the context of baseline air quality conditions and existing or candidate Air Quality Management Areas (AQMAs) identified by Renfrewshire Council in Paisley town centre and Renfrew respectively, and areas of potentially elevated pollutant levels in the Glasgow City Council area.

The assessment undertaken indicates that the preferred route option between would be route option C.

### **1.2.2.10 Sustainability**

Based on an evaluation of carbon use in the creation of earthworks to deliver the project and end user carbon emissions Corridor C is likely to provide the greatest benefit in terms of reduced end user carbon emissions. On balance, taking into account the impact on end user carbon emissions, there is no preferred option between routes X and Y.

### **1.2.2.11 Environmental Assessment Outcome**

Overall the assessment of Environmental aspects indicates the preferred route as Option C with a road skirting to the east of Blythswood and joining Inchinnan Road at Argyll Avenue.

### **1.2.2.12 Resulting Outcomes**

The resulting outcome table is shown at Table 1.2.A below. Refer to Figure 1.2.A which notes the preferred Corridors as route C and Route Y.

Table 1.2.A - Resulting Outcomes

	Route A1	Route A2	Route B	Route C1	Route C2	Route X	Route Y
Policies and Plans	XX	XX	X	XX	XX	XX	0
Local Use and Communities	XX	XX	XX	XX	XX	X	✓
Geology, Soils and Contaminated Land	XXX	XXX	X	X	X	X	X
Water Quality, Drainage and Flooding	X	X	X	X	X	0	0
Landscape and Visual Effects	XX	XX	XX	X	X	XX	0
Ecology and Nature Conservation	XX	XX	XX	XXX	XXX	XXX	XX
Archaeology and Cultural Heritage	XX	XX	X	X	X	X	X
Noise and Vibration	XX	XX	XX	X	X	X	X
Air Quality	XX	XX	0	X	X	X	X
Sustainability	XX	XXX	XXX	X	0	XX	XX
Environment Summary	XX	XX	XX	X	X	X	X
Preferred Option (Environment)				✓	✓		✓

### 1.2.3 Transport / Economic Assessment

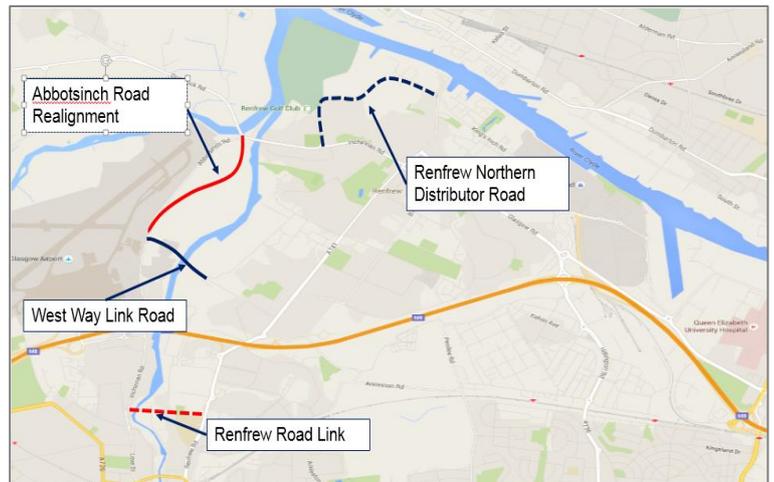
Transport Modelling was a key element of the project development involving close dialogue with key stakeholders, testing and scrutiny of potential options to assess the implications on the existing and future road network. To ensure that the testing of transport implications reflected the potential outcomes from the City Deal programme a range of tests were agreed and undertaken. This testing assessed the CWRR project individually and also collectively with the Glasgow Airport Investment Area project.

To assess the implications of all tested options against the do-minimum scenario a number of tests were completed.

- Traffic flows for the existing base condition (2015) were assessed.
- Flows generated in the road network based on development in line with the Local Development Plans of all three affected member authorities (2037) without the infrastructure created through City Deal.
- Flows generated in the road network based on development in line with the Local Development Plans of all three affected member authorities (2037) with the inclusion of the infrastructure created through City Deal. Each option for the infrastructure being tested separately.

As certain elements of the City Deal projects (both CWRR and the complementary Glasgow Airport Investment Area) are contained within the Renfrewshire Council LDP, that test assumed those infrastructure elements to be in place at that point in time (2037). The infrastructure elements included in the LDP model were:

- proposed Renfrew North Development Road (Route Y alignment);
- the re-alignment of Abbotsinch Road east of the Glasgow Airport Boundary;
- Bridge and link road to Wright Street from Abbotsinch Road (West Way Link);
- Road link between Inchinnan Road, Paisley and Renfrew Road Paisley.



These elements are indicated on Figure 1.2.B.

Figure 1.2.B - Elements included in the LDP model

A two tiered methodology approach was developed using the strategic model, Transport Model for Scotland (TMfS) and an operational model created in S-Paramics to assess traffic aspects and resulting economics. The operational model covers the areas of Renfrew, Paisley, Clydebank and Yoker, as shown in Figure 1.2.C below. To ensure that the transport modelling process allowed effective and accurate interpretation, close liaison was maintained between the project team and representatives from the three local roads authorities: Renfrewshire; Glasgow and West Dunbartonshire, with Transport Scotland representatives also given opportunity to input to the process. This liaison covered each key stage of the modelling process.

- The areal extent of the model was agreed at the outset.
- The “base model” created, was then assessed against existing conditions and agreed between all parties as reflecting conditions known to be present in the study area.

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- The range of scenarios and outputs from studies of the various infrastructure options, were agreed, reviewed and discussed by all parties and agreed as appropriate outcomes for consideration in the detailed infrastructure design process.
- The preferred option outcomes were agreed to be the most effective solution for the project.

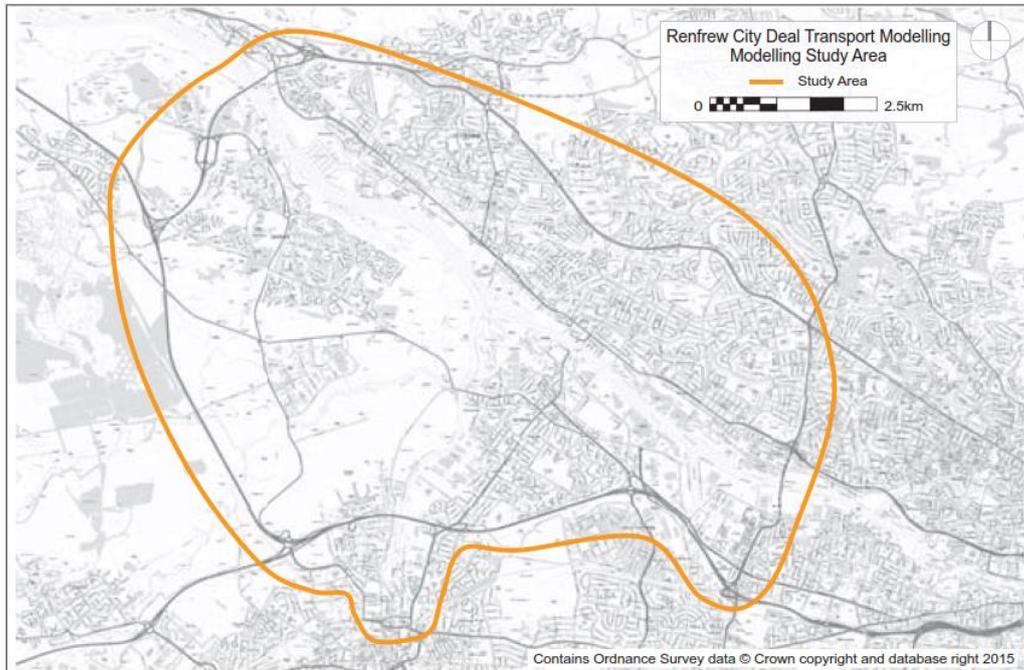


Figure 1.2.C - Areas covered by the operational model

A full report<sup>3</sup> on the modelling and outputs for the options testing was delivered by the specialist consultant who forms part of the Project team. The transport modelling process will continue during the detailed design stage to ensure that junction designs and road geometry provides the most effective outcomes.

A summary of the main traffic findings between the Base model and the LDP scenario are:

- Reduction in traffic flow on Inchinnan Road East between Argyll Avenue and Renfrew Cross as a result of the introduction of the Renfrew North Development Road.
- Renfrew North Development Road accounts for a significant increase in traffic flows during peak periods on Kings Inch Road.
- There is a reduction in southbound traffic flows on Hairst Street during the PM peak. This is largely due to the reassignment to the Renfrew North Development Road.
- Although there is an increase in peak period traffic flows on Dumbarton Road, no new infrastructure improvements are proposed in this area with the increase in flows being a function of general traffic growth.

A summary of the main traffic findings between the LDP scenario and the various corridor scenarios can be seen below:

- Increase in traffic volumes in the CWRR study area are associated with the increased traffic attracted to the new crossing.

<sup>3</sup> 'Part B: Option Testing Report' written by SIAS in June 2016

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- Corridor A (alignment further east in location of Ferry Road, Renfrew to Ferry Road Yoker): provides an alternative route for trips from the M8 eastbound to areas in Glasgow and Clydebank north of river. Of all bridge alignment locations tested, this one experiences the most trips which commence and finish outside the study area. In effect, the location of this option in relation to the Clyde tunnel makes it an alternative route choice for traffic which is not local in origin or destination.
- Corridor B (located near Neil Street on the south bank and Lasswade Street on the north) results in the lowest crossing flows. This is a consequence of the constrained junctions at the northern tie-in at Dumbarton Road and its proximity to the congested junction at Kelso Street.
- All location options indicate a significant increase in traffic flows on the Renfrew North Development Road and Kings Inch Road due to the flows attracted to the new River crossing.
- Options B and C indicate an increase in traffic flows to Dumbarton Road. Option C located near Lobnitz Dock on the south bank and Dock Street, Clydebank on the north) indicates a slight reduction as traffic moves south across the river rather than continuing on the congested Glasgow / Dumbarton Road route.
- All options indicate a slight increase in traffic flows on Inchinnan Road West

The detailed design and traffic modelling process will continue with development of proposals to manage and mitigate adverse effects in the existing road network resulting from the project. This work will continue in liaison with representatives of the member authorities.

Each of the crossing options carries a mixture of local (*internal* within the paramics model study area) and wider (*external* to the paramics model study area) trips. As the projects objectives are focused on providing local connectivity, a specific analysis was also produced to examine the effect of each option in attracting local trips (from or to internal locations) and wider journeys (from and to external locations) The results shown in Table 1.2.B below. demonstrate that Corridor C carries the lowest number of these wider trips due to its westerly location and lower attraction to traffic using the Clyde Tunnel route.

Table 1.2.B - Local & wider journey analysis

AM Peak		Northbound		Southbound		Northbound % trips			Southbound % Trips		
No. of Trips		Ext	Int	Ext	Int	Ext - Ext	Ext - Int / Int - Ext	Int - Int	Ext - Ext	Ext -Int / Int - Ext	Int - Int
Corridor A	External	534	545	267	395						
	Internal	329	289	391	350	31%	51%	17%	19%	56%	25%
Corridor B	External	383	451	251	384						
	Internal	221	230	407	336	30%	52%	18%	18%	57%	24%
Corridor C	External	381	516	242	344						
	Internal	209	234	403	326	28%	54%	17%	18%	57%	25%

Analysis of traffic queuing during the peak periods, including on Ferry Road, Kings Inch Road and Dumbarton Road was appraised. Flows and queuing were also reviewed at the southern tie in of the Renfrew North Development Road at Inchinnan Road, for route options X and Y.

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The study of traffic queuing indicated that options A and B resulted in significant queuing, primarily on the north bank, due to the congestion of junctions at Dumbarton Road, linked to the already busy junctions and Kelso Street and Ellerslie Road. Corridor C displayed the least amount of queuing and at levels which could be accommodated within junction designs.

At the southern end of the Renfrew North Development Road, traffic flows indicated by the modelling are similar to the northern bank. However due to the constraints imposed by the existing junction at Inchinnan Road (The Bascule Bridge, and Abbotsinch Road/ Greenock Road junction), the queuing which results in this area would impact on the effective operation of a new road along route X. Route Y is therefore deemed the most effective and was taken forward for the project development.

Average Cross Clyde journey times between Renfrew, Clydebank and Yoker and from the extremities of the model north and south, were also investigated and compared as part of the assessment process. All routes demonstrated that savings were possible over the existing network conditions. The greatest journey time saving was associated with Corridor C. This is due in part to the reduced junction congestion in that option, as the links to existing road network are removed from existing constrained junctions (e.g. Dumbarton Road / Kelso Street, Glasgow and Inchinnan Road/ Greenock Road, Renfrew). The comparative journey times across the study area at peak periods are shown on Table 1.2.C and Table 1.2.D below.

Table 1.2.C - AM Peak comparative journey times

From	To	Existing (from Google Maps)	Route A	Route B	Route C
Inchinnan Road	GWR East	18 mins	9 min	11 min	9 min
King's Inch Road	GWR West	18 mins	11 min	14 min	13 min
GWR West	King's Inch Road	18 mins	14 min	13 min	12 min
GWR East	Inchinnan Road	18 mins	15 min	13 min	12 min

Table 1.2.D - PM Peak comparative journey times

From	To	Existing (from Google Maps)	Route A	Route B	Route C
Inchinnan Road	GWR East	20 mins	10 min	13 min	11 min
King's Inch Road	GWR West	22 mins	13 min	16 min	15 min
GWR West	King's Inch Road	18 mins	17 min	15 min	13 min
GWR East	Inchinnan Road	18 mins	20 min	19 min	17 min

An objective of the project is to encourage the increased use of active travel options. The influence of the project interventions were therefore examined for journey time differences which would be achieved by non-motorised users. The journey time benefits for non-motorised users for each of the

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corridor options can be seen in Table 1.2.E and Table 1.2.F. These journey times are based on isochronal data produced by the multi-modal accessibility tool, TRACC.

Table 1.2.E - Cycle times from Renfrew Town Centre

<b>Cycle from Renfrew Town Centre to:</b>	<b>Existing Journey Time</b>	<b>Corridor A</b>	<b>Corridor B</b>	<b>Corridor C</b>
Yoker Rail Station	Over 30 Mins	5 - 10 mins	10-15 mins	10-15 mins
Braehead Shopping Centre	5 - 10 mins	5 - 10 mins	5 - 10 mins	5 - 10 mins
Clyde Shopping Centre	Over 30 Mins	15-20 mins	15-20 mins	15-20 mins
QEU Hospital	15-20 mins	15-20 mins	15-20 mins	15-20 mins
GJN Hospital	Over 30 Mins	20-25 mins	20-25 mins	20-25 mins
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Inchinnan Business Park	15-20 mins	15-20 mins	15-20 mins	15-20 mins
Netherton Farm	10-15 mins	10-15 mins	10-15 mins	10-15 mins
Junction 28	15-20 mins	15-20 mins	15-20 mins	15-20 mins
<b>Total Minutes Saved</b>		<b>-60</b>	<b>-55</b>	<b>-50</b>

Table 1.2.F - Cycle times from Yoker Rail Station

Cycle times from Yoker Rail Station	Existing Journey Time	Corridor A	Corridor B	Corridor C
Yoker Rail Station	N/A	N/A	N/A	N/A
Braehead Shopping Centre	Over 30 Mins	15-20 mins	15-20 mins	15-20 mins
Clyde Shopping Centre	5 - 10 mins	5 - 10 mins	5 - 10 mins	5 - 10 mins
QEU Hospital	25-30 mins	20-25 mins	20-25 mins	20-25 mins
GJN Hospital	10-15 mins	10-15 mins	10-15 mins	10-15 mins
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<b>Total Minutes Saved</b>		<b>-90</b>	<b>-95</b>	<b>-95</b>

The information outputs show that the three corridor options produce significant cycling journey time savings when compared to the existing routes. Although similar in the total minutes saved, it is apparent that from Renfrew Town Centre to the chosen destinations, Route A is the preferred option. Whereas from Yoker train station Routes B and C reduce the collective journey times by the largest amount.

All corridors link effectively to existing core paths and cycle routes on the northern (National Cycle Route 7) and southern (Renfrewshire Core Paths REN/2/1) extremities of the project. The northern link of Corridor C is closest to Yoker station, however and as a link, by cycle or walking, this route would be preferable to encourage use of the rail network.

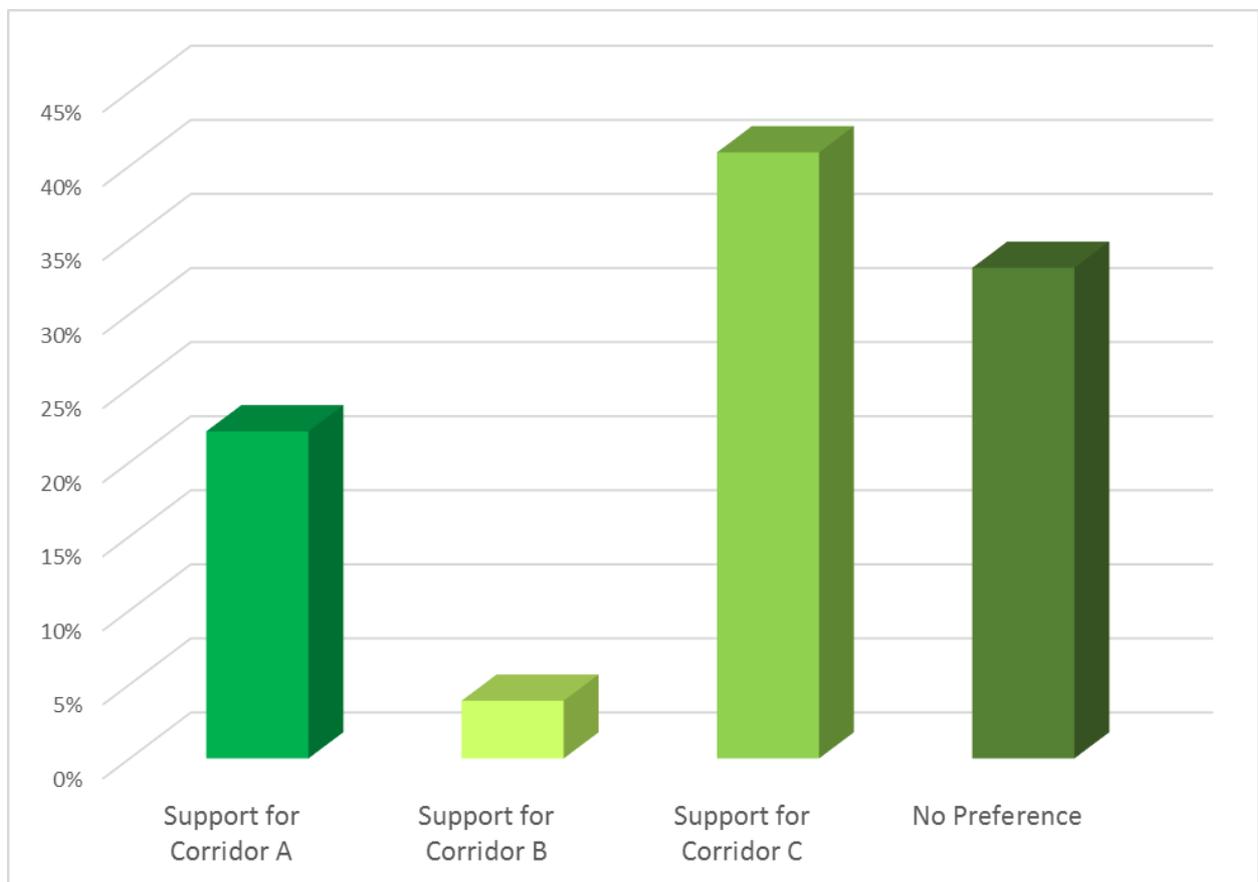
#### 1.2.4 Stakeholder and Public Feedback

During development of the project and particularly during appraisal of the various design options, the project team undertook a range of workshops, meetings, presentations and exhibitions to enable

stakeholders and the public to comment on the project outcomes and design principles. During May and June of 2016, a series of direct stakeholder and public engagement events were held, to enable opinions to be expressed on the options under consideration. A further round of public consultation was undertaken during May 2017 in advance of the planning application for the project.

Attendance and information gathered at these engagement events was recorded<sup>4</sup>. Analysis of the records notes that throughout the development of the CWRR project, over 1500 people were directly engaged during the three rounds of events and 568 feedback forms were returned. The analysis records that 90% of those who expressed an opinion were in support of the new river crossing.

In the first two rounds of consultation, many of the respondents who expressed their support for the proposed bridge also took the opportunity to state a preferred location from the corridors under consideration. However, 33% of respondents did not express a preference for the location of the bridge. Corridor C was found to be the most popular corridor with 41% of respondents giving their support to



this corridor. Figure 1.2.D shows the views of respondents to the bridge location.

Figure 1.2.D - Preferences on the bridge location

Respondents who expressed views on the link roads to the proposed bridge raised aspects such as potential traffic routing along corridors already perceived to be busy (Inchinnan Road, Renfrew/ Dumbarton Road, Glasgow/ Yoker Mill Road, Clydebank). In relation to new routes for the Renfrew

<sup>4</sup> 'Clyde Waterfront and Renfrew Riverside - 2016 Public Exhibitions Report' written by Sweco, June 2016

North Development Road, most respondents noted the potential adverse impact on the trees and habitat within Blythswood, Renfrew.

### **1.3 Preferred Option Alignment**

The project team have undertaken detailed analysis, comparison and evaluation of the options generated at the outset of the project, using technical and analytical research of the physical, environmental and transport constraints, together with the views of public and stakeholders provided during the design development. This exercise (described more fully within the Part B Report compiled by Sweco) has concluded that the most effective option, and therefore the preferred option is a bridge on Corridor C (refer to Figure 1.3.A below), linked to the new Renfrew North Development Road (RNDR), which will sit close to the existing Meadowside Street in this area, linking to the junction of Ferry Road / Kings Inch Road. The RNDR will then run south along the eastern edge of Blythswood (thereby minimising effects on trees and habitat in that area) and pass southwards along Argyll Avenue to the junction of Argyll Avenue and Inchinnan Road. On the north bank of the river, the road from the bridge head will link to Dock Street, Clydebank and continue to the junction of Dock Street / Glasgow.

Determination of the precise location of the bridge, resulted from evaluation of a range of influencing aspects and involved discussions with key landowners, the Harbour Authority and businesses potentially affected by the bridge. The evaluation also considered the need to: maximise development opportunity following completion of the project; minimise disruption to existing businesses; provide suitable processes for bridge maintenance, while not limiting river use. Consideration was also given to the options for construction of the bridge, while not adversely affecting river traffic or existing businesses in the area. The outcome of this evaluation process, resulted in a bridge location which is west of Lobnitz Dock on the south bank of the River Clyde and east of Rothesay Dock on the north bank (refer to figure 4.7.A below).

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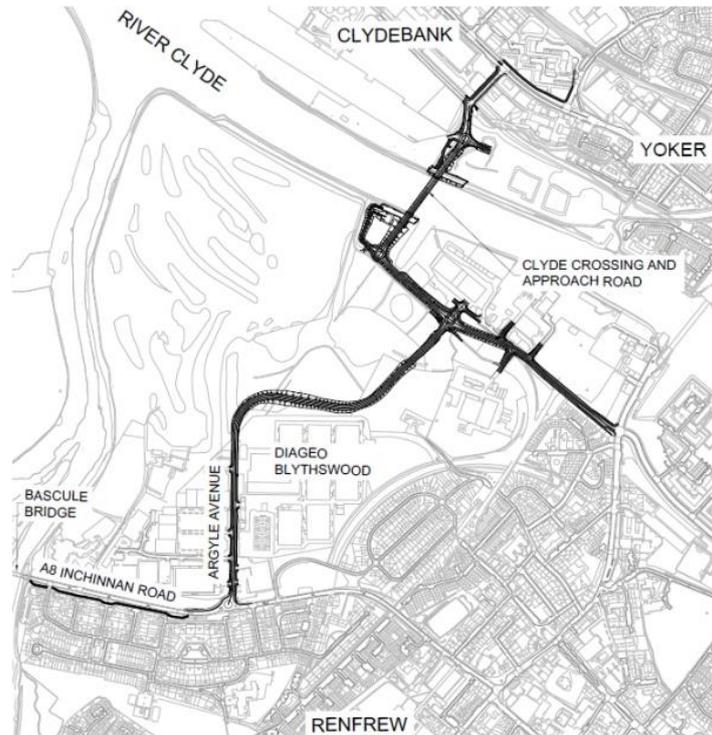


Figure 1.3.A - Preferred alignment

## 1.4 Bridge Form

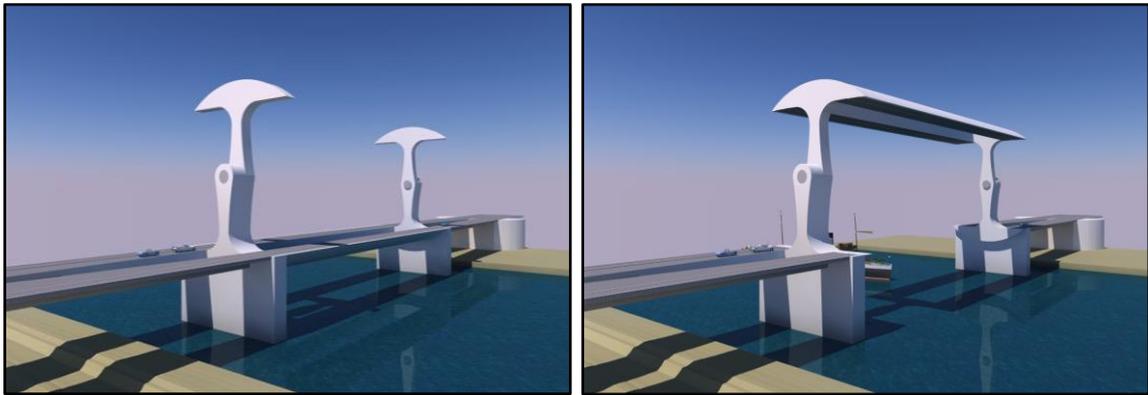
The GCR City Deal and the CWRR project within it, is aimed at major regeneration and resulting economic growth throughout the City Region. While the improved connectivity of the new Clyde Bridge will provide the conditions for that growth, the potential to transform the local environment using the bridge form as a catalyst for a step change in physical environment must be explored. All of this of course while acknowledging the underlying finance available and need to ensure value for money.

The location of the new bridge will provide specific constraints on its form, due to a variety of factors. These include: height restrictions in the area of safeguarding zones for Glasgow Airport, land availability for construction and operation, vertical alignment of road connections. The consideration of bridge form was therefore undertaken in parallel with the alignment consideration described in section 1.2.

Based on the design constraints identified through engagement with stakeholders, three bridge forms were considered in the engineering assessment for the Clyde Crossing. All of these forms are subject to development and greater design detailing, in parallel with the other constraints of the project;

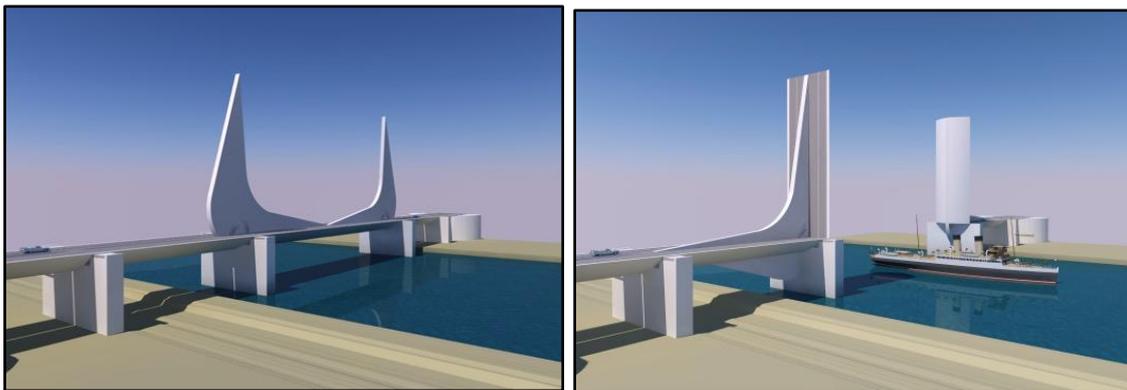
### 1.4.1 Rotating Bridge (a revision of a Vertical Lift Bridge)

The opening span consists of twin steel box girders supported off of a counterweighted steel frame which is rotated through 360 degrees on M&E equipment supported on intermediate fabricated steel columns. Approach spans consist of simply supported twin fabricated steel box girders. The bridge is supported on piled reinforced concrete piers and abutments.



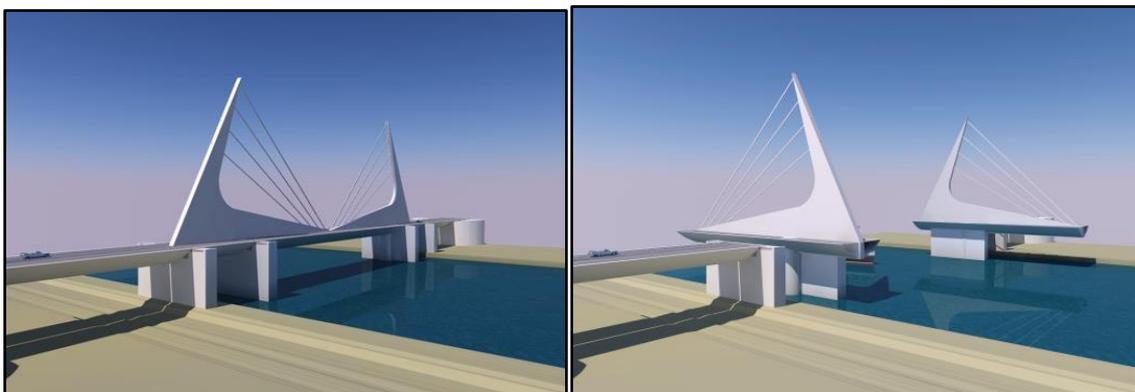
#### 1.4.2 Twin Leaf Rolling Bascule Bridge

The main opening span consists of two twin steel box girder decks with a central spine (probably of steel trussed construction with cladding) counterweighted behind a trunnion axis. Approach spans will consist of steel box girders. The bridge is supported on piled reinforced concrete piers and abutments.



#### 1.4.3 Twin Leaf Swing Bridge

The main opening span and back spans will consist of two steel box girder decks with a central spine (probably of steel trussed construction with cladding) with the counterweight behind a pivot axis within the deck construction. The bridge will be supported on piled reinforced concrete piers and abutments.



These bridges were assessed against each other using the benchmarks of Buildability, Durability and Maintenance, Functionality, Aesthetics and Environment, and Sustainability. The comparative analysis of these aspects was completed using a seven point assessment scale (based on STAG guidance)

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ranging from “Major Benefit” to “Major Cost or Negative Impact”. Detail of the evaluation process and each of the key parameters considered, is contained in the Part B report<sup>5</sup>. The summary of the outcomes from this exercise are shown in Table 1.4.A below.

Table 1.4.A - Comparative analysis of bridge forms / alignments

Topic and Assessment Criteria	Route A1 / A2			Route B			Route C1 / C2		
	Rotating Bridge	Bascule Bridge	Swing Bridge	Rotating Bridge	Bascule Bridge	Swing Bridge	Rotating Bridge	Bascule Bridge	Swing Bridge
<b>Buildability</b>									
Temporary Works requirements	XX	XX	XX	XX	XX	XX	XX	XX	XX
Craneage Requirements (e.g. size/no. of beams to be placed)	XX	X	✓	XX	✓	✓	XX	X	✓
Works required in navigation channel	XX	X	✓✓	XX	X	✓✓	XX	X	✓✓
Established form of construction	XX	✓	✓	XX	✓	✓	XX	✓	✓
Piling requirements	XXX	XX	X	XXX	XX	X	XXX	XX	X
<b>Buildability Summary</b>	<b>XX</b>	<b>X</b>	<b>0</b>	<b>XX</b>	<b>X</b>	<b>0</b>	<b>XX</b>	<b>X</b>	<b>0</b>

Topic and Assessment Criteria	Route A1 / A2			Route B			Route C1 / C2		
	Rotating Bridge	Bascule Bridge	Swing Bridge	Rotating Bridge	Bascule Bridge	Swing Bridge	Rotating Bridge	Bascule Bridge	Swing Bridge
<b>Durability and Maintenance</b>									
No. elements with <120 yr design life	X	X	X	X	X	X	X	X	X
Reliability of M&E	✓✓	✓	✓✓	✓✓	✓	✓✓	✓✓	✓	✓✓
Access to M&E	XX	0	✓	XX	0	✓	XX	0	✓
Access for maintenance	X	X	✓	X	X	✓	X	X	✓
Access for inspections	0	0	✓	0	0	✓	0	0	✓
<b>Durability and Maintenance Summary</b>	<b>0</b>	<b>0</b>	<b>✓</b>	<b>0</b>	<b>0</b>	<b>✓</b>	<b>0</b>	<b>0</b>	<b>✓</b>
<b>Functionality</b>									
Navigation of the River Clyde	XXX	X	✓✓	XXX	X	✓✓	XXX	X	✓✓
Glasgow Airport	X	0	0	XX	X	X	XXX	XX	XX
Adjacent land	XX	XX	XXX	XX	XX	XXX	XX	XX	XXX
Opening Mechanism	X	XX	✓✓	X	XX	✓✓	X	XX	0
<b>Functionality Summary</b>	<b>XX</b>	<b>X</b>	<b>0</b>	<b>XX</b>	<b>XX</b>	<b>0</b>	<b>XX</b>	<b>XX</b>	<b>X</b>

<sup>5</sup> ‘Clyde Waterfront and Renfrew Riverside Part B - Options Generation and Assessment’ Report written by Sweco in October 2016.

Topic and Assessment Criteria	Route A1 /A2			Route B			Route C1 / C2		
	Rotating Bridge	Bascule Bridge	Swing Bridge	Rotating Bridge	Bascule Bridge	Swing Bridge	Rotating Bridge	Bascule Bridge	Swing Bridge
<b>Aesthetics</b>									
Statement structure	✓✓✓	✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓✓	✓✓	✓✓
Aesthetic appeal	✓✓✓	✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓
Potential to create public attraction	✓✓✓	✓	✓	✓✓✓	✓	✓	✓✓	0	0
<b>Aesthetics Summary</b>	✓✓✓	✓✓	✓✓	✓✓✓	✓✓	✓✓	✓✓	✓	✓
<b>Environment and Sustainability</b>									
CAR License from SEPA	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	XX	XX	XX
Marine License from Marine Scotland	XXX	XXX	XX	XXX	XXX	XX	XXX	XXX	XX
Working in/above watercourse	XXX	XXX	XX	XXX	XXX	XX	XXX	XXX	XX
Flood Risk	XX	X	X	XX	X	X	XX	X	X
<b>Environment and Sustainability Summary</b>	XX	X	X	XX	X	X	XXX	XX	XX
<b>Overall Summary</b>	X	0	0	X	0	0	X	X	0
<b>Preferred Option</b>			✓			✓			✓

In conclusion, there are only minor differences between the Bridge Form options when considered against the criteria of aesthetics, environment and sustainability. All options have the potential to create a statement structure with public appeal by the mere fact that they are opening structures. It is however likely that the rotating bridge will generate more public interest due to its unique form of opening. All options impact the River Clyde and a Marine License will require to be approved for the works. All options will need further consideration during the developing design in relation to hydraulic flows in the River Clyde and impact, if any, on tidal flooding.

When considered against the criteria of buildability, durability and functionality however there is a clear preference towards the Swing Bridge. The Rotating Bridge and Bascule Bridge require extensive temporary works and craneage requirements within the navigation channel during construction which may impact upon the operations on the River Clyde, during that period. Both options will also need to be maintained in the open to traffic position which will result in regular restrictions to operation on the Clyde. The swing bridge can be constructed and maintained in its closed to traffic position which will significantly reduce the impact to operations on the Clyde. The swing bridge is the only form of structure that can be modified such that the height of the completed structure does not intrude on the Glasgow Airport safeguarding zones. The Swing bridge solution is therefore the only structural form which can be accommodated within Corridor C, without temporary or permanent infringement of the airport safeguarding zone.

The Swing Bridge is the preferred Bridge Option for Corridor C. Continuing development of this technical solution, in conjunction with stakeholders such as Architecture Design Scotland and representatives of the planning authorities from each affected member authority, has led to the refined design being taken forward, as shown in Table 1.4.A.

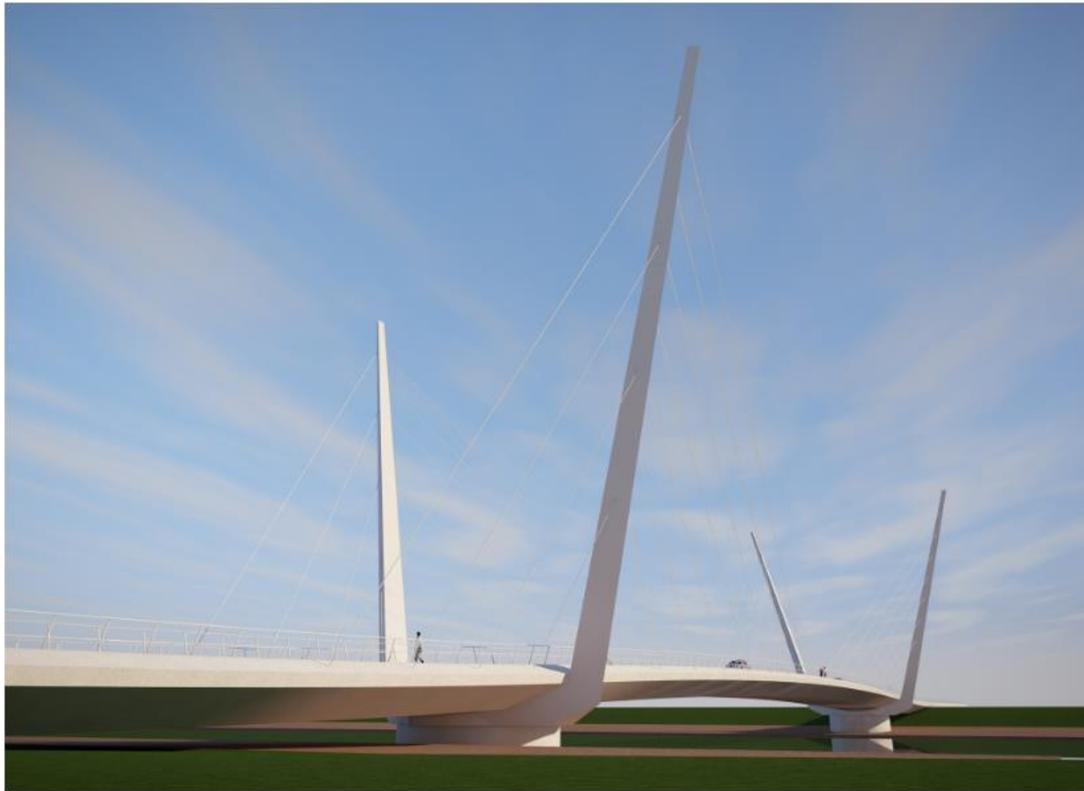


Figure 1.4.A - Refined design being taken forward