Vale of Glamorgan Council

Vale of Glamorgan Coastal Corridor – Sustainable Transport Impacts

Scheme Impacts Assessment Report – Final Draft

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Arup, 26 July 2018

0 Executive summary

0.1 Introduction

The Vale of Glamorgan Council has commissioned Arup to undertake an appraisal of the economic and transport benefits relating to a series of sustainable transport interventions along the Vale of Glamorgan to Cardiff coastal corridor. This involves the following seven potential schemes:

- Cycling and pedestrian routes:
  - Penarth Headland Link
  - Biglis Roundabout to Dinas Powys
  - Merrie Harrier to Pont-Y-Werin and Penarth Road
- Bus priority schemes:
  - Merrie Harrier to Cardiff Barrage (and onwards to Cardiff city centre)
  - Cosmeston to Cardiff Barrage (and onwards to Cardiff city centre)
  - Park & ride facility at Cosmeston Park
- Cogan rail station upgrade

The appraisal aims to identify the strategic, economic and transport benefits that could be realised due to the implementation of the schemes. This is intended to provide a body of evidence that can be developed into WelTAG Stage 1 and Stage 2 appraisals for any scheme that is progressed for further analysis.

0.2 Strategic context

Transport conditions along the corridor

Analysis of journey to work patterns indicates that levels of both public transport usage and active travel (walking or cycling) are generally low – each accounting for around 10- 15% of journeys along the corridor. Driving a car or van remains the dominant mode (around two thirds of total journeys).

Results from analysis of Trafficmaster data indicate that traffic congestion is a significant issue in peak periods. Investing in alternative / sustainable modes would help reduce traffic, ease congestion and reduce emissions.

Cycling infrastructure between Penarth, Dinas Powys and Barry

There are differences in levels of cycling within the corridor area. Levels of cycling are significantly higher for journeys to / from Penarth than for journeys to/from Dinas Powys or Barry. Low levels of cycling for Dinas Powys and Barry are likely to be due in part to the limited cycling infrastructure beyond Penarth – with particularly limited provision between Dinas and Barry.

There is a strong case for improving cycling facilities, as this would link Barry and Dinas to established cycle routes into Cardiff via the Barrage.

Bus journey times along the corridor

Bus usage accounts for between 2% and 4% of total journeys – below the Wales average. Journey times are also slow compared to car or rail journeys. This is partly to congestion along the coastal corridor as well as within Cardiff (the principal destination for commuters).

These factors support the case for bus priority measures along the corridor, coupled with a faster link into Cardiff (potentially via Cardiff barrage).

0.3 The Case for Change

Combining the assessment of transport issues along the corridor with the specific scheme proposals, the following six Strategic Objectives have been defined:

1. Reduce journey times and improve journey quality for sustainable transport modes (bus and rail services, pedestrian and cycling links) along the Vale of Glamorgan coastal corridor.
2. Increase the levels of active travel through provision of high quality pedestrian and cycling infrastructure along key routes.
3. Improve accessibility and connectivity between key destinations by all modes, in turn reducing the reliability on the car.
4. Enhance development opportunities by improving access to strategic development sites.
5. Encourage economic activity, leisure and tourism by reducing barriers to shoppers, tourists and other visitors.
6. Contribute towards reduced road traffic congestion, reduced emissions and improved air quality.

A comparative evaluation of the potential scheme options has been undertaken, to assess the extent to which each scheme option delivers against the above Strategic Objectives. A scoring mechanism has been applied, based on the WelTAG scoring matrix (see section 3.3.2). The results are summarised in Table 1.

Table 1: Appraisal of scheme options alignment with strategic objectives

Scheme option	Indicative score	Summary
Penarth Headland Link (ped & cycle)	+10	Strong strategic alignment due to encouragement of active travel, journey quality, and significant leisure and tourism benefits.
Biglis Roundabout to Dinas Powys (ped & cycle)	+12	Strong strategic alignment due to active travel benefits, journey quality, connectivity and congestion reduction.
Merrie Harrier to Pont-y-Werin and Penarth Road (ped & cycle)	+12	Strong strategic alignment due to active travel benefits, journey quality, connectivity and congestion reduction.

Scheme option	Indicative score	Summary
Merrie Harrier to Cardiff Barrage (bus)	+10	Strong strategic alignment due to journey quality, connectivity and congestion reduction.
Cosmeston to Cardiff Barrage (bus)	+10	Strong strategic alignment due to journey quality, connectivity and congestion reduction.
Park & Ride at Cosmeston (or alternative locations) (bus / rail)	+5	Positive strategic alignment due to connectivity and congestion reduction.
Cogan Station upgrade (rail)	+8	Positive strategic alignment due to connectivity and congestion reduction, development on site.

0.4 Options feasibility assessment

An assessment of the overall technical feasibility and deliverability of each scheme option has also been completed. For three of the proposed schemes (Cosmeston P&R / Cosmeston Bus Priority / Cogan Interchange), Arup has carried out its own feasibility analysis and appraisal of different sub-options, (see Appendix B). For the other schemes, the feasibility assessment draws upon other pre-existing feasibility reports.

The assessment includes a summary appraisal to compare the performance of each potential scheme option relative to three key criteria: technical feasibility and deliverability; potential cost; and dependencies and risks. A scoring mechanism has been applied to capture the results which is based on the WelTAG scoring matrix (see section 4.4). The results are summarised in Table 2.

Table 2: Comparative appraisal of scheme options feasibility

Scheme option	Indicative score	Summary
Penarth Headland Link (pedestrian & cycle)	-5	A significant engineering undertaking, and the most technically complex of all the scheme options with highest cost. Requires consultation / stakeholder engagement.
Biglis Roundabout to Dinas Powys (pedestrian & cycle)	-1	Project unlikely to pose significant technical or delivery challenges. Lower cost than other schemes. Potential risk associated with land acquisition / CPO.
Merrie Harrier to Pont-y-Werin and Penarth Road (pedestrian & cycle)	-1	Project unlikely to pose significant technical or delivery challenges, although works will require traffic management measures. Significant costs.
Merrie Harrier to Cardiff Barrage (bus)	-4	Technical challenges, significant costs and operational risks relating to implementation of buses over the barrage.
Cosmeston to Cardiff Barrage (bus)	-4	Technical challenges, significant costs and operational risks relating to implementation of buses over the barrage.

Scheme option	Indicative score	Summary
Park & Ride at Cosmeston (or alternative locations) (bus / rail)	0	Low technical complexity. Lower cost than other schemes. Preferred option (C) dependent on land acquisition.
Cogan Station upgrade (rail)	-3	Upgrade unlikely to pose significant technical or delivery challenges. Preferred sub-option (B) requires civils works to accommodate new platform and pedestrian linkage, potentially significant costs. Land acquisition required.

0.5 Transport impacts appraisal

Overview and results obtained

As appraisal has been carried out of the potential impact of each scheme option on transport usage, modal share and journey times. The key focus is on the increased usage of sustainable modes (walking / cycling / bus usage) that will arise. The results are summarised in Table 3.

Table 3: Sustainable transport scheme options – summary of transport impacts

Scheme	Current demand (2018)	Est. future demand – 2021 (post-option implementation)*
Pedestrian & cycling schemes		
Penarth Headland Link Walking & Cycling	Pedestrians: 118k Cyclists: 155k	Pedestrians: 271k (+ 130%) Cyclists: 288k (+ 86%)
Biglis-Dinas Powys Walking & Cycling	Pedestrians: 0 Cyclists: 21k	Pedestrians: 85k *(all new users)* Cyclists: 32k (+ 52%)
Merrie Harrier - Pont y Werin Walking & Cycling	Pedestrians: 0 Cyclists: 41k	Pedestrians: 41k *(all new users)* Cyclists: 62k (+ 51%)
Bus priority schemes		
Merrie Harrier - Barrage Bus Priority	Bus: 208k	Bus: 230k (+ 11%)
Cosmeston - Barrage Bus Priority	Bus: 285k	Bus: 300k (+ 5%)
Park & Ride schemes		
Cosmeston Park & Ride (plus potential alternatives)	n/a	Sub-option 1 (Cosmeston): (bus trips) 18k p.a. Sub-option 2 (Sully): (bus trips) 19k p.a. Sub-option 3 (Eastbrook): (train trips) 37k p.a.
Cogan Park & Ride	n/a	Train trips: 34k p.a.

* We note 2021 demand figures also incorporate underlying year-on-year demand growth – see Section 5.2.4

Summary – walking & cycling schemes

Comparing the percentage uplifts in levels of usage for sustainable modes, the Penarth Headland Link shows the biggest impact of all the scheme options. This is mainly because the link would connect with the already heavily used Cardiff Bay barrage, from which much of the new demand is expected to arise.

The Biglis to Dinas Powys and Merrie Harrier - Pont y Werin schemes are also expected to drive increased levels of walking and cycling, albeit to a lower level. Current provision along the two routes is limited, therefore providing safe, segregated walking and cycling links will have a significant impact.

Summary – bus priority schemes

The two bus priority schemes – Merrie Harrier to Cardiff Barrage and Cosmeston to Cardiff Barrage would each deliver journey time improvements that would give rise to increased demand. In both cases, bus demand is expected to increase from current levels, with around 15,000 – 22,000 additional bus trips per annum by 2021, and a related reduction in car trips.

Summary – park & ride schemes

The uplift in levels of public transport demand arising from the Park & Ride options / sub-options varies. Analysis of two potential locations for a bus P&R facility – at Cosmeston, or Sully – suggests either option would generate approximately 18 – 19,000 additional bus trips per annum. In contrast, expanding existing park & ride provision at Eastbrook rail would be expected to deliver roughly double the users – with around 37,000 additional (rail) trips per annum.

The expansion and upgrading of Cogan rail station P&R is expected to result in a similar growth in demand, with an additional 34,000 rail trips per annum forecast.

0.6 Economic impacts appraisal

Overview and results obtained

The focus of the economic impacts appraisal is on the specific benefits each of the scheme options will deliver, compared to the status quo (or "do nothing" scenario). The benefits are compared against the costs of implementation and operation (net of any direct revenues), in order for a net economic benefit to be calculated alongside a benefit-to-cost ratio. The results obtained for each scheme option are summarised in the table below.

Table 4: Economic impacts – scheme options (60-year totals, discounted), 2010 prices

Scheme option	Economic benefits	Economic costs	Total net benefit	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link Walking & Cycling	£7.07m	£12.38m	**-£5.31m**	**0.57**
Biglis-Dinas Powys Walking & Cycling	£2.83m	£1.16m	**£1.67m**	**2.44**
Merrie Harrier - Pont y Werin Walking & Cycling	£1.70m	£3.66m	**-£1.96m**	**0.46**
Bus priority scheme options				
Merrie Harrier - Barrage Bus Priority	£7.27m	£21.95m	**-£14.68m**	**0.33**
Cosmeston - Barrage Bus Priority	£4.58m	£6.41m	**-£1.83m**	**0.71**
Park & ride scheme options				
Cosmeston Park & Ride - Sub-option A: Cosmeston	£0.56m	£0.80m	**-£0.25m**	**0.69**

Scheme option	Economic benefits	Economic costs	Total net benefit	Benefit-Cost Ratio
Cosmeston Park & Ride - Sub-option B: Sully	£0.60m	£0.80m	**-£0.20m**	**0.75**
Cosmeston Park & Ride - Sub-option C: Eastbrook (rail)	£1.16m	£2.14m	**-£0.98m**	**0.54**
Cogan Park & Ride	£1.22m	£2.23m	**-£1.01m**	**0.55**

The results of the economic appraisal indicate that for most of the scheme options the costs for delivery will exceed the economic benefits calculated in this appraisal.

Only one scheme option – the Biglis to Dinas Powys walking & cycling route – delivers a positive economic net benefit of £1.7m (60 year NPV) with a benefit-cost ratio of 2.44 representing "high" value for money. For the remaining seven schemes the net economic benefit calculations show negative values ranging from -£0.2m (Cosmeston Park & Ride – sub-option B: Sully) to -£14.7m (Merrie Harrier to Barrage bus priority).

Two of the three walking & cycling schemes (Penarth Headland Link and Merrie Harrier – Pont y Werin) and both bus priority schemes will require major capital works, ranging (in NPV terms) from £3.2m (Merrie Harrier – Pont y Werin) to £10.9m (Penarth Headland Link). Furthermore, the two bus schemes will also involve additional costs to operate the enhanced services. In all four cases, the total costs incurred are in excess of the benefits delivered.

The park & ride scheme options involve significant lower costs for delivery. However, levels of usage and associated reductions in road traffic yield insufficient benefits to fully cover the costs incurred.

Programme-level results including potential synergies

As well as considering each scheme option in its own right (see above), a corridor-level assessment has also been made of the scheme options as a combined programme of measures. This also takes into account potential synergies associated with two of the pedestrian & cycle schemes and the two bus priority schemes – see section 6.4.2. Results are shown in the table below.

Table 5: Economic impacts – corridor-level (60-year totals, discounted), 2010 prices

Scheme option	Economic benefits	Economic costs	Total net benefit	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link Walking & Cycling	£7.07m	£12.38m	**-£5.31m**	**0.57**
Two-option synergy (with additional demand uplift): - Biglis-Dinas Powys - Merrie Harrier - Pont y Werin -	£4.98m	£4.81m	**£0.16m**	**1.03**
Bus priority scheme options				
Two-option synergy (with reduction in combined cost): - Merrie Harrier - Barrage - Cosmeston - Barrage	£11.85m	£20.26m	**-£8.41m**	**0.58**

Scheme option	Economic benefits	Economic costs	Total net benefit	Benefit-Cost Ratio
Park & ride scheme options				
Cosmeston Park & Ride (recommended sub-option): - Sub-option C: Eastbrook (rail)	£1.16m	£2.14m	**-£0.98m**	**0.54**
Cogan Park & Ride	£1.22m	£2.23m	**-£1.01m**	**0.55**
Programme-level total				
Total (all scheme options incl. synergies)	£26.28m	£41.83m	**-£15.55**	**0.63**

As indicated above, combining the two walking & cycling schemes along the Barry – Dinas – Cardiff Bay corridor (Biglis to Dinas Powys, plus Merrie Harrier to Pont y Werin), the joint economic benefit is sufficient to offset the economic cost, although the resulting benefit-cost ratio of only 1.03 represents "low" value for money according to HM Treasury standards. (We note that the inclusion of leisure-related benefits and public health benefits in the calculation would lead to a more positive result – see "wider economic benefits", discussed below).

Combining the two bus priority schemes enables costs to be substantially reduced. However, costs still remain significantly higher than benefits, such that the net economic benefit (60-year NPV) shows a negative figure of -£8.4m.

Combining all seven scheme options, the total economic benefits are significantly lower than the combined cost. As a result, the programme level economic net benefit shows a negative total of -£15.5m (in 60-year NPV terms), and a programme level benefit-cost ratio of 0.63.

Wider economic benefits

The three walking and cycling schemes are expected to deliver leisure-related benefits and public health benefits (see sections 6.5.2 and 6.5.3), neither of which has been quantified within this appraisal. Although the extent of such benefits is not currently known, these may be of sufficient scope to significantly improve the economic appraisal results. It is recommended that a quantitative appraisal of both leisure-related benefits and public health benefits is undertaken, should the scheme proposals be progressed for further feasibility analysis.

0.7 Conclusions and recommendations

Arup's key conclusions from this appraisal are as follows:

- The seven proposed scheme options would help to improve the quality and attractiveness of walking, cycling and bus usage as transport options along key sections of the Vale of Glamorgan to Cardiff coastal corridor. There is a strong justification for delivering the schemes from the context of local, regional and national policy.
- There is a clear rationale for increasing the levels of sustainable transport usage along the corridor. Current provision for walking and cycling is limited, and bus journey times are slow compared to other modes.

- With regard to the schemes' feasibility, constructing the Penarth Headland Link would be a major engineering undertaking, involving significant cost. The remaining scheme options are not considered particularly challenging from a technical or delivery perspective, however in most cases significant costs would still be involved in constructing and/or operating the schemes.

- The analysis of transport impacts suggests that the scheme options are likely to lead to demonstrable increases in the usage of sustainable transport modes. Users will experience improved amenity, journey quality and reduced travel times. However, delivery of the schemes is not expected to lead to major changes to wider travel patterns nor result in any significant reductions in road congestion.

- The results of the economic appraisal indicate that for most of the scheme options, costs for delivery will exceed the economic benefits calculated in this appraisal. However, for the three walking and cycling scheme options, additional benefits relating to public health improvements and increased leisure activity (particularly for Penarth Headland Link), are likely to result in significant additional benefits. While such benefits have not been quantified within this appraisal, it is recommended that such a quantification is undertaken should the scheme options be progressed for further feasibility analysis and development.

- For the bus priority schemes, the difference between benefits and costs is significant. It is also noted that, whilst operating buses over Cardiff Barrage would deliver significant benefits, similar improvements in connectivity and journey time savings could be achieved by routing additional services over the existing Cardiff Bay Link Road bridge (for which no capital investment would be required). It is recommended that the Vale of Glamorgan council examines the operation of services via this route as a potential lower-cost alternative.

Drawing upon the conclusions of this appraisal, it is recommended that further analysis is undertaken in relation to the following:

- Quantitative appraisal of both leisure-related benefits and public health benefits arising from the three walking and cycling schemes.

- Analysis of bus service improvements and associated increases in passenger numbers enabled by a high-frequency service over the existing Cardiff Bay Link Road bridge (as an alternative to routing services over Cardiff Barrage).

- Detailed appraisal of the likely capital investment costs for the delivery of the respective scheme options, including evaluation of potential scope modifications to enable cost reductions.

1 Introduction

The Vale of Glamorgan Council has commissioned Arup to undertake an appraisal of the economic and transport benefits that could be realised from a series of sustainable transport interventions along the Vale of Glamorgan to Cardiff coastal corridor.

This involves the following seven potential schemes:

- Cycling and pedestrian routes:
  - Penarth Headland Link
  - Biglis Roundabout to Dinas Powys
  - Merrie Harrier to Pont-Y-Werin and Penarth Road
- Bus priority schemes:
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  - Cosmeston to Cardiff Barrage (and onwards to Cardiff city centre)
  - Park & ride facility at Cosmeston Park
- Cogan rail station upgrade

The appraisal aims to identify the strategic, economic and transport benefits that could be realised due to the implementation of the schemes. This assessment is intended to provide a body of evidence that can be developed into WelTAG Stage 1 and Stage 2 appraisals for any scheme that is progressed forward for further development.

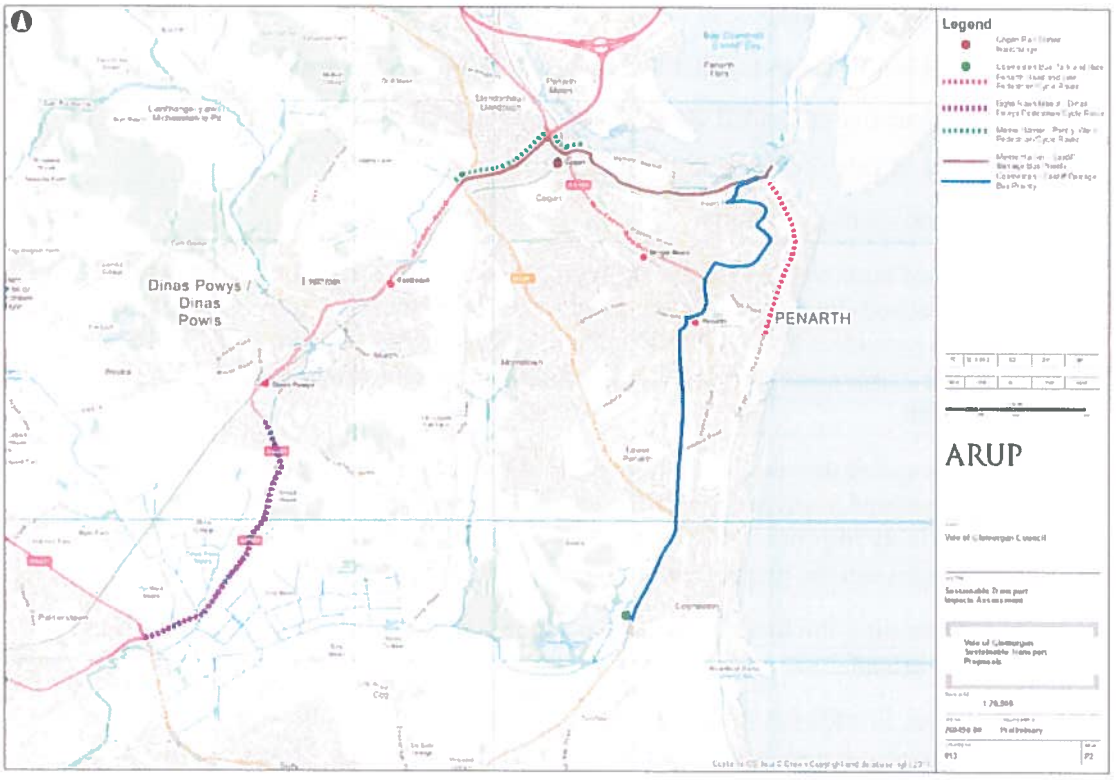
It should be noted that the seven transport interventions considered in this study can be considered a series of interrelated options, which when grouped together will collectively improve a single corridor of travel. Consideration of potential synergies between the projects is included in Section 6.4.2 of this report.

A plan illustrating the location of each scheme option geographically is shown in Figure 1 overleaf.

We note that, in addition to the seven interventions outlined above, the original project brief also listed the Vale of Glamorgan Parking Strategy as an additional scheme to be evaluated. To date this document has not been available, and it is not included in the scope of this report.

It is important to note that for our appraisal of the bus priority schemes, it has been assumed that Cardiff Council will implement the necessary measures to enable the relevant bus services to operate across Cardiff Barrage. The costs associated with operating the bus across the barrage into Cardiff, as well as the costs for scheme interventions within the Vale corridor, have been taken into account in the economic appraisal.

Figure 1: The Vale of Glamorgan Sustainable Transport Proposals



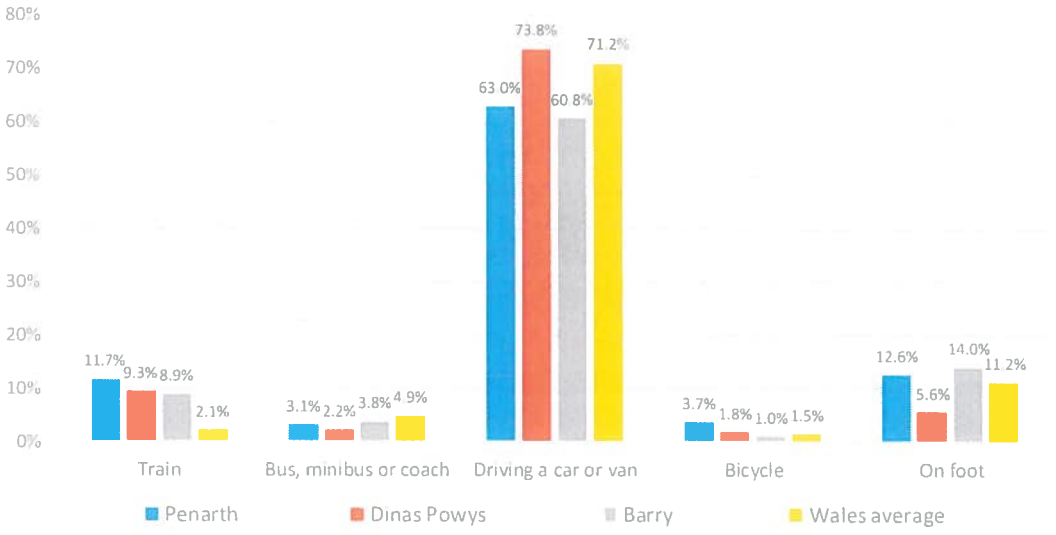
2 Strategic Context

2.1 Existing travel patterns

A review of journey to work patterns within the study area has been carried out using census data. Levels of public transport usage and active travel are low – each accounting for around 10- 15% – whilst driving a private car or van remains the dominant means (around two thirds of the total).

There are significant differences between locations within the study area with a breakdown by location shown in the chart below.

Figure 2: Current travel to work patterns



Source: census data (ONS website)

As illustrated above, while Penarth and Barry residents show a slightly higher tendency to walk to work compared to the Wales average, Penarth residents are almost four times more likely than Barry residents to commute by bicycle. Low levels of cycling for Dinas Powys and Barry are likely to be due in part to the limited cycling infrastructure beyond Penarth – with particularly low levels of provision between Dinas and Barry.

Arguably there is a strong case for improving cycling along the corridor, as this would link Barry and Dinas to the existing linkages into Cardiff via the Barrage, where good quality cycling infrastructure is likely to be a key reason for the high levels of cycle commuting already evident to / from Penarth.

The public transport usage shows that a far higher proportion of people along the corridor travel by train to work compared to the average. This is likely to be due to the comparatively frequent rail service into central Cardiff, with stations serving most key population centres. Conversely, levels of bus usage are lower than the average. This would suggest that investment in bus service improvements may be appropriate to bring usage levels closer to the Wales average.

2.2 Transport conditions along the corridor

2.2.1 Road traffic and emissions

Trafficmaster has been used to benchmark traffic speeds and journey times within the study area. The outputs are illustrated within Appendix A. Some of the key corridors reviewed using this data include:

- A4055 (between Dinas Powys and Cogan/Ferry Court)
- B4267, Lavernock Road / Redlands Road (between Cosmeston and Cogan)
- A4160, Windsor Road (between Penarth and Cogan)

Results indicate that traffic congestion is a significant issue, particularly during the AM peak (08:30 – 09:30) where significant sections of route show average traffic speeds of under 10mph.

With regard to emissions, the average CO^2 tonnes per Vale of Glamorgan resident in 2014 was 9.7 tonnes compared to 9.3 for Wales. The Vale also shows higher than average levels of car ownership, with more residents commuting to work via car than in other areas of Wales. Levels of emissions in the study area are higher than other parts of the Vale, principally due to higher population density, traffic volumes and proximity to heavy industry. A 250m section of Windsor Road, Penarth has been designated as Air Quality Management Area (AQMA), with high levels of nitrogen dioxide.[1]

Overall, these facts appear to support the argument for investing in alternative / sustainable modes, to help reduce car traffic, ease congestion and reduce emissions.

2.2.2 Public transport provision

The main corridor from Barry and Dinas Powys towards Cardiff is served by comparatively frequent public transport services. The Vale of Glamorgan rail line provides four services per hour in either direction, with a number of stations serving the main centres of population. Whilst rail travel times into central Cardiff compare favourably with car travel times, bus services take significantly longer (between 50% and 80% more than by car).

Penarth has less frequent (half hourly) rail services into Cardiff but more frequent bus services, whilst the route through Sully – Cosmeston – Merrie Harrier is also served by frequent bus services (ten buses per hour). The bus travel times are slow compared to car travel or rail times.

Public transport services from Sully are generally limited to three bus services per hour to Penarth (with a few additional off-peak services), one of two continue into Cardiff (Service 94).

[1] Windsor Road is the Vale of Glamorgan's only AQMA. Where an AQMA has been identified, the UK government requires the relevant local authority to implement a Local Air Quality Action Plan. Source: https://uk-air.defra.gov.uk/aqma/

It is evident that the speed and frequency of train services results in comparatively high levels of usage (around 10%), compared to bus usage which is low (less than 4%).

As well as buses being caught up in road congestion with the corridor, the length of time taken for buses to complete their journeys into central Cardiff (mainly through the congested Grangetown area) is a key contributor to long journey times. It is also evident that bus stop facilities are comparatively poor – with some bus stops lacking a shelter, and no real-time information provided at any stops along the route.

Overall, these factors support the case both for priority measures along the corridor, and for a more direct link into Cardiff (via Cardiff barrage) to speed up journey times and improve reliability.

2.2.3 Pedestrian and cycling infrastructure provision

The provision of walking and cycling infrastructure through the corridor is variable, with some significant gaps and limitations.

Pedestrian footways are provided alongside most main roads within residential areas, but on certain stretches footways are on one side of the road only, with some bus stops lacking any footway provision.

Cycling signs and markings are visible throughout the study area, with priority for cyclists at some of the key junctions including Merrie Harrier, Lavernock Road/Victoria Road, Redlands Road/A4055 and Cogan junction in the form of advanced stop lines and narrow cycle lanes on approach to junctions. Penarth is connected into Cardiff via National Cycle Route 88 (NCR88). A cycleway and footpath separate to the road runs southwards to Sully, although some sections of the path's surface are in poor condition.

However, a significant shortfall is the lack of any footway or cycle path alongside the A4055 between Dinas Powys and Barry. This is a narrow stretch of road with high traffic volumes, making this unattractive for cycling and unviable for walking.

Cycle connectivity from Merrier Harrier towards Pont-Y-Werin and the Cardiff Barrage area is also poor, with a lack of marked cycle routes, signage or segregated cycle infrastructure.

It is evident that investing in new cycle and pedestrian routes on key sections of the corridor would substantially improve the viability of sustainable modes – in particular cycling – by filling in gaps in current provision along the main Barry – Dinas – Cardiff Bay corridor.

2.3 Policy context

2.3.1 National and regional policy alignment

Delivery of the sustainable transport schemes aligns with a number key national and regional strategies and policies, as outlined in the table below.

Table 6: VoG sustainable transport schemes – alignment with national & regional policy

Policy overview	Alignment of schemes
Well-being of Future Generation (Wales) Act 2015[2] The 2015 Act is about improving the social, economic, environmental and cultural well-being of Wales.	The scheme proposals directly align with the goals of the act. Improved transport connectivity enhances social mobility, economic efficiency and access to employment opportunities, thereby support key goals such as "a prosperous Wales", "a more equal Wales", and "a Wales of cohesive communities". The creation of opportunities for active travel will support "a healthier Wales".
Prosperity for All: the National Strategy[3] A strategy takes commitments set out within the Taking Wales Forward strategy, placing them in a long-term context, and sets out how they fit with the work of the wider Welsh public service to lay the foundations for achieving prosperity for all.	The benefits of implementing the proposed sustainable transport measures sit in line with the plan's objectives, which are focused on delivering the right support for people and businesses, addressing regional inequalities and promoting fair work, and driving sustainable growth. The proposed schemes will drive growth and prosperity by improving travel conditions and helping reduce adverse traffic conditions as a potential barrier to economic activity. Enhanced connectivity and promotion of active travel will also support higher economic productivity and improved employee well-being.
Prosperity for All: Economic Action Plan [4] The plan seeks to grow the economy inclusively, spread opportunity and promote well-being. The Economic Action Plan	Delivering the proposed sustainable transport measures aligns directly with the plan's goals, which are to grow the economy and reduce inequality.

[2] https://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en

[3] https://gov.wales/docs/strategies/170919-prosperity-for-all-en.pdf

[4] https://gov.wales/docs/det/publications/171212-economic-action-plan-executive-summary-en.pdf

Policy overview	Alignment of schemes
supports delivery of Prosperity for All: the national strategy document.	The transport proposals will enhance economic opportunities in terms of connectivity and accessibility to key destinations (i.e. employment), and thus increasing productivity and facilitating economic growth.
Taking Wales Forward 2016-2021[5] The latest programme of the Welsh Government. Emphasises improvements to transport generally, and sets out a specific commitment to 'better access to active travel for all.'	The schemes would positively influence all modes of travel. Developing potential alternatives to car journeys would help reduce congestion, whilst bus priority measures would improve service quality and reduce journey times. The pedestrian and cycle schemes would also improve opportunities for active travel throughout the study area
Wales Transport Strategy, 2008[6] This strategy aims to promote sustainable transport networks that safeguard the environment while strengthening Wales' economic performance.	By encouraging sustainable transport usage and reduced car usage, the schemes will contribute towards reducing environmental impacts whilst increasing economic linkages across the corridor and into / out of Cardiff. Delivering the schemes in a coordinated manner will help create an integrated local transport package, one of the strategic priorities set out in the strategy.
National Transport Plan 2010 and Finance Plan 2017[7] The National Transport Finance Plan (which followed the National Transport Plan) lists the schemes the Welsh Government will deliver.	The proposed Cardiff and Vale Coastal Sustainable Transport Package scheme is included within the National Transport Finance Plan (2017), as one of the schemes that is integral to the realisation of the Active Travel (Wales) Act objectives.
Planning Policy Wales (PPW) 2016[8] This policy establishes the national planning framework for guiding development throughout Wales. It reaffirms the Welsh Government's commitment to developing of a	The schemes will improve connectivity, accessibility and sustainable development, as well as encouraging active travel, thereby positively contributing to the objectives of the policy.

[5] http://www.procurexlive.co.uk/wales/wp-content/uploads/sites/4/2017/05/Taking-wales-forward1621-en.pdf

[6] https://gov.wales/docs/det/publications/140909-transport-strategy-en.pdf

[7] https://beta.gov.wales/sites/default/files/publications/2017-12/national-transport-finance-plan-2017-update.pdf

[8] https://gov.wales/topics/planning/policy/ppw/?lang=en

Policy overview	Alignment of schemes
more effective and efficient transport system with a greater use of more sustainable and healthy forms of travel.	
Wales Spatial Plan, 2008[9] The plan states that "achieving sustainable accessibility" will be a key component in the success of "South East Wales Capital Region". The Vale of Glamorgan is identified by the plan as forming part of the "City Coastal Zone" regional sub-area, which "provides a superb environment in which to live". The plan notes that potential growth of housing and employment should be managed to ensure compatibly with the landscape, environment and communities in this area.	The proposed schemes would align with the objectives of the plan by providing new travel routes, whilst also embracing the natural environment of the area (e.g. the headland at Penarth). The schemes would also support sustainable accessibility by improving non-car transport modes.
Active Travel Wales Act, 2013[10] Places a legal requirement for local authorities to identify suitable routes for active travel, and to build and improve infrastructure for walking and cycling on a continual basis.	The expected outcomes from the proposed pedestrian and cycle schemes directly correspond to objectives of the act by improving walking and cycling provision and encouraging increased levels of active travel participation.
Sewta Regional Transport Plan, 2010[11] A 15-year, long term transport strategy. The plan sets out a number of priority areas focusing on increased usage of walking, cycling and public transport, improvements to the transport system, and reduced emissions.	Delivery of the proposed sustainable transport schemes directly corresponds with the priorities set out in the plan. The creation of active travel routes (walking and cycling) contributes to a sustainable transport system which encourages active and healthy lifestyles. These, as well as public transport improvements would serve to increase the proportions of trips undertaken using sustainable modes. Enhancements such as bus priority corridors and park & ride facilities improve the efficiency and functioning of the transport system. By encouraging the use of non-car modes, all the proposed schemes could help contribute to reduced greenhouse gas emissions.

[9] https://gov.wales/topics/planning/development-plans/wales-spatial-plan/?lang=en

[10] https://gov.wales/topics/transport/walking-cycling/activetravelact/?lang=en

[11] https://www.valeofglamorgan.gov.uk/Documents/Living/Planning/Policy/SEWTA_Regional_Transport_Plan.pdf

2.3.2 Local policy alignment

The schemes also support a number of policies at local level, as outlined in the table below.

It is important to note while the Local Development Plan and the Local Transport Plan highlight the need to make improvements to the key bus, cycling and pedestrian corridors that the scheme options will serve, neither document makes explicit reference to the individual schemes being reviewed in this report.

We note that many of the proposed schemes are focused on improving linkages into Cardiff, which directly adjoins the study area. Therefore, alongside policies relating to the Vale of Glamorgan, policies focused on Cardiff which the schemes support have also been highlighted.

Table 7: VoG sustainable transport schemes – alignment with local policy

Policy overview	Alignment of schemes
Vale of Glamorgan Local Development Plan (LDP) 2017[12] Sets out the land use policies of the Vale of Glamorgan over the period 2011- 2026. This includes adopted land use allocations for housing, employment and mixed use development. One of the key objectives cited in the document is "to reduce the need for Vale of Glamorgan residents to travel to meet their daily needs and enabling them greater access to sustainable forms of transport."	All of the proposed schemes would improve access to more sustainable forms of transport. A number of proposed developments would be directly served by the schemes. Of particular note are larger housing developments such as land at Upper Cosmeston Farm and Lavernock. We note that, while the LDP makes reference to the importance of the bus and cycle corridors that the schemes reviewed in this report will serve (e.g. NCN Route 88 and the Barry to Cardiff Bay bus corridor), it does not make specific proposals relating to the individual schemes. No direct reference is made in the document to Penarth Headland Link.
Vale of Glamorgan Local Transport Plan, 2015[13] The Local Transport Plan (LTP) is informed by the LDP and sets out the sustainable transport measures required in the Vale of Glamorgan to ensure it complies with the National Transport Policy.	The schemes being reviewed under this appraisal will directly support a proposals specified in the LTP including a Barry Waterfront to Dinas Powys Cycle Route and a Bus Park & Ride at Cosmeston. The LTP also designated the A4055 from Sully to Penarth is designated as a Strategic Transport Corridor.

[12] http://www.valeofglamorgan.gov.uk/en/living/planning_and_building_control/Planning/planning_policy/local_development_plan/Local-Development-Plan.aspx

[13] https://www.valeofglamorgan.gov.uk/Documents/Living/Planning/Policy/LTP/Local-Transport-Plan.pdf

Policy overview	Alignment of schemes
Vale of Glamorgan Wellbeing Statement, 2017[14] Published by the Vale Public Services Board (PSB), this statement focuses on the social, economic, environmental and cultural well-being of the Vale and is a precursor to the publication of the Well-being Plan. Formulation of the statement involved an engagement campaign which combined a number of surveys and focus groups. A key area of concern identified by consultees was "access to, and costs of, public transport", particularly for older people, with a common desire amongst many respondents for improvements to public transport. The statement also identifies high levels of road traffic as contributors to poor air quality in certain areas.	All of the proposed schemes proposed would serve to improve transport options. An improved interchange at Cogan and bus priority links would in particular improve options for public transport. The creation of more active travel options, would reduce the environmental impacts of transport, especially by relieving congestion on the roads, thereby contributing to improvements in air quality.
Cardiff Local Development Plan, 2016[15] Sets out the land use policies of Cardiff Council over plan period of 2006- 2026. Strategic sites include the Bay Business Area (appendix A.2.6) designated as "the focus for government, tourism and leisure development" and a site on Ferry Road allocated for provision of 500 homes and associated community uses.	Both the proposed pedestrian & cycle schemes and the bus priority linkage would improve connectivity to the Bay Business Area and the Ferry Road area.
Cardiff Capital Region City Deal Growth and Competitive Commission Report and Recommendations, 2016[16] This report presents an independent, evidence based review of the Cardiff Capital Region City Deal. The report highlights the delivery of the South Wales Metro as key to improving public transport provision, thereby unlocking development potential of surrounding land and improving access to employment, leisure and tourism opportunities.	The proposed schemes would serve to improve connectivity within the capital region, by enhancing connectivity along the Vale of Glamorgan coastal corridor. The proposed interchange at Cogan will form a direct part of the South Wales metro network. The schemes will link to a number of strategically allocated sites, and will also improve access to key leisure and tourist destinations including Cardiff Bay, Penarth, Cosmeston Lakes and Barry Island.

[14] https://www.valeofglamorgan.gov.uk/Documents/Our%20Council/Achieving%20our%20vision/Public-Services-Board/Well-being-Assessment/FINAL-ENGLISH-VERSIONS/Well-being-Assessment-English.pdf

[15] https://www.cardiff.gov.uk/ENG/resident/Planning/Local-Development-Plan/Pages/default.aspx

[16] http://www.cardiffcapitalregioncitydeal.wales/cardiff-capital-region-growth-competitiveness-commission-report.html

Policy overview	Alignment of schemes
Cardiff Cycling Strategy 2016-2026[17] Sets out Cardiff Council's vision for cycling; to double the number of cycle trips by 2026, continuing the growth trend from 2005. Challenges addressed by the strategy include a fragmented network, actual and perceived safety and low investment in cycling infrastructure. Key steps required include construction of additional primary route corridors and addressing missing links on key routes.	The proposed pedestrian and cycle schemes, as well as improving cycle connectivity within the study area, will also encourage increased levels of cycling into / out of Cardiff by providing new linkages into the Cardiff Bay area. These will connect to existing high-quality cycling infrastructure around Cardiff Bay (where existing cycle routes have attained Welsh Government Active Travel Design Guidance standards).

[17] https://www.cardiff.gov.uk/ENG/resident/Parking-roads-and-travel/Walking-and-cycling/Cycling-Strategy/Documents/Cardiff%20Cycling%20Strategy.pdf

3 The Case for Change

3.1 Problems to address

Taking into account the strategic context and the current transport situation within the corridor, a number of specific problems have been identified that the schemes should seek to address. These are summarised in the table below.

Table 8: VoG sustainable transport impacts – specific problems to address

Ref.	Description	Evidence
1	High modal use of the private car and limited use of public transport or active travel modes.	A significant proportion of those residing within the study area and work in Cardiff commute to work by private car (66.7%). Only 12.5% of those working in Cardiff commute to work by public transport (bus and rail) in spite of frequent rail and bus services.
2	Slow bus journey times	Journey times by bus are up to 80% longer than by car (section 2.2.2), significantly reducing the attractiveness of using bus as a primary transport method
3	Low quality pedestrian and cycling infrastructure along key sections of route.	Existing infrastructure along key parts of the coastal corridor offers a poor quality environment for walking or cycling. This includes no pedestrian footway or cycle path between Dinas Powys and Biglis and lack of footway provision leading to bus stops, poor condition of footway surfaces and a lack of marked cycle routes.
4	Road traffic congestion and unreliable journey times during peak periods.	Analysis of Trafficmaster data suggests significant congestion and delays along the corridor during peak periods. Average speeds in the morning peak are often 10mph or lower for the A4160 within Penarth, the A4055 around the Merrier Harrier junction and the B4267.
5	Significant limitations of existing park & ride facilities	Park & ride provision at existing rail stations within the study area is limited. Only Barry station has a car park greater than 100 spaces and this is often at capacity. Other rail stations have far lower provision (ca. 30 spaces or less) or none at all.

In order to address the above problems, a number of specific scheme options have been defined, involving sustainable transport infrastructure investments along the corridor. The specific scope, rationale and proposed benefits of each option are reviewed in the sections that follow.

3.2 Sustainable transport scheme options

3.2.1 Introduction

We describe in this section the specific sustainable transport scheme options, setting out their scope and rationale, and explaining how each scheme is intended to address the specific problems outlined above.

3.2.2 Penarth Headland Link cycle & pedestrian route

Scheme Description:

Penarth Headland Link is a proposed 1km rock-fill causeway which will extend the existing Welsh Coastal Path.

The proposal comprises the construction of a combined pedestrian and cycle path link to provide enhanced active travel connections between Penarth Esplanade and the western end of the Cardiff Bay Barrage.

Key Aspects of the Scheme:

Alleviation of local transport problems:

- North-south pedestrian routes through Penarth entail roads that are often busy with traffic, with traversal of a number of road intersections along the route.
- The proposed link would provide a high quality traffic-free route with enhanced convenience for walkers and cyclists.
- The likely economic benefits are significant and include transport user benefits from increased cycling activity, welfare benefits from increased leisure activity and health benefits from increassed walking and cycling activity.

Active travel

- The link provide a new coastal link from the Cardiff Bay Barrage to Penarth Esplanade. Currently, it is only possible to walk between these locations along the beach, a walk that is not possible when the tidal conditions are not favourable.
- For cyclists, the link would provide level access between Cardiff Barrage and Penarth's sea front, removing the requirement for cyclists to make the relatively steep cycle into the town centre. (We note that for onward journeys south of the sea front area, a steep climb is still required to reach Lower Penarth and beyond).

Leisure & tourism

- The route would provide a new connection between the Penarth sea front area and the Taff Trail, bringing Penarth Pier into the wider Cardiff bay leisure offering. Additionally, it would deliver an attractive new tourist route from Cardiff Bay to Cliff Walk, Cosmeston lakes, and Penarth more widely.

Other benefits to local population

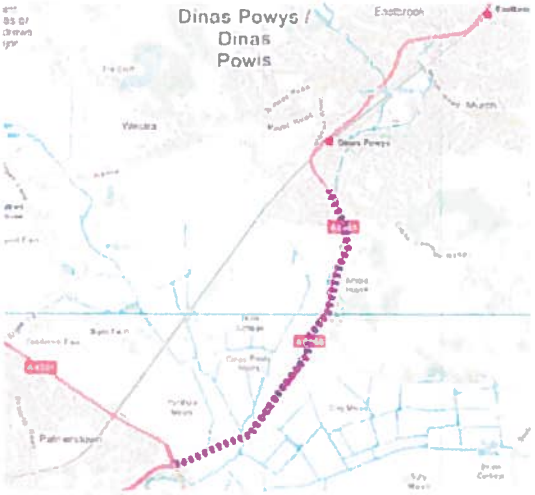
- The scheme would improve accessibility between the southern part of Penarth and Cardiff Barrage.
- The route's topography means that the disabled, elderly and families with children travelling between Cardiff Bay and Penarth sea front would be able to avoid the steep topography of Penarth, delivering an attractive route for all.

3.2.3 Biglis Roundabout to Dinas Powys cycle & pedestrian route

Scheme Description:

The scheme comprises a combined footway/cycleway measuring approximately 1.9km in length providing a link between Biglis Roundabout on the eastern extent of Barry and Dinas Powys.

The proposed cycleway is considered to be an important link in the National Cycle Network's (NCN) network strategy for the Vale of Glamorgan.



Key Aspects of the Scheme:

Alleviation of local transport problems:

- There is currently no footway or cycle path alongside the A4055 between Dinas Powys and Barry. The A4055 carriageway itself is narrow, and is observed to be extremely busy with traffic particularly within the commuting periods. This leads to an unattractive environment for cylists and pedestrians, hence minimising the number of those travelling along the route on foot or by bike.
- The scheme would enhance opportunities to travel sustainably within the region with subsequent transfer of trips from car to walking or cycling, reducing road congestion, noise and air pollution.

Active travel

- The scheme would provide an active travel connection between Barry and Dinas Powys, segregated from vehicular traffic.
- The scheme would assist in enhancing the safety of walking and cycling along the route, as well as improving the safety perception for active travel and thereby increasing its attractiveness as a means of transport.

Leisure & tourism

- The proposed route will constitute a new connection within the National Cycle Network (NCN) and thus increase accessibility for leisure travel for walkers, joggers and cyclists between Barry, Dinas Powys and ultimately Penarth and Cardiff.

3.2.4 Merrie Harrier to Pont-y-Werin and Penarth Road cycle & pedestrian route

Scheme Description:

The proposed scheme entails a number of facilities for shared cyclist and pedestrian use in the northern Penarth and Llandough Area, including a three-metre shared pathway between Barons Court junction and Llandough Hill, widening between Llandough Hill and the A4232 Grangetown link.

The scheme also entails cycling-specific measures along the route including Advance Stop Lines and carriageway cycle symbols to raise awareness.

Key Aspects of the Scheme:

Alleviation of local transport problems:

- A review of existing cycle facilities within the local area suggests the existing cycle network is fragmented, particularly between the Merrie Harrier junction and Pont-y-Werin where cyclists are largely required to travel along routes that are heavily trafficked, resulting in an unpleasant environment and hence reducing overall walking and cycling demand.
- The scheme therefore provides better quality, safer routes that are likely to result in increased levels of walking and cycling.

Active travel

- The scheme would provide a significantly improved route for pedestrians and cyclists, with enhanced connectivity to Pont-y-Werin bridge and Cardiff via National Cycle Route 88 from the northern part of Penarth and the Llandough area.
- Opportunities for sustainable travel in the western Cardiff/eastern Vale of Glamorgan area would be greatly enhanced.

Leisure & tourism

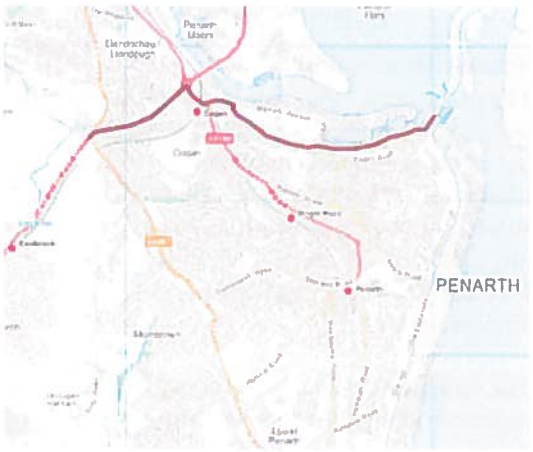
- The proposed cycleway would enhance connections to the National Cycle Network (NCN) and Cardiff, contributing to increased leisure and tourism activity, and the associated economic benefits.

3.2.5 Merrie Harrier to Cardiff Barrage bus priority route

Scheme Description:

The proposals comprise bus priority measures between the Merrie Harrier junction and Cardiff Barrage.

These include improvements at Cogan Hill junction to reduce delay, improvements at Merrie Harrier junction, rationalisation of existing traffic calming measures to improve public transport user experience and bus stop improvements along the entirety of the route.



Key Aspects of the Scheme:

Alleviation of local transport problems:

- Analysis of existing traffic conditions suggests that buses currently experience significant delay, particularly those which have to negotiate the Merrie Harrier junction and the Cogan Hill roundabout. This results in a slow and unreliable service, which reduces the attractiveness of buses as a primary transport method.
- The proposed scheme would help improve the capacity of junctions along the route through local widening, lane reallocation and junction upgrades at pinch points, thereby improving bus public transport journey times, particularly for those wishing to access Cardiff Bay for employment or leisure.
- Improvements in bus patronage could have positive impact on noise and air quality through reduced emissions from car traffic. A well-designed bus priority scheme could also benefit other road users such as cyclists, motorcyclists and taxis.

Active travel

- The scheme would have a beneficial impact on levels of active travel, as increases in bus patronage would subsequently lead to increases in those walking to bus stops at either end of their bus journey.

Leisure & tourism

- The proposed route would enhance connections between the area and Cardiff Bay, contributing to increased leisure and tourism activity, and the associated economic benefits.

Other benefits to local population

- Unemployment within Barry is higher than the level within Penarth, and that Barry has a higher number of elderly residents. Evidence suggests that bus services provide a particular benefit both to socially disadvantaged groups and the elderly.
- The improved bus connectivity delivered by this scheme option would benefit such groups within Barry, delivering social benefits for the elderly and the disabled through improved access to services, and enhancing access to employment opportunities, particularly within Cardiff.

3.2.6 Cosmeston to Cardiff Barrage bus priority route

Scheme Description:

The scheme comprises bus priority measures between Cosmeston and Cardiff Barrage.

This would include improvements at key junctions and optimisation of traffic signals to reduce bus journey times.

It would also entail improvements to bus stops along the entire route.

Key Aspects of the Scheme:

Alleviation of local transport problems:

- Analysis of existing transport conditions suggests that buses currently experience delays along the B4267, Lavernock Road and within Penarth town centre. This results in a slow and unreliable service, which reduces the attractiveness of buses as a primary transport method. This is reflected in the analysis of travel to work census data, set out within Section 2 of this report, showing low levels of bus usage within this area.
- The proposed scheme would improve bus journey times, particularly for those wishing to access Cardiff/Cardiff Bay for employment or leisure purposes. The scheme would be likely to encourage increased bus usage, thereby contributing towards mode shift away from the private car, thereby helping reduce congestion.

Active travel

- The scheme would have a beneficial impact on levels of active travel, as increases in bus patronage would subsequently lead to increases in those walking to bus stops at either end of their bus journey.

Leisure & tourism

- The proposed route would enhance connections between the area and Cardiff Bay, contributing to increased leisure and tourism activity, and the associated economic benefits.

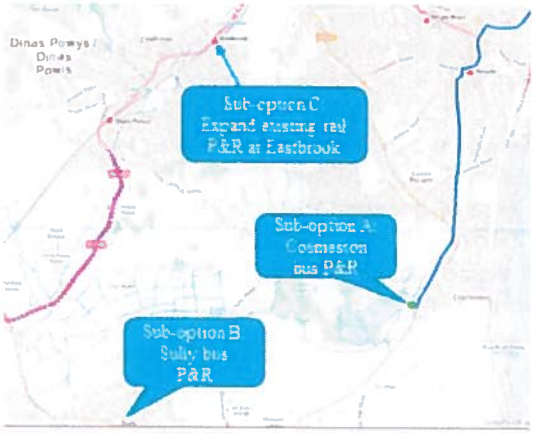
Other benefits to local population

- Evidence suggests that bus services provide a particular benefit both to socially disadvantaged groups and the elderly.
- The improved bus connectivity delivered by this scheme option would benefit such groups within the Lower Penarth / Cosmeston area, delivering social benefits for the elderly and the disabled through improved access to services, and enhancing access to employment opportunities, particularly within Cardiff.

3.2.7 Park & Ride (P&R) Facility at Cosmeston (or alternative locations)

Scheme Description:

This option comprises a new P&R facility at Cosmeston (or alternative locations).



Land at Cosmeston has been identified within The Vale of Glamorgan's Local Development Plan as being suitable to accommodate a large surface car park. We have considered this as the first ("Sub-option A") of three potential alternative sub-options.

Arup has identified and assessed the following two potential alternatives:

Sub-option B: A Bus P&R at Sully; and

Sub-option C: Enhancements to existing P&R facilities at Eastbrook rail station.

Key Aspects of the Scheme:

Alleviation of local transport problems:

- Currently there are no existing Park & Ride opportunities within the Cosmeston / Lower Penarth / Sully areas.
- Rail stations throughout the costal corridor are also either generally lack sufficient car parking capacity. Only Barry and Barry Docks stations have car parks which are greater than 100 spaces. These are also understood to be at capacity during peak times. Other rail stations have far lower provision (ca. 30 spaces or less) or none at all.
- The proposed option therefore has the potential benefit of inducing existing car users travelling along the B4267 route to use the P&R and switch to the bus, particularly those travelling to / from Cardiff. This would contribute to reduced congestion along the B4267, Lavernock Road due to existing P&R trips.

Leisure & tourism

- The proposed P&R could enhance opportunities for those residing within Barry / Sully to travel to and from Cardiff by bus. This would contribute to increased leisure and tourism activity, and the associated economic benefits.

3.2.8 Cogan Station Upgrade

Scheme Description:

This involves upgrading the existing railway station to create a new multi-modal transport facility serving the Penarth Marina and Cardiff Bay areas.

The proposed upgrade aims to deliver a mixed-use development that combines station enhancements, including an additional platform on the Penarth branch, with residential and retail facilities.

Key Aspects of the Scheme:

Alleviation of local transport problems:

- Current parking provision at Cogan is limited with poor quality pedestrian linkages in and around the parking area. The upgrade would rationalise parking provision and provide more direct, safe and attractive linkages to and from platforms for those parking, as well as for non-motorised users and mobility impaired users.
- The proposals would also improve (currently poor) pedestrian linkages between the station and the Penarth marina area.
- The proposed scheme would improve the adjoining road infrastructure, including adding a fourth arm to Cogan Hill roundabout to alleviate traffic issues, improve vehicular access and improve currently poor visibility at access junction.
- Provision of new space for buses / taxis to connect into the station would enhance connectivity between the station and the wider area around it.
- The upgrade would help facilitate wider regeneration opportunities for the area, complementing the on-going development of Cardiff Bay and Penarth Marina.

Leisure & Tourism

- The proposed Park and Ride improvements could enhance opportunities for those wishing to travel to Cardiff Bay and thus support increased leisure and tourism activity.
- The new interchange would also present a retail development opportunity. This would benefit station users including tourists and visitors, as well as residents within the station redevelopment area and the wider area.

3.3 Strategic objectives

3.3.1 Overview

Combining the assessment of problems along the corridor with the specific scheme proposals, a number of Strategic Objectives have been defined. These provide an overriding framework by which each of the potential scheme options can be evaluated. Using a set of qualitative evaluation criteria, a summary appraisal can be made of the key merits of each scheme option against the Strategic Objectives.

The strategic objectives are set out in Table 9 below.

Table 9: Sustainable Transport Interventions – Strategic Objectives

Ref.	Strategic Objective
1	Reduce journey times and improve journey quality for sustainable transport modes (bus and rail services, pedestrian and cycling links) along the Vale of Glamorgan coastal corridor;
2	Increase the levels of active travel through provision of high quality pedestrian and cycling infrastructure along key routes;
3	Improve accessibility and connectivity between key destinations by all modes, in turn reducing the reliability on the car;
4	Enhance development opportunities by improving access to strategic development sites;
5	Encourage economic activity, leisure and tourism by reducing barriers to shoppers, tourists and other visitors; and
6	Contribute towards reduced road traffic congestion, reduced emissions and improved air quality.

Each of the proposed scheme options will be evaluated against the above Strategic Objectives as the study progresses.

3.3.2 Summary strategic evaluation of scheme options

We present in Table 11 a qualitative appraisal of the key merits of each scheme option, in relation to the six strategic objectives set out above.

This appraisal has been completed using the following seven-point scale, which draws upon WelTAG appraisal guidance.[18]

[18] https://beta.gov.wales/welsh-transport-appraisal-guidance-weltag

Table 10 WelTAG Seven Point Assessment Scale

WelTAG Seven Point Assessment Scale		Equivalent score
Large Beneficial	+++	+3
Moderate Beneficial	++	+2
Slight Beneficial	+	+1
Neutral	0	0
Slight Adverse	-	-1
Moderate Adverse	--	-2
Large Adverse	---	-3

Using the above assessment scale, indicative scores have been allocated based on a judgment of the extent to which each scheme option fulfils the respective strategic objectives, and taking into account how it compares against the other scheme options.

A total indicative score has then been calculated, enabling the overall feasibility of the sub-options to compared on a holistic basis.

Table 11: Scheme Alignment with Strategic Objectives

Scheme option	Strategic Objective						Indicative Score	Summary
	1: Journey time and quality	2: Active travel levels	3: Multi-modal Accessibility and Connectivity	4: Access to strategic developments	5: Economic activity, leisure and tourism	6: Congestion, emissions and air quality		
Penarth Headland Link (ped & cycle)	++	[illegible]	+	0	[illegible]	+	+10	Strong strategic alignment due to encouragement of active travel, journey quality, and significant leisure and tourism benefits.
Biglis Roundabout to Dinas Powys (ped & cycle)	++	[illegible]	++	+	++	++	+12	Strong strategic alignment due to active travel benefits, journey quality, connectivity and congestion reduction.
Merrie Harrier to Pont-y-Werin and Penarth Road (ped & cycle)	++	[illegible]	++	+	++	++	+12	Strong strategic alignment due to active travel benefits, journey quality, connectivity and congestion reduction.
Merrie Harrier to Cardiff Barrage (bus)	++	+	++	+	++	++	+10	Strong strategic alignment due to journey quality, connectivity and congestion reduction.
Cosmeston to Cardiff Barrage (bus)	++	+	++	+	++	++	+10	Strong strategic alignment due to journey quality, connectivity and congestion reduction.
Park & Ride at Cosmeston (or alternative locations) (bus / rail)	0	0	++	0	+	++	+5	Positive strategic alignment due to connectivity and congestion reduction.
Cogan Station upgrade (rail)	0	+	++	++	+	++	+8	Positive strategic alignment due to connectivity and congestion reduction, development on site.

It is clear from that all of the schemes are well aligned with the strategic objectives set out as part of this project, albeit to varying degrees.

4 Options feasibility assessment

4.1 Introduction

This section of the report provides an assessment of the feasibility and deliverability of each potential scheme option. This includes an explanation of the overall configuration and functional specification for each option, including where potential variations or sub-options have been considered. An outline cost estimation for each option has also been provided.

For three of the proposed schemes (Cosmeston P&R / Cosmeston Bus Priority / Cogan Interchange), Arup has completed its own feasibility analysis and appraisal of different sub-options. Relevant detailed content is included in Appendix B to this report.

For the other schemes, the feasibility assessment provided within this chapter draws upon pre-existing feasibility reports.

This section concludes with a summary appraisal, comparing the overall feasibility of each scheme on a like-with-like basis.

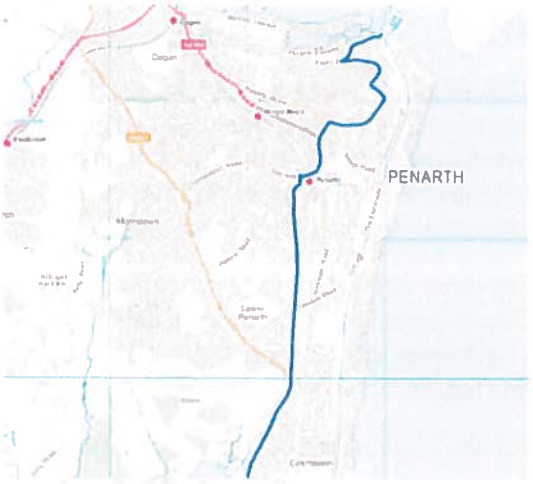
4.2 Arup feasibility appraisal

4.2.1 Cosmeston to Cardiff Barrage bus priority route

Overall configuration / functional specification

Bus priority measures between Cosmeston and Cardiff Barrage to improve journey times for buses, and allow for buses to access the barrage to access Cardiff.

Measures could include local widening, lane reallocation, junction upgrades at pinch points, and possible land take.



Arup feasibility appraisal

Arup has completed a feasibility assessment of four differing alignments for possible bus priority. These are described briefly below, and summarised in detail in Appendix B.

Variations / sub-options

Arup has examined four potential route sub-options:

- **Sub-option A**: Along Westbourne Road, the A4160 Stanwell Road, Clive Place and Paget Terrace/Road which subsequently provides access to Cardiff Barrage;
- **Sub-option B**: Along Lavernock Road, Victoria Road, the A4160 Stanwell Road, along Albert Road, Clive Place as well as Paget Road/Terrace before continuing to Cardiff Barrage;
- **Sub-option C**: Along Lavernock Road, Westbourne Road, Raisdale Road, Marine Parade, Cliff Hill/Cliff Parade and The Esplanade. The route also assesses Albert Road, Clive Place, Paget Road and Paget Terrace; and
- **Sub-option D**: Along the B4267, Lavernock Road, through the Merrie Harrier signalised junction, along the A4055, onto the A4160 and Terra Nova Way which leads to the barrage.

Recommendation: Arup's assessment concludes that Sub-option A is the 'emerging preferred sub-option' as it best addresses the existing problems and transport objectives.

Indicative cost (2018 prices, inclusive of optimism bias)

- Infrastructure improvements: £1.7m
- Bus across the barrage: £3.2m
- Optimism bias (44%): £1.4m
- **Total: £6.3m**

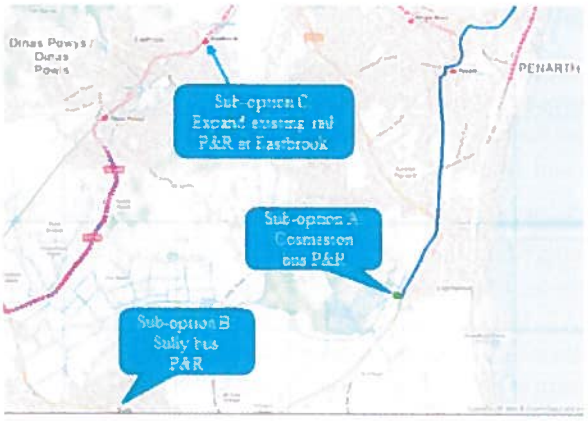
Key dependencies and risks

Success of scheme subject to implementation of bus services across Cardiff Barrage. Would require close cooperation with Cardiff Council. New bus service would need to be integrated into existing bus operation, in consultation with the service operator.

4.2.2 Park & Ride (P&R) Facility at Cosmeston (or alternative locations) – option feasibility

Overall configuration / functional specification

The scheme comprises a new P&R facility within the coastal corridor with the aim of reducing car journeys into town/city centres and supporting growth in usage on the public transport network.



Arup feasibility appraisal

Arup has examined three potential sub-options for a new P&R facility along the coastal corridor. These are described in turn below and assessed within Appendix B.

Variations / sub-options

- **Sub-option A**: A Bus Park & Ride at Cosmeston (150 spaces);
- **Sub-option B**: A Bus Park & Ride at Sully (150 spaces); and
- **Sub-option C**: Enhance existing rail P&R facility at Eastbrook (107 spaces).

Arup's feasibility study concludes that Sub-option C is the 'emerging preferred sub-option'. This is due to the high frequency of rail services at this location (four trains per hour), and rail journey times into Cardiff, which are quicker than the bus to central Cardiff (even after bus priority schemes have been implemented). It is evident the existing station P&R facility is operating at or in excess of capacity, therefore additional facilities are likely to attract further public transport (rail) users.

In contrast, neither Sub-option A nor Sub-option B are expected to attract as many users from their potential P&R catchment (car drivers within 2km). Potential P&R users residing in Barry (and further west) are considered less likely to divert along the B4267 to Cosmeston or Sully P&R than they are to continue along the more direct A4055 corridor. Bus users within the residential areas of Sully, Cosmeston or Lower Penarth are mostly already within walking distance of an existing bus stop, hence negating the need for a P&R facility.

Recommendation: Based on the above analysis, it is recommended that Sub-option C (expanded P&R facility at Eastbrook) is taken forward for further analysis.

Indicative cost (2018 prices, inclusive of optimism bias)

- Sub-option A (Bus Park & Ride at Cosmeston): **£1.0m**
- Sub-option B (Bus Park & Ride at Sully): **£1.0m**
- Sub-option C: (Enhance existing rail P&R at Eastbrook): **£2.6m**

Key dependencies and risks

The delivery of the scheme is likely to involve land acquisition, which could affect deliverability. New P&R facilities would alter traffic flows and patterns of road usage. Proposals would be likely to require extensive stakeholder consultations.

4.2.3 Cogan Station Upgrade – option feasibility

Overall configuration / functional specification

The upgrade comprises a series of improvements and modifications to Cogan Railway station, the adjoining car park and adjacent plots.

Proposed measures include improved passenger facilities, expanded car parking provision, improved access to / from adjacent road network, better interchange facilities for buses and taxis, a new platform on the Penarth branch line (Sub-option 2 only) and mixed-use development within the station area (Sub-option 2 only).

Arup feasibility appraisal

Arup has undertaken a feasibility appraisal of potential upgrade options at Cogan, the details of which are provided in Appendix B. This analysis draws upon a draft report completed by WSP on behalf of Transport for Wales in 2015 to assess potential station redevelopment and upgrade options.

Variations / sub-options

Principal sub-options (1 & 2)

Drawing upon the WSP study, Arup has review two principal sub-options for upgrading Cogan station.

- **Sub-option 1**: A large P&R facility with improved facilities and road access. This includes significantly expanded parking provision, a new station ticket hall, passenger waiting areas and customer toilets on the platform, improved access and egress on A4160 Windsor Road, improvements to roundabout capacity, provision of bus and taxi interchange to allow better links to Penarth Marina/Cardiff Bay.
- **Sub-option 2**: An expanded version of Sub-option 1 (with similar improvements to in-station passenger facilities and access to /from local road network). In addition, Sub-option 2 proposes a new platform on existing Penarth to Cardiff line, a new "access for all" footbridge to reach the main eastbound platform, and new residential development (social housing) on the currently vacant site to the east. This sub-option would require land currently in private ownership (Travis Perkins) to be acquired to accommodate car parking.

Park & ride sub-options (A – D)

As well as the two principal sub-options outlined above, a further set of sub-options have been analysed, looking at various configurations for the provision of Park and Ride capacity, with the following potential locations considered:

- **Sub-option A**: Vacant site in East of the study area (168 spaces)

- **Sub-option B**: Ground level parking on Travis Perkins Site and vacant site in the east of the study area (237 spaces)
- **Sub-option C**: Multi-storey car park on Travis Perkins site and ground level car parking on vacant site in the east of the study area (302 spaces)
- **Sub-option D**: Multi-storey car park on Travis Perkins site and bus interchange lane (152 spaces)

Recommendation (principal sub-options): it is concluded that Sub-option 2 has significantly higher transport benefits due to the inclusion of an additional platform on the Penarth branch line.

Recommendation (P&R sub-options): the evaluation has identified Sub-option A as the preferred option. This provides sufficient capacity to service the vast majority of expected P&R demand at Cogan, whilst avoiding some of the key delivery complexities associated with the alternative P&R sub-options.

Indicative cost (2018 prices, inclusive of optimism bias)

£3.1m

Key dependencies and risks

Given the density of both the road network and adjacent residential areas, the potential air quality, noise and traffic impacts during the construction phase of the upgrade works would require careful management.

Consultation of county archaeologist required for potential adverse impacts on the grade II listed Cogan Footbridge.

Enhanced infrastructure and development at the station has potential impacts in relation to the landscape and visual aesthetic of the area for nearby residents. Further assessment required in conjunction with Vale of Glamorgan council landscape team.

Significant construction costs due to the highway and railway structures that will be impacted.

Swept path analysis will be required for bus interchange.

4.3 Feasibility appraisal (informed by existing studies)

4.3.1 Penarth Headland Link cycle & pedestrian route

Overall configuration / functional specification

The scheme would comprise a 1km section of rock-fill causeway suitable for pedestrians and cyclists to connect the promenade at Penarth to the Outer Harbour at Cardiff Bay Barrage.

It is proposed that the link will run along the beach, between the cliff and intertidal zone. The aim is for the path to be at a sufficient elevation to remain open in all tide and most storm conditions.

Feasibility work done to date:

The scheme was initially proposed in 2007. Following appraisal of a number of potential design options and a public survey exercise, the option selected involved a pedestrian and cycle link built on an elevated structure.[19] This was forecast to cost around £23.5m.[20]

Arup on behalf of Penarth Headland Link produced a high-level appraisal of the economic benefits of an alternative less costly option in November 2016 involving a rock fill causeway structure[21], although this study did not provide any detailed designs.

Variations / sub-options

Sub-option 1: an aerial cycle path / aerial pedestrian walkway supported above the high tide by angled concrete stilts as originally proposed – estimated cost £23.5m; and

Sub-option 2: a rock-fill causeway – estimated cost - £16.6m.

Recommendation: Arup's high-level appraisal recommended that sub-option 2 is taken forward for further analysis, as it represents a lower cost solution than the original proposal for an elevated walkway than sub-option 1.

Indicative cost (2018 prices, inclusive of optimism bias)

£16.6m (capital cost of £10m identified in original Arup report, plus 66% optimism bias)

Key dependencies and risks

The scheme is a large-scale infrastructure project requiring a substantial amount of capital investment.

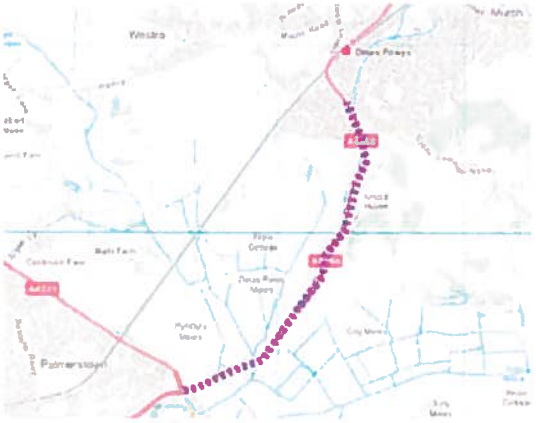
Construction of the causeway in a live maritime environment, adjacent to already popular leisure and tourist areas would require substantial and detailed planning and design. Delivering the works would be a potentially technically complex undertaking.

[19] Information provided by Vale of Glamorgan council.
[20] https://www.walesonline.co.uk/news/local-news/group-looking-revive-penarth-headland-10455731
[21] Outline Economic Impact Assessment (Arup), November 2016

4.3.2 Biglis Roundabout to Dinas Powys cycle & pedestrian route – option feasibility

Overall configuration / functional specification

The scheme would comprise a 1.9km pathway for shared pedestrian and cyclist usage between Cae'r Odyn in Dinas Powys with the A4055/A4231 Biglis Roundabout in Barry.



The majority of the new pathway would lie on the south eastern side of the A4055 Cardiff Road.

The route will follow a straight or gently curved alignment.

Feasibility work done to date:

A feasibility study produced in 2016 by Capita[22] presents proposals for the scheme. This draws upon previous feasibility work from 2011 that considered two potential options:

Sub-option 1: for most of its length passing on or close to the line of Public Footpath ROW14 on the north western side of the A4055 Cardiff Road.

Sub-option 2: is the same as Sub-option 1 at the Dinas Powys end, but then crosses the A4055 Cardiff Road and then runs adjacent to the south eastern side of that road.

Based on Sub-option 2, the study then compares two potential sub-options 2A and 2B.

Variations / sub-options

For both sub-options 2A and 2B, 30% of the cycleway route (at the Dinas Powys end) passes on or close to the line of Public footpath ROW14 through recreational land and agricultural land (on the north western side of the A4055 Cardiff Road). The remainder of the cycleway is located on the south eastern side of the A4055, traversing what is mainly agricultural land. The two sub-options, 2A and 2B, comprise the following:

- **Sub-option 2A:** an 'off-line' sub-option that runs approximately parallel with the road and has an embankment throughout the flood risk area.
- **Sub-option 2B:** a higher-cost 'on-line' sub-option with a 50cm buffer zone between the road and the cycleway, and an embankment throughout most of its length.

Recommendation: Based on Capita's study, it is recommended Sub-option 2A is taken forward for further appraisal.

Indicative cost (2018 prices, inclusive of optimism bias)

£1.5m (Sub-option 2A).

Key dependencies and risks

A Compulsory Purchase Order may be required for a section of the route on the north-western side of the A4055.

Progression of the design and planning process for the scheme would be subject to further work including topographical surveys, ground investigation, planning application and conditions, environmental mitigation measures and accommodation works.

[22] Barry to Dinas Powys Cycleway/Footway Review (Capita), March 2016

4.3.3 Merrie Harrier to Pont-y-Werin and Penarth Road cycle & pedestrian route – option feasibility

Overall configuration / functional specification

Proposals comprise shared use (cyclists and pedestrians) facilities in the northern part of Penarth and the Llandough Area, along key sections of route including:

(1) The northern side of the A4055 Cardiff Road to Penlan Road at Merrie Harrier junction;
(2) Links between the north side of Cardiff Road/Penlan Road and Andrew Road;
(3) Merrie Harrier junction to Barons Court junction (north side of the A4055 Barry Road);
(4) Barons Court junction to Ely Trail (west side of the A4160 Penarth Road); and
(5) Barry Road/Penarth Road to Pont-y-Werin and Windsor Road (and beyond).

Feasibility work done to date:

An initial feasibility study was undertaken by Capita in March 2016[23]. This reviewed existing cycle route provision in the Merrie Harrier to Barons Court area, and recommended route improvements and new connections at various locations to enable continuity of cycling provision between Merrie Harrier and Pont-y-Werin.

Variations / sub-options

The study proposes a series of improved cycle and pedestrian infrastructure measures. These include:

(1) A shared use pathway between the existing pedestrian/cycleway to the west, and Penlan Road. Some sections will be narrower than standard;
(2) A 3-metre-wide shared use pathway to Redlands Road and shared use facilities to Andrew Road adjacent to Cardiff Road;
(3) Shared use pathways at 3 metres wide, based on widening into the steep bank and provision of retaining walls;
(4) Provision of a 3-metre-wide shared use pathway between Barons Court junction and Llandough Hill, with the existing footway between Llandough Hill and the A4232 Grangetown link widened to accommodate the pathway;
(5) Advanced stop lines, carriageway cycle symbols on route to raise cycle awareness.

Recommendation: Capita's study recommends that the full package of measures outlined above are delivered as one package along the corridor.

Indicative cost (2018 prices, inclusive of optimism bias)

£4.9m

Key dependencies and risks

Comparatively high capital investment costs.

Implementation of a three-metre-wide shared use pathway will require significant earthworks along some sections. Traffic restrictions may be required during the construction period.

[23] Merrie Harrier to Barons Court Strategic Cycle Routes (Capita), March 2016

4.3.4 Merrie Harrier to Cardiff Barrage bus priority route – option feasibility

Overall configuration / functional specification

Bus priority measures between Merrie Harrier and Cardiff Barrage to improve journey times for buses, and allow for buses to travel along the barrage into Cardiff.

Measures could include local widening, lane reallocation and junction upgrades at pinch points.

Feasibility work done to date:

Capita undertook an initial feasibility study in May 2015[24]. This identified sub-options for infrastructure improvements that will benefit the route between Dinas Powys and the Cardiff boundary.

Variations / sub-options

Five sub-options were considered at Merrie Harrier junction, with a further three sub-options at Cogan Hill Junction.

- **Merrie Harrier Junction**: Road configuration improvements to reduce delays and bus stop enhancements to improve public transport user experience. This includes separation of straight and right-turning movements from the Barons Court junction to avoid any unnecessary lane changing and reduce congestion, thereby also benefitting the general traffic flow.
- **Cogan Hill Junction**: Road configuration improvements to reduce delays and bus stop enhancements to improve public transport user experience.

Recommendation: Capita's study recommends a package of measures comprising the following:

- Bus stop Improvement Works (ca. £0.5m)
- Cogan Roundabout Junction Improvement Works (ca. £1.0m)
- Merrie Harrier to Baron's Court Highway Improvement Works (ca. £1.4m)
- Merrie Harrier Junction Improvements Works (ca. £1.1m)
- Bus across the barrage (costs identified via a separate study): ca. £3.2m

Indicative cost (2018 prices, inclusive of optimism bias)

£6.3m

Key dependencies and risks

Success of scheme subject to implementation of bus services across Cardiff Barrage. This would require close cooperation with Cardiff Council. The new bus service would need to be integrated into existing bus operation, in consultation with the service operator.

Improvements at Cogan Hill Junction are likely to require an alteration to the current trief kerbs being used as bridge protection, and would result in the loss of one of the footpaths.

Improvements at critical junctions/pinch points would require substantial road works.

[24] Dinas Powys to Cardiff Corridor Bus Priority Measures (Capita), May 2015.

4.4 Summary options feasibility appraisal

We summarise in the table below, our feasibility assessment of each scheme option, in relation to the following three key feasibility criteria:

- Technical feasibility and deliverability
- Potential cost
- Dependencies and risks

For each scheme option indicative scores have been allocated against the three feasibility criteria using the following seven-point scale, which draws upon WelTAG appraisal guidance[25].

Table 12: WelTAG Seven Point Assessment Scale

WelTAG Seven Point Assessment Scale		Equivalent score
Large Beneficial	+++	+3
Moderate Beneficial	++	+2
Slight Beneficial	+	+1
Neutral	0	0
Slight Adverse	-	-1
Moderate Adverse	--	-2
Large Adverse	---	-3

Allocated scores are based on a judgement of how each sub-option performs relative to each of these three aspects, and taking into account how it compares against the other scheme options.

A total indicative score has then been calculated, enabling the overall feasibility of the sub-options to compared on a holistic basis.

[25] https://beta.gov.wales/welsh-transport-appraisal-guidance-weltag

Table 13: Scheme option feasibility appraisal

Scheme	Indicative cost (2018 prices)	Feasibility criteria: Technical feasibility & deliverability	Feasibility criteria: Potential cost	Feasibility criteria: Dependencies and risks	Indicative Score	Commentary
Penarth Headland Link (ped & cycle)	£16.6m	--	--	-	-5	A significant engineering undertaking, and the most technically complex of all the scheme options with highest cost. Requires consultation / stakeholder engagement.
Biglis Roundabout to Dinas Powys (ped & cycle)	£1.5m	0	0	-	-1	Project unlikely to pose significant technical or delivery challenges. Lower cost than other schemes. Potential risk associated with land acquisition / CPO.
Merrie Harrier to Pont-y-Werin and Penarth Road (ped & cycle)	£4.9m	0	-	0	-1	Project unlikely to pose significant technical or delivery challenges, although works will require traffic management measures. Significant costs.
Merrie Harrier to Cardiff Barrage (bus)	£6.3m	-	-	--	-4	Technical challenges, significant costs and operational risks relating to implementation of buses over the barrage.
Cosmeston to Cardiff Barrage (bus)	£4.9m	-	-	--	-4	Technical challenges, significant costs and operational risks relating to implementation of buses over the barrage.
Park & Ride at Cosmeston (or alternative locations) (bus / rail)	Sub-option A £1.0m Sub-option B £1.0m Sub-option C £2.6m	+	0	-	0	Low technical complexity. Lower cost than other schemes. Preferred option (C) dependent on land acquisition.
Cogan Station Upgrade (rail)	£5.2m	-	-	-	-3	Upgrade unlikely to pose significant technical or delivery challenges. Preferred sub-option (B) requires civils works to accommodate new platform and pedestrian linkage, potentially significant costs. Land acquisition required.

5 Transport impacts appraisal

5.1 Introduction

5.1.1 Purpose and approach

The purpose of the transport impacts appraisal is to quantify the potential impact of each scheme option on transport usage, modal share and journey times along the relevant routes.

The key focus is on the expected increase in usage of sustainable transport modes (bus / cycling / pedestrian) as a result of the schemes, as well as the extent to which these will reduce levels of car usage and alleviate congestion.

The first stage of the appraisal involves determining the "baseline" levels of usage for different modes along the relevant corridors, based on current trends and future usage projections.

An analysis is then made of the likely transport impact that each scheme will have on demand and modal share.

5.1.2 Input data sources

Key input data sources have included:

- 2011 census data detailing journey to work patterns, distances, modes used;
- DfT traffic count data for key corridors;
- Pedestrian and cycle count data for Cardiff Barrage and Pont Y Werin provided by Cardiff Council;
- Vehicle traffic count data provided by the Vale of Glamorgan Council;
- Rail passenger volumes at Cogan (and other stations relevant for this study) from ORR website; and
- Analysis of current and future pedestrian and cycle volumes on Cardiff Bay and the proposed Penarth Headlink Link undertaken by Sustrans.

5.2 Methodology – determining current transport patterns

5.2.1 Existing corridor volumes and mode shares

Demand matrix overview

In order to extract data to inform the estimation of existing transport demand by mode, Arup has developed origin-destination matrices using 2011 Journey-to-Work Census Data. The process entailed:

- Extraction of 2011 demographic Census Data;
- Identifying and mapping the schemes geographically to identify relevant corridors;
- Building demand matrices for pedestrians, cyclists bus users and car drivers; and
- Extracting associated average journey times and journey distances.

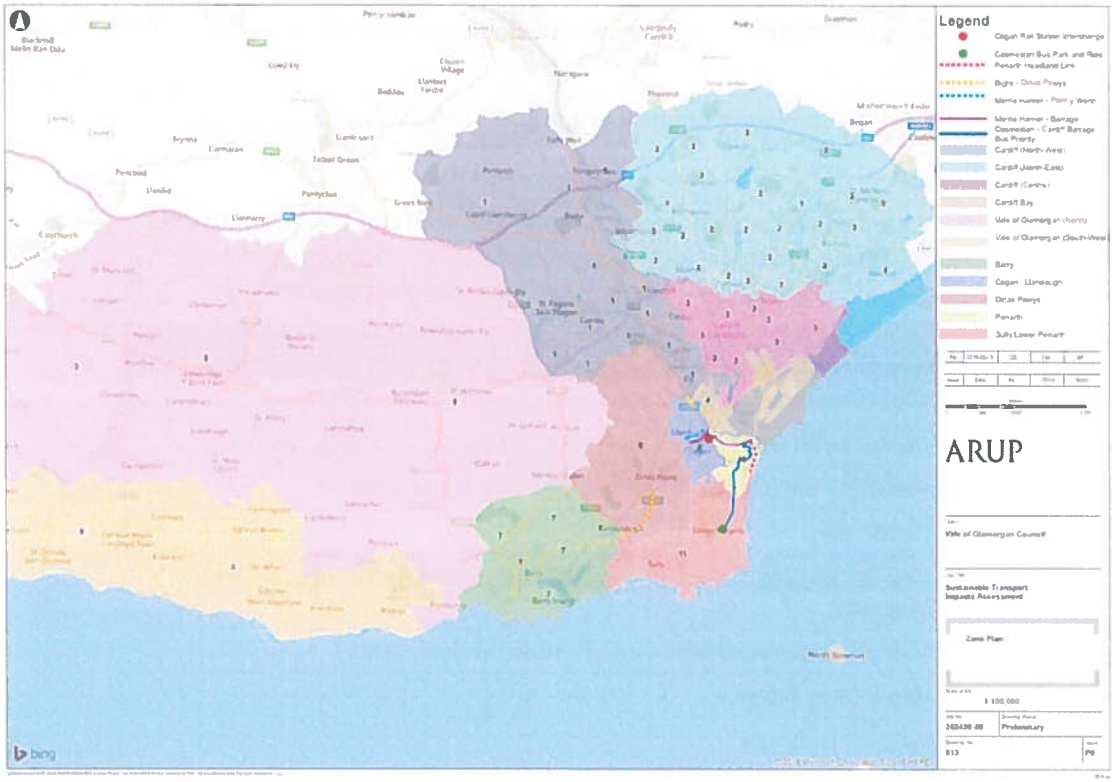
Zone system

The zone system used in order to produce the matrices are based on the census boundaries within the study area, which were combined to create larger model zone boundaries, based on their geographical location as listed below:

Study Zone	Main Corridor Areas
1	Cardiff North West (Caerau, St Fagans, Tongwynlais, Pentyrch)
2	Cardiff North East (St Mellons, Rumney, Lisvane, Llanishen, Birchgrove)
3	Cardiff Centre (City Centre, Roath, Splott, Adamsdown)
4	Cardiff Bay
5	Vale of Glamorgan North (Cowbridge, Bonvilston, St Nicholas, Dyffryn, Wenvoe)
6	Vale of Glamorgan South West (St Athan, Llantwit Major)
7	Barry, Barry Island
8	Cogan, Llandough
9	Dinas Powys
10	Penarth
11	Sully, Lower Penarth, Cosmeston

The geographic locations of each of the above zones are illustrated shown in Figure 3.

Figure 3: Plan of study zones (used to generate trip matrices)



Matrix summary (commuting trips only)

Using the zoning system outlined above, each zone has been allocated a demand value of between 0.0 and 1.0, based on its relevance to each of the schemes.

The resulting demand figures are presented in Table 14. We note these figures are for commuting trips only, i.e. based on census journey-to-work data)

Table 14: One-way demand (commuting only), no. trips per day

Corridor	Ave. commuting trips per day (one-way)
Biglis-Dinas Powys W+C	Cycle: 16 Walk: 0*[1] Car: 2,876
Merrie Harrier - Pont y Werin W+C	Cycle: 42 Walk: 0*[1] Car: 4,640
Penarth Headland Link W+C	Cycle: 135 Walk: 56 Car: 2,116
Merrie Harrier - Barrage Bus Priority	Bus: 178 Car: 2,459
Cosmeston - Barrage Bus Priority	Bus: 176 Car: 2,346

*1 – Please note that existing walking demand is assumed to be zero along these corridors.

Adjustment of demand (non-commuting trips)

The census-based data capturing commuting trips (as described above) has been combined with total trip volume data analysed through TEMPro (Trip End Model Presentation Program) software, in order to derive total trip figures by mode for each corridor (inclusive of commuting and non-commuting trips).

TEMPro contains data that is derived from the National Trip End Model (NTEM). NTEM forecasts the growth in trip origin-destinations by taking into account local authority projections of population, employment, housing and car ownership.

TEMPro data can be used to show the proportion of trips by mode, based on MSOA boundaries. For the purposes of this study, the TEMPro database (Version 7.2) has been used to provide an upwards adjustment of demand from "commuting" only to capture all journey purposes. This has been done through the following process:

- Working out the MSOA most relevant to each scheme;
- Allocating each trip purpose within TEMPro to "commuting" and "other"; and
- Calculating totals for "commuting" and "other" and producing/applying a demand adjustment factor for each scheme and mode.

The resulting adjustment factors are set out below in Table 15.

Table 15: Trip Purpose Calculations (TEMPro 7.2 Database)

Corridor	Ratio of total trips vs. commuting trips
Walk trips	
Biglis Roundabout-Dinas Powys	5.11
Merrie Harrier – Pont-y-Werin / Penarth Rd	2.96
Penarth Headland Link	4.00
Cycle trips	
Biglis Roundabout-Dinas Powys	2.51
Merrie Harrier – Pont-y-Werin / Penarth Rd	1.86
Penarth Headland Link	2.20
Bus trips	
Merrie Harrier-Cardiff Barrage	2.25
Cosmeston- Cardiff Barrage	3.11
Car trips	
Biglis Roundabout-Dinas Powys (proposed walking & cycling route)	2.44
Merrie Harrier – Pont-y-Werin / Penarth Rd (proposed walking & cycling route)	1.91
Penarth Headland Link (proposed walking & cycling route)	2.33
Merrie Harrier-Cardiff Barrage (proposed bus priority route)	1.91
Cosmeston- Cardiff Barrage (proposed bus priority route)	2.28

Using the above factors, total demand figures have been adjusted for each corridor to account for all trip purposes.

It is important to note that census data journey-to-work trips do not account for return journeys. Therefore, an additional adjustment has been made, based on the assumption that every one-way trip would eventually generate an equivalent return journey using the same mode. On this basis, the one-way figures have multiplied been two in order to obtain a two-way demand for all trip purposes.

Total existing demand

Based on the process described above, an estimation of total existing demand for all modes along the respective corridors has been derived. The resulting demand figures are shown in Table 16.

Table 16: Two-way demand, all trip purposes (no. trips per day)

Corridor	Ave. trips per day (all purposes, both directions)
Biglis-Dinas walking & cycling	Cycle: 81 Walk: 0*[1] Car: 15,081
Merrie Harrier – Pont-y-Werin / Penarth Rd walking & cycling	Cycle: 156 Walk: 0*[1] Car: 19,022
Penarth Headland Link walking & cycling	Cycle: 596 Walk: 452 Car: 10,611
Merrie Harrier-Cardiff Barrage bus priority	Bus: 798 Car: 10,084
Cosmeston- Cardiff Barrage bus priority	Bus: 1,093 Car: 11,489

*1 – Please note that existing walking demand is assumed to be zero along these corridors.

Count calibration & validation

To validate the figures derived on the basis outlined above, a calibration process was undertaken to identify whether the network-based calculations were replicating observed conditions to a satisfactory degree. This involved creating matrices, assessing the difference between the two-way counts for the given scheme and a number of observed survey counts.

This exercise drew upon the following sources of data:

- DfT traffic count data[26], with figures extracted for count site 10630 (A4055 between Biglis and Dinas), and count site 50578 (A4055 between Merrie Harrier and Barons Court)
- Count data provided by Arcadis along A4055 corridor, collected 23 November 2017.
- Automated count data (pedestrians / cyclists) for Pont Y Werin footbridge provided by Cardiff Council.

The calibration and validation process determined a high degree of correlation between modal flows calculated from census data and the above traffic count figures. Where discrepancies did arise, the figures from the census calculations were recalibrated to ensure alignment with actual count data.

5.2.2 Existing Journey Time and Distance

The Google Maps online planning tool has been used to calculate existing average journey times and distance matrices for each mode and scheme, based on MSOA

[26] Source: https://www.dft.gov.uk/traffic-counts/cp.php?la=The+Vale+of+Glamorgan

centroids. This tool has been utilised on previous studies carried out for Welsh Government and has been found to show a strong correlation with actual travel times – and hence is considered a robust source of data.

Average journey times and distances were subsequently calculated by weighting the demand and distance/journey time matrices. A summary of the resulting journey times and distances is provided in Table 17.

Table 17: Existing Scheme Journey Time and Distance

Corridor	Bus		Cycle		Walk		Car	
	Average Distance (km)	Average Time (mins)	Average Distance (km)	Average Time (mins)	Average Distance (km)	Average Time (mins)	Average Distance (km)	Average Time (mins)
Biglis-Dinas Powys W+C	*n/a*	*n/a*	6.4	22	5.9	73	12.8	20
Merrie Harrier - Pont y Werin W+C	*n/a*	*n/a*	6.0	20	4.7	58	11.9	19
Penarth Headland Link W+C	*n/a*	*n/a*	7.7	26	6.2	77	9.7	18
Merrie Harrier - Barrage Bus Priority	8.9	40	*n/a*	*n/a*	*n/a*	*n/a*	9.5	16
Cosmeston - Barrage Bus Priority	8.3	41	*n/a*	*n/a*	*n/a*	*n/a*	8.6	15

5.2.3 Park & ride schemes – existing demand

Cosmeston bus Park & Ride (plus alternative sites)

The appraisal of potential P&R facilities includes a potential site at Cosmeston, as well as alternative sub-options at Sully and Eastbrook (see Section 4.2.2).

Currently, neither Cosmeston nor Sully have any P&R facility in place (sub-options A & B). Eastbrook rail station does already function as a P&R location, but car parking provision at present is limited to 31 spaces. Appraisal of aerial photographs and field visits suggest the P&R car park at Eastbrook is already full to capacity during normal weekdays.

Cogan

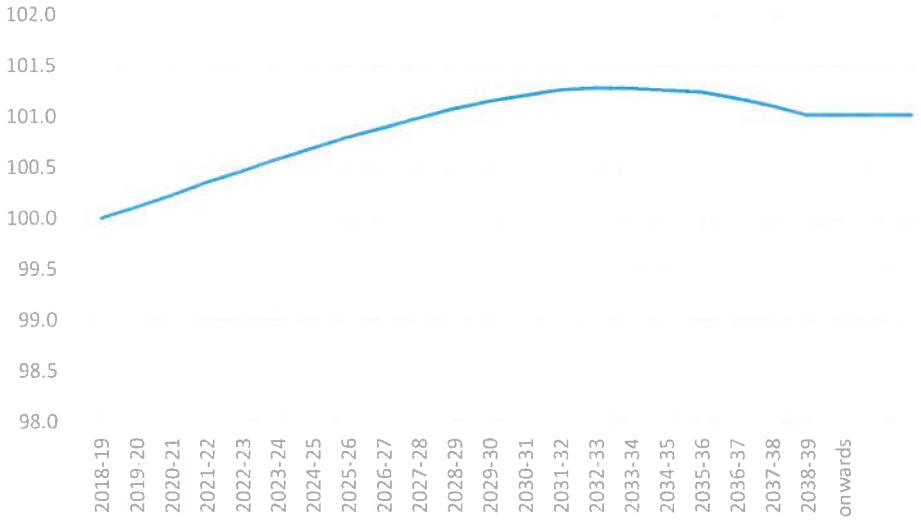
Cogan currently has approximately 55 car parking spaces. Appraisal of aerial photographs and field visits suggest the P&R car park at Cogan is already full to capacity during normal weekdays.

5.2.4 Underlying demand growth

It is assumed in this analysis that the underlying demand for all transport modes within the Vale of Glamorgan corridor, irrespective of whether or not proposed scheme options are implemented, will change in line with the underlying population growth trend for the Vale of Glamorgan up to the year 2038/29, and remain flat thereafter.

The resulting population growth profile for the Vale of Glamorgan is illustrated in Figure 4.

Figure 4: Population growth trend - Vale of Glamorgan (2018/19 = 100)



Source: derived from Statistics for Wales - local authority population projections (https://gov.wales/statistics-and-research/local-authority-population-projections/?lang=en)

5.3 Methodology - scheme options demand impact

5.3.1 Pedestrian & cycle schemes – Biglis to Dinas Powys and Merrie Harrier to Pont-y-Werin

For the two pedestrian and cycle scheme options that entail upgrading infrastructure along pre-existing routes (Biglis to Dinas Powys and Merrie Harrier to Pont-y-Werin), the impact on demand is based on an assumed percentage uplift in pedestrian and cycle volumes, drawing upon evidence from previous schemes.

With regard to cycling volumes, we summarise in Table 18 a number of selected schemes that have been used to derive an estimated uplift in demand.

Table 18: Sustainable transport schemes – case studies

Scheme	Description	Investment value	Impact on demand	Relevance for Vale of Glamorgan coastal corridor
Waltham Forest cycle corridor (Greater London)[27]	Range of cycling interventions, including segregated cycle lanes, routes targeted for specific journey purposes e.g. to and from a local town centre.	ca. £30m	42% increase in people cycling across the borough in 2016 compared to previous year.	**Relevant aspects / similarities** Interventions focusing on priority routes used for commuting and accessing key locations. Heavily trafficked routes – poor conditions for cycling prior to interventions. **Differences / limitations** Involves a broader range of measures (e.g. cycle storage facilities, traffic calming measures on residential streets) than those proposed for the Vale of Glamorgan.
Bloor Street cycle route (Toronto)[28]	Installation of a bike lane along a 2.4 km stretch of Bloor Street, a busy downtown commercial street and east-west thoroughfare.	ca. £0.3m	Cycling mode share along the route almost trebled, from 7% to 20% of all movements.	**Relevant aspects / similarities** Provision of a bike lane along a busy, heavily trafficked route where previously there was none. Substantial improvement in cycling conditions and perceptions of safety, resulting in significant growth in cycling volumes. **Differences / limitations** High-density urban setting, with majority of journeys likely to be shorter distance overall, making cycling journey times more competitive with the car, compared to where there are longer average journey distances (as in Vale of Glamorgan).

[27] Source: https://www.london.gov.uk/sites/default/files/londons_cycling_infrastructure.pdf
[28] Source: http://www.tcat.ca/knowledge-centre/economic-impact-study-of-bike-lanes-in-torontos-bloor-annex-and-korea-town-neighbourhoods/

Scheme	Description	Investment value	Impact on demand	Relevance for Vale of Glamorgan coastal corridor
Blackrock cycle route (Dublin)[29]	Cycle route and infrastructure improvements including separated cycle lane.	ca. £0.2m	Increase in cycling volumes of 49% over two years (published 2016).	**Relevant aspects / similarities** Targeted low-cost interventions involving improved road surfacing and enhanced cycle lane markings. **Differences / limitations** Scope of interventions more limited than what is proposed for Vale of Glamorgan, e.g. cycle lane as opposed to segregated route.
"Green route" cycle network (Copenhagen)[30]	A route network starting 15-20 km from city centre, intended for both tourists and commuters. Included segregated routes, new surfaces and better lighting.	(Not known)	Increases in cycling observed over two-year period following route upgrades. Increases of between 30% and 60%.	**Relevant aspects / similarities** Upgrade programme focusing on segregated cycle paths focusing on key arterial routes. **Differences / limitations** Programme involves upgrades to existing network of cycle paths rather than new facilities as proposed for Vale of Glamorgan.

[29] Source: https://www.nationaltransport.ie/wp-content/uploads/2017/12/Sustainable_Transport_Measures_Grant_Report_2016.pdf
[30] Source: http://www.fietsberaad.nl/index.cfm?section=nieuws&lang=nl&mode=newsArticle&repository=Deens+onderzoek:+Opwaarderen+fietsroutes+leidt+nauwelijks+tot+extra+fietsers

Based on the above studies, it has been assumed that the Biglis to Dinas Powys and Merrie Harrier to Pont-y-Werin pedestrian & cycle schemes will deliver a 50% increase in cycling volumes along the respective corridors, compared to current levels. This is considered a realistic estimation that takes into account the following factors:

- Conditions for cycling along both corridors are, at present, highly suboptimal with heavy traffic conditions and no dedicated cycling infrastructure of any type (e.g. road markings, cycle lanes) currently in place. Both schemes will deliver substantial improvements that will improve quality and safety of cycle journeys.
- Levels of cycling between Penarth and Cardiff, where high-quality infrastructure is in place, several times higher than the above two corridors.
- There is clear evidence that other similar schemes – in some cases involving less significant interventions – have resulted in significant growth in cycling, particularly where this has led to significantly improved safety (see Table 18).

For pedestrians, given that current facilities along the two routes are limited and on some stretches non-existent, the simplifying assumption has been made that current pedestrian volumes on both routes are zero.

Post-implementation of the two schemes, it is assumed that with provision of a high-quality pedestrian route, levels of pedestrian usage would no longer be inhibited. On this basis, pedestrian volumes along the two routes are projected to grow to a level that aligns with the general share of walking as a travel mode within the wider areas the schemes are located in.

On the above basis, the resulting change in demand assumed as a consequence of implementing the two schemes is shown in the table below.

Table 19: Pedestrian & cycle schemes – demand uplift (no. trips per day)

Scheme Option volumes (no. trips per day)	Mode	Current volume	With option	Change
Biglis – Dinas Powys	Walking	0	323	Adjusted to align with general journey patterns
Biglis – Dinas Powys	Cycling	80	120	+50% growth
Merrie Harrier – Pont-y-Werin / Penarth Rd	Walking	0	154	Adjusted to align with general journey patterns
Merrie Harrier – Pont-y-Werin / Penarth Rd	Cycling	156	234	+50% growth

5.3.2 Penarth Headland Link

For the Penarth Headland Link pedestrian & cycle scheme, a two-stage approach has been taken to assess the impact on demand. This is due the fact that the link will connect the Penarth Pier area with Cardiff Bay Barrage – where there is an existing pedestrian & cycle link located in a popular leisure area – and therefore the new link it is likely to attract far more leisure users than the other two

pedestrian & cycle routes. Therefore, the calculation of demand comprises two elements.

The first part of the analysis involves uplifting the existing levels of walking and cycling between the areas connected by the new link – following the same process as the other two pedestrian & cycling schemes (see previous section). Based on benchmark growth figures extracted from previous case studies, this assumes existing walking and cycling levels will increase by 50%.

The second part of the analysis focuses on additional demand that will accrue from existing users of Cardiff Barrage extending their journeys along the new headland link. This analysis draws upon survey data from existing Cardiff Bay Barrage users obtained by Sustrans, as part of their recent study regarding the Penarth Headland Link.[31] This involves the following:

- According to Sustrans' study, currently around 620,000 pedestrians use Cardiff Barrage annually, and around 340,000 cyclists.
- Sustrans also performed a route user intercept survey (with pedestrians and cyclists questioned). The results indicated that 64% of users said they would "always" use the Penarth Headland link if it were opened, while 35% of those surveyed indicated they would "sometimes" use the new link.
- The above information has been used in this study to generate an estimate of additional demand for the Penarth Headland link, based on the following assumptions:
    - Of the 64% of users who stated they would "always" use the new link, half have been assumed to use the new link;
    - Of the 35% of users who stated they would "sometimes" use the new link, one tenth have been assumed to use the new link.
- This results in a further increase demand of approximately 340,000 users (pedestrians and cyclists) p.a., in addition to the 50% increase in existing flows described earlier.

Combining the above factors, the total estimate of future pedestrian and cyclist demand for the Penarth Headland Link is summarised in Table 20.

Table 20: Penarth Headland Link – pedestrian & cycle volumes (annual)

	Current corridor users (annual)	Est. uplift in current users	Est. additional users (from Cardiff Barrage)	Est. total annual users for PHL (2021)
Pedestrian trips	117k	59k (+50%)	93k	**270k**
Cycling trips	155k	78k (+50%)	54k	**288k**

[31] "Penarth Headland Economic Impact Study", Sustrans, March 2018

5.3.3 Bus priority schemes

Overview

The estimation of the demand uplift relating to the two proposed bus priority schemes (Merrie Harrier to Cardiff Barrage and Cosmeston to Cardiff Barrage) is based on the reduction in bus journey times that the schemes will deliver, and the associated uplift in bus demand that will arise as a result. This involves a calculation combining the journey time saving and a demand elasticity factor (discussed further below).

Change in journey time and distance

The journey time and distance savings arising from the bus priority schemes is based on reductions in zone-to-zone centroids. Current journey times have been derived from existing timetables for relevant bus routes, differentiating between the a.m. peak, inter-peak and p.m. peak periods. To calculate the change in journey time, the speeds of buses travelling along priority routes elsewhere within the Vale of Glamorgan / Cardiff area have been analysed, using existing timetables.

The change in total journey distance following the implementation of the barrage bus route has also been included within the calculations. This includes accounting for three possible new bus stops along the route (with a dwell time of 30 seconds per bus stop).

The changes in bus route timings and distances have then been combined with the demand and distance/journey time matrices in order to derive average journey times and distances. The results of these calculations are shown in Table 21.

Table 21: Journey time and distance (post-implementation of scheme)

Scheme	Ave. distance (km)				Ave. time (min)		
	Pre-scheme implementation	Post-scheme implementation	Difference (%)		Pre-scheme implementation	Post-scheme implementation	Difference (%)
Merrie Harrier - Barrage Bus Priority	**8.9**	**8.5**	**-5%**		**40**	**32**	**-20%**
Cosmeston - Barrage Bus Priority	**8.3**	**7.9**	**-5%**		**41**	**37**	**-10%**

Resulting impact on demand

The resulting change in bus mode share was estimated using a bus demand elasticity value of 0.5. This was derived from research by Prof. David Begg[32]

[32] "The Impact of Congestion on Bus Passengers" (Prof. David Begg); Greener Journey, 2016. (Source: https://greenerjourneys.com/wp-content/uploads/2016/06/TTBusReport_Digital.pdf)

examining the quality, speed and reliability of bus journeys and how this impacts on demand.

When applied to demand on the two bus priority corridors, this results in an increase in the level of bus usage as a consequence of the reduced journey time. This calculation is shown in in Table 21.

Table 22: Bus priority schemes – impact on demand

Scheme	Reduction in journey time	Elasticity coefficient	Resulting demand increase	Demand impact
Merrie Harrier - Barrage Bus Priority	-20%	-0.5	+10%	Increase from 207k trips (2018) to 229k trips p.a. (2021)*
Cosmeston - Barrage Bus Priority	-10%	-0.5	+5%	Increase from 284k trips (2018) to 299k trips p.a.(2021)*
* We note 2021 demand figures also incorporate underlying year-on-year demand growth – see Section 5.2.4				

5.3.4 Park & Ride schemes – projected demand

Introduction

An estimation of the likely demand for the potential Park & Ride facilities along the Vale of Glamorgan coastal corridor has been arrived at based on evidence from other Park & Ride schemes. This has been combined with conservative assumptions to generate a realistic forecast that avoids overestimating patronage.

Evidence from over twenty existing Park & Ride sites in the UK suggests that between 1% and 11% of traffic on the adjacent main road is being diverted to the given Park & Ride facility[33]. Although interception rates vary depending on local conditions such as the structure of the local transport network, pricing, and congestion levels, they can provide a useful benchmark. Excluding the highest values, the evidence (based on sixteen example locations) suggests an average interception rate of around 1.5%.

For the Vale of Glamorgan coastal corridor, a traffic flow passing each potential Park & Ride site proposed under the three sub-options has been calculated. This has drawn upon data from obtained manual classified turning counts, which were undertaken on a weekday in November 2017.

Cosmeston Park & Ride (plus potential alternatives) – projected demand

At Cosmeston, plus the locations proposed as alternative sub-options (Sully, and an expanded rail P&R facility at Eastbrook – see section 4.2.1), Department for Transport traffic data has been used to establish existing road traffic flows. This data indicates that the annual average daily traffic (AADT) on the A4055 between

[33] Evidence listed in Perth P&R Appraisal and Nexus P&R Strategy, including cities such as Bath, Durham, Edinburgh, Maidstone, Cambridge, Norwich and Exeter.

Barry and Dinas Powys of around 18,239 vehicles per day. This flow was used to factor up the 07:00-19:00 counts to a daily traffic flow, using a calculated factor of 1.15.

Two of the proposed sup-options (A & B) – involving a bus P&R at Cosmeston or at Sully –would require drivers to divert from a more direct route along the A4055 to the B4267, and hence would impact on demand. As such, a further adjustment factor has been applied to account for the additional driving time incurred for the diversion, which has been extracted from Section B4.4 of PDFH (v5.1). This suggests a coefficient of 0.42 should be applied on a proportionate basis to the additional drive time for the diversion, in order to calculated the demand impact.

Combining all of the above calculation factors, an estimation of potential daily usage of the P&R facilities under each sub-option has been derived, plus the resulting additional public transport (bus or train) trip this would generate.

It should be noted that the calculations of P&R described above assume there is no difference between the different sub-options (A, B or C) in regard to any of the following:

- Overall costs for the journey, i.e. no additional advantage / disadvantage for the P&R user in selecting one or the other mode (bus or rail)
- Average waiting time: there is no difference in average wait time for P&R users between the different sites.
- Intrinsic preference for or bus: P&R users are assumed to be ambivalent with regard to whether they catch a bus or a train.

The resulting demand estimated for the Cosmeston P&R scheme, plus alternative sub-options, is shown in Table 23 below.

Table 23: Park & Ride sub-options – estimated demand

Scheme	P&R Inter-ception rate	Intercepted demand (daily)	Diversion adjustment factor	Estimated P&R demand (daily)
Sub-option A: Cosmeston Lakes P&R	1.5%	155	0.42	66
Sub-option B: Sully P&R	1.5%	167	0.42	71
Sub-option C: Eastbrook Rail Station Expansion	1.5%	274	1.0 (no adjustment)	274 (= baseline demand – limited to 138 spaces by actual capacity)*

* We note that for Sub-option C (expansion of P&R provision at Eastbrook), estimated demand is significantly in excess of the additional capacity proposed under the current feasibility assessment. As set out in Section 4.2.2, it has been identified that car parking provision at Eastbrook could be expanded from the current 31 spaces to 138 spaces in total (with 107 new spaces constructed). No suitable site has been identified beyond the 107 new spaces, therefore larger scale expansion would be required to accommodate up to 274 daily trips as outlined

above. We recommend this issue is examined further in later stages of business case development / feasibility work.

Cogan Park & Ride – projected demand

It is assumed that increased P&R capacity at Cogan coupled with improvements in the road connections into the station, as well as improved passenger facilities, would lead to significant growth in demand.

The estimation of future demand at Cogan has largely followed the same process as for Cosmeston (and potential alternative sites) as outlined above.

The Department for Transport (DfT's) traffic data indicates that the annual average daily traffic (AADT) on Windsor Road is around 12,043 vehicles per day. The interception rate of 1.5% has been applied to the AADT to calculate future demand, which equates to approximately 180 daily trips.

However, as there is an existing car park at Cogan rail station comprising 55 spaces, a reduction has been applied to account for trips already on the network. A deduction has been applied to account for demand already existing at the station.

A summary of the calculation is provided in Table 24.

Table 24: Cogan Park & Ride – projected demand uplift

Cogan Park & Ride	Daily flows
Average Daily Road Traffic	12,043
P&R Interception Rate	1.5%
Future Demand	180
Reduction for existing car park users (based on occupancy of 95%)	52
Total demand uplift (daily)	**128**

5.4 Transport impacts – results

Table 25 summarises the transport impacts from each proposed scheme options.

Table 25: Sustainable transport scheme options – summary of transport impacts

Scheme	Current demand (2018)	Est. future demand – 2021 (post-option implementation)*
Pedestrian & cycling schemes		
Penarth Headland Link Walking & Cycling	Pedestrians: 118k Cyclists: 155k	Pedestrians: 271k (+ 130%) Cyclists: 288k (+ 86%)
Biglis-Dinas Powys Walking & Cycling	Pedestrians: 0 Cyclists: 21k	Pedestrians: 85k *(all new users)* Cyclists: 32k (+ 52%)
Merrie Harrier - Pont y Werin Walking & Cycling	Pedestrians: 0 Cyclists: 41k	Pedestrians: 41k *(all new users)* Cyclists: 62k (+ 51%)
Bus priority schemes		
Merrie Harrier - Barrage Bus Priority	Bus: 208k	Bus: 230k (+ 11%)
Cosmeston - Barrage Bus Priority	Bus: 285k	Bus: 300k (+ 5%)
Park & Ride schemes		
Cosmeston Park & Ride (plus potential alternatives)	n/a	Sub-option 1 (Cosmeston): (bus trips) 18k p.a.

Scheme	Current demand (2018)	Est. future demand – 2021 (post-option implementation)*
		Sub-option 2 (Sully): (bus trips) 19k p.a. Sub-option 3 (Eastbrook): (train trips) 37k p.a.
Cogan Park & Ride	n/a	Train trips: 34k p.a.
* We note 2021 demand figures also incorporate underlying year-on-year demand growth – see Section 5.2.4		

5.5 Conclusions

Comparing the percentage uplift in levels of usage for sustainable modes (pedestrian, cycling or bus usage) across the different scheme options, the Penarth Headland Link shows the biggest impact. This is mostly due to the fact that the link would connect with the already heavily used Cardiff Bay barrage, from which much of the new demand is expected to arise as a result of barrage users choosing to extend their journeys along the new link. This effect, coupled with demand from existing road users switching to walking and cycling results in a substantial increase overall. Assuming the link is built by 2021, it is expected that the total number of people walking or cycling along the corridor will more than double.

The other two pedestrian and cycle schemes – Biglis to Dinas Powys and Merrie Harrier - Pont y Werin – are also expected to drive significant growth in levels of walking and cycling, albeit to a lower level than the Penarth Headland Link. Current provision along the two route sections is limited, therefore providing safe, segregated walking and cycling links will have a significant impact. In each case, the new links are expected to generate between 50,000 and 100,000 additional journeys per annum being undertaken on foot or by bicycle, instead of by car.

The two bus priority schemes – Merrie Harrier to Cardiff Barrage and Cosmeston to Cardiff Barrage would each deliver journey time improvements that would give rise to increased demand. In both cases, bus demand is expected to increase from current levels, with around 15,000 – 22,000 additional bus trips per annum by 2021, and a related reduction in car trips.

The uplift in levels of public transport demand arising from the Park & Ride options / sub-options varies. Analysis of two potential locations for a bus P&R facility – at Cosmeston, or Sully – suggests either option would generate approximately 18 – 19,000 additional bus trips per annum. In contrast, the analysis suggests that expanding existing park & ride provision at Eastbrook rail would have roughly double the benefit in terms of additional public transport trips – with around 37,000 additional (rail) trips per annum.

The proposed expansion and upgrading of Cogan rail station P&R is expected to result in similar growth in demand to expansion at Eastbrook, with an additional 34,000 rail trips per annum forecast.

6 Economic impacts appraisal

6.1 Introduction

Drawing upon results obtained via the transport impacts appraisal, the focus of the economic impacts appraisal is on the specific benefits each of the scheme options will deliver, compared to the status quo (or "do nothing" scenario).

The principal benefits associated with the schemes relate to journey time savings, amenity benefits (for pedestrians and cyclists) and reduced road congestion, all of which can be quantified using DfT WebTAG values.

The benefits delivered by each scheme option will be compared against the costs of implementation (net of any direct revenues), in order for a net economic benefit to be calculated alongside a benefit-to-cost ratio.

For each scheme option, timescales are assumed as follows:

- Construction: completed during the period 2019-20, with costs spread evenly over the two-year period.
- Operation: all scheme options are assumed to become operational from 2021 onwards – from which point, user benefits can accrue.

In accordance with HM Treasury Green Book guidance, the appraisal period is 60 years post-assumed scheme opening (2020), resulting in an appraisal period from 2018 – 2079. We note that, in line with standard WebTAG practice, all financial values are expressed in 2010 prices. Total benefits and costs are expressed in net present value (discounted) terms.

6.2 Economic benefits

6.2.1 Journey time savings

The quantification of economic benefits associated with journey time savings is based on weighted values of time, detailed in WebTAG guidance.[34] Based on the assumed commuter to leisure user split for each scheme option, the following specific values have been apportioned:

- For commuter users, £8.36/hour
- For leisure users, £3.80/hour

Total benefits have been calculated on the basis of the average travel time saving for the relevant mode, multiplied by estimated annual demand under each scheme. This has then been multiplied by the value of time attributed to the given time saving, to obtain a total annual benefit value. (We note that, for new users

[34] WebTAG Databook A1.3.1

attracted to a given mode, i.e. induced demand, the journey time benefit was halved in accordance with the "Rule of Half Principle[35]").

The calculation of journey time savings for each scheme option, and the resulting economic benefits, are summarised in provided in Table 24.

Table 26: Journey time savings – economic benefit calculation

Scheme option	Time saving (60-year total)	Total economic benefit (2010 prices), 60-year NPV
Pedestrian & cycling schemes		
Penarth Headland Link Walking & Cycling	Pedestrians: 12.0m minutes Cyclists: 6.5m minutes	Pedestrians: £639k Cyclists: £341k **Total: £979k**
Biglis-Dinas Powys Walking & Cycling	*None – user amenity & congestion alleviation benefit only*	n/a
Merrie Harrier - Pont y Werin Walking & Cycling	*None – user amenity & congestion alleviation benefit only*	n/a
Bus priority schemes		
Merrie Harrier - Barrage Bus Priority	Bus users: 114.0m minutes	**Total: £6.5m**
Cosmeston - Barrage Bus Priority	Bus users: 77.5m minutes	**Total: £4.1m**
Park & Ride schemes		
Cosmeston Park & Ride (plus potential alternatives)	*None –congestion alleviation benefit only*	n/a
Cogan Park & Ride	*None –congestion alleviation benefit only*	n/a

6.2.2 Amenity benefits

For the three cycling and pedestrian scheme options, economic benefits can be calculated on the basis of the improved amenity the schemes deliver.

For pedestrians, the following WebTAG values can be attributed to the scheme options[36]:

- Street lighting: 3.73 pence/km
- Kerb level: 2.63 pence/km
- Crowding: 1.87 pence/km
- Pavement evenness: 0.88 pence/km
- Information panels: 0.88 pence/km
- Benches: 0.55 pence/km
- Directional signage: 0.55 pence/km

The above amenity values associated with improvements to the pedestrian environment have been combined with an estimation of the average time spent by pedestrians walking along each of the respective schemes. This has then been

[35] Source: Department for Transport TAG Unit A1.3, "User and provider impacts", Section 2.1
[36] Source: WebTAG Databook A4.1.6

multiplied by the total annual number of pedestrians to obtain a total annual benefit.

For cyclists, the following WebTAG value can be attributed to the scheme options[37]:

- Off-road segregated cycle track: 7.03 pence/min

The above amenity value associated with improvements for cyclists using the new schemes has been combined with an estimation of the cycling distance along each of the respective schemes. This has then been multiplied by the total annual number of cyclists to obtain a total annual benefit.

We note that, for both pedestrians and cyclists, the amenity benefit for new users on each scheme option, i.e. induced demand, has been halved in line with the "Rule of Half Principle"[38].

The resulting amenity benefit from the three schemes is shown in Table 24.

Table 27: Amenity benefit calculation (pedestrian & cycle scheme options)

Scheme option	Scheme length	Annual users (2021)	Total economic benefit (2010 prices), 60-year NPV
Penarth Headland Link Walking & Cycling	1.0km	Pedestrians: 271k Cyclists: 288k **Total: 559k**	**£2.0m**
Biglis-Dinas Powys Walking & Cycling	1.9km	Pedestrians: 85k Cyclists: 32k **Total: 117k**	**£0.4m**
Merrie Harrier - Pont y Werin Walking & Cycling	1.2 km	Pedestrians: 41k Cyclists: 62k **Total: 103k**	**£0.3m**

6.2.3 Marginal external cost savings

Alongside the journey time saving and amenity benefits delivered directly to the users of the scheme options, benefits will also accrue as a consequence of any reduction in road traffic that the schemes deliver. These impacts are classed in WebTAG guidance as "marginal external costs", and relate to reduced congestion, pollution and other associated factors.

For each scheme option, a calculation has been made of the reduction in car km resulting from the increase in demand for sustainable modes (walking / cycling / bus usage). We note for the bus priority schemes, the reduction in car km is partially offset by an increase in bus km.

The reduction in car km has then been multiplied by values derived from WebTAG[39] associated with the following factors:

[37] Source: WebTAG Databook A4.1.7
[38] Source: Department for Transport TAG Unit A1.3, "User and provider impacts", Section 2.1
[39] Source: WebTag Databook A5.4.2

- Congestion reduction: 10.08 pence per km
- Infrastructure cost savings: 0.08 pence per km
- Accident reduction: 1.62 pence per km
- Local Air Quality improvement: 0.10 pence per km
- Noise reduction: 0.11 pence per km
- Greenhouse Gases reduction: 0.86 pence per km
- Indirect Taxation (negative value): -4.66 pence per km

Combining all of the above, a total marginal external cost saving (in 2010 prices) of £8.19 pence per car km saved has been applied.

Based on the above input factors, the resulting marginal external cost saving for each scheme option is summarised in Table 24.

Table 28: Marginal external cost savings – calculation

Scheme option	Reduction in vehicle km (example year 2021)		Total economic benefit (2010 prices), 60Y NPV
Pedestrian & cycling schemes			
Penarth Headland Link Walking & Cycling	Reduction in car trips: Ave. trip distance: **Total km saving:**	136,719 7.03 km **961,131 km**	**£4.1m**
Biglis-Dinas Powys Walking & Cycling	Reduction in car trips: Ave. trip distance: **Total km saving:**	94,778 6.09 km **577,196 km**	**£2.5m**
Merrie Harrier - Pont y Werin Walking & Cycling	Reduction in car trips: Ave. trip distance: **Total km saving:**	60,256 5.54 km **335,315 km**	**£1.4m**
Bus priority schemes			
Merrie Harrier - Barrage Bus Priority	Reduction in car trips: Ave. trip distance: Total car km saving Minus bus km increase: **Total net km saving:**	21,108 9.5 km 200,523 km 23,000 km **177,523 km**	**£0.8m**
Cosmeston - Barrage Bus Priority	Reduction in car trips: Ave. trip distance: Total car km saving Minus bus km increase: **Total net km saving:**	14,161 8.6 km 121,786 km 14,000 km **107,786 km**	**£0.5m**
Park & Ride schemes			
Cosmeston Park & Ride - Sub-option A: Cosmeston	Reduction in car trips: Ave. trip distance: Total car km saving Minus bus km increase: **Total km saving:**	17,220 8.6 km 148,094 km 17,000 km **131,094 km**	**£0.6m**
Cosmeston Park & Ride - Sub-option B: Sully	Reduction in car trips: Ave. trip distance: Total car km saving Minus bus km increase: **Total km saving:**	18,525 8.6 km 159,314 km 19,000 km **140,314 km**	**£0.6m**

Scheme option	Reduction in vehicle km (example year 2021)		Total economic benefit (2010 prices), 60Y NPV
Cosmeston Park & Ride - Sub-option C: Eastbrook (rail)	Reduction in car trips: Ave. trip distance: Total car km saving Minus bus km increase: **Total km saving:**	36,006 8.6 km 309,652 km 36,000 km **273,652 km**	**£1.2m**
Cogan Park & Ride	Reduction in car trips: Ave. trip distance: **Total km saving:**	33,397 8.6 km **287,213 km**	**£1.2m**

6.3 Economic costs

6.3.1 Capital investment costs

We summarise in the table below, the assumed capital investment costs that have been factored into the economic appraisal.

Table 29: Scheme options – capital investment costs

Scheme option	Capital investment cost (2018 prices)	Capital investment cost (2010 prices), 60Y NPV
Pedestrian & cycling schemes		
Penarth Headland Link Walking & Cycling	£16.6m	£10.9m
Biglis-Dinas Powys Walking & Cycling	£1.5m	£1.0m
Merrie Harrier - Pont y Werin Walking & Cycling	£4.9m	£3.2m
Bus priority schemes		
Merrie Harrier - Barrage Bus Priority	£8.5m	£5.6m
Cosmeston - Barrage Bus Priority	£6.3m	£4.0m
Park & Ride schemes		
Cosmeston Park & Ride		
- Sub-option A: Cosmeston	£1.0m	£0.7m
- Sub-option B: Sully	£1.0m	£0.7m
- Sub-option C: Eastbrook (rail)	£2.6m	£1.9m
Cogan Park & Ride	£3.1m	£2.0m

6.3.2 Operational and maintenance costs

Lifecycle maintenance

Cost provision has been made in the economic appraisal for major lifecycle maintenance on the new infrastructure delivered under each of the respective scheme options.

A general benchmark cost has been applied of 20% of total capital cost per major lifecycle intervention, incurred at 20-year intervals following the scheme opening.

The resulting costs are set out in in Table 24.

Table 30: Scheme options lifecycle maintenance costs

Scheme option	Total cost (2010 prices), 60Y NPV
Pedestrian & cycling schemes	
Penarth Headland Link Walking & Cycling	£1.5m
Biglis-Dinas Powys Walking & Cycling	£0.1m
Merrie Harrier - Pont y Werin Walking & Cycling	£0.5m
Bus priority schemes	
Merrie Harrier - Barrage Bus Priority	£0.6m
Cosmeston - Barrage Bus Priority	£0.1m
Park & Ride schemes	
Cosmeston Park & Ride	
- Sub-option A: Cosmeston	£0.1m
- Sub-option B: Sully	£0.1m
- Sub-option C: Eastbrook (rail)	£0.3m
Cogan Park & Ride	£0.2m

Bus operating costs

For the two bus priority schemes (Merrie Harrier – Cardiff Barrage and Cosmeston – Cardiff Barrage) additional operating costs will be incurred for the respective bus operations.

A bus operating cost spreadsheet has been developed by Arup to make an estimate of costs for existing and potential services, based on the hours and frequency of service, length and journey time. This information allows the "Peak Vehicle Requirement" (i.e. size of bus fleet needed to operate the service) and vehicle kilometres to be established, to which salary, fuel and vehicle costs are added. On this basis, an estimate of total operational expenditure can be made.

The estimated cost impacts for both the schemes and the existing services are presented in Table 31.

Table 31: Estimated Existing Bus Services Annual Operating Cost (2018 prices)

Cost Element	Merrie Harrier - Barrage Bus Priority	Cosmeston - Barrage Bus Priority
Existing total cost per annum	£360,000	£1,130,000
Proposed total cost per annum	£980,000	£1,230,000
Difference	**+ £620,000**	**+ £100,000**

It is evident that the Merrie Harrier – Barrage Bus Priority scheme would result in an increase in frequency from the existing service. As a result, this option will drive a more significant increase in operating cost.

6.4 Results

6.4.1 Scheme options results

We summarise in Table 32 the results from the economic appraisal for each scheme option.

All financial values shown are 60-year discounted totals, in 2010 prices.

Table 32: Economic impacts appraisal – scheme option results (60-year totals, discounted), 2010 prices

Scheme option	Total economic benefits		Total economic costs		Total net benefit	Benefit-Cost Ratio
Pedestrian & cycling scheme options						
Penarth Headland Link Walking & Cycling	Journey time savings Amenity benefit Marginal ext. cost savings **Total**	£0.98m £1.98m £4.11m **£7.07m**	Capital investment Operations &maintenance **Total**	£10.91m £1.47m **£12.38m**	-£5.31m	**0.57**
Biglis-Dinas Powys Walking & Cycling	Amenity benefit Marginal ext. cost savings **Total**	£0.39m £2.44m **£2.83m**	Capital investment Operations &maintenance **Total**	£1.01m £0.15m **£1.16m**	£1.67m	**2.44**
Merrie Harrier - Pont y Werin Walking & Cycling	Amenity benefit Marginal ext. cost savings **Total**	£0.29m £1.41m **£1.70m**	Capital investment Operations &maintenance **Total**	£3.19m £0.47m **£3.66m**	-£1.96m	**0.46**
Bus priority scheme options						
Merrie Harrier - Barrage Bus Priority	Journey time savings Marginal ext. cost savings **Total**	£6.50m £0.76m **£7.27m**	Capital investment Operations &maintenance **Total**	£5.59m £16.36m **£21.95m**	-£14.68m	**0.33**
Cosmeston - Barrage Bus Priority	Journey time savings Marginal ext. cost savings **Total**	£4.12m £0.46m **£4.58m**	Capital investment Operations &maintenance **Total**	£4.06m £2.35m **£6.41m**	-£1.83m	**0.71**
Park & ride scheme options						
Cosmeston Park & Ride - Sub-option A: Cosmeston	Marginal ext. cost savings **Total**	**£0.56m**	Capital investment Operations &maintenance **Total**	£0.70m £0.10m **£0.80m**	-£0.25m	**0.69**
Cosmeston Park & Ride - Sub-option B: Sully	Marginal ext. cost savings **Total**	**£0.60m**	Capital investment Operations &maintenance **Total**	£0.70m £0.09m **£0.80m**	-£0.20m	**0.75**
Cosmeston Park & Ride - Sub-option C: Eastbrook (rail)	Marginal ext. cost savings **Total**	**£1.16m**	Capital investment Operations &maintenance **Total**	£1.89m £0.25m **£2.14m**	-£0.98m	**0.54**
Cogan Park & Ride	Marginal ext. cost savings **Total**	**£1.22m**	Capital investment Operations &maintenance **Total**	£2.04m £0.20m **£2.23m**	-£1.01m	**0.55**

6.4.2 Combined results including potential synergies

As well as considering each scheme option in its own right (see above), a corridor-level assessment has also been made of the scheme options as a combined programme of measures.

Viewing all seven scheme options as a collective, the following two synergies have been identified and factored into the combined programme appraisal:

- Firstly, an additional uplift in pedestrian and cycling demand as a consequence of delivering both the Biglis-Dinas Powys and the Merrie Harrier - Pont y Werin pedestrian & cycling schemes. Having both scheme options delivered would result in a continuous pedestrian and cycle route all the way from Barry through to the Cardiff Bay area. With both schemes implemented, is assumed there will be a further 10% uplift in pedestrian and cycling demand on top of the demand generated for either scheme when delivered individually.
- Secondly, capital cost savings resulting from delivery of both Merrie Harrier - Barrage and Cosmeston - Barrage bus priority schemes. When viewed individually, for both scheme options the additional £3.2m capital investment cost (2018 prices) associated with "bus across the barrage" modifications has been taken into account. If both scheme options are delivered, this cost can be shared between them.

The combined economic benefit, incorporating the two synergies outlined above, plus the benefits and costs for the remaining scheme options, as well as the combined total for all seven scheme options, is summarised in the table overleaf.

Table 33: Economic impacts appraisal – corridor-level combined results (including synergies) (60-year totals, discounted), 2010 prices

Scheme option	Total economic benefits		Total economic costs		Total net benefit	Benefit-Cost Ratio
Pedestrian & cycling scheme options						
Penarth Headland Link Walking & Cycling	Journey time savings Amenity benefit Marginal ext. cost savings **Total**	£0.98m £1.98m £4.11m **£7.07m**	Capital investment Operations &maintenance **Total**	£10.91m £1.47m **£12.38m**	-£5.31m	**0.57**
Two-option synergy (with additional demand uplift): - Biglis-Dinas Powys Walking & Cycling - Merrie Harrier - Pont y Werin Walking & Cycling	Amenity benefit Marginal ext. cost savings **Total**	£0.74m £4.24m **£4.98m**	Capital investment Operations &maintenance **Total**	£4.20m £0.62m **£4.81m**	£0.16m	**1.03**
Bus priority scheme options						
Two-option synergy (with reduction in combined cost): - Merrie Harrier - Barrage Bus Priority - Cosmeston - Barrage Bus Priority	Journey time savings Marginal ext. cost savings **Total**	£10.63m £1.22m **£11.85m**	Capital investment Operations &maintenance **Total**	£6.89m £13.36m **£20.26m**	-£8.41m	**0.58**
Park & ride scheme options						
Cosmeston Park & Ride (recommended sub-option): - Sub-option C: Eastbrook (rail)	Marginal ext. cost savings **Total**	 **£1.16m**	Capital investment Operations &maintenance **Total**	£1.89m £0.25m **£2.14m**	-£0.98m	**0.54**
Cogan Park & Ride	Marginal ext. cost savings **Total**	 **£1.22m**	Capital investment Operations &maintenance **Total**	£2.04m £0.20m **£2.23m**	-£1.01m	**0.55**
Programme-level total						
Total (all scheme options incl. synergies)	**£26.28m**		**£41.83m**		**-£15.55**	**0.63**

6.4.3 Sensitivity tests

In order to assess the robustness of the economic appraisal results for the scheme options, six sensitivity tests have been undertaken.

Sensitivity 1: anticipated demand slightly lower than expected (-15%)

This sensitivity is based on the assumption that the level of demand for sustainable modes is 15% lower for each scheme option, compared to the "central case" demand detailed in Chapter 5. The results are shown in the table below.

Table 34: Sensitivity 1 – demand for all scheme options 15% lower than central case

Scheme option	Total benefits (£m)	Total costs (£m)	Economic net benefit (£m)	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link	£6.01	£12.38	**-£6.37**	**0.49**
Two-option synergy: - Biglis-Dinas Powys - Merrie Harrier - Pont y Werin	£4.23	£4.81	**-£0.58**	**0.88**
Bus priority scheme options				
Two-option synergy: - Merrie Harrier - Barrage Cosmeston - Barrage	£10.07	£20.26	**-£10.19**	**0.50**
Park & ride scheme options				
Park & Ride- Sub-opt. C: Eastbrook (rail)	£0.99	£2.14	**-£1.15**	**0.46**
Cogan Park & Ride	£1.04	£2.23	**-£1.20**	**0.46**
Programme-level total				
Total (all scheme options incl. synergies)	**£22.34**	**£41.83**	**-£19.50**	**0.53**

Sensitivity 2: anticipated demand significantly lower than expected (-35%)

This sensitivity is based on a significantly lower than expected level of demand for sustainable modes arising from the schemes, 35% lower for each scheme option compared to "central case". The results are shown in the table below.

Table 35: Sensitivity 2 – demand for all scheme options 35% lower than central case

Scheme option	Total benefits (£m)	Total costs (£m)	Economic net benefit (£m)	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link	£4.60	£12.38	**-£7.79**	**0.37**
Two-option synergy: - Biglis-Dinas Powys - Merrie Harrier - Pont y Werin	£3.23	£4.81	**-£1.58**	**0.67**
Bus priority scheme options				
Two-option synergy: - Merrie Harrier - Barrage Cosmeston - Barrage	£7.70	£20.26	**-£12.56**	**0.38**

Scheme option	Total benefits (£m)	Total costs (£m)	Economic net benefit (£m)	Benefit-Cost Ratio
Park & ride scheme options				
Park & Ride- Sub-opt. C: Eastbrook (rail)	£0.76	£2.14	**-£1.39**	**0.35**
Cogan Park & Ride	£0.79	£2.23	**-£1.44**	**0.35**
Programme-level total				
Total (all scheme options incl. synergies)	**£17.08**	**£41.83**	**-£24.75**	**0.41**

Sensitivity 3: capital investment costs 25% higher than expected

This sensitivity is based on capital investment costs being 25% higher than the levels assumed under the central case (see Section 6.3.1). The cost escalation is assumed to apply across the board, to all seven scheme options. The results are shown in the table below.

Table 36: Sensitivity 3 – capital investment costs 25% higher than expected

Scheme option	Total benefits (£m)	Total costs (£m)	Economic net benefit (£m)	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link	£7.07	£15.11	**-£8.04**	**0.47**
Two-option synergy: - Biglis-Dinas Powys - Merrie Harrier - Pont y Werin	£4.98	£5.86	**-£0.89**	**0.85**
Bus priority scheme options				
Two-option synergy: - Merrie Harrier - Barrage Cosmeston - Barrage	£11.85	£21.98	**-£10.13**	**0.54**
Park & ride scheme options				
Park & Ride- Sub-opt. C: Eastbrook (rail)	£1.16	£2.61	**-£1.45**	**0.44**
Cogan Park & Ride	£1.22	£2.74	**-£1.52**	**0.44**
Programme-level total				
Total (all scheme options incl. synergies)	**£26.28**	**£48.31**	**-£22.04**	**0.54**

Sensitivity 4: capital investment costs 25% higher than expected and demand slightly lower (-15%)

This sensitivity is based on capital investment costs being 25% higher than the central case (as per Sensitivity 3), and demand being 15% lower (as per Sensitivity 1).

The results are shown in the table below.

Table 37: Sensitivity 4 – capital investment costs 25% higher than expected and demand 15% lower

Scheme option	Total benefits (£m)	Total costs (£m)	Economic net benefit (£m)	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link	£12.58	£15.11	**-£2.54**	**0.83**
Two-option synergy: - Biglis-Dinas Powys - Merrie Harrier - Pont y Werin	£8.61	£5.86	**£2.75**	**1.47**
Bus priority scheme options				
Two-option synergy: - Merrie Harrier - Barrage Cosmeston - Barrage	£21.37	£9.12	**£12.25**	**2.34**
Park & ride scheme options				
Park & Ride- Sub-opt. C: Eastbrook (rail)	£1.96	£2.61	**-£0.65**	**0.75**
Cogan Park & Ride	£2.06	£2.74	**-£0.68**	**0.75**
Programme-level total				
Total (all scheme options incl. synergies)	**£46.58**	**£35.46**	**£11.13**	**1.31**

Sensitivity 5: bus priority schemes options non-viable

This sensitivity test assumes that the two bus priority scheme options are unviable, as a result of difficulties in implementing the bus over the barrage measures. As a consequence the two bus priority scheme options are omitted. All other options are assumed to be implemented with assumptions unchanged.

The programme-level results, without the two bus priority schemes, are shown below.

Table 38: Sensitivity 5 – bus priority schemes non-viable

Scheme option	Total benefits (£m)	Total costs (£m)	Economic net benefit (£m)	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link	£6.01	£15.11	**-£9.10**	**0.40**
Two-option synergy: - Biglis-Dinas Powys - Merrie Harrier - Pont y Werin	£4.23	£5.86	**-£1.63**	**0.72**
Park & ride scheme options				
Park & Ride- Sub-opt. C: Eastbrook (rail)	£10.07	£21.98	**-£11.91**	**0.46**
Cogan Park & Ride				
Programme-level total	£0.99	£2.61	**-£1.62**	**0.38**
Total (all scheme options incl. synergies)	£1.04	£2.74	**-£1.71**	**0.38**

Sensitivity 6: bus priority schemes options non-viable, and demand slightly lower than expected (-15%) for remaining schemes

This sensitivity test assumes that neither of the two bus priority scheme options are delivered (in line with Sensitivity 4). In addition, it is assumed that demand for the remaining scheme options is 15% lower than the central case (in line with Sensitivity 1). The results are shown in the table below

Table 39: Sensitivity 6 – bus priority schemes non-viable and lower demand for remaining scheme options (-15%)

Scheme option	Total benefits (£m)	Total costs (£m)	Economic net benefit (£m)	Benefit-Cost Ratio
Pedestrian & cycling scheme options				
Penarth Headland Link	£6.01	£12.38	**-£6.37**	**0.49**
Two-option synergy: - Biglis-Dinas Powys - Merrie Harrier - Pont y Werin	£4.23	£4.81	**-£0.58**	**0.88**
Park & ride scheme options				
Park & Ride- Sub-opt. C: Eastbrook (rail)	£0.99	£2.14	**-£1.15**	**0.46**
Cogan Park & Ride	£1.04	£2.23	**-£1.20**	**0.46**
Programme-level total				
Total (all scheme options incl. synergies)	**£12.27**	**£21.58**	**-£9.31**	**0.57**

6.5 Wider economic benefits

6.5.1 Introduction

Alongside the direct transport user benefits delivered by the scheme options (discussed in the preceding sections of this report), the scheme options will also provide a number of wider economic benefits. These include the following:

- Leisure-related benefits
- Public health benefits
- Development activity

We note that a quantitative appraisal of the above economic impacts has not been undertaken as part of this assessment. However, quantitative analysis of some or all the above may be beneficial at a later stage, should scheme proposals be progressed for further feasibility analysis.

6.5.2 Leisure-related benefits

Walking and cycling can be considered leisure activities in their own right, and it is likely that the three walking and cycling scheme options would result in increased levels of such activity for leisure purposes.

Of the three schemes, Penarth Headland Link is expected to attract the most significant levels of leisure usage. This scheme would provide a scenic coastal

route which, as discussed in section 5.3.2, would connect Cardiff Bay Barrage – already used by significant numbers of cyclists and pedestrians – with Penarth Pier and the seafront area to the south.

All three pedestrian and cycle schemes will provide better pedestrian and cycle connectivity between the Vale coastal corridor and the Cardiff Bay area. Key destinations for leisure activity around the bay include Cardiff Barrage (mentioned above), Cardiff Bay Trail (which is noted as a strategic recreational route[40]), Mermaid Quay (with cafes, restaurants and bars), Cardiff Marina and the International Sports Village (with various sport and leisure facilities).

From an economic perspective, it is assumed that individuals using walking and cycling facilities for leisure purposes experience a welfare benefit – in the same way they do when consuming any other product – and that such a benefit has an intrinsic value which can, in theory, be represented in monetary terms.

It is recommended that a quantified appraisal of the welfare benefit associated with leisure usage of the three walking and cycling scheme options is undertaken should the council decide to progress them to the next stage of development and feasibility analysis. The most appropriate method for such an appraisal would be to identify potential users of the new walking and cycling link via a survey, and ask how much they would, in theory, be willing to pay to utilise the new walking and cycling links. Whilst not a perfect approach, this would provide an indication of the approximate value potential users place on the new links, which can be used as a representation of the welfare benefit per user.

The two bus priority schemes would improve access from the Vale of Glamorgan into Cardiff Bay, with a direct bus linkage to Cardiff Bay Barrage and more direct linkages into Cardiff waterfront and Mermaid Quay areas. However, unlike the walking and cycling schemes it is assumed in most cases that bus usage is simply a means of transport and not a leisure activity in its own right. Therefore, while the schemes will deliver benefits in terms of reduced journey times (already captured in the economic appraisal), no significant benefit from usage of the bus for leisure purposes is expected. It is also noted that people accessing Cardiff Bay for leisure purposes would, in the absence of the bus priority schemes, still be able to able to access the bay by other, albeit slower, bus services (or other modes of transport), therefore it is not assumed the bus priority schemes will result in any net gain in leisure-related welfare benefit.

6.5.3 Public Health Benefits

Alongside the leisure-related benefits described above, the three walking & cycling scheme options will also provide health benefits. This is due to increased levels of walking and cycling activity expected as a result of the schemes.

The health and well-being benefits of walking and cycling schemes are evident in numerous studies and analyses. Examples of findings from such studies include:

- A clear association between increased walking and a reduction in deaths from all causes, lower blood pressure, improved blood cholesterol levels, reduced

[40] P.173, Ibid

body mass index, reduced risk of cardio-vascular disease, lower body fat and increased aerobic capacity.[41]

- Evidence that walking has a substantial and statistically significant effect on symptoms of depression.[42]
- Evidence that walking or cycling to school is associated with better cognitive performance.[43]
- Evidence that cycling as a means of transport to work reduces absenteeism and boosts productivity, with regular cyclists found to take one less sick day per year[44].
- Evidence that cyclists are most satisfied consumers of transport and that they benefit from positive effects on stress levels, mood and general wellbeing[45].

While such benefits have not been quantified within this study, tools are available to evaluate the economic benefits associated with walking and cycling activity. For example, the Health Economic Assessment Tool,[46] which captures and quantifies the health benefits associated with reduced mortality, lower pollution, reduced accident rates arising from walking and cycling activity.

It is recommended that a quantified appraisal of the health benefits associated with increased walking and cycling activity is undertaken for the three cycling and walking scheme options should the council decide to progress them to the next stage of development and feasibility analysis.

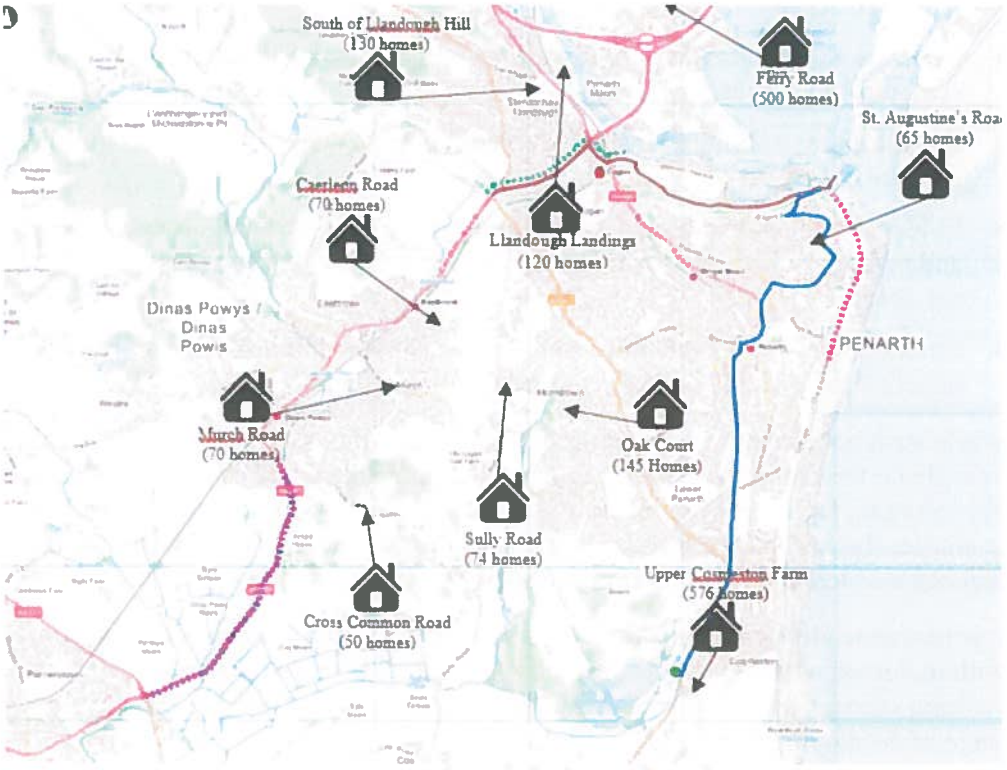
6.5.4 Development activity and land value uplift

Housing developments

A number of sites proposed for housing development within the Vale of Glamorgan Local Development Plan[47] are close to where the new sustainable transport links are located. The relevant sites are set out in Figure 5.

[41] https://www.c3health.org/wp-content/uploads/2017/07/C3-report-on-walking-v-1-20120911.pdf
[42] http://www.ncbi.nlm.nih.gov/pubmed/20625280
[43] http://www.springerlink.com/content/488406687w963150/
[44] P.3, DfT, 'The Value of Cycling'
[45] P.14, Ibid
[46] http://www.heatwalkingcycling.org/#homepage
[47] http://www.valeofglamorgan.gov.uk/Documents/Living/Planning/Policy/LDP/LDP-Adoption/Adopted-LDP-Written-Statement-June-2017-final-interactive-web-version.pdf

Figure 5: Residential development sites within Vale of Glamorgan LDP



As noted in the LDP, improved pedestrian and cycle routes and / or enhanced bus service quality and accessibility are likely to improve the attractiveness of these sites for future residents.[48] In encouraging the usage of sustainable transport modes, the schemes will also contribute to a reduction in additional traffic and congestion generated from the new developments.

Previous studies and analyses have shown that public transport investment can generate land value uplift benefits for locations experiencing improved accessibility[49]. It has been noted that, for residential development, access to improved transport links can have an "important influence on variations in house prices", particularly in lower-income areas[50].

It is however considered for the Vale of Glamorgan that such effects are likely to be comparatively limited, mainly due to the fairly small numbers of people using sustainable modes even after introduction of the scheme options (see section 5.4). As such, the scheme options are not expected to make a fundamental difference to transport patterns or mode shares for journeys undertaken by new residents. Nor would the scheme options be expected to directly result in any significant uplift in land values. Nevertheless, it is reasonable to assume minor increases in values could arise.

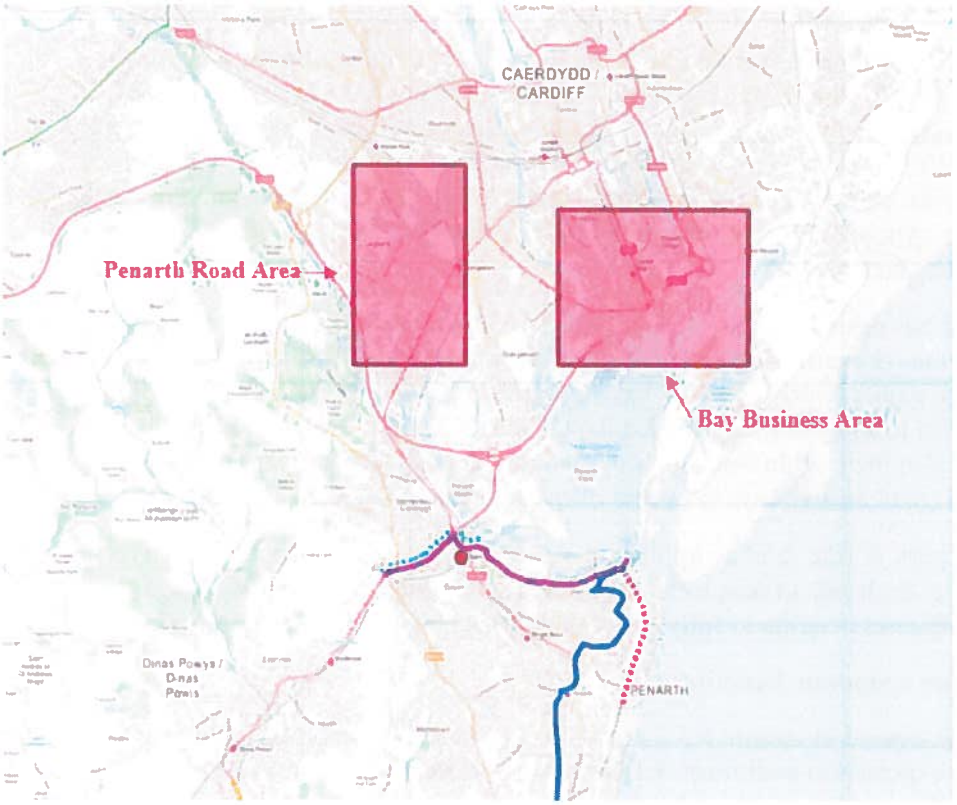
[48] P.177, Vale of Glamorgan LDP June 2017
(http://www.valeofglamorgan.gov.uk/Documents/Living/Planning/Policy/LDP/)
[49] http://journals.sagepub.com/doi/abs/10.1177/0042098013499082
[50] https://www.tandfonline.com/doi/abs/10.1080/02673030050134565

Employment areas

Employment areas within the vicinity of the proposed scheme options are likely to gain from the accessibility improvements that the scheme options will deliver. With shorter bus journey times, reduced road congestion and greater accessibility through walking and cycling, the scheme options are likely to contribute to the attractiveness of such areas for investment by enhancing access to the labour market within the vale coastal corridor.

The two most significant areas where development and growth of employment activity are expected are the Penarth Road Area and the Bay Business Area. The locations of these areas relative to the Vale of Glamorgan coastal corridor are shown in Figure 6 below.

Figure 6: Commercial development areas close to the Vale of Glamorgan coastal corridor



Both areas will benefit from better accessibility delivered by the scheme options. However, as with the housing development sites, these employment areas are not expected to be substantially affected by the scheme options. The impacts, whilst positive, are expected to be limited and are not anticipated to result in any major effect overall, such as demonstrable increases in commercial land values.

6.6 Conclusions

Scheme options – quantified economic impacts

The results of the economic appraisal indicate that for most of the scheme options, the costs for delivery will exceed the economic benefits calculated in this appraisal.

Only one of the eight scheme options – the Biglis to Dinas Powys walking & cycling route – delivers a positive economic net benefit of £1.7m (60 year NPV), with a benefit-cost ratio of 2.44 representing "high" value for money.

Net economic benefit figures (60 year NPVs) for the remaining seven schemes show negative values, which range from -£0.2m for Cosmeston Park & Ride (Sub-option B: Sully) to -£14.7m for the Merrie Harrier to Barrage bus priority scheme.

There is a general correlation between the level of capital investment cost involved for the respective scheme options and the level of economic benefit delivered. However, in each of the seven cases outlined above the quantum of benefit is insufficient to cover costs incurred. As a consequence, these seven schemes show benefit-cost ratios ranging from 0.75 for Cosmeston Park & Ride (Sub-option B: Sully) down to 0.33 for the Merrie Harrier to the Barrage bus priority scheme.

Both bus priority schemes, as well as two of the three potential walking & cycling schemes (Penarth Headland Link and Merrie Harrier – Pont y Werin), will require major capital works with NPVs ranging from £3.2m (Merrie Harrier – Pont y Werin) to £10.9m (Penarth Headland Link). Furthermore, the two bus schemes will also incur additional costs to operate the enhanced services. In each case the total costs incurred are in excess of the benefits delivered.

The park & ride scheme options involve significant lower costs for delivery. However, levels of usage and associated reductions in road traffic yield insufficient benefits to fully cover the costs incurred.

Wider economic benefits

As discussed in section 6.5.2 and 6.5.3, the three walking and cycling schemes are also expected to additional deliver leisure-related benefits and public health benefits, neither of which has been quantified within this appraisal. Although the extent of such benefits is not currently known, these may be of sufficient scope to improve the economic appraisal results such that all three schemes deliver a positive net benefit overall. It is recommended that a quantitative appraisal of both leisure-related benefits and public health benefits arising from the three walking and cycling schemes is undertaken, should the scheme proposals be progressed for further feasibility analysis.

Potential synergies and programme-level results

Calculations have also been made of the combined impact of individual scheme options at a corridor level, as well as the programme-level impact combining all seven potential interventions.

Combining the two walking & cycling schemes along the Barry – Dinas – Cardiff Bay corridor together (Biglis to Dinas Powys, plus Merrie Harrier to Pont y Werin), the joint economic benefit is sufficient to offset the economic cost. The resulting net economic benefit (60-year NPV) shows a positive figure of £0.2m, although the resulting benefit-cost ratio of only 1.03 represents "low" value for money according to HM Treasury standards. As noted previously, quantification of both leisure-related benefits and public health benefits for these two scheme options as well as the Penarth Headland Link) would be likely to lead to a more positive result in terms of the schemes' overall NPV and benefit-cost ratio.

The other potential synergy – involving the combining of the two bus priority schemes – enables the total cost for the two options to be substantially reduced. However, costs remain significant higher than benefits, such that the net economic benefit (60-year NPV) shows a negative figure of -£8.4m.

The seven individual options have also been combined in order for a total, programme-level calculation of the economic net benefit and benefit-cost ratio to be made. This assumes that the two pairs of schemes outlined above are delivered in combination (Biglis to Dinas Powys plus Merrie Harrier to Pont y Werin; and the two bus priority schemes), and the other three scheme options are delivered separately with results unchanged (noting that for Cosmeston Park & Ride, it is assumed that Sub-option C (Eastbrook) is taken forward as preferred option).

In 60-year NPV terms, the seven scheme options deliver a combined economic benefit of over £26m. However this is significantly lower than the combined cost, of just under £42m. As a result, the programme level economic net benefit shows a negative total of -£15.5m, and a programme level benefit-cost ratio of 0.63.

Recommendations

For the three walking and cycling scheme options, additional benefits relating to public health improvements and increased leisure activity (particularly for Penarth Headland Link), are likely to result in significant additional benefits. While such benefits have not been quantified within this appraisal, it is recommended that such a quantification is undertaken should the scheme options be progressed for further feasibility analysis and development.

For the bus priority schemes, it is considered that significant improvements in connectivity and journey time savings could be achieved by routing additional services over the existing Cardiff Bay Link Road bridge (for which no capital investment would be required). It is recommended that the Vale of Glamorgan council examines this as a lower-cost alternative to the routing of services over Cardiff Barrage.

Appendix A: Road traffic average speeds

[Please see separate attachment – "Appendix A-Road Traffic Average speeds.pdf"]

Source: Arup analysis, based on Trafficmaster data

Appendix B: Detailed scheme feasibility appraisal

B1. Introduction

Included within the scope of this appraisal is an evaluation of the potential feasibility of the following three schemes:

- Cosmeston – Cardiff Barrage bus priority
- Cosmeston Park & Ride
- Cogan Park & Ride

We share the results of the feasibility appraisal in the sections that follow. As indicated previously, for the Cosmeston – Cardiff Barrage and Cosmeston P&R scheme options, it is assumed that Cardiff Council will implement the measures to enable the relevant bus services to operate across Cardiff Barrage.

The feasibility appraisal includes a summary qualitative assessment against specific parameters. For this purpose, the following seven-point scale has been utilised, which draws upon WelTAG appraisal guidance.[51]

Table 40 WelTAG Seven Point Assessment Scale

Large Beneficial	+++
Moderate Beneficial	++
Slight Beneficial	+
Neutral	0
Slight Adverse	-
Moderate Adverse	--
Large Adverse	---

B2. Cosmeston – Cardiff Barrage bus priority

Scheme options

A preliminary feasibility appraisal has been carried out to assess the potential for providing bus priority measures between Cosmeston and Cardiff Barrage. The following four potential alignment sub-options have been assessed:

- Sub-option A: This option looks at a range of bus measures along Westbourne Road, the A4160 Stanwell Road, Clive Place and Paget Terrace/Road which subsequently provides access to Cardiff barrage;

[51] https://beta.gov.wales/welsh-transport-appraisal-guidance-weltag

- Sub-option B: A range of bus measures have been assessed along Lavernock Road, Victoria Road, the A4160 Stanwell Road, along Albert Road, Clive Place as well as Paget Road/Terrace before concluding at Cardiff barrage;
- Sub-option C: This option looks at a range of bus measures along Lavernock Road, Westbourne Road, Raisdale Road, Marine Parade (around 7m in width), Cliff Hill/Cliff Parade and The Esplanade. The route also assesses Albert Road, Clive Place, Paget Road and Paget Terrace; and
- Sub-option D: The option appraises bus priority measures along B4267, Lavernock Road which includes the Merrie Harrier signalised junction with the A4055. The A4160 at Cogan rail station is reviewed as well as Terra Nova Way which leads into the barrage.

Sub-options assessment

A summary of the assessment of each bus route is shown in the table below.

Table 41: Cosmeston - Cardiff Barrage Bus Priority: sub-option feasibility assessment

		Sub-option A	Sub-option B	Sub-option C	Sub-option D
Transport Objectives	Reduce delay and improve journey time for buses	++	+	+	0
	Opportunity for interchange with other public transport services / stops / stations and / or P&R	++	++	+	+++
Operational Effectiveness	Reduce bus operational costs	+	+	+	+
	Allow continuity of bus priority measures that buses can negotiate easily	+	+	+	++
	Measures do not significantly increase delay to general traffic	0	0	0	0
Engineering and Safety Objectives	Is measure geometrically feasible within existing roadspace or with limited road widening	++	++	+	+
	Provide a safe facility for all road users	++	++	++	++
	Impacts on utilities and roadside facilities / infrastructure	—	—	—	–
Deliverability	Land Availability	–	—	–	—
Indicative score		+7	+5	+4	+6

The above assessment suggests that Sub-option A is the preferred sub-option which is considered to best address the existing problems and transport objectives.

B3. Cosmeston Bus Park & Ride facility

Scheme sub-options

A preliminary feasibility appraisal has been carried out to assess the potential for providing a P&R site at Cosmeston (which we refer to as "Sub-option A"). As part of the assessment, we have also looked at two additional sub-options which may be taken forward as alternatives:

- "Sub-option B": Bus Park & Ride facility at Sully
- "Sub-option C": Enhancement of existing rail station Park & Ride facilities.

A summary of the characteristics of each potential sub-option in terms of population catchment and journey distance to Cardiff is provided below within Table 8. This includes:

- Population catchment within 500m: regarded as being within walking distance, hence parking facilities would be less necessary for this population grouping; and
- Population catchment between 500m and 2000m: this is considered to be the population group most likely to use a park & ride facility within the corridor area. Being more than 500m from the facility is likely to attract many users to drive, however any distance beyond 2km may make the diminish the benefit due to driving time required, and also may result in overlap with the 2km catchment of other P&R stations along the corridor.

Table 42: Park & Ride – potential scheme sub-options

	Sub-option A: Bus P&R at Cosmeston	Sub-option B: Bus P&R at Sully	Sub-option C[1]: enhance existing rail P&R facilities
Population Catchment (within 500m)[52]	244	1,187	910
Population Catchment (between 500m and 2000m)[53]	7,864	2,215	7,872
Journey distance to Cardiff (km)	9.6	10.9	6.7
Public transport journey time to Cardiff (minutes)	28[54]	30[55]	23

1. Based on Eastbrook Rail Station as a proxy

[52] Based on Output Area values from 2011 Census data.
[53] Based on Output Area values from 2011 Census data
[54] This assumes accompanying the upgrade of the Cosmeston to Cardiff bus corridor (including operating the bus across Cardiff barrage)
[55] *ibid*

Sub-option A: Cosmeston Bus Park & Ride

This sub-option involves a P&R facility at Cosmeston Lakes Country Park. The site currently comprises a car park with gravel surfacing. The site has good access to the adjacent B4267, with access into / out of the car park via a priority junction.

The location of the site means that the bulk of the population within its catchment would need to travel southwards to the P&R site, prior to travelling northwards to Cardiff by bus.

Sub-option B: Sully Bus Park & Ride

The sub-option focuses on a potential P&R facility towards the eastern extent of the village of Sully, as an alternative to Cosmeston. At this stage, the preferred site would be at the existing Library / Sports and Leisure Club car park. A large land parcel is situated to the south which could be utilised to extend the existing facility in order to enlarge the number of possible spaces. However, this could require a compulsory purchase order (CPO).

The site has good access to the strategic highway network, via the B4267, Lavernock Road accessed via a priority junction.

The site is well situated within Sully which is not served by an existing rail station. However, the total population within a 2km catchment is limited, with few residences outside the village of Sully itself. Much of the village is within 500m (i.e. walking distance) of a bus stop along the B4267, whilst the main population centres to the west of Sully (i.e. eastern Barry) are beyond 2km and also within the catchment of Cadoxton station which offers faster journey times into Cardiff (although car parking spaces at Cadoxton are limited).

Sub-option C: enhancements to existing rail park & ride facilities

As an alternative to a potential bus park & ride facility, the option to enhance existing park & ride facilities at rail stations along the corridor has been assessed.

Key population centres along the corridor are relatively well served by rail stations and services. However, the number of available car parking spaces at most stations is limited. We understand that in some instances, capacity is already insufficient to meet weekday demand (noting this is subject to further investigation / validation).

Enhanced P&R facilities are may mitigate capacity problems, encourage greater park & ride usage, and help reduce road traffic volumes and alleviate congestion.

The final sub-option involves enhancing P&R facilities at the following rail stations, where existing P&R capacity is considered particularly inadequate:

- **Eastbrook Rail Station** - There is possible scope for enhancements at Eastbrook station, where vacant land appears to be available (noting access to the primary road network is restricted from this location);
- **Dinas Powys Rail Station** - The existing Dinas Powys station has no car parking, with minimal on-road parking opportunities available along Station

Road. There may be potential for a limited number of spaces to the northeast of the existing platform directly linking to the A4055; and

- **Barry** - The station currently provides 115 parking spaces and is understood to be at capacity during peak periods. An unoccupied land parcel lies northeast of the existing station car park, which could be utilised for expansion.

Other stations situated within the study area have not been considered for this assessment, predominantly due to the fact that they are constrained in terms of the surrounding road network and land available for expansion.

We note that expanding P&R provision at Cogan rail station will be considered separately as part of the wider feasibility analysis for upgrading the station as a new interchange (see Section 4.4).

There may also be opportunity for the local authority to review the current policy of providing free parking at existing stations. Arguably, this policy has been successful in helping increase rail usage and ensuring high levels of P&R usage. However, the free parking policy does create a number of issues including:

- costs to the council and taxpayers;
- impact on the business case and viability of delivering new P&R sites across the region due to lack of income being generate; and
- lack of incentive for people who live within walking distance of a station to walk / cycle / use the bus rather than drive.

Sub-option assessment

The assessment of the different sub-options, based on the seven-point impact scale, is summarised in the table below.

Table 43: Park & Ride sub-options assessment

		Sub-option A Bus P&R at Cos-meston	Sub-option B: Bus P&R at Sully	Sub-option C: Enhance existing rail P&R	Comment
Transport Objectives	Improve journey time (to Cardiff)	++	++	+++	Journey times by rail quicker than by bus, with approximately four trains per hour operating to Cardiff along The Vale of Glamorgan line.
	Accessibility to/from the primary road network	--	--	+	In general all sub-options have good access to the primary road network. However, the majority of car drivers utilising both bus P&R sites would need to divert from the main A4055 corridor. This would be likely to add journey time and substantially reduce demand.
	Population catchment served by P&R site	0	0	+++	Eastbrook rail station is situated at location with a larger population catchment. Catchment around Sully is limited, whilst the majority

		Sub-option A Bus P&R at Cos-meston	Sub-option B: Bus P&R at Sully	Sub-option C: Enhance existing rail P&R	Comment
					of Cosmeston's catchment is situated to the north of the site.
Operational Effectiveness	Operational cost impact / potential to be served by existing services	+	+	++	Possibility to re-direct or utilise current bus services to serve both of the two bus P&R sites. Sub-option C a preferred sub-option with no alteration to existing train service needed and minimal operating costs impacts once parking expanded.
	Allow continuity of bus priority measures that buses can negotiate easily	++	++	-	Bus priority would enhance ease of access for buses into P&R facilities for Sub-options A and B. Sub-option C may require additional bus manoeuvres due to alterations to station road access.
Engineering and Safety Objectives	Is measure geometrically feasible within existing facility	+	-	-	Improvements to Sub-option A likely possible within the existing boundary, however limited space for major infrastructure works. Sub-option B and C likely to require acquisition of land.
	Provide a safe facility for all road users	+++	+++	+++	Active travel measures to be implemented to enhance access to stations/proposed P&R site, including enhanced footway provision, safe crossing points and cycle parking.
	Impacts on existing roadside facilities / infrastructure	0	0	0	Impact on junctions and existing infrastructure likely to be negligible.
Deliverability	Land Availability	0	—	—	Sub-option B also likely to require compulsory purchase order (CPO), whereas for Sub-option C land available for expanded parking is limited.
Indicative score		**+7**	**+3**	**+8**	

From the above assessment it is concluded that Sub-option C provides a significantly higher benefit in terms of potential utilisation and catchment, and therefore Sub-option C is the preferred sub-option which is considered to best address the existing problems and transport objectives.

B4. Cogan station interchange

Scheme sub-options

The feasibility appraisal for Cogan station interchange draws upon a report completed by WSP | Parsons Brinckerhoff on behalf of Transport for Wales (TfW). This report considered potential re-development, regeneration and enhanced interchange opportunities at Cogan station. Whilst the report provided is not presented as a "final" version, preliminary details have been used to inform the appraisal of P&R sub-options at the station in this study.

Two masterplan sub-options are identified within the WSP feasibility study, with four P&R sub-options, as follows:

- Sub-option 1: Enhancement of P&R facilities including expanded parking provision, improved road access on A4160 Windsor Road, improvements to roundabout capacity and provision of bus and taxi interchange;
- Sub-option 2: Variation on Sub-option 1 to include:
    - A new platform on existing Penarth to Cardiff line
    - Residential development (social housing) on the currently vacant site to the east with underground P&R parking provision
    - Provision of an 'access for all' bridge on the opposing platform (with existing bridge relocated).

Park and Ride Sub-options:

- Sub-option A: Vacant area in the East of the site (168 spaces);
- Sub-option B: Ground level parking on Travis Perkins Site and vacant site in the east of the study area (237 spaces);
- Sub-option C: Multi-storey car park on Travis Perkins site and ground level car parking on vacant site in the east of the study area (302 spaces); and
- Sub-option D: Multi-storey car park on Travis Perkins site and bus interchange provision (152 spaces).

Sub-option assessment

Each of the masterplan sub-options and P&R sub options have been assessed against the sub-option feasibility criteria. Results are shown in the table overleaf.

		Sub-option 1	Sub-option 2	P&R Sub-opt. A	P&R Sub-opt. B	P&R Sub-opt. C	P&R Sub-opt. D
Transport Objectives	Reduce delay and improve journey time for buses	++	+++	+	+	+	+
	Opportunity for interchange with other public transport services / stops / stations and / or P&R	++	+++	++	++	++	+++
Operational Effectiveness	Reduce bus operational costs	0	0	0	0	0	0
	Allow continuity of bus priority measures that buses can negotiate easily	+	+	+	+	+	+
	Measures do not significantly increase delay to general traffic	++	++	+	+	+	+
Engineering and Safety Objectives	Is measure geometrically feasible within existing roadspace or with limited road widening	-	--	-	-	-	-
	Provide a safe facility for all road users	+	++	+	+	+	+
	Impacts on utilities and roadside facilities / infrastructure	-	--	-	-	-	-
Deliverability	Land Availability	-	-	-	---	---	---
Indicative score		+5	+6	+3	+1	+1	+2

It is concluded that Sub-option 2 has significantly higher transport benefits due to the inclusion of an additional platform on the Penarth branch line, effectively doubling the frequency of rail services at the station (4tph on VoG line, and 4tph on Penarth branch), and providing enhanced options for travel/interchange. However, Sub-option 2 does have a number of technical/delivery issues to overcome, including pedestrian access between platforms.

In terms of the sub-options for P&R deliverability, sub-options B-D have a significant deliverability risk due to the requirement to obtain the land currently occupied by a private occupier (Travis Perkins). It is therefore recommended sub-option A is taken forward. Whilst this provides only 168 spaces in total, fewer than sub-options B and C, these additional spaces are sufficient to cover around 93% of total estimated demand (ca. 181 users per day according to Arup estimates – see Section 5.3.4) that the enhanced P&R facility at Cogan is likely to generate.