



A470/M4 Corridor Congestion Study (WelTAG Stage 2) *Outline Business Case Report*

ARUP

Welsh Government

A470/M4 WelTAG Stage 2

**Outline Business Case (Stage 2
WelTAG)**

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It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.



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Contents

	Page
Executive Summary	4
A470 Corridor Preferred Package of Schemes	5
M4 Corridor Preferred Package of Schemes	6
Recommendations for Stage 3	6
Medium-Long Term Concept Schemes	7
1 Introduction	8
1.1 The Brief	8
1.2 WelTAG	8
1.3 Background and Stage 1 Study	9
1.4 Study Approach	11
1.5 Summary of Report Structure	13
2 Strategic Case Context	15
2.1 Overview	15
2.2 Legislation & Policy	15
2.3 Regional Context	19
2.4 Local Context	21
2.5 Corridor Context	23
2.6 Engagement	30
3 Strategic Case Options	33
3.1 The Case for Change	33
3.2 Opportunities	39
3.3 Objectives	40
3.4 Developing a Corridor Strategy	41
3.5 Shortlisting of Design and Concept Options	43
3.6 Shortlisted Options	44
3.7 Options not to be further addressed in this Study	46
3.8 Testing of Future Impact of Concept Public Transport Measures	47
3.9 Priority Design Option Development	48
3.11 Priority Design Option Assessment	68
3.12 Priority Design Preferred Options	72
3.13 Options not to be taken forward in this Study	75
4 Transport Case	77
4.1 Preferred Priority Design Options	77
4.2 Package Approach to Appraisal	79
4.4 Design Option Appraisal	80
4.5 Concept Option Appraisal	91

4.6	Public Transport and Active Travel in Priority Design Schemes	95
4.8	Option Appraisal Summary	97
5	Financial Case	98
5.1	Introduction	98
5.2	Priority Design Scheme Cost Assessment	98
5.4	Concept Schemes Cost Assessment	100
5.5	Sources of Funding	101
5.6	Affordability Summary	101
6	Commercial Case	102
6.1	Priority Design Schemes	102
6.2	Concept Schemes	102
7	Management Case	103
7.1	Collaboration	103
7.2	Realisation of benefits	103
7.3	Key Risks	104
7.4	Delivery and Risk for Concept Public Transport Schemes	106
7.5	Delivery and Risk for Concept Highway Schemes	106
8	Summary and Next Steps	107
8.1	Key Conclusions	107
8.2	A470 Preferred Short-Term Schemes	108
8.3	M4 Preferred Short-Term Schemes	109
8.4	Stage 3 Recommendations	109
8.5	Medium-Long Term Concept Schemes	110

Figures

Figure 1: Study Area

Figure 2: Study Process

Figure 3: A470 Taffs Well signalisation of southbound slip road and improved Active Travel connection

Figure 4: A470 Nantgarw – traffic management and control measures

Figure 5: A470 Upper Boat - Traffic management and control measures

Figure 6: Bus Priority on A470 Nantgarw to Coryton – Southbound Bus Priority on A470 at Coryton

Figure 7: Lane drop/Lane Gain at A470 Nantgarw Interchange

Figure 8: Lane drop/Lane Gain at A470 Taffs Well Interchange

Figure 9: Lane Reallocation southbound and lane gain northbound at A470 Coryton

Figure 10: A470 Southbound to M4 Westbound Link Options

Figure 11: M4 Junction 33 traffic management and control improvement option with additional signalisation and lanes

Figure 12: M4 Junction 33 traffic management and control improvement options with grade-separated links

Figure 13: M4 Junction 33 traffic management and control improvement option with additional gyratory overbridges

Figure 14: M4 Junction 34 traffic management and control improvement option with additional signalisation and lanes and walk/cycle link

Figure 15: M4 Junction 34 traffic management and control improvement option with additional gyratory overbridges

Figure 16: Smart expressway & traffic management measures on the M4 Mainline J33-J34 – Eastbound lane reallocation and westbound lane-gain at Junction 33

Figure 17: Smart expressway and traffic management measures on the M4 Mainline J33-J34 – Eastbound lane reallocation and westbound 4-lane carriageway and lane-drop at Junction 34

Figure 18 WelTAG Seven Point Assessment Scale

Figure 19: A470 Corridor – Preferred Package of Schemes

Figure 20: M4 Corridor – Preferred Package of Schemes

Appendices

Appendix A

Option Shortlisting and Preferred Options

Appendix B

A470 Preferred Options Assessment

Appendix C

M4 Preferred Design Options Assessment

Appendix D

A470 General Arrangement and Junction Improvement Drawings

Appendix E

M4 General Arrangement and Junction Improvement Drawings

Appendix F

Map of Priority Design Schemes and Other Relevant Transport Proposals in Study Corridor

Executive Summary

Arup was commissioned by Welsh Government to undertake a WelTAG Stage Two study to cover the following:

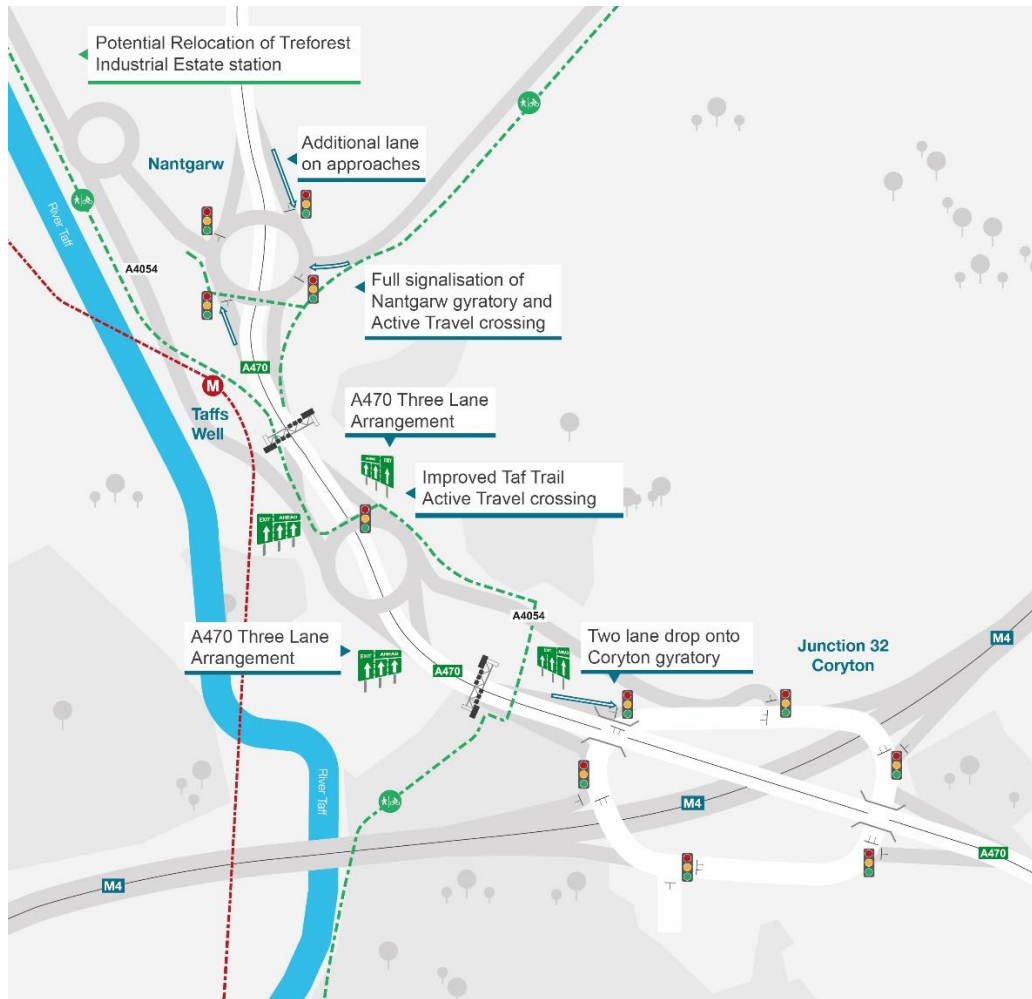
- Identify measures which can be taken forward within the Congestion Pinch Points Programme (subject to Ministerial approval, availability of resources, statutory processes) to tackle road-based congestion at the most severely congested locations on the M4 and A470 trunk roads (J32 – J35, Coryton-Merthyr Tydfil). The Brief was extended to cover integration of public transport initiatives (heavy rail, Metro), and to cover the A4232 and M4 between J33 and J32.
- Identify a preferred programme of schemes/measures which address problems & objectives, have a beneficial Transport Case, and no Delivery, Financial or Commercial deal-breakers, and are deliverable in the short to medium term, and are financially feasible.

Priority schemes for implementation have been identified which should be progressed to a Stage 3 appraisal. Key findings for both the A470 and M4 corridor, on the basis of key WelTAG appraisal criteria, are as follows:

- The problems are significant at present and will be significantly worsened as strategic development proceeds
- The Stage 2 priority interventions align well with delivery and programming opportunities in respect of funding and procurement processes.
- The Stage 2 options are judged to address key Strategic Case criteria (ie. problems and objectives), have an overall beneficial Transport Case, and there are no clear Delivery, Financial or Commercial Case deal-breakers e.g. land ownership constraints, affordability.

The Stage 2 study has identified for both corridors a short-term package of pinch-point schemes, together with potential longer-term public transport measures to form a coherent approach to addressing short-term and longer term problems. The Stage 2 output includes indicative costs, phasing programme and a risk register for priority pinch-point schemes.

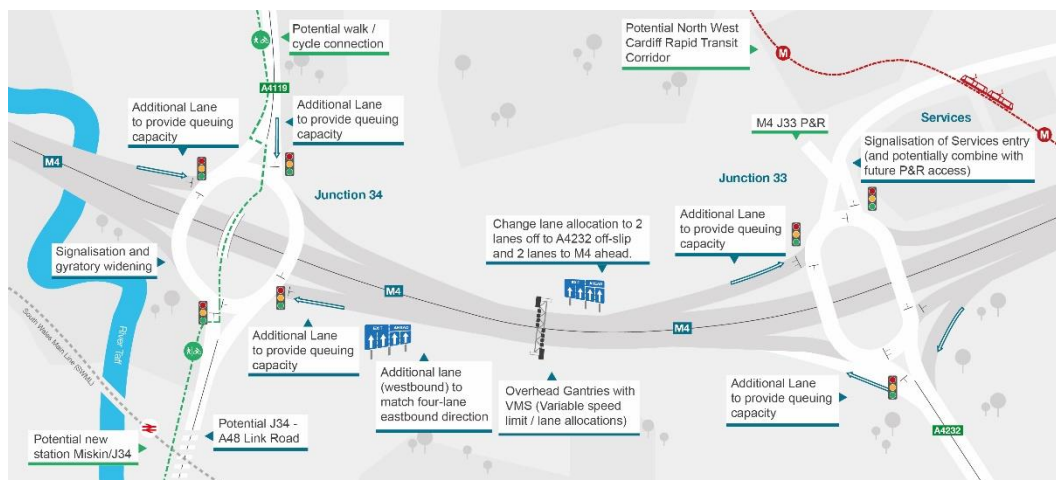
A470 Corridor Preferred Package of Schemes



The following Priority Design schemes for the **A470 corridor** have been identified, and subjected to stakeholder discussion:

- **Nantgarw Interchange:** Signalisation, widening of gyratory/slip road to better manage queues, pedestrian link
- **Taffs Well Interchange:** Signalisation of s/b off-slip and provide National Cycle Network (NCN) crossing;
- **A470 Nantgarw – Taffs Well:** 3 lanes on 2-lane sections Northbound and Southbound
- **A470 Taffs Well – Coryton, Southbound:** Reallocation of lanes from 1-exit/2-ahead to 2-exit/1-ahead, with potential bus priority to Cardiff
- **A470 Taffs Well – Coryton, Northbound:** 3-lanes (narrow) instead of 2-lanes, with lane-gain/lane drop at Coryton and Taffs Well
- **A470 Pontypridd to Coryton:** Reduced Speed Limit to address Air Quality and Safety, with VMS gantry signage on A470
- **Expressway Network Management Plans:** Updated Network Management Plans with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

M4 Corridor Preferred Package of Schemes



The following Priority Design schemes for the **M4 corridor** have been identified, and subjected to stakeholder discussion, as follows:

- **M4 J34 Interchange:** Signalisation and gyratory widening – with or without M4 J34 to A48 Link;
- **M4 J33 Interchange** - Additional signal control and slip road widening
- **M4 J34-J33 mainline carriageway:** Improved lane allocation on eastbound 4-lane carriageway
- **M4 J33-J34 mainline carriageway:** Provide additional lane on existing 3 lanes westbound carriageway
- **ITS solutions on M4 Junction 34 – 32:** Application of ITS facilities and techniques, initially based on VMS gantry signage to provide lane allocation and driver information.
- **Network Management Plans:** Updated Network Management Plans with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

Recommendations for Stage 3

Following the production of the Delivery Plan, it is recommended that a location-specific Stage 3 Full Business Case scheme-level WelTAG study is undertaken which will include.

- Progressing with priority measures design and appraisal with appropriate procurement and full business case to deliver within the short term;
- Informing the Wales Transport Plan (and/or a South East Wales Transport Strategy) to set the vision and pipeline in the longer term; and
- Progressing through the five ways of working including collaboration with key partners to assist funding and governance.

In particular, the Stage 3 appraisal should consist of further detailed investigations on the following:

- Preliminary detailed scheme design;
- Traffic forecasting and modelling;
- Economic appraisal/wider economic impact assessment results;
- Environmental Impact Assessment (and survey) results;
- Non-Motorised User/Active Travel opportunities – to tie-in pinch-point NMU improvements to local authority active travel plans to create seamless connectivity across and along the corridors;
- Further details and information around the Transport Case, Delivery, Financial and Commercial Cases; and
- Air quality monitoring during the development of the design schemes and in operation.

The key outputs from a Stage 3 study would be a preferred initial phase pinch-point scheme capable of being taken forward for implementation in the short-term, together with a programme of implementation for the remainder of the package pinch-point corridor scheme.

Early Delivery Opportunities

Prior to undertaking a Stage 3 Full Business Case Study, Welsh Government has requested that a Pinch Point Delivery Plan is produced as an immediate follow-up to the Stage 2 Study, aimed at identifying a stand-alone early delivery scheme. It is envisaged that an early delivery scheme would comprise of part of the package of pinch-point schemes, and would have delivery characteristics in line with Welsh Government's Congestion Pinch Points Programme timeline and budget.

Medium-Long Term Concept Schemes

The following public transport measures were assessed as having a positive beneficial impact, identified in an initial appraisal, and therefore are recommended for further consideration in separate studies. Based on their high costs and level of complexity they are anticipated to be only deliverable in the medium or long term (at 5+ years).

- Relocation of Treforest Industrial Estate Station to Nantgarw (Metro), with Park & Ride; and
- North West Cardiff Corridor - Rapid Transit Cardiff – Llantrisant;
- M4 J33 Park & Ride.
- Cross-Valley Bus Rapid Transit (Metro Extension) - Pontypool to Llantrisant /Talbot Green;
- New Rail Station – Miskin/Junction 34.

Potential major road schemes were also identified, but would require a separate investigation and business case – as it is not clear from this initial assessment that the schemes would be beneficial – in particular as they may undermine future public transport upgrades by easing the movement of cars.

1 Introduction

1.1 The Brief

Arup was commissioned by the Welsh Government to undertake a WelTAG Stage 2 study (which follows on from the Stage 1 study carried out in 2017) to cover the following:

- Project to tackle road-based congestion at the most severely congested locations on the M4 and A470 trunk roads (M4 J32 – J35, Coryton- Merthyr Tydfil);
- Identify measures which can be taken forward within the Congestion Pinch Points Programme (subject to Ministerial approval, availability of resources, statutory processes);
- Identify a preferred programme of schemes/measures which address problems and objectives, have a beneficial Transport Case, and no Delivery, Financial or Commercial deal-breakers; and
- Identify priority schemes where problems and potential solutions are well-defined, are deliverable in the short term, and are financially feasible.

During the study, the Welsh Government decided to extend the Brief to cover integration of public transport initiatives (heavy rail, Metro etc.), and to cover the A4232 and M4 stretch between M4 J33 and J32.

The study area for development of scheme solutions comprises two corridors, namely:

- The ‘A470 transport corridor’, which is a dual two-lane carriageway between Merthyr Tydfil in the north and Coryton (M4 Junction 32) in the south, and encompasses the principal road/rail corridor in the Cynon Valley through to Hirwaun on the A465; and
- The ‘M4 corridor’, which is a dual three-lane motorway between J33 and 35, with a fourth auxiliary lane on the eastbound carriageway between J33 and J34.

1.2 WelTAG

The Welsh Transport Appraisal Guidance (WelTAG) was first published in 2008¹ and provided guidance for use in the development, appraisal, and evaluation of transport related projects requiring Welsh Government funding. The Welsh Government consulted on revised guidance (‘WelTAG 2017’) between 8 December 2016 and 2 March 2017². The guidance was subsequently adopted in December 2017³.

¹<http://gov.wales/docs/det/policy/140923-weltag-guidance-en.pdf>

² Consultation Document Number: WG29831

(<https://consultations.gov.wales/consultations/welsh-transport-appraisal-guidance-2017>)

³ <https://beta.gov.wales/welsh-transport-appraisal-guidance-weltag>

The Welsh Government has instructed Ove Arup & Partners (Arup) to apply WelTAG 2017 in undertaking its Stage 2 (Outline Business Case) transport appraisal of the A470 corridor between Merthyr Tydfil in the north and Coryton (M4 Junction 32) in the south, and the M4 corridor between M4 J33 and 35.

The outputs produced at the end of each WelTAG 2017 stage are as follows:

- WelTAG Stage Report (this Report) which provides in summary format a description of the problems and objectives, the options developed, and the assessment of options, and recommendations for the next stage of appraisal; and
- WelTAG Impact Assessment Report (IAR), which sets out in a detailed manner the background and evidential material that underpins the options selection and development.

1.3 Background and Stage 1 Study

The A470/M4 Corridor Stage 2 Study aims to develop options to improve transport connectivity and accessibility on the two corridors (see Figure 1). Both of the corridors carry the main regional road and rail connectors and are hence critical to accommodating and supporting development and economic growth aspirations within the Cardiff City Region.

Arup, on behalf of Rhondda Cynon Taf County Borough Council, prepared an A470/M4 Corridor Transport Study WelTAG Stage 1 (Strategic Outline Case) published in July 2017^{4 5}. Stage 1 identified key problems on both corridors, and developed objectives, with stakeholder inputs, drawing on policies and objectives set out in the Wales Transport Strategy, Well-being of Future Generations (Wales) Act (2015), the South East Wales Valleys Local Transport Plan, and other government guidance / policy documents.

Conclusions at Stage 1 were a set of M4 corridor strategy elements as follows:

- Smart Motorway measures on M4;
- Signal control and local road widening at M4 Interchanges;
- Provide Park & Ride hubs with associated access enhancements from/to the M4 with connectivity to wider public transport network;
- Improved Public Transport to Cardiff via North West Cardiff Development (a phase 3 Metro scheme); and
- Traffic control and management measures on A4232.

A set of A470 corridor strategy elements were identified in Stage 1 as follows:

- Localised Traffic Management and Control measures at A470 interchanges;

⁴ A470 Corridor Transport Study, Strategic Outline Case (WelTAG Stage 1), Rhondda Cynon Taf County Borough Council, Arup July 2017

⁵ M4 Corridor Transport Study, Strategic Outline Case (WelTAG Stage 1), Rhondda Cynon Taf County Borough Council, Arup July 2017

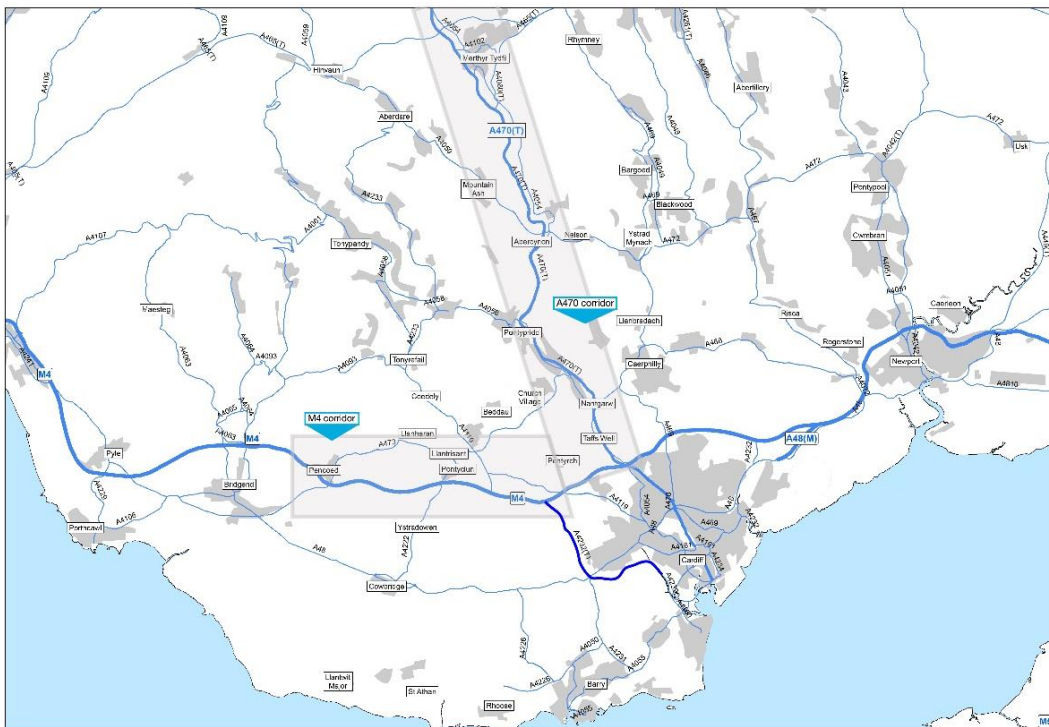
- Smart Expressway measures on A470 corridor;
- Provide new or enhanced Public Transport Hubs and / or Park & Ride hubs; and
- New Bus Rapid Transit cross-valley links (Llantrisant - Pontypridd - Ystrad Mynach – Newbridge – Pontypool; a Phase 3 Metro scheme).

The strategic transport measures identified were in addition to the Metro Phase 2 rail proposals, which involves conversion of the Valleys Lines heavy rail network to a more-frequent and electrified tram-train network – with the aim of underpinning the regional development aspirations set out in the Cardiff Capital City Region ‘City Deal’.

It should be noted the Stage 1 assessment concluded that transport problems and objectives would not be adequately addressed in a Do Nothing or Do Minimum scenario (with Metro in place), and that transport problems represented a potential barrier to strategic development aspirations. This Stage 2 study is therefore based on an assumption that doing ‘nothing’ is not a realistic way forward.

It is also assumed for this Study that ‘non-transport’ solutions are not realistic options, as the study is focused on short-term delivery. For example, mitigation of transport problems by changing land use policies, or altering commuting patterns (e.g. working from home) would only be feasible over the long-term.

Figure 1: Study Area



1.4 Study Approach

1.4.1 Multi-modal and Short/Long term Option Development

Options have been developed in this Stage 2 study which reflects a multi-modal approach and the need to address short and long-term problems, and follows:

- **Multi-modal approach:** The Stage 1 study identified a need for an integrated multi-modal approach to addressing transport-related problems on both corridors. Integration of public transport (heavy rail, Metro) and active travel initiatives has thus been integral to the development of options for this Stage 2 Study.
- **Short or long-term need and implementation:** The options developed have also been considered in respect of their prospective short or long-term need and implementation. For each corridor the proposed solutions have been designated as either short-term **Priority Design** (or Pinch-point) **Options** or longer-term **Concept Options** – which can combine together to form a comprehensive package of measures. The above approach provides an integrated means of addressing problems within the study area and ensures that need for short-term solutions is appropriately balanced against longer term planning, in line with the five ways of working, advocated by the Well-being of Future Generations Act.⁶

For purposes of the Study, the Priority Design Options and Concept Options are defined as follows:

- **Priority Design Options** are considered to have a potentially significant impact on addressing problems directly within study corridors and are likely to be deliverable in the short to medium term (say less than 5 years). Design schemes are focused on small to medium scale interventions to address road-based congestion at the most severely affected locations (as set out in the Brief).

The preferred Priority Design Options identified in this Study are formulated such that they provide a preferred package of measures which together provide a coherent corridor pinch-point solution. The package of pinch-point Priority Design measures can, as part of the Stage 3 Full Business Case study, be subdivided to identify a sub-set of ‘quick-win’ elements for early implementation.

It should be noted that in this Report, the term ‘Priority Design Options’ represents the options for ‘Pinch-point’ solutions referred to in the Brief as *‘measures which can be taken forward within the Congestion Pinch Points Programme’* (the terms ‘Priority Design Options’ and ‘Pinch-point’ measures are used interchangeably in this report).

- **Concept Options** which address corridor problems and objectives have also been identified, based on longer-term proposals that are already under consideration by local and regional authorities. Concept Schemes have been

⁶ Well-being of Future Generations (Wales) Act 2015
<http://www.legislation.gov.uk/anaw/2015/2/section/5/enacted>

subject to high level appraisal proportionate to the level of detail available. Taking forward Concept Options would require further appraisal and investigation of feasibility, costs and impacts beyond the scope of this Study.

It is important to note that the **Priority Design Options** have been formulated such that they are compatible and supportive of longer-term Concept Options.

1.4.2 Study Process

The Study has followed a process of **Long-list ► Shortlist ► Preferred Option** as set out in WelTAG 2017, and illustrated in Figure 2.

The key activities in the study process to identify preferred options are outlined below. The development and assessment of options is underpinned by a range of analysis and modelling tasks, as well as stakeholder engagement, as follows:

- **Strategy Elements:** The outline measures for each corridor are initially developed from the strategy elements identified in the Stage 1 study – and are a mixture of short-term pinch-point type measures and longer-term public transport measures. These strategy elements provide a basis for developing more detailed Priority Design options.
- **Sifting / Shortlisting:** A long-list of options has been produced, consisting of the Strategy Elements from the Stage 1 study and other measures being considered by local authorities and the Cardiff Capital City Region. The short-listing process identifies those measures which match well with Stage 1 Strategy Elements and also address key objectives.

Schemes not to be taken forward in this study are also identified in the shortlisting process, based on their limited impact on addressing corridor problems), limited affordability, non-feasibility within a short-term timeframe, and not directly within the study corridors. These measures are not rejected, but are rather recommended for further consideration in separate processes and assessments outside this study.

- Following the option short-listing, the **Corridor Strategy** is confirmed for each corridor, as the basis for development of outline design of options.
- **Outline Layout Design:** Scale drawings of Priority Designs have been developed to allow the feasibility and effectiveness of a range of options to be assessed.
- **Concept Design:** Concept designs have been devised for longer-term, mainly public transport, measures – sufficient to be able to code routes and frequencies into the SEWTM strategic model to test their impact.
- **Transport Modelling:** A range of analysis has been undertaken to both define and quantify problems. TrafficMaster data has been used to identify congestion hotspots where traffic speeds are very low, accident data has been collated and investigated, strategic SEWTM modelling has been undertaken to assess the regional impact of Priority Design and Concept Design options, and junction capacity analysis modelling has been undertaken to quantify local impacts on delays and queues.

- **Option Assessment:** Options have been assessed in respect of how well they address the corridor problems and objectives, and preferred Priority Design Options identified.
- **Preferred Option Appraisal:** The preferred A470 and M4 packages of Priority Design Options have been appraised in respect of the Environmental, Economic, Social and Cultural impacts – to address the Transport Case.
- **Financial, Commercial & Management Investigations:** The preferred package of Priority Design Options for both the A470 and M4 corridors are appraised in respect of the Financial, Commercial & Management Cases.

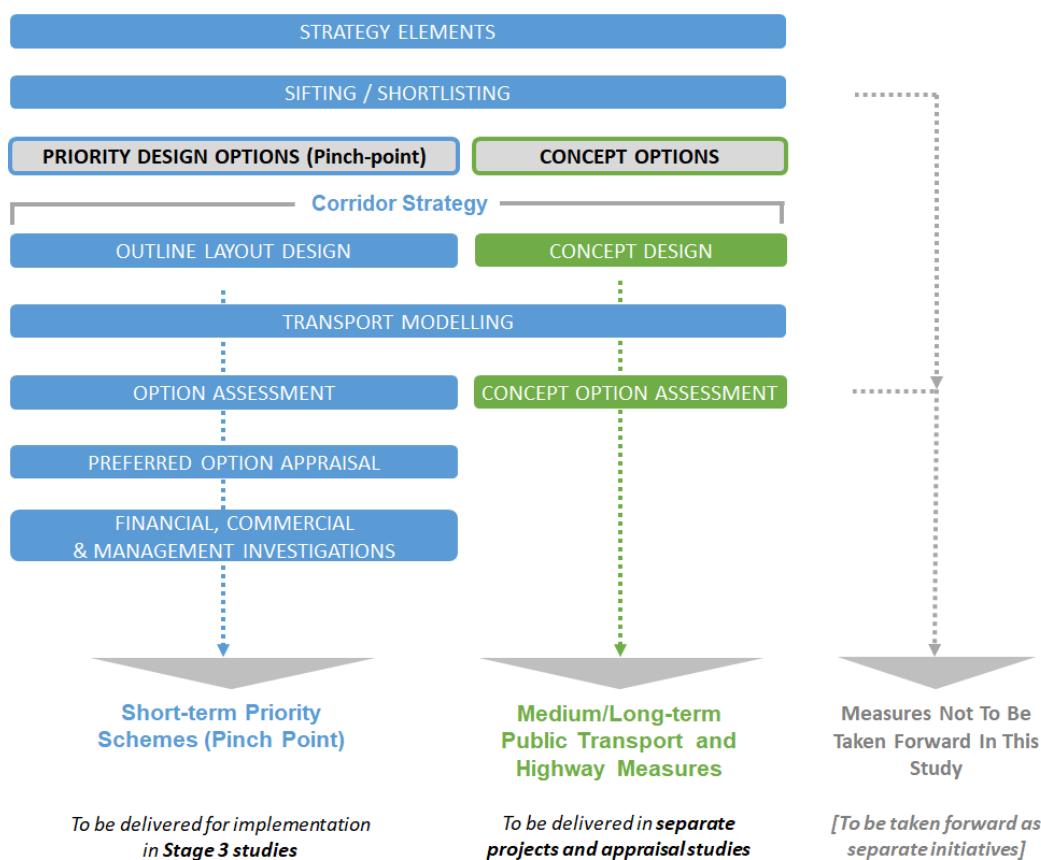


Figure 2: Study Process

1.5 Summary of Report Structure

The remainder of this Stage 2 report is structured as follows:

Section 1 – The remainder of this section provides a brief background to the study and outlines the methodology taken to arrive at the final options presented;

Section 2 – Summarises the Strategic Case context, in respect of policy and local characteristics, including the need for the interventions proposed, the existing problems and study objectives;

Section 3 – Outlines the Strategic Case options for change, including how the options proposed will address the problems and objectives;

Section 4 – Outlines the Transport Case appraisal of the preferred corridor package;

Section 5 – Summarises the Financial Case, including indicative costs and the affordability of the proposed interventions;

Section 6 – Presents the Commercial Case including possible procurement strategies;

Section 7 – Provides the Management Case, which outlines the deliverability of the preferred interventions;

Section 8 - Summarises the final findings of this WelTAG Stage 2 study and outlines the most appropriate next steps to be taken.

The Impact Assessment Report (IAR) sets out in a detailed manner the background and evidential material that underpins the options selection and development, and contains detailed information on existing traffic and travel, information on delays and travel times, option layout drawings, and modelling outputs for scenarios with and without improvements in place.

Whilst the full set of appendices is included within the IAR, for convenience Appendix D and E of this document includes the detailed drawings of the preferred Priority Design ‘Pinch-Point’ options.

Appendices to this Report are as follows:

- Appendix A: Option Shortlisting and Preferred Options
- Appendix B: A470 Preferred Options Assessment
- Appendix C: M4 Preferred Options Assessment
- Appendix D: A470 General Arrangement and Junction Improvement Drawings, and
- Appendix E: M4 General Arrangement and Junction Improvement Drawings
- Appendix F: Map of Priority Design Schemes and Other Relevant Transport Proposals in Study Corridor

2 Strategic Case Context

2.1 Overview

This section sets out the context of the Strategic Case, and provides information on policy and legislative aspects, planning context, and views of stakeholders.

2.2 Legislation & Policy

There are a range of policy documents relevant to this transport study; these are noted in the following paragraphs, and presented in more detail Section 3 of the IAR.

2.2.1 Taking Wales Forward 2016-2021

Taking Wales Forward is the latest Programme for Government and sets out how the Welsh Government will deliver more and better jobs through a stronger, fairer economy, improve and reform its public services, and build a united, connected and sustainable Wales.

It emphasises that the UK withdrawal from the European Union creates some uncertainty and challenges, but the Welsh Government's mandate is clear: The Welsh Government's relentless focus will be on driving improvement in the economy and public services.

2.2.2 Prosperity for All: The National Strategy and its Economic Action Plan

Taking Wales Forward is the latest Programme for Government and this strategy takes those key commitments, places 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 National Strategy explains how although Wales as a whole has grown strongly out of recession, there are areas of the country which have not seen the full benefits of growth. This has left some communities struggling to prosper and feeling isolated from other parts of Wales. Government has a key role in stimulating economic growth in areas of greatest need.

The Action Plan aims to grow the economy and reduce inequality.

2.2.3 Prosperity for All: A Low Carbon Wales

This Plan was published in March 2019 and sets the foundations for Wales to transition to a low carbon nation. The Plan is organised around Sector Emission Pathways, which includes power generation and transport.

In terms of the power sector, the plan identifies the need for low carbon electricity to become the main source of energy in Wales in order to meet targets including for 70% of Wales' electricity consumption to be from renewables by 2030.

In relation to transport, the plan highlights the need to further encourage mode shift to public transport and active travel to reduce carbon emissions in the short term. In the long term, the plan states that Wales will *‘embrace the adoption of zero and ultra-low emission vehicles in an inclusive manner and supported by the necessary investment in charging infrastructure.’*

2.2.4 Well-being of Future Generation (Wales) Act, 2015

The Act⁷ is about improving the social, economic, environmental and cultural well-being of Wales with an overarching aim of creating a Wales we all want to live in, now and in the future. The Act places a duty on public bodies in Wales and those listed in the Act to work to improve the economic, social, environmental and cultural well-being of Wales. To help do this they must set and publish Well-being Objectives and think more about the long term, work better with people and communities and each other, look to prevent problems and take a more joined-up approach.

Well-being Goals



The WellTAG 2017 guidance requires the consideration of the wellbeing goals and ways of working throughout appraisal.

2.2.5 Wales Transport Strategy, 2008

Published in 2008⁸, by the then Welsh Assembly Government, the overarching aim of the Wales Transport Strategy is to promote sustainable transport networks that safeguard the environment whilst strengthening the country's economic and social performance. The strategy has been prepared in the context of the One Wales programme, a progressive agenda for Wales. The strategy sets out a number of policy outcomes, delivered through strategic priorities; these are summarised below.

Reducing environment impacts from transport

Road schemes can contribute positively to reducing environmental impacts. For example, removing congestion by increasing road capacity and making journeys more reliable by providing better overtaking opportunities can reduce CO₂ emissions. In addition, bypassing settlements can remove traffic and improve air quality for existing communities.

Integrating local transport

Tackling congestion and ensuring journey reliability requires an integrated package of solutions that take account of a variety of local factors. This might

⁷ <http://gov.wales/topics/people-and-communities/people/future-generations-act/?lang=en>

⁸ <http://gov.wales/docs/det/publications/140909-transport-strategy-en.pdf>

include improvements to the public transport network, creation of more opportunities for walking and cycling, park and ride facilities and any future potential for road pricing.

Improving safety along transport corridors, by removing heavy traffic flows, can enhance opportunities for sustainable forms of travel, including walking and cycling. This is enshrined in Welsh Governments 'Safe Routes in Communities scheme'.

Improving access between key settlements and sites

The most effective way of improving access to essential services will be to improve links within key settlements and links between key settlements and employment sites and their hinterland. It is the aim of Welsh Government to improve links between north, west and south Wales. Specifically, by improving the reliability of the road system especially between key settlements and employment areas. Bypassing existing settlements can also help address severance and cohesiveness within existing communities.

Increasing safety and security

Reducing the number of road casualties is a priority – with the ultimate aspiration being no casualties. This will be facilitated through the 'Safe Routes in Communities scheme' and is linked to integrating local transport.

2.2.6 National Transport Plan 2010, Finance Plan 2015 and 2017 and 2019 Updates

Published in 2015 by the Welsh Government, the National Transport Finance Plan followed the National Transport Plan 2010 to list the schemes the Welsh Government will deliver across the different areas of transport policy for which it is responsible. The 2015 Plan is not a policy document but provides a framework of schemes pursuant to policy aims set out in the Wales Transport Strategy 2008. Relevant references are:

- In respect of Trunk Roads, adopting a corridor approach, identify where there are resilience issues on the network which justify the need for improvements (Ref. R27); and
- Improving Public Transport links to key sites and services – including (Ref. IT3) improving access to Enterprise Zones and Local Growth Zones.

The National Transport Finance Plan 2017 update identifies new schemes as part of the latest budget agreement which include pinch-point programmes on the M4 J32 to J35 corridor, M4 J35 to J49 corridor and improvements to A470 Corridor (Coryton to Taffs Well).

2.2.7 Planning (Wales) Act, 2015

Whilst the statutory procedures for delivering options recommended through the WelTAG process for this project are still to be determined, WelTAG users must take account of the duties set out in the Planning (Wales) Act 2015.

2.2.8 Planning Policy Wales, 2018

Published in December 2018, the tenth edition of Planning Policy Wales (PPW) sets out the land use planning policies of the Welsh Government. Within the latest edition, a new emphasis is given to the concept of placemaking, in conjunction with a closer alignment with the Well-being of Future Generations (Wales) Act 2015.

Within PPW, sustainable development is defined as *‘the process of improving the economic, social, environmental and cultural well-being of Wales by taking action, in accordance with the sustainable development principle, aimed at achieving the Well-being Goals.’*

It is stated that access to jobs and services through shorter, more efficient and sustainable journeys should be enabled through the planning system. Targeted new infrastructure is shown as an example of how more efficient movement of people can be achieved.

The Transport chapter⁹ emphasises the importance of integration within and between different types of transport, and between transport measures and land use planning. The documents set out the approach to development planning in respect of promoting active travel, supporting public transport, managing traffic and parking, and planning for roads/railways/airports.

It is relevant to note that Section 8.7.4 states that direct access to a motorway or motorway slip road would not be acceptable other than to a motorway service area approved by the Welsh Ministers.

2.2.9 Environment (Wales) Act, 2016

Enacted in 2016 by the National Assembly for Wales, the Environment (Wales) Act 2016 provides an iterative framework that ensures managing natural resources sustainably will be a core consideration in decision-making. Natural Resources Wales are the principal organisational body to help deliver the aims of the Act and are required to prepare several documents, which include:

- State of Natural Resources Report;
- National Natural Resources Policy; and
- Area Statements.

These documents will help inform the design of transport schemes so that they can be delivered in a way that manages natural resources sustainably. The Act also includes provisions to tackle climate change, through statutory emission reduction targets and carbon budgeting to support their delivery.

⁹ Planning Policy Wales, Chapter 8 (<http://gov.wales/docs/desh/publications/161117ppw-chapter-8-en.pdf>)

2.2.10 Active Travel Act 2013 and Interactive Mapping

Enacted in 2013 by the National Assembly for Wales, the Active Travel (Wales) Act 2013 requires legal requirement for local authorities in Wales to map and plan for suitable routes for active travel, and to build and improve their infrastructure for walking and cycling every year. It creates new duties for highways authorities to consider the needs of walkers and cyclists and make better provision for them. It also requires both the Welsh Government and local authorities to promote walking and cycling as a mode of transport so that local communities rely less on cars when making short journeys.

In the context of transport schemes and improvements, there is significant opportunity to reconfigure existing infrastructure so that it better meets the needs of existing and new settlements and facilitates active travel. For example, bypass road schemes can address settlement severance and in doing so provide opportunities for active travel because pedestrians and cyclists would no longer need to compete with significant volumes of vehicular traffic for short journeys in the locality.

As set out in the WeITAG 2017 Supplementary Guidance on legislative context, the Act requires the Welsh Ministers and local authorities to: *‘take reasonable steps to enhance the provision made for walkers and cyclists and to have regard to the needs of walkers and cyclists in the exercise of certain other functions... and to promote active travel journeys and secure new and improved active travel routes and related facilities’*.

The Act makes it a legal requirement for Local Authorities in Wales to map and plan for suitable routes for Active Travel. Section 3.5 of the IAR provides further information.

2.2.11 Welsh Language (Wales) Measure 2011

WeITAG users must adhere to the duties set out in the Welsh Language (Wales) Measure 2011, including compliance with the Welsh Language Standards.

2.3 Regional Context

2.3.1 City Region / City Deal

The Cardiff Capital Region City Deal is a £1.28 billion programme which will help achieve a 5% uplift in the region’s GVA by delivering a range of programmes which will increase connectivity, improve physical and digital infrastructure, as well as regional business governance¹⁰.

Over its lifetime, local partners expect the City Deal to deliver up to 25,000 new jobs and leverage an additional £4 billion of private sector investment.

The City Deal also provides an opportunity to continue tackling the area’s barriers to economic growth by: improving transport connectivity; increasing skill levels

¹⁰ Cardiff Region City Deal (<http://www.cardiffcapitalregioncitydeal.wales/>)

still further; supporting people into work; and giving businesses the support they need to innovate and grow.

This Strategic Outline Case is part of a process to deliver improved transport across the City Region – with City Deal providing a potential source of funding.

2.3.2 South East Wales Metro

Welsh Government's plan, being implemented by Transport for Wales, is to deliver a major upgrade to Public Transport in South East Wales. Phase 1 of the Metro has delivered a range of improvements largely focussed at local stations. Phase 2 of the project is a major upgrade of Valley Lines rail network to a 'Metro' public transport network of high frequency services (operated with electric rolling stock to the north of Cardiff Central). The aims of Metro are to link communities together and help transform the economy, as well as having a positive social, economic and environmental effect. The planned service will be 'turn up and go', with better integration with other modes of transport, including buses, and flexible ticketing options. Key elements of Metro¹¹ include:

- A Metro service that improves journey times and increases frequency to at least four trains per hour from the head of each valley using new trains.
- Introduce new Metro Vehicles with level boarding by December 2022, which will provide a modern metro-style service to the Treherbert, Aberdare and Merthyr valleys.
- Retain the link from Penarth, Barry and Bridgend to destinations north of Cardiff Central using new tri-mode trains (overhead electric, battery and diesel) from December 2023.
- Invest in Cardiff Central station from April 2025, Abergavenny station from April 2023, Chepstow from April 2025 and Merthyr Tydfil from April 2020.
- Build new stations at Crwys Road, Loudoun Square and Cardiff Bay by December 2023, and Gabalfa by 2028, and relocate Treforest Estate station by December 2025 to improve safety and convenience.
- Eliminate diesel use on the Central Metro lines by 2024.
- Provide ticket machines at all South Wales Metro stations by April 2019.
- Introduce pay-as-you-go for users of smartcards by April 2020.

Train service improvements include:

- 4tph between Cardiff and Treherbert from December 2022.
- 4tph between Merthyr Tydfil, Aberdare and Cardiff from December 2022.

Key aspects of Metro's role in improving the economy of South East Wales are:

¹¹ <http://tfw.gov.wales/whats-happening-south-east-wales>

- that it is designed to be extendable, with new stations, new routes, and increased frequencies bringing future better public transport to more communities and economic centres; and
- it will help regeneration through delivering better passenger facilities and community focal points around key stations and stimulate opportunities for more strategic development and regeneration across the region.

Metro will add considerable resilience to the transport network, through improved day-to-day public transport provision, but also with added benefits such as:

- Capacity to meet demand during special events;
- Accessibility improvements through coordination of services, and better facilities for disabled users;
- Reduced emissions through lower car use and more efficient, cleaner transit vehicles powered by sustainably generated electricity;
- Improved reliability in terms of availability and punctuality of services.

The next phase of Metro is being planned, but previously stated aspirations included cross-valley Bus Rapid Transit (between Pontypool and Pontypridd) connecting with north-south Metro rail services.

2.4 Local Context

2.4.1 Local Development Plans

To help understand the local context, it is important to consider the relevant local authority areas within the study area, which include the Vale of Glamorgan, Cardiff, Caerphilly, Bridgend, Merthyr Tydfil and Rhondda Cynon Taf (RCT).

Each has adopted Local Development Plans (LDPs) covering a period between 2006 and 2026, setting out policies of relevance to improving transport connectivity and accessibility across each local authority area. Key strategic site allocations relevant to the A470 and M4 study areas are shown in Table 1.

Table 1: Strategic Development Sites

Location	Land Use	Reference
Cardiff	Mixed Use	A – Cardiff Central Enterprise Zone & Regional Transport Hub
	Housing	B – Former Gas Works, Ferry Road
	Housing	C – North West Cardiff
	Housing	D – North of Junction 33 on M4
	Housing	E – South of Creigiau
	Housing	F – North East Cardiff (West of Pontprennau)
	Housing	G – East of Pontprennau Link Road
	Employment	H – South of St Mellons Business Park
	Mixed Use	St Athan
	Employment	Cardiff Airport
	Employment	Land south of Port Road

Location	Land Use	Reference
Vale of Glamorgan ¹²	Mixed Use	Barry Waterfront
Caerphilly	Employment	Ty Du
Bridgend	Housing	North east Brackla regeneration area
	Housing	Parc Derwen, Bridgend
	Housing	Parc Afon Ewenni, Bridgend
	Housing	Development west of railway line, Pencoed
Merthyr Tydfil	Employment	Hoover (car park)
	Employment	Trago Mills, Merthyr
	Employment	Hoover, Merthyr
RCT	Employment	Coed Ely, Tonyrefail
	Housing	Land at Robertstown
	Housing	Llanilid
	Housing	Farmhill Colliery
	Housing	Phurnacite Plant
	Housing	Cwm Colliery
	Housing	Mwyndy/Talbot Green
	Employment	Land South of Hirwaun
	Housing	Maerdy Colliery

Key developments which will have an influence on travel demand within the corridor area and its periphery are listed in the Impact Assessment Report, together with details of their size and approximate trip generation. The cumulative impact of these developments has been analysed in this Study through use of the SEWTM model – which includes development-related trip growth in future-year scenarios (and for which details are given in the IAR).

2.4.2 Local Transport Plans

Each Local Authority in the study area has also published a Local Transport Plan (LTP) to complement their adopted LDP. These plans identify specific transport interventions proposed within each local authority. A short summary of the relevant measures is outlined below.

- **Vale of Glamorgan:** The Vale of Glamorgan LTP (2015-2030) recognises that a high proportion of journeys by Vale residents are made by car which results in congestion on the strategic highway network. In order to resolve these issues, the plan proposes transport interventions to provide dedicated commuter routes to ease travelling towards the M4.
- **Cardiff:** The Cardiff LTP (2015-2020) references the problems with delays and traffic congestion along the A470. The Plan sets out a number of proposed schemes intended to mitigate these issues including park a ride facilities (J33) and bus lane improvements. On the M4 the plan proposes signal improvements at Junction 30.

¹² N.B. The Vale of Glamorgan strategic allocations are defined solely as 'strategic sites' and as such the land use appearing in column 2 of the above table has been self-determined by report author using professional opinion and the Vale of Glamorgan LDP.

- **Caerphilly, Merthyr Tydfil and RCT:** The above local authorities (along with Blaenau Gwent and Torfaen) have established a joint local transport known as South East Wales Valley Local Transport Plan (Plan Period 2015-2030). The Plan states that that connections to the Cardiff Capital Region and the M4 corridor are crucial to the successful future of the South East Wales Valleys. Options include strategic transport corridor management and new Park & Ride / Park & Share facilities along the A470.
- **Bridgend:** The Bridgend LTP (2015-2030) acknowledges the proximity of many developments within the County to the M4 and the associated traffic congestion that this causes. It also acknowledges that for many of the County's resident's private car travel remains the dominant mode of transport due to poor public transport services. Proposals suggested to alleviate these issues include Improvements to M4 Junction 35 and better Park and Ride provision at existing stations.

2.4.3 Well-being Plans

It should be noted that all local authorities across the study area either have, or are in the process of preparing Well-being Plans, which outline specific Well-being Objectives for the local authority areas and relevant Public Service Boards. The Well-being Plans reflect the overarching national Well-being Goals of the Welsh Government. Given that this is a Welsh Government study; the Welsh Government's Well-being Objectives are considered as part of this appraisal.

2.5 Corridor Context

Through assessment of existing transport data for the A470/M4 corridors, the environmental, social and cultural context of the study area and data investigation and transport modelling the scheme context has been analysed in detail to inform later stages of the study. Further detailed information is contained in the IAR Sections 6, 7, 8, 9 and 10.

2.5.1 Highway Network

Traffic flow data shows that there is significant traffic congestion on both the A470 and M4 corridors during the AM/PM peak hours. Traffic flow data and analysis of speeds and delays (using TrafficMaster data) suggests that congestion is particularly significant at major road junctions and interchanges. These include, the approach to the Coryton interchange and the Nantgarw and Pontypridd interchanges on the A470 corridor, and at J33 (westbound) and the A4232 junction on the M4 corridor.

Congestion in the existing network in turn, has a knock-on impact on journey time variability and reliability along both study corridors. There is a wide variation in journey time for travel on the strategic road network, for example between Nantgarw and Cardiff Bay, data shows that there is wide variation of up to 30 minutes in journey times on different observed journeys, and between Pencoed and Cardiff City Centre there is a 24-minute variation in journey times. This level

of journey time variability indicates that the network is at or near capacity at a number of locations with limited resilience to cope with any increase in flows.

SEWTM analysis (see IAR Section 20) provides conclusions on current congestion as follows:

- **A470 Corridor:** The SEWTM model indicates that all links on the A470 north of Pontypridd operate at less than 70% capacity during typical peak hours. South of Pontypridd, the network is more congested, with some links between 70% and 80% of capacity during the AM peak. During the PM peak, the northbound link from Taffs Well to Nantgarw operates between 80% and 90% of capacity, with most other A470 links south of Pontypridd operating between 70% and 80% of capacity.

The analysis of junction turning movements indicates that the Upper Boat, Nantgarw and Coryton junctions all experience congestion (Volume to Capacity ratio over 80%) during the AM and PM peak hours, with congestion also occurring at Taffs Well during the AM peak.

Further north, the congestion levels at the Treforest Interchange would be expected to operate within manageable levels. A470 junctions north of Treforest Interchange lie outside the Area of Detailed modelling and so cannot be included in this analysis.

The SEWTM analysis suggests that the A470 links are largely operating within capacity during peak periods and that the worst congestion occurs at the junctions along this corridor.

- **M4 Corridor:** The SEWTM model indicates that all M4 links operate at under 80% of capacity. The highest levels of congestion occur on the M4 J33 to J32 eastbound and A4232 southbound during the AM peak. In the PM peak, the reverse is true where the highest levels of congestion occur on the A4232 northbound and the M4 junctions 32 to 33 westbound. The M4 between junctions 33 and 34 westbound is also more congested during the PM peak, which is reflective of high levels of commuter traffic travelling between the A34232 from Cardiff and the A4119.

During the AM peak, the opposite movement is catered for by the fourth lane on the M4 eastbound between junctions 34 and 33. This keeps congestion levels in terms of link capacity at a low level, albeit through the use of very narrow lanes on the mainline motorway.

The analysis of junction turning movements indicates that both Junctions 33 and 34 regularly experience congestion during peak periods. Junction 35 lies outside the Area of Detailed Modelling and so cannot be included in this analysis.

The SEWTM analysis suggests that the M4 links operate within capacity during peak periods and that the worst congestion occurs at Junctions 33 and 34.

2.5.2 Public Transport

There are public transport options on both road (by bus) and rail within the A470 and M4 corridors. Patronage figures on these public transport services are high, particularly by rail, with peak hour rail services (primarily to and from central Cardiff) frequently experiencing overcrowding issues. The implementation of Metro proposals by 2022 is expected to improve overall comfort and passenger experience by implementing higher frequency services.

Evidence suggests that public transport journey times present a significant barrier to further uptake of services. Travel time analysis undertaken shows that almost all journeys take significantly longer by public transport than by car. Typical examples within the AM peak hour are shown below for both the M4 and A470 corridor, indicating that many journeys which take 40-50 minutes by car are well over 60 minutes by public transport – and often around 30 minutes longer. This shows that both the long journey time by public transport, and the comparison with car travel, will generally significantly undermine efforts to attract travellers to public transport.

2.5.3 Corridor-Specific Travel Demand Matrices

SEWTM was used to provide information on what trips currently use the M4 and A470 corridors within the study area.

A470 Corridor

SEWTM data shows that just over 180,000 people travelled on the A470 between the M4 and A465 in a car on a typical weekday in 2015. Just under 10% of daily trips were made during the peak hours. The majority (60%) of people travelled along this route for ‘other’ purposes, although the split by journey purpose varies throughout the day. As would be expected, during the AM peak hour, most trips (58%) are made by people commuting to or from work. During the PM peak, most people were travelling for ‘other’ purposes (53%). This may be due to ‘peak spreading’ during the PM, whereby commuters travel during a longer window of time or it may be due to ‘trip-chaining’ where they leave work and travel to somewhere other than home for ‘other’ purposes

An overview of car travel characteristics is given in Table 2.

	Weekday Person Trips			Percentage Journey Purpose		
Time Period	AM Peak Hour	PM Peak Hour	Average Day	AM Peak Hour	PM Peak Hour	Average Day
Car Business	1,740	1,000	14,710	11%	6%	8%
Car Commute	9,050	6,890	59,210	58%	41%	32%
Car Other	4,870	8,900	110,380	31%	53%	60%
Total Car	15,660	16,790	184,300			
Percentage of Daily Trips	8%	9%				

Table 2: SEWTM Summary of Weekday Person Trips on A470 Corridor (2015)

The trip matrices were also examined to identify where the majority of trips that use the A470 are travelling to or from. The main areas that generate trips on this corridor are summarised in Table 3.

Area	Approximate Proportion of Trips Generated
Cardiff	20%
Pontypridd, Trefforest and Taffs Well	20%
Caerphilly	12%
Merthyr Tydfil	10%
Ystrad Mynach, Bargoed and Hengoed	6%
Abercynon and Mountain Ash	5%
Rhondda Valley	4%

Table 3: SEWTM Summary of Main Origins/Destinations of A470 Trips (2015)

When both ends of the journey were considered, it was found that most people using the A470 were travelling between Pontypridd/Trefforest/Taffs Well and Caerphilly, at around 9% of total daily trips. Of these, 3% were very short trips that had both origin and destination in the Pontypridd/Trefforest/Taffs Well area.

A significant proportion of people (between 6% and 8%) were travelling between Cardiff and Pontypridd/Trefforest/Taffs Well/Caerphilly. This was the case across the whole day and during both peak hours, with no apparent tidality during the peaks.

When public transport trips are taken into account, it can be seen that car is the dominant mode for people travelling along the A470 corridor. The mode share from SEWTM correlates closely to the availability of public transport services, especially the Valley Lines rail network. People travelling between Cardiff and areas served by Valley Lines rail services display the highest proportion of trips made by public transport.

M4 Corridor

SEWTM indicates that around 145,000 people travelled on the M4 between Junctions 33 and 35 on a typical weekday in 2015. Around 10% of the daily trips were made during the peak hours. Half of the people travelling along this section of the M4 were travelling for 'other' purposes, with a third of car travellers commuting to work and the remaining (16%) of people travelling for business reasons. As for the A470, the majority of trips made during the AM peak hour were commuters, whilst during the PM peak the majority of people were travelling for 'other' purposes.

An overview of car travel characteristics is given in Table 4.

	Weekday Person Trips			Percentage Journey Purpose		
Time Period	AM Peak Hour	PM Peak Hour	Average Day	AM Peak Hour	PM Peak Hour	Average Day
Car Business	2,600	1,790	23,180	19%	12%	16%
Car Commute	8,040	6,400	49,980	58%	41%	34%
Car Other	3,280	7,300	72,500	24%	47%	50%
Total Car	13,920	15,500	145,650			
Percentage of Daily Trips	10%	11%				

Table 4: SEWTM Summary of Weekday Person Trips on M4 Corridor (2015)

The trip matrices were also examined to identify where the majority of trips that use this section of the M4 are travelling to or from. The main areas that generate trips on this corridor are summarised in Table 5.

Area	Approximate Proportion of Trips Generated
Cardiff	22%
Bridgend, Porthcawl and Pyle	12%
South West Wales	9%
Llantrisant, Beddau, Church Village and Tonyrefail	8%
Barry and Wenvoe	8%
Newport	7%
Pencoed, Pontyclun and Llanharan	6%

Table 5: SEWTM Summary of Main Origins/Destinations of M4 Trips (2015)

Further analysis suggests that the main component of traffic along the M4 between junctions 35 and 33 is that travelling between the zones that include Llantrisant, Pencoed, Bridgend and South West Wales and Cardiff. This is consistent with the table above.

There is some evidence of tidality during peak hours with movements from those zones in the west to Cardiff accounting for around 11% of trips in the AM peak hour and with those in the opposite, westbound, direction accounting for around 9% of trips. During the PM peak hour the corresponding movements account for around 12% of trips westbound and 8% of trips eastbound.

SEWTM output indicates that car is the dominant mode for people travelling between origins and destinations served by this section of the M4. In most cases, car mode share is well over 90%. Travel to and from Cardiff is the main exception to this, although car still accounts for the vast majority of these journeys as well.

2.5.4 Social, Cultural and Economic Conditions

Analysis of the social, cultural and economic context of the study area¹³ shows that whilst employment rates in the study area are generally high, there are also high rates of outflow commuting, particularly high levels of car ownership and that the private car is the most commonly used mode of transport for commuter journeys (e.g. 80% of commuters in the Vale of Glamorgan travel to work by car). This provides further explanation for the high levels of congestion along the A470/M4 corridors at peak times.

2.5.5 Tourism and Events

Figures show that tourism to Cardiff is increasing year on year with 21.3 million visitors reported in 2017, an increase on 5% on the preceding year¹⁴. Cardiff is a particularly popular destination for major events having hosted Six Nations Rugby, the UEFA Champions League Final and the Volvo Ocean Race, amongst others in the last three years alone. Whilst this is positive from an economic perspective, a lack of resilience within the existing highway network means that the approaches to Cardiff along both the M4 and A470 corridors experience high levels of congestion, and long journey times to travel short distances into the city centre, particularly on major event days. It is therefore considered that addressing existing highway pinch points not only serves to benefit commuter traffic but would also contribute to creating a more prosperous Wales by improving conditions for tourism within Wales and further afield.

2.5.6 Environmental Conditions

There are a number of Air Quality Management Areas (AQMAs) within the study area, which have been declared for exceedances of annual mean NO₂ concentrations. Air Quality therefore needs to be monitored closely to ensure that problems do not worsen.

Additionally, there are several Noise Action Planning Priority Areas within the study area for which mitigation may be required.

It is expected that further information with regards to environmental conditions will be available for WeITAG Stage 3.

2.5.7 Future Transport Commitments

Welsh Government commitments are set out in the National Transport Finance Plan 2018¹⁵, which provides a list of schemes that the Welsh Government will deliver on its own or with partners. The most significant intervention is Metro Phases 1 and 2, which are currently planned for implementation over the period to 2023. The transport measures developed in this study will therefore need to

¹³ Comprising the local authority areas of Bridgend, Cardiff, Caerphilly, Merthyr Tydfil, RCT and Vale of Glamorgan

¹⁴ Cardiff Council (2018) <https://www.cardiffnewsroom.co.uk/releases/c25/18168.html>

¹⁵ <https://gov.wales/sites/default/files/publications/2019-05/national-transport-finance-plan-2018-update.pdf>

consider the short-term pre-Metro situation as well as the longer-term ‘with Metro’ scenario. Relevant references are:

- R6; Junction 33 M4 west / A4232; South dedicated slip road - completed, north dedicated slip road to be constructed.
- R14; Improvements to Five Mile Lane, Vale of Glamorgan; Under construction. Planned completion Summer 2019.
- R30; Intelligent Transport Systems (ITS) and innovative technical solutions will continue to be investigated and rolled out at locations on the network that will provide benefits to the public, freight and those managing the network; New CCTV back office system installed for reliability to view images. New ICT network firewalls and hardware to protect against cybersecurity attacks. Updates planned for new launch of www.trafficwales.com website. Ongoing technology refresh of roadside equipment.
- R27e; A470 Corridor Coryton to Taff's Well Improvements; Range of improvements including major infrastructure improvements to reduce congestion and increase capacity at junctions.
- R27f; A470 Corridor Taff's Well to Merthyr Improvements; Range of improvements including major infrastructure improvements to reduce congestion and increase capacity at junctions.
- R27g; M4 J32 to J35 Corridor; Range of improvements including major infrastructure improvements to reduce congestion and increase capacity at junctions.
- R27h; M4 J35 to J49 Corridor; Range of improvements including major infrastructure improvements to reduce congestion and increase capacity at junctions.
- RI9a; Metro Phase 1 Station Improvement Programme - Line of route: Cardiff to Merthyr Tydfil. Range of station improvements (inc. accessibility) and Park & Ride improvements at all stations on route.
- CCRM10; Metro Phase 2 - Cardiff & Valleys Lines - Extension of platforms to 6 car length - feasibility and business development.
- CCRM 17; Metro Phase 3 - City Centre, City Line and Penarth Line improvements and Bay Line extension.
- NEW 15; Further work to explore possible extensions to the South Wales Metro network, including connecting Maerdy and Rhondda Fach; The Welsh Government has commissioned TfW to further progress the South Wales Metro including the transformation of the Core Valley Lines and the detailed delivery programme is being prepared.

It is assumed that the latter item includes potential cross-valley bus connections – which is referenced in earlier Metro documents¹⁶.

¹⁶ South Wales Metro Programme, Strategic Environmental Assessment, Environmental Report, 20 November 2017

In addition, the Welsh Government Local Transport Fund for 2019-2020¹⁷ includes allocations of funding for a number of measures relevant to the A470 and M4 study corridors (see Table 6).

Table 6: Welsh Government Local Transport Fund for 2019-2020

Area	Funding	Comment
Rhondda Cynon Taf	£1,086,000 £516,000	Active Travel Feasibility work for a new route Church Village - Treforest Industrial estate, Taff Trail – design and minor infrastructure
Rhondda Cynon Taf	£600,000	A4119 Strategic Corridor improvements
Merthyr Tydfil	£3,600,000	Strategic Interchange – Merthyr Tydfil Bus Station; Upgrade of bus station; identified in Long-list
Merthyr Tydfil	£3,500,000	RTA Metro Plus including Pentrebach Metro Station P&R
Cardiff	£206,000	A4119 Corridor Improvement Phase 2D
Cardiff	£670,000	A470 Bus Corridor Improvement; Coryton to Gabalfa
Vale of Glamorgan	£750,000	M4 Junction 34 to Cardiff Airport Transport Network Scheme

Within the M4 study corridor, the western portion of the A473 Llanharan Bypass has been constructed and currently acts as an access road to development areas at Llanilid (and hence has no ‘strategic effect’ in relief of traffic impacts on the existing A473 at Bryncae). The eastern section is currently being planned by RCT but a delivery programme is not in place – and is partially dependent on developer funding.

There are a several other major transport schemes listed in the 2015 LTP document which are currently not firmly programmed.

Local community active travel improvements noted in the LTP have not been considered within this study – and will be brought forward for implementation in accordance with funding availability and technical feasibility.

2.6 Engagement

2.6.1 Review Group

For this study, a Review Group was established at the beginning of the Stage 1 appraisal. This served to help ensure that key stakeholders were identified and could meet on a regular basis to be involved in decision making. As the study progressed to Stage 2, the Stage 2 Review Group members continued to help ensure consistency across all stages of the appraisal process.

In addition, further expertise and experience is provided by Transport for Wales (TfW), who now manage the rail public transport system in Wales. The Stage 2 Review Group consisted of:

- Welsh Government Transport

¹⁷ <https://gov.wales/sites/default/files/publications/2019-05/local-transport-fund-grants-awarded-2019-to-2020.pdf>

- Welsh Government Network Management
- Transport for Wales
- Representative of South East Wales Local Authority Areas
- South Wales Trunk Road Agency
- Arup (study consultants)

Review Group meetings were held as follows:

- Introduction to the study, the proposed programme of works and stakeholder engagement and focus meetings to inform the study.
- Review and agree a list of problems and objectives based on the outcomes of previous development work and in consideration of relevant legislation, policy and guidance.
- Option identification, design and development - to inform the sifting and appraisal process.

2.6.2 Focus Group Stakeholder Meetings

In addition to the Review Group, Arup identified key stakeholders with which focus meetings were held to focus on specific aspects of the study, namely Air Quality, ITS, and Public Transport.

- **Air Quality Focus Meeting:** The project team met with SWTRA, Welsh Government Transport Air Quality representatives and WSP (leading the WeITAG studies into trunk road air quality interventions in Wales) to discuss and better understand current air quality problems in the study areas, in particular relating to the A470 exceedance and proposed transport interventions on the trunk road. Welsh Government's pilot measure includes a temporary 50mph speed limit on the A470, with appropriate signage, and with monitoring using diffusion tubes.
- **ITS and Smart Motorways Focus Meeting:** The project team met with SWTRA and Welsh Government Network Management representatives to discuss and better understand current ITS systems and plans and aspirations for ITS and futureproofing the trunk road network. In summary, existing measures in place on both corridors were discussed including MS4 signage, CCTV and the 50mph speed limit being piloted on the A470, and it was agreed that more speed enforcement systems would be beneficial – but that there are limitations in respect of technology and legal compliances for variable speed limits on the A470 (as a non-motorway road). Future proofing discussions identified that in-car technology may reduce the need for ITS / VMS signage in the medium/long term (15-20 years).
- **Public Transport Focus Meeting:** The project team met with Welsh Government and representatives for the local authorities within the study area in order to update the interested parties on how the study is addressing longer term public transport developments within the study area so that these can be factored in to development of corridor strategies and measures.

2.6.3 Stakeholder Workshops

Workshop 1: Problems, Objectives & Solutions

The workshop was attended by a wide range of attendees, mainly from local authorities and introduced the study and presented the data and trends collated to inform the study. Stakeholders' views about the current problems on the A470/M4 corridors and priorities in terms of study objectives were identified. The shortlist of options identified by WelTAG Stage 1 and Stage 2 work were discussed and feedback gained as to the appropriateness of these options, and any barriers to delivery. Overall, feedback from stakeholders suggested that accessibility and connectivity to a wide range of designations and uses, including for example, transport interchanges, employment and leisure opportunities should be a priority for the study. Workshop participants agreed that a focus for both the A470 and M4 corridors should be modal shift and reducing reliance on private car. This was identified as being the most acute current problem in the study area. As part of this mode shift there needs to be greater choice and resilience in the current network. Although congestion was identified as a current problem, Stakeholders raised the need to consider both current and future scenarios to understand what the transport context may be in the longer-term accounting for social and technological advancements. On the A470 corridor, Stakeholders suggested that options should consider bus priority and active travel measures.

Workshop 2: Preferred Options and Phasing:

The workshop was attended by a wide range of attendees and helped gain stakeholder feedback as to how the shortlisted schemes would perform against the problems, objective and the Well-being Goals, and views on potential phasing of shortlisted schemes. There was general consensus that the Priority Design Pinch-point schemes would be most effectively delivered simultaneously as a package of measures and would be most deliverable in the short term. Stakeholders also agreed that concept public transport schemes and concept highway schemes would be more long term in scope and there would be more barriers to delivery e.g. some schemes would only be deliverable if Metro Phase 2 is put in place first.

2.6.4 Stakeholder Feedback

In addition to feedback received during the workshops, , the consultation process also provided stakeholders and various local authorities with the opportunity to provide written representations to inform the study.

3 Strategic Case Options

3.1 The Case for Change

Rates of commuting and other travel within the M4 and A470 transport corridors are resulting in congestion and unreliable journey times. Strategic development proposals within the City Region will potentially result in worsening transport conditions. Making the Case for Change has involved assessing the current situation and identifying current problems and trends – and in particular identifying future issues likely to arise if no action is taken.

The stakeholder engagement process and data analysis undertaken as part of the WelTAG Stage 1 Study led to the following set of key problems being formulated, representing the need for change:

1. Traffic congestion and unreliable journey times at major road junctions, with potential additional impacts due to major developments;
2. Over-reliance on a few main arteries of the road network for most car travel and hence a lack of resilience when congestion problems occur;
3. High modal use of private car for many journeys and corresponding low (<10%) mode use of public transport – with minimal impact on levels of car traffic flows;
4. Bus public transport journey times are much slower than by car or rail;
5. Reliance on car travel to access Strategic Development Sites;
6. Poor accident records at particular road locations/links;
7. Noise impacts from traffic;
8. High carbon and particulate emissions from transport; and
9. Poor walking and cycling routes to community services, public transport stops and stations, and to employment locations, and severance due to traffic, are barriers to active travel.

The problems listed above were investigated in this Stage 2 Study through analysis of the updated evidence base and in consideration of feedback from the Review Group and stakeholder engagement and were considered to represent well the locational problems on each corridor appropriate for the purposes of this WelTAG Stage 2 study. Conclusions of further analysis of problems are set out in the following sections.

3.1.1 Public Transport Conclusions

Consideration and analysis of public transport data (described in the IAR) indicates the following key conclusions can be drawn for the A470 corridor:

- The Metro rail network will provide a step-change in frequency and capacity, and quality, for movement along the A470 corridor by public transport. The

introduction of new rolling stock will improve the comfort of services and service reliability (including seeking to address overcrowding which is a key issue on the existing network during peak periods). The present provision of relatively frequent rail services to Cardiff from Pontypridd (and to a decreasing extent settlements to the north) results in a relatively significant journey-to-work rail mode-share of over 15% - which should increase with higher frequency and quality Metro rail services in place.

- The 132 Cardiff to Maerdy bus service (four per hour) and T4 Cardiff to Merthyr Tydfil (two per hour) and X4 Cardiff to Abergavenny via Merthyr Tydfil (two per hour) bus services provide an overall frequency of around eight services per hour at the southern section of the A470 – with some lower frequency services travelling on the A4054. However, the relatively poor overall journey time in comparison with car, and very slow bus speeds at peak times (at around 10 mph), indicates that bus priority measures and associated infrastructure are needed to improve bus speed and journey time in order to encourage mode switch from car to bus.
- It is noted that the limited destinations available via public transport (focused mainly on Central Cardiff) currently limit the scope for car journeys to transfer to rail/bus – since journeys from, for example, Pontypridd to north east Cardiff would currently not be convenient due to minimal or no co-ordination (fares and timetables) between rail and bus services.

Key conclusions for the M4 corridor are:

- Rail passenger services at stations in the study area (Pencoed, Llanharan and Pontyclun) have limited frequency (at one/two services per hour) – and hence passenger numbers are much lower than for the A470 corridor (which has higher frequency services). Hence the potential for major mode-shift to rail (through measures such as increased Park & Ride at existing stations) is limited and unlikely to significantly affect current car travel delays. It is hence further concluded that encouraging mode-shift to public transport on the M4 corridor will require a major intervention – which in Stage 1 investigations were based on a Rapid Transit service through North West Cardiff to Talbot Green (via M4 Junction 33) and/or a new rail station near M4 Junction 34, both with Park & Ride.
- The standard of existing bus services is poor in respect of frequency of services (at up to four services per hour for service 122 to Cardiff from Tonypany on the A4119), and journey time (as many journeys which take 40-50 minutes by car are in excess of 60 minutes by public transport). It is concluded that significant mode transfer to public transport will be difficult to achieve without major public transport services and infrastructure improvement.
- The limited destinations served by public transport (focused mainly on Central Cardiff) limits the potential scope for car journeys to transfer to rail/bus – since journeys from, for example, Talbot Green to north-east Cardiff would currently not be convenient due to no co-ordination (fares and timetables) between rail and bus services.

The proportion of journeys-to-work by public transport within the wider M4 corridor is less than 10% (mostly by rail) - which supports a conclusion that encouraging mode-shift to public transport on the M4 corridor will require a major intervention.

3.1.2 Highway Network Traffic Conclusions

For the M4 corridor, key conclusions in respect of highway travel are as follows:

- The M4 between Junction 33 and 35 is well within its link capacity, and hence it is concluded that the observed congestion and delay on the M4 is due to the impacts of downstream junctions and weaving interactions at merge/diverge slip roads.
- There is significant traffic delay on the M4 motorway between Junction 33 and 34 in the eastbound direction, predominantly due to junction capacity on the eastbound slip road to M4 Junction 33; delays also occur at M4 Junction 34 and in particular on the A4119 southbound approach to the junction (in the AM peak);
- Car journey times for trips involving use of the M4 have been observed to vary by up to 50% (increase) over a typical journey time. This illustrates that the M4 corridor is operating at its effective capacity – such that small changes in flows or minor traffic incidents lead to exponential increases in delays.
- Data shows that delays occur at locations outside the core study area, in particular at Culverhouse Cross on the A4232, which illustrates that solving traffic delay problems through location-specific traffic capacity increases could simply transfer delays from the M4 corridor to locations downstream (such as on the outskirts of Cardiff on the A4232).
- Accident rates on the M4 between Junction 33 and Junction 34 are higher than typical averages (based on DfT data) – and hence traffic management measures to improve conditions at merge/diverge weaving locations are likely to be beneficial.

For the A470 corridor, key conclusions in respect of highway travel are as follows:

- The busiest section of the A470, just north of the Coryton Interchange, is operating within its theoretical link capacity, and hence it is concluded that the observed congestion and delay on the A470 is due to the impacts of downstream junctions and weaving interactions at merge/diverge slip roads. This results in delay on the mainline A470 between the Taffs Well and Coryton junctions
- Locations where significant congestion occurs at junctions are at the A470 Nantgarw Junction at the interchange gyratory, at the A470 Upper Boat Junction interchange gyratory arms, at the Pontypridd northern and southern A470 junctions interchange gyratory approach arms, and at the at-grade A470/A4059 signalised gyratory at Abercynon. Congestion on approaches to these junctions often backs up onto the A470 mainline with consequent knock-on delays on the A470.

- Car journey times for trips involving use of the A470 are often 25% - 50% longer than typical. This illustrates that the A470 corridor is operating at its effective capacity – such that small changes in flows or minor traffic incidents lead to exponential increases in delays.
- Delays occur at locations outside the core study area, in particular on the A470 between north Cardiff and Gabalfa, which suggests that solving traffic delay problems through location-specific traffic capacity increases on the A470 could simply transfer delays from the A470 north of the M4 to locations downstream (within the Cardiff urban road network).
- Accident rates on the A470 between the Abercynon and Coryton junctions are higher than typical averages (based on DfT data) – and hence that improved traffic management to improve conditions at merge/diverge weaving locations are likely to be beneficial.

The unreliability of car-based journey times represents an economic impact on drivers as follows:

- Many drivers will travel earlier than they would wish in order to provide a time buffer in case of long delays (which occur on a regular basis);
- Driver Stress¹⁸ also occurs in cases where driver's inability to drive at a speed consistent with his or her own wishes in relation to the general standard of the road. Congestion can lead to frustration by creating a situation in which the driver does not feel in control, especially when he or she wishes to arrive at a destination by a particular time but is held up by traffic congestion whose duration cannot be determined/influenced.

There is a particular issue in respect of mainline (A470 and M4) lane allocations to diverging and straight-ahead traffic – in comparison with flows. In both cases, flows leaving the mainline are relatively high, but are only allocated the inside (nearside) lane, which is considered to result in some weaving congestion in the nearside lane. Flow data from SEWTM suggests that the diverge and mainline flow movements are as follows:

- On the A470, of the 3,400 vehicles per hour travelling southbound on the A470 towards J32 Coryton, around 2,400 (or approximately 70%) leave via the Coryton Interchange off-slip, with less than 1,000 travelling ahead via the A470 into Cardiff. This does not match well with the A470 lane allocations, which provides a 1-lane off-slip approach, and 2 lanes ahead to Cardiff (but with lane markings indicating the central lane can be used to diverge or travel straight ahead).
- Of the vehicles merging onto the A470 (southbound) from Taffs Well, the majority then use the off-slip to the M4 J32 Coryton gyratory (711 exit/ 198 ahead in the AM, and 325 exit/179 ahead in the PM);
- On the M4 (travelling between Junction 34 and 33), around 3,200 vehicles travel eastbound (in the AM peak) along the M4 past J33, whereas around 1,700 vehicles per hour leave the M4 at Junction 33 (predominantly travelling

¹⁸ DMRB Volume 11, Section 3, Part 9, Vehicle Travellers

to the A4232). This can be compared to the single-lane allocation on the M4 eastbound for the J33 off-slip, and a three-lane allocation for through traffic. It is relevant to note that on the M4 approaching J32 at Coryton, eastbound flows similar to those approaching J33 in the AM peak are allocated a two-lane exit to Coryton J32, and a two-lane allocation for through traffic;

- Between M4 J34 and J33 within the AM peak hour, a similar number of vehicles (around 700 vehicles per hour) travel from the A4119 (at M4 J34) to the A4232 (via M4 J33) as travel eastwards along the M4 towards J32;
- Between M4 J33 and J34 within the PM peak hour, around 750 vehicles travel along the A4232 onto the M4 westbound and diverge onto the J34 gyratory. This is compared to around 1,050 vehicles which travel along the same route but continue westbound along the M4 towards J35.

3.1.3 Mode share on Corridor Screenlines

The South East Wales Transport Model (SEWTM) was used to provide information on existing (2015) travel patterns within the study area. Screen line data from SEWTM indicates that although car mode share is significantly higher than public transport along the A470 corridor (at over 80%), there is significant rail use – at nearly 20% in the peak direction in the morning and evening peak hour. Bus use along the A470 appears to be low, with only up to 4% of those travelling along the A470 at the chosen screenlines doing so by bus.

On the M4 corridor, screenline data provides a comparison of the person trips made by car and public transport between Junctions 34 and 33 on the M4 corridor. Car mode share is significantly higher than public transport, varying between 81% and 85% within the morning and between 85% and 94% in the evening peak hour. There is a significant volume of car traffic commuting eastbound (towards the Cardiff area) in the AM peak and a returning tidal flow travelling westbound in the PM peak. The bus mode share figures presented for the M4 corridor are low, ranging between 0% and 2%, but with a relatively significant rail mode share of nearly 20% in the Cardiff-bound direction in the AM peak.

It is concluded that:

- On the A470 corridor, the relatively high (nearly 20%) rail mode share indicates that improved access and usage of rail offers the most likely means of reducing car mode share. The low bus mode-share indicates that even with significant increased proportionate bus use, the impact on traffic levels is unlikely to be significant i.e. a 50% increase in bus use might represent only a 1-2% increase in overall bus mode share.
- On the M4 corridor, there is low usage of public transport locally for journey-to-work purposes, although the mainline rail carries up to 20% of movements on the M4 J33-J34 screenline. Significant mode shift to public transport is thus likely to be only achievable through increased service frequency and quality of heavy rail services (plus local stations), which will mainly attract long distance movements, plus a local high-quality public transport service such as the proposed North-West Cardiff Rapid Transit Metro extension.

3.1.4 Future Forecasts of Traffic and Travel

The 2026 Do Minimum SEWTM forecasts have been analysed to provide an indication of how travel behaviours and traffic characteristics are likely to change compared to 2015. The key findings are (set out in the IAR):

- Trips made by car are forecast to increase by approximately 10% within South East Wales;
- This growth is expected to be more concentrated on the A470 and M4 corridors, with growth typically exceeding 10%;
- Congestion levels are expected to increase on both the A470 and M4 corridors, based on volume to capacity ratios;
- Traffic patterns, in terms of trip origins and destinations, and journey purpose according to time period are not expected to change significantly;
- Growth in rail trips is expected to be higher than that for car across the whole of South East Wales. This is particularly evident on the A470 corridor due to the Metro Phase 2 schemes; and
- On the A470 corridor, the rail mode use increases significantly, by around 15-20% (compared to present day) – but as a proportion of the total movement only increases by around 2%. Mode share on the M4 is not expected to change significantly between 2015 and 2026.

3.1.5 Environmental issues

Key issues are identified as follows:

- There is only one section of road within the study corridors which is currently predicted to exceed the $40\mu\text{g m}^3$ annual mean NO_2 limit, on the A470 between Upper Boat and Pontypridd (and there are no other links on the A470 or M4 corridor which are exceeding or expected to exceed the EU limit in the future); it is predicted by PCM to be $43.9\mu\text{g/m}^3$ in 2019. Welsh Government put in place a temporary 50mph zone on the A470 between Upper Boat and Pontypridd in 2018, aimed at achieving compliance with the annual mean NO_2 limit in the shortest possible time. The 50mph zone has been in operation since 2018 and there has been air quality monitoring implemented to track if the zones are effective – the results of which are presently not published. This 50mph zone between Upper Boat and Pontypridd has been considered in the development of options for interventions in this WelTAG study.
- It is likely that on both the A470 and M4 corridors, projected increases (due mainly to travel generated by strategic development) in vehicular traffic will result in increased vehicle noise. Welsh Government has identified a number of Noise Action Planning Priority areas, a number of which are on the A470 and M4 corridors. Following identification of preferred corridor schemes in this Stage 2 assessment, further detailed assessment of the impact of individual schemes (or packages of schemes) on the noise environment will be required during the Stage 3 WelTAG investigations.

For both air quality and noise, the present problems on local and regional roads are likely to be exacerbated by traffic choosing not to use the trunk road routes due to congestion at access points to the A470 and M4, and instead travelling via local routes.

3.2 Opportunities

There are opportunities to create synergies between current transport and development plans and potential transport interventions arising from this WellTAG study; these opportunities are set out below:

- **Metro:** The planned Metro system will provide a step-change in opportunities for travel behaviour with much less reliance on use of private cars. Even at locations away from the core Metro stations, there are likely to be opportunities to provide feeder bus services and/or Park & Ride facilities such that the whole region will benefit from improved accessibility by non-car modes.

Hence, transport proposals identified in this study should be fully compatible with, and support, the Metro strategy; for example, road-based improvements should improve linkage with Metro stations (to enhance Park & Ride opportunities) and/or assist bus movement.

- **Local travel from/to new employment and housing developments:** Strategic development within and adjacent to the M4 corridor should result in less reliance on long-distance travel for employment. Increasing the proportion of trips with origins and destinations within the local area (e.g. within the area of Rhondda Cynon Taf/Bridgend/Vale of Glamorgan) should reduce pressure on the congested M4 corridor.
- **Active travel associated with any new schemes or developments:** It is vital that new transport schemes (or services) are formulated such that they include high quality active travel links and facilities. For example, road-based improvements should include safe and convenient routes for travel on foot or by bicycle, new or upgraded public transport hubs should include convenient and safe access routes and facilities, and new developments should similarly include pedestrian and cycle access routes and facilities (such as cycle hire and cycle parking) both to and within development areas.

3.3 Objectives

3.3.1 Stage 1 Objectives

A detailed set of objectives were developed on the basis of:

- Review of problems identified in stakeholder discussions and investigated through review and analysis of transport data in respect of delays, travel time, mode-share etc;
- Draft objectives discussed at the stakeholder workshop meeting; and
- Alignment with previous Local Transport Plan objectives.

The finalised corridor objectives derived from the above process are summarised below.

- To reduce the number of road traffic accidents at hotspot locations;
- To improve walking and cycling connectivity to stations, bus stops, and development sites;
- To improve connectivity to transport hubs (P&R, Bus-Bus, Bus-Rail);
- To improve the opportunity for all to make journeys to key destinations (services, education, employment, leisure);
- To manage and control traffic congestion and improve the resilience of the transport network;
- To reduce carbon emissions, noise effects, and particulate emissions from transport; and
- To improve sustainable accessibility to strategic developments.

3.3.2 Well Being objectives

A review of the objectives was undertaken against the Well-being Goals as presented within the 2015 Well-being of Future Generations Act to ensure that they align with the wider sustainable development principle of the Welsh Government and consider the needs of Wales' future generations.

WellTAG 2017 Supplementary Guidance sets out that:

“When using WellTAG it is essential to comply with the duties set out in the Well-being of Future Generations (Wales) Act 2015. They are to follow the sustainable development principle through following the five ways of working and set Well-being Objectives that maximise contribution to the seven Well-being Goals.”

As noted in section 2.2.4, the Well-being of Future Generations Act places a duty on public bodies in Wales, including Welsh Ministers, to carry out sustainable development. This means that each public body must work to improve the economic, social, environmental and cultural well-being of Wales. To do this they

must set and publish Well-being Objectives designed to maximise their contribution to each of the seven Well-being Goals.

Although the legislation does not require a compliance-based exercise for individual projects, it is important that any solution progressed through this study is arrived at considering the Well-being Goals, Well-being Objectives and taking into account the five ways of working.

It is clear that a positive contribution to a Well-being Objective would align to the cross-cutting strategies and result in a positive contribution to one or more of the Well-being Goals.

The objectives of this Stage 2 study are considered to help the Welsh Government contribute to meeting its Well-being Objectives as follows:

- a. Improving journey time reliability and benefiting strategic A470/M4 traffic would contribute positively towards improving the movement of people and goods. That in turn would benefit access to communities, employment areas and opportunities, facilities and services.
- b. Encouraging economic activity by reducing transport related barriers to shoppers, tourists and other visitors would contribute positively to economic prosperity, sustainable growth and creating resilient communities. In turn that would help protect Wales' place in the world.
- c. Improving transport conditions would help connect young people to access employment, cultural, skills training and educational opportunities, contributing positively to helping them make the most of their potential.
- d. Reducing the risk of accidents and incidents, whilst improving journey time reliability to services including healthcare facilities, would contribute positively to health and wellbeing.
- e. Improving accessibility and connectivity between key destinations by all modes, in turn reducing the reliability on the car, would contribute positively to delivering modern and connected infrastructure as well as helping address regional inequality.
- f. Improving environmental and associated human health conditions including air quality, vehicle emissions and pollution caused by transport would contribute positively to tackling climate change and protecting Wales' place in the world.

The Well-being matrix developed, can be viewed in Section 15.2 of the IAR.

3.4 Developing a Corridor Strategy

Following the Stage 1 study, further review of problems and objectives and stakeholder engagement led to development of an 'emerging corridor strategy' for both corridors; these corridor strategies were an essential building block to devising a coherent set of short and long-term measures. It should be noted the Stage 1 assessment concluded that transport problems and objectives would not be adequately addressed in a Do Minimum scenario (with Metro in place), and that

transport problems represented a potential barrier to strategic development aspirations. This Stage 2 study is therefore based on an assumption that doing nothing beyond what is currently committed is not a realistic way forward.

3.4.1 A470 Emerging Strategy

For the A470 corridor, detailed analysis of problems concluded that:

- Fully addressing current traffic delays, and crucially, likely future delays with strategic development in place, will require some mode-shift to public transport on the A470 corridor through encouraging car travellers to switch to using the Metro network. The Metro network will provide a high capacity and high-quality service and a combination of feeder bus services, improved access to station on foot and by bicycle, and enhanced Park & Ride at stations would be likely to address to some degree corridor problems such as congestion and resilience; and
- In addition, road-based measures on the A470 (focused on junctions) are likely to be needed (even with some mode shift to public transport) to manage traffic impacts, and air quality problems in particular, and to ensure the resilience of the transport network.

The emerging elements of the A470 corridor strategy were identified as follows:

Public transport orientated elements:	<ul style="list-style-type: none"> ■ The Metro Rail network RCT and Merthyr Tydfil to central Cardiff and other major destinations in South East Wales (including via P&R). ■ Major P&R provision at Metro Stations accessed from the A470. ■ Bus Rapid Transit services (as a Metro extension) connecting cross-valleys (Pontypridd - Ystrad Mynach – Newbridge – Pontypool), extended to Talbot Green.
Highway orientated elements:	<ul style="list-style-type: none"> ■ Major traffic management and control measures at A470 Interchanges (Taffs Well, Nantgarw in particular). ■ SMART Expressway traffic management and control measures on the A470.
Supporting measures adjacent to the A470 corridor:	<ul style="list-style-type: none"> ■ Local bus service re-orientation to serve Metro Stations. ■ Localised road improvements and bus priority on major side roads. ■ Active travel improvements built in to all road-based improvement measures and into public transport measures.

3.4.2 M4 Emerging Strategy

For the M4 corridor, detailed analysis of problems concluded that:

- Fully addressing current traffic delays, and crucially, likely future delays with strategic development in place, will require encouraging mode-shift to public transport on the M4 corridor through major interventions; that is, incremental

improvements of existing bus and rail services are unlikely to result in sufficient mode-shift to address corridor problems and congestion in particular.

- In addition, road-based measures on the M4 (focused on junctions) are likely to be needed (even with some mode shift to public transport) to enable traffic impacts, and air quality problems in particular, to be managed in future within a resilient network.

The emerging elements of the M4 corridor strategy were identified as follows:

Public transport orientated elements:	<ul style="list-style-type: none"> ■ High quality 'mass transit' public transport (as a Metro extension) – including P&R provision – routed from the south-west of RCT to central Cardiff (with P&R at J33). ■ A new heavy rail station directly accessible from the M4 at J34 – including P&R provision. ■ Bus Rapid Transit services (as a Metro extension) connecting cross-valleys (Pontypridd - Ystrad Mynach – Newbridge – Pontypool), extended to Talbot Green.
Highway orientated elements:	<ul style="list-style-type: none"> ■ Major traffic management and control measures at M4 Interchanges (J33 and J34). ■ SMART Motorway traffic management and control measures on the M4.
Supporting measures adjacent to the M4 corridor:	<ul style="list-style-type: none"> ■ Local bus service re-orientation to serve Heavy Rail and future Rapid Transit Metro Extension Stations. ■ Localised road improvements and bus priority on major side roads. ■ Active travel improvements built in to all road-based improvement measures and into public transport measures.

3.5 Shortlisting of Design and Concept Options

This study focuses on identifying priority schemes for an accelerated delivery process. In order to ensure all potential measures are assessed for their suitability, the corridor strategies (as described in Section 3.4) have been combined with a range of other proposed transport schemes potentially relevant to the A470 and M4 corridors, mainly promoted by local authorities, and which are presently not committed. Through stakeholder engagement, these local authority proposals have been identified – many of which are station upgrades and Park and Ride proposals – to create a 'Long List' of potential measures. Proposals have been identified from the following sources:

- Cardiff Capital City Region (CCCR) Regional Transport Authority;
- Cardiff Council Local Development Plan (LDP);
- A470 Pontypridd – WelTAG Stage 2 Report (Welsh Government/WSP);

- A470 Bus Priority – Preliminary Feasibility Study (Welsh Government);
- Strategy elements outlined in the M4/A470 Stage 1 WelTAG study.

The resulting long-list of schemes and measures (i.e. the Stage 2 emerging strategy elements and local authority schemes) has been subject to checking/sifting, to identify priority measures for addressing corridor problems. This high-level assessment of the long-list considered the impact of each measure on the corridor problems and objectives and likely delivery timescale. The long-list assessment process sifted the measures into three categories - a Priority Design Scheme Option, a Concept Scheme Option, or an option not to be taken forward in this Study. The option assessment results are shown in detail in Appendix 4.1.

The definitions of Priority Design and Concept Options for purposes of identifying preferred options are as follows (and as set out in the report introduction in Section 1.4):

- **Design Options:** Considered to have a potentially significant impact on addressing problems, is within the corridor, and is likely to be deliverable in the short-medium term, and hence will be taken forward in this study as a priority Design Scheme Option. Modelling of these schemes is based on capacity modelling (using LinSig) and by testing an overall package at a strategic level using SEWTM;
- **Concept Options:** Considered to have a likely significant impact on addressing problems, is within or partially within the corridor; however, is likely to only be fully deliverable in the medium/long term, and hence will be considered as a Concept Scheme Option only in this study (i.e. not subject to preliminary design) – and will thereafter be considered for further development by local and/or national transport authorities. Modelling of public transport concept options is based on coding of concept schemes into the SEWTM model to assess their impact e.g. approximate alignment and timetable details. Modelling of long-term concept highway schemes is not undertaken in this study.

3.6 Shortlisted Options

Based on the process set out in Section 3.5, a number of scheme options were identified as priority measures for further outline design optioneering, and other schemes were selected for further consideration as medium-long term concept options (but not to be subject to design considerations in this study). The short-listed priority and concept measures are set out in the following paragraphs.

Shortlisted Priority Design Scheme Options: For the A470 and M4 corridors, the following schemes are taken forward for further option design development and assessment against more detailed localised objectives. Modelling of these schemes is based on capacity modelling (using LinSig), and also testing of the impact of the overall package is modelled at a strategic level using SEWTM.

Priority Design Scheme options in the A470 corridor are:

- Speed limit reduction to 50mph (or 40pmh) as an extension of trial 50mph Air Quality scheme on A470 at Pontypridd;
- Smart expressway and traffic management measures on the A470 South (Abercynon to Coryton);
- Major traffic management and control measures at A470 Nantgarw Interchange;
- Major traffic management and control measures at A470 Taffs Well Interchange;
- Major traffic management and control measures at A470 Coryton Interchange;
- Major traffic management and control measures at A470 Upper Boat Interchange; and
- A470 Bus Priority (Nantgarw to Coryton).

In the M4 corridor:

- Smart motorway & traffic management measures on the M4;
- Major traffic management and control measures at M4 J34 interchange; and
- Major traffic management and control measures at M4 J33 interchange.

Each of the above options has been developed into a range of scheme elements – which are described in Section 0.

For both corridors, stakeholder engagement has also identified that updating network management plans would be beneficial in respect of improving resilience and underpinning traffic management measures to provide travellers with more reliable journey times, as follows:

- Expressway Network Management Plans for the A470, with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience
- Network Management Plans for the M4, with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

Short-listed Concept Scheme Options: The schemes listed below are considered to be medium / long term measures and are taken forward at a concept level to assess their in-principle effect on problems, and also to enable judgements to be made as to whether longer term measures would obviate the need for short-term pinch-point measures. Strategic transport modelling (using SEWTM) of Concept Public Transport Options has been carried out in this Study to test their impact, based on coding approximate alignment, station location, and timetable details into the SEWTM model (see Section IAR Section 20).

Concept public transport measures are:

- **North West Cardiff Corridor Rapid Transit (Metro extension) Cardiff – Llantrisant:** This is a Metro Phase 3 proposal, which is presently not committed, for a bus or light rail rapid transit system serving the corridor from

Central Cardiff via North West Cardiff/Creigiau to Rhondda Cynon Taf. A rapid transit (Bus Rapid Transit or Light Rail) connection between Cardiff and the areas to the north of the M4 corridors and would significantly boost the overall accessibility of this area, facilitate the sustainable development of several major LDP allocated sites, would provide an alternative to car travel, with consequent benefits in terms of reducing road congestion and enhancing resilience of the transport network.

- **M4 J33 P&R:** A Park & Ride service, based on travel via the North West Cardiff Corridor Rapid Transit (noted above), would provide an attractive and reliable alternative to car travel into Cardiff from the west on the M4.
- **Cross-Valley Bus Rapid Transit services (as a Metro extension) connecting cross-valleys (Pontypool – Newbridge – Ystrad Mynach – Pontypridd) extending to Talbot Green:** The original Metro strategy stated that “*consideration will be given to bus rapid transit (BRT) on the network. Initial work suggests that BRT may be the answer on key corridors of lower demand where rail would be too expensive. This could include urban routes and some cross-valley connectivity.*” A cross-valley connection would significantly boost overall accessibility in the mid-Valleys area, and would provide an alternative to car travel, with consequent benefits in terms of reducing road congestion and enhancing resilience of the transport network.
- **Relocation of Treforest Industrial Estate Station to Nantgarw:** A new station, as part of Metro upgrades, is planned to increase public transport connectivity of employment and education destinations at Nantgarw and provide an attractive alternative to car travel. The new station offers the potential for a strategic Park & Ride facility on the Metro network between Pontypridd and Cardiff – and Nantgarw is a potential location;
- **New Rail Station – Miskin/Junction 34:** A new rail station on the South Wales Main Line SWML in the vicinity of M4 Junction 34 would provide a potential Park & Ride location for M4 traffic (with onward travel to Cardiff and Swansea and beyond).

Concept highway schemes: In respect of longer-term highway schemes, the potential for a new road link to connect A4119 north of J34 and the A4232 south of J33 has been assessed qualitatively.

These Concept Options have not been subject to option design development and are instead addressed at a high level in respect of the Transport Case appraisal (see Section 4) – and hence would need to be considered as separate investigations and business case processes.

3.7 Options not to be further addressed in this Study

Measures which do not match the criteria for Design Scheme Option or Concept Scheme Option are not taken forward for further investigation in this Study i.e. they do not have a significant impact as a stand-alone scheme, are not in the study corridor, or are likely to be only deliverable in the longer term and therefore are outside of the scope of this study.

These schemes should be considered outside this Study, as appropriate, by local or national transport authorities. In particular, many of the schemes are rail and bus hub upgrades associated with the South East Wales Metro project, under the auspices of Transport for Wales.

Options identified as not to be further addressed in this study are summarised as follows (and are listed in detail in Appendix A):

- Station upgrades on Metro rail network (as these were unlikely to significantly address current corridor problems);
- Highway improvements and bus corridor improvements on the County road network (mainly in RCT CBC) – as these were not directly within the study corridors and would be unlikely to significantly address current A470 or M4 corridor problems; and
- Particular schemes which are already subject to current WelTAG studies, including the A470 Swansea Road (Trago Mills) roundabout traffic management scheme (which has been investigated in a separate WelTAG Stage 2 Study for Welsh Government), and the Vale of Glamorgan's M4 J34 to A48 road link (which has been subject to Stage 2 assessment), and as such, these schemes are not taken forward as Priority Design Options in this study.

3.8 Testing of Future Impact of Concept Public Transport Measures

SEWTM was used to model a future (2026) scenario with the Concept Public Transport Options in place, representing large-scale public transport interventions on travel patterns within the A470 and M4 corridors. This modelling analysis was carried out to enable judgements to be made whether major public transport measures would obviate the need for pinch-point measures. Conclusions of this preliminary assessment are:

- Initial forecasts indicate that the public transport schemes would attract patronage and as such would be beneficial to pursue – although Value-for-Money will need detailed consideration. It should be noted that the modelled scenarios for new public transport interventions should be considered as preliminary – since other supporting measures such as integration of bus and rail services, in terms of timetabling and ticketing, has not been explicitly modelled; nor have policy elements such as parking charges. Hence the patronage estimates for public transport should, in this Stage 2 study, be considered as minimum estimations, and improved network integration would be expected to significantly increase the forecast patronage.
- The model outputs demonstrate that whilst the public transport proposals are attractive, they would not generate sufficient patronage to alleviate traffic problems on the A470 and M4 Corridors. The public transport measures would though partially address objectives for the corridors – and hence are recommended for further development and potential implementation as part of a long-term corridor package including shorter-term roads-based pinch-point measures.

It is concluded therefore that ‘Concept Public Transport Schemes’ would have beneficial impacts, but that they do not obviate the need for shorter-term pinch-point measures.

3.9 Priority Design Option Development

Design development has been undertaken for the Priority Design Options. Development of options has involved consideration of local problems, road geometry and engineering constraints. A range of measures on each corridor have been identified – which are assessed individually, although in practice they form an overall package with other measures.

The outline scheme design carried out provides a sound basis for assessing both traffic impact and deliverability; these outline design layouts are shown in Appendix E, and are described in Section 3.9.

3.9.2 A470 Priority Design Options

Each A470 corridor Priority Design Option and its expected benefit, and key design considerations, are described in the following sections.

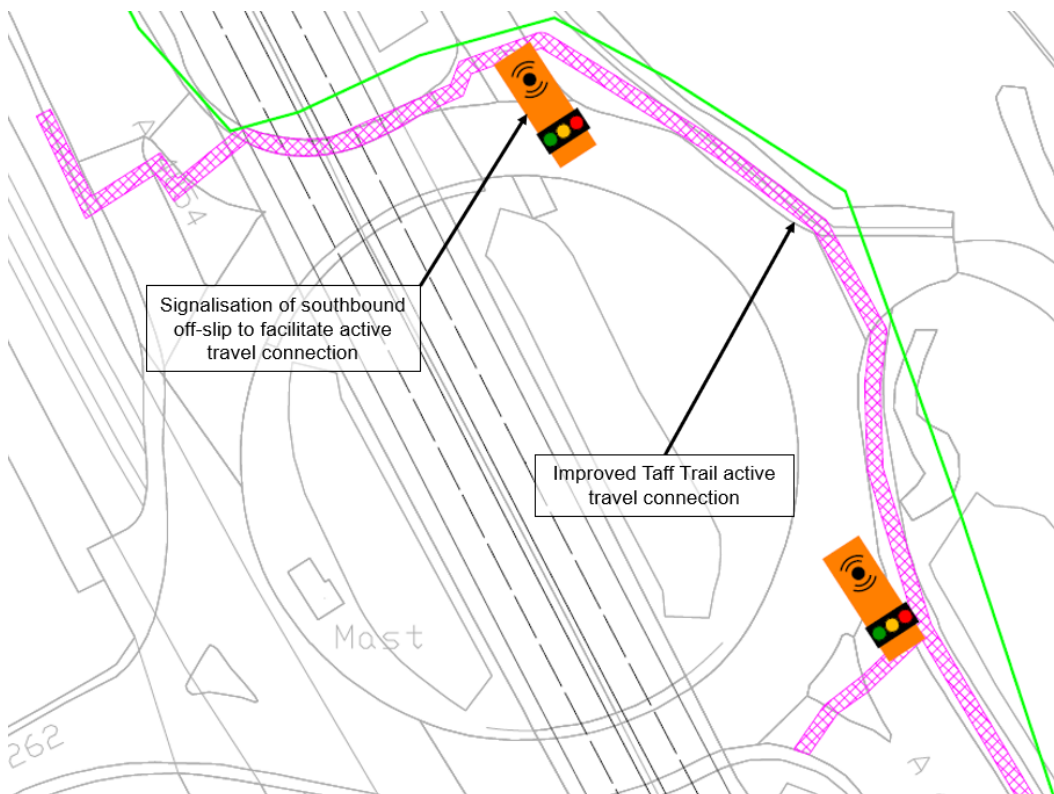
Traffic management and control measures at A470 Taffs Well

This improvement scheme is focused improving traffic management and journey time reliability for A470 southbound traffic, exiting at Taffs Well, as set out in Table 7., and shown in Figure 3.

Table 7: Traffic management and control measures at A470 Taffs Well

Measure	Expected Benefit	Design Consideration
Signalisation of southbound slip road onto junction and improved Active Travel connection	<ul style="list-style-type: none"> • Likely to provide a betterment with respect to road safety in comparison to the existing arrangement which requires cyclists to cross the roundabout at an uncontrolled crossing point, situated at the end of the southbound off-slip. This should encourage a small transfer of trips from private car. 	<p>Existing junction includes a cycleway on the nearside edge of the roundabout. This is a part of the National Cycle Network.</p> <p>Proposals include improving the standard of the NCN route by providing signalised crossings.</p>

Figure 3: A470 Taffs Well signalisation of southbound slip road and improved Active Travel connection



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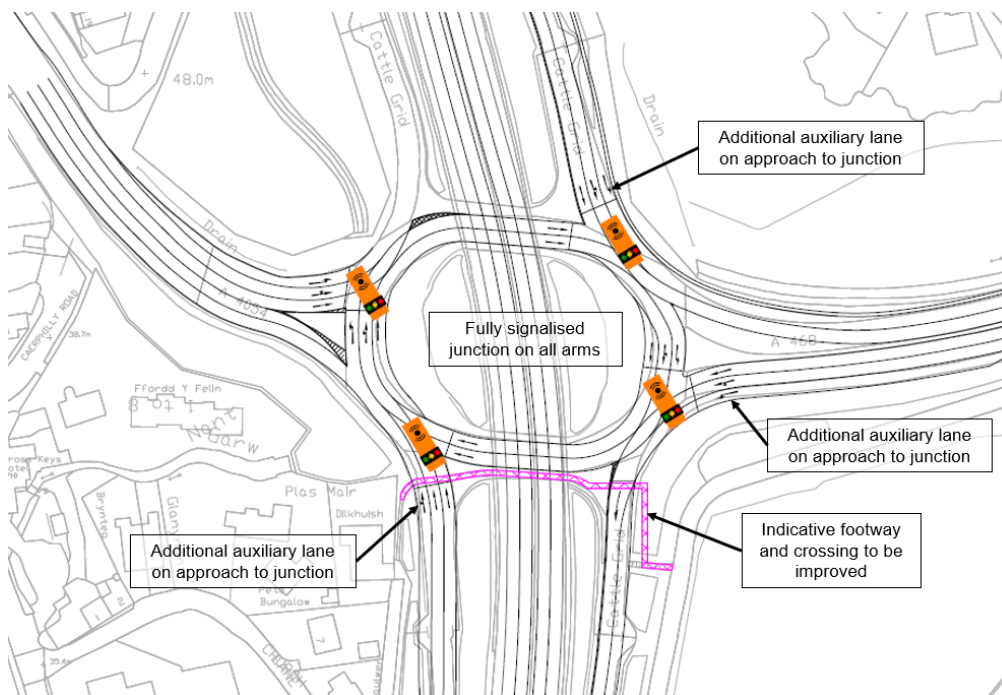
Traffic management and control measures at A470 Nantgarw

This improvement scheme is focused improving traffic management and journey time reliability for traffic travelling via the A470 interchange junction at Nantgarw, which is subject to severe congestion, as set out in Table 8, and shown in Figure 4.

Table 8: Traffic management and control measures at A470 Nantgarw

Measure	Expected Benefit	Design Consideration
Signalisation of Interchange	<ul style="list-style-type: none"> This will allow platooning and enhances opportunities to hold queues on the Nantgarw approach. 	<p>The existing Nantgarw junction has a gyratory roundabout layout and is grade-separated from the A470 mainline which bridges over the junction. The junction is not currently signalised.</p> <p>The gyratory carriageway under the A470 overbridges is considered unlikely to be able to accommodate three lanes and hence has been maintained as a two-lane cross-section, whilst the other parts have been widened to three lanes.</p>
Additional ancillary lane to exit lane (NB and SB)	<ul style="list-style-type: none"> Measure would lead to increased capacity along the northbound off-slip and provide related safety benefits with respect to rear-shunt incidents, which primarily occur due to queuing and slow-moving traffic on junction approach. 	
Additional lane on roundabout gyratory	<ul style="list-style-type: none"> An additional lane on parts of the roundabout gyratory will provide increased capacity and will also deliver additional 'stacking' space for vehicles following the signalisation of the junction. 	
Improved active travel connection	<ul style="list-style-type: none"> The existing footpath is informal, however is evidently utilised by pedestrians from initial investigation. Improvements to the existing situation should therefore result in a safety benefit and increase pedestrian usage. 	

Figure 4: A470 Nantgarw – traffic management and control measures



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

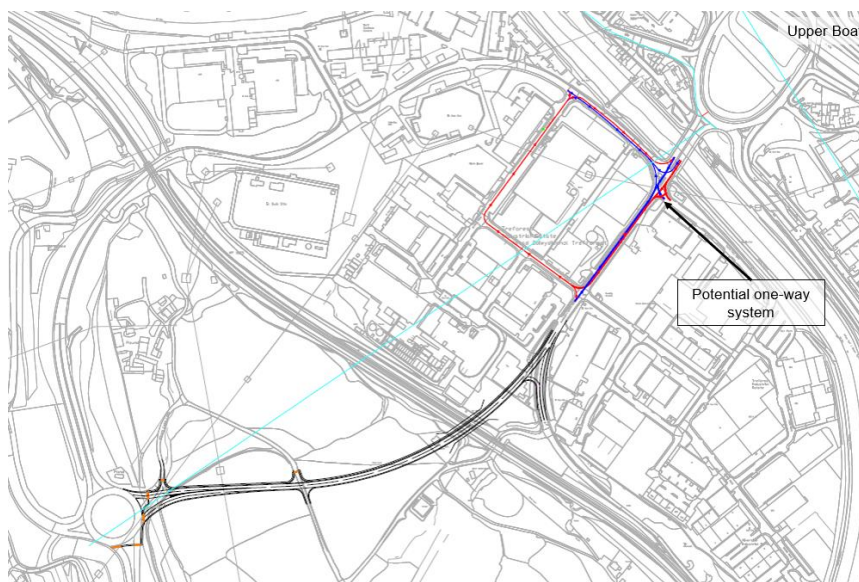
Traffic management and control measures at A470 Upper Boat

This improvement scheme is focused improving traffic management and journey time reliability for traffic in and around the A470 interchange junction at Upper Boat, where the approach roads are subject to congestion, as set out in Table 9, and shown in Figure 5.

Table 9: Traffic management and control measures at A470 Upper Boat

Measure	Expected Benefit	Design Consideration
Introduction of a one-way system through the industrial estate.	<ul style="list-style-type: none"> Implementation of a one-way system (or other traffic management variation) would improve the flow of traffic with potential to eradicate the existing issues relating to priority at junctions, which appears to be one of the main cause of queuing. 	Northbound vehicles currently enter Tonteg Road from Upper Boat junction and merge from two lanes to one lane immediately after Treforest Industrial Estate. This causes significant queuing traffic at peak periods back onto Upper Boat junction. Introducing traffic management at this location is aimed at addressing this issue.
Modification of Tonteg Road/Industrial Estate Junction	<ul style="list-style-type: none"> Junction modification would enable better traffic management to remove problem of traffic blocking back to A470. 	
New link road between Tonteg Road and Gwaelod-y-Garth Road	<ul style="list-style-type: none"> A new road link would relieve pressure on the existing Tonteg Road/Gwaelod y Garth Road junction (south-west of Upper Boat junction) through provision of an alternative route in/out of the various employment situated within Treforest Estate. 	A new road link between A473 and Gwaelod-y-Garth Road, with local junction modification, would require consideration of topography as the western portion of the new link is on higher ground than Upper Boat.

Figure 5: A470 Upper Boat - Traffic management and control measures



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Improvements at Upper Boat Interchange are not considered further in this WelTAG Study as Rhondda Cynon Taf CBC are progressing junction improvement measures at this location as part of a separate Study.

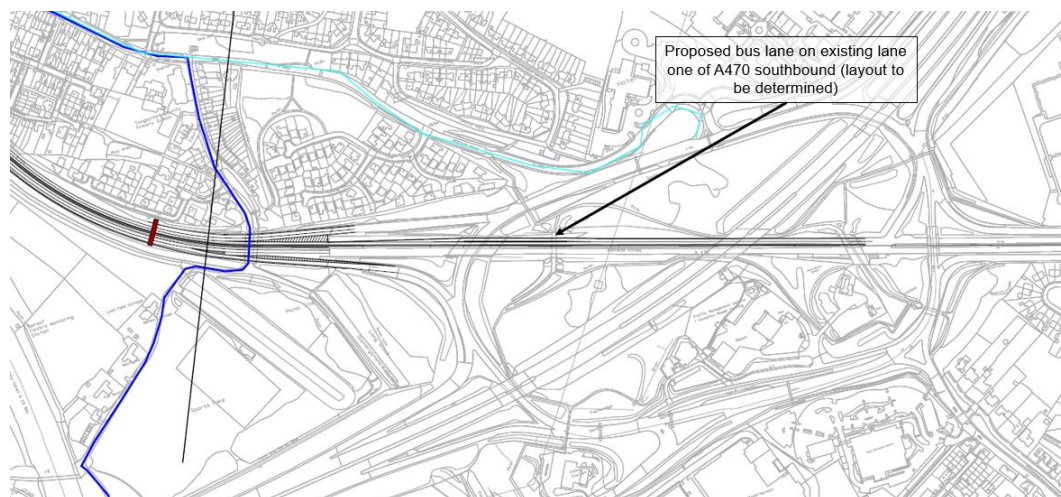
Bus Priority on A470 Nantgarw to Coryton

This improvement scheme is focused on improving the reliability of bus journey times in the A470 corridor.

Table 10: Bus Priority on A470 Nantgarw to Coryton

Measure	Expected Benefit	Design Consideration
A470 bus priority	<ul style="list-style-type: none"> The scheme would provide benefits with respect to bus journey time and reliability and should also encourage some modal shift from the private car to bus. 	<p>Preliminary investigation indicates that an intermittent bus lane on the A470 is unlikely to be feasible or effective.</p> <p>There is potential to provide a bus lane through Coryton Interchange on the A470 as part of a 1-lane Ahead, 2 lanes Exit on the approach to Coryton Interchange.</p>

Figure 6: Bus Priority on A470 Nantgarw to Coryton – Southbound Bus Priority on A470 at Coryton



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Smart expressway and traffic management measures on the A470 Upper Boat to Coryton

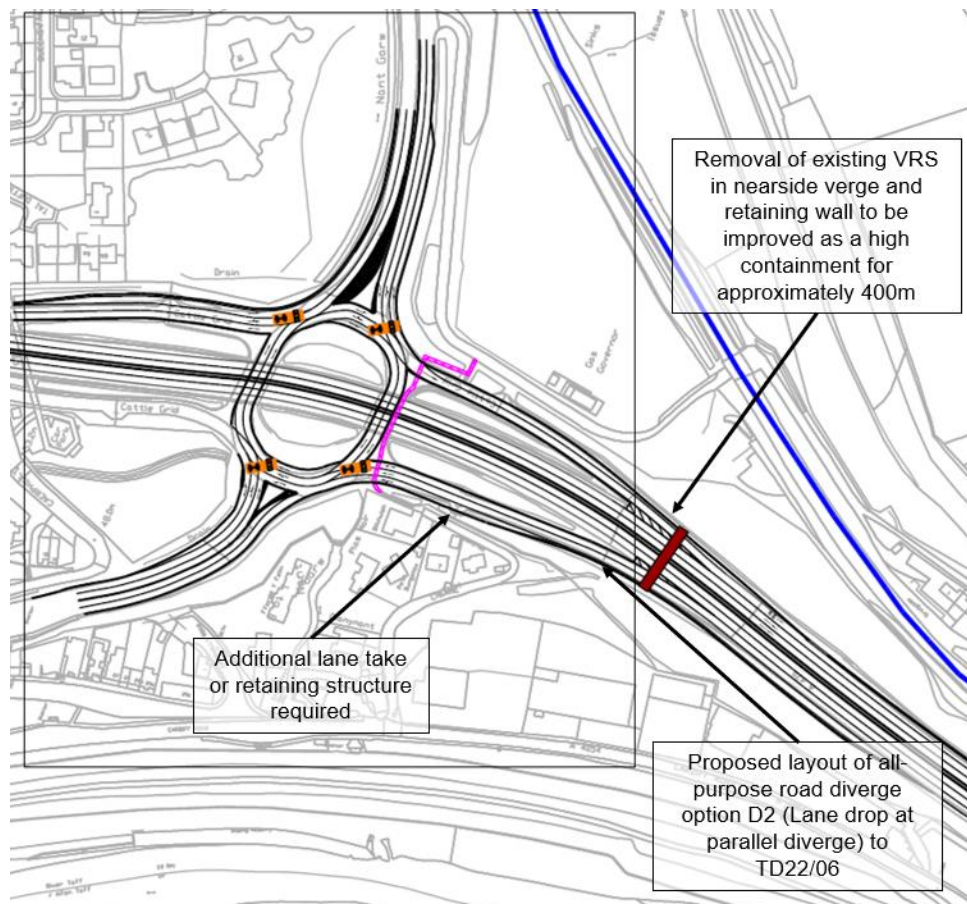
Measures on the A470 involve additional lanes on the A470 with lane drop/lane gain at junctions.

Table 11: Smart expressway & traffic management measures on the A470 Upper Boat to Coryton

Measure	Expected Benefit	Design Consideration
Additional 3 rd lane on the A470 mainline between Upper Boat and Nantgarw	<ul style="list-style-type: none"> It is proposed to include additional auxiliary lane for the A470 between Upper Boat and Nantgarw, which will provide additional capacity with the aim of reducing congestion and improving journey time reliability along the route. 	<ul style="list-style-type: none"> The additional lane will be provided in a lane drop/lane gain between diverge and merge slip roads. The additional auxiliary lane is likely to be able to be accommodated within the existing highway boundary – but with narrow lane widths with approximate dimensions: 1m hard strip, 3.6m lane one, 3.5m lane two, 3.35m lane three and 1m central reserve. An existing VMS cantilever sign would be likely to need relocation to accommodate the widening
Additional 3 rd lane on the A470 mainline between Nantgarw and Taffs Well	<ul style="list-style-type: none"> It is proposed to include additional auxiliary lane for the A470 between Nantgarw and Taffs Well, which will provide additional capacity with the aim of reducing congestion and improving journey time reliability along the route. 	<ul style="list-style-type: none"> The additional lane will be provided in a lane drop/lane gain between diverge and merge slip roads. The additional auxiliary lane is likely to be able to be accommodated within the existing highway boundary – but with narrow lane widths with approximate dimensions: 1m hard strip, 3.6m lane one, 3.5m lane two, 3.35m lane three and 1m central reserve.
Lane reallocation (southbound) and additional 3 rd lane (northbound) on the A470 mainline between Taffs Well and Coryton	<ul style="list-style-type: none"> It is proposed to provide three lanes in both directions with improved lane allocation to match traffic flows - which will reduce congestion and improve journey time reliability along the route. 	<ul style="list-style-type: none"> At A470 southbound – two lane diverge onto Coryton gyratory and one lane ahead onto A470 towards Cardiff. Narrow lane widths in the northbound direction with approximate dimensions: 1m hard strip, 3.6m lane one, 3.5m lane two, 3.35m lane three and 1m central reserve.

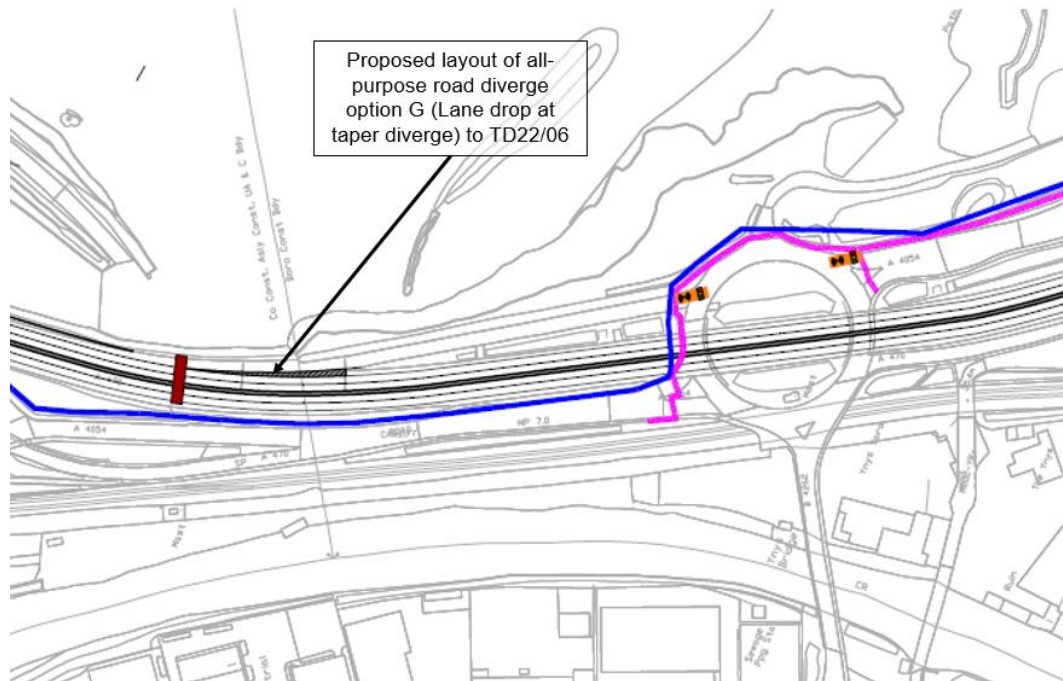
Measure	Expected Benefit	Design Consideration
Overhead Gantries with VMS on A470 (Variable speed limit/lane allocations)	<ul style="list-style-type: none"> Variable message signing provides improved traffic management with resilience and safety benefits. VMS signage can provide capability to vary speed limit according to conditions, and to vary lane allocation for 'ahead' and 'exit' movements depending on traffic conditions, roadworks, accidents etc. 	<ul style="list-style-type: none"> Existing overhead gantries are located on the approach to the southbound and northbound diverge slip roads to the Taffs Well junction. Speed limit signage is installed on the A470 southbound gantries only. Careful consideration will be the need to use existing gantries and insertion of new gantries in compliance with standard spacing requirements.
Speed reduction to 40 or 50 mph on A470 Upper Boat to Coryton	<ul style="list-style-type: none"> Scheme would be likely to result in benefits with respect to reducing emissions affecting air quality, whilst a reduction in speed along the section should also have a benefit relating to allowing safer merging/weaving movements. 	<ul style="list-style-type: none"> Existing variable speed limit signage is installed on the A470 southbound gantries only. A temporary speed limit of 50 mph is already in place on the A470 between Pontypridd and Upper Boat as part of an air quality mitigation scheme, and will be extended to include the A470 between Upper Boat and Coryton

Figure 7: Lane drop/Lane Gain at A470 Nantgarw Interchange



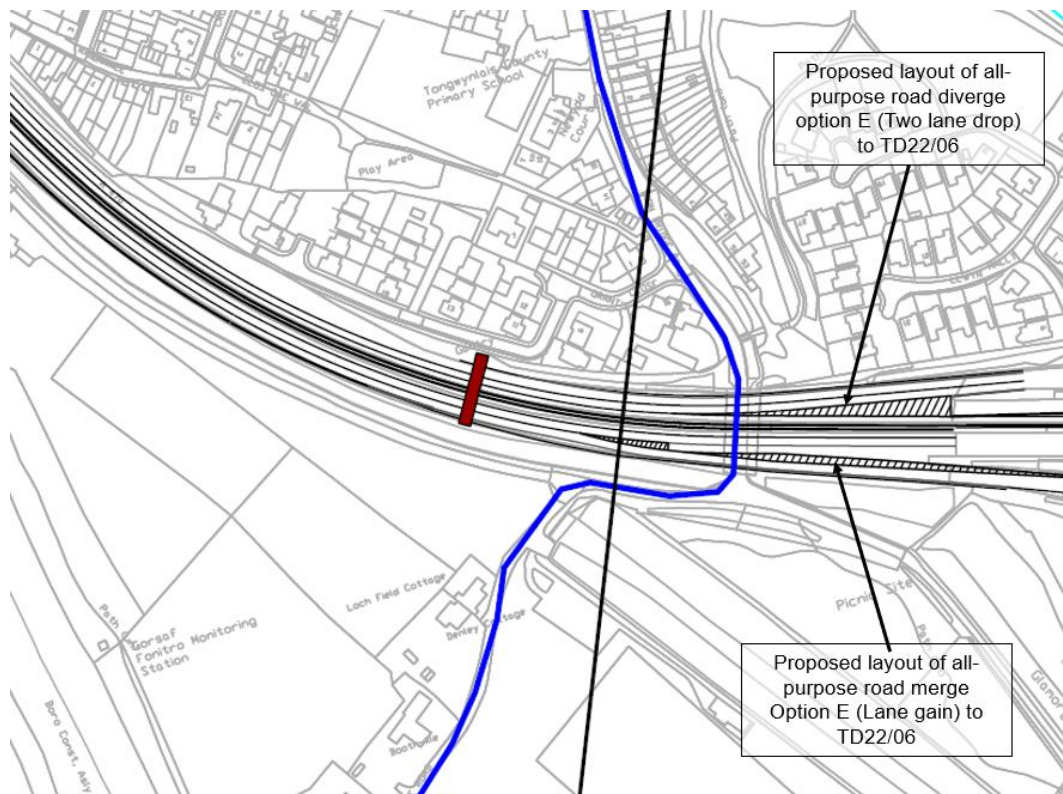
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Figure 8: Lane drop/Lane Gain at A470 Taffs Well Interchange



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Figure 9: Lane Reallocation southbound and lane gain northbound at A470 Coryton



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Traffic management and control measures at A470/M4 J32 Interchange - A470 Southbound to M4 Westbound Link

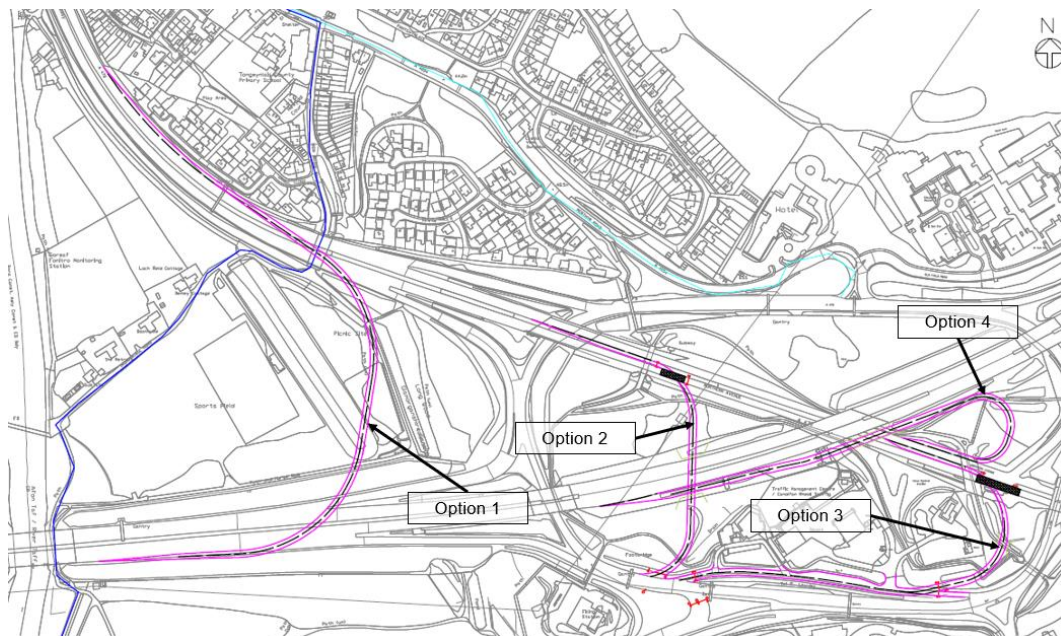
This option is aimed at providing a road link to allow A470 southbound traffic travelling to the M4 West to avoid Coryton Interchange

Table 12: Traffic management and control measures at A470/M4 J32 Interchange - A470 Southbound to M4 Westbound Link

Measure	Expected Benefit	Design Consideration
A470 Southbound to M4 Westbound – via an elevated structure over Longwood Woodland between the A470 southbound off-slip and the M4 westbound.	<ul style="list-style-type: none"> • The scheme would allow for all A470 southbound traffic looking to travel west along the M4 motorway to utilise the new structure, eradicating the need for vehicles to pass through the Coryton gyratory. This will assist in reducing delays and congestion on the Coryton gyratory. • Some journey time improvements and minor safety benefits also likely as a result of the scheme. 	<ul style="list-style-type: none"> • To improve the capacity of the Coryton Gyratory, a possible solution would be to provide a new link between A470 southbound to M4 westbound for this traffic movement. • The link could be an elevated structure diverging prior to the A470 slip road to Coryton and over the M4 to tie-in near the M4-J32 westbound merge. Conflict with the existing merge could arise here. However, the M4-J32 westbound merge could be redesigned to reflect the change in traffic movement.
A470 Southbound to M4 Westbound – via a through link from A470 Southbound to M4 Westbound with underbridge beneath the M4 motorway.	<ul style="list-style-type: none"> • The scheme utilises space beneath the existing M4 motorway, which is currently vacant and would allow for all A470 southbound traffic looking to travel west along the M4 motorway to utilise the new structure, eradicating the need for vehicles to pass through the Coryton gyratory. This will assist in reducing delay and congestion on the Coryton gyratory. • Some journey time improvements and minor safety benefits also likely as a result of the scheme. 	<ul style="list-style-type: none"> • To improve the capacity of the Coryton Gyratory, a possible solution would be to provide a new link between A470 southbound to M4 westbound for this traffic movement. • This link proposal could involve the construction of a new underbridge structure beneath the operational M4, signalised junction on the A470 and additional signals on the Coryton Gyratory.
A470 Southbound to M4 Westbound – via a through link from A470 Southbound to M4 Westbound via Traffic Control Wales side road, including provision of a new overbridge structure.	<ul style="list-style-type: none"> • The scheme would allow for all A470 southbound traffic looking to travel west along the M4 motorway to utilise the new route, reducing the need to pass through the Coryton gyratory with subsequent congestion/journey time benefits. • Partially comprises of upgrading the existing 	<ul style="list-style-type: none"> • To improve the capacity of the Coryton Gyratory, a possible solution would be to provide a new link between A470 southbound to M4 westbound for this traffic movement. • This proposal option would involve the addition of signals to the Coryton-A470 link junction to include this new

Measure	Expected Benefit	Design Consideration
	carriageway (i.e. the Traffic Control Wales side road) which runs parallel to the Coryton gyratory.	movement, construction of a new overbridge structure to span an existing cycleway, interact with an at-grade cycleway, new signals at the side road connection and improved signals at the Coryton Gyratory connection.
A470 Southbound to M4 Westbound – via a two-lane A470 Coryton exit slip road, linking to the M4 westbound via a new overbridge structure.	<ul style="list-style-type: none"> • The scheme would allow for all southbound traffic travelling west, to use this new lane, reducing vehicular congestion on the Coryton gyratory. • Some journey time improvements and minor safety benefits are also likely as a result of the scheme. 	<ul style="list-style-type: none"> • To improve the capacity of the Coryton Gyratory, a possible solution would be to provide a new link between A470 southbound to M4 westbound for this traffic movement. • This link proposal option would involve a diverge auxiliary lane off the A470, a hook layout link with constrained horizontal curvature, construction of a new overbridge on the A470 and merge slip road onto the M4 in advance of the existing M4-J32 merge slip road.

Figure 10: A470 Southbound to M4 Westbound Link Options



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Due to the engineering complexity of these options, they are likely to be high-cost and only deliverable in the medium to long term. As such, these options are unsuitable for delivery under the Pinch-Point programme and should be considered as concept design options.

3.9.3 M4 Priority Design Measures

Each M4 corridor Priority Design Option and its expected benefit, and key design considerations, are described in the following sections (and in Table 13 to Table 15).

Traffic management and control measures at M4 J33 Interchange

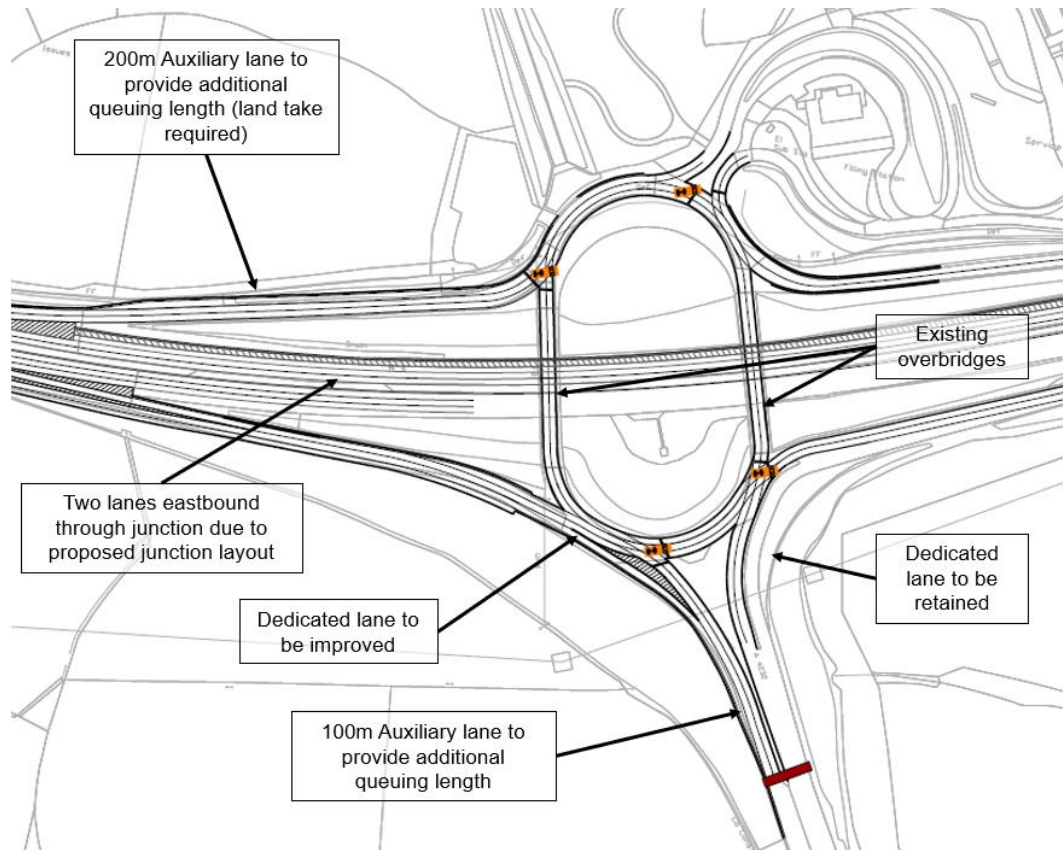
A range of options are described below – including signalisation and widening of existing infrastructure, and provision of additional infrastructure including overbridges.

Table 13: Traffic management and control measures at M4 J33 Interchange

Measure	Expected Benefit	Design Consideration
Three-lane approach on the eastbound exit slip for signal stacking (lane one would be dedicated for P&R).	<ul style="list-style-type: none"> This would allow a two-lane movement from the M4 (west) to the A4232 towards Cardiff. 	<ul style="list-style-type: none"> The existing junction was recently improved to include a dedicated lane for the M4 eastbound diverge to A4232 southbound vehicle movement. This dedicated lane is to be retained as part of all proposals.
100m ancillary lane on the A4232 approach arm.	<ul style="list-style-type: none"> An additional 100m ancillary would enhance stacking space at the junction and provide improve traffic flow from the A4232 towards M4 (west). 	<ul style="list-style-type: none"> All proposals have considered other proposals for integrated transport options and other schemes in the area, notably the M4 J34 to A48 Sycamore Cross scheme.
Signalisation of the A4232 approach arm and Services arm	<ul style="list-style-type: none"> Signalisation will allow improved platooning onto gyratory and will also ensure that both lanes on the overbridge are allocated to M4 eastbound, with Services traffic in the left-hand lane. Signalisation of services arm is intended to add capacity to serve future Park & Ride traffic flow. 	<ul style="list-style-type: none"> Constraints to all options include high-voltage power cables above the A4232, Cardiff West Services, operational M4 and the newly constructed M4-A4232 merge auxiliary lane.

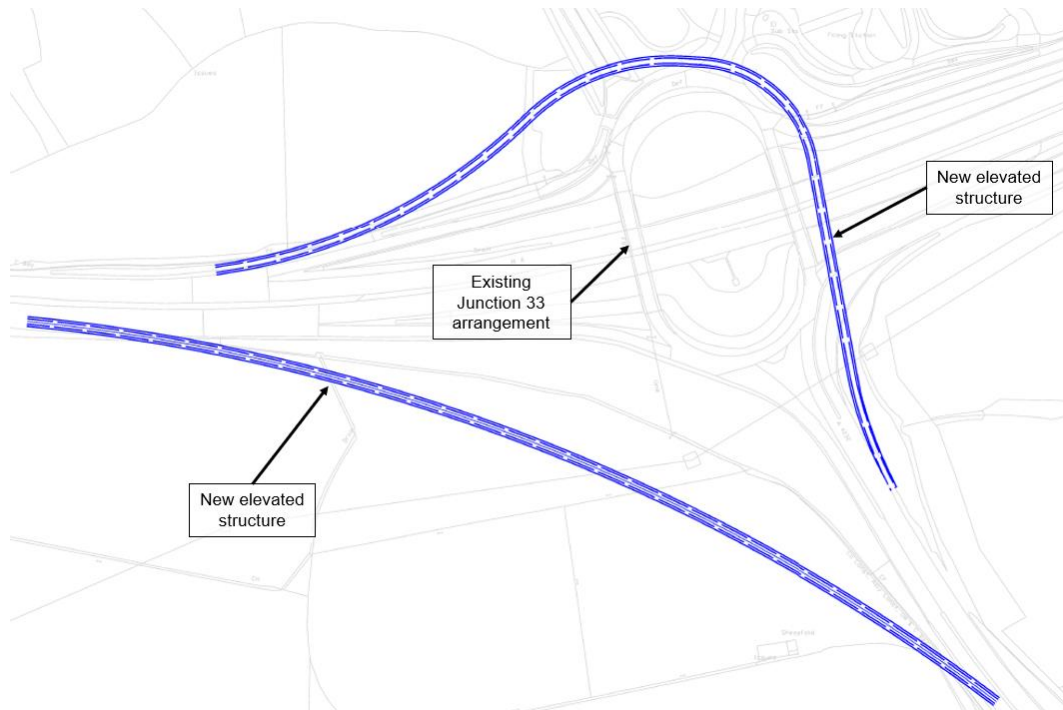
Measure	Expected Benefit	Design Consideration
Grade-separated connections between the A4232 to M4 westbound, and from the M4 (eastbound) to the A4232 (towards Cardiff)	<ul style="list-style-type: none"> The eastbound movement towards Cardiff along the A4232 is the predominant movement within the morning peak hour and would eradicate the need for all traffic to pass through the junction. The addition of a westbound connection would also ease congestion within the evening peak hour. 	<ul style="list-style-type: none"> This design proposal is to improve the M4 westbound and A4232 traffic movements. The high-voltage power cables above the A4232 arm are a potential constraint. An elevated structure is required to span over the operational M4 and merge adjacent to the newly constructed M4-A4232 merge auxiliary lane. The vertical alignment of this elevated structure would have to ensure avoidance of the HV power cables is achieved. An at-grade A4232 northbound/M4 westbound link is proposed and would likely require additional land acquisition outside the existing highway boundary.
Additional lanes on gyratory across motorway – which requires two new bridge structures adjacent to existing bridges.	<ul style="list-style-type: none"> Construction of new overbridges would allow greater scope for traffic management and improved journey time reliability. New bridges could also potentially carry a future BRT/light-rail connection into J33 P&R. 	<ul style="list-style-type: none"> This design proposal is to improve the westbound and eastbound M4, and A4232 traffic movements. Two additional structures would need to be constructed for this proposal and develop the junction into a fully signalised junction.
Additional lanes on western gyratory across motorway – which requires a new bridge structures adjacent to existing bridge.	<ul style="list-style-type: none"> Construction of a new overbridge would allow greater scope for traffic management and improved journey time reliability. A new bridge could also potentially carry a future BRT/light-rail connection into J33 P&R. 	<ul style="list-style-type: none"> This design proposal is to improve the westbound and eastbound M4, and A4232 traffic movements. One additional structure would need to be constructed for this proposal and develop the junction into a fully signalised junction.

Figure 11: M4 Junction 33 traffic management and control improvement option with additional signalisation and lanes



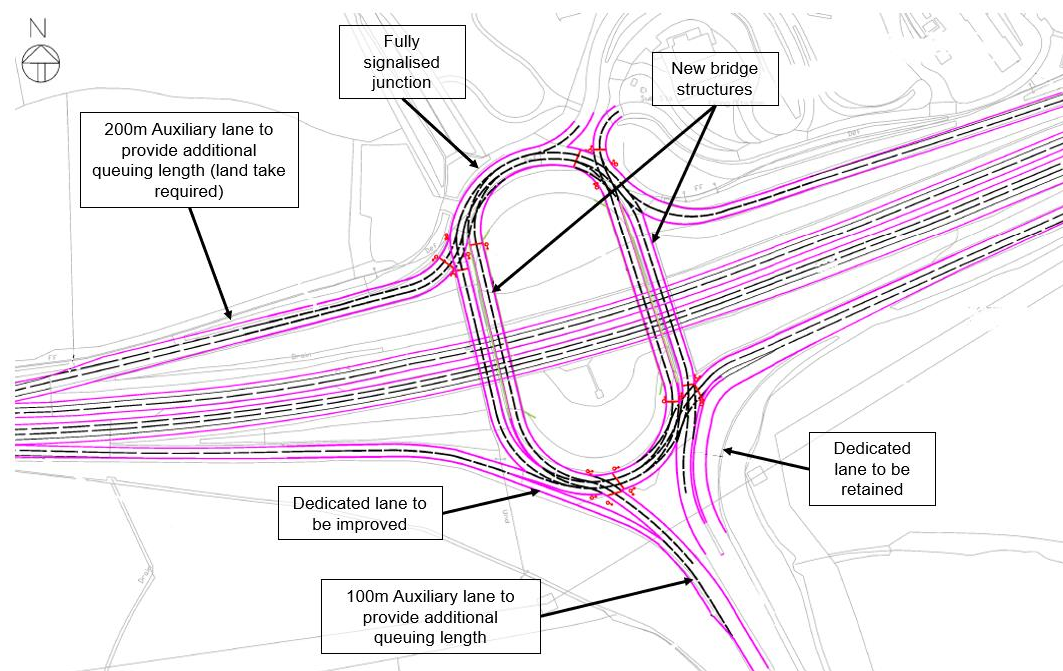
Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Figure 12: M4 Junction 33 traffic management and control improvement options with grade-separated links



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Figure 13: M4 Junction 33 traffic management and control improvement option with additional gyratory overbridges



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Traffic management and control measures at M4 J34 Interchange

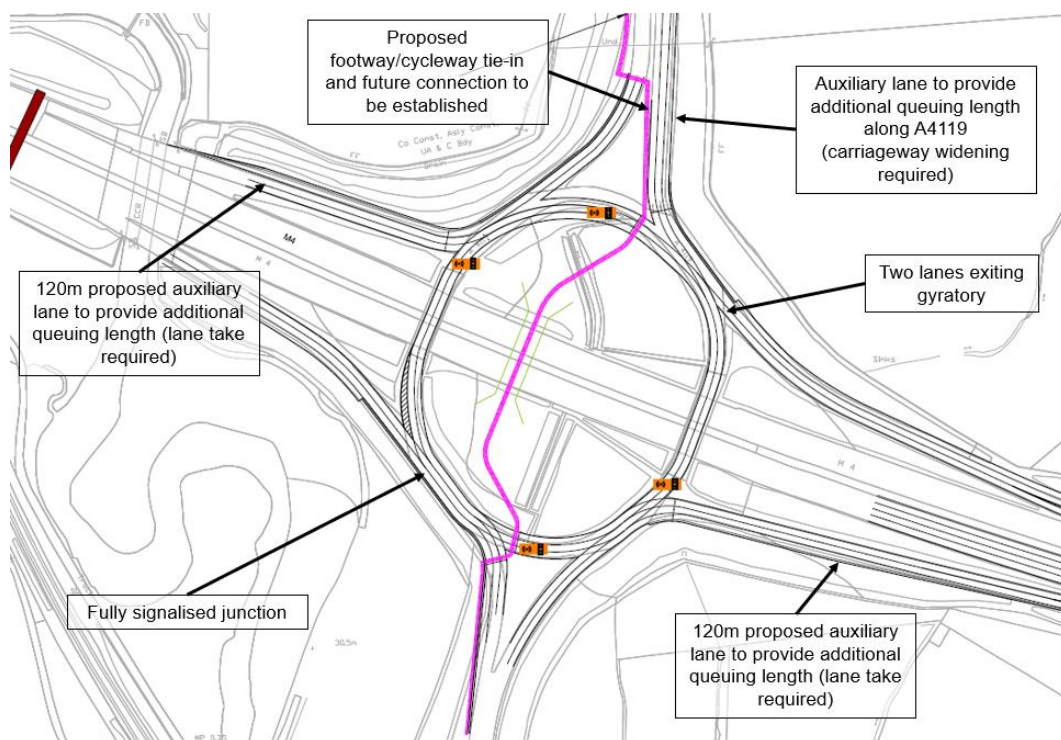
A range of options are described below – including signalisation and widening of existing infrastructure, and provision of additional infrastructure including overbridges.

Table 14: Traffic management and control measures at M4 J34 Interchange

Measure	Expected Benefit	Design Consideration
Three lanes on all approach arms to junction gyratory – with lane allocation towards Pendoylan arm.	<ul style="list-style-type: none"> The measure would improve traffic management of the junction and would improve junction traffic capacity with the proposed M4 J34 to A48 Sycamore Cross scheme and a potential new rail station at J34 (Miskin) in place. 	<ul style="list-style-type: none"> A dedicated left-turn lane to the M4 J34 to A48 Sycamore Cross Link could be provided from M4 westbound as an additional traffic capacity measure.
Full signalisation of the junction, including the A4119 entry, and widened gyratory (three lanes) at A4119 and at southern (Pendoylan) arm	<ul style="list-style-type: none"> Signalisation of A4119 entry allows a two-lane exit from the gyratory lanes An additional third lane on the gyratory improved traffic management capability at the A4119 and southern entry arms. 	<ul style="list-style-type: none"> All proposals have considered other proposals for integrated transport options and other schemes in the area, notably the M4 J34 to A48 Sycamore Cross scheme. Constraints to all options include Miskin Manor Hotel & Health Club, operational M4, Ely River and Great Western Railway.
Additional lanes on gyratory across motorway – which requires two new bridge structures adjacent to existing bridges.	<ul style="list-style-type: none"> Provision of new structures would increase capacity through providing additional exit lanes. 	<ul style="list-style-type: none"> This design proposal is to improve the westbound and eastbound M4, A4119 and Pendoylan traffic movements.
Proposed dedicated cycle lane (north to south) on an overhead structure.	<ul style="list-style-type: none"> The construction of a dedicated cycle lane will require construction of a structure over the M4 motorway, however would assist in promoting active travel, whilst encouraging an alternative travel option to the private car. This should connect to existing infrastructure north of the junction to provide an entire connection for residents in Talbot Green/Llantrisant. 	<ul style="list-style-type: none"> One additional structure would need to be constructed for this proposal, new dedicated lane for the A4119 southbound/M4 eastbound traffic movement and develop the junction into a fully signalised junction.
Additional lanes on eastern gyratory across motorway – which requires a new bridge structure adjacent to existing bridge.	<ul style="list-style-type: none"> Construction of new overbridges would increase 'stacking' space if junction becomes fully signalised and would also allow for an additional exit lane onto the A4119 and also M4 East. 	<ul style="list-style-type: none"> This design proposal is to improve the westbound and eastbound M4, A4119 and Pendoylan traffic movements. Scheme fully reliant on the construction of two additional structures, which would need to

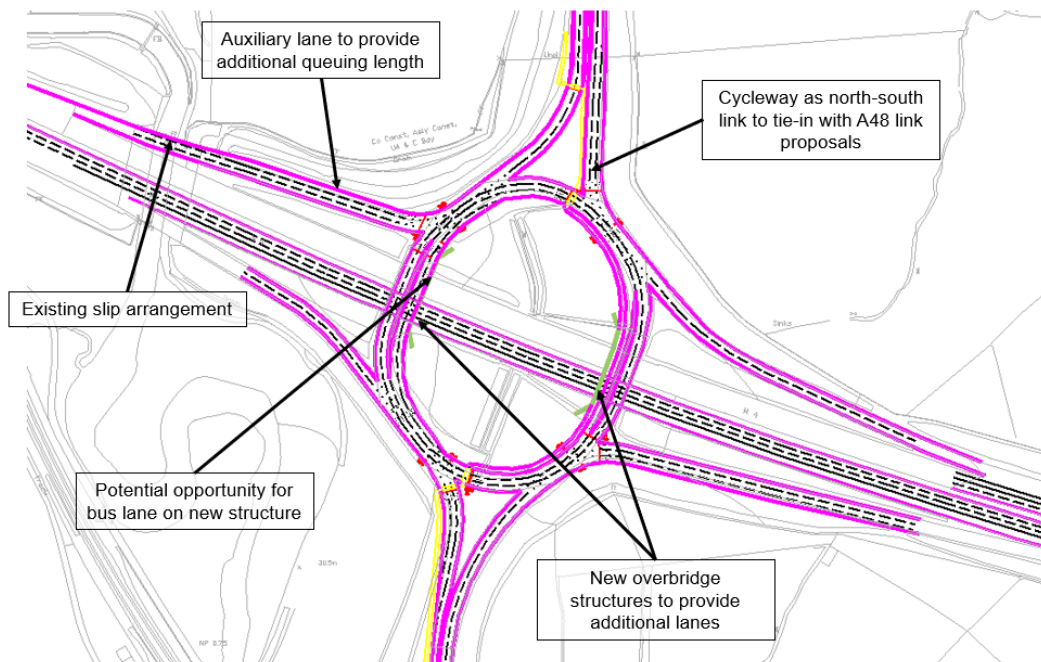
Measure	Expected Benefit	Design Consideration
Dedicated bus lane on western side of junction	<ul style="list-style-type: none"> Bus priority (from North-South) will improve bus journey times, with potential to connect to future rail station at J34 (Miskin). 	be constructed for this element of the proposal to be deliverable, as well as the fully signalling the junction.
Dedicated cycle lane on eastern side of junction	<ul style="list-style-type: none"> The implementation of a dedicated cycle lane on the eastern structure would assist in promoting active travel, whilst encouraging an alternative travel option to the private car. This should connect to existing infrastructure north of the junction to provide an entire connection for residents in Talbot Green/Llantrisant. 	

Figure 14: M4 Junction 34 traffic management and control improvement option with additional signalisation and lanes and walk/cycle link



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Figure 15: M4 Junction 34 traffic management and control improvement option with additional gyratory overbridges



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Smart expressway and traffic management measures on the M4 J33-J34

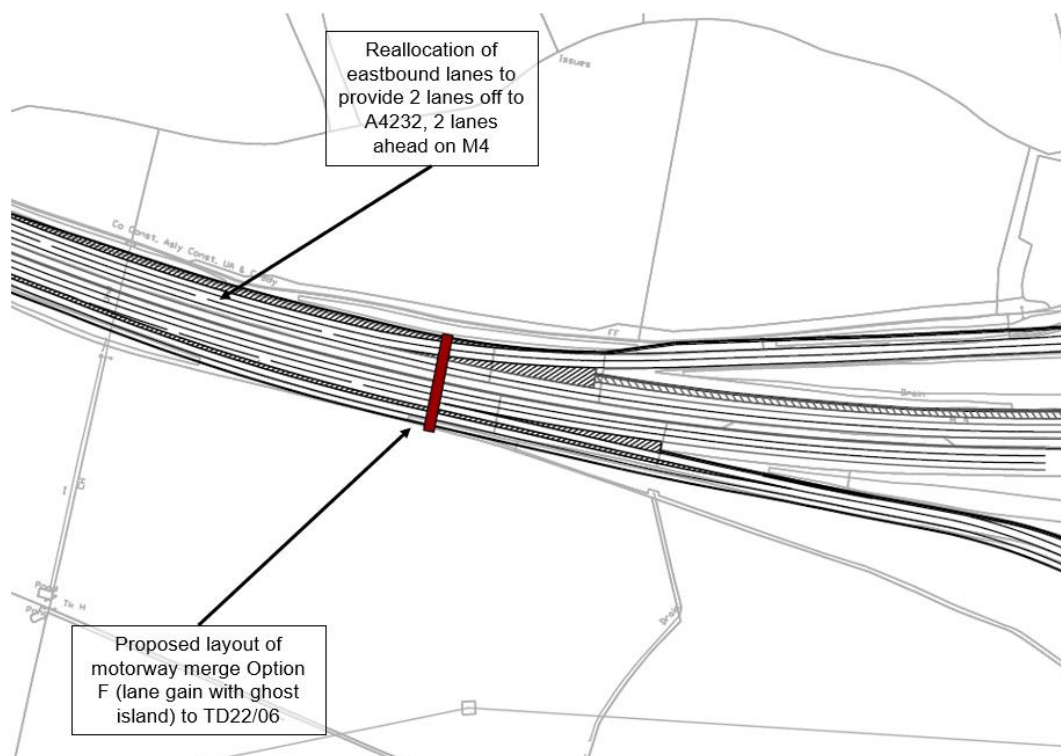
A range of options are described below – including additional lanes, reallocation of lanes, and provision of additional infrastructure including overbridges.

Table 15: Smart expressway and traffic management measures on M4 Mainline J33-J34

Measure	Expected Benefit	Design Consideration
Westbound narrow lanes to match cross-section of eastbound Narrow Lanes.	<ul style="list-style-type: none"> Narrow lanes on the westbound section between J33 and J34 would provide improved traffic management, providing an effective auxiliary lane for motorway traffic travelling from the A4232 (J33 southern arm) to the A4119 (J34 northern arm). 	<ul style="list-style-type: none"> It is considered that an upgrade from three to four lanes can be achieved within the existing highway boundary on the M4 Westbound – but only if narrow lanes are used (similar to the cross-section on the M4 Eastbound at this location). The slip road and narrow lane measures will need to be designed as a single scheme from Junction 33 to J34, in both directions.
Reallocation of lanes on M4 (J34 to J33) eastbound to 2-lane ahead and 2-lane exit (to J33).	<ul style="list-style-type: none"> Traffic flow data indicates that two lanes ahead/two lanes exit' to J33 is appropriate – and will provide a clearer and safer arrangement than the present three lanes ahead/one lane exit' arrangement. This layout will reduce weaving movements and effectively allow the nearside (inside) lane to operate as a direct route between J34 and J33. 	
Introduction of an additional merge lane at J34 eastbound on-slip, and at J33 on-slip going westbound.	<ul style="list-style-type: none"> Introduction of an additional lane at the on-slips eastbound and westbound from J34 and J33 respectively will be beneficial in providing safer merges onto the motorway. 	
Overhead Gantries with VMS on M4 J34-J33 and on A4232 (Variable speed limit/average speed enforcement cameras, lane allocations)	<ul style="list-style-type: none"> Variable message signing provides improved traffic management with resilience and safety benefits. VMS signage can provide capability to vary speed limit according to conditions, and to vary lane allocation for ahead and exit movements depending on traffic conditions, roadworks, accidents etc. VMS signage will provide greater capability for managing event traffic (e.g. major events in Cardiff) – for arrival (on M4) and departure (on A4232). 	<ul style="list-style-type: none"> VMS gantry signage will need to be designed to be incorporated within SWTRA's ITS management system Careful consideration will be needed to the type of gantry – either spanning the whole road corridor (i.e. both carriageways), or use of cantilever structures on carriageway only.
Parallel road link between Junction 34 and J33 (in the form of service roads alongside motorway, or separate	<ul style="list-style-type: none"> Removes significant proportion of traffic from M4 (i.e. all traffic between A4119 and A4232) which represent 	<ul style="list-style-type: none"> Major junctions on A4119 and A4232 would be needed – in the form of potentially a new signal-controlled junction on the A4119 north of Junction 34, and a

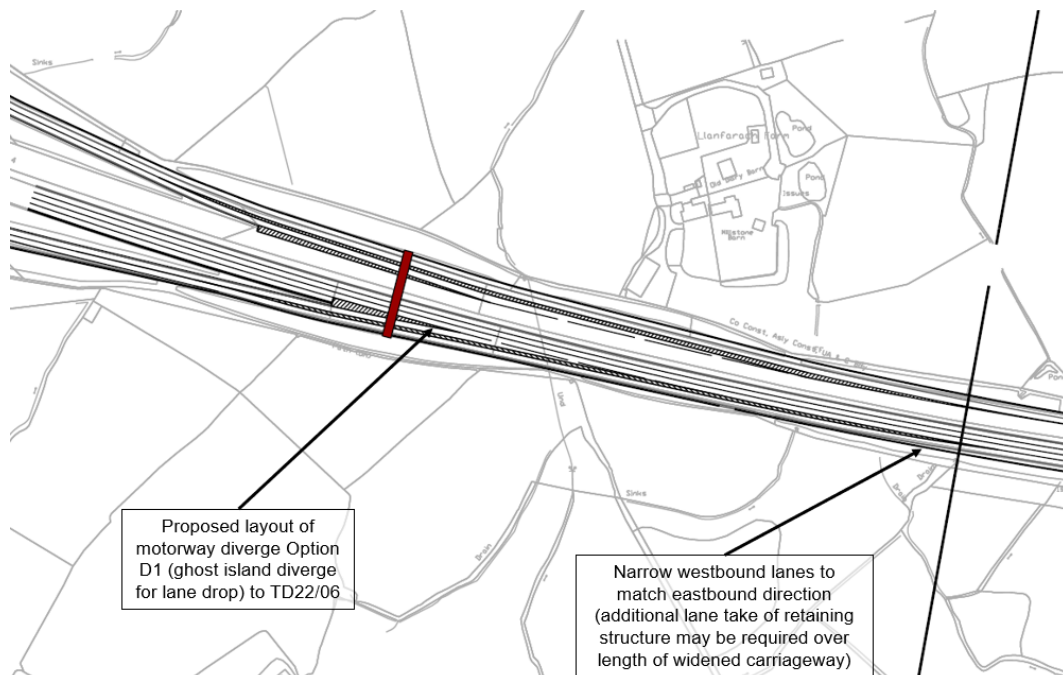
Measure	Expected Benefit	Design Consideration
road link between A4119 and A4232.	<p>around one third of traffic in peak period).</p> <ul style="list-style-type: none"> • Potential for creating local network in combination with proposed M4 J34 to A48 Sycamore Cross scheme being investigated by Vale of Glamorgan CBC 	<p>merge/diverge connection with the A4232 (with south-facing slip roads).</p> <ul style="list-style-type: none"> • Depending on the road layout and alignments, a number of major bridges would be required – over the M4 and the A4232. • This option would significantly alter regional traffic patterns and would need to be considered in combination with the proposed M4-A48 Link being investigated by Vale of Glamorgan CBC. Traffic and other impacts (e.g. air quality) would need to be considered. • Considered deliverable in the long term and thus will be considered at concept level only. (See Section 4.5.2

Figure 16: Smart expressway & traffic management measures on the M4 Mainline J33-J34 – Eastbound lane reallocation and westbound lane-gain at Junction 33



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

Figure 17: Smart expressway and traffic management measures on the M4 Mainline J33-J34 – Eastbound lane reallocation and westbound 4-lane carriageway and lane-drop at Junction 34



Not to be scaled (Excerpt from Priority Design Scheme drawing (see Impact Assessment Report))

3.11 Priority Design Option Assessment

A further optioneering process was undertaken to identify preferred short-term Priority Design ‘pinch-point’ measures for taking forward to option design in Phase 3 of this study, the corridor objectives have been further refined into range of assessment criteria – which encompass local problems and key transport objectives, operational effectiveness, engineering and safety issues, and deliverability. The range of assessment criteria are set out below:

Transport Objectives	<ul style="list-style-type: none"> • Reduce delays • Improves journey time reliability for road vehicles and buses • Provides opportunity for public transport interchange (stops, stations, Park & Ride) • Provides benefits for bus services • Provides benefits for pedestrians and/or cyclists • Improves safety for all road users • Reduces the transport contribution towards poor air quality
Operational Effectiveness	<ul style="list-style-type: none"> • Improves network resilience for highway and public transport networks • Improves overall traffic management capability
Engineering and Safety Objectives	<ul style="list-style-type: none"> • Is potentially feasible within existing highway corridor • Is geometrically feasible within existing road space or with limited road widening • Can be implemented with limited construction impact on traffic conditions • Provides a safe facility for all road users • Impacts on utilities and roadside facilities/infrastructure
Deliverability	<ul style="list-style-type: none"> • Cost • Buildability

The approach to option assessment for each of the above criteria is described below:

- **Transport Objectives:** For schemes which include junction improvements, quantitative assessment of traffic delays has been undertaken through local junction modelling (using LinSig) of outline design schemes, which is more appropriate than VISUM (the SEWTM model software) for testing traffic conditions at individual junctions. Traffic flows for input to LinSig are based on existing flows (from SEWTM) factored up to represent 2026 (Note: In Phase 3, flow data for the 2026 Do Minimum scenario will be utilised - from the SEWTM model). Traffic flows and local weaving movements at merge/diverge locations have also been reviewed and assessments made of the improved traffic management outcomes. Other assessments of public transport impacts, benefits for pedestrians and/or cyclists, road safety, and air quality are based on a qualitative approach.
- **Operational Effectiveness:** A qualitative assessment has been made of benefits in respect of the highway authority and public transport operators.

- **Engineering and Safety Objectives:** An assessment has been made of the scheme compatibility with highway design standards, and a qualitative assessment made of the potential road safety impact.
- **Deliverability:** At this stage a preliminary and non-technical view has been taken in respect of the magnitude of cost and the likelihood of risks in respect of deliverability.

Assessments of the measures have been made on a qualitative basis, according to the seven-point impact scale shown in Table 16 (which is derived from WelTAG 2017 guidance) – compared to a Do Minimum scenario – which is for purposes of this option assessment considered as being broadly similar to the present-day situation. The assessment of options is summarised in Table 17 and Table 18 (and presented in detail in Appendix B and C for the A470 and M4 respectively). It should be noted that an average assessment ‘score’ is shown in Table 17 and Table 18 in order to provide an indicative summary of the overall impacts. The impact of proposed measures on traffic congestion and delay impacts has been assessed as follows:

- Area-wide modelling using SEWTM which provides forecast traffic flows (including any traffic reassignment effects) for a 2026 scenario with development in place; and
- Preliminary capacity modelling (using LinSig software) of a future 2026 scenario (utilising traffic flow forecasts produced by the SEWTM 2026 model)

Modelling analysis is described in detail in the IAR Section 20 and 21.

Table 16: Assessment Impact Scale

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

Table 17: A470 Design Option Assessment

A470 Options			One-way system through the industrial estate.	Modification of Tonteg Road/Industrial Estate Junction	New link road between Tonteg Road and Gwaelod-y-Garth Road	Nantgarw Interchange – Signalisation, widening of gyratory/on approach	Taffs Well Interchange – Signalisation of SB off-slip and provide cycle crossing	A470 Southbound to M4 Westbound – via an elevated structure over Longwood Woodland	A470 Southbound to M4 Westbound – via a through link with underbridge beneath M4	A470 Southbound to M4 Westbound – via a through link via Traffic Control Wales side	A470 Southbound to M4 Westbound – via a two-lane link with new overbridge structure.	Insertion of Intermittent Bus Lane on A470	Narrow lanes on the A470 mainline between Upper Boat and Nantgarw	Taffs Well to Nantgarw – Implementing 3 lanes Northbound and Southbound	Reallocation of 3 Southbound lanes and narrow lanes in Northbound direction north of Coryton	VMS gantry signage (and updates to Network Management Plans, ITS and traffic officers)	Pontypridd to Coryton – Reduced Speed Limit
			Upper Boat	Upper Boat	Upper Boat	Nantgarw	Taffs Well	Coryton	Coryton	Coryton	Coryton	Nantgarw to Coryton	Upper Boat to Nantgarw	Taffs W to Nantgarw	Coryton to Taffs Well	A470 Mainline	Pont'dd to Coryton
Strategic Case	Transport Objectives	Reduce delays	+	+	++	+	+	++	++	++	++	0	++	++	++	+	+
		Improves journey time reliability (cars, bus, hgv)	+	+	++	++	+	+++	+	++	++	+	++	++	++	++	++
		Opportunity for public transport interchange	0	0	0	0	0	0	0	0	0	+	0	0	0	+	0
		Provides benefits for bus services	0	+	+	+	+	+	+	+	+	+++	0	+	+	+	+
		Provides benefits for pedestrians and/or cyclists	0	+	0	++	++	0	0	0	0	0	0	0	0	0	0
	Operational Effectiveness	Reduces the transport air quality impact	+	+	+	+	+	+	+	+	+	+	+	+	+	+	++
		Improves network resilience (Highway PT)	0	+	++	++	+	+	+	+	+	+	++	++	++	++	0
		Improves overall traffic management capability	+	++	+	+++	++	+	+	+	+	0	++	++	++	+++	++
	Engineering and Safety Objectives	Potentially feasible within existing highway	+++	+++	---	++	+++	---	---	-	-	++	---	0	0	++	+++
		Geometrically feasible (in roadspace)	+++	++	---	-	0	---	---	-	-	+	---	0	0	+++	+++
		Limited construction impact on traffic conditions	+	0	--	-	0	--	--	-	-	--	--	--	--	++	++
		Provides a safe facility for all road users	0	+	+	++	++	+	+	+	+	0	0	+	+	++	++
		Impacts on utilities and roadside facilities	0	-	--	-	-	--	--	-	-	-	--	-	-	0	0
	Deliverability	Cost	-	-	---	--	-	---	--	-	--	--	--	--	--	---	-
		Buildability	-	-	---	-	-	---	---	--	--	--	--	--	--	-	-
Average Score (indicative only)			+0.6	+0.7	-0.4	+0.7	+0.7	-0.4	-0.5	+0.1	+0.1	+0.2	-0.3	+0.3	+0.3	+1.1	+1.1

Table 18: M4 Design Option Assessment

M4 Options			M4 J33 - Improved signal control efficiency by signalising A4232 entry and signalisation of Services entry	Grade-separated connections between the A4232 to M4 westbound, and from the M4 (eastbound) to the A4232 (towards Cardiff)	Additional lanes on gyratory across motorway – which requires two new bridge structures	Additional lanes on western gyratory across motorway – which requires a new bridge structures adjacent to existing bridge.	M4 J34 - Signalisation and gyratory widening – with or without M4 J34 to A48 Transport Link	Additional lanes on gyratory across motorway – which requires two new bridge structures	Proposed dedicated cycle lane (north to south) on an overhead structure.	Additional lanes on eastern gyratory across motorway – which requires a new bridge structure	Dedicated bus lane on western side of junction	Dedicated cycle lane on eastern side of junction	Westbound 4-lane carriageway to match cross-section of eastbound carriageway	Reallocation of lanes on M4 (J34 to J33) eastbound to 2-lane ahead and 2-lane off (to J33).	VMS gantry signage on M4 (incl. updates to Network Management Plans, utilising ITS and traffic officers)	
			J33	J33	J33	J33	J34	J34	J34	J34	J34	J34	J33-J34	J33-J34	J33-J34	
Strategic Case	Transport Objectives	Reduce delays	++	++	++	++	++	++	0	++	++	0	++	++	+	
		Improves journey time reliability (cars, bus, hgv)	++	+++	++	++	++	++	0	++	++	0	++	++	++	
		Opportunity for public transport interchange	++	0	0	0	++	+	0	0	0	++	0	+	+	+
		Provides benefits for bus services	+	+	0	0	+	+	0	0	0	+++	0	+	+	+
		Provides benefits for pedestrians and/or cyclists	0	0	0	0	+	0	+++	0	0	0	+++	0	0	0
		Reduces the transport air quality impact	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Operational Effectiveness	Improves network resilience (Highway PT)	+	++	+	+	+	+	0	+	+	0	+	+	+	++
		Improves overall traffic management capability	++	+	++	++	++	++	0	++	++	0	++	++	++	+++
	Engineering and Safety Objectives	Potentially feasible within existing highway	-	---	---	--	-	---	-	---	---	---	---	-	0	++
		Geometrically feasible (in roadspace)	-	---	---	---	--	---	-	---	---	---	---	-	0	+++
		Limited construction impact on traffic conditions	--	--	---	--	--	--	+	---	---	---	---	--	--	++
		Provides a safe facility for all road users	++	0	0	0	++	++	++	0	0	0	+	0	+	++
		Impacts on utilities and roadside facilities	-	-	--	-	-	-	-	-	-	0	0	-	-	0
	Deliverability	Cost	-	---	---	--	--	-	-	---	---	---	---	--	---	---
		Buildability	-	---	---	---	--	---	--	---	---	---	---	--	--	-
Average Score (indicative only)			+0.4	-0.3	-0.6	-0.3	+0.3	-0.1	+0.1	-0.5	-0.1	-0.7	+0.1	+0.2	+1.1	

3.12 Priority Design Preferred Options

From the assessment process described in Section 3.11, the Stage 2 preferred schemes for the A470 and M4 corridors have identified on the basis of their overall positive impact and potential affordability and deliverability. The preferred options are set out in Table 19 and Table 20 for the A470 and M4 corridors respectively.

Table 19: A470 Preferred Design Scheme Options

Scheme Location	Measures
Traffic management and control measures at A470 Nantgarw	<ul style="list-style-type: none"> • Signalisation of Interchange; • Additional ancillary lane to exit lane (NB and SB); • Additional lane on Roundabout Gyratory; and • Improved active travel connection.
Traffic management and control measures at A470 Taffs Well	<ul style="list-style-type: none"> • Signalisation of southbound slip road onto junction; and • Improved Active Travel connection.
Smart expressway and traffic management measures on the A470 Abercynon to Coryton	<ul style="list-style-type: none"> • Additional third lane on the A470 mainline between Nantgarw and Taffs Well.
	<ul style="list-style-type: none"> • Reallocation of southbound lanes from one-exit/two-ahead to two-exit/one-ahead and additional third lane (northbound) on the A470 mainline between Taffs Well and Coryton.
	<ul style="list-style-type: none"> • Speed limit reduction to 50mph as an extension of trial 50mph 'Air Quality' scheme on A470 at Pontypridd.
	<ul style="list-style-type: none"> • Overhead Gantries with VMS on A470 (Speed limit/lane allocations), with average speed enforcement systems; and • Expressway Network Management Plans, with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

The option of implementing 3 narrow lanes on the 2-lane section of the A470 between Nantgarw and Upper Boat was found to perform reasonably well against the option assessment criteria (Table 17). However, since delays at this section are less than the southernmost section (from Nantgarw southwards) this measure is less effective at addressing key objectives. For the purposes of this Study, this option is therefore designated as a concept design option, most appropriate for consideration as a longer-term measure, and is discussed further in Section 4.5.2.

Two of the options to connect the A470 Southbound and the M4 Westbound at Coryton Interchange were found to perform reasonably well against the option assessment criteria. However, the overbridge structures that would be required to provide this connection would be high-cost for both options, and are more likely to be deliverable in the medium to long term given the engineering complexity. These options are unsuitable for delivery under the Pinch-Point programme given the time and cost restrictions and so, for the purposes of this Study, these options are considered as concept design options and are discussed further in Section 4.5.2.

It should be noted that Traffic management and control measures at A470 Upper Boat are being progressed by Rhondda Cynon Taf CBC and as such will not be included in the priority design preferred options to be taken forward as part of this Study.

Table 20: M4 Preferred Design Scheme Options

Scheme Location	Measures
Traffic management and control measures at M4 J33 Interchange	<ul style="list-style-type: none"> • Three-lane approach on the eastbound exit slip for signal stacking (lane 1 would be dedicated for P&R); • 100m ancillary lane on the A4232 approach arm; • Widening and potential signalisation of the A4232 approach arm and Services arm; and • Introduction of an additional westbound merge lane at J33 on-slip. .
Traffic management and control measures at M4 J34 Interchange	<ul style="list-style-type: none"> • Three lanes on all approach arms to junction gyratory– with lane allocation towards Pendoylan arm; • Full signalisation of the junction, including the A4119 entry, and widened gyratory (3 lanes) at A4119 and at southern (Pendoylan) arm; • Introduction of an additional merge lane at J34 eastbound on-slip; • There is also potential for the following measures in future with the proposed A48 Link in place: <ul style="list-style-type: none"> ○ Proposed dedicated cycle lane (north to south) on an overhead structure; and ○ Dedicated bus lane on western side of junction, to enable a public transport link between Talbot Green and the Vale of Glamorgan to be established. This measure requires a new bridge structure in place adjacent to existing bridge.
Smart expressway & traffic management measures on the M4 Mainline J33-J34	<ul style="list-style-type: none"> • Westbound four-lane carriageway to match cross-section of eastbound carriageway.
	<ul style="list-style-type: none"> • Reallocation of lanes on M4 (J34 to J33) eastbound to 2-lane ahead and 2-lane exit (to J33).
	<ul style="list-style-type: none"> • Overhead Gantries with VMS on M4 J34-J33 and on A4232 (Variable speed limit/lane allocations); and • Network Management Plans, with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

The assessment of preferred options against key objectives identified the following key beneficial effects:

- **More reliable journey times by car:** By introduction of more signal control, additional queue storage lanes, modified lane allocations, and better platooning of vehicles, more reliable journey times by car can be achieved. SEWTM modelling also shows that with measures in place, traffic increases at major junctions on the M4 and A470 corridor due to re-assignment effects i.e. traffic which currently uses county roads transfers onto Trunk Roads when delays there are reduced.

- **Improved resilience of transport network:** When congestion problems occur – more lanes, better management information, better road user information, multi-modal options for travel, and an updated network resilience plan will improve the ability of the transport network to perform efficiently under stress.
- **Reduce the number of road traffic accidents:** Improved lane allocations to better manage queues and reduce weaving, and signalisation of gyratory entries – with consequent improved road safety.
- **Improve walking and cycling connectivity:** Longer term walking/cycling link A4119 to A48.
- **Improve connectivity to transport hubs:** Stations and P&R at J33 and J34 (on M4) and Trefforest Industrial Estate, Taffs Well and at future Metro stations (A470), provide hubs for local and longer distance travel by Bus/Rail, with access walk/cycle routes.
- **Reduce carbon, noise, particulate emissions:** Attract traffic to trunk roads – alleviating side road problems; Promote use of non-car modes.
- **Public Transport improvements impacts:** Strategic modelling shows that the need for pinch-point schemes on the M4 and A470 corridors is not significantly influenced by introduction of major public transport improvements. Rail use on both corridors equates to around 15%-20% of movement on the corridors, with bus carrying less than 2%. Even with increases to public transport use due to the committed Metro service and introduction of potential concept options (such as North West Cardiff Rapid Transit and a new station near M4 J34), SEWTM modelling indicates that traffic conditions on the M4 and A470 would remain congested with a consequent case for introduction of short-term pinch point measures.

Bus Priority on the A470

On the A470 corridor, mode use of bus is presently at less than 2% (compared to up to 20% for rail). A review of the potential for bus priority lanes on the A470 has revealed that feasibility is limited by carriageway and corridor width constraints, that continuous bus lanes are not feasible due to interactions with on and off-slips, and that there is limited scope for bus stopping facilities close to local Metro stations (e.g. Taffs Well). There is however potential for a southbound section of bus lane on the A470 through the Coryton interchange as a result of the proposed Pinch-point scheme to reallocate lanes on the A470 (providing two lanes exit to Coryton and one lane ahead to Cardiff. Hence, it is concluded that:

- Significant mode share impact is most realistic for the rail or Metro modes.
- Bus travel serves local journeys but is unlikely to make a significant difference in the short term to corridor travel mode share and congestion impacts – although over the long-term with a Metro/Bus co-ordinated network a greater overall impact could be achieved.
- There is an opportunity for limited bus lanes on A470 through the Coryton interchange, but potentially it would be most beneficial in the longer term for

buses to be routed as feeders into rail and Metro hubs when delivered in conjunction with integrated ticketing that does not penalise journeys using both bus and rail.

SEWTM Modelling of Priority Design Options

A SEWTM 'Do Something' test was undertaken to forecast the potential impact of the Pinch Point schemes on travel patterns within the A470 and M4 corridors, particularly the wider highway network.

Model outputs indicate that the Pinch Point schemes would be expected to change traffic volumes on key roads within the Study area. The changes in traffic flows on other local roads as a result of the Pinch Point schemes would be expected to be relatively minor. The forecasts suggest that traffic volumes on the M4 to the west of Junction 34 would reduce as a result of the schemes.

However, the measures would be expected to significantly increase traffic volumes on the A4232 south of Junction 33 and the A468 Caerphilly Road approach to Nantgarw. Traffic volumes on the A4119 approach to Junction 34 during the AM peak are also expected to increase, whilst PM peak flows on this approach would be expected to reduce.

The additional traffic attracted through these junctions would mean that levels of delay at the junctions would be expected to remain about the same for individual vehicles as a result of the increased throughput.

Congestion on the sections of road that are to be widened to accommodate extra lanes is expected to reduce as a result of the additional capacity provided. This is the case on the A470 between Nantgarw and Taffs Well and the M4 westbound between Junctions 33 and 34.

The model outputs suggest that the Pinch Point schemes would increase congestion on some local road approaches to the A470/M4. The measures would be expected to increase throughput at junctions which in turn could negate any potential journey time savings to individual vehicles.

Key benefits are considered to be as follows:

- maintaining road hierarchy by attracting strategic traffic away from the local roads;
- improving safety and control over the A470 and M4 corridors; and
- improved journey time reliability both in terms of day to day variability and also due to reduced incidents on the network.

3.13 Options not to be taken forward in this Study

Measures which do not match the criteria for Design Scheme Option or Concept Scheme Option are not taken forward for further investigation in this Study i.e. they do not have a significant impact as a standalone scheme, are not in the study corridor, or are likely to be only deliverable in the longer term. These schemes should be considered outside this Study as appropriate by local or

national transport authorities. In particular many of the schemes are rail and bus hub upgrades associated with the South East Wales Metro project, under the auspices of Transport for Wales.

Particular schemes are also subject to current WelTAG studies and are therefore not taken forward within this particular study. Discussions held with relevant stakeholders ensure that all relevant information is gathered and that the schemes can be considered as part of any new measures proposed within this study. These are as follows:

- The A470 Swansea Road (Trago Mills) roundabout traffic management scheme is being investigated in a separate WelTAG Stage 2 Study for Welsh Government.
- M4 Junction 34 to A48 road link – currently being investigated by the Vale of Glamorgan.

Options not to be taken forward in this Study are listed in the IAR (Section 17) and also summarised in Appendix A.

4 Transport Case

4.1 Preferred Priority Design Options

The Stage 2 preferred schemes for the A470 and M4 corridors are as set out in Table 21 and Table 22 respectively.

Table 21: A470 Preferred Design Scheme Options

Scheme Location	Measures
Traffic management and control measures at A470 Nantgarw	<ul style="list-style-type: none"> • Signalisation of Interchange; • Additional ancillary lane to exit lane (NB and SB); • Additional lane on Roundabout Gyratory; and • Improved active travel connection.
Traffic management and control measures at A470 Taffs Well	<ul style="list-style-type: none"> • Signalisation of southbound slip road onto junction; and • Improved Active Travel connection.
Smart expressway and traffic management measures on the A470 Abercynon to Coryton	<ul style="list-style-type: none"> • Additional 3rd lane on the A470 mainline between Nantgarw and Taffs Well.
	<ul style="list-style-type: none"> • Reallocation of southbound lanes from 1-exit/2-ahead to 2-exit/1-ahead and additional 3rd lane (northbound) on the A470 mainline between Taffs Well and Coryton.
	<ul style="list-style-type: none"> • Speed limit reduction to 50mph as an extension of trial 50mph 'Air Quality' scheme on A470 at Pontypridd.
	<ul style="list-style-type: none"> • Overhead Gantries with VMS on A470 (Speed limit/lane allocations), with average speed enforcement systems; and • Expressway Network Management Plans, with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

Table 22: M4 Preferred Design Scheme Options

Scheme Location	Measures
Traffic management and control measures at M4 J33 Interchange	<ul style="list-style-type: none"> • Three-lane approach on the eastbound exit slip for signal stacking (lane 1 would be dedicated for P&R); • 100m ancillary lane on the A4232 approach arm; • Widening and potential signalisation of the A4232 approach arm and Services arm; and • Introduction of an additional westbound merge lane at J33 on-slip. .
Traffic management and control measures at M4 J34 Interchange	<ul style="list-style-type: none"> • Three lanes on all approach arms to junction gyratory– with lane allocation towards Pendoylan arm; • Full signalisation of the junction, including the A4119 entry, and widened gyratory (3 lanes) at A4119 and at southern (Pendoylan) arm; • Introduction of an additional merge lane at J34 eastbound on-slip; • There is also potential for the following measures in future with the proposed A48 Link in place: <ul style="list-style-type: none"> ○ Proposed dedicated cycle lane (north to south) on an overhead structure; and ○ Dedicated bus lane on western side of junction, to enable a public transport link between Talbot Green and the Vale of Glamorgan to be established. This measure requires a new bridge structure in place adjacent to existing bridge.
Smart expressway & traffic management measures on the M4 Mainline J33-J34	<ul style="list-style-type: none"> • Westbound 4-lane carriageway to match cross-section of eastbound carriageway.
	<ul style="list-style-type: none"> • Reallocation of lanes on M4 (J34 to J33) eastbound to 2-lane ahead and 2-lane exit (to J33).
	<ul style="list-style-type: none"> • Overhead Gantries with VMS on M4 J34-J33 and on A4232 (Variable speed limit/lane allocations); and • Network Management Plans, with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

4.2 Package Approach to Appraisal

In this Stage 2 study, the Priority Design Options (i.e. pinch-point schemes) have been developed as individual schemes – and assessed in respect of how they address problems and objectives. However, the individual schemes have been devised as part of an overall corridor strategy which emerged from the Stage 1 studies, such that they work as an overall package to maximise benefits and resilience outcomes.

Therefore, for the Transport Appraisal, which addresses wider Social, Cultural, Environmental and Economic considerations, the individual schemes have been appraised as an overall package. This reflects an appropriate scale of assessment in respect of Transport Case criteria, as well as the significant interdependency of the individual schemes.

For example, on the M4 corridor, the scheme linkages include the following tie-ins between individual schemes:

- Road widening on the A4119 approach to Junction 34, to allow Cardiff-bound traffic to queue in the nearside lane, and M4 East-bound traffic to queue in the middle lane, with M4 West-bound traffic in the offside lane;
- Widening on the eastbound on-slip road to create two lanes, to allow traffic to split into Cardiff-bound (A4232) movement and M4 East-bound movement, with the nearside on-slip road forming a lane-gain on the M4 mainline between J34 and J33; and
- On the approach to M4 Junction 33, the eastbound Lane 1 (nearside) and Lane 2 would be designated as off-slip lanes, with the two outer lanes designated as through lanes (towards M4 Junction 32).

Similarly, on the A470 corridor, scheme linkages include the following tie-ins between individual schemes:

- Signalisation and slip road widening measures at Nantgarw Interchange are linked with a lane gain arrangement on the A470 to the south;
- Signalisation at Taffs Well southbound off-slip junction is linked with the new lane drop upstream on the A470; and
- A lane gain on the A470 northbound from Coryton is tied in to a modified lane allocation on Coryton gyratory at the A470 northbound exit junction.

4.4 Design Option Appraisal

The Transport Case appraisal has considered the proposed options in relation to the following, as outlined within WelTAG guidance:

- a) **Problems;**
- b) **Objectives;**
- c) **Social and Cultural** considerations;
- d) **Environmental** considerations; and
- e) **Economic** considerations.

In accordance with WelTAG, appraisal summary tables (ASTs) have been prepared for both the A470 and M4 package of schemes, as presented in Sections 4.4.1 and 4.4.3. WelTAG appraisal criteria have been utilised for the assessment. The methodology adopted in appraising the significance and scale of impacts uses the seven-point scale as set out in Figure 18.

Figure 18 WelTAG Seven Point Assessment Scale

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

It is noted that the ‘do nothing’ option (see IAR Section 23) received a neutral scoring against the majority of the criteria with some minor adverse scoring based on the expected worsening of some problems e.g. traffic congestion, based on SEWTM modelling forecasts outlined in Section 3.1.4.

It is relevant to note that with the pinch-point measures in place, benefits are expected to accrue to the wider transport network and local communities beyond the A470 and M4 corridors, due to the effects of traffic reassignment which has been observed in SEWTM modelling tests. For example, flows on the A470 and M4 increase marginally (compared with a Do Minimum scenario) with improvement measures in place, leading to a corresponding reduction in traffic flows on parallel local roads. This effect would contribute beneficially to local communities in respect of reducing impacts of severance air quality, and noise.

4.4.2 A470 Design Option Appraisal

The appraisal of A470 Priority Design Options against Problems and Objectives are provided in Table 23 and Table 24 respectively.

Table 23: A470 Priority Design Options Package Assessment against Problems

Criteria	A	Evidence
Traffic congestion and unreliable journey times at major road junctions, with potential additional impacts due to major developments	++	Addressing pinch point areas along the A470 corridor (set out within Section 21 Junction Traffic Capacity Modelling of the IAR) would reduce congestion and add resilience to the network resulting in improvements to journey times.
Over-reliance on a few main arteries of the road network for most car travel and hence a lack of resilience when congestion problems occur	+	Network Management Plans would include contingency planning, with pre-determined diversion routes in the event of incidents. Targeting pinch point areas within the current network would increase resilience and reduce congestion problems on the A470 corridor.
High modal use of private car for many journeys and corresponding low (<<10%) mode use of public transport – with minimal impact on levels of car traffic flows	-	Improving journey time reliability and reducing congestion may encourage more people to travel by car without interventions to make public transport and active travel attractive.
Bus public transport journey times are much slower than by car or rail	+	Reduced congestion and improved journey times on the A470 corridor and parallel local roads, together with bus priority measures at A470 Coryton, will improve journey times by bus.
Reliance on car travel to access Strategic Development sites	+	Pinch point schemes are likely to have a minor beneficial impact on access to strategic development sites by generally improving travel conditions on the network, and through improved active travel links at junctions.
Poor accident records at particular road locations/links	++	Improved lane allocations and traffic management through signalisation and VMS will tend to reduce the number and severity of accidents.
Noise impacts from traffic	0	There is likely to be a negligible impact on noise pollution, although on local roads there could be a reduction in noise impact if pinch-point measures attract traffic, which currently uses local roads, to use the A470.
High carbon and particulate emissions from transport	+	Reduced speed limit and improved traffic management would help reduce carbon emissions and help to minimise pollution effects of transport.
Poor walking and cycling routes to community services, public transport stops and stations, and to employment locations, and severance due to traffic, are barriers to active travel	+	Measures include opportunities for enhanced active travel links along the corridor and to stations.

Table 24: A470 Design Options Package Assessment against Objectives

Criteria	A	Evidence
To reduce the number of road traffic accidents at hotspot locations	++	Improved lane allocations and traffic management through signalisation and VMS will tend to reduce the number and severity of accidents.
To improve walking and cycling connectivity to stations, bus stops and development sites	+	Measures include enhanced active travel links at junctions along the corridor and to public transport hubs.
To improve connectivity to transport hubs (P&R, Bus-Bus, Bus-Rail)	+	Reduced road congestion and enhanced active travel measures should improve access to existing and proposed hubs.
To improve the opportunity for all to make journeys to key destinations (services, education, employment, leisure)	+	Reducing congestion and increasing resilience in the network would improve access to strategic sites and key destinations.
To manage and control traffic congestion and improve the resilience of the transport network	+++	Pinch points schemes have been designed to manage and control traffic congestion, and include VMS measures and a proposal to update/improve the Network Management Plan.
To reduce carbon emissions, noise effects, and particulate emissions from transport	+	Reduced speed limits and improved traffic management, giving more reliable journey times, would help reduce carbon emissions on the A470 and local roads (by attracting some local traffic to re-route to the improved A470 corridor).
To improve sustainable accessibility to strategic developments	+	The package of schemes includes opportunities for access to strategic Park and Ride sites, better walking and cycling facilities, and bus priority measures.

Table 25, Table 26, and Table 27 show the appraisal outputs for Social and Cultural, Environmental, and Economic criteria respectively.

Table 25: A470 Design Options Package Assessment against Social and Cultural Criteria

Criteria	A	Evidence
Accidents	++	Reduced congestion and lower speed limits/VMS signage on mainline would reduce the number and severity of accidents.
Access to Employment	+	Reduced congestion, improved journey time reliability (including on public transport) would result in a net improvement to access to employment.
Access to Services	+	Reduced congestion, improved journey time reliability would result in a net improvement to access to employment along the corridor.
Option & non-use values (Resilience)	++	Network Management Plans would be updated to improve contingency planning, Priority Design measures would increase overall network resilience by providing additional roadspace and improved signal control.
Physical Activity	+	Improved active travel measures are incorporated into the Priority Design measures which will to encourage physical activity.
Journey Quality	++	Improved journey time and reliability and reduced stress would result from less congestion.
Security	+	Improved infrastructure should result in a minor security improvement.
Affordability for users	0	Likely to be comparable to existing journeys made by private car/bus.
Severance	+	Improved cycle and pedestrian crossing facilities at Nantgarw interchange and Taffs Well interchange.

Table 26: A470 Design Options Package Assessment against Environmental Criteria

Criteria	A	Evidence
Noise	0	There is likely to be a negligible impact on noise pollution, although on local roads there could be a reduction in noise impact if pinch-point measures attract traffic, which currently uses local roads, to use the A470.
Air Quality	+	Reduced speed limits and reduced congestion would help to minimise emissions and pollution from transport.
Greenhouse Gases	+	Reduced speed limits and reduced congestion would help to minimise carbon emissions.
Landscape	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on landscape would be negligible.
Townscape	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on townscape would be negligible.
Historic Environment	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on the historic environment would be negligible.
Bio-diversity	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on bio-diversity would be negligible.
Water Environment	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on the water environment would be negligible.

Table 27: A470 Design Options Package Assessment against Economic Criteria

Criteria	A	Evidence
Journey Time Changes	+++	Pinch point measures would result in reduced congestion and improved network journey times.
Journey Time Reliability Changes	+++	Pinch point measures would result in reduced congestion and improved network journey time reliability and resilience.
Accidents (Costs)	++	Improved lane allocations and traffic management through signalisation and VMS will tend to reduce the number and severity of accidents.
Capital Costs	-	The overall cost is estimated to be £13-31M.
Transport Costs	0	Negligible impact anticipated on user costs compared to existing journeys by private car.
Changes in Productivity	+	Enhanced connectivity/reduced congestion will result in less stressful/shorter journeys and increase productivity.
Local Economy	++	Improving traffic conditions and helping ensure that adverse traffic conditions are not a barrier to economic activity.
Land	0	Pinch point schemes will not require significant land take and are likely to be restricted to the existing highway.
Revenue Costs	-	Revenue costs to operate/maintain infrastructure would be incurred.

4.4.4 M4 Design Option Appraisal

Table 28 and Table 29 set out the appraisal of the M4 Priority Design Options against Problems and Objectives.

Table 28: M4 Design Options Package Assessment against Problems

Criteria	A	Evidence
Traffic congestion and unreliable journey times at major road junctions, with potential additional impacts due to major developments	++	Addressing pinch point areas along the M4 corridor (set out within Section 21 Junction Traffic Capacity Modelling of the IAR) would reduce congestion and add resilience to the network resulting in improvements to journey times.
Over-reliance on a few main arteries of the road network for most car travel and hence a lack of resilience when congestion problems occur	+	Network Management Plans would include contingency planning, with pre-determined diversion routes in the event of incidents. Targeting pinch point areas within the current network would increase resilience and reduce congestion problems on the M4 corridor.
High modal use of private car for many journeys and corresponding low (<<10%) mode use of public transport – with minimal impact on levels of car traffic flows	-	Improving journey time reliability and reducing congestion may encourage more people to travel by car without interventions to make public transport and active travel attractive.
Bus public transport journey times are much slower than by car or rail	+	Reduced congestion and improved journey times on the M4 corridor will improve journey times by bus or coach.
Reliance on car travel to access Strategic Development sites	+	Pinch point schemes are likely to have a minor beneficial impact on access to strategic development sites by generally improving travel conditions on the network, and through future improved active travel links at junctions.
Poor accident records at particular road locations/links	++	Improved lane allocations and traffic management through signalisation and VMS will tend to reduce the number and severity of accidents.
Noise impacts from traffic	0	There is likely to be a negligible impact on noise pollution, although on local roads there could be a reduction in noise impact if pinch-point measures attract traffic, which currently uses local roads, to use the M4.
High carbon and particulate emissions from transport	+	Reduced speed limits and improved traffic management would help reduce carbon emissions and help to minimise pollution effects of transport.
Poor walking and cycling routes to community services, public transport stops and stations, and to employment locations, and severance due to traffic, are barriers to active travel	+	Measures include opportunities for enhanced active travel links along the corridor and to potential new stations.

Table 29: M4 Design Options Package Assessment against Objectives

Criteria	A	Evidence
To reduce the number of road traffic accidents at hotspot locations	++	Improved lane allocations and traffic management through signalisation and VMS will tend to reduce the number and severity of accidents.
To improve walking and cycling connectivity to stations, bus stops and development sites	+	Measures include enhanced active travel links at junctions along the corridor and to public transport hubs.
To improve connectivity to transport hubs (P&R, Bus-Bus, Bus-Rail)	+	Reduced road congestion and enhanced active travel measures should improve access to existing and proposed hubs.
To improve the opportunity for all to make journeys to key destinations (services, education, employment, leisure)	+	Reducing congestion and increasing resilience in the network would improve access to strategic sites and key destinations.
To manage and control traffic congestion and improve the resilience of the transport network	+++	Pinch points schemes have been designed to manage and control traffic congestion and include VMS measures and a proposal to update/improve the Network Management Plan.
To reduce carbon emissions, noise effects, and particulate emissions from transport	+	Improved traffic management, giving more reliable journey times, would help reduce carbon emissions on the M4, and on local roads (by attracting some local traffic to re-route to the improved A470 corridor).
To improve sustainable accessibility to strategic developments	+	The package of schemes is aligned well with potential concept public transport schemes which would improve access to strategic Park and Ride Sites, better walking and cycling facilities, and bus priority measures.

Table 30, Table 31, and Table 32 show the appraisal outputs for Social and Cultural, Environmental, and Economic criteria respectively.

Table 30: M4 Design Options Package Assessment against Social and Cultural Criteria

Criteria	A	Evidence
Accidents	++	Reduced congestion and lower speed limits/VMS signage on mainline would reduce number and severity of accidents.
Access to Employment	+	Reduced congestion, improved journey time reliability would result in a net improvement to access to employment.
Access to Services	+	Reduced congestion, improved journey time reliability would result in a net improvement to access to employment along the corridor.
Option & non-use values (Resilience)	++	Network Management Plans would be updated to improve contingency planning, Priority Design measures would increase overall network resilience by providing additional roadspace and improved signal control.
Physical Activity	+	Improved active travel measures are incorporated into the Priority Design measures which will to encourage physical activity.
Journey Quality	++	Improved journey time and reliability and reduced stress would result from less congestion.
Security	+	Improved infrastructure should result in a minor security improvement.
Affordability for users	0	Likely to be comparable to existing journeys made by private car/bus.
Severance	+	Potential for some reductions in traffic on local roads because of traffic diverting to the improved M4 corridor.

Table 31: M4 Design Options Package Assessment against Environmental Criteria

Criteria	A	Evidence
Noise	0	There is likely to be a negligible impact on noise pollution, although on local roads there could be a reduction in noise impact if pinch-point measures attract traffic, which currently uses local roads, to use the A470.
Air Quality	+	Improved traffic management and reduced congestion would help to minimise emissions and pollution from transport.
Greenhouse Gases	+	Reduced speed limits and reduced congestion would help to minimise carbon emissions.
Landscape	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on landscape would be negligible.
Townscape	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on townscape would be negligible.
Historic Environment	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on the historic environment would be negligible.
Bio-diversity	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on bio-diversity would be negligible.
Water Environment	0	Pinch point measures do not require significant new infrastructure/construction works as such impact on the water environment would be negligible.

Table 32: M4 Design Options Package Assessment against Economic Criteria

Criteria	A	Evidence
Journey Time Changes	+++	Pinch point measures would result in reduced congestion and improved network journey times.
Journey Time Reliability Changes	+++	Pinch point measures would result in reduced congestion and improved network journey time reliability and resilience.
Accidents (Costs)	++	Improved lane allocations and traffic management through signalisation and VMS will tend to reduce the number and severity of accidents.
Capital Costs	-	The overall cost is estimated to be £11-27M.
Transport Costs	0	Negligible impact anticipated on user costs compared to existing journeys by private car.
Changes in Productivity	+	Enhanced connectivity/reduced congestion will result in less stressful/shorter journeys and increase productivity.
Local Economy	++	Improving traffic conditions and helping ensure that adverse traffic conditions are not a barrier to economic activity.
Land	0	Pinch point schemes will not require significant land take and are likely to be restricted to the existing highway.
Revenue Costs	-	Revenue costs to operate/maintain infrastructure would be incurred.

4.5 Concept Option Appraisal

4.5.1 Concept Public Transport Outline Appraisal

A full appraisal has not been undertaken for longer-term concept public transport measures, however, an initial assessment including area-wide SEWTM modelling (see IAR Section 20) suggests the following potential impacts.

For the **North West Cardiff Rapid Transit and associated Park & Ride at M4 Junction 33**, key impacts are considered to be as follows:

- Mode share is currently car dominated – and hence some mode shift from private car to public transport could result in some reduction in overall network congestion impacts i.e. not just on the trunk roads but also on the local road network;
- A significant increase in resilience would accrue due to the availability of an alternative travel corridor/transport mode;
- The scheme would be expected to improve public transport journey times and reliability which are currently slow and unreliable;
- Public transport usage should result in some decrease in traffic noise and emissions (compared to the Do Minimum);
- Potential for improved access by rapid transit to Strategic Development sites in NW Cardiff and RCT CBC;
- The Rapid Transit corridor, and Park & Ride facility, should include complimentary walking/cycling measures linking with surrounding areas; and
- Overall deliverability is challenging due to high construction cost and potential land ownership complexity; and
- Need to determine longer-term operational and financial viability – revenue costs to operate/maintain facilities and services, which could be offset by revenue stream associated with patronage.

For a **cross-valley bus service** at a ‘rapid transit’ level of quality, key impacts are considered to be as follows:

- The availability of a frequent and reliable public transport link between the A470 and M4 corridors would provide a new opportunity to travel by public transport and would be an alternative to car travel. Bus journey times are currently significantly longer than car, and services operate at low frequencies of 1- or 2 buses per hour;
- A significant increase in resilience would accrue due to the availability of an alternative travel corridor/transport mode;
- Access to a specific new cross-valley public transport service with associated infrastructure would provide users with a reliable public transport journey times and reliability compared to present car or bus journeys;

- Public transport usage should result in some decrease in traffic noise and emissions (compared to the Do Minimum);
- Potential for improved access by cross-valley bus to Strategic Development sites in RCT CBC, especially if the service is connected to the Metro network which will significantly increase the range of destinations (which will also require cross-ticketing and timetable co-ordination);
- Proposal should include complimentary walking/cycling measures along the cross-valley corridor;
- Overall deliverability is challenging due to high construction cost (depending on the extent of segregated infrastructure) and potential land ownership complexity; and
- Need to determine longer-term operational and financial viability – revenue costs to operate/maintain facilities and services, which could be offset by revenue stream associated with patronage.

For a **new rail station near (and accessed from) M4 Junction 34**, key impacts are considered to be as follows:

- Mode share on the M4 corridor and into Cardiff is currently car dominated – and hence some mode shift from private car to public transport would result in some reduction in overall network congestion impacts i.e. not just on the trunk roads but also on the local road network;
- A significant increase in resilience would accrue due to the availability of an alternative travel corridor/transport mode;
- Access to a new rail station would provide users with a reliable public transport journey times and reliability compared to present car or bus journeys;
- Public transport usage should result in some decrease in traffic noise and emissions (compared to the Do Minimum);
- Potential for improved access by rail and connecting bus to Strategic Development sites in RCT CBC;
- Proposal should include complimentary walking/cycling measures linking the rail station with surrounding areas;
- Overall deliverability is challenging due to high construction cost and potential land ownership complexity; and
- Need to determine longer-term operational and financial viability – revenue costs to operate/maintain facilities and services, which could be offset by revenue stream associated with patronage.

For a **relocation of Treforest Industrial Estate Station to Nantgarw** (as a Metro station), with P&R facilities, key impacts could be:

- Relocating the rail station to better serve strategic sites may encourage mode shift and reduce reliance on private car and associated congestion problems;

- Encouraging mode shift through the relocation of the station to strategic employment and leisure sites could reduce congestion and increase resilience in the network;
- Current public transport journey times are slow and relocating the station closer to employment sites would reduce walk times between the station and workplace;
- Enhanced active travel routes could be incorporated into the scheme depending on land availability; and
- Public transport usage should result in some decrease in traffic noise and emissions (compared to the Do Minimum).

4.5.2 Concept Highway Schemes Outline Appraisal

A full appraisal has not been undertaken for longer-term concept highway schemes, however, an initial assessment of impacts has been undertaken. Whilst the schemes noted below would address some of the congestion-related problems and objectives, due to their engineering complexity and associated cost and deliverability challenges, it is concluded that they are unsuitable for delivery within the short-term (in the Pinch-point programme).

For a **connector link from A470 Southbound to M4 Westbound**, key impacts could be:

- Existing congestion on approach to Coryton could be partially addressed by creation of a westbound link which would reduce southbound congestion on the A470;
- A new road link would increase resilience in the network by providing alternative route for trunk road traffic;
- Commuting mode share is currently dominated by the private car – and creation of a through link and the associated reduced journey times by private car would not encourage modal shift to alternative modes;
- Bus journey times are currently slow and unreliable; however the scheme is unlikely to impact significantly on bus journey times into Cardiff;
- Use of modes other than car to access Strategic sites would not be encouraged through the creation of a new link road;
- There is likely to be a negligible impact on noise pollution, although use of low noise road surfacing where any interventions are made could help create benefits/effective mitigation;
- Some benefit may accrue on local roads if traffic which currently avoids the congested southern end of the A470 re-assigns to the trunk road network with some consequent reduced emissions on local roads; and
- The scheme is unlikely to encourage walking or cycling.

For **implementing 3 lanes on 2-lane sections of the A470 between Nantgarw and Upper Boat**, key impacts could be:

- Should have benefits in reducing congestion and improving journey times along this section of the A470, where there are currently congestion issues;
- Should benefit network resilience;
- Encourages use of the car along the A470 as the primary mode of travel, therefore negative impacts on modal share which is already dominated by the private car;
- Should provide benefits for buses travelling along the A470 with reduced congestion, and improve journey times which are currently slow;
- Encourages car use along the A470 to access strategic development sites;
- Reduced congestion would reduce stop-start conditions and associated risk of rear shunt accidents. Lower speed limits and VMS signage on mainline carriageway likely to reduce number and severity of accidents;
- Reduces noise from queuing traffic but potential to create 'new' noise sources from free-flowing traffic;
- Impact on air quality likely to be negligible due to potential increase in traffic, but offset by less time spent queuing; and
- Impact on active travel likely to be minimal.

For a **implementing a new road link connection between the A4119 and the A4232 avoiding M4 Junction 34 and Junction 33**), key impacts could be:

- A new road link would reduce the impact on the existing road network thereby reducing congestion at existing problematic locations and improving journey times;
- An increase in resilience would be created by addressing the overreliance on the main arteries of the road network i.e. M4;
- The provision of an additional road link may encourage further use of the private car rather than promoting modal shift which is already dominated by the private car;
- An additional road link would contribute to reducing congestion which in turn could reduce bus journey times, which are currently slow;
- A new road link could increase reliance on private car journeys and discourage modal shift;
- Reduced congestion and lower speed limits/VMS signage on mainline would reduce number and severity of accidents;
- A new road link would provide a new noise source for local receptors;
- A new road link could encourage additional traffic onto the A4119 which has a designated AQMA location; and
- Potential active travels links could be incorporated into the scheme, but a new road link may discourage take up of these options in favour of private car journeys.

4.6 Public Transport and Active Travel in Priority Design Schemes

Development of the Priority Design Options has included a focus on addressing the needs of sustainable transport modes, and as such the schemes include a range of cycling/walking measures, and assistance for bus movement.

The WelTAG appraisal of Priority Design Options includes consideration of benefits related to sustainable travel – and to inform this process the key aspects of cycling/walking/bus measures are highlighted in Sections 4.6.1 to 4.6.2.

4.6.1 Bus Priority

Bus Priority on the A470 corridor

Journeys by bus currently account for less than 2% of all journeys (compared to up to 20% for rail) at peak times. A review of the potential for bus priority lanes on the A470 has revealed that feasibility is limited by carriageway and corridor width constraints. Continuous bus lanes are not feasible due to the presence of on and off-slips, and there is limited scope for bus stopping facilities close to local Metro stations (e.g. Taffs Well).

However, the proposed Pinch-point scheme provide two exit lanes to Coryton and one lane ahead to Cardiff on the A470 facilitates the potential for a section of bus lane on the A470 southbound (towards Cardiff) through Coryton.

In respect of the feasibility and effectiveness of bus priority measures:

- Significant mode share impact is most realistic for the rail modes;
- Bus travel serves local journeys but is unlikely to make significant difference to corridor travel mode share and congestion impacts;
- There is an opportunity for limited bus lanes on A470 through Coryton, but potentially it would be most beneficial in the longer term for buses to be routed as feeders into rail and Metro hubs;
- Significant bus priority measures would be likely to require major new infrastructure which is considered outside the scope of this ‘pinch-point’ study; and
- Attracting car users to public transport would require a carefully planned co-ordinated bus-and-rail approach. This would be most effective if buses were routed to Metro stations north of Cardiff to allow passengers to transfer to the quicker, and more reliable, rail mode. This arrangement would require institutional and legal processes to be addressed.

Proposals for bus priority interventions towards Cardiff have hence been incorporated within overall ‘Smart expressway and traffic management measures on the A470 Abercynon to Coryton’ measures – rather than be dealt with as a stand-alone scheme.

Bus Priority on the M4 corridor

Journeys by bus currently account for less than 2% of all journeys, and there is very limited scope and benefit for bus priority measures on the M4 itself. However, measures devised for M4 Junction 34 have incorporated potential north-south bus priority lanes on the A4119 – which would only be feasible in future if the M4 J34 to A48 Sycamore Cross scheme is constructed. The feasibility of this link is currently being investigated by the Vale of Glamorgan CBC.

4.6.2 Active Travel

Active Travel on the A470 corridor

On the A470 corridor, preferred Priority Design schemes have significant elements aimed at improving facilities for pedestrians and cyclists, as follows:

- **Taffs Well Interchange:** The proposed Priority Scheme includes a new controlled pedestrian/cycle crossing of the southbound off-slip at its junction with the interchange gyratory (on the NCN 8 route).
- **Nantgarw Interchange:** The proposed Priority Scheme includes a controlled pedestrian/cycle crossing at the northbound off-slip junction with the gyratory, and an uncontrolled crossing at the southbound on-slip just south of the gyratory. This provides a high quality and safe pedestrian/cycle link from east-to-west (and linking NCN 8 with employment and education centres on the Trefforest Industrial Estate).

Active Travel on the M4 corridor

On the M4 corridor, it is proposed to incorporate cycle/walk facilities measures as part of improvement schemes as follows:

- **M4 Junction 34:** A walk/cycle link across the interchange has been devised, including a new bridge over the M4. This scheme would only be feasible in future if the M4 J34 to A48 Sycamore Cross scheme is constructed. The feasibility of this link is currently being investigated by the Vale of Glamorgan CBC.
- **North West Cardiff Rapid Transit:** It is relevant that future consideration and investigation of the proposed North West Cardiff Rapid Transit scheme (which is identified as a Concept Option in this Study) should include for the potential to include a cycle path alongside the rail (or busway) infrastructure.
- **Park and Ride at M54 Junction 33:** It would be beneficial to include provision for cycle parking at this potential future Park & Ride site, such that cyclists can arrive from the A4119 (north of the location), park near M4 Junction 33, and travel onwards to Cardiff on the (proposed) North West Cardiff Rapid Transit.

4.8 Option Appraisal Summary

Conclusions of assessment against Transport Case criteria are summarised as follows:

- Doing nothing is considered unacceptable, given the likely significant impediments to the movement of people and goods, with associated adverse economic, social, cultural and environmental impacts;
- The priority design schemes performed well against the problems, objectives and impact assessment criteria displaying mostly large beneficial, moderate beneficial or slight beneficial scoring – and analysis of options gives confidence that the preferred measures provide a feasible and effective set of proposals to address transport problems and especially congestion and delay;
- The public transport concept schemes performed well against the problems and objectives – but have a relatively high cost and are unlikely to be deliverable in the short-term, and would require further detailed investigations to address effectiveness, cost, delivery, timescale and institutional issues; and
- The concept highway schemes are mixed in terms of their ability to address all problems and objectives, as they are predominantly car-based solutions. As for public transport measures, further detailed investigations would be needed to identify the need, impact, costs and delivery issues associated with highway-based solutions.

The key benefits of the Priority Design Schemes are set out below.

Transport Economic Impacts are:

- Reduced journey time on the road network;
- More reliable journey times;
- Reduced driver stress;
- Reduced accident occurrence;
- Improved cycle/walk routes including safety; and
- Improve access to public transport hubs (especially future planned hubs).

Wider Impacts (Economic\Environmental\Social & Cultural) are:

- Encourages and facilitates development and investment;
- Increases network resilience;
- Enables management of air quality impacts; and
- Reassigned traffic reduces local flows, noise, local safety, community connectivity.

5 Financial Case

5.1 Introduction

The Financial Case considers the affordability and long-term financial viability of the option(s). Consideration is given to both capital and annual revenue requirements.

Given the corridor nature of this Study, a detailed Financial Case has not been carried out. Instead this section summarises the cost assessment presented in Section 22 of the IAR and broadly considers issues that may affect the selection of options. It is anticipated that further, more detailed information would be provided as the process progresses towards a Stage 3 Full Business Case.

5.2 Priority Design Scheme Cost Assessment

This WelTAG Stage 2 considers many options and lifetime costs have not been calculated at this stage, given that it is likely that options would be delivered on a phased basis and packaged in different ways depending on needs and affordability.

By WelTAG Stage 3, a whole-life costing will be required for each option to ensure optimum long-term return. This will include consideration of maintenance costs, which should be minimised using materials which will likely have a greater life-span and by installing long-life assets.

Broad capital cost estimates have been provided for the purposes of this Stage 2 study. The capital scheme costs for preferred Priority Design Schemes have been estimated based on benchmark costs of comparable schemes within the South East Wales region. Capital costs for Concept Public Transport and Highway schemes have also been considered as broad cost bands, given the early nature of feasibility work. These are identified as:

- Low (up to £3m)
- Medium (£3m – £7m)
- High (£7m - £20m)
- Very High (£20m - £100m+).

These costs are indicative at this stage but nevertheless have been included below given that they may serve to identify and help address any affordability issues.

The estimated capital costs for each of the short-listed schemes are set out in Table 33 and Table 34.

Table 33 – A470 Pinch-point design schemes – Indicative costs

Scheme(s)	Indicative Cost (£m)
Nantgarw Interchange – Signalisation, widening of gyratory/on approach to better manage queues	Medium (£3m-7m)
Taffs Well Interchange – Signalisation of SB off-slip and provide National Cycle Network (NCN) crossing	Low (up to £3m)
Upper Boat – Revised traffic management to address queues blocking back to A470	Not included; assumed as being developed by RCT CBC-
Taffs Well to Nantgarw (2.7km) – Implementing 3 narrow lanes on 2-lane sections Northbound and Southbound	Medium (£3m-7m)
Coryton to Taffs Well (1.4km) – Reallocation of 3 Southbound lanes and narrow lanes in Northbound direction north of Coryton	Medium (£3m-7m)
Pontypridd to Coryton – Reduced Speed Limit to address Air Quality	Incl. below
VMS gantry signage on A470 (incl. updates to Network Management Plans, utilising ITS and traffic officers to improve everyday operation and network resilience, particularly in the event of incidents or road works)	Medium (£3m-7m)

Table 34: M4 Pinch-point design schemes - Indicative Costs

Scheme(s)	Indicative Cost (£m)
M4 J34 - Signalisation and gyratory widening – with or without M4 J34 to A48 Transport Link	Low (up to £3m)
M4 J33 - Improved signal control efficiency by signalising A4232 entry to improve platooning on gyratory and signalisation of Services entry	Medium (£3m-7m)
Improved lane allocation on eastbound carriageway J34-J33, providing 2 lanes exit to A4232 off-slip and 2 lanes to M4 ahead eastbound	Low (up to £3m)
J33-J34 (3.4km)- Provide additional lane on existing 3 lanes westbound carriageway	Medium (£3m-7m)
VMS gantry signage on M4 (incl. updates to Network Management Plans, utilising ITS and traffic officers to improve everyday operation and network resilience, particularly in the event of incidents or road works)	Medium (£3m-7m)

The overall package of pinch-point measures are costed (on an indicative basis only) as £13M to 31M for the A470, and £14M to £27M for the M4 corridor. At the next stage of design, it will be feasible to determine quantities and hence formulate more accurate cost estimates.

5.4 Concept Schemes Cost Assessment

For purposes of this Study only, in order to provide a broad comparison with the Design Scheme cost estimations, an initial budget estimate of costs for public transport-orientated schemes has been undertaken.

Table 35: Public transport concept schemes- Indicative Costs

Scheme(s)	Indicative Cost (£m)
Cross-Valley Bus Rapid Transit (Metro Extension) – Pontypool – Llantrisant/Talbot Green	£25m-£50m, based on 13km extension between Pontypridd and Talbot Green only
Relocation of Treforest Industrial Estate Station to Nantgarw (Metro) – With P&R	£7m - £20m, excluding Park & Ride
North West Cardiff Corridor Rapid Transit (metro extension) – Cardiff to Llantrisant	£250m - £350m rail scheme
M4 J33 P&R	£3m - £7m
New Rail Station – Miskin/Junction 34	£7m - £20m for station, excluding Park & Ride and associated road improvements

Table 36: Highway concept schemes – Indicative Costs

Scheme(s)	Indicative Cost (£m)
Through link from A470 Southbound to M4 Westbound at M4 J32 (Coryton)	£7m - £20m
Nantgarw to Upper Boat (2.5km) - Implementing 3 narrow lanes on 2-lane sections	£7m - £20m
New road link from A4119 to A4232 (approx 3km)	£7m - £20m

Road-based infrastructure solutions will require some maintenance but do not have significant ongoing operational cost. The public transport-based options will need to be investigated in future in respect of revenue and operational costs – as this represents a long-term affordability risk.

5.5 Sources of Funding

The options at this Stage are still preliminary in nature. As such, whilst potential sources of funding have been considered, nothing has been confirmed.

Additionally, there are uncertainties surrounding delivery of the schemes proposed due to external forces, for example the UK's planned exit from the European Union which could have serious implications on funding sources (e.g. European Structural Funds).

In light of this, attention has been paid to the most probable sources of funding with further detail to be provided during future stages of appraisal.

The potential sources of funding which could be considered are summarised below:

- Welsh Government as sole funder (Pinchpoint Funding);
- Welsh European Funding Office (WEFO) – Connecting Europe Fund;
- Contributions from Local Authorities' at Interchange locations;
- Welsh Government Road Restraint Programme Funding;
- Cardiff Capital Region City Deal – via the Regional Transport Authority; and
- Section 106/Community Infrastructure Levy (CIL).

5.6 Affordability Summary

The pinch-point programme is aimed at delivering schemes within the short term, and at relatively low cost, compared to major new infrastructure. The preferred Priority Design pinch-point schemes in each corridor could be delivered as a single overall package but will require further consideration at Stage 3 to determine affordability in respect of available budgets. For purposes of affordability and deliverability, the package of schemes in each corridor could be delivered as single schemes in a phased and prioritised programme.

The public transport and highways concept schemes are medium-long term solutions which are likely to require more complex financing arrangements given the higher costs associated with these schemes, and the longer-term revenue costs associated with public transport operations.

6 Commercial Case

6.1 Priority Design Schemes

The Commercial Case considers the viability of the proposed schemes through an assessment of the proposed procurement route and how they will continue to progress in the future.

Given the preliminary information available, a high-level view of Commercial Case issues is that conventional highway procurement processes appear feasible and appropriate for construction elements.

At Stage 3, a delivery plan will be developed, aimed at achieving the appropriate procurement and construction programme in Welsh Government's funding stream requirements.

6.2 Concept Schemes

For **Concept Public Transport Schemes**, a conventional procurement approach appears feasible for construction elements. However, procurements of public transport services and operations will require detailed investigation of the business case, costs, revenues and institutional/organisational arrangements.

For **Concept Highway Schemes**, conventional Highway procurement approached appear feasible for construction elements – although it is highly likely that land acquisition would be necessary – as well as a detailed modelling of regional impacts of major highway interventions.

7 Management Case

7.1 Collaboration

As set out in WelTAG 2017, the Management Case sets out the delivery arrangements for the proposed Schemes and how they will be managed throughout their lifetime. This allows an assessment to be made as to whether options are achievable in practice.

Delivery of the pinch-point schemes would be a collaborative process:

- The Welsh Government and SWTRA would plan and deliver the schemes, with appropriate input from relevant local stakeholders as necessary;
- It is noted that some parts of the scheme proposals either lie within the jurisdiction of the Local Authorities, or are operationally tied in to local roads and hence Rhondda Cynon Taff CBC, Cardiff County Council, and the Vale of Glamorgan CBC will need to be included as partners in the delivery process;
- It is critical that TfW are fully involved in planning the schemes – in their role of delivering the Metro rail system in South East Wales;
- There are a significant number of transport schemes and initiatives in development or delivery phases in the study corridors, and it is important that liaison and collaboration is maintained with local authorities to ensure that the policy, programme, and operational aspects of schemes are aligned and co-ordinated. Information on other relevant transport proposals, and strategic developments, are shown in Appendix F; and
- Public engagement will be needed to fully understand local public acceptability of the schemes proposed.

7.2 Realisation of benefits

The A470 and M4 corridor schemes should be treated as an overall coherent package – with scheme elements and Network Management Plans being delivered in a staged manner. If schemes are taken forward individually, they should be developed as ‘Interim Scheme Designs’ which are capable of being linked and combined with adjacent future improvements.

Modelling indicates that reassignment of traffic from other routes onto the M4 and A470 corridors is likely to occur because of road improvements. This will have a positive network benefit within local communities – and with more reliable journey times on M4 and A470 corridors. However, it is important to note that journey times on the M4 and A470 may not be significantly improved; instead, journey time objective would be to ensure that journey times become more reliable and that the network is more resilient.

Traffic data is based on observed counts and modelled data from 2015. Updated count data would be beneficial to confirm current traffic movements and the suitability of improvement schemes as planned.

7.3 Key Risks

The key risk items are set out below (and in more detail in the IAR Section 25). The major risks to delivery at the Stage 2 phase are associated with dimensions and geometry of road improvements, and the risk that there will be requirement for third party land, and/or the road improvements will require departures from standard to achieve the proposed improved layout. The key Deliverability, Stakeholder, Benefits, Inter-dependency and External risks are set out respectively in Table 37 - Table 41 below.

Table 37: Feasibility/Delivery Risks

Feasibility/delivery Risks	Proposed Mitigation
Schemes based on OS Mapping, and hence need for and cost for third-party land not fully identified	WelTAG Stage 3 work should include for commissioning of topographical survey in order to obtain full information on land ownership.
Scheme based on OS Mapping, and hence highway land and boundary not known in detail	WelTAG Stage 3 work should ensure commissioning of topographical survey in order to accurately locate the highway boundary.
Full lane widths not able to be accommodated within the available existing or widened operational boundary of the highway	Departure from Standards for lane widths to accommodate design within the operational boundary of the highway; or land acquisition to enable full lane widths.
Road widening works may impact on statutory utilities, with consequent cost and delivery impacts	Detailed Statutory Utility information needed to inform next stage of design
Early WelTAG stages mean that it is currently difficult to assess and quantify environmental impacts of the schemes	Conduction of detailed surveys within the next WelTAG Stage 3 work, including air quality and noise monitoring/assessments
Costs of measures escalate due to complexities and extraneous impacts (e.g. utilities)	Scheme budgets should be estimated in detail in Stage 3 with uncertainties and optimism bias included for.

Table 38: Stakeholder Risks

Stakeholder Risks	Proposed Mitigation
Lack of public and stakeholder acceptability for proposed schemes	All pinch-point design schemes would be subject to stakeholder engagement and consultation to understand any issues and to test public acceptability of the schemes proposed.
Schemes are insufficiently focused on active travel measures and are opposed for sustainability reasons.	Measures to assist active travel should be incorporated in priority scheme/pinch-point design as far as possible.
Schemes are insufficiently focused on bus priority measures and are opposed for sustainability reasons.	Measures to assist bus movement should be incorporated in priority scheme/pinch-point design as far as possible.
Traffic management congestion impacts during construction of pinch-point schemes are considered as unacceptable to stakeholders	Traffic management during construction will require attention during the planning phase to minimise impacts (but could increase costs)

Table 39: Risk to Realisation of Benefits

Risk to Realisation of Benefits	Proposed Mitigation
Traffic flow patterns at weaving sections are complex and require checking to ensure feasibility	Use of modelling techniques (including micro-simulation) to test benefits/safety of schemes
Pinch-point corridor schemes are inter-linked and hence have a dependency on each other for maximum effectiveness	A programme of schemes should be devised to ensure that schemes align well with other schemes or can be delivered in stages
Beneficial impacts on air quality are not clearly established due to overall trip growth due to land use development, which offsets traffic management and Metro mode-shift benefits.	Further analysis of air quality impacts should be carried out at Stage 3 to establish extent and location of beneficial effects.

Table 40: Inter-dependency Risks

Inter-dependency Risks	Proposed Mitigation
Upgrades to road restraint systems on the A470 between Taffs Well and Nantgarw are planned by SWTRA, which could impinge of the delivery of pinch-point schemes	Close liaison should be in place between pinch-point delivery and planning of road restraint upgrade schemes.
Upgrades to road restraint systems on the M4 between Junction 33 and 34 are planned by SWTRA, which could impinge of the delivery of pinch-point schemes	Close liaison should be in place between pinch-point delivery and planning of road restraint upgrade schemes.
Implementation of the M4 J34 to A48 Sycamore Cross scheme will change traffic flow patterns on the M4 at junction 33 and 34 – and hence impact on the impact of measures there.	The area-wide traffic impact of the M4 J34 to A48 Sycamore Cross scheme will require detailed investigation of reassignment effects to understand the impact on the M4 at Junction 33 and 34.
The positioning of existing and new ITS infrastructure will influence the feasibility of adding additional lanes	ITS measured will require liaison with SWTRA at the next stage to establish current and future requirements (including future-proofing).

Table 41: External Risks

External Risks	Proposed Mitigation
Costs of measures escalate due to complexities and unforeseen impacts (e.g. utilities)	Scheme budgets should be estimated in detail in Stage 3 with uncertainties and optimism bias included for.
Budgetary pressures in Welsh Government due to construction of other major infrastructure schemes	Review schemes/programme/commitments if budget changes during year, or through budget. Progress through liaison with Welsh Government and other stakeholders.

7.4 Delivery and Risk for Concept Public Transport Schemes

Delivery processes for public transport concept schemes may differ for each option. The North West Cardiff Corridor Rapid Transit (metro extension) for example would need to consider relevant legislation, planning consents, regulatory matters and governance prior to delivery.

New Rail Stations and P&R sites are dependent on delivering frequent services (rail or bus) and are likely to follow conventional delivery processes. Transport for Wales (TfW) and Network Rail (NR) have responsibility for management and development of the rail network in Wales, including stations. Planning and delivery of these schemes would therefore be undertaken by TfW/NR. It is anticipated that these schemes would require planning consent, SUDS approval and potentially would need to at least be screened and/or scoped to understand EIA requirements.

Certain options e.g. North West Cardiff Rapid Transit, are reliant on initial phases of the South Wales Metro plans being brought forward and as such may only be deliverable after the first phases of Metro are complete. This reliance on other improvements may mean that the scheme will not synchronise well with ongoing development; that is, unless the scheme is in place prior to major development then its benefits will be reduced.

7.5 Delivery and Risk for Concept Highway Schemes

Concept Highway schemes are likely to follow conventional delivery processes. Detailed attention in respect of policy aspects of access to trunk roads will be necessary.

The Welsh Government/SWTRA have responsibility for management and development of the trunk road network in Wales, including motorways. Planning and delivery of the relevant schemes would therefore be undertaken by Welsh Government, with appropriate input from relevant local stakeholders as necessary.

It is possible that the public acceptability for Concept Highway Schemes would be low given that delivery of these schemes may mean the diversion of funds from other more sustainable options e.g. public transport schemes.

The benefits of each scheme are to some extent dependent on the overall A470/M4 corridor road capacity given that addressing congestion through the implementation of one scheme could simply 'move' the problem downstream. It is important therefore that the overall A470/M4 corridor is treated as a single entity with schemes being delivered in a staged manner.

All options may have land requirements which could impact on deliverability.

8 Summary and Next Steps

8.1 Key Conclusions

Priority schemes for implementation have been identified which should be progressed to a Stage 3 appraisal. Key findings for both the A470 and M4 corridor based on key WelTAG appraisal criteria, are as follows:

- The problems are significant at present and will be significantly worsened as strategic development proceeds;
- The Stage 2 priority interventions align well with delivery and programming opportunities in respect of funding and procurement processes; and
- The Stage 2 options are judged to address key Strategic Case criteria (i.e. problems and objectives), have an overall beneficial Transport Case, and no clear Delivery, Financial or Commercial Case deal-breakers have been identified.

The Stage 2 study has identified a short-term package of pinch-point schemes for both corridors, together with potential longer-term public transport measures which would form a coherent approach to addressing short-and longer-term problems. The Stage 2 output includes indicative costs, phasing programme and risk register for priority pinch-point schemes.

Figure 19 and Figure 20 below illustrate diagrammatically the preferred options for both the A470 and M4 corridors.

Figure 19: A470 Corridor – Preferred Package of Schemes

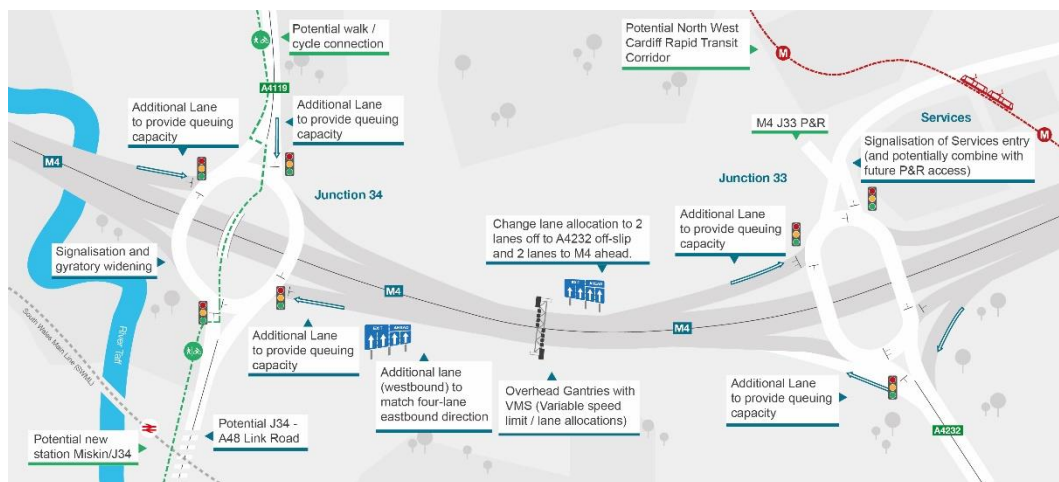


Figure 20: M4 Corridor – Preferred Package of Schemes



8.2 A470 Preferred Short-Term Schemes

Based on their positive beneficial impact and the likelihood of being deliverable in the short-to-medium term, the following Priority Design schemes for the **A470 corridor** have been identified, and subjected to stakeholder discussion, as follows:

- **Nantgarw Interchange:** Signalisation, widening of gyratory/slip road to better manage queues, pedestrian link;
- **Taffs Well Interchange:** Signalisation of s/b off-slip and provide National Cycle Network (NCN) crossing;
- **A470 Nantgarw – Taffs Well:** 3 lanes on 2-lane sections Northbound and Southbound;
- **A470 Taffs Well – Coryton, Southbound:** Reallocation of lanes from 1-off/2-ahead to 2-exit/1-ahead, with potential bus priority to Cardiff;
- **A470 Taffs Well – Coryton, Northbound:** 3-lanes (narrow) instead of 2-lanes, with lane-gain/lane drop at Coryton and Taffs Well;

- **A470 Pontypridd to Coryton:** Reduced Speed Limit to address Air Quality and Safety, with VMS gantry signage on A470, and average speed enforcement cameras; and
- **Expressway Network Management Plans:** Updated Network Management Plans with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

In consideration of the evidence collated, and the appraisal outcome, it is recommended that the above A470 pinch-point design schemes should be taken forward to WelTAG Stage 3 (Full Business Case). The schemes could be delivered either as a package in each corridor, or as individual schemes.

8.3 M4 Preferred Short-Term Schemes

Based on their positive beneficial impact and the likelihood of being deliverable in the short-to-medium term, the following Priority Design schemes for the **M4 corridor** have been identified, and subjected to stakeholder discussion, as follows:

- **M4 J34 Interchange:** Signalisation and gyratory widening – with or without M4 J34 to A48 Link;
- **M4 J33 Interchange** - Additional signal control and slip road widening;
- **M4 J34-J33 mainline carriageway:** Improved lane allocation on eastbound 4-lane carriageway;
- **M4 J33-J34 mainline carriageway:** Provide additional lane on existing 3 lanes westbound carriageway;
- **ITS solutions on M4 Junction 34 – 32:** Application of ITS facilities and techniques, initially based on VMS gantry signage to provide lane allocation and driver information, and average speed enforcement cameras; and
- **Network Management Plans:** Updated Network Management Plans with ITS & traffic officer deployment strategies to improve everyday operation, average speed management and network resilience.

In consideration of the evidence collated, and the appraisal outcome, it is recommended that the above pinch-point design schemes should be taken forward to WelTAG Stage 3 (Full Business Case). The schemes could be delivered either as a package in each corridor, or as individual schemes.

8.4 Stage 3 Recommendations

Following the production of the Delivery Plan, it is recommended that a location-specific Stage 3 Full Business Case scheme-level WelTAG study is undertaken which will include.

- Progressing with priority measures design and appraisal with appropriate procurement and full business case to deliver within the short term;

- Informing the Wales Transport Plan (and/or a South East Wales Transport Strategy) to set the vision and pipeline in the longer term; and
- Progressing through the five ways of working including collaboration with key partners to assist funding and governance.

In particular, the Stage 3 appraisal should consist of further detailed investigations on the following:

- Preliminary detailed scheme design;
- Traffic forecasting and modelling;
- Economic appraisal/wider economic impact assessment results;
- Environmental Impact Assessment (and survey) results;
- Non-Motorised User/Active Travel opportunities – to tie-in pinch-point NMU improvements to local authority active travel plans to create seamless connectivity across and along the corridors;
- Further details and information around the Transport Case, Delivery, Financial and Commercial Cases; and
- Air quality monitoring during the development of the design schemes and in operation.

The key outputs from a Stage 3 study would be a preferred initial phase pinch-point scheme capable of being taken forward for implementation in the short-term, together with a programme of implementation for the remainder of the package pinch-point corridor scheme.

Early Delivery Opportunities

Prior to undertaking a Stage 3 Full Business Case Study, Welsh Government has requested that a Pinch Point Delivery Plan is produced as an immediate follow-up to the Stage 2 Study, aimed at identifying a stand-alone early delivery scheme. It is envisaged that an early delivery scheme would comprise of part of the package of pinch-point schemes, and would have delivery characteristics in line with Welsh Government's Congestion Pinch Points Programme timeline and budget.

8.5 Medium-Long Term Concept Schemes

The following public transport measures were assessed as having a positive beneficial impact, identified in an initial appraisal, and therefore are recommended to be taken forward to further business case and design investigations (i.e. as separate studies from the current Stage 1 and 2 A470/M4 studies). Based on their costs and level of complexity they are anticipated to be deliverable in the medium or long term (at 5+ years).

- Relocation of Treforest Industrial Estate Station to Nantgarw (Metro), with Park & Ride;
- M4 J33 Park & Ride;

- Cross-Valley Bus Rapid Transit (Metro Extension) – Pontypool to Llantrisant /Talbot Green;
- North West Cardiff Corridor – Rapid Transit Cardiff – Llantrisant; and
- New Rail Station –Miskin/Junction 34.

Potential road schemes were also identified, as follows

- Through link from A470 Southbound to M4 Westbound at M4 J32 (Coryton); and
- Nantgarw to Upper Boat -Implementing 3 narrow lanes on 2- lane sections.

These highway schemes would require a separate investigation and business case as it is not clear from this initial assessment that the schemes would be beneficial as they may undermine future public transport upgrades by easing the movement of cars.