



A55 / A494 Network Resilience Study

Weltag Stage 2

Executive Summary

June 2021



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North & Mid Wales Trunk Road Agent



Executive Summary

Background

In April 2017, the Cabinet Secretary for Economy and Infrastructure announced that a commission to investigate options to improve journey times, reliability and the resilience of the A55 corridor from Holyhead to Post House would be undertaken. This would also include associated routes such as the A494 corridor from the Ewloe Interchange to Drome Corner, Strategic Diversion Routes (via trunk roads) and Tactical Diversion Routes (via county roads).

WSP was commissioned by the North and Mid Wales Trunk Road Agent (NMWTRA) to undertake a WelTAG Stage 1 study to improve resilience of the A55/ A494 dual carriageway network in North Wales. The Stage 1 study was completed in November 2017. A WelTAG Stage 2 study was subsequently commenced in May 2018 and concluded in March 2020. This note summarises the findings of the study and provides recommendations for the next steps, including how changes to the transport landscape within Wales, policies and Welsh Government initiatives could be captured within the next stages of the study.

Current route performance

In recognition of the strategic importance of the route, the current approach to managing the A55 / A494 exceeds the statutory requirements for a rural dual carriageway and adopts a number of provisions that would normally be associated with motorway management, e.g. Traffic Management Centre and Welsh Government Traffic Officer Service. Current performance levels for operation of the route consistently meet or exceed standards, as defined in Welsh Government's Trunk Road Maintenance Manual (WGTRMM).

During normal operating conditions, the route performs well with some localised congestion during peak traffic flows. The route however is vulnerable during incidents or significant road work events due to a combination of topographical and infrastructure constraints and lack of viable diversion routes. The route runs close to capacity during normal traffic flows and is above capacity at peak times.



Whilst the network in the main is currently operating at a manageable level, traffic growth projections indicate that without significant interventions, normal operation will start to breakdown in the medium-term. It is therefore critical that proposed medium and long-term interventions are implemented to maintain current performance.

Asset management and approach to funding

Research undertaken by the Organisation for Economic Co-operation and Development (OECD) and County Surveyors Society (CSS) has shown that investment into maintenance of structures at less than 1.0% of the asset value will lead to long-term deterioration. Structures are a major part of the network and represent over 30% of the total asset value. Investment below 0.5% of the asset value will result in unplanned events. Historically the maintenance investment into the A55/A494 has fallen below this absolute minimum level, and as a result the asset is degrading, leading to increasing levels of unplanned and reactive maintenance which will increasingly impact on network resilience and performance and is more expensive in the long-term. Appropriate funding of optimal asset management interventions across the wider transport network (to include all asset types such as pavement and drainage) will assist in maintaining and improving network resilience and reliability.

In addition, the current programme of funding is on an annual basis with uncertainty around overall allocation and with a significant proportion of capital allocations being provided at short notice in quarter 4. This limits the opportunity to proactively plan for longer term maintenance programmes (e.g. over 3 to 5 years), and often leads to a short lead-in time for maintenance works to align with confirmed funding availability. It has been demonstrated, through recent project/maintenance works such as Kneeshaw Lupton deck joint and re-waterproofing that appropriate planning enables sufficient time to advise stakeholders and the public, leading to less negative feedback during planned maintenance works.

What has been achieved to date?

WelTAG Stage 1 Study

During the WelTAG Stage 1 study, problems and opportunities associated with network resilience were identified through analysis of current performance and extensive stakeholder consultation. In total, 33 unique problems/opportunities were identified across the study area and these were grouped into a number of key themes:

- Communication
- Asset Management
- Demand & Capacity
- Incident Management
- Diversion Routes
- Environment
- Sustainable Travel
- Future Proofing

Study objectives were agreed in consultation with key stakeholders, based on the identified problems and opportunities and aligned with the Future Generations Act and other relevant local and national policies.

Over 100 potential options were identified across the above themes which included Quick Wins, Short, Medium and Long-term options. All options were appraised against the study objectives and WelTAG appraisal areas and those deemed feasible and scoring positively during appraisal, were proposed for progression to WelTAG Stage 2.

Quick Win options were focussed on Welsh Government and NMWTRA's processes for communication and management of the network; appraised as having a beneficial impact on resilience and deliverable within a 6-month period from the end of the WelTAG 1 study.

These options, which have now been implemented, are included in table 1 below:

Table 1 – Quick Win Options implemented and associated benefits:

Option (Option No.)	Benefits
Wireless CCTV (S7b)	Provides the Traffic Management Centre with additional coverage of congestion hotspots allowing quicker incident detection and response.
CCTV Incident Detection Software (S3)	Flags congestion and incidents on the network automatically to operational staff allowing quicker detection and response. Currently being trialled on Anglesey.
Purchase INRIX - Real Time Floating Vehicle Data (S4)	Purchase of INRIX data to provide access to real time traffic information to help support several options relating to managing the network, communication and performance analysis.
Enhanced Communications Team (S28)	Proactive engagement with the media and the public has resulted in an improvement in perception of how the network is managed through real-time information transfer to the travelling public via social media. This has been for both incidents and planned works.
Mobile Variable Message Signs (S6b)	Installed at incident hotspots to provide roadside driver information and safety messages.
Free Vehicle Recovery at Incident Hotspots (S16b)	Trial completed for the length of the A55 and the A494, covered by 2 units, one based at J34 and one at J23 to minimise disruption caused by broken down vehicles. This was over each bank holiday in 2018.
Extend Welsh Government Traffic Officer Operation (S36); and Additional Welsh Government Traffic Officer teams (S37)	Welsh Government Traffic Officer service operating hours have been adjusted to move to a 12-hour shift pattern and increased staffing by 4, which has enabled the service to be extended to the whole of the A55 and A494 dual carriageway corridor. This has resulted in improved response times as well as better coverage

Option (Option No.)	Benefits
	and an increase in the number of incidents being dealt with solely by Welsh Government Traffic Officers.
Roads Timetable (S83)	Roads Timetable established to advise customers on future typical travel times and real-time traffic conditions, enabling improved journey planning. The Roads Timetable is now available on the Traffic Wales Website
Average Speed Enforcement (ASE) at Rhuallt Hill (S85)	Inappropriate speed contributes to around 11% of all injury collisions reported to the police, 15% of crashes resulting in a serious injury and 24% of collisions that result in a death. The installation of average speed cameras in this location has significantly reduced the percentage of vehicles travelling over 70mph from 55% to 3%. Average speed in this location has dropped with 96% of vehicles now travelling at 70mph or less compared to just 45% prior to ASE implementation. A quantitative assessment of incident reduction will be made when a sufficient data sample is available.

WelTAG stage 2 study

The WelTAG Stage 2 (Outline Business Case) has examined, in more detail, how each option performs against the Study Objectives (aligned with the Future Generations Act) as well as the founding WelTAG principles of economy, environment, social and cultural development.

During the WelTAG Stage 2 study, comprehensive stakeholder engagement has been carried out to get wider views on existing issues and proposed options. Over 30 stakeholder organisations have contributed to the development of the study through 13 workshops, resulting in over 1,000 person-hours of engagement during the study to date.

The Stage 2 Study has concluded that the options fall within the following groups:

- Options to be implemented as Short Term Options (requiring approval to implement prior to completion of the Stage 2 study to allow delivery by May 2019)
- Options to be discarded from further consideration;
- Options requiring further investigation;
- Options to be transferred to other parties; and
- Options to be considered further

The options forming each of the above groups are summarised below:

Options implemented in the short term (by May 2019)

Due to the timescale for implementation of Short Term Options, by May 2019, there was a need to confirm suitability and acceptability of these options prior to completion of the Stage 2 study. The positive engagement that has been carried out throughout the study has enabled a selection of options to be identified for implementation in the short term. These options and their benefits are detailed in Table 2 below. Where identified Short Term options could not be implemented within the identified timeframe (e.g. additional work required prior to implementation), an update on their status has been noted:

Table 2 – Short Term Options implemented and their associated benefits:

Option (Option No.)	Benefits	Date Implemented	Completed / status
VMS Templates and Campaign Messages (S6c)	To provide effective and meaningful traffic information to the travelling public, including live journey times, road conditions and campaign messages, to improve customer experience.	01/08/2018	Implemented as part of S28 Enhanced Communications Team
Live Journey Time Information (S5)	Using real time information to inform journey times for the travelling public to inform decision making and improve the customer experience.	24/04/2019	Implemented

Option (Option No.)	Benefits	Date Implemented	Completed / status
Enhanced Winter Maintenance (S24)	Additional gritters dedicated to Rhuallt Hill to support winter maintenance of this vulnerable stretch of the A55, improving resilience and reducing the risk of incidents along this section.	30/11/2018	Implemented
Driver Behavioural Campaign (S86)	Targeted safety campaign, led by NMWTRA's Enhanced Communications Team, via media platforms and roadside message signs to improve driver behaviour and reduce incidents.	01/08/2018	Implemented as part of S28 Enhanced Communications Team
Performance Targets & Analysis (S15&S65)	Using real time information to set network performance targets and evaluate the impact of works and the performance of schemes to ensure continuous improvement and service monitoring.	S15 – 01/01/2020 S65 – N/A	S15 Implemented as part of S81 Enhanced Road Space Planning (01/01/2020). S65 dropped in favour of S83 Roads Timetable.
Service Monitoring (S43)	Targeted training / employment to carry out more robust analysis of data to support improvements to the maintenance regimes and strategies.	N/A	Not implemented as part of A55 Network Resilience Study – WG Option
Enhanced Diversion Route	Development of improved procedures for implementing	N/A	Moved to Medium Term

Option (Option No.)	Benefits	Date Implemented	Completed / status
Operation Procedures (S73)	diversion routes following an incident.		
Enhanced Diversion Route Traffic Management Plans (S76)	Standardised plans for implementing closures of the network to allow for faster response to incidents and reduced costs.	N/A	Moved to Medium Term
Strategic Symbol Signs (S74)	Installation of permanent signs to waymark strategic diversion routes allowing quicker implementation and improved driver experience.	N/A	Moved to Medium Term
Tactical Symbol Signs (S75)	Installation of permanent signs to waymark tactical diversion routes allowing quicker implementation and improved driver experience. This will need to be agreed with Local Authorities.	N/A	Moved to Medium Term
Enhanced Road Space Planning (S81)	Enhanced coordination of maintenance works across all relevant stakeholders to provide efficiencies and reduce disruption. This option would require funding for significant planned works to be confirmed sufficiently in advance to enable	01/01/2020	Implemented together with S15 Performance Targets – Business Analytics Platform

Option (Option No.)	Benefits	Date Implemented	Completed / status
	planning and notification to be undertaken.		
Britannia Bridge Operational Improvements (S94)	Provision of lane markings and signage to prevent overtaking and reduce the risk of incidents; permanent Temporary Traffic Management signs (TTMs) to reduce the time take to implement bridge closures during high wind events; and prohibition of pedestrian signs to improve safety of both road users and pedestrians.	01/01/2020	Implemented
Vehicle Recovery (S16a)	Welsh Government Traffic Officers would be allowed to remove vehicles from the scene of an incident where they are causing a danger or obstruction, improving journey time reliability and lowering the duration of incidents.	N/A	Trialled (May 2018) and was proven ineffective. Dropped at outset of WelTAG Stage 3
Improved Emergency Crossing Point Operation (S46)	Improve inter agency operational protocols to enable more effective ECP utilisation.	31/05/2019	Implemented
Incident and Asset Management	App based software to allow quicker reporting of incidents	Nov 2018	Implemented

Option (Option No.)	Benefits	Date Implemented	Completed / status
Smart Phone App (S1/S2)	and asset condition to reduce impact on network resilience.		
Enhanced Staff Responsibility (S39)	Operation team managers have been appointed to direct operations from the Traffic Management Centre to allow for faster response to incidents.	03/01/2018	Implemented
Emergency Resurfacing Contractor (S98)	Specialist contractor rapid response capability to respond to major incidents requiring resurfacing of the carriageway leading to quicker recovery of the network.	N/A	Moved to Medium Term

Options to be discarded

The following options are recommended to be discarded from further consideration. Whilst each option has its own reason for being discounted, these can be generalised as those that either:

- fail to provide a sufficiently positive contribution across well-being areas and study objectives;
- perform less favourably when compared to other similar measures; or
- conflict with, or are superseded by, other committed schemes.

No communication, sustainable travel or future-proofing themed options have been discarded at this stage.

Table 3 – Option to be discarded

Option (Option No.)	Reason for being discarded
Concrete central reserve barriers along whole route of A55/A494 Excl. Britannia Bridge and tunnels (S59b)	The Anglesey section of the network currently performs well in terms of resilience, so this option is superseded by Option 59a which proposes concrete barriers along the whole network, excluding Anglesey.
<p>Third Lane and Hard Shoulder A55 J35 (Dobshill) - J36a (Warren Bank) (S56a)</p> <p>Third Lane Expressway (congestion hotspots) (56b)</p> <p>Third Lane Expressway (network wide) (56c)</p> <p>3 lanes to Junction 23 (Llanddulas) from border (56j)</p> <p>Motorway Standards (S104)</p> <p>Consideration of Relief Roads (S110)</p>	<p>Whilst these options would lead to increased capacity and resilience, disruption to road users, local communities and the landscape/environment, both during and after construction, outweigh the benefits they provide.</p> <p>The projects would require significant capital investment over an extended period; be likely to raise significant opposition and challenges during development; and result in substantial disruption and delays to road users during their implementation.</p> <p>These options have been discarded in favour of the two-lane expressway option (S56), which provides large scale benefits, a reduced level of impact on the surrounding environment, and is more deliverable and acceptable to stakeholders.</p>
A55 Task Force (S101)	Following further consultation, the purpose of the task force is deemed to already be dealt with through separate measures, including periodic liaison/coordination meetings with key stakeholders such as Welsh Government, police and Local Authorities.

Option (Option No.)	Reason for being discarded
Increased Speed Limits (S82)	Implementation of this option would significantly reduce safety of road users at the proposed locations.
Enhanced Common Location Referencing (S13)	Distance marker posts are already in place for the majority of the network making this option effectively redundant.
Dedicated Welsh Government Traffic Officer / Police Laybys (S38)	After stakeholder consultation, it was decided mobile patrols are preferable to stationary observation hence this option was discarded.
Extend Welsh Government Traffic Officer Dynamic Risk Assessment (S40)	Increased demand on Welsh Government Traffic Officers could lead to irrational decisions. It is instead recommended to appoint Operation Team Managers (OTMs) (S39) for operational decision making. (OTMS are now in place).
Provision of Hard Shoulder (incident hotspots) (S56d) Provision of Hard Shoulder (network wide) (S56e)	Emergency refuge areas, part of the two-lane expressway option (S56), are a preferred alternative to this and would cause less disruption to communities, the travelling public (during construction) and the environment.
Provide wireless electronic driver information signs on Strategic Diversion Routes (S77)	This option provides added operational benefits when diversion routes are required, however they would incur much higher costs in comparison to Strategic Symbol Signage (S74) which provide similar benefit and have reduced negative impact on the setting of the national park.
Provide wireless CCTV on Strategic Diversion Routes (S78)	This requires large investment over a prolonged period of time, whilst other forms of technology i.e. INRIX real time data (S83) are now available to

Option (Option No.)	Reason for being discarded
	identify problem hotspots prior to opening diversion routes.
<p>Strategic Diversion Route 18 & 19 A470 Llanrwst Bypass (S79a)</p> <p>Strategic Diversion Route 17 A470 - Road Widening to the South of Waterloo Bridge (S79b)</p> <p>Strategic Diversion Route 19 A494 – Road widening and change to junction priority (S79c)</p> <p>Strategic Diversion Route 19 A494/A5104 junction remodelling (S79d)</p>	<p>These Strategic Diversion Route improvements would require significant financial investment and would only improve short sections of diversion routes rather than directly improve the resilience of the A55/A494.</p> <p>Should any of these diversion route options be progressed outside of the A55/A494 Resilience study, the identified benefits to A55/A494 diversion routes could be incorporated to support business cases.</p>
<p>Strategic Diversion Route 17 & 18 A5/A470 Urban Areas – Additional on-street parking restrictions (S79e)</p>	<p>Parking restrictions could negatively impact businesses at key tourist destinations. Where specific issues are identified with parking this should be addressed at local authority level; would likely face opposition; and wouldn't directly improve the resilience of the A55/A494.</p>
<p>Increase Variable Message Signage (VMS) along the A55 & A494 between each junction (S80)</p>	<p>The benefits of this option are comparable with that achieved by the 'Strategic Infill of VMS' option (S6a), which is preferred.</p>
<p>New Diversion Route A55 J12 - J14 Upgrade Roman Road (S88a)</p> <p>New Diversion Route A55 J12 - J14 New Parallel Route (S88b)</p>	<p>This option has been discarded as during this study WG has published plans to improve this section under another scheme.</p>

Options requiring further investigation

The following options are identified for further investigation. While each option has its own reason for deferring a decision at this stage, these can be generalised as those that require either:

- Further liaison with key stakeholders, such as the North Wales Police, to determine their likely level of support and inform the business case; or
- A more detailed option assessment to identify likely trends in technological advances during the implementation period; or
- A review of business case need following confirmation of other committed schemes (i.e. Third Menai Crossing)

Table 4 – Options requiring further investigation

Option (Option No.)	Reason for further investigation required
High Tech Asset Monitoring (S22)	It is recommended that developments in the field be monitored and implemented once the business case and regulations (i.e. Civil Aviation Regulations for use of drones) come into force.
Review Special Status of A55 J17 to J23 (S97)	Changes to the special road status will need to be coordinated with any other recommendations taken forward following the WeITAG Stage 3 study
Extend Welsh Government Traffic Officer Operation to 24 hours (S36a)	This option is suggested for further investigation following the results of extending WGTO operation (S36).
Weight-in-motion & tyre sensors (S100) More Enforcement Through ANPR (S105) Weigh Bridge Sites (S107)	Prior to the implementation of these measures, further consultation with enforcement agencies would be required to ensure such technology matches their needs.

Option (Option No.)	Reason for further investigation required
<p>Improve tactical diversion routes “pinch points” on prioritised basis (S113)</p>	<p>Due to this option not directly affecting resilience of the A55/A494, it is proposed further consideration of such measures would therefore need to be considered outside of this study.</p>
<p>Smart Road Technology – EV Charging Points (S9a)</p>	<p>The current level of installed EV charging points on, or close to, the route is seen to be adequate for existing EV usage and no immediate intervention is deemed necessary. Officials have confirmed that provision of EV charging points is a matter for a national strategy and that strategy will be used to determine the requirements along the A55/A494.</p>
<p>Smart Road Technology – Solar Road (S9b)</p>	<p>This technology is largely untested within the UK and carries significant risk that technology will change over time. It is recommended that this option be monitored over the coming years and reviewed at a later date.</p>
<p>Smart Road Technology – Wireless Power Transfer (S9c)</p>	<p>Until electrical vehicles have become mainstream and technology advances, its immediate implementation would offer little to improve network resilience.</p>
<p>Connected Vehicle Corridor (S10)</p>	<p>Monitor the progress of ongoing trials elsewhere to establish whether this future aspiration for autonomous and semi-autonomous vehicles can be realised within the next 10 to 15 years.</p>
<p>Improve NMU Footbridges (S67c)</p>	<p>It is recommended that these options be incorporated into a wider package of measures to be delivered by Welsh Government and Local Authorities to deal with both improved NMU facilities, improved traffic flows and increased capacity.</p>

Option (Option No.)	Reason for further investigation required
Britannia Bridge – High Wind Mitigation (S47) Gantries on Britannia Bridge for Speed and Traffic Control (S91) Wind Deflectors on Britannia Bridge (S92)	These options would provide potential benefits to resilience of the network across the Britannia Bridge, however, should the Third Menai Crossing be constructed, the need for these improvements is reduced. It is proposed that these options be deferred, subject to confirmation that the third Menai Crossing progressing.

Options to be transferred for delivery by others

The following options have been identified as those that would be better suited for further consideration in collaboration with other organisations. These measures are outside the established remit of the Welsh Government’s Trunk Road Agent and whilst these measures have demonstrated an overall benefit to the resilience of the network, their development and implementation would be better suited for promotion by others.

The likely collaborators are:

- Local Authorities;
- Transport for Wales; and
- Welsh Government – Major Projects.

Table 5 – Options to be transferred to others

Option (Option No.)	Reason to be transferred to others
Improved Public Transport (S64)	It would be advisable for TrawsCymru to take forward the concept of an express bus service and for TfW to link the potential park and share sites to their strategy.
Improve NMU crossings - Glan Conwy Interchange (S67b)	Improved NMU provision is proposed as part of a separate project for improvements at Glan Conwy Interchange being delivered by NMWTRA.

Option (Option No.)	Reason to be transferred to others
Promote sustainable transport – improve capacity and collaborative working across services e.g. integrated ticketing (S111)	It is recommended that organisations such as TrawsCymru and Transport for Wales take forward this concept to establish a robust business case for this option’s implementation for further development as part of the North Wales Metro.
Coastal Erosion Protection (S109)	It is recommended that WG work in collaboration with Local Authorities and Network Rail to ensure the transport corridor is protected.
New Penmaenbach Tunnel (S87) Penmaenbach Eastbound Marine Viaduct (S90)	It is advisable for these options to be given further consideration together and with any other variable solutions as a detailed study delivered under the Welsh Government’s National Transport Plan.
Over bridges to be engineered to prevent self-harm events (S106)	Whilst it is acknowledged that such events lead to extended periods of delay and congestion, it is suggested that this option be transferred to Welsh Government for investigation – potentially addressing health issues (preventative) rather than mitigation through infrastructure changes.

Medium & Long-term options to be considered further

The medium and long-term options identified for further consideration are summarised in Table 6 below. Although already implemented, or due for implementation, Quick Win and Short-Term options should also be incorporated into the WeITAG Stage 3 study for completeness and to fully capture the cumulative resilience benefits of the study.

Table 6 – Medium and Long-term Options to be Considered Further

Option (option no.)	Medium	Long	Reason for being progressed
Review and Enhance Maintenance Processes (S19)	Medium		Enhanced operating procedures to improve performance, provide operational efficiencies and speed up decision making.
Preventative Maintenance (S20)	Medium		This option would help reduce deterioration of existing assets by maintaining them regularly and reducing the amount of emergency maintenance works; allowing works to be planned and reducing disruption to the network.
Offline Access Points (S21)	Medium		Reducing the need to close live lanes for inspections and maintenance works, reducing risk to maintenance workers and reducing traffic management costs and associated traffic delays.
High Tech Asset Monitoring (S22)	Medium		The use of technology to monitor assets would help avoid the need to place staff within the highway, reduce traffic management and associated costs and traffic delays.
Route Based Maintenance (S23)	Medium		Completing works in sections instead of by asset type would reduce repeat area closures, give cost savings and reduce traffic management and delays.

Option (option no.)	Medium	Long	Reason for being progressed
Long Term Asset Specification (S26)	Medium		The use of materials and products with an extended design life would reduce the frequency of highway maintenance schemes and associated disruption.
Programme of Funding (S44)	Medium		The current programme of funding is on an annual basis with uncertainty around overall allocation and with a significant proportion of capital allocations being provided at short notice in quarter 4. A longer-term programme of funding (e.g. over 3 to 5 years) would provide the opportunity to proactively plan for longer term maintenance programmes, leading to improved resilience and reduced negative feedback during planned maintenance works.
Concrete Central Reserve Barriers at Road Traffic Collision Hotspots (S59a)	Medium		Whilst their installation would cause short-term disruption to the network, the long-term benefits generated by reduced maintenance and extended life compared to existing steel barriers are deemed to provide whole-life gains.
Concrete central reserve barriers along whole route of A55 Excl. Britannia Bridge, the tunnels, and Anglesey (59c)		Long	Whilst their installation would cause disruption to the network, the long-term benefits generated by reduced maintenance and

Option (option no.)	Medium	Long	Reason for being progressed
			extended life compared to existing steel barriers are deemed to provide whole-life gains.
Ramp Metering (S55)	Medium		Ramp metering at certain locations would increase capacity of the highway and prevent traffic flow breakdown and the onset of congestion.
Two-Lane Expressway - Eastern / Deeside hotspots (S56h)	Medium		<p>The two-lane expressway with grade separated junctions and technology to support operational regimes would help to smooth traffic flows, reduce congestion and provide enhanced incident management, which would in turn provide significant safety benefits and improved journey time reliability.</p> <p>Many of the other recommended options form the building blocks of the expressway, such as concrete central reserve, emergency refuge areas, comprehensive CCTV coverage and Variable message signs.</p> <p>It is anticipated that the two-lane expressway would initially be constructed at eastern / Deeside congestion hotspots (Tying in with other committed schemes) and subsequently rolled out across other congestion hotspots, and the corridor as a whole.</p>

Option (option no.)	Medium	Long	Reason for being progressed
			<p>Where committed schemes are currently being progressed (e.g. Dee Bridge), consideration should be given to incorporating expressway requirements (e.g. ducting), where appropriate.</p>
<p>Two-Lane Expressway Congestion Hotspots (S56f)</p> <p>Two-Lane Expressway (network wide) (S56g)</p>		<p>Long</p>	<p>The two-lane expressway with grade separated junctions and technology to support operational regimes would help to smooth traffic flows, reduce congestion and provide enhanced incident management, which would in turn provide significant safety benefits and improved journey time reliability.</p> <p>Many of the other recommended options form the building blocks of the expressway, such as concrete central reserve, emergency refuge areas, comprehensive CCTV coverage and Variable message signs.</p> <p>It is anticipated that the two-lane expressway would initially be constructed at eastern / Deeside congestion hotspots (Tying in with other committed schemes) and subsequently rolled out across other congestion hotspots, and the corridor as a whole.</p> <p>Where committed schemes are currently being progressed (e.g. Dee Bridge), consideration should be given to</p>

Option (option no.)	Medium	Long	Reason for being progressed
			incorporating expressway requirements (e.g. ducting), where appropriate.
Improve Non- Standard Junctions (S58)	Medium		This option would improve safety at non-standard junctions and reduce disruption caused by vehicles entering/exiting the carriageway slowly.
Reduce Number of Junctions (S69)	Medium		This option would improve safety and traffic flow on the trunk road.
Limit HGV Overtaking on Uphill Gradients (S72a)	Medium		Reducing delays on uphill gradients caused by slow moving vehicles.
Introduce a Climbing Lane on Northop Hill in the Westbound Direction (S72b)	Medium		Enabling road users to overtake slow moving vehicles on Northop Hill, reducing delays.
Vehicle Restrictions (S84)	Medium		Prohibiting slow moving vehicles would help to maintain consistent traffic flows and reduce driver frustration.
Variable Message Signs (Strategic Infill) (S6a)	Medium		Installing VMS would help to improve safety, journey time reliability and customer experience by improving communication with road users in regard to the status of the road ahead.

Option (option no.)	Medium	Long	Reason for being progressed
CCTV (S7a)	Medium		Enhanced CCTV coverage would help speed up response and resolution time for incidents on the network and enable more informed decision making.
Sidefire Radar (Queue Protection) (S8)	Medium		Installing Sidefire Radar to monitor traffic volume, vehicle classification and speed would help improve safety, journey times and asset maintenance.
Integrating Control Room Systems and Data (S12)	Medium		Integrating control room systems and data would improve current performance in communication, network management, incident recovery and would ensure the control room staff have accurate information in real time.
Integrated Control Room (S31)	Medium		This option would look to better coordinate all staff (NMWTRA, Emergency Services etc). It is recognised that co-locating all staff in a single location would have challenges; improvements to staff integration could be 'virtual' through better utilisation of IT / Systems.
Additional Laybys (S57)	Medium		More regular emergency lay-bys would give an alternative to a hard shoulder, improve journey times and reduce the number of incidents and their duration.

Option (option no.)	Medium	Long	Reason for being progressed
A55 Lay-by Improvements (S93)	Medium		Improvements to the consistency and standard of existing lay-bys would lead to a reduction in incidents and improved journey quality. Officials are working with tourism colleagues on this objective.
Improve Water Supply for Emergency Services (S102)	Medium		A comprehensive review of the existing hydrants and water sources located along the A55/A494 accompanied with a programme to fill any gaps would allow the fire service to respond to an incident faster and more efficiently.
Improve Rest Areas (S103)	Medium		New and improved rest areas provided across the network would encourage drivers to take regular breaks and mitigate the impact of incidents relating to tiredness and fatigue. Officials are working with tourism colleagues on this objective.
Review Prohibition of No Entry's on junctions and slip roads (S114)	Medium		Review prohibition of No Entry's on junctions and slip roads where a motorist could drive onto the A55/A494 trunk road network in the wrong direction, to identify and implement improvements that reduce the risk of occurrence and associated incidents.

Option (option no.)	Medium	Long	Reason for being progressed
Wireless Electronic Driver Information Sign at Waterloo Bridge (S77b)	Medium		Enabling quicker implementation and waymarking of the diversion route and help to reduce driver frustration and confusion.
<p>Close At-Grade Pedestrian Crossings (S71a)</p> <p>Close & Reroute At-Grade Pedestrian Crossings (71b)</p> <p>Close At-Grade Pedestrian Crossings and Create New Routes (71c)</p> <p>Close At-Grade Pedestrian Crossings and Provide Alternative Crossing (71d)</p>	Medium		<p>Various options focussed on closing at-grade crossings of the trunk road. This would remove the risk of incidents resulting from the presence of pedestrians within the carriageway.</p> <p>Further development will be required to focus on the specific sub options and ensure coordination with wider active travel routes and provision of suitable alternative arrangements.</p>
Improve Existing NMU Routes Running Parallel with the A55 (S108)	Medium		The diversion and improvement of existing NMU routes running parallel with the A55 would remove the risk of incidents resulting from the presence of pedestrians adjacent to the high-speed carriageway

Summary & Recommendations

Quick Win Options deemed to have benefit and suitable for implementation following completion of WelTAG Stage 1 were previously taken forward and implemented by May 2018. **Short-term Options** have been proposed for implementation during the WelTAG Stage 2 Study, with support from key stakeholders. The implementation of these short-term measures, which are predominantly sourced from the three themes of communication, diversion routes and incident management, build upon the benefits generated from the quick win interventions. Short Term options were implemented by May 2019.

These options have already progressed to WelTAG Stage 3, 4 and 5 with an agreed Monitoring and Evaluation Plan developed to capture the benefits of these options to network resilience.

Medium-term (by May 2020) and Long-term Options, recommended for further development as part of this WelTAG Stage 2 Study, should now be progressed.

The preferred options will be further developed and their impacts/benefits appraised. Due to the number and scale of options being proposed for progression, a realistic and achievable implementation plan should be developed that focusses on priorities; coordinates with other committed schemes on the network; and aligns with funding programmes.

The medium and long-term options can be categorised into two distinct delivery and funding mechanisms; those that are operational based, requiring continued revenue support, and those that are infrastructure-based projects that require capital investment. To simplify the future management of implementing these measures, it would be advisable to align operational and infrastructure interventions as packages of measures focused towards their individual stakeholders, funding mechanisms and routes to procurement.

Options to be further investigated or transferred to others should be further investigated and their status confirmed prior to progression through the WelTAG stages.



Summary of options recommended for progression

All options identified for further consideration, including those to be progressed by others or requiring further investigation, together with their associated timeframe for implementation are summarised overleaf.

Figures illustrating the combined Quick-win and Short-term interventions, and the medium-term options recommended for progression are presented in separate document Appendix A.

Table 7 – Summary of Options Recommended for Progression – Communication

Option	Description	Quick	Short	Medium	Long
S5	Real-time Floating Vehicle Data - Travel Times on VMS		Short		
S6c	Variable Message Sign Templates and Campaign Messages		Short		
S28	Enhanced Communication Team	Quick			
S63	Cross border collaboration		Short		
S83	Roads Timetable	Quick			
S86	Driver Behavioural Change Campaign		Short		

Table 8 – Summary of Options Recommended for Progression – Asset Management

Option	Description	Quick	Short	Medium	Long
S1 & S2	Incident & Asset Management Smart Phone App		Short		
S19	Review and Enhance Maintenance Processes			Medium	
S20	Preventative Maintenance			Medium	
S21	Offline Access Points			Medium	
S22**	High tech Asset Monitoring			Medium	
S23	Route based Maintenance			Medium	
S24	Enhanced Winter Maintenance		Short		
S26	Long-term Asset Specification			Medium	
S59a	Concrete central reserve barriers at road traffic collision hotspots			Medium	
S59c	Concrete central reserve barriers along A55 excluding Anglesey Excl. Britannia Bridge, tunnels and sections with concrete barriers				Long
S39	Enhanced Staff Responsibility		Short		
S43	Service Monitoring		Short		
S44	Programme of Funding			Medium	
S109	Coastal Erosion Protection				Long
S106*	Over bridges Re-engineered to Mitigate Self-harm Events				Long

Table 9 – Summary of Options Recommended for Progression – Capacity and Demand

Option	Description	Quick	Short	Medium	Long
S55	Ramp Metering			Medium	
S56f	Two Lane Expressway (congestion hotspots)				Long
S56g	Two Lane Expressway (network wide)				Long
S56h	Expressways (Eastern/Deeside hotspots)			Medium	
S58	Improve Non-standard Junctions			Medium	
S65	Performance Analysis		Short		
S69	Reduce Number of Junctions				Long
S72a	Limit HGV Overtaking on Uphill Gradients				Long
S72b	Introduce Crawler Lane on Northop Hill				Long
S84	Vehicle Restrictions				Long
S97**	Review Special Status of A55 J17 to J23				Long

Table 10 – Summary of Options Recommended for Progression – Incident Management

Option	Description	Quick	Short	Medium	Long
S3	CCTV Incident Detection Software	Quick			
S4	Purchase INRIX - Real-time Floating Vehicle Data	Quick			
S6a	Variable Message Signs - Strategic Infill			Medium	
S6b	Mobile Variable Message Signs	Quick			
S7a	CCTV			Medium	
S7b	Wireless CCTV	Quick			
S8	Sidefire Radar (Queue Protection)			Medium	
S12	Integrating Control Room Systems and Data			Medium	
S15	Performance Targets - Business Analytics Platform		Short		
S16a	Vehicle Recovery		Short		
S16b	Free Vehicle Recovery at Incident Hotspots	Quick			
S31a	Integrated Control Room			Medium	
S31b	Virtual Integrated Control Room			Medium	
S36	Extend Welsh Government Traffic Officer Operation	Quick			
S37	Additional Welsh Government Traffic Officer Teams	Quick			
S36a**	Extend Welsh Government Traffic Officer Operation to 24 hours			Medium	

Option	Description	Quick	Short	Medium	Long
S46	Improved Emergency Crossing Point Operation		Short		
S57	Additional Lay-bys			Medium	
S85	Average Speed Enforcement at Rhuallt Hill	Quick			
S93	A55 Lay-by Improvements			Medium	
S98	Emergency Resurfacing Contractor		Short		
S100**	Weigh-in-motion Sensors and Tyre Pressure Sensors			Medium	
S102	Improved Water Supply for Emergency Services			Medium	
S103	Improve Rest Areas			Medium	
S105	More Enforcement Through ANPR**			Medium	
S107**	Provision of Weigh Bridge Sites at suitable locations			Medium	
S114	Prohibition of Entry on Junctions and Slip Roads			Medium	

Table 11 – Summary of Options Recommended for Progression – Diversion Route

Option	Description	Quick	Short	Medium	Long
S47**	Britannia Bridge – High Wind Mitigation				Long
S73	Diversion Route Operation Procedures		Short		
S74	Strategic Diversion Routes Symbol Signage		Short		
S75	Tactical Diversion Routes Symbol Signage		Short		
S76	Diversion Route Traffic Management Plans		Short		
S77b	Wireless Electronic Driver Information Sign at Waterloo Bridge			Medium	
S81	Enhanced Roadspace Planning		Short		
S87*	New Penmaenbach Tunnel				Long
S90*	Penmaenbach Eastbound Marine Embankment				Long
S91**	Roadside VMS on Britannia Bridge for Traffic Control			Medium	
S92**	Wind Deflectors on Britannia Bridge				Long
S94	Britannia Bridge Operational Improvements		Short		
S113**	Improve Tactical Diversion Route Pinch Points			Medium	

Table 12 – Summary of Options Recommended for Progression – Future-proofing

Option	Description	Quick	Short	Medium	Long
S9a**	Smart Road Technology – EV Charging Points			Medium	
S9b**	Smart Road Technology – Solar Road				Long
S9c**	Smart Road Technology – Wireless Power Transfer				Long
S10**	Connected Vehicle Corridor				Long

Table 13 – Summary of Options Recommended for Progression – Sustainable Travel

Option	Description	Quick	Short	Medium	Long
S64*	Improved public transport				Long
S67a	Improve NMU crossings - Penmaenmawr Beach Subway		Short		
S67b*	Improve NMU crossings - Glan Conwy Interchange			Medium	
S67c*	Improve NMU footbridges				Long
S71a	Close at-grade pedestrian crossings			Medium	
S71b	Close at-grade & reroute pedestrian Crossings			Medium	
S71c	Close at-grade pedestrian crossings, & create new routes			Medium	
S71d	Close at-grade pedestrian crossings and provide alternative provision			Medium	
S108	Improve existing NMU routes running parallel with A55			Medium	



Option	Description	Quick	Short	Medium	Long
S111*	Promote Sustainable Transport			Medium	

* Options to be developed by others. ** Options requiring further investigation

Next Steps

This WelTAG Stage 2: Outline Business Case can now be used to:

- Provide future justification of the reasons why particular measures have been recommended for further consideration whilst others have been discarded;
- Prepare a delivery strategy and funding programme and take forward measures to improve the resilience of the A55/A494 transport corridor; and
- Consult further with stakeholders on measures best delivered by organisations other than NMWTRA.

Key considerations include:

Changes in policy and Welsh Government initiatives requiring renewed focus over a range of areas including:

- Publication of the Welsh Transport Strategy;
- Welsh Government's interim guidance on carbon accounting; and
- The impact of Covid-19

As the high-level options recommended within the report do not directly compare options, instead offering a programme of interventions across the A55/A494 corridor to improve resilience, the changes outlined above would not directly alter the options themselves and revisiting WelTAG Stage 2 is therefore unlikely to change the outcome. Changes in policy and initiatives will however shape how options are further developed and appraised when taken forward.

The below provides outline guidance for the proposed approach to incorporate further policy changes within the next steps of the study to ensure the latest thinking, policy and wider opportunities are captured:

- Review of objectives to ensure relevance to specific study and current policies;
- Links into wider local authority and Welsh Government aspirations for active travel provision;
- Consideration of how schemes can support the North Wales Metro;

- Consideration of the role of carbon reduction in the design process and inclusion of carbon accounting within the appraisal;
- Contribution to Green Corridor improvements and consideration of biodiversity net gain;
- Review of linkages to neighbouring and wider regional projects such as Flintshire Corridor;
- Consideration of opportunities for wider route corridor enhancement; and
- Holistic review of asset management within the study area.

The next steps for the Welsh Government are to:

- Confirm arrangements for funding the future progression of this study;
- Allocate suitable funding to permit the implementation of short-term measures;
- Develop evaluation and monitoring plans for the Quick Win and Short-Term options that have been implemented and ensure resilience benefits from these options are captured in line with WeITAG guidance;
- Agree that medium and long-term measures can be progressed as a package of interventions for further consideration;
- Liaise with identified organisation(s) responsible for undertaking further work;
- Liaise with Local Authorities to agree how best to approach and implement a package of active travel measures that provide benefits to the well-being of future generations beyond the remit of this study;
- Liaise the Transport for Wales to agree how best to approach and implement a package of public transport measures that provide benefits to the well-being of future generations beyond the remit of this study;
- Liaise with Local Authorities to agree how best to approach and implement a package of measures to improve diversion routes that provide benefits to the local community, whilst benefiting the A55|A494 transport corridor during periods of necessity;
- Undertake a more detailed option assessment of the identified technology-based measures aimed at future-proofing the network to identify likely trends in technological advances. Where a more robust Outline Business Case can be established to intervene now, then these should be put forward for further consideration;
- Consider how the recommendations of this study can be implemented within currently committed transport infrastructure projects, such as Dee Bridge Replacement and Flintshire Corridor (Red Route); and



- As this initial study has a focus on highway network resilience there may be a need for complementary work along the corridor for both active travel and public transport to provide wider transport network resilience. It is recommended that scheme proposals taken forward consider, in detail, recent changes to WG transport policy defined within the Wales Transport Strategy (WTS) as part of the WelTAG 3 FBC stage or, if deemed appropriate, WelTAG 1 and 2 will be revisited to capture requirements and update reporting before progressing WelTAG 3.



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