Welsh Government

A483 WREXHAM - WELTAG STAGE 2 REPORT

Consideration of interventions on the Welsh Government Trunk Road and Motorway Network for Nitrogen Dioxide reduction

Yn gweithio ar ran
Llywodraeth Cymru
Working on behalf of the
Welsh Government

70040135
JANUARY / FEBRUARY 2018

PUBLIC

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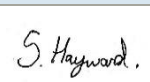
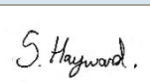
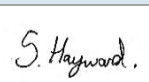
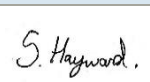
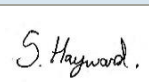
Signature					
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CONTENTS

TABLES

FIGURES

1 INTRODUCTION

1.1 CONTEXT

The European Union Ambient Air Quality Directive (2008/50/EC) sets legally binding limits for concentrations of certain air pollutants in outdoor air, termed 'limit values'. The Directive requires that Member States report annually on air quality within zones designated under the Directive and, where the concentration of pollutants in air exceeds limit values, to develop air quality plans that set out measures in order to attain the limit values. The only limit values that the UK currently fails to meet are those set in respect of nitrogen dioxide (NO_2).

In July 2017, the UK Government published its Air Quality Plan (the 2017 Plan) for tackling roadside NO_2 concentrations[1]. The 2017 Plan set out details of the authorities responsible for delivering air quality improvements including devolved administrations and Local Authorities.

Wales is divided into 4 zones under the Directive:

- Two urban agglomeration zones (Cardiff and Swansea)
- Two non-agglomeration zones (North Wales and South Wales)

WSP have been commissioned by Welsh Government (WG) to undertake a WelTAG Stage 1 (Strategic Outline Case) and 2 (Outline Business Case) appraisals of potential Network Management measures for reducing NO_2 levels arising from traffic emissions at five separate locations on the Welsh Strategic Road Network. The five locations (and the respective zones) are:

- A494 Deeside (North Wales)
- A483 Wrexham (North Wales)
- A470 Upper Boat to Pontypridd (South Wales)
- M4 J41 – J42, Port Talbot (South Wales and Swansea)
- M4 J25 – J26, Newport (South Wales)

Given the differences between the five identified locations, five separate WelTAG Stage 1 reports have been produced. It is acknowledged that what might represent a practical measure in one location, might not be viable or deliverable in another. Therefore, the reports have been produced independently in parallel to ensure that the individual requirements of any one location do not dictate the measures considered at the others.

For parity with the Stage 1 reports, five separate WelTAG Stage 2 reports have been produced. All the reports are supported by the WelTAG Impact Assessment Report (IAR) and Effectiveness Review which are reported in separate documents from this Report.

1.2 STUDY CORRIDOR

This report presents the Stage 2: Outline Business Case of the WelTAG process for reducing the levels of NO_2 on the A483 dual carriageway through shortlisted network management measures. The other four locations are considered under separate cover.

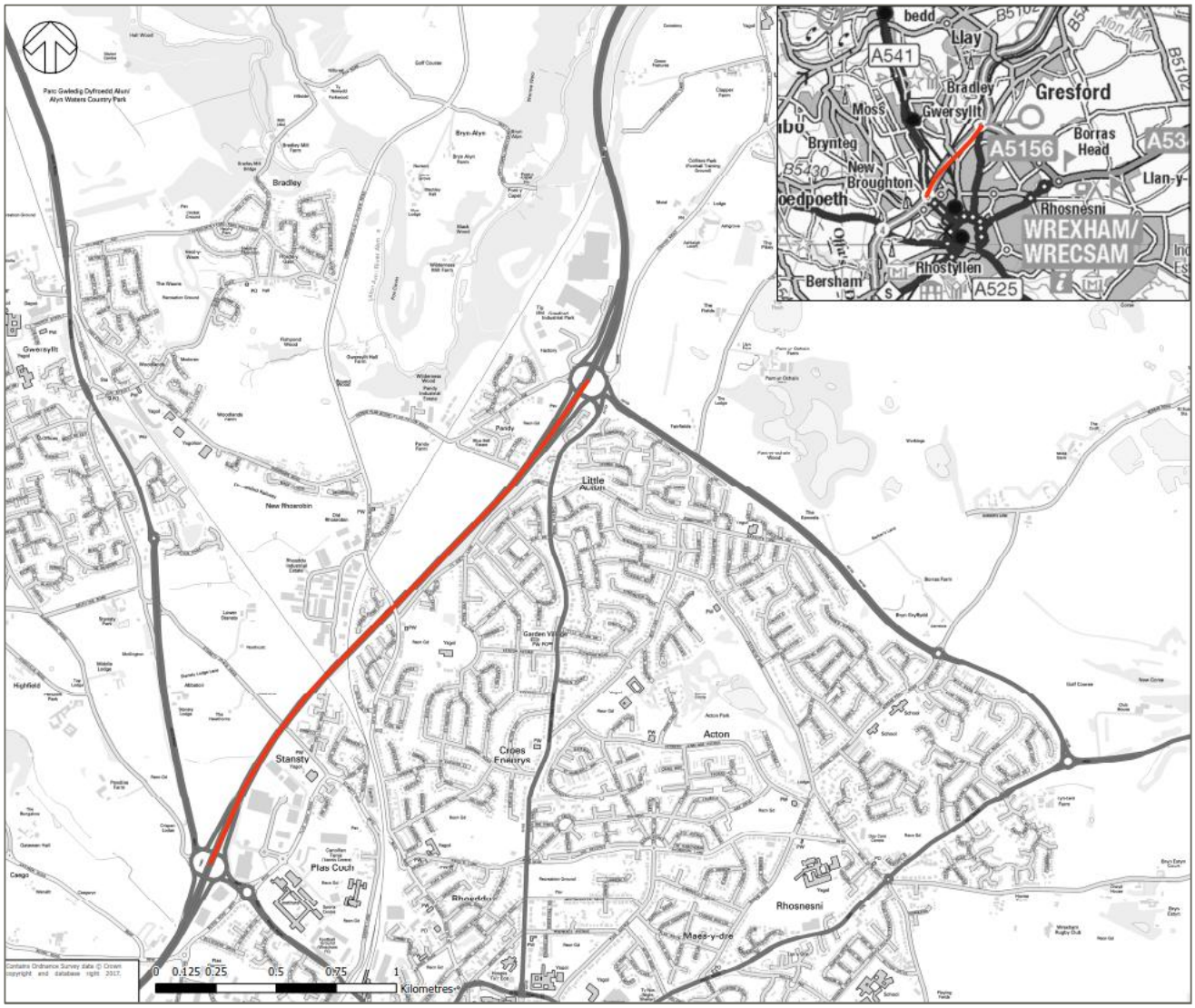
The A483 study corridor is located in North Wales to the west of Wrexham, which is part of the Wrexham County Borough. Wrexham is the largest town in the north of Wales, situated close to the Welsh/English borders to the south of Chester. At the 2011 Census, Wrexham had a population of 61,603, and is the fourth largest urban area in Wales.

[1] UK plan for tackling roadside nitrogen dioxide concentrations; Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633269/air-quality-plan-overview.pdf - Accessed 10th November 2017

The study corridor considered in this report covers the principal corridor on the A483 between J5 (Mold Road Interchange) to J6 (Gresford Interchange). This is shown in Figure 1.

The A483 study corridor assumed for the purposes of this WelTAG study is independent of the PCM model. Whilst the study corridor encompasses the links in the PCM model that have shown an exceedance in limit values, it is not limited to these. This acknowledges that the measures and their subsequent impacts may be realised beyond the identified area with NO_2 exceedances.

Figure 1: The Study Corridor



The study corridor is approximately 2.6km in length and has a north east to south west alignment. The A483 study corridor is a 2 lane all-purpose dual carriageway (D2AP).

1.3 APPROACH

The Draft WelTAG 2017 Guidance[2], which was out for consultation when this study commenced, is used as the basis for this appraisal. The guidance is significantly different to the 2008 version and provides a switch to the WG's Five Case Model for Public Sector Business Cases.

The Five Cases in the draft guidance are:

- **The strategic case**: the case for change, fit with other policies and objectives
- **The transport case**: the social and cultural, environmental, and economic impacts of the change including a value for money assessment
- **The delivery case**: can the scheme be delivered?
- **The financial case**: is the proposed spend affordable?
- **The commercial case**: how can the scheme be procured, is it attractive to the private sector, is it commercially viable?

The WelTAG guidance states that the purpose of the Stage 2: Outline Business Case is to:

'examine in greater detail the short list of options (measures) for tackling the problem under consideration'.

As such, this Stage 2: Outline Business Case report:

- Determines whether there are any transport measures that can address the identified problem(s) and can be delivered;
- Selects a preferred measure(s) to be taken forward to Stage Three (the Full Business Case);
- Agrees the methods to be used to provide additional evidence where required for the Stage Three (Full Business Case) assessment;
- Identifies any legislative requirements that need to be met during the Stage Three (Full Business Case) assessment; and,
- Documents the decisions of the Stage Two Review Group, and the basis for these decisions.

Whilst WelTAG provides a fixed framework for appraisal, the guidance acknowledges that the level of detail provided in the WelTAG reports should be proportionate to the impacts under consideration. All major impacts and issues that could have a significant influence on delivery should be presented, but the level of detail in any analytical work should be proportionate to the scale and significance of the impact and sufficiently accurate for the decisions that need to be made.

The objective of this study is to carry out an initial investigation and identify potential network management measures which will assist in bringing forward reductions in NO_2 in the shortest possible time to ensure compliance with the Air Quality Framework Directive requirements in five locations on the Welsh SRN listed above. Therefore, the transport case will focus on air quality and reflect the key considerations in relation to the EU Air Quality Directive and bringing forward compliance with limit values.

[2] Available at: https://consultations.gov.wales/sites/default/files/consultation_doc_files/161208-weltag-consultation-en.pdf Accessed 3rd November 2017

1.4 REPORT STRUCTURE

The structure of this Stage 2 report is as follows:

Chapter 2: Strategic case

This chapter presents a baseline of the existing situation, including an overview of legislation and policies and a description of the current EU Limit Value compliance status. It outlines the objective and the EU Air Quality Directive and includes an evidence-based description of the current problem. A brief commentary is provided regarding the development of the long list of measures and how they plan to address the current problem. Information is provided on how the Well-Being of Future Generation Act (2015) Goals, related Objectives and Ways of Working have been considered.

Chapter 3: Transport case

This chapter provides a summary of the appraisal against the objective through consideration of the key and secondary criteria and appraisal against the relevant WelTAG impact areas.

Chapter 4: Delivery case

This chapter identifies the WelTAG Review Group and the delivery arrangements of any potential measures.

Chapter 5: Financial case

This chapter provides a high level analysis of potential funding mechanisms for delivery.

Chapter 6: Commercial case

This chapter includes a description as to whether the measures are commercially viable, and provides an analysis as to whether measures could be packaged together for a phased delivery.

The conclusion of this Stage 2 report includes a list of preferred measures, or package of measures which should be taken forward to Stage 3 (Full Business Case), based on their ability to solve the problem, their fit with the objective, and their impacts, deliverability and robustness under uncertainty.

The Impact Assessment Report is structured in the same way as this report; and provides evidence of the assessments and information used to support the work reported here.

2 STRATEGIC CASE

2.1 CASE FOR CHANGE

2.1.1 LEGISLATIVE AND POLICY CONTEXT

This Chapter of the Stage 2 report builds on the Strategic Case included as part of the Stage 1 report for the A483. It provides a narrative of how the short list of measures was derived and considers in greater detail how each measure tackles the problem.

This section provides a brief summary of relevant policies and plans that are pertinent to the A483 WelTAG Stage 2 appraisal. There are a number of overarching policies that set the context for the study, and those set out below have been used to assess against any potential network management measures for reducing NO_2 levels along the corridor.

UK and Welsh policies shape and guide respective regional and local plans and policies. Reference is made to them as appropriate.

UK and Welsh legislation and policy Summary

The requirements of the EU Ambient Air Quality Directive are transcribed into Welsh legislation via the Air Quality Standards (Wales) Regulations 2010 (Welsh Statutory Instrument No 1433 (W.126)). The regulations designate Welsh Ministers as the competent authority for the purposes of the Directive and place duties on Welsh Ministers to draw up and implement air quality plans in relation to achieving the Directive limit values where they are currently exceeded. The latest overarching UK Air Quality Plan was published in July 2017[3], including zone plans for all four Welsh zones[4].

National policies highlight commitment within the UK to reduce the amount of airborne pollutants, with the 1995 Environment Act making air quality control a statutory requirement for all local authorities. Thereafter, air quality has been monitored annually with action plans and Air Quality Management Areas (AQMAs) being set up where standards fall below the limits set by the Environment Act and the Air Quality (Wales) Regulations. The Environment (Wales) Act 2016 imposes various duties relation to the sustainable management of natural resources, including the air.

In Wales, national planning policy is comprised of Planning Policy Wales (PPW), Technical Advice Notes (TANs), circulars and policy clarification letters. PPW states “Development plan policies and decisions on planning applications should take into account national air quality objectives, EU limit and target values”. The Local Air Quality Management (LAQM) Policy Guidance in Wales provides guidance for local authorities on how to meet the statutory objectives set within the UK legislation.

Air quality related commitments are included in a number of policy documents, such as The Wales Transport Strategy (which is currently under review and will be published in draft for consultation during 2018), and the National Transport Finance Plan which are designed to promote a shift to more sustainable methods of transport such as walking and cycling and integrated public transport; and supporting highway schemes that are designed to reduce traffic congestion.

[3] Available at https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017
[4] Available at https://uk-air.defra.gov.uk/library/no2ten/2017-zone-plan-documents

The Well-being of Future Generations (Wales) Act strives to improve the social, economic, environmental and cultural well-being of Wales. Its goals, as summarised in The Essentials of the Act[5], are as follows:

Goal	Description of the goal
A prosperous Wales	An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including acting on climate change); and which develops a skilled and well-educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work.
A resilient Wales	A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).
A healthier Wales	A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.
A more equal Wales	A society that enables people to fulfil their potential no matter what their background or circumstances (including their socio economic background and circumstances).
A Wales of cohesive communities	Attractive, viable, safe and well-connected communities.
A Wales of vibrant culture and thriving Welsh language	A society that promotes and protects culture, heritage and the Welsh language, and which encourages people to participate in the arts, and sports and recreation.
A globally responsible Wales	A nation which, when doing anything to improve the economic, social, environmental and cultural well-being of Wales, takes account of whether doing such a thing may make a positive contribution to global well-being.

Regional Summary

The Moving North Wales Forward Plan (MNWF) looks to create a sustainable, reliable, efficient and quality integrated transport network across the region. Their vision is to connect people, communities and businesses to jobs, facilities and services, and maximise economic opportunities. One of the outcomes hoped for is to deliver reduced emissions and improved air quality.

The MNWF looks to provide a modern, high quality transport system, which is considered to be fundamental to achieving economic growth. In addition, the plan shares the same ambitions as Planning Policy Wales in wanting the region to be a competitive and connected component of the Northern Powerhouse.

Local Summary

The Air Quality Progress Report for Wrexham County Borough Council (WCBC) was produced in 2016 in fulfilment of the Environment Act. It found that NO_2 concentrations in the county were all below the limit set in the objectives of the Air Quality Regulations, therefore there was no requirement for WCBC to undertake a detailed assessment at the time.

[5] Available at: https://futuregenerations.wales/wp-content/uploads/2017/01/150623-guide-to-the-fg-act-en.pdf - Accessed 8th January 2018

2.1.2 AIR QUALITY

The section of the A483 under consideration in this study sits within Wrexham County Borough. There are no designated AQMAs within the vicinity of the scheme, or located within Wrexham itself. However the A483 is considered to be the principal local source of air pollution.

Air quality baseline data for the A483 Wrexham has been derived from both local authority (as uploaded on the Air Quality in Wales website[6]) and UK air quality reports.

Specifically, baseline and future baseline air quality NO_2 concentrations has considered outputs from the Pollution Climate Mapping (PCM) model developed by Ricardo AEA on behalf of Defra/DfT.

The PCM model projections presented in support of the 2017 Plan indicate that annual mean NO_2 concentrations will reach compliance with air quality limit values by 2018 (i.e. projected concentrations at or below 40µg/m^3) on the A483 in Wrexham.

The dates in Table 1 set the timescales within which the measures must be deliverable to bring forward compliance.

The percentage reduction in emissions from road transport required to achieve compliance has been estimated using the maximum PCM concentration in any given year, the corresponding background NO_2 concentration and Defra's NOx to NO_2 calculator (v6.1) to calculate the roadside contribution to NOx concentrations and the level of emissions required to give a roadside concentration of 40µg/m^3.

Table 1: Baseline PCM Predicted NO_2 Concentrations at Wrexham, without NO_2 reduction network measures (projections from 2017 Plan, July 2017)

Site Location	NO_2 Predicted Baseline Concentration (µg/m^3)					
	2017	2018	2019	2020	2021	2022
A483 Wrexham	**41**	39	38	36	33	31
Approx. % Reduction in NOx Emissions from Road Transport Required for Compliance	4%	-				

The closest monitoring stations to the section of the A483 under consideration are locations 20 and 32 on Chester Road. Concentrations at these locations are well within the air quality objectives but the sites are too distant from the A483 to assess whether the PCM modelled concentrations are consistent with local monitoring.

The only location close to the A483 at which Wrexham County Borough Council monitors air quality is location 30 (Rhostyllen Roundabout), where concentrations are just within the air quality objective. Whilst this monitoring location is at a junction (where concentrations are likely to be higher than on other sections of the road), the A483 is elevated at this location (which will lead to reduced contribution from the A483 in comparison to locations where the road is at grade). As such, it is concluded that concentrations at this location are consistent with the PCM modelled concentrations in Table 1, since a marginal exceedance of the objective is likely at 4m from the A483.

[6] Available at: http://www.welshairquality.co.uk/

Table 2: Monitored Annual Mean NO_2 concentrations alongside the A483 (µg/m^3)

ID	Location	Distance to A483	Bias-adjusted Annual Mean			Adjusted to 4m from A483		
			2014	2015	2016	2014 (4m)	2015 (4m)	2016 (4m)
19	Mold Road	>300m	21.6	20.1	-	Not Applicable		
20	Chester Road	90m	25.6	24.2	-			
32	Chester Road	50m	27.6	25.7	-			
30	Rhostyllen R'bout	7m	39.9	36.9	-	**46.0**	**42.9**	-

2.1.3 INFRASTRUCTURE AND LOCAL FACILITIES

The A483 between J5 (Mold Road Interchange) and J6 (Gresford Interchange) is a 2 lane all-purpose dual carriageway, subject to National Speed Limit. The study corridor operates with No Stopping (Clearway) Order.

The A483 is part of the strategic corridor between North and South Wales. Furthermore, to the south, the A483 provides access to towns such as Welshpool, Newtown, and Builth Wells. It also provides access to the A5, connecting Wrexham with Shrewsbury, and routes to Hereford and Cardiff. North of the study corridor, the A483 provides access to the A55 and Chester, Liverpool, and Manchester.

J5 (Mold Road Interchange) to the south of the study corridor is a grade separated roundabout with the A541 (Mold Road), providing access Mold to the north, and to Plas Coch Retail Park, Wrexham Glyndwr University, Wrexham Maelor Hospital, Wrexham General railway station, and the town centre to the east.

J6 (Gresford Interchange) to the north of the study corridor is a grade-separated roundabout with seven exits and entries, including the A5156, A5152, B5445, and Blue Bell Lane. This junction provides access to Nantwich, Acton, Gresford, and Wrexham Industrial Estate.

The infrastructure, including structures and junctions, on the A483 study corridor from south to north is summarised as follows:

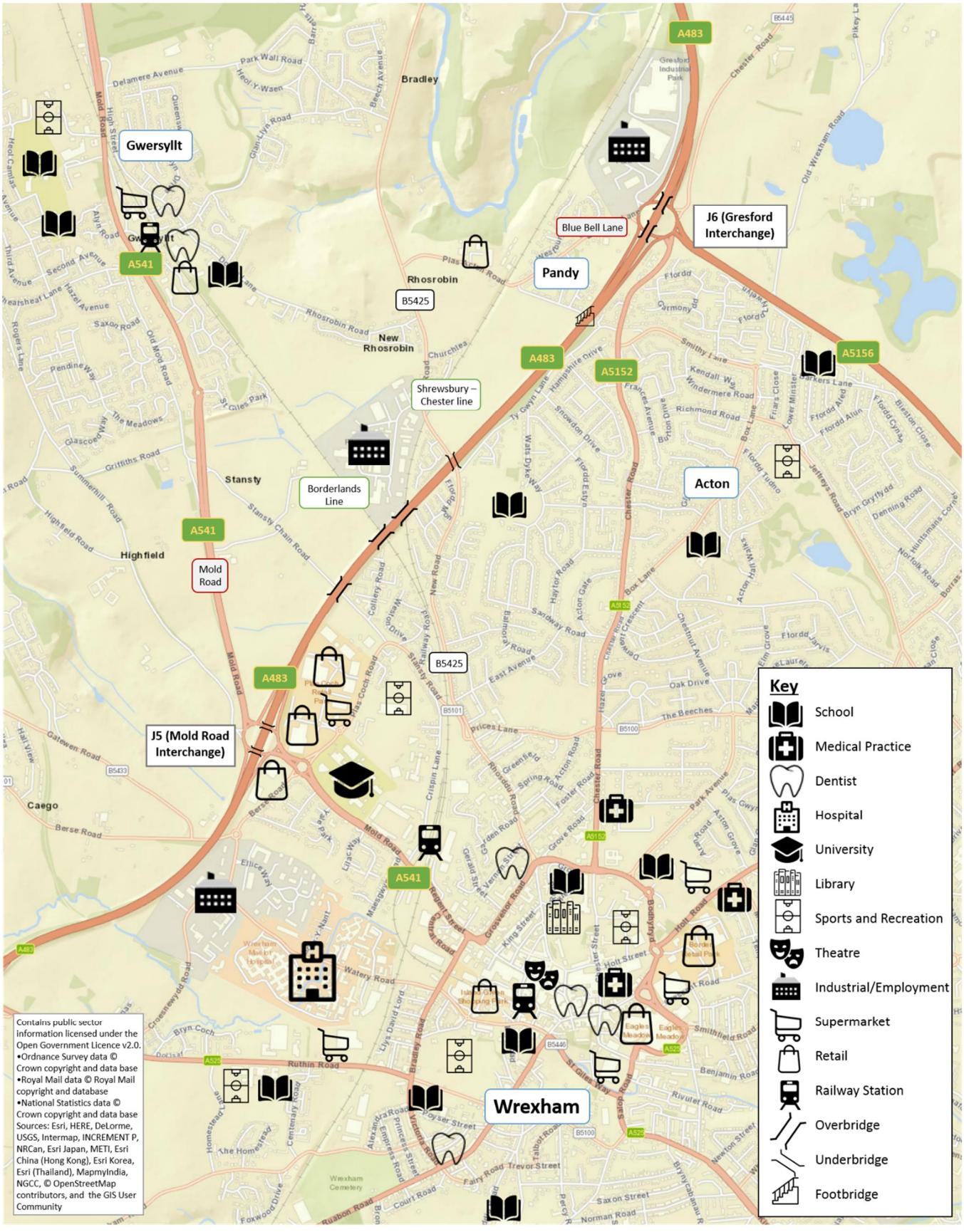
- Grade separated roundabout at J5 (Mold Road Interchange), with the circulatory forming two consecutive overbridges to west of Wrexham Glyndwr University;
- Stansty Chain Rd underbridge to the north of J5 (Mold Road Interchange);
- Rail underbridge to the south of Rhosddu Industrial Estate (Borderlands Line);
- Rail underbridge to the east of Rhosddu Industrial Estate (Shrewsbury–Chester line);
- B5425 overbridge;
- Footbridge to the south of J6 (Gresford Interchange); and
- Grade separated roundabout at J6 (Gresford Interchange) with the A483 on structures above the circulatory.

The A483 study corridor borders the north western edge of Wrexham and is therefore in a relatively built-up area, passing retail parks, industrial estates, and residential areas including Gwersyllt, Pandy, and Acton.

Around the study corridor, there are various community facilities, for instance schools (including several Welsh Medium primary and secondary schools), medical practices, libraries, leisure centres, employment areas, and supermarkets.

The infrastructure and local facilities in the vicinity of the A483 are illustrated in Figure 2.

Figure 2: Infrastructure and Local Facilities nearby the A483 Study Corridor



2.1.4 TRAFFIC FLOWS

Annual Average Daily Flows (AADF) have been extracted from the Department for Transport (DfT). Traffic flows on the A483 study corridor between J5 (Mold Road Interchange) and J6 (Gresford Interchange) is approximately 50,000 vehicles, with the percentage of Heavy Goods Vehicles (HGVs) at about 5%.

Trafficmaster Data

Trafficmaster has been used to analyse the difference in annual average weekday vehicle speeds between cars / Light Good Vehicles (LGVs), and HGVs for both directions on the A483 study corridor. The data has been separated into four periods, as follows; AM Peak (07:00-10:00), Inter Peak (10:00-16:00), PM Peak (16:00-19:00), and Off Peak (19:00-07:00). The data used for this study is from the period between 1st June 2015 and 30th July 2016. Vehicle speeds below are all presented in kilometres per hour (kph).

Vehicle Speeds

Speeds of cars and LGVs are noticeably greater than HGV speeds along the A483 in both directions. Car and LGV speeds are at their highest during the Off Peak (110kph northbound, 105kph southbound), and lowest during the AM Peak (103kph northbound, 99kph southbound). The speed of southbound cars and LGVs are similar during the PM Peak and Inter Peak, at 103kph and 102kph respectively, with a slightly greater divergence between the PM Peak and Inter Peak for cars and LGVs on the northbound carriageway, at 107kph and 104kph respectively.

By comparison, the greatest HGV speeds recorded for both northbound and southbound flows occurred within the PM Peak, with average speeds of 91kph in both directions. The lowest HGV speeds occurred within the Inter Peak for northbound flows (87kph), and in the AM Peak for southbound flows (83kph). Average HGV speeds within the Off Peak were recorded at 88kph for northbound traffic and 89kph for southbound.

2.1.5 PUBLIC TRANSPORT

Analysis[7] shows that there was an annual increase of 3.5% in the number of station entries/exits across Wales in 2015-16 compared to the year before. There are two railway stations in Wrexham; Wrexham Central railway station is the smaller of two railway stations serving the central area of Wrexham in Wales, the other is Wrexham General. Wrexham General is a main line railway station and is one of the 20 busiest stations in Wales, although a 2.5% decrease in passenger numbers was observed in 2015-16.

Wrexham General railway station is operated by Arriva Trains Wales (ATW), with services also provided by Virgin Trains who operate a once daily service to London Euston. There is 1 train per hour towards Biston via Shotton, Wrexham Central, Holyhead via Chester, and Shrewsbury. There is also 1 train every 2 hours to Cardiff central, as well as to Birmingham. Parking provision is operated by NCP at Wrexham General, with 68 spaces available (none of which are accessible).

Bus services in the vicinity of the study corridor are operated privately, predominantly by Arriva. No services operate on the A483; however, buses use local roads to reach Chester, Llay, and Mold to the north, and Penycae and Llangollen to the south.

2.1.6 ECONOMY

The Labour Market Profile of Wrexham[8] has identified that 79.5% are economically active (for those aged 16-64), which is above the average in Wales of 75.2%. There are 7,300 workless households in Wrexham, which equates to 17% of households, which is 0.8% lower than across Wales. Wrexham has lower than average out-of-work benefits claimants, however, full time workers earn less than the national average.

[7] Source Location: http://gov.wales/docs/statistics/2017/170510-rail-station-usage-2015-16-en.pdf - Accessed 13th November 2017
[8] Nomisweb.co.uk – Accessed on 9th November 2017

2.1.7 DEMOGRAPHICS

The Local Area Report for Wrexham[9] covers the characteristics of people and households with information sourced from the 2011 Census key statistics. Of the 134,844 usual residents, 49.7% were males and 50.3% were females. 98.8% of the usual residents lived in households and 1.2% lived in communal establishments. Furthermore, the average (mean) age of residents was 39.8 years, which is younger than the national average of 40.6 across Wales.

Of all usual residents aged 3 and over in Wrexham, 78.7% have no Welsh language skills, which is 5.4% higher than across Wales. 12.9% of residents in Wrexham can speak Welsh, and 9.2% can speak, read, and write Welsh. This compares to the national average of 19.0% and 14.6% respectively.

2.1.8 OTHER SENSITIVE ENVIRONMENTAL AREAS

This section of the report identifies and determines the potential environmental constraints and opportunities within the vicinity of the A483 between J5 (Mold Road Interchange) and J6 (Gresford Interchange). The report has been compiled using aerial imagery and ordnance survey maps.

Statutory Designations

European Designated Sites (also known as Natura 2000 Sites) include any Special Protection Area (SPA), Special Area of Conservation (SAC), Sites of Community Importance (SCI's) and RAMSAR sites. There are no SACs within 1km of the A483 (measured from closest point).

There is one Site of Special Scientific Interest (SSSI) within proximity to the A483 comprising the Gatewen Marsh located approximately 50m north west; Chwarel Singret located 790m north west; and Marford Quarry located approximately 80m south east.

There are no Areas of Outstanding Natural Beauty (AONB) located within 1km proximity to the proximity to the A483, nor are there any other Statutory Designations (National Parks and Country Parks) located within 1km to the A483.

Non Statutory Designations

There are three Country Parks within proximity to the A483 comprising the Moss Valley Country Park located approximately 1.4km north west; and the Alyn Waters Country Park located 1.9km north west; and Erddig Park located approximately 1.4km east.

There are no Local Nature Reserves (LNR) or Natural Nature Reserves (NNR) within 1km. Nor are there any Special Landscape Areas within the vicinity of the highway on the A483.

Areas of Population, Community Resources and Infrastructure

There are more than 20 sensitive human receptors (i.e. residential properties, hotels etc.) and community resources (i.e. footpaths, cycleways etc.) located within 1km of the A483. For instance, there are several areas with residential dwellings that are within 50m of the A483 at the closest point, as well as footpaths, retail parks, and industrial parks within 100m of the carriageway.

Sensitive Noise Receptors

Noise Sensitive Areas located within 1km of the A483 study corridor include a designated Noise Action Planning Priority Area (NAPPA) for road noise on a section of the A483 between J5-6. There is also a NAPPA located on the A525 near Rhostyllen approximately 2km south east from the A483.

Water Environment

There are six water courses and permanent water bodies located within 1km of the A483, including the River Alyn, which runs parallel to the north of the study corridor. The River Clywedog flows beneath the A483 approximately 900m south of J4, and the River Gwenfro flows beneath the A483 approximately 500m north east of J4.

[9] Nomisweb.co.uk – Accessed on 8th January 2018

Cultural Heritage, Historic and Landscape designations

There are eight Listed Buildings within 1km of the A483, including various cottages, Berse Drelincourt Church, Lower Berse Farmhouse, and Croesnewydd Hall.

There are no Scheduled Monuments located on the A483, however there are several within the vicinity comprising; Wat's Dyke at Crispin Lane Wrexham approximately 800m east; Wat's Dyke: Garden Village Section located approximately 200m south east; and Wat's Dyke section W of Ty-Gwyn located approximately 200m north west.

There are no Conservation Areas within 1km of A483 between J5 and J6, nor are there any Historic Parks and Gardens.

2.2 PROBLEM IDENTIFICATION

The A483 lies within the North Wales zone for the purpose of the assessment of compliance with the EU Air Quality Directive.

The national assessment[1] of roadside NO_2 undertaken for the North Wales zone indicates that the annual limit value was exceeded in 2015 but it likely to be achieved by 2021. The compliance date of the North Wales zone is, in current projections, determined by the compliance of the A494 between J34 (Ewloe) of the A55 and the Welsh/English borders.

The section of the A483 under consideration in this study is expected to have achieved compliance in 2018. Elevated concentrations of NO_2 on this study corridor are due to high traffic volumes. WG are investigating additional network management measures for the strategic trunk road and motorway network that could bring forward the projected compliance date.

2.3 OBJECTIVE OF THE STUDY

Whilst WelTAG provides a fixed framework for appraisal, the guidance acknowledges that the level of detail provided in the WelTAG report should be proportionate to the impacts under consideration.

As identified in the Stage 1 report, **the objective of this study is to carry out an initial investigation and identify potential network management measures which will assist in bringing forward reductions in NO_2 in the shortest possible time to ensure compliance with the Air Quality Framework Directive requirements in five locations on the Welsh SRN listed above. Therefore, the transport case will focus on air quality and reflect the key considerations in relation to the EU Air Quality Directive and bringing forward compliance with limit values.**

The following **key criteria** were described in the Project Brief for the high level appraisal of the potential measures:

- ***Effectiveness***
- ***Timescales***
- ***Feasibility***

This has been interpreted for the purposes of this appraisal as meaning:

- ***Effectiveness*** – Is the measure likely to deliver reductions in roadside concentrations proportionate to the scale of the exceedance above the 40µg/m^3 legal limit
- ***Timescales*** – Can the measure be implemented within timescales that are meaningful (short enough) to have an impact on bringing forward the projected compliance date
- ***Feasibility/Deliverability*** – Can the measure be delivered in the location involved with the powers available to the Highway Authority

For the purpose of this appraisal, the phrase deliverability has been used, instead of feasibility to match more clearly the requirements of WelTAG for delivery.

In addition to the Air Quality Directive, the study contributes to the strategic priorities of the Welsh Government, including that of the Well-being of Future Generations (Wales) Act 2015. As such, based on the Future Generations Act and the recommendations within The National Institute for Health and Care Excellence (NICE) air quality guidelines[10] so that health impacts can be more fully considered, the following are considered as **secondary criteria** in the appraisal process:

- Will the measure deliver an overall reduction in NO_2 emissions to air
- Will the measure result in unintended consequences or other environmental impacts
- Will the measure contribute to well-being

  - Will the measure impact equally across multiple vehicle classes and journey types
  - Will the measure have a positive impact on wider public health and inequalities

It is possible that measures could be used in combination. Each individual measure need not bring forward compliance in itself but the improvement in NO_2 brought about by the measure should be proportionate to the scale of the exceedance of the limit value.

The Stage 1 appraisal focused on the three key criteria. The secondary criteria has been considered in further detail during this Stage 2 appraisal, and will likely be significant where two measures are mutually incompatible. In such cases, delivery against the secondary criteria could weigh in favour of a particular measure.

Information was collected on the legislative, policy and context of the area (see 2.1 Case for Change) and used within the WelTAG process to inform consideration of the implications of measures on the impact areas as reported in the Appraisal Summary Tables for each measure. The impacts are organised by the four areas of Sustainable Development – Environment, Economy, Social and Cultural.

More detailed consideration of how the goals and objectives are integrated with other objectives, including objectives of other public bodies, will be undertaken in WelTAG stage 3, when further detail of the measures will be available.

While this appraisal is aimed as shortening the period of compliance against the required limit values, the measures when applied could themselves be helpful in the longer term by providing solutions which prevent environmental, social and health issues getting worse or even occurring. Collaboration and involvement while limited to WG Departments and Trunk Road Agents at this stage, will need to be continued and expanded in later stages to ensure the appraisal, development and delivery of the measures considers the views of those affected and avoids unintended consequences.

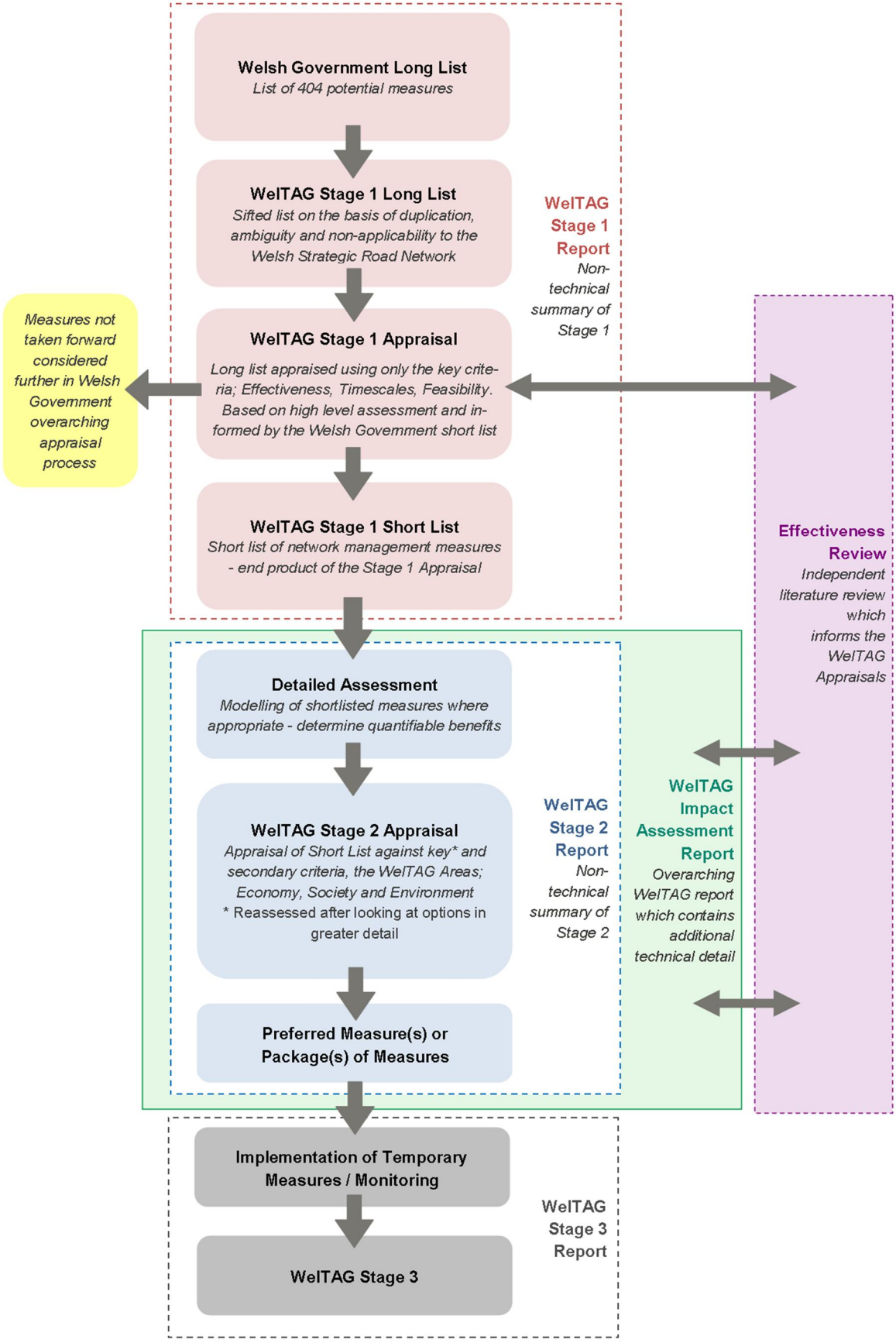
2.4 THE PROCESS

This study has been undertaken following the WelTAG framework and with consideration of the goals of the Future Generations Act as above. Preliminary work was undertaken by the WG, who produced a long list and short list of measures. These are not the WelTAG long list and short list, although have been used to inform this study.

Stage 1 (Strategic Outline Case) identified the issue and objective, developed a long list of possible measures, and recommended a short list of measures to take forward to Stage 2 (Outline Business Case). The WelTAG documents are supported by an Effectiveness Review, which considers documented evidence of the effectiveness of measures. This process is summarised in Figure 3.

[10] Air pollution: outdoor air quality and health, NICE guideline [NG70] Published date: June 2017

Figure 3: The Process



2.5 SHORT LIST OF MEASURES

The WelTAG Stage 1 appraised the long list of 56 measures against the key criteria for meeting the objective. The sifting of measures resulted in the short list of 19 network management measures for Stage 2 (the Outline Business Case), based on their ability to bring forward the date of compliance with EU Limit Values on the A483 against the key criteria (Effectiveness, Timescales, and Deliverability), as follows:

- S1: NOx Absorbing Materials
- S4: Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers
- S7: Enforce/Reduce Speed Limit
- S10: Flow Management (Upstream)
- S14: Ramp Metering
- S16: Junction Closures
- S17: Variable Message Signs (VMS)
- S18: Expressway
- S19: Variable Diversions
- S26: Reallocation of Road Space
- S28: Behaviour Change
- S44: Vehicle Emission Testing
- S46: Clean Air Zones / Low Emission Zones
- S51: Intelligent Traffic Management
- S53: Enhanced Traffic Officer Service
- S62: Signage
- S63: Distance Chevrons
- S65: Air Quality Areas
- S66: Air Quality Communications

The appraisal of this short list is documented in Chapter 3.

3 TRANSPORT CASE

3.1 METHODOLOGY

The approach to the Stage 2 level of appraisal is intended to examine in greater detail the short list of measures for tackling the problem under consideration. The short list of measures has been appraised against the key criteria and secondary criteria for the objective and the three WelTAG areas.

The objective of this study is to carry out an initial investigation and identify potential network management measures which will assist in bringing forward reductions in NO_2 in the shortest possible time to ensure compliance with the Air Quality Framework Directive requirements in five locations on the Welsh SRN. Therefore, the transport case will focus on air quality and reflect the key considerations in relation to the EU Air Quality Directive and bringing forward compliance with limit values.

Whilst the measures have already been appraised against the key criteria for the objective, this has been revaluated at Stage 2. It is recognised that in looking at measures in greater detail during Stage 2, the findings of Stage 1 may need updating.

The three WelTAG areas are:

- Economy
- Environment
- Society

The measures have been appraised against the WelTAG Impact Areas which were identified within the Scoping Report and are outlined in Table 3. For a selection of impact areas, denoted with strikethrough, the decision was taken against undertaking an appraisal. Given that the measures are targeted at reducing NO_2 levels, it was not considered necessary to appraise against every impact area. The areas which have been excluded from the appraisal have been done so on the basis of there being no notable impacts resulting from any of the measures. Equally, it has not been possible to appraise some of the impact areas due to the limitations of Stage 2, which are outlined in Section 4.4. It may be pertinent to re-introduce these impact areas at Stage 3.

Table 3: WelTAG Impact Areas that have been appraised

Environment	Social and Cultural	Economy
Air Quality	Physical Activity	Journey time changes and Journey time reliability
Noise	Journey Quality	Capital Cost
Landscape	Accidents	Land
Townscape	Access to employment and services	~~Transport costs~~
Historic Environment	~~Security~~	~~Accidents~~
Biodiversity	~~Affordability~~	~~Changes in productivity~~
Water Environment	~~Severance~~	~~Local Economy~~
~~Greenhouse gases~~	~~Option and non-use values~~	~~Revenue costs~~

3.2 APPRAISAL OF WELTAG IMPACT AREAS

The following sections set out how each of the impact areas were appraised during Stage 2 of the study. The appraisals undertaken adhere to the WelTAG 2017 consultation guidance.

3.2.1 ENVIRONMENTAL APPRAISAL

Air Quality

The appraisal of air quality impacts was undertaken semi-quantitatively using a combination of professional judgement and, where possible, robust, detailed emissions and dispersion modelling. A three step approach was adopted for each potential measure:

Step 1: The output of the effectiveness review and professional judgement were used in combination with baseline vehicle speed and flow data to review whether the measure has the potential to significantly affect emissions of nitrogen oxides. This review extended the WelTAG Stage 1 appraisal by incorporating more detailed traffic information and location specific conditions. Where no likely impact was identified, the measure was assumed to have a neutral impact and to be ineffective. In this case, no further appraisal was undertaken.

Step 2: Where a likely impact was identified, the measure was subject to NO_X *emissions modelling*. Defra's Emissions Factor Toolkit v8.01[11] (EfT) was used to model the change in emissions for a representative section of the PCM link in exceedance of the limit value. The modelling was based on traffic data for 2018, for scenarios without and with the measure. The percentage change in emissions between the without and with measure scenarios was used to categorise the impact of the measure using the following criteria:

- Large impact = change of >5% of emissions without the measure
- Moderate impact = change of >1% - 5% of emissions without the measure
- Slight impact = change of ~1% of emissions without the measure

Step 3: Where possible, the measure was subject to detailed *dispersion modelling* using the ADMS new generation dispersion model to quantify the potential change in roadside NO_2 concentrations. ADMS is the model most commonly used within the UK for dispersion modelling of air quality impacts. If the measure resulted in an increase in emissions on the PCM link in exceedance of the limit value, the measure was considered ineffective even if there were potential air quality benefits elsewhere.

The impacts of some measures could not be modelled at Step 2 above, due to their impact being unrelated to either changes in traffic or dispersion conditions e.g. the use of surface coating to remove NO_2 from air. For these measures, the potential impact of the measure was estimated using the outcome of the Effectiveness Review.

Where the impacts have been calculated as a range, the worst case scenario is presented within the ASTs.

Noise

The WelTAG 2017 Consultation guidance states that the Noise appraisal should be an evaluation of the degree to which any changes in noise levels occur and are experienced. A qualitative appraisal has been undertaken.

Landscape

A qualitative appraisal has been undertaken in order to assess both visual as well as other impacts on the landscape which occur as a result of the measure.

Townscape

A qualitative appraisal has been undertaken in order to assess both the visual impact as well as other impacts on the townscape which occur as a result of the measure.

Historic Environment

A qualitative appraisal has been undertaken in order to assess the extent of any changes which occur in areas of historical interest as a result of the measure.

[11] Available at https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html, accessed 02/01/2018

Biodiversity

A qualitative appraisal has been undertaken in order to assess the extent to which there is an impact on wildlife and the number of species as a result of the measure.

Water Environment

A qualitative appraisal has been undertaken in order to assess the extent to which water courses are impacted as a result of the measure.

3.2.2 SOCIAL AND CULTURAL APPRAISAL

Physical Activity

A qualitative appraisal has been undertaken in order to assess the amount of walking, cycling and other physical exercise which is undertaken as a result of the measure.

Journey Quality

A qualitative appraisal has been undertaken in order to assess the extent of impact of each of the measures on journey quality, taking into consideration the following aspects:

- Traveller care: aspects such as cleanliness, level of facilities, information and the general transport environment
- Travellers' views: the view and pleasantness of the external surroundings in the duration of the journeys
- Traveller stress: frustration, fear of accidents and route uncertainty

Accidents

A qualitative appraisal has been undertaken in order to assess the extent of potential anticipated change which occurs in the number and severity of injuries as a result of the measure.

Access to Employment and Services

A qualitative appraisal has been undertaken in order to assess how many jobs people can reach and the respective journey times, and the impact on journeys to key services such as health facilities and schools which occurs as a result of the measure.

Whilst the WelTAG 2017 consultation guidance outlines access to employment and access to services as two separate appraisal areas, both areas have been combined within this assessment, as the appraisals will be proportionate to one another, with little to no difference in appraisal outcomes between the two considered likely to take place.

3.2.3 ECONOMIC APPRAISAL

Journey Time and Journey Time Reliability Changes

A qualitative appraisal has been undertaken in order to assess changes in journey times across all affected modes both for users and non-users of the measure. The appraisal also takes into account changes in the variation in journey times between times of day and between journeys made at the same time each day i.e. morning and evening peak periods.

Whilst the WelTAG 2017 consultation guidance outlines journey time and journey time reliability changes as two separate appraisal areas, both areas have been combined within this assessment, as the appraisals are proportionate to one another, with little to no difference in appraisal outcomes between the two considered likely to take place.

Capital Costs

The measures have been costed within the following cost bands:

- Low – up to £500k
- Medium – £500k – £2m
- High – £2m+

Cost banding has been used to denote the costs of each measure in order to differentiate between more cost effective measures which could be implemented within a shorter timeframe, and those which will require more funds and longer lead-in periods. The banding takes into account the capital costs of each measure, and does not take account of revenue costs.

Land

A qualitative appraisal has been undertaken to assess the extent to which the measure will potentially reduce the amount of agricultural land, and open up development sites.

3.2.4 VALUE FOR MONEY ASSESSMENT

The value for money assessment categorises measures within banded ranges. Categorisation has been determined based on the banding of capital costs and broad benefits which have been weighted as far as possible in favour of the objective. Whilst all benefits have been be taken into account, the final value for money score has taken into the impact on air quality as the primary consideration. Value for money will be presented in line with anticipated Benefit to Cost ratios as per the following:

Poor: BCR of 0 – 1
Fair: BCR of 1 – 2
Good: BCR of 2+

3.2.5 OTHER ISSUES

Further potential issues with each measure have been explored and considered accordingly in the instance that they have not been covered under any of the other appraisal areas. These include:

Overall Acceptability

A qualitative appraisal has been undertaken in order to assess the receptivity of the public, local authorities and key stakeholders, both groups and individuals to the measure. The appraisal has been undertaken on a measure by measure basis.

Technical, Operational and Financial Feasibility

Where appropriate a qualitative appraisal has been undertaken in order to assess measures on the following criteria:

- Technical: The extent to which the measure is technically feasible within the specified budget and timeframe
- Operational: The extent to which the measure is operationally feasible within the specified budget and timeframe
- Financial: The extent to which the measure is financially feasible

Deliverability and Risk

At this stage, it is difficult to identify issues regarding deliverability and risk given the high level nature of the measure's development. Where possible, this has been identified as qualitative statements though should be reassessed at WelTAG Stage 3 when the measures are developed further.

3.3 APPRAISAL AGAINST OBJECTIVES

The Stage 1 procedure involved undertaking the appraisal of the long list of measures, with each measure assessed against the WelTAG criteria, and then considered within the context of the study objective; namely, the extent to which each measure would be successful in bringing forward reductions in NO_2 in the shortest possible time to ensure compliance with the air quality framework directive requirements within each of the 5 specified study corridors on the Welsh Strategic Road Network.

The Stage 2 appraisal essentially comprised a re-undertaking of this process. This was necessary, as it elicited different results in cases where additional evidence had been produced or sourced, allowing appraisals to be undertaken in greater detail and with a greater degree of certainty, with the potential for differing appraisal outcomes in comparison to Stage 1.

3.3.1 KEY CRITERIA

Effectiveness – *Is the measure likely to deliver reductions in roadside concentrations proportionate to the scale of the exceedance above the 40µg/m3 legal limit*

This has been updated in lieu of more detailed assessment work at Stage 2.

Timescales – *Can the measure be implemented within timescales that are meaningful (short enough) to have an impact on bringing forward the projected compliance date*

This has been updated in lieu of more detailed assessment work at Stage 2.

Deliverability – *Can the measure be delivered in the location involved with the powers available to the Welsh Government as Highway or Traffic Authority*

This has been updated in lieu of more detailed assessment work at Stage 2.

3.3.2 SECONDARY CRITERIA

Will the measure deliver an overall reduction in NO_2 emissions to air

This is a qualitative appraisal based on the likelihood of overall reduction to NO_2 resulting from the measure. This will enable the differentiation of measures which simply redistribute the impacts rather than seeking to reduce overall NO_2 emissions to air.

Will the measure result in unintended consequences or other environmental impacts

This is a qualitative appraisal that considers whether there will be any other adverse environment impacts resulting from the measures. This will summarise the findings of the appraisal against the Environmental Impact Areas.

Will the measure contribute to well-being

This will be a qualitative appraisal which considers the objectives of the Well-being of Future Generations (Wales) Act 2015.

3.4 STAGE 2 APPRAISAL

For Stage 2 of the study, the appraisal outcomes have been summarised solely within the Appraisal Summary Table (AST) in order to avoid unnecessary duplication of summaries and appraisal outcomes within the report. The appraisals have been undertaken on a measure by measure basis, and the appraisal outcomes have been derived based upon the assessments undertaken in accordance with the WelTAG 2017 consultation guidance. The AST provides a breakdown of the impact of each measure on each of the WelTAG appraisal areas. The scoring has been undertaken using the WelTAG 7-point scale where applicable.

The outcome of the Stage 2 appraisal is summarised in Table 4.

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S1 / Air Quality Technology

Name of scheme:		**NOx Absorbing Materials**
Location:		**A483**
Description of scheme:		**NOx absorbing paint / coatings and fencing / panels. This could either be added to existing fencing, structures, and walls; painted over hard surfaces; or as new installations. 'Air purifying concrete', which contains Titanium Dioxide, and can also be used combined with Asphalt.**
Key Criteria	**Effectiveness:**	**Ineffective**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. WG Network management division could commissioned application of NOx absorbing paint on their assets.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	Photocatalytic coating applied to surfaces such as existing barriers/concrete removes NO2 from ambient air. The removal rate is, however, likely to be negligible in comparison to the rate of emission of NOx from vehicles on the road resulting in negligible change to air pollutant concentrations.	Neutral
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. The option proposed should have no impact on Noise.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. Depending on the colour of the proposed paint this could have a slight adverse impact to the A483.	Slight Adverse
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to have an impact other than a slight adverse impact on the setting of listed buildings.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. With the use of best practise and the pollution prevention guidelines no significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	NOx absorbing paint / coatings and fencing / panels should not on impact journey time changes or reliability along the study route. Therefore, it is considered that the impact should be neutral on the study route.	Neutral
	Capital Costs	Low (up to £500k)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	NOx absorbing paint / coatings and fencing / panels should not impact on journey quality along the study route. Therefore, it is considered that the impact should be neutral on the A494.	Neutral
	Physical Activity	NOx absorbing paint / coatings and fencing / panels should not on impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A494.	Neutral
	Accidents	NOx absorbing paint / coatings and fencing / panels is not expected to impact on accidents along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Access	NOx absorbing paint / coatings and fencing / panels is not expected to impact on access to services, employment, or healthcare along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	It is considered that NOx absorbing materials should have minimal impacts on overall reduction in NO2	
	Will the intervention result in unintended consequences or other environmental impacts	Yes, there is a slight adverse impact on the Townscape, Historic Environment and Landscape	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. NOx absorbing paint / coatings and fencing / panels should not impact wider public health and inequalities. Therefore, it is considered that the impact should be neutral.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S4 / Air Quality Technology

	Name of scheme:	**Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers**
	Location:	**A483**
	Description of scheme:	**Install screens / barriers / fencing without special surfaces at sensitive locations – physical barrier to air movement between source & receptor. AQ canopies with over-arching the carriageway design. There is some evidence for effectiveness of 4-6m height environmental barriers in Dutch & American studies.**
Key Criteria	**Effectiveness:**	**Medium**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. Road network is managed by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	The installation of screens presents a physical barrier to air movement between source and receptor, reducing roadside exposure to pollution without reducing emissions. Driver exposure to pollution, inside the barriers, potentially increases although the exposure duration on the road is limited. 4m high barriers assumed. Emissions Reduction = 0%; Concentration Reduction up to 3.9ug/m3	Moderate Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme intervention is likely to generate a slight beneficial reduction in noise impacts from source to receptor.	Slight Beneficial
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme intervention should reduce natural views of the landscape however it is situated within the existing transportation corridor and therefore the impact is likely to be reduced as a result.	Slight Adverse
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme could affect the setting of listed buildings.	Slight Adverse
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. There could be slight adverse impacts from minimal vegetation clearance works required for construction.	Slight Adverse
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. With the use of best practise and the pollution prevention guidelines no significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. There is thought to be a slight adverse impact to the setting of listed buildings.	Slight Adverse
Economy	Journey Time Changes	It is thought that NOx technology should not impact on journey time or reliability along the study route. Therefore, it is considered that the impact should be neutral on the study route.	Neutral
	Capital Costs	Low (up to £500k) - if canopies, cost could be Medium (£500k - £2m)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	It is thought that NOx technology should not impact on journey quality along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Physical Activity	NOx technology should not impact on physical activity along the study route. Therefore, it is considered that the impact should be neutral along the study route.	Neutral
	Accidents	It is expected that the air quality package should not impact on accidents along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Access	It is expected that the air quality package should not impact on access to services, employment, or healthcare along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	No. Screening/Fencing/Canopy/Barriers should not result in a reduction of NO2 emissions	
	Will the intervention result in unintended consequences or other environmental impacts	Yes. There are slight adverse consequences to townscape, biodiversity, historic environment and landscape	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	Yes. Decrease in road traffic noise as a consequence of the fencing/ barrier should be a benefit to local residents.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S7 / Network Demand and Capacity

	Name of scheme:	**Enforce/Reduce Speed Limit**
	Location:	**A483**
	Description of scheme:	**Ensure that the strategic routes are run efficiently, for instance by introducing average speed limits in the areas most impacted by poor air quality. Could reduce speed limit and enforce current (or revised) speed limit using either spot cameras or average speed cameras. Predictable speed control on sections of trunk road network - can be refined to deliver specific levels of improvement.**
Key Criteria	**Effectiveness:**	**High**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes - This option can be delivered by WG Network Management Division**

Impacts		**Summary of key impacts**	**Assessment**
			Qualitative
Environmental	Air Quality	The measure reduces emissions and hence roadside pollutant concentrations where vehicles currently travel at high speed (i.e. speeds greater than the optimal speed for minimising emissions from light duty vehicles ~60 - 70 kph). For maximum impacts the speed limit should be enforced with average speed cameras and include off-peak /inter-peak periods. Advisory speed limits could be accompanied by Air Quality Communications measures to maximise efficacy. Emissions reduced by up to 18%; Roadside concentrations reduced by up to 6.9ug/m3	Large Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This could generate a slight beneficial impact through reduction of speed variables along the route.	Slight Beneficial
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Reducing speed limits on the strategic route should allow for a more efficient carriageway, therefore benefitting the reliability of journeys. However, it is considered that there should be minimal benefits in terms of improved journey times.	Slight Beneficial
	Capital Costs	Medium (£500k - £2m)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	Reducing speed limits on the strategic route should allow for a more efficient carriageway, therefore improving journey quality.	Slight Beneficial
	Physical Activity	A reduction in speed limit should not impact on physical activity along the study route. Therefore, it is considered that the impact should be neutral along the study route.	Neutral
	Accidents	It is envisaged that enforcing and/or reducing the speed limit should have a benefit on the number and severity of recorded accidents.	Slight Beneficial
	Access	It is envisaged that enforcing and/or reducing the speed limit should not have an impact on the access to services, employment, or healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within greater than 2	Good
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. Marginal reductions anticipated.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have a equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	Yes - A reduction is speed is believed to have associated public health (related to air quality) and noise benefits.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S10 / Network Demand and Capacity

	Name of scheme:	**Flow Management (Upstream)**
	Location:	**A483**
	Description of scheme:	**Flow management away from area of exceedance, either by delaying flows or balancing them across alternative routes. - Control flows from upstream by inducing delay elsewhere on the network outside areas of exceedance on wider approach routes (away from receptors) by speed limits, lights, and lane closures. - Redistribute traffic to alleviate flow/congestion at AQ hotspots. For instance by using signage, traffic info, Sat Nav instructions, to inform route choices during periods of peak congestion (causing diversion of some traffic to alternative routes).**
Key Criteria	**Effectiveness:**	**Low**
	Timescales:	**12 months**
	Feasibility:	**Yes - This option can be delivered by WG Network Management Division**

Impacts		**Summary of key impacts**	**Assessment**
			Qualitative
Environmental	Air Quality	The measure reduces emissions and hence roadside pollutant concentrations by either removing vehicles from the strategic network and, potentially, reducing congestion. There are, however, limited options for alternative routes and, therefore, the potential reduction in flows is low (0 - 2%) and limited to passenger vehicles during the peak hours. Emissions reduced by up to 1%; Roadside concentrations reduced by up to 0.4ug/m3	Slight Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This could generate a slight beneficial impact through reduction of speed variables along the route.	Slight Beneficial
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Controlling flows by speed limits, lights, and lane closures could have a marginal impact on journey times and reliability. Redistributing traffic using signage, traffic info, Sat Nav instructions could also improve journey time changes and reliability. Although there may be instances where delaying flows lengthens journey times. Therefore, the scheme is considered to have a neutral impact on journey time.	Neutral
	Capital Costs	Medium (£500k - £2m)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	Controlling flows by speed limits, lights, and lane closures could improve journey quality. Redistributing traffic using signage, traffic info, Sat Nav instructions could improve journey quality. Therefore, the scheme considered to have a positive impact on journey quality.	Slight Beneficial
	Physical Activity	Flow Management (upstream) should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A483.	Neutral
	Accidents	Controlling and redistributing flows could see a reduction in the number and severity of accidents. The scheme is considered to have a positive impact on accident rates.	Slight Beneficial
	Access	It is considered that flow management (upstream) should not result in significant benefits for access to services, employment, and healthcare. Therefore, it is considered that the impact should be neutral.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. Marginal reductions are anticipated.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	Yes. Smoother traffic movements should decrease risk of collision and improve driver experience. Though inducing delays elsewhere could result in a degradation of air quality in other areas.	

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Appraisal Summary Table

Option No. / Theme S14 / Network Demand and Capacity

	Name of scheme:	**Ramp Metering**
	Location:	**A483**
	Description of scheme:	**Use ramp metering to control traffic entering the road in question from side junctions / slip roads by traffic lights**
Key Criteria	**Effectiveness:**	**Ineffective**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. Road network is managed by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	Measure has no effect since there is no evidence for congestion at junctions induced by the merging on traffic from slip roads.	Neutral
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Introducing ramp metering is likely to improve journey time changes on the strategic network. However, this could lead to increased congestion and delays on the more local network, effecting the reliability of a journey. Ramp metering is considered to have a neutral impact	Neutral
	Capital Costs	Medium (£500k - £2m)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	Introducing ramp metering is likely to improve flow on the strategic network. However, this could lead to increased congestion on the local network. Ramp metering is considered to have a neutral impact	Neutral
	Physical Activity	Ramp Metering should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A483.	Neutral
	Accidents	Ramp metering should contribute to smoother flows during peak hours. This should decrease the likelihood of accidents.	Slight Beneficial
	Access	Ramp metering could cause congestion on roads connecting to the strategic network. Therefore impacting on local trips to services, employment, and healthcare. The impact is considered to be slightly adverse.	Slight Adverse
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 0 to 1	Poor
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	This scheme is anticipated to result in minor overall benefits with respect to the overall reduction in NO2 emissions to air.	
	Will the intervention result in unintended consequences or other environmental impacts	Yes. Ramp metering could have a slightly adverse impact on access to local services. There are not deemed to be any environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Ramp metering should have a neutral impact on public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S16 / Network Demand and Capacity

	Name of scheme:	**Junction Closures**
	Location:	**A483**
	Description of scheme:	**Close individual junction or junctions – either full time or part time, temporarily or permanently.**
Key Criteria	**Effectiveness:**	**Medium**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. Junction closures can managed by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	Measure reduced emissions by potentially removing traffic from the link and is targeted at local journeys using the strategic network. The measure has an effect outside of peak hours if not limited to peak hours. The volume of traffic affected is likely to be modest. Emissions reduced by up to 1% near junction; Roadside pollutant concentrations reduced by 0.3ug/m3.	Moderate Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There are no conservation areas located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. Full time closure of the junction that serves the town surrounding the junction may have an impact on the town and the facilities and communities located there. The scheme may also cause congestion/queing elsewhere whilst travellers find alternative access routes. However no significant impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	The closure of junctions is likely to improve journey times and reliability along the strategic route. However, the scheme may cause congestion and commuter journey time delay and reliability for vehicles looking to enter the strategic road network locally. Therefore the scheme is considered to have a neutral impact overall.	Neutral
	Capital Costs	Medium (£500k - £2m)	N/A
	Land	It is assumed that some junctions should be permanently closed. Permanent junction closure should result in land becoming available for alternative use.	Slight Beneficial
S&C	Journey Quality	The closure of junctions is likely to cause local congestion and commuter journey time delay. However, through traffic using the strategic network may benefit from improved journey quality. The scheme is considered to have slight adverse impacts on journey times, which can be primariliy attributed to the traffic currently using the junctions.	Slight Adverse
	Physical Activity	Junction closures should not impact on physical activity along the study route. Therefore, it is considered that the impact should be neutral along the study route.	Neutral
	Accidents	Junction closures are considered to have a neutral impact on accident rates.	Neutral
	Access	Junction closure could cause congestion on roads connecting to the strategic network. Therefore impacting on local trips to services, employment, and healthcare. Traffic currently using these junctions may experience increase journey times and find some services less accessible. The impact is considered to be moderately adverse.	Moderate Adverse
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	No. Junction closures should divert traffic elsewhere causing similar NO2 emissions.	
	Will the intervention result in unintended consequences or other environmental impacts	There is anticipated to be slight adverse impacts on journey time and moderate adverse impacts on access to employment and services.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Junction closures should not have a positive impact on the wider public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S17 / Network Demand and Capacity

	Name of scheme:	**Variable Message Signs (VMS)**
	Location:	**A483**
	Description of scheme:	**Use VMS/gantry information boards for information/awareness, and to display real time air quality & travel information e.g. to highlight AQ issues associate with vehicle travel. Drivers would be informed of information that could help to address air quality issues on network – either standalone or as part of other traffic information – e.g. promotion of Park & Ride, 'drive smoothly for air quality' etc. This may involve improving the VMS spec, such as upgrading the designs to that which allow more text/images to be used to display messages.**
Key Criteria	**Effectiveness:**	**Low**
	Timescales:	**12 months**
	Feasibility:	**Yes. VMS/ gantry boards can be commissioned by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	The measure may reduce emissions through smoothing traffic flows and increasing driver awareness of areas of poor air quality/campaigns. Emissions reduced by up to 1%	Slight Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This may have impact up the setting cultural heritage sites and therefore the impacts are considered to be slight adverse.	Slight Adverse
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. This has the potential to cause slight adverse impacts upon ecology due to vegetation clearance.	Slight Adverse
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	No conservation areas have been identified within 1km of the site route. Several listed buildings are located within 100m's of the carriageway at the northern extent. It is anticipated that the impacts upon townscape features could be slight adverse.	Slight Adverse
Economy	Journey Time Changes	It is considered that road users may experience marginal benefits from the scheme.	Neutral
	Capital Costs	High (£2m+)	N/A
	Land	It is anticipated that new gantries should be required to display VMS/variable speed limit information. Some additional land acquisition might be required	Slight Adverse
S&C	Journey Quality	Road users should be better informed of up to date travel information and education on air quality. There is potential that the scheme should have a benefit on Journey quality.	Slight Beneficial
	Physical Activity	The promotion of Park & Ride should involve a short walk to the bus. However, overall there should be a negligible impact on levels of physical activity.	Neutral
	Accidents	It is not considered that VMS signage should have a significant impact on accident rates.	Neutral
	Access	It is not considered that VMS should have a significant impact on access to services, employment, or healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 0 to 1	Poor
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. If the measures are used effectively then a reduction in NO2 would be expected.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Variable message signs should have a neutral impact on wider public health and inequalities.	

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Appraisal Summary Table

Option No. / Theme S18 / Network Demand and Capacity

	Name of scheme:	**Expressway**
	Location:	**A483**
	Description of scheme:	**Implement Controlled Expressway using variable speed limits without hard-shoulder running. These scheme use active traffic management techniques to increase capacity by use of variable speed limits at busy times. Benefits include smoother traffic flow, more reliable journey times, fewer road traffic collisions, and reduced noise and harmful vehicle emissions.**
Key Criteria	**Effectiveness:**	**Ineffective**
	Timescales:	**18-24 months**
	Feasibility:	**Yes. Traffic management is within WG Network Management Division scope.**

Impacts		**Summary of key impacts**	**Assessment**
			Qualitative
Environmental	Air Quality	The impact of the measure is difficult to estimate but is likely to range from large beneficial (where vehicle speeds become optimal for emissions) to moderate adverse (where increased capacity dominates). Since it would not be feasible to install short stretches of expressway, the measure is unlikely to be effective overall. Emissions reduction up to 16%; Roadside pollutant concentrations reduced by up to 6.1ug/m3; but this is driven by imposition of speed limit rather than congestion relief.	Moderate Adverse
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This could generate a slight beneficial impact through reduction of speed variables along the route.	Slight Beneficial
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	An expressway using variable speed limits should target more reliable journey times and reliability. The scheme is considered to have a positive impact on journey times.	Moderate Beneficial
	Capital Costs	High (£2m+)	N/A
	Land	It is anticipated that new gantries should be required to display VMS/variable speed limit information. Some additional land acquisition might be required	Slight Adverse
S&C	Journey Quality	An expressway is likely to improve journey quality by resulting in; smoother traffic flow, more reliable journey times, fewer road traffic collisions, and reduced noise and harmful vehicle emissions.	Slight Beneficial
	Physical Activity	Introducing an expressway should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A483.	Neutral
	Accidents	Variable speed limits should give better traffic control. Therefore reducing the chance of an accident occurring and severities.	Slight Beneficial
	Access	An expressway is not expected to result in any significant impact on access to services, employment, or healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 0 to 1	Poor
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	No - Increased capacity is likely to result in an overall increase in NO2 emissions.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	No. Should charging be used, it may disproportionately impact upon HGVs and lower income groups.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Diversion of excluded vehicles via rat-runs and alternative routes which may be over capacity, leading to a reduction in road safety and rat-running.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S19 / Diversion Routes

	Name of scheme:	**Variable Diversions**
	Location:	**A483**
	Description of scheme:	**Variable diversions within set NO2 limits (using continuous monitoring equipment)**
Key Criteria	**Effectiveness:**	**Medium**
	Timescales:	**12 months**
	Feasibility:	**Yes. Traffic management is within WG Network Management Division scope.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	The measure has the potential to reduce emissions and hence roadside pollutant concentrations through the removal of traffic from the strategic road network. If linked to real time air quality and/or congestion, impacts are likely to be limited to reductions in peak hour flows. Traffic may be diverted into areas of existing poor air quality Emissions reduced by up to 3%; Roadside pollutant concentrations reduced by 1.0ug/m3	Moderate Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This could generate a slight beneficial impact through reduction of speed variables along the route.	Slight Beneficial
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Variable Diversions are likely to increase journey times and negatively impact reliability. Therefore, the scheme is considered to have a negative impact.	Moderate Adverse
	Capital Costs	Medium (£500k - £2m)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	Depending on the extent of the diversion route, there could potentially be adverse impacts on journey quality given traffic is not using the strategic road network..	Slight Adverse
	Physical Activity	Diversions should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A483.	Neutral
	Accidents	Variable diversions are not expected to result in any significant reduction/prevention of accidents	Neutral
	Access	Diversions on to local roads should potentially lead to congestion and a delay in access to services, employment, and healthcare.	Slight Adverse
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	No. Diversions may potentially divert problems elsewhere.	
	Will the intervention result in unintended consequences or other environmental impacts	Yes. Variable diversions are predicted to have a moderately adverse impact on journey times, as they could have a negative impact on reliability. They could have a slightly adverse effect on journey quality, depending on the diversion route, and limit access to services due to congestion. There are not deemed to be any environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Diversion of excluded vehicles via rat-runs and alternative routes which may be over capacity, leading to a reduction in road safety and rat-running, on a less local scale.	

Date Produced - 06/02/2018

Appraisal Summary Table | **Option No. / Theme** | S26 / Sustainable Travel

	Name of scheme:	**Reallocation of Road Space**
	Location:	**A483**
	Description of scheme:	**Bus Lane to encourage modal shift.** **Low Emission Vehicle Lane to encourage shift to ULEVs.** **High Occupancy Vehicle Lane to encourage car sharing and reduce traffic.** **Specific lane for a range of specific vehicle/mode types to encourage modal shift etc.**
Key Criteria	**Effectiveness:**	**Ineffective**
	Timescales:	**12 months**
	Feasibility:	**Yes - This option can be delivered by WG Network Management Division**

Impacts		**Summary of key impacts**	**Assessment**
			Qualitative
Environmental	Air Quality	Reallocation of road space is likely to result in a significant reduction in vehicle speeds and a decrease in vehicle flow as vehicles are deterred from using the route by increased journey times. These impacts imply that, depending on the specific traffic conditions, the measure can result in either a decrease in emissions (where conditions are currently free flowing and the reduction in speed optimises emissions per vehicle) or an increase in emissions (where vehicle flow is currently near capacity and a reduction in speed results in increased emissions per vehicle). It is unlikely that the measure would be effective if applied for a short length of the road and as a result of increase in congestion. Emissions reduced by up to 10%; Roadside pollution concentrations reduced by up to 4.3ug/m3.	Moderate Adverse
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This could generate a slight beneficial impact through reduction in vehicle numbers.	Slight Beneficial
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This may generate localised moderate adverse impacts though the removal of vegetation to add a new lane.	Moderate Adverse
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme could affect the setting of listed buildings or scheduled ancient monuments.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. A moderate impact could be generated due to the requirement for vegetation clearance to accommodate the new lane.	Moderate Adverse
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. With the use of best practise and the pollution prevention guidelines no significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. There is thought to be a slight adverse impact to the setting of listed buildings.	Slight Adverse
Economy	Journey Time Changes	Sustainable travel schemes are likely improve journey times and reliability for those who change mode choice. However, for those who are unable to switch modal choice, journey time and reliability could potentially be negatively impacted on. There is not sufficient capacity with the reallocation of one lane. This should result in a capacity delay to road users on this part of the network. Road users that are able to utilise the converted lane may experience a benefit, though this is not believed to outweigh the disbenefits to other road users.	Moderate Adverse
	Capital Costs	High (£2m+)	N/A
	Land	Additional lanes should not be accommodated within existing highway boundary. It is anticipated that additional land acquisition should be required	Slight Adverse
S&C	Journey Quality	Sustainable travel schemes are unlikely to have a significant journey quality impact on road users. Therefore, a neutral journey quality would be expected.	Neutral
	Physical Activity	If the reallocated lane were to be a bus lane - likely to result in a slight improvement on physical activity, as public transport users are more likely to walk longer distances to transport hubs than car users do to their parked vehicles. However, the impact would be negligible.	Neutral
	Accidents	Reallocation of road space is not expected to result in any significant reduction/prevention of accidents	Neutral
	Access	Reallocation of road space is not expected to have significant impacts on access to services, employment, and healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 0 to 1	Poor
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasability	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	It is possible that this option could result in an overall reduction in NO2 though the modelling suggests that an overall increase in NO2 may also be possible. More detailed modelling should be required at Stage 3.	
	Will the intervention result in unintended consequences or other environmental impacts	Yes. There are large adverse consequence on journey time and there is a slight adverse consequences to Townscape and moderate adverse to biodiversity	
	Will the intervention impact equally across multiple vehicle classes and journey types	No. Access to lane for specific vehicle could be bias towards newer more advanced vehicles.	
	Will the intervention have a positive impact on wider public health and inequalities	Yes. Promotes opportunity for an increase in active travel, as public transport users are more likely to walk longer distances to transport hubs than car users do to their parked vehicles.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S28 / Sustainable Travel

Name of scheme:		**Behaviour Change**
Location:		**A483**
Description of scheme:		**Package of several options aimed at changing travel behaviour, resulting in a mode shift away from private car use. For instance, introducing Active Travel campaigns through school & business Travel Plans and using Personalised Travel Planning. Promote Active Travel with facilities, measures, incentives, and technology. Air quality awards for those organisations/companies that have changed behaviour. Measures could also include workplace Charging Levies and staggered timings for school buses. Potential to promote a 'No Car Day' event, which would encourage / incentivise the use of public transport. Whilst the benefit on the day may be minimal, it could provide long term benefits with a change in modal split.**
Key Criteria	**Effectiveness:**	**Low**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes - This option can be delivered by WG Network Management Division**

Impacts		Summary of key impacts	Assessment Qualitative
Environmental	Air Quality	The package of measures may reduce total emissions through encouraging people to shift from private vehicles to more sustainable traffic modes. There is, however, limited scope for switching to public transport on the A483 Emissions may reduce by up to 1%; Roadside pollutant concentrations reduce by up to 0.4ug/m3.	Slight Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This could generate a slight beneficial impact through reduction in vehicle numbers.	Slight Beneficial
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Delivery of a scheme that can capture a behaviour change using incentives and encouragement could result in less vehicles on the strategic network. Therefore a decrease in journey time and improved reliability could be achieved.	Slight Beneficial
	Capital Costs	Low (up to £500k)	N/A
	Land	Measure does not require any physical infrastructure. No land acquisition required	Neutral
S&C	Journey Quality	The package would look to achieve a change in driver behaviour, resulting in mode shift away from the private car. This would free up capacity on the strategic routes and therefore improve the journey quality.	Slight Beneficial
	Physical Activity	Achieving a behaviour change is likely to result in a slight improvement on physical activity. Therefore, a positive impact would be expected.	Slight Beneficial
	Accidents	A package of measures that encourages modal shift is not expected to have a significant impact on accidents.	Neutral
	Access	A package of measures that encourages modal shift could be expected to result in a minor impact on access to services, employment, and healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. Modal shift to sustainable travel should see a reduction in NO2 levels.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	This option aims to improve equality across all modes.	
	Will the intervention have a positive impact on wider public health and inequalities	Yes. Promotes opportunity for an increase in active travel. Car sharers and public transport users are more likely to walk longer distances to transport hubs than car users do to their parked vehicles.	

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Appraisal Summary Table

Option No. / Theme S44 / Policy and Funding

	Name of scheme:	**Vehicle Emission Testing**
	Location:	**A483**
	Description of scheme:	**Using The Road Traffic (Vehicle Emissions) (Fixed Penalty) (Wales) Regulations 2003 - Issue road-side penalties for vehicles exceeding emissions, and tackle unnecessary idling.**
Key Criteria	**Effectiveness:**	**Ineffective**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes - This option can be delivered by WG Network Management Division**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	Increased vehicle testing could have a beneficial impact on air quality through reducing the length of time that vehicles are driven with failed emissions control. The measure would need to target cars, lgv and hdvs. However, it is not considered feasible that sufficient numbers of vehicles should be affected to drive a perceptible decrease in vehicle emissions. Emissions should reduce by <<1%	Neutral
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Vehicle emission testing is not though to significantly impact on journey time or reliability along the study route. Therefore, it is considered that the impact should be neutral on the study route.	Neutral
	Capital Costs	Low (up to £500k)	N/A
	Land	Measure does not require any physical infrastructure. No land acquisition required	Neutral
S&C	Journey Quality	It is considered that vehicle emission testing should not significantly impact on journey quality along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Physical Activity	Vehicle emission testing should not impact on physical activity along the study route. Therefore, it is considered that the impact should be neutral on the study route.	Neutral
	Accidents	It is considered that vehicle emission testing should have a negligible impact on accidents.	Neutral
	Access	It is considered that vehicle emission testing should have a negligible impact on access to services, employment, and healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 0 to 1	Poor
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	No. Vehicle emission testing should not result in a reduction in NO2 levels.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	No. Older vehicles may be targeted.	
	Will the intervention have a positive impact on wider public health and inequalities	Yes. Vehicle emission testing should positively impact the wider public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table | **Option No. / Theme** | S46 / Policy and Funding

	Name of scheme:	**Clean Air Zones / Low Emission Zones**
	Location:	**A483**
	Description of scheme:	**Promotion of Clean Air Zones and/or Low Emission Zones - implement with use of ANPR cameras/GPS/Bluetooth. Negotiate new vehicle emissions standards, establish a bus operator NOx emissions cap, and determine specific targets in terms of vehicle type and journeys taken to inform measures focussed on specific effects on traffic in locations of interest. Including requirement to display stickers on vehicles showing emissions category - higher emission vehicles banned during periods of high pollution levels (as in France). Could involve limiting HGV weight or emission, and zone charging.**
Key Criteria	**Effectiveness:**	**High**
	Timescales:	**18-24 months**
	Feasibility:	**Yes. Traffic management is within WG Network Management Division scope.**

Impacts		**Summary of key impacts**	**Assessment**
			Qualitative
Environmental	Air Quality	The measure should improve air quality through acting as a deterrent for older/more polluting vehicles to use the strategic network. If the measure is limit to peak hours, the effects should be limited since significant emissions occur outside of such zones. The measure would be most effective if linked to road charges. If vehicles are limited to Euro 4 and above, emissions may reduce by up to 4% (or greater); Roadside pollutant concentration change by 1.5ug/m3.	Large Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	It is not envisaged that Clean Air Zones and/or Low Emission Zones should have a significant impact on journey time or reliability. However., this could result in slightly less HGVs. Therefore the impact is considered to be neutral.	Neutral
	Capital Costs	High (£2m+)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	It is not envisaged that Clean Air Zones and/or Low Emission Zones should have a significant impact on journey quality. However., this could result in slightly less HGVs. Therefore the impact is considered to be neutral.	Neutral
	Physical Activity	Clean Air Zones / Low Emission Zones should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A483.	Neutral
	Accidents	It is expected that clean air zones / low emission zones should not impact accidents along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Access	It is expected that clean air zones / low emission zones may impact upon people's journeys and local business, thus it is considered that there may be a moderate adverse impact to access to services, employment, and healthcare along the study route.	Moderate Adverse
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	There may potentially be an overall reduction to NO2 though it is likely that there may be localised increases in NO2 elsewhere.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	No. Older/heavier vehicles may be targeted.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Diversion of excluded vehicles via rat-runs and alternative routes which may be over capacity, leading to a reduction in road safety and rat-running.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S51 / Traffic Management

	Name of scheme:	**Intelligent Traffic Management**
	Location:	**A483**
	Description of scheme:	**Intelligent Traffic Management, linking real-time emissions/AQ data with TM - &/or remote monitoring through use of Intelligent Transport System (ITS) & other innovative technological systems. Linked to Air Quality and/or traffic flows. Use systems to smooth out traffic flows when AQ issues and/or traffic congestion occurs, and/or link to travel info to influence route / mode / time of travel choices.**
Key Criteria	**Effectiveness:**	**Medium**
	Timescales:	**18-24 months**
	Feasibility:	**Yes. Intelligent traffic management systems can be commissioned by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	Intelligent traffic management could reduce emissions on the strategic network by providing information on optimum route choices; air quality , and travel mode. The option could contribute to modal shift, diversions etc. Emissions are estimated to reduce by up to 2%.	Moderate Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Intelligent traffic systems are not expected to result in any significant improvements in journey time along the study route, however could have minor benefits to reliability.	Neutral
	Capital Costs	High (£2m+)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	Intelligent traffic systems are expected to result in minor positive impacts on journey quality along the study route.	Slight Beneficial
	Physical Activity	Traffic management should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A483.	Neutral
	Accidents	It is thought that intelligent traffic management could smooth out traffic flows and therefore have a minor benefit to accident rates along the study route.	Neutral
	Access	Access to Services, Employment, and Healthcare is not expected to be significantly impacted from intelligent traffic management.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. If used effectively, less congestion can result in reduced NO2 levels.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Intelligent Traffic Management should not impact on wider public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table | **Option No. / Theme** | S53 / Traffic Management

	Name of scheme:	**Enhanced Traffic Officer Service**
	Location:	**A483**
	Description of scheme:	**An enhanced Traffic Officer Service in Wales to clear motorway incidents quickly thereby reducing emissions from idling vehicles caught up in congestion. Could involve upgrading their operation, providing additional teams, or expanding the service to routes that are not currently being covered.**
Key Criteria	**Effectiveness:**	**Ineffective**
	Timescales:	**6 months**
	Feasibility:	**Yes - This option can be delivered by WG Network Management Division**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	An enhance traffic officer service could have a beneficial impact on air quality through reducing the length of time that there is road congestion (through clearly accidents etc.). The measure would need to target cars, lgv and hdvs. However, it is not considered feasible that air quality would be improved over sufficient number of incidents and times to drive a perceptible decrease in vehicle emissions. Emissions should reduce by <<1%	Neutral
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Enhancing Traffic Officer Services is not considered to have a significant impact on journey time changes or reliability along the study route.	Neutral
	Capital Costs	Low (up to £500k) - revenue costs likely to outweigh capital costs	N/A
	Land	Measure does not require any physical infrastructure. No land acquisition required	Neutral
S&C	Journey Quality	Enhancing Traffic Officer Services is not thought to have a significant impact on journey quality along the study route.	Neutral
	Physical Activity	Enhanced traffic officer service is not thought to impact physical activity along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Accidents	Enhancing Traffic Officer Services is not likely to have a significant impact on accidents along the study route.	Neutral
	Access	Enhanced traffic officer service is not thought to have an impact on access to services, employment, and healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 0 to 1	Poor
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. Marginal reductions anticipated on occasions.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Enhanced traffic officer services should not have a significant impact on wider public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S62 / Network and Asset Management

	Name of scheme:	**Signage**
	Location:	**A483**
	Description of scheme:	**Signage within area of exceedance to encourage improved driving behaviour, reminding drivers to turn off engines when static (e.g. anti-idling), and emphasise awareness of other measures and/or awareness of entering area of any special measures etc.**
Key Criteria	**Effectiveness:**	**Low**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. Traffic signage can managed by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	The measure may reduce emissions through smoothing traffic flows and increasing driver awareness of areas of poor air quality/campaigns. Emissions reduced by up to 1%	Slight Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This may cause localised impacts upon the landscape however not upon designated sites.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. This has the potential to cause slight adverse impacts upon ecology due to vegetation clearance.	Slight Adverse
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Signage is not expected to have a significant impact on journey time changes or reliability along the study route.	Neutral
	Capital Costs	Low (up to £500k)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	Signage is not expected to have a significant positive or negative impact on journey quality along the study route.	Neutral
	Physical Activity	Signage should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Accidents	It is envisaged that signage should have a minor benefit to driver behaviour and a minor benefit to preventing/reducing accidents.	Neutral
	Access	Signage is not expected to impact access to services, employment, and healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. Marginal reductions anticipated on occasions.	
	Will the intervention result in unintended consequences or other environmental impacts	Yes. There are slight adverse consequences to biodiversity and landscape	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Signage is not expected to have a positive impact on wider public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S63 / Network and Asset Management

	Name of scheme:	**Distance Chevrons**
	Location:	**A483**
	Description of scheme:	**Painted signs on road surface and supporting signs to increase buffer distances between vehicles, encouraging slower & smoother driving behaviour (& safer).**
Key Criteria	**Effectiveness:**	**Ineffective**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. Sign and chevrons can managed by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	The measure may reduce emissions through smoothing traffic flows. It is only effective if traffic is prone to breakdown, where vehicles are travelling at moderate to high speeds , as on the A483,it may have an adverse impact through drivers braking on seeing the chevrons causing a ripple effect Emissions reduction should be negligible	Neutral
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme intervention is unlikely to have an impact upon the landscape of the surrounding area.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. No vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. With the use of best practise pollution prevention guidelines during construction no significant adverse water environment impact is anticipated to occur from this intervention.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	Distance chevrons are not expected to have any significant impact on journey time changes or reliability along the study route.	Neutral
	Capital Costs	Medium (£500k - £2m)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	Distance chevrons are not expected to have any significant impact on journey quality along the study route.	Neutral
	Physical Activity	Distance chevrons should not impact physical activity along the study route. Therefore, it is considered that the impact should be neutral on the A483.	Neutral
	Accidents	Distance chevrons are considered to have a positive impact on reducing or preventing accidents by managing the flow of traffic.	Slight Beneficial
	Access	Distance chevrons are unlikely to have an impact on access to services, employment, or healthcare.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 0 to 1	Poor
Other Issues	Acceptability	Given the nature of the proposals, this measure is anticipated to be opposed by some groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. Marginal reductions anticipated.	
	Will the intervention result in unintended consequences or other environmental impacts	Yes,. There are slight adverse consequences to biodiversity and landscape	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Distance chevrons are unlikely to have a positive impact on wider public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table

Option No. / Theme S65 / Communication

	Name of scheme:	**Air Quality Areas**
	Location:	**A483**
	Description of scheme:	**Publicity campaigns to raise awareness using branding/presentation of areas where multiple activities are applied for air quality – e.g.: information, speed control, to raise awareness and encourage compliance.**
Key Criteria	**Effectiveness:**	**Low**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. Branding of area can be developed by WG Network Management Division.**

Impacts		Summary of key impacts	Assessment
			Qualitative
Environmental	Air Quality	The measure may reduce emissions through smoothing traffic flows and increasing driver awareness of areas of poor air quality/campaigns. Emissions reduced by up to 1%	Slight Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	It is not envisaged that Air Quality Areas should have an impact on journey time changes or reliability. Therefore the impact is considered to be neutral.	Neutral
	Capital Costs	Low (up to £500k)	N/A
	Land	It is anticipated that this option can be accommodated within the verge, and on existing infrastructure. This is not anticipated to have any requirements for additional land.	Neutral
S&C	Journey Quality	It is not envisaged that Air Quality Areas should have an impact on journey quality. Therefore the impact is considered to be neutral.	Neutral
	Physical Activity	Air Quality Areas should not impact on physical activity along the study route. Therefore, it is considered that the impact should be neutral on the study route.	Neutral
	Accidents	Air quality areas are not expected to impact accidents along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Access	Air quality areas are not expected to impact on access to services, employment, or healthcare along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes - though anticipated that the reduction would be marginal	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. publicity campaigns are unlikely to have a positive impact on wider public health and inequalities.	

Date Produced - 06/02/2018

Appraisal Summary Table | **Option No. / Theme** | S66 / Communication

	Name of scheme:	**Air Quality Communications**
	Location:	**A483**
	Description of scheme:	**A package of measures that provides information regarding air quality that raise awareness. For instance, adding air quality locations to Traffic Wales Website and including air quality in outward facing communications plans / announcements to inform drivers alongside information on speeds/road works. Daily information should be added to the UK air website, and information provided for local residents. Real-time information should be provided, with online tools/phone apps that provide route options and times as well as air quality implications across all modes. Investing in smart technology should make it easier to 'see' air pollution and see effects of actions to tackle it. May also include the use of a pollution car labelling scheme and signage to influence route choice. A national communications strategy should be used to communicate risks and advice on measures.**
Key Criteria	**Effectiveness:**	**Low**
	Timescales:	**Up to 5 months**
	Feasibility:	**Yes. Traffic Wales Website managed by WG. WG can input data into this. Network Management Division.**

Impacts		**Summary of key impacts**	**Assessment**
			Qualitative
Environmental	Air Quality	The measure may reduce emissions through smoothing traffic flows and increasing driver awareness of areas of poor air quality/campaigns. Could include information about real time air quality. The measure should be most effective when combined with other measures such as speed advisories / diversions / junction closures etc. Emissions reduced by up to 1% (due to communications alone)	Slight Beneficial
	Noise	There are no noise impact areas along the study area or within 1km of the route. The A483 runs along the outskirts of Wrexham adjacent to sensitive receptors including residential housing, schools, hospitals and the university. This scheme is unlikely to generate significant noise impacts.	Neutral
	Landscape	The site is not situated within 1km of or within close proximity to an AONB area, Special Landscape Area, National Nature Reserve or Country Park. This scheme is unlikely to generate significant impacts upon the landscape.	Neutral
	Historic Environment	There are no Conservation Areas within 1km of A483 between J4 and J6, nor are there any Historic Parks and Gardens. Wat's Dyke a scheduled ancient monument is located to the northern extent of the route with Wat's Dyke garden village section located between the two junctions. Several listed buildings are located within 1km of the route corridor both north and south bound. This scheme is unlikely to effect the historic environment.	Neutral
	Biodiversity	There is one SSSI site within 1km of the route called Gatewen Marsh at the southern extent of the scheme with Chwarel Singret and Marford Quarry SSSI located at the northern extent of the scheme. There are no SPA, SAC or RAMSAR Sites within 1km of the route. With limited vegetation clearance required no significant impact upon ecology is anticipated to occur.	Neutral
	Water Environment	The River Gwenfro is located 500m north of J4 along with an unnamed stream located south of J5. The River Clywedog flows beneath the A483 south of junction 4. No significant impact is anticipated to occur as a result of this scheme.	Neutral
	Townscape	There is no conservation area located within 1km of the route. Several listed buildings are located within 1km of the route corridor both north and south bound. No impact upon townscape features is anticipated to occur as a result of this scheme.	Neutral
Economy	Journey Time Changes	It is not envisaged that Air Quality Communications should have an impact on journey times or reliability. Therefore the impact is considered to be neutral.	Neutral
	Capital Costs	Low (up to £500k)	N/A
	Land	Measure does not require any physical infrastructure. No land acquisition required	Neutral
S&C	Journey Quality	It is not envisaged that Air Quality Communications should have an impact on journey quality. Therefore the impact is considered to be neutral.	Neutral
	Physical Activity	Air Quality Communications should not impact on physical activity along the study route. Therefore, it is considered that the impact should be neutral on the study route.	Neutral
	Accidents	Air quality communications are not expected to impact on accidents along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
	Access	Air quality communications are not expected to impact on access to services, employment, or healthcare along the study route. Therefore, it is considered that the impact should be neutral.	Neutral
VfM	Value For Money	It is anticipated that the Benefit to Cost ratio for this option would be within the range of 1 to 2	Fair
Other Issues	Acceptability	Given the nature of the proposals, this measure is unlikely to be opposed by any groups or individuals.	
	Technical, Operational & Financial Feasbility	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
	Deliverability & Risk	None identified at this stage. To be re-evaluated at Stage 3 when detailed scheme drawings and cost estimates are available.	
Secondary Criteria of the Objective	Will the intervention deliver an overall reduction in NO2 emissions to air	Yes. Marginal reductions anticipated. NO2 reduction should not be able to be attributed to Traffic Wales Website information supply.	
	Will the intervention result in unintended consequences or other environmental impacts	No. There are no adverse consequences to other environmental impacts.	
	Will the intervention impact equally across multiple vehicle classes and journey types	Yes. This scheme should have an equal impact on all vehicle classes/well-being.	
	Will the intervention have a positive impact on wider public health and inequalities	No. Air quality communications are unlikely to have a positive impact on wider public health and inequalities.	

Table 4: Summary of WelTAG Stage 2 Appraisals

	Key Criteria			Environment							Social and Cultural				Economy			
Shortlisted Measure	Effectiveness	Timescales	Fesibility	Air Quality	Noise	Landscape	Historic Environment	Biodiversity	Water Environment	Townscape	Physical Activity	Journey Quality	Accidents	Access to Services	Journey time / reliability	Land	Capital Costs	Implementation Timeframe
S1: NOx Absorbing Materials	Ineffective	Y	Y	0	0	-	0	0	0	0	0	0	0	0	0	0	up to £500k	Up to 5 months
S4: Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers	Medium	Y	Y	++	+	-	-	-	0	-	0	0	0	0	0	0	up to £500k	Up to 5 months
S7: Enforce/Reduce Speed Limit	High	Y	Y	+++	+	0	0	0	0	0	0	+	+	0	+	0	£500k - £2m	Up to 5 months
S10: Flow Management (Upstream)	Low	Y	Y	+	+	0	0	0	0	0	0	+	+	0	0	0	£500k - £2m	12 months
S14: Ramp Metering	Ineffective	Y	Y	0	0	0	0	0	0	0	0	0	+	-	0	0	£500k - £2m)	Up to 5 months
S16: Junction Closures	Medium	Y	Y	++	0	0	0	0	0	0	0	-	0	- -	0	+	£500k - £2m	Up to 5 months
S17: Variable Message Signs (VMS)	Low	Y	Y	+	0	0	-	-	0	-	0	+	0	0	0	-	£2m+	12 months
S18: Expressway (incl. speed limit)	Ineffective	N	Y	- -	+	0	0	0	0	0	0	+	+	0	++	-	£2m+	18-24 months
S19: Variable Diversions	Medium	Y	Y	++	+	0	0	0	0	0	0	-	0	-	- -	0	£500k - £2m	12 months
S26: Reallocation of Road Space	Ineffective	Y	Y	- -	+	- -	0	- -	0	-	0	0	0	0	- -	-	£2m+	12 months
S28: Behaviour Change	Low	Y	Y	+	+	0	0	0	0	0	+	+	0	0	+	0	up to £500k	Up to 5 months
S44: Vehicle Emission Testing	Ineffective	Y	Y	0	0	0	0	0	0	0	0	0	0	0	0	0	up to £500k	Up to 5 months
S46: Clean Air Zones / Low Emission Zones	High	Y	Y	+++	0	0	0	0	0	0	0	0	0	- -	0	0	£2m+	18-24 months
S51: Intelligent Traffic Management	Medium	Y	Y	++	0	0	0	0	0	0	0	+	0	0	0	0	£2m+	18-24 months
S53: Enhanced Traffic Officer Service	Ineffective	Y	Y	0	0	0	0	0	0	0	0	0	0	0	0	0	up to £500k	6 months
S62: Signage	Low	Y	Y	+	0	0	0	-	0	0	0	0	0	0	0	0	up to £500k	Up to 5 months
S63: Distance Chevrons	Ineffective	Y	Y	0	0	0	0	0	0	0	0	0	+	0	0	0	£500k - £2m	Up to 5 months
S65: Air Quality Areas	Low	Y	Y	+	0	0	0	0	0	0	0	0	0	0	0	0	up to £500k	Up to 5 months
S66: Air Quality Communications	Low	Y	Y	+	0	0	0	0	0	0	0	0	0	0	0	0	up to £500k	Up to 5 months

Where +++ *Large Beneficial*, ++ *Moderate Beneficial*, + *Slight Beneficial*, 0 *Neutral*, - *Slight Adverse*, - - *Moderate Adverse*, - - - *Large Adverse*

3.5 APPRAISAL OUTCOME

This Stage 2 has reappraised measures against the Key Criteria of the objective in lieu of further refinement of measures and more detailed appraisal. Consequently, the following measures have been identified as failing against one or more of the criteria:

- S1: NOx Absorbing Materials **[Fails on Effectiveness]**
- S14: Ramp Metering **[Fails on Effectiveness]**
- S18: Expressway (incl. speed limit) **[Fails on Effectiveness and Timescales]**
- S26: Reallocation of Road Space **[Fails on Effectiveness]**
- S44: Vehicle Emission Testing **[Fails on Effectiveness]**
- S53: Enhanced Traffic Officer Service **[Fails on Effectiveness]**
- S63: Distance Chevrons **[Fails on Effectiveness]**

4 DELIVERY CASE

4.1 OVERVIEW

The Delivery Case 'covers the delivery arrangements for the project and proposed management during its life time'. The WelTAG guidance states that in the Stage 1 report the Delivery Case needs to 'set out which organisation and groups within that organisation will sit on the Review Group that meets at the end of each WelTAG stage'.

4.2 PROJECT PLANNING – GOVERNANCE, ORGANISATIONAL STRUCTURE

4.2.1 KEY PROJECT PARTIES & ROLES

Welsh Government (WG)

Ultimate client commissioning the study and part of the Project Board overseeing delivery.

WSP

Project Consultant, delivering the study.

4.2.2 REVIEW GROUP

A Project Board has been set up to guide the WelTAG process and have met regularly to discuss the project. This group will take on the role of the Review Group and its members are as follows:

- Welsh Government
- North and Mid Wales Trunk Road Agent (NMWTRA)
- Third party consultants (WSP at Stage 1 and 2)

4.3 COMMUNICATIONS & STAKEHOLDER MANAGEMENT PLAN

Key stakeholders for the current stage of the study are:

Welsh Government and NMWTRA/SWTRA

The study team will consult with Welsh Government and NMWTRA/SWTRA staff who currently manage and operate the network to capture views on current processes, issues and potential measures. Consultation will be carried out informally throughout the study. These also form the Review Group and their comments have been incorporated into the Report.

Other Third Party Stakeholders

Third party stakeholders were not consulted to support the development of the study. Third party consultation will be carried out in a later stage of the WelTAG process.

The Public

Public consultation was not carried out during this stage of the study, however it will form part of a later stage.

4.4 KEY CONSIDERATIONS FOR WELTAG STAGE 3

This section highlights the key requirements for Stage 3, particularly with respect to the elements which have not been undertaken at Stage 2.

The WelTAG Stage 3 assessment will need to include:

- Preliminary scheme drawings
- Preliminary costs estimates
- Assessment of Technical, Operational and Financial Feasibility, and Deliverability and Risk
- Qualitative Value for Money assessment
- Detailed modelling of impacts – both traffic modelling and emissions/dispersion modelling.

4.5 MEASURE IMPLEMENTATION

There are a number of routes available to facilitate the implementation of preferred measures identified in Stage 2.

It is envisaged that measures that involve physical works, e.g. painting, installation of fencing, signing, are likely to be procured through the appropriate Trunk Road Agent (TRA) for geographical location of the site. The TRAs have further options to procure construction directly through their maintenance partnerships, or via existing Consultant and Contractor Frameworks.

Proposals associated with the use of Traffic Officers or which involve policy, publications, communication and advertising are likely to be undertaken jointly between the Welsh Government and Traffic Wales.

Traffic Wales also have the capability to implement ITS solutions themselves or via their own supply chain. The supply chain could also extend to the TRA's Consultant and Contractor Frameworks.

Given the uncertainties surrounding some aspects of the Stage 2 appraisal, it is recognised that it is important to use an adaptive approach to implementation of measures, whereby the impact of measures is monitored and adjusted based upon emerging evidence.

By adopting a flexible approach to implementation and integrating robust measurement and evaluation of the performance of these measures to meet the objective, measures can be adjusted based on an improving evidence base. As such, it has been identified that it may be beneficial to take forward the measures below as 'measure packages' as opposed to standalone measures. Similarly, consideration should be given as to whether there is merit in packaging the measures which have been identified as ineffective during the Stage 2 appraisal, should it be proven that the preferred measures are not as effective as this study has determined on the basis of the information available.

The implementation timeframes assumed for this report are considered to be an optimistic, best case scenario, and in reality some measures may take longer to implement.

4.6 IMPLEMENTATION TIMEFRAME

SHORT TERM MEASURES

It is recognised that many of the measures identified within this assessment have the potential for immediate implementation, with potential benefits to the reduction of NO_2. Immediate measures include the low cost, short timeframe measures, and other low to medium costs measures that could be implemented in a trial basis and then considered for longer term use. For the A483, Wrexham these include:

- S7 Enforce/ Reduce Speed Limit
- S17 Variable Message Signs (VMS)
- S28 Behaviour Change
- S62 Signage
- S65 Air Quality Areas
- S66 Air Quality Communications

By implementing measures on a trial basis, on-site monitoring can be utilised to evidence the effectiveness of these measures before applying them permanently. The results of monitoring could also be used to inform the WelTAG Stage 3 appraisal process.

LONG TERM MEASURES

Other measures have been identified as meeting the objective, whilst ensuring acceptable impacts against the other appraisal areas. These may be implemented on a permanent basis though would be required to undergo Stage 3 (Business Case) appraisal. These are:

- S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers
- S7 Enforce/ Reduce Speed Limit
- S10 Flow Management (Upstream)

- S16 Junction Closures
- S17 Variable Message Signs (VMS)
- S19 Variable Diversions
- S28 Behaviour Change
- S46 Clean Air Zones/ Low Emission Zones
- S51 Intelligent Traffic Management
- S62 Signage
- S65 Air Quality Areas
- S66 Air Quality Communications

5 FINANCIAL CASE

5.1 OVERVIEW

The financial case 'presents information on whether an option (measure) is affordable in the first place and long term financial viability. It covers both capital and annual revenue requirements over the life cycle of the project and the implications of these for the balance sheet, income and expenditure accounts of public sector organisations.'

5.2 ASSESSMENT

The WelTAG Stage 2 report represents an Outline Business Case and the details to inform the financial case are of a preliminary nature at this stage. No lifetime costs have been calculated at this stage. The Stage 2 appraisals have been undertaken in line with broad capital cost estimates and should be refined at Stage 3.

Lifetime costs and the anticipated scheme life of measures have been identified as broad cost bands at Stage 2 for the short list of measures.

5.3 AFFORDABILITY

Capital scheme costs have been considered as broad costs bands. It is considered that any of the measures identified in the Low (up to £500k) and Medium (£500k – £2m) are affordable within the information available to inform the study, though the measures identified with High costs will need the affordability re-evaluated when detailed designs are available at Stage 3.

6 COMMERCIAL CASE

6.1 OVERVIEW

The commercial case covers ‘whether it is going to prove possible to procure the scheme and then to continue with it in the future’.

6.2 ASSESSMENT

It is not considered possible at this stage to determine the commercial case of each measure, given the preliminary information available.

7 SUMMARY AND NEXT STEPS

7.1 OVERVIEW

The European Union Ambient Air Quality Directive (2008/50/EC) sets legally binding limits for concentrations of certain air pollutants in outdoor air, termed 'limit values'. The Directive requires that Member States report annually on air quality within zones designated under the Directive and, where the concentration of pollutants in air exceeds limit values, to develop air quality plans that set out measures in order to attain the limit values.

The A483 lies within the North Wales zone for the purpose of the assessment of compliance with the EU Air Quality Directive. The national assessment[1] of roadside NO_2 undertaken for the North Wales zone indicates that the annual limit value was exceeded in 2015 but it is likely to be achieved by 2021 through the introduction of committed measures. WG are investigating additional network management measures for the Strategic Trunk Road and Motorway Network that could bring forward the projected compliance date.

The compliance date of the North Wales zone is, in current projections, determined by the compliance of the A494 between J34 (Ewloe) of the A55 and the Welsh/English borders. The section of the A483 under consideration in this study is expected to have achieved compliance in 2018.

This report has presented the Stage 2: Outline Business Case of the WelTAG process for reducing the levels of NO_2 on the A483 dual carriageway network in North East Wales. Elevated concentrations of NO_2 on this study corridor are due to a combination of high traffic volumes.

The appraisal of measures has been undertaken in accordance with the Welsh Government's consultation draft version of WelTAG [2017]. A short list of measures has been appraised against the key criteria and secondary criteria for the objective and the three WelTAG impact areas.

7.2 PREFERRED MEASURES

7.2.1 SHORT TERM MEASURES

It is recognised that many of the measures identified within this assessment have the potential for immediate implementation, with potential benefits to the reduction of NO_2. Immediate measures include the low cost, short timeframe measures, and other low to medium costs measures that could be implemented in a temporary, and then permanent basis. For the A483, Wrexham these include:

- S7 Enforce/ Reduce Speed Limit
- S17 Variable Message Signs (VMS)
- S28 Behaviour Change
- S62 Signage
- S65 Air Quality Areas
- S66 Air Quality Communications

Given the uncertainties surrounding some aspects of the Stage 2 appraisal, it is recognised that it is important to use an adaptive approach to implementation of measures, whereby the impact of measures is monitored and adjusted based upon emerging evidence.

By implementing measures on a temporary basis, on-site monitoring can be utilised to evidence the effectiveness of these measures. This could be used to inform the WelTAG Stage 3 appraisal process. This could include trials of measures which have been identified as ineffective during the Stage 2 appraisal to provide a robust evidence base. However, it is believed that the preferred measures should be prioritised based on their effectiveness.

7.2.2 LONG TERM MEASURES

Other measures have been identified as meeting the objective, with acceptable impacts against the other appraisal areas. These may be implemented on a permanent basis though would be required to undergo Stage 3 (Business Case) appraisal. These are:

- S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers
- S7 Enforce/ Reduce Speed Limit
- S10 Flow Management (Upstream)
- S16 Junction Closures
- S17 Variable Message Signs (VMS)
- S19 Variable Diversions
- S28 Behaviour Change
- S46 Clean Air Zones/ Low Emission Zones
- S51 Intelligent Traffic Management
- S62 Signage
- S65 Air Quality Areas
- S66 Air Quality Communications

7.3 NEXT STEPS

This study has taken appraisal of measures through WelTAG Stage 2. The Stage 2 appraisals have been undertaken at a high level in acknowledgement of the uncertainties of a number of the network management measures. It is recognised that it is important to use an adaptive approach to implementation of measures, whereby the impact of measures is monitored and adjusted based upon emerging evidence. This study has identified measures that are likely to bring forward the date of compliance with EU Limit Values, pending confirmation of future assessments and results on the ground.

The WelTAG Stage 3 assessment will need to include elements of the Stage 2 appraisal which have not been undertaken at this time and should be undertaken in accordance with the official release of the final WelTAG 2017 guidance, released 13 December 2017. The WelTAG 2017 guidance embeds the Well-being of Future Generations (Wales) Act 2015, to ensure that the network management measures are developed using the sustainable development principle and maximise their contribution to the well-being of future generations. There is a Future Generations framework, which is associated with the WelTAG guidance.

In addition to utilising the new WelTAG guidance, the Stage 3 will need to address the elements of Stage 2 which have not yet been undertaken for the reasons identified herein, these include:

- Qualitative analysis of impacts against WelTAG impact areas where appropriate. This should include all relevant traffic and air quality modelling and outline quantifiable benefits in order to determine a Present Value of Benefits (PVB) for each measure assessed
- Detailed scheme drawings
- Detailed costs estimates
- Assessment of Technical, Operational and Financial Feasibility, and Deliverability and Risk
- Quantitative Value for Money assessment

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