Welsh Government

IMPACT ASSESSMENT 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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DRAFT (FINAL) PUBLIC

PROJECT NO. 70040135
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DATE: JANUARY / FEBRUARY 2018

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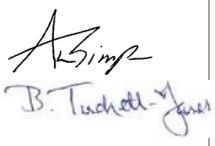
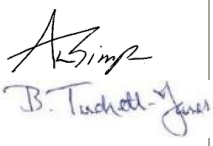
Signature					
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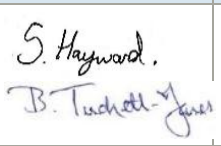
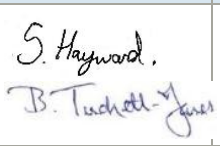
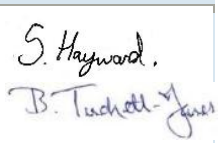
Signature					
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INTRODUCTION

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. This Impact Assessment Report (IAR) provides detailed evidence, data and analysis underlying the statements made in the WelTAG Stage 2 reports for this study.

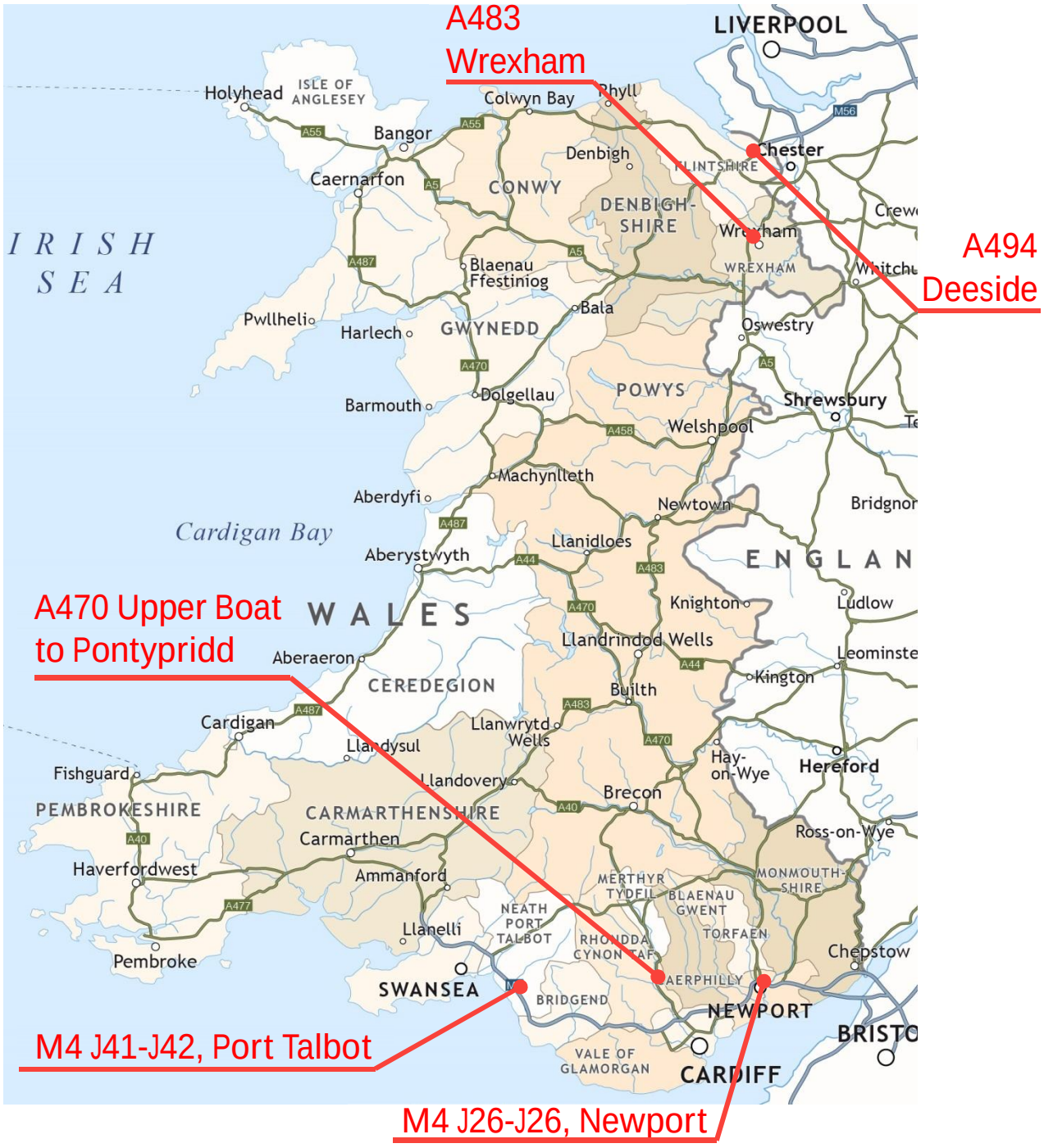
1.2 STUDY CORRIDORS

Figure 1 provides an overview of the 5 study locations in relation to the rest of Wales. For each of the locations a Study Corridor has been identified. Further detail on each of the individual study corridors is contained within the respective Stage 2 Reports.

The 5 study corridors assumed for the purposes of this WelTAG study are independent of the PCM model. Whilst the study corridors encompass the links in the PCM model that have shown an exceedance in limit values, they are not limited to these. This acknowledges that the measures and their subsequent impacts may be realised beyond the identified areas with NO_2 exceedances.

[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

Figure 1: Overview of Study Corridors



1.3 APPROACH

A detailed outline of the approach undertaken for the Stage 2: Outline Business Case is contained within the WelTAG Stage 2 reports. This IAR will therefore build upon the content of the WelTAG Stage 2 Reports, providing additional information where relevant, and is intended to be used as a supporting document.

1.4 REPORT STRUCTURE

The structure of this Impact Assessment Report is as follows:

Chapter 2: Strategic case

This chapter presents additional detail and supporting information to the baseline presented in each of the WelTAG Stage 2 reports, including the analysis applied to the Trafficmaster data and a detailed description of the other sensitive environmental areas for each of the 5 study corridors. A brief commentary is provided regarding the development of the long list and short list of measures.

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 Impact Assessment Report includes a list of preferred measures, or package of measures for each of the sites 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.

2

STRATEGIC CASE

2 STRATEGIC CASE

2.1 CASE FOR CHANGE

2.1.1 POLICY CONTEXT

A comprehensive overview of the policy context is included within the WelTAG Stage 2 reports.

2.1.2 AIR QUALITY

The Air Quality Baseline for each of the 5 study corridors is outlined in detail within the WelTAG Stage 2 reports.

2.1.3 INFRASTRUCTURE AND LOCAL FACILITIES

Details of the infrastructure, including structures and junctions situated throughout each of the 5 study corridors are outlined within the WelTAG Stage 2 reports.

2.1.4 MAJOR SCHEMES

An overview of the major schemes proposed within the context of each of the 5 study corridors is included in the WelTAG Stage 2 reports.

2.1.5 TRAFFIC FLOWS

An overview of the existing traffic flows at each of the 5 study corridors is included in the WelTAG Stage 2 reports.

2.1.6 TRAFFICMASTER DATA

Trafficmaster data has been used to analyse the difference in annual average weekday vehicle speeds between cars / Light Good Vehicles (LGVs), and Heavy Goods Vehicles (HGVs) for both directions within each of the 5 study corridors. An outline of the time periods within which speeds were analysed and an overview of the analysis results are included within each of the WelTAG Stage 2 reports.

The Trafficmaster database holds data collected from in-vehicle GPS and mobile communication devices used for fleet tracking, stolen vehicle tracking, and satellite navigation purposes. The Trafficmaster system works by generating positional reports of vehicles fitted with the software, and then mapping these reports to the Ordnance Survey Integrated Transport Network (ITN). When a vehicles ignition is on, a report is generated every 10 seconds allowing the progress of the vehicle to be monitored along the ITN. This in turn allows average vehicle journey times and speeds to be calculated along individual ITN links. Data is extracted in the average time(s) along a link, the average time is generated from the number of observations along every link within the study corridor. It should be noted that historically, cars generate higher observation counts than Heavy Goods Vehicles. This will be explained further in the following sections.

Filter Files

The aim of the Trafficmaster analysis is to investigate vehicle speeds along the A494, as well as a number of connecting links; using Trafficmaster data provided by Welsh Government. Speeds were analysed over the 12-month period between 1st June 2015 and 30th July 2016 (the latest available 12-month period) and broken down by direction, weekdays, and time period.

This report refers to peak periods throughout the day as follows:

- AM Peak Period – refers to the typical morning peak in traffic for the period between 0700 to 1000
- Inter Peak Period – refers to the period between the typical morning and evening peak in traffic, and is the time between 1000 to 1600
- PM Peak Period – refers to the typical evening peak in traffic for the period between 1600 to 1900
- Off Peak Period – refers to the period between the typical evening and morning peak in traffic, and is the time between 1900 to 0700

The analysis excluded school holidays, to ensure that all days included within the analysis were neutral. In addition, separate analysis was undertaken to distinguish annual average vehicle speeds for both Cars and HGVs (up to and over 7,500kg).

Methodology

Once filters had been applied to extract the relevant Trafficmaster data for the study corridor, average vehicle speeds were calculated using the following calculation[2]:

Step 1: Average Vehicle Speeds – Individual Vehicles

For each individual vehicle record, an average speed was calculated for the journey (a movement across an individual ITN link) using the following calculation:

$$\text{Average Vehicle Speed} = \left(\frac{Road\ Length}{Journey\ Time}\right)$$

For example;

- Journey time = 0.5 hours
- Road Length = 20 miles
- Average Speed = $\frac{20\ (\text{miles})}{0.5\ (\text{hours})}$ = 40 miles per hour

Step 2: Average Vehicle Speeds – Multiple Vehicles

For multiple cars undertaking the same journey, an average journey speed across the ITN link was calculated as follows:

$$\text{ITN Average Speed} = \left(\frac{Road\ Length}{Average\ Journey\ Time}\right)$$

For example;

- Journey Time Vehicle 1 = 0.6 hours
- Journey Time Vehicle 2 = 0.8 hours
- Road Length = 35 miles
- Average Speed = $\frac{35}{(\,(0.6 + 0.8)\,/\,2\,)}$ = 50 miles per hour

Step 3: Average Vehicle Speeds – Multiple Sections of Road

Each study corridor within this report is made up of multiple ITN links. Average journey speeds for each individual study corridor were calculated as follows:

$$\text{Section Average Speed} = \left(\frac{Sum\ (ITN\ Average\ Vehicle\ Speed * ITN\ Average\ Journey\ Time)}{Sum\ (ITN\ Average\ Journey\ Time)}\right)$$

For example;

- Average Journey Time Road A = 0.5 hours
- Average Journey Time Road B = 0.7 hours
- Average Speed Road A = 40 mph
- Average Speed Road B = 50 mph
- Average Speed = $\frac{(40 * 0.5) + (50 * 0.7)}{(0.5 + 0.7)}$ = 45.8 miles per hour

Summary

Whilst analysing the average annual speeds in each study corridor, it was evident that in some cases average HGV speeds were equal to, if not greater than average car speeds. After further analysis of the Trafficmaster data it was clear that there was missing data for a large proportion of link IDs that represented HGVs. Research implies that HGVs do not yet have the in-vehicle technology that cars do, and therefore few facilitate the GPS and mobile communication devices that generate the Trafficmaster data. Therefore significantly fewer results are included within the analysis.

Subsequently, it is recommended that the HGV results are not to be compared against those for cars. The reason why HGVs appear be faster than cars is because HGV data may only be available for short links that

[2] Welsh Government Statistics Article, *Vehicle speeds on Welsh motorways,* Available at: http://gov.wales/docs/statistics/2017/170517-vehicle-speeds-welsh-motorways-april-june-2016-en.pdf

have small average speeds e.g. HGVs take very little time to pass through the link. When taking an average of the few links that there is data for, the speeds will appear high, and as a result will not be representative of the actual speeds. This gives unreliable results and should therefore not be comparable with car speeds.

2.1.7 VEHICLE SPEEDS

An analysis of vehicle speeds at each of the 5 study corridors is outlined in detail within the WelTAG Stage 2 reports.

2.1.8 PUBLIC TRANSPORT

An overview of the existing public transport provision within each of the 5 study corridors is included in the respective WelTAG Stage 2 reports.

2.1.9 ECONOMY

An overview of the Labour Market Profile for each of the 5 study corridors is included within the respective WelTAG Stage 2 reports.

2.1.10 DEMOGRAPHICS

An overview of The Local Area Report and the demographics for each of the 5 study corridors is included within the WelTAG Stage 2 reports.

2.1.11 OTHER SENSITIVE ENVIRONMENTAL AREAS

This section of the report identifies and determines the potential environmental constraints and opportunities within each of the 5 study corridors. It provides further detail which builds upon the information presented in the WelTAG Stage 2 reports regarding the exact nature and location of sensitive human receptors, Noise Action Planning Priority Areas (NAPPAs), watercourses and listed buildings.

A494 DEESIDE

Statutory Designations

European Designated Sites (also known as Natura 2000 Sites) include any Special Protection Area (SPA), Special Area of Conservation (SAC), and RAMSAR sites. There are two SACS located within 1km of the A494 (measured from closest point) comprising the Deeside and Buckley Newt Sites, which is located approximately 1km north west from the A494, and River Dee and Bala Lake SAC which flows beneath the A494.

There are two Sites of Special Scientific Interest (SSSI) within proximity to the A494 comprising Connah's Quay Ponds SSSI located 1km north west, and River Dee SSSI, which flows beneath the A494.

There are no Areas of Outstanding Natural Beauty (AONB) located within 1km proximity to the proximity to the A494, nor are there any other Statutory Designations (National Parks and Country Parks) located within 1km to the A494.

Non Statutory Designations

There are no other non statutory designations within 1km of the A494, and no Special Landscape Areas within the vicinity of the highway on the A494.

Areas of Population, Community Resources and Infrastructure

Sensitive human receptors (i.e. residential properties, hotels etc.) and community resources (i.e. footpaths, cycleways etc.) located within 1km of the A494 comprising are listed in Table 1.

Table 1: Sensitive Receptors within 1km of the A494

Receptor / Resource	Distance & Direction from A494
Residential dwellings of Ewloe	Residential dwellings off Carlines Avenue adjacent to A494 (within 20m at closest point)
Public footpaths	Adjacent to northern side of A494 within 20m at closest point
Residential dwellings	Residential properties along Old Ashton Hill, Alder Avenue, Wedgwood road and The Croft (north) and Hillfield Road (south east) adjacent to A494

	(within 20m)
The Plough Inn	Within 40m north west
McDonald's	36m north
Residential dwellings	Residential properties along Dyfed Drive adjacent to A494 within 100m south east at closet point
Industrial Park	Adjacent to east side of A494
Residential Dwellings	Adjacent to north side of A494, properties on Queen Street within 30m of A494 at closest point
Industrial Park comprising Caravan Site and Royal Mail	Adjacent to north side of A494, within 30m at closest point
Residential dwellings	Properties on Claremont Avenue, and Riverside Park are adjacent to the A494, within 40m at closest point
Gateway to Wales Hotel	Adjacent to Deeside Park Junction, within 30m north of A494
Megasheds Chester	135m west
The Amantola – Indian Restaurant and Bar	180m north west of Deeside Park Junction
Footpath	Adjacent to east side of A494
National Cycle Route 563	30m west of A494
Deeside Industrial Park	Industrial units adjacent to A494 up to Junction within 30m south east at closest point
Residential dwellings of Ewloe	Residential dwellings off Carlines Avenue adjacent to A494 (within 20m at closest point)
Public footpaths	Adjacent to northern side of A494 within 20m at closest point
Residential dwellings	Residential properties along Old Ashton Hill, Alder Avenue, Wedgwood road and The Croft (north) and Hillfield Road (south east) adjacent to A494 (within 20m)
The Plough Inn	Within 40m north west
McDonald's	36m north
Residential dwellings	Residential properties along Dyfed Drive adjacent to A494 within 100m south east at closet point

Sensitive Noise Receptors

Noise Sensitive Areas, including NAPPAs, located within 1km of the A494 are listed in Table 2.

Table 2: Noise Action Planning Priority Areas within 1km of the A494

NAPPA Sites
A494 – West side of J33B (within 40m of A55)
A494 – near Ashton Hill
A494 – Near Queensferry
A494 – Adjacent to industrial park on eastside of A494
A494 – Site from the roundabouts on either side of the A494 up to where the bridge and footpath crosses the A494.

Water Environment

Water courses and permanent water bodies located within 1km of the A494 are listed in Table 3.

Table 3: Watercourses within 1km of the A494

Main Water course / Water Body	Distance & Direction from A494
Series of unnamed drainage ditches	Adjacent to the A494 near Queensferry.
River Dee	Flows beneath the A494.
Unnamed drainage ditches/watercourses	There are a series of unnamed drainage ditches/watercourses which flow adjacent, underneath and within proximity to the A494, some of which are tributaries of the larger main watercourses.

Cultural Heritage, Historic and Landscape Designations

Listed Buildings, Scheduled Monuments, Historic Parks and Gardens and Conservation Areas within 1km of the A494 are presented in Table 4.

Table 4: Listed Buildings within 1km of the A494

Listed Structure	Distance & Direction from A494
Ferry Bank Farm	Approximately 50m south east of A494 on Fox's Drive
Bascule Bridge	Located on bridge adjacent to bridge over the River Dee on the A494 (approximately 200m north west)

There is one Scheduled Monument comprising Trueman's Hill Motte located 1km south east of the A494 near Hawarden.

There are no conservation areas within 1km of A494, and there are also no Historic Parks and Gardens within 1km of the A494.

A483 WREXHAM

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

Sensitive human receptors (i.e. residential properties, hotels etc.) and community resources (i.e. footpaths, cycleways etc.) located within 1km of the A483 comprising are listed in Table 5.

Table 5: Sensitive Receptors within 1km of the A483 Study Corridor

Receptor / Resource	Distance & Direction from A483
Ysgol Clywedog	1km east
Residential properties within Heritage Gardens	Closest residents are situated on Wilkinson Drive located approximately 45m east
Bersham Heritage Centre and Ironworks	155m east
Bangor University, Wrexham Campus	660m south east
Ysbyty Wrexham	130m east
Wrexham Glyndwr University	210m south east
Sainsbury's Petrol Station	80m south east
Wrexham Industrial Estate	35m south east
Residential properties within Rhos-Ddu	Closest residential properties located on Colliery Road, Ffordd Mon, Ty Gwyn Lane and Chester road located approximately 25m south east
Residential properties within Acton	Closest residential properties are located on Chester Road, Adderley Bank, Ffordd Garmonydd and Ty Gwyn Lane located approximately 33m south east
Wat's Dyke County Primary School	260m south east
Residential properties within Old Rhosrobin	Closest residential properties are located Top Farm Road located approximately 35m north west
Industrial retail park near Rhosrobin	100m north west
Premier Inn Wrexham	200m east
Ashleigh Court Care Home	340m east
Marford Wood	92m south east
Residential properties within Gresford	Closest residential properties are located on Greenway View and Church Green located approximately 200m south east
Fore Golf	550m west
Residential properties within Pandy	Closest residential properties are located on Plas Action Road and Alyn Close approximately 20m south east
Gresford Colliery Sports and Social Club	Adjacent to A483 (within 0m)
Charlie's Hand Car Wash	50m south east
Footpaths	There are several footpaths adjacent to the A483 (including Offas Dyke Path located to the west of the A483) which transverse the agricultural fields surrounding the A483

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

Water courses and permanent water bodies located within 1km of the A483 between J4 and J6 are listed in Table 6.

Table 6: Watercourses within 1km of the A483 Study Corridor

Main Water course / Water Body	Distance & Direction from M4
River Clywedog	Flows beneath the A483 approx. 900m south of J4.
River Gwenfro	Flows beneath the river approx. 300m north east
Unnamed drainage ditch	60m north west from J5
River Alyn	595m west
The Flash Pool	530m east of J6
Lake in Pant yr Ochain Wood	730m south east

Cultural Heritage, Historic and Landscape Designations

Throughout the route, there are many Listed Buildings, predominately concentrated within Wrexham Town Centre and also dispersed more widely within the surrounding villages and along an unknown road opposite Bersham Road. Many of these buildings fall within the 1km radius from the carriageways. Those considered in the study are listed in Table 7.

Table 7: Listed Buildings within 1km of the A483 Study Corridor

Listed Structure	Distance & Direction from A483
East Weir on River Clywedog	200m west near Junction 4
Bridge Cottages	150m east near Junction 4
Bersham Mill and associated buildings surrounding the land	250m west
Lower Berse Farmhouse	300m west
Croesnewydd Hall	400m east
Berse Drelincourt Church	450m west
Number of buildings and structures within the grounds surrounding the Griffin Inn	550m east
Cluster of residential cottages within Marfod	Within 150m south east

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.

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 highway between Pontypridd and the Upper Boat Roundabout or within 30km where bats are one of the qualifying interests of the designated site (measured from closest point).

There are no Sites of Special Scientific Interest (SSSI) within 1km of the highway between Pontypridd and the Upper Boat Roundabout. There are also no Areas of Outstanding Natural Beauty (AONB) located within 1km of the highway between Pontypridd and the Upper Boat Roundabout.

There is one Local Nature Reserves (LNR) within 1km of the highway comprising the Craig Yr Hesg located approximately 400m north west of the A470. There are no other Statutory Designations located within 1km of the highway between Pontypridd and the Upper Boat Roundabout.

Non Statutory Designations

There are no non statutory designations within 1km of the study corridor, and no Special Landscape Areas within the vicinity of the highway on the A470.

Areas of Population, Community Resources and Infrastructure

Sensitive human receptors (i.e. residential properties, hotels etc.) and community resources (i.e. footpaths, cycleways etc.) located within 1km of the A470 between Pontypridd and the Upper Boat Roundabout are listed in Table 8.

Table 8: Sensitive Receptors within 1km from the A470 Study Corridor

Receptor / Resource	Distance & Direction from A470
Ponty Lido	240m south west
Pontypridd Golf Club	840m north east
Pontypridd Museum	200m west
Ynysangharad Park	Adjacent to A470 (within 15m south west)
Residential properties within Trallwn	Closest residential properties situated on Coedpenmaen Road (located within 10m north west)
Retail park containing several commercial business units comprising; B&Q, Argos, Currys, Halfords and Sainsbury's	Adjacent to A470 (within 20m north east)
Residential properties within Coedpenmaen	Closest residential properties situated on Merthyr Road approximately 57m south west
Residential properties within Pentrebach	Closest residential properties situated on Graig yr Helfa road located approximately 100m north east
Residential dwellings within Treforest	Closest residential properties are situated on River Side Street approximately 100m west of the A470
Small commercial businesses and convenience stores within Treforest	150m west
Treforest Train Station	200m west
University of South Wales, Pontypridd Campus	40m east
N Powell and Son Scrap Metal Recycling	40m east

Glyntaff Crematorium	130m east
Commercial businesses and industrial units	Situated adjacent to the A470 on the western side of the dual carriageway (within 20m west)
Wales University of South Wales Treforest Campus	680m west
Heol y Celyn Primary School	530m west
Residential properties within Rhydyfelin	Closest residential properties situated on Warren Close and Poplar Road (within 15m north of the A470)
Cardinal Newman RC School	195m north east
Hawthorn Leisure Centre	30m south east
Residential properties within Hawthorn	Closest residential properties situated on Hawthorn Crescent (located approximately 12m south west from the A470)
Treforest Industrial Estate comprising of several restaurants, commercial business units, super markets and car dealers.	Within 60m south surrounding the Upper Boat Roundabout
Taff Trail	The trail is adjacent to the A470 near Pontypridd and

Sensitive Noise Receptors

Noise Sensitive Areas located within 1km of the A470 study corridor include a designated Noise Action Planning Priority Area (NAPPA) on the majority of the A470 between Nantgarw and just north east of Pontypridd.

Water Environment

Water courses and permanent water bodies located within 1km of Pontypridd and Upper Boat are listed in Table 9.

Table 9: Watercourses within 1km of the A470 Study Corridor

Main Water course / Water Body	Distance & Direction from A470
Rhondda River	470m south west from A470 near Ynysangharad Park. The river converges with the River Taff.
River Taff	The River Taff flows adjacent to the A470, the river is approximately 15m south west at its closest point, near College Way.
Unnamed drainage ditch	26m north east near the University of South Wales.
Nant Corrwg	Flows beneath the A470 near the Tesco Extra (within 0m).

Cultural Heritage, Historic and Landscape Designations

Listed Buildings, Scheduled Monuments, Historic Parks and Gardens and Conservation Areas within 1km of the A470 between Pontypridd and Upper Boat are presented.

Throughout the route, there are many Listed Buildings, predominately situated within Pontypridd Town Centre located along the A48 and within the surrounding villages. Within the towns there are many Listed Buildings which cluster within the centre of each of the towns and villages, these buildings fall within the 2km radius from the carriageways.

Table 10: Listed Buildings within 1km from the A470 Study Corridor

Listed Structure	Distance & Direction from A470
48 Pentrebach road	25m east
Several residential buildings along Graig-Yr-Helfa Road	30m east
Glamorgan centre for Art and design	200m east
Castle bridge	100m west
14 Residential houses on Broadway Road	300m south west
Machine Bridge	30m west
Church of St Dyfrig	100m west
Buildings on Cardiff Road	400m south west
Two buildings within Treforest Estate	450m south west

Table 11: Scheduled Monuments within 1km of the A470 Study Corridor

Scheduled Monument	Distance & Direction from A470
Pontypridd Bridge	100m west
Ring Cairn and two standing stones	450m east
Y Garreg	500m east

There are several Conservation Areas surrounding Pontypridd town (7 in total). The A470 is not within any Conservation Areas, the nearest designated area is located within Treforest on the western side of the River Taff which is approximately 100m west of the A470.

There is one Historic Park and Garden comprising the Ynysangharad War Memorial Park located adjacent to the A470, approximately 15m south west.

M4 J41-42

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 (SCIs), and RAMSAR sites. There are no SACs within 1km of the M4 between Aberavon and Baglan in Port Talbot.

There are two Sites of Special Scientific Interest (SSSI) within 1km of the M4 comprising Crymlyn Burrows SSSI located 950m south west from the M4 near Earlswood, and Earlswood Road Cutting and Ferryboat Inn Quarries SSSI which is located within the M4 boundary.

There are no Areas of Outstanding Natural Beauty (AONB) located within 1km of the M4 between Aberavon and Baglan, nor are there any other Statutory Designations located within 1km of the M4 study corridor.

Non Statutory Designations

There are no non statutory designations within 1km of the M4 between Aberavon and Baglan.

There is one Special Landscape Area comprising Margam Mountain located adjacent to the eastbound carriageway of the M4 at Margam and between the A474 in Cwmavon and the B4281 near Kenfig Hill.

Areas of Population, Community Resources and Infrastructure

Sensitive human receptors (i.e. residential properties, hotels etc.) and community resources (i.e. footpaths, cycleways etc.) located within 1km of the M4 are listed in Table 12.

Table 12: Sensitive Receptors within 1km of the M4 Study Corridor

Receptor / Resource	Distance & Direction from M4
Port Talbot Parkway	540m south west in Port Talbot
Aberavon Rugby Football Club	60m south west from the M4
Talbot Memorial Park	50m south west of M4 J40
Don Leisure	460m south west
Tesco	330m south west
Aberafan Centre	500m west
Residential properties adjacent to the M4 throughout the route between Baglan and Aberavon	Within 10m on Ynys St, King Street, Evans Street, Da – y – Bryn Road, Bridge Street, Brynheulog Street, Mayfield Street, Park view, Dyffyn Road
Neath Port Talbot Hospital	300m south west from M4 near J41
St Joseph's RC Comprehensive School	100 south west from M4 near J41
Port Talbot Resource Centre	385m north east from M4 near J41
Baglan Train Station	Adjacent to M4
Beefeater Bagle Brook	200m north east
Residential Properties	Within 130m of M4 in Baglan
Waterside Medical Practice	380m south west from M4 near J42
Baglan Energy Park	430m north east from M4 near J42
Pinetree Car Superstore	80m east from M4
Baglan Bay Innovation Centre	150m east from M4
Aberavon Beach	1.7km south west from M4
Various recreational and tourism places within Aberavon	300m south west from M4 near J41
Afan Valley Trail	Goes beneath the M4 near Port Talbot Parkway

Sensitive Noise Receptors

Noise Sensitive Areas located within 1km of the M4 study corridor include a designated Noise Action Planning Priority Area (NAPPA) for road noise between J42 and J39. Within this area there are three additional NAPPA sites for railways.

Water Environment

Water courses and permanent water bodies located within 1km of the M4 are listed in Table 13.

Table 13: Watercourses within 1km of the M4 Study Corridor

Main Water course / Water Body	Distance & Direction from M4
River Afan	Flows beneath the M4 (0m)
Ffrwd Wyllt	Flows beneath the M4 at J41 (0m)

Cultural Heritage, Historic and Landscape Designations

Throughout the route, there are many Listed Buildings within Port Talbot town, located along the A48, and within the surrounding villages. There are many Listed Buildings that cluster within the centre of each of the towns and villages. These buildings fall within the 2km radius from the carriageways. However, only listed buildings within 1km of the carriageway have been considered within this desk study, which are identified in Table 14.

Table 14: Listed Buildings within 1km of the M4 Study Corridor

Listed Structure	Distance & Direction from M4
Velindre Bridge	130m north east from M4 near the River Afan
Holycross Church	75m north east from M4 near J40.

M4 J25-26

Statutory Designations

European Designated Sites (also known as Natura 2000 Sites) include any Special Protection Area (SPA), Special Area of Conservation (SAC), and RAMSAR sites located within 1km of the M4 between the M4 J26 and J25 (measured from closest point). There is one SAC within proximity to the M4 between J25 and J26 comprising the River Usk SAC, which is located beneath the M4 near the Brynglas Tunnels (within 0m).

There is one Site of Special Scientific Interest (SSSI) within proximity to the M4 between J25 and J26 comprising the River Usk SSSI located beneath the M4 near the Brynglas Tunnels (within 0m). There is also one Local Nature Reserve (LNR) within 1km of the M4 highway comprising the Allt-Yr-Yn LNR.

There are no Areas of Outstanding Natural Beauty (AONB), nor any other Statutory Designations (National Parks and Country Parks), located within 1km proximity to the M4 study corridor.

Non Statutory Designations

There are no Natural Nature Reserves (NNR) within 1km and there are also no Special Landscape Areas within the vicinity of the highway on the M4 study corridor between J25 and J26.

Areas of Population, Community Resources and Infrastructure

Sensitive human receptors (i.e. residential properties, hotels etc.) and community resources (i.e. footpaths, cycleways etc.) located within 1km of the M4 study corridor are listed in Table 15.

Table 15: Sensitive Receptors within 1km from the M4 Study Corridor

Receptor / Resource	Distance & Direction from M4
Residents within 100m of either side of the M4 at Malpas	100m north and south
Crindau Park	50m north
Malpas Fire Station	200m north east
Hotel Ibis Budget	150m north east
Malpas Brook Health Centre	180m south east
Christchurch Centre	310m north east
Kimberley Nursery School	300m north west
Cyril Rogers and Sons	150m north
Crystal Cleaning Solutions	290m north west
Aria Care Home	340m north east
Kimberley Park	55m north west
Gwent Glass	180m south west
Brooklyn Motors	308m west
Residential properties on Allt Yr Yn View	200m south east
Residential properties on Pant Road	40m south west
Residential properties on Brynglas Road	Above Brynglas Tunnels approximately 26m south east
Aria Care Home	77m south
Glan Usk Primary School	335m south
Newport Indoor Bowls Centre	97m south
Gleblands Park	The park continues below the M4 corridor
St Julian's School	98m south west
St Julius and St Aaron's Church	220m south west
St Julians Baptist Church	160m south west
Residential properties on Rembrandt Way	40m south
Residential properties within St Julians	Closest residential properties located on Hogarth Close (approximately 43m south west)
Residential properties within Old Barn Estate	Closest residential properties on Old Barn Road (approximately 30m south)

Sensitive Noise Receptors

Noise Sensitive Areas located within 1km of the M4 study corridor include a designated Noise Action Planning Priority Area (NAPPA) for road noise on the majority of the M4 highway between J24 and J26. The A4051 between J26 and the roundabout at the northern end of Malpas is also a designated NAPPA for road noise.

Water Environment

Water courses and permanent water bodies located within 1km of the M4 between J25-J26 are listed in Table 16.

Table 16: Watercourses within 1km of the M4 Study Corridor

Main Water course / Water Body	Distance & Direction from M4
Monmouthshire Brecon Canal	20m south east at closest point
Crindau Pill	Flows beneath the M4 (0m)
Malpas Brook	10m north west from J26 sliproad
River Usk	Flows beneath the M4 near the Brynglas Tunnels (within 0m)
Unnamed drainage ditch	20m south west from J25
Morgans Pool	435m north west
Woodstock Pool	550m north west

Cultural Heritage, Historic and Landscape Designations

Throughout the route, there are many Listed Buildings, predominately situated within Newport Town Centre, along the A48, and within the surrounding villages. Within the towns there are many Listed Buildings, which cluster within the centre of each of the towns and villages. These buildings fall within the 2km radius from the carriageways.

Listed Buildings within 1km of the M4 J25-J26 are presented in Table 17.

Table 17: Listed Buildings within 1km from the M4

Listed Structure	Grade	Distance & Direction from M4
Aqueduct over Malpas Brook	Grade II	Adjacent to M4 sliproad at J26
Bottom lock and bridge	Grade II	20m south
Gwastad Bridge over the MBC	Grade II	0.5km north west
Crindau Bridge over the MBC	Grade II	100m north east
Bottom Lock and Bridge on MBC	Grade II	0.5km south west

There are no Scheduled Monuments within proximity to the M4 between J25-J26. The closest Scheduled Monument is Newport Castle located approximately 1.3km south east from the M4.

There are no Conservation Areas within 1km of the M4 between J26-25.

There is one Historic Park and Garden comprising the land surrounding the Brynglas House and Community Learning Centre located approximately 150m north west from the M4 near the Brynglas Tunnels.

2.2 PROBLEM IDENTIFICATION

An outline of the problem identification process undertaken within each of the 5 study corridors is included in each of the respective WelTAG Stage 2 reports.

2.3 OBJECTIVE OF THE STUDY

The objective of this study is to carry out an initial investigation into 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 for the 5 study corridors, therefore the transport case focuses on air quality.

An outline of the appraisal criteria used within the study is included in the respective WelTAG Stage 2 reports.

2.4 THE PROCESS

An overview of the process adhered to within Stage 2 of this study is included within each of the 5 respective WelTAG Stage 2 reports. The technical detail of the Stage 2 air quality appraisals are contained within this Impact Assessment Report.

2.5 SUMMARY OF WELTAG STAGE 1

2.5.1 GENERAL

WG has already undertaken a significant amount of work producing a list of 404 potential measures, which include ideas, strategies, and policies to reduce levels of NO_2 at the roadside. These high level preliminary ideas were compiled at a series of workshops (including brainstorming events) with a number of internal stakeholders within WG between September 2016 and September 2017; and from a review of publications and lessons learnt from other organisations such as the Scottish Government, DEFRA, and Highways England.

Prior to undertaking the Stage 1 WelTAG appraisal, WSP undertook a review of WG's list and considered that it is neither practical nor necessary to take all 404 potential measures through the formal WelTAG process. The Stage 1 appraisal took account of information generated by the effectiveness review and the professional experience of the WSP team.

In WSP's review, each idea was considered and all potential measures that could be immediately sifted out of consideration where there is an unambiguous and, insofar as is practical, uncontestable failure against the objective were removed (e.g. not related to roadside emissions, or carried a significant safety risk if applied to the WG network). The sifting was undertaken generically and did not take account of location-specific constraints for measures, unless the idea was related to a specific location not associated with the WG network. The ideas were also sifted on the basis of ambiguity, for instance if the idea was more of an approach than a tangible measure. Measures that were duplications or were similar enough to be considered as one package of measures were combined and taken forward together.

2.5.2 WELTAG STAGE 1 LONG LIST OF MEASURES

The measure development process considered all measures that had the potential to meet the key criteria for delivering the objective. Table 18 details the number of measures which were included in the long list at each study location within Stage 1 following the review of WG's list of 404 potential measures, strategies and policies.

Table 18: Number of Measures in the Stage 1 Long List

Study Corridor	Number of Stage 1 Measures in WelTAG Long List
A494	57
A483	57
A470	56
M4 J25-26	58
M4 J41-42	58

As there was a degree of overlap between many of the measures, they were grouped into the following key themes:

- Air Quality Technology and Abatement
- Network Capacity and Demand
- Diversion Routes
- Policy and Funding
- Sustainable Travel
- Traffic Management
- Network Asset Management
- Communication

2.6 SHORT LIST OF MEASURES

The WelTAG Stage 1 appraised the long list of measures against the key criteria for meeting the objective for each of the 5 study corridors. The measure sifting resulted in the short list for Stage 2 (the Outline Business Case), based on their ability to bring forward the date of compliance with EU Limit Values against the key criteria (Effectiveness, Timescales, and Feasibility). The measures shortlisted from Stage 1 for the 5 study corridors are set out below.

2.6.1 A494 STAGE 1 SHORTLIST

- S1: NOx Absorbing Materials
- S4: Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers
- S7: Enforce/Reduce Speed Limit
- S10: Flow Management (Upstream)
- S14: Ramp Metering
- 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

2.6.2 A483 STAGE 1 SHORTLIST

- 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

2.6.3 A470 STAGE 1 SHORTLIST

- 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: Controlled Motorway
- S19: Variable Diversions
- S26: Reallocation of Road Space
- S27: Parking Improvement
- S28: Behaviour Change
- S29: Car Sharing
- 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

2.6.4 M4 J41-42 STAGE 1 SHORTLIST

- S1: NOx Absorbing Materials
- S7: Enforce/Reduce Speed Limit
- S14: Ramp Metering
- S16: Junction Closures
- S19: Variable Diversions
- S28: Behaviour Change
- S44: Vehicle Emission Testing
- S46: Clean Air Zones / Low Emission Zones
- S51: Intelligent Traffic Management
- S53: Enhanced Traffic Officer Service
- S63: Distance Chevrons
- S65: Air Quality Areas
- S66: Air Quality Communications

2.6.5 M4 J25-26 STAGE 1 SHORTLIST

- S1: NOx Absorbing Materials
- S7: Enforce/Reduce Speed Limit
- S8: HGV Overtaking Bans
- S14: Ramp Metering
- S16: Junction Closures
- S19: Variable Diversions
- S28: Behaviour Change
- S44: Vehicle Emission Testing
- S46: Clean Air Zones / Low Emission Zones
- S51: Intelligent Traffic Management
- S53: Enhanced Traffic Officer Service
- S65: Air Quality Areas
- S66: Air Quality Communications

The following section outlines the air quality appraisal outcomes of the measures shortlisted for Stage 2, based upon the draft WelTAG 2017 guidance.

3

TRANSPORT CASE

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 network management 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.

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 following WelTAG Impact Areas which were identified within the Scoping Report. For a selection of impact areas, 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.

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~~

A detailed overview of the appraisal methodology employed across each of the relevant WelTAG Impact Areas is contained within the 5 respective WelTAG Stage 2 Reports, and is presented within the form of Appraisal Summary Tables (ASTs). The following section outlines the appraisal outcomes of the detailed air quality modelling which was undertaken as part of the Stage 2 appraisal, and builds upon the initial appraisals undertaken and presented within the WelTAG Stage 2 Reports.

3.2 AIR QUALITY

3.2.1 EMISSIONS AND DISPERSION MODELLING

The appraisal of air quality impacts was undertaken semi-quantitatively using a combination of detailed emissions and dispersion modelling and on experience of modelling similar situations. 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[3] (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 from the "without the measure" scenario.
- Moderate impact = change of >1% - 5% of emissions from the "without the measure" scenario
- Slight impact = change of ~1% of emissions from the "without the measure" scenario

Step 3: Where possible, the measure was subject to detailed *dispersion modelling* using the ADMS new generation dispersion model (v4.2) 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 in other locations.

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. Table 19 to 23 provide a summary of modelled measures.

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

A494 Deeside (North Wales)

Baseline (2015) traffic data on the A494 study corridor for the assessment of measures were provided by WSP transport planners based on a combination of vehicles flows and fleet composition from DfT traffic count points and vehicle speeds from Trafficmaster (Appendix A.1, Tables A.1.1 and A.1.6).

The area modelled for the Deeside study corridor is shown in Appendix A.2 (Figure A.2.1). Defra's EfT was used to generate NO_X emissions data for the without and with measure 2018 scenarios for input into the dispersion modelling and the model verified against monitoring data (Appendix A.3). Emissions of NO_X from road vehicles occur primarily in the form of nitrogen oxide, NO, with a relatively small fraction of NO_2 (termed primary NO_2). In ambient air, the NO is oxidised to form NO_2. The modelled road contribution to NOx concentrations was converted to NO_2 using Defra's NOx to NO_2 calculator v6.1[4].

Emissions modelling and dispersion modelling were undertaken for 2018 – selected due to it being the earliest year in which any measure could be implemented. The future year traffic data without the measure were calculated using the baseline traffic flows, increased in line with Tempro growth factors (Appendix A.1, Table A.1.11) but without a change in speed or fleet mix (vehicle classes).

[3] Available at https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html, accessed 02/01/2018
[4] Available at https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc, accessed 02/01/2018

For the modelling, vehicle speeds and flows were varied with period of the day. The speed data were taken directly from the Trafficmaster data (adjusted as set out below); the total daily traffic flows were assigned to the relevant periods of the day using the average proportions for UK traffic (Appendix A.1, Table A.1.12).

The effect(s) of the measure were discussed within the assessment team (air quality and transport planning) and, taking into account the outcome of the Effectiveness Review and professional judgement, the traffic data were manually adjusted to represent the expected effect of the measure on vehicle flows, speeds and fleet mix. Secondary traffic impacts (for example, the effects of changes to vehicle speeds resulting from small changes in vehicle numbers) were not taken into account with the exception that where diversion routes were being modelled the traffic flows on potential diversion routes were increased in line with the expected decrease on the mainline. Details of the adjustments to traffic made for the Deeside 'with measures' models are provided in Table 19.

Measures designed to encourage behaviour change (S62/S65/S66) were not modelled explicitly but an estimate of their effectiveness has been made with reference to the modelling of the Behaviour Change measure (S28) under Sustainable Travel.

The Deeside model was run using meteorological data from Hawarden.

The indicative emissions data (Step 2) and dispersion model results (Step 3) are provided in Appendix A.4 and Appendix A.5 (Table A.5.1) respectively.

Table 19: Summary Table of Modelled Measures for Deeside

Measure	Estimated Change in flow	Estimated Change in Speed	Commentary
S1	Not Modelled		
S4	N/A	N/A	Modelled using ADMS built in noise barrier module with 4m high barriers on both sides of the road
S7	N/A	Where speeds exceed 70kph, set to 70kph	
S10	-2% (Passenger vehicles only, AM and PM)	N/A	Limited choices for redistribution of traffic so low (~0-2%) reduction in AADT. Cars only and only in peaks
S14	N/A	PM increased by 20%	Only around Drome Corner and Queensferry Interchange SB on slips; 20% increase in speeds from literature. Affects PM only due to flow characteristics
S18	5% increase	Where speeds exceed 70kph, set to 70kph	Considered likely to attract traffic; Need to limit speeds
S19	-2% (Passenger vehicles only, AM and PM)	N/A	Limited choices for redistribution of traffic so low (~0-2%) reduction in AADT. Cars only and only in peaks
S26	-5%	50% reduction	Considered likely to deter traffic; Significant reduction in speeds
S28	-2% (Passenger vehicles only, AM and PM)	N/A	Limited potential for modal shift so low (~0-2%) reduction in AADT. Affects commuter traffic only
S44	Not Modelled (Likely insignificant impact on emissions)		
S46	-2%	N/A	Considered likely to deter traffic; modelled assuming minimum Euro 4/IV standards for vehicles
S51	Not modelled individually		Measure assumed to contribute to S28 – Behaviour Change and/or S19 - Diversions
S53	Not Modelled (Likely insignificant impact on emissions)		
S63	-1% (AM and PM only, Proxy for reduced stop start traffic)	(Modelled as flow change)	Based on emissions in congestion and high speed scenarios; measure considered to reduce speed of top 10% of vehicles and increase speed of bottom 10% during peak hours only

A483 Wrexham (North Wales)

Baseline (2015) traffic data on the A483 study corridor for the assessment of measures were provided by WSP transport planners based on a combination of vehicles flows and fleet composition from DfT traffic count points and vehicle speeds from Trafficmaster (Appendix A.1, Tables A.1.2 and A.1.7).

The area modelled for the Wrexham study corridor is shown in Appendix A.2 (Figure A.2.2). Defra's EfT was used to generate NO_X emissions data for the without and with measure 2018 scenarios for input into the dispersion modelling and the model verified against monitoring data (Appendix A.3). Emissions of NO_X from road vehicles occur primarily in the form of nitrogen oxide, NO, with a relatively small fraction of NO_2 (termed primary NO_2). In ambient air, the NO is oxidised to form NO_2. The modelled road contribution to NOx concentrations was converted to NO_2 using Defra's NOx to NO_2 calculator v6.1[5].

Emissions modelling and dispersion modelling were undertaken for 2018 – selected due to it being the earliest year in which any measure could be implemented. The future year traffic data without the measure were calculated using the baseline traffic flows, increased in line with Tempro growth factors (Appendix A.1, Table A.1.11) but without a change in speed or fleet mix (vehicle classes).

For the modelling, vehicle speeds and flows were varied with period of the day. The speed data were taken directly from the Trafficmaster data; the total daily traffic flows were assigned to the relevant periods of the day using the average proportions for UK traffic (Appendix A.1, Table A.1.12).

The effect(s) of the measure were discussed within the assessment team (air quality and transport planning) and, taking into account the outcome of the Effectiveness Review and professional judgement, the traffic data were manually adjusted to represent the expected effect of the measure on vehicle flows, speeds and fleet mix. Secondary traffic impacts (for example, the effects of changes to vehicle speeds resulting from small changes in vehicle numbers) were not taken into account with the exception that where diversion routes were being modelled the traffic flows on potential diversion routes were increased in line with the expected decrease on the mainline. Details of the adjustments to traffic made for the Wrexham 'with measures' models are provided in Table 20.

Measures designed to encourage behaviour change (S17/S62/S65/S66) were not modelled explicitly but an estimate of their effectiveness has been made with reference to the modelling of the Behaviour Change measure (S28) under Sustainable Travel.

The Wrexham model was run using meteorological data from Hawarden.

The indicative emissions data (Step 2) and dispersion model results (Step 3) are provided in Appendix A.4 and Appendix A.5 (Table A.5.2) respectively.

Table 20: Summary Table of Modelled Measures for Wrexham

Measure	Estimated Change in flow	Estimated Change in Speed	Commentary
S1	Not Modelled		
S4	N/A	N/A	Modelled using ADMS built in noise barrier module with 4m high barriers on both sides of the road
S7	N/A	Where speeds exceed 70kph, set to 70kph	
S10	-2% (Passenger vehicles only, AM and PM)	N/A	Limited choices for flow management of traffic so low (~0-2%) reduction in AADT. Cars only and in peak hours only
S14	Not modelled – considered measure has no effect given that there is no evidence for congestion at junctions induced by the merging of traffic from slip roads.		

[5] Available at https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc, accessed 02/01/2018

S16	-2%	No change	Significant proportion of through traffic limits choices for redistribution of traffic so low (~0-2%) reduction in AADT. No change in speed due to no congestion in baseline.
S18	3% increase	Where speeds exceed 70kph, set to 70kph	Considered likely to attract traffic (medium potential 1-3%); Need to limit speeds
S19	-3% (Passenger vehicles only, AM and PM)	N/A	Moderate availability for redistribution of traffic so low (~0-2%) reduction in AADT. Affects peaks only and cars only
S26	-5%	50% reduction	Considered likely to deter traffic; Significant reduction in speeds
S28	-2% (Passenger vehicles only, AM and PM)	N/A	Limited potential for modal shift. Affects commuter traffic only
S44	Not Modelled (Likely insignificant impact on emissions)		
S46	-2%	N/A	Considered likely to deter traffic; modelled assuming minimum Euro 4/IV standards for vehicles
S51	Not modelled individually		Measure assumed to contribute to S28 – Behaviour Change and S19 – Diversions;
S63	Not Modelled – It is considered that this measure would only be effective where there is evidence of flow breakdown occurring and this was not identified in the baseline assessment.		

A470 Upper Boat to Pontypridd (South Wales)

Baseline (2015) traffic data on the A470 for the assessment of measures were provided by WSP transport planners based on a combination of vehicles flows and fleet composition from DfT traffic count points and vehicle speeds from Trafficmaster (Appendix A.1, Tables A.1.3 and A.1.8).

The area modelled for the Pontypridd study corridor is shown in Appendix A.2 (Figure A.2.3). Defra's EfT was used to generate NO_X emissions data for the without and with measure 2018 scenarios for input into the dispersion modelling and the model verified against monitoring data (Appendix A.3). Emissions of NO_X from road vehicles occur primarily in the form of nitrogen oxide, NO, with a relatively small fraction of NO_2 (termed primary NO_2). In ambient air, the NO is oxidised to form NO_2. The modelled road contribution to NOx concentrations was converted to NO_2 using Defra's NOx to NO_2 calculator v6.1[6].

Emissions modelling and dispersion modelling were undertaken for 2018 – selected due to it being the earliest year in which any measure could be implemented. The future year traffic data without the measure were calculated using the baseline traffic flows, increased in line with Tempro growth factors (Appendix A.1, Table A.1.11) but without a change in speed or fleet mix (vehicle classes).

For the modelling, vehicle speeds and flows were varied with period of the day. The speed data were taken directly from the Trafficmaster data; the total daily traffic flows were assigned to the relevant periods of the day using the average proportions for UK traffic (Appendix A.1, Table A.1.12).

The effect(s) of the measure were discussed within the assessment team (air quality and transport planning) and, taking into account the outcome of the Effectiveness Review and professional judgement, the traffic data were manually adjusted to represent the expected effect of the measure on vehicle flows, speeds and fleet mix. Secondary traffic impacts (for example, the effects of changes to vehicle speeds resulting from small changes in vehicle numbers) were not taken into account with the exception that where diversion routes were being modelled the traffic flows on potential diversion routes were increased in line with the expected decrease on the mainline. Details of the adjustments to traffic made for the Pontypridd 'with measures' models are provided in Table 21.

[6] Available at https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc, accessed 02/01/2018

Measures designed to encourage behaviour change (S17/S61/S62/S65/S66) were not modelled explicitly but an estimate of their effectiveness has been made with reference to the modelling of the Behaviour Change measure (S28) under Sustainable Travel.

The Pontypridd model was run using meteorological data from Rhoose Airport.

The indicative emissions data (Step 2) and dispersion model results (Step 3) are provided in Appendix A.4 and Appendix A.5 (Table A.5.3) respectively.

Table 21: Summary Table of Modelled Measures for Pontypridd

Measure	Estimated Change in flow	Estimated Change in Speed	Commentary
S1	Not Modelled		
S4	N/A	N/A	Modelled using ADMS built in noise barrier module with 4m high barriers on both sides of the road
S7	N/A	Where speeds exceed 70kph, set to 70kph	
S10	-3% (Passenger vehicles only, AM and PM)	N/A	Moderate availability of choices for flow management of traffic so medium (~1-3%) reduction in AADT. Affects peaks only
S14	N/A	Set AM speeds to 60kph	Based on increase in speeds of ~20% from literature. No effect outside of congested peaks
S16	-3%	Increase by 20% in AM peak	Availability of choices for redistribution of traffic downstream so medium (~1-3%) reduction in AADT. Change in speed from literature. AM only because of flow characteristics
S18	5% increase	Where speeds exceed 70kph, set to 70kph	Considered likely to attract traffic (high potential 2-5%); Need to limit speeds
S19	-3% (Passenger vehicles only, AM and PM)	N/A	Moderate availability for redistribution of traffic so medium (~1-3%) reduction in AADT. Cars only.
S26	-10% on A470; +1% on Cardiff Road; +4% on A473	50% reduction	Considered likely to deter traffic; Significant reduction in speeds
S27	-3% (Passenger vehicles only, AM and PM)	N/A	Moderate potential for modal shift so medium (~1-3%) reduction in AADT. Affects commuter traffic only.
S28	-5% (Passenger vehicles only, AM and PM)	N/A	High potential for modal shift so high (~2-5%) reduction in AADT. Affects commuter traffic only
S29	-1% (Passenger vehicles only, AM and PM)	N/A	Limited potential for car sharing so low (~1-3%) reduction in AADT. Affects commuter traffic only
S44	Not Modelled (Likely insignificant impact on emissions)		
S46	-2%	N/A	Considered likely to deter traffic; modelled assuming minimum Euro 4/IV standards for vehicles
S51	Not modelled individually		Measure assumed to contribute to S28 – Behaviour Change and S19 – Diversions;
S53	Not Modelled (Likely insignificant impact on emissions)		
S63	-2% (AM and PM only, Proxy for reduced stop start traffic)	(Modelled as flow change)	Based on emissions in congestion and high speed scenarios; measure considered to reduce speed of top 10% of vehicles and increase speed of bottom 10% during peak hours only

M4 J41 – J42, Port Talbot (South Wales and Swansea)

Baseline (2015) traffic data on the M4 between J41 and J42 for the assessment of measures were provided by WSP transport planners based on a combination of vehicles flows and fleet composition from DfT traffic count points and vehicle speeds from Trafficmaster (Appendix A.1, Tables A.1.5 and A.1.10).

The area modelled for the Port Talbot study corridor is shown in Appendix A.2 (Figure A.2.5). Defra's EfT was used to generate NO_X emissions data for the without and with measure 2018 scenarios for input into the dispersion modelling and the model verified against monitoring data (Appendix A.3). Emissions of NO_X from road vehicles occur primarily in the form of nitrogen oxide, NO, with a relatively small fraction of NO_2 (termed primary NO_2). In ambient air, the NO is oxidised to form NO_2. The modelled road contribution to NOx concentrations was converted to NO_2 using Defra's NOx to NO_2 calculator v6.1[7].

Emissions modelling and dispersion modelling were undertaken for 2018 – selected due to it being the earliest year in which any measure could be implemented. The future year traffic data without the measure were calculated using the baseline traffic flows, increased in line with Tempro growth factors (Appendix A.1, Table A.1.11) but without a change in speed or fleet mix (vehicle classes).

For the modelling, vehicle speeds and flows were varied with period of the day. The speed data were taken directly from the Trafficmaster data; the total daily traffic flows were assigned to the relevant periods of the day using the average proportions for UK traffic (Appendix A.1, Table A.1.12).

The effect(s) of the measure were discussed within the assessment team (air quality and transport planning) and, taking into account the outcome of the Effectiveness Review and professional judgement, the traffic data were manually adjusted to represent the expected effect of the measure on vehicle flows, speeds and fleet mix. Secondary traffic impacts (for example, the effects of changes to vehicle speeds resulting from small changes in vehicle numbers) were not taken into account with the exception that where diversion routes were being modelled the traffic flows on potential diversion routes were increased in line with the expected decrease on the mainline. Details of the adjustments to traffic made for the Port Talbot 'with measures' models are provided in Table 22.

Measures designed to encourage behaviour change (S51/S65/S66) were not modelled explicitly but an estimate of their effectiveness has been made with reference to the modelling of the Behaviour Change measure (S28) under Sustainable Travel.

The Port Talbot model was run using meteorological data from Pembrey.

The indicative emissions data (Step 2) and dispersion model results (Step 3) are provided in Appendix A.4 and Appendix A.5 (Table A.5.5) respectively.

Table 22: Summary Table of Modelled Measures for Port Talbot

Measure	Estimated Change in flow	Estimated Change in Speed	Commentary
S1	Not Modelled		
S7	N/A	Where speeds exceed 70kph, set to 70kph	
S14	N/A	+20% in peaks	Change in speed from literature. Both peaks congested so speed change in AM and PM
S16	-3%	+20% in peaks	Moderate availability of choices for flow management of traffic so medium (~1-3%) reduction in AADT. Change in speed from literature. Both peaks congested so speed change in AM and PM

[7] Available at https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc, accessed 02/01/2018

S19	-5% (Passenger vehicles only, AM and PM)	+2% in peaks	Significant potential for diversions so high (~2-5%) reduction in AADT with corresponding slight increase in speeds. Affects peaks only
S28	-3% (Passenger vehicles only, AM and PM)	N/A	Moderate potential for mode shift so medium (~1-3%) reduction in AADT. Peak commuter traffic only.
S44	Not Modelled (Likely insignificant impact on emissions)		
S46	-2%	N/A	Considered likely to deter traffic; modelled assuming minimum Euro 4/IV standards for vehicles
S51	Not modelled individually		Measure assumed to contribute to S28 – Behaviour Change and S19 – Diversions;
S53	Not Modelled (Likely insignificant impact on emissions)		
S63	-2% (AM and PM only, Proxy for reduced stop start traffic)	(Modelled as flow change)	Based on emissions in congestion and high speed scenarios; measure considered to reduce speed of top 10% of vehicles and increase speed of bottom 10% during peak hours only

M4 J25 – J26, Newport (South Wales)

Baseline (2015) traffic data on the M4 between J25 and J26 for the assessment of measures were provided by WSP transport planners based on a combination of vehicles flows and fleet composition from DfT traffic count points and vehicle speeds from Trafficmaster (Appendix A.1, Tables A.1.4 and A.1.9).

The area modelled for the Newport study corridor is shown in Appendix A.2 (Figure A.2.4). Defra's EfT was used to generate NOX emissions data for the without and with measure 2018 scenarios for input into the dispersion modelling and the model verified against monitoring data (Appendix A.3). Emissions of NOX from road vehicles occur primarily in the form of nitrogen oxide, NO, with a relatively small fraction of NO_2 (termed primary NO_2). In ambient air, the NO is oxidised to form NO_2. The modelled road contribution to NOx concentrations was converted to NO_2 using Defra's NOx to NO_2 calculator v6.18.

Emissions modelling and dispersion modelling were undertaken for 2018 – selected due to it being the earliest year in which any measure could be implemented. The future year traffic data without the measure were calculated using the baseline traffic flows, increased in line with Tempro growth factors (Appendix A.1, Table A.1.11) but without a change in speed or fleet mix (vehicle classes).

For the modelling, vehicle speeds and flows were varied with period of the day. The speed data were taken directly from the Trafficmaster data; the total daily traffic flows were assigned to the relevant periods of the day using the average proportions for UK traffic (Appendix A.1, Table A.1.12).

The effect(s) of the measure were discussed within the assessment team (air quality and transport planning) and, taking into account the outcome of the Effectiveness Review and professional judgement, the traffic data were manually adjusted to represent the expected effect of the measure on vehicle flows, speeds and fleet mix. Secondary traffic impacts (for example, the effects of changes to vehicle speeds resulting from small changes in vehicle numbers) were not taken into account with the exception that where diversion routes were being modelled the traffic flows on potential diversion routes were increased in line with the expected decrease on the mainline. Details of the adjustments to traffic made for the Newport 'with measures' models are provided in Table 23.

Measures designed to encourage behaviour change (S51/S65/S66) were not modelled explicitly but an estimate of their effectiveness has been made with reference to the modelling of the Behaviour Change measure (S28) under Sustainable Travel.

The Newport model was run using meteorological data from Rhoose Airport.

[8] Available at https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc, accessed 02/01/2018

The indicative emissions data (Step 2) and dispersion model results (Step 3) are provided in Appendix A.4 and Appendix A.5 (Table A.5.4) respectively.

Table 23: Summary Table of Modelled Measures for Newport

Measure	Estimated Change in flow	Estimated Change in Speed	Commentary
S1	Not modelled		
S7	N/A	Where speeds exceed 70kph, set to 70kph	(Effective in offpeak period only)
S8	N/A	Lights - 8.5% Speed Increase Heavies - 1.5% Speed Increase (Uphill section to the east of Brynglas Tunnels only)	Speed changes from literature assuming medium %HDV and gradient
S14	Not Modelled as it is considered that this measure has no effect given that congestion effects dominated by capacity of tunnels rather than junction merging		
S16	-3%	N/A	No significant speed change due to constraints of Brynglas tunnels
S19	-5% (Passenger vehicles only, AM and PM)	+2% in peaks	Significant potential for diversions so high (~2-5%) reduction in AADT with corresponding slight increase in speeds. Affects peaks only
S28	-5% (Passenger vehicles only, AM and PM)	N/A	Significant potential for mode shift so high (~2-5%) reduction in AADT. Peak commuter traffic only.
S44	Not Modelled (Likely insignificant impact on emissions)		
S46	-3%	N/A	Considered likely to deter traffic; modelled assuming minimum Euro 4/IV standards for vehicles
S51	Not modelled individually		Measure assumed to contribute to S7 - speed limits and S28 – Behaviour Change
S53	Not Modelled (Likely insignificant impact on emissions)		

3.3 OTHER APPRAISALS

All other appraisals against the WelTAG impact areas, the key and secondary criteria for the objective, and consideration for the future generations act are contained within the WelTAG Stage 2 Report. This report does not contain any additional technical information for these sections.

4

DELIVERY CASE

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) – for A494 and A483
- South Wales Trunk Road Agent (SWTRA) – for A470, M4 Newport, and M4 Port Talbot
- 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 the relevant Trunk Road Agent (TRA), therefore NMWTRA for the A494 and A483, and SWTRA for the A470, M4 Newport, and M4 Port Talbot. The TRA staff 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.

Other Third Party Stakeholders

Third party stakeholders may be consulted to support development of the study. Third party consultation will be carried out in a later stage of the WelTAG process.

The Public

Public consultation has not been 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:

- 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

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's) for geographical location of the site. The TRA's 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 measures 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 the five assessments have the potential for immediate implementation, with immediate benefits to the reduction of NO_2. Immediate measures include the low cost, short timeframe measures implemented on a permanent basis, and other low to medium costs measures that could be implemented in a trial basis and then considered for longer term use. These have been summarised in Table 24.

Table 24: Short Term Measures

A494, Deeside	A483, Wrexham	A470, Pontypridd	M4, Port Talbot	M4, Newport
S7 Enforce/ Reduce Speed Limit	S7 Enforce/ Reduce Speed Limit	S7 Enforce/ Reduce Speed Limit	S7 Enforce/ Reduce Speed Limit	S7 Enforce/ Reduce Speed Limit
S17 Variable Message Signs (VMS)	S17 Variable Message Signs (VMS)	S17 Variable Message Signs (VMS)	S19 Variable Diversions	S28 Behaviour Change
S28 Behaviour Change	S28 Behaviour Change	S28 Behaviour Change	S28 Behaviour Change	S51 Intelligent Traffic Management
S62 Signage	S62 Signage	S62 Signage	S63 Distance Chevrons	S65 Air Quality Areas
S63 Distance Chevrons	S65 Air Quality Areas	S63 Distance Chevrons	S65 Air Quality Areas	S66 Air Quality Communications
S65 Air Quality Areas	S66 Air Quality Communications	S65 Air Quality Areas	S66 Air Quality Communications	
S66 Air Quality Communications		S66 Air Quality Communications		

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 have been summarised in Table 25.

Table 25: Long Term Measures

A494, Deeside	A483, Wrexham	A470, Pontypridd	M4, Port Talbot	M4, Newport
S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers	S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers	S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers	S7 Enforce/ Reduce Speed Limit	S7 Enforce/ Reduce Speed Limit
S7 Enforce/ Reduce Speed Limit	S7 Enforce/ Reduce Speed Limit	S7 Enforce/ Reduce Speed Limit	S14 Ramp Metering	S16 Junction Closures
S10 Flow Management (Upstream)	S10 Flow Management (Upstream)	S10 Flow Management	S16 Junction Closures	S19 Variable Diversions
S14 Ramp Metering	S16 Junction Closures	S14 Ramp Metering	S19 Variable Diversions	S28 Behaviour Change
S17 Variable Message Signs (VMS)	S17 Variable Message Signs (VMS)	S16 Junction Closures	S28 Behaviour Change	S46 Clean Air Zones/ Low Emission Zones
S19 Variable Diversions	S19 Variable Diversions	S17 Variable Message Signs (VMS)	S46 Clean Air Zones/ Low Emission Zones	S51 Intelligent Traffic Management
S28 Behaviour Change	S28 Behaviour Change	S19 Variable Diversions	S51 Intelligent Traffic Management	S66 Air Quality Communications
S46 Clean Air Zones/ Low Emission Zones	S46 Clean Air Zones/ Low Emission Zones	S27 Parking Improvement	S65 Air Quality Areas	
S51 Intelligent Traffic Management	S51 Intelligent Traffic Management	S28 Behaviour Change	S66 Air Quality Communications	
S62 Signage	S62 Signage	S29 Car Sharing		
S65 Air Quality Areas	S65 Air Quality Areas	S46 Clean Air Zones/ Low Emission Zones		
S66 Air Quality Communications	S66 Air Quality Communications	S51 Intelligent Traffic Management		
		S62 Signage		
		S65 Air Quality Areas		
		S66 Air Quality Communications		

5

FINANCIAL CASE

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 to a point, though the measures identified with High costs (£2m+) will need the affordability re-evaluated when detailed designs are available at Stage 3.

6

COMMERCIAL CASE

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 SUMMARY AND NEXT STEPS

7.1 OVERVIEW

An overview of the assessment undertaken and the next steps required is outlined for each of the 5 study corridors in the respective Stage 2 reports. The following section provides a summary of the short term and long term measures selected to be taken forward from stage 2.

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 immediate benefits to the reduction of NO_2. Immediate measures include the low cost, short timeframe measures implemented on a permanent basis, and other low to medium costs measures that could be implemented in a temporary basis. Table 26 outlines the short term measures for each of the 5 study corridors.

7.2.2 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 outlined in Table 27.

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. This includes the Future Generations framework, which should:

"enable the public sector in Wales to deliver a transport system which is fit for the future by giving us travel measures that are low- or zero-carbon, mitigating air pollution problems, catalysing the green economy and making people, goods and services mobile in ways that do not cost the earth."

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

Table 26: Short Term Measures

A494, Deeside		A483, Wrexham		A470, Pontypridd		M4, Port Talbot		M4, Newport	
S7 Enforce/ Reduce Speed Limit	Emissions reduced by up to 17%; Roadside concentrations reduced by up to 6.9ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 18%; Roadside concentrations reduced by up to 6.9ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 11%; Roadside concentrations reduced by up to 12.0ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 8%; Roadside concentrations reduced by up to 3.5ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 4%; Roadside concentrations reduced by up to 3.8ug/m3
S17 Variable Message Signs (VMS)	Emissions reduced by up to 1%	**S17 Variable Message Signs (VMS)**	Emissions reduced by up to 1%	**S17 Variable Message Signs (VMS)**	Emissions reduced by up to 1%	**S19 Variable Diversions**	Emissions reduced by up to 3%; Roadside pollutant concentrations reduced by 0.8ug/m3	**S28 Behaviour Change**	Emissions may reduce by up to 3%; Roadside pollutant concentrations reduce by up to 1.2ug/m3.
S28 Behaviour Change	Emissions may reduce by up to 1%; Roadside pollutant concentrations reduce by up to 0.4ug/m3.	**S28 Behaviour Change**	Emissions may reduce by up to 1%; Roadside pollutant concentrations reduce by up to 0.4ug/m3.	**S28 Behaviour Change**	Emissions may reduce by up to 2%; Roadside pollutant concentrations reduce by up to 1.9ug/m3.	**S28 Behaviour Change**	Emissions may reduce by up to 2%; Roadside pollutant concentrations reduce by up to 0.5ug/m3.	**S51 Intelligent Traffic Management**	Emissions are estimated to reduce by up to 5%
S62 Signage	Emissions reduced by up to 1%	**S62 Signage**	Emissions reduced by up to 1%	**S62 Signage**	Emissions reduced by up to 1%	**S63 Distance Chevrons**	Emissions reduced by up to <0.5%; Roadside pollutant concentrations reduced by up to 0.1ug/m3.	**S65 Air Quality Areas**	Emissions reduced by up to 1%
S63 Distance Chevrons	Emissions reduced by <0.5%; Roadside pollutant concentrations reduce by up to 0.1ug/m3.	**S65 Air Quality Areas**	Emissions reduced by up to 1%	**S63 Distance Chevrons**	Emissions reduced by up to <0.5%; Roadside pollutant concentration reduced by up to 0.2ug/m3.	**S65 Air Quality Areas**	Emissions reduced by up to 1%	**S66 Air Quality Communications**	Emissions reduced by up to 1% (due to communications alone)
S65 Air Quality Areas	Emissions reduced by up to 1%	**S66 Air Quality Communications**	Emissions reduced by up to 1% (due to communications alone)	**S65 Air Quality Areas**	Emissions reduced by up to 1%	**S66 Air Quality Communications**	Emissions reduced by up to 1% (due to communications alone)		
S66 Air Quality Communications	Emissions reduced by up to 1% (due to communications alone)			**S66 Air Quality Communications**	Emissions reduced by up to 1% (due to communications alone)				

Table 27: Long Term Measures

A494, Deeside		A483, Wrexham		A470, Pontypridd		M4, Port Talbot		M4, Newport	
S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers	Emissions Reduction = 0%; Concentration Reduction up to 4.5ug/m3	**S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers**	Emissions Reduction = 0%; Concentration Reduction up to 3.9ug/m3	**S4 Air Quality Screening/ Fencing/ Canopy/ Environmental Barriers**	Emissions Reduction = 0%; Concentration Reduction up to 9.3ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 8%; Roadside concentrations reduced by up to 3.5ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 4%; Roadside concentrations reduced by up to 3.8ug/m3
S7 Enforce/ Reduce Speed Limit	Emissions reduced by up to 17%; Roadside concentrations reduced by up to 6.9ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 18%; Roadside concentrations reduced by up to 6.9ug/m3	**S7 Enforce/ Reduce Speed Limit**	Emissions reduced by up to 11%; Roadside concentrations reduced by up to 12.0ug/m3	**S14 Ramp Metering**	Emissions reduced by up to 1% near junction; Roadside pollutant concentrations reduced by 0.4ug/m3.	**S16 Junction Closures**	Emissions reduced by up to 2% near junction; Roadside pollutant concentrations reduced by 0.6ug/m3.
S10 Flow Management (Upstream)	missions reduced by up to 2%; Roadside concentrations reduced by up to 0.8ug/m3	**S10 Flow Management (Upstream)**	Emissions reduced by up to 1%; Roadside concentrations reduced by up to 0.4ug/m3	**S10 Flow Management**	Emissions reduced by up to 3%; Roadside concentrations reduced by up to 1.8ug/m3	**S16 Junction Closures**	Emissions reduced by up to 3% near junction; Roadside pollutant concentrations reduced by 0.4ug/m3.	**S19 Variable Diversions**	Emissions reduced by up to 5% Roadside pollutant concentrations reduced by 2.0ug/m3
S14 Ramp Metering	Emissions reduced by up to 0.5% near junction; Roadside pollutant concentrations reduced by 0.6ug/m3.	**S16 Junction Closures**	Emissions reduced by up to 1% near junction; Roadside pollutant concentrations reduced by 0.3ug/m3.	**S14 Ramp Metering**	Emissions reduced by up to 0.3% near junction; Roadside pollutant concentrations reduced by 0.2ug/m3.	**S19 Variable Diversions**	Emissions reduced by up to 3%; Roadside pollutant concentrations reduced by 0.8ug/m3	**S28 Behaviour Change**	Emissions may reduce by up to 3%; Roadside pollutant concentrations reduce by up to 1.2ug/m3.
S17 Variable Message Signs (VMS)	Emissions reduced by up to 1%	**S17 Variable Message Signs (VMS)**	Emissions reduced by up to 1%	**S16 Junction Closures**	Emissions reduced by up to 2% near junction; Roadside pollutant concentrations reduced by 1.2ug/m3.	**S28 Behaviour Change**	Emissions may reduce by up to 2%; Roadside pollutant concentrations reduce by up to 0.5ug/m3.	**S46 Clean Air Zones/ Low Emission Zones**	If vehicles are limited to Euro 4 and above, emissions may reduce by up to 5% (or greater); Roadside pollutant concentration reduced by up to 2.0ug/m3.
S19 Variable Diversions	Emissions reduced by up to 2%; Roadside pollutant concentrations reduced by 0.8ug/m3	**S19 Variable Diversions**	Emissions reduced by up to 3%; Roadside pollutant concentrations reduced by 1.0ug/m3	**S17 Variable Message Signs (VMS)**	Emissions reduced by up to 1%	**S46 Clean Air Zones/ Low Emission Zones**	If vehicles are limited to Euro 4 and above, emissions may reduce by up to 3% (or greater); Roadside pollutant concentration change by 1.0ug/m3.	**S51 Intelligent Traffic Management**	The measure could be used to set variable speed limits in the off-peak period which will provide users with real-time air quality information
S28 Behaviour Change	Emissions may reduce by up to 1%; Roadside pollutant concentrations reduce by up to 0.4ug/m3.	**S28 Behaviour Change**	Emissions may reduce by up to 1%; Roadside pollutant concentrations reduce by up to 0.4ug/m3.	**S19 Variable Diversions**	Emissions reduced by up to 2%; Roadside pollutant concentrations reduced by 1.5ug/m3	**S51 Intelligent Traffic Management**	Emissions are estimated to reduce by up to 2%.	**S66 Air Quality Communications**	Emissions reduced by up to 1% (due to communications alone)
S46 Clean Air Zones/ Low Emission Zones	If vehicles are limited to Euro 4 and above, emissions may reduce by up to 5% (or greater); Roadside pollutant concentration change by 2.2ug/m3.	**S46 Clean Air Zones/ Low Emission Zones**	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.	**S27 Parking Improvement**	Emissions may reduce by up to 2%; Roadside pollutant concentrations reduce by up to 1.0ug/m3.	**S65 Air Quality Areas**	Emissions reduced by up to 1%		

A494, Deeside		A483, Wrexham		A470, Pontypridd		M4, Port Talbot		M4, Newport	
S51 Intelligent Traffic Management	Emissions are estimated to reduce by up to 2%.	**S51 Intelligent Traffic Management**	Emissions are estimated to reduce by up to 2%.	**S28 Behaviour Change**	Emissions may reduce by up to 2%; Roadside pollutant concentrations reduce by up to 1.9ug/m3.	**S66 Air Quality Communications**	Emissions reduced by up to 1% (due to communications alone)		
S62 Signage	Emissions reduced by up to 1%	**S62 Signage**	Emissions reduced by up to 1%	**S29 Car Sharing**	Emissions may reduce by up to 1%; Roadside pollutant concentrations reduce by up to 0.4ug/m3.				
S65 Air Quality Areas	Emissions reduced by up to 1%	**S65 Air Quality Areas**	Emissions reduced by up to 1%	**S46 Clean Air Zones/ Low Emission Zones**	If vehicles are limited to Euro 4 and above, emissions may reduce by up to 3% (or greater); Roadside pollutant concentration reduce by up to 2.4ug/m3.				
S66 Air Quality Communications	Emissions reduced by up to 1% (due to communications alone)	**S66 Air Quality Communications**	Emissions reduced by up to 1% (due to communications alone)	**S51 Intelligent Traffic Management**	Emissions are estimated to reduce by up to 2%.				
				S62 Signage	Emissions reduced by up to 1%				
				S65 Air Quality Areas	Emissions reduced by up to 1%				
				S66 Air Quality Communications	Emissions reduced by up to 1% (due to communications alone)				

APPENDIX A – TRAFFIC DATA FOR AIR QUALITY APPRAISAL

A.1 TRAFFIC DATA SUMMARY

The tables below present a summary of the baseline 2015 traffic data with flows and fleet mix supplied from DfT traffic count points and vehicle speeds provided by Trafficmaster. Speed data provided by period of day, defined as

AM Peak = 07:00 – 10:00

Inter Peak = 10:00 – 16:00

PM Peak = 16:00 – 19:00

Off Peak = 00:00 – 07:00; 19:00 – 00:00

Table A.1.1 – Summary data for Deeside Baseline 2015 (Daily Vehicle Flows and Composition)

Road	Street Name/Description	Two way flow	% Cars	% HGV	% LGV	% Bus and Coach	% Motor-cycle
A494	Aston Hill	70994	80.91%	5.57%	12.82%	0.25%	0.69%
A494	A494 near River Dee	63469	81.63%	6.63%	11.31%	0.27%	0.43%
A494	Bypass Road	72387	78.55%	6.63%	14.14%	0.43%	0.68%
A550	Gladstone Way	6170	84.20%	2.58%	12.14%	1.36%	1.09%
A548	Shotwick Road	15059	75.06%	9.77%	13.62%	0.55%	1.54%
A494	Welsh Road	47876	76.92%	7.77%	14.78%	0.25%	0.53%

Table A.1.2 – Summary data for Wrexham baseline 2015 (Daily Vehicle Flows and Composition)

Road	Street Name/Description	Two way flow	% Cars	% HGV	% LGV	% Bus and Coach	% Motor-cycle
A5156	A5156 west of A483 junction 6	21699	74.65%	9.53%	15.23%	0.39%	0.59%
A483	A483 south of junction 5	49054	78.53%	6.37%	14.86%	0.53%	0.23%
A483	A483 north of junction 5	50271	80.54%	5.50%	13.41%	0.37%	0.55%
A483	A483 north of junction 6	42724	75.24%	9.03%	15.20%	0.43%	0.53%
A5152	Chester road	10583	87.49%	2.54%	9.56%	1.64%	0.39%
A541	Mold Road north of A483 junction 5	15365	85.14%	2.04%	12.44%	0.53%	0.39%
A541	Mold Road south of A483 junction 5	17704	86.22%	2.66%	10.63%	1.70%	0.49%

Table A.1.3 – Summary data for Pontypridd Baseline 2015 (Daily Vehicle Flows and Composition)

Road	Street Name/Description	Two way flow	% Cars	% HGV	% LGV	% Bus and Coach	% Motor-cycle
A470	A470 South of Pontypridd	72540	84.59%	3.30%	11.63%	0.43%	0.49%
A470	A470 Llantrisant exit	57732	82.83%	3.38%	13.23%	0.55%	0.55%
A470	A470 near centre of Pontypridd	31176	75.21%	4.80%	19.68%	0.37%	0.30%
A4223	Bridge Street	13314	79.16%	7.80%	12.59%	6.56%	0.45%
A4058	Broadway	25625	80.94%	3.61%	14.79%	1.93%	0.66%

Road	Street Name/Description	Two way flow	% Cars	% HGV	% LGV	% Bus and Coach	% Motor-cycle
A473	Broadway	142867	99.03%	0.97%	0.00%	0.00%	0.00%
A4054	Cardiff Road	7464	80.80%	3.59%	14.92%	2.84%	0.66%
A4054	Coedpenmaen Road	6421	82.85%	1.67%	15.06%	0.50%	0.42%
A4054	College way	7464	80.80%	3.59%	14.92%	2.84%	0.66%
A4054	Merthyr Road	6421	82.85%	1.67%	15.06%	0.50%	0.42%
A473	Park Street	7219	99.26%	0.74%	0.00%	0.00%	0.00%
A4054	Pentrebach Road	6421	82.85%	1.67%	15.06%	0.50%	0.42%
A473	River Street	7219	99.26%	0.74%	0.00%	0.00%	0.00%
A4058	Sardis Road	25625	80.94%	3.61%	14.79%	1.93%	0.66%

Table A.1.4 – Summary data for Newport Baseline 2015 (Daily Vehicle Flows and Composition)

Road	Street Name/Description	Two way flow	% Cars	% HGV	% LGV	% Bus and Coach	% Motor cycle
M4	M4 west of junction 26	114773	78.22%	8.43%	12.89%	0.49%	0.46%
A4042	South of junction 25a	18678	95.11%	4.89%	0.00%	0.00%	0.00%
M4	M4 east of junction 25a	113793	75.10%	10.38%	14.21%	0.32%	0.31%
M4	M4 west of junction 25a	81972	75.54%	10.09%	13.81%	0.60%	0.56%
A4042	After junction 25A slip road	9876	95.67%	4.33%	0.00%	0.00%	0.00%
A4051	Malpas road south of junction 26	22005	80.90%	5.26%	13.26%	3.28%	0.58%
B4596	Caerleon Road	7053	96.47%	3.53%	0.00%	0.00%	0.00%
B4596	Church Road	7053	96.47%	3.53%	0.00%	0.00%	0.00%
B4591	Clarence Place	7053	96.47%	3.53%	0.00%	0.00%	0.00%
A4051	Malpas road north of junction 26	35094	81.42%	4.01%	13.94%	1.57%	0.63%

Table A.1.5 – Summary data for Port Talbot Baseline 2015 (Daily Vehicle Flows and Composition)

Road	Street Name/Description	Two way flow	% Cars	% HGV	% LGV	% Bus and Coach	% Motor-cycle
A48	A48 between M4 junction 41 and 42	25608	76.53%	3.39%	19.51%	1.01%	0.57%
A48	A48 east of M4 junction 42	27346	81.98%	3.09%	14.23%	0.55%	0.71%
M4	M4 north of Port Talbot	79296	77.85%	6.41%	15.30%	0.24%	0.44%
M4	Slip road off and on junction 41	14250	77.65%	4.20%	17.76%	0.62%	0.40%
M4	M4 south of junction 41	65656	74.80%	8.28%	16.74%	0.42%	0.18%
A48	Dinas Baglan Road	7717	86.41%	2.41%	10.70%	1.59%	0.48%
A48	Heilbronn Way	15651	98.26%	6.95%	0.00%	0.00%	0.00%
A48	Pentwyn Baglan Road	7717	86.41%	2.41%	10.70%	1.59%	0.48%
A48	Pentyla-Baglan Road	7717	86.41%	2.41%	10.70%	1.59%	0.48%
A48	Sarnfan Baglan Road	7717	86.41%	2.41%	10.70%	1.59%	0.48%
A4241	Seaway Parade	3112	98.28%	2.40%	0.00%	0.00%	0.00%

Table A.1.6 – Speed data for Deeside PCM links produced by Trafficmaster

		Speed (kph)			
Road	Trafficmaster Link ID	AM	IP	PM	OP
A494	4000000013567396A	74	78	76	85
A494	4000000013087603A	73	95	91	100
A494	4000000013087606A	88	91	84	95
A494	4000000013087607A	72	97	96	101
A494	4000000013087602A	92	94	88	98
A494	4000000013087614A	71	95	95	99
A494	4000000013087613A	86	89	82	92
A494	4000000013087610A	84	86	80	90
A494	4000000013087612A	75	96	93	99
A494	4000000013087616A	68	83	82	90
A494	4000000013087624A	75	80	79	88
A494	4000000013087611A	87	89	84	94
A494	4000000013087649A	79	80	75	85
A494	4000000013087633A	80	81	80	87
A494	4000000013087650A	77	81	79	87
A494	4000000013087642A	76	79	75	85
A494	4000000013087661A	76	79	76	85
A494	4000000013087630A	80	82	77	87
A494	4000000013048007A	83	84	82	91
A494	4000000013087615A	66	91	89	96
A494	4000000013097270A	106	107	109	110
A494	4000000013097266A	96	99	94	105
A494	4000000013097269A	105	106	108	110
A494	**4000000013097227A**	**103**	**95**	**57**	**102**
A494	4000000013095287B	79	77	69	84
A494	4000000013087628B	82	78	62	85
A494	4000000013087625B	80	77	67	84
A494	4000000013087644B	81	78	66	85
A494	4000000013087643B	79	76	65	83
A494	4000000013087648B	81	78	64	83
A494	4000000013087634B	84	80	70	85
A494	4000000013087646B	84	80	62	86
A494	4000000013087627B	81	77	66	84
A494	4000000013087617B	77	76	70	83
A494	**4000000013097226B**	**102**	**105**	**107**	**110**
A494	4000000013097268B	105	93	45	100
A494	4000000013097271B	103	89	38	98
A494	4000000013097265B	83	77	56	87
A494	4000000013097264B	96	84	39	95

Links shown in bold red text used to calculate indicative emission change on PCM link (2-way)

Table A.1.7 – Speed data for Wrexham PCM links produced by Trafficmaster

		Speed (kph)			
Road	Trafficmaster Link ID	AM	IP	PM	OP
A483	4000000013073102A	99	100	102	106
A484	4000000013073085A	103	108	105	111
A485	4000000013077274A	102	103	103	109
A486	**4000000013077271A**	**103**	**102**	**104**	**110**
A487	4000000013073084B	105	109	112	113
A488	4000000013075037B	97	101	102	106
A489	4000000013077276B	107	109	111	112
A490	4000000013077286B	105	107	107	109
A491	**4000000013077270B**	**97**	**98**	**99**	**103**
A492	4000000013077294B	9	9	7	11
A493	4000000013077273B	98	102	102	106

Links shown in bold red text used to calculate indicative emission change on PCM link (2-way)

Table A.1.8 – Speed data for Pontypridd PCM links produced by Trafficmaster

		Speed (kph)			
Road	Trafficmaster Link ID	AM	IP	PM	OP
A470	4000000021668886A	61	101	103	99
A470	4000000021669247A	95	96	92	101
A470	4000000021669216A	85	95	92	100
A470	4000000021616901A	94	98	94	102
A470	4000000021625518A	95	98	92	102
A470	4000000021625536A	105	105	105	109
A470	4000000021625539A	97	97	94	102
A470	**4000000022098280A**	**97**	**96**	**94**	**101**
A470	4000000021668885B	101	103	84	107
A470	4000000021616887B	67	105	112	109
A470	4000000021616921B	98	100	90	105
A470	4000000021640628B	88	89	71	94
A470	4000000021616920B	62	98	104	100
A470	4000000021616886B	103	104	91	110
A470	4000000021640629B	49	74	78	75
A470	4000000021640799B	56	97	100	95
A470	4000000021640739B	57	96	100	95
A470	4000000021669248B	54	95	98	93
A470	4000000021616902B	61	96	100	96
A470	4000000021625519B	61	96	100	96
A470	**4000000022098279B**	**54**	**92**	**96**	**90**

Links shown in bold red text used to calculate indicative emission change on PCM link (2-way)

Table A.1.9 – Speed data for Newport PCM links produced by Trafficmaster

		Speed (kph)			
Road	Trafficmaster Link ID	AM	IP	PM	OP
M4	4000000021693227A	83	87	85	96
M4	4000000021693343A	87	86	91	97
M4	4000000021693291A	85	85	87	98
M4	4000000021693346A	95	92	100	107
M4	4000000021693344A	62	70	40	78
M4	4000000021633041A	83	87	85	96
M4	4000000021633053A	93	93	99	106
M4	4000000021633078A	90	92	97	103
M4	**4000000021633056A**	**88**	**87**	**92**	**100**
M4	4000000021633036A	84	87	85	97
M4	4000000021780847A	93	92	96	109
M4	4000000021780848A	88	87	90	101
M4	4000000021621396A	90	92	97	102
M4	4000000021654937A	126	127	128	144
M4	4000000021654938A	85	84	87	97
M4	4000000021765076A	87	86	89	99
M4	4000000021633079B	71	78	37	93
M4	4000000021633052B	68	75	38	87
M4	4000000021693345B	66	72	38	82
M4	4000000021693226B	81	92	84	100
M4	4000000021693288B	69	72	66	83
M4	4000000021633039B	80	88	82	96
M4	**4000000021633057B**	**63**	**71**	**44**	**81**
M4	4000000021780849B	69	73	66	83
M4	4000000021621395B	74	80	36	98
M4	4000000021654939B	68	72	66	83
M4	4000000021654975B	92	90	95	102
M4	4000000021654936B	109	117	109	132
M4	4000000021654974B	64	71	40	79
M4	4000000021654905B	81	94	85	101
M4	4000000021765075B	79	85	72	96

Links shown in bold red text used to calculate indicative emission change on PCM link (2-way)

Table A.1.10 – Speed data for Port Talbot PCM links produced by Trafficmaster

		Speed (kph)			
Road	Trafficmaster Link ID	AM	IP	PM	OP
M4	4000000020930694A	67	95	81	105
M4	4000000020915207A	58	97	77	108
M4	4000000020942146B	90	93	70	100
M4	4000000020930691B	88	89	64	99
M4	4000000020930681B	91	94	70	102
M4	4000000020930693B	89	91	68	100
M4	4000000020930692B	67	95	81	104
M4	**4000000020918502B**	**49**	**90**	**63**	**100**
M4	4000000020915208B	92	98	78	107
M4	**4000000020918503B**	**88**	**94**	**73**	**101**
M4	4000000020918501B	40	69	47	75
M4	4000000020972318B	51	95	71	106
M4	4000000020955782B	87	88	65	99
M4	4000000020923188B	66	70	52	75
M4	4000000020923192B	72	76	65	78
M4	4000000020923356B	68	93	81	104
M4	4000000020923357B	87	89	67	99
M4	4000000020965958B	90	97	75	106
M4	4000000020930092B	59	69	62	73

Links shown in bold red text used to calculate indicative emission change on PCM link (2-way)

Table A.1.11 – Traffic growth factors used to scale 2015 Baseline flow data to 2018 / 2022 (Factors produced by TEMPro)

	2018	2022
Deeside	1.04	1.07
Wrexham	1.04	1.09
Pontypridd	1.04	1.08
Newport	1.04	1.08
Port Talbot	1.04	1.08

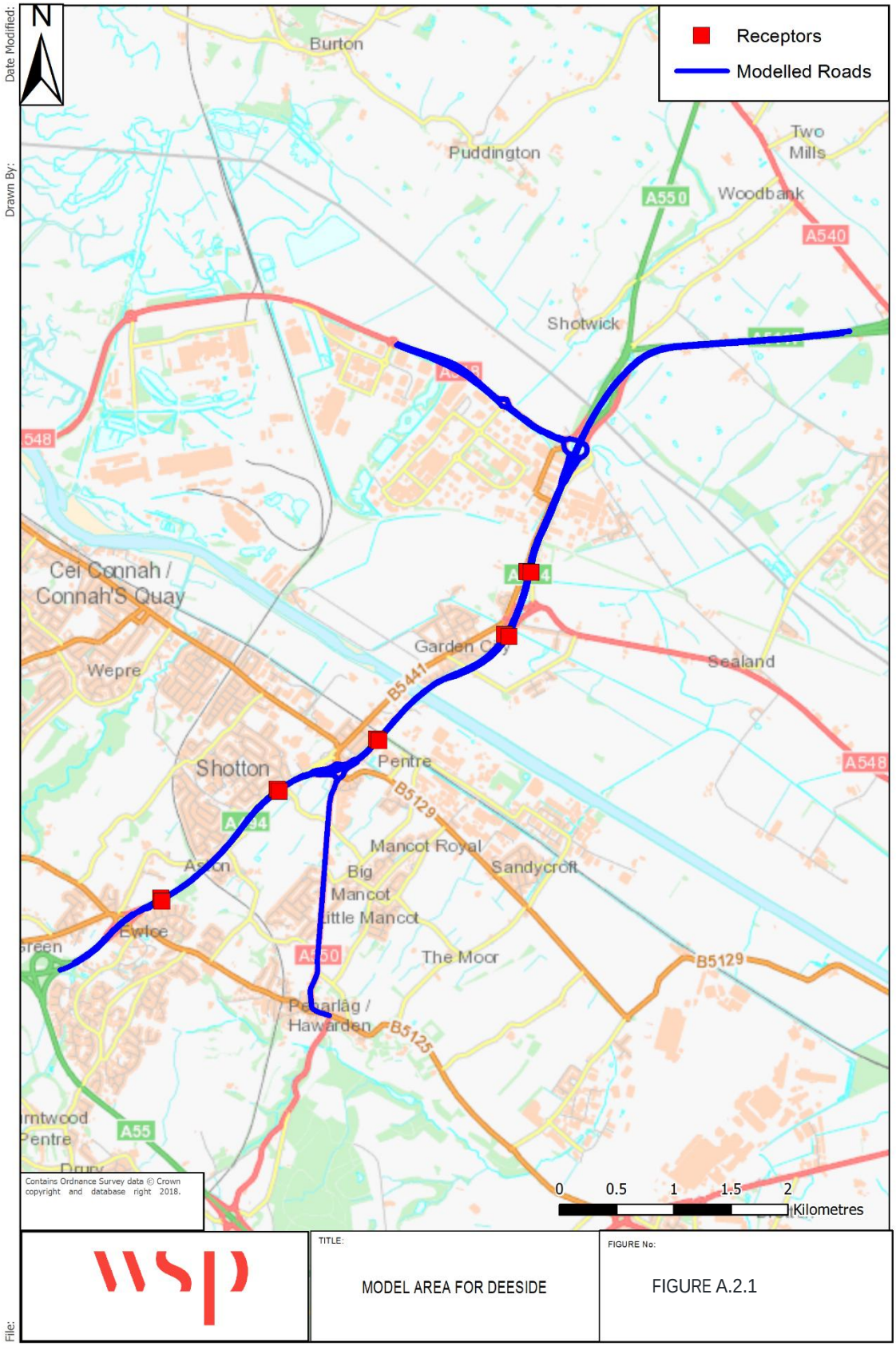
Table A.1.12 – Proportion of daily traffic assumed for each time period (Obtained from DfT[9])

Period	Period Factor
AM	18.06%
IP	39.03%
PM	21.53%
OP	21.38%

[9] DfT (2015) Traffic distribution by time of day on all roads in Great Britain. Accessed via: Traffic (www.gov.uk/government/organisations/department-for-transport/series/road-traffic-statistics)

A.2 MODEL EXTENTS

Figures A.2.1 to A.2.5 show the modelled extents for the 5 study locations.
The modelled roads are shown in blue.
The receptors at which impacts were assessed are shown as red squares. These receptors are located at a distance of 4m from the roadside (as in the PCM model), and at 0m height.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Puddington
Two Mills
Woodbank
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A540
Shotwick
A548
Cei Connah / Connah'S Quay
Wepre
Garden City
Sealand
B5441
A548
Shotton
Pentre
B5129
Mancot Royal
Sandycroft
Big Mancot
Little Mancot
Ewloe
The Moor
B5129
Penarlâg / Hawarden
B5125
A55
Contains Ordnance Survey data © Crown copyright and database right 2018.
0 0.5 1 1.5 2
Kilometres
TITLE:
MODEL AREA FOR DEESIDE
FIGURE No:
FIGURE A.2.1


Date Modified:
Drawn By:
N
Receptors
Modelled Roads
Ty Newydd
Bryn Alyn Farm
Green Pastures
Wilderness Mill Farm
Bradley
The W auns
Gwersyllt Hall Farm
Gwersyllt
Pant-yr-Ochain Farm
Little Acton
Highfield
Northcott
White House
The Hawthorns
Stansty
Garden Village
Borras
Acton
Croes Eneurys
Pendine Farm
Plas Coch
Rhosddu
Maes-y-Dre
Rhosnesni
Wrexham General
Wrecsam
Wrexham
Wrexham Central
Lower
A541
B5425
B5445
A5156
A5152
A483
A541
B5101
B5433
B5100
A534
A525
Contains Ordnance Survey data © Crown copyright and database right 2018.
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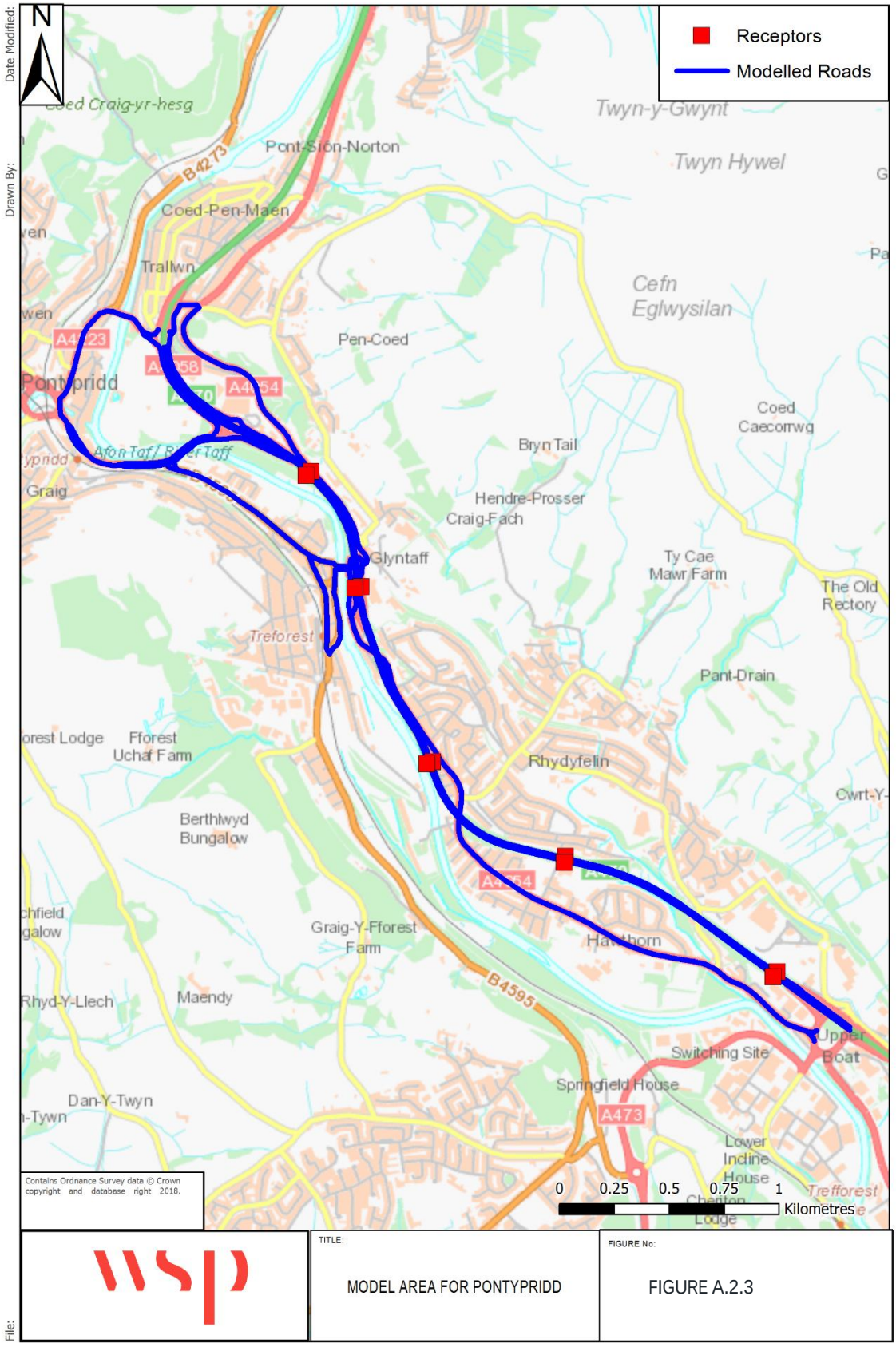
Kilometres
TITLE:
MODEL AREA FOR WREXHAM
FIGURE A.2.2
File:


Date Modified:
Drawn By:
File:
N
Receptors
Modelled Roads
Twyn-y-Gwynt
Twyn Hywel
Pont-Sion-Norton
B4273
Coed-Pen-Maen
Trallwn
Cefn Eglwysilan
Pen-Coed
Pontypridd
Afon Taf / River Taff
Graig
Bryn Tail
Hendre-Prosser
Craig-Fach
Coed Caecornwg
Glyntaff
Ty Cae Mawr Farm
The Old Rectory
Treforest
Pant-Drain
Fforest Uchaf Farm
Rhydyfelin
Berthlwyd Bungalow
Graig-Y-Fforest Farm
Maendy
Rhyd-Y-Llech
Dan-Y-Twyn
Switching Site
Springfield House
A473
Lower Incline House
Trefforest
B4595
Contains Ordnance Survey data © Crown copyright and database right 2018.
0 0.25 0.5 0.75 1
Kilometres
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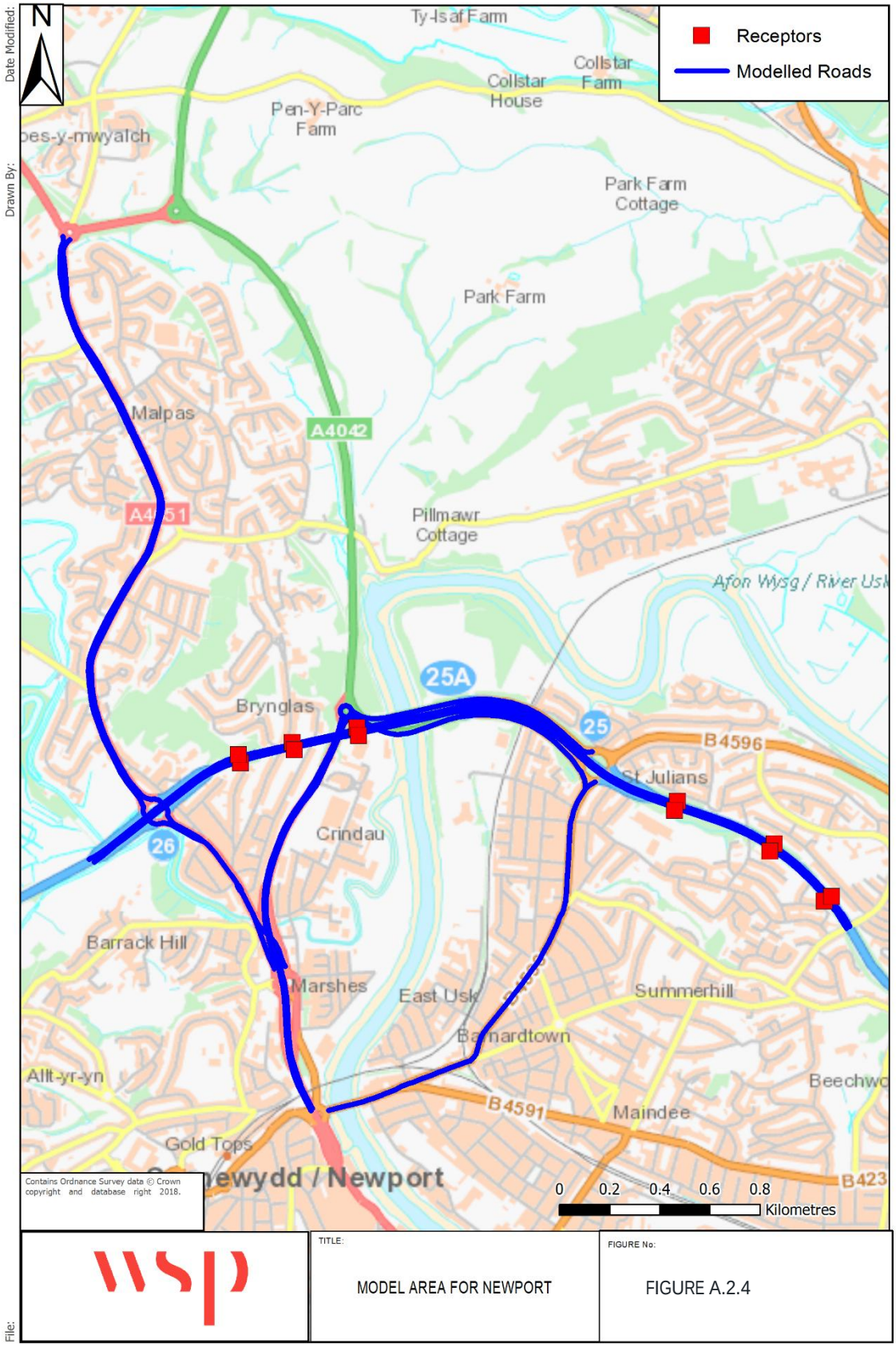
MODEL AREA FOR PONTYPRIDD
FIGURE No:
FIGURE A.2.3


Date Modified:
Drawn By:
File:
N
Receptors
Modelled Roads
Ty-Isaf Farm
Collstar Farm
Collstar House
Pen-Y-Parc Farm
Park Farm Cottage
Park Farm
Malpas
A4042
Pillmawr Cottage
Afon Wysg / River Usk
25A
Brynglas
25
B4596
St Julians
26
Crindau
Barrack Hill
Marshes
East Usk
Summerhill
Allt-yr-yn
B4591
Maindee
Gold Tops
B423
Contains Ordnance Survey data © Crown copyright and database right 2018.
0 0.2 0.4 0.6 0.8
Kilometres
TITLE:
MODEL AREA FOR NEWPORT
FIGURE No:
FIGURE A.2.4


Date Modified:
Drawn By:
File:
N
Receptors
Modelled Roads
A474
Brynhyfryd
Cwrt Sart
Ynysmaerdy
Giants Grave
Briton Ferry
Cwm-Nant-Yr-Arllwys
Goytre
Pant-Howel-Ddu
Gelli-Gaer-Fach
Gelli-Gaer-Fawr
Yr Hen Dy
Shelone
Warren Hill
Llansawel / Briton Ferry
Daren Wen
Mynydd-y-Gaer
Tyle'r-Fedwen
Blaen-Baglan
Cwmdais Farm
Mynydd Dinas
Aberavon Sands
Sandfields
Corlannau
A4107
Velindre
Llety'harri
Port Talbot
A4241
Aberavon
Port Talbot Parkway
Pen-y-cae
Contains Ordnance Survey data © Crown copyright and database right 2018.
0 0.3 0.6 0.9 1.2
Kilometres
TITLE:
MODEL AREA FOR PORT TALBOT
FIGURE No:
FIGURE A.2.5

A.3 DISPERSION MODEL VERIFICATION

Dispersion modelling is an inherently uncertain procedure with potential errors in the model output arising from both systematic and random errors.

Systematic errors occur where a distinct trend is apparent in the model output i.e. a tendency to under or over predict known values. This type of error may arise where emissions have been underestimated, or unrepresentative meteorological data used. Whilst it is rarely possible to identify a specific reason for the systematic error, the errors can be quantified and allowed for by comparing modelled concentrations against monitored concentrations in order to derive a scaling factor (the process is termed model verification). Monitored data itself has an associated uncertainty which must be borne in mind.

In the adjustment for systematic errors, it is best to calculate the scaling factor using the monitoring sites that best represent the exposure of the receptors being assessed.

Random errors, as the name suggests, do not show a distinct trend and result in a scatter of modelled concentrations about monitored data even after an allowance for systematic error has been made. The degree of uncertainty i.e. random error, in the model results may be estimated by calculating the standard deviation of the verified modelled results.

Since the correction of the modelled results relates to the road-side component of the pollutant only, the scaling factor is calculated by first removing the background contribution to the monitored and modelled concentrations and then comparing the roadside components only.

Following the methodology set out in LAQM TG(16), the verification is based on road contribution to nitrogen oxides. The Defra LAQM NO_X to NO_2 calculator (v6.1) has been used to calculate the road contribution NO_X from the diffusion tube data.

Three verification factors were derived for the study:

- North Wales: Covering Deeside and Wrexham, but based on Wrexham County Borough Council monitoring for 2015 only since no appropriate data were identified for Deeside – Factor = 3.58
- South Wales Non-Motorway Covering Pontypridd model, based on Rhondda Cynon Taf County Borough Council air quality monitoring for 2015 – Factor = 5.46
- South Wales Motorway: Covering Newport and Port Talbot, but based on Newport City Council monitoring for 2015 only since no appropriate data were identified for Port Talbot – Factor = 2.36

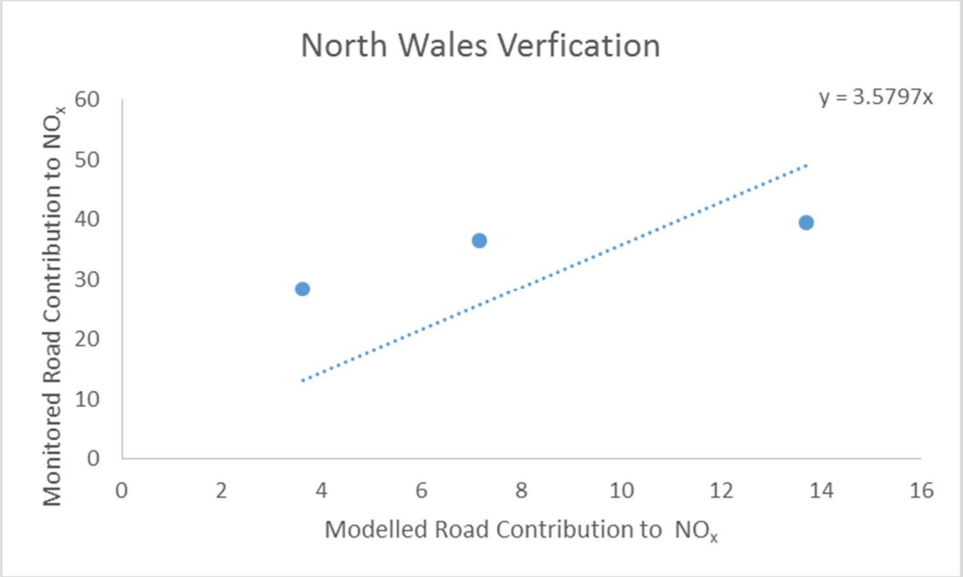


Figure A.3.1 – Derivation of North Wales verification factor based on Wrexham County Borough Council's monitoring. Concentrations plotted in µg/m^3.

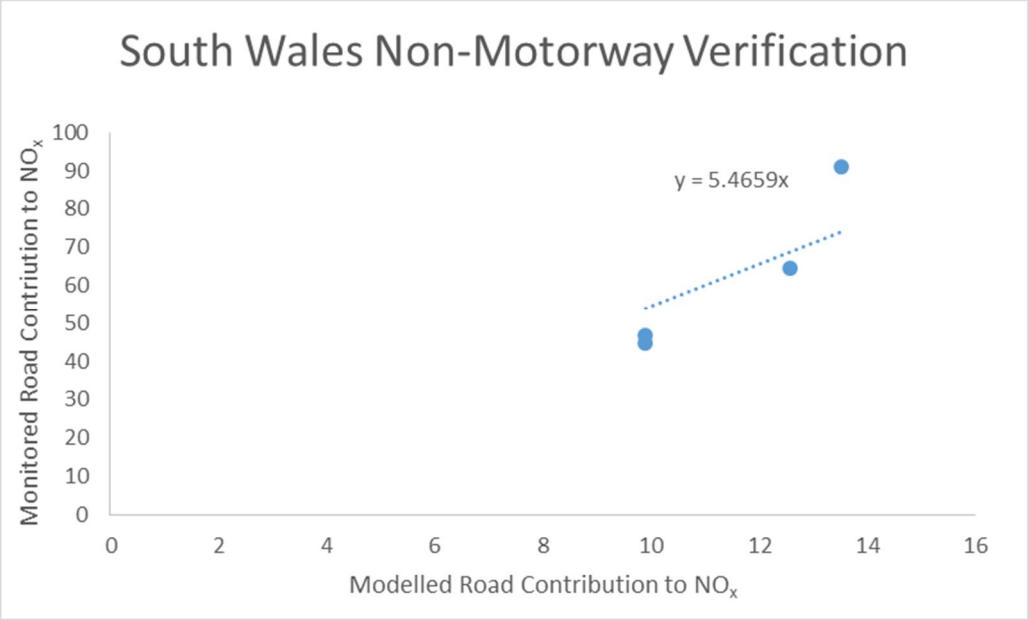


Figure A.3.2 - Derivation of South Wales non-motorway verification factor based on Rhondda Cynon Taf County Borough Council's monitoring data. Concentrations plotted in µg/m³.

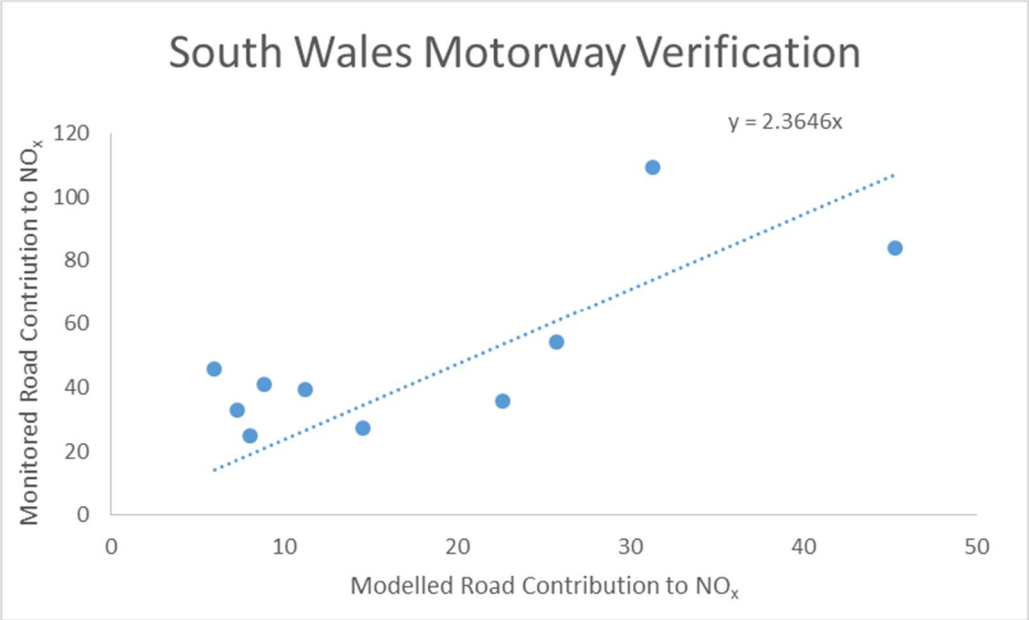


Figure A.3.3 - The South Wales motorway verification this was obtained from Newport City Council's monitoring data. Concentrations plotted in µg/m³.

A.4 EMISSION MODELLING RESULTS

The table below summarises the potential change in emissions brought about by the relevant measures between the “Without Measure” scenario and “With Measure” scenarios in the 2018 model year.

The change is shown as the ‘With Measure’ emissions less the ‘Without Measure’ emissions. Therefore, a negative change implies a reduction in emissions with the measure.

Emissions were calculated for an indicative road link in each study corridor using Defra’s Emission Factor Toolkit (v8). The selected links are highlighted in Appendix A.2.

Table A.4.1 – Total emissions (kg/km/yr) without measures (DM 2018) and with measures (S*XX* 2018) in 2018 for indicative links within the study corridor, and % change in emissions with measure

Study Corridor	DM 2018	S4 2018	S7 2018	S8 2018	S10 2018	S14 2018	S16 2018	S18 2018	S19 2018	S26 2018	S27 2018	S28 2018	S29 2018	S46 2018
							Emissions (kg/km/yr)							
Deeside	8,375	8,375	6,925	N/A	8,208	8,333	N/A	7,242	8,208	7,877	8,375	8,299	N/A	7,917
Wrexham	8,336	8,336	6,825	N/A	8,252	N/A	8,273	7,025	8,086	7,514	8,336	8,252	N/A	N/A
Pontypridd	8,469	8,469	7,532	N/A	8,215	8,447	8,309	7,843	8,267	8,172	8,330	8,275	8,423	8,174
Newport	19,961	19,961	19,156	20,820	N/A	N/A	19,653	N/A	18,974	N/A	N/A	19,447	N/A	N/A
Port Talbot	13,871	13,871	12,785	N/A	N/A	N/A	13,523	N/A	13,487	N/A	N/A	13,642	N/A	13,448
							% Change With Measure							
Deeside		0%	-17%	N/A	-2%	-0.5%	N/A	-14%	-2%	-6%	-0%	-1%	N/A	-5%
Wrexham		0%	-18%	N/A	-1%	N/A	-1%	-16%	-3%	-10%	-0%	-1%	N/A	N/A
Pontypridd		0%	-11%	N/A	-3%	-0.3%	-2%	-7%	-2%	-4%	-1.6%	-2%	-1%	-3%
Newport		0%	-4%	+4%	N/A	N/A	-2%	N/A	-5%	N/A	N/A	-3%	N/A	N/A
Port Talbot		0%	-8%	N/A	N/A	N/A	-3%	N/A	-3%	N/A	N/A	-2%	N/A	-3%

A.5 DISPERSION MODEL RESULTS

The tables below summarise the difference in NO_2 concentrations between the "Without Measure" scenario and "With Measure" scenarios in the 2018 model year for the measures for which modelling was undertaken. The minimum and maximum changes in NO_2 concentrations show the range of results across all receptors in the models.

The change in both columns is shown as the 'With Measure' concentration less the 'Without Measure' concentration. A negative change implies an improvement in concentrations with the measure, while a positive an increase in concentrations with the measure.

Table A.5.1 – Impact of Measures for Deeside

Measure	Min NO_2 Change ($\mu g/m^3$)	Max NO_2 Change ($\mu g/m^3$)
S4 2018	-4.5	-2.8
S7 2018	-6.9	-0.4
S10 2018	-0.8	-0.6
S14 2018	-0.6	0.1
S18 2018	-5.7	1.4
S19 2018	-0.8	-0.6
S26 2018	-3.9	7.5
S28 2018	-0.4	-0.3
S46 2018	-2.2	-1.5
S63 2018	-0.1	-0.0

Table A.5.2 – Impact of Measures for Wrexham

Measure	Min NO_2 Change ($\mu g/m^3$)	Max NO_2 Change ($\mu g/m^3$)
S4 2018	-3.9	-3.6
S7 2018	-6.9	-6.1
S10 2018	-0.4	-0.3
S16 2018	-0.3	-0.2
S18 2018	-6.1	-5.2
S19 2018	-1.0	-1.0
S26 2018	-4.3	-3.1
S28 2018	-0.4	-0.3
S46 2018	-1.5	-1.4

Table A.5.3 – Impact of Measures for Pontypridd

Measure	Min NO_2 Change ($\mu g/m^3$)	Max NO_2 Change ($\mu g/m^3$)
S4 2018	-9.3	-3.8
S7 2018	-12.0	-4.1
S10 2018	-1.8	-1.0
S14 2018	-0.2	0.1
S16 2018	-1.2	-0.6
S18 2018	-9.9	-2.7
S19 2018	-1.5	-0.8
S26 2018	-9.9	-0.9
S27 2018	-1.0	-0.6
S28 2018	-1.9	-0.8
S29 2018	-0.4	-0.2
S46 2018	-2.4	-1.3
S63 2018	-0.2	-0.0

Table A.5.4 – Impact of Measures for Newport

Measure	Min NO_2 Change ($\mu g/m^3$)	Max NO_2 Change ($\mu g/m^3$)
S7 2018	-3.8	-1.9
S8 2018	1.4	3.3
S16 2018	-0.6	-0.5
S19 2018	-2.0	-1.5
S28 2018	-1.2	-0.8
S46 2018	-2.0	-1.4

Table A.5.5 – Impact of Measures for Port Talbot

Measure	Min NO_2 Change ($\mu g/m^3$)	Max NO_2 Change ($\mu g/m^3$)
S7 2018	-3.5	-0.1
S14 2018	-0.4	0.1
S16 2018	-0.8	-0.3
S19 2018	-0.8	-0.6
S28 2018	-0.5	-0.3
S46 2018	-1.0	-0.7
S63 2018	-0.1	-0.0

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