



Llywodraeth Cymru
Welsh Government

Tackling roadside nitrogen dioxide concentrations in Wales

Welsh Government supplemental plan to the
UK plan for tackling roadside nitrogen dioxide
concentrations 2017

November 2018



Mae'r ddogfen yma hefyd ar gael yn Gymraeg.
This document is also available in Welsh.

Foreword

Tackling poor air quality is a priority for the Welsh Government and this is reflected in our national strategy – ‘Prosperity for All’. The Welsh Government is committed to building healthier communities and better environments. The contribution made by the environment to good health cannot be overstated. The actions we take to improve air quality in Wales have a key role in supporting the right conditions for better health, well-being and greater physical activity. We will reduce emissions and deliver vital improvements in air quality through planning, infrastructure, regulation, and health communication measures.

The Welsh Government is working actively, alongside the other devolved administrations, to meet our joint objective with the UK Government to transform the UK’s most polluted towns and cities into clean and healthy urban spaces, supporting those most directly affected and ensuring that vehicle manufacturers play their part to improve the nation’s air quality.

The Welsh Government supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017 sets out work that has been, and continues to be, done to identify how we will reduce concentrations of nitrogen dioxide around roads where levels are above legal limits in Wales in the soonest time possible.

Minister for Environment, Cabinet Secretary for Energy, Planning and Rural Affairs and
Cabinet Secretary for Economy and Transport.

The Welsh Government Supplemental Plan to the ‘UK plan for tackling roadside nitrogen dioxide concentrations 2017’

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Introduction

1. This document is the Welsh Government supplemental plan to the 'UK plan for tackling roadside nitrogen dioxide concentrations 2017' ("WGSP"), which supplements the 'UK plan for tackling roadside nitrogen dioxide concentrations 2017'¹ (the 2017 Plan).
2. The WGSP should be read in conjunction with the UK Air Quality Plan for tackling roadside nitrogen dioxide concentrations 2017 (the 2017 Plan)², the Air Quality Plan for tackling roadside nitrogen dioxide in South Wales (UK0041)³, the Air Quality Plan for tackling roadside nitrogen dioxide in North Wales (UK0042)⁴, the Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Cardiff Urban Area (UK0026)⁵ and the Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Swansea Urban Area (UK0027)⁶.
3. A supplemental plan is necessary to satisfy the requirements of the Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe⁷ (the "Directive") and the Air Quality Standards (Wales) Regulations 2010⁸ (the "Welsh Regulations"). As accepted by the Welsh Ministers, the 2017 Plan does not satisfy these requirements because the Welsh Government did not, at the time when the 2017 Plan was drawn up, have sufficient information properly to consider what measures within their devolved competence (if any) would ensure compliance with the limit values for nitrogen dioxide (NO₂) laid down by the Directive and the Welsh Regulations within the shortest possible time.
4. Combustion of fossil fuels, for example in power generation, industrial processes, domestic heating, and vehicles, gives rise to air pollutants including nitrogen oxides (NO_x). NO_x emissions include both primary NO₂ and nitric oxide (NO), with the latter

¹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf

² The UK Air Quality Plan for tackling roadside nitrogen dioxide concentrations 2017 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf

³ The Air Quality Plan for tackling roadside nitrogen dioxide in South Wales (UK0041) - https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0041.pdf

⁴ The Air Quality Plan for tackling roadside nitrogen dioxide in North Wales (UK0042) - https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0042.pdf

⁵ Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Cardiff Urban Area 2017 – https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0026.pdf

⁶ Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Swansea Urban Area (UK0027) 2017

– https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0027.pdf

⁷ The UK Air Quality Plan for tackling roadside nitrogen dioxide concentrations 2017 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0050&from=en>

⁸ The Air Quality Standards (Wales) Regulations - 2010 <http://www.legislation.gov.uk/wsi/2010/1433/contents/made>

reacting in the atmosphere to produce secondary NO₂. Other reactions can lead to the generation of additional pollutants. For example, harmful ozone produced by the action of sunlight on NO_x and secondary particulate matter (PM) produced by reactions involving NO_x. Measures to tackle NO_x can also have beneficial effects in terms of reducing other air pollutants, such as particulate matter.

5. Defra coordinates assessment and air quality plans for the UK as a whole. Based on Defra's projections for the air quality plan for NO₂ published in 2015, all zones in Wales were predicted to be compliant with limit values by 2020 (the earliest projected date) or earlier.
6. Evidence has emerged over recent years in relation to the real world emissions of NO_x exceeding legal type approval emissions limits, on which modelling assumptions are based. This disparity has meant the projected reductions in emissions from the introduction of stricter European standards have not materialised to the degree expected, and the scale of projected non-compliance in Wales, and elsewhere in the UK, has changed significantly over time. UK-scale compliance projections produced in 2017, based on updated emission factors, now show predicted areas of non-compliance in Wales in 2020 and beyond, unless further measures are taken.
7. The Defra UK-wide assessment which informed the 2017 Plan indicated air quality issues for Wales where, without further action, non-compliance may exist in future years.
8. Section 7.6 of the 2017 Plan⁹, the Air Quality Plan for tackling roadside nitrogen dioxide in South Wales (UK0041)¹⁰, the Air Quality Plan for tackling roadside nitrogen dioxide in North Wales (UK0042)¹¹, the Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Cardiff Urban Area (UK0026)¹² and the Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Swansea Urban Area (UK0027)¹³ identified actions to be taken by the Welsh Government to achieve statutory limit values for NO₂ in Wales within the shortest possible time. In summary these were to:

⁹ Section 7.6 of the 2017 Plan – Page 45 – 49 – Paragraphs 148 - 164

¹⁰ Air Quality Plan for tackling roadside nitrogen dioxide in South Wales (UK0041) 2017 – https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0041.pdf

¹¹ Air Quality Plan for tackling roadside nitrogen dioxide in North Wales (UK0042) 2017 – https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0042.pdf

¹² Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Cardiff Urban Area 2017 – https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0026.pdf

¹³ Air Quality Plan for tackling roadside nitrogen dioxide concentrations in Swansea Urban Area (UK0027) 2017 –

https://uk-air.defra.gov.uk/assets/documents/no2ten/2017-zone-plans/AQplans_UK0027.pdf

- consult on the detail for a Clean Air Zone (CAZ) Framework for Wales within 12 months of the publication of the 2017 Plan. This aims to ensure the effective implementation of Clean Air Zones in locations where they would bring about compliance with limit values before other measures and in the shortest possible time¹⁴;
- work with Cardiff Council to ensure they undertake a local assessment to understand what measures are required to achieve statutory limit values for NO₂ in the Cardiff area within the shortest possible time¹⁵;
- work with local authorities in areas where a Clean Air Zone would not be appropriate to identify specific local solutions on a case-by-case basis¹⁶;
- continue to invest in measures to promote modal shift from and within road transport¹⁷;
- review measures to improve NO₂ levels on the 5 stretches of the motorway and trunk road network across Wales where there are exceedances; and
- review the siting of the monitoring station at Hafod-yr-ynys to ensure further local targeted, measures are effective and proportionate.

Interim and final WGSP

9. The interim WGSP was published on 31 July and identified work completed to date and set out how we will reduce concentrations of nitrogen dioxide around roads where levels are above legal limits. This followed a consultation held between 25 April and 19 June 2018. The Welsh Government took action as soon as possible to deliver immediate improvements to air quality by implementing temporary 50 mph speed limits at each of the 5 sections of the motorway and trunk road network in exceedance in June 2018.
10. Work undertaken through the Welsh Government Transport Planning Appraisal (WelTAG) process (WelTAG Stage 3¹⁸, was completed within programme timescales (August 2018) and published in September 2018. Measures have been identified on the Welsh Government motorway and trunk road network that would be likely to bring about compliance with NO₂ limit values within the shortest possible time. The interim WGSP did not set out all final measures required on the 5 locations on the motorway and trunk road network in Wales as this process was not completed at the time of publication.

¹⁴ Section 7.6 of the 2017 Plan – Page 46 – Paragraph 156

¹⁵ Section 7.6 of the 2017 Plan – Page 46 - 47 – Paragraph 157 - 159

¹⁶ Section 7.6 of the 2017 Plan – Page 47 – Paragraph 160

¹⁷ Section 7.6 of the 2017 Plan – Page 47 - 48 – Paragraph 162

¹⁸ Page 33 – Paragraph 101

11. Between 21 September and 2 November 2018, the Welsh Government consulted on final measures proposed on each of the 5 locations on the motorway and trunk road network to achieve compliance with nitrogen dioxide limit levels. The proposed final measures have been identified following completion of detailed investigations and modelling undertaken in line with the WelTAG Stage 3 process in August 2018. The overarching objective of these studies was to identify for each location the measure or package of measures that:
 - a) will achieve compliance with the NO₂ limit values as soon as possible;
 - b) will do so in a way that reduces exposure to NO₂ as quickly as possible; and
 - c) will mean that achieving compliance is not just possible but likely.
12. This final WGSP sets out actions the Welsh Government has taken since the publication of the 2017 Plan and is going to take to support delivery of our statutory limit values for nitrogen dioxide in Wales within the shortest possible time and in accordance with the Directive and the Welsh Regulations. This plan should be read in conjunction with the 2017 Plan. References to the relevant parts of the 2017 Plan have been included in this WGSP to assist cross referencing
13. The Welsh Government will ensure funding is in place to support the activities set out in this WGSP, which are required to bring forward compliance.
14. Whilst the focus of this plan is to reduce concentrations of NO₂ around roads exceeding legal limits in Wales, the Welsh Government is also developing a wide range of measures to support our aspirations for clean air, including:
 - Identifying key pollutants and their affects on public health and the natural environment in Wales, including noise; and creating legally binding targets to reduce emissions of the most damaging pollutants under the National Emissions Ceiling Directive (fine particulate matter, ammonia, nitrogen oxides, sulphur dioxide, non-methane volatile organic compounds) by 2020 and 2030.
 - Measures to achieve compliance with the European and domestic legislative requirements.
 - Actions across a range of Welsh Government departments and sectors to achieve clean air in Wales. For example, Environment, Decarbonisation, Transport, Planning, Agriculture and Industry.
 - A robust and focused Welsh evidence base, informing local and national government on the extent of poor air quality and the effectiveness of current and future actions.
 - Proposed communications, engagement and education to deliver behavioural

change to support air quality improvements.

15. Further detail about these measures will be included in the Clean Air Plan for Wales which will be published in 2019. We will be taking account of responses to the consultations which have been held to inform this WGSP as we develop further policy to improve air quality in Wales.

Objective

16. Tackling poor air quality in all its forms is a priority for Government. The UK currently meets its international commitments for overall emissions of all air pollutants. The only statutory air quality limit that Wales, and the rest of the UK, is currently failing to meet is on NO₂ concentrations.
17. This plan focuses on the Welsh Government's most urgent and immediate air quality challenge. Action is necessary to reduce concentrations of NO₂ around roads in Wales where levels are above legal limits within the shortest possible time, in a way which reduces exposure as quickly as possible and by taking steps which mean meeting the limit values is not just possible but likely.
18. The Welsh Government is committed to protecting public health and believes everyone in Wales has the right to breathe clean air. We recognise measures to improve air quality can be costly and in some cases unpopular. However, these are not lawful reasons for disregarding effective measures to tackle air pollution. We will ensure necessary actions are taken to meet our legal obligations and, most importantly, improve health.
19. The objective of the Welsh Government, the UK Government and the other devolved administrations is to transform the UK's most polluted towns and cities into clean and healthy urban spaces. This will support those most directly affected and ensure vehicle manufacturers play their part to improve the nation's air quality.

Impacts of air pollution in Wales

20. The Welsh Government is committed to improving outdoor air quality in Wales, but it is clear we face significant challenges in doing so. Air pollution impacts on public health, the natural environment, and the economy.

Air pollution and health

21. Outdoor air pollution is a significant environmental determinant of health¹⁹. Exposure can adversely affect health, particularly amongst vulnerable population groups. The pollutants of most widespread concern in the context of air quality management are particulate matter (PM) and nitrogen dioxide (NO₂), but as air pollution is a complex mixture of gases, other pollutants may also affect health²⁰.

Particulate matter (PM₁₀, PM_{2.5})

22. Particulate matter is a term that refers to tiny particles of varying chemical composition less than 2.5µm (PM_{2.5}) or 10µm (PM₁₀) in diameter. When inhaled, particles less than 10µm in diameter (the PM₁₀ 'thoracic' fraction) can penetrate, and get deposited in, the human upper respiratory tract; particles less than 2.5µm in diameter (the fine PM_{2.5} 'respirable' fraction) can penetrate deep into the alveoli of the lungs. Both have the same biological mechanism which causes the lining of the lungs to become inflamed. A process of oxidative stress places pressure on, and compromises the function of, various body systems. Short-term exposure can result in eye, nose and throat irritation, asthma symptom exacerbation, headaches and nausea. Long-term exposure increases morbidity and mortality risks from heart disease and strokes, respiratory diseases, lung cancer and other effects²¹.
23. Particulate matter from road transport sources comprises primary particles emitted directly to atmosphere from combustion sources, tyre and brake wear, and secondary particles formed by chemical reactions in the air.

Nitrogen dioxide, sulphur dioxide and ozone

24. These gases irritate the airways of the lungs, increasing symptoms of those suffering from lung diseases. Short-term exposure to nitrogen dioxide is associated with increased cardiovascular and respiratory morbidity.

¹⁹ World Health Organization (2015). Economic cost of the health impact of air pollution in Europe: Clean air, health and wealth. WHO: Copenhagen, Denmark.

²⁰ http://www.euro.who.int/_data/assets/pdf_file/0006/298482/Health-risk-assessment-air-pollution-General-principles-en.pdf?ua=1

²¹ World Health Organization (2013). Review of evidence on health aspects of air pollution—REVIHAAP. WHO: Copenhagen, Denmark.

25. All combustion processes in air produce oxides of nitrogen (NO_x) that include nitrogen dioxide; and all combustion process of fuels containing sulphur produce sulphur dioxide. Non-methane volatile organic compounds emitted from combustion of fuels such as petrol can react with other atmospheric pollutants, primarily NO_x, to produce ozone.
26. In the UK each year, it is estimated that the equivalent of 29,000 deaths^{22,23} are attributed to long-term exposure to fine particulate matter (PM_{2.5}) air pollution and the equivalent of 23,500 deaths²⁴ are attributed to long-term nitrogen dioxide (NO₂) exposure. Accounting for the potential overlapping health effects of PM and NO₂ (believed to be around 30%), it is estimated that the equivalent of 40,000 deaths occur annually in the UK as a result of exposure to outdoor pollution²⁵. On average, exposure reduces the life expectancy of every person in the UK by 7 to 8 months²⁶. The societal cost of air pollution (accounting for health service costs and reduced productivity through lost work-days) in the UK is significant, standing at around £20bn every year²⁷.

Air pollution and the environment

27. Air pollution results in damage to the natural environment. NO₂ contributes to acidification, where chemical reactions involving air pollutants create acidic compounds which when deposited on land and aquatic systems can cause harm to soils, vegetation and buildings. It also contributes to eutrophication, where nitrogen can be deposited in soils or in rivers and lakes through rain, affecting the nutrient levels and diversity of species in sensitive environments, for example encouraging algae growth in lakes and water courses. In addition, it contributes to ground-level ozone which can damage wild plants, crops, forests and some materials, and is a greenhouse gas contributing to global warming²⁸.

²² Gowers, A.M., Miller, B.G., Stedman, JR (2014). Estimating Local Mortality Burdens Associated with Particulate Air Pollution. Public Health England: London, UK.

²³ COMEAP (2010). The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. COMEAP.

²⁴ Defra (2015). Draft Plans to Improve Air Quality in the UK: Tackling Nitrogen Dioxide in Our Towns and Cities. UK Overview Document. Defra: London, UK.

²⁵ Royal Colleges of Physicians and Paediatrics Child Health (2016). *Every breath we take – the lifelong impact of air pollution*. London: Royal College of Physicians.

²⁶ Defra (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (volume 1). Defra: London, UK.

²⁷ Royal Colleges of Physicians and Paediatrics Child Health (2016). *Every breath we take – the lifelong impact of air pollution*. London: Royal College of Physicians.

²⁸ National Statistics (2016) Emissions of air pollutants in the UK, 1970 to 2015
www.gov.uk/government/statistics/emissions-of-air-pollutants.

Pollution sources

28. The principal source of particulate matter and nitrogen dioxide affecting people is road transport emissions, but other transport sources as well as industrial, agricultural, domestic and natural sources also contribute (Figure 1).



Figure 1 - Principal sources of outdoor air pollution – Source: Defra

(http://www.local.gov.uk/sites/default/files/documents/6.3091_DEFRA_AirQualityGuide_9web_0.pdf)

29. Pollutants may not only cause problems locally in the immediate vicinity of sources; if suspended in air they can travel long distances and affect more people over wider geographical areas. This calls for action at international, national, regional and local levels.

Roles and Responsibilities

30. The Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe (“the Directive”) imposes various obligations on the United Kingdom in relation to air quality.
31. At the domestic level, responsibility for implementing the Directive is a devolved matter, and the Welsh Ministers are the competent authority in respect of Wales. The Directive is implemented in Wales by way of the Air Quality Standards (Wales) Regulations 2010 (“the Welsh Regulations”). The Welsh Government and the other UK administrations support local authorities and public transport providers via guidance and access to grant funding schemes. The roles and responsibilities of responsible authorities across the UK are described in Section 5 of the 2017 Plan²⁹.
32. The Welsh Government’s ability to take action in relation to air quality is limited to taking steps that fall within the scope of its devolved competence. The Welsh Government engages with the United Kingdom Government on relevant matters that are outside its devolved competence, such as vehicle specification standards, vehicle excise duty, fuel duty, and the enforcement of Euro emission standards (all of which are matters for the United Kingdom Government).

²⁹ Section 5 – the 2017 Plan – Page 11-15 -

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf

33. In broad terms, the Welsh Government's obligations under the Directive and the Regulations are as follows:



- (i) Wales must be divided into zones and agglomerations. Wales has been divided into two zones (North Wales and South Wales) and two agglomerations (Cardiff Urban Area and Swansea Urban Area).
- (ii) Insofar as is relevant, an agglomeration is treated in the same way as a zone.
- (iii) The Welsh Government must ensure that the level of NO₂ in any zone or agglomeration does not exceed the relevant limit values set out in the Directive and the Welsh Regulations.

- (iv) Where the level of NO₂ in any zone exceeds a relevant limit value, the Welsh Government must draw up and implement an air quality plan to achieve the limit value in that zone or agglomeration. Where the Welsh Government proposes to prepare, modify or review such an air quality plan, they must consult the public. The WGSP is being consulted on in recognition of this obligation.
- (v) An air quality plan must include measures intended to ensure compliance with the relevant limit value within the shortest time possible. The Welsh Government must choose a route to that objective which reduces exposure as quickly as possible, and take steps which mean meeting the NO₂ limit values is not just possible, but likely³⁰.

³⁰ *R. (on the application of ClientEarth (No. 2)) v Secretary of State for the Environment, Food and Rural Affairs* [2016] EWHC 2740 (Admin), at paragraph 95(i) and *R (on the application of ClientEarth (No.3)) v Secretary of State for Environment, Food and Rural Affairs and others* [2018] EWHC 315 (Admin), at paragraph 73.

Locations of excess pollution in Wales

34. The Directive and the Welsh Regulations provide for an hourly and an annual limit value for NO₂:
 - (i) an hourly limit value of an average of 200 micrograms per cubic metre (which must not be exceeded more than 18 times in a calendar year);
 - (ii) an annual limit value of an average of 40 micrograms per cubic metre.
35. The UK is divided into forty-three zones for air quality reporting purposes under the Directive, with four in Wales, based on population size and clusters. This includes the North Wales and South Wales zones and two urban agglomeration zones (large urban areas) for Cardiff and Swansea.
36. The annual assessment of compliance is based on a combination of information from the UK national monitoring networks and the results of modelling assessments. The Directive sets out how monitoring for the purpose of compliance assessment should be undertaken, including how many stations are required and detailed criteria on where to locate stations and the equipment that should be used. The number of stations required is calculated for each pollutant for each zone and is based on an assessment of concentrations over a 5 year period, together with population information for that zone. In accordance with the requirements of the Directive, monitoring networks are reviewed periodically by the Department for the Environment, Food and Rural Affairs (“Defra”) to ensure they remain compliant, with a minimum review requirement of once every 5 years.
37. There are several air quality monitoring networks operating across the UK, each with different objectives, scope and coverage and these are operated on behalf of Defra and the Devolved Administrations by the Environment Agency (EA). The Automatic Urban and Rural Network (AURN) is the largest automatic monitoring network in the UK and forms the bulk of the UK’s statutory compliance monitoring evidence base, including for NO₂.
38. The Directive also allows use of supplementary assessment using modelling and the number of stations required is more flexible where modelling is used. UK compliance assessment modelling is undertaken using national models known as the Pollution Climate Mapping (“PCM”) models. The PCM models have been designed to assess compliance with the limit values at locations defined within the Directive.

39. The air quality assessment for each pollutant is derived from a combination of measured and modelled concentrations. Where both measurements and model results are available, the assessment of compliance for each zone is based on the higher of the two. The air quality compliance assessment is submitted to the European Commission via e-Reporting. With respect to NO₂, any exceedances of the hourly or annual limit value, where measured or modelled, will result in non-compliance within the respective zone or agglomeration being assessed.
40. The annual limit value for NO₂ is currently exceeded in Cardiff and Caerphilly (Hafod-yr-ynys) and at 5 other locations on the motorway and trunk road network in Wales. The hourly limit value for NO₂ is currently achieved in all locations throughout Wales, with the exception of Hafod-yr-ynys. The overall position as to exceedances and the projections as to when limit values will be met in each zone in Wales under baseline conditions³¹ is:
- (1) In North Wales, the limit value is exceeded on a total of 7.7 km of road, on the A494 at Deeside and the A483 near Wrexham. The current projection is that the limit value will be met in North Wales in 2021.
 - (2) In South Wales, the limit value is exceeded on a total of 15.1 km of road. This is on the A48 near Cardiff, the A472 near Hafod-yr-ynys, the A470 between Upper Boat and Pontypridd and the M4 between Junctions 41 and 42 (Port Talbot) and between Junctions 25 and 26 (Newport). There are additional short stretches of road which are the responsibility of Cardiff Council. However, because of the location of the zone boundaries, those stretches fall within the South Wales zone rather than the Cardiff Urban Area. The current projection is that the limit value will be met in South Wales in 2026. However, as explained below, this projected date is the result of data produced by a monitoring station at Hafod-yr-ynys, the degree of uncertainty of which is currently being investigated.
 - (3) In the Cardiff Urban Area, the limit value is exceeded on a total of 16.3 km of road. This is on the A4161, the A4232, the A4234, the A470 and the A48. The A48, which extends out of the Cardiff Urban Area agglomeration zone and into the South Wales non-agglomeration zone, is not projected to achieve compliance until 2023 without further measures. This stretch of the A48 is the responsibility of

³¹ "Baseline conditions" refers to the situation where only those EU, regional and local measures currently planned are implemented, i.e. additional measures are such as those referred to below are not implemented. The modelled projections for each year from 2017 to 2030, using 2015 as the reference year, indicate when compliance with the NO₂ limit values is likely to be achieved under baseline conditions. Details of the methods used for the baseline emissions and projections modelling are provided in the UK technical report. <https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017>

Cardiff Council. However, the current projection is that the limit value will be met in the Cardiff urban area agglomeration zone itself in 2021.

- (4) In Swansea Urban Area, the limit value is exceeded on a total of 2.7 km of road. This is on the M4 between Junctions 41 and 42 (Port Talbot). The current projection is that the limit value will be met in Swansea in 2020.

41. Maps showing each exceedance situation are included at Annex B.

Actions to reduce NO₂ concentrations to within legal limits in Wales

Local solutions on local authority managed roads

42. The stretches of road exceeding NO₂ limit values for which local authorities are responsible are described in Annex B. They are a single stretch of road on the A472 at Hafod-yr-ynys, for which Caerphilly County Borough Council is responsible, and the A4161, the A4232, the A4234, the A470 and the A48, for which Cardiff Council is responsible.
43. Local knowledge is vital to finding air quality solutions that are suited to local areas and the communities and businesses affected. Local characteristics can affect local levels of pollution and national modelling will not pick up all of the necessary local detail. The size of the exceedance can also vary according to local circumstances. A leading role for local authorities responsible for roads which are non-compliant is essential.
44. Annex F sets out the modelling techniques and assumptions that Caerphilly County Borough Council and Cardiff Council should adopt when identifying their local solutions in accordance with the provisions set out below.
45. The Welsh Government expects Cardiff Council and Caerphilly County Borough Council to include local air quality data in their assessments. Different models are unlikely to produce exactly the same results, particularly when operating on different scales. The PCM model was developed specifically to meet the requirements of Annex III of the Ambient Air Quality Directive and was therefore designed for UK-scale assessments. Local models tend to be optimised for more detailed local scale assessments. For example, local models can incorporate information on the identification of local traffic flow compositions, street geometry and topography, which would not be accounted for by the UK-scale modelling. The Welsh Government has provided guidance which sets out the local air quality monitoring and modelling data requirements, to ensure the local data meets appropriate and consistent standards.

Implementing measures in Cardiff

46. The Technical Report³² published alongside the 2017 Plan identified Clean Air Zones that include charging access restrictions, as the measure Government was able to model nationally which will achieve statutory NO₂ limit values in towns and cities in the shortest possible time (potentially reducing NO₂ concentrations by up to 11.0µg/m³³³). The assumptions in the Technical Report were quantified and supplied by Defra. The assessment in that report indicated that Cardiff was one area where non-compliance might be resolved by implementing a charging Clean Air Zone.
47. A Clean Air Zone is an area where targeted action is taken to improve air quality. This may include the need to restrict the access of the most polluting vehicles from the areas, through either banning or charging for access. Clean Air Zones aim to reduce all types of air pollution, including nitrogen dioxide and particulate matter, so that people breathe in less of all these pollutants. Clean Air Zones are area specific and so what works in one city or place may not necessarily have the same impact elsewhere. There are currently no Clean Air Zones in Wales.
48. On 9 March 2018, the Welsh Ministers issued a Direction entitled ‘ Environment Act 1995 (Feasibility Study for Nitrogen Dioxide Compliance) Air Quality Direction’³⁴ to Cardiff Council to undertake a local feasibility assessment to identify the best option for achieving the statutory NO₂ limit values within the shortest possible time.
49. The Ministerial Direction set clear deadlines for the delivery of a plan and full business case setting out the preferred option for delivering compliance with NO₂ limit values in the shortest possible time in the areas for which Cardiff Council is responsible.
50. The timetable for implementation is as follows:

³² https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/632916/air-quality-plan-technical-report.pdf

³³ Table 3.8, Draft Technical Report, May 2017 https://consult.defra.gov.uk/airquality/air-quality-plan-for-tackling-nitrogen-dioxide/supporting_documents/Technical%20Report%20%20Amended%209%20May%202017.pdf

³⁴ Environment Act 1995 (Feasibility Study for Nitrogen Dioxide Compliance) Air Quality Direction 2018 - <https://gov.wales/legislation/subordinate/nonsi/epwales/2018/180430-feasibility-study-for-nitrogen-dioxide-compliance-air-quality-direction-2018/?lang=en>

	2018				2019			
Action	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Cardiff Council must provide to the Welsh Ministers scoping proposals for their feasibility study as soon as possible and by 31 March at the latest.	Cardiff Council proposal to the Welsh Government. Completed.							
Transport and air quality data collection.								
Local modelling to inform the assessment of options to accelerate compliance. Local modelling assessments will include transport (e.g. vehicle flows and fleet compositions) and air quality dispersion modelling of the local situation.								
Options will be examined and evaluated by local authorities as the findings of the assessments and local consultation become available.								
Initial plans will be drawn up and submitted to the Welsh Ministers.			As soon as possible and by the end of September 2018 at the latest.					
Local consultation, held during the final stages of the assessment period, will be completed by the local authorities.					By the end of March 2019.			
Final plans (i.e. a feasibility study) and full business case including implementation arrangements will be drawn up and finalised by the local authorities and submitted to the Welsh Ministers.						As soon as possible and by the end of June 2019 at the latest.		
Welsh Ministers will consider and sign off the plans following advice received from a full and independent assessment.							As soon as possible and by the end of July 2019 at the latest.	

51. The basis for the timeline is described below. This covers data collection, transport, air quality and economic modelling of the local situation, options assessment, production of an initial plan (outlining an initial long list of options to refine to a short list for further assessment) local consultation and production and approval by the Welsh Ministers of a final business case/plan (for a preferred option/measure).
52. The timings are the Welsh Government's estimate of the necessary time to undertake a full business case prior to the implementation of a preferred option. The preferred option is expected to be implemented by 2020 or sooner, to achieve compliance in the soonest time. However, Cardiff Council is responsible for developing its own timeline for determining measures and implementing them as part of their business cases to achieve compliance in the soonest time. Cardiff Council's timeline is dependent on the scale and complexity of the local situation and the remedial options considered. The Welsh Government is working with Cardiff Council throughout the process to provide guidance and ensure timelines are the shortest possible, and will require delivery ahead of the dates in the direction where it is possible to do so. This includes the need to assess, and implement where possible, additional measures to accelerate reductions in exposure prior to the implementation of a preferred option.
53. Cardiff Council must undertake the feasibility assessment in accordance with the HM Treasury's Green Book approach, a recognised business case model used across UK Governments and public bodies. The direction requires the development of business cases for an initial and final plan.
54. The Welsh Government expected the collection of data to continue at least until September 2018, in support of an initial plan, and it is likely to continue to support the development of the short list of measures (for example, helping to improve confidence in current predictions, define the boundaries of a potential measure, or support areas of identified weakness in current evidence). Timescales for data collection is dependent on the availability and quality of existing data and the complexity of the local situation.
55. Examples of data collection can include traffic surveys of all vehicle types across the study area, estimates of likely behavioural responses to measures, local meteorological data, terrain data and air quality data. Data should be representative of the range of conditions expected over long term annual periods to ensure local assessments are robust. Traffic surveys should cover the major routes that will provide effective coverage of journeys in the study area (the area expected to be affected significantly by measures to be implemented under the local plan). The surveys may be undertaken on a number of roads (non-compliant and adjacent compliant roads in

the study area) for a sustained period of time (weeks to months). Further data may need to be captured following development of the initial plan in support of the preferred option. Air quality monitoring data should be measured using roadside monitors located within the study area. Local meteorological data should also be measured at the same time as the air quality data. Further measurements may be required as the scenarios are developed to support confidence in the scenario assessments, and may continue following development of the initial plan in support of a preferred option.

56. Remedial options will need to be scoped and developed, informed by local engagement, prior to commencing assessments. The local modelling will need to assess a range of scenarios and be based on robust and representative data, including the data referred to above. Air dispersion modelling is expected to be required throughout the study period to underpin all stages of the options appraisal process, and continue to be refined as new data becomes available, beginning once input data has been pre-processed and transport and other local emissions data are available. Timings will depend on the availability of robust datasets and the complexity of the local situation and of the measures proposed.
57. Options will be assessed and evaluated as soon as information becomes available, in parallel with the local assessments and consultation.
58. The HM Treasury Green Book approach provides an iterative process to the development of the business case. A robust options appraisal, including an assessment of the wider impacts of an option, is an important part of the business case. The broad aim of the options appraisal process is to demonstrate that the preferred option of a scheme delivers compliance within the shortest possible time. This requires demonstrating that a range of options have been considered and assessed in a consistent way, so that there is confidence in the preferred option.
59. The first stage of the options appraisal process is generating a broad list (examining all potential locally effective options) and reducing it to a shortlist of options that the local authority proposes to explore further, forming the main element of a local authority's initial plan. Initial modelling outputs, particularly air quality and transport, should facilitate this high level assessment. The initial plan should include all latest evidence deliverables.
60. The HM Treasury Green Book approach includes consideration of value for money. However, for the purpose of this feasibility study the determining factor when selecting measures to tackle air quality must be their effectiveness, not their cost. Local authorities must identify which measures will meet the legal limits in the shortest time. The only situation in which cost can be taken into consideration is where there are two

equally effective measures. For instance, only where two measures can be shown to be equally effective at bringing forward the likely date of compliance can the local authority lawfully choose the lowest cost option. Therefore, cost benefit analysis is not an appropriate primary method for selecting measures which would be most effective in bringing forward the likely compliance date. The Welsh Government anticipates this stage could take the local authority up to 2 months in cumulative time to develop and clear prior to submission to the Welsh Government.

61. The Welsh Government requested local authorities to submit initial plans by 30 September which should set out the case for change and identify options to accelerate compliance, including indicative costs.
62. Cardiff Council submitted their initial plan to Welsh Ministers on 30 September and has published it on their website. Their plan can be viewed at the following web link:

<http://cardiff.moderngov.co.uk/documents/s25635/Cabinet%2015%20November%202018%20Air%20Quality%20-%20WG%20Direction%20App%201.pdf>
63. If you have any questions in relation to proposed measures to tackle air pollution in Cardiff, please contact Cardiff Council directly at Connect 2 Cardiff (C2C):

Telephone number: 029 2087 2087
64. The Welsh Government has established an expert panel to undertake an independent assessment of the interim and final plans which will advise Welsh Ministers and ensure measures in the plans deliver compliance in the soonest time.
65. Sufficient time should be provided for all stakeholders to consider the local proposals and respond to local consultations. The Welsh Government anticipates that significant measures affecting local citizens will require local consultation, which is likely to run for up to 3 months. Drafting of a consultation is likely to take up to a month, drawing on emerging data and proposals for a preferred measure.
66. Final plans and a full business case must be submitted to the Welsh Ministers by the end of June 2019 at the latest. The business case will describe the final, preferred, option for delivering compliance in the shortest possible time. These plans could take up to 3 months, following local consultation, to develop and sign-off prior to submission to the Welsh Ministers.
67. Following consideration and approval of the plans, the Welsh Ministers will require (by Direction) Cardiff Council to implement the measure or measures in the plans which deliver compliance in the soonest possible time.

68. Implementation of the plans will depend on the nature of the measures identified. Significant measures could require a period of infrastructure procurement and installation, for example signs, traffic management systems and cameras. This would be expected to take up to six months. A period of systems testing and local engagement may also be likely to take up to six months to enable businesses and individuals to adjust.
69. The Welsh Government expects implementation of Clean Air Zones could take up to three years from the start of the assessment process (i.e. by the end of 2020), achieving compliance in 2021. Unless Cardiff Council identifies an alternative measure or measures which would bring the roads for which they are responsible (in the Cardiff Urban Area and South Wales zone) into compliance at least as quickly as a charging CAZ, Cardiff Council will be required by direction to introduce a charging CAZ.

Implementing measures at Hafod-yr-ynys

70. On 9 March 2018, the Welsh Ministers issued a Direction entitled 'Environment Act 1995 (Feasibility Study for Nitrogen Dioxide Compliance) Air Quality Direction 2018'³⁵ to Caerphilly County Borough Council to undertake a local feasibility assessment to identify the best option to achieve the statutory NO₂ limit values within the shortest possible time.
71. The Ministerial Direction set clear deadlines for the delivery of a plan and full business case setting out the preferred option for delivering compliance with NO₂ limit values in the shortest possible time in the areas for which Caerphilly County Borough Council are responsible.
72. The timetable for implementation is as follows:

³⁵ Environment Act 1995 (Feasibility Study for Nitrogen Dioxide Compliance) Air Quality Direction 2018 - <https://gov.wales/legislation/subordinate/nonsi/epwales/2018/180430-feasibility-study-for-nitrogen-dioxide-compliance-air-quality-direction-2018/?lang=en>

	2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Caerphilly County Borough Council must provide to the Welsh Ministers scoping proposals for their feasibility study.	Caerphilly Council proposal to the Welsh Government. Completed.							
Transport and air quality data collection.								
Local modelling to inform the assessment of options to accelerate compliance. Local modelling assessments will include transport (e.g. vehicle flows and fleet compositions) and air quality dispersion modelling of the local situation.	May to December 2018							
Options will be examined and evaluated by local authorities as the findings of the assessments and local consultation become available.	July to March 2019							
Initial plans will be drawn up and submitted to the Welsh Ministers.			As soon as possible and by the end of September 2018 at the latest.					
Local consultation, held during the final stages of the assessment period, will be completed by the local authorities.					By the end of March 2019.			
Final plans (i.e. a feasibility study) and full business case including implementation arrangements will be drawn up and finalised by the local authorities and submitted to the Welsh Ministers.						As soon as possible and by the end of June 2019 at the latest.		
Welsh Ministers will consider and sign off the plans following advice received from a full and independent assessment.							As soon as possible and by the end of July 2019 at the latest.	

73. The basis for the timeline is described below, covering data collection, transport, air quality and economic modelling of the local situation, options assessment, production of an initial plan (outlining an initial long list of options to refine to a short list for further assessment) local consultation and production and approval by the Welsh Ministers of a final business case/plan (for a preferred option/measure).
74. The timings are the Welsh Government's estimate of the necessary time to undertake a full business case prior to the implementation of a preferred option. The preferred option is expected to be implemented by 2020 or sooner, to achieve compliance in the soonest time. However, Caerphilly County Borough Council will develop its own timeline for determining measures and implementing them as part of their business cases to achieve compliance in the soonest time. Caerphilly County Borough Council's timeline will depend on the scale and complexity of the local situation and the remedial options considered. The Welsh Government is working with Caerphilly County Borough Council throughout the process to provide guidance and ensure timelines are the shortest possible, and will require delivery ahead of the dates in the direction where it is possible to do so. This includes the need to assess, and implement where possible, additional measures to accelerate reductions in exposure prior to the implementation of a preferred option.
75. Caerphilly County Borough Council must undertake the feasibility assessment in accordance with the HM Treasury's Green Book approach, a recognised business case model used across UK Governments and public bodies. The direction requires the development of business cases for an initial and final plan.
76. The Welsh Government expected the collection of data to continue at least until September 2018, in support of an initial plan, and it is likely to continue to support the development of the short list of measures (for example, helping to improve confidence in current predictions, define the boundaries of a potential measure, or support areas of identified weakness in current evidence). Timescales for data collection is dependent on the availability and quality of existing data and the complexity of the local situation.
77. Examples of data required to be collected may include traffic surveys of all vehicle types across the study area, estimates of likely behavioural responses to measures, local meteorological data, terrain data and air quality data. Data should be representative of the range of conditions expected over long term annual periods to ensure local assessments are robust. Traffic surveys should cover the major routes that will provide effective coverage of journeys in the study area (the area expected to

be affected significantly by measures to be implemented under the local plan). The surveys may be undertaken on a number of roads (non-compliant and adjacent compliant roads in the study area) for a sustained period of time (weeks to months). Further data may need to be captured following development of the initial plan in support of the preferred option. Air quality monitoring data should be measured using roadside monitors located within the study area. Local meteorological data should also be measured at the same time as the air quality data. Further measurements may be required as the scenarios are developed to support confidence in the scenario assessments, and may continue following development of the initial plan in support of a preferred option.

78. Remedial options will need to be scoped and developed, informed by local engagement, prior to commencing assessments. The local modelling will need to assess a range of scenarios and be based on robust and representative data, including the data referred to above. Air dispersion modelling is expected to be required throughout the study period to underpin all stages of the options appraisal process, and continue to be refined as new data becomes available, beginning once input data has been pre-processed and transport and other local emissions data are available. Timings will depend on the availability of robust datasets and the complexity of the local situation and of the measures proposed.
79. Options will be assessed and evaluated as soon as information becomes available, in parallel with the local assessments and consultation.
80. The HM Treasury Green Book approach provides an iterative process to the development of the business case. A robust options appraisal, including an assessment of the wider impacts of an option, is an important part of the business case. The broad aim of the options appraisal process is to demonstrate that the preferred option of a scheme delivers compliance within the shortest possible time. This requires demonstrating that a range of options have been considered and assessed in a consistent way, so that there is confidence in the preferred option.
81. The first stage of the options appraisal process is generating a broad list (examining all potential locally effective options) and reducing it to a shortlist of options that the local authority proposes to explore further, forming the main element of a local authority's initial plan. Initial modelling outputs, particularly air quality and transport, should facilitate this high level assessment. The initial plan should include all latest evidence deliverables.
82. The HM Treasury Green Book approach includes consideration of value for money. However, for the purpose of this feasibility study the determining factor when selecting

measures to tackle air quality must be their effectiveness, not their cost. Local authorities must identify which measures will meet the legal limits in the shortest time. The only situation in which cost can be taken into consideration is where there are two equally effective measures. For instance, only where two measures can be shown to be equally effective at bringing forward the likely date of compliance can the local authority lawfully choose the lowest cost option. Therefore, cost benefit analysis is not an appropriate primary method for selecting measures which would be most effective in bringing forward the likely compliance date. The Welsh Government anticipates this stage could take the local authority up to 2 months in cumulative time to develop and clear prior to submission to the Welsh Government.

83. The Welsh Government requested local authorities to submit initial plans by 30 September which should set out the case for change and identify options to accelerate compliance, including indicative costs.

84. Caerphilly County Borough Council submitted their initial plan to Welsh Ministers on 27 September and has published it on their website. Their plan can be viewed at the following web links:

https://www.caerphilly.gov.uk/CaerphillyDocs/Pollution/NO2_WelTAG_Stage1_Hafodyrynys.aspx

https://www.caerphilly.gov.uk/CaerphillyDocs/Pollution/NO2_WelTAG_Stage2_Hafodyrynys.aspx

85. If you have any questions in relation to proposed measures to tackle air pollution in Caerphilly, please contact Caerphilly County Borough Council Environmental Health Department directly at:

Telephone number - 01443 811346

Email - ehadmin@caerphilly.gov.uk

86. The Welsh Government has established an expert panel to undertake an independent assessment of the interim and final plans which will advise Welsh Ministers and ensure measures in the plans deliver compliance in the soonest time.

87. Sufficient time should be provided for all stakeholders to consider the local proposals and respond within local consultations. The Welsh Government anticipates that significant measures affecting local citizens will require local consultation, which would run for up to 3 months. Drafting of a consultation is likely to take up to a month, drawing on emerging data and proposals for a preferred measure.

88. Final plans and a full business case must be submitted to the Welsh Ministers by the end of June 2019 at the latest. The business case will describe the final, preferred, option for delivering compliance in the shortest possible time. These plans could take up to 3 months, following local consultation, to develop and sign-off prior to submission to the Welsh Ministers.
89. Following consideration and approval of the plans, the Welsh Ministers will require (by Direction) Caerphilly County Borough Council to implement the measure or measures in the plans which deliver compliance in the soonest possible time.
90. The Welsh Government recognises that a Clean Air Zone may not be appropriate for the purposes of accelerating compliance in all cases. For example, outside of urban areas where no alternative routes are available. In such situations, of which Hafod-yr-ynys is one, alternative measures may be required. The maximum time required to reach compliance in this area is currently uncertain and will be determined following Caerphilly County Borough Council's feasibility study. The Welsh Government expects that the local authority will begin to implement the most effective measures identified in the study (including potential infrastructure measures) by October 2019 and that they will be completed as soon as possible, and by the end of December 2020 at the latest, to achieve compliance by 2021 and sooner if possible.

Air quality data on A472 at Hafod-yr-ynys

91. Following concerns that the measured levels at this location were highly likely to be influenced by the unusual siting of the existing monitoring station, the Welsh Government commissioned an expert review. Resolution of the issue is ongoing. However, in light of the local monitoring and modelling data collected and assessed by Caerphilly County Borough Council as part of its feasibility study assessment we are confident that their proposals to address non-compliance in the soonest time are based on robust evidence. Therefore the siting of the monitor is no longer material to this WGSP.

Welsh Government support for Cardiff Council and Caerphilly County Borough Council

92. To support the development and implementation of feasibility studies, the Welsh Government has:

- Shared details of the road links identified as non-compliant in the national PCM model.
- Provided supporting information and guidance to inform the process and expected information required in feasibility studies including:
 - The approach to developing feasibility study set out in the UK Government's Inception Guidance, WelTAG guidance, HM Treasury Green book guidance and we have also requested local authorities to take account of the requirements of the Well-being of future generations Act 2015.
 - Ongoing support to local authorities has been provided through agreed governance arrangements. This involves frequent meetings, with each local authority and ongoing appraisal and feedback as each study has progressed.
- Allocated over £20 million for an Air Quality Fund through to 2021 to help accelerate compliance with NO₂ limits and improve air quality in Wales.

93. The Air Quality Fund will primarily be used to provide ongoing support, guidance and finance to enable Cardiff Council and Caerphilly County Borough Council to take action to achieve compliance with legal limits for NO₂ in the shortest possible time on roads, for which they are responsible. The funding will support the work of these local authorities to conduct feasibility studies, implement early measures which help accelerate exposure reduction and deliver the options which will achieve compliance with limit values in the shortest possible time.

Local Solutions on Welsh Government Managed Road Networks

94. As the relevant highway authority, the Welsh Ministers have direct responsibility for the motorway and trunk road network in Wales. Exceedances of legal limits for NO₂ have been identified on the following discrete stretches of motorway and trunk road outside the Cardiff and Swansea Urban Areas:
- (i) A494 at Deeside (North Wales Zone);
 - (ii) A483 near Wrexham (North Wales Zone);
 - (iii) M4 between Junctions 41 and 42 at Port Talbot (Swansea and South Wales Zone);
 - (iv) M4 between Junctions 25 and 26 at Newport (South Wales Zone); and
 - (v) A470 between Upper Boat and Pontypridd (South Wales Zone).
95. These areas are geographically isolated from each other, and have been assessed on an individual basis.
96. The Welsh Ministers have adopted a precautionary approach to the identification of measures. A measure has been identified for implementation, unless there is reasonable scientific certainty that it would *not* accelerate compliance with NO₂ limit values (either on its own or in combination with other measures) or, although a measure would achieve compliance at the relevant location, in doing so it would cause non-compliance elsewhere so that compliance overall is not accelerated or is even delayed.
97. Where more than one measure or a package of measures has been identified as accelerating compliance with the limit values, the Welsh Ministers have identified the measure or a package of measures that will accelerate compliance in a way which reduces NO₂ concentrations as quickly as possible.
98. Where more than one measure or package of measures has been identified as taking the same time to accelerate compliance, the Welsh Ministers have identified the measure or package of measures that has been assessed as being the most likely to accelerate compliance.
99. The assessment of measures has been predominantly based on using the Pollution Climate Mapping (PCM) model (2017) to define the future conditions and the assessment of measures using micro simulation traffic models focused on exceedance areas and air quality models using the Defra emission factor toolkit and air quality dispersion models adjusted with local monitoring, which is recognised practice for air

quality assessments and is also the best available information. Ongoing on site air quality monitoring is being undertaken to supplement the PCM information. Further measures have been included in this plan should the PCM data transpire to be lower than the on site results. For instance, NO₂ concentrations are higher than those modelled.

100. These measures have been classed as 'precautionary retained measures' (PRM). It should also be recognised that these PRM have the ability to reduce NO₂ concentrations, but would fail to achieve compliance in the shortest possible time. These measures require either a time period beyond that which could be achieved with alternative measures or rely on third party involvement and are not capable of being directly controlled by the Welsh Ministers.

The WelTAG process

101. To assess the measures required at the 5 locations, the Welsh Transport Appraisal Guidance (WelTAG) has been used whilst also satisfying the requirements of the Directive and Regulations.
102. WelTAG provides a robust framework for identifying and appraising the likely effectiveness of proposed measures in delivering specific objectives. In this case the focus is on air quality and the objective set is to identify measures which will assist in bringing forward reductions in NO₂ in the shortest possible time at each location.
103. WelTAG studies are taken forward in stages of increasing detail as potentially effective measures move through identification, comparison and selection. The outcome is a set of measures or packages of measures that are most likely to be effective in achieving compliance in the shortest possible time at a particular location.
104. WelTAG Stage 1 (Strategic Outline Case) identifies a long list of viable measures and, depending on their fit with the objective, is used to select a short list for further consideration. Following further investigation, WelTAG Stage 2 (Outline Business Case) is used to select measures on the basis of their performance against the objective preferred measures to be taken forward. WelTAG Stage 3 (Full Business Case) is used to make a full and detailed assessment of preferred measures to inform a final decision on their implementation.
105. In order to quantify the potential benefits at WelTAG Stage 3 detailed traffic and emissions/ dispersion modelling have been undertaken. This includes reviewing traffic data, reviewing air quality monitoring results, developing a base year air quality model,

generating baseline emissions data, verifying the base year air quality model, developing options models, developing options emissions data, limit value compliance assessments, re-run options models, re-run emissions options data and re-run limit value compliance assessments for each of the 5 locations.

106. WelTAG Stages 1, 2 and 3 were completed between December 2017 and September 2018 in order to inform the production of this plan.
107. At WelTAG Stages 1 and 2, a long list of measures was identified and then scrutinised and reviewed to provide a short list that was taken forward to the WelTAG Stage 3 process.
108. WelTAG Stage 1 included around 50 to 60 potential measures reduced from approximately 400 initial measures for all 5 sites, and a shortlist was assessed semi-qualitatively in WelTAG Stage 2. Due to the large number of measures considered, appraisal of their impact on air quality at WelTAG Stage 1 was undertaken using professional judgement. The WelTAG Stage 2 appraisal (including traffic and air quality monitoring data) used emissions and dispersion modelling but was based on assumed changes in traffic flow characteristics and volume for each measure.
109. Between 25 April and 19 June 2018, the Welsh Government consulted on the draft supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017. This included the outcome of WelTAG stages 1 and 2.
110. As a result of the WelTAG Stage 2 assessment the Welsh Ministers implemented speed restrictions at all 5 NO₂ exceedance sites at the end of June 2018 to reduce levels and exposure in the soonest time. These restrictions were identified as something which, without scientific doubt, would reduce exposure and speed up compliance with NO₂ limit values (assuming compliance with speed limits).
111. The introduced measure at all 5 exceedance sites was:
- A reduced 50 mph speed limit (current speed limit 70 mph) over the length of the exceedance combined with variable message signs informing drivers of the reason for the new speed limit and encouraging smooth traffic flows*.

*(*The Variable Speed Limit (VSL) in place on the M4 through Newport is presently set to the lower limit overnight over the length of the exceedance.)*

112. The methodology adopted at WelTAG stage 3 is summarised in Annex G.

113. The Welsh Government published a consultation entitled 'Tackling roadside NO₂ concentrations in Wales - Achieving Compliance with NO₂ Limit Levels on the Motorway and Trunk Road Network'³⁶ on 21 September 2018. The consultation ran for a period of 6 weeks, closing on 2 November 2018. The consultation sought views on the outcomes of the WelTAG Stage 3 assessments at each of the 5 NO₂ exceedance sites following completion of detailed investigations and modelling at the end of August 2018.
114. Key points from the WelTAG Stage 3 Assessments are summarised below, and should be read in conjunction with the WelTAG Stage 3 reports³⁷:
- A494 Deeside – Welsh Transport Appraisal Guidance (WelTAG) Stage 3 Report - September 2018
 - A483 Wrexham – Welsh Transport Appraisal Guidance (WelTAG) Stage 3 Report - September 2018
 - A470 Pontypridd – Welsh Transport Appraisal Guidance (WelTAG) Stage 3 Report - September 2018
 - M4 Port Talbot Junction 41 – Junction 42 - Welsh Transport Appraisal Guidance (WelTAG) Stage 3 Report - September 2018
 - M4 Newport Junction 25 – Junction 26 - Welsh Transport Appraisal Guidance (WelTAG) Stage 3 Report - September 2018
 - Impact Assessment Report - Consideration of interventions on the Welsh Government motorway and trunk road network for Nitrogen Dioxide reduction - September 2018
 - Summary of Responses to Welsh Government consultation on tackling roadside NO₂ concentrations in Wales - Achieving Compliance with NO₂ Limit Levels on the Motorway and Trunk Road Network - November 2018

The Baseline

115. The starting point for identifying the measures that are required by the Directive and the Regulations is the “baseline” at each relevant location. This refers to the concentrations of NO₂ at each location that are predicted if no measures are implemented (For instance, in a “do nothing” scenario). The air quality baseline has

³⁶ Welsh Government consultation on tackling roadside NO₂ concentrations in Wales - Achieving Compliance with NO₂ Limit Levels on the motorway and trunk road network'
https://beta.gov.wales/sites/default/files/consultations/2018-09/tackling-roadside-nitrogen-dioxide-concentrations-in-wales-consultation-document_1.pdf

³⁷ WelTAG Stage 3 Reports - <https://beta.gov.wales/tackling-roadside-nitrogen-dioxide-concentrations-wales-weltag-stage-3>

been derived from a combination of national modelling (PCM model) and monitoring undertaken by the local authorities and the Welsh Government specifically for these appraisals.

116. The on site monitoring involved the use of triplicate diffusion tubes exposed for approximately two weeks at each of the relevant locations. The diffusion tubes were located approximately 4 metres from the edge of the carriageway, at a height of approximately 2 metres. By the time the WelTAG Stage 3 reports were produced in August 2018, 6 months (12 exposure periods) of data was available. Ideally, monitoring data should continue for a full year in order to enable calculation of annual averages. Therefore, monitoring will continue during the implementation of the measures referred to below to assess their effectiveness and inform future studies.
117. In addition, as part of the WelTAG Stage 3 appraisal, locations have been identified for the installation of continuous monitoring stations to provide a reference method for monitoring the effect of the measures implemented (and to allow localised adjustment to the ongoing diffusion tube surveys). Depending upon the implemented measures at each site, additional diffusion tube survey sites (beyond the ongoing seven sites at each exceedance location) may also be identified.
118. The predicted baseline NO₂ concentrations are as follows.

Table 1: Baseline PCM predicted NO₂ concentrations at the 5 sites on the motorway and trunk road network without any measures

Stretch of Road	Extent	Site Location	NO ₂ Predicted Baseline Concentrations (µg/m ³)					
			2017	2018	2019	2020	2021	2022
A494 Deeside	5.9km	Aston Hill (PCM Link 559)	50.3	47.9	45.7	43.2	40.4	37.8
		Junction A550 – Junction A548 (PCM Link 30571)	48.4	46.1	44.1	41.7	39.1	36.7
		Junction A458 Shotwick Rd (PCM Link 30625)	41.9	39.8	37.9	35.9	33.7	31.6
A483 Wrexham	2.6km	Wrexham (PCM Link 30560)	41.2	39.3	37.6	35.7	33.5	-
A470 Pontypridd	4.2km	Pontypridd (PCM Link 40548)	47.6	45.7	43.9	41.7	39.1	-
		Upper Boat (PCM Link 10548)	41.8	40.1	38.5	36.6	34.3	-
M4 Newport Junction 25-26	1.4km	East of River Usk (PCM Link 70057)	40.8	38.9	37.2	35.3	33.1	-
		West of River Usk (PCM Link 40500)	48.5	46.1	44.0	41.7	39.0	-
M4 Port Talbot Junction 41-42	5km	Junction 41-42 (PCM Link 77075)	45.2	43.2	41.4	39.4	36.9	-

119. The table above shows that without the implementation of any measures, full compliance at the site is predicted as follows:

- A494 Deeside – by the end of 2022
- A483 Wrexham – by the end of 2018 (this year)
- A470 Pontypridd – by the end of 2021

- M4 Newport – by the end of 2021
- M4 Port Talbot – by the end of 2020

The measures considered

120. The table below summarises the steps in the assessment undertaken to identify the measures to be implemented at each of the 5 locations.

Table 2: Numbers of potential measures appraised by WelTAG stage of assessment

Site	Initial list	Stage 1	Stage 2	Stage 3 (inc CM*)	Stage3 sifting (inc CM*)	Stage 3 Air quality modelled	Selected action	Precautionary Retained Measures
A494 Deeside	404	56	18	13	9	4	1	1
A483 Wrexham	404	56	19	12	9	3	1	1
A470 Pontypridd	404	57	21	16	10	8	1	3
M4 Junction 25-26 Newport	404	57	13	8	7	4	2	1
M4 Junction 41-42 Port Talbot	404	58	13	10	9	5	1	2

*Inc CM = Including complementary measures package refer to paragraph 168

121. The table below describes the measures considered for all 5 sites for WelTAG Stage 3:

Table 3: Description of measures considered for the 5 sites for WelTAG Stage 3

Measure	Description	Anticipated Timescale
S4: Air Quality Screening/ Fencing/ Environmental Barriers	Physical barrier between the road and receptor. Barrier could be up to 9 metres in height above ground with a 3 metres foundation.	Up to 3 years
S7: Enforce/ Reduce Speed Limit	Mandatory reduction in the speed of vehicles on the site to 50mph by use of orders made under the Road Traffic Regulation Act 1984 and assumed to be enforced to ensure compliance. The 50mph speed limit was based on the fact that speed emission curves for vehicles indicate that 50 mph is likely to be the speed at which vehicles emit the lowest level of NOx.	In place June 2018
S14: Ramp Metering	A ramp meter, ramp signal or metering light is a device, usually a basic traffic light or a two-section signal (red and green only, no yellow) light together with a signal controller, that regulates the flow of traffic entering mainline flows according to current traffic conditions. In effect, it is the use of traffic signals at slip roads to manage the rate of vehicles entering the mainline flow.	Up to 1 year
S16: Junction Closures	Total closure of the slip road with a diversion route via more local roads. The closure of the slip roads requires a traffic regulation order under the Road Traffic Regulation Act 1984. The procedure to be adopted when making such orders is set out in legislation and requires consultation and publication of the proposals. Time must also be allowed for objections to be made and duly considered before the order can be	Up to 1 year

	made.	
S19: Variable Diversions	The implementation of advisory variable diversion routes. Altering road signs to encourage traffic to use particular junctions, thereby helping to reduce traffic at the relevant location. Advisory variable diversions do not require any traffic regulation orders and are quicker to install on the network than junction closures. However, they suffer from the fact they are entirely voluntary. Drivers relying on local knowledge or satellite navigation would be unlikely to comply with them.	Up to 1 year
S27: Parking Management	The review of park and ride sites along a particular route to provide the choice to drivers of using alternative means of transport.	Up to 2 years
S46: Clean Air Zones / Low Emission Zones	<p>A Clean Air Zone (CAZ) defines an area where targeted action is taken to improve air quality and resources are prioritised and coordinated in order to shape the urban environment in a way that delivers improved health benefits and supports economic growth.</p> <p>A low-emission zone (LEZ) is a defined area where access by some polluting vehicles is restricted or deterred with the aim of improving the air quality. This may favour vehicles such as (certain) alternative fuel vehicles, hybrid electric vehicles, or zero-emission vehicles such as all-electric vehicles.</p> <p>A CAZ or LEZ can be charging or non-charging and is made by subordinate legislation, either regulations or an order.</p>	Up to 4 years
S63: Distance Chevrons	Road markings placed on the carriageway to help drivers ensure the safe separation of vehicles, thereby smoothing the flow of traffic and reducing acceleration / deceleration.	Up to 1 year

122. The table below shows the measures tested at each exceedance location with comments why they were not tested at certain sites as part of WelTAG Stage 3.

Table 4: Measures appraised by NO₂ exceedance location

Measure	A494	A483	A470	M4 Junction 25-26	M4 Junction 41-42
S4: Air Quality Screening/ Fencing/ Environmental Barriers #	Yes	Yes	Yes	Sifted out at WelTAG Stage 2 due to ineffectiveness.	Sifted out at WelTAG Stage 1 due to ineffectiveness and deliverability.
S7: Enforce/ Reduce Speed Limit ##	Yes	Yes	Yes	Yes	Yes
S14: Ramp Metering	Yes	Sifted out at WelTAG Stage 2 due to ineffectiveness	Yes	Sifted out at WelTAG Stage 2 due to ineffectiveness.	Yes
S16: Junction closures	Sifted out at WelTAG Stage 1 due to deliverability.	Yes* – Sifted at WelTAG Stage 3 due to no suitable routes available and network capacity issues.	Yes	Yes	Yes
S19: Variable diversions	Yes	Yes	Yes	Yes	Yes
S27: Parking management	Sifted out at WelTAG Stage 1 due to ineffectiveness.	Sifted out at WelTAG Stage 1 due to ineffectiveness.	Yes	Sifted out at WelTAG Stage 1 due to ineffectiveness.	Sifted out at WelTAG Stage 1 due to ineffectiveness.
S46: Clean Air Zones / Low Emission Zones	Sifted out at WelTAG Stage 2 due to due to ineffectiveness and deliverability.	Sifted out at WelTAG Stage 2 due to due to ineffectiveness and deliverability.	Yes	Yes	Sifted out at Stage 3 due to timescales for implementation.

S63: Distance chevrons	Sifted out at WelTAG Stage 2 due to due to ineffectiveness.	Sifted out at WelTAG Stage 2 due to due to ineffectiveness.	Yes	Sifted out at WelTAG Stage 1 due to due to ineffectiveness.	Yes
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For S4, impacts of barriers on air quality were not modelled explicitly and they were conservatively estimated to reduce roadside concentrations by a maximum of $2\mu\text{g}/\text{m}^3$.

For S7, the effect of this measure is assessed on its own, but S7 is then also included as an existing measure in place for all other measures (F example, the S16 test is a test of S16+S7).

* This measure was carried forward from WelTAG Stage 2 assessments but was not considered further as part of WelTAG Stage 3 due to lack of suitable routes.

Effectiveness – Is the measure likely to deliver reductions in roadside concentrations proportionate to the scale of the exceedance above the $40\mu\text{g}/\text{m}^3$ legal limit.

Deliverability – Can the measure be delivered in the location by virtue of the powers available to Welsh Ministers.

A494 at Deeside (North Wales Zone)

123. The A494 through Deeside is a two lane dual carriageway. Deeside is predominantly an industrial conurbation of towns and villages in Flintshire. It is close to the Wales–England border lying near the River Dee that flows from neighbouring Chester into the Dee Estuary. Due to the river crossing and available road network in the area, diverting trunk road traffic (multi vehicle and high flows) options are limited. To displace significant traffic volumes with routes going through local towns and villages, there is not a route which would lend itself to remove traffic and reduce traffic volumes significantly enough to have a major impact. The Welsh Government is currently considering a bypass for the area as part of the A55 / A494 / A548: Deeside Corridor, but a bypass cannot be completed in time to accelerate compliance with limit values.

124. Table 5 shows the modelled impact of the measures selected through the WeITAG 3 process. The table illustrates the impact of the various measures starting in 2017 (2017 is included for comparative purposes) with the baseline.

Table 5: Impact of measures on roadside annual mean concentrations (Equivalent PCM Concentration, $\mu\text{g}/\text{m}^3$) on A494

Measure	Impact*	2017	2018	2019	2020	2021	2022
PCM Link 559							
Baseline		50.3	47.9	45.7	43.2	40.4	37.8
001 Speed Limit (SL)	-1.3		46.6	44.4	42.0	39.3	36.9
003 SL + Ramp Metering	-1.3			44.4	42.0	39.3	36.8
004 SL + Variable Diversions	-1.3			44.3	41.9	39.2	36.8
002 SL + Air Quality Barriers	-3.0						34.9
PCM Link 30571							
Baseline		48.4	46.1	44.1	41.7	39.1	36.7
001 Speed Limit (SL)	-1.5		44.7	42.6	40.4	37.9	35.5
003 SL + Ramp Metering	-1.5			42.6	40.3	37.8	35.5
004 SL + Variable Diversions	-1.5			42.6	40.3	37.8	35.5
002 SL + Air Quality Barriers	-3.2						33.5
PCM Link 30625							
Baseline		41.9	39.8	37.9	35.9	33.7	31.6
001 Speed Limit (SL)	-2.8		37.0	35.2	33.3	31.2	29.3
003 SL + Ramp Metering	-2.6			35.3	33.4	31.3	29.4
004 SL + Variable Diversions	-2.7			35.2	33.3	31.2	29.3
002 SL + Air Quality Barriers	-4.4						27.3

Note: **Red Box** Non-compliant, **Green Box** compliance achieved, **Grey Box** before implementation timeframe

125. The measure identified by the modelling as reducing levels in the shortest possible time is speed restrictions alongside variable diversions.
126. Given the marginal difference that variable diversions would make and taking into account the limited number of suitable alternative route these will not be pursued at this site. The modelling used in the table does not take account of the fact that the only viable alternative routes would require vehicles to either travel down Shotton Lane, a single track minor road or the B5125, which redirects traffic past a high school and day nursery.
127. This not only gives rise to wider health and safety concerns but would also lead to a consequential drop in air quality around the school and day nursery which, although likely to remain compliant, is highly undesirable. Public and local authority resistance to such a step would also be likely to delay the implementation of such a measure significantly. Both routes add over ten minutes to the journey time. Therefore, drivers with local knowledge or using satellite navigation are unlikely to comply with the diversion. This significantly diminishes the impact of such a measure.
128. It is noted that ramp metering alongside speed limits would reduce levels in a timespan marginally longer than variable diversions. However, this would not be any sooner than speed restrictions alone and the implementation period needed for these is longer. Further, the length of the slip road would not be suitable for the method of control, causing traffic to queue onto the local road network and road safety issues.
129. The installation of Air Quality Barriers has the potential to reduce concentrations significantly (3.0-4.4 μ g/m³). However, due to the time required for design including the potential need for planning permission, compliance with standards, technical approval (1.5 years) and construction (1.5 years) to implement this measure, the earliest date that these could be constructed is 2021 (3 years time). This is therefore not a measure which will mean compliance is achieved any sooner than speed restrictions alone. This is a PRM.
130. The Welsh Ministers have taken a considered decision that speed restrictions alone are the only measure that will achieve compliance with the NO₂ limit values in this air quality zone as soon as possible, in a way that reduces exposure to NO₂ as quickly as possible, and which mean it is likely, not just possible, that the limit values will be complied with.

A483 near Wrexham (North Wales Zone)

131. The A483 through Wrexham is a dual two lane carriageway. It passes through a semi urban part of Wrexham with residential properties to one side of the A483 and industrial areas/farming fields to the other.

Table 6: Impact of measures on roadside annual mean concentrations (Equivalent PCM Concentration, $\mu\text{g}/\text{m}^3$) on A483

Measure	Impact*	2017	2018	2019	2020	2021	2022
PCM Link 30560							
Baseline		41.2	39.3	37.6	35.7	33.5	31.4
001 Speed Limit (SL)	-4.3		35.2	33.6	31.9	29.9	28.1
004 SL + Variable Diversions	-4.2			33.4	31.7	29.7	27.9
002 SL + Air Quality Barriers	-5.6						26.1

Note: **Red Box** Non-compliant, **Green Box** compliance achieved, **Grey Box** before implementation timeframe

132. The installation of Air Quality Barriers has the potential to reduce concentrations significantly ($5.6\mu\text{g}/\text{m}^3$). However, due to the time required for design including the potential need for planning permission, compliance with standards, technical approval (1.5 years) and construction (1.5 years) to implement this measure the earliest date that these could be constructed is 2021 (3 years time). They are therefore not a measure which will mean compliance occurs any sooner than speed restrictions alone, but this has been identified as a PRM for the site.

133. Variable diversions would reduce concentrations, however, given the time to implement these in comparison with speed limits which reduce NO_2 exposure in the shortest possible time, they have not been considered further. In addition, the A483 does not have a suitable alternative route that drivers would use without a closure of the slips roads. The A5152 could be utilised as an alternative route but it is twice the distance to use this route and the journey would be approximately 5 times longer than if drivers used the A483 to travel between Junctions 5 and 6. Drivers with local knowledge or who are using satellite navigation are unlikely to comply with the advisory variable diversion, significantly diminishing the impact of such a measure. There are also more receptors affected on the A5152 than on the PCM link.

134. Based on the 2017 PCM model, the A483 will be compliant by the end of 2018 without any measures. However, due to the potential variance with PCM data and to help ensure compliance is achieved in the shortest possible time, the Welsh Ministers have implemented the measure likely to achieve this outcome, 50mph speed limits at this

site. The 50mph speed limits will be reviewed when sufficient information is available to confirm compliance. This will be September 2019 at the earliest.

135. The Welsh Ministers have taken a considered decision that the speed restrictions alone are the only measure that will achieve compliance with the NO₂ limit values in this air quality zone as soon as possible, in a way that reduces exposure to NO₂ as quickly as possible, and which mean it is likely, not just possible, that the limit values will be complied with.

A470 between Upper Boat & Pontypridd (South Wales Zone)

136. The A470 through Upper Boat to Pontypridd is a dual two lane carriageway. It passes through an urban area with residential properties, schools, colleges and a university to both sides of the A470. The diversion route for the slip road closures or variable diversion routes pass through local Air Quality Management Areas (AQMA) and therefore have been considered carefully with any proposed measures.

Table 7: Impact of measures on roadside annual mean concentrations (Equivalent PCM Concentration, $\mu\text{g}/\text{m}^3$) on A470

Measure	Impact*	2017	2018	2019	2020	2021	2022
PCM Link 40548							
Baseline		47.6	45.7	43.9	41.7	39.1	36.7
001 Speed Limit (SL)	-4.8		41.0	39.4	37.4	35.1	33.0
003 SL + Distance Chevrons	-6.2				35.9	33.7	31.7
007 SL + Ramp Metering	-4.6				37.3	35.0	32.9
008 SL + Variable Diversions	-4.6				37.3	35.0	32.9
004 SL + J-Close SB Bridge St.	-10.3				32.0	30.1	28.4
005 SL + J-Close SB Glyntaff	-4.8				37.1	34.9	32.7
006 SL + J-Close SB Both Jcts	-18.2				24.7	23.4	22.3
010 SL + Improved Car Parking	-5.0					34.5	32.4
002 SL + Air Quality Barriers	-6.0						31.0
009 SL + Clean Air Zone	-4.1						32.7
PCM Link 10548							
Baseline		41.8	40.1	38.5	36.6	34.3	32.2
001 Speed Limit (SL)	-2.7		37.5	36.0	34.1	32.0	30.0
003 SL + Distance Chevrons	-2.5				34.2	32.1	30.1
007 SL + Ramp Metering	-2.5				34.2	32.1	30.1
008 SL + Variable Diversions	-3.2				33.6	31.5	29.6
004 SL + J-Close SB Bridge St.	-8.8				28.4	26.8	25.2
005 SL + J-Close SB Glyntaff	-2.9				33.8	31.8	29.8
006 SL + J-Close SB Both Jcts	-12.6				24.9	23.5	22.3
010 SL + Improved Car Parking	-3.0					31.5	28.0
002 SL + Air Quality Barriers	-4.3						28.0
009 SL + Clean Air Zone	-2.5						29.8

Note: **Red Box** Non-compliant, **Green Box** compliance achieved, **Grey Box** before implementation timeframe

137. The greatest reduction in concentrations can be achieved with slip road closures or variable diversions. However, as already mentioned due to the diverted traffic needing to travel through local AQMAs there will be a displacement of the concentrations and increase in the concentrations by up to $10 \mu\text{g}/\text{m}^3$ in the Management Areas with the potential for them to become non-compliant with the Directive as a consequence. Furthermore, the diversion route passes local schools, colleges and residential areas and is highly undesirable. Public and local authority resistance to such a step would also be likely to delay the implementation of such a measure significantly.
138. Ramp metering has the potential to reduce concentrations on the A470 ($2.5\text{--}4.6\mu\text{g}/\text{m}^3$) but by no more than the speed limit measure. Also as with the other sites, the A470 does not have sufficient slip roads to safely install ramp metering without queues forming on local roads and causing road safety concerns.
139. Distance chevron markings have been reviewed for the site and due to the number of slip roads on the link and distance between the slip roads these may cause potential road safety concerns. Options have been considered, including only having lane 2 of the link marked with chevrons. However, this option will only produce half the effect with drivers either not using lane 2 or not being suitably separated when travelling in lane 1. When the chevron measure is considered alongside the speed limits, this brings the time period beyond that which can be achieved by the enforced speed limits alone and considering this, and the above issues, it has not been considered any further.
140. Parking improvements have the potential to reduce concentrations along the A470. The South Wales Metro system is currently being designed and in time the A470 will have a series of park and ride sites provided along the route. However, due to land constraints, impacts on the rail network and current progress of the Metro in the area, the earliest date that this could be achieved is by the end of 2020. It is therefore a PRM.
141. Air Quality Barriers have the potential to reduce concentrations, but as previously reported they require at least 3 years to implement. However, the measure has been retained as a PRM.
142. Clean Air Zones have the potential to reduce concentrations on the link. However, this needs some careful consideration due to the close proximity of the AQMAs. Further work with the local authority is required to review the potential for the CAZ and therefore it has been retained as a PRM. In any event the implementation period

brings the time at which a CAZ would begin reducing the levels beyond that achievable by speed restrictions alone.

143. The Welsh Ministers have therefore taken the considered decision that the enforced speed restrictions alone are the only measure that will achieve compliance with the NO₂ limit values in this air quality zone as soon as possible, in a way that reduces exposure to NO₂ as quickly as possible, and which mean it is likely, not just possible, that the limit values will be complied with.

M4 between Junctions 25 & 26 (Newport) (South Wales Zone)

144. The M4 at Newport has the highest annual average daily traffic flow (circa 80,000-100,000 vehicles per day). The route cuts through a densely populated area of Newport and is constrained either side by retaining walls and steep embankments. It is within a cutting and due to the topography the eastbound traffic has a steep incline from Junction 25 east of 5%. This gradient causes issues in particular for HGVs travelling through the area. In 2011, a Variable Speed Limit (VSL) system was installed to help improve traffic flow, reduce congestion and as a consequence improve air quality. This VSL system is subject to enforcement via fixed speed camera. At the time of writing there is a proposal to construct a corridor around Newport, the new M4. This will lower the NO₂ concentrations on the existing M4 with the reductions in traffic. This is currently awaiting a decision whether it will proceed to construction. If it does then the earliest date of opening is the end of 2023.

Table 8: Impact of measures on roadside annual mean concentrations (Equivalent PCM Concentration, µg/m³) on M4 Junction 25-26

Measure	Impact*	2017	2018	2019	2020	2021	2022
PCM Link 70057							
Baseline		40.8	38.9	37.2	35.3	33.1	31.1
001 Speed Limit (SL)	-0.9		38.0	36.3	34.4	32.2	30.2
002 SL + J-Close J25A WB off-slip	-1.4				34.0	31.8	29.9
003 SL + J-Close J26 WB off-slip	-0.9				34.4	32.2	30.2
004 SL + J-Close J26 EB on-slip	-1.0				34.4	32.2	30.2
005 SL + J-Close J26 WB off-slip and EB on-slip	-0.9				34.4	32.3	30.2
006 SL + Variable Diversions	-1.1				34.2	32.1	30.1
007 SL + Clean Air Zone	-0.9						30.2
PCM Link 40500							
Baseline		48.5	46.1	44.0	41.7	39.0	36.5
001 Speed Limit (SL)	-0.9		45.2	43.1	40.7	38.1	35.6
002 SL + J-Close J25A WB off-slip	-1.0				40.8	38.1	35.6
003 SL + J-Close J26 WB off-slip	-1.2				40.6	37.9	35.5
004 SL + J-Close J26 EB on-slip	-1.4				40.3	37.7	35.2
005 SL + J-Close J26 WB off-slip and EB on-slip	-1.7				40.1	37.5	35.1
006 SL + Variable Diversions	-1.6				40.1	37.5	35.1
007 SL + Clean Air Zone	-0.9						35.5

Note: **Red Box** Non-compliant, **Green Box** compliance achieved, **Grey Box** before implementation timeframe

145. Due to the traffic flow, topographical and highway layout through Newport, Link 40500 has no measures that will accelerate compliance until the end of 2021. The greatest reduction can be achieved with the rerouting of traffic, variable diversion routes or junction closures. Closure of Junction 26 westbound off slip and eastbound on slip roads has the potential to achieve this but as referenced above (Table 3), this measure requires a traffic regulation order. Furthermore, it only has a marginal difference to the variable diversions measure, which has the potential to achieve compliance in the shortest possible time as it does not require a traffic regulation order.
146. A Clean Air Zone does have the potential to reduce concentrations but will not accelerate compliance any quicker than a speed limit with variable diversions, due to the process and procedures involved in the implementation of a CAZ measure.
147. The 50mph speed limit alone at this site does not reduce the concentrations as quickly and as much as a combination of a 50mph speed limit with variable diversions. The reason for this is the high volume of traffic travelling through the site and by diverting some of the traffic accelerates compliance. Also the road network in this area makes it suitable for variable diversions as there are a number of viable routes to Newport City Centre.
148. The Welsh Ministers have taken a considered decision that speed restrictions with variable diversions are the only measure that will achieve compliance with the NO₂ limit values in this air quality zone as soon as possible, in a way that reduces exposure to NO₂ as quickly as possible, and which mean it is likely, not just possible, that the limit values will be complied with.
149. The current 50mph speed limit is implemented via the Variable Speed Limit system. At present, the limit is only set overnight, but the intention is for it to be active at all times where the limit would otherwise be set at 60mph or the VSL would be inoperative, i.e. when the default National Speed Limit would apply. Limits lower than 50mph will still be utilised when traffic flows and road conditions dictate that a lower limit is necessary.

M4 between Junctions 41 & 42 (Port Talbot) (Swansea & South Wales)

150. The M4 through Port Talbot is on an elevated section of the M4 to the east of the site and on the western extent. The site crosses the River Neath and alongside the site are industrial/commercial parks and a railway line. The site is semi urban. To the eastern end of the site, there is currently a mandatory 50mph speed limit adjoining the site which is enforced with Average Speed Enforcement (ASE).

Table 9: Impact of measures on roadside annual mean concentrations (Equivalent PCM Concentration, $\mu\text{g}/\text{m}^3$) on M4 Junction 41- 42

Measure	Impact*	2017	2018	2019	2020	2021	2022
PCM Link 77075							
Baseline		45.2	43.2	41.4	39.4	36.9	34.6
001 Speed Limit (SL)	-2.5		40.8	39.0	37.1	34.8	32.7
002 SL + Distance Chevrons	-2.4				37.1	34.8	32.7
003 SL + J-Close J41 EB on-slip	-2.3				37.3	35.0	32.8
004 SL + J-Close J41 WB on-slip	-3.5				36.1	33.9	31.8
005 SL + J-Close J41 EB & WB on-slip	-3.3				36.3	34.0	31.9
006 SL + Ramp Metering	-2.4				37.1	34.8	32.7
007 SL + Variable Diversions	-2.8				36.8	34.5	32.3

Note: **Red Box** Non-compliant, **Green Box** compliance achieved, **Grey Box** before implementation timeframe

151. For all measures at this site, the amount of reduction in concentrations is between 2.3-3.5 $\mu\text{g}/\text{m}^3$ and therefore closely aligned. Measures that do not achieve compliance any quicker than the proposed measure (speed limits) have not been progressed.

152. The distance chevrons, as with the A470 site, cause road safety concerns with the layout that can be achieved given the number and close proximity of slip roads on the site that will not allow the measure to be fully realised.

153. Junction 41 eastbound, or eastbound and westbound on slip road closures do not achieve as great a reduction in concentrations as the Junction 41 westbound on slip only road closure would as a stand alone measure. This measure has the potential to bring compliance and concentrations down by 3.5 $\mu\text{g}/\text{m}^3$, although the redistribution of traffic could result in increased exposure overall, as there are more receptors adjacent to the alternative route (Harbour Way) than the PCM link.

154. A trial slip road closure of this junction was carried out previously by the Welsh Government in 2015. The slip road closure was not implemented at that time due to the public feedback and other issues in the area, in particular the uncertain future of Port Talbot Steelworks.
155. Since 2015 and the trial closure, the diversion route that could be used has had a number of further developments constructed including a super school created following the closure of several local high schools. It is therefore deemed to be a precautionary retained measure until further work and discussion can take place with the local authority and stakeholders in the area. It is also acknowledged that this measure is likely to be strongly resisted by local residents and the local authority. The Welsh Ministers therefore consider that the potentially significant time period required to investigate and implement the closure means that this measure would not reduce NO₂ concentrations any sooner than the speed limits alone.
156. The variable diversions have been classed as a precautionary retained measure as it is expected that the rate of compliance with air quality limits is only marginally greater than with speed limits alone. As with the closures of the slip road and available diversion routes, this measure needs to be explored further to assess the impact with diverting the traffic close to the super school and the potential additional measures that this may require on the local road network.
157. Ramp metering has the potential to bring NO₂ concentrations down, although no quicker than the enforced speed limits measure. A previous design assessment has taken place of this measure and there is only one slip road that could be used for this operation, the Junction 41 eastbound on-slip. This slip road is sufficiently long enough to accommodate ramp metering without causing a concern with traffic backing back onto local roads. However, the reduction cannot be achieved any sooner than with the speed limits alone and It is not proposed to consider this measure any further.
158. The Welsh Ministers have taken the considered decision that the speed restrictions are the only measure that will achieve compliance with the NO₂ limit values in this air quality zone as soon as possible, in a way that reduces exposure to NO₂ as quickly as possible, and which mean it is likely, not just possible, that the limit values will be complied with.

Summary of WelTAG Stage 3 Action Plan

159. The table below shows the measures to be implemented at the 5 exceedance locations, in respect of which there is reasonable scientific certainty that they will accelerate compliance with the limits set out in the Ambient Air Quality Directive (2008/50/EC) and the Air Quality Standards (Wales) Regulations 2010 in the shortest possible time. The subsequent table shows the PRM for the same 5 exceedance locations, in respect of which there is reasonable scientific certainty that they will accelerate compliance with the limits set out in the Ambient Air Quality Directive (2008/50/EC) and the Air Quality Standards (Wales) Regulations 2010 but not in the shortest possible time.

Table 10: Action Plan measures by Exceedance Location

Location	Measure	Definition	Implementation Date	Compliance Achieved
A494 Deeside	S7: Enforce / Reduce Speed Limit	50 mph Speed Limit – B5125 St David's Interchange (Holywell Road) to the A458 Deeside Park Interchange (Shotwick Road) at the Welsh/ English Border (approximately 5.9km)	June 2018	2021 (1yr earlier)
A483 Wrexham	S7: Enforce / Reduce Speed Limit	50 mph Speed Limit – Junction 5 (Mold Road Interchange) to Junction 6 (Gresford Interchange) (approximately 2.6km)	June 2018	2018 (no change)
A470 Pontypridd	S7: Enforce / Reduce Speed Limit	50 mph Speed Limit – Upper Boat Roundabout and the A4058 Roundabout at Pontypridd (approximately 4.2km)	June 2018	2019 (2yrs earlier)
M4 J25-26	S7: Enforce / Reduce Speed Limit	Off and inter peak 50 mph Speed Limit – To the east of Junction 25 (Caerleon Road) to Junction 26 Malpas (approximately 1.4km)	June 2018 (off peak) December 2018 (off peak and inter peak)	2021 (no change)
	S19: Variable Diversions	Variable Diversion – encouraging local traffic for Newport to leave the M4 prior to Junctions 25 and 26 when periods of high concentrations of NO ₂ are likely.	December 2019	
M4 Junction 41-42	S7: Enforce / Reduce Speed Limit	50 mph Speed Limit – From the end of the current 50mph speed limit near Junction 41 (Baglan) to Junction 42 (approximately 5.0km)	June 2018	2019 (1yr earlier)

Table 11: PRM measures by Exceedance Location

Location	Measure*	Definition
A494 Deeside	S4 - Air Quality Barrier	One location where there is potential exposure to air pollution above the limit value where the installation of barriers could be of benefit.
A483 Wrexham	S4 - Air Quality Barriers	One location where there is potential exposure to air pollution above the limit value where the installation of barriers could be of benefit.
A470 Pontypridd	S4 - Air Quality Barriers	Six locations have been identified where there is potential exposure to air pollution above the limit value where the installation of barriers could be of benefit.
	S46 Clean Air Zone	This measure here specifically relates to the imposition of restrictions on the most polluting vehicles, whether as absolute bans or via charging.
	S27 improved car parking	The Welsh Government are appraising options for improved parking under the South Wales Metro proposals and seeking to bring forward implementation timeframes.
M4 Junction 25-26	S46 Clean Air Zone	This measure here specifically relates to the imposition of restrictions on the most polluting vehicles, whether as absolute bans or via charging.
M4 Junction 41-42	S16 – junction closures	Closure of Junction 41 Westbound On-slip, plus 50mph Speed Limit – The measure currently does not bring forward compliance or reduce NO ₂ exposure in non-compliant areas beyond that achieved by the existing speed limit measure alone but has been demonstrated to reduce concentrations on the M4.
	S19 – variable diversions	The measure currently does not bring forward compliance or reduce NO ₂ exposure in non-compliant areas beyond that achieved by the existing speed limit measure alone but has been demonstrated to reduce concentrations on the M4.

all PRM assume that the 50mph speed limit is also already in place.

Summary Local Solutions on Welsh Government Managed Road Networks

160. 50mph speed limits have been in place at each of the 5 exceedance locations since June 2018. It is proposed that the current temporary orders made under section 14 of the Road Traffic Regulation Act 1984 will be revoked and replaced with orders made under section 84 of the Road Traffic Regulation Act 1984. This will ensure that the limits can remain in force beyond 2019 where they are required. This is particularly necessary given the potential variance regarding the PCM data. The 50mph speed limit on the M4 is implemented through the existing Variable Speed Limit order and as such can remain in place for as long as it is required.
161. The Welsh Ministers anticipate that the speed limits will remain in force for as long as they are required to maintain air quality standards. Accordingly, it is not possible to confirm the duration of the limits at this stage. It is expected that vehicle emissions will reduce as more new and cleaner vehicles come into use and older, more polluting vehicles become obsolete. However, the 50mph speed limits will be reviewed periodically to determine whether they are still necessary.
162. The WelTAG Stage 3 assessment has shown that 50mph speed limits are the optimal approach in all 5 locations. In addition, a Variable Diversion to encourage local traffic for Newport to leave the M4 prior to Junctions 25 and 26 when periods of high concentrations of NO₂ are likely at the M4 Junction 25-26 Newport location.
163. Compliance with the 50mph speed limits is central to the effectiveness of the measures and enforcement of the speed limits is required to ensure the greatest compliance. Engagement with the Police is ongoing in respect of enforcement of the speed limits. The Welsh Government has committed to providing the necessary funding and support to assist in this regard.
164. The attached timetable confirms the further work taking place along with key milestones when decisions are required on the precautionary measures. It is planned that work will continue with these precautionary retained measures in parallel to the monitoring.
165. The effect of the measures on NO₂ concentrations at each of the 5 exceedance locations is currently being monitored by diffusion tubes and the intention is to supplement these with continuous monitoring using reference method analysers by early 2019.

166. The proposed measures outlined above are likely to achieve compliance with NO₂ limit values as soon as possible in a way that reduces exposure to NO₂ as quickly as possible in relation to the current PCM predicted NO₂ concentrations.
167. Depending on the results of the onsite air monitoring, the “Precautionary Retained Measures” contained in the summary tables above may also have to be implemented to achieve ongoing compliance with the air quality limits. These precautionary retained measures will be subject to ongoing review using the Welsh Government monitoring put in place specifically for this purpose

Complementary Measures

168. For WelTAG Stage 3, measures have been subdivided into ‘hard measures’ with tangible benefits on the network with reductions in concentrations being a direct consequence of the measure imposed and the soft or ‘complementary measures’ which could provide benefits at all 5 locations on the network, and potentially across the Welsh trunk road and motorway network as a whole. However, it is not possible to attribute any specific numerical reduction in NO₂ concentrations to such soft or complementary measures given they rely on conscious decisions by the drivers.
169. The complementary measures have therefore been included in all site-specific action plan packages going forward to implementation, but there has been no specific assessment of their impact. Whilst the direct benefits of the ‘soft measures’ are generally less than the ‘hard measures’, the ‘soft measures’ have little to no adverse impacts against other WelTAG impact areas, and so there is no reason not to universally include them in the WGSP.
170. The set of ‘soft measures’ identified as the complementary package of measures are:
- S28: Behaviour Change – implement a package of several measures aimed at changing travel behaviour, encouraging mode shift away from private car use.
 - S51: Intelligent Traffic Management* - linking real-time emissions / air quality data with traffic management, and / or remote monitoring through use of Intelligent Transport Systems and other innovative technological systems.
 - S62: Signage - implement signage on the A483 to encourage better driving behaviour, reminding drivers to turn off their engine when stationary and emphasise awareness of other measures and/or awareness of entering an area of any special measures.
 - S65: Air Quality Areas - use publicity campaigns and branding of areas to raise awareness of poor air quality within the area.

- S66: Air Quality Communications - implement a package of measures to generally raise awareness of air quality.

* To complement the reduced speed limits, additional signs will be placed at the start of the reduced speed limit areas to relay the reasons for the speed limit reductions.

171. The complementary measures will initially be based on a significant communications campaign using social media, radio and signs on the network to highlight the air quality issues. This campaign will be reiterated throughout the year at key periods when the air quality is measured to be at a high level from the roadside monitors. There will also be regular updates and announcements provided on the air quality monitoring results at key stages over the coming years which should help reaffirm the messages and understanding of the issues.

172. There are plans to launch a Wales wide schools competition. This competition will provide an opportunity for school children to design a symbol and sign that could be used at the 5 sites and provide further public awareness. This will also help with furthering education on air quality issues.







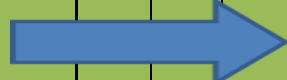
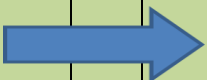
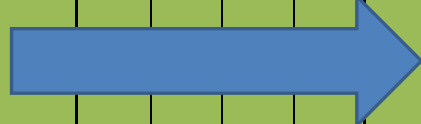
Next steps in relation to action being taken on the Welsh Government motorway and trunk road network to meet NO₂ legal limits

173. The next steps are:

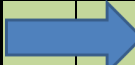
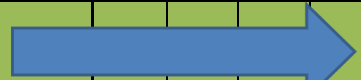
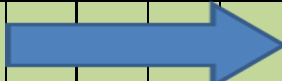











- Revoke and replace the current temporary orders to ensure that the limits can remain in force beyond 2019 where required;
- Implement additional signing at the sites on the A494, A483, A470 and M4 Port Talbot. The M4 Newport VSL already has electronic signs in place for speed limits;
- To launch a communication campaign and take forward the complementary measures;
- To launch a schools competition to educate children on air quality and look to badge the sites with a symbol to help raise awareness of the issues;
- To continue discussions and engagement with the Police regarding enforcement and education around the 50mph speed limits at the 5 locations;
- For the M4 Junction 25-26 to implement the Variable Diversion as soon as possible and work with Newport City Council on the measure proposed;
- To continue with the ongoing monitoring and report in September 2019 when a full set of validated data is available;
- To implement the electronic monitoring air quality instruments at all 5 sites; and

- To continue developing the design of the PRM as measures to be ready to implement if required.

Programme for implementation of measures, design and construction for PRM and air quality monitoring

Action	2018 Q4	2019 Q1 Q2 Q3 Q4				2020 Q1 Q2 Q3 Q4				2021 Q1 Q2 Q3 Q4				2022 Q1 Q2 Q3 Q4				2023 Q1 Q2 Q3 Q4				2024 Q1 Q2 Q3 Q4			
Publish Welsh Government Supplemental Air Quality Plan																									
Revoke and replace the current traffic orders to ensure that the limits can remain in force beyond 2019 where required																									
Launch Complementary Measures and Communications Campaign																									
Launch Schools Campaign																									
Design permanent speed limit sign and road marking layouts for the four sites (A470, A494, A483 and M4 Jct 41 to 42) Adjust VSL for off peak and overnight 50mph																									
Install the electronic monitors at all the sites																									
Consultation with Local Authorities and key stakeholders																									
Install the permanent speed limit signs and road markings for the four sites (A470, A494, A483 and M4 Jct 41 to 42)																									
Install the Average Speed Enforcement Cameras (subject to further engagement with the Police)																									

Programme for implementation of measures, design and construction for PRM and air quality monitoring (continued)

	2018	2019				2020				2021				2022				2023				2024			
Action	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Install the additional information signs at all sites and variable diversion routes signs for Newport																									
Design the Precautionary Retained Measures for all sites including engagement with key stakeholders																									
Construct the PRM at applicable sites (To be confirmed during the design phase for durations)*																									
Publish the Annual Average Air Quality Results																									
A494 Deeside - compliance by the end of 2021																									
A483 Wrexham - compliance by the end of 2018																									
A470 Pontypridd - compliance by the end of 2019																									
M4 Junction 25 to Junction 26 - compliance by the end of 2021																									
M4 Junction 41 to Junction 42 - compliance by the end of 2019																									

Additional Welsh Government measures to support compliance

Welsh Government Transport Policy



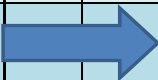



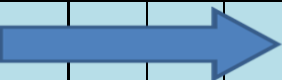




174. A broad range of actions to tackle transport emissions across the whole of Wales have been and will be implemented by the Welsh Government and further measures are being considered. Many within the context of the decarbonisation of transport. Improving air quality by reducing emissions from transport will be a key pillar in the development of a new Wales Transport Strategy by the end of 2019
175. The Welsh Government is also commissioning a further WelTAG assessment of the potential measures originally identified in a list of 404, but weren't developed through the original Stage 1 WelTAG appraisal. The original list was sifted on the basis of duplication, ambiguity and non-applicability to the Welsh Government strategic road network. A programme for the WelTAG assessment of these potential measures is included below.
176. Encouraging a shift from an overreliance on the private car to more sustainable modes of transport such as walking and cycling and public transport is a key element of the Welsh Government's policy approach.
177. The Welsh Government's Active Travel (Wales) Act 2013³⁸ came into force in September 2014. It requires local authorities to map and continuously improve routes and facilities for cycling and walking. This is being supported by an investment of £60 million over three years from 2018 to create new active travel routes across Wales. It will make active modes of transport safer and more attractive prospects and will thereby encourage people to choose these instead of private cars.
178. The new Wales and Borders rail franchise, awarded by the Welsh Government in 2018, will deliver a £2 billion investment to introduce new, cleaner, rolling stock, modernise all 247 stations and provide new, additional services, bringing about a 65% increase in capacity and greatly increasing the attractiveness of rail travel.
179. The new South Wales Metro and plans for other Metro schemes in Wales will bring about a step change in the integration and frequency of public transport services to offer a compelling alternative to car journeys. These wider measures will all contribute to an overall reduction in emissions across Wales, including at the sites identified as not being compliant with NO₂ limits.

³⁸ Active Travel (Wales) Act 2013 - [Http://www.legislation.gov.uk/anaw/2013/7/contents](http://www.legislation.gov.uk/anaw/2013/7/contents)

180. The Welsh Government will engage with stakeholders as we develop further policies and proposals which will contribute towards Wales meeting its current and future air quality legal obligations, carbon budgets and targets. This will encompass all transport modes, and will include measures to help promote the uptake of low emission vehicles in Wales. We will consider the feasibility of introducing a car scrappage scheme and we have already committed to providing £2 million to help secure a network of electric vehicle charging points throughout Wales.
181. We have also set out a bold ambition to reduce the carbon footprint of buses and taxis in Wales to zero by 2028 with a consequent significant reduction in emissions. Through this action we will bring about significant improvements to air quality in our towns and cities and show leadership in the drive to low carbon and low emission transport.
182. The Welsh Government will continue to advise local authorities, bus operators and other businesses on bidding for UK Government funding that extends to Wales, including the Low Emission Bus Fund and Workplace Charging Scheme
183. The Welsh Government's ability to take action in relation to air quality is limited to taking steps that fall within the scope of the matters within the devolved competence of the Welsh Ministers and the National Assembly for Wales. The Welsh Government engages with the United Kingdom Government on relevant matters that are outside its devolved competence, such as regulation of the construction and equipment of motor vehicles and trailers, including vehicle specification standards, vehicle excise duty and fuel duty. However, the Welsh Government will take any opportunity within devolved competence, where it is possible to bring about behavioural or other changes that will contribute towards improved air quality in these areas. The investment in electric vehicle charging infrastructure and the carbon footprint reduction targets for buses and taxis being examples of this.
184. The Welsh Government will welcome proposals from the UK government in these areas which will contribute towards the overall reduction in emissions including NO₂.

Assessment of options not taken forward under WelTAG Stage 1

The following programme is intended to demonstrate the commitment to progress the sifted options that were initially highlighted as part of the WelTAG Stage 1 process on the Welsh Government strategic road network. These options are mainly policy decisions and require longer periods to consider and assess, but they should help towards achieving improved air quality for Wales in the longer term.

Action	2018	Q1 2019			Q2 2019			Q3 2019			Q4 2019		
	Q4	Jan	Feb	March	April	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Procure consultant to undertake assessment of options not taken forward under WelTAG Stage 1 assessment													
Consultant Initiation													
Consultant undertakes WelTAG Stage 1 assessment (SOC)													
Stakeholder workshop													
Stage 1 Report													
Review Group assessment													
Consultant undertakes WelTAG Stage 2 (OBC) and 3 (FBC) assessment													
Stakeholder workshop													
Stage 2 Report													
Review Group assessment													
Stage 3 Report													

Additional Welsh Government support for all local authorities in Wales

185. The new Enabling Natural Resources and Well-being grant supports projects that make improvements in and around residential areas by delivering benefits for people, businesses and their communities by making clear and visible improvements in and around the places where people live including improving access across Wales.

186. The grant seeks collaborative cross sector projects that will deliver a range of benefits to communities and improved outcomes across the well-being goals, helping to achieve more sustainable models for delivery in the longer term. It provides a combination of revenue and capital funding with a focus on pilot and demonstration projects, promoting cooperation and collaboration. The following themes of action clearly support the reduction of pollution levels in our air and the enhancement of air quality:

- Developing, regenerating and broadening access to sustainable green infrastructure;
- Improving the quality of the urban and rural built environment; and
- Developing resilient ecological networks, areas and nature based solutions.

Glossary

Air quality zone	An area for the assessment of air quality under the Directive
ANPR	Automatic Number Plate Recognition
AQD	Ambient Air Quality Directive
AQMA	Air Quality Management Area
CAZ	Clean Air Zone
COMEAP	Committee on the Medical Effects of Air Pollutants
COPERT	Computer Programme to calculate Emissions from Road Transport
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emissions Factor Toolkit
EU	European Union
Euro standards	EU-wide standards for exhaust emissions of air pollutants
EV	Electric vehicle
HGV	Heavy Goods Vehicle
HMT	Her Majesty's Treasury
INRIX	A dataset that's collated from billions of observed GPS devices on the road network and then split out into five different time periods (AM,PM, Peak, Off Peak and Night)
Inter Peak	Period between the AM and PM peaks for travel time
LAQM	Local Air Quality Management

LEZ	Low-emission zone
LGV	Light Goods Vehicle
MPH	Miles per hour
NO	Nitric oxide
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides (includes NO and NO ₂)
Off Peak	Period overnight for travel time
PCM	Pollution Climate Mapping
PM	Particulate matter
PRM	Precautionary retained measures
UK	United Kingdom
Urban Agglomeration	A large urban area for the assessment of air quality under the Directive
WelTAG	Welsh Transport Appraisal Guidance

Annex A – General information about each air quality zone

The climate

187. Information on UK climatic data is provided in the *Technical Report*³⁹ of the *UK Plan for tackling roadside nitrogen dioxide concentrations*. The UK lies in the latitude of predominately westerly winds where depressions and their associated bands of cloud and rain ('fronts') move eastwards or north-eastwards across the North Atlantic, bringing with them unsettled and windy weather particularly in winter. Between the depressions there are often small mobile anticyclones that bring fair weather. It is the sequence of depressions and anticyclones that is responsible for the UK's changeable weather.
188. The western and northern parts of the UK tend to lie close to the normal path of the Atlantic depressions. Consequently, in those parts of the UK winters tend to be mild and stormy while the summers, when the depression track is further north and the depressions less deep, are mostly cool and windy. The mountains in these regions have the effect of producing a marked increase in rainfall. The lowlands of England have a climate similar to that in continental Europe: drier with a wider range of temperatures than in the north and west. However, the winters are not as severe as those on the continent. Overall, the south of the UK is usually warmer than the north, and the west is wetter than the east. The more extreme weather tends to occur in mountainous regions where it is often cloudy, wet and windy.
189. Detailed UK climatic data is available on the Met Office website.
190. National Meteorological Library and Archive Fact sheet 4 Climate of the British Isles - <https://www.metoffice.gov.uk/learning/library/publications/factsheets>.

Topography

191. The mountainous regions of mid and north Wales include the highest point 1085 metres above sea level. The population is concentrated in the lowland South which includes Cardiff and Swansea. Detailed UK population density data is available from the Office of National Statistics - https://www.ons.gov.uk/visualisations/nesscontent/dvc134_c/index.html).

³⁹ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/632916/air-quality-plan-technical-report.pdf

192. General information in relation to each zone is provided below, including the zone boundaries, population estimates and compliance status.

Cardiff Urban Area

193. Figure 1 shows the area covered by the Cardiff Urban Area agglomeration zone and the location of monitoring stations in the region. NO₂ measurements in this zone were available in 2015 from the following national network monitoring stations (NO₂ data capture for each station in 2015 shown in brackets).

Site name	Latitude, Longitude:
Cardiff Centre GB0580A (80%)	51.481780, -3.176250

194. Full details of monitoring stations within the South Wales non-agglomeration zone are available from <http://uk-air.defra.gov.uk/networks/network-info?view=aurn>.

195. Local authority boundaries do not necessarily coincide with zone boundaries. Hence local Authorities may be listed within more than one zone plan. The local authorities within the zone are:

- Cardiff County Council.
- Vale of Glamorgan Council.

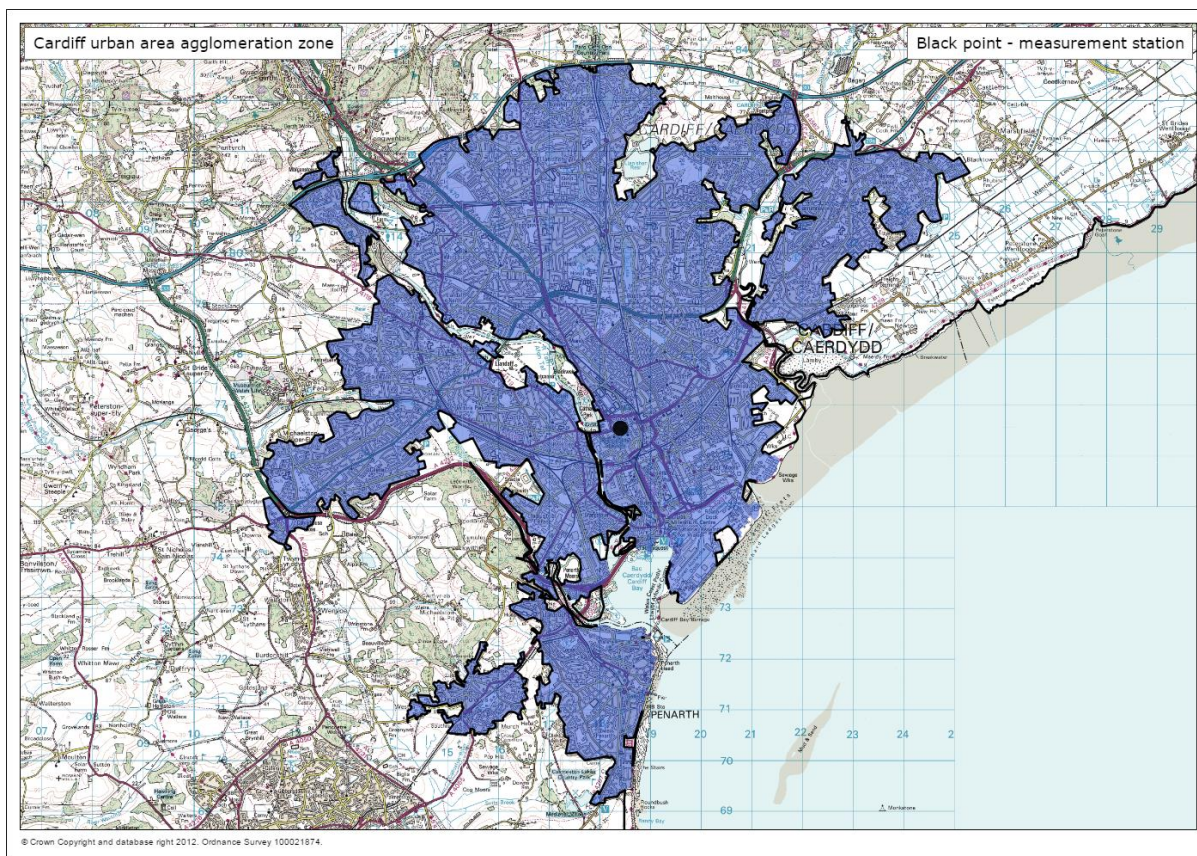


Figure 1: Map of Cardiff Urban Agglomeration zone and measurement station (black dot).

196. The total population within the zone is approximately 327,129. Within the Cardiff Urban Area agglomeration zone the annual limit value was exceeded in 2015.

Swansea Urban Area

197. Figure 1 shows the area covered by the Swansea Urban Area agglomeration zone and the location of monitoring stations in the region. NO₂ measurements in this zone were available in 2015 from the following national network monitoring stations (NO₂ data capture for each station in 2015 shown in brackets):

Site name	Latitude, Longitude:
Port Talbot Margam GB0906A (94%)	51.583950, -3.770822
Swansea Roadside GB0896A (99%)	51.632696, -3.947374

198. Full details of monitoring stations within the South Wales non-agglomeration zone are available from <http://uk-air.defra.gov.uk/networks/network-info?view=aurn>.

199. A list of local authorities within the zone is given below:

- City and County of Swansea
- Neath & Port Talbot County Borough Council

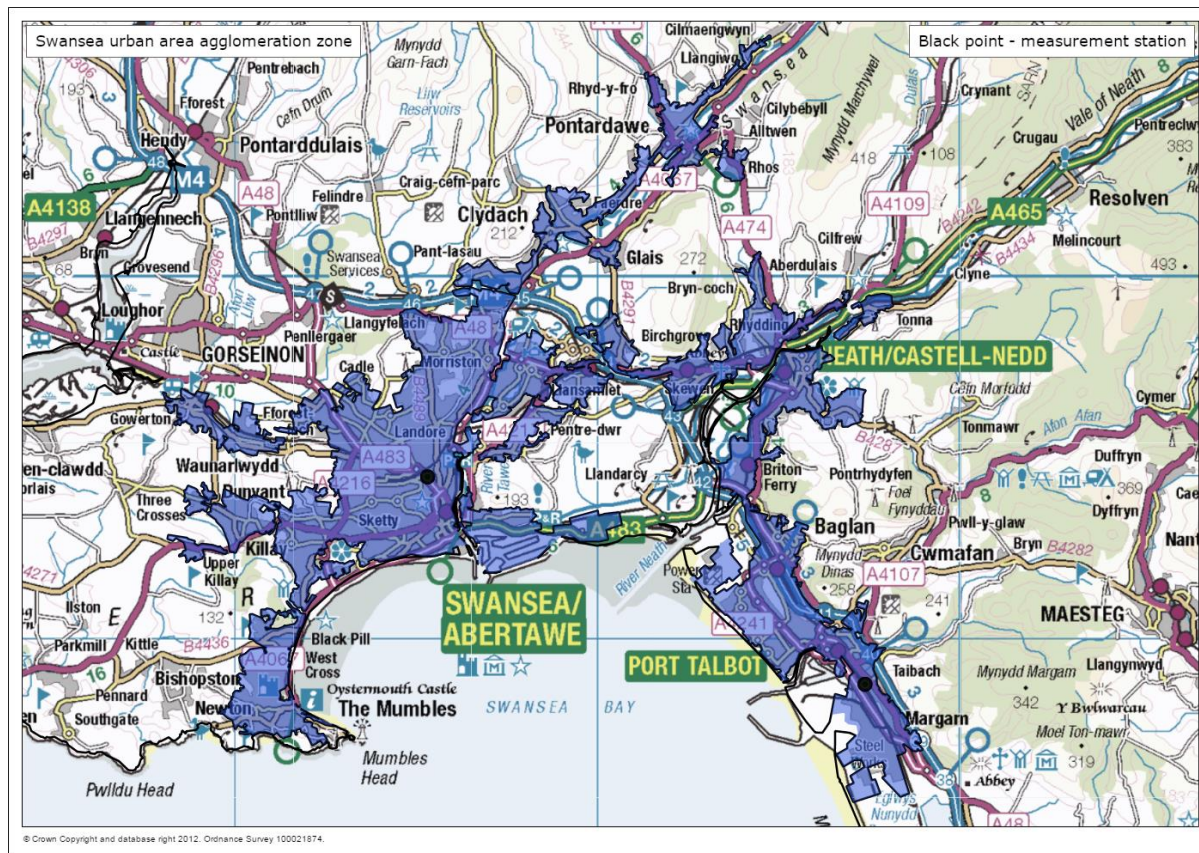


Figure 2: map of Swansea Urban Agglomeration zone and measurement stations (black dots).

200. The total population within the zone is approximately 210,269. Within the Swansea Urban Area agglomeration zone the annual limit value was exceeded in 2015.

South Wales non-agglomeration zone

201. Figure 2 shows the area covered by the South Wales non-agglomeration zone and the location of monitoring stations in the region. NO₂ measurements in this zone were available in 2015 from the following national network monitoring stations (NO₂ data capture for each station in 2015 shown in brackets):

Site name	Latitude, Longitude:
Chepstow A48 GB0921A (98%)	51.638094, -2.678731
Cwmbran GB0744A (99%)	51.653800, -3.006953
Narberth GB0043R (99%)	51.781784, -4.691462
Newport GB0962A (86%)	51.601203, -2.977281
Hafod-yr-ynys Roadside GB1038A (99%)	51.680579, -3.133508

202. Full details of monitoring stations within the South Wales non-agglomeration zone are available from <http://uk-air.defra.gov.uk/networks/network-info?view=aurn>.

203. A list of local authorities within the zone is given below:

1. Blaenau Gwent County Borough Council
2. Bridgend County Borough Council
3. Caerphilly County Borough Council
4. Cardiff County Council
5. Carmarthenshire County Council
6. Ceredigion County Council
7. City and County of Swansea
8. Merthyr Tydfil County Borough Council
9. Monmouthshire Council
10. Neath & Port Talbot County Borough Council
11. Newport City Council
12. Pembrokeshire Council
13. Powys County Council
14. Rhondda-Cynon-Taff Council
15. Torfaen County Borough Council
16. Vale of Glamorgan Council

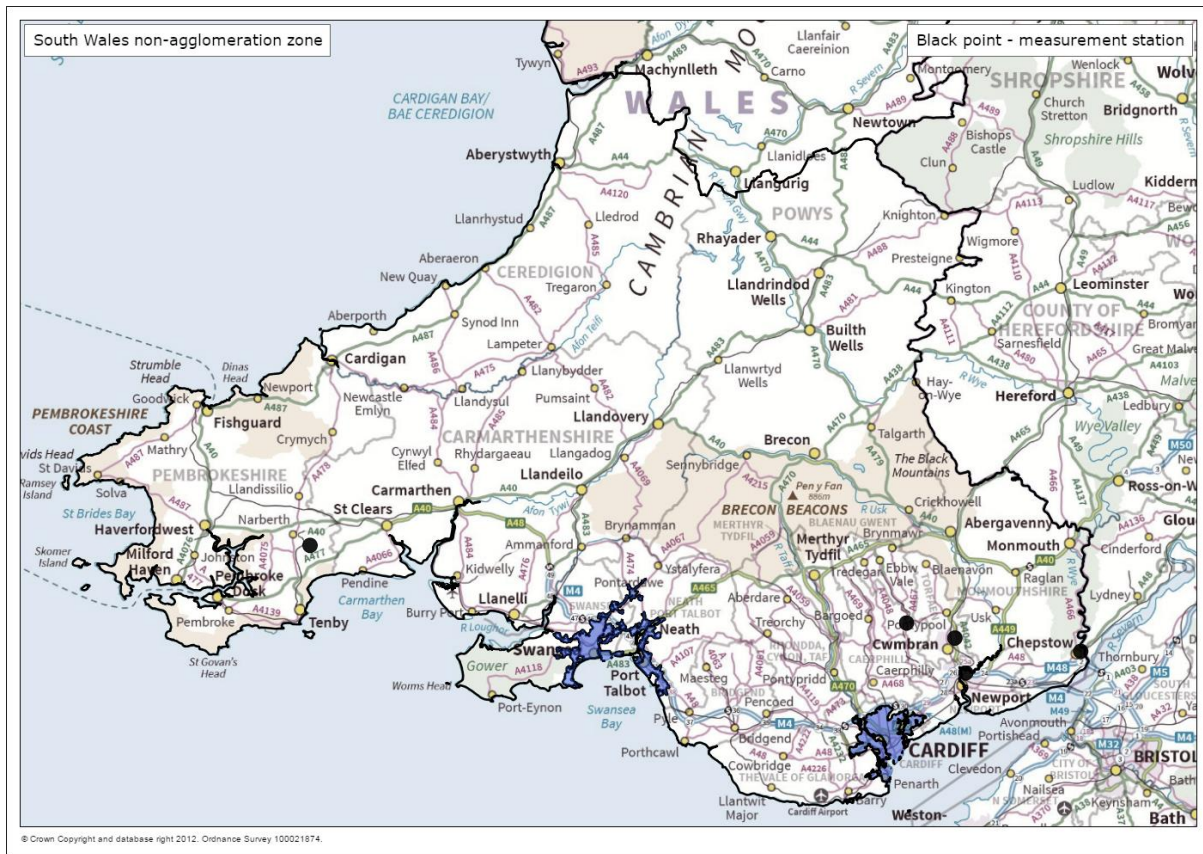


Figure 3: map of South Wales Urban Agglomeration zone and measurement stations (black dots).

204. This zone includes urban, industrial and rural locations. Within the South Wales non-agglomeration zone the annual limit value and the hourly limit value were exceeded in 2015.

North Wales non-agglomeration zone

205. Figure 3 shows the area covered by the North Wales non-agglomeration zone and the location of monitoring stations in the region. NO₂ measurements in this zone were available in 2015 from the following national network monitoring stations (NO₂ data capture for each station in 2015 shown in brackets):

Site name	Latitude, Longitude:
Wrexham GB0755A (99%)	53.042220, -3.002778
Aston Hill GB0031R (98%)	52.503850, -3.034178

206. Full details of monitoring stations within the South Wales non-agglomeration zone are available from <http://uk-air.defra.gov.uk/networks/network-info?view=aurun>.

207. A list of local authorities within the zone is given below:

- Conwy County Borough Council
- Denbighshire Council
- Flintshire County Council
- Gwynedd Council
- Isle of Anglesey County Council
- Powys County Council
- Wrexham County Borough Council

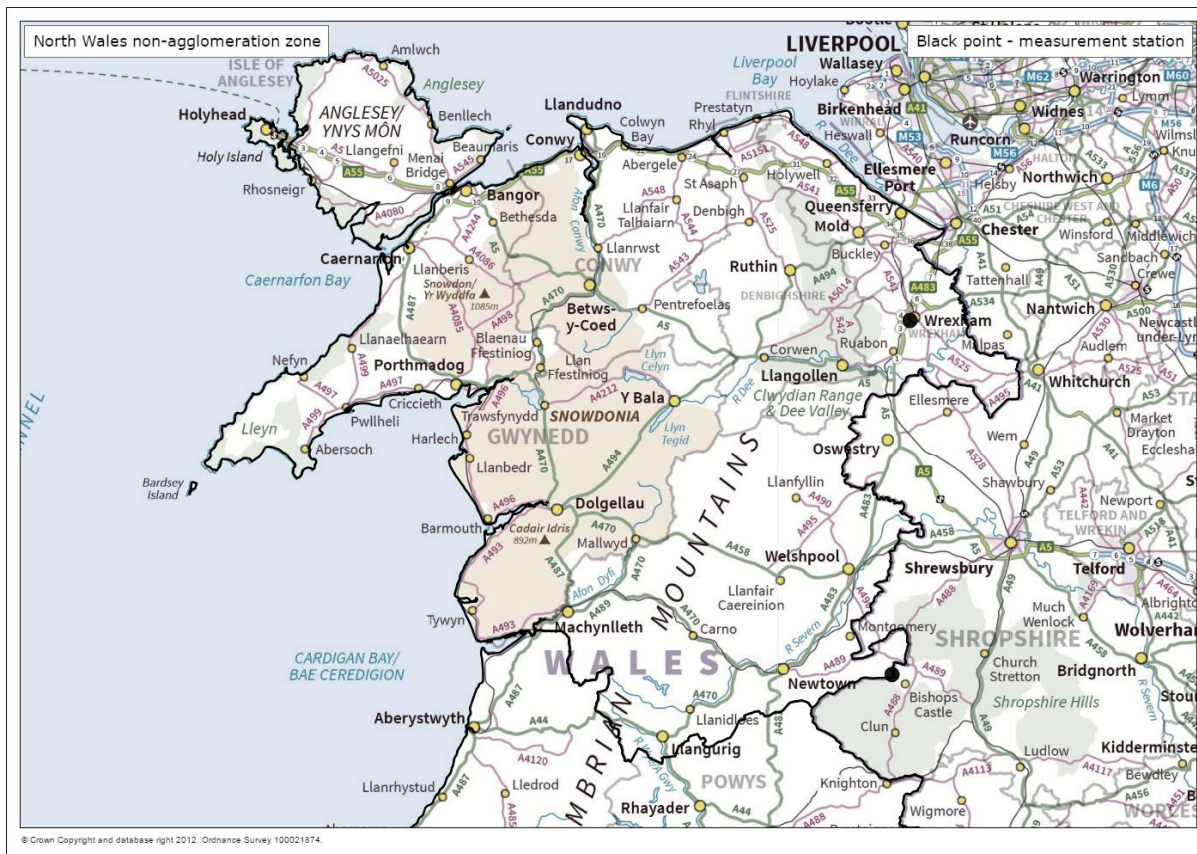


Figure 4: map of North Wales Urban Agglomeration zone and measurement stations (black dots).

208. This zone includes urban, industrial and rural locations. The total population within the zone is approximately 749,704. Within the North Wales non-agglomeration zone the annual limit value was exceeded in 2015.
209. Compliance with the annual limit value in this exceedance situation has been assessed using a combination of air quality measurements and modelling. There were no measured exceedances of the annual limit value in this zone in 2015. However, 7.7 km of road length was modelled to exceed the annual limit value. The roads which have been modelled as exceeding the annual limit value include the A494 at Deeside and the A483 near Wrexham.
210. The model results suggest that compliance with the NO₂ annual limit value is likely to be achieved by 2021 under baseline conditions.

Annex B – Locations of roads exceeding EU NO₂ limits in 2015

Cardiff Urban Area

211. Compliance with the annual limit value in this exceedance situation has been assessed using a combination of air quality measurements and modelling. There were no measured exceedances of the annual limit value in this zone in 2015. However, 16.3 km of road length was modelled to exceed the annual limit value. The roads which have been modelled as exceeding the annual limit value are the A4161, the A4232, the A4234, the A470 and the A48. The A48, which extends out of the Cardiff Urban Area agglomeration zone and into the South Wales non-agglomeration zone, is not projected to achieve compliance until 2023 without further measures. However, the current projection is that the limit value will be met in the Cardiff urban area agglomeration zone itself in 2021 under baseline conditions.

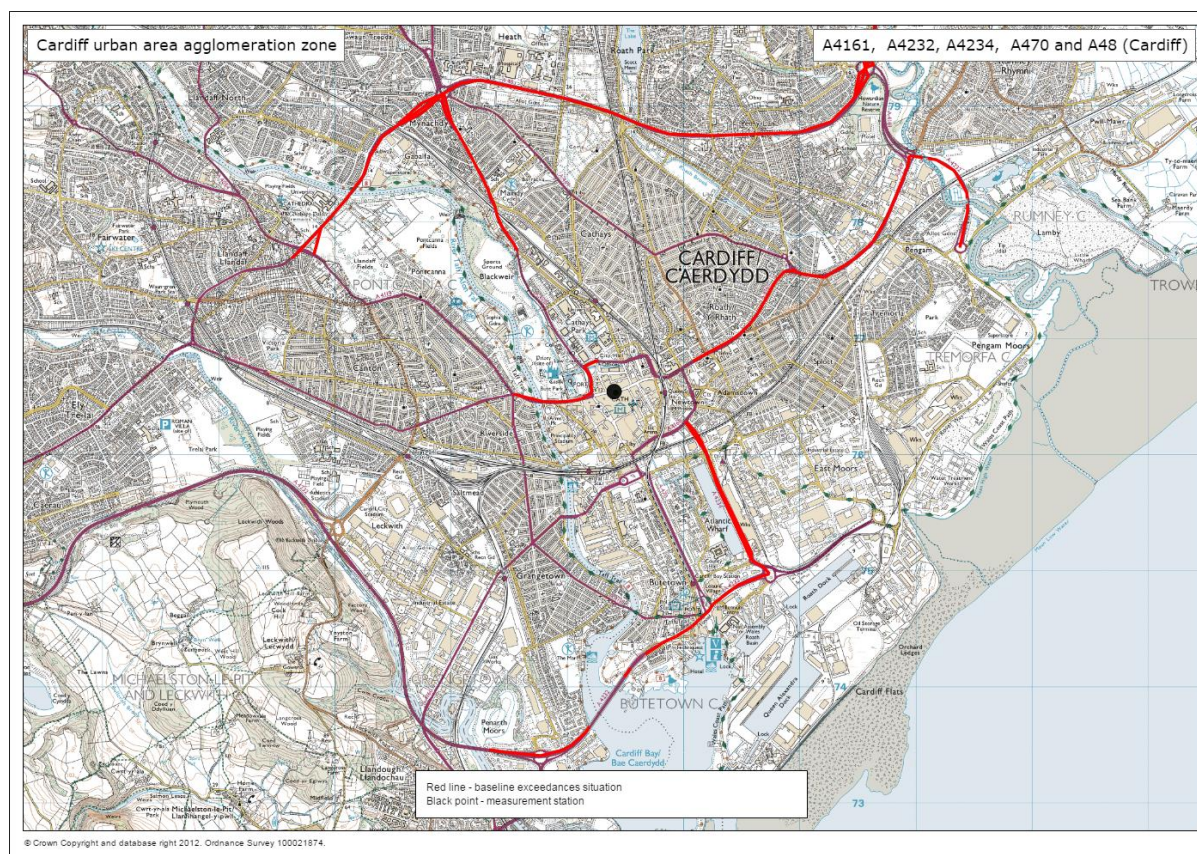


Figure 5: Exceedance situation in 2015 for Cardiff urban area agglomeration.

Swansea Urban Area

212. Compliance with the annual limit value in this exceedance situation has been assessed using a combination of air quality measurements and modelling. There were no measured exceedances of the annual limit value in this zone in 2015. However 2.7 km of road length on the M4 (between Junctions 41 and 42 near Port Talbot) was modelled to exceed the annual limit value. Model results suggest that compliance with the NO₂ annual limit value is likely to be achieved by 2020 under baseline conditions.

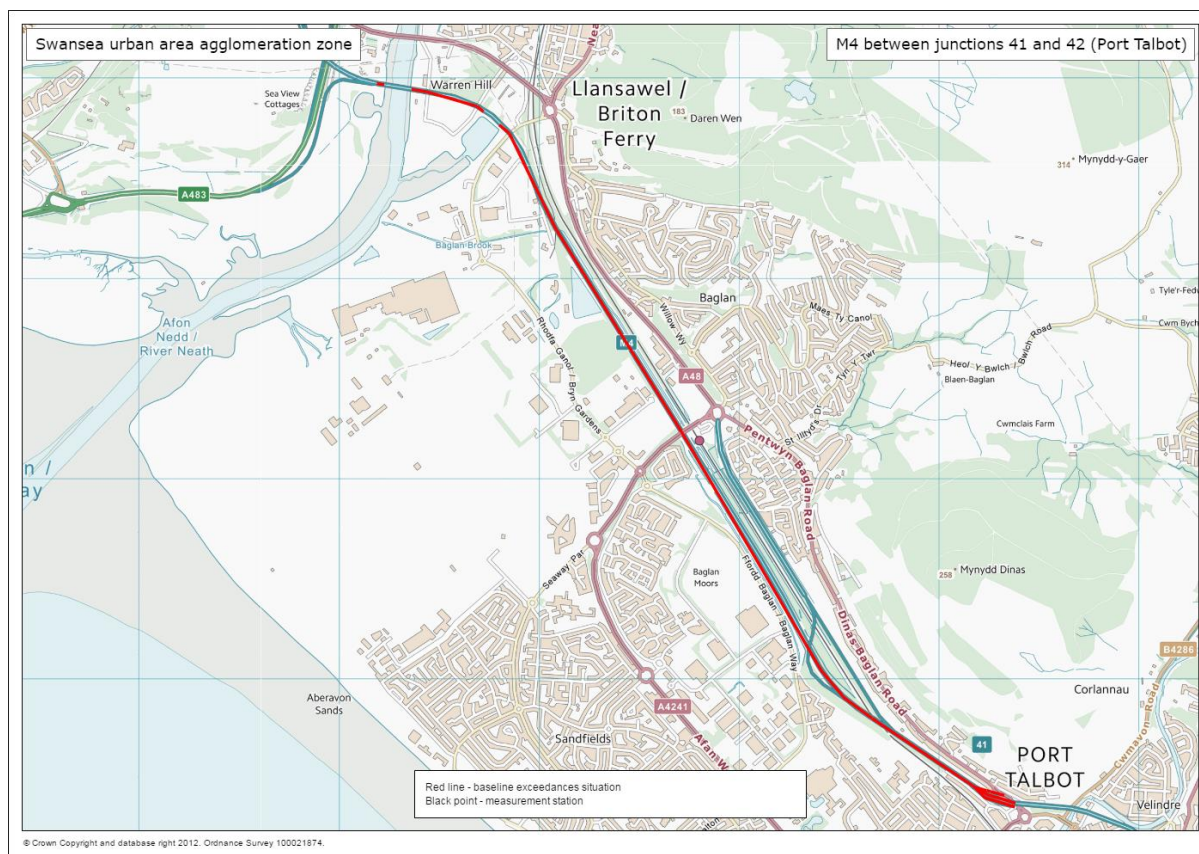


Figure 6: Exceedance situation in 2015 for Swansea urban area agglomeration.

South Wales non-agglomeration zone

213. The current projection is that the limit value will be met in South Wales in 2026 under baseline conditions. However, this projected date is the result of apparently anomalous data produced by a monitoring station at Hafod-yr-ynys, which is currently being investigated.

Annual limit value exceedance

214. In South Wales, the limit value is exceeded on a total of 15.1 km of road, on the A48 near Cardiff, on the A472 near Hafod-yr-ynys, on the M4 between Junctions 41 and 42 (Port Talbot) and between junctions 25 and 26 (Newport), and on the A470 between Upper Boat and Pontypridd (there are additional short stretches of road which are the responsibility of Cardiff Council but, owing to the location of the zone boundaries, fall within the South Wales zone rather than the Cardiff Urban Area).
215. In the South Wales non-agglomeration zone the measured concentration at one monitoring station, Hafod-yr-ynys Roadside (GB1038A; 68 $\mu\text{g m}^{-3}$), exceeded the annual mean limit value in 2015 and was greater than the modelled concentration at the adjacent road link (traffic count point 78422 on the A472) of 28 $\mu\text{g m}^{-3}$.

Hourly limit value exceedance

216. Compliance with the hourly limit value in this exceedance situation has been assessed using air quality measurements only. A site exceeds the hourly limit value for NO_2 when NO_2 concentrations exceed 200 $\mu\text{g m}^{-3}$ for more than 18 hours per calendar year. There was a measured exceedance of the hourly limit value at Hafod-yr-ynys Roadside (GB1038A), which exceeded the limit 38 times in 2015.

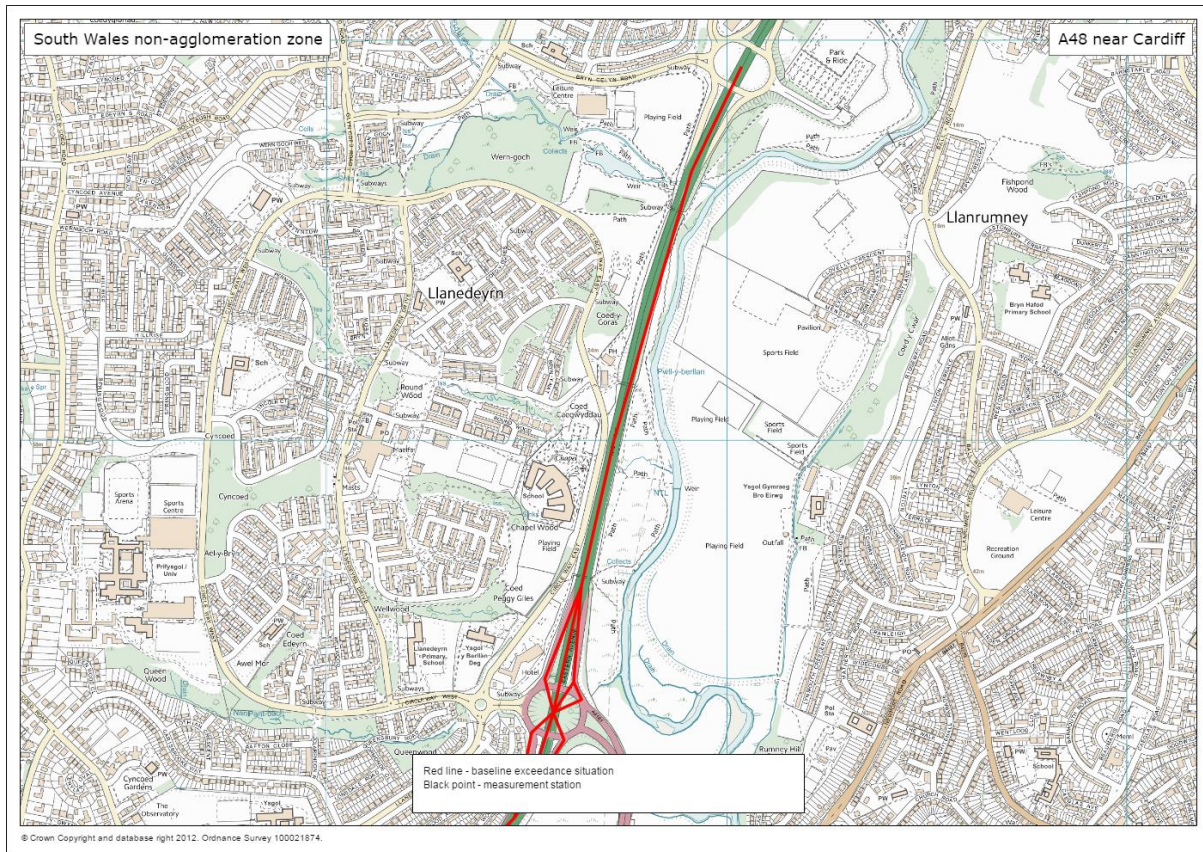


Figure 7: Exceedance situation in 2015 for A48 near Cardiff

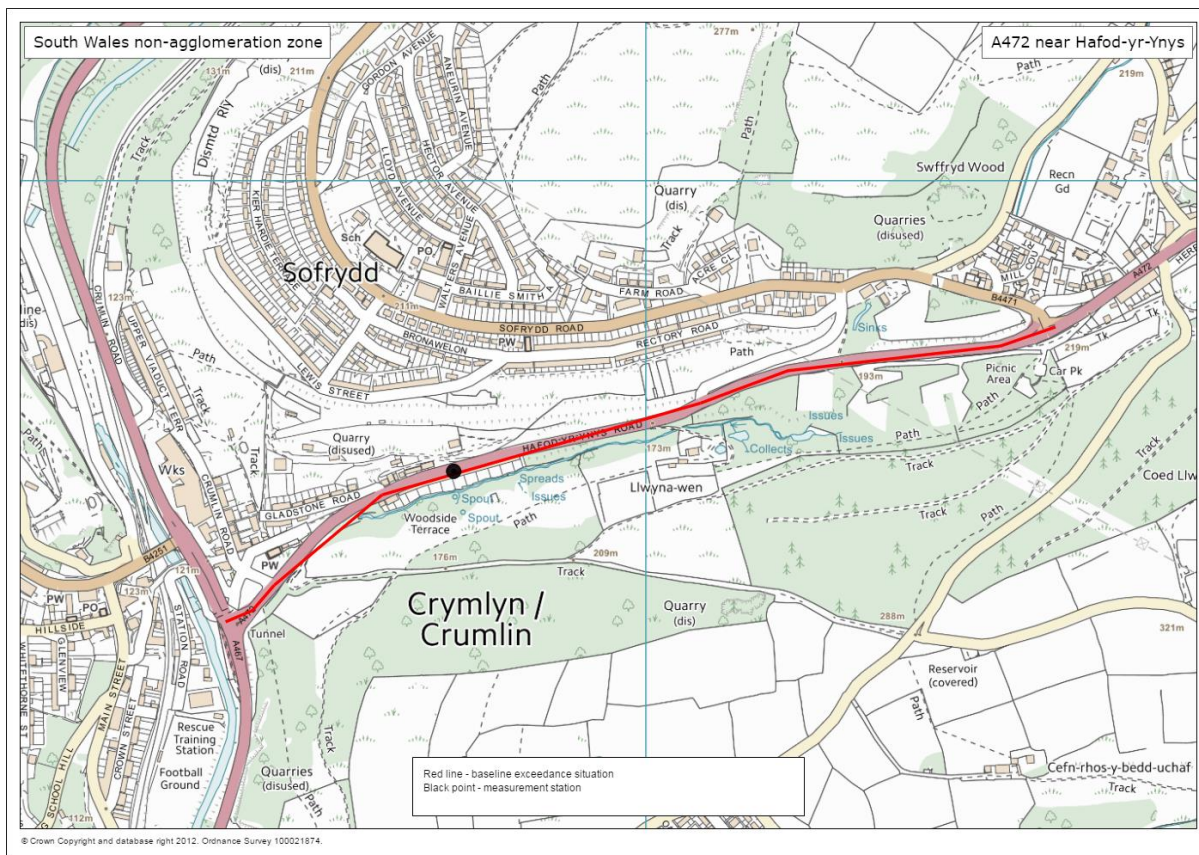


Figure 8: Exceedance situation in 2015 for A472 near Hafod-yr-ynys.

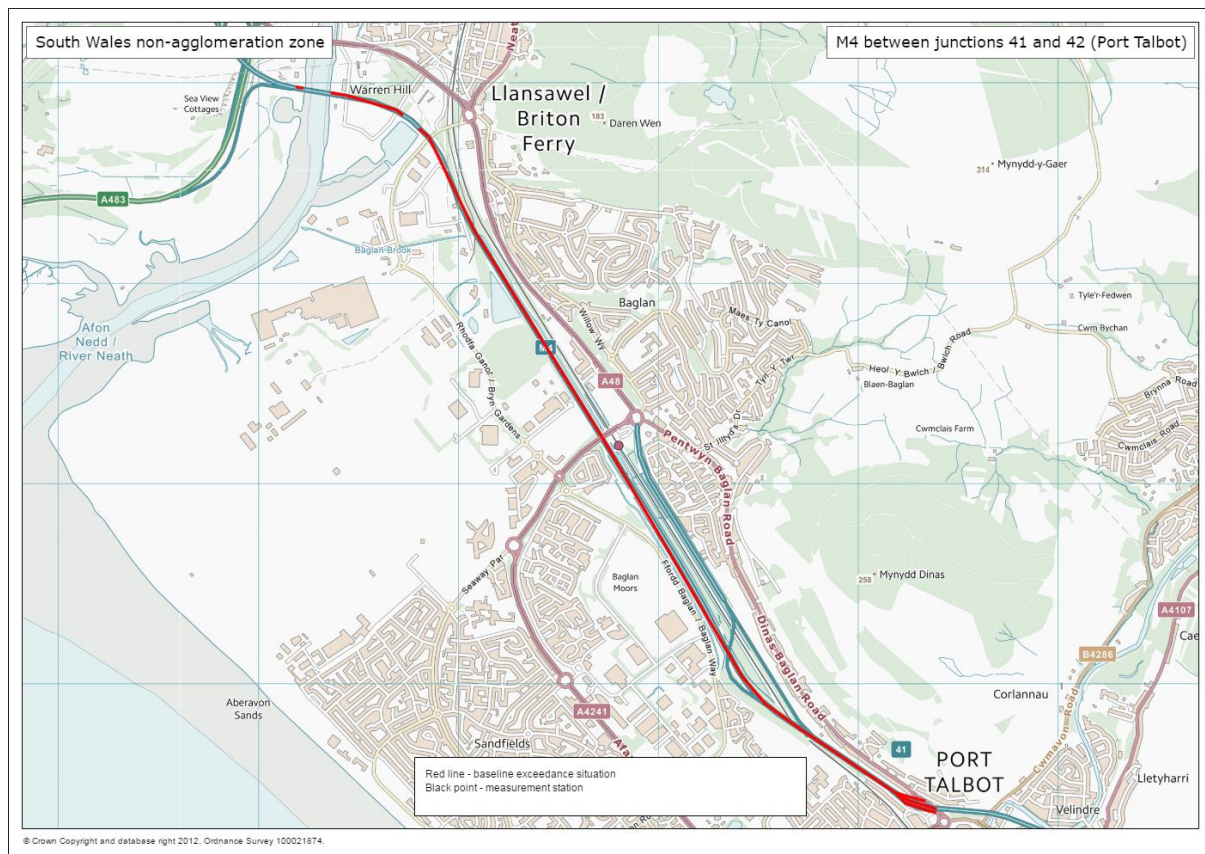


Figure 9: Exceedance situation in 2015 for M4 between Junctions 41 and 42 (Port Talbot)

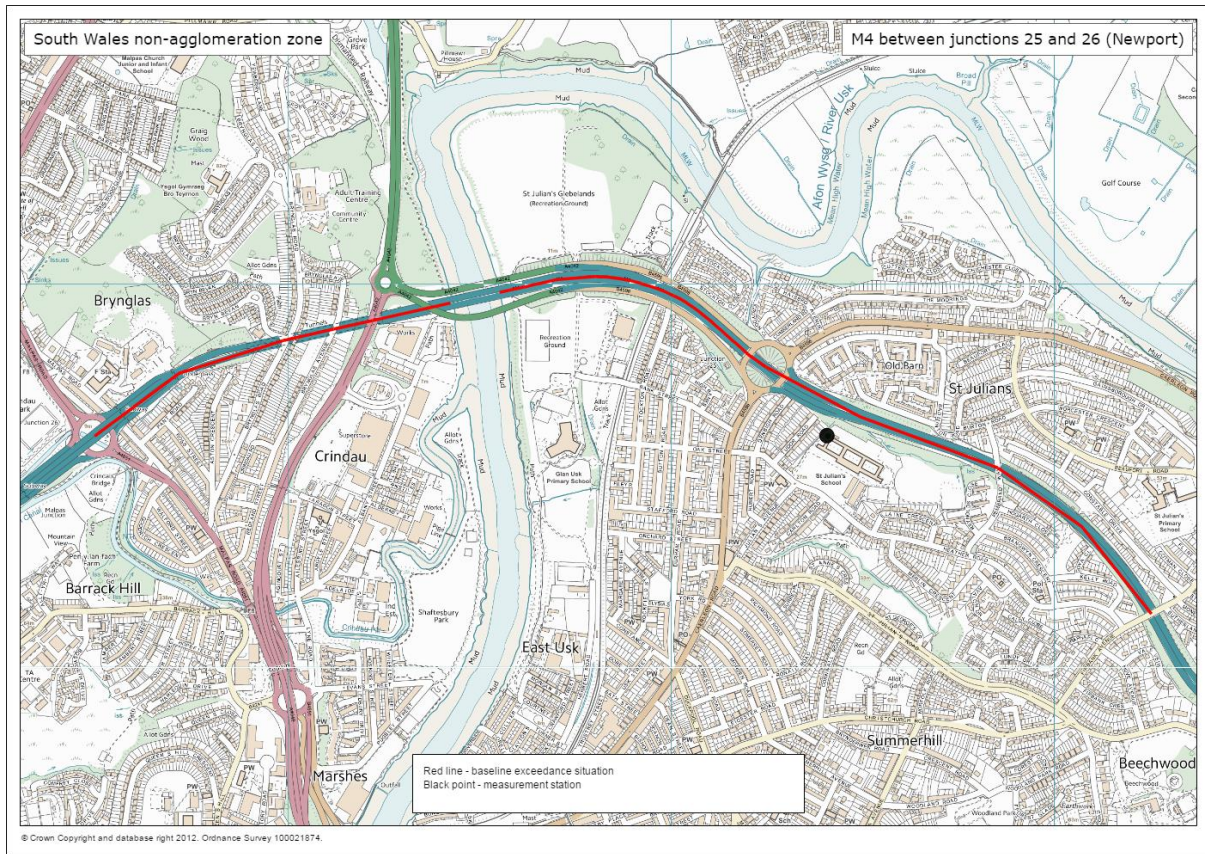


Figure 10: Exceedance situation in 2015 for M4 between Junctions 25 and 26 (Newport)

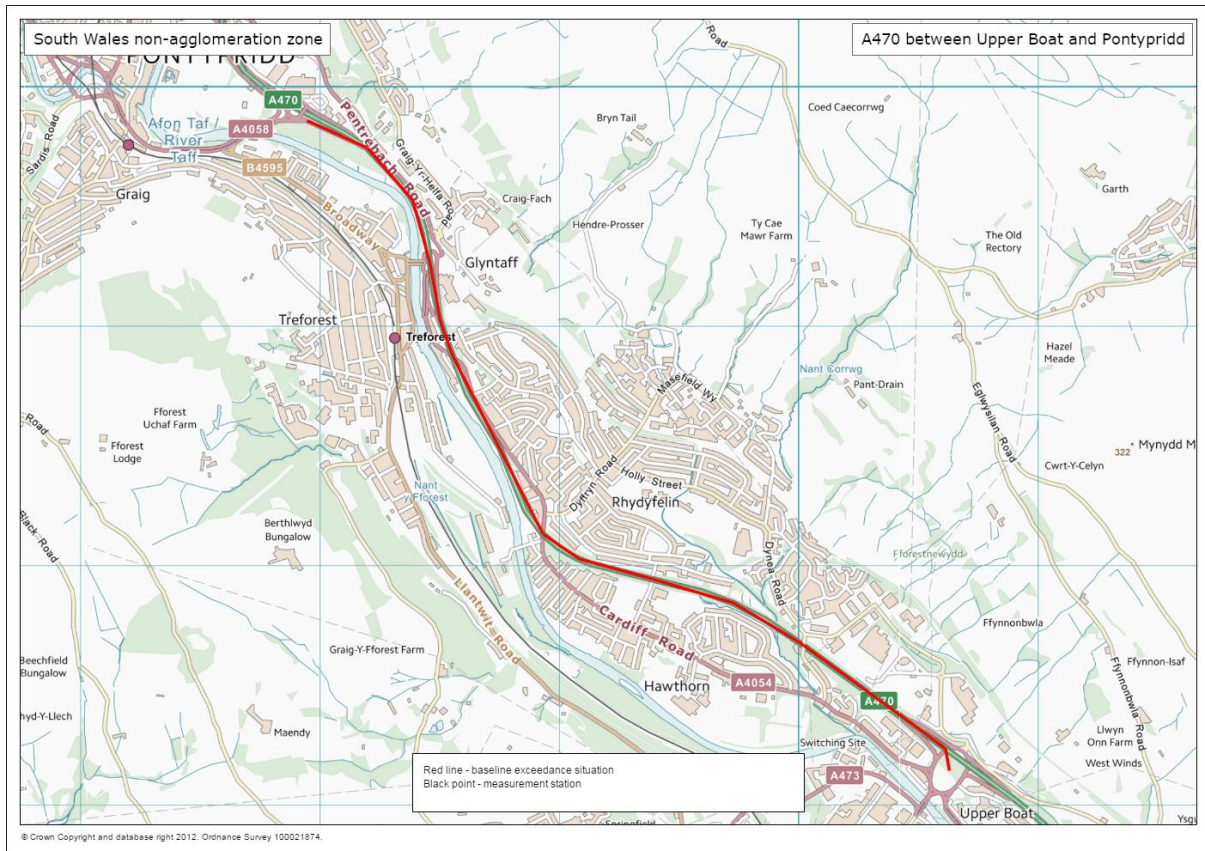


Figure 11: Exceedance situation in 2015 for A470 between Upper Boat and Pontypridd

North Wales non-agglomeration zone

217. Compliance with the annual limit value in this exceedance situation has been assessed using a combination of air quality measurements and modelling. There were no measured exceedances of the annual limit value in this zone in 2015. However, 7.7 km of road length was modelled to exceed the annual limit value. The roads which have been modelled as exceeding the annual limit value are the A494 at Deeside and the A483 near Wrexham.

218. The model results suggest that compliance with the NO₂ annual limit value is likely to be achieved by 2021 under baseline conditions.

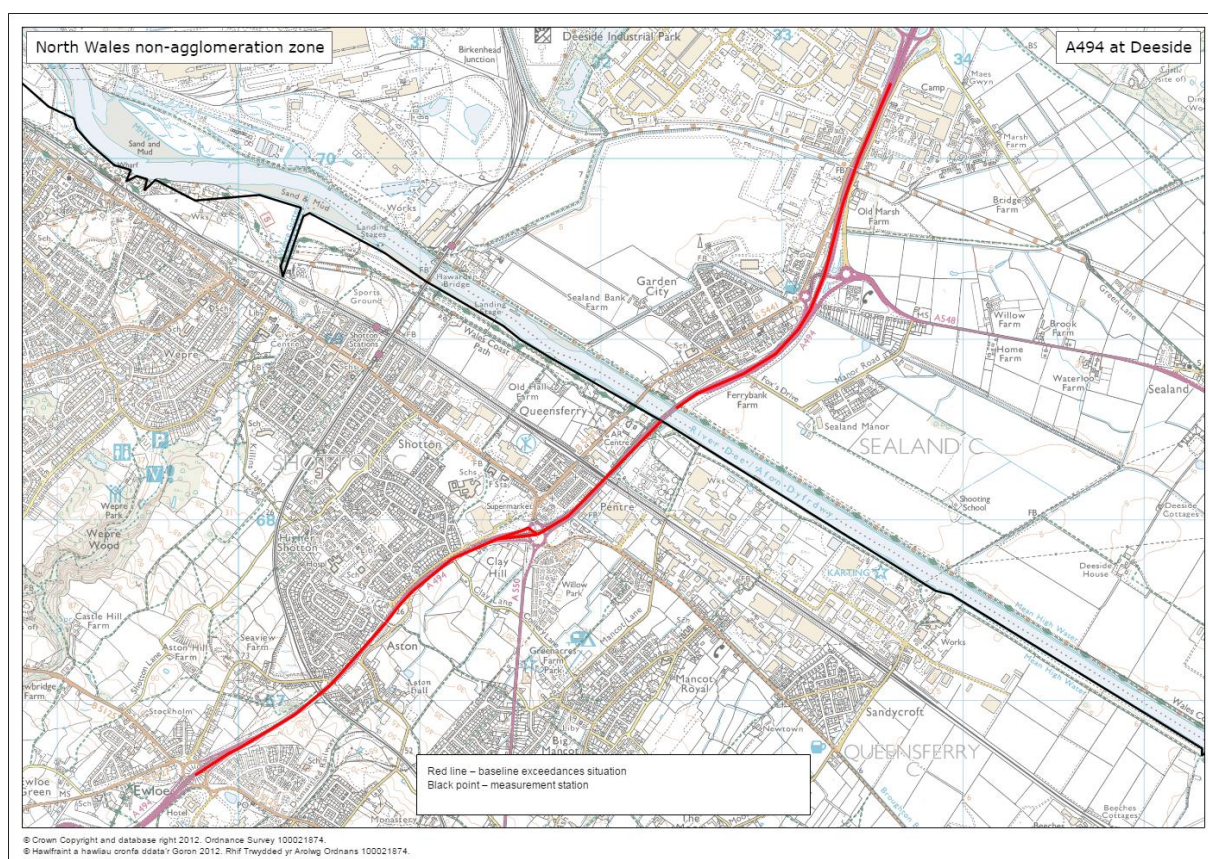


Figure 12: Exceedance situation in 2015 for A494 at Deeside

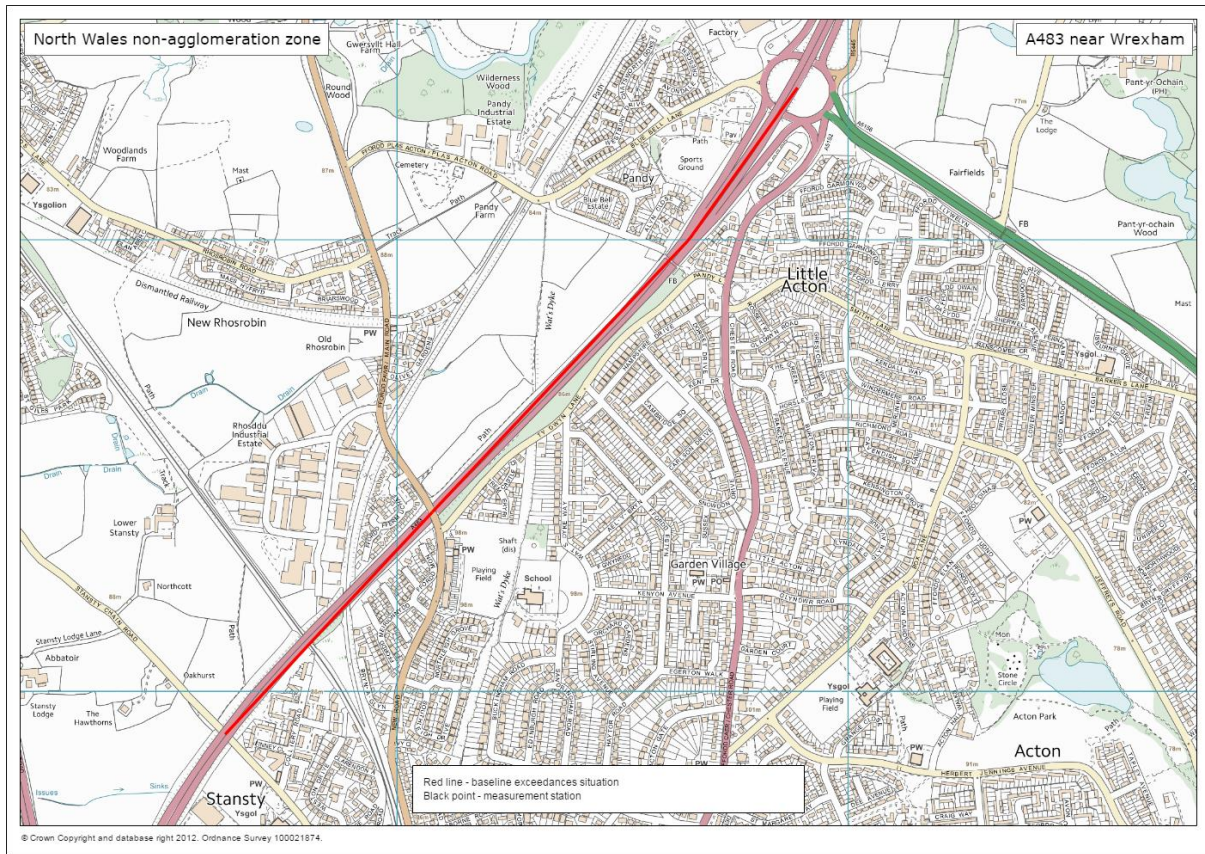


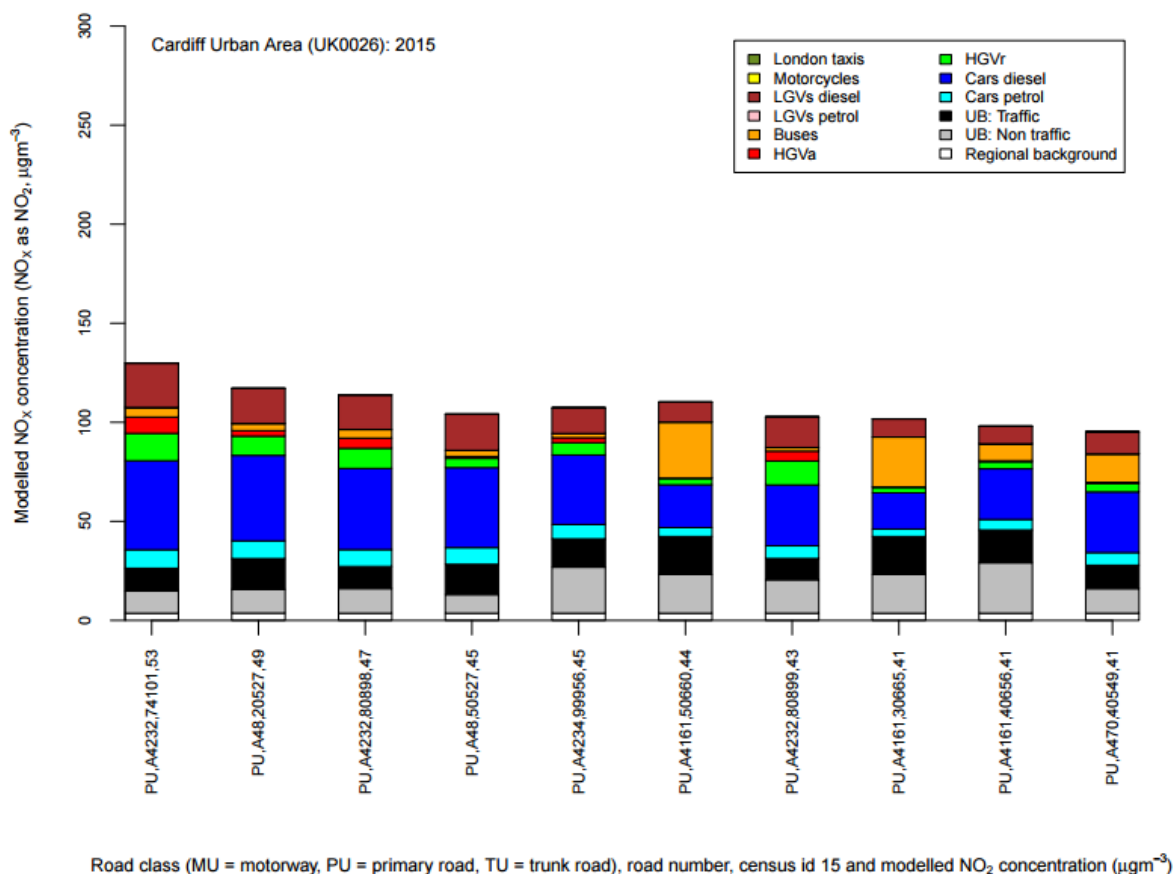
Figure 13: Exceedance situation in 2015 for A483 near Wrexham

Annex C – main sources of pollution in each zone

Cardiff Urban area

219. Local road traffic was the dominant source in this exceedance location in the reference year. The largest contribution was from diesel cars at the location of maximum exceedance with a contribution of 44.9 μgm^{-3} of NO_x out of a total of 130 μgm^{-3} of NO_x . Diesel cars, diesel LGVs and on some roads rigid and articulated HGVs and buses were important sources on the primary roads with the highest concentrations. This indicates that appropriate measures should impact on local road traffic sources in this zone. Other measures to address the urban background sources may also be beneficial.

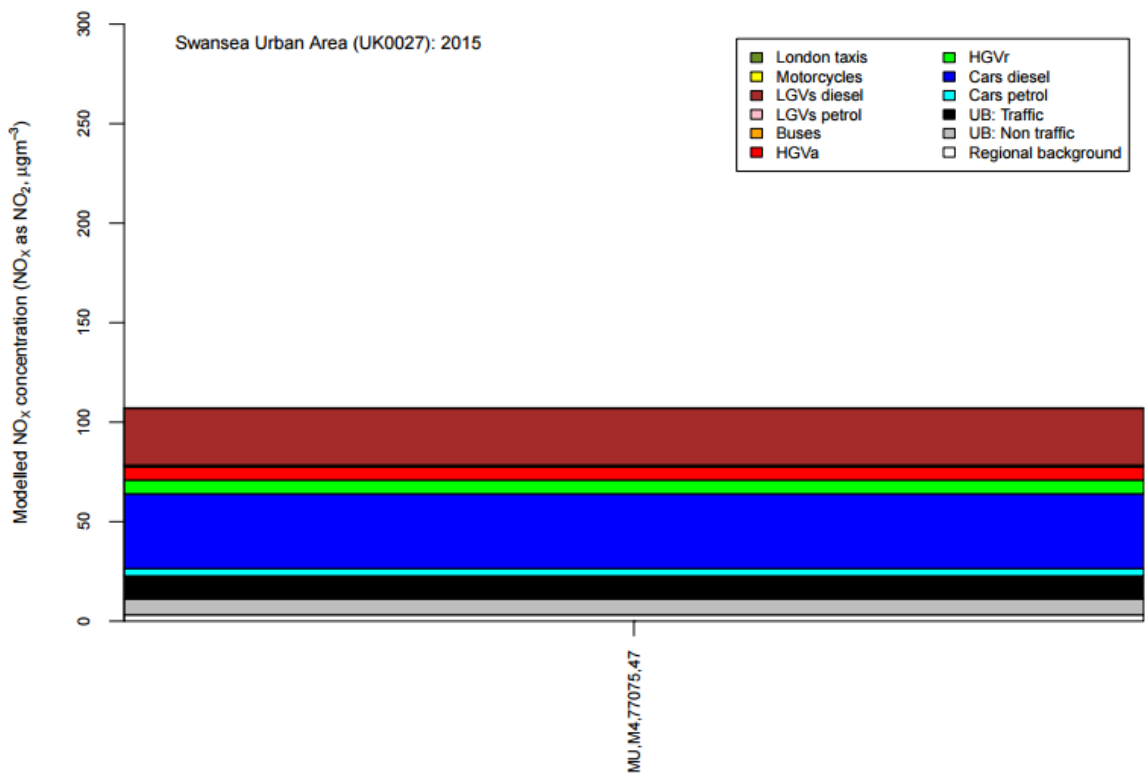
220. Annual mean roadside NO_x source apportionment plots for all roads exceeding the annual mean NO_2 limit value in 2015.



Swansea Urban area

221. Local road traffic was the dominant source in this exceedance location in the reference year. The largest contribution was from diesel cars at the location of the exceedance with a contribution of 37.5 μgm^{-3} of NO_x . LGVs provided the next largest contribution, contributing 28.5 μgm^{-3} to total NO_x . This indicates that appropriate measures should impact on local road traffic sources in this zone. Other measures to address the urban background sources may also be beneficial.

222. Annual mean roadside NO_x source apportionment plots for all roads exceeding the annual mean NO_2 limit value in 2015.

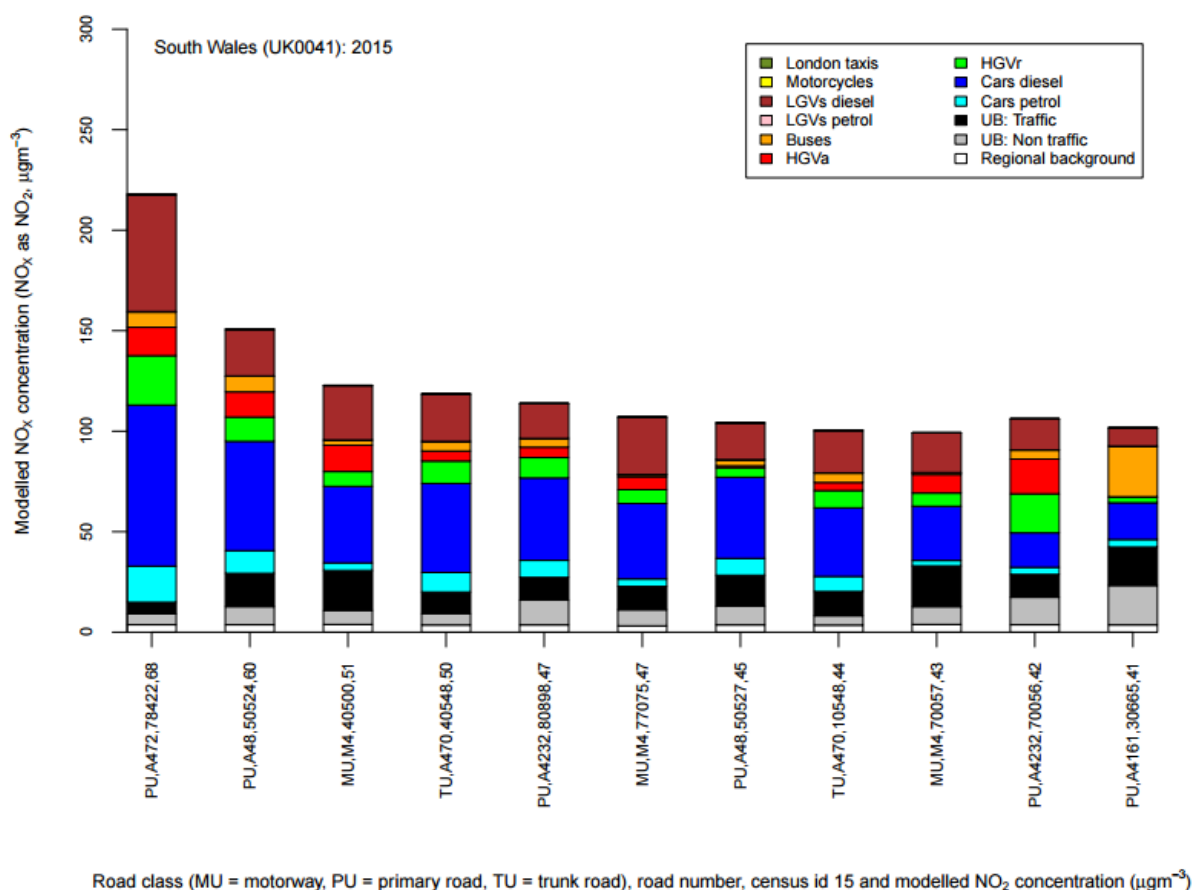


Road class (MU = motorway, PU = primary road, TU = trunk road), road number, census id 15 and modelled NO_2 concentration (μgm^{-3})

South Wales non-agglomeration zone

223. Local road traffic was the dominant source in this exceedance location in the reference year. The largest contribution was from diesel cars at the location of maximum exceedance with a contribution of 80.1 μgm^{-3} of NO_x out of a total of 218 μgm^{-3} of NO_x . Diesel cars and diesel LGVs were important sources on the motorway roads with the highest concentrations in this exceedance situation. Diesel cars and diesel LGVs, and for some roads articulated HGVs and rigid HGVs or buses, were important sources on the primary roads with the highest concentrations. Diesel cars and diesel LGVs were important sources on the trunk roads with the highest concentrations. This indicates that appropriate measures should impact on local road traffic sources in this zone. Other measures to address the urban background sources may also be beneficial.

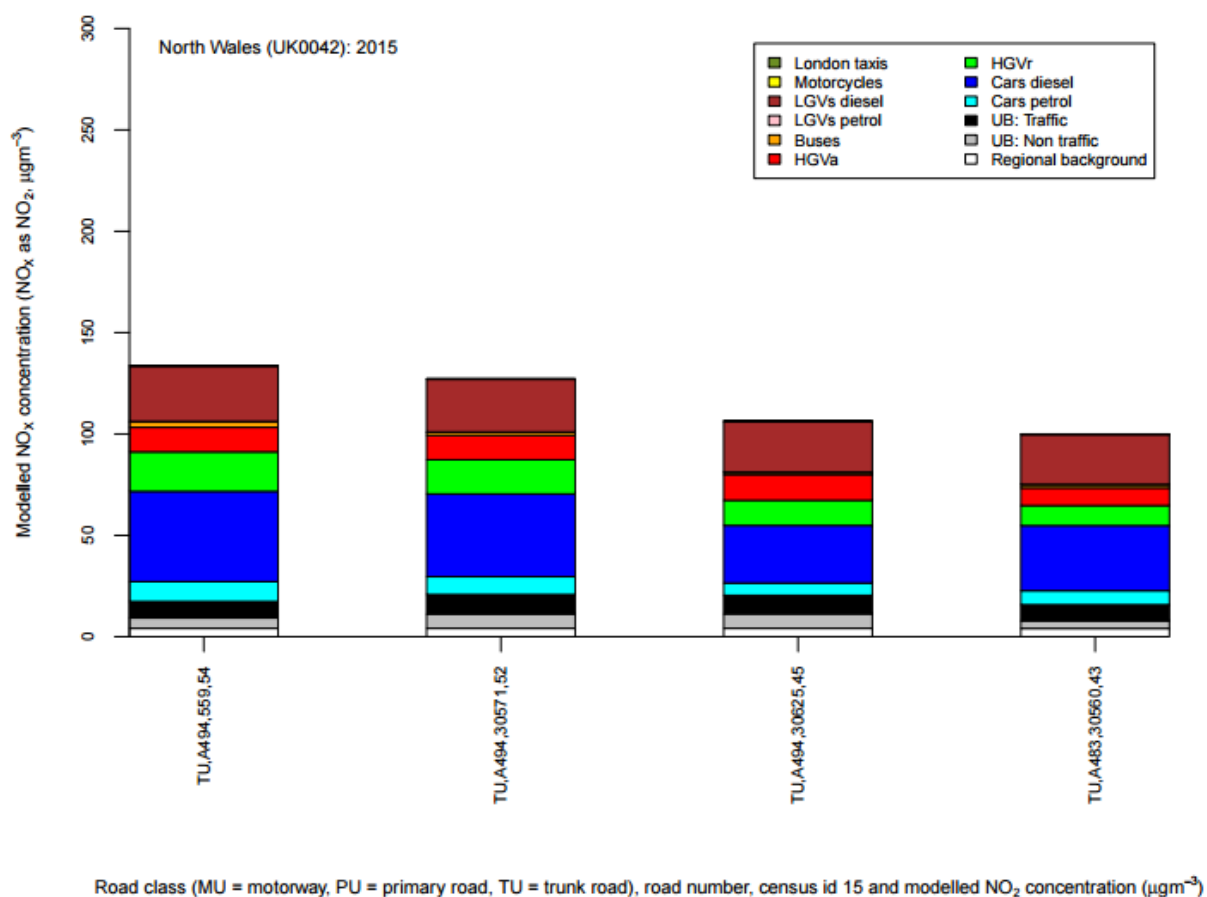
224. Annual mean roadside NO_x source apportionment plots for all roads exceeding the annual mean NO_2 limit value in 2015.



North Wales non-agglomeration zone

225. Local road traffic was the dominant source in this exceedance location in the reference year. The largest contribution was from diesel cars at the location of maximum exceedance with a contribution of 44.5 μgm^{-3} of NO_x out of a total of 133.8 μgm^{-3} of NO_x . Diesel cars and diesel LGVs were important sources on the trunk roads with the highest concentrations. This indicates that appropriate measures should impact on local road traffic sources in this zone. Other measures to address the urban background sources may also be beneficial.

226. Annual mean roadside NO_x source apportionment plots for all roads exceeding the annual mean NO_2 limit value in 2015.



Total quantity of emissions from these sources (tonnes per year)

227. Emissions from the National Atmospheric Emissions Inventory (NAEI) are mapped across the UK within a Geographic Information System (GIS). Emissions data is available from National Atmospheric Emissions Inventory - <http://naei.defra.gov.uk/>.

Annex D – Air Quality Plans prior to 2017

228. Details of UK-wide measures and measures taken in Wales prior to July 2017 are provided in UK Air Quality Plans highlighted below for the achievement of EU air quality limit values for nitrogen dioxide in the UK⁴⁰.
229. In September 2011, Defra, the Welsh Government and the other devolved administrations published updated air quality plans for the achievement of the NO₂ limits in the UK as soon as possible. This plan has been replaced by the plans listed below in this Annex. The 2011 plan was accompanied by a list of UK and national measures that helped to reduce or was expected to reduce concentrations of NO₂. The list covered UK measures⁴¹ and specific measures in England, Scotland, Wales⁴² and Northern Ireland. The measures listed had been introduced since the NO₂ limit values were agreed in 1999 and also included measures that had either just taken effect or were to be implemented shortly afterwards. Where possible, costs of the measures were included and impacts were quantified.
230. The 2011 plan was also accompanied by Welsh zone plans for the achievement of the EU air quality limit values for nitrogen dioxide (NO₂) in the Cardiff Urban Area⁴³, the Swansea Urban Area⁴⁴, North Wales⁴⁵ and South Wales⁴⁶.
231. In June 2012, the European Commission published its assessment of 24 of the 40 UK Air Quality Plans⁴⁷. In response to the conclusions in this assessment, the UK submitted to the Commission new evidence with respect to projected compliance in the Northern Ireland zone and Re-Notifications for the Birkenhead, Preston and Swansea zones⁴⁸.

⁴⁰ Air quality plans for nitrogen dioxide (NO₂) in the UK - <https://uk-air.defra.gov.uk/library/no2ten/index>

⁴¹ List of UK and National Measures September 2011- UK Measures – Page 4-31 – https://uk-air.defra.gov.uk/assets/documents/no2ten/110921_List_of_UK_and_national_measures.pdf

⁴² List of UK and National Measures September 2011- Wales Measures – Page 40-48 – https://uk-air.defra.gov.uk/assets/documents/no2ten/110921_List_of_UK_and_national_measures.pdf

⁴³ Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO₂) in Cardiff Urban Area (UK0026)2011 - <https://uk-air.defra.gov.uk/assets/documents/no2ten/UK0026.pdf>

⁴⁴ Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO₂) in Swansea Urban Area (UK0027) 2011 <https://uk-air.defra.gov.uk/library/no2ten/index?aid=27> and <https://uk-air.defra.gov.uk/assets/documents/no2ten/UK0027.pdf>

⁴⁵ Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO₂) in North Wales 2011(UK0042) - <https://uk-air.defra.gov.uk/assets/documents/no2ten/UK0042.pdf>

⁴⁶ Air Quality Plan for the achievement of EU air quality limit values for nitrogen dioxide (NO₂) in South Wales 2011(UK0041) - <https://uk-air.defra.gov.uk/assets/documents/no2ten/UK0041.pdf>

⁴⁷ Commission Decision - 25.6.2012 - on the notification by the United Kingdom of Great Britain and Northern Ireland of a postponement of the deadline for attaining the limit values for NO₂ in 24 air quality

⁴⁸ Re-Notification of the Air Quality Plan to meet the Annual Mean NO₂ Limit Value in the Swansea Agglomeration, UK (UK0027) 2012 <https://uk-air.defra.gov.uk/library/no2ten/index>

232. In December 2015, Defra, the Welsh Government and the other devolved administrations published updated air quality plans for the achievement of the NO₂ limits in the UK as soon as possible⁴⁹. The 2015 plan was accompanied by a list of UK and national measures that have supported achievement of NO₂ limit values in the EU Ambient Air Quality Directive (2008/50/EC) in the shortest possible time. The list identified UK measures⁵⁰ and specific measures for England, Wales⁵¹, Scotland and Northern Ireland.
233. The 2015 plan was also accompanied by Welsh zone plans for the achievement of the EU air quality limit values for nitrogen dioxide (NO₂) in the Cardiff Urban Area⁵², the Swansea Urban Area⁵³, North Wales⁵⁴ and South Wales⁵⁵.
234. The 2017 Plan replaces all of the abovementioned plans detailed in this Annex.

⁴⁹ Improving air quality in the UK - Tackling nitrogen dioxide in our towns and cities 2015 - <https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions>.

⁵⁰ List of UK and national measures implemented or planned 2015 – UK Measures – Page 1 – 37 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486619/aq-plan-2015-list-uk-national-measures.pdf

⁵¹ List of UK and national measures implemented or planned 2015 - Wales Measure Page 44-55 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/486619/aq-plan-2015-list-uk-national-measures.pdf

⁵² Air Quality Plan for the achievement of EU air quality limit value for nitrogen dioxide (NO₂) in Cardiff Urban Area (UK0026) 2015 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/632688/aq-plan-2015-cardiff-urban-area-uk0026.pdf

⁵³ Air Quality Plan for the achievement of EU air quality limit value for nitrogen dioxide (NO₂) in Swansea Urban Area (UK0027) 2015 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/632712/aq-plan-2015-swansea-urban-area-uk0027.pdf

⁵⁴ Air Quality Plan for the achievement of EU air quality limit value for nitrogen dioxide (NO₂) in North Wales (UK0042) 2015 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/632701/aq-plan-2015-north-wales-uk0042.pdf

⁵⁵ Air Quality Plan for the achievement of EU air quality limit value for nitrogen dioxide (NO₂) in South Wales (UK0041) 2015 - https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/632710/aq-plan-2015-south-wales-uk0041.pdf

Annex E – Assessment of air pollution and historic concentrations

Nature and assessment of pollution

235. The annual assessment of compliance is based on a combination of information from the UK national monitoring networks and the results of modelling assessments. The Directive sets out how monitoring for the purpose of compliance assessment should be undertaken, including how many stations are required and detailed criteria on where to locate stations and the equipment that should be used. The number of stations required is calculated for each pollutant for each zone and is based on an assessment of concentrations over a 5 year period, together with population information for that zone. In accordance with the requirements of Articles 5 and 9 of the Directive, monitoring networks are reviewed periodically by Defra to ensure they remain compliant, with a minimum review requirement of once every 5 years. There are several air quality monitoring networks operating across the UK, each with different objectives, scope and coverage and these are operated on behalf of Defra and the Devolved Administrations by the Environment Agency (EA). The Automatic Urban and Rural Network (AURN) is the largest automatic monitoring network in the UK and forms the bulk of the UK's statutory compliance monitoring evidence base, including for NO₂.
236. The Directive also allows use of supplementary assessment using modelling and the number of stations required is more flexible where modelling is used. UK compliance assessment modelling is undertaken using national models known as the Pollution Climate Mapping ("PCM") models. The PCM models have been designed to assess compliance with the limit values at locations defined within the Directives.
237. The air quality assessment for each pollutant is derived from a combination of measured and modelled concentrations. Where both measurements and model results are available the assessment of compliance for each zone is based on the higher of the two. The air quality compliance assessment is submitted to the European Commission via e-Reporting. With respect to NO₂, any exceedances of the hourly or annual limit value, where measured or modelled, will result in non-compliance within the respective zone or agglomeration being assessed.

Concentrations observed over previous years (before the implementation of the improvement measures)

238. From 2001 to 2012 the UK has reported annually on air quality concentrations using a standard Excel questionnaire (Decision 2004/461/EC). These questionnaires are available online from <http://cdr.eionet.europa.eu/gb/eu/annualair>. Since 2013 reporting has been via an e-reporting system (Decision 2011/850/EU) - <http://cdr.eionet.europa.eu/gb/eu/>. In addition, the UK has reported on air quality plans and programmes (Decision 2004/224/EC) since 2003. The most recent previous UK air quality plan for nitrogen dioxide was published in 2017. The plan and supporting documents are available at <https://uk-air.defra.gov.uk/library/no2ten/> and the submission of this plan via e-reporting is published at <http://cdr.eionet.europa.eu/gb/eu/aqd/h/envvryhbq/>. Historic plans and programmes are available on <http://cdr.eionet.europa.eu/gb/eu/agpp>.

Cardiff Urban area agglomeration zone

239. Measured annual mean NO₂ concentrations at national network stations in Cardiff Urban area agglomeration zone NO₂_UK0026_Annual_1 for 2001 onwards, µgm-3 (a). Data capture shown in brackets.

Site name (EOI code)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Cardiff Centre (GB0580A)	33 (93)	33 (94)	35 (87)	30 (97)	35 (56)	31 (97)	31 (98)	29 (99)	31 (98)	33 (95)	27 (95)	27 (91)	26 (96)	25 (98)	27 (80)

240. Annual mean NO₂ model results in Cardiff Urban area agglomeration zone NO₂_UK0026_Annual_1 for 2001 onwards.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Road length exceeding (km)	19.5	3.1	37.6	17.1	16.1	16.0	15.6	18.4	18.8	25.9	24.3	23.2	19.8	19.8	16.3
Background exceeding (km ²)	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Maximum modelled concentration (µgm ⁻³) (a)	48.9	46.1	62.3	61.0	58.6	58.5	62.6	58.7	57.5	60.9	55	69	54	60	53

Swansea Urban area agglomeration zone

241. Measured annual mean NO₂ concentrations at national network stations in Swansea Urban area agglomeration zone NO₂_UK0027_Annual_1 for 2001 onwards, µgm-3 (a). Data capture is shown in brackets.

Site name (EOI code)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Port Talbot (GB0651A)	22 (96)	19 (97)	22 (97)	21 (84)	19 (97)	18 (97)	18 (55)								
Port Talbot Margam (GB0906A)							19 (42)	18 (95)	17 (95)	19 (96)	18 (99)	18 (99)	17 (95)	17 (91)	17 (94)
Swansea (GB0609A)	36 (95)	31 (98)	34 (98)	37 (91)	34 (95)	31 (54)									
Swansea Roadside (GB0896A)						36 (28)	31 (98)	32 (99)	33 (99)	36 (99)	32 (99)	31 (99)	31 (99)	31 (99)	27 (99)

242. Annual mean NO₂ model results in Swansea Urban area agglomeration zone NO₂_UK0027_Annual_1 for 2001 onwards.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Road length exceeding (km)	0.0	3.4	11.3	0.0	0.0	0.0	2.5	2.5	5.4	5.4	5.4	2.7	2.7	2.7	2.7
Background exceeding (km ²)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Maximum modelled concentration (µgm ⁻³) (a)	38.4	49.9	72.6	39.5	37.2	38.5	41.8	44.1	56.5	58.6	47	46	48	42	47

South Wales non-agglomeration zone

243. Measured annual mean NO₂ concentrations at national network stations in NO₂_UK0041_Annual_1 for 2001 onwards, µgm-3 (a). Data capture shown in brackets.

Site name (EOI code)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Chepstow A48 (GB0921A)								41 (98)	38 (97)	39 (99)	40 (99)	41 (72)	36 (96)	39 (91)	37 (98)
Cwmbran (GB0744A)	18 (43)	20 (90)	19 (88)	17 (99)	17 (99)	14 (96)	14 (82)	14 (88)	14 (91)	16 (98)	13 (99)	13 (95)	13 (99)	12 (99)	12 (99)
Narberth (GB0043R)	7 (64)	7 (86)	9 (79)	5 (89)	5 (92)	5 (94)	5 (89)	6 (94)	5 (92)	5 (95)	4 (98)	6 (76)	5 (98)	4 (98)	3 (99)
Newport (GB0962A)								24 (97)	25 (99)	26 (96)	22 (91)	22 (96)	23 (89)	22 (95)	21 (86)
Hafod-yr-ynys Roadside (GB1038A)														78 (21)	68 (99)

Table 2: Annual mean NO₂ model results in NO₂_UK0041_Annual_1 for 2001 onwards.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015(b)
Road length exceeding (km)	30.3	14.5	96.2	50.7	47.7	44.2	44.2	31.5	38.1	42.4	38.5	32.6	30.3	25.3	15.1
Background exceeding (km ²)	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Maximum modelled concentration (µgm ⁻³) (a)	54.0	63.8	81.1	67.6	71.6	69.5	67.9	72.0	70.9	73.7	70	69	66	60	68

North Wales non-agglomeration zone

244. Measured annual mean NO₂ concentrations at national network stations in North Wales non-agglomeration zone UK0042_Annual_1 for 2001 onwards, µgm⁻³ (a). Data capture shown in brackets.

Site name (EOI code)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Aston Hill (GB0031R)			10 (19)	6 (87)	5 (98)	5 (70)	13 (92)	6 (85)	5 (91)	6 (99)	5 (99)	4 (98)	5 (97)	4 (94)	3 (98)
Mold (GB0999A)										17 (31)	11 (92)	10 (76)	9 (82)		
Wrexham (GB0755A)		24 (78)	25 (98)	21 (96)	19 (95)	21 (94)	20 (92)	20 (99)	21 (99)	24 (97)	19 (99)	20 (95)	22 (97)	21 (94)	19 (99)

245. Annual mean NO₂ model results in North Wales non-agglomeration zone NO₂_UK0042_Annual_1 for 2001 onwards.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Road length exceeding (km)	0.0	0.0	21.3	12.7	12.7	12.7	13.4	11.0	11.0	10.4	9.7	9.6	7.7	5.8	7.7
Background exceeding (km ²)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum modelled concentration (µgm ⁻³) (a)	39.7	37.4	67.6	64.9	67.8	68.9	67.3	59.2	62.6	71.5	64	62	55	48	54

246. Latest measurement data are available from <https://uk-air.defra.gov.uk>. Since 2013 reporting to the European Commission has been via an e-reporting system (Decision 2011/850/EU) available from <http://cdr.eionet.europa.eu/gb/eu/>.

Techniques used for the assessment

247. In brief, emissions from the National Atmospheric Emissions Inventory (NAEI)²² are mapped across the UK within a Geographic Information System (GIS). Deterministic dispersion models specific to each pollutant are used to simulate atmospheric mixing and to generate background concentrations for different pollutants. The modelled results are then calibrated against measured concentrations from the national monitoring network and then verified. This modelling provides an estimate of the distribution of atmospheric pollutants including NO₂ on a 1km x 1km grid and for individual roads. Collectively, this is known as the Pollution Climate Mapping (PCM) model and is operated on behalf of Defra by Ricardo Energy & Environment.

248. For detailed information on the UK assessment method, the 2017 Plan technical report, in conjunction with the respective zone plans, provides details of the methods used to model and monitor air quality to assess compliance with NO₂ limits and to model future concentrations - <https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017>.
249. A full description of modelling techniques and assumptions to be used by local authorities in the course of future feasibility studies is provided in **Annex F**.

Annex F - Modelling techniques to be used and assumptions to be made by local authorities in relation to feasibility assessments

250. Local authorities named in this plan are required to undertake local assessments to consider the best option to achieve compliance with nitrogen dioxide limit values within the shortest possible time, in a way which reduces exposure as quickly as possible and by taking steps which mean meeting the limit values is not just possible but likely.
251. There are legally binding limit values for concentrations of several pollutants in outdoor air, including NO₂. The UK Government uses a combination of national modelling and monitoring in accordance with legislation to determine the concentrations of these pollutants in order to assess compliance.
252. The Pollution Climate Mapping (PCM) model is the UK's national air quality model and provides outputs of pollutant concentrations in the UK at a 1x1 km resolution and also at around 9,000 roadside locations for urban major roads (A and M class roads). Emissions from the National Atmospheric Emissions Inventory (NAEI) are mapped across the UK within a Geographic Information System (GIS). Deterministic dispersion models specific to each pollutant are used to simulate atmospheric mixing and to generate background concentrations for different pollutants. The modelled results are then calibrated against measured concentrations from the national monitoring network and then verified. This modelling provides an estimate of the distribution of atmospheric pollutants including NO₂ on a 1km x 1km grid and for individual roads.
253. Collectively, this is known as the Pollution Climate Mapping (PCM) model and is operated on behalf of Defra by Ricardo Energy & Environment. For detailed information on the UK assessment method, the 2017 Plan technical report, in conjunction with the respective zone plans, provides details of the methods used to model and monitor air quality to assess compliance with NO₂ limits and to model future concentrations. This is available at - <https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017>.
254. Local authorities identified by the PCM model as having persistent NO₂ exceedances are required to implement local plans to reduce pollution to compliant levels in the shortest time possible. The measures implemented as part of the local plan need to be informed by local evidence and understanding. Local authority feasibility studies will provide robust evidence on the impact of measures, informed by local traffic and air quality models. This will provide a more detailed assessment of the specific local situation than the national air quality model.

255. In submitting their proposals for feasibility studies, the Welsh Government will review the local authorities' proposed approaches. The Welsh Government will ensure the review process is robust by including independent experts on a review panel. Examples of expected approaches for review would include the proposed traffic and air quality monitoring collation, air dispersion, traffic and economic modelling and comparison with the national assessment. The Welsh Government will work with the local authorities to frequently review the approaches taken to ensure they are robust and appropriate. In addition the Welsh Government expects local authorities to outline whether they are designing a local plan to address exceedances in a larger area or focus on a few roads. The local evidence base will need to consider roads which are currently not in compliance and likely not to be in the future.

Criteria for Transport Modelling

256. Welsh Government's transport appraisal guidance, WelTAG⁵⁶, recommends that the methods used to model transport impacts should follow the advice set out by the Department of Transport in their Transport Appraisal Guidance (WelTAG).

Automatic Number Plate Recognition Traffic survey

257. Local authorities should determine traffic fleet compositions (including the Euro standard proportions) using traffic survey data that is less than 5 years old. The survey data should be derived from Automatic Number Plate Recognition (ANPR) cameras and associated equipment at key locations to simultaneously monitor traffic coming into/out of the study area over a continuous seven day period. The data should be representative of long term annual average and should capture vehicle registrations twenty four hours per day in both directions alongside the location, direction of travel and time at each of the survey locations. Surveys should cover the major routes that will provide effective coverage of journeys in to the study area (the area expected to be affected significantly by measures to be implemented under the local plan).

Transport Models

258. The model domain should cover any significant traffic re-routing that may result from the implementation of local measures and include all roads that are listed within the national PCM model for the study area. All roads where the limit value is either known to be exceeded in the most recent historical assessment or are likely to exceed thereafter should also be included. The most recent historical assessment should include the national compliance data for NO₂ and can be supplemented with local data

⁵⁶ WelTAG - <https://beta.gov.wales/welsh-transport-appraisal-guidance-weltag>

on exceedances. The traffic model road network should be geographically accurate in order to ensure the correct mapping of transport road links into those in air quality model.

259. Modelling input data should aim to be validated against recently observed data from the study area (less than 5 years old), in line with WelTAG Unit M3.1 requirements. Variables such as fleet composition, flows, link and turning movements, traffic pattern and journey time should be compared with observed values from an ANPR survey or similar which is less than 5 years old. The modelling should be in accordance WelTAG validation guidance as far as is reasonably possible, and justified where it isn't.

Input Data

260. Observation data is preferred over modelled data. Where modelled data is used it should be validated.
261. Air quality modelling will require data in relation to buses, taxis, coaches, rigid HGVs, articulated HGVs, LGVs, cars and motorcycles. If this level of detail is not available via the traffic model, then data will need to be acquired in another way, such as from post processing of transport modelling or separate studies on vehicle numbers. The model should include any further vehicle types as required in order to model the likely measures (e.g. electric vehicles). The data should include at least fuel type and their engine emission standard.

Criteria for Air Quality Modelling

262. Air quality modelling should be undertaken following the broad principles defined in Local Air Quality Management guidance⁵⁷.

Source term estimation

263. An appropriate emissions model should be selected which uses the latest COPERT emission factors and allows users to define their vehicle fleet composition by vehicle type, fuel type and Euro standard. The Welsh Government will make available the latest Emissions Factor Toolkit (EFT), containing the latest emission factors, to the relevant local authorities. If using a different model, it should be appropriately validated against the EFT to ensure consistency of outputs across different categories and

⁵⁷ <http://gov.wales/topics/environmentcountryside/epq/airqualitypollution/airquality/guidance/technical-guidance/?lang=en>

years. Gradient effects should be included where appropriate (particularly on roads with a gradient of greater than 2.5%)⁵⁸.

Air quality model domain

264. The domain of the model should include all roads that are listed within the national PCM model for the study area. All roads where the NO₂ limit value is either known to be exceeded in the most recent historical assessment or are likely to exceed thereafter should be included. The most recent historical assessment should include the national compliance data and can be supplemented with local data on exceedances. All potential displacement routes should be included (routes that traffic may be diverted to if measures are implemented).

Air quality model receptor resolution

265. The following receptor locations should be included in the model:

- 1) Receptor grid. The grid should be at a resolution of at least 10m x 10m within the first 50m from roads. The roadside receptors will be used to calculate population-weighted mean concentration values.
- 2) Discrete receptors:
 - i. Monitoring site locations. These receptors will be required in order to compare with modelling predictions.
 - ii. A receptor for each link modelled in the PCM model, at 2m height and 4m distance from the kerbside. This will facilitate a comparison between the local model results and the PCM model.
 - iii. A receptor for each location identified as either exceeding or likely to exceed the NO₂ limit between the most recent historic assessment and projected years inclusive. Where these locations are local roads, the receptor should be at 2m height and 4m distance from the kerbside.

266. Compliance should be assessed at locations in accordance with the Ambient Air Quality Directive (AQD) (Annex III: A, B, and C).

267. The macro and micro siting criteria listed in Annex III of the AQD should be considered carefully when defining receptors for compliance assessments. The receptors should be at least 25m from major junctions and be representative of at least 100m road

⁵⁸ Refer to TG16 paragraph 7.437

length. The siting criteria are different to those specified in TG16, which are typically at the highest pollution hotspot. Receptors within the carriageway of the road must be excluded except where there is normally pedestrian access to the central reservation.

Base year

268. The air quality model should use the most recent base year, allowing comparison of the model predictions with the most recent measurement data. The transport model base year should preferably be the same as the air quality model base year. However, where this is not practical, forecast years from the transport model can be used if the local authority can demonstrate that there has been no significant change in fleet or network compared to the transport base year.
269. The model should be calibrated against meteorological and measurement data from the same year as the base year. The appropriate base year and meteorological site location should be used when considering meteorological data. For information on meteorological data requirements please refer to TG16 paragraphs 7.476 to 7.489.

Input data from traffic model

270. Air quality modelling will require data in relation to buses, taxis, coaches, rigid HGVs, articulated HGVs, LGVs, cars and motorcycles. If this level of detail is not available via the traffic model, then data will need to be acquired in another way, such as from post processing of transport modelling or separate studies on vehicle numbers.
271. A realistic representation of road locations is required - roads cannot be represented as straight lines between junctions. This may be achieved using a geo-referenced transport model, or including an additional step to transfer the traffic counts from the transport model to a more realistic representation of the geography of the roads. Welsh Government managed roads within the model area should be included in the modelling but will be treated separately when comparing the results of the local model to the national PCM model.
272. The distribution of vehicles by Euro standard should be included in the dispersion model. Information on this distribution for the local fleet will come from local ANPR data collection. The distribution from the updated EFT may be used as a back-up where local fleet composition is not available by Euro standard (e.g. motorways). Where local fleet projections differ from national-based projections significantly, rationale for this must be outlined.

273. Measured vehicle speed data for the local area should be used where possible, instead of national data e.g. from Trafficmaster.

NO_x to NO₂ emissions assumptions

274. Primary NO₂ fractions (f-NO₂) should be calculated using the guidance notes and spreadsheet on the NAEI website⁵⁹.

Non-road transport modelling

275. If potential non-transport measures exist then they should be accounted for within the modelling. If the local authority decides not to model non-transport sources, it should set out why it is confident there are no potential material measures from these sources. In the event that no measures are being considered for non-transport sources, the LAQM background maps⁶⁰ can be used to define the contribution to ambient concentrations from non-local sources.

276. The contribution from local road transport sources that are modelled should be subtracted from the background maps. Alternatively local authorities may model all sources rather than use the background maps if they wish. If non-transport measures are planned, local authorities should model non-transport sources separately and remove their contribution from the background maps.

Measurement data for model comparison

277. Model predictions should be compared with measurement data to check they agree within the expected uncertainty bounds. Where they do not, a robust uncertainty assessment should be carried out and an explanation provided. Where no practical explanation can be identified, the modelling predictions may need to be scaled according to nearby roadside monitoring station data, or if not available, bias adjusted diffusion tube data.

278. All available measurement data, including local data, within the study area should be included in the comparison, unless there is reason to believe that certain data is unreliable or unrepresentative (e.g. data quality issues). Justification of exclusion of any monitored data should be provided to Welsh Government.

⁵⁹ <http://naei.defra.gov.uk/data/ef-transport>

⁶⁰ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

Criteria for Projections Modelling

Projections without additional mitigation measures

279. Annual projections should be assessed between the base year and compliance year to ensure that a clear pathway towards compliance is demonstrated by the study. Interpolation methods can be used to estimate impacts in interim years to ensure robust modelling can be completed in the shortest possible time. However, additional years should also be modelled if infrastructure changes are expected to have a significant impact on air quality when measures are in place (e.g. currently planned road layout changes or housing development projects).
280. Projected fleet composition calculated using local projections is preferred. Any local assumptions made should be explained clearly. If local projections are not available, the national fleet composition projections from EFT can be used. Where local fleet projections differ from national-based projections significantly, rationale for this must be outlined.
281. Road traffic fleet growth rates should be calculated using the Trip End Model Presentation Program or TEMPro11 to generate the projected fleet based on national information. TEMPro is software that allows users to view travel forecasts up to 2051 from the National Trip End Model (NTEM) datasets. Alternatively, local assumptions may be made, in which case these should be explained.
282. The fleet penetration of vehicles that meet more stringent Euro standards (e.g. Euro 6d based on real driving emissions) should be included in all projections. Local authorities should calculate expected emissions of the fleet under baseline conditions for NO₂, particulate matter (PM_{2.5} and PM₁₀) and carbon dioxide (CO₂) for 10 years after the compliance year. This is needed to compare long term costs and benefits of options that are equally effective (i.e. equally able to achieve compliance in the shortest time possible). Interpolation methods can be used.

Projections modelling with measures included

283. Local authorities should model projections for the earliest year by which they expect to be able to achieve compliance through having taken measures to address exceedances, which should be no later than 2021. Annual projections should be assessed between the base year and compliance year to ensure that a clear pathway towards compliance is demonstrated by the study. Additional years should also be modelled if relevant, for example if major infrastructure changes are expected that

might affect air quality. Interpolation methods can be used to estimate impacts in interim years. The measures to be modelled will vary depending on the local authority.

284. Local authorities should calculate expected emissions of the fleet under each short list option for NO₂, particulate matter (PM_{2.5} and PM₁₀) and carbon dioxide (CO₂) for 10 years after the compliance year. This is needed to compare long term costs and benefits of options that are equally effective. Interpolation methods can be used.

Behavioural response assumptions

285. An assessment of the behavioural responses will be necessary for all measures to understand their impacts. These could include responses to measures for access restrictions, encouraging an uptake of electric vehicles, retrofitting vehicles with clean technology, encouraging active travel, amongst others.
286. Within Defra's PCM modelling for the introduction of charging measures the response of affected drivers was categorised, as shown in Table 3.3 of the 2017 Plan Technical Report. However, detailed local data is to be preferred where available. Where a measure is being assessed, the same categories of behavioural responses should be used as a minimum. For some options it may be necessary to allow drivers to take a different response, such as changing mode of travel. Local authorities should obtain localised information on how drivers might respond to measures themselves. The accessibility of diversion (or avoidance) routes might vary according to the local road infrastructure, for instance.

Annex G – Modelling techniques to be used and assumptions to be made for the assessment of Welsh Government Managed Road Networks

287. The WelTAG Stage 3 assessment has, through local monitoring and detailed modelling, increased confidence in the findings of WelTAG 2.
288. For the purposes of testing the earliest achievable compliance date for the annual mean NO₂ limit value, WelTAG Stage 3 assessments included the use of microsimulation traffic models focused on the exceedance areas, air quality assessments using the Defra emission factor toolkit and air quality dispersion models. To assess the efficacy of measures designed to bring forward the date of compliance with limit values the baseline and future baseline NO₂ concentrations outputs of the PCM model were used.
289. The percentage reduction in emissions from road transport required to achieve compliance has been estimated using the maximum PCM concentration in any given year, the corresponding background NO₂ concentration and Defra's NO_x to NO₂ calculator (v6.1) to calculate the roadside contribution to NO_x concentrations and the level of emissions required to give a roadside concentration below 40µg/m³ (compliance).
290. Traffic data comes from microsimulation traffic modelling of the exceedance corridor for the AM and PM peak hours, modelled for vehicle type's car/LGV/HGV, and verified using INRIX data for 2018. Robust long-term traffic counts from Traffic Wales were used to factor the modelled data to AM, Inter Peak, PM and Off Peak periods covering 24 hours in total. There are no future year scenarios from the traffic models produced given the time to undertake the assessment and require to ensure compliance in the shortest possible time.
291. It was not necessary to undertake traffic modelling for all measures as some (e.g. Air Quality Barriers) are not fundamentally expected to result in a change in traffic flows and are changes to the site infrastructure helping to provide barriers to receptors.
292. For the air quality assessment, the impact of the measures on compliance on each PCM link was assessed following the methodology set out in the Design Manual for Roads and Bridges Interim Advice Note 175/13 and based on the results of the national PCM modelling.

293. A modelled impact of a measure (a decrease in concentrations of roads-sourced NO₂) is added to the PCM future year concentration to derive an Equivalent 'with Measure' PCM concentration.
294. Air quality impacts were modelled at a distance of 4 metres from the roadside. This is the nominal distance at which concentrations are area assessed within the UK's national PCM modelling. Multiple 'receptors' were modelled along each PCM link, and the impact of the measure was assessed as the average impact at all modelled receptors along the link.
295. The air quality assessments consider the implementation of measures and their impact relative to the 'no measures' base year.
296. The air quality impacts in future years (whether compliance is achieved or not) have been modelled by running the Emissions Factor Toolkit with 2017/2018 traffic data but year-specific vehicle emissions from 2017 to 2022.
297. The modelled impact of a measure is determined using a local dispersion model verified using the Welsh Government site specific monitoring. The impact of the measure over the years of assessment is then added (as NO₂) to the future year national PCM model estimate for that PCM link to determine the total concentration of NO₂ in each year after implementation of the measure.
298. Offline Screening of Impacts - acknowledging that some measures may have an impact on adjacent routes, screening of potential impacts was undertaken to determine the likelihood of significant 'offline' impacts. This involved a review of local authority monitoring and the attractiveness of potential diversion routes, combined with a site-specific calculation of the 'NO₂ per vehicle' and an estimate of a change in annual average daily traffic flow and properties counts in bands along main line and diversion routes. These were then used to identify whether any significant offline impact would be associated with an exceedance issue (especially in adjacent AQMA) and net change in exposure to NO₂.