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Llywodraeth Cymru
Welsh Government

**Annual Data for NO₂ Concentrations
for the Motorway and Trunk Road**

Network: 2022 and 2023

Llywodraeth Cymru Welsh Government

July 2024

Annual Report 2022_3_Final

WELSH GOVERNMENT ANNUAL REPORTING 2022 AND 2023

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Foreword

The Welsh Government is committed to building healthier communities and better environments, acknowledging that clean air supports improved health and wellbeing. Our national air quality strategy – Clean Air Plan for Wales: Healthy Air, Healthy Wales – describes our long-term ambition to improve air quality and reduce the impacts of air pollution on human health, biodiversity, the natural environment and our economy. The Environment (Air Quality and Soundscapes) (Wales) Act, which received Royal assent in February 2024, has provided Welsh Ministers with strengthened powers to tackle poor air quality.

In November 2018 Welsh Government published a supplemental plan to the UK plan for tackling roadside nitrogen dioxide (NO₂) concentrations 2017. This detailed actions that were being taken to reduce NO₂ concentrations around several roads where levels were above legal limits. The supplemental plan built on Section 7.6 (Additional Actions in Wales) of the 2017 UK plan, setting out how to comply within the shortest possible time. These limit values were set by the Ambient Air Quality Directive (2008/50/EC) and transposed into Welsh law through the Air Quality Standards (Wales) Regulations 2010.

Since publication of the supplemental plan, much progress has been made and Welsh Government continues to assess and review the impact of mitigating measures on air pollutant concentrations. Two monitoring reports have previously been published, setting out the annual data that has been collected and what this tells us about changes in air quality on the motorway and trunk road network where reduced 50 mph speed limits are being enforced.

This report presents data on the 2022 and 2023 pollutant concentrations measured on the five sites on the Welsh Government Motorway and Trunk Road network previously identified as exceeding the limit value. This report also provides an update on the Welsh Government's progress in implementing actions to achieve sustained compliance at the five sites.

This report should be read in conjunction with preceding reporting on the Welsh Government supplemental plan to the UK plan for tackling roadside nitrogen dioxide (NO₂) concentrations 2017:

- Annual Data for NO₂ Concentrations for the Motorway and Trunk Road for 2020 and 2021, published in September 2022¹
- Annual Data for NO₂ Concentrations for the Motorway and Trunk Road for 2018 and 2019, published in March 2020²
- Tackling roadside nitrogen dioxide concentrations in Wales, published in September 2019³
- Air quality plan: roadside nitrogen dioxide, published in November 2018⁴
- Welsh Government Transport Appraisal Guidance Reports Stages 1, 2 and 3 for Tackling Roadside Nitrogen Dioxide Concentrations on the Motorway and Trunk road Network sites in Wales:
 - Tackling roadside nitrogen dioxide concentrations in Wales⁵

¹ [Annual NO2 Data for 2020 and 2021](#)

² [Annual NO2 data for 2018 and 2019](#)

³ [Tackling roadside nitrogen dioxide concentrations in Wales, 2019](#)

⁴ [Air Quality Plan, 2018](#)

⁵ [Weltag stage 1 and 2 reports](#)



- Tackling roadside nitrogen dioxide concentrations in Wales (WeITAG stage 3)⁶

⁶ [Weltag stage 3 reports](#)



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1. Introduction

In November 2018, the Welsh Government published a supplemental plan to the UK plan for tackling roadside nitrogen dioxide concentrations 2017, which included a commitment to report on measured concentrations at sites of non-compliance and actions taken to reduce pollutant concentrations.

As detailed in the supplemental plan, five sites were identified where NO₂ concentrations were above the limit value of 40 µg/m³ as set in the EU Ambient Air Quality Directive (2008/50/EC) and the Air Quality Standards (Wales) Regulations 2010. These are:

- A483 near Wrexham (North Wales Zone)
- A494 at Deeside (North Wales Zone)
- A470 between Upper Boat and Pontypridd (South Wales Zone)
- M4 between Junctions 25 and 26 at Newport (South Wales Zone)
- M4 between Junctions 41 and 42 at Port Talbot (Swansea and South Wales Zone)

The locations of these sites are shown in Appendix B.

This report provides an updated review of compliance status for the five sites. It presents measured concentration data for 2022 and 2023, together with information on traffic data, speed data and an overview of existing actions taken to achieve compliance.

A glossary of terms is provided in Appendix A.



2. Methodology

2.1 Process for Evaluating Road Links Exceeding the Limit Value

The Department for Environment, Food and Rural Affairs (DEFRA)'s Pollution Climate Mapping (PCM) model provides projected roadside concentrations for road links throughout the UK to determine which ones are exceeding the air quality limit values. The UK 2017 plan used projected results from the PCM model with a reference year of 2015. The PCM model was updated to provide concentrations for a 2017 reference year, and the current version of the PCM model, which was last revised in 2020, provides projected results for the years 2018 to 2030 inclusive, based on a 2018 reference year. This has meant that there has been a revision in the labelling and the extent of PCM links at some of the sites. Figures in this report show both the 2017 and 2018 PCM links at each site.

2.2 Data Sources

This report has included a review of data from the following sources:

- Annual mean monitoring data for 2022 and 2023
- Traffic flow and speed data for appraised road links
- OS mapping to identify locations representative of public access, where there were exceedances of the limit value at monitoring sites

2.2.1 Air Quality Monitoring

2.2.1.1 Diffusion Tube Monitoring

In 2023 diffusion tube monitoring for NO₂ was conducted at 43 roadside and 5 background locations within the five sites, as shown in Table 2-1. There were some changes in the monitoring locations at three of the sites between 2022 and 2023, and the revised monitoring locations are shown in Appendix C.

Table 2-1 – Locations of Sites and Diffusion Tube Numbers

Road	Area of Wales	Location	When did monitoring commence?	Number of Diffusion Tube Locations (2023)
A483, Wrexham	North Wales	J5-J6	18 th December 2017	5 roadside 1 background
A494, Deeside	North Wales	Between the B5125 St Davids Interchange and the A458 Deeside Park Interchange	18 th December 2017	7 roadside 1 background
A470, Upper Boat to Pontypridd	South Wales	Between the Upper Boat roundabout and the A4058 roundabout	19 th December 2017	10 roadside 1 background



Road	Area of Wales	Location	When did monitoring commence?	Number of Diffusion Tube Locations (2023)
M4, Newport	South Wales	J25–J26	18 th December 2017	11 roadside 1 background
M4, Port Talbot	Swansea and South Wales	J41-42	18 th December 2017	10 roadside 1 background

Average monthly concentrations of NO₂ at each of the sites have been measured by deploying sets of triplicate diffusion tubes at each monitoring location⁷. The tubes are changed over monthly, according to the dates in the DEFRA diffusion tube monitoring calendar⁸.

The locations of the diffusion tube monitoring sites are illustrated in Section 3. The diffusion tubes were prepared using a 20% triethanolamine (TEA) in water method and were supplied and analysed by Staffordshire Scientific Services Ltd. Further details of the diffusion tube monitoring methodology, including limitations, quality assurance and quality control (QA/QC) procedures are provided in Appendix G.

Appendix E presents the measured NO₂ concentrations at the diffusion tube monitoring sites during the calendar years 2018 - 2023. The data at each site have been averaged using the monthly averages, and adjusted in accordance with DEFRA guidance LAQM.TG22 using national bias adjustment factors⁹. Where necessary, data were annualized in accordance with LAQM.TG22.

2.2.1.2 Continuous Monitoring

Continuous analysers were set up in 2019 at each site to provide further information on measured pollutant concentrations. Diffusion tubes have been co-located with the continuous analysers for comparison purposes. The locations of the continuous monitors and the co-located diffusion tubes are summarised in Table 2-2 below.

Table 2-2 – Continuous Monitoring Sites

Continuous Monitor Name (Operator)	Co-located Diffusion Tube
A483 Wrexham, North Wales (Envitech)	Wrexham 9
A494 Deeside Aston Hill, North Wales (Envitech)	Deeside 8
A470 Pontypridd, South Wales (Envitech)	Pontypridd 8
M4 Newport - M4 Junction 25, South Wales (WG)	Newport 8
M4 Newport - M4 Junction 25, South Wales (Envitech)	Newport 9
M4 Port Talbot – M4 Junction 40 and 41, South Wales (Envitech)	Port Talbot 9

⁷ Using triplicate tubes allows checks to be made for precision, improving the reliability of the measured data

⁸ Department for Environment Food & Rural Affairs, NO₂ Diffusion Tube Monitoring Calendar. Available at: [NO₂ Diffusion Tube Monitoring Calendar](#)

⁹ Department for Environment Food & Rural Affairs, National Bias Adjustment Factors. Available at: [National Bias Adjustment Factors](#)

2.2.2 Traffic Data

Traffic data have been collected from the Department for Transport (DfT) road traffic statistics website¹⁰. The data used are the Annual Average Daily Flow (AADF), recording the number of vehicles that travel past the count point on an average day of the year. These data are summarised in Appendix D.

2.2.3 Speed Data

Average speed data for each road section for both 2022 and 2023 have been derived from the INRIX website¹¹. Summaries are provided in Appendix F which show the differences by direction for each day at each site.

¹⁰ Department for Transport - [Map Road traffic statistics - Road traffic statistics \(dft.gov.uk\)](https://www.dft.gov.uk/road-traffic-statistics)

¹¹ Available at: [Transportation Planning | Roadway Analytics by INRIX](https://www.inrix.com/transportation-planning/roadway-analytics)



3. Summary of Findings

Summary data for each of the five links are presented below, with further details provided in Appendices D, E and F. It should be noted that although the annual mean limit value is 40 µg/m³, due to rounding, annual mean concentrations are only deemed to be in exceedance of this value where they are measured to be 40.5 µg/m³ and above.

3.1 A483 Wrexham

Table 3-1 below provides a summary of the findings for this location. The monitoring locations and traffic count point, together with the 2017 PCM link or the 2018 PCM link are shown in Figure 3-1 and Figure 3-2 respectively. The trends in the average roadside and background concentrations are shown in Figure 3-3. Concentrations can be seen to have decreased over time at both roadside and background locations. Concentrations at all sites in both 2022 and 2023 were compliant with the limit value, and average speeds were also shown to be below 50 mph in both directions on all days. Traffic flows in 2022 and 2023 were higher than in 2020 and 2021, but not as high as in 2018 or 2019.

Table 3-1 - A483 near Wrexham (North Wales)

Item	Description
Location	A483 between J5 (Mold Interchange) and J6 (Gresford Interchange)
Non-compliant PCM Link IDs	2017 ID: 30560 2018 ID: 801030560
Zone	North Wales
Local Authority Area	Wrexham County Borough Council
Nearby Air Quality Management Areas (AQMAs)	None – no AQMAs in North Wales
Mitigations	50 mph speed limit - introduced June 2018 Complementary package of soft measures including: <ul style="list-style-type: none"> • Behaviour Change • Intelligent Traffic Management • Signage • Air Quality Areas • Air Quality Communications
Precautionary Retained Measure(s)	Air quality barrier, plus 50 mph speed limit
Are annual mean concentrations compliant?	2022: Yes – all sites were below 40 µg/m ³ 2023: Yes – all sites were below 40 µg/m ³
AADT Traffic Flows	2022: 48,190
DfT Count Site 30560	2023: 48,951
Average speed	2022: <50 mph 2023: <50mph



Figure 3-1 - A483 Wrexham (2017 PCM Link)

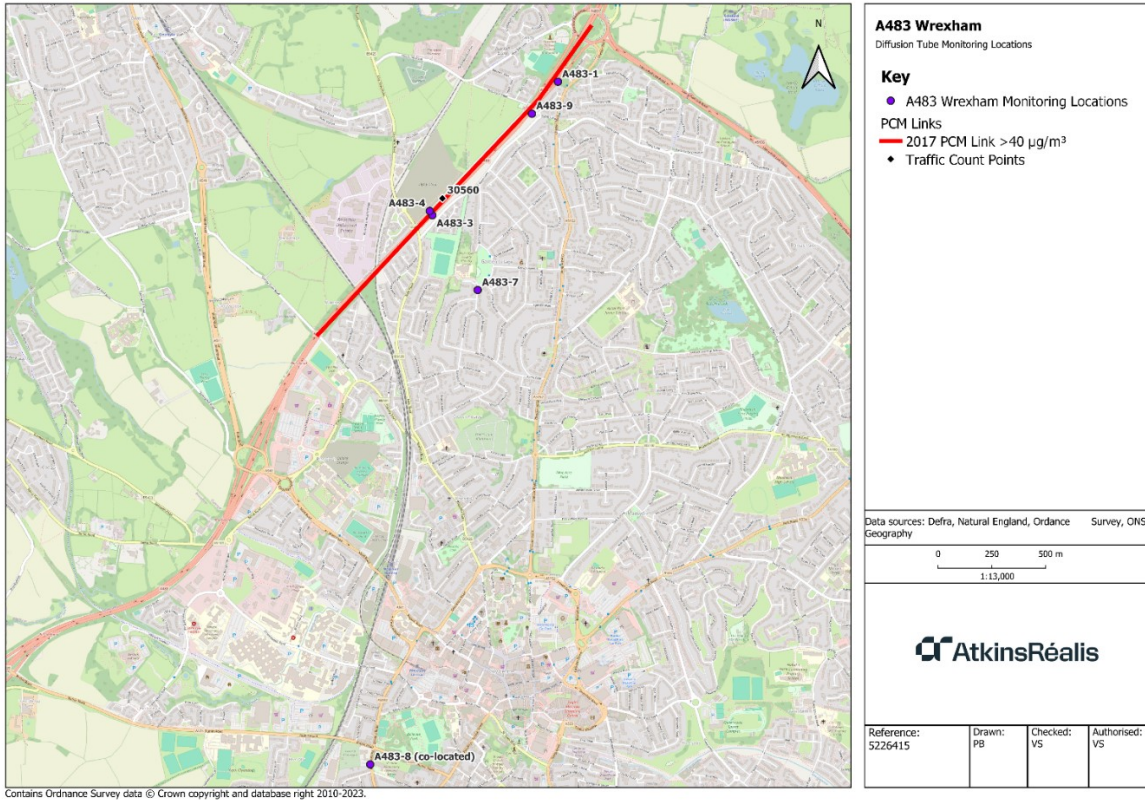


Figure 3-2 - A483 Wrexham (2018 PCM Link)

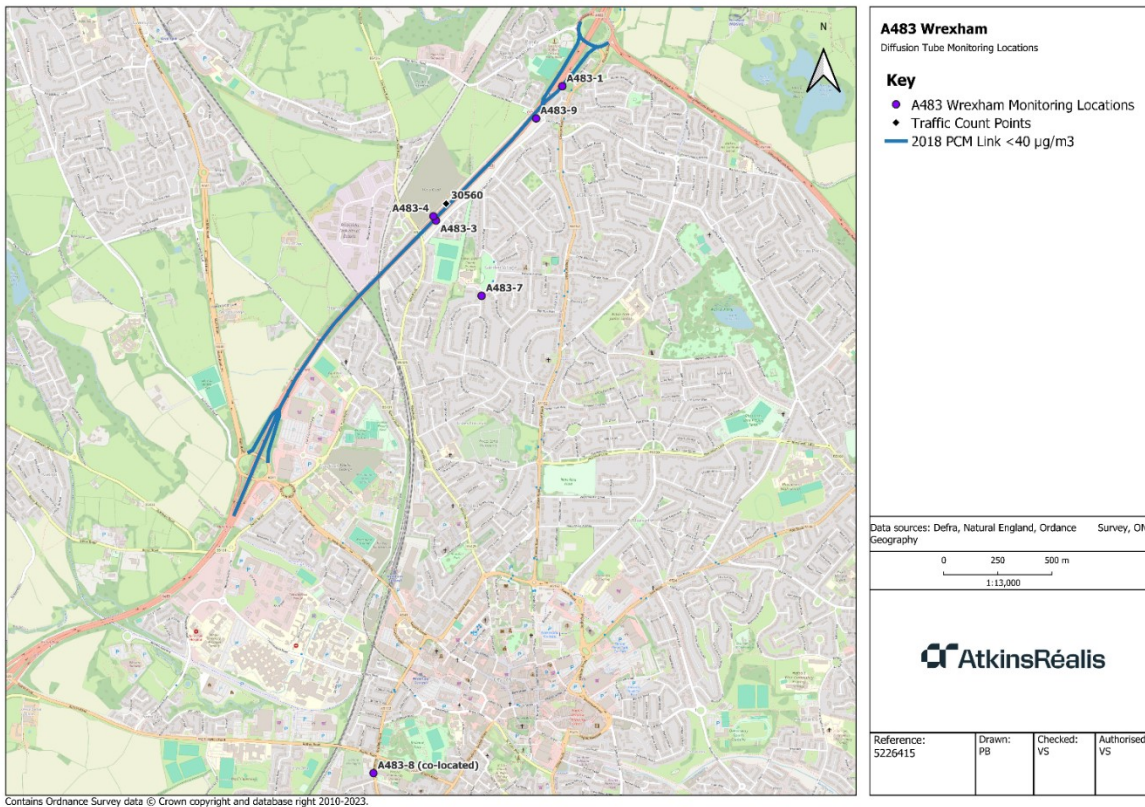
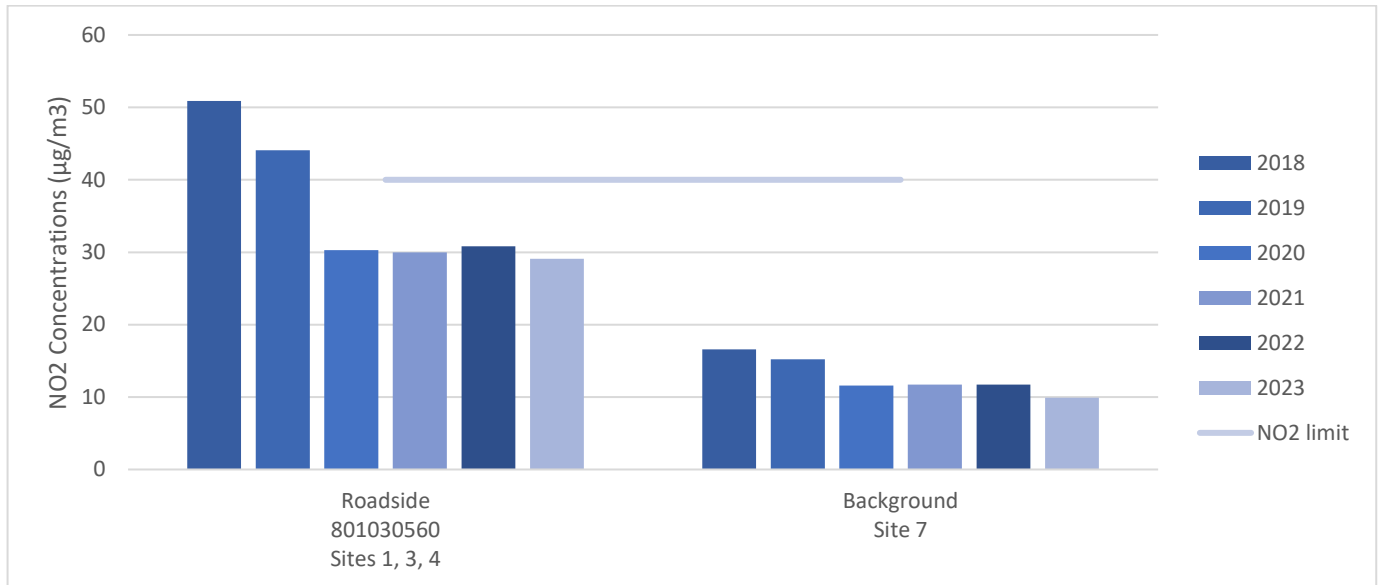


Figure 3-3 – Trends in average concentrations at A483 Wrexham



3.2 A494 Deeside

Table 3-2 below provides a summary of the findings for this location.

Figure 3-4 shows the monitoring locations and traffic count points. The monitoring locations and traffic count point, together with the 2017 PCM link or the 2018 PCM link are shown in Figure 3-4 and Figure 3-5 respectively.

The trends in the average roadside and background concentrations are shown in Figure 3-6. Concentrations can be seen to have decreased over time at both roadside and background locations. Concentrations at all sites in both 2022 and 2023 were compliant with the limit value, and average speeds were also shown to be below 50 mph in both directions on all days. Traffic flows in 2022 and 2023 were higher than in 2020 and 2021, but not as high as in 2018 or 2019.

Table 3-2 – A494 Deeside (North Wales)

Item	Description
Location	A494 between the B5125 St Davids Interchange and A458 Deeside Park Interchange
Non-compliant PCM Link IDs	2017 ID: 559, 30571, 30625 2018 ID: 801000559, 802030571, 802030625
Zone	North Wales
Local Authority Area	Flintshire County Council
Nearby Air Quality Management Areas (AQMA)	None – no AQMAs in North Wales
Mitigations	50mph speed limit Complementary package of soft measures including: Behaviour Change Intelligent Traffic Management

Item	Description
	Signage Air Quality Areas Air Quality Communications
When was 50 mph speed limit implemented?	June 2018
Precautionary Retained Measure(s)	Air quality barrier, plus 50 mph speed limit
Are annual mean concentrations compliant?	2022: Yes – all sites were below 40 µg/m ³ 2023: Yes – all sites were below 40 µg/m ³
AADT Traffic Flows	2022: 69,794, 65,018, 35,037
DfT count site 559	2023: 71,832, 65,638, 55,326
DfT count site 91225	
DfT count site 30625	
Average speed	2022: <50 mph 2023: <50mph

Figure 3-4 - A494 Deeside (2017 PCM Link)

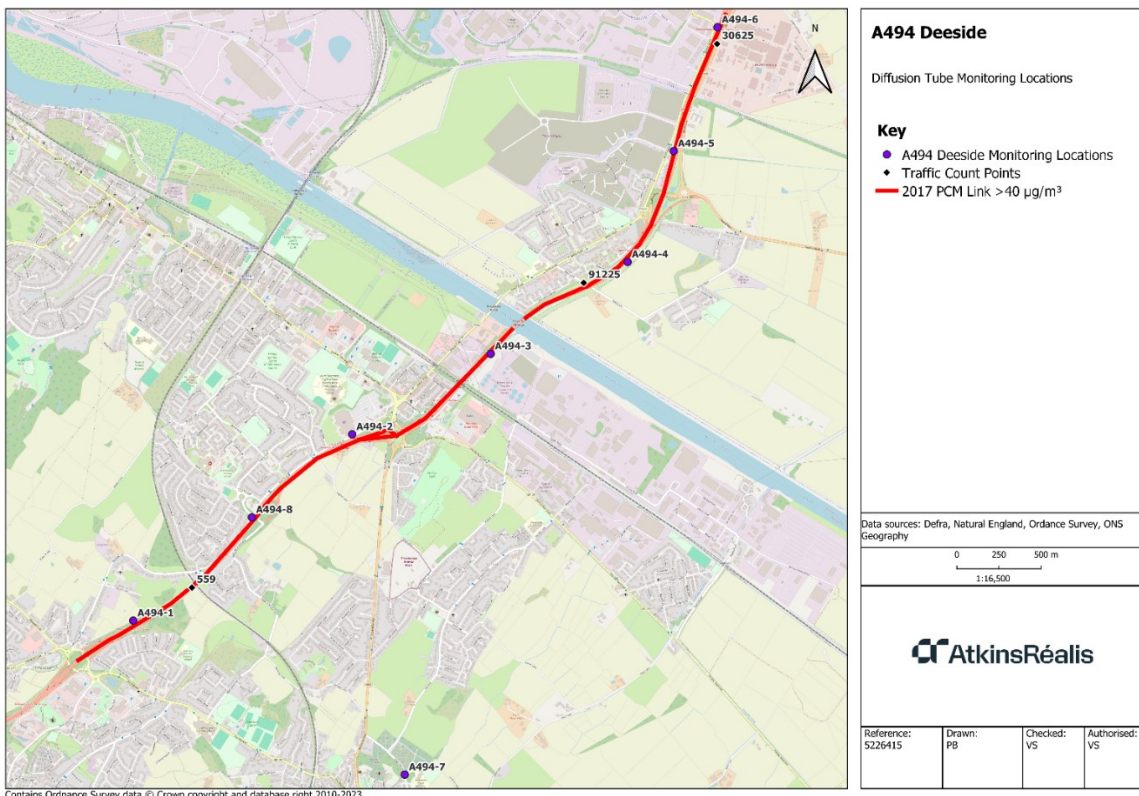


Figure 3-5 - A494 Deeside (2018 PCM Link)

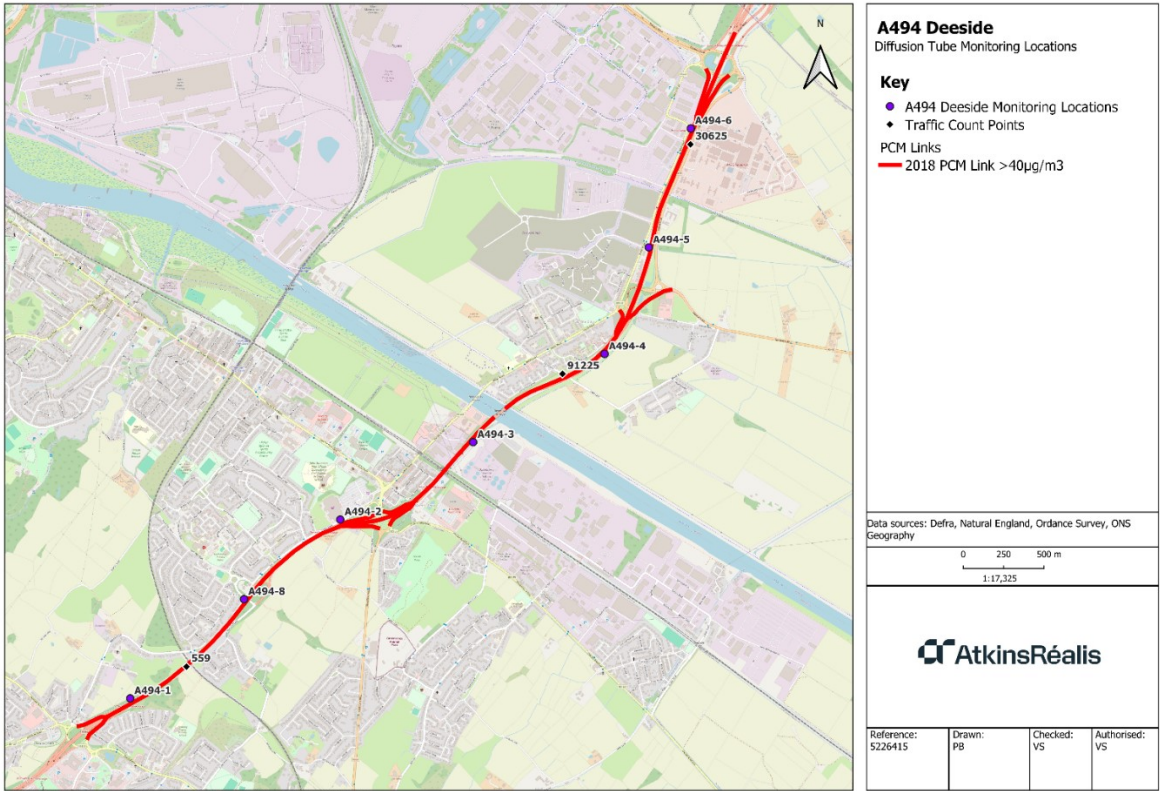
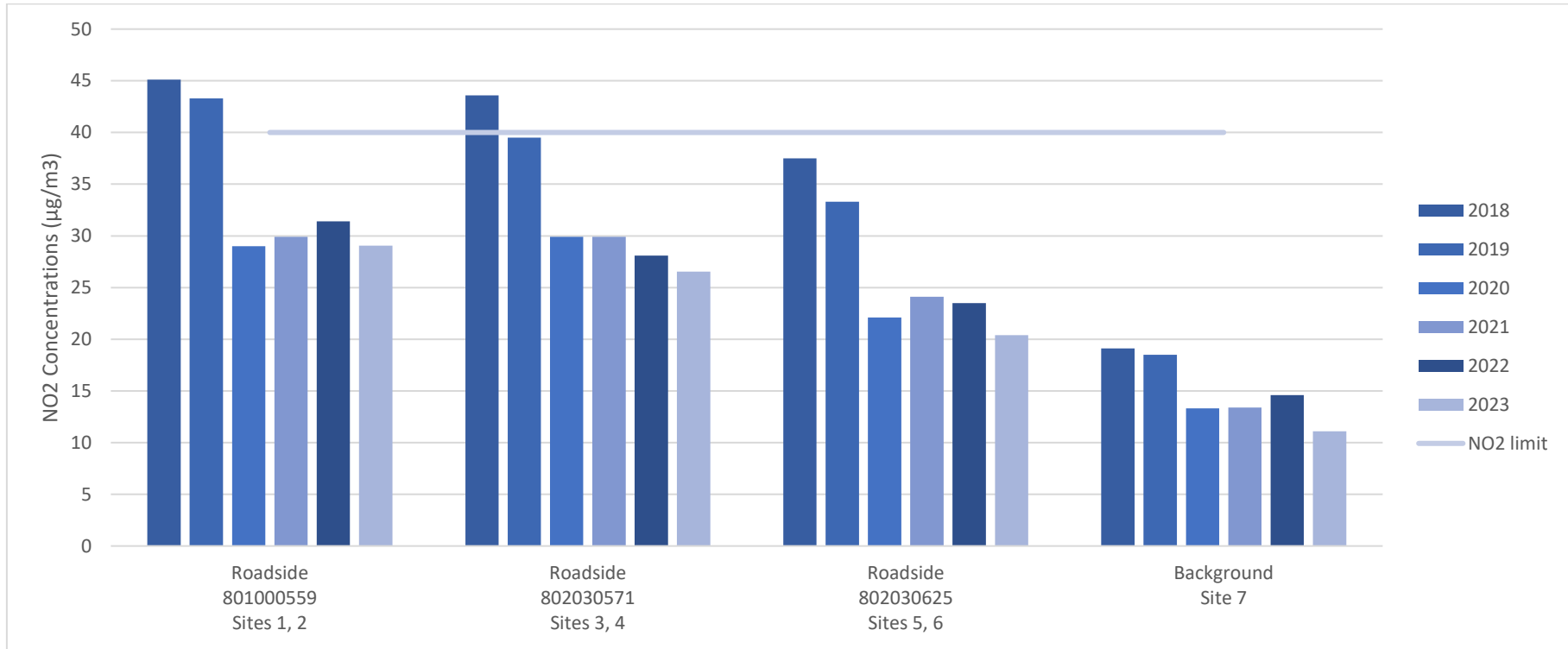


Figure 3-6 – Trends in average concentrations at A494 Deeside



3.3 A470 Pontypridd to Upper Boat

Table 3-3 below provides a summary of the findings for this location. The monitoring locations and traffic count point, together with the 2017 PCM link or the 2018 PCM link are shown in Figure 3-7 and Figure 3-8 respectively.

The trends in the average roadside and background concentrations are shown in Figure 3-9. Concentrations can be seen to have decreased over time at both roadside and background locations. Concentrations at the roadside sites 1, 2,3 and 4 exceeded the limit value in 2022, however all sites were compliant in 2023. Average speeds were shown to be below 50 mph in both directions on all days. Traffic flows in 2022 and 2023 were higher than in 2020 and 2021, but not as high as in 2018 or 2019.

Table 3-3 - A470 Pontypridd to Upper Boat (South Wales)

Item	Description
Location	A470 from Pontypridd to Upper Boat, between the Upper Boat Roundabout junction and the A4058 roundabout
Non-compliant PCM Link IDs	2017 ID: 10548, 40548 2018 ID: 802010548, 802040548
Zone	South Wales
Local Authority Area	Rhondda Cynon Taf County Borough Council
Nearby Air Quality Management Areas (AQMA)	Nightingales Bush AQMA Broadway AQMA Treforest AQMA
Mitigations	50mph speed limit – introduced June 2018 Complementary package of soft measures including: <ul style="list-style-type: none"> • Behaviour Change • Intelligent Traffic Management • Signage • Air Quality Areas • Air Quality Communications • Car Sharing
Precautionary Retained Measure(s)	Air Quality Barrier, plus 50 mph speed limit Clean Air Zone, plus 50 mph speed limit Parking Improvement, plus 50 mph speed limit
Are annual mean concentrations currently compliant?	2022: No – sites 1, 2, 3, and 4 were all above 40 µg/m ³ . All other sites were compliant. 2023: Yes – all sites were below 40 µg/m ³
AADT Traffic Flows	2022: 55,558, 61,740
DfT count site 10548	2023: 56,195, 61,194
DfT count site 40548	
Average speed	2022: <50 mph 2023: <50mph



Figure 3-7 - A470 Pontypridd (2017 PCM Link)

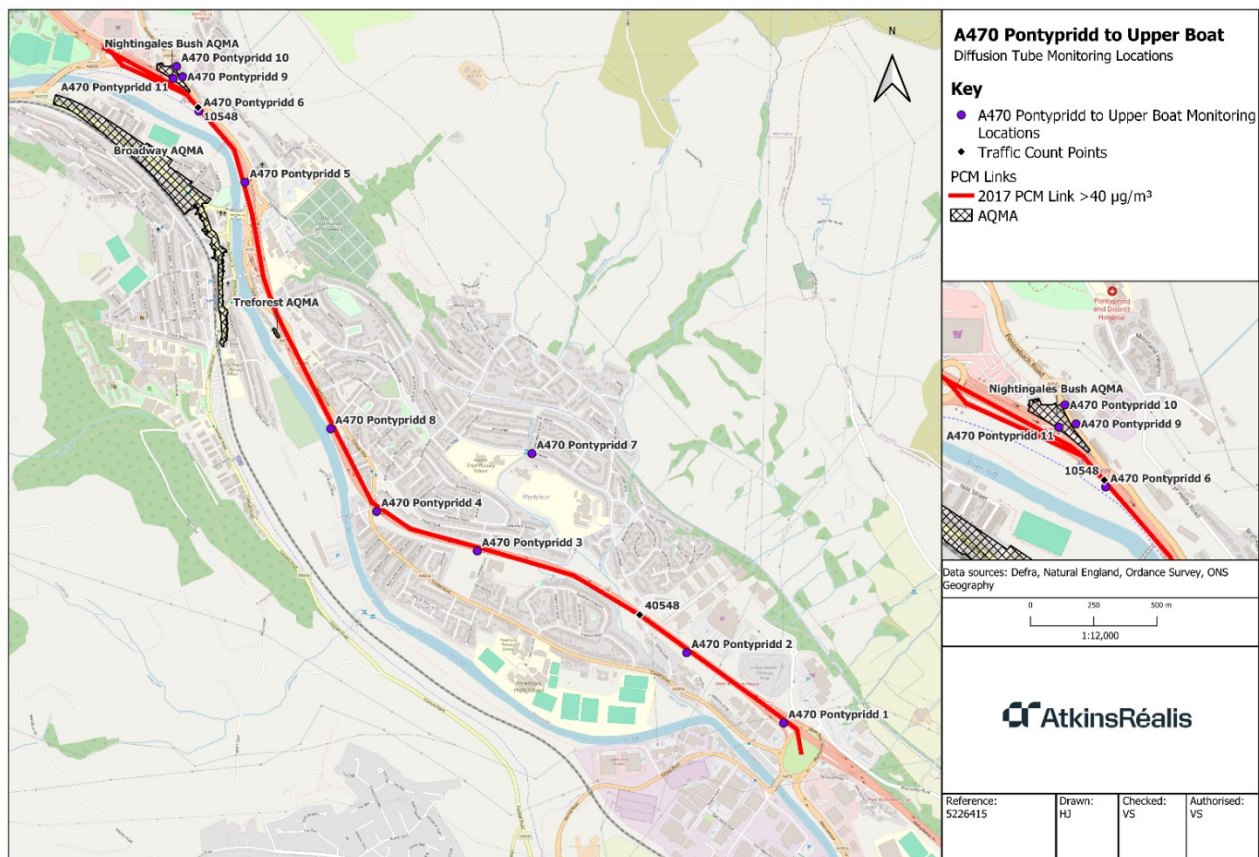


Figure 3-8 - A470 Pontypridd (2018 PCM Link)

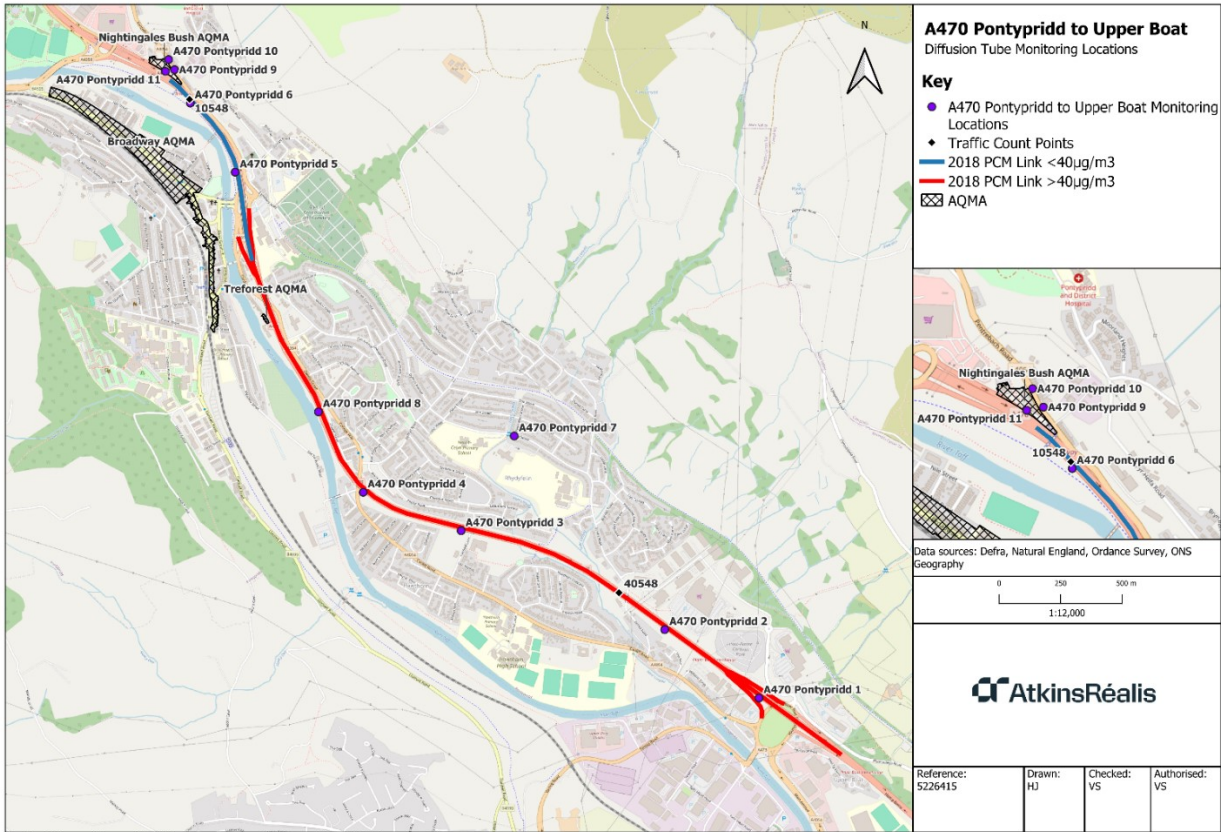
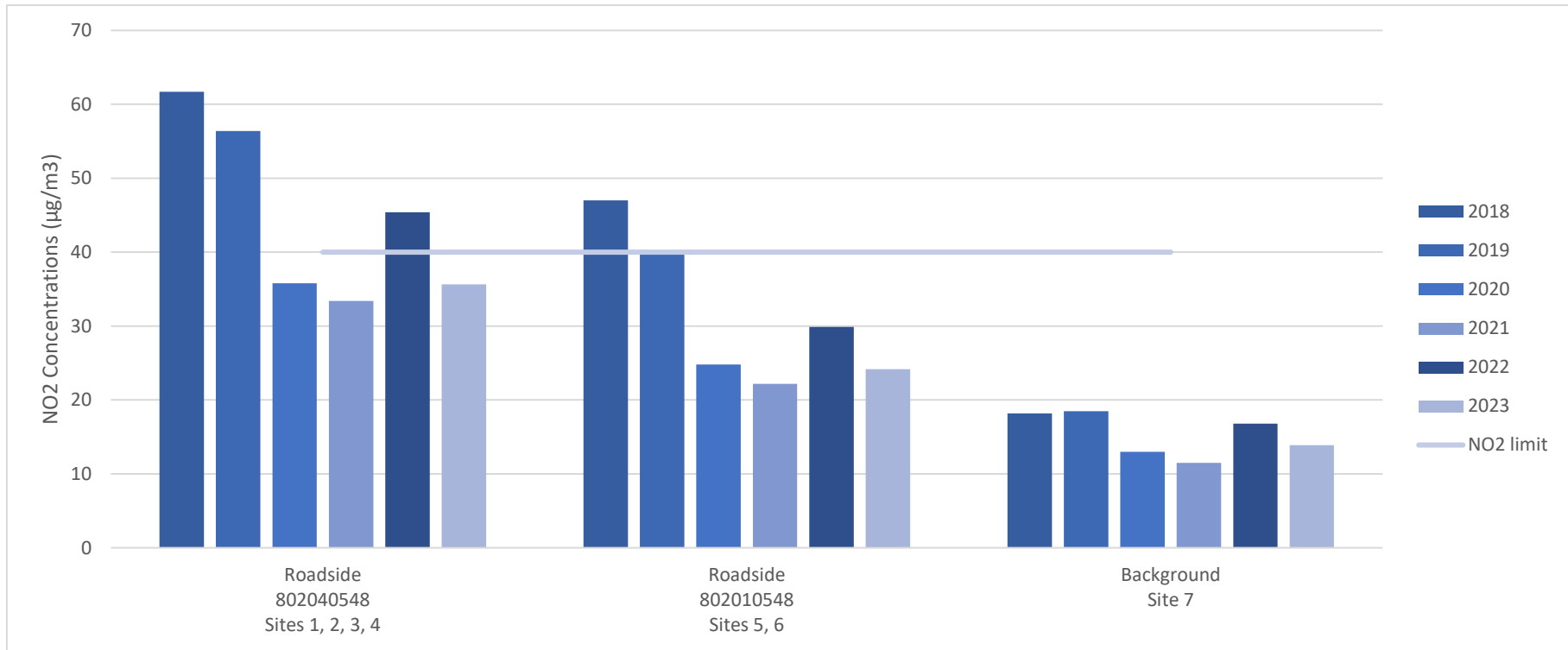


Figure 3-9 – Trends in average concentrations at A470 Pontypridd to Upper Boat



3.4 M4 J25-26 Newport

Table 3-4 below provides a summary of the findings for this location. The monitoring locations and traffic count point, together with the 2017 PCM link or the 2018 PCM link are shown in Figure 3-10 and Figure 3-11 respectively.

The trends in the average roadside and background concentrations are shown in Figure 3-12. Concentrations can be seen to have decreased over time at both roadside and background locations. The annual mean limit value was exceeded at five roadside sites in 2022, and at two roadside sites in 2023. Average speeds were shown to be below 50 mph in both directions on all days. Traffic flows in 2022 and 2023 were higher than in 2020 and 2021, but not as high as in 2018 or 2019, with the exception of count point 10500, where traffic flows could be considered to have returned to pre-pandemic levels.

Further review has taken place of the monitoring locations which are exceeding the limit value in 2023, sites 1 and 6. Site 1 is located east of junction 25, which is further east of the PCM link under investigation, while site 6 is located west of the Brynglas Tunnel. Neither site is representative of a qualifying feature¹², as both sites are located adjacent to the M4, where there is no public access.

For site 1, there are residential properties with gardens, approximately 8 metres further away from this monitoring site, and at this distance concentrations would be lower than at the roadside and calculated to comply with the limit value when using DEFRA's NO₂ distance calculator¹³.

For site 6, there are no qualifying features directly within 15 metres of this location. To the east of this monitoring site, the nearest residential properties are approximately 50 metres north of the M4, and to the west, there is a car park adjacent to the slip road, however, it is at a lower elevation than the M4, and approximately 70 metres away from the monitoring site.

Table 3-4 - M4 J25-26 Newport

Item	Description
Location	M4 Newport Junction 25 to Junction 26
Non-compliant PCM Link IDs	2017 ID: 40500, 70057 2018 ID: 802040500, 802070057, 802010500*
Zone	South Wales
Local Authority Area	Newport City Council
Nearby Air Quality Management Areas (AQMAs)	Caerleon Road AQMA Malpas Road AQMA St Julians AQMA
Mitigations	50mph speed limit – introduced February 2019 Signs to redirect traffic to Newport docks – introduced in May 2024 Complementary package of soft measures including: <ul style="list-style-type: none"> • Behaviour Change • Intelligent Traffic Management

¹² A qualifying feature can be defined as a location where there is public access, such as a footpath, or a sensitive receptor such as a residential property within 15 metres of the edge of the road, but not within 25 metres of a junction, as defined in National Highways' Design Manual for Roads and Bridges LA 105

¹³ Available at [NO2 Fall Off With Distance Calculator | LAQM \(defra.gov.uk\)](https://www.gov.uk/guidance/no2-fall-off-with-distance-calculator-laqm)

Item	Description
	<ul style="list-style-type: none"> • Signage • Air Quality Areas • Air Quality Communications
Precautionary Retained Measure(s)	Clean Air Zone, plus speed limit
Are annual mean concentrations compliant?	<p>2022: No – sites 1, 3, 5, 6 and 10 were above 40 µg/m³. All other sites compliant.</p> <p>2023: No – sites 1 and 6 were above 40 µg/m³, although they are not representative of public access. All other sites compliant.</p>
AADT Traffic Flows	2022: 80,282, 103,280
DfT count site 40500	2023: 82,165, 105,780
DfT count site 10500	
Average speed	<p>2022: <50 mph</p> <p>2023: <50mph</p>



Figure 3-10 - M4 J25-26 Newport (2017 PCM Link)

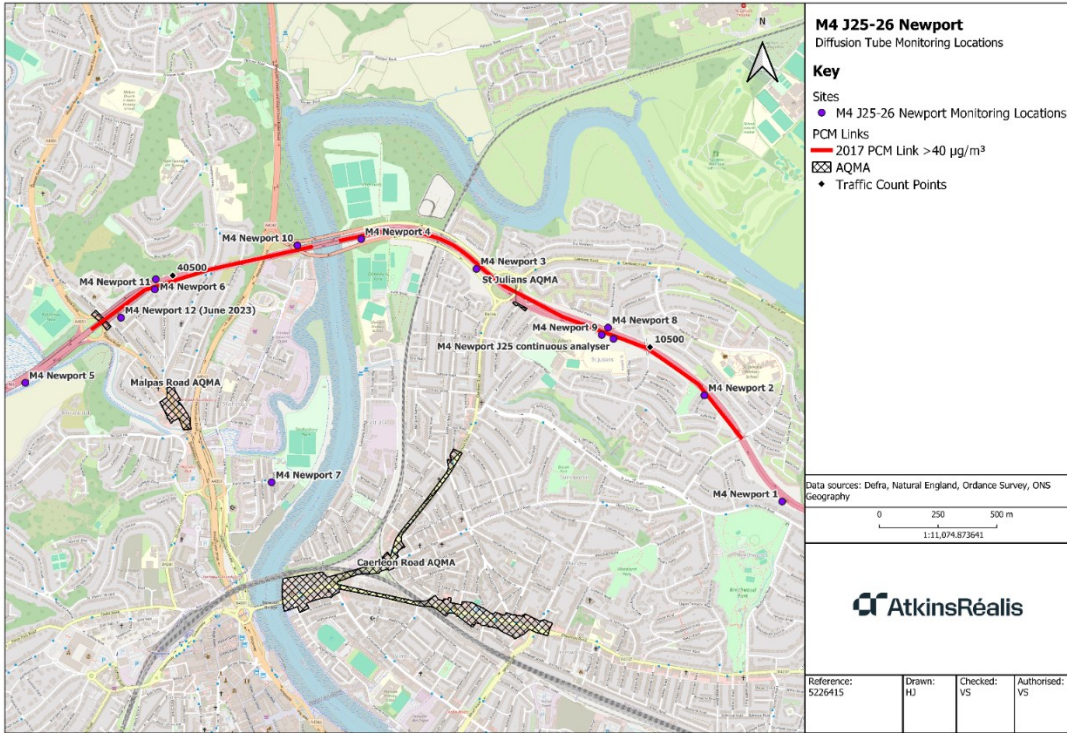


Figure 3-11 - M4 J25-26 Newport (2018 PCM Link)

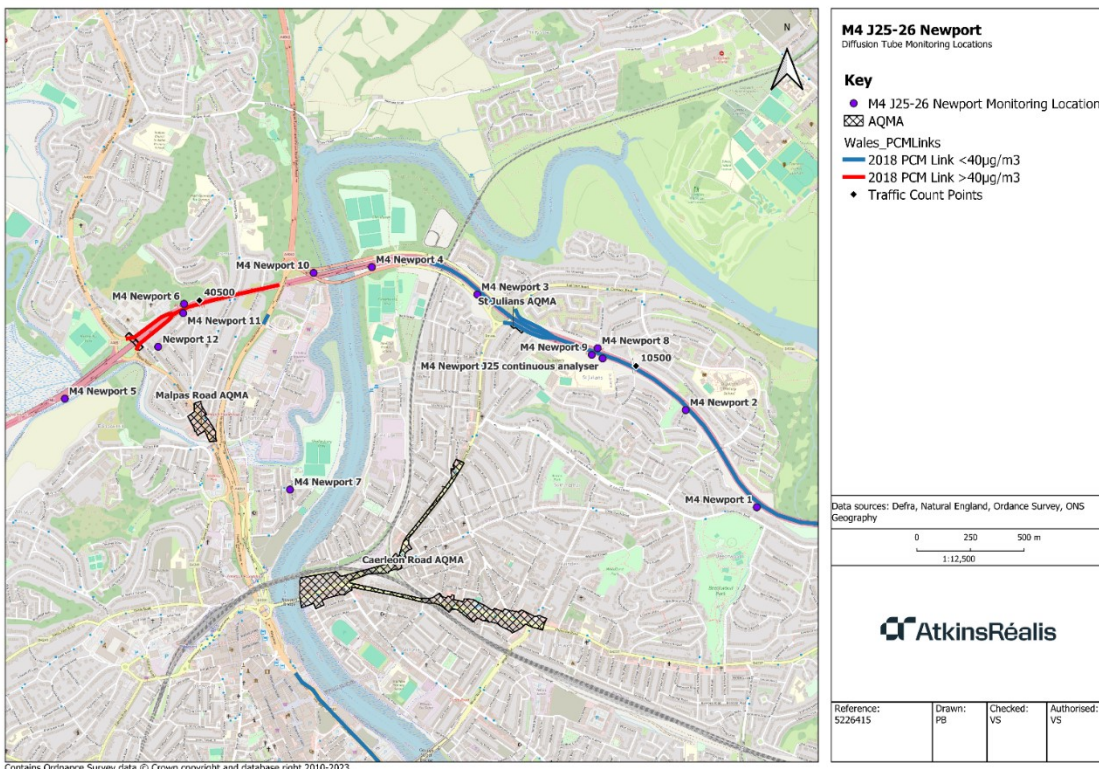
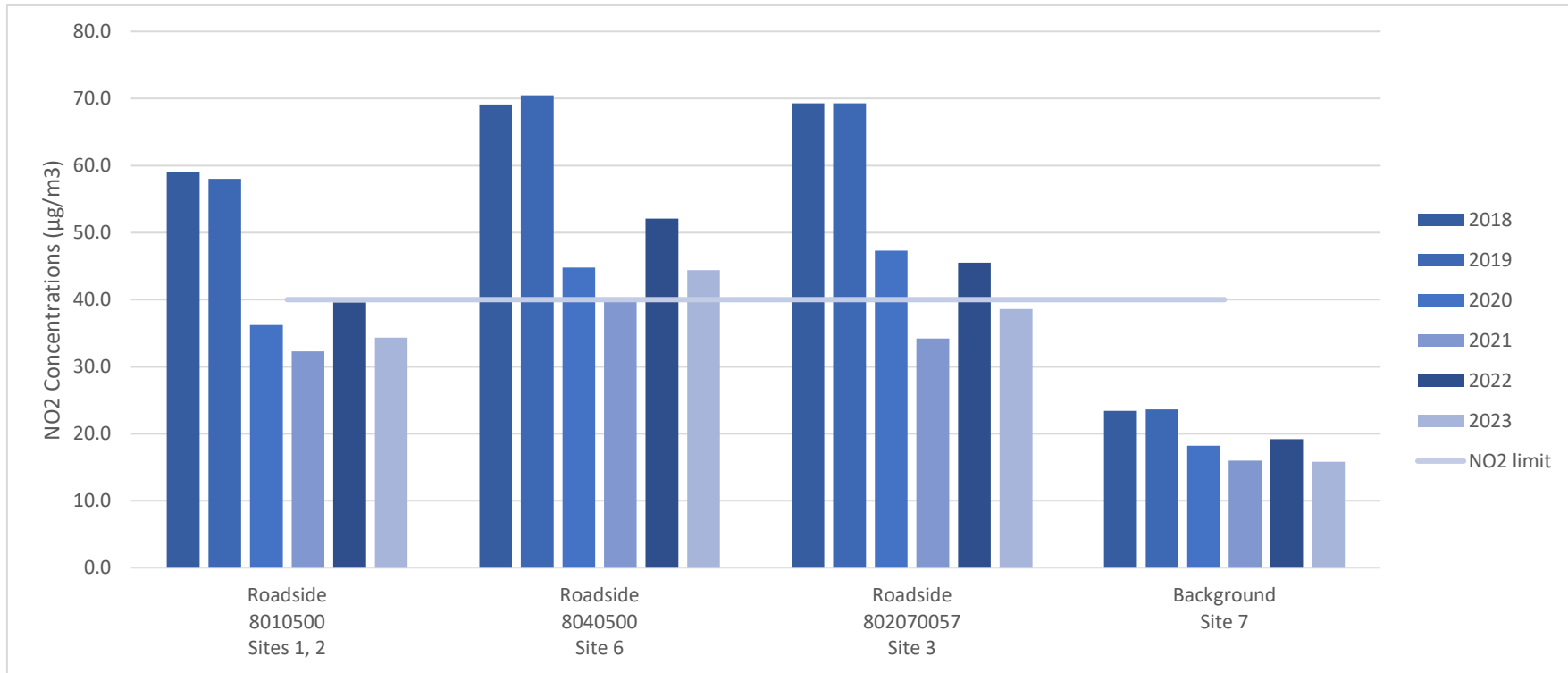


Figure 3-12 – Trends in average concentrations at M4 J25-26 Newport



3.5 M4 J41-42 Port Talbot

Table 3-5 below provides a summary of the findings for this location. The monitoring locations and traffic count point, together with the 2017 PCM link or the 2018 PCM link are shown in Figure 3-13 and Figure 3-14 respectively.

The trends in the average roadside and background concentrations are shown in

Figure 3-15. Concentrations can be seen to have decreased over time at both roadside and background locations. Concentrations at all sites in both 2022 and 2023 were compliant with the limit value, and average speeds were also shown to be below 50 mph in both directions on all days. Traffic flows in 2022 and 2023 were higher than in 2020 and 2021, but not as high as in 2018 or 2019.

Table 3-5 - M4 J41-42 Port Talbot (South Wales)

Item	Description
Location	M4 Port Talbot Junction 41 to Junction 42
Non-compliant PCM Link IDs	2017 ID: 77075 2018 ID*: 802077075
Zone	Swansea and South Wales
Local Authority Area	Neath Port Talbot County Borough Council
Nearby Air Quality Management Areas (AQMAs)	Neath Port Talbot AQMA
Mitigations	50 mph speed limit – introduced June 2018 Complementary package of soft measures including: <ul style="list-style-type: none"> • Behaviour Change • Intelligent Traffic Management • Air Quality Areas • Air Quality Communications
Precautionary Retained Measure (s)	Closure of J41 westbound on-slip, plus 50mph speed limit Variable diversions, plus 50mph speed limit
Are annual mean concentrations compliant?	2022: Yes – all sites were below 40.2 µg/m ³ 2023: Yes – all sites were below 40 µg/m ³
AADT Traffic Flows	2022: 64,919, 62,094
DfT count site 77075	2023: 66,563, 66,217
DfT count site 40503	
Average speed	2022: <50 mph 2023: <50mph

Figure 3-13 - M4 J41-42 Port Talbot (2017 PCM Link)

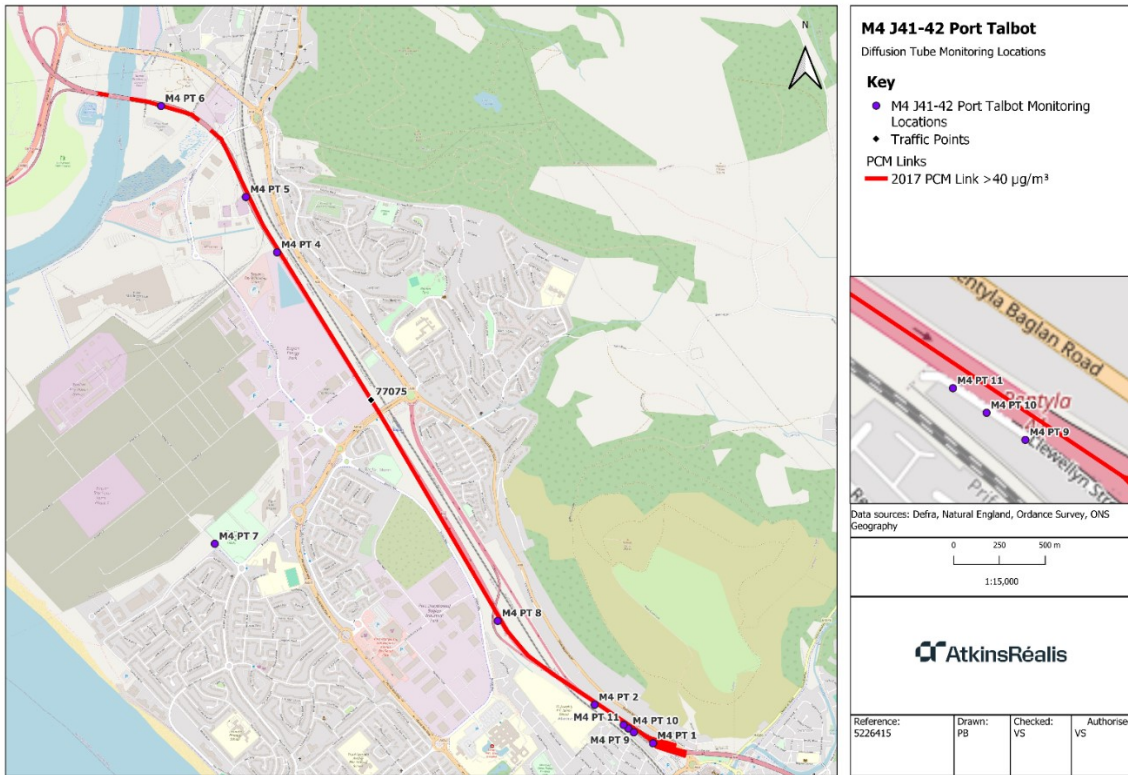


Figure 3-14 - M4 J41-42 Port Talbot (2018 PCM Link)

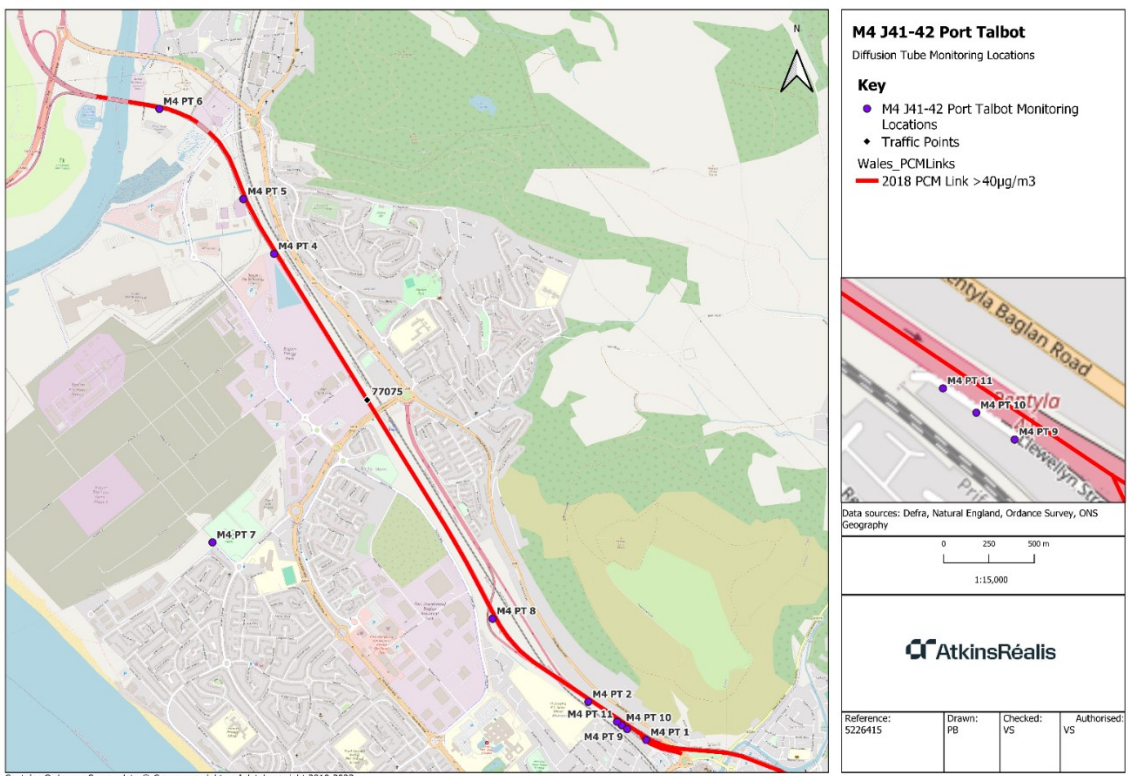
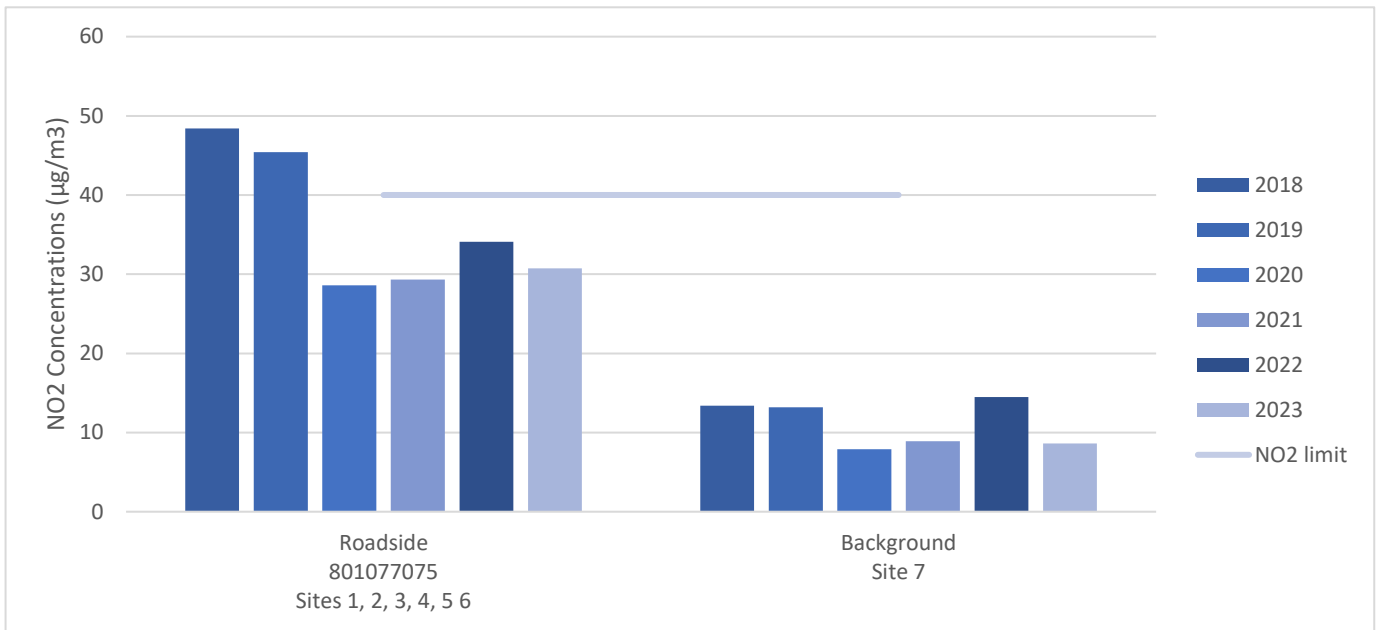


Figure 3-15 – Trends in average concentrations at M4 J41-42 Port Talbot



4. Summary

An evaluation of compliance status for the five road links on the motorway and trunk road network within Wales has been completed, using data collated for the calendar years 2022 and 2023. Table 4-1 below presents a summary on compliance status. In 2022, all road links achieved compliance with the exception of A470 Pontypridd and M4 Newport J25-26, where a number of monitoring sites exceeded the limit value. In 2023, all road links achieved compliance with the exception of M4 Newport J25-26, where two monitoring sites exceeded the limit value. However neither site was considered to be representative of any public access.

The trend in concentrations is one of general improvement at all monitoring sites from 2018 to 2023. Although concentrations decreased notably at the majority of sites in 2020, and to a lesser extent in 2021 as a result of the reduction in traffic during the global pandemic, concentrations in 2022 and 2023 have remained lower than in 2018 and 2019, despite a return in traffic levels to near pre-pandemic conditions. Furthermore, the average speed data collected at each site shows that there is compliance at all five sites with the 50 mph speed limit on all days and in both directions at each location in both 2022 and 2023.

Table 4-1 - Summary compliance status

Road Link	Description	Compliance status 2022	Compliance status 2023
A483 Wrexham	Between J5 (Mold Interchange) and J6 (Gresford Interchange)	Yes – all sites were below 40 µg/m ³	Yes – all sites were below 40 µg/m ³
A494 Deeside	A494 between the B5125 St Davids Interchange and A458 Deeside Park Interchange	Yes – all sites were below 40 µg/m ³	Yes – all sites were below 40 µg/m ³
A470 Pontypridd to Upper Boat	A470 from Pontypridd to Upper Boat, between the Upper Boat Roundabout junction and the A4058 roundabout	No – sites 1, 2, 3, and 4 were all above 40 µg/m ³ . All other sites were compliant.	Yes – all sites were below 40 µg/m ³
M4 J25 – 26 Newport	M4 Newport Junction 25 to Junction 26	No – sites 1, 3, 5, 6 and 10 were above 40 µg/m ³ . All other sites compliant.	No – sites 1 and 6 were above 40 µg/m ³ however they are not representative of public access. All other sites compliant.
M4 J41-42 Port Talbot	M4 Port Talbot Junction 41 to Junction 42	Yes – all sites were equal or lower to 40.1 µg/m ³ .	Yes – all sites were below 40 µg/m ³

Due to the success of the 50 mph speed limits in achieving compliance, consideration can now be given to the next steps. It is expected that compliance with the limit value will continue in future years, especially as the vehicle fleet becomes progressively cleaner with the turnover of older vehicles being replaced by lower emitting ones, although this could be offset by any significant additional development.

For the two road links in North Wales, the precautionary retained measures are now considered unlikely to be required, and can be discounted. Monitoring will be continued to give three consecutive years of monitoring post pandemic, i.e. from 2022 onwards, to give confidence that the results are likely to remain below the limit value, and an exit strategy can be prepared.

Similarly, for the M4 Port Talbot road link, the precautionary retained measures are now considered unlikely to be required, and can be discounted. Monitoring will be continued to give three consecutive years of monitoring post pandemic to give confidence that the results are likely to remain below the limit value, and an exit strategy can be prepared.

For the A470 Pontypridd to Upper Boat road link, the precautionary retained measures are also unlikely to be required and can be discounted. Monitoring should continue at this site for a minimum of two further years to give confidence that the limit value will continue to be met.

For the M4 Newport road link, two monitoring sites exceeded the limit value, although these were not considered representative of public access, and all other sites were compliant in 2023. The precautionary retained measure is hence considered unlikely to be required and can be discounted. Monitoring should continue at this site for a minimum of two further years to give confidence that the limit value will continue to be met.

In all cases, it is considered that messaging to raise awareness of air quality should be continued, and ideally strengthened to encourage changes in travel behaviour and lead to modal shift or a reduction in road travel, which would be in line with the Welsh Transport Strategy.

The next steps are summarised in Table 4-2 for each of the five sites.

Table 4-2 - Continued and proposed interventions

Link	Continued interventions	Proposed new interventions
A483 Wrexham	Continue to monitor NO ₂ concentrations throughout 2024 to give three consecutive years of monitoring below the limit value post pandemic, thus giving confidence in the results	<ul style="list-style-type: none"> • Discontinue implementation of the precautionary retained measure of the air quality barrier • Develop an exit strategy, considering the impact to air quality of any change to speed along the road, any impacts from future development, and any indirect effects, to be implemented once the 2024 results have been received
A494 Deeside	Continue to monitor NO ₂ concentrations throughout 2024 to give three consecutive years of monitoring below the limit value post pandemic, thus giving confidence in the results	<ul style="list-style-type: none"> • Discontinue implementation of the precautionary retained measure of the air quality barrier • Develop an exit strategy, considering the impact to air quality of any change to speed along the road, any impacts from future development, and any indirect effects, to be implemented once the 2024 results have been received
A470 Pontypridd to Upper Boat	Continue to monitor NO ₂ concentrations throughout 2024 and 2025 to give three consecutive years of monitoring below the limit value, thus giving confidence in the results	<ul style="list-style-type: none"> • Discontinue implementation of the precautionary retained measures: air quality barrier, clean air zone, and parking improvement • Develop an exit strategy, considering the impact to air quality of any change to speed along the road, any impacts from future development, and any indirect effects, to be implemented once the 2025 results have been received

Link	Continued interventions	Proposed new interventions
M4 J25 – 26 Newport	Continue to monitor NO ₂ concentrations throughout 2024 and 2025 to give three consecutive years of monitoring below the limit value, thus giving confidence in the results	<ul style="list-style-type: none"> • Discontinue implementation of the precautionary retained measure: clean air zone • Develop an exit strategy, considering the impact to air quality of any change to speed along the road, any impacts from future development, and any indirect effects, to be implemented once monitoring data shows compliance has been achieved
M4 J41-42 Port Talbot	Continue to monitor NO ₂ concentrations throughout 2024 to give three consecutive years of monitoring below the limit value post pandemic, thus giving confidence in the results	<ul style="list-style-type: none"> • Discontinue implementation of the precautionary retained measures: close of J41 westbound on-slip and variable diversions • Develop an exit strategy, considering the impact to air quality of any change to speed along the road, any impacts from future development, and any indirect effects, to be implemented once the three consecutive years of monitoring results have been received

APPENDICES

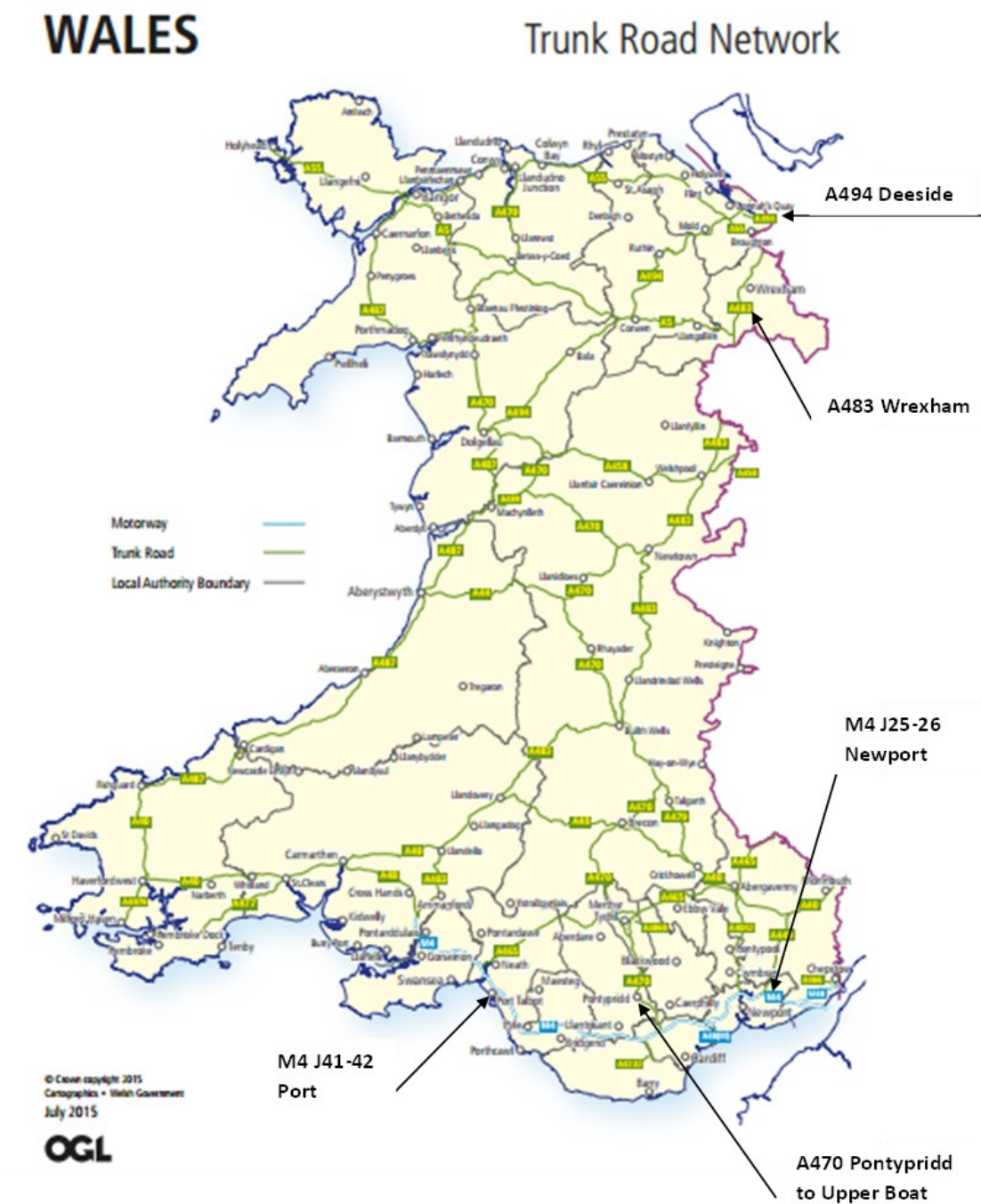
Appendix A. Glossary

Table A-1 - Glossary of technical terms

Annual Average Daily Flow/Traffic (AADF/ AADT)	The average over a full year of the number of vehicles passing a point in the road network each day.
Air Quality Management Area (AQMA)	An area designated by a local authority as exceeding an air quality objective
Air quality objective	The air quality objectives are national policy targets generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances, within a specified timescale
Annual mean	The average concentration of a pollutant measured over one calendar year
Continuous analyser	Instrument that continuously measures air pollution
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
Diffusion Tube	A device which passively monitors concentrations of gases in the air, over a period ranging from days to a month
Exceedance	An exceedance is defined as whether a measured pollutant concentration is above the air quality criteria
LAQM	Local Air Quality Management, the process by which local authorities are required to periodically review and assess the current and future quality of air in their areas
Limit Value	Legally binding criteria for air pollutants that must not be exceeded
Microgrammes per cubic metre ($\mu\text{g}/\text{m}^3$)	A measure of concentration in terms of mass per unit volume
NO_2	Nitrogen dioxide – an air pollutant composed of nitrogen and oxygen
PM10	Airborne particulate matter with an aerodynamic diameter of less than 10 micrometres (μm)
PM2.5	Airborne particulate matter with an aerodynamic diameter of less than 2.5 micrometres (μm)
Pollution Climate Mapping (PCM) Model	The government's national air quality model used to assess compliance with the Air Quality Directive
Strategic Road Network (SRN)	Motorways and major A roads

Appendix B. Overview Map of PCM links

Figure B-1 - Map of areas identified for non-compliance



Appendix C. Changes to monitoring locations

C.1 M4 J25-26 Newport

Figure C-1 - 2022 M4 J25-26 Newport monitoring locations

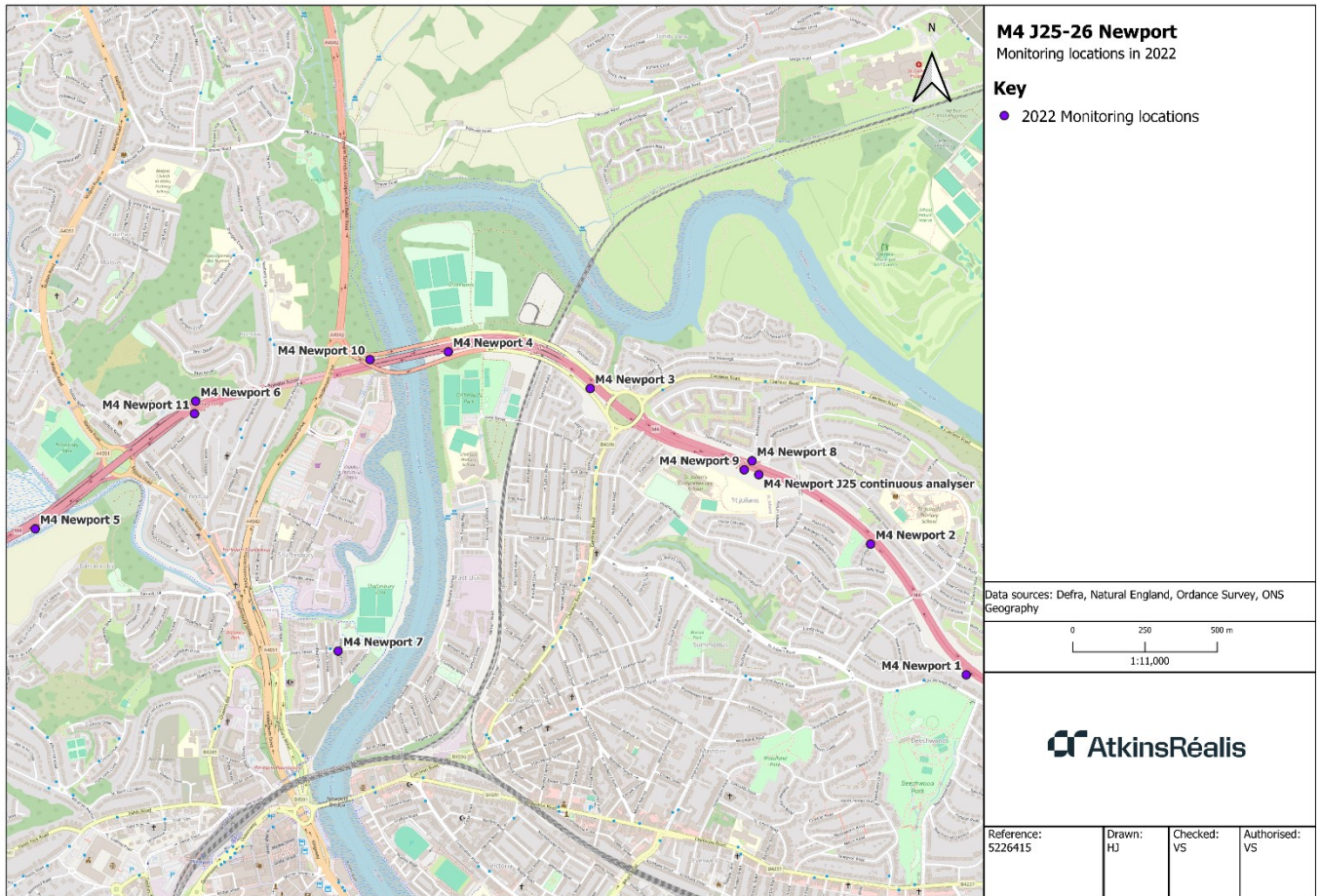
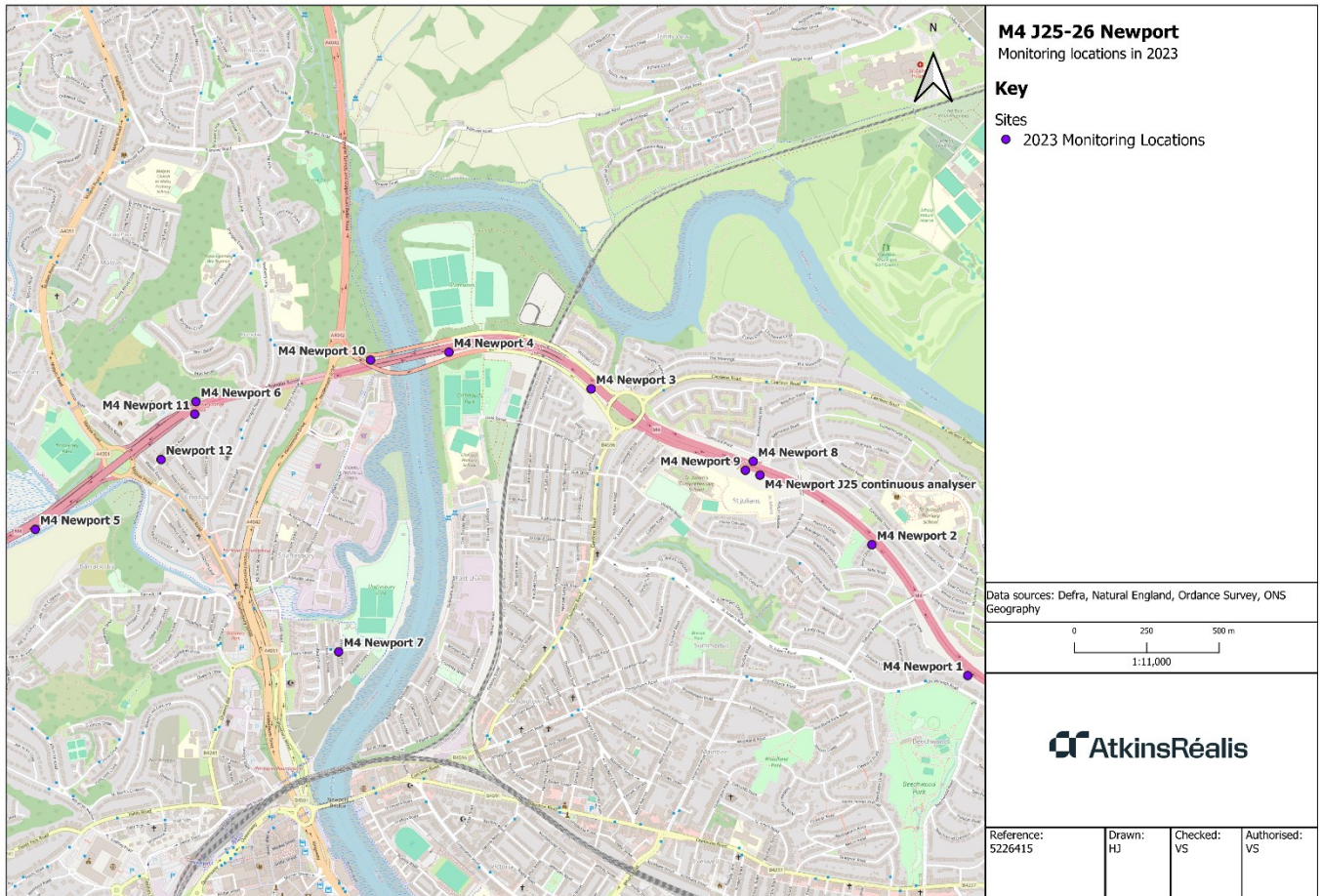


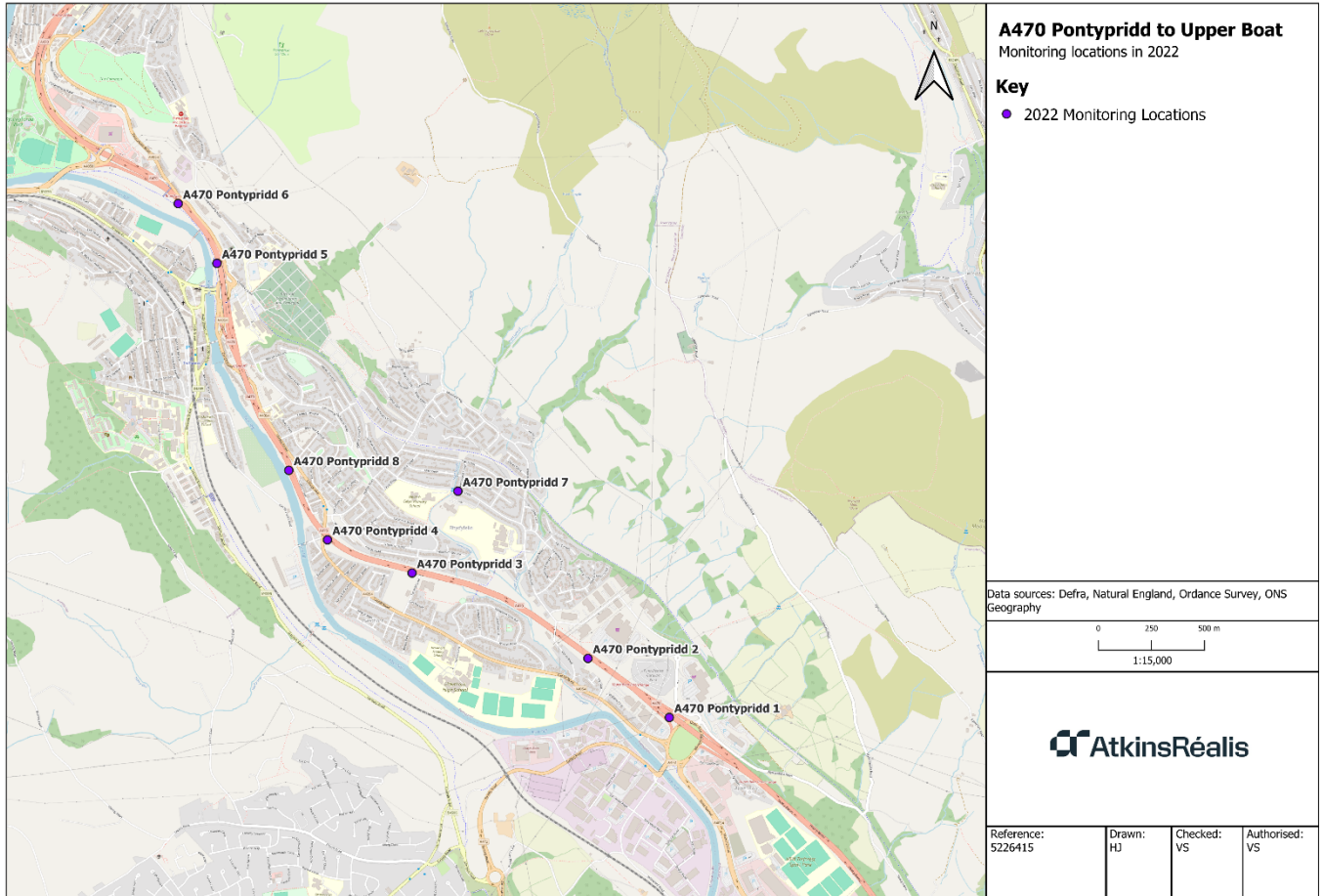
Figure C-2 - 2023 M4 J25-25 Newport monitoring locations



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C.2 A470 Pontypridd to Upper Boat

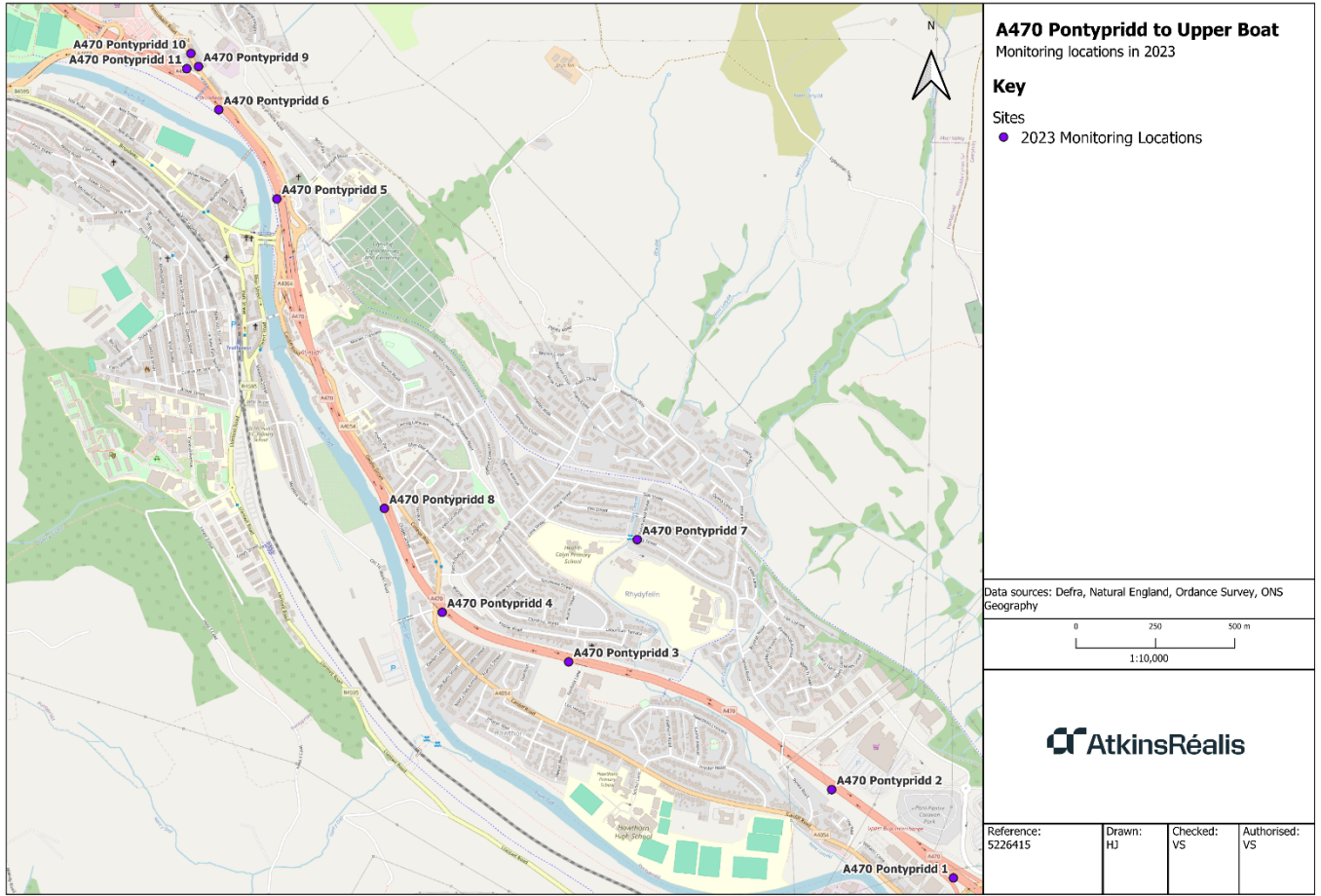
Figure C-3 - 2022 A470 Pontypridd to Upper Boat monitoring locations



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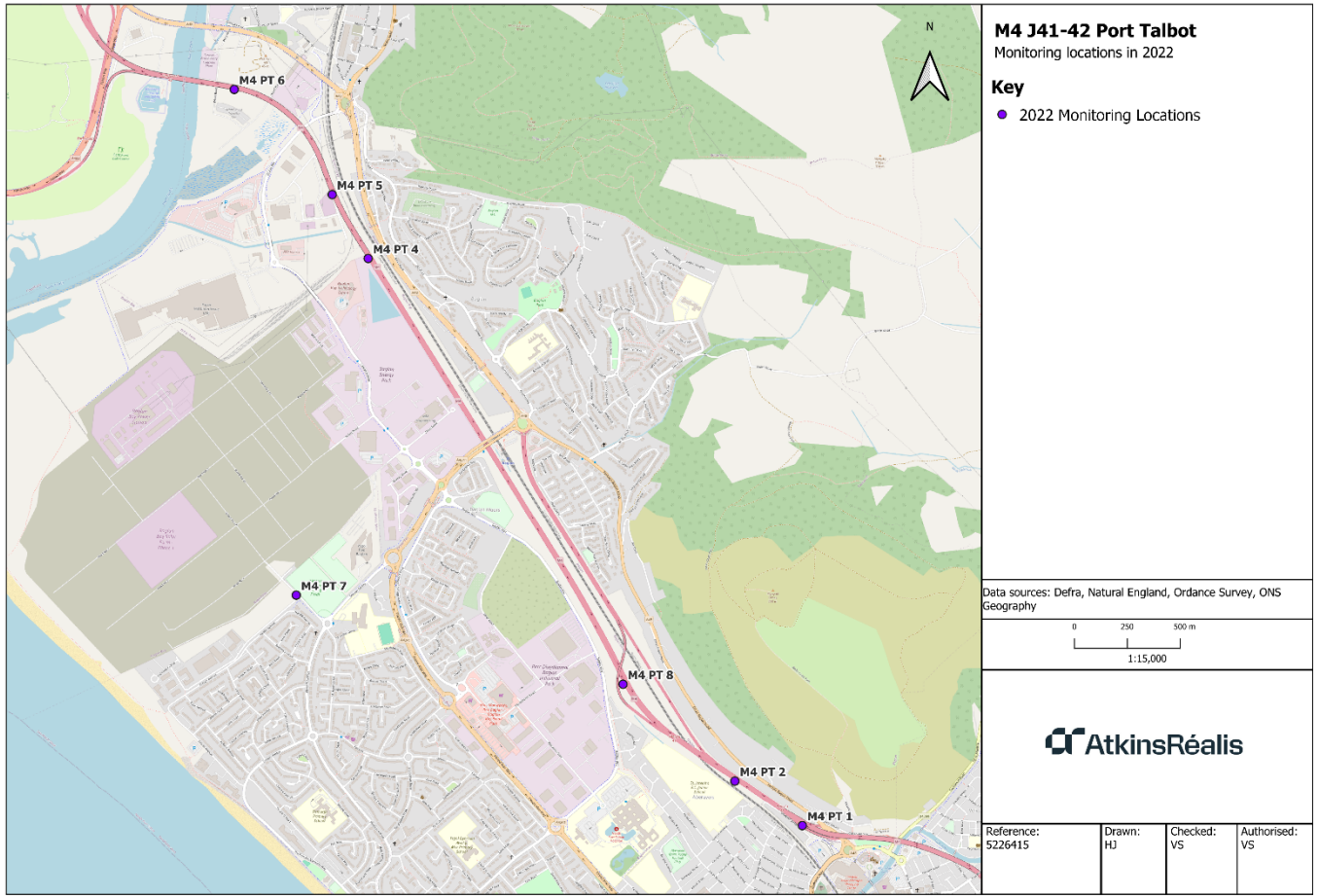
Figure C-4 - 2023 A470 Pontypridd to Upper Boat monitoring locations



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C.3 M4 J41-42 Port Talbot

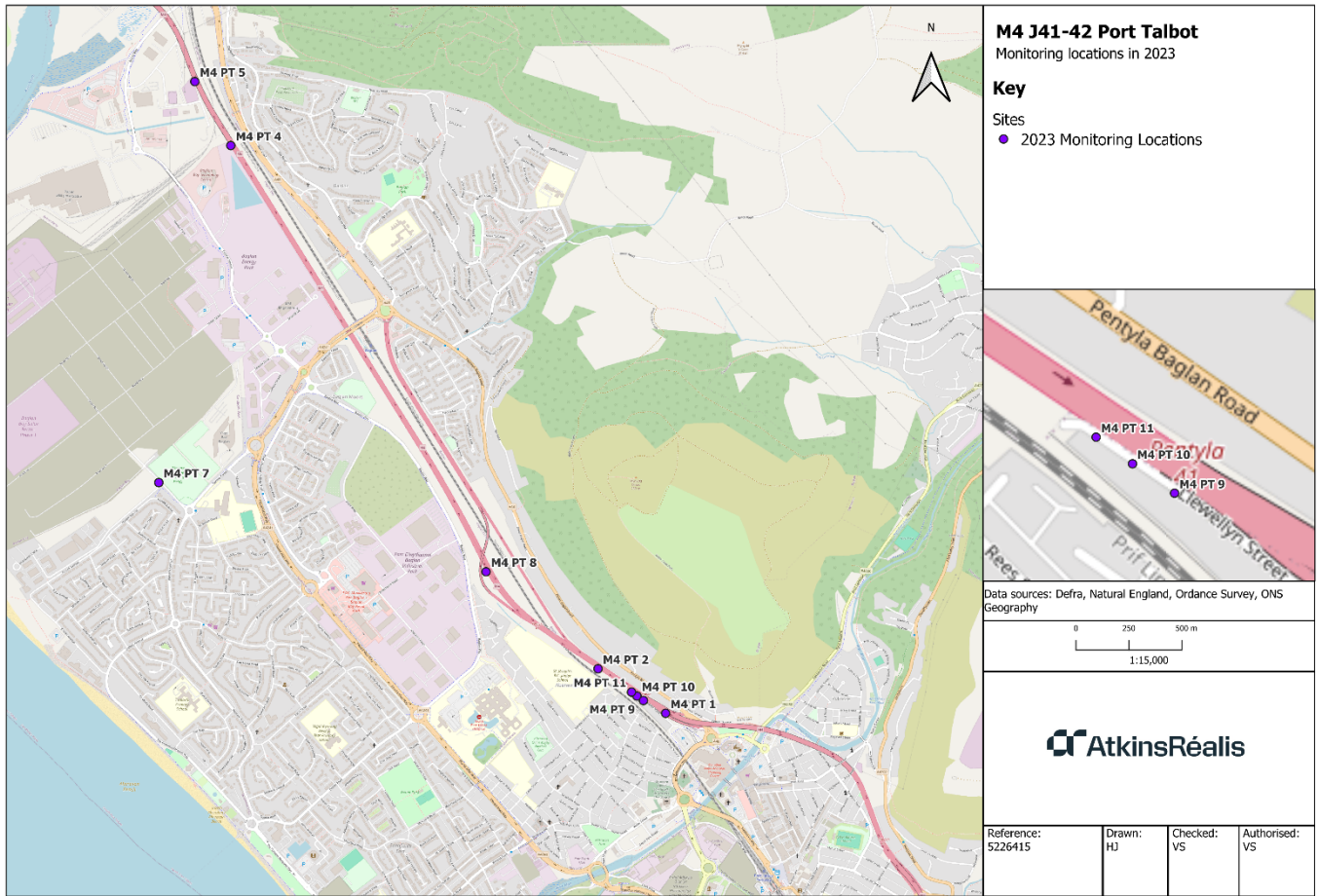
Figure C-5 - 2022 M4 J41-42 Port Talbot monitoring locations



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Figure C-6 - 2023 M4 J41-42 Port Talbot monitoring locations



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Appendix D. Traffic Data

Table D-1 - Measured Annual Traffic Count on the A483, Wrexham (AADF)

Count point ID	2018	2019	2020	2021	2022	2023
30560	54,852	55,168	37,192	43,055	48,190	48,951

Figure D-1 - Wrexham Traffic Data

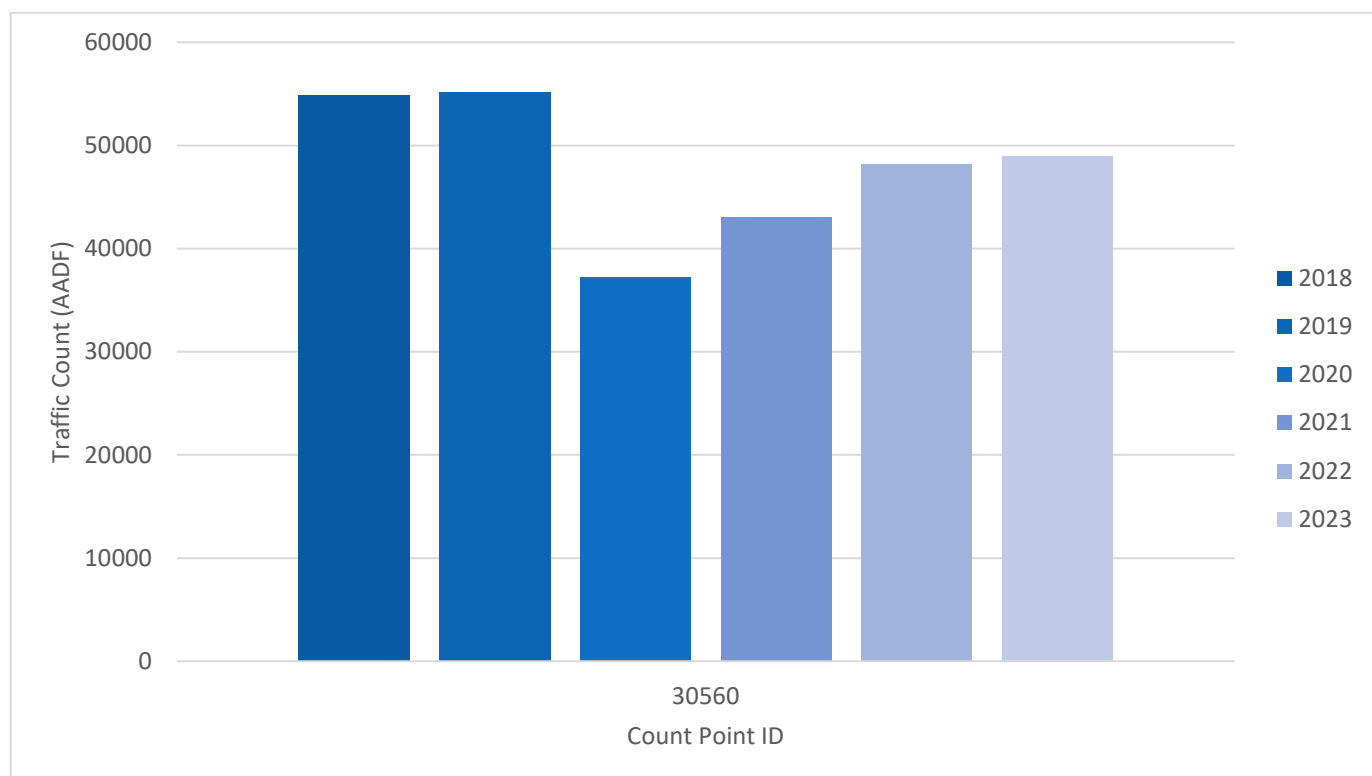


Table D-2 - Measured Annual Traffic Count on the A494, Deeside (AADF)

Count point ID	2018	2019	2020	2021	2022	2023
559	75,353	72,430	50,567	65,483	69,794	71,833
30571 (2018)/ 91225 (2019 onwards)	71,024	70,479	54,083	61,470	65,018	65,638
30625	55,767	57,282	29,515	33,384	35,037	55,326

Figure D-2 - Deeside Traffic Data

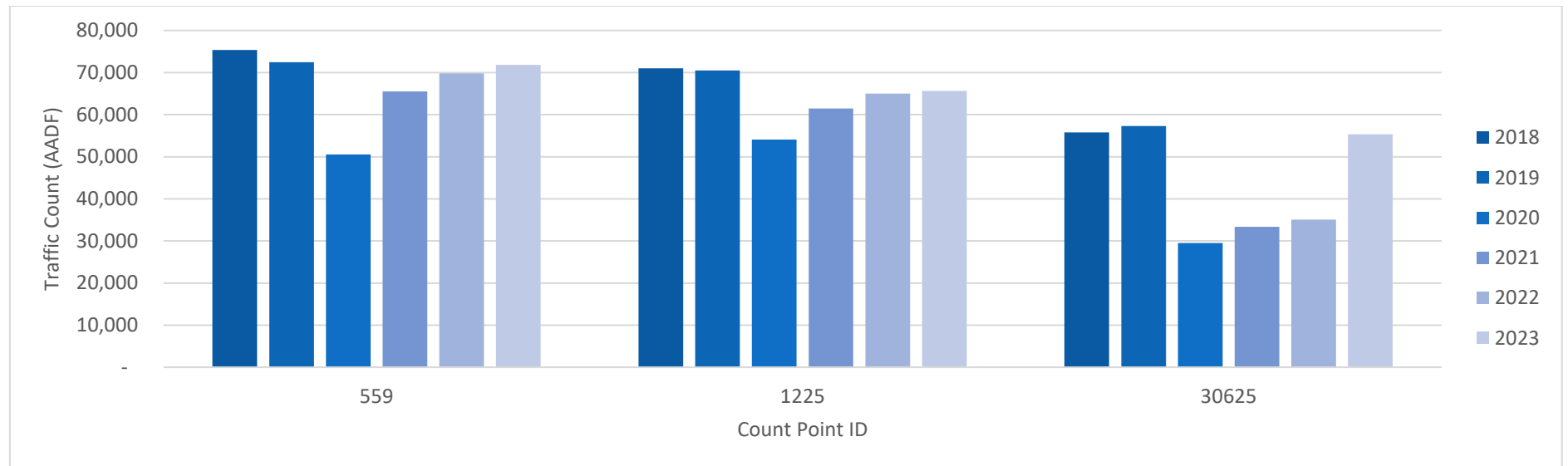


Table D-3 - Measured Annual Traffic Count on the A470, Pontypridd (AADF)

Count point ID	2018	2019	2020	2021	2022	2023
10548	57,890	59,466	38,496	43,646	55,558	56,195
40548	68,619	64,731	49,436	58,201	61,740	61,194

Figure D-3 - Pontypridd Traffic Data

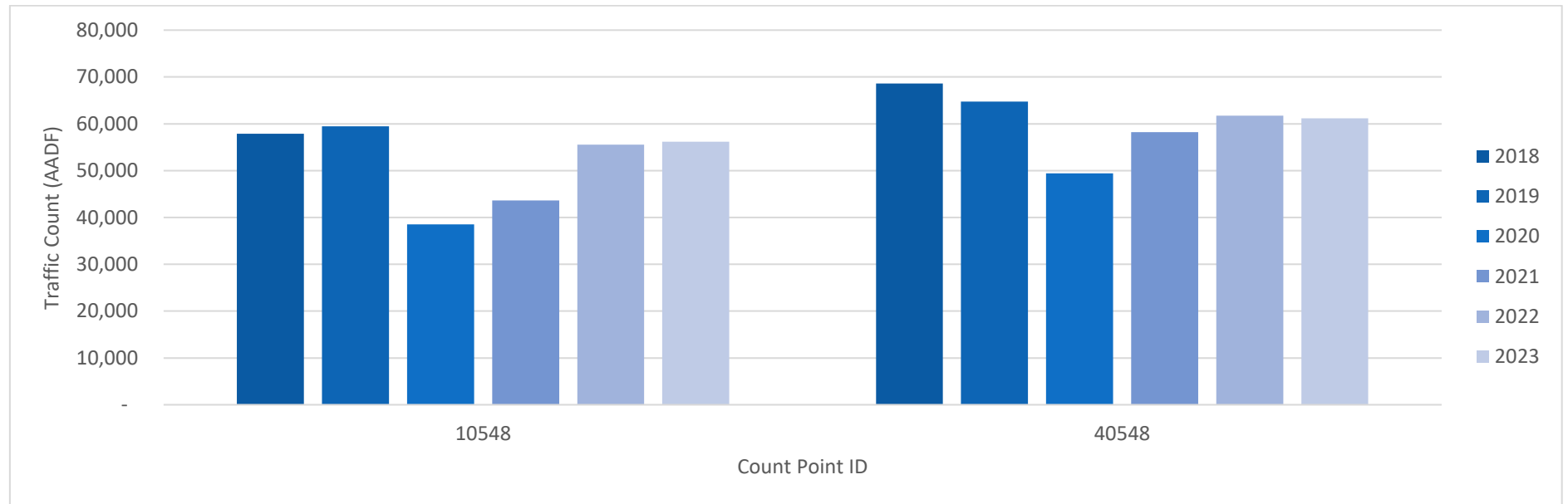


Table D-4 - Measured Annual Traffic Count on the M4, Newport (AADF)

Count point ID	2018	2019	2020	2021	2022	2023
40500	84,436	85,379	61,468	70,143	80,282	82,165
10500	102,949	104,164	75,207	85,852	103,280	105,780

Figure D-4 - Newport Traffic Data

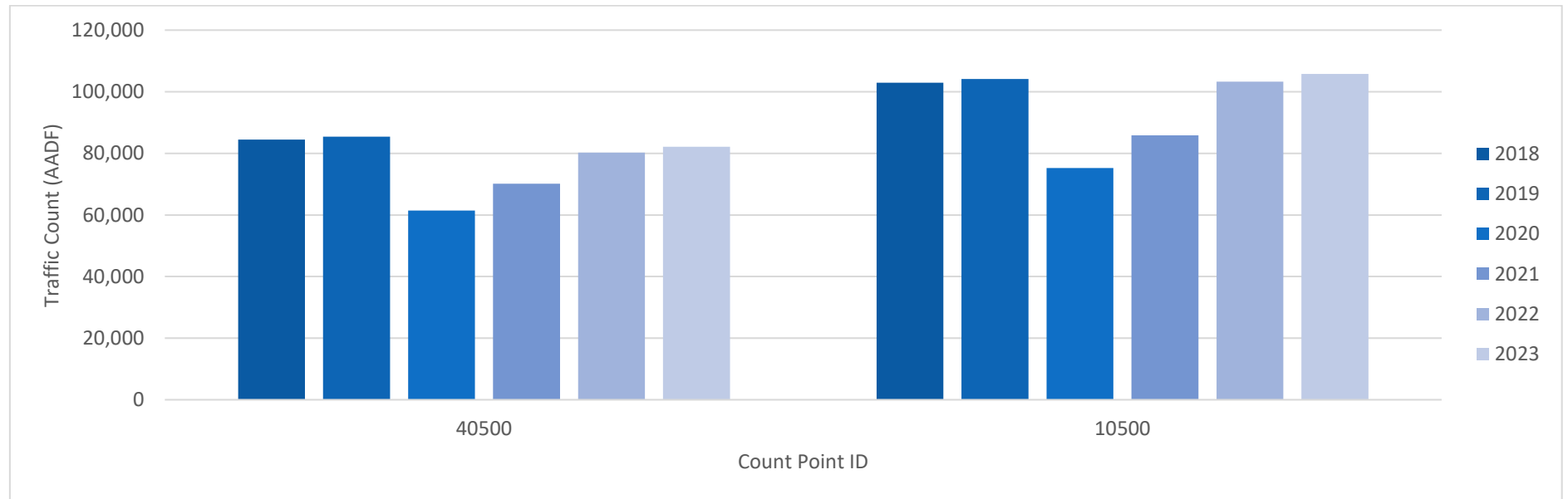
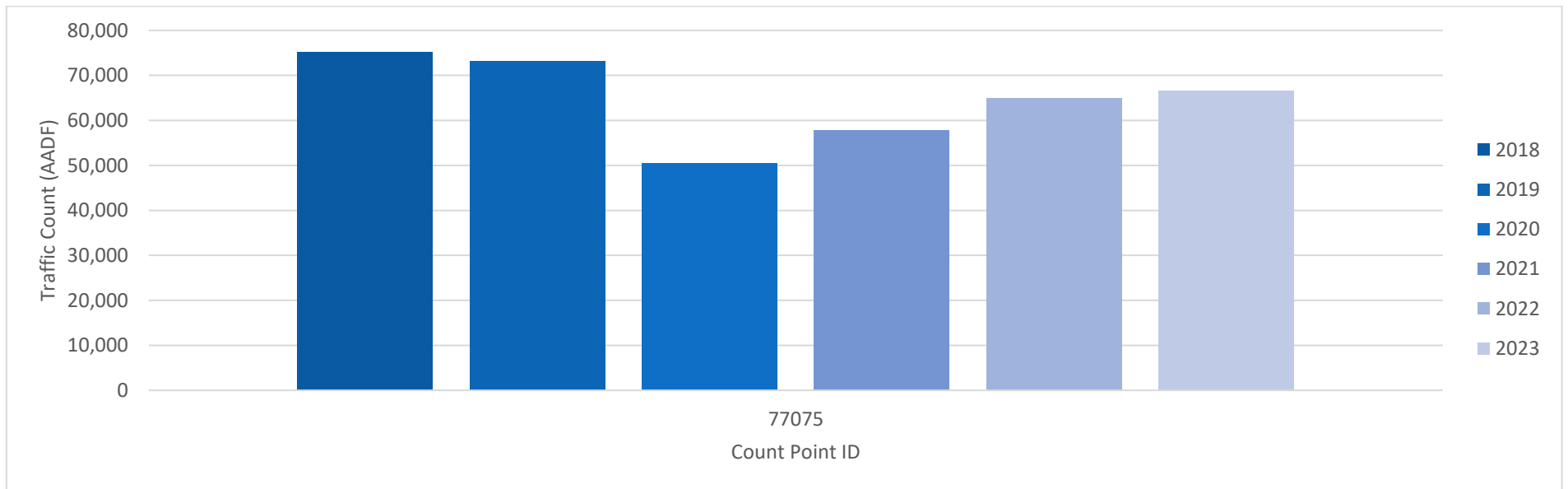


Table D-5 - Measured Annual Traffic Count on the M4, Port Talbot (AADF)

Count point ID	2018	2019	2020	2021	2022	2023
77075	75,115	73,201	50,479	57,739	64,919	66,563

Figure D-5 - Port Talbot Traffic Data



Appendix E. Air Quality Monitoring Data

Table E-1 – Measured annual mean NO₂ concentrations on the A483, Wrexham (µg/m³)

Monitoring site ID	Site type	X	Y	2018	2019	2020	2021	2022	2023
Wrexham 1	Roadside	333786	353152	43.9	37.5	26.0	25.4	25.1	24.9
Wrexham 3	Roadside	333171	352459	50.3	44.4	30.6	29.9	30.2	29.6
Wrexham 4	Roadside	333157	352510	58.6	50.5	34.2	34.8	37.3	32.8
Wrexham 7	Background	333367	352099	16.6	15.2	11.6	11.7	11.7	9.9
Wrexham 8	Roadside (co-located)	332857	349904	19.7	18.2	14.0	15.0	15.2	13.9
Wrexham 9	Roadside	333622	352942	-	30.6	20.9	20.6	21.4	20.4
Continuous Analyser	Roadside	333622	352942	-	-	17.3	18.3	18.2	17.5

Figure E-1 - Wrexham Monitoring Data

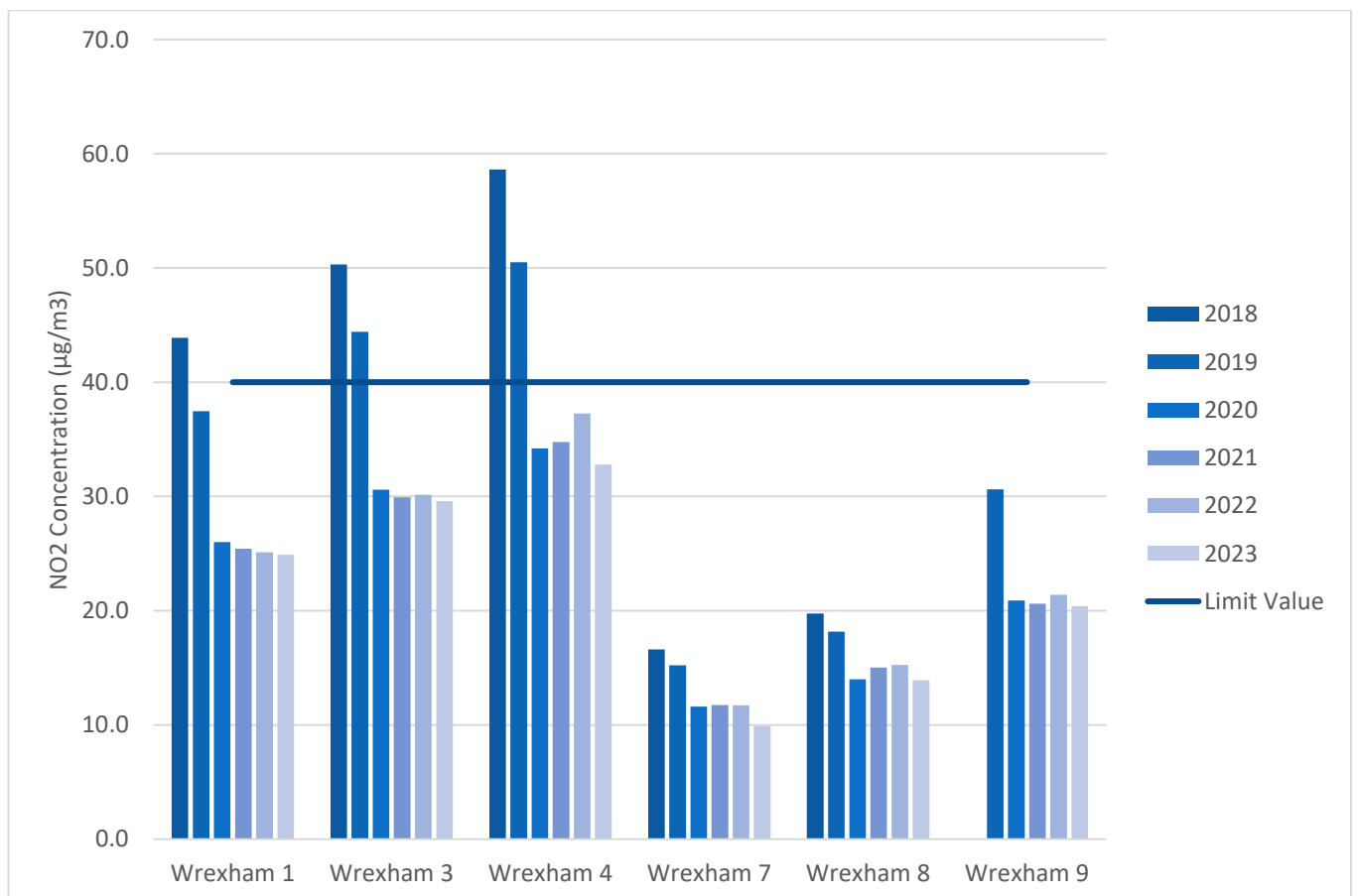


Table E-2 - Measured annual mean NO₂ concentrations on the A494, Deeside (µg/m³)

Monitoring site ID	Site type	X	Y	2018	2019	2020	2021	2022	2023
Deeside 1	Roadside	329890	366710	43.9	41.2	28.6	29.7	31.8	30.6
Deeside 2	Roadside	330790	367432	46.4	45.5	29.4	30.2	31.1	27.5
Deeside 3	Roadside	332980	368906	49.7	47.1	36.6	36.2	26.9	21.5
Deeside 4	Roadside	332264	368471	37.6	31.9	23.2	23.6	29.4	31.6
Deeside 5	Roadside	333283	369609	38.7	34.9	22.9	25.2	24.2	22.8
Deeside 6	Roadside	333556	370382	36.3	31.8	21.3	23.1	22.8	18.0
Deeside 7	Background	331641	366017	19.1	18.5	13.3	13.4	14.6	11.1
Deeside 8	Roadside	330791	367434	-	38.2	23.7	25.8	26.5	24.6
Continuous Analyser	Roadside	330791	367434	-	-	20.0	24.0	24.7	22.2

Figure E-2 - Deeside Monitoring Data

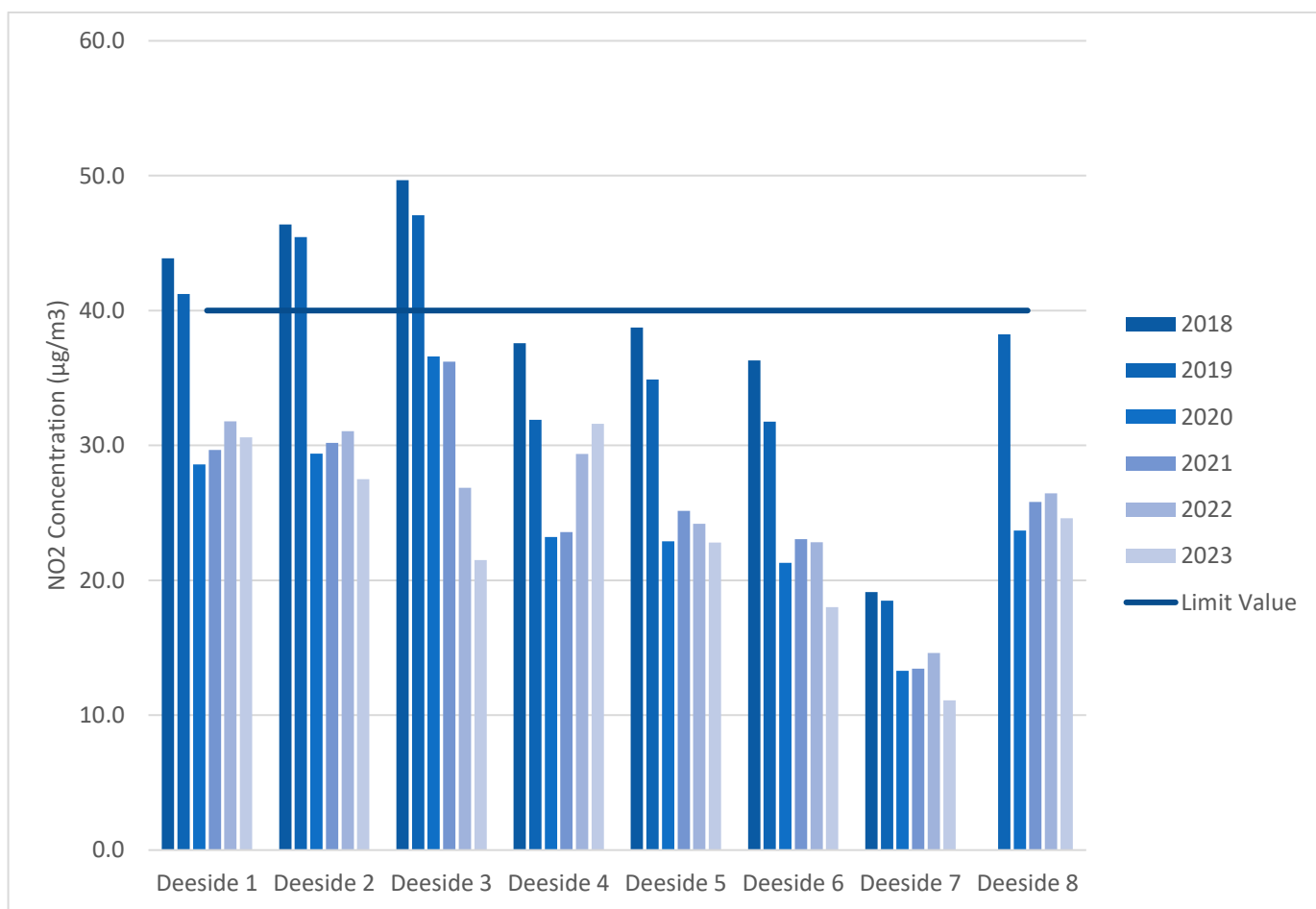


Table E-3 - Measured annual mean NO₂ concentrations on the A470, Pontypridd (µg/m³)

Monitoring site ID	Site type	X	Y	2018	2019	2020	2021	2022	2023
Pontypridd 1	Roadside	310558	187259	59.2	56.1	37.7	34.6	44.9	34.6
Pontypridd 2	Roadside	310175	187537	68.0	56.9	32.4	30.2	43.6	34.9
Pontypridd 3	Roadside	309347	187939	53.8	51.2	31.7	30.7	41.9	33.8
Pontypridd 4	Roadside	308949	188095	66.0	61.3	41.5	38.2	51.1	39.2
Pontypridd 5	Roadside	308419	189433	44.3	39.5	23.9	23.8	32.1	26.0
Pontypridd 6	Roadside	308246	189677	49.7	39.9	25.8	20.6	27.7	22.3
Pontypridd 7	Background	309563	188324	18.2	18.5	13.0	11.5	16.8	13.9
Pontypridd 8	Roadside	308767	188422	-	37.0	20.4	19.9	26.1	19.2
Pontypridd 9	Roadside	308182	189813	-	-	-	-	-	21.3
Pontypridd 10	Roadside	308158	189854	-	-	-	-	-	22.8
Pontypridd 11	Roadside	308145	189806	-	-	-	-	-	38.8
Continuous Analyser	Roadside	308767	188422	-	-	n/a	n/a	n/a	n/a

Figure E-3 - Pontypridd Monitoring Data

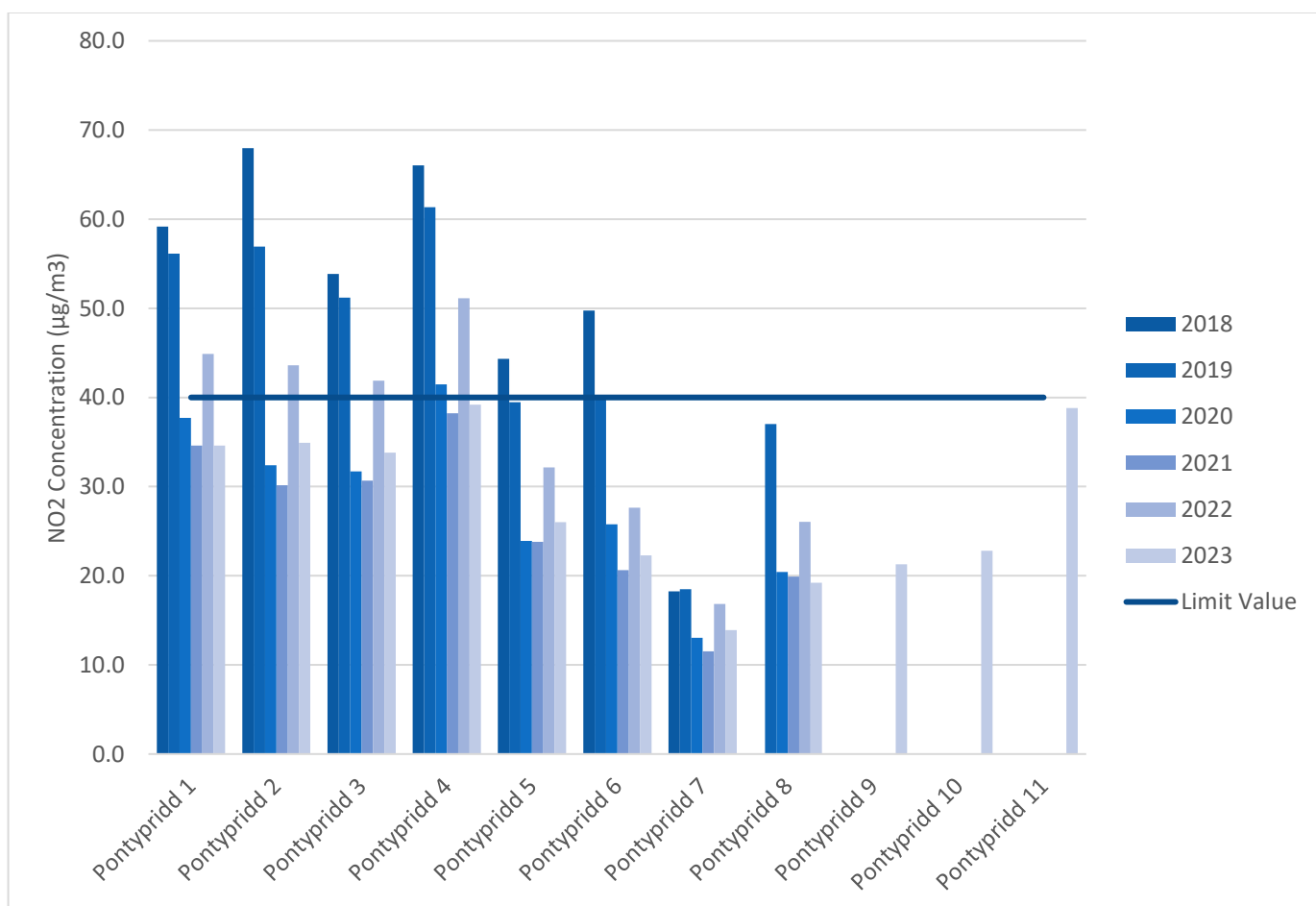


Table E-4 - Measured annual mean NO₂ concentrations on the M4, Newport (µg/m³)

Monitoring site ID	Site type	X	Y	2018	2019	2020	2021	2022	2023
Newport 1	Roadside	333430	188868	68.8	70.0	43.9	38.8	46.1	42.9
Newport 2	Roadside	333099	189320	49.2	46.1	28.5	25.8	33.2	25.8
Newport 3	Roadside	332129	189858	69.3	69.3	47.3	34.2	45.5	38.6
Newport 4	Roadside	331638	189985	50.1	49.0	30.9	28.6	36.3	31.3
Newport 5	Roadside	330209	189373	80.4	76.9	51.3	40.8	48.1	40.0
Newport 6	Roadside	330764	189814	69.1	70.5	44.8	40.2	52.1	44.4
Newport 7	Background	331257	188950	23.4	23.6	18.2	16.0	19.2	15.8
Newport 8	Roadside (co-located)	332689	189608	57.9	56.1	37.5	36.5	38.9	32.6
Newport 9	Roadside (co-located)	332662	189577	-	38.6	23.2	21.3	33.1	25.7
Newport 10	Roadside	331367	189958	-	-	-	-	43.1	34.8
Newport 11	Roadside	330760	189771	-	-	-	-	30.8	26.4
Newport 12	Roadside	330616	189650	-	-	-	-	-	23.3
Continuous Analyser	Roadside	332662	189577	-	-	19.7	21.6	16.8	21.2

Figure E-4 - Newport Monitoring Data

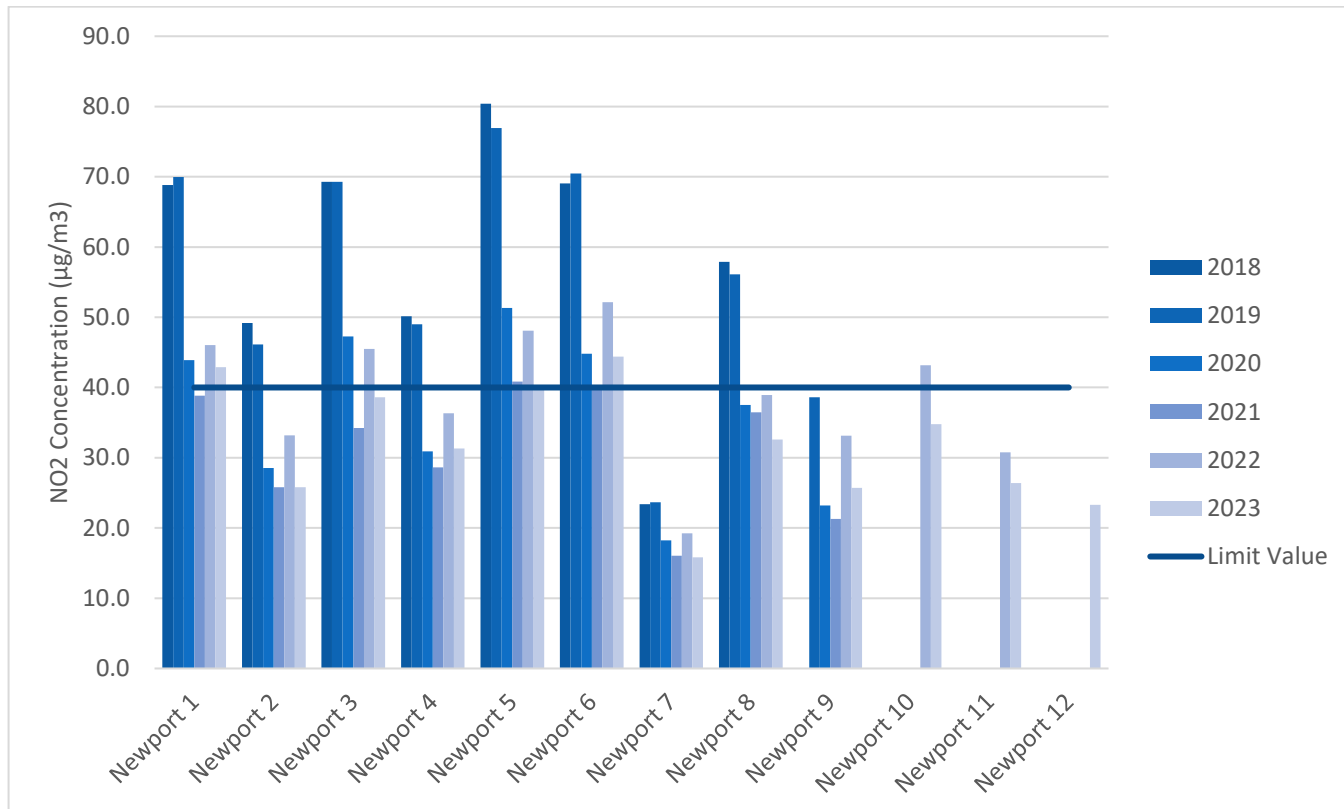
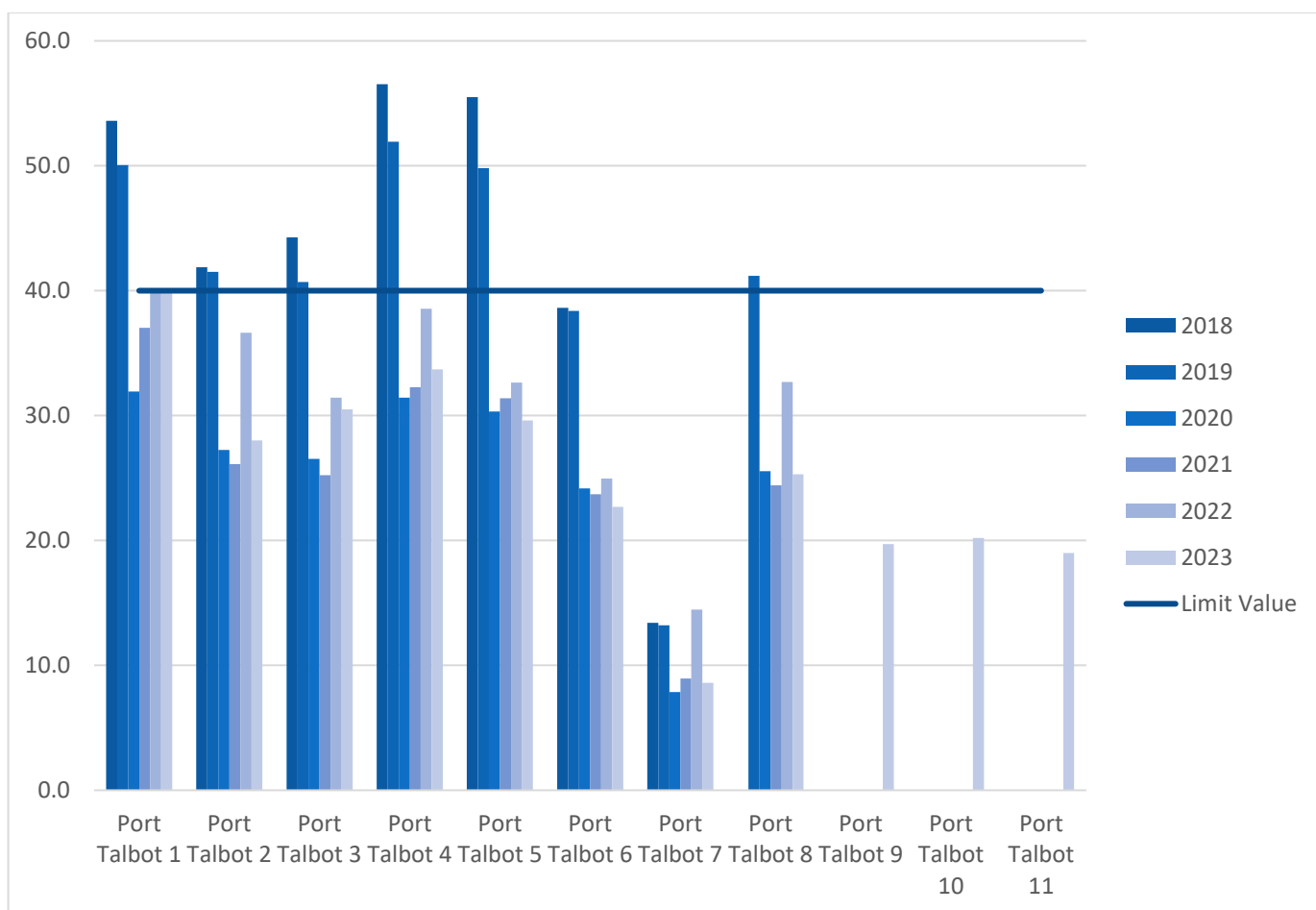


Table E-5 – Measured annual mean NO₂ concentrations on the M4, Port Talbot (µg/m³)

Monitoring site ID	Site type	X	Y	2018	2019	2020	2021	2022	2023
Port Talbot 1	Roadside	276210	190426	53.6	50.0	31.9	37.0	40.1	39.9
Port Talbot 2	Roadside	275891	190636	41.9	41.5	27.3	26.1	36.6	28.0
Port Talbot 3	Roadside	275407	191023	44.3	40.7	26.5	25.2	31.4	30.5
Port Talbot 4	Roadside	274157	193106	56.5	51.9	31.4	32.3	38.6	33.7
Port Talbot 5	Roadside	273987	193408	55.5	49.8	30.3	31.4	32.6	29.6
Port Talbot 6	Roadside	273524	193905	38.6	38.4	24.2	23.7	25.0	22.7
Port Talbot 7	Background	273817	191515	13.4	13.2	7.9	8.9	14.5	8.6
Port Talbot 8	Roadside	275362	191094	-	41.2	25.5	24.4	32.7	25.3
Port Talbot 9	Roadside	276105	190486	-	-	-	-	-	19.7
Port Talbot 10	Roadside	276075	190507	-	-	-	-	-	20.2
Port Talbot 11	Roadside	276049	190526	-	-	-	-	-	19.0
Continuous Analyser	Roadside	275362	191094	-	-	29.8	n/a	n/a	19.8

Figure E-5 - Port Talbot Monitoring Data



Appendix F. Speed Data

Table F-1 – Speed Data for A494 Deeside

	A494 Deeside Eastbound 2022	A494 Deeside Westbound 2022	A494 Deeside Eastbound 2023	A494 Deeside Westbound 2023
Monday	47.70	46.61	47.00	45.44
Tuesday	47.57	46.05	47.40	46.20
Wednesday	47.79	46.30	47.44	45.49
Thursday	47.73	45.87	47.50	44.91
Friday	47.85	39.88	47.41	37.27
Saturday	48.29	46.48	47.84	45.59
Sunday	47.95	47.93	47.33	47.52

Figure F-1 - A494 Deeside Speed Data for Year 2022

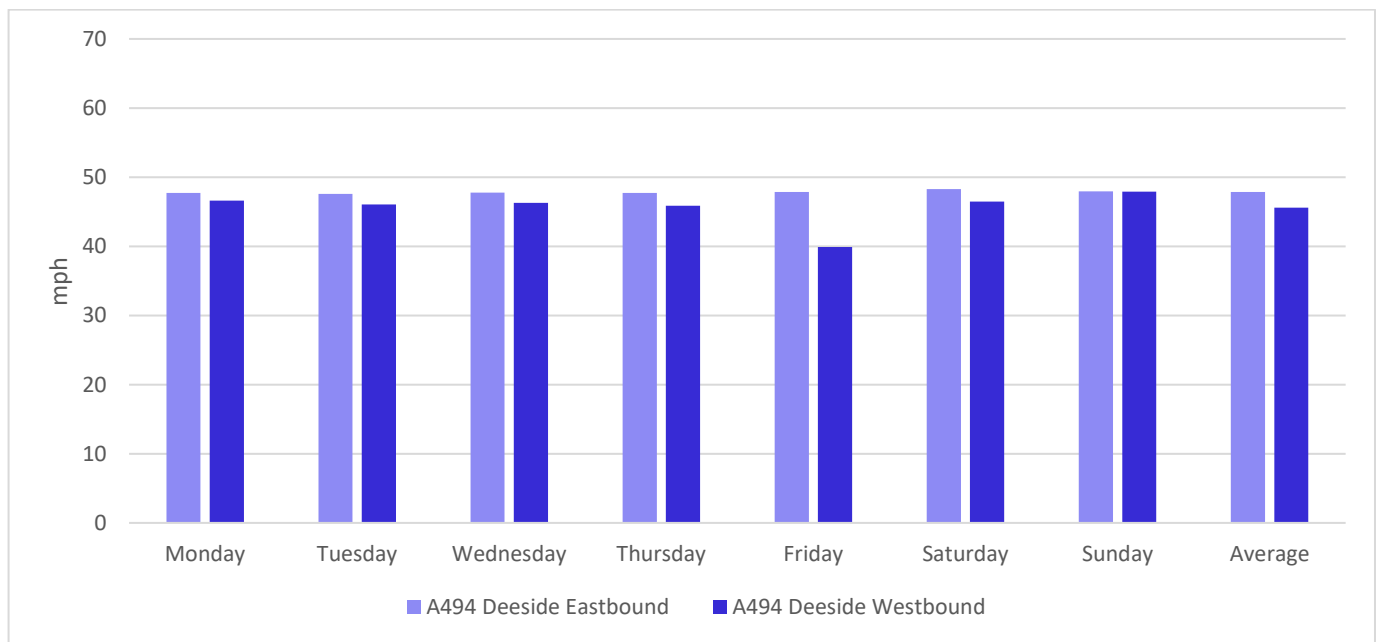


Figure F-2 - A494 Deeside Speed Data for 2023

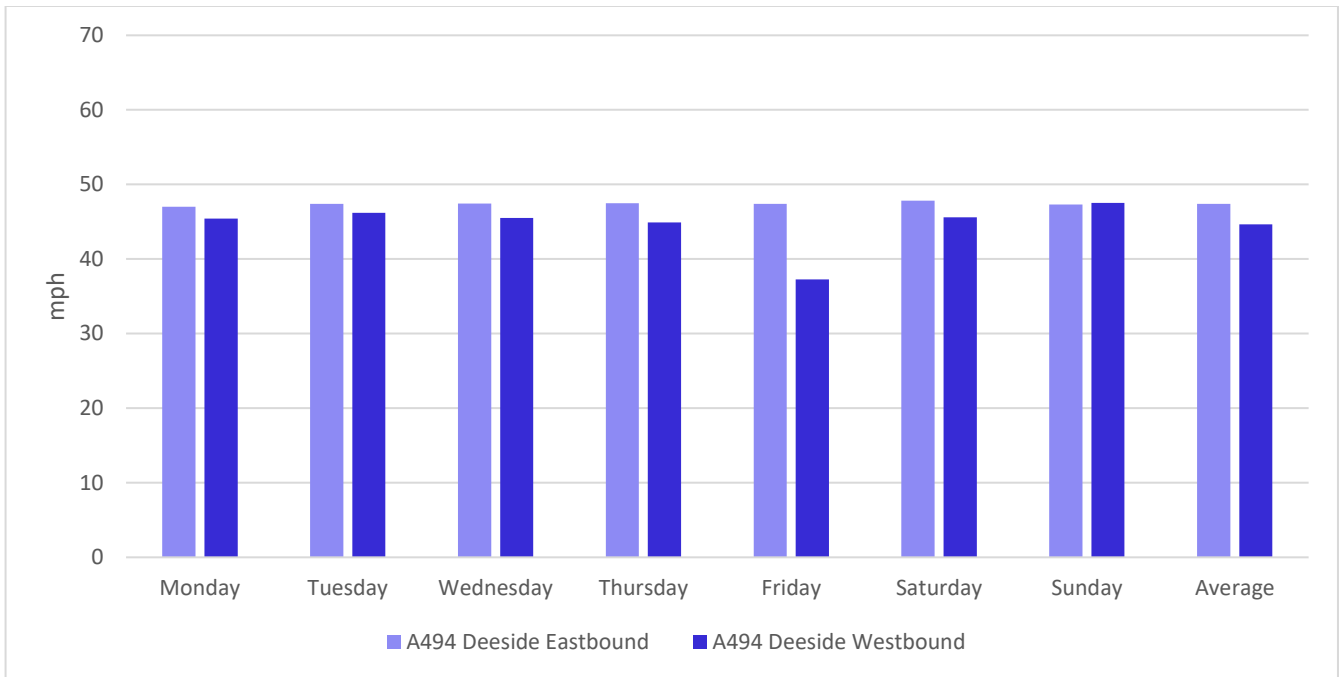


Table F-2 - Speed Data for A483 Wrexham

	A483 Wrexham Northbound 2022	A483 Wrexham Southbound 2022	A483 Wrexham Northbound 2023	A483 Wrexham Southbound 2023
Monday	47.59	47.18	47.00	47.24
Tuesday	47.09	47.06	46.28	46.68
Wednesday	47.50	47.35	46.91	47.06
Thursday	47.28	47.11	47.11	47.07
Friday	47.67	47.35	46.93	47.06
Saturday	47.78	47.33	47.15	47.12
Sunday	47.93	47.69	47.19	47.28

Figure F-3 - Wrexham Speed Data for 2022

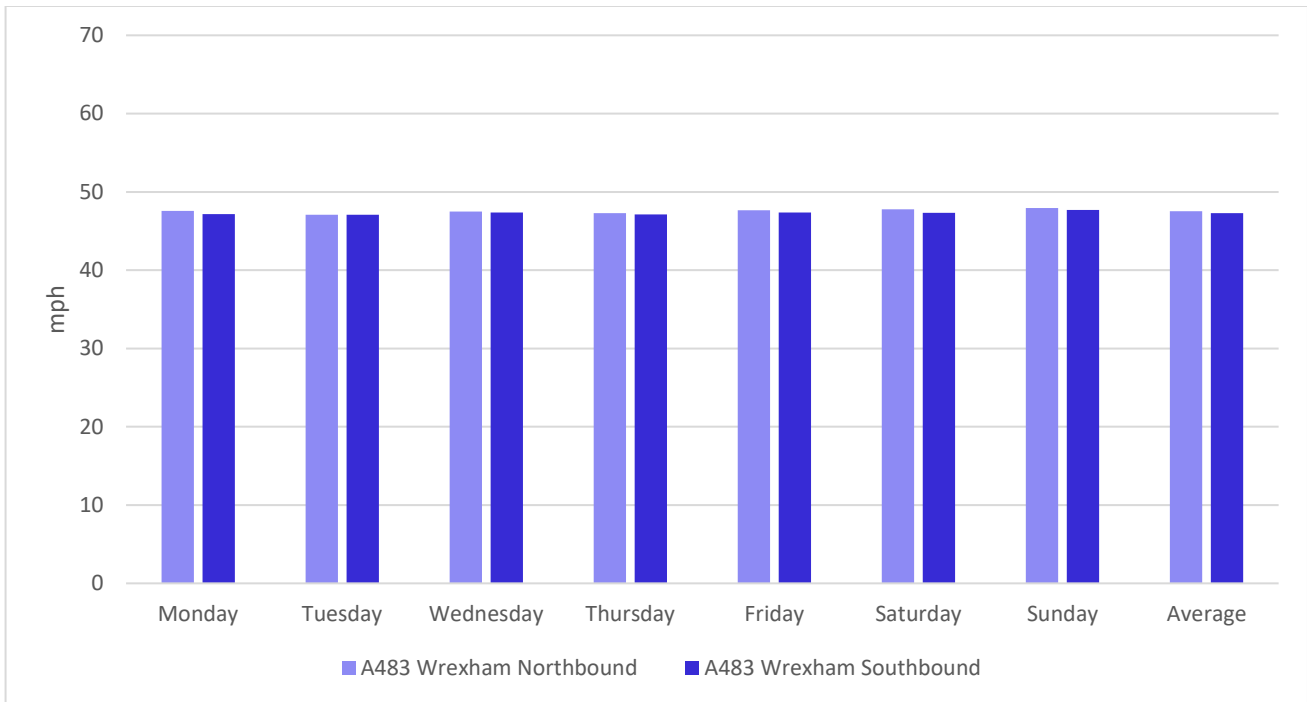


Figure F-4 – Wrexham Speed Data for 2023

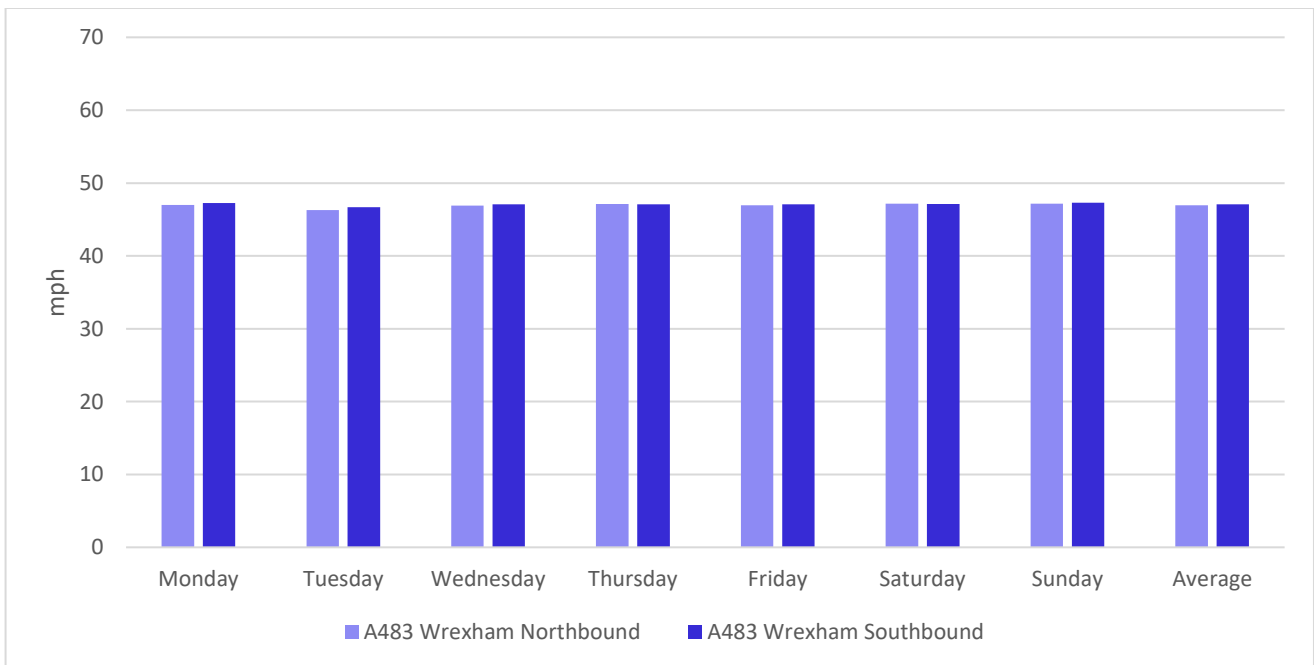


Table F-3 – Speed Data for Pontypridd to Upper Boat

	A470 Upper Boat to Pontypridd Northbound 2022	A470 Pontypridd to Upper Boat Southbound 2022	A470 Upper Boat to Pontypridd Northbound 2023	A470 Pontypridd to Upper Boat Southbound 2023
Monday	46.82	45.80	46.01	45.74
Tuesday	46.26	46.09	46.22	44.79
Wednesday	46.63	46.01	46.14	44.58
Thursday	46.56	46.04	45.77	44.84
Friday	46.72	46.83	46.47	46.35
Saturday	47.23	47.21	46.73	45.18
Sunday	47.14	47.14	46.90	46.62

Figure F-5 - Upper Boat to Pontypridd Speed Data for 2022

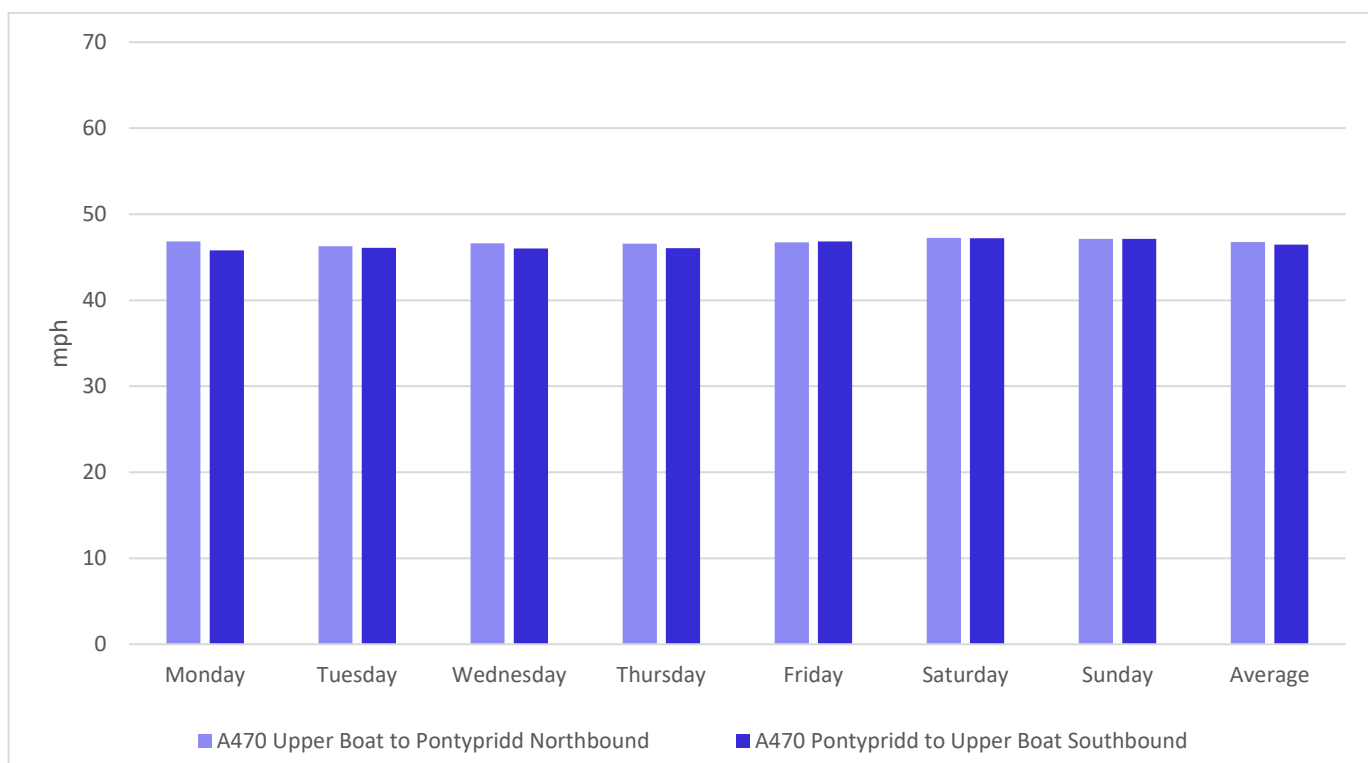


Figure F-6 - Upper Boat to Pontypridd Speed Data for Year 2023

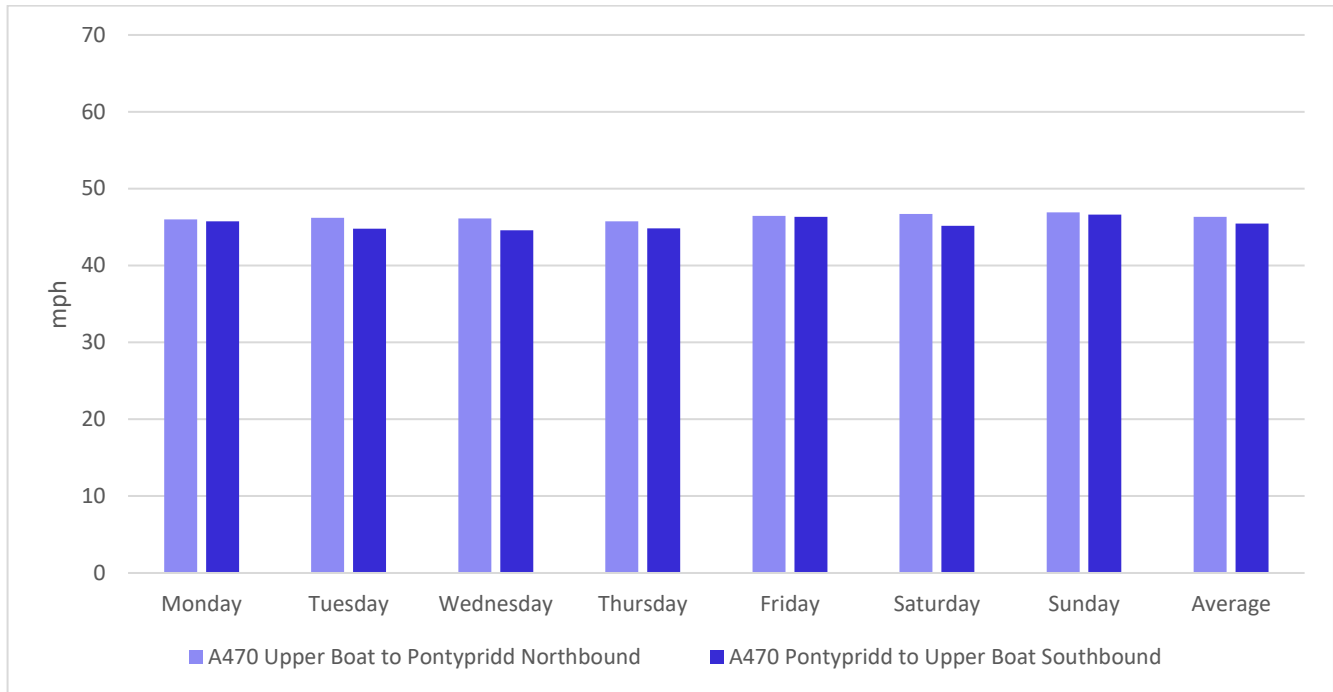


Table F-4 - Speed Data for M4 Newport

	M4 Newport Eastbound 2022	A470 M4 Newport Westbound 2022	M4 Newport Eastbound 2023	A470 M4 Newport Westbound 2023
Monday	45.41	43.24	45.01	42.30
Tuesday	46.43	44.78	45.17	42.57
Wednesday	45.79	42.92	44.86	41.72
Thursday	46.35	42.22	45.62	41.43
Friday	46.23	37.85	45.62	37.61
Saturday	46.58	43.57	45.22	41.73
Sunday	46.99	45.51	45.55	42.01

Figure F-7 - Newport Speed Data for Year 2022

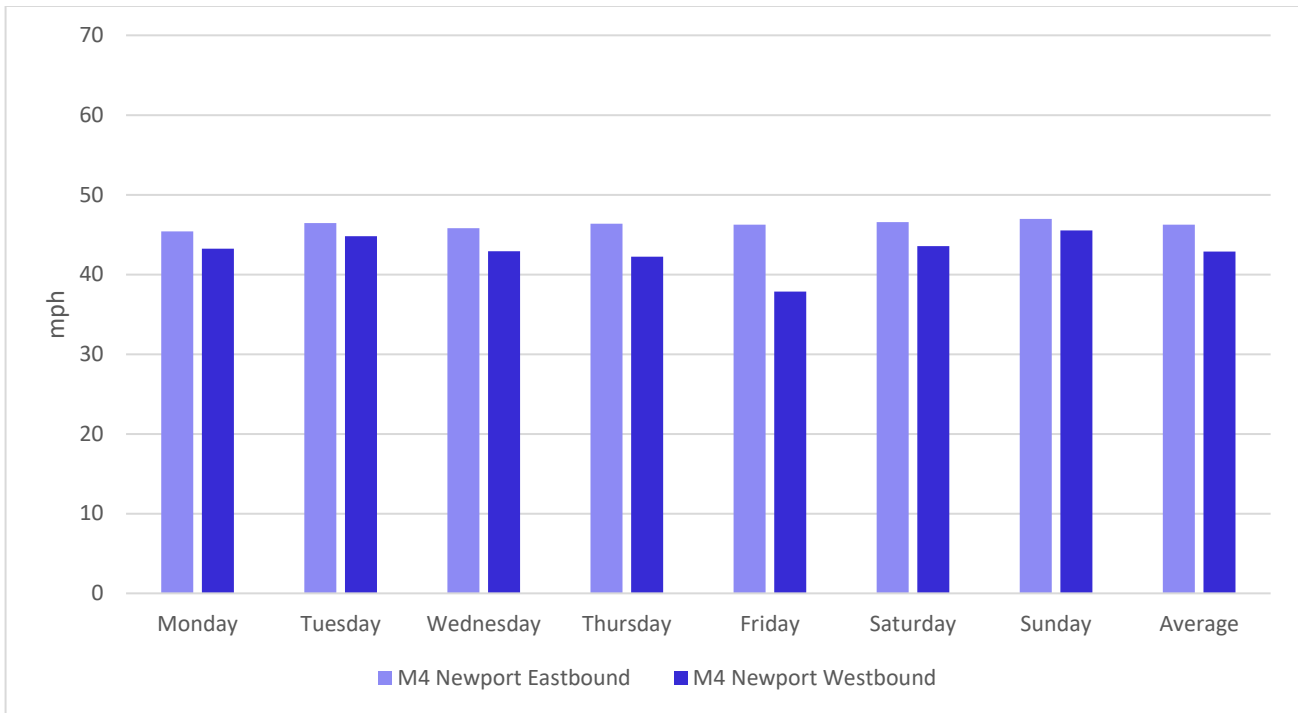


Figure F-8 - Newport Speed Data for Year 2023

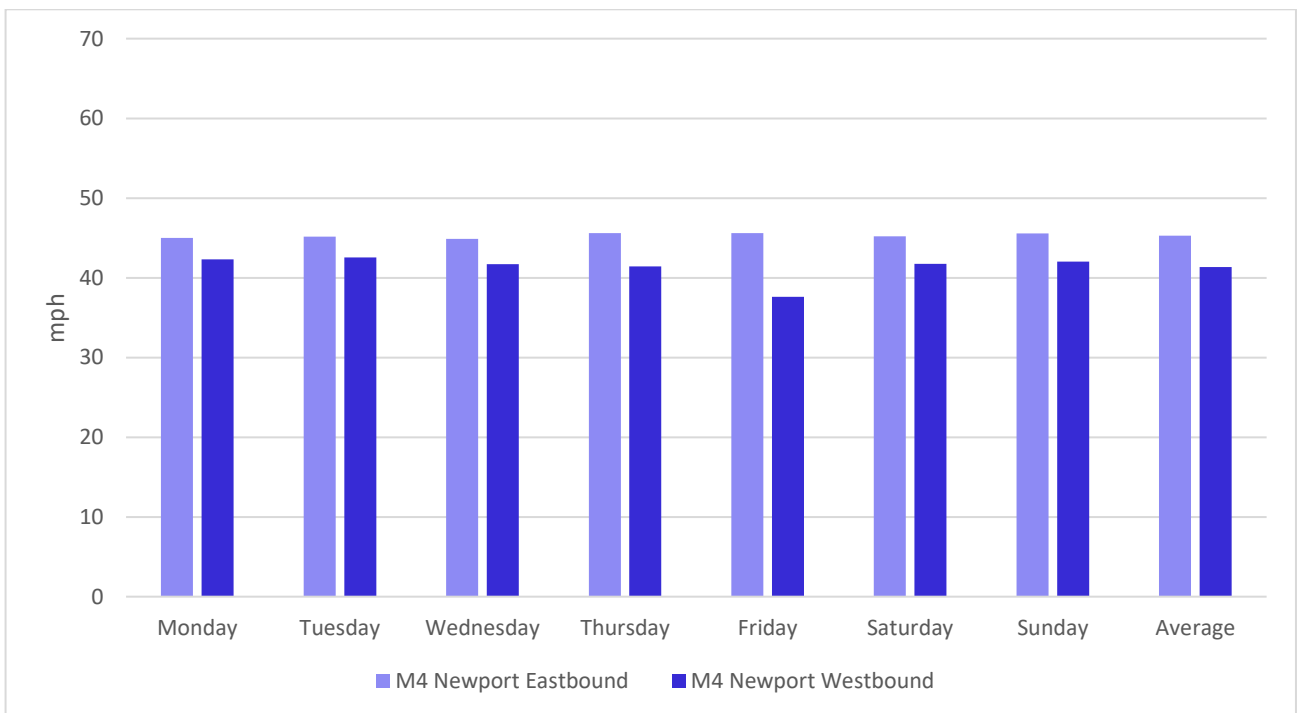


Table F-5 - M4 Port Talbot Speed Data

	M4 Port Talbot Northwestbound 2022	M4 Port Talbot Southeastbound 2022	M4 Port Talbot Northwestbound 2023	M4 Port Talbot Southeastbound 2023
Monday	44.94	43.95	44.94	43.95
Tuesday	41.28	40.45	41.28	40.45
Wednesday	41.87	34.26	41.87	34.26
Thursday	40.19	33.08	40.19	33.08
Friday	35.10	40.40	35.10	40.40
Saturday	41.85	43.98	41.85	43.98
Sunday	46.13	46.42	46.13	46.42

Figure F-9 - Port Talbot Speed Data for Year 2022

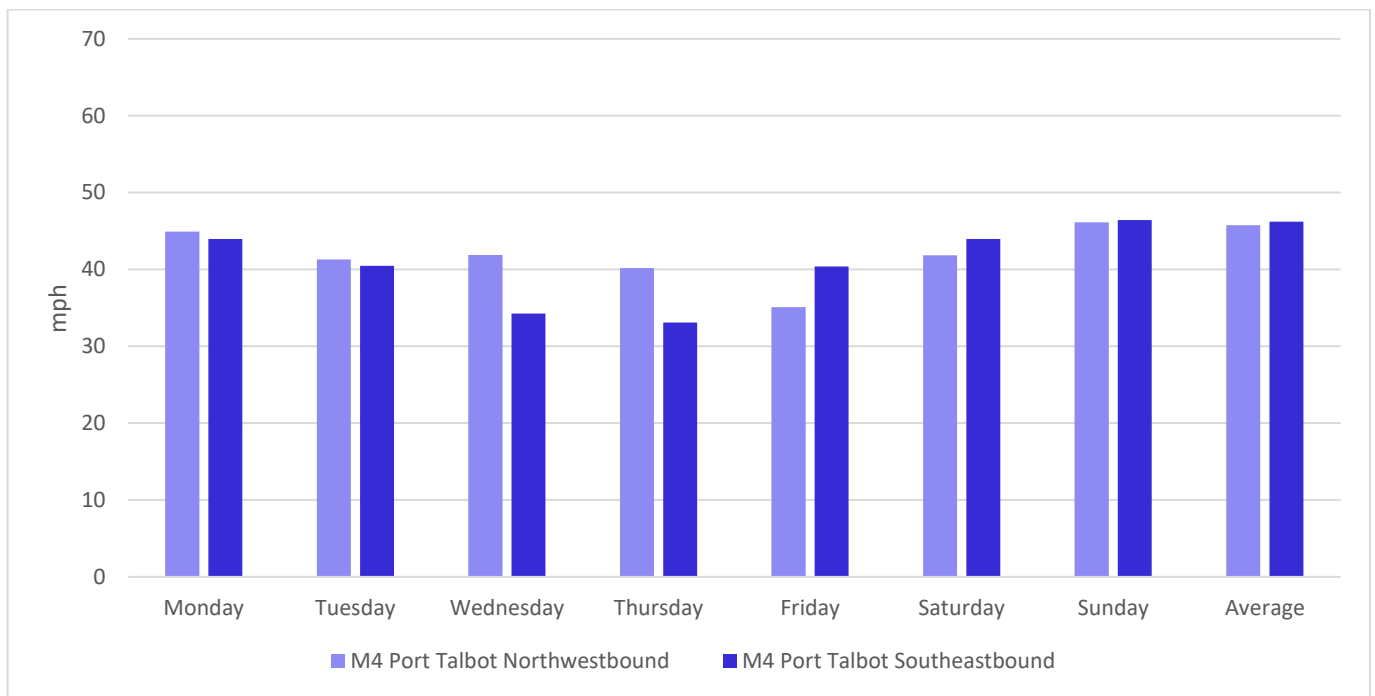
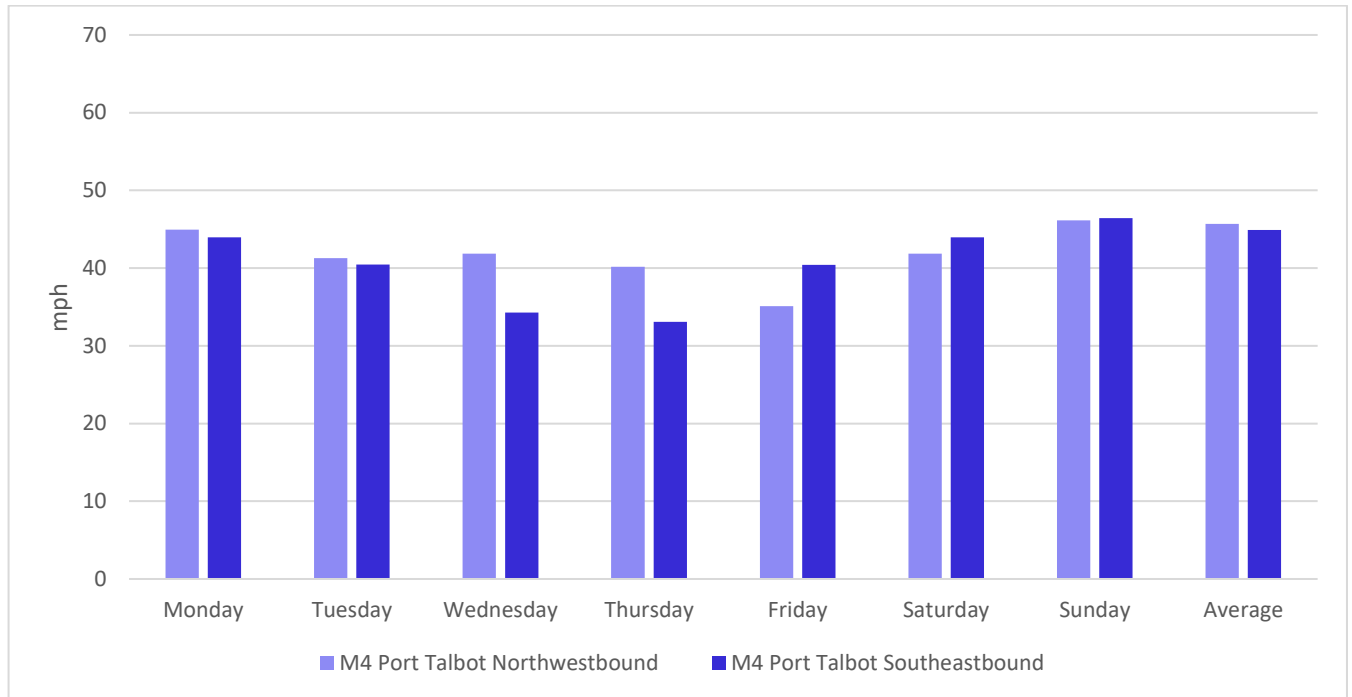


Figure F-10 - Port Talbot Speed Data for Year 2023



Appendix G. Diffusion Tube Monitoring Methodology

G.1 Procedures

All diffusion tubes used in the network were stored in a refrigerator prior to deployment and after collection to reduce the possibility of degradation of the chemicals involved. Tubes subject to contamination (e.g. spider webs, foreign bodies, etc.) or vandalised have also been excluded from the final dataset.

G.2 Tube Preparation, Analysis and Laboratory QA/QC

The diffusion tubes were supplied and analysed by UKAS accredited Staffordshire Scientific Services Ltd (part of Staffordshire County Council), using a 20% triethanolamine (TEA) in water method. The lab participates in the AIR Proficiency Testing (PT) scheme for diffusion tubes, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL), which provides a Quality Assurance / Quality Control (QA/QC) framework for diffusion tube monitoring. The percentage of results submitted by Staffordshire Scientific Services that were determined to be satisfactory was 100% for all tests in the AIR-PT (rounds 18-21) from January-August 2017¹⁴.

G.3 Factors Affecting Diffusion Tube Performance

Diffusion tubes are an indicative monitoring technique, as they do not offer the same accuracy as the reference method for NO₂, the automatic chemiluminescent analyser. NO₂ diffusion tubes are affected by several factors, which may cause them to exhibit bias relative to the reference technique.

Over-estimation may be attributed to one of the following three interfering factors:

- The shortening of the diffusive path length caused by the wind;
- The blocking of UV light resulting in reduced NO₂ photolysis in the tube; and
- The interference effects of peroxyacetyl nitrate (PAN).
- Under-estimation can be caused by the following factors:
 - Increasing exposure period, and is thought to be due to degradation of the absorbed nitrate with time;
 - Insufficient extraction of nitrite from the meshes;
 - The photochemical degradation of the TEA-nitrite complex by light, although this is minimised by the use of opaque end-caps; and

¹⁴ Summary of Laboratory Performance in AIR NO₂ Proficiency Testing Scheme. Available at: <https://laqm.defra.gov.uk/assets/airptrounds10to21oct2015aug20171.pdf>

- The solution used. For example, 50% solution of TEA in water has been reported to lead to comparatively reduced NO₂ uptake.

There are a number of additional factors that may also affect diffusion tube performance including time of the year, the exposure setting (i.e. sheltered or open sites), the proximity to roads, the preparation method and analytical laboratory used, the exposure concentration and the ratio of NO₂ to NO_x.

To correct this over or underestimation, comparison of the NO₂ concentration as measured by diffusion tubes is made with continuous monitoring data to derive a bias-adjustment factor.

G.4 Data Validation and QA/QC

Validation of diffusion tube readings is vital to ensure public confidence in the measurements produced and a number of steps are put in place as part of this process.

The laboratory reserved a set of diffusion tubes for use as laboratory blanks for each dispatched set of tubes. These were kept in sealed containers in a refrigerator and analysed with the exposed tubes to provide a measure of nitrite concentration on unexposed tubes.

One field blank was taken to site during each changeover. These tubes accompanied the user during tubes changeover but were not exposed. The purpose of these tubes is to identify possible contamination of the tubes during transportation or in storage by the user.

Neither the laboratory blanks nor the travel blank results were subtracted from the results of exposed tubes, in accordance to Defra's Local Air Quality Management Technical Guidance (LAQM.TG(22))¹⁵ and the Diffusion Tube Practical Guidance.

Diffusion tube results obtained for each month were checked to meet the following criteria for inclusion in the final dataset:

- Correct calculation of exposure hours
- Rejection of tubes with concentrations less than 3 µg/m³ as these concentrations are unlikely to occur at these sites
- Assessment of high concentrations at the high end. These were not routinely rejected unless good evidence was shown to prove they were spurious results
- Review of exposure records for possible explanation of any unusual results (e.g. foreign objects, bonfires, pollution episodes, construction works, tampering, etc.)

¹⁵ LAQM Technical Guidance LAQM.TG22. Available at: <https://laqm.defra.gov.uk/air-quality/featured/uk-regions-exc-london-technical-guidance/>

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