September
2023

Wales 20mph
Impact Analysis

Independent analysis of vehicle speeds in the first week after the implementation of 20mph speed limits in Wales

agilysis

CONTENTS

INTRODUCTION

On the 17th September 2023 the default urban speed limit in Wales changed to 20mph from the existing 30mph on 'restricted' roads (usually those with streetlights). Although many towns and cities in Great Britain have introduced 20mph limits on a case-by-case basis, this is by far the most widespread change seen on a single day. The success of this legislation will be judged in many ways including long-term casualty reduction, changes in cycling and walking, and vehicle emissions. There are also negative impacts to consider including increased travel times, especially for those travelling for work purposes.

Critical to the success of the policy is an observed change in vehicle speeds, with drivers expected to reduce speeds to match the new limit. This could prove challenging as evidence from the Department for Transport[1] shows that, on free-flowing roads, 84% of cars exceed the limit; although it is recognised that the roads surveyed are not representative of most 20mph roads in the UK. Previous analysis of vehicle speeds following a change in speed limit[2] demonstrated a 0.7mph drop in vehicle speeds post-scheme implementation. More recent initiatives, notably that in Scottish Borders[3], illustrated much greater reductions of around 3mph in mean speeds.

These reductions may seem small compared with a speed limit of 30mph, but the truth is that driven speeds on most 30mph roads are already well below the limit. In the case of Scottish Borders, speeds

[1] https://www.gov.uk/government/statistics/vehicle-speed-compliance-statistics-for-great-britain-2022/vehicle-speed-compliance-statistics-for-great-britain-2022

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/784905/technical-appendix-2-20mph-gps-journey-speed-analysis-report.pdf

[3] https://scottishborders.moderngov.co.uk/documents/s60637/20mphtrialKeyResultsFinalpresentation.pdf

were a little over 25mph prior to the change for example. On free-flowing, wide urban distributor roads, traffic speeds are expected to be higher. Although many of these roads will remain at the 30mph limit following reviews by individual highways authorities in Wales, who have the powers to create order to set limits higher than the new default 20mph.

WHAT ARE WE TRYING TO DO?

Historically, the evaluation of changes in vehicle speeds has relied on roadside equipment positioned permanently or temporarily to classify, count and measure speeds of vehicles passing along a small sample of roads. With the increase in the number of connected vehicles on our roads[4], it is now possible to retrieve and analyse data on typical speeds within 24 hours by using GPS data, collected anonymously, from millions of drivers. Agilysis have partnered with mapping company TomTom to carry out a study to see what the immediate impact of the new legislation has been in Wales in the days after the change. This research has been conducted independently of the Welsh Government or any other statutory body, although we have used evidence made publicly available by the Welsh Government to inform the selection of our study areas. We are undertaking the work as we believe it will demonstrate the effective use of this connected vehicle data to inform road authorities and members of the public.

Although it would be possible to analyse vehicles speeds on all roads in Wales, we have chosen to restrict the analysis to a small sample in ten towns and cities due to the limited time available. Within these urban areas we have selected 491.8km of roads that have changed from 30mph to 20mph on the 17th September 2023 (*Table 1*). The aim is not to identify specific roads from this sample, but instead review the change in median speed post-implementation, compared the week before the change.

We have separately selected two sample routes, one in Cardiff and one in Wrexham to illustrate impacts on typical journeys. These surveys do not form a part of the main study's findings but will be considered in the discussion.

METHODOLOGY

We have already mentioned that the data is provided by connected vehicles that upload data anonymously to allow the assessment of vehicle speeds. More information on the *TomTom Traffic Stats* product can be found on their website[5]. Although the data does not comprise 100% of all vehicles using the roads, it is a very significant sample and more than sufficient for this type of analysis. Roads with low probe counts (*probe* is the technical term used to describe a vehicle or device that provides anonymised GPS data) are excluded from the research. The vehicles providing the probe data are a mixture of privately owned cars, vans, plus commercial vehicles. Motorcycles and bicycles are not included in the data.

AREA SELECTION

We wanted to select parts of towns and cities that will provide a good sample of roads. As mentioned previously, not all roads will be analysed. The total road lengths included in the study are shown in *Table 1* below. Roads have been selected based on the speed limit stated in the TomTom database prior to the changeover. These stated limits have been cross-referenced against other sources

[4] https://agilysis.co.uk/wpfd_file/agilysis-whitepaper-1-23-connected-vehicle-data-for-road-safety/
[5] https://www.tomtom.com/products/traffic-stats/

including DataMapWales[6] and www.speedmap.co.uk. Only roads that are changing from 30mph to 20mph will be analysed.

Minor local roads including quiet residential roads have been excluded from the analysis as they will not have sufficient sample sizes for the time periods selected. Analysis over a longer time period, say several weeks or months would allow for an analysis on these quieter roads.

Table 1 – Road Lengths (km) in study areas

Town / City	Road Length Selected for Analysis
Cardiff	94.3km
Newport	52.3km
Swansea	78.2km
Wrexham	60.9km
Rhyl/Prestatyn	85.8km
Merthyr Tydfil	40.7km
Lampeter	10.2km
Bangor	25.1km
Haverfordwest	22.2km
Newtown	21.9km
TOTAL	**491.8km**

We have chosen over ten thousand road sections to analyse in our study. In urban environments with frequent junctions, roundabouts and side roads, the average section length will be shorter than in rural areas or on motorways for example. The decisions on network selection and methodology we made at the start of the study and have not been influenced by the data. We welcome further analysis of this type of data to gain a greater understanding of the nuances within the selected road networks and choice of speed metrics.

SPEED MEASUREMENT

There are many different metrics provided in the data from TomTom including average (mean) and median speeds. We have chosen to use the median speed value as it more closely represents free-flow speeds on congested roads. There can be significant differences on busy roads, or those with lots of turning traffic with mean speeds reported as being lower than median speeds. Significant consideration was given in the 2018 report published by the Department for Transport reviewing 20mph speeds[7]. This report concluded that the use of the median speed was the most appropriate as it "Is least affected by the slow-moving vehicles, and therefore most closely represents typical performance". We have analysed speeds on weekdays only between 6am and 6pm. It would have been possible to define alternative periods but we felt that this selection most closely represented driver's experiences of road traffic. This does mean that we will not be reviewing speeds in the late evening and at night-time which are expected to be higher.

For each town or city, and for all roads combined, we have used three values to create a weighted average for each road section. Using a weighted average is essential as it allows us to place appropriate emphasis on longer road sections and those with higher traffic rates. The method used is as follows:

[6] https://datamap.gov.wales/maps/roads-affected-by-changes-to-the-speed-limit-on-re/view#/

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/784905/technical-appendix-2-20mph-gps-journey-speed-analysis-report.pdf

1. Define areas, time periods and dates to order and download data from the TomTom Traffic Stats portal.
2. Import GeoJSON files that include road geometry and data for traffic movements, and process through to a Geodatabase for matching and analysis.
3. Check and exclude road sections that have not changed to 20mph.
4. Exclude road sections with probe counts lower than 100 vehicles in the pre- and post-implementation periods.
5. Create the weighted median speed for each link using the formula.

$$\text{WeightedSpeed} = \frac{\Sigma\text{SampleSize} \cdot \text{Distance} \cdot \text{MedianSpeed}}{\Sigma\text{Distance} \cdot \text{MedianSpeed}}$$

6. Calculate average weighted median speed in the pre- and post-implementation periods.

RESULTS

PRE-IMPLEMENTATION (11TH – 15TH SEPTEMBER 2023)

From the original network selection of 491.8km, 69.2km were excluded due to low sample size. The total sample in the period for the selected roads is 13.09 million probe counts. The calculated speed values for each location are shown in *Table 2* below.

Table 2 – Summary of results in the pre-implementation period

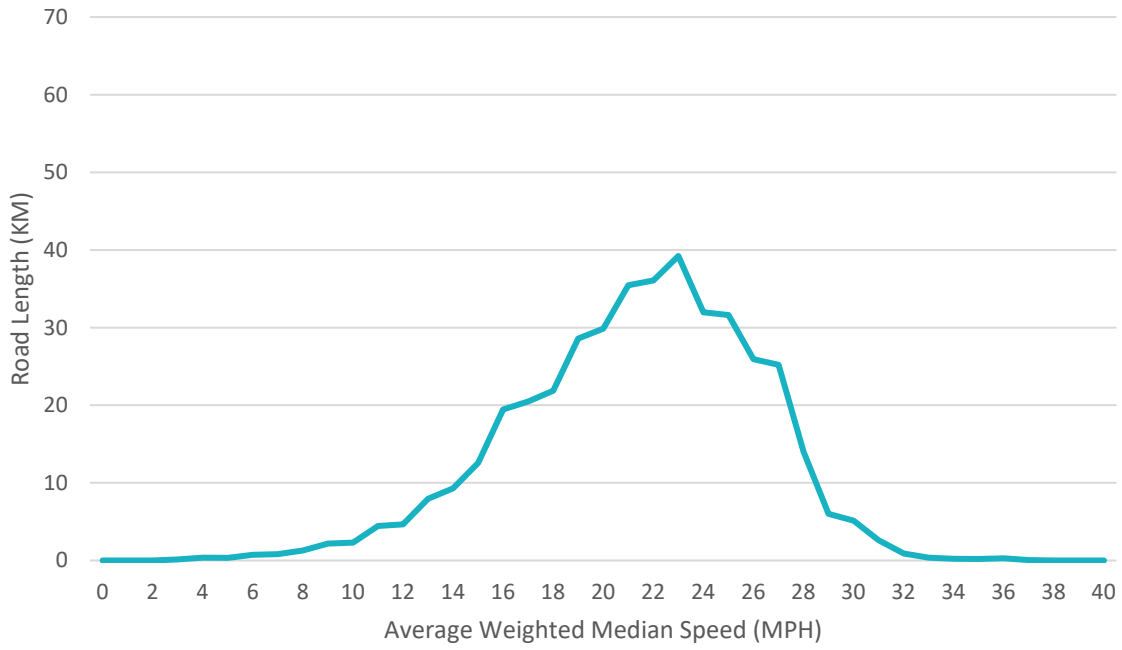
Town / City	Road length meeting selection criteria (KM)	Average weighted median speed (MPH)
Bangor	19.6	22.0
Cardiff	81.8	22.6
Haverfordwest	18.9	22.9
Lampeter	7.2	23.6
Merthyr Tydfill	33.8	22.2
Newport	50.1	22.8
Newtown	14.8	21.2
Rhyl & Prestatyn	70.0	23.2
Swansea	74.1	22.1
Wrexham	52.2	23.2
	422.5	**22.7**

The headline figure in this analysis showed an average weighted median speed of 22.7mph. This is significantly lower than many people would expect and much lower than the official DfT statistics for free-flow roads. It is worth repeating that in this analysis we are illustrating average speeds along entire roads and not at a single location along a section where speeds may be higher.

By reviewing the distribution of roads by length and by speed band (*Figure 1*), we can review the speed profile of the roads in the sample. There are large variances in traffic speeds and only 2.3% of roads by length carry traffic at or above the current 30mph limit. Furthermore, the analysis shows that average speeds on 32.5% of roads by length are already below 20mph. The speed choice of individual drivers cannot be analysed in the data as it is anonymised, although this distribution chart is likely to align closely with speeds for individual vehicles along the same roads. The median speed is also known

as the 50th percentile; reviewing 85th or 95th percentiles would elicit deeper insight into speed choice. Although these data are available, they have not been included in this analysis.

Figure 1 – Distribution of speeds by road segment in the pre-implementation period



POST-IMPLEMENTATION (18TH – 22ND SEPTEMBER 2023)

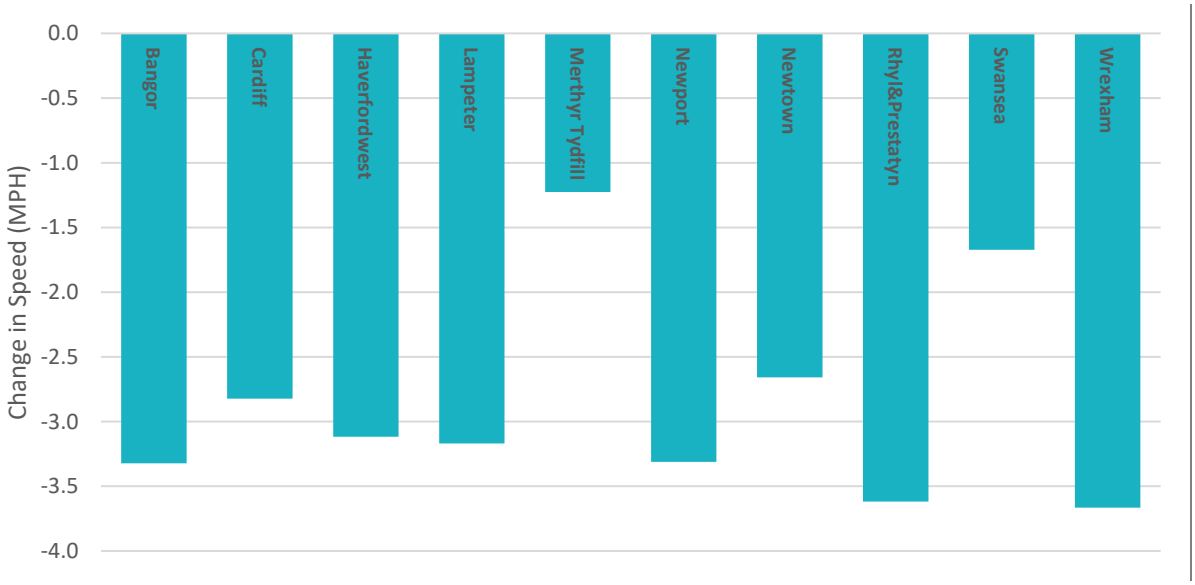
The total road length in the post-implementation analysis was reduced slightly from 422.5km to 419.9km due to low sample size on a handful of road sections compared to the pre-implementation values. Overall probe sample counts reduced slightly from 13.09 million to 12.75 million. The calculated speed values for each location are shown in Table 3 below.

Table 3 – Summary of results in the post-implementation period

Town / City	Road length meeting selection criteria (KM)	Average weighted median speed (MPH)
Bangor	19.6	18.7
Cardiff	81.8	19.7
Haverfordwest	18.8	19.8
Lampeter	6.9	20.5
Merthyr Tydfill	33.6	20.9
Newport	49.7	19.5
Newtown	14.6	18.6
Rhyl & Prestatyn	69.5	19.6
Swansea	73.5	20.5
Wrexham	51.9	19.6
	419.9	**19.8**

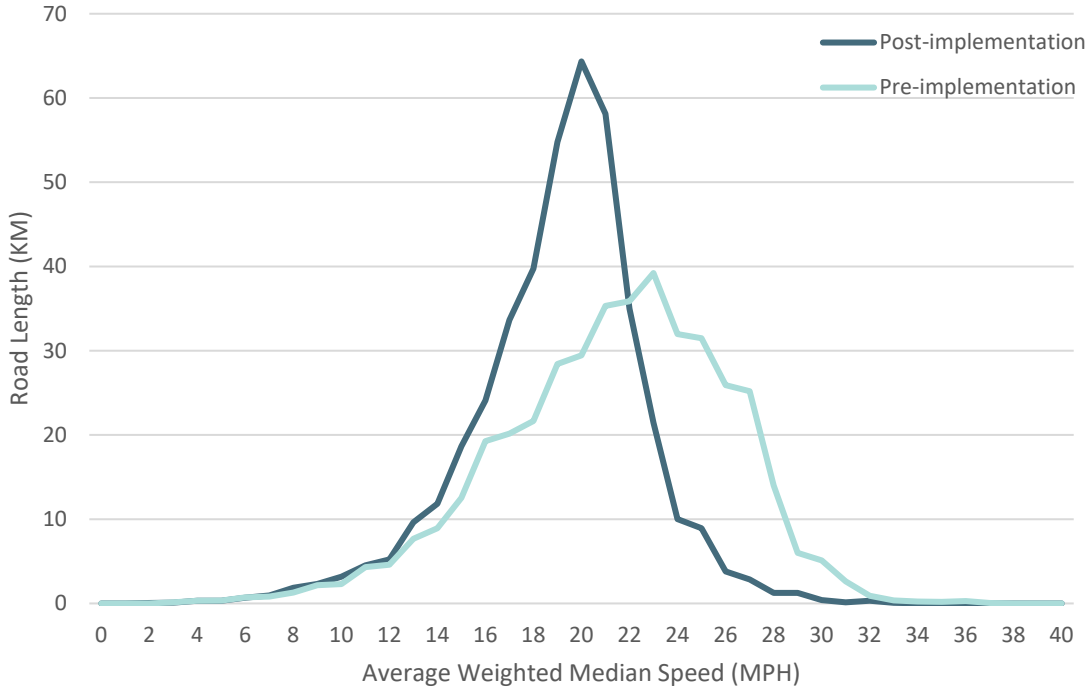
Based on the sample roads, speeds have reduced by 2.9mph (12.8%) in the week following the change in limit. Changes in speed vary in the sample areas (*Figure 2*) with the greatest reduction seen in Wrexham (-3.7mph) and the lowest reduction in Merthyr Tydfil (-1.2mph)

Figure 2 – Change in speeds by location post-implementation



When reviewing the distribution of roads by length and by speed band (*Figure 3*), we can see a significant change in the distribution of speeds by road section. Comparing pre-implementation with post-implementation illustrated a much narrower range of speeds on roads clustered around the central 20mph speed. Just over half (49.5%) of roads have average speeds above the new limit of 20mph, and only 0.2% of roads by length carry traffic at or above the old 30mph limit. The proportion of roads with low speeds, associated with congestion (less than 15mph), does not appear to have changed significantly (9.8% compared to 8.0%).

Figure 3– Distribution of speeds by road segment in the post-implementation period



ROUTE ANALYSIS

To illustrate changes in a real-world scenario we have analysed two roads of around 2.5km in length in Cardiff and Wrexham. These roads are the A5152 Chester Road in Wrexham and the B4487 Newport Road in Cardiff. Detailed maps illustrate the roads where speeds have changed most significantly, as illustrated in Figure 4 for Chester Road, Wrexham. Compliance with the new limit is consistent with lower variations in speeds along the route.

Figure 4– Comparison of pre- and post-implementation speeds (A5152 Chester Road, Wrexham)

The data also allows for a review in travel times. In this analysis the comparisons have been made for both routes using the two directions of travel. As well as changes in median travel times between the start and end of the route, the high and low travel times typically experienced have also been reviewed by assessing the 15th and 85th percentile values. Figure 4 contains the analysis showing that median travel times increased by between 45 and 63 seconds. Travel times for those drivers travelling at lower speed, either through choice or due to congestion, have not changed as much (30-46 second increase), but those who previously travelled faster have only been affected as much as those who travel at a median speed. A list showing travel times is included as *Table 4*.

This is a complex analysis with some degree of assumption and interpretation by the author, but it seems to indicate that travel times have increased reasonably consistently where some form of speed choice or free-flow traffic was present. To illustrate this on the sample route in Wrexham, Figure 5 shows the road sections along the route that have seen the greatest increase in travel time.

The overall picture does show that journey times have increased, which is to be expected given the overall reduction in vehicle speeds. The relationship between traffic speeds and journey times varies greatly according to route characteristics and this small sample may not be representative of similar routes in Wales.

Figure 5– Changes in travel time along the A5152 Chester Road, Wrexham

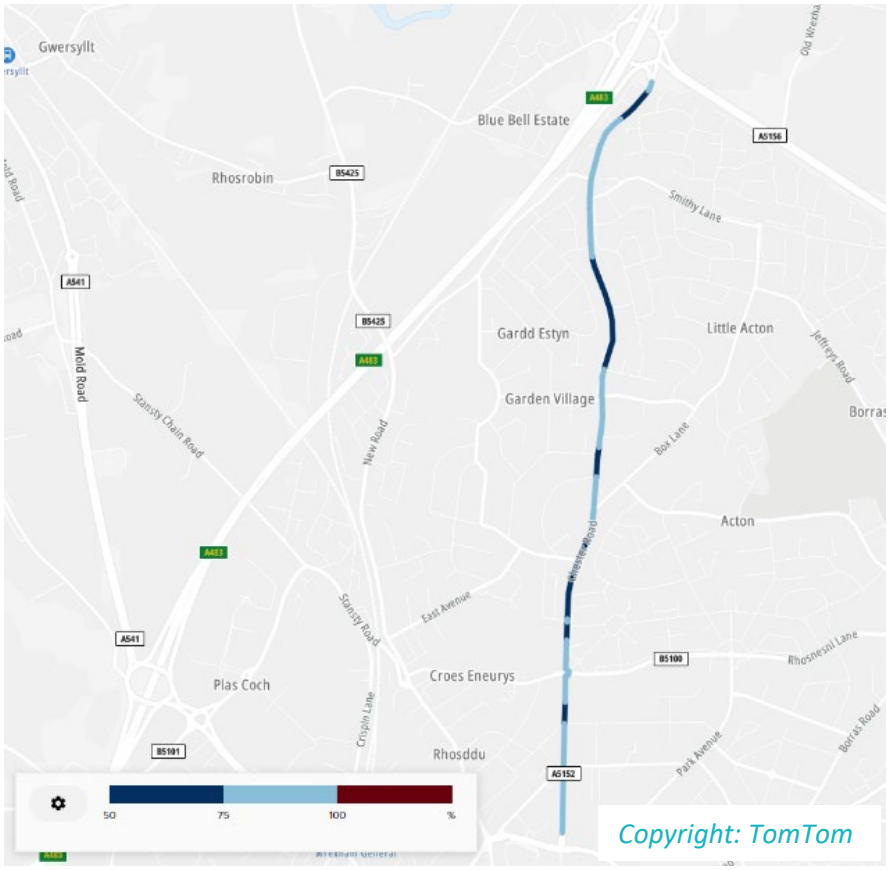


Figure 6 – Changes in travel time along the Chester Road, Wrexham and the Newport Road, Cardiff

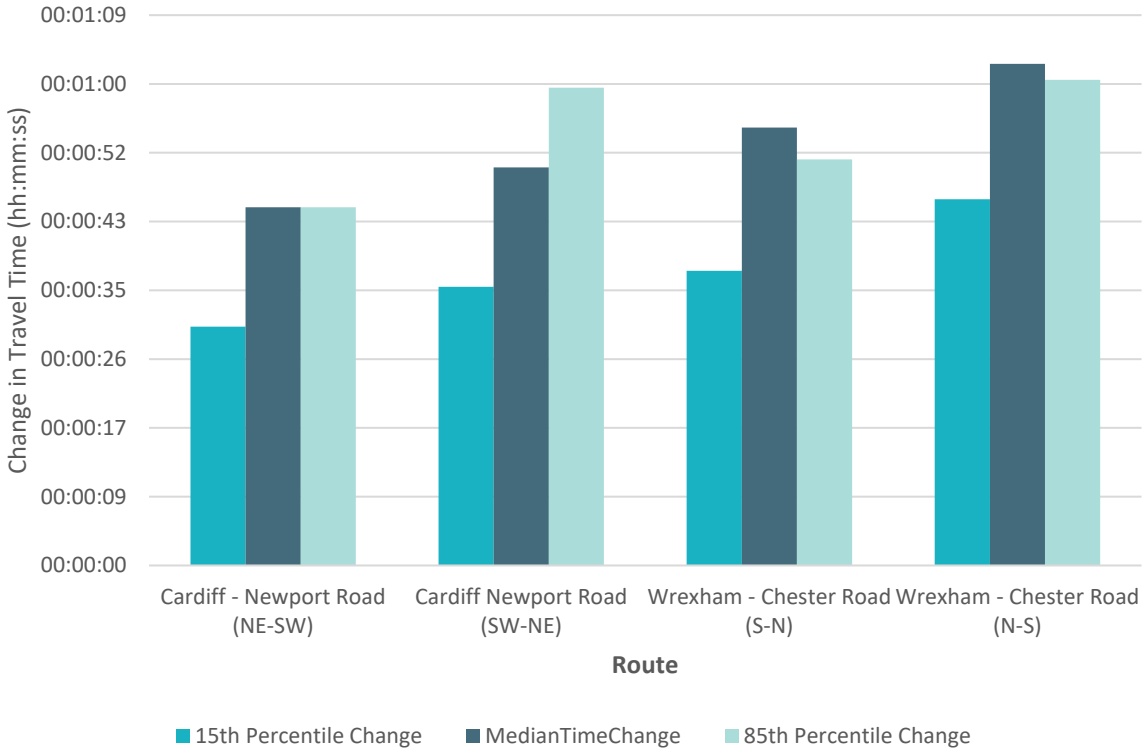


Table 4– Changes in travel time pre-and post-implementation

	Pre-Implementation			Post-Implementation		
	Median	**15th Percentile**	**85th Percentile**	**Median**	**15th Percentile**	**85th Percentile**
Cardiff - Newport Road (NE-SW)	00:03:48	00:03:03	00:06:16	00:04:33	00:03:33	00:07:01
Cardiff Newport Road (SW-NE)	00:03:41	00:03:02	00:05:11	00:04:31	00:03:37	00:06:11
Wrexham - Chester Road (S-N)	00:03:39	00:03:05	00:04:56	00:04:34	00:03:42	00:05:47
Wrexham - Chester Road (N-S)	00:03:42	00:03:05	00:04:58	00:04:45	00:03:51	00:05:59

CONCLUSION AND RECOMMENDATIONS

The change in traffic speeds on urban roads in Wales has been dramatic following the implementation of widespread 20mph limits. Reductions of 2.9mph are similar to those achieved in other areas such as Scottish Borders but on a much wider scale. The use of connected vehicle GPS data has allowed for a rapid analysis which would not have been possible using legacy infrastructure and equipment, and certainly not without enormous expense.

Compliance using the chosen median speed metric is very good, with half of drivers sticking to the new limit. There has been a very significant reduction on the length of roads where speeds are well-above 24 miles per hour, the speed at which enforcement would typically take place. Although the analysis does not pick out speeds of individual vehicles if uses a vast sample of over 25 million vehicle trips on individual roads in the combined analysis periods, and this gives significant confidence in the results.

The analysis period covered the 6am to 6pm period and compliance is expected to be lower outside of these times. Fewer vulnerable road users (cyclists and pedestrians) are likely to use the roads at these times however and the impact on those killed or seriously injured may be lower. Nevertheless, there are opportunities using this approach to review compliance at different times of the day.

It is not possible to say precisely what the impact on road casualties may be as a result of the observed changes in speeds. An evaluation of post-implementation road casualties will need to take place over several years. Speed monitoring should also continue to see how drivers react in the long-term to the change in speed limit.

ABOUT AGILYSIS AND TOMTOM TRAFFIC STATS

Agilysis are a specialist consultancy helping road authorities, governments, charities and other stakeholders in a variety of ways. We provide advice on strategy, conduct independent research, and deliver power data solutions in the UK and around the world.

We have partnered with TomTom to access connected vehicle data for this project, and we already supply this data for analysis on congestion management and road safety projects. Our expertise in analysing connected vehicle data is significant, delivering solutions to several dozen GB road safety organisations, private companies, and research organisations. We are grateful to TomTom for allowing free use of their Traffic Stats solution to carry out this research without charge.

To find out more about Agilysis and our solutions please visit www.agilysis.co.uk and for more information on our Traffic Insights solution go to https://agilysis.co.uk/trafficinsights/.

ABOUT THE AUTHOR

Richard Owen is our CEO and has 20 years of experience in analysing road safety data. He has led our partnership with TomTom and worked with our team of talented analysts and data scientists to understand the potential for this type of research.

He is a significant figure in road safety both in the UK and overseas, with experience of delivering award-winning projects covering multiple disciplines.

His experience as a manager of a multi-partner enforcement organisation led to a deep understanding of matters relating to enforcement technology, deployment and management of resources and partner relationships. His historic work in geospatial and database systems has brought insight into effective analysis techniques and system design which has been used extensively in our work for clients.

Richard regularly provides policy and strategy advice to organisational leaders and has appeared at conferences and events across the globe.

About Agilysis

Agilysis is a leading transport safety consultancy who provide strategic support and data platforms to local authorities, road safety partnerships and roads policing throughout Great Britain and across the globe. Specialising in Safe System methodology, we have supported national governments and transport authorities to develop and deliver on new strategies to help them achieve their Vision Zero goals.

We have an extensive track record of working with public and private sector clients to deliver perceptive and relevant studies using state of the art techniques, including multidimensional data mining, socio demographic segmentation, geo-spatial methodology and contextualisation.

With access to a wide variety of datasets such as live and historical connected vehicle data, the Agilysis team provide insightful and rigorous analysis of trends in road traffic collisions and the people involved in them.

At Agilysis we have the ambition to create safe and sustainable communities for all. Our experienced team have been working together on innovative projects for over a decade. We are absolutely focussed on understanding 'what works', using evidence from all available data sources, as well as published research.

As both researchers and practitioners in social marketing, we also understand the practical requirements of those delivering training, campaigns and public relations exercises. Our principles are therefore directed towards ensuring that realistic, effective interventions can deliver outputs and outcomes for clients.

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