

## Vehicle speeds on Welsh motorways, April to June 2016 - Revised

19 June 2018

This experimental statistical article has been revised due to processing errors in calculating average speeds. The original version of the article was available between 17/05/2017 and 19/06/2018.

Since the original release we have continued to explore the quality of the Trafficmaster data, and we have updated the presentation of statistics in this article to match our current understanding.

This article provides information on average vehicle speeds on Welsh motorways, that is the A48(M), M4 and the M48, using Trafficmaster data. This is the first statistical publication of average motorway speeds in Wales.



The data for this article are taken from Trafficmaster in-vehicle global positioning systems (GPS) tracking data. The data are collected for a range of purposes including fleet management and stolen vehicle tracking services. There are therefore likely to be unquantifiable biases in the data as they do not randomly represent all vehicles, and this may impact on any conclusions drawn from the data. However the data do provide useful comparisons across times of day and locations. This can aid understanding of relative speeds across the network.

Further information on the quality and methodology can be found in the [key quality information](#).

### 1. Key points

- Average speeds for the M4 were consistently above 60mph across four out of nine local authorities.
- Slower average speeds were recorded in Neath Port Talbot and Newport for all directions, during the morning and evening peaks.
- The A48(M) often saw quarterly average speeds under 60 mph during peak times. The westbound A48(M) routinely saw average speeds under 50 mph during the morning peak.
- Average speeds on the M48 were consistent in each direction during morning peak hours, but lower westbound for the rest of the day.
- Analysis suggests a small increase in the average speed on the M4 over the period covered by the data.

### About this article

This article provides estimates of road traffic speeds on Welsh motorways, using Trafficmaster data.

The continuation and/or expansion of this product are dependent on user feedback. We welcome all feedback on any aspect of these statistics which can be provided by via the [contact information below](#).

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## 2. Changes to the presentation of statistics in this article

This “Vehicle speeds on Welsh motorways” article is revised from the original article available between 17/05/2017 and 19/06/2018. The revisions were necessary due to a processing error that is further explained in the [key quality information](#).

At the same time the statistics were revised, their presentation in this article has been revised too. Since the original release we have continued to explore the quality of the Trafficmaster data, and have carried out a similar analysis with the data for the A55 trunk road in North Wales. This has led us to update the presentation of statistics in this article to match our current understanding of how the data is best interpreted. The update reflects the way average speed statistics will be presented in an upcoming article on the A55.

### 2.1 Interpreting the statistics

The statistics in this article are based on Trafficmaster in-vehicle global positioning systems (GPS) tracking data. The data are collected for a range of purposes including fleet management and stolen vehicle tracking services. Certain types of vehicles and drivers, with potentially different types of driving patterns, are therefore likely to be over- or under-represented in the dataset, compared with what we might expect if the dataset were a random sample of all vehicles. During busy periods, when all traffic moves at similar speeds, this is less likely to cause any issues but may have more of an impact when traffic is free-flowing. Our expectation is that broad comparisons over time, road type or location will be valid which can aid understanding of the relative speeds of the network. However, because any biases are unquantifiable, detailed use of precise average speeds, or precise comparisons between different estimates from these data may be less valid.

A range of external factors might also each have an impact on average speeds in a given time period that we are unable to quantify from the data available. The factors include: the infrastructure (for example number of lanes and differing speed limits), road conditions, weather, road accidents, road works – as well as the number of vehicles on the road.

You should bear the possibility of all of these potential biases in mind when using these statistics.

### 2.2 List of changes

- Data have been updated to correct for the processing errors.
- The commentary in this article has been rewritten to focus on the broad messages of the data. The order of the sections have been rearranged to support this and to emphasise the most relevant statistics.
- The section on average speeds by time period and the section on average speeds by time of day have been merged.
- Estimates are rounded to whole numbers, instead of one decimal place, to avoid the risk of conveying more precision than the data can support.
- All graph axes start at zero to accurately show the scale of patterns in average speed.
- Information about the quality of the data has been strengthened and has been placed more prominently throughout the article.

It is our hope that these changes will help our readers understand the key messages of the data.

### 3. Context

These experimental statistics have been developed following user feedback which requested official statistics on average speeds for Welsh motorways. They use a commercial GPS based data source.

Potential uses of these statistics include:

- monitoring transport policy and infrastructure development in Wales;
- providing a picture of congestion on Welsh motorways; and
- investigating the impact of road accidents on motorways in Wales.



The analysis included in this article focus on indicators which could be used to measure road traffic congestion. Road traffic congestion is defined as overcrowding of vehicles on a road. Congestion on roads has been shown to have a negative impact on both the environment and the economy. Vehicles travelling at a reduced speed for longer periods of time are likely to cause additional pollution. Delays in journey times mean that the volume of business and personal travel is reduced, leading to fewer goods and services provided as well as commuting to and from employment. There are additional costs too, with a high volume of congestion emergency services find it difficult to carry out their functions.

Road traffic congestion can be measured in a variety ways, for example: traffic moving at a lower speed than expected, increased journey times, and/or unreliable journeys times; this article focuses on the average vehicle speed of road traffic. Other measures, such as average delay, journey reliability and the impact of road accidents are also important factors when trying to fully understand a road as a whole. The focus of this article is on motorways in Wales only.

As the sampled data have not been weighted to the estimated road traffic flows, individual roads and vehicles types are specified throughout this article. This means that aggregations should not be calculated (to combine different roads or sections of roads) as the difference in the sampled observations does not allow simple averaging.

There are three motorways in Wales; these are the A48(M), M4 and the M48. The map below shows the coverage of each road used in this analysis. The M4 in Wales runs from Carmarthenshire through 8 local authorities and finishes at the end of the Second Severn Crossing at junction 22. The A48(M) and the M48 branch off the M4. The A48(M) connects Cardiff and Newport, whilst the M48 branches off the M4 at Monmouthshire.

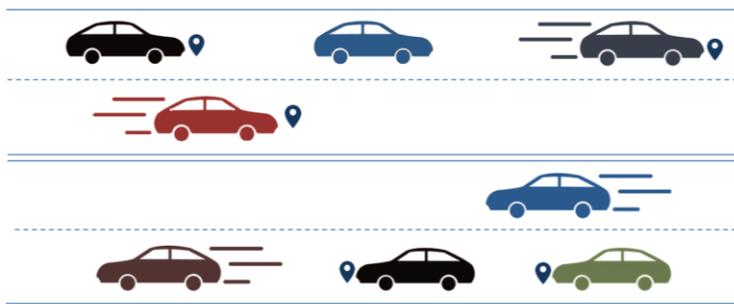


## 4. Methods used in this article

The figures below outline how the data were collected and analysed for this article, further information can be found in the key quality section.

### Data collection

- The data are sourced through in-vehicle global positioning systems (GPS) installed in some vehicles, which measure journey times.
- The data are collected from a commercial data supplier and supplied to the Welsh Government in an anonymised form.



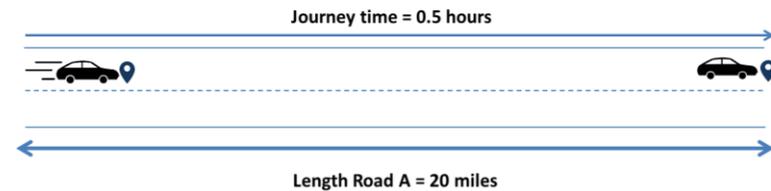
### Data Analysis 1

- The data are subsequently put onto Welsh Government servers and analysed as follows:

- Average (mean) vehicle speeds =  $\left(\frac{\text{Road Length}}{\text{Journey Time}}\right)$

For example

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



### Data Analysis 2

- For multiple cars travelling the same journey, the average journey time is calculated as follows
- Average (mean) vehicle speeds =  $\left(\frac{\text{Road Length}}{\text{Average Journey Time}}\right)$

For example,

- The journey time for the blue car = 0.6 (hours)
- The journey time for the black car = 0.8 (hours)
- Road length = 35 miles

$$\text{Speed} = \frac{35}{((0.6+0.8)/2)} = 50.0 \text{ miles per hour}$$



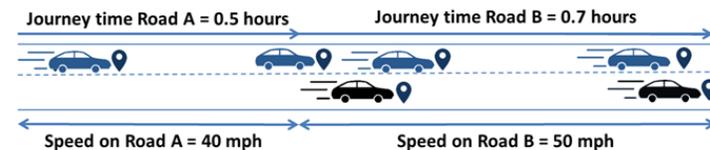
### Data Analysis 3

- For multiple sections of roads, journey times are calculated as follows
- Average (mean) vehicle speeds =  $\left(\frac{\text{Speed} * (\text{Average journey time})}{\text{Sum (Average Journey Time)}}\right)$

For example,

- The average journey time for road A = 0.5 (hours)
- The average journey time for road B = 0.7 (hours)
- Speed Road A = 40 mph
- Speed Road B = 50 mph

$$\text{Speed} = \frac{(40 * 0.5) + (50 * 0.7)}{(0.5 + 0.7)} = 45.8 \text{ mph}$$





## 5. A time series of quarterly average car speeds

This section investigates what has happened to average car speeds over time on the A48(M), M4 and the M48. The weather, the number of road accidents, road works, and the number of vehicles on the road all might have an impact on average speeds in a time period.

The speeds in this article are averages. They talk about the general speed over a period of months. On any particular day, incidents can occur which lead to speeds lower or higher than the average on different sections of the road.

The peak times used in this article are the conventional peak times: morning peak (07:00 to 10:00), evening peak (16:00 to 19:00). These peak times may not be when traffic peaks for a particular road. All average speeds in the article are car speeds, unless otherwise stated.

For the A48(M) and M48, average speeds didn't change over covered time period from October 2013 to June 2016 (Chart 1 & Chart 3). Analysis of the data suggests a small increase in the average speed on the M4 over this period (Chart 2).

Average speeds at peak times tended to be slower, as expected. All three motorways showed a pattern of one direction of travel being slower than the other during the evening peak time. The A48(M) was also slower westbound during the morning peak.

## 5.1 A48(M)

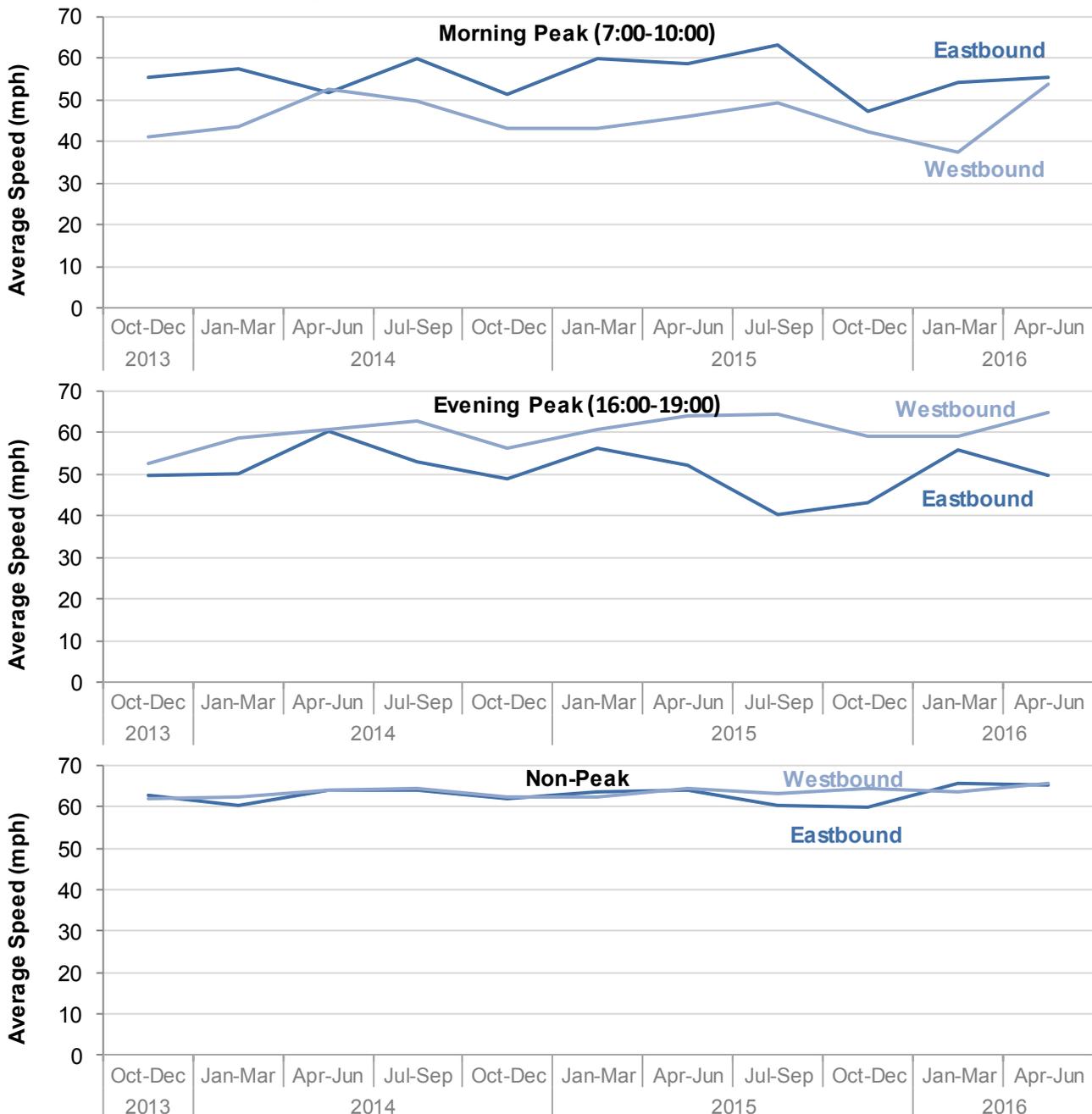


Chart 1 shows that average car speeds regularly fell below 60 miles per hour (mph) in the morning peak on the A48(M), dipping below 50 mph for westbound traffic. The A48(M) also saw slow eastbound traffic during the evening peak.

There was a lot of variance in average speed estimates each quarter during peak times. There was no clear evidence of the A48(M) getting faster or slower over time.

During the morning, the A48(M) was slowest heading westbound, towards Cardiff. During the evening it was slowest heading eastbound, towards Newport.

**Chart 1 – Quarterly average car speeds (mph) on the A48(M) by direction and time of day**



Source: Welsh Government analysis of TrafficMaster dataset

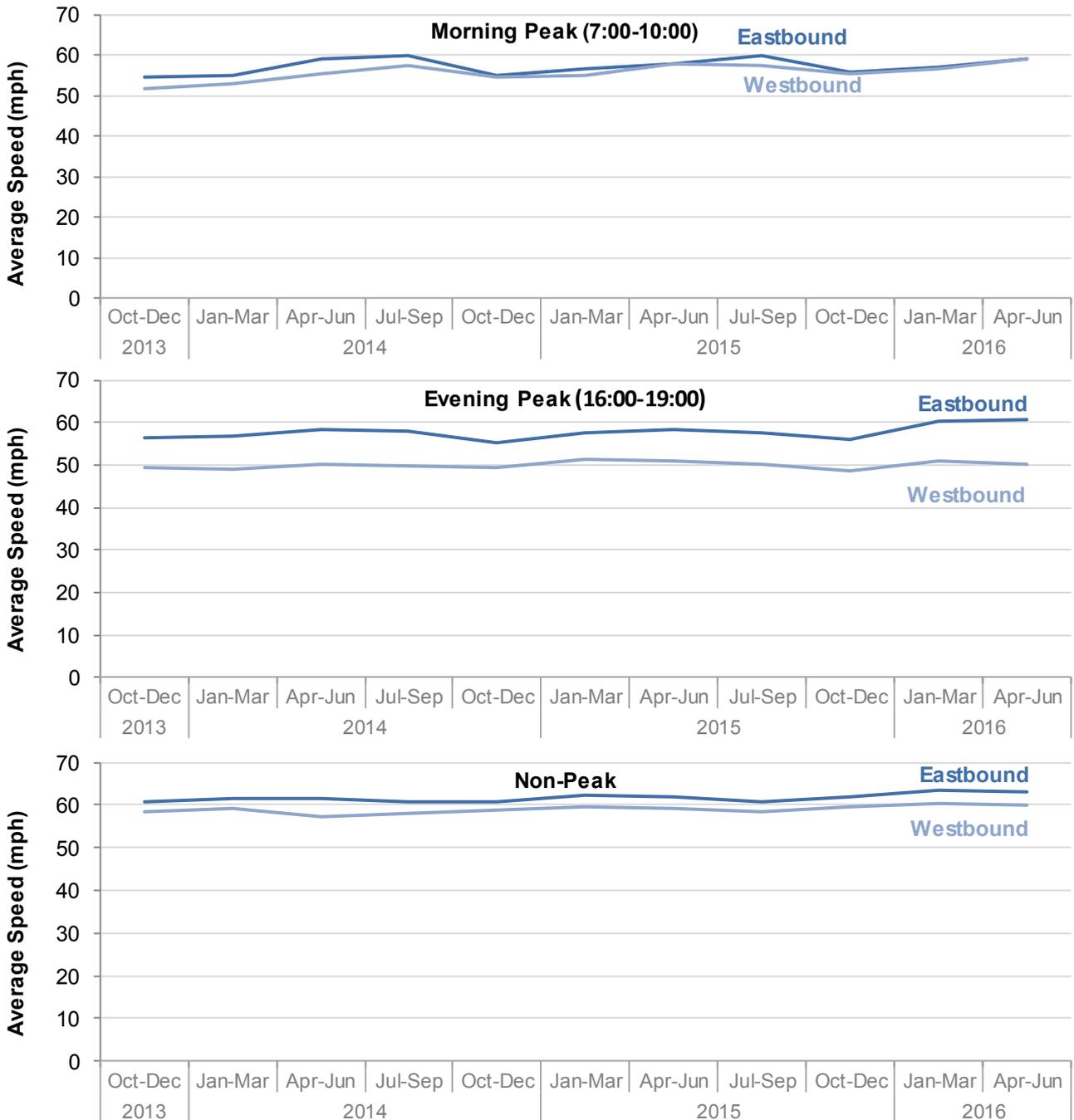
**5.2 M4**



Chart 2 highlights that average speeds on the M4 each quarter were consistently around 50 to 60 mph.

Analysis of the data suggests that average quarterly speeds may have slightly increased over the time period from October 2013 to June 2016. The increase, as seen in the Trafficmaster data, was about 1 mph year-on-year depending on direction and time of travel.

**Chart 2 – Quarterly average car speeds (mph) on the M4 by direction and time of day**



Source: Welsh Government analysis of TrafficMaster dataset

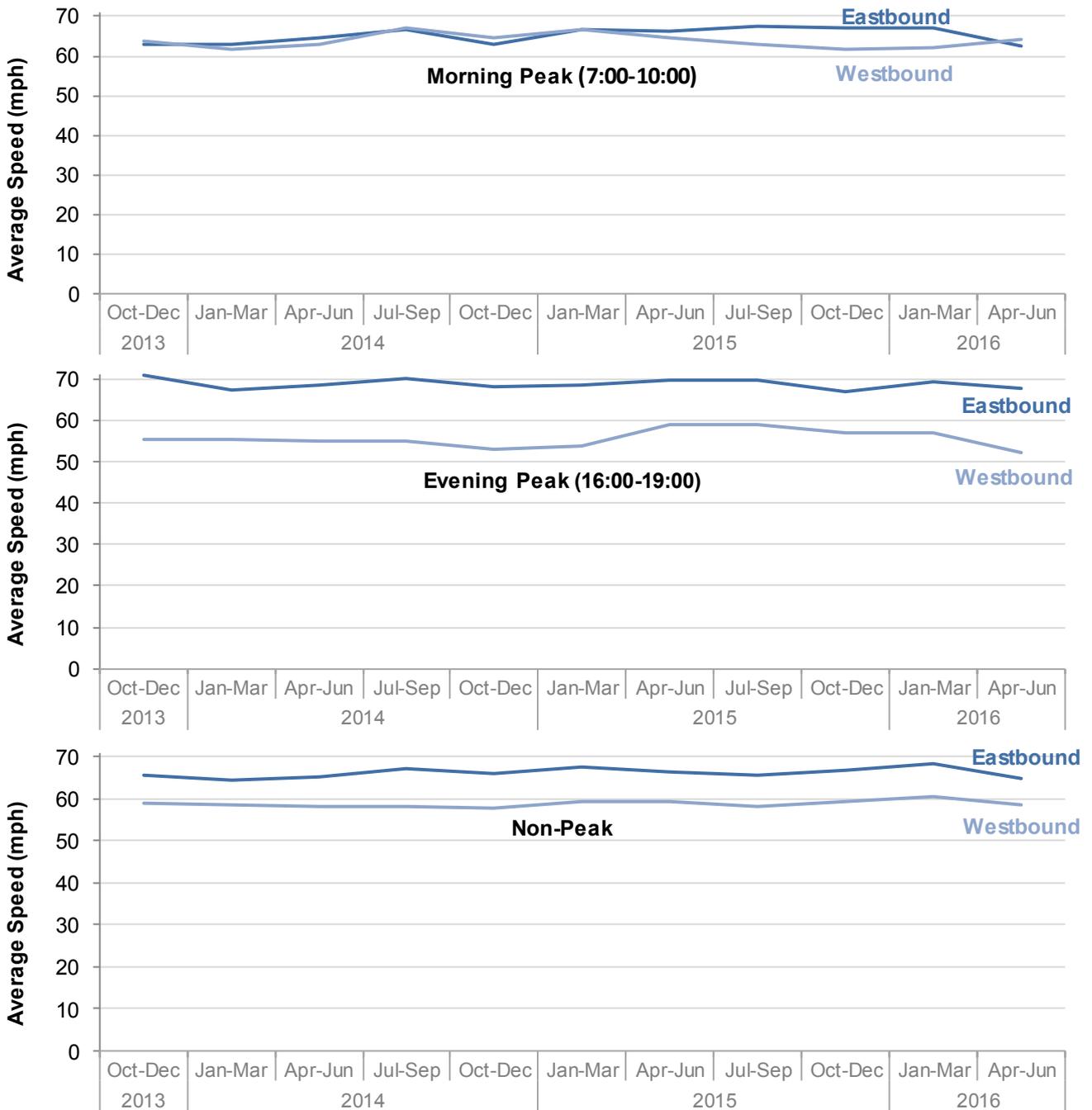
### 5.3 M48



Chart 3 reveals that average speeds on the M48 were above 60 mph heading eastbound, towards England. In the evening peak, and during non-peak times, average speeds fell below 60 mph heading westbound. The westbound M48 includes the section of road with the Severn Crossing toll, which requires cars to stop and could reduce the average speed of the road.

There is no evidence that average speeds on the M48 increased or decreased during the time period covered by this data.

**Chart 3 – Quarterly average car speeds (mph) on the M48 by direction and time of day**



Source: Welsh Government analysis of TrafficMaster dataset



## 6. Average car speeds by time of day

This section highlights the difference in average car speeds by time of day and direction of travel. The statistics are for April to June 2016.

Table 1 gives the average speed for the A48(M), M4 and M48 by peak time period and direction.

The following subsections show the average speeds for each 15 minute period in the day (Chart 4, Chart 5 & Chart 6). The beginning of each 15 minute interval is labelled, for example 12:00 refers to 12:00 to 12:14:59. Average speeds are only presented where there were at least 50 observations during the interval in our sample to make sure the estimates are accurate.

**Table 1: Average car speeds (mph) on Welsh motorways by time period and direction, April to June 2016**

	<i>Miles per hour</i>					
	<b>Morning Peak (07:00-10:00)</b>		<b>Evening Peak (16:00-19:00)</b>		<b>Non-Peak Times</b>	
	<u>Eastbound</u>	<u>Westbound</u>	<u>Eastbound</u>	<u>Westbound</u>	<u>Eastbound</u>	<u>Westbound</u>
A48(M)	55	54	50	65	65	66
M4	59	59	61	50	63	60
M48	62	64	68	52	65	58

*Source: Welsh Government analysis of TrafficMaster dataset*

## 6.1 A48(M)

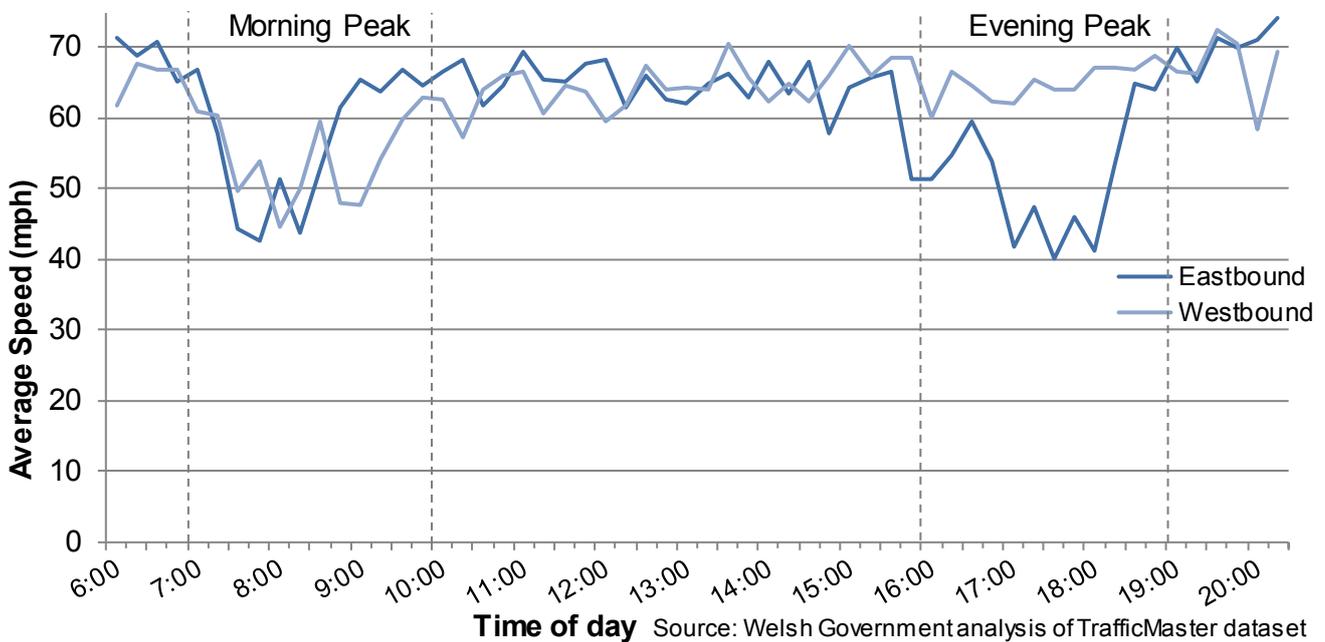


Average car speeds by time of day on the A48(M) are only available from 06:00, due to a low number of vehicles travelling in the early hours of the morning (Chart 4).

The A48(M) saw dips in average speeds in both directions during the morning peak, with average speeds falling below 50 mph. The westbound road (heading towards Cardiff) stayed slow for longer in the morning than the eastbound road (heading towards Newport). Westbound average speeds were still below 50 mph at 9:00.

Westbound average speeds on the A48(M) stayed above 60 mph through the evening peak. However the eastbound average speeds started dropping at 15:45, falling below 50 mph at 17:00 and remaining low until 18:30.

**Chart 4 – Average car speeds on the A48(M) by time of day and direction, during April to June 2016**



## 6.2 M4



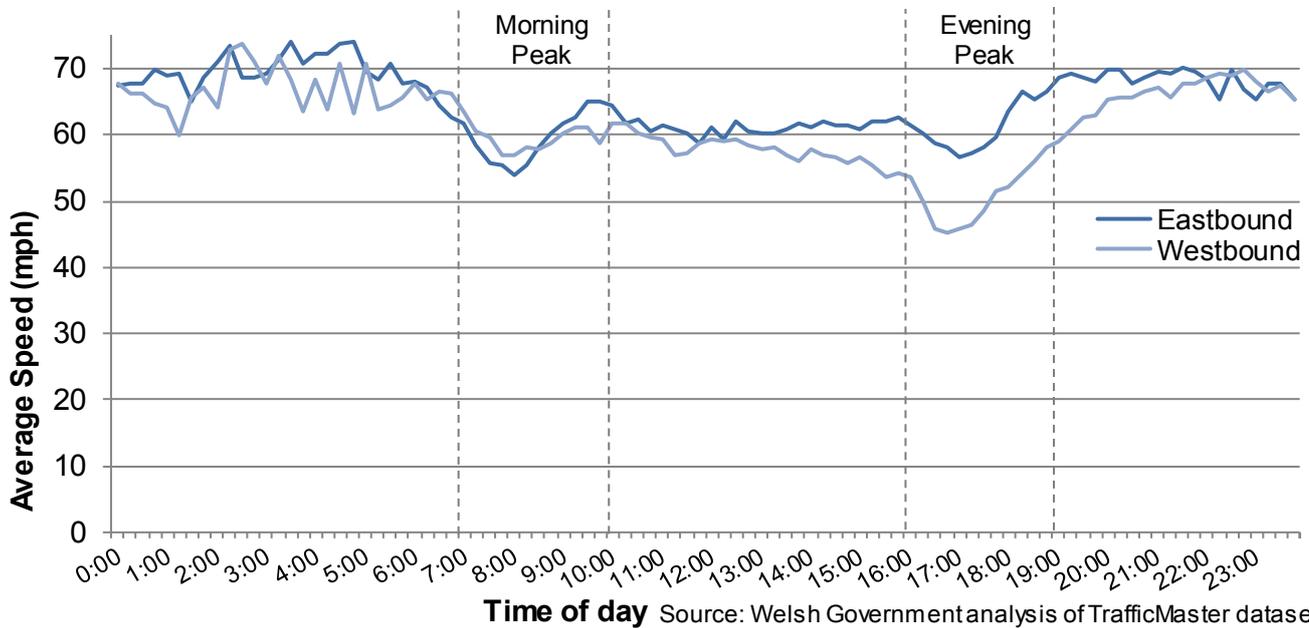
Chart 5 shows that the average speeds on the M4 were below 60 mph in the beginning half of the morning peak.

The westbound M4 experiences a prolonged afternoon dip in average speed. Average speeds started dropping around midday and got consistently slower until they dropped below 50 mph in the afternoon peak. Estimates didn't get above 60 mph again until 19:15.

The eastbound M4 only experienced a small drop in average speeds in the evening peak, staying above 55 mph.

The statistics cover the average speed of the M4 as a whole in Wales. Some sections of the M4 are slower than others. Section 7 looks at the average speeds of the M4 through each Local Authority.

**Chart 5 – Average car speeds on the M4 by time of day and direction, during April to June 2016**



### 6.3 M48



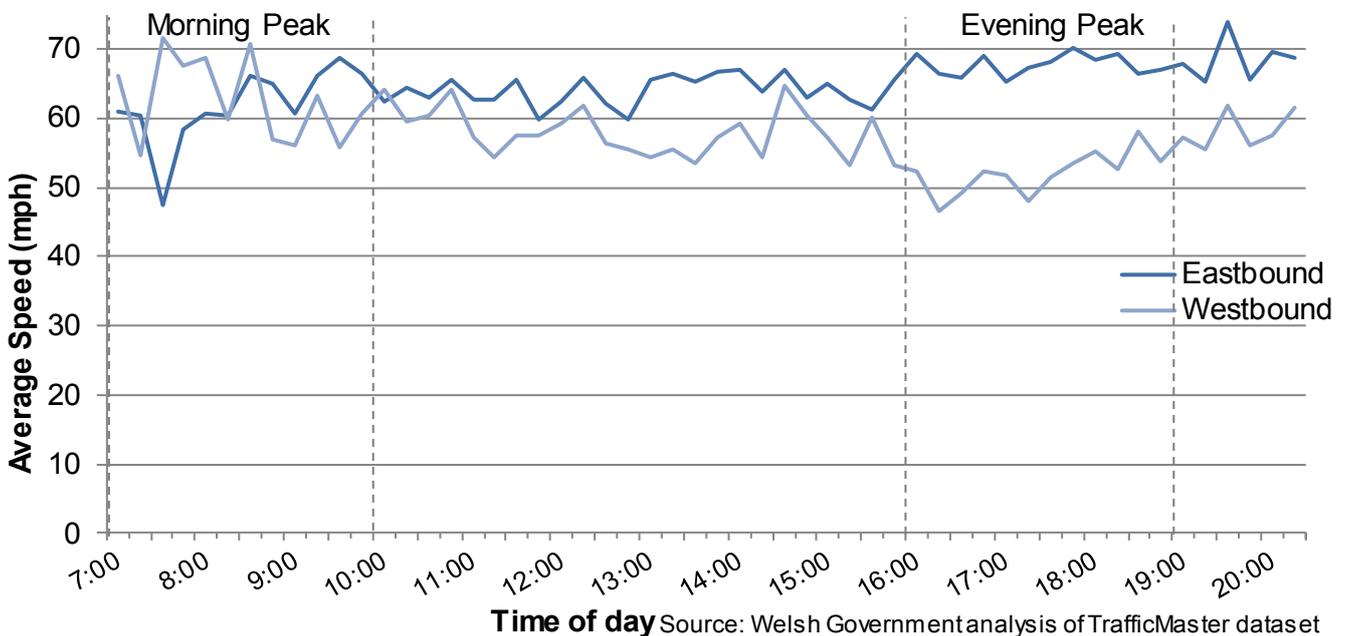
The M48 is presented from 07:00 to between 20:15 and 20:30, due to the low sample size (Chart 6). The chart shows the volatility of the average speed estimates for this road compared to the previous two roads.

#### M48

The eastbound M48, heading towards England, saw average speeds dip briefly below 50 mph during the morning peak, but stayed above 60 mph for the rest of the day.

The westbound M48 was slower than the eastbound side, except during the first half of the morning peak. Average speeds throughout the evening peak were slower than at other times, but only briefly fell below 50 mph.

**Chart 6 – Average car speeds on the M48 by time of day and direction, during April to June 2016**





## 7. Average car speeds on the M4 by local authority, direction of travel and time of day

This section looks at the average speeds for the stretches of M4 in each local authority in Wales. The statistics are for April to June 2016.

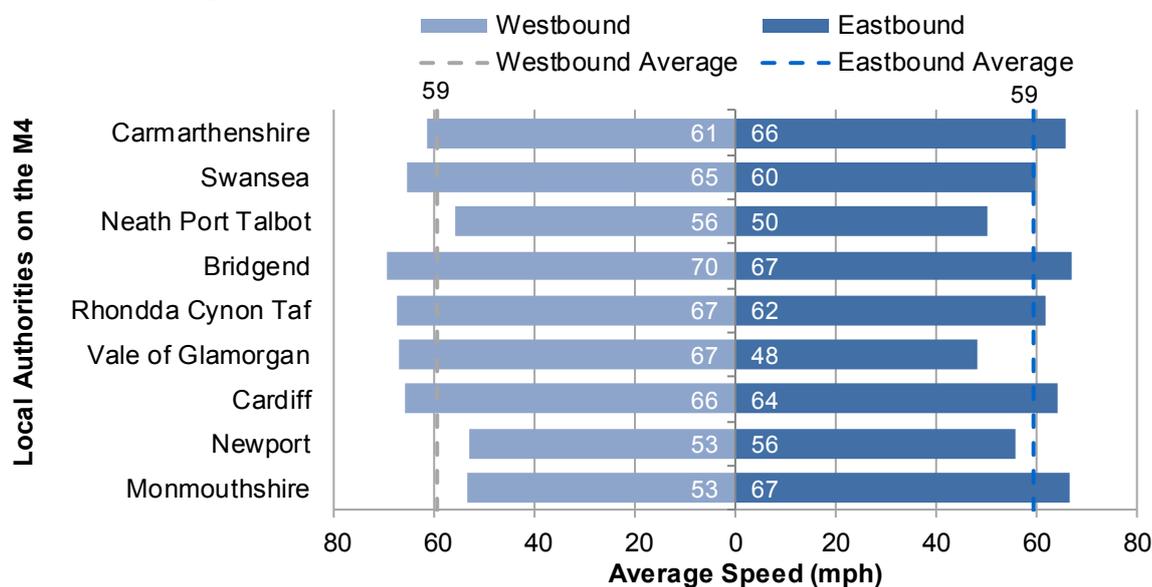
The M48 and A48(M) are not included because they're only located in one and two local authorities in Wales respectively. The Welsh part of the M48 is entirely within Monmouthshire, and the A48(M) covers Cardiff and Newport. The M4 spans nine different local authorities in Wales. Annex A outlines which junctions are within each local authority.

Out of the nine local authorities spanned by the M4, there are four where average speeds fell below 60 mph (Chart 7 & Chart 8). Neath Port Talbot and Newport were slow in both directions.

The Vale of Glamorgan average speeds were only slow during the morning peak, and only eastbound, reflecting commuter traffic heading towards Cardiff and other destinations. Carmarthenshire average speeds were only slow during the evening peak, and only westbound.

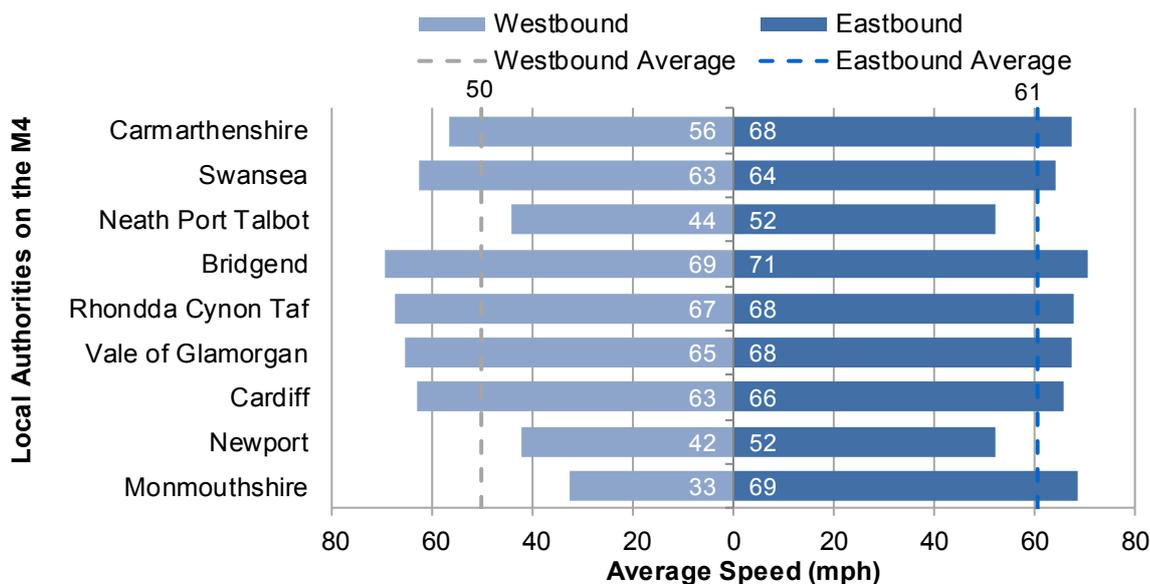
The average speed in Monmouthshire, westbound, during the evening peak was 33 mph. This was the slowest average speed for any time, direction or local authority. The stretch of M4 with the Second Severn Crossing toll lies in Monmouthshire, which forces cars to stop. This could pull down the average speeds for the westbound M4 in Monmouthshire.

**Chart 7 – Morning peak average car speeds (mph) on the M4 by local authority and direction, during April to June 2016**



Source: Welsh Government analysis of TrafficMaster dataset

**Chart 8 – Evening peak average car speeds (mph) on the M4 by local authority and direction, during April to June 2016**



Source: Welsh Government analysis of TrafficMaster dataset

Table 2 investigates how average car speeds during April - June have changed between 2015 and 2016. The weather, the number of road accidents, road works, and the number of vehicles on the road all might have an impact on average speeds in a given time period.

Generally average speed estimates on the M4 increased in this time period, but there were some small slowdowns in the morning peak. There were large slowdowns travelling westbound in Monmouthshire in evening and non-peak times.

The largest increases in average speed were in Carmarthenshire, Swansea, Neath Port Talbot and Cardiff at particular times of the day and in certain directions. Although average speeds in Neath Port Talbot increased over this time period, Chart 7 and Chart 8 show that it still contained some of the slowest sections of the M4 in Wales.

**Table 2: Change in average car speeds (mph) on the M4 by time period, direction of travel and local authority, between April to June 2015 and April to June 2016**

	<i>Change in miles per hour</i>					
	<b>Morning Peak (07:00-10:00)</b>		<b>Evening Peak (16:00-19:00)</b>		<b>Non-Peak Times</b>	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
Carmarthenshire	4	-1	2	1	2	4
Swansea	4	-1	3	0	1	2
Neath Port Talbot	1	2	4	0	3	2
Bridgend	-2	1	2	1	2	2
Rhondda Cynon Taf	-2	1	1	2	2	2
Vale of Glamorgan	1	1	3	2	3	2
Cardiff	3	4	2	1	2	2
Newport	1	2	2	1	0	3
Monmouthshire	3	0	3	-11	1	-5

Source: Welsh Government analysis of TrafficMaster dataset



## 8. Average car speeds during school days and non-school days

This section highlights the difference in average car speeds during school days and non-school days, for April to June 2016. School days are defined as week days during term time, non-school days are defined as all days during non-term time and weekends during term time. School terms vary between local authorities in Wales. We were not able to take INSET days into account as they can differ within local authorities.

For all three roads, average speeds were generally slower during the morning and evening peaks on school days than on non-school days. The difference in average speeds ranged from being 2 mph lower on the A48(M) in the evening peak, to a 16 mph difference travelling eastbound on the A48(M) in the morning.

The M48 westbound in the morning, and the M48 eastbound in the afternoon, were both faster on school days than non-school days. The M48 had the smallest average (mean) difference between school days and non-school days.

**Table 3: Average car speeds (mph) by school days and non-school days**

		<i>Miles per hour</i>					
		<b>Morning Peak (07:00-10:00)</b>		<b>Evening Peak (16:00-19:00)</b>		<b>Non-Peak times</b>	
		School day	Non-School day	School day	Non-School day	School day	Non-School day
A48(M)	Eastbound	51	67	49	51	66	64
	Westbound	51	65	64	67	65	67
M4	Eastbound	57	65	59	62	64	62
	Westbound	58	63	48	53	60	59
M48	Eastbound	62	64	69	66	65	65
	Westbound	65	60	50	57	58	59

*Source: Welsh Government analysis of TrafficMaster dataset*



## 9. Average vehicle speeds by type of vehicle

The statistics in this release have dealt with cars exclusively. This section analyses the difference in average vehicle speeds between cars and Light Good Vehicles (LGVs). Buses and taxis were excluded due to the stop-start nature of these vehicles. Heavy Goods Vehicles (HGVs) were also excluded due to their speed restrictions on certain roads.

Table 4 shows average vehicle speed estimates for cars and LGVs, for April to June 2016 across all times of the day. The largest difference in average vehicle speeds between vehicle types were observed on the M4 at 60 mph for cars and 53 mph for LGVs, a difference of 7 mph. Average vehicle speeds on the A48(M) were 6 mph slower for LGVs than cars. On the M48, average vehicle speeds were 3 mph slower for LGVs than cars.

The total volume of motorised traffic on all Welsh motorways for 2015 was estimated to be 76.8 per cent for cars and taxis compared to 14.3 per cent for light vans<sup>1</sup>.

**Table 4: Average vehicle speeds (mph) by vehicle type and road name, April to June 2016**

	<i>Miles per hour</i>		
	Cars	LGVs	Difference (a)
A48(M)	61	55	6
M4	60	53	7
M48	61	57	3

*Source: Welsh Government analysis of TrafficMaster dataset*

a) Differences are calculated before rounding and may appear different from the rounded totals.

<sup>1</sup> Source: [Road Traffic in Wales during 2015](#)

## Key quality information

### Revisions

This release was published as a statistical article as it presents a ‘new experimental series of data’. Experimental statistics aim to use new techniques and data sources to provide insight into areas of interest. However, as the techniques are experimental there are also more risks attached to it.

A flaw was discovered in the process of calculating average speeds in the original version of this article, which affected the statistics in this article. In some cases, the overall messages in the article were affected. Overall the revised average speeds are slower for the M4 and A48(M) but faster for the M48. However, there is no consistent pattern across every breakdown of the data.

The processing error has been corrected and the statistics in this version have been revised.

The following table demonstrates the scope of the impact:

**Table 5: Average car speeds (mph) on Welsh motorways by time period and direction, April to June 2016, for cars only – comparison of revision versus original**

		<i>Miles per hour</i>					
		Morning Peak (07:00-10:00)		Evening Peak (16:00-19:00)		Non-Peak Times	
		Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
<u>Original</u>	A48(M)	63	60	53	68	68	68
	M4	65	67	65	57	68	67
	M48	60	54	61	44	63	51
<u>Revised:</u>	A48(M)	55	54	50	65	65	66
	M4	59	59	61	50	63	60
	M48	62	64	68	52	65	58
<u>Difference</u>	A48(M)	-8	-6	-3	-3	-3	-3
	M4	-6	-8	-5	-7	-5	-7
	M48	2	11	7	8	2	8

*Source: Welsh Government analysis of TrafficMaster dataset*

In more detail, average speeds in this article are calculated from journey times and aggregated from millions of records over several steps. The average speeds are not weighted on the number of vehicles observed, but in the original process the calculations used journey times which **had** been weighted on the number of vehicles observed. The combination of unweighted average speeds, but weighted average journey times introduced inconsistent behaviour every time the data was aggregated.

As the flaw depends on the number of vehicles on the road at any one point, there is no overall pattern to the errors it introduced. In some cases average speeds have increased, in others they decreased.

## Relevance

This release provides an estimate on average vehicle speed on Welsh motorways. These statistics will be used to monitor speeds on motorways in Wales.

These statistics could be used by a variety of organisations within and outside the Welsh Government to assess the transportation needs for Wales. Key users are expected to be:

- Ministers and the Members research Service in the National Assembly for Wales;
- Interested parties in the M4 Corridor Around Newport Public Local Inquiry
- Welsh Government transport policy teams;
- Trunk Road Agents;
- Businesses
- Academia;
- Local Authorities;
- Students; and
- the media.

Users are encouraged to provide feedback on how these statistics have been published, presented and how well they meet users' needs. Comments on any issues relating to this statistical release are welcomed and encouraged. Contact information is outlined in the ['We want your feedback'](#) section.

## Accuracy

In this statistical article estimates are only presented where there are 50 observations. The data are compiled from a sample of observations from Trafficmaster GPS data. The data are collected through GPS and mobile communications functionality fitted in vehicles, for Fleet Tracking, Stolen Vehicle Tracking and Satellite Navigation purposes, amongst others. This information is sent in an anonymised form to the Welsh Government. The data are likely to be a biased sample of traffic, and it is not possible to quantify the effects of that bias.

This information is then linked to the Integrated Transport Network (ITN) to calculate an average speed for each section of the road. This data are obtained from administrative sources and thus may be affected by changes in procedures within those systems.

The statistics presented in this release do not take into consideration other factors that could have influenced the data such as road works/diversions, weather, accidents or localised events.

Table 6 below displays that across all three Welsh motorways, the number of observations of cars are lower than for LGVs, this reflects how the data are collected. The data are collected from in-built satellite navigation or having stolen vehicle tracking services activated within their vehicle. LGVs are more likely to have this technology activated in their vehicles; therefore the number of observations is much larger for LGVs. However, as LGVs have additional speed restrictions on motorways they have typically been excluded from analysis presented in this article.

**Table 6: The number of observations by type of vehicle and road name, April to June 2016<sup>(1)</sup>**

	<i>Number</i>		
	Cars	LGVs	Difference
A48(M)	30,500	115,300	-84,800
M4	1,491,700	7,570,200	-6,078,500
M48	32,400	91,900	-59,500

*Source - Statistics for Wales, Welsh Government*

<sup>(1)</sup> This includes duplicated vehicles

### Timeliness and punctuality

The data in this release cover April to June 2014 to April to June 2016. The frequency of future updates to this analysis will be decided on depending user responses to our upcoming consultation.

### Accessibility and clarity

This release and headline are available on the [Welsh Governments Statistics website](#).

### Definitions

- See annex C on the area of the **A48(M), M4, M48** used in this article.
- **Morning peak time** is the time between 07:00 to 10:00.
- **Evening peak time** is the time between 16:00 to 19:00.
- **Non-peak times**, excludes the morning and evening peak time (00:00 to 07:00 and 10:00 to 16:00 and 19:00 to 00:00).

### Comparability and coherence

The methodology for developing this analysis has been developed in conjunction with the Department for Transport (DfT). However the Welsh average speed estimates are not comparable to the methodology used by DfT to calculate travel time measures for England. Scotland publishes travel time data using the Scotland's Intelligent Transport Systems (ITS), due to this methodological difference it is not directly comparable to this release. Northern Ireland does not currently publish any travel time statistics. See links for further information:

**England:** [Road congestion and travel times](#)

**Scotland:** [Technology and Traffic Scotland](#)

It should be noted the road structures in Wales differ to those of England, Scotland and Northern Ireland. Any comparisons between countries and local authorities should take into consideration the different road types, lengths, locations and speed restrictions. The individual named roads within Wales should also not be compared, as the flow of traffic on each one differs in quantity.

The analysis in this article differs from that used in the [M4 Corridor Around Newport Public Local Inquiry](#). For example, in the public enquiry evidence the vehicle speeds are presented by junctions whilst this article does not. Annex A provides a junction to local authority lookup for reference. Also, the public enquiry evidence includes vehicle speeds for both cars and LGVs.

## **Well-being of Future Generations Act (WFG)**

The Well-being of Future Generations Act 2015 is about improving the social, economic, environmental and cultural well-being of Wales. The Act puts in place seven well-being goals for Wales. These are for a more equal, prosperous, resilient, healthier and globally responsible Wales, with cohesive communities and a vibrant culture and thriving Welsh language. Under section (10)(1) of the Act, the Welsh Ministers must (a) publish indicators (“national indicators”) that must be applied for the purpose of measuring progress towards the achievement of the Well-being goals, and (b) lay a copy of the national indicators before the National Assembly. The 46 national indicators were laid in March 2016.

Information on the indicators, along with narratives for each of the well-being goals and associated technical information is available in the [Well-being of Wales report](#).

Further information on the [Well-being of Future Generations \(Wales\) Act 2015](#).

The statistics included in this release could also provide supporting narrative to the national indicators and be used by public services boards in relation to their local well-being assessments and local well-being plans.

### **Notes on the use of statistical articles**

Statistical articles generally relate to one-off analyses for which there are no updates planned, at least in the short-term, and serve to make such analyses available to a wider audience than might otherwise be the case. They are mainly used to publish analyses that are exploratory in some way, for example:

Introducing a new experimental series of data;

A partial analysis of an issue which provides a useful starting point for further research but that nevertheless is a useful analysis in its own right;

Drawing attention to research undertaken by other organisations, either commissioned by the Welsh Government or otherwise, where it is useful to highlight the conclusions, or to build further upon the research;

An analysis where the results may not be of as high quality as those in our routine statistical releases and bulletins, but where meaningful conclusions can still be drawn from the results.

Where quality is an issue, this may arise in one or more of the following ways:

- being unable to accurately specify the timeframe used (as can be the case when using an administrative source);
- the quality of the data source or data used; or
- other specified reasons.

However, the level of quality will be such that it does not significantly impact upon the conclusions. For example, the exact timeframe may not be central to the conclusions that can be drawn, or it is the order of magnitude of the results, rather than the exact results, that are of interest to the audience.

The analysis presented does not constitute a National Statistic, but may be based on National Statistics outputs and will nevertheless have been subject to careful consideration and detailed checking before publication. An assessment of the strengths and weaknesses in the analysis will be included in the article, for example comparisons with other sources, along with guidance on how the analysis might be used, and a description of the methodology applied.

Articles are subject to the release practices as defined by the release practices protocol, and so, for example, are published on a pre-announced date in the same way as other statistical outputs.

Missing value symbols used in the article follow the standards used in other statistical outputs, as outlined below.

- .. The data item is not available
- . The data item is not applicable
- The data item is not exactly zero, but estimated as zero or less than half the final digit shown
- \* The data item is disclosive or not sufficiently robust for publication

## Further details

The document is available at:

<http://gov.wales/statistics-and-research/vehicle-speeds-welsh-motorways/?lang=en>

## Next update

We are currently reviewing our outputs and the continuation of this product is dependent on our user feedback.

## We want your feedback

We welcome any feedback on any aspect of these statistics which can be provided by email to [stats.transport@gov.wales](mailto:stats.transport@gov.wales).

## Open Government Licence

All content is available under the [Open Government Licence v3.0](#), except where otherwise stated.



## Annex A – List of junctions and road lengths, by local authority

LACode	RoadName	Junction	Percentage of the road length in LA
Monmouthshire	M4	J23A-J23	100%
Monmouthshire	M4	J23A-J24	10%
New port	M4	J23A-J24	90%
Monmouthshire	M4	J23-J22	100%
Monmouthshire	M4	J23-J23A	100%
Monmouthshire	M4	J24-J23A	8%
New port	M4	J24-J23A	92%
New port	M4	J25A-J25	100%
New port	M4	J25A-J26	100%
New port	M4	J25-J24	100%
New port	M4	J25-J25A	100%
New port	M4	J26-J25A	100%
New port	M4	J26-J27	100%
New port	M4	J27-J26	100%
New port	M4	J27-J28	100%
New port	M4	J28-J27	100%
New port	M4	J28-J29	100%
Cardiff	M4	J29-J30	10%
New port	M4	J29-J30	90%
Cardiff	M4	J30-J29	28%
New port	M4	J30-J29	72%
Cardiff	M4	J30-J32	100%
Cardiff	M4	J32-J30	100%
Cardiff	M4	J32-J33	100%
Cardiff	M4	J33-J32	94%
The Vale of Glamorgan	M4	J33-J32	6%
Cardiff	M4	J33-J34	19%
The Vale of Glamorgan	M4	J33-J34	81%
The Vale of Glamorgan	M4	J34-J33	100%
Rhondda Cynon Taff	M4	J34-J35	91%
The Vale of Glamorgan	M4	J34-J35	9%
Bridgend	M4	J35-J34	6%
Rhondda Cynon Taff	M4	J35-J34	80%
The Vale of Glamorgan	M4	J35-J34	15%
Rhondda Cynon Taff	M4	J35-J36	8%
Bridgend	M4	J36-J35	100%
Bridgend	M4	J36-J37	100%
Bridgend	M4	J37-J36	100%
Bridgend	M4	J37-J38	63%
Neath Port Talbot	M4	J37-J38	37%
Bridgend	M4	J38-J37	41%
Neath Port Talbot	M4	J38-J37	59%
Neath Port Talbot	M4	J38-J40	100%
Neath Port Talbot	M4	J40-J38	100%
Neath Port Talbot	M4	J40-J41	100%
Neath Port Talbot	M4	J41-J40	100%
Neath Port Talbot	M4	J41-J42	100%
Neath Port Talbot	M4	J42-J41	100%
Neath Port Talbot	M4	J42-J43	100%
Neath Port Talbot	M4	J43-J42	100%
Neath Port Talbot	M4	J43-J44	100%
Neath Port Talbot	M4	J44-J43	78%
Sw ansea	M4	J44-J43	22%
Sw ansea	M4	J44-J45	100%
Sw ansea	M4	J45-J44	100%
Sw ansea	M4	J45-J46	100%
Sw ansea	M4	J46-J45	100%
Sw ansea	M4	J46-J47	100%
Sw ansea	M4	J47-J46	100%
Sw ansea	M4	J47-J48	100%
Carmarthenshire	M4	J48-J47	9%
Sw ansea	M4	J48-J47	91%
Carmarthenshire	M4	J48-JEnd	100%
Carmarthenshire	M4	JEnd -J48	100%

## Annex B – Quality assurance undertaken on the data

Each vehicle collects its position (from GPS) data every 10 seconds when the ignition is 'on' and the data are downloaded (via GPRS) to their servers. Prior to receiving the data the following steps are taken to clean the data:

- 1) Filter out low quality GPS data - This removes the GPS data that is deemed either physical impossible (e.g. an impossibly high speed or acceleration) or self-contradictory (e.g. speed/direction travelled does not agree with change in position).
- 2) Interpolate at 1-second intervals – The data are then interpolated to 1-second intervals. This ensures that the GPS data feed into subsequent phases are consistent 1-second frequency, making it much easier to test and ensure correctness.
- 3) Correct GPS-shift errors - This stage initially maps the GPS location to closest road by triangulating the direction travelled.
- 4) Final map-matching phase - This phase map-matches the filtered, interpolated and corrected GPS data using a "restricted and weighted routing algorithm", as follows:
  - a) Draw a time-gap-dependent buffer around the GPS data.
  - b) Identify the road segments that lie within the buffer.
  - c) Assign a weight to each road segment depending on how well the position and direction of the GPS matches the road segment geometry.
  - d) Identify the "clear-winner" GPS points. These are the points that are a very good match for precisely one road segment and a poor match for all other road segments.
  - e) Use Dijkstra's algorithm to calculate the optimal route from the first to last clear-winner GPS point using the weighted road speeds.
  - f) The algorithm allows illegal manoeuvres, but legal routes are favoured to give the driver the benefit of the doubt in ambiguous cases.
  - g) Snap the GPS data to the closest point on the calculated optimal route.
  - h) Check that the snapped GPS data are both spatially and temporally consistent with the calculated optimal route.
  - i) If there are any inconsistencies, use a binary chop algorithm to split the GPS into sections that can be map-matched consistently.
  - j) Note that each section can have one or more unmatched (i.e. off-network) GPS points at the start and end of the journey.
  - k) Insisting on beginning and ending at a clear winner prevents from falsely matching off-network driving (e.g. driving in car parks) at the start and end of the journey.

# Annex C – Map of the motorways in Wales

**WALES  
CYMRU**

**Motorways  
Traffyrdd**

