

Adran yr Economi a'r Seilwaith
Department for Economy and Infrastructure



Llywodraeth Cymru
Welsh Government

This document is an update to the ‘Proof of Evidence – Traffic’ document WG 1.2.1 Rev A. It contains a scheme evidence update following the recent Department for Transport announcement that tolls on the Severn Crossings will be removed by the 31st December 2018.

Scheme Evidence Update

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Document Reference: WG 1.2.7

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1. AUTHOR

- 1.1 My name is Bryan Whittaker. I am a Director of WSP Group, a multi-disciplinary consultancy where I have responsibility for strategic transport modelling and appraisal for the UK. My professional qualifications are as set out in my Revised Proof of Evidence (WG 1.2.1 Rev A) submitted to the Public Local Inquiry as WG 1.2.6 and not repeated here.
- 1.2 The evidence, which I have prepared and provided in this Scheme Evidence Update, is true and I confirm that the opinions expressed are my true and professional opinions.

2. SCOPE AND PURPOSE OF THIS SCHEME EVIDENCE UPDATE

- 2.1 My Revised Proof of Evidence WG 1.2.1 Rev A was produced following the March 2016 Budget in which the UK Government announced its intent to retain tolls on the Severn Crossings at half of their current values. The Revised Proof of Evidence documented the M4CaN transport model base year and future year model development together with and forecast year model outputs based on the assumption that the tolls would be retained in future years at half of the current values, consistent with the Government's announcement.
- 2.2 Subsequently, in January 2017, the UK Government published a Consultation Document on the future of the Severn Crossing Tolls. That document set out the UK Governments proposals for the future of the Severn Crossing Tolls and continued to suggest that the tolls would be a half of the current value.
- 2.3 During the lead up to the 8th June General Election however, most of the major political parties in the UK however indicated their intention to remove the tolls from the Severn Crossings. Subsequently, a letter written on the 7th August by the Parliamentary Under Secretary of State for Transport confirmed that all tolls would end on the Severn Crossings by 31st December 2018. The final outcome and Government response to the Severn Crossing tolls consultation was published on the 15th September 2017. Hence, no tolls will be in place upon scheme opening.

2.4 This Scheme Evidence Update reports the changes to the Traffic Revised Proof of Evidence WG 1.2.1 Rev A (submitted to the Public Local Inquiry as WG 1.2.6) arising from the change in toll scenario. The sections of the Revised Proof which are affected as follows;

- 1) Section 9.6 (Severn Crossing Tolls)
- 2) Section 10 (Model Forecasts)
- 3) Section 11 (Journey Times)
- 4) Section 16 (Conclusions)

3. SCHEME EVIDENCE UPDATE

3.1. Severn Crossing Tolls

- 3.1.1. The traffic model network includes the two Severn River Crossings (the M48 Bridge and the M4 Second Severn Crossing), that provide a link between Wales and South West England. Both these bridges are currently tolled in the westbound direction via the toll booths located at Aust on the first Severn Bridge and on the approach to Magor for the Second Severn Crossing. The tolls are taken into account in the base year model through a monetary penalty (in 2014 prices) to represent the toll charge for each of the different vehicle types and a time penalty to represent the delay occurred at the toll booths.
- 3.1.2. My Revised Proof of Evidence assumed that for forecasting, a half toll representing the cumulative changes announced in the 2015 and 2016 Budgets would be in place in future years. Since then, it is now the UK Governments intention to end the tolls. A letter written on the 7th August 2017 by the Parliamentary Under Secretary of State for Transport confirmed that the current tolls would end on the Severn Crossings by the 31st December 2018. The final outcome and Government response to the Severn Crossing Tolls consultation was released on the 15th September 2017.
- 3.1.3. As a consequence of the above, tolls have now been removed from the transport model, the consequence of which is a change in the future year forecast model results and these are provided below in subsequent sections of this Scheme Evidence Update.

3.2. Model Forecasts

Overview

- 3.2.1. Accordingly, revised traffic forecasting in respect of the Core Scenario (Draft Supplementary Scheme Order (No 2) dated March 2017) has been undertaken for the forecast years of 2022, 2037 and 2051 with the half tolls that had previously been applied now removed from the Severn Crossings.
- 3.2.2. In practice, the full effect of the removal of the toll on traffic demand will take a number of years to play out. The issue of the timing of a demand response is amplified by the fact that removing the tolls results in a large change in generalised cost (as compared generally to highway improvement schemes). Therefore, there is good reason to believe that the traffic response to this change depends, to a greater degree than is usually the case, on longer-term behavioural responses such as those involving behavioural, labour market or land use changes.
- 3.2.3. TAG Unit M2 characterises the fuel cost elasticity of -0.3 as broadly reflective of a 10-year demand response. At five years, WebTAG suggests an elasticity of -0.2. By inference, two-thirds of the long term demand response is realised in the first five years after the change in travel cost. By the scheme-opening year of 2022, the removal of the toll will have been in place 5 years.
- 3.2.4. In view of this, it is appropriate to apply a 'ramp up' factor to the forecast traffic response to the removal of the toll. Reflecting the evidence in WebTAG, a ramp up factor of 0.67 has been applied (such that the actual response is two thirds of the model response). By the design year of 2037, the changes resulting from the toll removal will have been in place many years. Therefore, no such 'ramp up' factor was necessary in the design year.

3.2.5. The output matrices resulting from variable demand modelling varies between the Base and the Do-Minimum and the Do-Minimum and Do-Something scenarios in respect of changes in the total number of trips, vehicle kilometres travelled and total network hours across the modelled area. The relative changes in trips, kilometres and hours travelled between scenarios as follows;

Table 1: Changes in Trips in the Core Scenario

Year	Scenario	Change in trips		
		AM	IP	PM
2022	Base to DM	+6.6%	+8.2%	+6.6%
2022	DM to DS	+0.0%	+0.1%	+0.0%
2037	Base to DM	+21.5%	+24.8%	+21.2%
2037	DM to DS	+0.1%	+0.1%	+0.1%
2051	Base to DM	+30.3%	+33.6%	+30.2%
2051	DM to DS	+0.1%	+0.0%	+0.1%

Table 2: Changes in Vehicle-Kilometres in the Core Scenario

Year	Scenario	Change in Veh-Km		
		AM	IP	PM
2022	Base to DM	+11.4%	+12.8%	+11.5%
2022	DM to DS	+0.0%	-0.1%	-0.1%
2037	Base to DM	+31.5%	+35.1%	+31.9%
2037	DM to DS	+0.3%	+0.2%	+0.1%
2051	Base to DM	+42.1%	+47.2%	+43.1%
2051	DM to DS	+0.9%	-0.0%	+0.7%

Table 3: Effects of VDM on Vehicle-Hours in the Core Scenario

Year	Scenario	Effects on Veh-hours		
		AM	IP	PM
2022	Base to DM	+13.0%	+13.9%	+13.1%
2022	DM to DS	-0.7%	-0.4%	-0.6%
2037	Base to DM	+44.3%	+38.9%	+43.6%
2037	DM to DS	-1.3%	-0.7%	-0.9%
2051	Base to DM	+68.9%	+54.1%	+66.9%
2051	DM to DS	-0.4%	-1.3%	-0.4%

- 3.2.6. There is an increase in the number of trips between the base year and forecast Do-Minimum largely resulting from traffic growth, together with an increase arising from redistribution effects that result from the removal of the toll charge across the Severn Crossings. Slightly counteracting this is a modal shift response from private to public transport as people respond to changes in highway network congestion. The difference in highway trips between the Do-Minimum and Do-Something in the forecast years captures the modal shift response that is to result directly from the introduction of the scheme. As the Do-Something also includes the reclassification of the existing M4, this also impacts on modal shift.
- 3.2.7. The increase in vehicle-kilometres between the base year and Do-Minimum in the forecast years is forecast to be higher than the growth in the number of trips because of average trip lengths increasing over time, in the main because of the removal of the tolls across the Severn Crossings. This response also reflects the reducing cost of car travel in real terms arising from increased fuel efficiency and increases in average income level in the future. The difference in highway vehicle-kilometres between Do Minimum and Do Something captures the overall distance changes that occur as the result of the scheme. There are a number of trips experiencing shorter journeys on the motorway around Newport as a result of reassignment, however there are also a number of trips experiencing an increase in trip length that are a consequence of redistribution as travellers take advantage of the reduced levels of congestion in the Do-Something scenario. Therefore, in some periods and years, vehicle kilometre savings are achieved despite the number of trips increasing slightly and trips lengthening in response to the Scheme.

3.2.8. The increase in vehicle-hours between the base year and the forecast Do-Minimum is forecast to be slightly higher than the growth in the number of vehicle kilometres. By 2037 and 2051, this difference is forecast to be significant. This illustrates the increasing levels of traffic congestion predicted to result from general traffic growth. A slight decrease in vehicle hours is predicted between the Do-Minimum and Do-Something scenarios in all three forecast years. This is despite a small increase in the total number of highway trips and a greater increase in total vehicle kilometres.

Forecast Traffic Flows

3.2.9. The removal of the toll increases the demand for travel across the Severn Crossings and thereby increases the traffic flow on all M4 Motorway sections in both the Do-Minimum and Do Something scenarios in both scheme opening year and design year. However, the greatest increases arising from the toll removal occurs between Junctions 23 and 23a, which then diminish the further the travel distance from Junction 23 as shown in the Tables below.

Table 4: Do-Minimum 2037

TWO-WAY		Mar-17 Half Toll				Mar-17 No Toll				Difference			
		DM08				DM08							
		AM	IP	PM	AADT	AM	IP	PM	AADT	AM	IP	PM	AADT
J23A-J23		8795	7186	8859	107072	9856	8259	9140	118876	12%	15%	3%	11%
J24-J23A	Coldra-Magor	8638	7091	8596	105056	9226	7749	8636	111661	7%	9%	0%	6%
J25-J24	Caerleon-Coldra	10293	8446	10150	124858	10414	8795	10049	127343	1%	4%	-1%	2%
J25A-J25		9432	7856	9123	114644	9640	8166	8978	117006	2%	4%	-2%	2%
J26-J25A	Brynglas Tunnel	7137	6171	7156	89132	7255	6361	7027	90414	2%	3%	-2%	1%
J27-J26	Malpas Straight	10793	8752	10586	130023	10842	8898	10444	130735	0%	2%	-1%	1%
J28-J27	Tredegar Pk-High Cross	11137	8417	10339	128034	11180	8545	10163	128494	0%	2%	-2%	0%
J29-J28	Castleton-Tredegar Pk	11670	8663	11793	136166	11723	8753	11630	136437	0%	1%	-1%	0%
New M4	west of Magor	0	0	0	0	0	0	0	0				
New M4	Docks to Glan Llyn	0	0	0	0	0	0	0	0				
New M4	west of Docks	0	0	0	0	0	0	0	0				

Table 5: Do-Something 2037

TWO-WAY		Mar-17 Half Toll				Mar-17 No Toll				Difference			
		DM08				DM08							
		AM	IP	PM	AADT	AM	IP	PM	AADT	AM	IP	PM	AADT
J23A-J23		3980	3009	3877	46354	4317	3527	3860	50981	8%	17%	0%	10%
J24-J23A	Coldra-Magor	4169	2968	4033	47189	4396	3317	4019	50303	5%	12%	0%	7%
J25-J24	Caerleon-Coldra	6582	4698	5890	73050	6668	4876	5912	74625	1%	4%	0%	2%
J25A-J25		3890	3072	3425	45033	3932	3160	3408	45723	1%	3%	0%	2%
J26-J25A	Brynglas Tunnel	5132	3977	4591	59118	5156	4051	4527	59504	0%	2%	-1%	1%
J27-J26	Malpas Straight	8113	5555	7461	89053	8107	5542	7373	88660	0%	0%	-1%	0%
J28-J27	Tredegar Pk-High Cross	8138	5140	7045	84924	8064	5100	6938	84065	-1%	-1%	-2%	-1%
J29-J28	Castleton-Tredegar Pk	7434	4634	7049	79133	7399	4552	6910	78000	0%	-2%	-2%	-1%
New M4	west of Magor	6004	4954	6105	73615	6567	5473	6276	79599				
New M4	Docks to Glan Llyn	5946	4820	5865	71725	6361	5227	5842	75822				
New M4	west of Docks	5364	4499	5805	67405	5564	4791	5743	69874				

3.2.10. In the Do-Minimum, the two-way AADT in 2037 through Brynglas Tunnel is 90,400 comprising:

- a) 53% two-way through traffic travelling between east of J23 and west of J29;
- b) 13% two-way traffic joining or leaving at Junctions 28, 27 and 26 travelling through the tunnels to the east of J23a;
- c) 23% two-way traffic travelling from west of J28 through the tunnels and joining or leaving at J24 or J23a and;
- d) 12% two-way traffic both joining and leaving between Junctions 23 and 29.

- 3.2.11. In the Do-Something with the scheme in place, the two-way AADT through Brynglas Tunnels reduces from 90,400 to 59,500 comprising:
- a) 3% two-way through traffic travelling between east of J23 and west of J29;
 - b) 19% two-way traffic joining or leaving at Junctions 28, 27 and 26;
 - c) 41% two-way traffic travelling from west of J28 through the tunnels and joining or leaving at J24 or 23a;
 - d) 37% two-way traffic both joining and leaving between junctions 23 and 29.

3.2.12. The AADT two-way flows on the proposed scheme in 2037 are;

- 1) West of Magor - 79,600
- 2) Docks to Glan Llyn - 75,800
- 3) West of Docks – 69,850

The forecast traffic flow on the proposed scheme between Docks Junction and Glan Llyn (River Usk Crossing), comprising;

- a) 65% through traffic travelling the whole length of proposed new section of motorway between Junctions 23 and 29,
- b) 15% two-way traffic joining or leaving at Docks Junction and using proposed new section of motorway to east of J23,
- c) 13% two-way traffic joining or leaving at Glan Llyn/Magor Junctions and using proposed new section of motorway to west of J29'
- d) 7% two-way traffic travelling between Docks Junction and Glan Llyn/Magor Junctions on proposed new section of motorway.

3.2.13. The Scheme impacts on journey times throughout the network. The Tables below shows the journey times between Junction 30 and the M4 Toll Plaza in both the 'Half-Toll' and 'No Toll' scenario's. In practice, traffic travelling the full length of M4 between Junction 30 and the Second Severn Crossing would use the new motorway. Traffic travelling along the existing M4 when the new M4 is in place, would therefore only be travelling on part of the route between Junctions 23 and 29.

Table 6: Journey Times between Junction 30 and M4 Toll Plaza (min:sec)

Half Toll

Direction	Time	Route	2022		2037		2051	
			Central Growth		Central Growth		Central Growth	
			Do Minimum	Do Something	Do Minimum	Do Something	Do Minimum	Do Something
Eastbound	AM	Via existing M4	19:30	18:59	24:23	19:55	28:00	20:50
	IP		17:30	17:54	19:34	18:26	22:10	18:49
	PM		18:04	18:09	20:51	18:55	23:02	19:27
	AM	Via proposed new motorway		15:03		16:03		16:35
	IP			14:50		15:29		15:49
	PM			14:53		15:34		15:51
Westbound	AM	Via existing M4	19:56	18:23	23:19	20:16	26:08	21:37
	IP		17:12	17:08	18:08	17:54	18:53	18:11
	PM		19:33	18:28	24:04	19:57	27:22	21:08
	AM	Via proposed new motorway		15:35		16:38		17:29
	IP			14:40		15:11		15:30
	PM			15:32		16:38		17:27

Table 7: Journey Times between Junction 30 and M4 Toll Plaza (min:sec)

No Toll

Direction	Time	Route	2022 Central Growth		2037 Central Growth		2051 Central Growth	
			Do Minimum	Do Something	Do Minimum	Do Something	Do Minimum	Do Something
Eastbound	AM	Via existing M4	20:19	19:02	26:07	19:53	29:25	20:44
	IP		17:53	17:55	20:26	18:27	23:19	18:47
	PM		18:33	18:12	21:53	19:00	24:04	19:27
	AM	Via proposed new motorway		15:23		16:33		17:02
	IP			15:11		15:58		16:19
	PM			15:09		15:58		16:19
Westbound	AM	Via existing M4	20:34	18:36	24:57	20:56	27:27	22:12
	IP		17:29	17:15	18:38	18:03	19:30	18:34
	PM		20:26	19:49	23:42	21:07	26:17	21:57
	AM	Via proposed new motorway		15:52		17:03		17:53
	IP			14:51		15:29		15:49
	PM			15:51		16:42		17:23

3.2.14. In the half toll case, journey times in 2022 along the existing M4 north of Newport when the proposed scheme is in place decrease at peak times in both directions. The exception to this is eastbound in the PM peak, which experiences an insignificant increase of 5 seconds. A slight increase in journey time also occurs during the Inter-Peak in the eastbound direction of 24 seconds, which is followed by reductions in subsequent years as traffic growth occurs. By 2037, the journey time analysis shows that travel times along the existing M4 would decrease in both directions at all times of the day with the largest decreases eastbound in the AM and westbound in the PM by up to 4.5 minutes.

- 3.2.15. Through traffic, using the proposed new section of motorway to travel east - west between Magor and Castleton would experience more significant journey time savings due to the shorter distance and reduced congestion levels. During the inter-peak, the time savings in comparison to the Do-Minimum would be expected to be around 2.5 to 3.5 minutes in 2022, increasing to between 3 and 4 minutes by 2037 and between 3 and 6 minutes in 2051, and the greatest savings being in the eastbound direction. During the peak hours, the journey time savings could be expected to be between 3 to 5 minutes in 2022, increasing to between 5.5 and 8 minutes in 2037, rising to be between 7 and 11.5 minutes in 2051. Both eastbound and westbound directions in 2037 and 2052 experience a similar level of saving.
- 3.2.16. In the no toll case, journey times in 2022 along the existing M4 north of Newport when the proposed scheme is in place decreases in all time periods in both eastbound and westbound directions and in all years. The only exception is in 2022 in the Inter-Peak in the eastbound direction, which increases by 2 seconds. In 2037, the largest decrease in journey time in the eastbound direction occurs in the AM and is in the order of 6 minutes. The largest decrease in the westbound direction is again in the AM and is in the order of 4 minutes.

3.2.17. Through traffic using the new section of motorway to travel east-west between Magor and Castleton would experience significantly higher journey time savings due to the shorter distance and reduced congestion levels. In 2037, the time savings provided by the proposed scheme in comparison to the Do-Minimum in the eastbound direction are in the order of 9.5 minutes in the AM, 4.5 minutes in the Inter-Peak and 6.0 minutes in the PM. In the westbound direction, the time savings are in the order of 8.0 minutes in the AM, 3.0 minutes in the Inter-Peak and 7.0 minutes in the PM. In 2051 in the eastbound direction, the time savings provided by the scheme are in the order of 12 minutes in the AM, 7 minutes in the inter-peak and 8 minutes in the PM. In the westbound direction, the time savings are 9.5 minutes in the AM, 4 minutes in the inter-peak and 9 minutes in the PM.

4. CONCLUSIONS

- 4.1 Evidence previously provided to the Public Local Inquiry on matters of traffic forecasts assumed that for forecasting, a half toll representing the cumulative changes announced in the 2015 and 2016 Budgets would be in place in future years. Since then, the Parliamentary Under Secretary of State for Transport confirmed on the 7th August that tolls would cease on the Severn Crossing by the 31st December 2018. The final outcome and Government response to the Severn Crossing Tolls Consultation was released on the 15th September 2017.
- 4.2 Removal of the Severn Crossing Toll results in a significant change in ‘the ‘generalised cost’ of travel across the Crossings that makes travel across the Crossings more attractive leading to behavioral changes in current trip making through trip reassignment and redistribution effects. However, the further distance from the Severn Crossing, a diminishing effect in behavioral change occurs.
- 4.3 As a direct consequence of the removal of the toll, increased traffic is experienced on the existing M4 north of Newport bringing about increasing congestion, slower speed of travel and increasing journey times. With the proposed scheme in place, increased flows are experienced on the proposed scheme, but the impacts on speed of travel and journey time are marginal on the proposed scheme where adequate capacity is provided. As a result, the time savings that the proposed scheme provide are greater than those provided in the half toll scenario. Accordingly, in traffic terms the removal of the tolls strengthens the case for the proposed scheme.