

A417 Missing Link
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8.15 Leckhampton Hill
Technical Note

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A417 Missing Link

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Leckhampton Hill Technical Note

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Table of contents

	Pages
1 Introduction	1
2 Traffic flows	2
2.2 2026 traffic flows	3
2.3 2041 traffic flows	5
3 Journey times and junction delay	7
3.2 Journey times via A435	9
3.3 Journey times via Leckhampton Hill	10
4 Environmental impacts	11
5 Conclusion	12

Table of Figures

Figure 2-1	Location of traffic counts	3
Figure 3-1	Journey time routes – to/from Cheltenham	7

Table of Tables

Table 2-1	2015 Base year and 2026 forecast traffic flows	3
Table 2-2	2015 Base year and 2041 forecast traffic flows	5
Table 3-1	Distances for the two journey time routes	8
Table 3-2	2026 Journey times – A417 to/from Cheltenham	8
Table 3-3	2041 Journey times – A417 to/from Cheltenham	8
Table 3-4	2026 Total junction delay – A417 to/from Cheltenham	9
Table 3-5	2041 Total junction delay – A417 to/from Cheltenham	9

1 Introduction

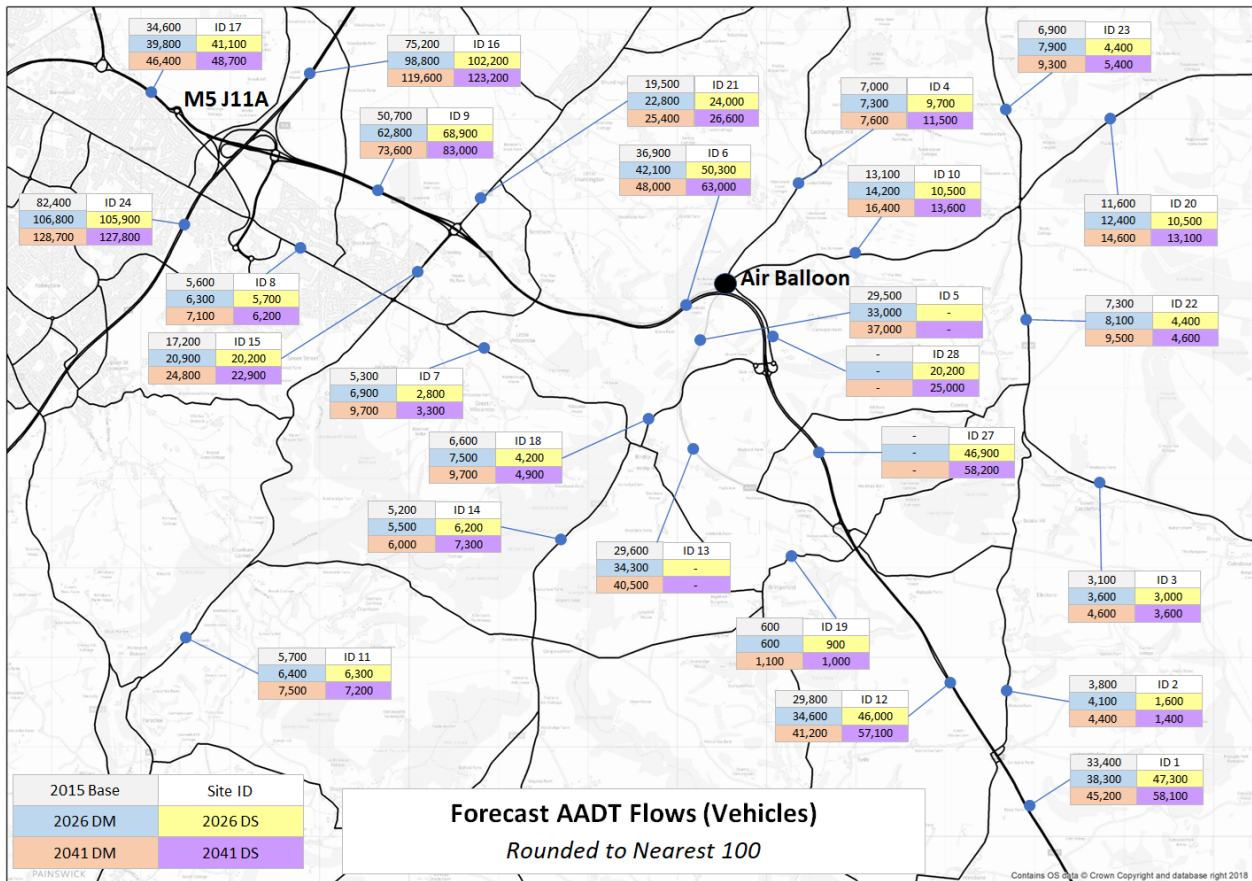
- 1.1.1 This technical note has been produced by National Highways in response to the Examining Authority's Written Questions (ExQ1, PD-008) question 1.11.20:
- “Paragraph 7.3.27 of the Transport Report [APP-426] states that Leckhampton Hill would experience an increase in traffic as a result of the Proposed Development. Appendix J to the ComMA [APP-7422] report does not provide great detail on this. Provide a Technical Note describing the effects upon traffic flow, queue, delay and overall performance of Leckhampton Hill as a result of the proposed new Ullenwood roundabout junction and whether any effects are considered to be adverse or severe in nature compared to the current baseline.”*
- 1.1.2 The Combined Modelling and Appraisal (ComMA) Report (Document Reference 7.63, APP-422) sets out the situation for the A417 Missing Link, hereafter referred to as the 'Existing A417', in terms of traffic flows, accidents and the alternative mode assessment. It then discusses the development of the base scheme traffic model, the development of the forecast scheme traffic models and the methodology and results of the economic appraisal of the scheme. The Transport Report (Document Reference 7.10, APP-426) provides a summary of the contents of the ComMA Report and the impacts in terms of traffic flows and journey times relating to the scheme on the local and wider road networks. Section 10.7 and 11.4 of the ComMA Report set out the calculation of annual average daily traffic (AADT) and annual average weekday traffic (AAWT) and how these feed into the environmental impact assessment of the scheme.
- 1.1.3 The traffic effects of the scheme from an environmental perspective are presented in the environmental impact assessment in certain chapters, namely Environmental Statement (ES) Chapter 5 Air quality (Document Reference 6.2, APP-036), ES Chapter 11 Noise and vibration (Document Reference 6.2, APP-042), ES Chapter 13 Road drainage and water environment (Document Reference 6.2, APP-044) and ES Chapter 14 Climate (Document Reference 6.2, APP-045). These assessments require traffic flow and speed data inputs taken from the scheme traffic models (which are presented in the ComMA Report (Document Reference 7.6, APP-422) and Transport Report (Document Reference 7.10, APP-426)).
- 1.1.4 This technical note uses the scheme traffic model to provide information in relation to traffic flows, journey times and delays to describe the impact that Ullenwood junction has on Leckhampton Hill. This is based on the information provided in the ComMA Report (Document Reference 7.6, APP-422) and the Transport Report (Document Reference 7.10, APP-426) (traffic flows, queues and delays) together with a small amount of additional information relating to the overall performance of Leckhampton Hill in the form of forecast journey time data taken from the scheme traffic model.
- 1.1.5 Analysis is presented from the base year model scenario, the forecast year Do-Minimum (DM) scenario and forecast year Do-Something (DS) scheme scenario traffic models. This is shown in terms of traffic flows on key local roads, journey times to/from Cheltenham via Leckhampton Hill and the A435 and junction delays.
- 1.1.6 For information, Air Balloon roundabout refers to the existing Air Balloon roundabout that provides a connection between the A417 and the A436. To the

east of Air Balloon roundabout is the existing junction between the A436 and Leckhampton Hill. Ullenwood junction refers to the new roundabout that is constructed as part of the scheme and replaces the Air Balloon roundabout and A436/Leckhampton Hill junction.

- 1.1.7 The Air Balloon roundabout is a key point of congestion on the Existing A417 and therefore any improvements to this junction would likely have an impact on the roads connecting to the roundabout.
- 1.1.8 With the scheme in place the Ullenwood junction replaces the Air Balloon roundabout and the A436/Leckhampton Hill junction and has two advantages over the Air Balloon roundabout. These being the A417 mainline traffic bypasses this junction, and that Ullenwood junction has been designed based on the 2041 forecast traffic flows. Given these changes there are likely to be impacts on traffic on Leckhampton Hill due to the improved access to the A417 and the wider area to the south the changes provide.
- 1.1.9 Although there would be increases in traffic on Leckhampton Hill, there would be wider traffic and economic related benefits of the scheme. These are outlined in the Transport Report (Document Reference 7.10, APP-426) with more details contained in the ComMA Report (Document Reference 7.6, APP-422).

2 Traffic flows

- 2.1.1 Traffic flows have been extracted from the scheme traffic models for the base year of 2015 and the forecast DM and DS scenarios for the modelled scheme opening year of 2026 and the design year of 2041 for the AM and PM average hour models. Annual Average Daily Traffic (AADT) flows are also provided, of which further details on these are in the ComMA Report (Document Reference 7.6, APP-422). The location of the counts referred to in the following sections are shown in Figure 2-1. The ID in the table refers to the ID located in each table in Figure 2-1.



Source: National Highways

Figure 2-1 Location of traffic counts

2.2 2026 traffic flows

2.2.1 AM and PM average hour and AADT traffic flows are provided for the base year (2015) and 2026 in Table 2-1. The counts presented are those that are relevant to Leckhampton Hill and the A435.

Table 2-1 2015 Base year and 2026 forecast traffic flows

ID	Location	Direction	Period	Base year (2015)	Do-Minimum (2026)	Do-Something (2026)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
23	A435 north of A436	NB	AM	336	361	235	25	-101	-126
			PM	455	486	335	31	-120	-151
		SB	AM	382	451	198	69	-184	-252
			PM	287	336	183	49	-104	-154
	Two-way	AADT	6,910	7,926	4,445	1,016	-2,465	-3,481	
22	A435 south of A436	NB	AM	300	324	208	24	-92	-116
			PM	471	484	291	12	-180	-192
		SB	AM	396	471	191	75	-205	-280
			PM	309	373	152	64	-156	-221
	Two-way	AADT	7,318	8,075	4,384	757	-2,933	-3,690	
20	A436 east of	EB	AM	443	484	441	41	-2	-42

ID	Location	Direction	Period	Base year (2015)	Do-Minimum (2026)	Do-Something (2026)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
	A435	WB	PM	384	439	383	55	-1	-56
			AM	369	411	368	42	-1	-43
			PM	477	492	504	14	27	13
		Two-way	AADT	11,647	12,414	10,539	767	-1,108	-1,875
10	A436 west of A435	EB	AM	570	617	464	46	-106	-153
			PM	463	541	414	78	-50	-128
		WB	AM	430	467	369	37	-61	-98
			PM	573	578	530	5	-43	-48
		Two-way	AADT	13,130	14,249	10,542	1,120	-2,587	-3,707
4	Leckhampton Hill	NB	AM	430	370	445	-61	15	75
			PM	265	335	336	70	71	1
		SB	AM	262	248	458	-15	195	210
			PM	324	249	559	-75	235	310
		Two-way	AADT	6,981	7,333	9,681	352	2,700	2,347
2	Elkstone village	NB	AM	154	176	86	23	-67	-90
			PM	254	259	142	4	-112	-117
		SB	AM	188	199	54	11	-134	-145
			PM	151	174	40	22	-111	-133
		Two-way	AADT	3,775	4,064	1,644	289	-2,131	-2,421
3	A435	NB	AM	125	127	116	2	-9	-11
			PM	188	206	190	19	2	-16
		SB	AM	198	257	171	59	-27	-86
			PM	135	178	122	43	-12	-55
		Two-way	AADT	3,107	3,587	2,981	479	-126	-606
21	A46, north of A417	NB	AM	949	987	1,021	38	72	34
			PM	884	964	1,066	80	182	103
		SB	AM	843	1,013	1,033	170	190	20
			PM	1,003	1,128	1,065	125	62	-63
		Two-way	AADT	19,519	22,766	23,954	3,247	4,435	1,187

Note: Discrepancies of 1 in the change columns are due to the rounding of traffic flow numbers

2.2.2 As shown in Table 2-1 between the base year and 2026 DM scenario there would be an overall increase in traffic on the roads presented in Table 2-1. The exception to this is Leckhampton Hill where the northbound AM and southbound AM and PM average hour traffic flows would decrease. This decrease in traffic on Leckhampton Hill would be due to increased congestion and delays at the Air Balloon roundabout. Table 3-4 provides 2026 total junction delays and this shows that for the route via Leckhampton Hill there is an increase in total junction delay between the base year and 2026 DM scenario for northbound AM and southbound AM and PM average hours.

2.2.3 Between the base year and DS 2026 scenario there would be an overall decrease in traffic on the majority of local roads as a result of the scheme. The exceptions to this are Leckhampton Hill and A46 north of the A417 for northbound and

southbound AM and PM average hour where the scheme traffic models forecast there would be an increase in traffic in comparison to the base year.

- 2.2.4 Between the DM 2026 and DS 2026 scenarios the scheme traffic model forecasts there would be an overall decrease in traffic on the majority of the local roads as a result of the scheme. The exceptions to this are Leckhampton Hill for both directions and AM and PM average hours and for the A46 north of the A417¹ for northbound AM and PM average hour and southbound AM average hour where the scheme traffic model forecasts there would be an increase in traffic between the DM and DS scenario.
- 2.2.5 The reductions in traffic on the A435 north of the A436 are comparable to the increases on Leckhampton Hill and the A46 north of the A417. This indicates that traffic would reassign to the A417 and access Cheltenham either by Leckhampton Hill or the A46 whereas in the base and DM scenario vehicles would travel via the A435.

2.3 2041 traffic flows

- 2.3.1 AM and PM average hour and AADT traffic flows are provided for the base year (2015) and 2041 in Table 2-2. The counts presented are those that are relevant to Leckhampton Hill and the A435.

Table 2-2 2015 Base year and 2041 forecast traffic flows

ID	Location	Direction	Period	Base year (2015)	Do-Minimum (2041)	Do-Something (2041)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
23	A435 north of A436	NB	AM	336	436	319	101	-17	-118
			PM	455	539	350	84	-104	-189
		SB	AM	382	506	269	124	-113	-238
			PM	287	450	280	163	-7	-170
		Two-way	AADT	6,910	9,266	5,376	2,356	-1,534	-3,890
22	A435 south of A436	NB	AM	300	396	225	96	-74	-170
			PM	471	541	256	69	-215	-285
		SB	AM	396	530	220	134	-176	-309
			PM	309	488	184	179	-125	-304
		Two-way	AADT	7,318	9,488	4,646	2,170	-2,672	-4,842
20	A436 east of A435	EB	AM	443	570	531	127	88	-39
			PM	384	484	452	100	67	-32
		WB	AM	369	464	420	95	51	-43
			PM	477	567	620	90	143	53
		Two-way	AADT	11,647	14,557	13,060	2,910	1,413	-1,497
10	A436 west of A435	EB	AM	570	699	614	129	44	-85
			PM	463	591	512	128	48	-80
		WB	AM	430	507	456	76	26	-51

¹ National Highways acknowledge that paragraph 7.3.27 of the Transport Report (Document Reference 7.6, APP-426) does not include a reference to increases on the A46 north of the A417 as an exception to decreases, but there is a small increase in traffic as a result of the scheme

ID	Location	Direction	Period	Base year (2015)	Do-Minimum (2041)	Do-Something (2041)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
			PM	573	665	691	92	118	26
			Two-way	AAADT	13,130	16,437	13,566	3,307	436
4	Leckhampton Hill	NB	AM	430	295	511	-136	81	217
			PM	265	310	431	45	166	120
		SB	AM	262	241	511	-21	249	270
			PM	324	150	621	-174	297	471
		Two-way	AAADT	6,981	7,639	11,544	658	4,563	3,905
2	Elkstone village	NB	AM	154	207	82	53	-71	-125
			PM	254	267	103	13	-152	-165
		SB	AM	188	197	38	9	-151	-160
			PM	151	233	41	82	-110	-192
		Two-way	AAADT	3,775	4,446	1,365	671	-2,410	-3,082
3	A435	NB	AM	125	165	137	40	12	-28
			PM	188	258	221	70	33	-37
		SB	AM	198	317	223	119	25	-94
			PM	135	231	157	96	22	-74
		Two-way	AAADT	3,107	4,580	3,644	1,473	537	-936
21	A46, north of A417	NB	AM	949	1,081	1,111	132	162	30
			PM	884	1,064	1,150	180	266	86
		SB	AM	843	1,127	1,115	284	271	-13
			PM	1,003	1,281	1,192	278	189	-89
		Two-way	AAADT	19,519	25,366	26,619	5,848	7,100	1,252

Note: Discrepancies of 1 in the change columns are due to the rounding of traffic flow numbers

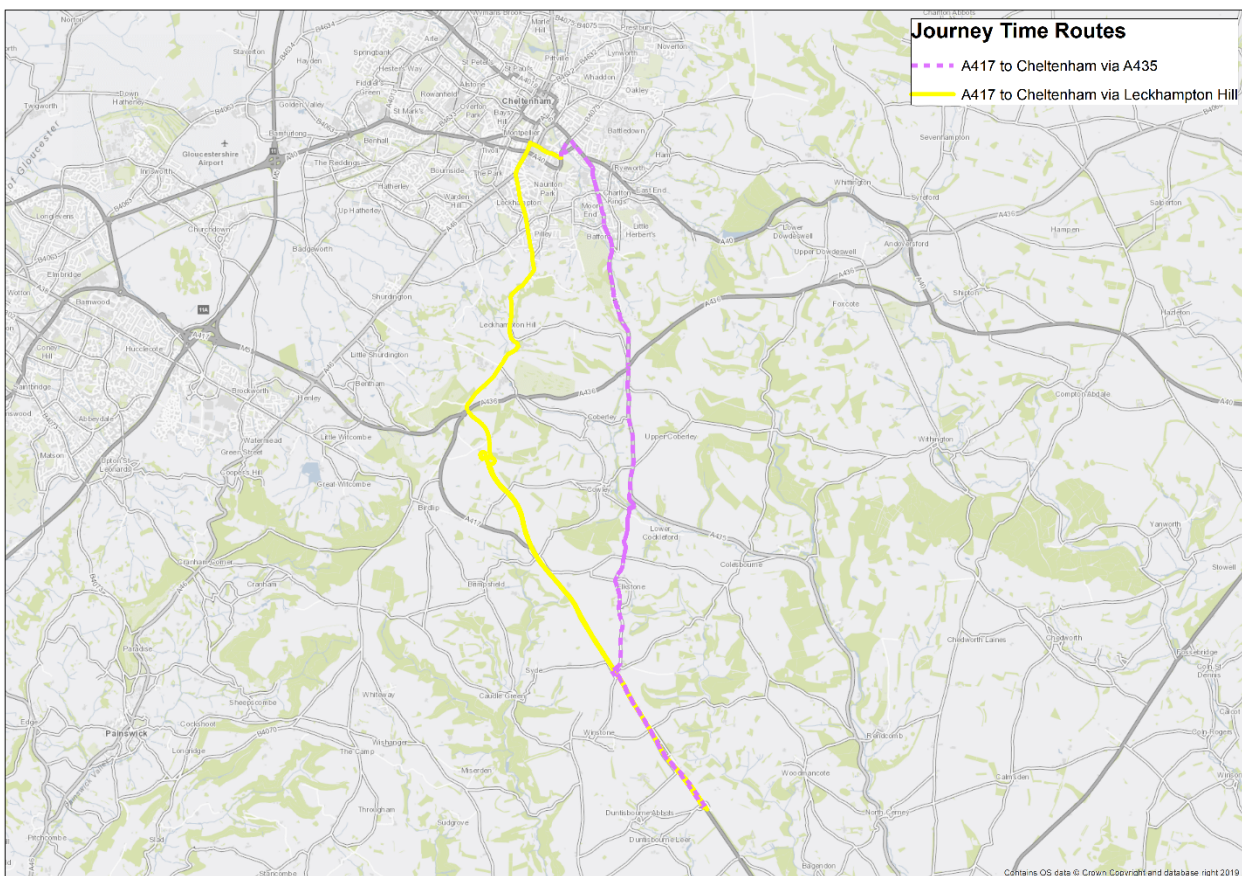
- 2.3.2 As shown in Table 2-2 between the base year and the 2041 DM scenario there would be an overall increase in traffic at the locations shown. The exception to this is Leckhampton Hill where the AM average hour northbound and AM and PM average hour southbound traffic flows would decrease. This decrease in traffic on Leckhampton Hill would be due to increased congestion and delays at the Air Balloon roundabout. Table 3-5 shows 2041 total junction delays and this shows that for the route via Leckhampton Hill there is an increase in total junction delay between the base year and 2041 DM scenario for northbound and southbound AM and PM average hours.
- 2.3.3 Between the base year and the DS 2041 scenario only the A435 north and south of the A436 and the road through Elkstone village would have a decrease in forecast traffic. All other links would have an increase in forecast traffic between the base year and DS 2041 scenario. Overall, the difference between the base and the DS scenario is lower than between the base year and the DM scenario.
- 2.3.4 Between the DM and DS 2041 scenarios the scheme traffic model forecasts there would be decreases on all the roads in Table 2-2, except for Leckhampton Hill and the A46 north of the A417 northbound where the scheme traffic model forecasts these two roads would have an increase in traffic as a result of the scheme.

2.3.5 The reductions in traffic on the A435 north of the A436 are comparable to the increases on Leckhampton Hill and the A46 north of the A417. This indicates that traffic would reassign to the A417 and access Cheltenham either by Leckhampton Hill or the A46 whereas in the base and DM scenario vehicles would travel via the A435.

3 Journey times and junction delay

3.1.1 The Air Balloon roundabout is a key point of congestion on the Existing A417 and therefore any improvements to this junction would have an impact on the roads connecting to the roundabout. With Ullenwood junction replacing the Air Balloon roundabout and the A436/Leckhampton Hill junction then there would be changes to traffic, journey times on Leckhampton Hill as well as junction delays. Appendix J of the ComMA Report (Document Reference 7.6, APP-422) provides details of the operational assessment (including the assessment junction delays) undertaken on Ullenwood junction to ensure the scheme design would operate in line with the forecast traffic flows.

3.1.2 Forecast journey times have been extracted from the scheme traffic model for the two routes shown in Figure 3-1 between the A417 and Cheltenham via Leckhampton Hill and via the A435. The routes are between the A41, south of the Highwayman junction, and the junction of the A40 and Sandford Road in Cheltenham. The A435 route has been chosen for this assessment because it is the main alternative to the A417 and Leckhampton Hill for those journeys travelling to/from the southern parts of Cheltenham.



Source: National Highways

Figure 3-1 Journey time routes – to/from Cheltenham

3.1.3 The distances for the two journey time routes are shown in Table 3-1.

Table 3-1 Distances for the two journey time routes

Route via	Direction	Base distance (miles)	DM distance (miles)	DS distance (miles)
A435	NB	9.4	9.4	9.4
	SB	9.4	9.4	9.4
Leckhampton Hill	NB	10.7	10.7	10.5
	SB	10.8	10.8	10.3

3.1.4 In Table 3-1 it can be seen that the route via the A435 is shorter than that via Leckhampton Hill by approximately one mile. Although the distance via Leckhampton Hill would decrease in the DS scenario due to the modified alignment, the route via the A435 is still shorter.

3.1.5 Forecast journey times for the two routes for the base year, 2026 and 2041 respectively are shown for the AM and PM average hours in Table 3-2 and Table 3-3.

Table 3-2 2026 Journey times – A417 to/from Cheltenham

Route via	Direction	Period	Base year (2015) time (mm:ss)	DM time (2026) (mm:ss)	DS time (2026) (mm:ss)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
A435	NB	AM	16:18	16:32	16:07	00:14	-00:11	-00:25
		PM	17:13	17:13	16:36	00:00	-00:37	-00:37
	SB	AM	18:30	18:57	18:18	00:27	-00:12	-00:39
		PM	17:34	18:12	17:49	00:38	00:15	-00:23
Leckhampton Hill	NB	AM	19:43	20:47	17:55	01:04	-01:48	-02:52
		PM	21:41	20:56	16:55	-00:45	-04:46	-04:01
	SB	AM	18:42	19:55	17:21	01:13	-01:21	-02:34
		PM	21:02	22:42	18:06	01:40	-02:56	-04:36

Table 3-3 2041 Journey times – A417 to/from Cheltenham

Route via	Direction	Period	Base year (2015) time (mm:ss)	DM time (2041) (mm:ss)	DS time (2041) (mm:ss)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
A435	NB	AM	16:18	16:57	16:23	00:39	00:05	-00:34
		PM	17:13	17:35	16:29	00:22	-00:44	-01:06
	SB	AM	18:30	20:08	19:12	01:38	00:42	-00:56
		PM	17:34	19:25	18:45	01:51	01:11	-00:40
Leckhampton Hill	NB	AM	19:43	22:07	19:02	02:24	-00:41	-03:05
		PM	21:41	23:59	20:31	02:18	-01:10	-03:28
	SB	AM	18:42	21:37	18:12	02:55	-00:30	-03:25
		PM	21:02	26:00	19:15	04:58	-01:47	-06:45

- 3.1.6 Journey times are the sum of free flow travel time, link delay and junction delay. Link delay is delay to vehicles as they travel between two junctions and would be due to the level of traffic on the section of road reducing the speed. Junction delay is delay to vehicles at a junction. Forecast total junction delay for the two routes for the base year, 2026 and 2041 respectively are shown for the AM and PM average hours in Table 3-4 and Table 3-5.

Table 3-4 2026 Total junction delay – A417 to/from Cheltenham

Route via	Direction	Period	Base year (2015) delay (mm:ss)	DM delay (2026) (mm:ss)	DS delay (2026) (mm:ss)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
A435	NB	AM	01:16	01:21	01:19	00:06	00:03	-00:03
		PM	01:32	01:30	01:25	-00:02	-00:08	-00:06
	SB	AM	02:57	03:12	03:10	00:16	00:13	-00:03
		PM	02:21	02:50	02:50	00:29	00:29	00:00
Leckhampton Hill	NB	AM	04:29	05:24	03:18	00:55	-01:11	-02:06
		PM	06:23	05:24	02:26	-00:59	-03:57	-02:58
	SB	AM	03:40	04:37	03:05	00:58	-00:35	-01:32
		PM	06:19	07:48	03:55	01:29	-02:24	-03:52

Table 3-5 2041 Total junction delay – A417 to/from Cheltenham

Route via	Direction	Period	Base year (2015) delay (mm:ss)	DM delay (2041) (mm:ss)	DS delay (2041) (mm:ss)	Change (DM-base)	Change (DS-base)	Change (DS-DM)
A435	NB	AM	01:16	01:29	01:22	00:13	00:07	-00:06
		PM	01:32	01:40	01:23	00:08	-00:09	-00:17
	SB	AM	02:57	04:13	03:49	01:17	00:53	-00:24
		PM	02:21	03:41	03:31	01:21	01:11	-00:10
Leckhampton Hill	NB	AM	04:29	06:27	04:02	01:59	-00:27	-02:25
		PM	06:23	08:24	05:41	02:01	-00:42	-02:43
	SB	AM	03:40	06:16	03:32	02:36	-00:08	-02:45
		PM	06:19	10:59	04:47	04:40	-01:31	-06:12

3.2 Journey times via A435

- 3.2.1 The route via the A435 would be used by vehicles travelling between Cheltenham and origin/destinations to the south as this is a shorter route compared to Leckhampton Hill, see Table 3-1. Travelling via the A435 is generally quicker than via Leckhampton Hill in the Base and DM scenarios and this is shown in Table 3-2 and Table 3-3. Table 3-4 and Table 3-5 show total junction delay and these tables show that in the Base and DM scenarios the total junction delay is lower travelling via the A435 than it would be via Leckhampton Hill. Overall, the shorter distance and quicker journey times in the Base and DM scenarios result in travelling via the A435 to origin/destinations to the south from Cheltenham being a more suitable route option than travelling via Leckhampton Hill.

- 3.2.2 In 2026, the journey time via the A435 would increase in the DM scenario compared with the 2015 base year and this would be due to an increase in forecast traffic in 2026. Table 2-1 shows that between the base year and the 2026 DM scenario there would be an increase in traffic on the A435.
- 3.2.3 When comparing the DS scenario with the 2015 base year and 2026 DM scenario, journey times via the A435 would decrease. This decrease in the forecast journey time in the DS scenario would be due to the reassignment of traffic travelling via the A435 to the A417. Table 2-1 shows the base and 2026 traffic flows and it can be seen that when comparing the 2026 DS scenario with the base year of 2015 and the 2026 DM scenario there would be a decrease in traffic on the A435. This decrease in traffic would generally result in higher link speeds and reduced junction delay but there would be no significant changes to either. Changes to junction delay would make up only a small proportion of the journey time improvements on the A435.
- 3.2.4 In 2041, the forecast journey time changes follow the same pattern as 2026 when comparisons are made between the three scenarios. The journey time improvements in 2041 between the DM and DS scenario would be greater in 2041 than in 2026 but would still not be significant. Changes to junction delay would make up a much greater proportion of the journey time improvements in 2041 compared to 2026.

3.3 Journey times via Leckhampton Hill

- 3.3.1 In 2026 and 2041, the DM scenario journey time via Leckhampton Hill would increase when compared to the 2015 base year (Table 3-2 and Table 3-3). The exception is in 2026 in the northbound direction in the PM average hour where the journey times would decrease. This decrease would be due to a decrease in total junction delay for that journey time route in the PM average hour, as shown in Table 3-4.
- 3.3.2 In 2026 and 2041 journey times via Leckhampton Hill would become significantly faster in the DS scenario when compared with the 2015 base year and the DM scenario, in all directions and time periods (Table 3-2 and Table 3-3). The forecast journey time savings in 2041 would be greater than those forecast in 2026.
- 3.3.3 In 2026, the reduction in forecast journey time via Leckhampton Hill with the scheme would be almost all due to reductions in junction delay; in particular at Air Balloon roundabout/Ullenwood junction. For northbound, junction delay at Ullenwood junction would decrease from 137 seconds (2 minutes 17 seconds) to five seconds in the AM average hour and from 163 seconds (2 minutes 43 seconds) to five seconds in the PM average hour. For southbound junction delay would decrease from 74 (1 minute 14 seconds) seconds to eight seconds in the AM average hour and from 227 seconds (3 minutes 47 seconds) to eight seconds in the PM average hour². The junction delay times set out for Ullenwood junction are a subset of the total junction delay in Table 3-4 and account for between 72% and 104% of the decrease in total junction delay. Percentage changes of more than 100% occur where there would be increases in delay at other junctions on

² The Ullenwood junction delay numbers are extracted from the Leckhampton Hill journey time and are included within the total junction delays set out in the relevant tables

the route and thus offset some of the benefits of the reduction in delay at Ullenwood junction.

- 3.3.4 In 2041, the reduction in forecast journey time via Leckhampton Hill with the scheme in place would again be almost all due to reductions in junction delay; in particular at Air Balloon roundabout/Ullenwood junction. For northbound, junction delay would decrease from 177 seconds (2 minutes 57 seconds) to six seconds in the AM average hour and from 214 seconds (3 minutes 34 seconds) to five seconds in the PM average hour. For southbound junction delay would decrease from 141 seconds (2 minutes 21 seconds) to eight seconds in the AM average hour and 376 (6 minutes 16 seconds) seconds to 10 seconds in the PM average hour³. The forecast junction delay reductions in 2041 would be greater than in 2026 and would make up a greater proportion of the forecast journey time decreases than in 2026. The junction delay times set out for Ullenwood junction are a subset of the total junction delay in Table 3-5 and account for between 81% and 128% of the journey time savings. Percentage changes of more than 100% occur where there have been increases in delay at other junctions on the route and thus erodes some of the benefits of the reduction in delay at Ullenwood.
- 3.3.5 The percentage change of 128% occurs for the northbound direction in the PM average hour, and to a lesser degree the AM average hour, where an increase in forecast delay at the junction of Bath Road and Sandford Road in Cheltenham would offset some of the journey times savings from the scheme.
- 3.3.6 The reduction in total junction delay would be as a result of the A417 mainline traffic bypassing the Ullenwood junction, which has been designed and assessed to work with the forecast 2041 traffic flows and therefore traffic would flow around the junction more freely. The reduction in traffic passing through and the design of Ullenwood junction would result in a decrease in congestion and thus a corresponding decrease in delay which induces traffic to use the scheme and Leckhampton Hill to travel to/from Cheltenham.

4 Environmental impacts

- 4.1.1 As stated in section 1, the environmental impacts of the scheme from a traffic perspective are assessed within specific chapters of the environmental statement. These being ES Chapter 5 Air quality (Document Reference 6.2, APP-036), ES Chapter 11 Noise and vibration (Document Reference 6.2, APP-042), ES Chapter 13 Road drainage and the water environment (Document Reference 6.2, APP-044) and ES Chapter 14 Climate (Document Reference 6.2, APP-045).
- 4.1.2 The outcome of these assessments is that it is only the noise assessment that results in a significant adverse effect on Leckhampton Hill due to the increased traffic. The outcome of the noise assessment is that five residential properties on Leckhampton Hill would be assessed as having a significant adverse effect as a result of the increase in traffic. The increase in noise for these five residential properties would be approximately 1 decibel (dBA) and would be assessed as significant adverse due to the existing high levels of noise due to the traffic volumes and the proximity of these five residential properties to the Leckhampton Hill.

³ The Ullenwood junction delay numbers are extracted from the Leckhampton Hill journey time and are included within the total junction delays set out in the relevant tables.

- 4.1.3 Although the noise impact has been assessed as significant adverse, National Highways note that in The Joint Councils Local Impact Report (Document Reference REP1-133) the joint councils acknowledge that the marginal noise increase of approximately 1dBA would 'likely be indiscernible'. This assumption would be based on the Institute of Environmental Management and Assessment *Guidelines for Noise Impact Assessment* which considers a 1dBA increase in noise levels only being perceptible under laboratory conditions.

5 Conclusion

- 5.1.1 The provision of the Ullenwood junction as part of the DS scenario is a key reason for the forecast increase in traffic on Leckhampton Hill. The Ullenwood junction performs better with reduced congestion and delays due to the A417 mainline traffic bypassing the Ullenwood junction and being designed to accommodate 2041 forecast flows. This results in reduced junction delays which contribute towards reduced journey times when travelling via Leckhampton Hill between origin/destinations to the south of Cheltenham. This reduction in journey time for travelling via Leckhampton Hill results in this route becoming a more attractive option in the DS scenario and attracts vehicles to use this route.
- 5.1.2 Whilst there would be an increase in forecast traffic on Leckhampton Hill, when the base year is compared to the DS scenarios for 2026 and 2041, there would be wider traffic and economic related benefits of the scheme. These are important benefits that would overall improve the area for local communities and those travelling to/from the area for other reasons. Full details on these traffic and economic benefits are detailed in the ComMA Report (Document Reference 7.6, APP-422) and the Transport Report (Document Reference 7.10, APP-426).
- 5.1.3 As outlined in section 1, the environmental impact of the scheme from a traffic perspective is assessed in the ES Chapter 5 Air quality (Document Reference 6.2, APP-036), ES Chapter 11 Noise and vibration (Document Reference 6.2, APP-042), ES Chapter 13 Road drainage and the water environment (Document Reference 6.2, APP-044) and ES Chapter 14 Climate (Document Reference 6.2, APP-045). All of these utilise traffic data from the scheme traffic models as outlined in section 1 of this technical note.
- 5.1.4 As noted in the ES (Document Reference 6.2, APP-031 to APP-049) the outcome of these assessments is that the only environmental factor from a traffic perspective that would be assessed as significant adverse for Leckhampton Hill would be the noise assessment. For five residential properties on Leckhampton Hill the increase in traffic would result in an increase in noise that would be deemed as significant adverse, this increase would be 1dBA. National Highways note that in the Joint Councils Local Impact Report (Document Reference REP1-133) the joint councils acknowledge that the 1dBA increase in noise as a result of the scheme would be indiscernible.