A1(M) Junction 47 Study – Stage 2

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Introduction

CH2M have been commissioned by Highways England to undertake a study at Junction 47 of the A1(M) [Jn 47] which is a four-arm grade separated roundabout that connects the Strategic Road Network [SRN] with the primary road network, in the form of the A59, approximately seven miles east of Harrogate. Junction 47 has been identified through planning applications, Harrogate District Local Plan [HDLP] assessment work and the Local Enterprise Partnership [LEP] as a significant constraint to development in the area. The junction already exhibits peak hour queues and delays.

North Yorkshire County Council [NYCC] supported by the LEP successfully bid through the Local Growth Fund for money to implement a junction improvement at Jn 47. The scheme includes:

- Traffic signals on all approaches to Jn 47 of the A1(M).
- Widening on all approaches in order to accommodate left turn flares on both diverge slips, and to increase the length of both right turn flares on the A59 approaches.
- Three lane circulatory carriageway at both the north-east and south-west corners of the junction, in order to reduce conflict between exiting and queueing vehicles. Widening is needed to accommodate the introduction of a third lane.

In addition, NYCC are proposing to fund:

- The introduction of traffic signals on the A59 at the junction with the A168 Link Road including islands which are proposed to house the required signal infrastructure. Minimal kerbline changes are required at this junction.

  For the remainder of this the above schemes will be referred to as the LEP scheme.

Purpose of this Study

Highways England is therefore looking to undertake a study which will determine:

- how much capacity will be provided by the LEP scheme and when further improvements are likely to be required; and
- Interim and final solutions for junction improvements to accommodate future likely traffic levels.

This will help with the evidence base for the Local Plan and help determine the viability of the Local Plan, help determine a consistent approach to planning applications and secure appropriate contributions or junction improvements which are consistent with the long term vision for the junction.

It is considered important that the study is carried out with full involvement of Harrogate Borough Council [HBC], NYCC and the LEP to ensure that the outcomes can be supported by all parties.

The CH2M study is to be undertaken in three discrete stages. The remainder of this technical note presents the work undertaken and findings of Stage 2 of the study, the primary objective of which is

to establish how much capacity will be provided by the LEP scheme and when further improvements are likely to be required. The findings of Stage 1 of the study were reported in the October 2016 technical note *A1(M) Junction 47 Study – Stage 1* (Document Ref 679066.AF.16.13 TN002).

Stage 2

The main elements of Stage 2 of the study are set out below:

- Develop TRANSYT traffic models, based upon the linear extrapolation of future year traffic flows, to understand when the LEP scheme will reach theoretical capacity (90% degrees of saturation) and when the scheme will have queues and delays on the A1(M) slip roads and/or A59, which are likely to reach the unacceptable level, for both the Flaxby and Hammerton growth option scenarios within the HDLP.
- TRANSYT Models will be built for the AM and PM peak periods of the 2017 (LEP opening year) and 2025 (future year) flow scenarios as well as two additional interim years, which will vary by peak period and equate to the years where the theoretical capacity and unacceptable level of queuing is reached. All peak period and traffic year scenarios will be run twice, once for each of the growth scenarios, with the interim traffic year scenarios being variable by peak period and growth scenario.
- Develop TRANSYT models of the 2035 (end of HDLP) flow scenario, for both settlement options, to establish where and how badly the operation of the junction would get without further improvements.
- Undertake Merge/Diverge assessments in accordance with DMRB document TD 22/06, for the 2025 and 2035 future year scenarios of both growth assumptions.
- Hold an optioneering workshop with stakeholders to discuss the results of the LEP scheme TRANSYT modelling and consider potential interventions which will be modelled within Stage 3 of the study.

LEP Scheme TRANSYT Assessments

The LEP scheme improvement has been assessed using TRANSYT v15 software. Geometrical measurements used in the calculation of stopline saturation flows, were taken from the most recently available scheme drawing, provided to CH2M by AECOM and referenced *60483848_AEC_00_L0_M2_ZX_00040*. The methodology used in determining the opening and future year flows is described in the October 2016 Stage 1 report preceding this note. The LEP scheme has been assessed against both of the Harrogate Local Plan growth scenarios currently being considered. For each scenario, five 'future flow' years have been modelled within TRANSYT, these are briefly described below and reported in turn within the remaining sections of this note:

- Opening Year (2017)
- Short-term horizon (2025)
- Medium-term horizon (2035)
- First year that a single A59 or A1(M) approach reaches a 90% degree of saturation (DoS), in either peak period (herein referred to as the 90% DoS assessment), this represents the junction reaching theoretical capacity
- First year that a single A59 or A1(M) approach reaches a 100% degree of saturation (DoS), in either peak period (herein referred to as the 100% DoS assessment), this represents operating over capacity but associated queues and delays can be managed in the short term.

The 90% DoS and 100% assessments were undertaken using an iterative process to determine the first relevant year.

Opening Year TRANSYT Assessments (2017)

The TRANSYT capacity and queue length outputs for the Flaxby and Hammerton opening year flow assessments are presented in Tables 1 and 2 respectively. It can be seen that the junction is predicted to operate within capacity during both periods in its opening year. The 2017 assessments include only a small amount of local plan growth and, as such, the Flaxby and Hammerton growth assumptions result in very similar opening year capacity performance. The results of both growth scenarios indicate that one lane, the nearside lane of the A59 eastbound approach, will operate at close to its theoretical capacity in the opening year, with a DoS of 87% and resulting queue of 16 pcus in the PM peak.

TABLE 1

2017 LEP Opening Year TRANSYT Assessment Results (Flaxby Growth Assumption)

Flaxby Growth Scenario		2017 (Opening Year)			
		AM		PM	
Approach Arm	Lane	DoS	MMQ (pcus)	DoS	MMQ (pcus)
A59 Harrogate	Nearside Entry	78	12	87	16
A59 Harrogate	Offside Entry	34	3	26	2
A59 Harrogate	Single Lane Approach	80	2	81	2
Circ @ A59 Harrogate	Nearside	58	3	70	3
Circ @ A59 Harrogate	Offside	56	1	47	2
A1(M) North	Nearside	49	4	70	6
A1(M) North	Offside	49	4	38	3
Circ @ A1(M) North	Nearside	78	10	75	10
Circ @ A1(M) North	Offside	41	3	30	1
A59 York	Nearside	63	5	53	6
A59 York	Offside	64	6	59	7
Circ @ A59 York	Nearside	66	9	68	7
Circ @ A59 York	Offside	33	2	24	0
A1(M) South	Nearside	50	4	33	2
A1(M) South	Offside	50	4	52	4
Circ @ A1(M) South	Nearside	41	1	49	4
Circ @ A1(M) South	Offside	69	3	65	5
A168 Approach	Single Lane Approach	74	4	68	4
A59 WB Approach to A168	Nearside	72	10	65	8
A59 WB Approach to A168	Offside	20	3	22	3
A59 WB Approach to A168	Single Lane Approach	53	0	48	0
A59 EB Approach to A168	Single Lane Approach	76	14	75	12

TABLE 2
2017 LEP Opening Year TRANSYT Assessment Results (Hammerton Growth Assumption)

Hammerton Growth Scenario		2017 (Opening Year)			
		AM		PM	
Approach Arm	Lane	DoS	MMQ (pcus)	DoS	MMQ (pcus)
A59 Harrogate	Nearside Entry	78	12	87	16
A59 Harrogate	Offside Entry	33	3	25	2
A59 Harrogate	Single Lane Approach	77	1	81	2
Circ @ A59 Harrogate	Nearside	53	3	71	3
Circ @ A59 Harrogate	Offside	52	3	51	2
A1(M) North	Nearside	49	4	53	4
A1(M) North	Offside	49	4	53	4
Circ @ A1(M) North	Nearside	78	11	76	12
Circ @ A1(M) North	Offside	39	2	30	3
A59 York	Nearside	65	9	51	7
A59 York	Offside	65	6	57	6
Circ @ A59 York	Nearside	63	5	58	5
Circ @ A59 York	Offside	32	2	36	2
A1(M) South	Nearside	50	4	52	4
A1(M) South	Offside	50	4	52	4
Circ @ A1(M) South	Nearside	41	2	36	2
Circ @ A1(M) South	Offside	70	6	65	6
A168 Approach	Single Lane Approach	75	4	68	4
A59 WB Approach to A168	Nearside	74	11	65	8
A59 WB Approach to A168	Offside	20	3	21	3
A59 WB Approach to A168	Single Lane Approach	54	0	48	0
A59 EB Approach to A168	Single Lane Approach	75	15	77	15

Flaxby Growth Assumption - Future Year TRANSYT Assessments

The reported results of the Flaxby growth assumption, future year modelling exercise are presented in Tables 3 to 5 with the key considerations summarised below:

- The first link to operate at or above its theoretical capacity of 90% DoS will be the nearside lane of the A59 eastbound approach to J47 (92%) during the 2019 PM peak. The associated mean queue will be approximately 120m in length.
- The first link to operate at or above its theoretical capacity of 90% DoS during the AM peak is the single lane A59 eastbound approach, before the start of the two lane section. This link will operate with a DoS of 91% in 2021. The associated mean queue will be approximately 30m in length.
- In 2022 the single lane approach of the A59 eastbound arm will begin to operate (approximately) at capacity during the PM peak period (DoS of 99%). This rises to 102% DoS in 2023. Both junctions are predicted to operate within capacity during the AM peak until 2024. By 2025, the single lane A59 eastbound approach to J47 will operate above capacity (DoS 103%) during the AM peak. Once above 100% DoS, mean queues of 350m and 230m are predicted on this approach in the PM and AM peaks respectively. A queue of 350m is sufficient enough to extend back to the upstream roundabout.
- In the 2022 PM and 2024 AM peaks, vehicles approaching J47 from Harrogate will experience approximately 1 minute of delay when travelling between the upstream 'Flaxby' roundabout

and A1(M) J47. By 2025, this rises to 1.5 and 3 minutes of delay for the AM and PM peaks respectively.

- By 2035 several links are predicted to be operating above their theoretical capacity of 90% Dos, with 4 to 5 links being over capacity (100% DoS) in each peak period. The majority of links operating above 90% DoS are located on the A59 and A168 approaches. The most notable queues include the single lane A59 eastbound approach (2.6km and 2.3km in the AM and PM peaks respectively) and a 1km queue on the A59 westbound single lane section, approaching the A168 signalised T-junction during the AM peak.
- By 2035, drivers are predicted to experience between 9 and 11 minutes delay whilst travelling between the Flaxby roundabout and J47. Average delay in excess of 6 minutes is expected when travelling on the A59 westbound approach to J47 during the AM peak hour.

It can therefore be determined that the LEP scheme, when considered in the context of Harrogate Borough Council [HBC] pursuing the Flaxby settlement within its Local Plan, will operate within capacity until 2022 in the PM peak period. The junction is predicted to operate within capacity until 2024 during the AM peak period. By 2035 several links within the modelled area are predicted to operate considerably above their capacity threshold, resulting in substantial queues and delay on both A59 approaches to J47 during the AM peak and on the A59 eastbound approach in the PM peak.

TABLE 3

AM Peak Hour Future Year TRANSYT Assessments – Capacity & Queue Results (Flaxby Growth Assumption)

Flaxby Growth Scenario		AM Peak							
		Interim Yr 1 - 2021		Interim Yr 2 - 2024		2025		2035	
Approach Arm	Lane	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
A59 Harrogate	Nearside Entry	87	16	95!	25	95!	24	100!	42
A59 Harrogate	Offside Entry	39	3	43	4	43	4	51	5
A59 Harrogate	Single Lane Approach	91!	5	100!	22	103!	40	148!	448
Circ @ A59 Harrogate	Nearside	69	2	72	2	73	3	33	3
Circ @ A59 Harrogate	Offside	69	4	75	4	76	4	42	3
A1(M) North	Nearside	59	5	76	6	77	6	76	7
A1(M) North	Offside	59	5	76	6	77	6	75	7
Circ @ A1(M) North	Nearside	84	17	84	17	84	17	87	17
Circ @ A1(M) North	Offside	45	5	47	6	47	6	52	9
A59 York	Nearside	78	12	86	14	89	15	95!	17
A59 York	Offside	78	11	84	13	86	14	92!	15
Circ @ A59 York	Nearside	73	7	81	8	81	8	90	16
Circ @ A59 York	Offside	33	4	35	4	36	4	45	2
A1(M) South	Nearside	60	5	66	5	68	6	84	9
A1(M) South	Offside	60	5	66	5	68	6	84	9
Circ @ A1(M) South	Nearside	46	9	50	10	51	11	67	7
Circ @ A1(M) South	Offside	75	16	81	18	83	19	98!	31
A168 Approach	Single Lane Approach	84	6	91!	7	93!	8	120!	30
A59 WB Approach to A168	Nearside	82	14	89	18	92!	19	99!	28
A59 WB Approach to A168	Offside	25	3	31	3	31	3	29	3
A59 WB Approach to A168	Single Lane Approach	61	0	70	4	73	7	120!	167
A59 EB Approach to A168	Single Lane Approach	84	20	91!	25	91!	32	86	20

TABLE 4

PM Peak Hour Future Year TRANSYT Assessments – Capacity & Queue Results (Flaxby Growth Assumption)

Flaxby Growth Scenario		PM Peak							
		Interim Yr 1 - 2019		Interim Yr 2 - 2022		2025		2035	
Approach Arm	Lane	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
A59 Harrogate	Nearside Entry	92!	21	99!	36	100!	43	100!	43
A59 Harrogate	Offside Entry	27	2	30	2	31	2	35	3
A59 Harrogate	Single Lane Approach	86	3	93!	6	107!	96	140!	390
Circ @ A59 Harrogate	Nearside	72	3	74	4	77	4	78	4
Circ @ A59 Harrogate	Offside	50	2	54	3	62	3	63	3
A1(M) North	Nearside	60	4	60	5	64	5	85	8
A1(M) North	Offside	60	4	60	5	64	5	85	8
Circ @ A1(M) North	Nearside	77	11	86	16	89	18	87	16
Circ @ A1(M) North	Offside	32	3	36	4	37	3	39	4
A59 York	Nearside	56	6	64	9	70	10	76	9
A59 York	Offside	62	7	70	10	74	11	80	9
Circ @ A59 York	Nearside	62	7	66	6	69	6	92!	16
Circ @ A59 York	Offside	37	2	38	4	40	4	53	0
A1(M) South	Nearside	54	4	60	5	67	6	87	9
A1(M) South	Offside	54	4	60	5	67	6	87	9
Circ @ A1(M) South	Nearside	40	2	44	7	49	7	65	10
Circ @ A1(M) South	Offside	71	7	76	16	81	18	100!	31
A168 Approach	Single Lane Approach	72	4	78	5	85	6	103!	14
A59 WB Approach to A168	Nearside	69	10	75	11	81	14	98!	27
A59 WB Approach to A168	Offside	24	3	28	3	30	3	36	4
A59 WB Approach to A168	Single Lane Approach	51	0	55	0	60	0	101!	46
A59 EB Approach to A168	Single Lane Approach	80	13	86	19	89	28	91!	25

TABLE 5

AM & PM Peak Hour Future Year TRANSYT Assessments –Delay Analysis (Flaxby Growth Assumption)

Route			Delay per Vehicle (secs)									
			AM					PM				
From	To	Description	2017	Interim Yr 1 - 2021	Interim Yr 2 - 2024	2025	2035	2017	Interim Yr 1 - 2019	Interim Yr 2 - 2022	2025	2035
A59 Harrogate	A1(M) North	Flaxby Roundabout to J47 roundabout	15	25	70	102	659	20	28	64	191	575
A59 Harrogate	A59 York	Flaxby Roundabout to A168 T-junction	37	52	101	134	687	38	48	95	228	613
A59 Harrogate	A1(M) South	Flaxby Roundabout to A1(M) SB On-slip	42	47	94	127	712	46	53	84	212	630
A1(M) North	A59 York	A1(M) SB Off-slip	30	37	54	56	44	36	35	38	41	66
A1(M) North	A59 Harrogate	A1(M) SB Off-slip to A59 WB exit	39	59	74	76	84	44	42	54	57	111
A59 York	A1(M) South	A59 WB approach	25	52	65	72	403	22	23	38	42	125
A59 York	A59 Harrogate	A59 WB approach to A59 WB exit	31	74	89	96	427	29	28	57	62	165
A59 York	A1(M) North	A59 WB approach to A1(M) NB On-slip	62	120	148	158	479	56	61	102	111	240
A1(M) South	A59 Harrogate	A1(M) NB Off-slip	23	27	29	30	38	20	24	26	28	43
A1(M) South	A59 York	A1(M) NB Off-slip to A168 T-junction	63	118	122	124	76	90	89	113	124	139

Flaxby Growth – 90% and 100% DoS Assessment Level of Development

The TRANSYT analysis presented above provides an estimate year at which the (LEP scheme) junction will cease to operate efficiently with the addition of any additional traffic growth. Two estimates are presented, one based on the 90% DoS threshold and one on the 100% DoS threshold.

When using the 90% threshold, the final year of satisfactory junction operation would be 2019, based on the PM peak results. Under the Flaxby Growth Assumption, this is equivalent to Local Plan growth of 2,389 dwellings with 333 dwellings at Flaxby settlement and 49,793 sqm of employment, of which 8,977 sqm would be the Flaxby employment site.

When using the 100% threshold, the final year of satisfactory junction operation would be 2022, based on the PM peak results. Under the Flaxby Growth Assumption, this is equivalent to Local Plan

growth of 3,823 dwellings with 532 dwellings at Flaxby settlement and 79,668 sqm of employment, of which 14,364 sqm would be the Flaxby employment site.

Hammerton Growth Assumption - Future Year TRANSYT Assessments

The reported results of the Hammerton growth assumption, future year modelling exercise are presented in Tables 6 to 8 with the key considerations summarised below:

- As for the Flaxby growth scenario, the first link to operate at or above its theoretical capacity of 90% DoS will be the nearside lane of the A59 eastbound approach to J47 (92%) during the 2019 PM peak. The associated mean queue will be approximately 120m in length.
- The first links to operate at or above its theoretical capacity of 90% DoS during the AM peak are the single lane A59 eastbound approach to J47 (90%) the A168 single lane approach to the signalised T-junction (93%) and the nearside lane of the A59 westbound approach to J47. A queue of approximately 110m will occur in the nearside lane of the A59 westbound approach. Queue on the other two links will remain minimal.
- In 2022 the nearside lane of the two-lane A59 eastbound approach arm will begin to operate at capacity during the PM peak period (DoS of 100%) resulting in a mean queue of 242m along the approach (including the single lane section). By 2023 this queue is predicted to increase to 600m. Both junctions are predicted to operate within capacity during the AM peak, until 2025, at which point the A168 single lane approach, and the A59 nearside lane of the westbound approach to the signalised T-junction, will operate with DoSs of 99% and 98% respectively. Mean queues of 65m and 150m are predicted on each of the links respectively.
- In the 2022 PM peak, drivers approaching J47 from Harrogate will experience approximately 1 minute of delay when travelling between the upstream 'Flaxby' roundabout and A1(M) J47. This rises to 2 minutes in 2023. In the 2025 AM peak, drivers approaching J47 from the A59 York will experience approximately 1 minute of delay when travelling from upstream of the signalised T-junction to the roundabout entry. This rises to over 2.5 minutes in 2026.
- By 2035 several links are predicted to be operating above their theoretical capacity of 90% Dos, with 3 or 5 links being over capacity (100% DoS) in each peak period. The majority of links operating above 90% DoS are located on the A59 and A168 approaches. The most notable queues include the single lane A59 eastbound approach (850m and 3.1km in the AM and PM peaks respectively) and a 2.1km queue on the A59 westbound single lane section, approaching the A168 signalised T-junction during the AM peak.
- By 2035, drivers are predicted to experience between 4.5 (AM) and 14 (PM) minutes of delay whilst travelling between the Flaxby roundabout and J47. Average delay in excess of 11 minutes is expected when travelling on the A59 westbound approach to J47 during the AM peak hour.

It can therefore be determined that the LEP scheme, when considered in the context of Harrogate Borough Council [HBC] pursuing the Hammerton settlement within HDLP, will operate within capacity until 2022 in the PM peak period. The junction is predicted to operate within capacity until 2025 during the AM peak period. By 2035 several links within the modelled area are predicted to operate considerably above their capacity threshold, resulting in substantial queues and delay on both A59 approaches to J47 during the AM peak and on the A59 eastbound approach in the PM peak.

TABLE 6

AM Peak Hour Future Year TRANSYT Assessments – Capacity & Queue Results (Hammerton Growth Assumption)

Hammerton Growth Scenario		AM Peak							
		Interim Yr 1 - 2023		Interim Yr 2 - 2025		2025		2035	
Approach Arm	Lane	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
A59 Harrogate	Nearside Entry	89	18	-	-	94!	22	100!	43
A59 Harrogate	Offside Entry	37	3	-	-	39	3	39	3
A59 Harrogate	Single Lane Approach	90!	4	-	-	95!	7	113!	148
Circ @ A59 Harrogate	Nearside	67	4	-	-	70	4	49	3
Circ @ A59 Harrogate	Offside	70	2	-	-	74	3	82	5
A1(M) North	Nearside	69	5	-	-	76	6	92!	10
A1(M) North	Offside	69	5	-	-	76	6	92!	10
Circ @ A1(M) North	Nearside	82	14	-	-	84	15	93!	22
Circ @ A1(M) North	Offside	41	4	-	-	42	4	40	7
A59 York	Nearside	81	16	-	-	87	17	93!	20
A59 York	Offside	76	12	-	-	80	9	78	12
Circ @ A59 York	Nearside	77	6	-	-	81	6	84	6
Circ @ A59 York	Offside	38	3	-	-	40	0	48	4
A1(M) South	Nearside	63	5	-	-	70	6	84	9
A1(M) South	Offside	63	5	-	-	70	6	84	9
Circ @ A1(M) South	Nearside	49	8	-	-	51	2	58	7
Circ @ A1(M) South	Offside	80	15	-	-	82	9	91!	15
A168 Approach	Single Lane Approach	93!	8	-	-	99!	11	168!	78
A59 WB Approach to A168	Nearside	92!	19	-	-	98!	26	99!	29
A59 WB Approach to A168	Offside	31	3	-	-	34	3	39	4
A59 WB Approach to A168	Single Lane Approach	73	7	-	-	81	12	146!	360
A59 EB Approach to A168	Single Lane Approach	87	21	-	-	91!	32	99!	42

TABLE 7

PM Peak Hour Future Year TRANSYT Assessments – Capacity & Queue Results (Hammerton Growth Assumption)

Hammerton Growth Scenario		PM Peak							
		Interim Yr 1 - 2019		Interim Yr 2 - 2022		2025		2035	
Approach Arm	Lane	DoS	MMQ	DoS	MMQ	DoS	MMQ	DoS	MMQ
A59 Harrogate	Nearside Entry	92!	21	100!	37	100!	44	100!	42
A59 Harrogate	Offside Entry	26	2	28	2	28	2	27	2
A59 Harrogate	Single Lane Approach	85	2	92!	5	107!	98	174!	547
Circ @ A59 Harrogate	Nearside	73	3	76	3	79	4	44	3
Circ @ A59 Harrogate	Offside	58	3	69	4	79	3	72	2
A1(M) North	Nearside	63	5	66	5	75	6	89	9
A1(M) North	Offside	63	5	66	5	75	6	89	9
Circ @ A1(M) North	Nearside	78	11	86	17	87	17	89	18
Circ @ A1(M) North	Offside	30	3	32	3	31	2	24	5
A59 York	Nearside	56	8	60	10	63	10	78	11
A59 York	Offside	61	7	64	7	65	8	74	9
Circ @ A59 York	Nearside	59	5	66	5	70	5	60	5
Circ @ A59 York	Offside	36	2	40	1	44	1	51	1
A1(M) South	Nearside	53	4	59	4	64	5	83	8
A1(M) South	Offside	53	4	59	4	64	5	83	8
Circ @ A1(M) South	Nearside	39	2	42	1	45	2	51	2
Circ @ A1(M) South	Offside	70	6	75	8	79	7	91!	20
A168 Approach	Single Lane Approach	72	4	78	5	84	6	116!	24
A59 WB Approach to A168	Nearside	69	10	74	11	80	13	97!	24
A59 WB Approach to A168	Offside	26	3	29	3	32	3	43	4
A59 WB Approach to A168	Single Lane Approach	51	0	55	0	59	0	81	10
A59 EB Approach to A168	Single Lane Approach	82	14	91!	23	94!	36	99!	38

TABLE 8

AM & PM Peak Hour Future Year TRANSYT Assessments –Delay Analysis (Hammerton Growth Assumption)

Route			Delay per Vehicle (secs)									
			AM					PM				
From	To	Description	2017	Interim Yr 1 - 2023	Interim Yr 2 - 2025		2035	2017	Interim Yr 1 - 2019	Interim Yr 2 - 2022	2025	2035
A59 Harrogate	A1(M) North	Flaxby Roundabout to J47 roundabout	15	27	-	40	277	20	28	65	197	857
A59 Harrogate	A59 York	Flaxby Roundabout to A168 T-junction	37	56	-	76	355	40	49	97	240	923
A59 Harrogate	A1(M) South	Flaxby Roundabout to A1(M) SB On-slip	40	56	-	75	313	44	51	92	227	900
A1(M) North	A59 York	A1(M) SB Off-slip	31	45	-	56	117	32	38	46	58	104
A1(M) North	A59 Harrogate	A1(M) SB Off-slip to A59 WB exit	38	61	-	57	99	39	43	47	53	85
A59 York	A1(M) South	A59 WB approach	26	57	-	71	670	20	23	24	26	56
A59 York	A59 Harrogate	A59 WB approach to A59 WB exit	31	76	-	75	681	25	28	30	34	68
A59 York	A1(M) North	A59 WB approach to A1(M) NB On-slip	50	120	-	112	718	58	62	88	82	107
A1(M) South	A59 Harrogate	A1(M) NB Off-slip	23	28	-	32	40	24	24	25	27	39
A1(M) South	A59 York	A1(M) NB Off-slip to A168 T-junction	100	96	-	115	147	86	91	108	131	132

Hammerton Growth – 90% and 100% DoS Assessment Level of Development

The TRANSYT analysis presented above provides an estimate year at which the (LEP scheme) junction will cease to operate efficiently with the addition of any additional traffic growth. Two estimates are presented, one based on the 90% DoS threshold and one on the 100% DoS threshold.

When using the 90% threshold, the final year of satisfactory junction operation would be 2019, based on the PM peak results. Under the Hammerton Growth Assumption, this is equivalent to Local Plan growth of 2,315 dwellings of which 259 dwellings would be on the Hammerton site and 49,793 sqm of employment, of which 8,977 sqm would be the Flaxby employment site.

When using the 100% threshold, the final year of satisfactory junction operation would be 2022, based on the PM peak results. Under the Hammerton Growth Assumption, this is equivalent to Local Plan growth of 3,704 dwellings of which 414 dwellings would be on the Hammerton site and 79,668 sqm of employment, of which 14,364 sqm would be the Flaxby employment site.

Merge/Diverge Assessments – 2025 and 2035

Merge and diverge assessments have been undertaken for the A1(M) J47 slip roads in the 2025 and 2035 future year flow scenarios (Flaxby and Hammerton growth options) in accordance with figures 2/3MW and 2/5MW from Design Manual for Roads and Bridges TD22/06, to determine the standard of infrastructure required to accommodate flows in each scenario. All of the assessments are based on the hourly flows of the evening peak hour, which has higher mainline and slip road flows than the morning peak and therefore provides the most robust assessment. Mainline flows were obtained from the 2015 TRIS database, and growthed to 2025 and 2035 levels using TEMPro v7 local growth rates for North Yorkshire Rural Motorway.

It can be seen from Tables 9 and 10 that, given the existing 3-lane mainline provision upstream, through and downstream of J47, no modifications are required to either of the merges or diverges as a result of future year development (2035) under either of the Flaxby or Hammerton growth assumptions.

Table 9: CH2M Merge / Diverge Assessment A1(M) J47 (Flaxby Growth Assumption)

		2025 PM			2035 PM		
		Flow	Requirement (Given 3-lane mainline)	Upgrade Required?	Flow	Requirement (Given 3-lane mainline)	Upgrade Required?
Diverge NB	Mainline Flow	3113	A – taper diverge	X	3304	A – taper diverge	X

(existing A – taper diverge)	Diverge Flow	623			846		
Diverge SB (existing A - taper diverge)	Mainline Flow	3020	A – taper diverge	X	3206	A – taper diverge	X
	Diverge Flow	616			724		
Merge NB (existing A - taper merge)	Mainline Flow	3113	A - taper merge	X	3304	A - taper merge	X
	Merge Flow	667			794		
Merge SB (existing A - taper merge)	Mainline Flow	3020	A - taper merge	X	3206	A - taper merge	X
	Merge Flow	561			766		

Table 10: CH2M Merge / Diverge Assessment A1(M) J47 (Hammerton Growth Assumption)

		2025 PM			2035 PM		
		Flow	Requirement (Given 3-lane mainline)	Upgrade Required?	Flow	Requirement (Given 3-lane mainline)	Upgrade Required?
Diverge NB (existing A – taper diverge)	Mainline Flow	3113	A – taper diverge	X	3304	A – taper diverge	X
	Diverge Flow	596			779		
Diverge SB (existing A - taper diverge)	Mainline Flow	3020	A – taper diverge	X	3206	A – taper diverge	X
	Diverge Flow	597			663		
Merge NB (existing A - taper merge)	Mainline Flow	3113	A - taper merge	X	3304	A - taper merge	X
	Merge Flow	658			765		
Merge SB (existing A - taper merge)	Mainline Flow	3020	A - taper merge	X	3206	A - taper merge	X
	Merge Flow	548			733		

Conclusions

CH2M have undertaken a series of TRANSYT model junction capacity assessments in order to establish how much capacity will be provided by the LEP scheme and when further improvements are likely to be required. Separate TRANSYT assessements of the LEP scheme have been undertaken for each of the Flaxby and Hammerton Growth Assumptions currently being considered by HBC in the development of the HDLP.

The estimation of when further improvements are required has been determined for two threshold assumptions, one being the first year that a single A59 or A1(M) approach reaches a 90% DoS in either peak period, the other being when an approach reaches 100% DoS. The assessments for both the Flaxby and Hammerton Growth Assumption produced identical approximations of when further improvements will be required. Using the 90% DoS threshold gave a final satisfactory year of 2019, whilst the 100% DoS threshold gave an estimate of 2022. The level of Local Plan development that corresponds to these future years has been determined for each Growth Assumption and for each capacity assessment threshold, the results of which are presented in the relevant sections above.

By the end of the HDLP period 2035 the junction is predicted to operate significantly over capacity with maximum DoS of between 140% and 174% dependent on the peak hour and the growth option modelled. Significant queues will form and therefore appropriate mitigation will need to be delivered in order to accommodate the HDLP.