Tritax Symmetry (Hinckley) Limited

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

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Narborough Level Crossing Traffic Modelling

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TRANSPORT TECHNICAL NOTE – NARBOROUGH LEVEL CROSSING

Hinckley National Rail Freight Interchange

PROJECT NAME	**Hinckley National Rail Freight Interchange**		
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1. INTRODUCTION

1.1 This Technical Note has been produced to outline modelling undertaken to predict the operation of Narborough Level crossing in the 2036 forecast modelling scenarios.

2. MODELLING METHODOLOGY

SURVEY DATA ANALYSIS

2.1 Manual turning count and queue surveys were commissioned at the following locations between 11/10/2023 and17/10/2023.

- J1 – Leicester Road / Station Road mini-roundabout;
- J2 – Leicester Road / Coventry Road / School Lane / Desford Road mini-roundabout;
- J3 – Station Road / Riverside Way priority junction.

2.2 Further to the above, concurrent surveys were undertaken at Narborough Level Crossing to record the duration of barrier downtime and uptime and associated queues. It is acknowledged that school holidays started week commencing 16/10/2023 in Narborough. However, the survey results provide an illustration of how the crossing operates during weekdays (in school term), weekend and school holidays respectively.

2.3 Traffic movements originating from J1 and J3 were used to calculate the number of vehicles travelling southbound and northbound across the Narborough Level crossing. **Table 1** shows the total number of vehicles crossing Narborough Level Crossing, the frequency of barrier downtimes and the average barrier downtime for each day. Full survey results are contained in **Appendix 1**.

Table 1: Daily Survey Results

	Traffic Flow (veh)	No. Down Time	Avg. Downtime (s)
11/10/2023	8674	83	213
12/10/2023	8214	75	205
13/10/2023	8142	83	206
14/10/2023	6054	66	195
15/10/2023	4169	42	196
16/10/2023	6123	83	203

17/10/2023	6534	85	200

2.4 **Table 1** indicates that the traffic flows and average downtimes were the highest on Wednesday 11th October. Consequently, to provide a robust assessment, the data from this survey day has been utilised to provide a basis for future year assessment.

2.5 An analysis was undertaken to understand the extents of the existing queues formed as a result of the Narborough Level crossing. It was noted that the maximum level of queues formed between 0800-0900 and 1700-1800 in the morning and evening peak hours respectively. The extents of the queues are illustrated in **Figure 1** and **2** below.

Figure 1: Morning Peak Hour Queues

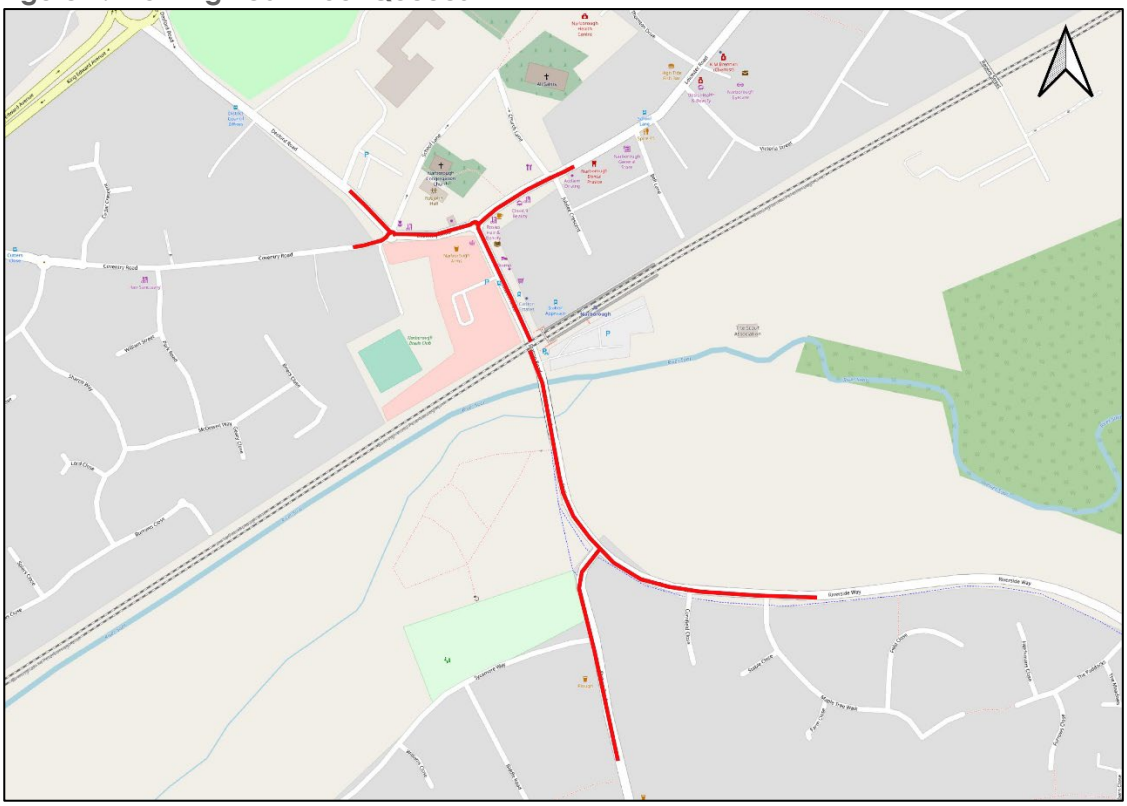
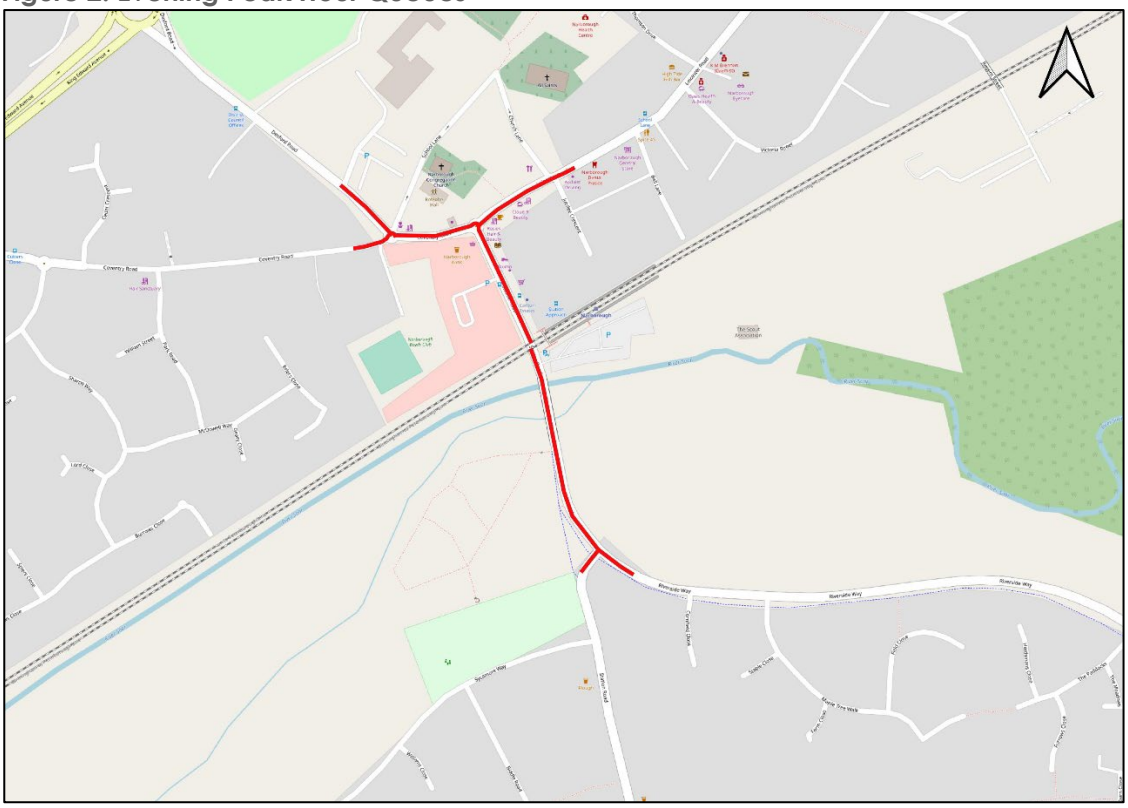


Figure 2: Evening Peak Hour Queues

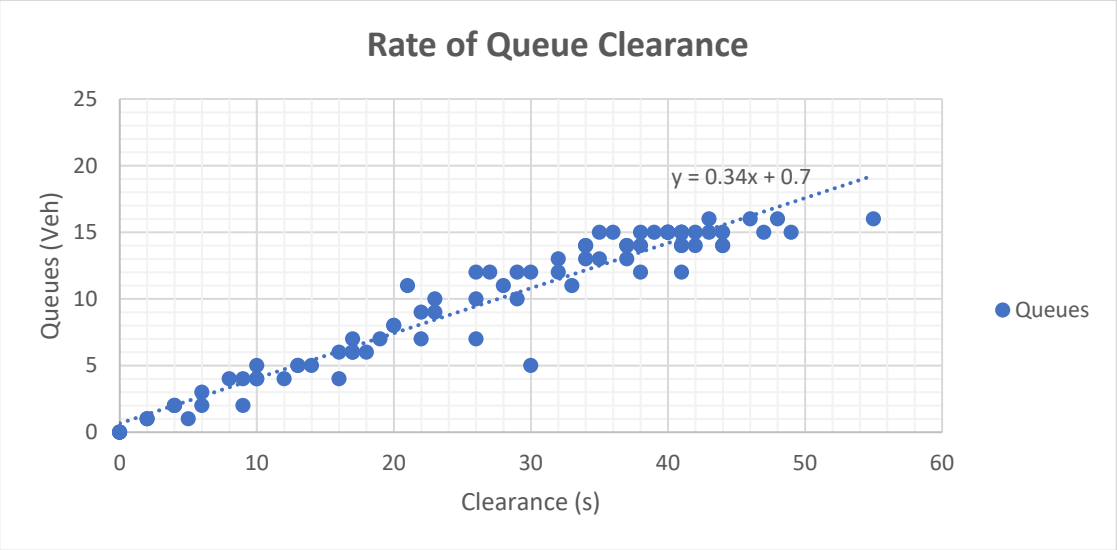


2.6 It should be noted that when queuing traffic at the Narborough Level Crossing extends beyond the Leicester Road/Station Road and Station Road/Riverside Way junctions, additional traffic that is not routing via Station Road will become part of the queue. Consequently, exacerbating congestion.

RATE OF QUEUE CLEARANCE

2.7 In addition to the queue surveys, video footage for the surveyed periods was obtained. This has been utilised to record the clearance time for queues at Narborough Level Crossing on the survey day. The correlation between queues and the subsequent clearance time is shown in **Figure 3** below.

Figure 3: Rate of Queue Clearance



2.8 As expected, there is a strong correlation between the queues and the time taken for queues to clear. Based on the above, the following formula can be used to calculate the local clearance time based on the queues forecast in the future year assessments:

$$x = \frac{(y - 0.7)}{0.34}, where\ x = clearance\ time\ \&\ y = number\ of\ vehicles\ in\ the\ queue$$

BASELINE QUEUE VALIDATION

2.9 It is anticipated that the HNRFI will result in additional trains running between 06:00 and 23:00. Therefore, Linsig was used to construct baseline models for the survey day downtimes. The modelled queues were compared to the observed data to ensure the Linsig models were representative. The comparison is presented in **Table 2**.

Table 2: Base Model Queue Comparison (PCU)

	Southbound			Northbound		
	Observed	Modelled	Difference	Observed	Modelled	Difference
0600-0700	2	5	3	6	7	1
0700-0800	29	27	-2	70	79	9
0800-0900	42	37	-5	89	79	-10
0900-1000	9	16	8	30	27	-3
1000-1100	11	20	9	17	20	3
1100-1200	14	17	3	11	16	5
1200-1300	21	21	0	19	22	3
1300-1400	13	18	5	10	17	7
1400-1500	22	24	2	15	20	5
1500-1600	41	30	-11	22	26	4
1600-1700	36	46	10	25	34	9
1700-1800	38	48	10	35	36	1

1800-1700	23	27	4	22	20	-2
1900-2000	21	12	-9	13	10	-3
2000-2100	7	8	1	6	6	0
2100-2200	7	10	3	5	8	3
2200-2300	2	3	1	2	3	1

2.10 The table above indicates that the modelled queues are generally reflective of observed queues. Therefore, the model is considered 'fit for purpose' for future year assessment.

2036 FORECAST TRAFFIC FLOWS

2.11 The PRTM outputs are limited to peak hour flows, Annual Average Daily Traffic (AADT) and Annual Average Weekday Traffic (AAWT). Therefore, to generate an hourly profile of non-peak hours for the forecast modelling scenario, the surveyed peak hour flows were subtracted from the surveyed 24-hour flows and the profile of the remaining traffic calculated. The profile of non-peak hour surveyed traffic is shown in **Table** 3.

Table 3: Non-Peak Hour Surveyed Traffic Profile

		Survey (PCU)		Survey %	
From	To	SB	NB	SB	NB
00:00:00	01:00:00	6	6	0.2%	0.2%
01:00:00	02:00:00	9	5	0.2%	0.1%
02:00:00	03:00:00	7	2	0.2%	0.1%
03:00:00	04:00:00	6	4	0.2%	0.1%
04:00:00	05:00:00	6	18	0.2%	0.5%
05:00:00	06:00:00	22	34	0.6%	1.0%
06:00:00	07:00:00	80	115	2.3%	3.5%
07:00:00	08:00:00	222	406	6.4%	12.2%
08:00:00	09:00:00	299	533	-	-
09:00:00	10:00:00	216	326	6.2%	9.8%
10:00:00	11:00:00	216	209	6.2%	6.3%
11:00:00	12:00:00	226	201	6.5%	6.0%
12:00:00	13:00:00	263	265	7.6%	7.9%
13:00:00	14:00:00	237	212	6.8%	6.3%
14:00:00	15:00:00	304	255	8.7%	7.7%
15:00:00	16:00:00	364	304	10.4%	9.1%
16:00:00	17:00:00	521	369	14.9%	11.1%
17:00:00	18:00:00	509	368	-	-
18:00:00	19:00:00	334	243	9.6%	7.3%
19:00:00	20:00:00	152	121	4.4%	3.6%
20:00:00	21:00:00	139	107	4.0%	3.2%
21:00:00	22:00:00	96	77	2.8%	2.3%
22:00:00	23:00:00	38	43	1.1%	1.3%
23:00:00	00:00:00	22	15	0.6%	0.4%

Total	4294	4240	3485	3338

2.12 The AM, PM peak hour flows and AAWT flows have been extracted from PRTM and presented in **Table 4** below.

Table 4: Narborough Traffic Flows (PCU)

	Survey SB	Survey NB	2019 SB	2019 NB	2036 WoD SB	2036 WoD NB	2036 WD SB	2036 WD NB
AM	299	533	299	385	343	443	357	496
PM	509	368	595	477	644	635	574	587
AAWT	4294	4240	4992	4884	5712	6304	5370	6330

2.13 The table above indicates that the 2019 PRTM flows are approximately 15% higher than the surveyed 24-hour flows in 2023. Consequently, as with the methodology agreed with the TWG for deriving traffic flows for the junction modelling within the Transport Assessment, the following formula has been used to predict the increase in traffic approach the Narborough Level Crossing in the forecast year.

Forecast Flows = 2023 Survey Flow + ('2036 PRTM' – '2019 PRTM')

2.14 It should be noted that the above provides a highly robust assessment of future non-peak traffic flows as it assumes:

- The predicted PRTM growth between 2019 and 2036 will be realised. Global COVID adjustment factors recently provided by AECOM suggest that peak hour trips through the PRTM could between 10% and 15% lower than currently predicted.

- The PRTM predicts that the introduction of a train in the evening peak hour would result in traffic on Station Road reducing by 9% in 2036, as background traffic re-routes to Croft Road and Enderby Road. Whilst the AAWT flows from the PRTM also show further re-routing of background traffic will occur, it has not been possible to accurately reflect this for specific hours.

2.15 Based on the above and **Table** 3, the hourly profile of the 2036 With (WD) and Without Development (WoD) scenarios is shown in **Table 5** below.

Table 5: Forecast Hourly Flows (PCU)

		2036 WoD		2036 WD	
From	To	SB	NB	SB	NB
00:00:00	01:00:00	7	8	7	8
01:00:00	02:00:00	10	11	9	11
02:00:00	03:00:00	8	9	8	9
03:00:00	04:00:00	7	8	7	8
04:00:00	05:00:00	8	8	7	8
05:00:00	06:00:00	26	29	24	29
06:00:00	07:00:00	94	104	87	104

07:00:00	08:00:00	262	290	244	291
08:00:00	09:00:00	343	591	357	644
09:00:00	10:00:00	254	281	237	282
10:00:00	11:00:00	255	282	238	283
11:00:00	12:00:00	266	294	248	295
12:00:00	13:00:00	311	343	289	345
13:00:00	14:00:00	280	309	260	310
14:00:00	15:00:00	358	396	333	398
15:00:00	16:00:00	429	474	399	476
16:00:00	17:00:00	615	679	572	682
17:00:00	18:00:00	558	526	488	478
18:00:00	19:00:00	395	436	367	438
19:00:00	20:00:00	179	198	167	199
20:00:00	21:00:00	164	181	153	182
21:00:00	22:00:00	114	126	106	126
22:00:00	23:00:00	45	50	42	50
23:00:00	00:00:00	26	29	24	29
Total		5014	5662	4672	5686

PROPOSED TRAIN TIMES

2.16 The forecast modelling has been undertaken assuming 10 additional trains each way. A summary of the anticipated train downtimes and uptimes have been obtained from Baker Rose and presented in Table 6 below.

Table 6: Proposed Additional Train Times

No.	ORIGIN	DESTINATION	Crossing Down Time (from red light warning)	Crossing Up Time	Time Crossing Closed
1	HNRFI	FLX/LGP/ANO	06:08:00	06:10:31	00:02:31
2	FLX/LGP/ANO	HNRFI	09:11:00	09:13:31	00:02:31
3	FLX/LGP/ANO	HNRFI	11:12:00	11:14:31	00:02:31
4	HNRFI	FLX/LGP/ANO	11:49:53	11:52:24	00:02:31
5	FLX/LGP/ANO*	HNRFI	12:09:00	12:11:26	00:02:26
6	FLX/LGP/ANO	HNRFI	13:12:15	13:14:46	00:02:31
7	HNFRI	FLX/LGP/ANO	13:18:00	13:20:31	00:02:31
8	HNRFI*	FLX/LGP/ANO	13:44:35	13:47:56	00:03:21
9	FLX/LGP/ANO	HNRFI	14:12:00	14:14:31	00:02:31
10	HNRFI*	FLX/LGP/ANO	14:45:00	14:47:31	00:02:31
11	HNRFI	FLX/LGP/ANO	15:55:00	15:57:31	00:02:31
12	FLX/LGP/ANO*	HNRFI	16:11:00	16:16:05	00:05:05
13	HNRFI	FLX/LGP/ANO	17:15:00	17:17:31	00:02:31
14	FLX/LGP/ANO*	HNRFI	19:07:48	19:12:58	00:05:10
15	HNRFI	FLX/LGP/ANO	19:54:15	19:56:46	00:02:31
16	FLX/LGP/ANO*	HNRFI	20:12:15	20:15:44	00:03:29

17	HNRFI	FLX/LGP/ANO	20:54:15	20:56:46	00:02:31
18	FLX/LGP/ANO*	HNRFI	21:11:20	21:17:12	00:05:52
19	HNRFI	FLX/LGP/ANO	21:44:15	21:46:46	00:02:31
20	FLX/LGP/ANO	HNRFI	22:04:15	22:06:46	00:02:31
*downtime for existing train times extended					

2.17 It should be noted that even with the additional trains, the downtimes at the Narborough Level Crossing would be well below the 45 minutes barrier downtime in any hour at town centre locations that Network Rail and the HM Railway Inspectorate at the Office of Road and Rail consider would trigger a site safety risk assessment (document reference 18.4.4, REP2-075 Appendix D: National Transportation Policy Note)).

ASSESSMENT SCENARIOS

2.18 The following scenarios will be assessed as part of the forecast modelling:

- 2036 Without Development (WoD) with existing train up/down times retained.
- 2036 With Development (WD) with additional train times included as part of HNRFI.

3. MODELLING RESULTS

3.1 The LinSig model has been run for the forecast modelling scenarios. A summary of the queue results is presented in the table below. A copy of the full output is presented in **Appendix 2**.

Table 7: Queue Results

		Queue Comparison (PCU)					
		Southbound			Northbound		
	No. Trains (WoD / WD)	2036 WoD	2036 WD	Difference	2036 WoD	2036 WD	Difference
0600-0700	6 / 7	6	5	-1	6	6	0
0700-0800	3 / 3	33	30	-3	42	42	0
0800-0900	4 / 4	43	45	2	91	102	11
0900-1000	4 / 5	20	18	-2	23	23	0
1000-1100	3 / 3	25	23	-2	29	29	0
1100-1200	5 / 7	20	19	-1	24	24	0
1200-1300	6 / 6	25	23	-2	30	30	0
1300-1400	4 / 6	22	20	-2	26	26	0
1400-1500	3 / 5	28	26	-2	34	34	0
1500-1600	6 / 7	32	33	1	42	44	2
1600-1700	6 / 6	57	58	1	74	83	9
1700-1800	5 / 6	54	46	-8	56	49	-7
1800-1900	5 / 5	33	29	-4	40	38	-2
1900-2000	3 / 4	14	15	1	16	18	2

2000-2100	6 / 7	9	9	0	10	12	2
2100-2200	5 / 6	12	11	-1	13	13	0
2200-2300	2 / 3	4	3	-1	4	4	0

3.2 The formula derived in paragraph 2.9 has been utilised to calculate the forecast clearance times. This is presented in **Table 8.**

Table 8: Clearance Times (s)

			Southbound			Northbound		
	No. Trains (WoD / WD)	Average available barrier uptime	2036 WoD	2036 WD	Difference	2036 WoD	2036 WD	Difference
0600-0700	6 / 7	274	16	13	-3	16	16	0
0700-0800	3 / 3	601	95	86	-9	121	121	0
0800-0900	4 / 4	734	124	130	6	266	298	32
0900-1000	4 / 5	486	57	51	-6	66	66	0
1000-1100	3 / 3	831	71	66	-5	83	83	0
1100-1200	5 / 7	430	57	54	-3	69	69	0
1200-1300	6 / 6	230	71	66	-5	86	86	0
1300-1400	4 / 6	542	63	57	-6	74	74	0
1400-1500	3 / 5	441	80	74	-6	98	98	0
1500-1600	6 / 7	312	92	95	3	121	127	6
1600-1700	6 / 6	506	166	169	3	216	242	26
1700-1800	5 / 6	373	157	133	-24	163	142	-21
1800-1900	5 / 5	485	95	83	-12	116	110	-6
1900-2000	3 / 4	625	39	42	3	45	51	6
2000-2100	6 / 7	436	24	24	0	27	33	6
2100-2200	5 / 6	320	33	30	-3	36	36	0
2200-2300	2 / 3	585	10	7	-3	10	10	0

3.3 **Table 8** demonstrates that the effect of the 'With Development' scenario would be negligible throughout the day. The modelling indicates that the largest increase in queue of 11 PCU being between 0800 and 0900 hours (see Table 7). It should be noted that no additional trains are proposed during this time period and the resultant increase in queue is due to increased traffic flow forecast by the PRTM.

3.4 Further to the above, **Table 8** illustrates that the increase in queue of 11 PCU queue generated as a result of the 'WD' scenario will clear with an additional 32 seconds equating to a total of 298 seconds to clear. This is still well within the average available uptime of 734 seconds during that period.

3.5 **Table 7** also illustrates that there is an increase in queue of 9 PCU forecast between 1600-1700 as a result of the additional train proposed during this hour. This equates to an additional clearance time of 26 seconds. However, the resulting 242 seconds clearance time remains well within the average available uptime of 506 seconds during that period.

3.6 Based on the above, it is concluded that neither the traffic nor trains associated with HNRFI would materially exacerbate queuing at the Narborough Level Crossing.

4. SENSITIVITY TEST

4.1 It is noted that in general there is a decrease in forecast hourly flows from 2036 WoD to WD scenario. This reduction is attributed to PRTM predicting an overall decrease in AAWT at this location. Therefore, to provide a sensitivity assessment, the flows have been retained from WoD scenario and assessed with the proposed additional train times. A summary of the queue results is presented below.

Table 9: Queue Results (PCU) (Sensitivity Test)

		Queue Comparison					
		Southbound			Northbound		
	No. Trains (WoD / WD)	2036 WoD	2036 WD	Difference	2036 WoD	2036 WD	Difference
0600-0700	6 / 7	6	6	0	6	6	0
0700-0800	3 / 3	33	33	0	42	42	0
0800-0900	4 / 4	43	43	0	91	91	0
0900-1000	4 / 5	20	20	0	23	23	0
1000-1100	3 / 3	25	25	0	29	29	0
1100-1200	5 / 7	20	20	0	24	24	0
1200-1300	6 / 6	25	25	0	30	30	0
1300-1400	4 / 6	22	22	0	26	26	0
1400-1500	3 / 5	28	28	0	34	34	0
1500-1600	6 / 7	32	36	4	42	44	2
1600-1700	6 / 6	57	63	6	74	82	8
1700-1800	5 / 6	54	54	0	56	56	0
1800-1900	5 / 5	33	33	0	40	40	0
1900-2000	3 / 4	14	16	2	16	19	3
2000-2100	6 / 7	9	10	1	10	12	2
2100-2200	5 / 6	12	12	0	13	13	0
2200-2300	2 / 3	4	3	-1	4	4	0

4.2 A summary of the clearance time is presented in **Table 10**.

Table 10: Clearance Time (s) (Sensitivity Test)

	Southbound	Northbound

	No. Trains	Average available barrier uptime	2036 WoD	2036 WD	Difference	2036 WoD	2036 WD	Difference
0600-0700	7	274	16	16	0	16	16	0
0700-0800	3	601	95	95	0	121	121	0
0800-0900	4	734	124	124	0	266	266	0
0900-1000	5	486	57	57	0	66	66	0
1000-1100	3	831	71	71	0	83	83	0
1100-1200	7	430	57	57	0	69	69	0
1200-1300	6	230	71	71	0	86	86	0
1300-1400	6	542	63	63	0	74	74	0
1400-1500	5	441	80	80	0	98	98	0
1500-1600	6	312	92	104	12	121	127	6
1600-1700	6	506	166	183	17	216	239	23
1700-1800	6	373	157	157	0	163	163	0
1800-1900	5	485	95	95	0	116	116	0
1900-2000	4	625	39	45	6	45	54	9
2000-2100	7	436	24	27	3	27	33	6
2100-2200	6	320	33	33	0	36	36	0
2200-2300	3	585	10	7	-3	10	10	0

4.3 **Table 9** demonstrates that the largest increase in queue clearance is again noted between 1600 and 1700 hours. This equates to an additional 23 seconds. However, the resulting 239 seconds clearance time remains well within the average available uptime of 506 seconds during that period. Consequently, the conclusions above remain valid.

5. ADDITIONAL ANALYSIS

5.1 At the request of Leicestershire County Council, new surveys were undertaken of the Narborough level crossing and surrounding roads for 7 days between Saturday 25 November and Friday 1 December 2023. This was due to concerns that the previous surveys were carried out close to the school holidays which could have resulted in traffic flows being lower.

5.2 The new surveys recorded two-way traffic flows, queue lengths, average crossing downtimes and the total number of downtimes across each survey day. A summary of the daily results is included at Table 11.

Table 11: Revised Survey Results

	Traffic Flow (veh)	No. Down Time	Avg. Downtime (s)
25/11/2023	6313	80	208
26/11/2023	5086	42	205
27/11/2023	7599	75	206
28/11/2023	7945	88	206
29/11/2023	8273	87	199
30/11/2023	8263	87	202
01/12/2023	7897	77	231

5.3 The results show that the traffic flows and average downtimes were the highest on Wednesday 29 November 2023, when there was a total two-way flow of 8273 vehicles, a total of 87 downtimes and an average downtime of 199 seconds. When comparing this to the data set out in Table 1, which formed the basis of the assessment carried out earlier in this report, the original dataset is robust and higher than the new data (8674 two-way movements, a total of 83 downtimes and an average downtime of 213 seconds). For this reason, there is no requirement to revisit the assessment using the new data.

5.4 Notwithstanding the above, various plots have been created to show the extent of queueing recorded on each of the roads in the vicinity of Narborough level crossing:

- Figure 1: morning peak hour (worst-case SB queuing) – 08:38 hours
- Figure 2: morning peak hour (worst-case NB queueing) – 09:07 hours
- Figure 3: evening peak hour (combined worst-case queues) – 17:16 hours

Figure 4: Morning Peak Hour Queuing (worst-case SB Queue)

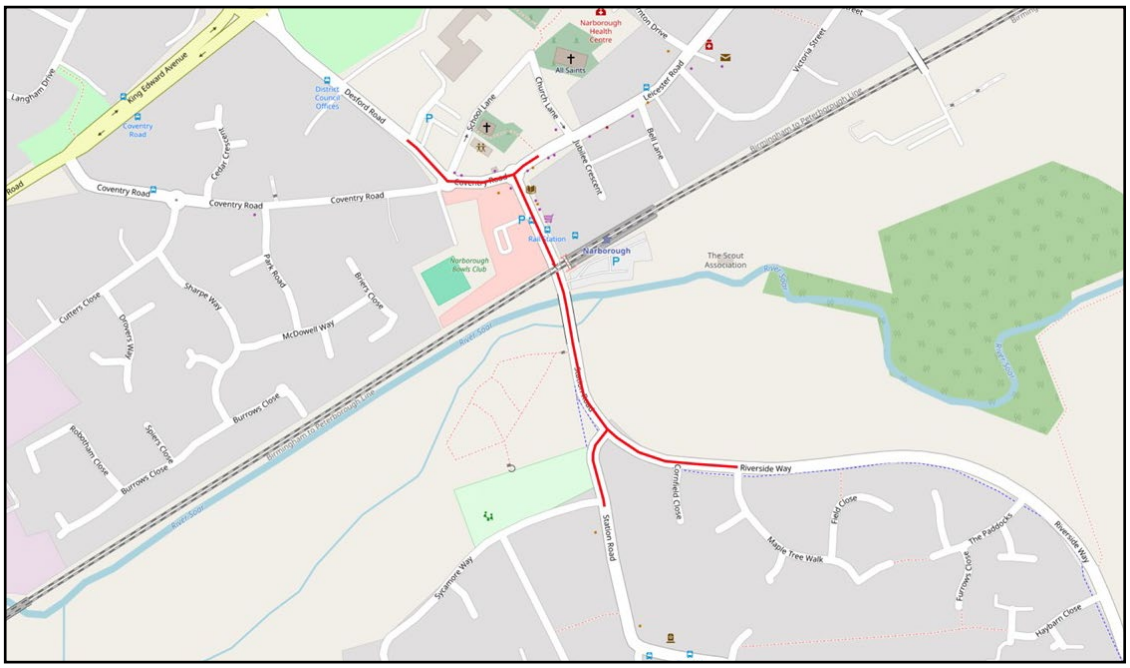
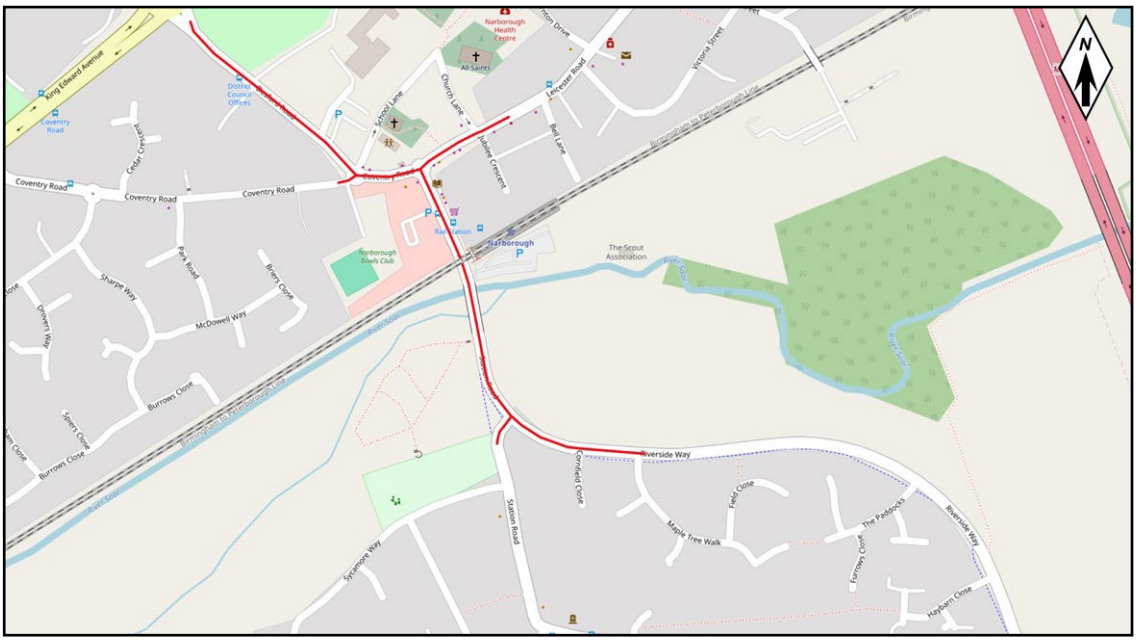


Figure 5: Morning Peak Hour Queuing (worst-case NB Queue)

Figure 6: Evening Peak Hour Queuing (combined NB and SB)



5.5 The plots show that queueing does occur along the roads in the vicinity of Narborough Level Crossing, however these quickly disperse once the level crossing is up. However, given the previous assessment concluded that neither the traffic nor trains associated with HNRFI would materially exacerbate queuing at the Narborough Level Crossing, based on more robust data previously gathered, this conclusion remains unchanged.

6. SUMMARY & CONCLUSION

6.1 The purpose of this Technical Note is to outline modelling undertaken to understand the impact of the proposed development on Narborough Level Crossing.

6.2 Manual turning count and queue surveys were undertaken at local junctions between 11/10/2023 and17/10/2023, with concurrent surveys also undertaken at the Narborough Level Crossing to record the duration of barrier downtime and uptime and associated queues.

6.3 The survey results on Wednesday 13th October were found to provide the highest traffic flows, number of downtimes and average downtime per period. Hence, it was adopted as the surveyed assessment day.

6.4 2036 Forecast traffic flows were produced for the With and Without Development scenarios using PRTM peak hour and AAWT flows.

6.5 Baseline 2023 LINSIG models were produced and validated against observed queues for each period. These were then used to model the effects of the additional downtime associated with 20 HDRFI trains provide by Baker Rose on the 2036 forecast traffic flows.

6.6 The modelling demonstrates that the effect of the increased traffic or additional trains associated with HNRFI would be negligible throughout most of the day, with the largest increase in queue clearance being between 0800 to 0900 hours and 1600- to 1700 hours. However, the resulting clearance time is still well within the average available uptime during that period. Therefore, it is concluded that neither the traffic nor trains associated with HNRFI would materially exacerbate queuing at the Narborough Level Crossing.

6.7 An additional analysis using new traffic data was undertaken between Saturday 25 November and Friday 1 December 2023 at the request of Leicestershire County Council. The data recorded confirms that the assessment carried out was robust and therefore the conclusions of the assessment remain unchanged.

APPENDICES

APPENDIX 1: Narborough Level Crossing Survey

APPENDIX 2: LinSig Output