Horse Crossing Assessment - Rayes Lane, Newmarket

Client name	Project name	Date	Prepared by
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Revision History

Revision	Revision date	Details	Authorised	Name	Position
3.0	20 June 2018	Final	NA	N. Anderson	Regional Director

1.0 Introduction

1.1 AECOM have been commissioned by Suffolk County Council (SCC), the highway authority, to assess whether the proposal to signalise a number of existing horse crossings within Newmarket will have an impact on the operation of the local road network as a result of traffic from the Forest Health District Council (FHDC) Local Plan growth. This work has been undertaken as a result of a query raised by Cottee Transport Planning, the transport consultants for the Horse Racing Industry.

2.0 Assessment

2.1 To inform the assessment, discussions were held with SCC to understand whether operational information was available to assess the impact of the horse crossings on highway operation. SCC confirmed that they have not undertaken any detailed work on the operation of the proposed horse crossings within Newmarket.

2.2 It is understood that SCC have undertaken some initial work on one of the crossings near the racecourse, however this work does not provide a definitive answer on how they would operate beyond the fact that the length of crossing time would be driven by the size of the horse group as horses cannot wait for a long period of time for the lights to change and there will be a minimum length of green time available for cars between each horse crossing movement.

2.3 As a result of the absence of any detailed work on signalising horse crossings in Newmarket a first principles approach has been undertaken to determine the vehicle flow against available capacity and the potential maximum queue length at the worst case crossing location. The following approach has been undertaken;

1. The "worst case" scenario for traffic flows across horse crossings in Newmarket town centre in the 2031 future year with Local Plan Site Allocations has been determined.
2. The town centre horse crossing with the highest traffic flow within the worst case scenario has been established and the theoretical saturation flow for vehicles at the crossing has been calculated.
3. Using Rayes Lane crossing as a proxy for how traffic signals would likely operate, a "first principles" assessment for the AM peak hour (08:00-09:00) using timings based on the 2012 survey of the crossing has been undertaken. This provides an indication of the capacity of the crossing for vehicles compared to demand (Degree of Saturation) and also maximum queue lengths on Fordham Road at the crossing.

2.4 This approach is explained in further detail in the following sections

1. *Worst Case Scenario for Traffic Flows Across Horse Crossings*

2.5 Only traffic flows at town centre horse crossings have been reviewed as signalising these crossings will have the greatest impact on surrounding junctions due to their close proximity, if excessive queuing occurs.

2.6 From reviewing the 2031 Future Year with Local Plan Site Allocations traffic flow scenarios at town centre horse crossings within the road network AM peak hour (0800 hours to 0900 hours), the worst case scenario is 'Scenario 2' March 2017 SALP + 450 Newmarket' which comprises of an additional 400 dwellings at Hatchfield Farm and an additional 50 dwellings at Queensbury Lodge. This scenario has therefore been used within this assessment.

2. Town Centre Horse Crossing with the Highest Traffic Flow

2.7 The 2031 Future Year with Local Plan Site Allocations 'Scenario 2' traffic flows at each of the Newmarket town centre horse crossings have been reviewed. From this it has been determined that the highest traffic flow is at Rayes Lane; this horse crossing therefore represents the worst case and has therefore been assessed in detail. The 2031 Future Year with Local Plan Site Allocations 'Scenario 2' traffic flows (in Passenger Car Units (PCU)) at the Rayes Lane horse crossing for the AM peak hour are set out in **Table 1** below.

Table 1. 2031 with Scenario 2 Traffic Flows (Passenger Car Unit) at Rayes Lane Horse Crossing (AM Peak Hour)

Direction of Travel on Fordham Road	AM Peak Hour Traffic Flow (PCU)
Northbound	601
Southbound	681
Two Way	1283

Source: Two-way flow from Junction Survey Commissioned by WSP used for Hatchfield Farm application. Survey data used from RPS TN dated 3rd Nov 2017 titled 'COMPARISON OF TRAFFIC FLOW DATA', directional flows have been extrapolated.

2.8 The traffic flows in the above table provide the likely traffic demand at the horse crossing in the worst case future year scenario. These flows have been used in the first principles approach, as set out in the below section.

3. First Principles Assessment of Rayes Lane Horse Crossing on Highway Operation

2.9 A video survey undertaken at Rayes Lane by SCC in 2012 has been used within this first principles assessment to establish the likely green and red time for vehicular traffic within the AM peak hour. **Table 2** below sets out the video survey data for horse crossings that occurred within the AM peak hour (0800 hours to 0900 hours). The full survey data is included at **Appendix A**.

Table 2. Observations at Rayes Lane Horse Crossing

String	No. Horses	Southbound Traffic Queue Length	Direction of Horse Travel	Start (Crossing Time)	End (Crossing Time)
9	1	2	Wb	08:04:26	08:04:31
10	1	1	Wb	08:06:33	08:06:39
11	1	0	Eb	08:07:14	08:07:19
12	1	0	Eb	08:07:50	08:07:54
13	26	7	Wb	08:09:22	08:10:18
14	5	4	Wb	08:11:40	08:11:58
15	5	3	Wb	08:12:35	08:12:51
16	10	9	Wb	08:19:53	08:20:26
17	6	4	Eb	08:21:05	08:21:20
18	26	3	Both	08:22:18	08:22:51
19	10	6	Eb	08:27:37	08:28:03
20	1	6	Wb	08:35:55	08:36:00
21	1	0	Wb	08:36:39	08:36:44
22	1	7	Wb	08:39:34	08:39:38
23	22	10+	Eb	08:41:57	08:42:43
24	4	7	Eb	08:45:29	08:45:36
25	6	7	Eb	08:46:49	08:47:08
26	26	8	Both	08:47:30	08:48:45
27	5	10+	Eb	08:49:06	08:49:20

String	No. Horses	Southbound Traffic Queue Length	Direction of Horse Travel	Start (Crossing Time)	End (Crossing Time)
28	5	10+	Wb	08:49:47	08:50:01
29	13	10+	Wb	08:50:06	08:50:35
30	6	7	Eb	08:54:04	08:54:24
31	8	4	Eb	08:55:13	08:55:32

Source: SCC 2012 Survey

2.10 Using the data above the crossing movements have been assessed as if they were controlled by signals. It has been assumed that when horses are crossing, the vehicles would be held by a red light as horses are unable to wait at the crossing for a prolonged period of time. When no horses are crossing it has been assumed that traffic would pass through the crossing on a green light. From this information the total red and green time for traffic has been calculated based on the crossing start and end times. An intergreen time of ten seconds has also been allowed. This takes into account the expected time between cars having a green light and horses having a green light and vice versa, which reflects how the crossing would operate if it was signalised. This intergreen is considered robust. Previous analysis undertaken by JCT on behalf of COTTEE assumed an intergreen of 5 seconds. This reduced intergreen would increase capacity for cars.

2.11 Vehicular saturation flow for both northbound and southbound lanes on Fordham Road at the crossing has been estimated from lane geometry using the RR67 method, which is from the Research Report 67 entitled 'The Prediction of Saturation Flows for Road Junctions Controlled by Traffic Signals'. The following assumptions have been used to calculate the saturation flow.

- Lane width - 3.10 metres (used for northbound and southbound lanes on Fordham Road), based on the existing road layout;
- Lanes classified as a nearside lane; and
- No gradient has been applied.

2.12 Based on the above assumptions, the saturation flow has been calculated at 1,952 PCU's per hour for both southbound and northbound lanes on Fordham Road, at the Rayes Lane horse crossing. This assumes that 1,952 PCU's can pass through the crossing in each direction freely in an hour assuming that the green signal is available at all times. However in reality this would not be the case as horses will be crossing causing vehicles to wait; and if the junction was signalised vehicles would wait at a red light and also have intergreen time. Therefore taking this into account, the number of vehicles which could realistically travel though the junction if it was signalised within the hour would be reduced, as total green time for vehicles across the hour would be less. Taking into account this reduction in green time, which has been calculated from the horse crossing survey data in Table 2, the capacity of both lanes on Fordham Road at the crossing would be reduced to 1,286 PCU's per hour.

2.13 Using the 2031 Future Year with Local Plan Site Allocations 'Scenario 2' traffic demand in the AM peak hour identified at Rayes Lane set out in Table 1 and the capacity of each lane calculated at 1,286 PCU's per hour, the Degree of Saturation (DoS) can be calculated for both of these northbound and southbound lanes. It is generally accepted that DoS values of 90% and less are indicators that a junction is operating within capacity. Although a junction would be said to be operating at capacity at values of 100%, the use of 90% allows for a margin of error and fluctuations in traffic flows. Junctions are therefore only identified as operating over capacity if these values are exceeded.

2.14 The DoS values for each lane approaching the Rayes Lane crossing on Fordham Road are set out in Table 3 below for the 2031 Future Year with Local Plan Site Allocations 'Scenario 2'.

Table 3. DoS on Fordham Road at the Rayes Lane Crossing - 2031 Future Year with Local Plan Site Allocations 'Scenario 2'

Lane	Degree of Saturation (DoS)
Fordham Road Northbound	42%
Fordham Road Southbound	47%

2.15 The DoS above indicates that for the Rayes Lane horse crossing, both northbound and southbound lanes on Fordham Road are predicted to operate with spare capacity in the Worst Case scenario '2031 Future Year with Local Plan Site Allocations 'Scenario 2'' within the AM peak hour, with the highest DoS of 47% occurring on the southbound lane.

2.16 Over the course of the AM peak hour the maximum queue has been calculated for both northbound and southbound lanes on Fordham Road, using the maximum duration of red time from the survey data and adding 20 seconds of intergreen time. The maximum queue in PCU's and length of queue (assuming each PCU is 6 metres), is set out in Table 4 below for both northbound and southbound lanes.

Table 4. Maximum Queue and Queue Length on Fordham Road at the Rayes Lane Crossing - 2031 Future Year with Local Plan Site Allocations 'Scenario 2'

Lane	Maximum Queue (PCU's)	Maximum Queue Length (metres)
Fordham Road Northbound	16	95
Fordham Road Southbound	18	108

2.17 In the AM peak hour the maximum queue on the southbound lane is predicted to be a18 PCU queue which will not extend back to any significant junctions and would therefore not impact on the surrounding junctions. A 16 PCU queue is predicted to occur on the northbound lane in the AM peak hour. This maximum queue would finish 48 metres to the north of the Fred Archer Way / Fordham Road signalised junction located to the south of the Rayes Lane horse crossing. It is important to note that these are maximum queues, and therefore over the course of the AM peak hour queueing will fluctuate depending on the varying duration of crossing times and demand on the approach over the course of the hour and therefore this represents the worst case.

3.0 Impact of growth in horse movements

3.1 The above analysis is based on a 2012 survey of horse crossing movements. As identified in Table 11 of AECOM Technical Note "Newmarket Horse Crossings – Traffic Impact Assessment (FHDC Local Plan Cumulative Traffic Impact Study)", horse crossing movements at Rayes Lane are expected to increase to 372 by the end of the Local Plan period in 2031. It is very hard to determine the impact of this increase on the operation of the crossing. This increase may occur by the strings of horses getting longer or by additional strings crossing. Some of the existing strings are very short and an increase to those strings would have little impact on the operation of the crossing. The extension of longer strings would increase the red time for cars but not in proportion to the increase in horses. Additional horses may increase the occasions when two horse crossing activities are too close together that it is not possible to run a stage for cars in between, leading to an extended period of red time for cars.

3.2 Rather than trying to assess the impact of additional horses directly, it is possible to consider how great the impact would have to be, to be significant for vehicle operations. Based on the 2012 surveyed crossing movements there would be a total red period for cars of 15.57 minutes during the AM peak hour. For the degree of saturation to exceed the design maximum of 90% the capacity of the busiest approach would have to reduce to 757 pcu/hr and that would require the sum of red periods for cars in the hour to increase to 36.7 minutes, more than a 100% increase.

3.3 Having determined that it is unlikely that the crossing would be over capacity in traditional degree of saturation terms, the impact of queuing traffic should be considered. The critical spacing between the crossing and adjacent junctions is to the south. The immediate junction is the junction between Fordham Road and Fred Archer Way and then the Clock Tower junction. The Fred Archer Way/Fordham Road junction could be kept clear of queuing traffic by the installation of a yellow box if necessary. Any queuing round into Fred Archer Way would not impact on other traffic movements because the left turning traffic on Fred Archer Way has its own dedicated lane.. Queuing on Fordham Road on the approach from the Clock Tower could be an issue if the queue reached back to the Clock Tower junction. The queue would have to extend to 214 metres or some 36 pcu. If it is assumed that the entire northbound approach flow of 601 pcu is approaching from the Clock Tower, a highly unlikely scenario, the signals at the horse crossing would have to be red for cars for 223 seconds before the queue starts to reach back to the Clock Tower. The longest stop period assessed by JCT on the basis of their modelling was 114 seconds. The length of the longest stop period would need to more than double for this before the queue would reach the Clock Tower.

4.0 Conclusions

4.1 A first principles approach has been undertaken to assess whether the proposals to signalise a number of horse crossings within Newmarket will have an impact on traffic operation of the local road as a result of traffic from the

Forest Health District Council (FHDC) Local Plan growth. The assessment uses the worst case future year scenario with the Local Plan Site Allocations, this being scenario 2 which comprises of an additional 400 dwellings at Hatchfield Farm and an additional 50 dwellings at Queensbury Lodge

4.2 As a detailed programme is still being developed by SCC, the racing industry and other local partners (e.g. District Council and Suffolk Police), the town centre horse crossing with the highest traffic flow in the future year with the Local Plan Site Allocations has been used to assess the operational impact through using a first principles approach, this crossing is that located at Rayes Lane on Fordham Road. This approach has been informed by a survey undertaken by SCC at the Rayes Lane horse crossing in 2012 providing a proxy for how traffic signals at this location would likely operate.

4.3 The results indicate that if the Rayes Lane horse crossing was signalised, it would operate with significant spare capacity on both northbound and southbound lanes on Fordham Road in the Worst Case scenario 'Future year With the 2031 Future Year with Local Plan Site Allocations 'Scenario 2'' AM peak hour, with a maximum DoS of 47% occurring on the southbound lane.

4.4 It has been considered how great the impact of the growth of horse crossing movements would have to be, for this to be significant for vehicle operations. For the degree of saturation to exceed the design maximum of 90%, the capacity of the busiest approach would have to reduce to 757 pcu/hr and that would require the sum of red periods for cars in the hour to increase to 36.7 minutes which is more than a 100% increase.

4.5 The impact of queuing traffic has also been considered. The Fred Archer Way/Fordham Road junction could be kept clear of queuing traffic by the installation of a yellow box. Any queuing round into Fred Archer Way would not impact on other traffic movements. Queuing on Fordham Road on the approach from the Clock Tower is not expected to be an issue. From reviewing the predicted red time for cars, assuming all future year northbound traffic will use the Clock Tower (assumes a worst case scenario), and comparing this to the JCT modelling results, the length of the longest stop period would need to more than double before the queue would reach the Clock Tower. Signalising the Rayes Lane horse crossing is therefore not expected to significantly impact on the traffic conditions within the area, in terms of additional queuing.

4.6 Based on the results of the assessment, the signalisation of the horse crossing is anticipated to have an acceptable impact on the operation of the local road network whilst providing a safer crossing environment for horses. This would also be true at other locations within the town where signalisation is proposed.

Appendix A: Rayes Lane Horse Crossing Survey (2012)

		Queue Length					
String	Number of horses	Northbound	Southbound	Direction of horses	Time Start	Time Ending	Duration
1	2	*Cannot be observed*	0	Westbound	07:42:50	07:42:58	00:00:08
2	12		6	Westbound	07:43:19	07:43:40	00:00:21
3	7		0	Eastbound	07:46:23	07:46:44	00:00:21
4	9		1	Westbound	07:47:13	07:47:37	00:00:24
5	2		0	Westbound	07:48:19	07:48:26	00:00:07
6	1		2	Westbound	07:55:05	07:55:09	00:00:04
7	5		3	Eastbound	07:56:16	07:56:28	00:00:12
8	4		0	Westbound	07:58:43	07:58:57	00:00:14
9	1		2	Westbound	08:04:26	08:04:31	00:00:05
10	1		1	Westbound	08:06:33	08:06:39	00:00:06
11	1		0	Eastbound	08:07:14	08:07:19	00:00:05
12	1		0	Eastbound	08:07:50	08:07:54	00:00:04
13	26		7	Westbound	08:09:22	08:10:18	00:00:56
14	5		4	Westbound	08:11:40	08:11:58	00:00:18
15	5		3	Westbound	08:12:35	08:12:51	00:00:16
16	10		9	Westbound	08:19:53	08:20:26	00:00:33
17	6		4	Eastbound	08:21:05	08:21:20	00:00:15
18	26		3	Both ways	08:22:18	08:22:51	00:00:33
19	10		6	Eastbound	08:27:37	08:28:03	00:00:26
20	1		6	Westbound	08:35:55	08:36:00	00:00:05
21	1		0	Westbound	08:36:39	08:36:44	00:00:05
22	1		7	Westbound	08:39:34	08:39:38	00:00:04
23	22		10+	Eastbound	08:41:57	08:42:43	00:00:46
24	4		7	Eastbound	08:45:29	08:45:36	00:00:07
25	6		7	Eastbound	08:46:49	08:47:08	00:00:19
26	26		8	Both ways	08:47:30	08:48:45	00:01:15
27	5		10+	Eastbound	08:49:06	08:49:20	00:00:14
28	5		10+	Westbound	08:49:47	08:50:01	00:00:14
29	13		10+	Westbound	08:50:06	08:50:35	00:00:29
30	6		7	Eastbound	08:54:04	08:54:24	00:00:20
31	8		4	Eastbound	08:55:13	08:55:32	00:00:19
32	24		10+	Eastbound	09:00:17	09:01:16	00:00:59
33	18		1	Both ways	09:04:20	09:04:58	00:00:38
34	7		7	Eastbound	09:05:55	09:06:12	00:00:17
35	4		8	Eastbound	09:10:05	09:10:16	00:00:11
36	11		4	Eastbound	09:13:28	09:13:59	00:00:31
37	3		1	Eastbound	09:14:54	09:15:03	00:00:09