A428 Black Cat to Caxton Gibbet Scheme

Wyboston and Barford Road Roundabouts Mitigation Note

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Introduction

CCC have concerns about the impact of the proposed A428 Black Cat to Caxton Gibbet scheme at the Wyboston and Barford Road roundabouts in St Neots. Strategic modelling commissioned by National Highways (NH), demonstrating the case for the scheme shows that in the 2040 design year:

- Although the scheme reduces total in flows to the Wyboston junction by some 5,700 pcu (AADT flow), the flow from St Neots on the Great North Road north approach arm increases by 1,690 pcu (AADT), an increase of 21%
- Total in flows to the Barford Road junction reduce by 13,700 pcu (AADT) but flows from the Barford Road north approach arm increase by 490 pcu (AADT), an increase of 7%.

CCC are concerned that if sufficient capacity is not provided on the Great North Road north and Barford Road north approach arms to these two key junctions, the wider scheme benefits to St Neots will not be realised.

To assess the impact of the proposed scheme at the two junctions in more detail, NH built junction models and reported findings in the Transport Assessment Annex (A428 inquiry document reference **APP-243**). The results from this modelling were unacceptable to CCC because NH used turning flows from the strategic SATURN model as direct inputs to the junction models. Since the strategic model was only calibrated using link flows, use of turning flows output from the model in this manner was wholly inappropriate unless observed turning flows had been used to calibrate them at the junctions in question. NH subsequently undertook sensitivity tests at the junctions using CCC's suggested method for developing forecast year flows (Appendix 1) and reported this work at deadline 5 in "9.68 Junction Model Sensitivity Test Results" [**REP5-018**].

The flows used in this modelling were accepted by CCC with the sensitivity modelling showing the Wyboston roundabout to be operating over capacity in 2040 with the introduction of the scheme, particularly the Great North Road north arm. The tests also showed the Barford Road roundabout to be operating over capacity in 2040 with the introduction of the scheme, with the Barford Road north and south, and A428 east approach arms worst affected.

Based on these results, CCC discussed the need for mitigation at these two junctions at a meeting on 29 November 2021. NH agreed to investigate road space reallocation at the junctions to see if this could mitigate the impacts of the scheme at these junctions. This work was reported by the Applicant in Chapter 6 of "9.105 Applicants Response to issues raised at Issue Specific Hearing 5 on 1 December 2021" [**REP8-022**].

The note considered options but contrary to CCC's understanding, NH did not use the junction models to support their conclusions and instead undertook a desk top exercise that stated lane reallocation would not have a significant impact at these

junctions and therefore there was no mitigation suggested. As a result, CCC have investigated options using NH's junction models and this note presents our results and conclusions.

Discussion

The following sections present CCC's modelling results for the Wyboston and Barford Road junctions and discuss options and CCC's conclusions.

Wyboston Roundabout

NH reported results from junction model sensitivity tests, including the Wyboston junction in their document "9.68 Junction Model Sensitivity Test Results" [**REP5-018**]. Forecast year traffic flows used in this analysis were developed using a method similar to the method suggested by CCC and as a result CCC broadly accept the flows used as well as the results and conclusions from this modelling.

We note however that NH used the strategic model to calculate growth factors between the base and forecast year Do Minimum (DM) scenario, and then applied differences between the Do Something (DS) and DM scenarios to obtain the forecast year DS sensitivity test demand. CCC's method recommended using differences between the DM / DS scenarios and base year to generate demand for the respective future year scenarios. Both methods are equally valid, and in this case very similar forecast year demand was obtained using either method.

Junction results for Wyboston junction in the 2040 design year without and with the proposed A428 Black Cat to Caxton Gibbet scheme, the Do Minimum (DM) and Do Something (DS) scenarios respectively are shown below. The results shown below differ slightly from those presented by NH in **REP5-018** because CCC re-ran the models using Junctions 10 software rather than Junctions 9 that was used by NH. *Note: the differences are minimal and do not change any conclusions drawn.*

Table 1 – Wyboston junction NH Sensitivity test results

	AM					PM				
Approach Arm	**Set ID**	**Queue (Veh)**	**Delay (s)**	**RFC**	**LOS**	**Set ID**	**Queue (Veh)**	**Delay (s)**	**RFC**	**LOS**
	[Lane Simulation] – 2040 DM									
Great North Road (N)	D7	9	45	0.89	E	D8	50	145	1.00	F
A428		11	23	0.83	C		14	27	0.90	D
Great North Road (S)		53	139	1.11	F		67	180	1.12	F
Premier Inn Access		0	14	0.11	B		1	18	0.40	C
A1 Southbound Offslip		42	172	0.95	F		1	14	0.41	B
	[Lane Simulation] – 2040 DS									
Great North Road (N)	D9	33	109	0.99	F	D10	55	145	1.01	F
A428		8	23	0.83	C		13	28	0.88	D
Great North Road (S)		3	10	0.72	B		10	27	0.93	D
Premier Inn Access		0	10	0.10	A		1	30	0.50	D
A1 Southbound Offslip		29	111	0.97	F		2	19	0.55	C

Junction Models\2021.11.24 Sensitivity Test Junction Models\4. Wyboston\Models\ST Wyb rbt lane sim_051121-NH.j10

Notes:

1. RFC = Ratio of Flow to Capacity. Values greater than 0.85 indicate the junction operates over its operational capacity with little reserve capacity and will be unable to cope effectively with daily fluctuations in traffic flows. Values greater than 1.00 indicate the junction operates over practical capacity and significant queuing and delays will be experienced by users.
2. LOS = Level of service. A = free flow, B = reasonably free flow, C = stable flow, D = approaching unstable flow, E = unstable flow, F = breakdown flow.

Results from the table above show:

- Although the scheme provides some slight benefits especially in the morning peak, overall junction performance does not markedly improve between DM and DS scenarios
- The Great North Road north approach arm remains over capacity in the DS scenario in both morning and evening peak hours. Importantly the queues on this approach would extend for distances of 190m and 316m upstream of the junction in the morning and evening peak hours respectively, with the queue projected to reach the junction of Howard Road in the evening peak hour
- Great North Road south approach arm experiences the most benefit from the scheme although this arm is still shown to be operating over capacity in the PM peak.
- The A1 off-slip remains over capacity in the morning peak hour in the DS scenario although the model indicates that the levels of queuing and delay reduces slightly.
- In the morning peak two of the five arms are shown to be operating very close to the absolute capacity
- in the evening peak three of the five approach arms are either at or close to the absolute capacity in the DS scenario during the evening peak hour, with the exceptions being the A1 off-slip and the lightly trafficked Premier Inn access.

For completeness, results using CCC forecast demand are shown in Table 2 below.

Table 2 - Wyboston junction NH Sensitivity test results, using CCC demand

	AM					PM				
Approach Arm	**Set ID**	**Queue (Veh)**	**Delay (s)**	**RFC**	**LOS**	**Set ID**	**Queue (Veh)**	**Delay (s)**	**RFC**	**LOS**
	[Lane Simulation] – 2040 DM									
Great North Road (N)	D13	11	53	0.90	F	D14	51	150	0.99	F
A428		8	17	0.79	C		11	21	0.88	C
Great North Road (S)		52	136	1.08	F		58	149	1.09	F
Premier Inn Access		0	14	0.10	B		1	17	0.38	C
A1 Southbound Offslip		23	97	0.96	F		2	14	0.40	B
	[Lane Simulation] – 2040 DS									
Great North Road (N)	D15	21	72	0.98	F	D16	40	104	0.99	F
A428		7	20	0.84	C		11	27	0.87	D
Great North Road (S)		2	9	0.70	A		6	18	0.88	C
Premier Inn Access		0	10	0.08	B		1	25	0.45	C
A1 Southbound Offslip		13	59	0.89	F		2	16	0.50	C

Junction Models\2021.11.24 Sensitivity Test Junction Models\4. Wyboston\Models\ST Wyb rbt lane sim_051121-NH.j10

Notes:
1. RFC = Ratio of Flow to Capacity. Values greater than 0.85 indicate the junction operates over its operational capacity with little reserve capacity and will be unable to cope effectively with daily fluctuations in traffic flows. Values greater than 1.00 indicate the junction operates over practical capacity and significant queuing and delays will be experienced by users.
2. LOS = Level of service. A = free flow, B = reasonably free flow, C = stable flow, D = approaching unstable flow, E = unstable flow, F = breakdown flow.

Inspection of results in Table 2 shows the conclusions drawn from the NH modelling still apply with the Great North Road north approach arm being over capacity with the introduction of the A428 scheme.

National Highways Options Investigation for Wyboston Roundabout

NH examined options for improving capacity at the Wyboston roundabout and presented their findings in Chapter 6 of "9.105 Applicants Response to issues raised at Issue Specific Hearing 5 on 1 December 2021" [**REP8-022**].

This document reported a desktop exercise in examining options at the junction, with NH's questionable decision not to use the ARCADY model to test options. CCC note that this would have been a relatively quick and easy task.

The Applicant's opening statement that mitigation would not include carrying out physical construction work on the local road network is also disputed by CCC as the capacity issues at this junction are a direct result of building the proposed scheme and need to be mitigated by the applicant as part of the scheme.

NH set out a number of options in the note, these focussed on the Great North Road north approach arm, the options considered were:

- Retain the existing layout: re-mark the current lanes to allocate straight ahead traffic to the offside lane only;
- Increase the capacity of the roundabout approach;
- Provide a free-flow left turn lane from Great North Road north into the A428 eastbound exit;
- Reduce the capacity of one of the other arms to provide more gaps in the circulatory flow at the Great North Road north arm.
- Signalisation of the junction

NH's conclusions for the Wyboston junction were:

- that by solely adjusting the lane markings, the benefits in traffic operations would be negligible or marginal
- that more substantive widening or improvements could bring in some potential benefits but they were beyond the proper scope of the Scheme
- that NH did not propose to undertake any further sensitivity tests of any alternative schemes for these junctions, which were unaltered from their current forms in the assessment of this scheme

CCC disagree that more substantive widening or improvements are beyond the scope of the A428 scheme and as a result undertook testing of the junction to determine what mitigation might be needed. Only impacts in the 2040 design year for the DS scenario were considered, using both NH and CCC derived flows for completeness.

CCC Options Investigation for the Wyboston Roundabout

NH modelling showed the Great North Road north approach arm was most in need of mitigation at this junction. There were a number of options for mitigation but tests undertaken by CCC using NH's ARCADY model indicate the provision of a free-flow left turning lane between the Great North Road northern arm and the A428 east

bound would be the most viable solution. Results from this test are shown in the table below, using both NH and CCC derived forecast year flows.

Table 3 - Wyboston junction mitigation test results (segregated left turn traffic)

	AM					PM				
Approach Arm	**Set ID**	**Queue (Veh)**	**Delay (s)**	**RFC**	**LOS**	**Set ID**	**Queue (Veh)**	**Delay (s)**	**RFC**	**LOS**
	[Lane Simulation] – 2040 DS No LT traffic from GNR – NH demand									
Great North Road (N)	D11	1	7	0.32	A	D12	1	8	0.48	A
A428		8	22	0.84	C		15	35	0.91	E
Great North Road (S)		3	10	0.72	B		9	28	0.92	D
Premier Inn Access		0	10	0.08	B		2	30	0.52	D
A1 Southbound Offslip		28	112	0.95	F		2	19	0.57	C
	[Lane Simulation] – 2040 DS No LT traffic from GNR – CCC demand									
Great North Road (N)	D17	1	7	0.30	A	D18	1	7	0.47	A
A428		7	18	0.82	C		11	25	0.89	D
Great North Road (S)		2	9	0.70	A		6	18	0.87	C
Premier Inn Access		0	9	0.07	A		1	24	0.45	C
A1 Southbound Offslip		14	58	0.91	F		2	15	0.50	C

Junction Models\2021.11.24 Sensitivity Test Junction Models\4. Wyboston\Models\ST Wyb rbt lane sim_051121-NH.j10

Notes:

1. RFC = Ratio of Flow to Capacity. Values greater than 0.85 indicate the junction operates over its operational capacity with little reserve capacity and will be unable to cope effectively with daily fluctuations in traffic flows. Values greater than 1.00 indicate the junction operates over practical capacity and significant queuing and delays will be experienced by users.
2. LOS = Level of service. A = free flow, B = reasonably free flow, C = stable flow, D = approaching unstable flow, E = unstable flow, F = breakdown flow.

Results from the table above show:

- results from both demand sets are consistent
- queues and delay on Great North Road north arm are significantly reduced, to such a level that even when the left turning traffic is included in the traffic flow upstream of the junction, no significant queues should form
- the A1 off-slip remains over capacity in the morning peak hour, although there is sufficient queuing space on this arm to accommodate the expected 28 queued vehicles in the NH demand scenario. Due to flaring on this approach arm, queued vehicles will extend approximately 113m along the 400m long slip road
- The A428 approach arm remains over reserve capacity in the evening peak hour (RFC =0.91) with average delays of 35s per vehicle in the NH demand scenario.

Providing a free-flow left turn slip from Great North Road north on to the existing A428 eastbound would therefore be a realistic option to improve capacity at this junction.

CCC ran an additional test examining the impact of adding a give-way left turn lane on the Great North Road north approach arm but this showed a marked deterioration in the performance of this arm, with delays increasing from 145s to 254s per vehicle during the evening peak hour. This option was therefore not considered viable.

NH mention the presence of a bus layby and an uncontrolled crossing on the A428 east of the Wyboston Roundabout as reasons why they have not tested the effectiveness of a filter lane at this junction. However, the bus layby is not currently in

use and if such a facility were required in the future the location could be explored at that time. The uncontrolled crossing is substandard (due to crossing the 3-lane widened approach and areas of carriageway hatching) and the pedestrian route may be better provided for on the west side of the roundabout, routing to Wyboston Lakes via improved pedestrian facilities at the existing traffic light junction. Therefore, neither of these features precludes the introduction of a left filter lane in this location.

In addition, there would appear to be sufficient existing verge and road width to be able to construct the segregated left turn without additional land take.

Barford Road Roundabout

NH reported results from junction model sensitivity tests, including Barford Road junction in their document "9.68 Junction Model Sensitivity Test Results" [**REP5-018**]. Forecast year traffic flows used in this analysis were developed using a method similar to that suggested by CCC and as a result CCC broadly accept the flows used as well as the results and conclusions from this modelling.

Junction results for Barford Road junction in the 2040 design year without and with the proposed A428 Black Cat to Caxton Gibbet scheme, the Do Minimum (DM) and Do Something (DS) scenarios respectively are shown below. The results shown below differ slightly from those presented by NH in **REP5-018** because CCC re-ran the models using Junctions 10 software rather than Junctions 9 that was used by NH. Note however that the differences are minimal and do not change any conclusions.

Table 4 – Barford Road junction NH Sensitivity test results

	AM					PM				
	Set ID	Queue (Veh)	Delay (s)	RFC	LOS	Set ID	Queue (Veh)	Delay (s)	RFC	LOS
	[Lane Simulation] – 2040 DM									
Barford Road (N)	D7	10	38	0.95	E	D8	8	36	0.86	E
A428 (E)		345	1227	1.00	F		277	867	1.00	F
Barford Road (S)		2	13	0.55	B		252	939	0.96	F
A428 (W)		71	142	0.98	F		309	757	0.98	F
	[Lane Simulation] – 2040 DS									
Barford Road (N)	D9	6	21	0.85	C	D10	14	58	0.96	F
A428 (E)		4	17	0.68	C		5	17	0.78	C
Barford Road (S)		0	9	0.20	A		86	311	0.96	F
A428 (W)		5	11	0.74	B		63	114	0.96	F

Junction Models\2021.11.24 Sensitivity Test Junction Models\5. Barford Road\Models\ST Barford Road Roundabout_051121-NH.j10

Notes:

1. RFC = Ratio of Flow to Capacity. Values greater than 0.85 indicate the junction operates over its operational capacity with little reserve capacity and will be unable to cope effectively with daily fluctuations in traffic flows. Values greater than 1.00 indicate the junction operates over practical capacity and significant queuing and delays will be experienced by users.
2. LOS = Level of service. A = free flow, B = reasonably free flow, C = stable flow, D = approaching unstable flow, E = unstable flow, F = breakdown flow.

Results from the table above show:

- Introduction of the scheme provides most benefit during the morning peak hour with all approach arms operating within reserve capacity

- The junction performs particularly badly during the evening peak hour in the DS scenario, with three approach arms operating in excess of the operational capacity and close to absolute capacity

CCC conclude based on these results that mitigation is required at the junction.

National Highways Options Investigation for the Barford Road Roundabout

NH examined options for improving capacity at the junction and presented their findings in Chapter 6 of "9.105 Applicants Response to issues raised at Issue Specific Hearing 5 on 1 December 2021" [**REP8-022**].

This document reported a desktop exercise in examining options at the junction, with NH's decision not to use the junction model to test any options being questionable as it would have been a relatively quick and easy task.

Furthermore, NH's opening statement that mitigation would not include carrying out physical construction work on the local road network is disputed by CCC as capacity issues at the junction are a direct result of building the proposed scheme.

Options identified for the Barford Road roundabout focussed on improving capacity for right turning traffic from the Barford Road north approach, with the following options suggested:

- Retain the existing layout: re-model the junction in ARCADY to reflect the allocation of straight ahead traffic to the nearside lane only
- Increase the capacity of the roundabout approach;
- Reduce the capacity of one of the other arms to provide more gaps in the circulatory flow at the Barford Road (N) arm.
- Signalisation of the junction

With respect to the first bullet point above, CCC note the Barford Road north approach was modelled incorrectly by NH for the sensitivity test, which permitted ahead traffic to use both lanes. This is incorrect because there is only a single lane exit on Barford Road south, hence the ahead movement should be restricted to a single approach lane. CCC corrected this in their subsequent modelling of the junction.

NH's conclusions for the junctions assessed in **REP8-022** were:

- that by solely adjusting the lane markings, the benefits in traffic operations would be negligible or marginal
- that more substantive widening or improvements could bring in some potential benefits but they are beyond the proper scope of the Scheme
- that NH does not propose to undertake any further sensitivity tests of any alternative schemes for these junctions, which are unaltered from their current forms in the assessment of this scheme

CCC disagree that more substantive widening or improvements are beyond the scope of the A428 scheme and as a result undertook testing at the junction to ascertain what mitigation might be needed.

CCC Options Investigation for the Barford Road Roundabout

Solving capacity problems caused by the A428 scheme at the Barford Road junction appears more difficult due to the number of approach arms that are over capacity in

NH's sensitivity test modelling and the extremely high levels of delay forecast by the model.

As outlined above CCC noted an error in NH's sensitivity test modelling that allowed traffic from Barford Road north to use both lanes to travel straight ahead to Barford Road south. Since Barford Road south only has a single exit lane, this is incorrect and not how the junction currently operates. The table below shows junction results with this error corrected.

Table 5 – Barford Road junction NH Sensitivity test results – corrected Barford Rd north approach arm

	AM					PM				
	Set ID	Queue (Veh)	Delay (s)	RFC	LOS	Set ID	Queue (Veh)	Delay (s)	RFC	LOS
	[Lane Simulation] – 2040 DM									
Barford Road (N)	D7	11	37	0.92	E	D8	8	34	0.87	D
A428 (E)		343	1211	1.01	F		271	851	1.00	F
Barford Road (S)		2	13	0.57	B		255	953	0.98	F
A428 (W)		67	138	1.00	F		310	757	1.00	F
	[Lane Simulation] – 2040 DS									
Barford Road (N)	D9	7	25	0.85	D	D10	14	57	0.95	F
A428 (E)		4	19	0.69	C		5	17	0.78	C
Barford Road (S)		1	8	0.21	A		81	297	0.97	F
A428 (W)		4	10	0.73	A		58	107	0.95	F

ST Barford Road Roundabout_051121-NH-correction-v1

Notes:

1. RFC = Ratio of Flow to Capacity. Values greater than 0.85 indicate the junction operates over its operational capacity with little reserve capacity and will be unable to cope effectively with daily fluctuations in traffic flows. Values greater than 1.00 indicate the junction operates over practical capacity and significant queuing and delays will be experienced by users.
2. LOS = Level of service. A = free flow, B = reasonably free flow, C = stable flow, D = approaching unstable flow, E = unstable flow, F = breakdown flow.

Correcting this error improved junction performance slightly but it is still clearly over capacity in the DS evening peak hour scenario.

As for the Wyboston junction, we note that NH used the strategic model to calculate growth factors between the base and forecast year Do Minimum (DM) scenario, and then applied differences between the Do Something (DS) and DM scenarios to obtain the forecast year DS sensitivity test demand. CCC's method recommended using differences between the DM / DS scenarios and base year to generate demand for the respective future year scenarios. As noted previously, both methods are equally valid but in this case NH's method produced much higher forecast year flows as shown in the table below.

Table 6 – Differences between NH and CCC forecast flows for Barford Road junction (total arrive flow)

Scenario	Peak Hour	NH Forecast	CCC Forecast	Difference (NH – CCC)
2040 DM	AM	3,866	3,798	+73
	PM	4,820	4,148	+672
2040 DS	AM	2,998	2,863	+145

	PM	4,076	3,356	+720

The differences between the two alternative forecasts are largest in the evening peak hour which is when the junction is most congested. For completeness CCC re-ran the junction sensitivity test using CCC forecast demand. Results are summarised in the table below.

Table 7 – Barford Road junction NH Sensitivity test results – corrected Barford Rd north approach arm using CCC forecast flows

	AM					PM				
	Set ID	Queue (Veh)	Delay (s)	RFC	LOS	Set ID	Queue (Veh)	Delay (s)	RFC	LOS
	[Lane Simulation] – 2040 DM									
Barford Road (N)	D7	13	45	0.94	E	D8	6	25	0.82	D
A428 (E)		381	1439	0.99	F		213	757	0.99	F
Barford Road (S)		2	12	0.55	B		13	50	0.86	E
A428 (W)		67	138	1.00	F		92	174	1.00	F
	[Lane Simulation] – 2040 DS									
Barford Road (N)	D9	6	19	0.83	C	D10	4	17	0.77	C
A428 (E)		5	27	0.80	D		4	16	0.75	C
Barford Road (S)		0	8	0.17	A		2	17	0.58	C
A428 (W)		3	8	0.65	A		7	14	0.74	B

ST Barford Road Roundabout_051121-NH-correction-v1

Notes:

1. RFC = Ratio of Flow to Capacity. Values greater than 0.85 indicate the junction operates over its operational capacity with little reserve capacity and will be unable to cope effectively with daily fluctuations in traffic flows. Values greater than 1.00 indicate the junction operates over practical capacity and significant queuing and delays will be experienced by users.
2. LOS = Level of service. A = free flow, B = reasonably free flow, C = stable flow, D = approaching unstable flow, E = unstable flow, F = breakdown flow.

The table above shows that using CCC forecasts the junction is forecast to be within capacity in the DS scenario. In reality the future year flows may lie somewhere between the NH and CCC forecasts. CCC therefore suggest NH monitor queuing on the Barford Road north arm and provide mitigation if it blocks the upstream junction at Barford Road/Chapman Way.

In this case the mitigation would be to provide a short two lane section for exiting traffic on the A428 west exit. This would allow right turning traffic from Barford Road north to use two lanes, as well as permitting ahead traffic from A428 east to use two lanes. Results of this test are shown in the table below, which for obvious reasons uses only the NH forecast flows.

Table 8 – Barford Road junction including mitigation – NH forecast flows

	AM					PM				
	Set ID	Queue (Veh)	Delay (s)	RFC	LOS	Set ID	Queue (Veh)	Delay (s)	RFC	LOS
	[Lane Simulation] – 2040 DS									
Barford Road (N)	D9	3	9	0.68	A	D10	2	10	0.66	B
A428 (E)		3	10	0.53	B		2	8	0.58	A
Barford Road (S)		0	8	0.19	A		88	306	0.95	F
A428 (W)		5	10	0.74	B		63	116	0.95	F

Junction Models\2021.11.24 Sensitivity Test Junction Models\5. Barford Road\Models\ST Barford Road Roundabout_051121-NH-cap-changes-v2.j10

Notes:

1. RFC = Ratio of Flow to Capacity. Values greater than 0.85 indicate the junction operates over its operational capacity with little reserve capacity and will be unable to cope effectively with daily fluctuations in traffic flows. Values greater than 1.00 indicate the junction operates over practical capacity and significant queuing and delays will be experienced by users.
2. LOS = Level of service. A = free flow, B = reasonably free flow, C = stable flow, D = approaching unstable flow, E = unstable flow, F = breakdown flow.

Results from the table above show:

- Queues and delays on Barford Road north arm will be reduced to negligible levels if right turning traffic is permitted to use both approach lanes
- Queues and delays on the A428 east approach arm will also be reduced to negligible levels if the straight ahead traffic is permitted to use two lanes for that movement
- Barford Road south arm would remain over capacity.
- A428 west approach would remain close to capacity but due to reasonably well balanced flows in each approach lane, providing additional lanes offers limited benefit.

Overall, providing a two lane exit flare on the A428 west exit arm would mitigate unacceptable delays on the Barford Road north arm while offering benefits to the A428 east arm.

Provision of the exit flare west of the roundabout would require some pavement widening into the southern verge. This would require some earthworks and drainage works as the road is on low embankment, but no other serious constraints are apparent.

Summary and Conclusions

The NH sensitivity test modelling for the Wyboston and Barford Rd roundabouts has been broadly accepted by CCC. This work showed that both Wyboston and Barford Road roundabouts would be over capacity in 2040 with the introduction of the proposed A428 Black Cat to Caxton Gibbet scheme.

CCC note NH's forecasting method differed slightly from CCC's suggested method. Differences in forecast year demand produced by the two methods were small at the Wyboston junction but much larger at the Barford Road junction. Using CCC derived forecast year flows the Wyboston junction remained over capacity with the introduction of the scheme, reinforcing the need for mitigation. The Barford Road junction on the other hand operated within capacity using CCC demand flows.

NH performed a desktop exercise looking at options to mitigate the issues at these two junctions but concluded that by solely adjusting lane markings, the benefits in traffic operations would be negligible or marginal. NH further concluded that more substantive widening or improvements could bring some potential benefits but were in their opinion beyond the proper scope of the proposed scheme.

CCC disagree with this conclusion as the capacity problems are a direct result of the proposed scheme. CCC therefore recommend the following:

- Wyboston junction - provision of a free flow left turn slip lane from the Great North Road north approach arm on to A428 eastbound. This was needed using either NH or CCC forecasts.

- Barford Road junction - monitor levels of queuing on the Barford Road north approach arm. If/when queues extend to Barford Road/Chapman Way, provide a localised two-lane flared exit on the A428 east approach arm. This is proposed due to the discrepancy between the NH and CCC forecast year flows and their impact on junction performance.

While it is acknowledged there are physical constraints associated with both these recommendations, none of those constraints is of such technical difficulty so as to preclude them.

Appendix 1

A428 Black Cat to Caxton Gibbet – CCC Preferred Method for Deriving Junction Model Flows

Prepared by: Cambridgeshire County Council

Authors: Lou Mason-Walsh/Steve Newby

Date: 27 September 2021

Introduction

CCC officers have concerns about the traffic flows that have been used in the detailed operational junction modelling that has been used to underpin the proposed A428 Black Cat to Caxton Gibbet highway scheme.

These concerns have been raised with National Highways (NH) on a number of occasions via the joint Issues Log, in meetings, in the Public Inquiry Written Representations and Local Impact Report as well as at the recent Issue Specific Hearing (ISH) that covered Highway matters. Following the ISH, CCC again sought to resolve these concerns by seeking meetings to discuss in advance of Deadline 2 but it was not possible to agree a position statement, so this note is being shared with NH.

NH approach to the junction modelling means that CCC consider the current junction assessments to be unreliable, which has a direct impact on assessment of required mitigation for the scheme, highway design for new junctions and may lead to changes with the scheme design itself. CCC are also keen not to adopt more assets than necessary due to the ongoing maintenance burden. For these reasons getting the junction modelling as reliable as possible is a key requirement for CCC.

In an attempt to move this forward this technical note outlines two options for NH to consider that CCC would find acceptable. CCC note that NH stated their intention to carry out sensitivity testing during the ISH. Without knowing the nature or coverage of this sensitivity testing CCC are unable to confirm that it would meet their requirements, so urge NH to proceed using one of the two options outlined in this note.

National Highways Methodology

In deriving turning movements for use in the local junction models, NH have adopted one of three approaches depending on their assessment of which of the following categories the junction should fall in to:

1. Junctions which do not exist in the base year, or where there are fundamental changes in layout – '***scheme junctions'.***
   Demand for these junctions was taken directly from the strategic model in future years, with no base year model developed.
2. Junctions which do exist in the base year and are not significantly changed by the Scheme, but where no base models were developed: referred to as '***existing junctions with no calibrated/ validated base models****'*.

Demand for these junctions was taken directly from the strategic model in future years

3. Junctions which do exist in the base year and are not significantly changed by the Scheme, but where observed data was available and base models were developed: referred to as '***existing junctions with calibrated/ validated base models'***.
   Demand for these models was taken in some cases from observed counts in the base year and in others it was taken directly from the strategic model. Demand was taken directly from the strategic model in future years.

CCC fundamentally disagree with use of unmodified strategic model flows in the local junction models. This is primarily because the strategic model is not validated to turning movements at individual junctions, as evidenced by CCC comparison of modelled and observed flows at a number of junctions.

NH have undertaken a comparison of the available observed count data and the base year strategic model and have concluded that the strategic model flows are sufficiently close to the observed data. The table below shows an example of the comparison undertaken by NH.

From/To	SATURN Flows (2015)					Survey Flows (2016)					Difference (SATURN - Survey)				
	A1198 Ermine Street (North)	A428 (East)	A1198 (South)	A428 Cambridge Road (West)	Total	A1198 Ermine Street (North)	A428 (East)	A1198 (South)	A428 Cambridge Road (West)	Total	A1198 Ermine Street (North)	A428 (East)	A1198 (South)	A428 Cambridge Road (West)	Total
A1198 Ermine Street (North)	0	416	227	0	**642**	0	422	172	38	**632**	0	-6	55	-38	**10**
A428 (East)	271	0	1	892	**1164**	430	1	99	812	**1342**	-159	-1	-98	80	**-178**
A1198 (South)	280	29	0	61	**369**	211	274	0	106	**591**	69	-245	0	-45	**-222**
A428 Cambridge Road (West)	0	1075	21	0	**1096**	6	914	113	0	**1033**	-6	161	-92	0	**63**
Total	**551**	**1520**	**249**	**952**	**3273**	**647**	**1611**	**384**	**956**	**3598**	**-96**	**-91**	**-135**	**-4**	**-325 (-9%)**

Source: A428_MCTC_Analysis_SATURN Flows_Scheme Vissim Junctions

NH have reviewed this and concluded that the model flows are representative of the observed traffic data and it is acknowledged that the flows on each arm of the junction in the strategic model would appear to be reasonably comparable with the observed data meaning that the link flow validation is acceptable at this location. However, the important measure for deciding if the use of flows from the strategic model in the assessment of individual junction models is appropriate should be based on the representation of the turning proportions in the model.

The table below was prepared by CCC using the data above to compare the turn proportions at this junction in the base year model.

From/To	SATURN Flows (2015)					Survey Flows (2016)					Difference (SATURN - Survey)				
	A1198 Ermine Street (North)	A428 (East)	A1198 (South)	A428 Cambridge Road (West)	Total	A1198 Ermine Street (North)	A428 (East)	A1198 (South)	A428 Cambridge Road (West)	Total	A1198 Ermine Street (North)	A428 (East)	A1198 (South)	A428 Cambridge Road (West)	Total
A1198 Ermine Street (North)	0.0%	64.7%	35.3%	0.0%	**100%**	0.0%	66.8%	27.2%	6.0%	**100%**	0%	-2%	8%	-6%	**0%**
A428 (East)	23.3%	0.0%	0.1%	76.6%	**100%**	32.0%	0.1%	7.4%	60.5%	**100%**	-9%	0%	-7%	16%	**0%**
A1198 (South)	75.8%	7.8%	0.0%	16.4%	**100%**	35.7%	46.4%	0.0%	17.9%	**100%**	40%	-39%	0%	-1%	**0%**
A428 Cambridge Road (West)	0.0%	98.1%	1.9%	0.0%	**100%**	0.6%	88.5%	10.9%	0.0%	**100%**	-1%	10%	-9%	0%	**0%**
Total	16.8%	46.4%	7.6%	29.1%	**100%**	18.0%	44.8%	10.7%	26.6%	**100%**	**31%**	**-31%**	**-8%**	**9%**	

From this it is possible to see that the turning proportions vary significantly. For example, the strategic model indicates that 75.8% of traffic on the A1198 (south) continues on the A1198 (north) when in the count only 35.7% of traffic makes this movement. From this it is possible to confirm that the turning proportions at the

junctions examined do not compare well, from which CCC conclude that all of the junction models should be based on observed turning counts in the base year.

CCC would like to see base year models developed for all of the junction models produced by NH. This is because all of the junctions assessed currently exist in some form, for which base models could be built to calibrate demand. Demand for totally new movements in future years could be taken directly from the strategic model, which would be an acceptable use for these flows.

Furthermore, direct use of strategic model flows in future year scenarios is not agreed because of the discrepancies between modelled and observed flows in the base year. CCC maintain that future year flows should be produced by using strategic model flows to modify observed base year counts.

While CCC would like to see base year models produced in each case, we have set out two options below for discussion.

Option 1

Base year models should be built for all junctions so that base year demand and junction operation can be calibrated to existing conditions.

In the case of VISSIM models this would include calibrating observed demand to ensure that base year queues are representative of observed conditions. CCC are not suggesting collecting new queue length data but simply using information that already exists, for example, historic WebTRIS or Trafficmaster data.

Future year demand should be estimated using strategic modelled turning flows that have been converted to vehicles and adjusted to convert peak period to peak hour flows. Differences between base and forecast year can be calculated and applied to observed base year turning flows to produce respective forecast year demands per scenario. These should then be used in the junction models. The process is outlined in Appendix A using a Do Minimum scenario as an example but the method applies equally to Do Something scenarios.

Option 2

Despite CCC repeatedly asking for validated base year models for all of the junctions assessed, NH have to date resisted this saying that the approach taken is appropriate and proportionate. Therefore, in an attempt to move this forward CCC propose the following compromise position.

CCC note the base year models that NH have already built and will not request NH build any additional ones.

However, for those junctions that have a base year observed count, CCC request that NH assume that the count data would have been used instead of base year flows from the strategic model had a base year model been produced.

CCC then request that the future year matrices should be built using the methodology set out in Option 1 above (see Appendix A), that is, using strategic modelled turning flows that have been converted to vehicles and adjusted to convert peak period to peak hour flows. Calculate differences between base and forecast year and apply those to observed base year turning flows to produce respective forecast year demands per scenario. These should then be used in the future year junction models.

Summary

CCC consider Option 1 to be the preferred option as this follows industry standard best practice. However, CCC put forward Option 2 as an alternative that would be acceptable as it would provide a much better estimate of future year junction performance than the method used by NH to date. CCC request that the methodology going forward be discussed and agreed BEFORE the work is undertaken so that the risk of further disagreement in minimised. The junctions affected are summarised in Appendix B.

Additional Junctions models requested by CCC

CCC note they have asked NH to assess additional junctions on Great North Road and Cambridge Road in St Neots as the strategic modelling undertaken by NH indicates that both these roads see a significant increase in traffic as a direct result of the scheme. CCC need to be confident that the adjacent junctions on these roads can accommodate the suggested increase in trips (circa 200 PCU/hour in the AM and PM Peak periods). These junctions are listed in Appendix C and their assessments should be carried out using Option 1 above.

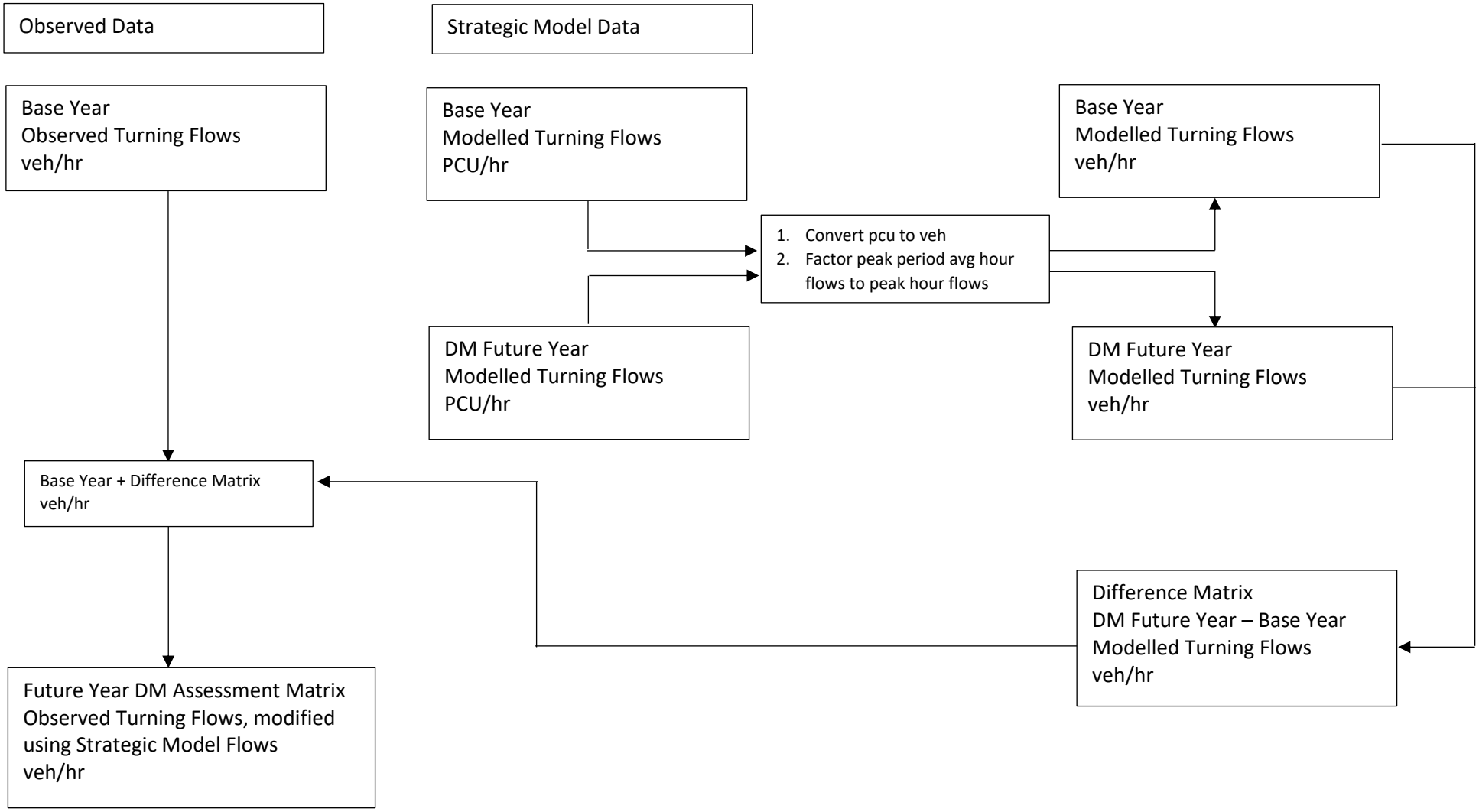
Summary and Conclusions

CCC are concerned about the use of unmodified strategic model flows in local junction model assessments supporting the proposed A428 Black Cat to Caxton Gibbet scheme.

These concerns arise because of the poor comparison between modelled and observed turning flows in the base year at a number of the junctions assessed, undermining confidence in the ability of the strategic model to model turning movements accurately. Since turning movements are at the heart of any junction assessment this is a major concern.

Two options for producing more accurate future year flows for use in the junction assessments are suggested above, which would provide a sounder basis to determine mitigation measures for the proposed scheme.

Appendix A – Method for producing forecast year matrices – Do Minimum (DM) scenario used for illustrative purposes



Appendix B – Junctions requiring further assessment

HE Ref No	Junction Name
1	A1 Buckden roundabout
2	Yelling & Toseland crossroads
5	Cambourne North Roundabout - 2025 only
6	Cambourne South Roundabout - 2025 only
7	Cambourne junction -2040 only
8	Scotland Road, Hardwick, Junction
9	Madingley Mulch junction
10	M11 Junction 13
12	Wyboston roundabout
13	Barford Road roundabout
24	Black Cat
25	Cambridge Road
26	Caxton Gibbet
29	B1046/ Potton Road junction
30	A428/ Toseland Road/ Abbotsley Road junction
31	Eltisley link

Appendix C – New Junctions requiring assessment

HE Ref No	Junction Name
-	Great North Road/Alpha Drive/Marlborough Road
-	Great North Road/Howard Road
-	Great North Road/Little End Road
-	Great North Road/Nelson Road
-	Cambridge Street/Cromwell Road/Station Road/Cambridge Road
-	Cambridge Road/Dramsell Rise
-	Cambridge Road/Stone Hill/Wintringham park access