TECHNICAL NOTE

Hither Green Lane, Redditch

LinSig Analysis – Response to Highways Comments

transport planning
Lombard House
145 Great Charles Street
Birmingham
B3 3LP

0121 7948390
info@modetransport.co.uk

Client:	Barratt David Wilson Homes (Mercia)	Job No:	325756
Date:	12 December 2022	File Name:	221208_325756_TN003
Prepared by:	JFN	Approved by:	BDF

1. Introduction

1.1 Overview

1.1.1 This Technical Note (TN) has been prepared in response to post-application comments provided by Worcestershire County Council (WCC) in relation to the Full Planning Application (Ref: *21/01830/FUL*) for land to the west of Hither Green Lane in Redditch, Worcestershire. Specifically, this TN sets out mode's response to WCC comments regarding LinSig modelling of the Dagnell End Road / Birmingham Road (A441) junction.

1.1.2 The development proposals comprise the following:

"*Residential development (Class C3) with a vehicular access point onto Hither Green Lane, play areas, public open space including footways and cycleways, sustainable urban drainage systems and all other ancillary and enabling infrastructure.*"

1.1.3 WCC provided comments in their role as Local Highway Authority (LHA) on 7th February 2022, in which they recommended that the application be deferred. WCC's comments are provided in **Appendix A**, for reference.

2. Background Information

2.1 Dagnell End Road / Birmingham Road - Mitigation Scheme

2.1.1 The Transport Assessment (Ref: *211015_325756_TA 001*), submitted as part of the planning application for the proposed development (Ref: *21/01830/FUL*) provides details of the mitigation scheme for the Dagnell End Road / Birmingham Road signalised junction, which is to be implemented as part of the adjacent Brockhill East Phase 3 application (Ref: *19/00976/HYB*).The mitigation scheme is outlined on drawing Ref: 2809-P-12-P4, which is attached as **Appendix B**, for reference.

2.1.2 This mitigation scheme was previously identified in the Redditch District Infrastructure Delivery Plan (IDP) (CDR51). As outlined in WCC's formal response to the Brockhill East Phase 3 (Ref: *19/00976/HYB*); this scheme has been considered acceptable in what is considered a "constrained location in terms of land ownership" and is to be delivered as part of a S278 Agreement.

2.2 Modelling Details – Brockhill East Application 19/00976/HYB

2.2.1 As set out in technical notes 'Dagnell End Road – Junction Design Note' (16/09/2020) and 'Dagnell End Road – Junction Design Modelling Update' (24/11/2020) submitted as part of the Brockhill East application (Ref: *19/00976/HYB*), peak hour pedestrian crossing demand at the new signalised crossing was forecast to be relatively low, and it was anticipated that the crossing would therefore be called infrequently.

2.2.2 In addition to the above, WCC raised concerns over the incorporation of the left turn filter arrow from Dagnell End Road, as a pedestrian wishing to cross over the A441 southbound may see a stationary vehicle in the offside lane of Dagnell End Road (controlled by Phase D), without seeing the filter arrow for Phase E.

2.2.3 WCC noted that this arrangement is provided at other junctions elsewhere, and that concerns were not raised within the RSA. WCC therefore suggested that a further stage sequence, excluding the left turn filter, should be included in the modelling. The matter would then be resolved at detailed design stage or following installation of the junction based on site observations.

2.2.4 In light of the above, the modelling submitted as part of the application for Brockhill East included 3 stage sequences. A summary of the stage sequences was provided in the TA prepared by mode (Ref: *211015_325756_TA 001*), along with reference to a stage sequence diagram for each; included at Appendix H of the TA.

- Staging Sequence 1 – Pedestrian Crossing Not Called;
- Staging Sequence 2 – Pedestrian Crossing Not Called, No Filter Arrow; and,
- Staging Sequence 3 – Pedestrian Crossing Called Every Cycle (Sensitivity Test).

2.2.5 The A441 / Dagnell End Road junction was therefore modelled with consideration of each of the 3 Stage Sequences in mode's TA, to replicate the modelling scenarios used for the purpose of the Brockhill East Phase 3 application.

2.3 Planning Context

2.3.1 When the TA for Hither Green was produced, the application for Brockhill East Phase 3 was marked as 'awaiting decision'; however, it was noted that WCC, in their capacity as LHA, had already undertaken a full review of the planning application and subsequently raised no objections. Given the site's status as the final part of a strategic allocation in the Bromsgrove District Plan and Redditch Local Plan, and the approved position from the LHA, Brockhill East Phase 3 was considered as a committed development in the modelling section of the TA produced by mode.

2.3.2 Consideration was also made of the potential highway mitigation / improvement measures associated with Brockhill East Phase 3, to ensure the proposed development at Hither Green Lane takes account of any amendments to the surrounding highway network. The mitigation scheme for the Dagnell End Road / Birmingham Road junction had been designed on topographical survey data and was deemed acceptable by WCC for the purpose of granting planning permission and was therefore considered as the baseline position for the purpose of the detailed capacity assessment presented in mode's TA.

2.3.3 The application for Brockhill East Phase 3, with the inclusion of the mitigation scheme, has since received planning consent, therefore all of the assumptions above remain valid.

3. WCC Comments

3.1 Overview

3.1.1 As part of their response to the proposed development, WCC has stated the following, in relation to the detailed junction capacity assessment for the Dagnell End Road / Birmingham Road (A441) junction:

"*Despite utilising information from the Brockhill Phase 3 application, the capacity results for the Dagnell End Road Signal Junction do not match those previously approved by the Highway Authority for the same modelling scenarios, built from a fully validated and calibrated junction model. From a review of the LinSig modelling results, it is apparent that the model itself and results are different.*

The Mode LinSig model shows the nearside lane on the Birmingham Road (S) approach to be a short lane, whereas in the previously approved model, this is shown to be a 'long lane'. As the LinSig model has not been provided, it is anticipated that further differences will also be apparent. The previously approved model should be used to assess capacity at this junction, otherwise a new model should be created, which would first require revalidation and calibration.

Adding vehicle trips to an already congested junction, increasing vehicles queues and delays in this location is not acceptable. This is a key junction provided along an arterial connecting Redditch to the M42 to the north and Birmingham beyond."

4. Modelling Input Parameters

4.1 Comparison with Approved Model

4.1.1 As part of their consultation response to the application, WCC raised concerns regarding the modelling analysis presented as part of mode's Transport Assessment (Ref: *211015_325756_TA 001*), which was included as part of the planning application submission.

4.1.2 Specifically, concerns were raised over differences between the input parameters used within the approved LinSig model and the model prepared by mode. A copy of the approved model was subsequently requested by mode; however, WCC indicated that they did not have a copy of the model on file. WCC provided a contact within the delivery team for Brockhill East Phase 3, to approach for a copy of the LinSig model; however, this was considered unfeasible as the delivery team for Brockhill (or their client) would have no obligation to provide a copy of the model.

4.1.3 In the absence of an approved model file, mode endeavoured to replicate this using publicly available details/data from the summary output reports provided in the Brockhill East Phase 3 TN dated 24/11/2020, which was obtained from Redditch Borough Council's (RBC) Planning Portal. This was considered a suitable and feasible approach, and a copy of the subsequent LinSig model prepared by mode was provided to WCC for their consideration.

4.1.4 The model outputs in the Brockhill East Phase 3 TN include a range of options including no pedestrians, no filter arrow and pedestrians called every cycle, which have formed the basis of different modelling scenarios presented. mode took the same approach, to enable comparison with the results presented in TN for Brockhill East Phase 3.

4.1.5 In this regard, it should be noted that the Brockhill East Phase 3 TN, as obtained from RBC's planning portal, contains only the summary version of the model output report. Consideration was therefore also made of the detail in the approved mitigation scaled drawing (Ref: 2809-P-12-P4, attached at **Appendix B**), where specific details could not be obtained from the Brockhill East Phase 3 TN; however, variations in the exact results of the two models were to be expected; given the limited information regarding certain modelling parameters contained within the summary model output report.

4.1.6 With regard to the comments relating to the location of the long and short lanes on the Birmingham Road (S) approach, this was assumed to be a typing error. The location of the long and short lanes on the southern approach of the LinSig model prepared by mode are comparable to those contained within the Brockhill East Phase 3 model. Instead, it has been assumed that WCC was intending to query the alignment of the Birmingham Road (N) approach, as the nearside lane had previously been modelled so as to account for the diverge of the lanes and the primary movement through the junction.

4.1.7 The other item to note in this regard is the saturation flows assumed within the model. The Brockhill East Phase 3 TN provides reference to upstream lane widths, not stop line widths. This was not replicated within the LinSig model presented in mode's TA, as measurements had instead been taken from the scaled mitigation drawing (Ref: 2809-P-12-P4, at Appendix B) associated with Brockhill East Phase 3.

4.2 Revised mode LinSig File

4.2.1 The variations between the LinSig model presented within mode's TA, and the approved Brockhill East Phase 3 model were considered somewhat minor, and it was not envisaged that these would have a significant impact on the results of the modelling analysis.

4.2.2 Nonetheless, to address the concerns raised by highways, mode has produced a revised LinSig model (Ref: v2 Rev A), which was made available to WCC, for their detailed review. In summary, this included the following amendments:

- Saturation flows on Arm 1 (Birmingham Road (N)) were updated using upstream lane widths of 3m. Arm 2 (Dagnell End Road) was also updated to include upstream lane widths of 3.1m;
- The composition of short and long lane widths on Arm 1 (Birmingham Road (N)) were amended to align with the comments made by highways (assuming the comments were meant to refer to Birmingham Road (N) rather than Birmingham Road (S)); and,
- Intergreen from Phase 1 in the model was set to 8 seconds (mode had previously utilised 9 seconds, based on moderate use, crossing length and standard on-crossing direction).

4.3 Final WCC LinSig File

4.3.1 Following further discussions with WCC further concerns were raised over the parameters used within the updated model, and WCC requested that a copy of mode's LinSig model was provided to them. WCC indicated that they were now in a position to obtain a copy of the Brockhill East Phase 3 model and would therefore provide a subsequent comparison with mode's model.

4.3.2 mode submitted a copy of the latest LinSig model prepared, along with a new request to WCC to utilise a copy of the approved LinSig model, stating the following:

"It is noted that WCC are in possession of a copy of the approved model, however thus far a copy of this has not been provided to the design team. Given WCC's stance that the LinSig they have on file is the approved model, and that our results should mirror those of the approved model, it is our stance that we should be provided with a copy of the LinSig model, in order to allow us to run our additional traffic through the model and report back on the results as part of a post-application response. The model will only be utilised for the purpose of this task."

4.3.3 This request was refused by WCC, on the basis that the approved model is owned by the applicant for Brockhill East Phase 3 and therefore not available for issue. In an email dated 15th September WCC stated the following: "…*whilst WCC does hold the PJA LINSIG model, this model is owned by PJA. It is not our model to issue to you. We are only able to provide you with information that is publicly available on the planning website and unfortunately this final version of the model is not."*

4.3.4 In the interest of moving matters forward, WCC instead provided some minor amendments to the model, taking into account the parameters from the Brockhill East Phase 3 model they have on file. These included some minor amendments to intergreens, phase delays, saturation flows and lane lengths.

4.3.5 The latest model issued by WCC – hereby referred to as 'v2 Rev B' has been utilised by mode for the purpose of assessing the impacts of the proposed development at the junction. A review of the modelling outputs from the revised model is provided in Section 5, for reference. This model has been validated by WCC to get the same results which were presented as part of the Brockhill East Phase 3 application. The parameters used within the LinSig v2 Rev B model have therefore been accepted by WCC, and this is the baseline position utilised for the assessments undertaken within this TN.

5. Modelling Scenarios & Methodology

5.1 Existing Situation

5.1.1 The requirement for a comprehensive review of capacity, traffic flows, design and signalling apparatus at the Dagnell End / Birmingham Road signalised junction was previously identified in WCC's Local Transport Plan 4 (LTP4) in 2017.

5.1.2 As outlined within the subsequent Redditch District IDP (CDR51), background work was undertaken by WCC to consider the cumulative transport impacts arising from the development identified in both the Redditch and Bromsgrove Local Plans.

5.1.3 The IDP subsequently identified the potential for an additional approach lane on the eastern arm (Dagnell End Road) and the implementation of Microprocessor Optimised Vehicle Actuation (MOVA); to enable maximisation of the throughput at the junction under actual observed conditions. The IDP indicates that funding for this mitigation scheme would be secured from developer contributions, with a total cost in the order of £520,000.

5.1.4 An overview of the base model for the existing layout of the Dagnell End Road / Birmingham Road junction was presented in the Junction Design Modelling Update TN (24/11/2020) for the consented application at Brockhill East Phase 3. An overview of the base model (optimised) results for the junction, as taken from the Brockhill East Phase 3 TN for the consented application, is provided in **Table 5.1**, covering the following scenarios:

- Existing Layout Scenario 1 (**EL1**) - 2018 Base;
- **EL2** - 2030 Base + Committed; and
- **EL3** - 2030 Base + Committed + Brockhill East Phase 3.

Table 5.1 : Existing Situation

Arm	AM Peak Hour (0800 – 0900)			PM Peak Hour (1700 – 1800)		
	DoS (%)	MMQ (PCU)	Delay / PCU (s)	DoS (%)	MMQ (PCU)	Delay / PCU (s)
2018 Base Existing Layout (**EL1**)						
A441 (N)	93.5%	28	38	82.3%	24	33
Dagnell End Road	92.4%	12	78	106.3%	43	201
A441 (South)	81.7%	17	24	107.2%	85	182
PRC		-3.9%			-19.1%	
2030 Base + Committed (But Excluding Brockhill East Phase 3) & Existing Layout (**EL2**)						
A441 (N)	108.2%	86	183	94.8%	38	52
Dagnell End Road	104.9%	25	184	119.9%	80	400
A441 (South)	105.9%	43	72	120.9%	165	381
PRC		-20.2%			-34.4%	
2030 Base + Committed (Including Brockhill East Phase 3) & Existing Layout (**EL3**)						
A441 (N)	114.4%	123	274	110.4%	106	231
Dagnell End Road	110.9%	34	266	126.1%	97	482
A441 (South)	111.1%	115	224	128.8%	215	480
PRC		-27.1%			-43.2%	

5.1.5 As outlined in **Table 5.1**, in its existing format (prior to the implementation of the mitigation scheme) the junction is forecast to operate beyond its theoretical capacity prior to future year assessments and/or the introduction of the additional traffic associated with the Brockhill East Phase 3 development.

5.2 Committed Mitigation Scheme

5.2.1 The committed mitigation scheme at the junction is to be delivered as part of the Brockhill East Phase 3 scheme. As outlined in WCC's formal response to the Brockhill East Phase 3 (Ref: *19/00976/HYB*):

"*The junction scheme utilises land currently within the ownership of the Local Planning Authority for the sole purpose of delivering a junction improvement in this location, in what is a constrained location in terms of land ownership. Following the delivery of the junction scheme, the land will be dedicated highway land*".

Existing Assessments – 2018 Survey Data

5.2.2 An overview of the modelling results for the Committed Mitigation scheme using the previous 2018 survey data is presented within the accompanying TN 221011 – 325756-TN002-LinSig Review Rev C prepared by mode. The full model output report is attached at **Appendix C**, for reference. This scenario utilises the v2 Rev B LinSig model agreed with WCC, with the previous 2018 survey data.

- Committed Mitigation (CM) – *based upon 2018 survey data*
  - **CM3** - 2030 Base (Inc. Committed Development); and,
  - **CM4** - 2030 Base (Inc. Committed Development) + Proposed Development.

5.2.3 The results outlined in the accompanying TN show that the junction is predicted to operate above its theoretical capacity in the CM3 scenario prior to the additional traffic associated with the proposed development. The addition of traffic associated with the proposed development in the CM4 scenario does not typically result in a significant impact on the PRC at the junction.

5.2.4 The results also demonstrate that the level of operation forecast in the CM4 (Stage 1) scenario is comparable to that of the EL2 scenario, with PRC values of -21.5% and -32.7% during the respective AM and PM peaks of the CM4 scenario, compared with values of -20.2% and -34.4% during the corresponding peak periods in the EL2 scenario. This demonstrates that following the introduction of development traffic and the delivery of the committed mitigation, the junction operates at a comparable level to the existing situation; without the implementation of the committed mitigation scheme or additional trips associated with Brockhill East Phase 3.

5.2.5 Furthermore, it should be noted that the proposed scheme is forecast to generate approximately 152 additional two-way trips during the AM peak and 162 two-way trips during the PM peak. This equates to a c. 5% increase in development trips through this junction, when considered in context to the 2030 (effective base – including Brockhill East Phase 3) background traffic figures of 3,077 two-way trips during the AM peak and 3,172 two-way trips during the PM peak. As outlined within Section 6.4 of the accompanying TA, it is considered that this minor percentage increase would likely be accounted for within daily variations in background traffic.

5.3 Assessment Parameters

Existing Survey Data

5.3.1 As outlined above, an initial review of capacity at the Dagnell End Road / Birmingham Road junction has been undertaken based on the previous data submitted as part of the Brockhill East Phase 3 (Ref: *19/00976/HYB*) application, which utilises survey data collected in November 2018.

5.3.2 The existing survey data utilised as part of the previous assessment is now c. 4 years old, and therefore may not provide an accurate indication of the current traffic profile at the junction. Previous DfT 'Guidance on Transport Assessments' (2007), Paragraph 4.18 stipulated that assessments should "*include recent counts (normally surveyed within the last three years) for peak periods turning movements at critical junctions*".

5.3.3 Guidance on Transport Assessments was withdrawn in 2014, with alternative guidance in terms of highway assessments now provided by Planning Practice Guidance; specifically, 'Travel Plans, Transport Assessments and Statements in Decision Taking'. The updated documentation does not stipulate a specific timescale for which survey data can be considered representative, however the 3-year timescale outlined within the previous DfT guidance is still considered pertinent in this regard.

5.3.4 Given that the existing survey data is now c. 4 years old, updated traffic surveys have been obtained along the local highway network in the vicinity of the junction. The updated traffic surveys provide a more accurate indication of current travel plans and takes account of sustained changes in the type and scale of travel patterns which have occurred in the UK, since the onset of the COVID-19 pandemic.

5.3.5 Turning counts surveys were undertaken at the Dagnell End Road / Birmingham Road junction on Tuesday 15th November 2022, covering the periods from 07:00 – 10:00 and 16:00 – 19:00.

5.3.6 In addition to this two Automated Traffic Counts (ATCs) were undertaken on Dagnell End Road and the Birmingham Road link south of the junction for a 7 day, between 15th November and 22nd November 2022.

Background Traffic Growth / Committed Development

5.3.7 Similar to the Brockhill East Phase 3 application, the capacity of the local network has been assessed for a forecast year of 2030, which represents the end of the current Redditch Local Plan Period.

5.3.8 Future year background growth has therefore been calculated using TEMPro, and adjusted using the study area for the Redditch (main) geographical area; which is consistent with the agreed approach presented as part of the Brockhill East Phase 3 application.

5.3.9 Once the factors had been calculated, an adjustment was applied to provide a local growth rate. A growth calculation factor for 'principal' roads was then applied to each TEMPro growth factor to reflect the specific characteristics of Birmingham Road. A summary of the TEMPro growth factors is provided in **Table 5.1**.

Table 5.2 : TEMPro Growth Factors

Growth Period	Weekday AM Peak	Weekday PM Peak
2022 - 2030	1.0524	1.0519

5.3.10 As part of the Brockhill East Phase 3 application, consideration was made of the additional traffic associated with the allocated sites at Webheath and Foxlydiate. The additional development trips were extracted from the respective TAs and manually assigned to the study network. These committed development trips have obtained directly from the LinSig model inputs for the Brockhill East Phase 3 TN, and included within the 2030 Base scenario for the purpose of the modelling work presented in this TN.

5.3.11 In the TA for Brockhill East Phase 3, in order to avoid 'double counting' of traffic, National Trip End Model (NTEM) data within TEMPro was adjusted to deduct the proposed development and committed development from the planning assumptions.

5.3.12 As part of the TEMPro growth factors presented in **Table 5.2**, no alternative assumptions have been applied to the 2022 – 2030 growth factors, this is considered to be 'overly robust', given that there is likely to be an element of double counting of committed development trips in the 2030 Base Scenario.

Assessment Years

5.3.13 A summary of the assessment years which have been considered when assessing the Dagnell End Road / Birmingham Road junction is provided below. In both scenarios we have assumed that the committed mitigation associated with Brockhill East Phase 3 has been fully implemented at the junction. The base traffic flows include 2030 survey data (growthed from 2022), along with committed development trips associated with Brockhill East Phase 3, Webheath and Foxlydiate.

- Committed Mitigation scenario 1 (CM1) - 2030 Base (Inc. Committed Development); and,
- CM2 - 2030 Base (Inc. Committed Development) + Proposed Development.

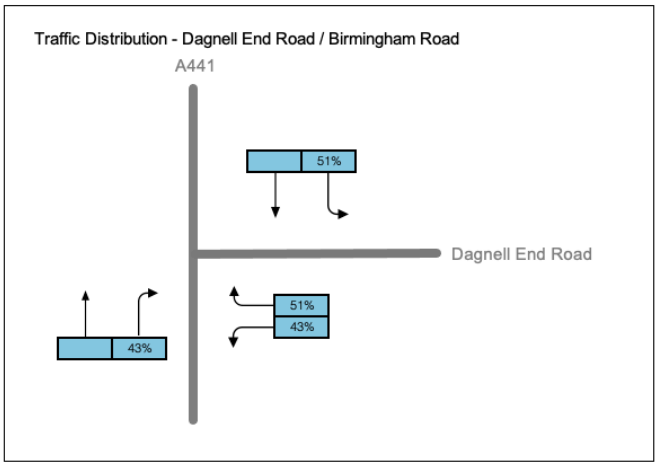
Traffic Distribution

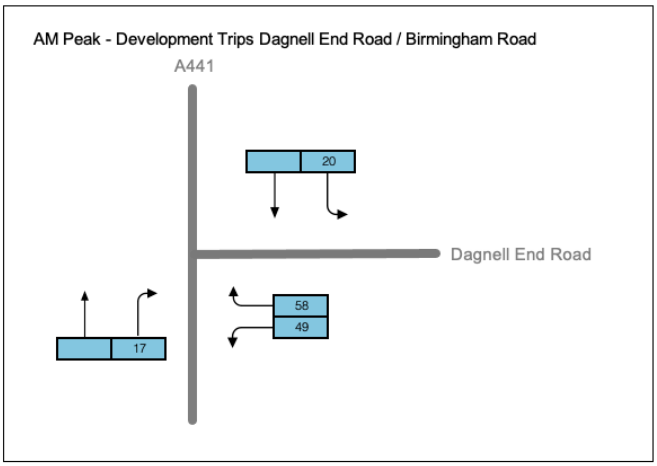
5.3.14 A summary of the trip distribution and resulting trip generation associated with the proposed development during the respective AM and PM peak periods is outlined in Section 5 of the TA, and is also shown diagrammatically in the traffic flow diagrams attached as Appendix F of the TA.

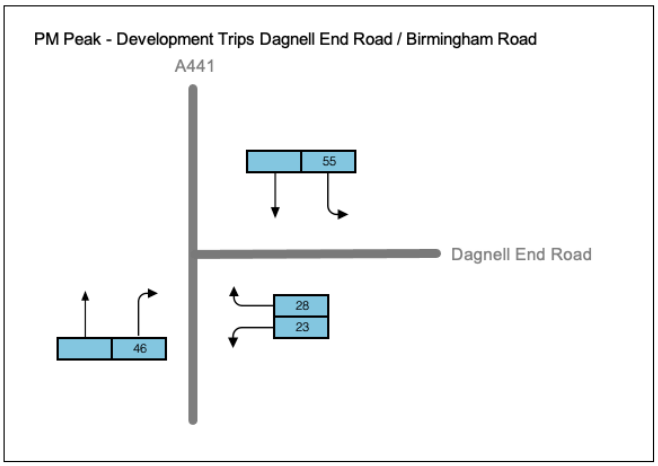
5.3.15 As detailed within the TA, the traffic distribution exercise has been undertaken based on the distribution profile for the Brockhill East residential development; which was deemed acceptable by WCC. This takes account of the distribution of traffic north and south along the Birmingham Road (A441) corridor from Brockhill East onto the Weights Lane roundabout, and the subsequent distribution onto the wider study network.

5.3.16 For the purpose of this TN, an overview of the traffic distribution and subsequent trip generation at the Dagnell End Road / Birmingham Road junction is provided in Figure 5.1 for reference. The remaining 6% of development traffic not accounted for in Figure 5.1 routes to the east of the Hither Green Lane / Dagnell End Road junction; based upon the distribution taken from the Brockhill East application.

Figure 5.1 : Traffic Distribution / Assignment – Dagnell End Road / Birmingham Road Junction

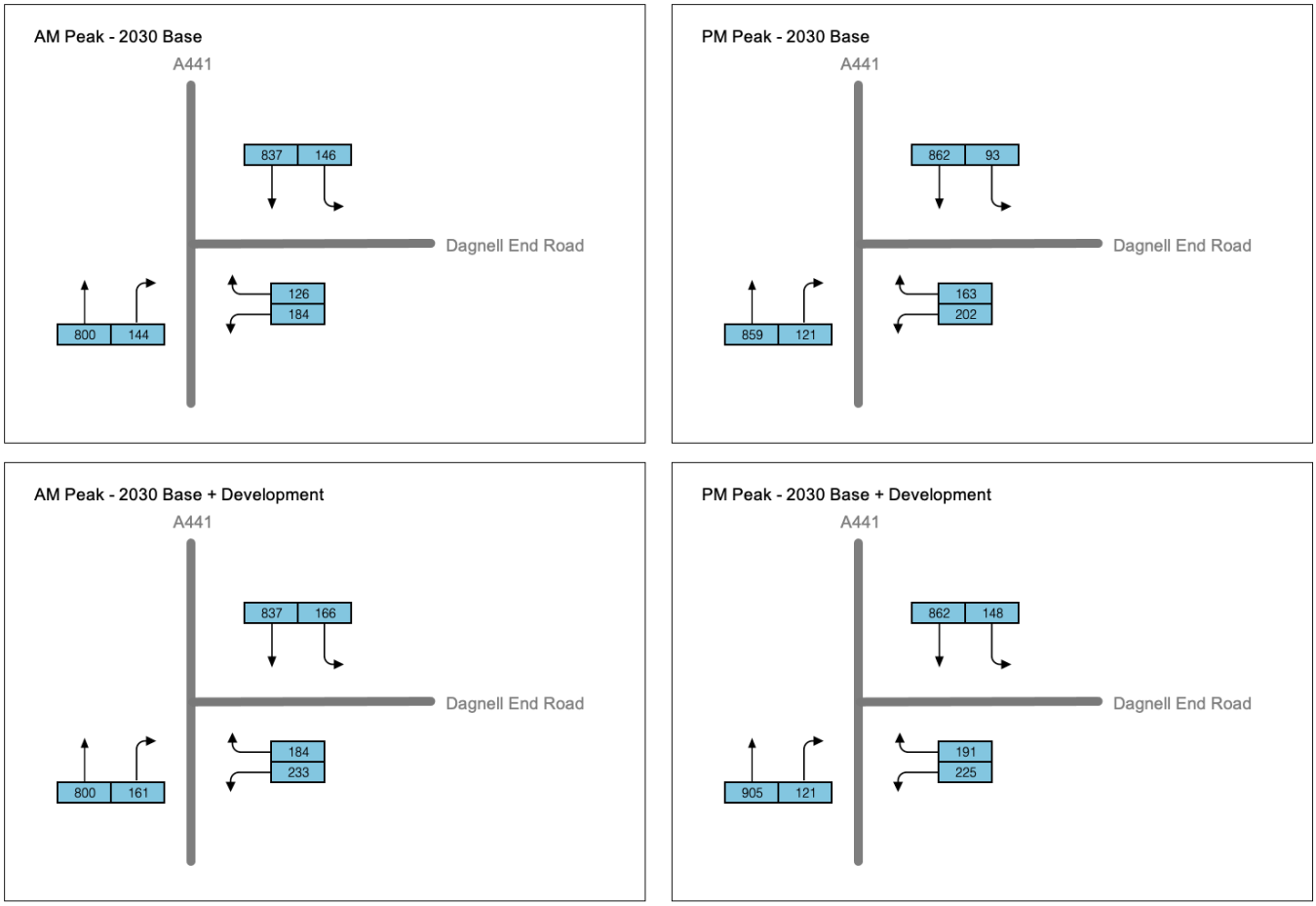






5.3.17 An overview of the resulting traffic flows forecast at the Dagnell End Road / Birmingham Road junction for a 2030 Base (Inc. Committed Development), and 2030 Base (Inc. Committed Development) + Development scenario are outlined in **Figure 5.2**, for reference.

Figure 5.2 : Modelled Traffic Flows – Dagnell End Road / Birmingham Road Junction



5.3.18 A summary of the results using the revised 'v2 Rev B' model issued to mode by WCC, and the updated traffic flows outlined above, is shown in **Table 5.3**, with the full output report attached at **Appendix D**, for reference.

5.3.19 As specified in **Section 2** of this TN, the mitigation scheme for the A441 / Dagnell End Road junction has been modelled with consideration of 3 x stage sequences to reflect the scenarios presented as part of the now consented Brockhill East Phase 3 application. It should be noted, however, that pedestrian demand at the junction is relatively low and therefore as specified in the PJA Junction Design Modelling Update TN (24/11/2020) submitted as part of the Brockhill East Phase 3 application, it is highly unlikely the crossing will be called every cycle.

5.3.20 In light of this, the results presented in **Table 5.3** for Stage Sequences 1 and 2 are considered to be the most representative of the typical day-to-day operations of the junction.

Table 5.3 : A441 / Dagnell End Road – Committed Mitigation Scheme

Arm	AM Peak Hour (0800 – 0900)			PM Peak Hour (1700 – 1800)		
	DoS (%)	MMQ (PCU)	Delay / PCU (s)	DoS (%)	MMQ (PCU)	Delay / PCU (s)
2030 Base (Stage Sequence 1 – No Peds) (**CM1 – Stage 1**)						
A441 (N)	71.4%	11	12	69.1%	14	13
Dagnell End Road	70.3	5	43	71.5%	7	59
A441 (South)	68%	10	10	74.6%	17	14
PRC		26%			20.6%	
2030 Base + Development (Stage Sequence 1 – No Peds) (**CM2 – Stage 1**)						
A441 (N)	77.5%	14	16	74.2%	17	15
Dagnell End Road	73%	6	45	79.1%	9	62
A441 (South)	72.2%	12	15	79.1%	21	17
PRC		16.1%			13.8%	
2030 Base (Stage Sequence 2 – No Peds & No Left Filter) (**CM1 – Stage 2**)						
A441 (N)	74.7%	12	15	69.9%	15	14
Dagnell End Road	70.3%	5	49	74.5%	8	64
A441 (South)	70.9%	11	13	75.4%	18	15
PRC		20.5%			19.3%	
2030 Base + Development (Stage Sequence 2 – No Peds & No Left Filter) (**CM2 – Stage 2**)						
A441 (N)	78.7%	15	17	75.1%	18	16
Dagnell End Road	77.2%	7	48	78.6%	9	66
A441 (South)	73.8%	13	16	79.9%	21	18
PRC		14.3%			12.6%	
2030 Base (Stage Sequence 3 – Peds & Left Filter) (**CM1 – Stage 3**)						
A441 (N)	83.5%	18	23	82.1%	26	26
Dagnell End Road	83.1%	6	55	78.9%	8	69
A441 (South)	71.9%	12	15	77%	19	18
PRC		7.7%			9.6%	
2030 Base + Development (Stage Sequence 3 – Peds & Left Filter) (**CM2 – Stage 3**)						
A441 (N)	88.4%	21	29	82.4%	24	24
Dagnell End Road	89%	8	60	83%	10	71
A441 (South)	74.8%	14	17	81.7%	23	21
PRC		1.1%			8.4%	

5.3.21 The results show that the junction is predicted to operate within its practical capacity following the introduction of additional traffic associated with the proposed development during all scenarios.

5.3.22 As outlined above, it is highly unlikely the pedestrian crossing will be called every cycle therefore Stage Sequences 1 and 2 are considered to be the most representative of the typical day-to-day operation of the junction.

5.3.23 Within the 2030 Base + Development (Stage Sequence 1 – No Peds & No Left Filter), the junction operates with a Practical Reserve Capacity (PRC) value of 16.1% during the AM Peak, with all approaches operating with a Degree of Saturation (DoS) below 90%; which typically denotes the level of satisfactory operation at the junction. During the PM Peak, the junction operates with a PRC of 13.8%, with all approaches operates with a DoS of below 90%.

5.3.24 Within the 2030 Base + Development (Stage Sequence 2 – No Peds & No Left Filter), the junction operates with a PRC value of 14.3% during the AM Peak, with all approaches operating with a DoS below 90%. During the PM Peak, the junction operates with a PRC of 12.6%, with all approaches operates with a DoS of below 90%.

5.3.25 As outlined above, the addition of traffic associated with the proposed development does not typically result in a significant impact in the PRC across each of the scenarios at the junction and does not result in a significant increase in the DoS recorded on the respective approaches, when compared with the existing junction layout baseline reference case.

5.3.26 Furthermore, it should be noted that the proposed scheme is forecast to generate approximately 144 additional two-way trips through the Dagnell End Road / Birmingham Road junction during the AM peak, and 152 two-way trips during the PM peak. This equates to a c. 6% increase in total trips through this junction during the AM and c.7% increase, when considered in context to the CM1 - 2030 (effective base – including Brockhill East Phase 3) background traffic figures of 2,238 two-way trips during the AM peak and 2,301 two-way trips during the PM peak.

5.3.27 In the accompanying TA, it is also noted that the trip generation associated with the development include trip rates taken from the donor site at Brockhill East Phase 1, which are far greater than those obtained from the TRICS database, using more recent datasets. As noted in WCC Highways Response to the Brockhill East Phase 3 application (Dated 5th January 2021)

"*the trip rates are based on surveys of a site that is still yet to build a district centre, school, or be served by public transport routing through the site, and as such, the trip rates will reflect higher car trips than anticipated when the amenities are in place. The trip generation presented is considered to be robust*".

5.3.28 It is therefore considered that the trip rates utilised as part of the modelling work are robust, and the actual trip generation associated with the proposed development could likely be lower.

5.3.29 The junction capacity assessment also includes 8-years of forecast background traffic growth and utilises 100% of trip generation associated with the proposed development and does not take account of any sustainable measures to reduce the traffic impact of the scheme, as set out in the accompanying Travel Plan.

5.3.30 It is therefore considered that the proposed development scheme will have a relatively minor impact on the overall operation of the junction and no further mitigation is required.

Incorporation of Microprocessor Optimised Vehicle Actuation (MOVA)

5.3.31 Furthermore, it is understood that the mitigation scheme for the junction will incorporate MOVA (Microprocessor Optimised Vehicle Actuation) control, which can be connected to the Urban Traffic Control)UTC) to enable monitoring and help maximise efficiency / operation of the junction. MOVA is considered to be the most efficient method of signal control, using a series of detectors that allow signal timings and cycle times to respond to changes in local traffic patterns and conditions.

5.3.32 As outlined in Department for Transport Traffic - TAL 03/97 'The MOVA signal control system', TRL/Department for Transport research indicates that through the implementation of a MOVA system, the efficiency and operation of signalised junctions can be improved, and that up to an average 13% delay reduction may be achievable. However, it should be noted, that the effects of these optimisation improvements cannot be simulated within the LinSig model. It is therefore noted that the junction may have capability to run more efficiently than is demonstrated in the above modelling analysis and results, and that the junction could potentially operate with a greater level of capacity than indicated above. The assessment results which have been reported are therefore considered to be robust.

5.4 Sensitivity Scenario

5.4.1 As outlined in Section 5.2, in addition to the turning counts undertaken at the junction on Tuesday 15th November, two Automated Traffic Counts (ATCs) were undertaken on Dagnell End Road and the Birmingham Road link south of the junction for a 7 day, between 15th November and 22nd November.

5.4.2 In order to provide a further level of robustness to the modelling of the junction, a sensitivity scenario has been considered, to account for the highest level of two-way trips recorded by each ATC during the respective weekday AM and PM peak periods.

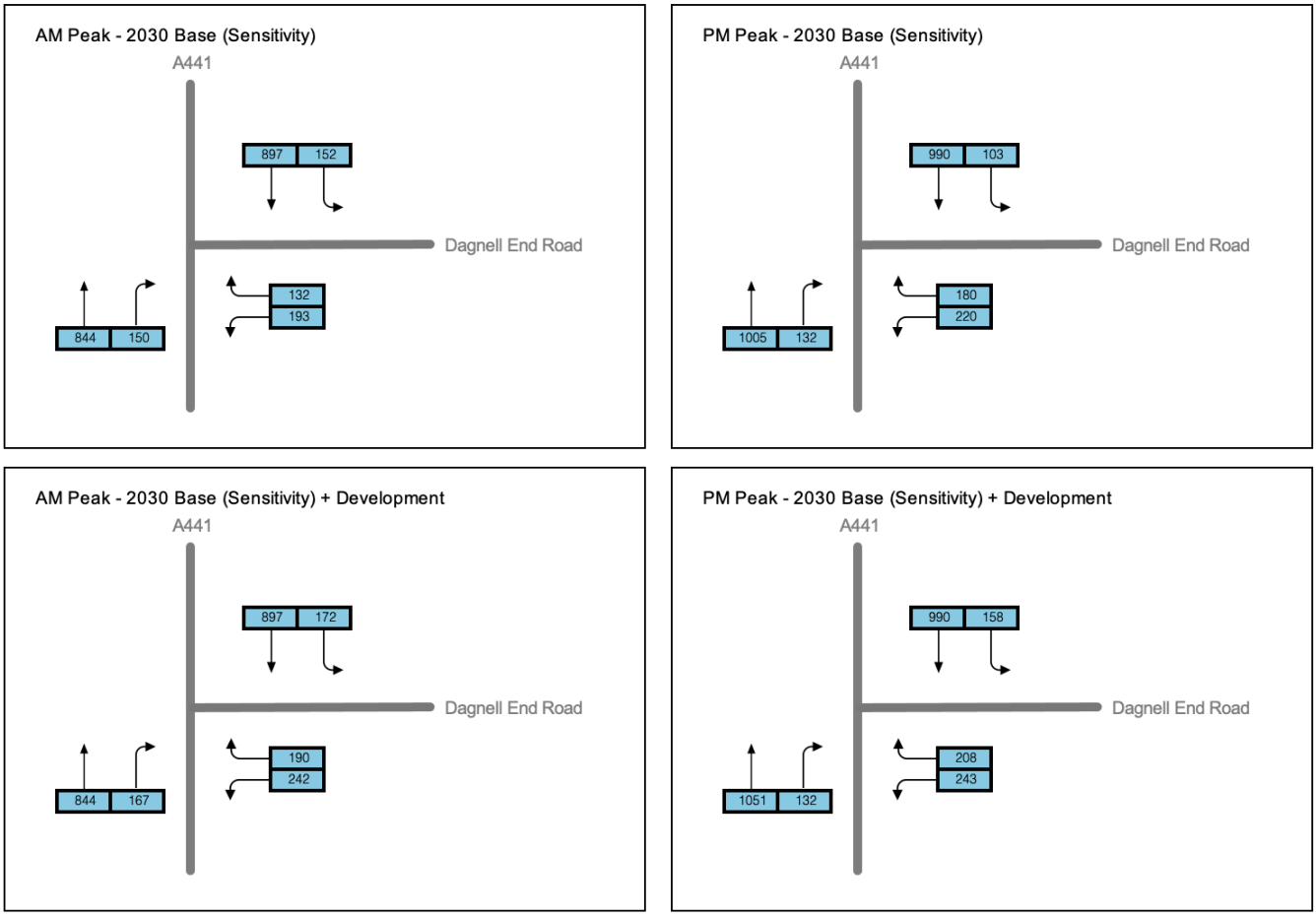
5.4.3 A percentage increase has been calculated between the two-way ATC data for Tuesday, and the maximum weekday recorded, as outlined within Table 5.4.

Table 5.4 : Percentage Increases – Sensitivity Scenario

	Tuesday (2-Way Flow)	Max Recorded Weekday (2-Way Flow)	Percentage Difference
ATC 1 (AM)	1,393	1,513	9%
ATC 1 (PM)	1,512	1,838	22%
ATC 2 (AM)	519	544	5%
ATC 2 (PM)	489	538	10%

5.4.4 The percentage increases for ATC 1 (Birmingham Road - A441) have been applied to northbound and southbound traffic along Birmingham Road, whereas the increases for ATC 2 (Dagnell End Road) have been applied to traffic routing to and from the Dagnell End Road arm of the junction. The resultant traffic flows for the sensitivity scenarios are outlined in **Figure 5.3**.

Figure 5.3 : Modelled Traffic Flows (Sensitivity Scenario) – Dagnell End Road / Birmingham Road Junction



5.4.5 A summary of the results using the revised 'v2 Rev B' model issued to mode by WCC, and the sensitivity traffic flows outlined above, is shown in **Table 5.5**, with the full output report attached at **Appendix E**, for reference. The results provide comparisons of the following:

- Committed Mitigation (Sensitivity) scenario 1 (SEN 1) - 2030 Base (Inc. Committed Development); and,
- (SEN 2) - 2030 Base (Inc. Committed Development) + Proposed Development.

5.4.6 The sensitivity scenario has been modelled to account for any isolated spikes in traffic movements identified during the weekday AM and PM peak periods surveyed. A summary of the results is provided in Table 5.5, for reference.

Table 5.5 : A441 / Dagnell End Road – Committed Mitigation Scheme (Sensitivity Scenario)

Arm	AM Peak Hour (0800 – 0900)			PM Peak Hour (1700 – 1800)		
	DoS (%)	MMQ (PCU)	Delay / PCU (s)	DoS (%)	MMQ (PCU)	Delay / PCU (s)
2030 Base Sensitivity (Stage Sequence 1 – No Peds)						
A441 (N)	77.0%	14	14	79.3%	22	16
Dagnell End Road	73.6%	5	43	84.3%	9	70
A441 (South)	71.6%	11	12	85.9%	27	21
PRC		16.8%			4.7%	
2030 Base Sensitivity + Development (Stage Sequence 1 – No Peds)						
A441 (N)	82.2%	18	18	84.6%	27	20
Dagnell End Road	81.5%	8	52	91.2%	12	82
A441 (South)	75.5%	14	16	90.5%	33	28
PRC		9.4%			-1.3%	
2030 Base Sensitivity (Stage Sequence 2 – No Peds & No Left Filter)						
A441 (N)	79.4%	16	16	80.2%	22	17
Dagnell End Road	79.9%	6	53	85.9%	10	76
A441 (South)	73.6%	13	14	86.8%	28	23
PRC		12.6%			3.7%	
2030 Base Sensitivity + Development (Stage Sequence 2 – No Peds & No Left Filter)						
A441 (N)	84.8%	19	21	85.9%	28	22
Dagnell End Road	80.1%	8	50	89.7%	12	82
A441 (South)	77.7%	15	18	91.4%	35	30
PRC		6.1%			-1.6%	
2030 Base Sensitivity (Stage Sequence 3 – Peds & Left Filter)						
A441 (N)	90.3%	23	30	89%	31	30
Dagnell End Road	87.2%	7	58	85.9%	10	76
A441 (South)	75.5%	14	16	89.6%	32	28
PRC		-0.3%			0.5%	
2030 Base Sensitivity + Development (Stage Sequence 3 – Peds & Left Filter)						
A441 (N)	95.4%	29	44	94.3%	39	41
Dagnell End Road	92.5%	9	65	94.9%	13	94
A441 (South)	78.8%	16	19	93.4%	38	35
PRC		-6%			-5.5%	

5.4.7 As outlined within **Table 5.5**, the results indicate that the junction operates within its practical capacity during the AM peak, with positive PRC values across each of the 2030 Base Sensitivity (Stage 1 / 2) and 2030 Base Sensitivity + Development scenarios.

5.4.8 During the 2030 Base Sensitivity (Stage 3) scenario, the junction operates slight beyond its practical capacity prior to the onset of development traffic, with a PRC value of -0.3% and a maximum DoS of 90.3% recorded on the A441 (N) approach. Following the introduction of development traffic, the PRC is reduced to -6%, and the maximum DoS increases by 5.1% on the A441 (N) approach. This is relatively minor in context to the overall operation of the junction, which is further evidenced by the minor increase in the recorded MMQ; from 23 to 29 PCU, and the average delay per PCU; which increases from 30 to 44 seconds. As noted in **Section 2**, pedestrian demand at the junction is relatively low and therefore as specified in the PJA Junction Design Modelling Update TN (24/11/2020) submitted as part of the Brockhill East Phase 3 application, it is highly unlikely the crossing will be called every cycle.

5.4.9 During the PM peak, the junction operates within its practical capacity during the 2030 Base Sensitivity (Stage 1) scenario with a PRC of 4.7% and a maximum DoS of 85.9% recorded on the A441 (South) approach to the junction. Following the introduction of development traffic, the junction operates at its practical capacity, with an increase in the DoS of 4.6% recorded on the A441 (South) approach to the junction. The impact of development traffic is considered to be relatively minor, with associated Mean Max Queues (MMQs) increasing from 27 to 33 PCU, and the average delay per PCU increasing from 21 to 28 seconds.

5.4.10 In the 2030 Base Sensitivity (Stage 2) scenario, the junction operates with a PRC of 3.7% in the PM peak, and a maximum DoS of 86.8% recorded on the A441 (South) approach. Once again, the proposed development is forecast to have a relatively minor impact at the junction, with an increase in the DoS of 4.6% recorded on the A441 (South) approach to the junction. The associated increases in MMQs from 28 to 35 PCU, and average delay from 23 to 30 seconds per PCU is also considered to be relatively minor in context to the overall operation of the junction.

5.4.11 In the 2030 Base Sensitivity (Stage 3) scenario, the junction is approaching its practical capacity during the PM peak prior to the onset of development traffic, with a PRC of 0.5%, and a maximum DoS of 89.6% recorded on the A441 (S) approach. Following the introduction of development traffic, the PRC is reduced to -5.5%, and the maximum DoS increases by 3.8% on the A441 (S) approach. This is relatively minor in context to the overall operation of the junction, which is further evidenced by the minor increase in the recorded MMQ; from 32 to 38 PCU, and the average delay per PCU; which increases from 28 to 35 seconds. As outlined above, on account of the relatively low pedestrian demand at the junction, it is highly unlikely the crossing will be called every cycle.

5.4.12 In light of the above, the impact of the proposed development is considered to be relatively minor in context, notably given that the modelling results in **Table 5.5** represent a sensitivity scenario; including a greater level of traffic than is likely to be the case for day-to-day operations of the junction.

5.4.13 Furthermore, and as noted above, the trip generation associated with the development is based upon trip rates taken from the donor site at Brockhill East Phase 1, which are far greater than those obtained from the TRICS database. The junction capacity assessment also includes 8-years of forecast background traffic growth and utilises 100% of trip generation associated with the proposed development and does not take account of any sustainable measures to reduce the traffic impact of the scheme, as set out in the accompanying Travel Plan.

5.4.14 In addition to the above, as part of the modelling work presented above, consideration has been made of the additional traffic associated with the allocated sites at Webheath and Foxlydiate, however as part of the TEMPro growth factors utilised no alternative assumptions have been applied to the 2022 – 2030 growth factors, this is considered to be 'overly robust', given that there is likely to be an element of double counting of committed development trips in the 2030 Base Scenario.

5.4.15 Taking into account all of the above, it is considered that the proposed development scheme will have a relatively minor impact on the overall operation of the junction and no further mitigation is required.

5.5 Comparison Graphs

5.5.1 In order to illustrate the traffic impacts associated with the various scenarios which have been modelled, comparison graphs have been provided, which show the PRC value of the junction and the maximum DoS recorded on any of the approaches during the AM and PM peaks of the following scenarios:

- Committed Mitigation (CM) – *based upon 2022 survey data*
  - **CM1** - 2030 Base (Inc. Committed Development); and,
  - **CM2** - 2030 Base (Inc. Committed Development) + Proposed Development.
- Committed Mitigation Sensitivity (**SEN**) – *based upon 2022 survey data*
  - **SEN 1** - 2030 Base (Inc. Committed Development); and,
  - **SEN 2** - 2030 Base (Inc. Committed Development) + Proposed Development.

5.5.2 The graphs also reference the modelling results for the existing junction layout, based upon 2018 survey data, as taken from the Junction Design Modelling Update TN (24/11/2020) for Brockhill East Phase 3 (and summarised in **Table 5.1**).

5.5.3 An overview of the results for the Committed Mitigation scheme using the previous 2018 survey data is also presented within the graphs, as taken from TN 221011 – 325756-TN002-LinSig Review Rev C prepared by mode. This scenario utilises the same LinSig model as the CM and SEN scenarios outlined above, albeit with the previous 2018 survey data.

5.5.4 A summary of these scenarios is provided below for reference.

- Existing Layout (**EL**) – *based upon 2018 survey data*
  - **EL1** - 2018 Base;
  - **EL2** - 2030 Base + Committed; and
  - **EL3** - 2030 Base + Committed + Brockhill East Phase 3.
- Committed Mitigation (CM) – *based upon 2018 survey data*
  - **CM3** - 2030 Base (Inc. Committed Development); and,
  - **CM4** - 2030 Base (Inc. Committed Development) + Proposed Development.

5.5.5 An overview of the PRC values for the above scenarios is outlined in **Figure 5.4**, with an overview of the maximum DoS recorded on any of the approaches provided in **Figure 5.5**.

Figure 5.4 : Comparison Graph – PRC Values

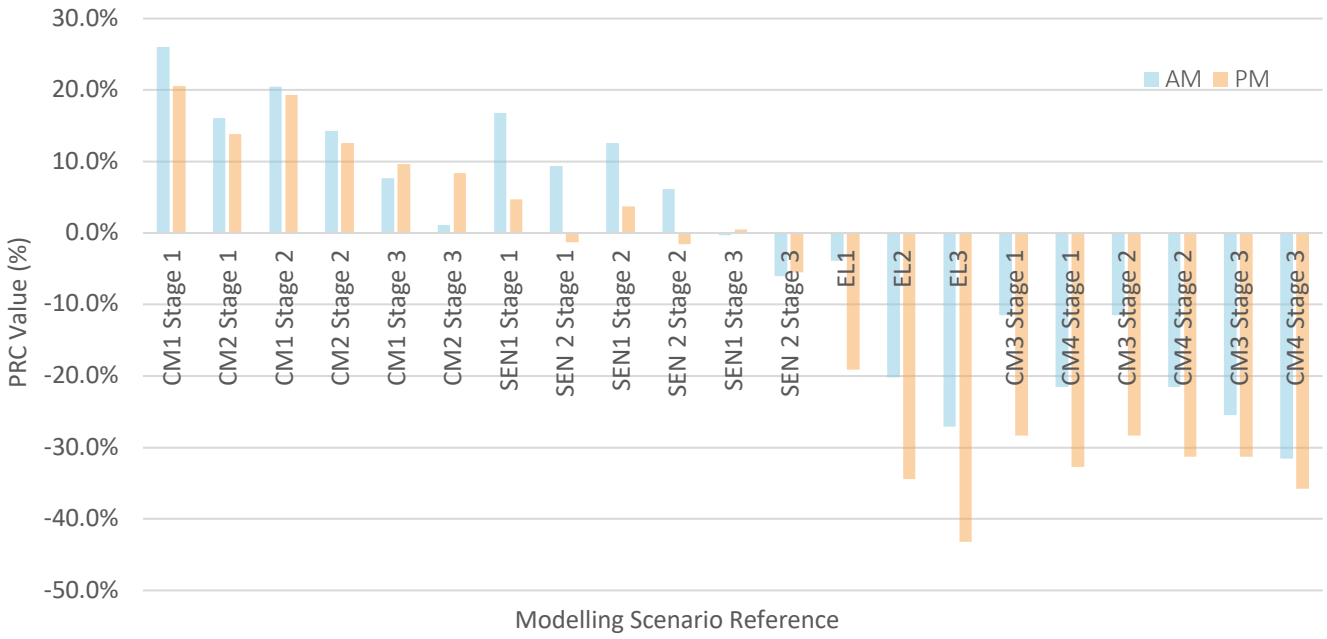
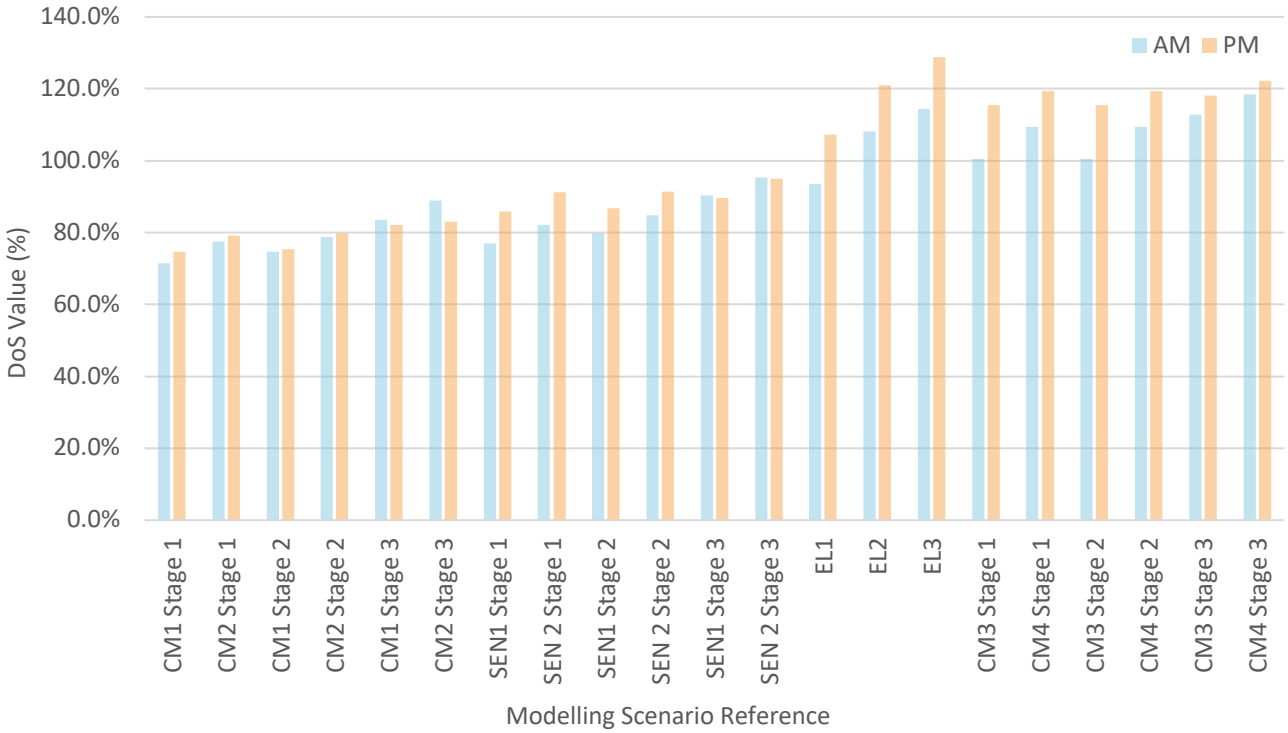


Figure 5.5 Comparison Graph – Maximum DoS Values



5.5.6 As outlined above, the junction is forecast to operate within its practical capacity with positive PRC values and maximum DoS values below 90% across all CM2 scenarios, which include the addition of development trips, the implementation of the committed mitigation scheme and survey data reflective of the current year operations at the junction.

5.5.7 As outlined above, the lowest PRC recorded during any CM2 scenario is 1.1%, during the Stage 3 AM Peak. This represents a significantly improved level of operation when compared with the AM Peak PRC values of -27.1% for the EL3 situation, and -25.5% for the CM3 Stage 3 scenario; both of which exclude traffic associated with the proposed development at Hither Green.

5.5.8 The greatest DoS recorded during any CM2 scenario is 89%, also during the Stage 3 AM Peak. This denotes a satisfactorily level of operation at the junction, and again demonstrates a significantly improved level of operation when compared with the AM Peak maximum DoS values of 114.4% for the EL3 situation, and 112.7% for the CM3 Stage 3 scenario; both of which exclude traffic associated with the proposed development at Hither Green.

5.5.9 A sensitivity scenario (SEN2) scenario has been modelled to account for any isolated spikes in traffic movements identified during the weekday AM and PM peak periods surveyed. As outlined above, the lowest PRC recorded during any SEN2 scenario is -6%, during the Stage 3 AM Peak. This represents a significantly improved level of operation when compared with the AM peak PRC values of -27.1% for the EL3 situation, and -25.5% for the CM3 Stage 3 scenario; both of which exclude traffic associated with the proposed development at Hither Green.

5.5.10 The greatest DoS recorded during any SEN2 scenario is 95.4%, also during the Stage 3 AM Peak, which indicates that the approach will operate within its theoretical capacity. This also demonstrates a significantly improved level of operation when compared with the AM Peak DoS values of 114.4% for the EL3 situation, and 112.7% for the CM3 Stage 3 scenario; both of which exclude traffic associated with the proposed development at Hither Green.

5.5.11 Taking into account all of the above, it is considered that the proposed development scheme will have a relatively minor impact on the overall operation of the junction. **Figure 5.4** demonstrates that the lowest PRC values recorded during any of the CM2 and SEN2 scenarios are 1.1% and -6% respectively, which represent a significantly improved level of operation when compared with the PRC value of -25.5% for the CM3 scenario, which was deemed acceptable by WCC in their formal response to the Brockhill East Phase 3 application (dated 5th January 2021), where they stated:

"The Highway Authority concludes that there would not be a severe impact and therefore there are no justifiable grounds on which an objection could be maintained".

5.5.12 It is also worth noting that within the CM2 and SEN2 scenarios, the junction is shown to operate with a greater PRC than in the EL2 scenario; i.e. the existing situation at the junction without the implementation of the committed mitigation scheme or additional trips associated with Brockhill East Phase 3.

5.5.13 It is therefore concluded that the additional trips associated with the proposed development can be accommodated at the junction. Taking into account the current level of operation, and the projected growth in background traffic by the end of the current Redditch Local Plan Period, it is not considered that any further mitigation is required at the Dagnell End Road / Birmingham Road junction.

6. Summary & Conclusion

6.1 Summary

6.1.1 This TN has been prepared by mode in response to post-application comments provided by WCC regarding the Full Planning Application (Ref: *21/01830/FUL*) for land to the west of Hither Green Lane in Redditch, Worcestershire, with consideration of the impacts on the Dagnell End Road / Birmingham Road (A441) junction.

6.1.2 Updated turning count surveys were undertaken at the junction on Tuesday 15th November 2022, covering the periods from 07:00 – 10:00 and 16:00 – 19:00. Background growth has been calculated using TEMPro for a 2030 future year, consistent with the end of the current Redditch Local Plan period.

6.1.3 Committed development trips associated with Webheath and Foxlydiate have obtained from the Brockhill East Phase 3 modelling work and included within the 2030 future year assessments. In the TA for Brockhill East Phase 3, in order to avoid 'double counting' of traffic, alternative assumptions were applied to the growth factors to deduct the committed development trips. As part of the growth factors applied within this TN, no alternative assumptions have been applied which is considered to be 'overly robust', given that there is likely to be an element of double counting of committed development trips.

6.1.4 The modelling work presented within this TN is based upon trip rates taken from the donor site at Brockhill East Phase 1 (obtained in 2018), which are far greater than those obtained from the TRICS database, using more recent datasets. As noted in WCC Highways Formal Response to the Brockhill East Phase 3 application (Dated 5th January 2021)

"*the trip rates are based on surveys of a site that is still yet to build a district centre, school, or be served by public transport routing through the site, and as such, the trip rates will reflect higher car trips than anticipated when the amenities are in place. The trip generation presented is considered to be robust*".

6.1.5 The modelling is also based upon 100% of trip generation associated with the proposed development quantum at Hither Green and does not take into account changes in working patterns (i.e., home / remote working) or other measures set out in the accompanying Travel Plan, which may reduce the impact of the proposed scheme further. It is therefore considered that the trip rates utilised as part of the modelling work are robust, and the actual trip generation associated with the proposed development could likely be lower.

6.1.6 As detailed within the TA submitted for the proposed development at Hither Green, the traffic distribution exercise undertaken has been based on the distribution profile for the Brockhill East development, which was deemed acceptable by WCC. This takes account of the distribution of traffic north and south along the Birmingham Road (A441) corridor from Brockhill East onto the Weights Lane roundabout, and the subsequent distribution onto the wider study network.

6.1.7 In summary, the proposed scheme is forecast to have a minor impact on the operation of the Dagnell End Road / Birmingham Road junction. The junction is forecast to operate within its practical capacity with positive PRC values and maximum DoS values below 90% across all CM2 scenarios modelled, which include the addition of development trips, the implementation of the committed mitigation scheme and survey data reflective of the current year operation at the junction. The development trips equate to a 6% and 7% increase in throughput during the respective AM and PM peaks.

6.1.8 The lowest PRC values recorded during any of the CM2 and SEN2 scenarios are 1.1% and -6% respectively, which represent a significantly improved level of operation when compared with the PRC value of -25.5% for the CM3 scenario, which was deemed acceptable by WCC in their formal response to the Brockhill East Phase 3 application (dated 5th January 2021), where they stated:

"The Highway Authority concludes that there would not be a severe impact and therefore there are no justifiable grounds on which an objection could be maintained".

6.1.9 It is also worth noting that within the CM2 and SEN2 scenarios, the junction is shown to operate with a greater PRC than in the EL2 scenario; i.e. the existing situation at the junction without the implementation of the committed mitigation scheme or additional trips associated with Brockhill East Phase 3.

6.1.10 It is also understood that the mitigation scheme for the junction is to include MOVA. TRL/Department for Transport research indicates that through the implementation of a MOVA system, the efficiency and operation of signalised junctions can be improved, and that up to an average 13% delay reduction may be achievable. It is noted, however, that the effects of these optimisation improvements cannot be simulated within the LinSig model. It is therefore considered that the mitigation scheme for the junction may have capability to run more efficiently than is demonstrated in the forecast modelling results and that the junction could potentially operate with a greater level of capacity than indicated.

6.1.11 It has been demonstrated that the additional trips associated with the proposed development can be accommodated at the junction. Taking into account the current level of operation, and the projected growth in background traffic by the end of the current Redditch Local Plan Period, it is not considered that any further mitigation is required at the Dagnell End Road / Birmingham Road junction in order to accommodate the additional trips associated with the proposed development.

6.2 Conclusion

6.2.1 In light of the above, it is not considered that the proposed development will have a severe impact on the operation of the Dagnell End Road / Birmingham Road junction. The capacity assessment outlined within this TN demonstrates that junction will operate within acceptable capacity parameters following the introduction of the development proposals, and no further mitigation is therefore deemed necessary.

6.2.2 Paragraph 111 of the NPPF states:

"Development should only be prevented or refused on highways grounds if there would be an unacceptable impact on highway safety, or the residual cumulative impacts on the road network would be severe."

6.2.3 In light of the evidence presented to date within this TN and the accompanying TA, it is not considered that the proposed development would result in a severe impact on the local highway network, and as such should be considered acceptable in transport and highway grounds.