Southbourne Level Crossing

Paramics Discovery Modelling Update

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# Introduction

## Introduction

* + 1. In November 2019 Stantec were commissioned by Chichester District Council (CDC) to undertake a baseline safety review and level crossing impact assessment, by developing a Paramics Discovery model of the level crossing at Stein Road, Southbourne. The main purpose of the study was to understand the impact of development in Southbourne, located to the north of the Stein Road level crossing.
    2. The results of this baseline safety review ware documented in the report: “Southbourne Level Crossing Baseline Safety Review, issued in November 2020.
    3. Following a review of the modelling, West Sussex County Council (WSCC) requested that the Paramics Discovery model is updated with new traffic data to understand traffic impacts of the proposed Southbourne development. WSCC wanted further consideration to be given to flow changes on Stein Road and the ability of the level crossing to cope with generated traffic. The previous modelling used the Chichester SATURN model to provide data, but it was noted that this was not validated on Stein Road, thus the request from WSCC. There was concern that the model may not represent base and/or background traffic to realistically assess crossing performance when CATM flows are used in the microsimulation model.
    4. WSCC requested that a new Automatic Traffic Count (ATC) survey be undertaken at the level crossing to validate the microsimulation assessment of the level crossing as the strategic Chichester Area Transport Model (CATM) SATURN model link representing Stein Road was not validated.
    5. To allay WSCC concerns, surveys were commissioned in the study area on Stein Road to inform the update and validation of the Paramics Discovery microsimulation model.
    6. This document is an addendum to the November 2020 report and reports solely on the microsimulation update and the results thereof. While the addendum is largely self-contained, the full context of the study and key assumptions can be found in the 2020 report.
    7. As per the 2020 microsimulation modelling, the outputs of this study are intended to provide an indicative trigger point for a bridge rather than to prescribe when a bridge is required and must therefore be understood in the context of the limited nature of the modelling exercise to be indicative rather than prescriptive.
    8. Following this introduction, this addendum is organised as follows:
* Section 2 reports on the Paramics Discovery modelling updates including data collected.
* Section 3 reports on the Reference Case and Development Options undertaken in Paramics Discovery.
* Section 4 provides results of the Paramics Discovery modelling.
* Section 5 provides a Summary and Conclusion.

# Paramics Discovery Modelling Update

## New Survey Data

* + 1. New survey data was collected in the Stein Road area in October 2022 to inform the model calibration and validation. The delay in collecting data was to ensure that impacts of the changes in travel behaviour resulting from the COVID pandemic had settled down enough to provide reasonably stable counts. The counts included the following and are shown within figure 2-1 below:
* Old Farm Lane and Stein Road – a simple priority T-junction. A Manual Classified Turn Count (MCC1) and queue length survey was undertaken on Thursday 20th October 2022 between 0700 and 1900.
* A259 Main Road and Stein Road – Mini roundabout. A Manual Classified Turn Count (MCC2) and queue length survey was undertaken on Thursday 20th October 2022 between 0700 and 1900.
* Link Manual Classified Count (MCC) and Queue Length Survey at Southbourne Level Crossing - undertaken on Thursday 20th October 2022 between 0700 and 1900.
* Automatic Traffic Counts (ATC) on Stein Road – North (ATC1) and South (ATC2) of the level crossing. The surveys ran from Friday 7th October to Sunday 23rd October 2022.
* Video Footage - Footage of level crossings has been made available, enabling observation of the barrier operation across the full day covering the time period between 0700-1900. This enabled durations of the barrier closures and openings to be estimated for input into the Paramics Discovery model to simulate the barrier operation.

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Figure 2‑1: Traffic Survey Location

* + 1. Surveyed data was checked against WSCC permanent count site at the A259 west of Thorney Road and it was concluded that traffic count data reflected typical traffic trends across a wider survey period.

## Initial Comparison of Model and Count Data

* + 1. Following the receipt of the new survey data and following sense checks, basic comparisons were made to see how the traffic flows in the previous models compared with the newly collected data. The collected data is shown for the link MCC and for the ATC 1 and ATC 2 counts. The results are shown in Table 2-1.

Table 2-1: AM Peak hour 0800 – 0900 flow Stein Road Level Crossing flow comparison (Vehicles/hour)

| **From time**  **Direction** | **Link MCC (Thursday 20.10.2022)** | **ATC 1 (Tuesday-Thursday average)** | **ATC 2 (Tuesday-Thursday average)** | **2035 Ref Case (previous microsim)** | **2014 Base (CATM)** | **2035 Ref Case (CATM)** |
| --- | --- | --- | --- | --- | --- | --- |
| Northbound (NB) | 245 | 211 | 217 | 360 | 146 | 288 |
| Southbound (SB) | 293 | 278 | 272 | 194 | 337 | 158 |

* The data shows reasonable consistency between the link Manual Classified Count (MCC) and the Automatic Traffic Counts (ATC). ATC 1 was taken just north of the Southbourne Level Crossing (SLC) while ATC 2 was taken just south of the crossing.
* There is reasonable consistency between ATC 1 and ATC 2 giving a northbound ATC average flow of 214 vehicles/hour and southbound average flow of 275 vehicles/hour.
* In the northbound direction the 2035 Reference Case previous Paramics Discovery model has 146 vehicles more than the observed 214 vehicle/hour ATC average or 68% higher
* In the southbound direction the 2035 Reference Case previous Paramics Discovery model has 81 vehicles/hour less than the observed 275 vehicle/hour average or 30.4% lower.
  + 1. In the AM peak, most development traffic is expected to cross the level crossing southbound hence the future Paramics Discovery Reference Case model having less traffic than the 2022 observed flow, has the potential to underestimate impact at the level crossing. It was considered appropriate to update the Paramics Discovery model by first producing a 2022 Base Year model that was calibrated and validated against the collected survey data.

## Paramics Discovery Base Year Model

* + 1. As before, the purpose of the microsimulation model is to assists in understanding the impacts of the proposed Southbourne development traffic on the operation of the level crossing. The model was coded using Paramics Discovery version 25.0.2.
    2. The micro-simulation model in addition to being an analytical tool, also acts as a visual tool that therefore aids understanding of the operation of the level crossings as the number of proposed Southbourne homes are increased. In particular, the changes in queue length on the approaches to the level crossing can be visually assessed and understood, as are the potential changes in delays experienced by travellers.
    3. The observed queueing at the level crossing, reported for each time the barriers are raised after a train has passed, shows comparable maximum queues within the AM and PM Peak period. With maximum queues of the AM peak shown at the Northbound approach as 75 metres and within the PM peak as 78 metres. As the observed flow data from the ATC located south of the level crossing show that the northbound flows in the AM peak hour (217 vehicles for three-day average) are higher than in the PM peak (199 vehicles), therefore the assessment assessment of the level crossing through an AM Peak model would provide the worst-case scenario of peak traffic conditions at the crossing and on the approach arms.
    4. Matrix demands for the Base Paramics Discovery model were created using the manual classified link count observed at the Southbourne Level Crossing. Analysis of the ATC and MCC counts on Stein Road indicates the AM peak hour as 0800 to 0900. The two-hour AM model period of 0715 to 0915 used in the previous Paramics Discovery model has been retained and gives a sufficient warm up period of 0715 to 0800 and cool down period 0900 to 0915, with model validation and analysis focussed on the peak hour 0800 to 0900.

**Model Area and Zones**

* + 1. As before, the modelling has focussed on the Stein Road level crossing although in principle, the basic modelling principles would remain the same as would the number of crossing closures at the Inlands Road level crossing. It was agreed that any forecast traffic conditions at Inlands Road would not necessitate a bridge and Stein Road would provide a stronger indication of whether a bridge is required. Network Rail could decide to close both crossings following any bridge being in place but might have to provide an additional footbridge to reduce diversions for pedestrians.
    2. The Paramics Discovery model consisted of coding a stretch of road to represent Stein Road on both sides of the level crossing. The model consists of two traffic zones representing the entry and exit point of traffic at the northern end (Zone 1) and similarly on the southern end of the model (Zone 2). Additionally, a further two zones (Zones 3 and 4) were coded into the model to enable visual of trains crossing the level crossing when the barrier is down. Zones 3 and 4 have no road traffic associated with them.
    3. An aerial map was used to provide an overlay against which the model was coded and to give context to the model. Figure 2-2 shows a snapshot of the Paramics Discovery model with zones shown as blue boxes.

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Figure 2-2: Paramics Discovery Model network snapshot

**Network and Signal**

* + 1. Stein Road was modelled as a 30-mph single carriageway which reflects the onsite speed limit.
    2. The West Coastway railway line was modelled as a road without any traffic flow spanning across the north-south Stein Road to create the level crossing ‘junction.’
    3. The level crossing is represented by a traffic signal at the intersection node of the road and railway line. This allowed traffic to be stopped to simulate the times during which the barriers were down, and the level crossing closed to traffic.
    4. The signal timings were obtained from the survey video footage. Timings covering the two-hour period 0715 to 0915 were extracted from video footage of the barrier closures and openings as trains passed the level crossing. Both level crossings were surveyed within the AM peak period (07:00-10:00).
    5. With regards to the AM Peak scenario a thorough analysis was undertaken that looked at the length of closures and the percentage of time that crossing was available to highway traffic. Table 2-2 shows the barrier activation start and end times, this equated to the highway having 67% crossing time across the AM peak period (07:00-10:00).

Table 2‑2: Barrier Activation Timings

|  |  |  |  |
| --- | --- | --- | --- |
| Start Time/Barrier Down | End Time/Barrier Up | Time Length Barrier down (hh:mm:ss)(Phase B train crossing) | Time Length Barrier Up (hh:mm:ss)(Phase A Cars Green) |
| 07:01:38 | 07:05:23 | 00:03:45 | 00:00:28 |
| 07:05:51 | 07:08:20 | 00:02:29 | 00:03:56 |
| 07:12:16 | 07:14:45 | 00:02:29 | 00:08:08 |
| 07:22:53 | 07:26:10 | 00:03:17 | 00:05:33 |
| 07:31:43 | 07:32:57 | 00:01:14 | 00:09:09 |
| 07:42:06 | 07:45:14 | 00:03:08 | 00:01:41 |
| 07:46:55 | 07:49:28 | 00:02:33 | 00:03:08 |
| 07:52:36 | 07:55:07 | 00:02:31 | 00:01:06 |
| 07:56:13 | 07:58:45 | 00:02:32 | 00:03:38 |
| 08:02:23 | 08:05:20 | 00:02:57 | 00:17:31 |
| 08:22:51 | 08:26:37 | 00:03:46 | 00:01:37 |
| 08:28:14 | 08:30:01 | 00:01:47 | 00:01:39 |
| 08:31:40 | 08:34:17 | 00:02:37 | 00:09:58 |
| 08:44:15 | 08:45:13 | 00:00:58 | 00:09:23 |
| 08:54:36 | 08:58:00 | 00:03:24 | 00:02:21 |
| 09:00:21 | 09:02:00 | 00:01:39 | 00:04:09 |
| 09:06:09 | 09:08:44 | 00:02:35 | 00:05:03 |
| 09:13:47 | 09:17:42 | 00:03:55 | 00:01:35 |
| 09:19:17 | 09:22:01 | 00:02:44 | 00:02:50 |
| 09:24:51 | 09:26:56 | 00:02:05 | 00:04:55 |
| 09:31:51 | 09:33:54 | 00:02:03 | 00:08:49 |
| 09:42:43 | 09:43:24 | 00:00:41 | 00:07:33 |
| 09:50:57 | 09:53:51 | 00:02:54 | 00:05:25 |

* + 1. It should be noted that throughout the observed survey period conducted on the 20/10/2022, the AM and PM Peak periods have similar barrier activation frequency, with the 0700-0800 period showing a maximum number of 10 barrier activations.

Figure 2‑3: Barrier Activation Frequency Per Hour

* + 1. By coding in train schedules within the Paramics Discovery model, it was possible to visually represent traffic stopped at the level crossing as a train passes. Figure 2-4 shows a snapshot at around 07:42 when traffic has been stopped as a train passes the level crossing.

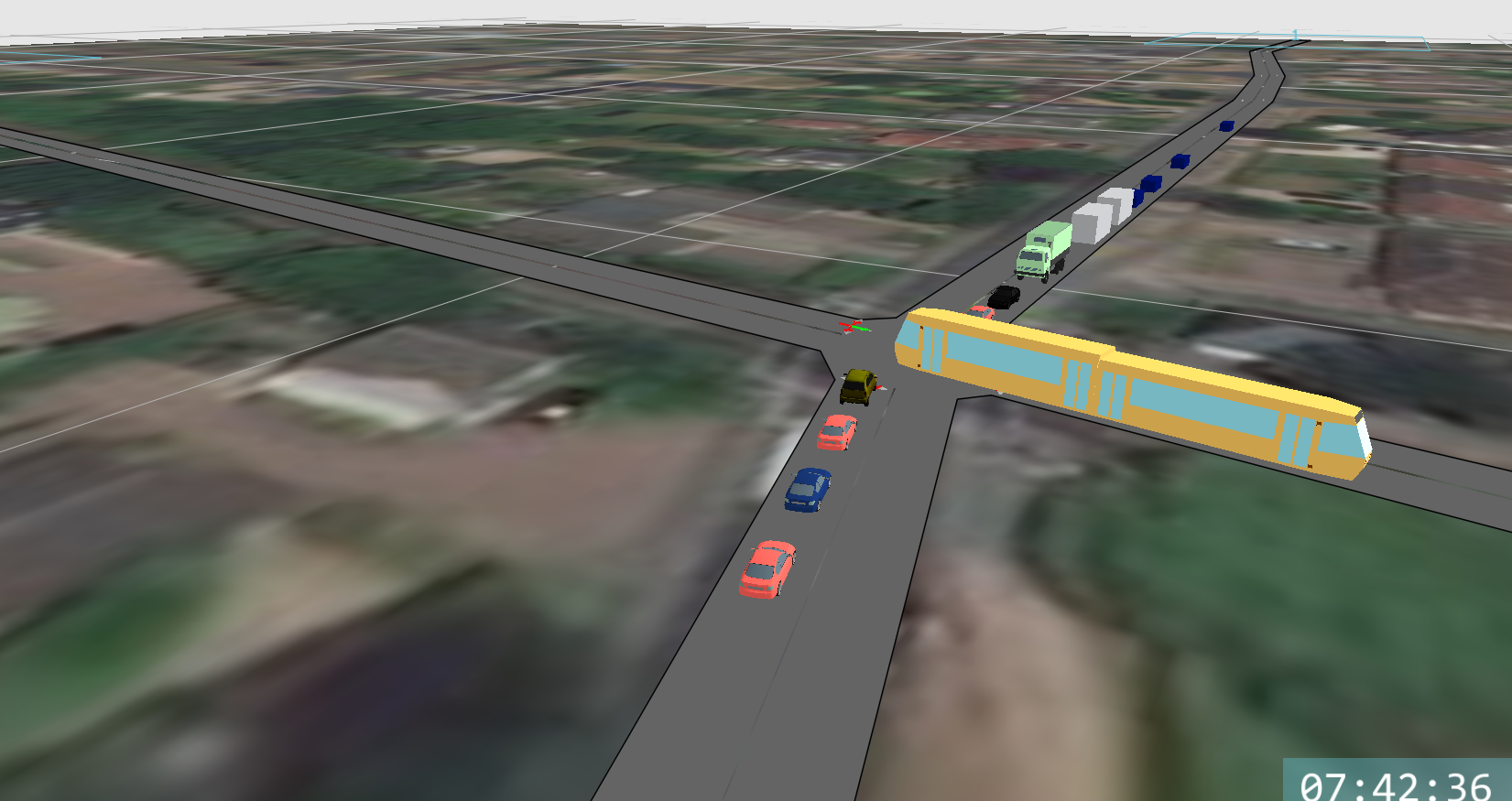


Figure 2-4: Paramics Discovery Model network snapshot with road traffic stopped as train crosses level crossing

## Base Model Matrix Demands

* + 1. Matrix demands for the Base Paramics Discovery model were created using the (MCC’s observed at the Southbourne Level Crossing. The matrices were created with five matrix levels as follows:
* Matrix 1 – represents 2022 Base Year car demands (100%)
* Matrix 2 – Represents 2022 Base year Light Goods Vehicle (LGV) demands (100%)
* Matrix 3 – represents a combination of 2022 Base Medium/Other Goods Vehicles (OGV1) (67%), Heavy/Other Goods Vehicles (13%) and coaches (20%). These proportions were estimated from the MCC link count at the level crossing.
* Matrix 4 – represents all vehicle types of future background/committed traffic up and above the 2022 Base Year demands and first appear in the Reference Case, assumed to be 2039 consistent with the local plan review period. The vehicle proportions have been estimated from the MCC counts and comprises 83.2% Car, 15% LGV, 1.2% OGV1, 0.2% HGV/OGV2 and 0.4% Coach. It is evident that Car and LGV by far comprise the highest proportion (98.2%) of traffic crossing the level crossing with Medium and or Heavy Goods Vehicles and coaches combined comprising only 1.8%.
* Matrix 5 – represents all vehicle types of future Southbourne development traffic over and above the Reference Case. This matrix has assumed the same vehicle mix as background traffic in Matrix 4 above.
  + 1. In the Base Year, Matrix 4 and Matrix 5 have no trips, while Matrix 5 only has trips in the Southbourne development scenarios.

**Demand Profile**

* + 1. Demand Profiles are used to specify the release of traffic onto the network and are input into Paramics Discovery at 5-minute intervals. The build-up and decay of traffic demand in the Paramics Discovery model is thus specified through the use of demand profiles.
    2. Separate northbound and southbound demand profiles were created and were assumed for all vehicle types given the dominance of cars and light goods vehicles. The profiles were informed by the Stein Road MCC.

## Base Model Checks

* + 1. Following the creation of the 2022 Base Year model, the model was observed running to check that vehicle behaviour was reasonable, and the barrier timings were correctly simulated. Model statistics were collected for 10 model runs based on a random seed. The random seed controls the release of vehicles on the network such that day to day variations in traffic are represented and that no two model runs are identical.
    2. Link flow, queues in metres and journey times in seconds were obtained from the model and compared with the observed data.
    3. Queue lengths were output at a minute-by-minute interval to make comparison with observed data more representative. It is noted that there are no criteria within TAG for queue validation given the subjective nature of queues.
    4. Table 2-3 shows the model flow comparison on Stein Road across the level crossing compared to the observed ATC flow taken as the average of ATC 1 and ATC 2. This is an independent data set from the MCC link flow which was used to create the Base Year matrices.

Table 2-3: AM Peak hour 0800 – 0900 flow Stein Road Level Crossing flow comparison – 2022 Base Year Paramics Discovery Model (Vehicles/hour)

| **From time**  **Direction** | **ATC 1 &2 average** | **2022 Base Year (microsim)** | **Difference (M – C)** | **% Difference** | **GEH** | **Pass/Fail** |
| --- | --- | --- | --- | --- | --- | --- |
| Northbound (NB) | 214 | 244 | +30 | +14 | 1.98 | Pass |
| Southbound (SB) | 275 | 288 | +13 | +4.7 | 0.78 | Pass |

* + 1. As expected, the model link flow is seen to adequately match the observed ATC count data and is with flow validation criteria in TAG Unit M3.1 Highway Assignment.
    2. The Base Model has also been checked for how model queues in metres compare to the observed queues. The results are shown in Table 2–4. It can be seen that there is reasonable agreement with observed queue lengths. The model shows higher queue lengths than observed in some instances. The data suggests that in the AM peak, the highest/longest observed southbound queues occur at around 08:26 and are of the order of 45 metres. The equivalent northbound queues are highest at around 07:58 and are estimated at 75 metres.

Table 2-4: Base Mode Queue Comparison(metres)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time barrier raises** | **Observed**  **(SB)** | **Model led**  **(SB)** | **Difference**  **(SB)** | **Observed**  **(NB)** | **Modelled NB)** | **Difference**  **(NB)** |
| 07:26:10 | 30 | 57 | 27 | 66 | 63 | -3 |
| 07:32:57 | 6 | 2 | -4 | 18 | 13 | -5 |
| 07:45:14 | 30 | 53 | 23 | 24 | 40 | 16 |
| 07:49:28 | 30 | 68 | 38 | 42 | 45 | 3 |
| 07:55:07 | 24 | 73 | 49 | 42 | 67 | 25 |
| 07:58:45 | 36 | 40 | 4 | 75 | 79 | 4 |
| 08:05:20 | 45 | 129 | 84 | 36 | 116 | 80 |
| 08:26:37 | 36 | 160 | 124 | 66 | 115 | 49 |
| 08:30:01 | 36 | 76 | 40 | 63 | 53 | -10 |
| 08:34:17 | 42 | 119 | 77 | 42 | 69 | 27 |
| 08:45:13 | 18 | 43 | 25 | 12 | 27 | 15 |
| 08:58:00 | 36 | 83 | 47 | 60 | 121 | 61 |

* + 1. It is considered that the 2022 Base Year Paramics Discovery model adequately and replicates observed conditions at the Southbourne Level Crossing and is a robust tool to underpin and produce future forecasts and understand the potential impacts of the proposed future Southbourne development on this level crossing. It is noted that the model does not have route choice and represents a worst-case scenario. This could explain the higher queues in the model as in reality, drivers with local knowledge may divert away from Stein Road and use Cooks Lane/Inland Road for instance to avoid the worst queuing times.

# Reference Case and Development Options

## Reference Case Paramics Model

* + 1. Following the development of the Base Year Paramics Discovery model, a future Reference Case forecast model was created based on the CATM SATURN Reference Case model. This is assumed to be 2039 Reference Forecast model corresponding to the Local Plan Review end year. The CATM model has been used to estimate background/committed trips to add on top of the Base Year 2022 Paramics model.
    2. This was done by looking at the growth between the 2039 CATM Reference Case model and the 2014 CATM Base Year model and then taking the pro-rata growth from 2022, corresponding to the observed Paramics Discovery base year. The growth was estimated by looking at the flow changes on Stein Road in both the northbound and southbound directions between aforementioned CATM models for the AM peak. The growth was entered into the 2022 Base Year Paramics Discovery model in vehicles to create the 2039 Reference Case Paramics Discovery model which formed the basis against which the Southbourne development scenarios were compared.

Table 3-1: 2039 Reference Case Paramics Discovery Model demands AM Peak hour 0800 – 0900 (Vehicles/hour)

| **Direction** | **2022 Base Paramics trips** | **Growth in trips 2022 to 2039** | **2039 Reference Case Paramics trips** | **% Increase** |
| --- | --- | --- | --- | --- |
| Northbound (NB) | 245 | 95 | 340 | +38.9% |
| Southbound (SB) | 293 | 118 | 411 | +40.3% |

* + 1. Table 3 - 1 summarises the peak hour trip matrix changes in the Paramics Discovery models between the Base Year and Reference Case. The advantage of using the CATM growth to inform the Paramics Discovery Reference Case model is that reassignment effects are considered, whereas an approach that growthed up base Paramics Discovery demands using NTEM/TEMPro growth factors would not account for future reassignment on Stein Road. The approach also maintains as much consistency as possible with Local Plan Review Transport Assessment (TA) evidence base.
    2. No network changes were made to the Base Year Paramics Discovery model in creating the Reference Case Paramics Discovery model.

## Southbourne development location

* + 1. The transport modelling for this work considered two potential development site location options for the Southbourne development. These are as follows and have been reviewed from documents provided by CDC:
* Option A: North East of Southbourne site location (Site A NE Southbourne) promoted by Barton Willmore[[1]](#footnote-1)
* Option B: North West of Southbourne location (Site B NW Southbourne) promoted by Lichfields/Church Commissioners[[2]](#footnote-2).
  + 1. The proposed North East Southbourne development site and the locations of the two-level crossings are shown in Figure 3-1 while the North West Southbourne development site location is shown in Figure 3-2. In August 2020, Southbourne Parish Council published a draft Neighbourhood Plan which set out proposals for expansion of the village to the east. These proposals are considered broadly consistent with Option A (Site A NE Southbourne) for the purposes of this exercise.

Figure 3-1: Site A North East Southbourne site and level crossing locations

Map

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Figure 3-2: Site B North West Southbourne site location

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## Modelled Development Scenarios

* + 1. As per the previous model tests, the modelled development scenarios were informed by a review of the vision documents for both the Site A NE Southbourne development site location and the Site B NW Southbourne development site location. These are listed below:
* 250 dwellings which tests for a scenario below the 500 dwellings generally assumed to be delivered early in the plan period (Phase 1)
* 500 dwellings
* 750 dwellings
* 1,000 dwellings
* 1,250 dwellings
  + 1. The development demands from each scenario were added to the Reference Case Demands which represents the Without Development scenario. The Reference Case formed the baseline against which the proposed development scenarios were compared.

## Trip Generation, Distribution and Assignment

* + 1. The trip generation for the Southbourne development for the modelled scenarios are presented in Table 3-2. The trip rates assumed those used in the Local Plan modelling and would apply to both the Site A NE Southbourne and Site B NW Southbourne development locations.

Table 3-2: Trip generation

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Scenario** | **No of Homes** | **Arrivals** | **Departures** | **Total Trip Generation** |
| 1 | 250 | 27 | 95 | 122 |
| 2 | 500 | 55 | 189 | 244 |
| 3 | 750 | 82 | 278 | 360 |
| 4 | 1000 | 109 | 378 | 487 |
| 5 | 1250 | 136 | 473 | 609 |

* + 1. Thus, the trip generation and distribution assumptions were retained from the previous modelling. Using these assumptions, the development trips for each of the above development scenarios were added into their respective models. Following visual analysis of the models, statistics were created for 10 runs for all the models and compared to the Reference Case. Results were compared for journey times and queues.

# Paramics Modelling Results and Analysis

## Results

* + 1. The following model output parameters have been used to compare the impacts of the Southbourne development against the Reference Case:
* Changes in journey times in seconds comparing each modelled scenario (With Development Scenario) against the Reference Case (Without development). Journey time paths routes were coded in each model to measure the southbound and northbound journey times across the level crossing (Zone to Zone journey time). Path journeys times southbound and northbound from each respective zone to the stop line were also coded to measure delays at the stop line. These journey times/delays were measured at 5-minute intervals.
* Difference in queue length in metres,). To expedite this comparison, queue routes were coded in each model to measure the queue length in both the southbound and northbound stop lines. These were measured at one-minute intervals to capture impacts during barrier closures.
  + 1. In all cases the analysis has been informed by ten (10) model runs to take account of the potential day to day variability in network conditions. This is in line with good practice when using microsimulation models.

## Journey Time Analysis

Southbound Journey Times

* + 1. Figure 4 -1 shows a graph of the variation of average maximum journey times in seconds in the southbound direction across the level crossing as measured by Journey Time Path 4 (JT4). This is measured from Zone 1 in the north to Zone 2 in the south.

Figure 4‑1: Variation of Southbound Maximum path Journey Times (seconds) across Level Crossing by Number of Homes

* + 1. The equivalent data used in the Figure 4-1 is shown in Table 4-1. Table 4-2 shows the difference in journey time for each scenario when compared to the Reference Case. A positive value implies an increase in journey time over that in the Reference Case, while a negative value implies a decrease.

Table 4-1: Southbound Journey Maximum Journey Time (JT4) across Level Crossing (Z1 to Z2) by Number of Homes (Seconds)

| **From time** | **To time** | **2022 Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 269.6 | 270.4 | 270.1 | 268.7 | 268.6 | 269.0 | 271.4 |
| 08:05 | 08:10 | 101.7 | 100.9 | 102.3 | 105.2 | 105.8 | 112.3 | 115.7 |
| 08:10 | 08:15 | 100.8 | 101.7 | 101.3 | 101.7 | 102.3 | 101.3 | 102.2 |
| 08:15 | 08:20 | 101.3 | 102.2 | 102.4 | 102.8 | 102.8 | 103.2 | 102.4 |
| 08:20 | 08:25 | 311.1 | 317.7 | 320.3 | 323.2 | 320.8 | 325.0 | 324.0 |
| 08:25 | 08:30 | 193.2 | 198.7 | 196.3 | 199.6 | 212.1 | 214.3 | 244.2 |
| 08:30 | 08:35 | 244.5 | 241.6 | 250.6 | 252.1 | 253.1 | 253.6 | 252.0 |
| 08:35 | 08:40 | 101.4 | 101.6 | 102.6 | 102.6 | 102.3 | 102.5 | 102.6 |
| 08:40 | 08:45 | 153.7 | 149.3 | 152.5 | 154.9 | 149.1 | 150.2 | 155.9 |
| 08:45 | 08:50 | 100.2 | 101.5 | 101.2 | 102.0 | 101.0 | 101.8 | 101.0 |
| 08:50 | 08:55 | 279.2 | 290.2 | 293.6 | 293.2 | 290.5 | 296.7 | 298.7 |
| 08:55 | 09:00 | 209.8 | 222.4 | 219.7 | 225.7 | 221.2 | 228.2 | 230.2 |

Table 4-2: Southbound Change in Journey Maximum Journey Time (JT4) v Reference Case across Level Crossing (Z1 to Z2) by Number of Homes (Seconds)

| **From time** | **To time** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 0 | -0.3 | -1.7 | -1.8 | -1.4 | 1 |
| 08:05 | 08:10 | 0 | 1.4 | 4.3 | 4.9 | 11.4 | 14.8 |
| 08:10 | 08:15 | 0 | -0.4 | 0 | 0.6 | -0.4 | 0.5 |
| 08:15 | 08:20 | 0 | 0.2 | 0.6 | 0.6 | 1 | 0.2 |
| 08:20 | 08:25 | 0 | 2.6 | 5.5 | 3.1 | 7.3 | 6.3 |
| 08:25 | 08:30 | 0 | -2.4 | 0.9 | 13.4 | 15.6 | 45.5 |
| 08:30 | 08:35 | 0 | 9 | 10.5 | 11.5 | 12 | 10.4 |
| 08:35 | 08:40 | 0 | 1 | 1 | 0.7 | 0.9 | 1 |
| 08:40 | 08:45 | 0 | 3.2 | 5.6 | -0.2 | 0.9 | 6.6 |
| 08:45 | 08:50 | 0 | -0.3 | 0.5 | -0.5 | 0.3 | -0.5 |
| 08:50 | 08:55 | 0 | 3.4 | 3 | 0.3 | 6.5 | 8.5 |
| 08:55 | 09:00 | 0 | -2.7 | 3.3 | -1.2 | 5.8 | 7.8 |

* + 1. The results indicate modest journey time increases from the Reference Case through the various scenarios of Southbourne dwellings from 250 dwellings to 1,250 dwellings across the analysed 5-minute time intervals. A 30 second increase in delay or travel time over the Reference Case is usually considered a material change.
    2. It can be seen that in most cases the changes or increases in journey time are less than 30 seconds. However, for the time slice 08:25 to 8:30, the journey times increases by 45.5 seconds in 1,250 dwellings scenario, which indicates a material change. This suggest that the 30 second threshold increase, is exceeded between 1,000 and 1,250 dwellings.

Figure 4‑2: Variation of Southbound Maximum path Journey Times (seconds) at Level Crossing by Number of Homes

* + 1. Figure 4-2 shows the southbound journey but only to the level crossing stop line akin to measuring the stop line delays. This journey time path is labelled as JT2. The equivalent journey time data used in the Figure 4-2 is shown in Table 4-3. The equivalent changes in journey times for this path when compared to the Reference Case are shown in Table 4-4.
    2. The journey time or delay increases, mirror those shown for the zone to zone (JT4). In particular, the delay increase of 45.1 seconds with 1,250 dwellings, largely matches the full journey time delay of 45.5 seconds in Table 4-2. This indicates that the majority of the journey time increase is incurred at the level crossing.

Table 4-3: Southbound Journey Maximum Journey Time (JT2) to Level Crossing (Z1 to stop line) by Number of Homes

| **From time** | **To time** | **2022 Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 234.7 | 236.1 | 235.6 | 234.2 | 233.7 | 235.3 | 236.2 |
| 08:05 | 08:10 | 67.7 | 67.1 | 68.0 | 71.8 | 72.8 | 79.0 | 83.1 |
| 08:10 | 08:15 | 67.1 | 67.9 | 67.4 | 67.7 | 68.1 | 67.6 | 68.2 |
| 08:15 | 08:20 | 67.5 | 68.0 | 68.2 | 68.4 | 68.7 | 68.7 | 68.3 |
| 08:20 | 08:25 | 277.4 | 283.6 | 285.4 | 288.6 | 286.4 | 289.9 | 289.4 |
| 08:25 | 08:30 | 158.3 | 164.2 | 162.3 | 165.5 | 177.3 | 179.7 | 209.3 |
| 08:30 | 08:35 | 210.2 | 207.4 | 215.7 | 217.2 | 218.2 | 218.6 | 218.2 |
| 08:35 | 08:40 | 67.6 | 67.7 | 68.3 | 68.3 | 67.9 | 68.3 | 68.5 |
| 08:40 | 08:45 | 118.4 | 114.4 | 118.4 | 120.1 | 114.7 | 115.6 | 121.4 |
| 08:45 | 08:50 | 66.8 | 67.8 | 67.5 | 67.9 | 67.2 | 67.8 | 67.5 |
| 08:50 | 08:55 | 245.4 | 256.1 | 258.5 | 258.5 | 256.6 | 262.4 | 264.1 |
| 08:55 | 09:00 | 176.6 | 188.9 | 185.9 | 192.3 | 188.2 | 194.7 | 196.9 |

Table 4-4: Southbound Change in Journey Maximum Journey Time (JT2) v Reference Case to Level Crossing (Z1 to stop line) by Number of Homes (Seconds)

| **From time** | **To time** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 0 | -0.5 | -1.9 | -2.4 | -0.8 | 0.1 |
| 08:05 | 08:10 | 0 | 0.9 | 4.7 | 5.7 | 11.9 | 16 |
| 08:10 | 08:15 | 0 | -0.5 | -0.2 | 0.2 | -0.3 | 0.3 |
| 08:15 | 08:20 | 0 | 0.2 | 0.4 | 0.7 | 0.7 | 0.3 |
| 08:20 | 08:25 | 0 | 1.8 | 5 | 2.8 | 6.3 | 5.8 |
| 08:25 | 08:30 | 0 | -1.9 | 1.3 | 13.1 | 15.5 | 45.1 |
| 08:30 | 08:35 | 0 | 8.3 | 9.8 | 10.8 | 11.2 | 10.8 |
| 08:35 | 08:40 | 0 | 0.6 | 0.6 | 0.2 | 0.6 | 0.8 |
| 08:40 | 08:45 | 0 | 4 | 5.7 | 0.3 | 1.2 | 7 |
| 08:45 | 08:50 | 0 | -0.3 | 0.1 | -0.6 | 0 | -0.3 |
| 08:50 | 08:55 | 0 | 2.4 | 2.4 | 0.5 | 6.3 | 8 |
| 08:55 | 09:00 | 0 | -3 | 3.4 | -0.7 | 5.8 | 8 |

Northbound Journey Times

Figure 4‑3: Variation of Northbound Maximum path Journey Times (seconds) across Level Crossing by Number of Homes

* + 1. Figure 4-5 shows the variation of average maximum journey times in seconds in the northbound direction across the level crossing as measured by Journey Time Path 3 (JT3). This is measured from Zone 2 in the south to Zone 1 in the north.

Table 4 - 5: Northbound Journey Maximum Journey Time (JT3) across Level Crossing (Z2 to Z1) by Number of Homes (Seconds)

| **From time** | **To time** | **2022 Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 265.6 | 265.8 | 270.3 | 266.8 | 266.3 | 270.3 | 272.2 |
| 08:05 | 08:10 | 108.8 | 119.4 | 119.3 | 125.4 | 126.1 | 132.4 | 131.0 |
| 08:10 | 08:15 | 100.4 | 101.8 | 101.9 | 101.5 | 101.5 | 101.5 | 103.4 |
| 08:15 | 08:20 | 101.0 | 102.2 | 101.3 | 100.6 | 102.6 | 102.3 | 102.1 |
| 08:20 | 08:25 | 312.0 | 314.2 | 313.7 | 318.3 | 320.4 | 320.0 | 319.7 |
| 08:25 | 08:30 | 197.9 | 197.9 | 198.4 | 200.2 | 203.8 | 201.6 | 202.6 |
| 08:30 | 08:35 | 242.5 | 242.4 | 253.3 | 244.3 | 251.1 | 245.3 | 250.8 |
| 08:35 | 08:40 | 99.9 | 100.8 | 100.7 | 101.5 | 102.3 | 101.7 | 101.8 |
| 08:40 | 08:45 | 143.8 | 141.0 | 141.2 | 149.7 | 148.7 | 149.3 | 150.5 |
| 08:45 | 08:50 | 100.8 | 101.6 | 100.5 | 101.0 | 102.1 | 102.3 | 102.5 |
| 08:50 | 08:55 | 292.6 | 290.2 | 293.5 | 294.0 | 297.0 | 299.6 | 296.0 |
| 08:55 | 09:00 | 243.7 | 249.2 | 245.0 | 255.2 | 252.5 | 257.4 | 252.1 |

* + 1. The equivalent data used in Figure 4-3 is shown in Table 4-5. Table 4-6 shows the difference in journey time for each scenario when compared to the Reference Case. A positive value implies an increase in journey time over that in the Reference Case, while a negative value implies a decrease.

Table 4-6: Southbound Change in Maximum Journey Time (JT4) v Reference (Seconds)

| **From time** | **To time** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 0 | 4.5 | 1 | 0.5 | 4.5 | 6.4 |
| 08:05 | 08:10 | 0 | -0.1 | 6 | 6.7 | 13 | 11.6 |
| 08:10 | 08:15 | 0 | 0.1 | -0.3 | -0.3 | -0.3 | 1.6 |
| 08:15 | 08:20 | 0 | -0.9 | -1.6 | 0.4 | 0.1 | -0.1 |
| 08:20 | 08:25 | 0 | -0.5 | 4.1 | 6.2 | 5.8 | 5.5 |
| 08:25 | 08:30 | 0 | 0.5 | 2.3 | 5.9 | 3.7 | 4.7 |
| 08:30 | 08:35 | 0 | 10.9 | 1.9 | 8.7 | 2.9 | 8.4 |
| 08:35 | 08:40 | 0 | -0.1 | 0.7 | 1.5 | 0.9 | 1 |
| 08:40 | 08:45 | 0 | 0.2 | 8.7 | 7.7 | 8.3 | 9.5 |
| 08:45 | 08:50 | 0 | -1.1 | -0.6 | 0.5 | 0.7 | 0.9 |
| 08:50 | 08:55 | 0 | 3.3 | 3.8 | 6.8 | 9.4 | 5.8 |
| 08:55 | 09:00 | 0 | -4.2 | 6 | 3.3 | 8.2 | 2.9 |

* + 1. The results indicate modest journey time increases from the Reference Case through the various scenarios of Southbourne dwellings from 250 dwellings to 1,250 dwellings across the analysed 5-minute time intervals. A 30 second increase in delay or travel time over the Reference Case is usually considered a material change.
    2. There is no instance in the northbound scenario in the modelled AM peak, where the with development scenario has a change of 30 seconds or more over the Reference Case. These results are also confirmed in Figure 4-4 and associated Table 4-7 and Table 4 – 8 which pertain to Path JT1 which is coded to the level crossing stop line (northbound) and hence measures delays at the level crossing.

Figure 4‑4: Variation of Northbound Maximum path Journey Times (seconds) at Level Crossing by Number of Homes

Table 4-7: Northbound Journey Maximum Journey Time (JT1) to Level Crossing (Z2 to stop line) by Number of Homes

| **From time** | **To time** | **2022 Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 196.8 | 198.9 | 203.6 | 199.7 | 198.7 | 203.1 | 205.2 |
| 08:05 | 08:10 | 40.5 | 50.4 | 51.2 | 58.2 | 59.1 | 64.6 | 63.8 |
| 08:10 | 08:15 | 32.7 | 33.1 | 33.2 | 32.9 | 32.8 | 33.0 | 33.5 |
| 08:15 | 08:20 | 32.7 | 33.2 | 32.8 | 32.7 | 33.3 | 33.2 | 33.1 |
| 08:20 | 08:25 | 243.6 | 247.6 | 246.3 | 251.6 | 251.4 | 252.7 | 251.0 |
| 08:25 | 08:30 | 131.4 | 129.9 | 132.0 | 133.2 | 135.6 | 133.9 | 137.2 |
| 08:30 | 08:35 | 174.3 | 175.4 | 185.4 | 177.6 | 184.0 | 177.8 | 182.9 |
| 08:35 | 08:40 | 32.2 | 32.8 | 32.6 | 32.9 | 33.0 | 32.9 | 32.9 |
| 08:40 | 08:45 | 76.2 | 72.9 | 74.6 | 82.9 | 81.6 | 81.6 | 82.1 |
| 08:45 | 08:50 | 32.8 | 33.0 | 32.4 | 32.7 | 33.7 | 33.4 | 33.4 |
| 08:50 | 08:55 | 224.4 | 222.9 | 227.0 | 225.4 | 230.0 | 231.7 | 228.9 |
| 08:55 | 09:00 | 176.7 | 182.4 | 176.6 | 187.3 | 185.5 | 189.8 | 185.2 |

Table 4-8: Northbound Change in Maximum Journey Time (JT1) v Reference Case (Seconds)

| **From time** | **To time** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 08:00 | 08:05 | 0 | 4.7 | 1 | -0.2 | 4.2 | 6.3 |
| 08:05 | 08:10 | 0 | 0.8 | 7.8 | 8.7 | 14.2 | 13.4 |
| 08:10 | 08:15 | 0 | 0.1 | -0.2 | -0.3 | -0.1 | 0.4 |
| 08:15 | 08:20 | 0 | -0.4 | -0.5 | 0.1 | 0 | -0.1 |
| 08:20 | 08:25 | 0 | -1.3 | 4 | 3.8 | 5.1 | 3.4 |
| 08:25 | 08:30 | 0 | 2.1 | 3.3 | 5.7 | 4 | 7.3 |
| 08:30 | 08:35 | 0 | 10 | 2.2 | 8.6 | 2.4 | 7.5 |
| 08:35 | 08:40 | 0 | -0.2 | 0.1 | 0.2 | 0.1 | 0.1 |
| 08:40 | 08:45 | 0 | 1.7 | 10 | 8.7 | 8.7 | 9.2 |
| 08:45 | 08:50 | 0 | -0.6 | -0.3 | 0.7 | 0.4 | 0.4 |
| 08:50 | 08:55 | 0 | 4.1 | 2.5 | 7.1 | 8.8 | 6 |
| 08:55 | 09:00 | 0 | -5.8 | 4.9 | 3.1 | 7.4 | 2.8 |

## Queue Length Analysis in metres

Southbound Queue Results

Figure 4-5: Variation of Southbound Maximum Queue lengths (metres) at Level Crossing by Number of Dwellings

* + 1. Figure 4-5 shows the variation of maximum queue lengths in metres in the southbound direction at the level crossing across the modelled scenarios. These were measured at one-minute intervals to capture impacts during barrier closures. For information, the 2022 Base year model queue lengths are also shown. The equivalent queue data used in Figure 4-5 is shown in Table 4-9.
    2. Table 4-10 further adds context to the changes in queue lengths. It shows the changes in queues as a growth factor compared to the queue length in the Reference Case. A factor greater than 1 implies the scenario queues are greater than the Reference Case while a factor less than 1 implies the scenario queues are less than those in the Reference Case and is most evident when the Base is compared to the Reference Case.
    3. Table 4-11 shows the difference in journey time for each scenario when compared to the Reference Case. A positive value implies an increase in queue length over that in the Reference Case, while a negative value implies a decrease, and is most evident when the Base is compared to the Reference Case.

Table 4 -9: Southbound Maximum Queue Lengths (metres) at Level Crossing by Number of Homes

| **From time** | **To time** | **2022 Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:02 | 08:03 | 27.4 | 35.1 | 32.0 | 34.0 | 41.1 | 42.3 | 53.6 |
| 08:03 | 08:04 | 70.5 | 85.6 | 100.0 | 98.6 | 117.8 | 136.1 | 126.5 |
| 08:04 | 08:05 | 102.4 | 139.6 | 158.3 | 166.5 | 194.7 | 218.6 | 210.1 |
| 08:05 | 08:06 | 122.4 | 173.0 | 196.1 | 225.3 | 244.2 | 277.9 | 286.0 |
| 08:23 | 08:24 | 44.4 | 70.9 | 71.1 | 92.4 | 83.4 | 108.1 | 110.3 |
| 08:24 | 08:25 | 87.8 | 131.0 | 142.4 | 165.3 | 158.2 | 201.3 | 207.7 |
| 08:25 | 08:26 | 125.8 | 184.7 | 206.5 | 217.4 | 253.1 | 285.6 | 305.2 |
| 08:26 | 08:27 | 165.0 | 234.0 | 283.8 | 285.1 | 321.2 | 365.2 | 396.9 |
| 08:28 | 08:29 | 20.2 | 44.6 | 44.6 | 50.3 | 72.2 | 87.8 | 123.3 |
| 08:29 | 08:30 | 65.8 | 107.6 | 104.5 | 118.1 | 150.0 | 161.2 | 227.5 |
| 08:30 | 08:31 | 71.8 | 111.8 | 116.8 | 131.9 | 184.5 | 196.5 | 284.3 |
| 08:31 | 08:32 | 4.1 | 9.6 | 16.1 | 18.3 | 19.6 | 19.7 | 25.1 |
| 08:32 | 08:33 | 59.7 | 71.4 | 89.4 | 99.4 | 97.6 | 112.0 | 135.2 |
| 08:33 | 08:34 | 87.5 | 134.1 | 156.0 | 173.4 | 185.5 | 198.3 | 229.1 |
| 08:34 | 08:35 | 103.2 | 173.8 | 208.1 | 222.4 | 234.8 | 269.6 | 306.3 |
| 08:44 | 08:45 | 30.5 | 38.3 | 47.7 | 51.2 | 53.1 | 55.6 | 65.4 |
| 08:45 | 08:46 | 42.0 | 62.4 | 62.9 | 90.6 | 87.0 | 89.6 | 112.7 |
| 08:54 | 08:55 | 3.8 | 15.8 | 9.7 | 11.6 | 11.1 | 15.2 | 18.1 |
| 08:55 | 08:56 | 35.8 | 46.0 | 46.2 | 63.9 | 71.3 | 76.7 | 75.5 |
| 08:56 | 08:57 | 60.1 | 86.3 | 87.2 | 108.1 | 122.7 | 131.1 | 135.0 |
| 08:57 | 08:58 | 83.1 | 119.1 | 122.5 | 150.3 | 170.7 | 177.5 | 195.3 |
| 08:58 | 08:59 | 84.5 | 129.2 | 127.3 | 165.2 | 193.7 | 197.0 | 227.0 |

Table 4-10: Southbound Maximum Queue Lengths growth factors compared to Reference Case

| **From time** | **To time** | **2022**  **Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:02 | 08:03 | 0.8 | 1.0 | 0.9 | 1.0 | 1.2 | 1.2 | 1.5 |
| 08:03 | 08:04 | 0.8 | 1.0 | 1.2 | 1.2 | 1.4 | 1.6 | 1.5 |
| 08:04 | 08:05 | 0.7 | 1.0 | 1.1 | 1.2 | 1.4 | 1.6 | 1.5 |
| 08:05 | 08:06 | 0.7 | 1.0 | 1.1 | 1.3 | 1.4 | 1.6 | 1.7 |
| 08:23 | 08:24 | 0.6 | 1.0 | 1.0 | 1.3 | 1.2 | 1.5 | 1.6 |
| 08:24 | 08:25 | 0.7 | 1.0 | 1.1 | 1.3 | 1.2 | 1.5 | 1.6 |
| 08:25 | 08:26 | 0.7 | 1.0 | 1.1 | 1.2 | 1.4 | 1.5 | 1.7 |
| 08:26 | 08:27 | 0.7 | 1.0 | 1.2 | 1.2 | 1.4 | 1.6 | 1.7 |
| 08:28 | 08:29 | 0.5 | 1.0 | 1.0 | 1.1 | 1.6 | 2.0 | 2.8 |
| 08:29 | 08:30 | 0.6 | 1.0 | 1.0 | 1.1 | 1.4 | 1.5 | 2.1 |
| 08:30 | 08:31 | 0.6 | 1.0 | 1.0 | 1.2 | 1.6 | 1.8 | 2.5 |
| 08:31 | 08:32 | 0.4 | 1.0 | 1.7 | 1.9 | 2.1 | 2.1 | 2.6 |
| 08:32 | 08:33 | 0.8 | 1.0 | 1.3 | 1.4 | 1.4 | 1.6 | 1.9 |
| 08:33 | 08:34 | 0.7 | 1.0 | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 |
| 08:34 | 08:35 | 0.6 | 1.0 | 1.2 | 1.3 | 1.4 | 1.6 | 1.8 |
| 08:44 | 08:45 | 0.8 | 1.0 | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 |
| 08:45 | 08:46 | 0.7 | 1.0 | 1.0 | 1.5 | 1.4 | 1.4 | 1.8 |
| 08:54 | 08:55 | 0.2 | 1.0 | 0.6 | 0.7 | 0.7 | 1.0 | 1.1 |
| 08:55 | 08:56 | 0.8 | 1.0 | 1.0 | 1.4 | 1.6 | 1.7 | 1.6 |
| 08:56 | 08:57 | 0.7 | 1.0 | 1.0 | 1.3 | 1.4 | 1.5 | 1.6 |
| 08:57 | 08:58 | 0.7 | 1.0 | 1.0 | 1.3 | 1.4 | 1.5 | 1.6 |
| 08:58 | 08:59 | 0.7 | 1.0 | 1.0 | 1.3 | 1.5 | 1.5 | 1.8 |

Table 4-11: Southbound change in Maximum Queue Lengths compared to Reference Case (metres)

| **From time** | **To time** | **2022**  **Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:02 | 08:03 | -7.7 | 0.0 | -3.2 | -1.2 | 5.9 | 7.1 | 18.4 |
| 08:03 | 08:04 | -15.1 | 0.0 | 14.4 | 13.0 | 32.2 | 50.5 | 40.9 |
| 08:04 | 08:05 | -37.2 | 0.0 | 18.7 | 26.9 | 55.1 | 79.0 | 70.5 |
| 08:05 | 08:06 | -50.6 | 0.0 | 23.1 | 52.3 | 71.2 | 104.9 | 113.0 |
| 08:23 | 08:24 | -26.5 | 0.0 | 0.1 | 21.5 | 12.5 | 37.2 | 39.4 |
| 08:24 | 08:25 | -43.2 | 0.0 | 11.4 | 34.3 | 27.2 | 70.4 | 76.8 |
| 08:25 | 08:26 | -58.9 | 0.0 | 21.8 | 32.8 | 68.5 | 101.0 | 120.5 |
| 08:26 | 08:27 | -69.0 | 0.0 | 49.9 | 51.2 | 87.2 | 131.2 | 162.9 |
| 08:28 | 08:29 | -24.4 | 0.0 | -0.1 | 5.6 | 27.6 | 43.1 | 78.7 |
| 08:29 | 08:30 | -41.8 | 0.0 | -3.0 | 10.6 | 42.5 | 53.6 | 119.9 |
| 08:30 | 08:31 | -40.0 | 0.0 | 5.0 | 20.0 | 72.6 | 84.7 | 172.5 |
| 08:31 | 08:32 | -5.5 | 0.0 | 6.6 | 8.8 | 10.1 | 10.1 | 15.6 |
| 08:32 | 08:33 | -11.7 | 0.0 | 18.0 | 28.0 | 26.2 | 40.6 | 63.8 |
| 08:33 | 08:34 | -46.6 | 0.0 | 21.9 | 39.3 | 51.4 | 64.1 | 95.0 |
| 08:34 | 08:35 | -70.6 | 0.0 | 34.3 | 48.7 | 61.1 | 95.8 | 132.6 |
| 08:44 | 08:45 | -7.8 | 0.0 | 9.4 | 12.9 | 14.9 | 17.4 | 27.1 |
| 08:45 | 08:46 | -20.4 | 0.0 | 0.5 | 28.2 | 24.5 | 27.1 | 50.3 |
| 08:54 | 08:55 | -12.0 | 0.0 | -6.2 | -4.2 | -4.7 | -0.6 | 2.2 |
| 08:55 | 08:56 | -10.2 | 0.0 | 0.2 | 17.9 | 25.3 | 30.7 | 29.5 |
| 08:56 | 08:57 | -26.2 | 0.0 | 0.9 | 21.8 | 36.4 | 44.7 | 48.7 |
| 08:57 | 08:58 | -36.0 | 0.0 | 3.4 | 31.2 | 51.5 | 58.4 | 76.2 |
| 08:58 | 08:59 | -44.7 | 0.0 | -1.9 | 36.0 | 64.5 | 67.8 | 97.9 |

* The results indicate that the Base Year queue lengths are generally 30% lower than those in the Reference case in the southbound direction with some variations by within the analysed AM peak hour.
* In terms of queue lengths in metres the Base Year queues vary between about 5.5 metres to 70.6 metres shorter than those in the Reference Case.
  + 1. When considering the Reference Case against the development scenarios, the changes from one scenario to another is as follows:
* For 250 and 500 development scenarios, most of the queue lengths are generally higher than those in the Reference Case by a factor of the order of 10% to 20% with increases varying between under 1 metre to 51.2 metres.
* A noticeably jump is seen with 750 dwellings where most of the queue lengths are 40% higher than in the Reference Case, with queues being up to 87.2 metres higher than in the Reference Case.
* By 1,000 and 1,250 dwellings, the queue lengths are higher still with most queue lengths being on average 50% to 70% higher respectively with some evident higher factors in some time slices. Queues are up to 131.2 metres higher with 1,000 dwellings and up to 172.5 metres at 1,250 dwellings.
* In absolute terms, queues are seen to be highest between 08:26 and 08:27 where they increase from 165 metres in the Base, to 234 metres in the Reference Case before jumping to 321.2 metres at 750 dwellings, and higher still at 365.2 metres at 1,000 dwellings and 396.9 metres at 1,250 dwellings.
* For context in relation to the local road network, the results indicate that in the Reference Case, queues may occasionally extend and potentially block egress/access from/to the Stein Road/Cooks Lane junction about 117 metres to the north of the railway line. By 500 and 750 dwellings scenarios, queues may extend past the Stein Road/Manor Road junction approximately 160 metres to the north. Between 750 dwellings and 1,000 dwellings, the queue length may approach or extend past the southern junction of Stein Road and Kelsey Avenue about 250 metres north of the railway line. This could result in a need to consider additional road markings to help vehicles emerge safely from these minor roads onto Stein Road.
* The maximum predicted queue length of 396.2 metres extends between the southern junction of Kelsey Avenue and Stein Road and the northern junction of Kelsey Avenue and Stein Road which is about 427 metres from the level crossing.
* Generally, it is considered that at 750 dwellings the queue lengths are seen to show a jump in increase from the Reference Case, indicating a potential threshold at which impacts increase noticeably.

Northbound Queue Results

Figure 4-6: Variation of Northbound Maximum Queue lengths (metres) at Level Crossing by Number of Dwellings

* + 1. Figure 4-6 shows the variation of maximum queue lengths in metres in the northbound direction at the level crossing across the modelled scenarios. Tables 4-12, 4-13, and 4-14 show the equivalent queue results in the northbound direction in tabular format. The southbound direction is the most critical direction as more trips in the morning peak period are expected to use the level crossing in this direction.
    2. The main concern for northbound queues is whether queues would extend to A259 Main Road/Stein Road junction, approximately 425 metres to the south of the level crossing. The results indicate that across all scenarios none of the queue lengths re predicted to extend to the junction. The maximum queue length predicted for northbound queues is 246.6 metres and occurs for the 1,250 dwelling scenario as expected and is well within the 427 metres to the A259 Main Road/Stein Road junction.

Table 4-12: Northbound Maximum Queue Lengths (metres) at Level Crossing by Number of Homes (metres)

| **From time** | **To time** | **2022**  **Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:02 | 08:03 | 25.5 | 26.1 | 33.4 | 34.2 | 38.3 | 48.1 | 39.0 |
| 08:03 | 08:04 | 70.0 | 81.1 | 87.3 | 96.3 | 92.8 | 121.7 | 110.0 |
| 08:04 | 08:05 | 95.3 | 128.1 | 132.6 | 162.9 | 152.1 | 183.5 | 177.4 |
| 08:05 | 08:06 | 112.0 | 161.4 | 162.3 | 203.3 | 193.3 | 222.3 | 220.4 |
| 08:23 | 08:24 | 38.8 | 43.6 | 49.1 | 59.2 | 65.6 | 65.9 | 60.6 |
| 08:24 | 08:25 | 74.1 | 90.1 | 97.6 | 116.1 | 119.7 | 117.8 | 135.8 |
| 08:25 | 08:26 | 104.5 | 130.8 | 133.8 | 166.9 | 177.8 | 188.9 | 196.0 |
| 08:26 | 08:27 | 133.0 | 171.4 | 172.0 | 231.3 | 235.5 | 241.7 | 246.6 |
| 08:28 | 08:29 | 27.1 | 35.3 | 31.4 | 34.2 | 39.1 | 46.5 | 59.0 |
| 08:29 | 08:30 | 53.8 | 81.2 | 85.8 | 90.0 | 81.2 | 107.6 | 122.1 |
| 08:30 | 08:31 | 57.9 | 90.7 | 97.7 | 100.2 | 90.0 | 115.3 | 140.9 |
| 08:32 | 08:33 | 31.3 | 49.3 | 48.5 | 51.7 | 60.9 | 57.7 | 70.2 |
| 08:33 | 08:34 | 55.1 | 76.4 | 85.1 | 98.6 | 107.3 | 114.7 | 129.6 |
| 08:34 | 08:35 | 64.7 | 87.8 | 102.5 | 117.0 | 134.7 | 145.4 | 156.9 |
| 08:44 | 08:45 | 22.5 | 25.7 | 24.2 | 35.4 | 39.2 | 31.1 | 42.5 |
| 08:45 | 08:46 | 24.0 | 33.1 | 41.0 | 46.6 | 63.4 | 54.8 | 59.7 |
| 08:54 | 08:55 | 9.1 | 9.7 | 9.3 | 13.9 | 11.7 | 14.5 | 23.1 |
| 08:55 | 08:56 | 45.6 | 59.4 | 52.4 | 61.6 | 58.2 | 75.0 | 74.1 |
| 08:56 | 08:57 | 70.8 | 96.3 | 100.6 | 103.3 | 100.9 | 117.2 | 133.0 |
| 08:57 | 08:58 | 99.4 | 133.9 | 140.9 | 144.5 | 144.9 | 172.5 | 187.9 |
| 08:58 | 08:59 | 103.1 | 149.3 | 154.0 | 158.7 | 159.6 | 186.6 | 202.1 |

Table 4-13: Northbound Maximum Queue Lengths growth factors compared to Reference Case

| **From time** | **To time** | **2022**  **Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:02 | 08:03 | 1.0 | 1.0 | 1.3 | 1.3 | 1.5 | 1.8 | 1.5 |
| 08:03 | 08:04 | 0.9 | 1.0 | 1.1 | 1.2 | 1.1 | 1.5 | 1.4 |
| 08:04 | 08:05 | 0.7 | 1.0 | 1.0 | 1.3 | 1.2 | 1.4 | 1.4 |
| 08:05 | 08:06 | 0.7 | 1.0 | 1.0 | 1.3 | 1.2 | 1.4 | 1.4 |
| 08:23 | 08:24 | 0.9 | 1.0 | 1.1 | 1.4 | 1.5 | 1.5 | 1.4 |
| 08:24 | 08:25 | 0.8 | 1.0 | 1.1 | 1.3 | 1.3 | 1.3 | 1.5 |
| 08:25 | 08:26 | 0.8 | 1.0 | 1.0 | 1.3 | 1.4 | 1.4 | 1.5 |
| 08:26 | 08:27 | 0.8 | 1.0 | 1.0 | 1.3 | 1.4 | 1.4 | 1.4 |
| 08:28 | 08:29 | 0.8 | 1.0 | 0.9 | 1.0 | 1.1 | 1.3 | 1.7 |
| 08:29 | 08:30 | 0.7 | 1.0 | 1.1 | 1.1 | 1.0 | 1.3 | 1.5 |
| 08:30 | 08:31 | 0.6 | 1.0 | 1.1 | 1.1 | 1.0 | 1.3 | 1.6 |
| 08:32 | 08:33 | 0.6 | 1.0 | 1.0 | 1.0 | 1.2 | 1.2 | 1.4 |
| 08:33 | 08:34 | 0.7 | 1.0 | 1.1 | 1.3 | 1.4 | 1.5 | 1.7 |
| 08:34 | 08:35 | 0.7 | 1.0 | 1.2 | 1.3 | 1.5 | 1.7 | 1.8 |
| 08:44 | 08:45 | 0.9 | 1.0 | 0.9 | 1.4 | 1.5 | 1.2 | 1.7 |
| 08:45 | 08:46 | 0.7 | 1.0 | 1.2 | 1.4 | 1.9 | 1.7 | 1.8 |
| 08:54 | 08:55 | 0.9 | 1.0 | 1.0 | 1.4 | 1.2 | 1.5 | 2.4 |
| 08:55 | 08:56 | 0.8 | 1.0 | 0.9 | 1.0 | 1.0 | 1.3 | 1.2 |
| 08:56 | 08:57 | 0.7 | 1.0 | 1.0 | 1.1 | 1.0 | 1.2 | 1.4 |
| 08:57 | 08:58 | 0.7 | 1.0 | 1.1 | 1.1 | 1.1 | 1.3 | 1.4 |
| 08:58 | 08:59 | 0.7 | 1.0 | 1.0 | 1.1 | 1.1 | 1.2 | 1.4 |

Table 4-14: Northbound change in Maximum Queue Lengths compared to Reference Case (metres)

| **From time** | **To time** | **2022**  **Base** | **Reference** | **250 Homes** | **500 Homes** | **750 Homes** | **1000 Homes** | **1250 Homes** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 08:02 | 08:03 | -9.6 | 0.0 | 7.3 | 8.1 | 12.2 | 21.9 | 12.9 |
| 08:03 | 08:04 | -15.6 | 0.0 | 6.2 | 15.3 | 11.7 | 40.6 | 28.9 |
| 08:04 | 08:05 | -44.3 | 0.0 | 4.5 | 34.8 | 24.0 | 55.4 | 49.3 |
| 08:05 | 08:06 | -61.0 | 0.0 | 1.0 | 41.9 | 32.0 | 60.9 | 59.0 |
| 08:23 | 08:24 | -32.1 | 0.0 | 5.5 | 15.5 | 21.9 | 22.3 | 17.0 |
| 08:24 | 08:25 | -56.9 | 0.0 | 7.5 | 26.0 | 29.6 | 27.7 | 45.7 |
| 08:25 | 08:26 | -80.2 | 0.0 | 3.0 | 36.1 | 47.0 | 58.1 | 65.2 |
| 08:26 | 08:27 | -101.0 | 0.0 | 0.6 | 59.8 | 64.1 | 70.2 | 75.1 |
| 08:28 | 08:29 | -17.5 | 0.0 | -3.9 | -1.1 | 3.8 | 11.2 | 23.7 |
| 08:29 | 08:30 | -53.8 | 0.0 | 4.6 | 8.8 | 0.0 | 26.4 | 40.8 |
| 08:30 | 08:31 | -53.9 | 0.0 | 6.9 | 9.5 | -0.7 | 24.6 | 50.2 |
| 08:32 | 08:33 | -40.1 | 0.0 | -0.8 | 2.4 | 11.6 | 8.4 | 20.9 |
| 08:33 | 08:34 | -79.0 | 0.0 | 8.7 | 22.2 | 30.9 | 38.3 | 53.2 |
| 08:34 | 08:35 | -109.1 | 0.0 | 14.7 | 29.2 | 46.9 | 57.7 | 69.1 |
| 08:44 | 08:45 | -15.8 | 0.0 | -1.4 | 9.7 | 13.5 | 5.4 | 16.9 |
| 08:45 | 08:46 | -38.4 | 0.0 | 7.9 | 13.4 | 30.3 | 21.7 | 26.6 |
| 08:54 | 08:55 | -6.7 | 0.0 | -0.4 | 4.2 | 1.9 | 4.7 | 13.4 |
| 08:55 | 08:56 | -0.4 | 0.0 | -7.0 | 2.3 | -1.2 | 15.7 | 14.8 |
| 08:56 | 08:57 | -15.5 | 0.0 | 4.4 | 7.1 | 4.7 | 20.9 | 36.8 |
| 08:57 | 08:58 | -19.7 | 0.0 | 7.0 | 10.6 | 11.0 | 38.6 | 54.0 |
| 08:58 | 08:59 | -26.1 | 0.0 | 4.6 | 9.4 | 10.3 | 37.3 | 52.8 |

## Summary

* + 1. This section has summarised the results of a Paramics Discovery micro-simulation model to understand the potential impacts of the proposed Southbourne development on the level crossings. The modelling has benefitted from new data with which to cross check and develop a base Paramics Discovery model. Having created validated model, the model has been used to test levels of proposed development for the Southbourne development ranging between 250 dwellings and 1,250 dwellings. The scenarios have been compared against a Reference Case. The testing has been undertaken for the AM peak focussing on the AM peak hour 08:00 to 09:00.
    2. Both visual and analytical outputs of the micro-simulation modelling were used in the assessment. Path journey times and maximum queue lengths in metres provided were used to inform when a bridge may potentially be required. The analysis considered that the changes in journey times and queue length in the southbound direction were the most critical, given that in the AM peak period most trips would be leaving the development and crossing the level crossings to access the wider network via the A259 Main Road to the south of the railway line.
    3. The results indicate modest journey time increases from the Reference Case through the various scenarios of Southbourne dwellings from 250 dwellings to 1,250 dwellings across the analysed 5-minute time intervals. A 30 second increase in delay or travel time over the Reference Case is usually considered a material change.
    4. In the southbound direction, it was seen that in most cases the changes or increases in journey time are less than 30 seconds. However, for the time slice 08:25 to 8:30, the journey times increases by 45.5 seconds in 1,250 dwellings scenario, which indicates a material change. This suggest that the 30 second threshold increase, is exceeded between 1,000 and 1,250 dwellings.
    5. There is no instance in the northbound scenario in the modelled AM peak, where the with development scenario has a change of 30 seconds or more over the Reference Case.
    6. Maximum queue lengths in metres were also analysed. In the critical southbound direction, for the 250 and 500 development scenarios, most of the queue lengths are generally higher than those in the Reference Case by a factor of the order of 10% to 20% with increases varying between under 1 metre to 51.2 metres.
    7. A noticeably jump is seen with 750 dwellings where most of the queue lengths are 40% higher than in the Reference Case, with queues being up to 87.2 metres higher than in the Reference Case.
    8. By 1,000 and 1,250 dwellings, the queue lengths are higher still with most queue lengths being on average 50% to 70% higher respectively with some evident higher factors in some time slices. Queues are up to 131.2 metres higher with 1,000 dwellings and up to 172.5 metres at 1,250 dwellings.
    9. In absolute terms, queues are seen to be highest between 08:26 and 08:27 where they increase from 165 metres in the Base, to 234 metres in the Reference Case before jumping to 321.2 metres at 750 dwellings, and higher still at 365.2 metres at 1,000 dwellings and 396.9 metres at 1,250 dwellings.
    10. For context in relation to the local road network, the results indicate that in the Reference Case, queues may occasionally extend and potentially block egress/access from/to the Stein Road/Cooks Lane junction about 117 metres to the north of the railway line. By 500 and 750 dwellings scenarios, queues may extend past the Stein Road/Manor Road junction approximately 160 metres to the north. Between 750 dwellings and 1,000 dwellings, the queue length may approach or extend past the southern junction of Stein Road and Kelsey Avenue about 250 metres north of the railway line. This could result in a need to consider additional road markings to help vehicles emerge safely from these minor roads onto Stein Road.
    11. The maximum predicted queue length of 396.2 metres extends between the southern junction of Kelsey Avenue and Stein Road and the northern junction of Kelsey Avenue and Stein Road which is about 427 metres from the level crossing.
    12. The main concern for northbound queues is whether queues would extend to A259 Main Road/Stein Road junction about 427 metres to the south of the level crossing. The results indicate that across all scenarios none of the queue lengths are predicted to extend to the junction. The maximum queue length predicted for northbound queues is 246.6 metres and occurs for the 1,250 dwelling scenario as expected and is well within the 427 metres to the A259 Main Road/Stein Road junction.
    13. In the context of this study, the indicative trigger for a bridge applies to both the Site A NE and Site B NW Southbourne options. The main difference is that in the Site A NE Southbourne option, the phasing indicates that about 152 dwellings are planned south of the railway line. It is considered that these dwellings do not rely on a level crossing, given their location. Therefore, with the Site A NE Southbourne option it may be possible to provide the 152 dwellings plus the limiting 750 dwellings assumed to be north of the railway line (or 902 dwellings for this option).
    14. Subject to monitoring or further analysis at application stage, alternative options to alleviate the impacts of the increased queueing could include improvements that consider additional road markings to help vehicles emerge safely from minor roads onto Stein Lane, including improved pedestrian crossing infrastructure. Furthermore, cycle priority lanes may be desirable to deliver cyclists to the head of queues if space permits.

# Summary and Conclusion

## Overview

* + 1. Stantec have undertaken a baseline review of the railway level crossings at Stein Road and Inlands Road. Transport modelling has also been undertaken to gain an indication when a railway bridge maybe required in light of the Southbourne development proposals.
    2. A Paramics Discovery micro-simulation model has further been used to understand and indicate when a bridge over the railway line may be required when the Southbourne development is built out. The AM period was modelled and analysed as it was considered that this is when most trains crossed the level crossings in the Southbourne area and would best illustrate impacts of the proposed development on the level crossings. Vision documents were reviewed to understand phasing of both the Site A NE Southbourne development option and the Site B NW Southbourne development option. This phasing information has been used to inform development tests undertaken in the micro-simulation as follows:
* 250 dwellings which tests for a scenario below the 500 dwellings generally assumed to be delivered early in the plan period (Phase 1)
* 500 dwellings, the amount indicated by both visions as deliverable early in the plan period (Phase 1)
* 750 dwellings
* 1,000 dwellings
* 1,250 dwellings.
  + 1. Visual and analytical outputs of the micro-simulation modelling were used to assess the model. The analysis considered that the changes in journey times and queue length in the southbound direction was the most critical direction to look at given that in the AM peak period, most trips would be leaving the development and crossing the level crossings to access the wider network via the A259 Main Road to the south of the railway line.

## Journey Time Summary

* + 1. The results indicate modest journey time increases from the Reference Case through the various scenarios of Southbourne dwellings from 250 dwellings to 1,250 dwellings across the analysed 5-minute time intervals. A 30 second increase in delay or travel time over the Reference Case is usually considered a material change.

**Southbound Journey Time Summary**

* In the southbound direction, it was seen that in most cases the changes or increases in journey time are less than 30 seconds.
* However, for the time slice 08:25 to 8:30, the journey times increases by 45.5 seconds in 1,250 dwellings scenario, which indicates a material change. This suggest that the 30 second threshold increase, is exceeded between 1,000 and 1,250 dwellings.

**Northbound Journey Time Summary**

* There is no instance in the northbound scenario in the modelled AM peak, where the with development scenario has a change of 30 seconds or more over the Reference Case.

## Queue Length Summary

* + 1. In terms of queue lengths the following summary is given:

**Southbound Queue Length Summary**

* In the critical southbound direction, for the 250 and 500 development scenarios, most of the queue lengths are generally higher than those in the Reference Case by a factor of the order of 10% to 20% with increases varying between under 1 metre to 51.2 metres.
* A noticeably jump is seen with 750 dwellings where most of the queue lengths are 40% higher than in the Reference Case, with queues being up to 87.2 metres higher than in the Reference Case.
* By 1,000 and 1,250 dwellings, the queue lengths are higher still with most queue lengths being on average 50% to 70% higher respectively with some evident higher factors in some time slices. Queues are up to 131.2 metres higher with 1,000 dwellings and up to 172.5 metres at 1,250 dwellings.
* In absolute terms, queues are seen to be highest between 08:26 and 08:27 where they increase from 165 metres in the Base, to 234 metres in the Reference Case before jumping to 321.2 metres at 750 dwellings, and higher still at 365.2 metres at 1,000 dwellings and 396.9 metres at 1,250 dwellings.
* For context in relation to the local road network, the results indicate that in the Reference Case, queues may occasionally extend and potentially block egress/access from/to the Stein Road/Cooks Lane junction about 117 metres to the north of the railway line.
* By 500 and 750 dwellings scenarios, queues may extend past the Stein Road/Manor Road junction approximately 160 metres to the north.
* Between 750 dwellings and 1,000 dwellings, the queue length may approach or extend past the southern junction of Stein Road and Kelsey Avenue about 250 metres north of the railway line. This could result in a need to consider additional road markings to help vehicles emerge safely from these minor roads onto Stein Road.
* The maximum predicted queue length of 396.2 metres with 1,250 dwellings, extends between the southern junction of Kelsey Avenue and Stein Road and the northern junction of Kelsey Avenue and Stein Road which is about 427 metres from the level crossing.
  + 1. This is similar to the previous modelling reported in November 2020 which indicated that queues increased significantly between the 750 dwelling and 1,000 dwelling scenarios southbound and that a bridge may be required by the 750-home scenario or by the 1,000 dwelling scenario.

**Northbound Queue Length Summary**

* The main concern for northbound queues is whether queues would extend to the A259 Main Road/Stein Road junction about 427 metres to the south of the level crossing.
* The results indicate that across all scenarios none of the queue lengths are predicted to extend to the junction. The maximum queue length predicted for northbound queues is 246.6 metres and occurs for the 1,250 dwelling scenario as expected and is well within the 427 metres to the A259 Main Road/Stein Road junction.

## Overall Summary

* + 1. As per the 2020 microsimulation modelling, the outputs of this study are intended to provide an indicative trigger point for a bridge rather than to prescribe when a bridge is required and must therefore be understood in the context of the limited nature of the modelling exercise to be indicative rather than prescriptive.
    2. In the context of this study, the indicative trigger for a bridge applies to both the Site A NE and Site B NW Southbourne options. The main difference is that in the Site A NE Southbourne option, the phasing indicates that about 152 dwellings are planned south of the railway line. It is considered that these dwellings do not rely on a level crossing, given their location. Therefore, with the Site A NE Southbourne option it may be possible to provide the 152 dwellings plus the limiting 750 dwellings assumed to be north of the railway line (or 902 dwellings for this option).
    3. Providing a new railway bridge would significantly reduce trips on the existing level crossings potentially limiting these crossings to use by local traffic.
    4. Subject to monitoring or further analysis at application stage, alternative options to alleviate the impacts of the increased queueing could include improvements that consider additional road markings to help vehicles emerge safely from minor roads onto Stein Lane, including improved pedestrian crossing infrastructure. Furthermore, cycle priority lanes may be desirable to deliver cyclists to the head of queues if space permits.
    5. In conclusion, the study suggests that for Site A NE Southbourne option, 902 dwellings can be provided before conditions approaching the crossing reach the indicative trigger point for a bridge to be provided (750 dwellings north of the railway line plus the 152 dwellings estimated south of the railway line). Beyond this, a new railway bridge is likely to be of some benefit, if the traffic conditions cannot be otherwise mitigated by altering forecasted demand patterns.
    6. For Site B NW Southbourne option, 750 dwellings, all north of the railway line, can be provided before a new bridge is required. Beyond 750 dwellings, a new railway bridge is likely to be of some benefit if the forecasted traffic conditions cannot otherwise be mitigated.
    7. These conclusions are consistent with those reported in the November 2020 study.

1. Traffic Survey Data

1. Barton Willmore – A Vision for Southbourne.pdf (A Vision for Southbourne Vision Document February 2019) [↑](#footnote-ref-1)
2. West D2654\_R001\_REVI\_Southbourne Vision\_reduced.pdf (Land at Southbourne Vision Document February 2019) [↑](#footnote-ref-2)