Appendix E- Operational Assessment Technical Note

# M11 Junction 7a

## Operational Assessment Technical Note

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# M11 Junction 7a

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# Executive Summary

It is proposed to provide an additional access to Harlow by introducing a new motorway junction on the M11 north of Junction 7, namely Junction 7a.

The proposed scheme includes widening the B183 Gilden Way to three lanes from the B183 Gilden Way / London Road Roundabout to Marsh Lane, to facilitate increased traffic on the B183 corridor due to local districts planned growth and the introduction of Junction 7a.

The planned opening year for the scheme is 2021 and the design year is 2036.

Five junctions were operationally assessed in total, of which three are existing key junctions along the B183 corridor and they are listed below:

- The B183 Gilden Way / Sheering Road / Harlowbury Access Road junction (Churchgate Roundabout) – Site 4
- The B183 Gilden Way / London Road Roundabout – Site 5
- The A414 / B183 First Avenue Roundabout – Site 6

Two new junctions were also assessed:

- A new grade separated dumbbell layout motorway junction; Junction 7a - Site 1
- A new roundabout where the Junction 7a link road meets Sheering Road ; Sheering Road Roundabout - Site 2

The above five junctions were assessed using either LINSIG (signal controlled junctions) or JUNCTIONS (priority junctions) traffic modelling software and all formed part of the road network modelled in VISSIM microsimulation software.

Three more junctions or traffic loading points along the B183 corridor / Gilden Way were included in the VISSIM modelled network. These junctions, one signal controlled and two ‘left-in left-out’ arrangements were requested by Essex County Council to be added to the VISSIM network to reflect potential access points related to the Harlow East Development and Harlowbury Development. No LINSIG or JUNCTIONS assessment was carried out for these three junctions.

To further allow for potential access to the Harlow East Development, Essex County Council requested that a fifth arm be added to the proposed Sheering Road Roundabout (Site 2). There is no design layout for this arm and industry standards and best practice have been assumed. This was modelled in JUNCTIONS and VISSIM.

The five junctions (and the VISSIM network covering the five junctions) were assessed for two scenarios – a Do Nothing scenario (without Junction 7a) and a Do Something scenario (with Junction 7a).

The junction capacity assessments for the Do Something (DS) scenarios were carried out to determine if the existing junctions along the B183 corridor would have sufficient capacity in 2021 and 2036 to facilitate increased traffic (future demand) due to local districts planned growth (housing and/or retail developments), and the introduction of Junction 7a. VISSIM microsimulation assisted in the operational assessment and also demonstrated the spacial interaction between vehicles.

Our junction traffic and microsimulation models suggest that in 2021 and 2036, in the **Do Nothing** scenario:

- At Sites 4 and 5 in 2021 both peak periods traffic should flow through these junctions without any issues. However in 2036 AM peak period, traffic is likely to experience significant delays at these junctions due to congestion at Site 6 that causes a slow moving westbound queue on the B183 Gilden Way, resulting in exit blocking. This situation improves slightly in the PM peak period.
- At Site 6 for both 2021 and 2036 operating years in both peak periods, traffic is likely to experience significant delays with queuing on most of the junction approach arms.

Our junction traffic models suggest that in 2021 and 2036, in the **Do Something** scenario:

- At Site 4 (Churchgate Roundabout) in both 2021 and 2036 operating years in both peak periods, traffic should flow through the junction without any issues.
- At Site 5 in 2021 PM peak period London Road southbound experiences increased delays due to the major eastbound traffic flows. In 2036 both peak periods the junction experience significant delays due to the Harlow East Development signalised T-junction access further east causing exit blocking and grid lock.
- At Site 6 in both operating years, traffic will experience significant delays at this junction, but slightly less compared to the Do Nothing situations. A main contributor to these delays is the Harlow East Development signalised T-junction access further east causing exit blocking and grid lock.

Without any layout amendments at these junctions (i.e. just retaining the existing layouts), the junction capacity assessments suggest that these junctions will not operate satisfactory in the design year 2036 in the Do Northing and Do Something scenarios.

A summary of the recommendations at the existing junctions along the B183 corridor is given below.

| Site | Recommendations<br><br>(for scheme opening year 2021) | Recommendations<br><br>(for scheme design year 2036) |
|---|---|---|
| 4 | Throughabout (hamburger roundbout) layout with traffic signal control | N/A (Throughabout layout with traffic signal control is sufficient for design year 2036) |
| 5 | Widening of the Gilden Way arm to three lanes - two lanes westbound and one lane eastbound | Consider an additional lane for eastbound traffic between London Road and new signalised T-junction at the Harlow East Development (Loading point 4)<br><br>Consider local widening and introduction of traffic signals at the roundabout |
| 6 | N/A (retain existing layout i.e. priority roundabout with segregated left turn slip roads) | Partial signalised roundabout – A414 approaches, retaining the left turn slip roads<br><br>Further widening of the roundabout to provide more storage space for traffic queueing at the internal stop lines on the gyratory<br><br>Consider removing eastbound bus lane on First Avenue |

# 1. Introduction

## 1.1 Background

Harlow is a key town in the West of Essex, close to the boarder of Hertfordshire. North of Harlow are the smaller towns of Bishops Stortford and Sawbridgeworth, to the South is Epping, and Stansted Airport is just 13 miles away.

Harlow has significant plans for growth. It has been recognised as one of 24 Enterprise Zones by the South East Local Enterprise Partnership (SELEP) and there are ambitions to regenerate the town centre. As a result there is focussed effort to create jobs and building new homes in the local area. This predicted growth puts additional strain on the transport network of Harlow, which is now one of the most significant barriers to development – which has already limited the size of recent Enterprise Zone development.

Highways England acknowledges that Junction 7 is already over capacity, with drivers experiencing significant delays and congestion.

Currently Gilden Way is a major access road connecting the town centre with the suburban residential areas to the East of Harlow.

## 1.2 The Proposed Scheme

The proposed scheme includes widening Gilden Way to three lanes from the B183 Gilden Way / London Road Roundabout to Marsh Lane. This Gilden Way improvement works are to facilitate increased traffic on the B183 corridor due to planned housing and/or retail developments in the local area, and the introduction of Junction 7a (J7a).

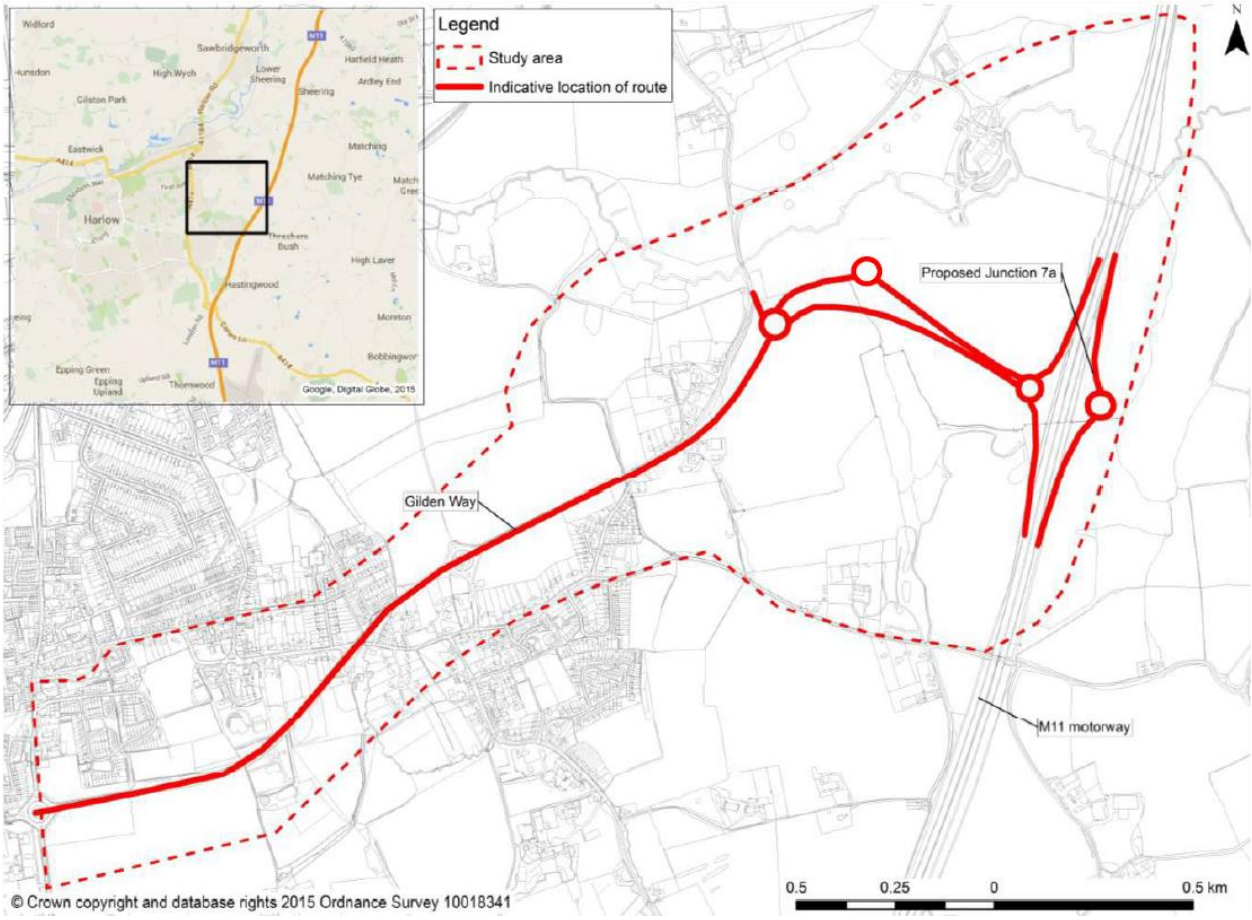
When completed, two of the lanes will take traffic westbound towards Harlow Town and the third lane will take the outbound traffic onto the M11 (via J7a). These enabling works will include changes to existing junctions (roundabouts).

The enabling works to Gilden Way would all be accommodated within the existing highway boundaries or the land of Harlow District Council and would not require the purchasing of land from private properties.

The proposals will also lead to the upgrade of the existing footway along Gilden Way to accommodate both pedestrians and cyclists. The scheme will not close or sever any existing public right of ways along Gilden Way and signalised crossings.

The proposed scheme and study area are shown in the figure below.

**Figure 1.1 : Proposed Scheme and Study Area**




The proposed scheme does not include:

- Junction alterations at the A414 / B183 First Avenue Roundabout – Site 6
- Widening of the B183 First Avenue between the A414 and London Road roundabouts (between Sites 6 and 5)
- A new signal controlled T-junction related to the Harlow East Development, east of the B183 Gilden Way / London Road Roundabout (Site 5)
- A new left-in left-out arrangement related to the Harlow East Development further east of Churchgate Roundabout (Site 4)
- Incorporation of the fifth arm related to the Harlow East Development at the new Sheering Road Roundabout (Site 2)

## 1.3 This Technical Note

This technical note assesses the operational performance of the proposed junctions and links using local and microsimulation traffic models. The assessment was carried out at the affected junctions along the B183 corridor / Gilden Way as well as the new junctions proposed as part of the M11 J7a scheme. The aim was to report any junction capacity and operational issues within the affected road network both in the proposed opening year of the scheme (2021) as well as for 15 years later in 2036 (design year), that would require further investigation in subsequent design stages.

The B183 corridor junctions (referred to as 'sites' in this note) for which junction capacity assessments have been carried out are listed in the table below, with a location plan following that.

**Table 1.1 : Gilden Way and Proposed Scheme Junctions**

| Site No. | Location | Description |
|---|---|---|
| Site 1 | M11 J7a – the proposed new grade separated 'dumbbell' layout motorway junction | Two new dumbbell roundabouts will be constructed on either sides of the M11 and connected by a new bridge over the M11. There will be slip roads on to and off the M11 for both northbound and southbound traffic |
| Site 2 | Sheering Road Roundabout (new junction) | This is a new roundabout which will link Gilden Way to the M11 |
| Site 3 | Campions Access | New Give Way access to the Campions |
| Site 4 | B183 Gilden Way / Sheering Road / Harlowbury Access Road (Churchgate Roundabout) | This is an existing three arm roundabout which will be converted to a four-arm signalised throughabout (hamburger roundabout). The fourth arm will offer access and egress to the new Harlowbury Development |
| Site 5 | B183 Gilden Way / London Road Roundabout | This is an existing four arm roundabout |
| Site 6 | A414 / First Avenue Roundabout | This is an existing four arm roundabout |

**Figure 1.2 : Gilden Way and Proposed Scheme Junction Locations**

It is noted that Site 3 shown in the figure above, is a minor priority junction providing access and egress to a small complex of residential properties. As such, it has been excluded from traffic capacity assessments.

This technical note is an update to the previous technical note (reference B3553F05/REP/47) released at the end of Stage 2. It reports the modelling results related to the latest highway design (capturing design changes that may have occurred since April 2016) and summarises the capacity results following the release of the Variable Demand Model (VDM) traffic flows from the Harlow Strategic Model.

It does not provide a detailed description of the optioneering and sifting process that took place to arrive at the current junction design layouts. Please refer to the Stage 2 report (reference B3553F05/REP/47) for the junction

design development details. Sections 2.2 and 2.3 of that report also describe in detail the modelling scenarios and methods, which are similar for this design stage.

Chapter 2 presents the local junction modelling undertaken in JUNCTIONS and LINSIG software packages.

Chapter 3 presents and discusses the network VISSIM microsimulation modelling of the design layouts, assisting in the operational assessment of the road network. VISSIM models each vehicle individually, including driver behaviour characteristics and illustrates congested networks and queuing traffic more accurately than local modelling (JUNCTIONS and LINSIG).

Following the reporting of the modelling results and assessment in Chapters 2 and 3, Chapter 4 highlights congested sections or junctions within the road network and lists design considerations that would require further investigation in subsequent design stages.

# 2. Local Modelling (JUNCTIONS and LINSIG)

## 2.1 Modelling / Junction Assessment Approach

In this chapter, local junction modelling results are reported. Junction modelling was undertaken using JUNCTIONS (v9) and LINSIG (v3) software packages for roundabouts and signalised junctions respectively.

At the time of modelling, the proposed scheme design was frozen for this design stage (Stage 3); therefore any design alterations that may be required (as highlighted in this technical note), would need further investigation in subsequent design stages. Chapter 4 touches on this subject.

This section includes existing and proposed modelling results for the latest highway design freeze (Stage 3 design). The results are grouped per junction and are reported in the following sequence (refer to Section 2.2 of the Stage 2 report for more detailed descriptions of the scenarios):

- Do Nothing results (reference case) 2021 and 2036
- Do Something (DS) results 2021 and 2036.

In the following sections the information is presented as follows for every junction

- Existing layout modelling results (if applicable):
  - Screenshot of existing layout
  - Do Nothing flows
  - Do Nothing modelling results (approach or lane capacity, delay, queues)
- Proposed layout (Stage 3 scheme design freeze) modelling results:
  - Screenshot of proposed layout (as shown in the Stage 3 design freeze, if applicable)
  - Do Something flows
  - Do Something modelling results (approach or lane capacity, delay, queues)

## 2.2 Site 1 – M11 Junction 7a dumbbell layout motorway junction

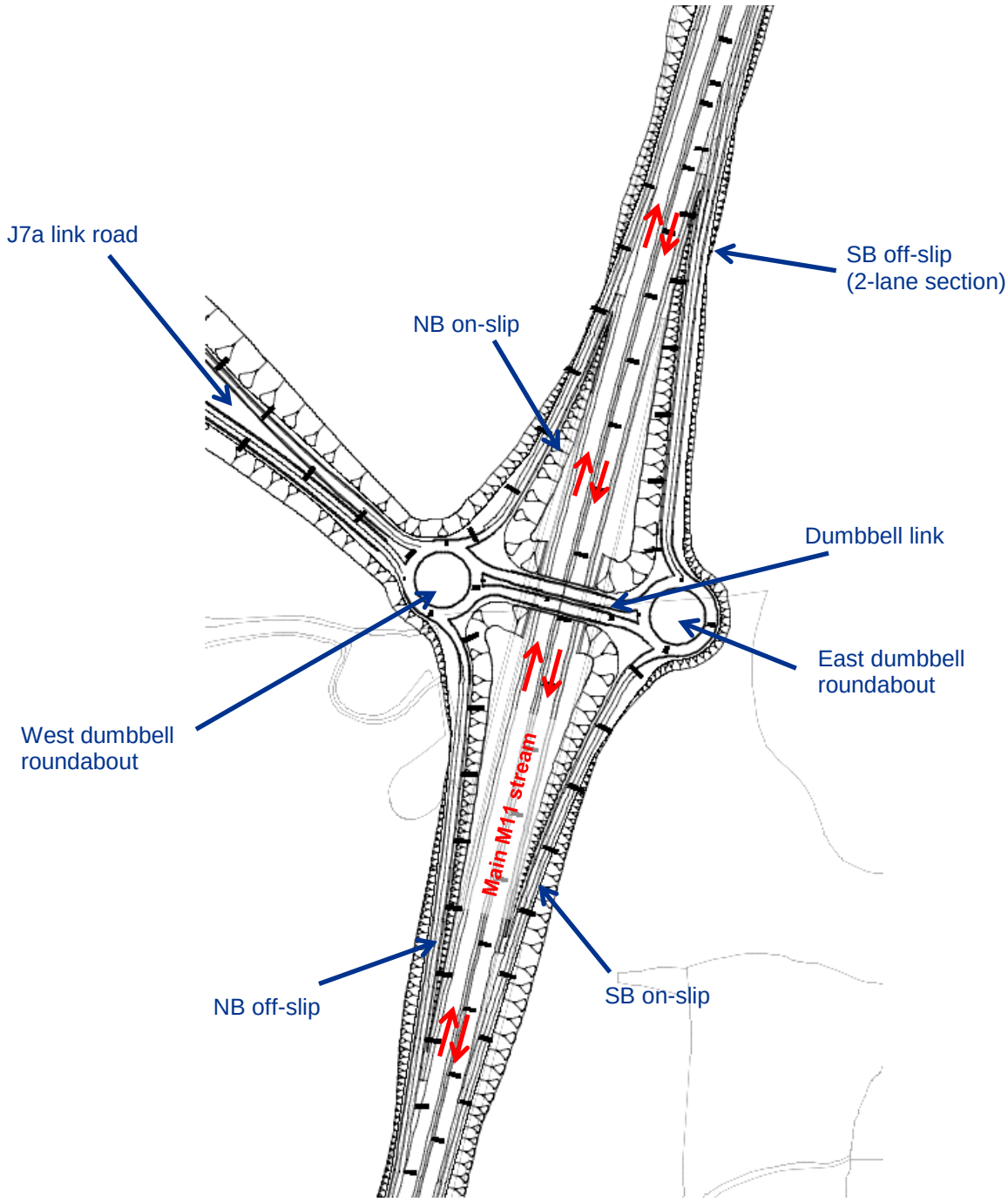
### 2.2.1 Existing layout (Do Nothing) modelling results

There is no existing layout as it is a new junction.

### 2.2.2 Proposed layout (Do Something) modelling results

A screenshot of the proposed highway design that has been tested in Junctions9 is shown below.

**Figure 2.1 : Site 1 Proposed Design**



The (updated) flows that have been coded in the traffic models are summarised in the tables below.

**Table 2.1 : Site 1 West Dumbbell VDM Do Something Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | NB off-slip | Dumbbell link (WB) | NB on-slip | J7a link (EB) | NB off-slip | Dumbbell link (WB) | NB on-slip | J7a link (EB) |
| | West Dumbbell roundabout - Do Something (DS) 2021 | | | | | | | |
| Northbound off-slip | 0 | 0 | 0 | 294 | 0 | 0 | 0 | 370 |
| Dumbbell link (WB) | 0 | 0 | 0 | 1188 | 0 | 0 | 0 | 1071 |
| Northbound on-slip | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| J7a link (EB) | 0 | 183 | 702 | 0 | 0 | 142 | 1021 | 0 |
| | West Dumbbell roundabout - Do Something (DS) 2036 | | | | | | | |
| Northbound on-slip | 0 | 0 | 0 | 554 | 0 | 0 | 0 | 690 |
| Dumbbell link (WB) | 0 | 0 | 0 | 1170 | 0 | 0 | 0 | 1161 |
| Northbound off-slip | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| J7a link (EB) | 0 | 404 | 988 | 0 | 0 | 250 | 1229 | 0 |

**Table 2.2 : Site 1 East Dumbbell VDM Do Somthing Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | PM | | |
|---|---|---|---|---|---|---|
| | SB off-slip | SB on-slip | Dumbbell link (EB) | SB off-slip | SB on-slip | Dumbbell link (EB) |
| | East Dumbbell roundabout - Do Something (DS) 2021 | | | | | |
| Southbound off-slip | 0 | 0 | 1188 | 0 | 0 | 1071 |
| Southbound on-slip | 0 | 0 | 0 | 0 | 0 | 0 |
| Dumbbell link (EB) | 0 | 183 | 0 | 0 | 142 | 0 |
| | East Dumbbell roundabout - Do Something (DS) 2036 | | | | | |
| Southbound off-slip | 0 | 0 | 1170 | 0 | 0 | 1161 |
| Southbound on-slip | 0 | 0 | 0 | 0 | 0 | 0 |
| Dumbbell link (EB) | 0 | 404 | 0 | 0 | 250 | 0 |

Coding the above demand traffic flows in the junction models returned the modelling results as shown in the tables below.

**Table 2.3 : Site 1 Proposed Design (Do Something) Modelling Results - West Dumbbell**

| West Dumbbell Roundabout | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AM | | | | PM | | | |
| | Q (PCU)[1] | Delay (s)[2] | RFC[3] | LOS[4] | Q (PCU) | Delay (s) | RFC | LOS |
| | Site 1 (proposed design) - Do Something (DS) 2021 | | | | | | | |
| M11 NB Off Slip | 0.5 | 4.49 | 0.34 | A | 0.4 | 4.56 | 0.29 | A |
| Link Road | 1.2 | 3.35 | 0.54 | A | 0.7 | 2.63 | 0.41 | A |
| Dumbbell (Bridge) Link | 1.1 | 3.39 | 0.52 | A | 1.4 | 3.95 | 0.58 | A |
| | Site 1 (proposed design) - Do Something (DS) 2036 | | | | | | | |
| M11 NB Off Slip | 1.9 | 9.17 | 0.66 | A | 1.1 | 6.8 | 0.53 | A |
| Link Road | 2.2 | 4.86 | 0.68 | A | 1.8 | 4.32 | 0.64 | A |
| Dumbbell (Bridge) Link | 1.3 | 3.74 | 0.57 | A | 1.4 | 3.92 | 0.57 | A |

**Table 2.4 : Site 1 Proposed Design (Do Something) Modelling Results - East Dumbbell**

| East Dumbbell Roundabout | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | AM | | | | PM | | | |
| | Q (PCU) | Delay (s) | RFC | LOS | Q (PCU) | Delay (s) | RFC | LOS |
| | Site 1 (proposed design) - Do Something (DS) 2021 | | | | | | | |
| M11 SB Off Slip | 1 | 3.04 | 0.5 | A | 1.3 | 3.59 | 0.56 | A |
| Dumbbell (Bridge) Link | 0.1 | 1.78 | 0.07 | A | 0.1 | 1.84 | 0.09 | A |
| | Site 1 (proposed design) - Do Something (DS) 2036 | | | | | | | |
| M11 SB Off Slip | 1.3 | 3.58 | 0.56 | A | 1.5 | 4.26 | 0.59 | A |
| Dumbbell (Bridge) Link | 0.1 | 1.87 | 0.12 | A | 0.3 | 2.07 | 0.2 | A |

The above junction modelling results suggest that both proposed dumbbell roundabouts operate within capacity (maximum RFC is less than 0.70). The modelling results also suggest that the estimated queue lengths can be contained within the available physical stacking space.

[1] **Q**: This is the maximum queue in PCU that represents the longest average queue encountered in any of the time segment results.
[2] **Delay**: This is the average time in seconds that a vehicle must wait on the approach before it can enter the junction.
[3] **RFC**: Rate of Flow to Capacity; also known as V/C ratio (traffic volume to capacity ratio). The RFC provides a basis for judging the acceptability of junction designs and typically an RFC of less than 0.85 is considered to indicate satisfactory performance.
[4] **LOS**: This is the unsignalised Level of Service. The LOS outputs show the unsignalised level of service values for the time segment, based on the Average Delay per Arriving Vehicle. The transportation LOS system uses the letters A through F, with the definitions below being typical:
A = Free flow, B = Reasonably free flow, C = Stable flow, D = Approaching unstable flow, E = Unstable flow, F = Forced or breakdown flow. The LOS in Junctions9 is based purely on the queueing delay, taking into account delay experienced in previous time segments (i.e. the Average Delay per Arriving Vehicle). The LOS results are shown for reference.

### 2.2.3 M11 Links Analysis

The above results show that there is no queuing back onto the M11. The traffic flow table below indicates that there is no change in the number of lanes required except for one section (between J7 and 8).

The increase is not significant and the section would still operate adequately as three lanes, considering the fact that the distance between Junction 7a and 8 is significant to mitigate any potential weaving issues.

**Table 2-5: M11 Links Lane Requirements for Do Nothing and Do Something scenarios**

| PM Peak Hour | | Link Traffic flows | | | | Lanes Required for: | |
|---|---|---|---|---|---|---|---|
| | | 2021 | | 2036 | | 2036 | |
| **Direction** | **M11 Section** | **Do Nothing** | **Do Something** | **Do Nothing** | **Do Something** | **Do Nothing** | **Do Something** |
| M11 Northbound | Jn 6 - Jn 7 | 4,945 | 5,235 | 5,756 | 6,147 | 3.2 | 3.4 |
| | Jn 7 - Jn 7a | 4,268 | 4,081 | 5,124 | 5,258 | 2.8 | 2.9 |
| | Jn 7a - Jn 8 | | 4,741 | | 5,748 | | 3.2 |
| | Jn 8 - Jn 9 | 2,773 | 2,787 | 3,232 | 3,288 | 1.8 | 1.8 |
| M11 Southbound | Jn 9 - Jn 8 | 2,914 | 2,935 | 3,418 | 3,436 | 1.9 | 1.9 |
| | Jn 8 - Jn 7a | 3,220 | 3,791 | 3,812 | 4,356 | 2.1 | 2.4 |
| | Jn 7a - Jn 7 | | 2,847 | | 3,433 | | 1.9 |
| | Jn 7 - Jn 6 | 3,693 | 3,776 | 4,264 | 4,430 | 2.4 | 2.5 |

This table shows the PM peak hour flows only because it is the worst case scenario.

## 2.3 Site 2 – Sheering Road Roundabout

### 2.3.1 Existing layout (Do Nothing) modelling results

There is no existing layout as it is a new junction.

### 2.3.2 Proposed layout (Do Something) modelling results

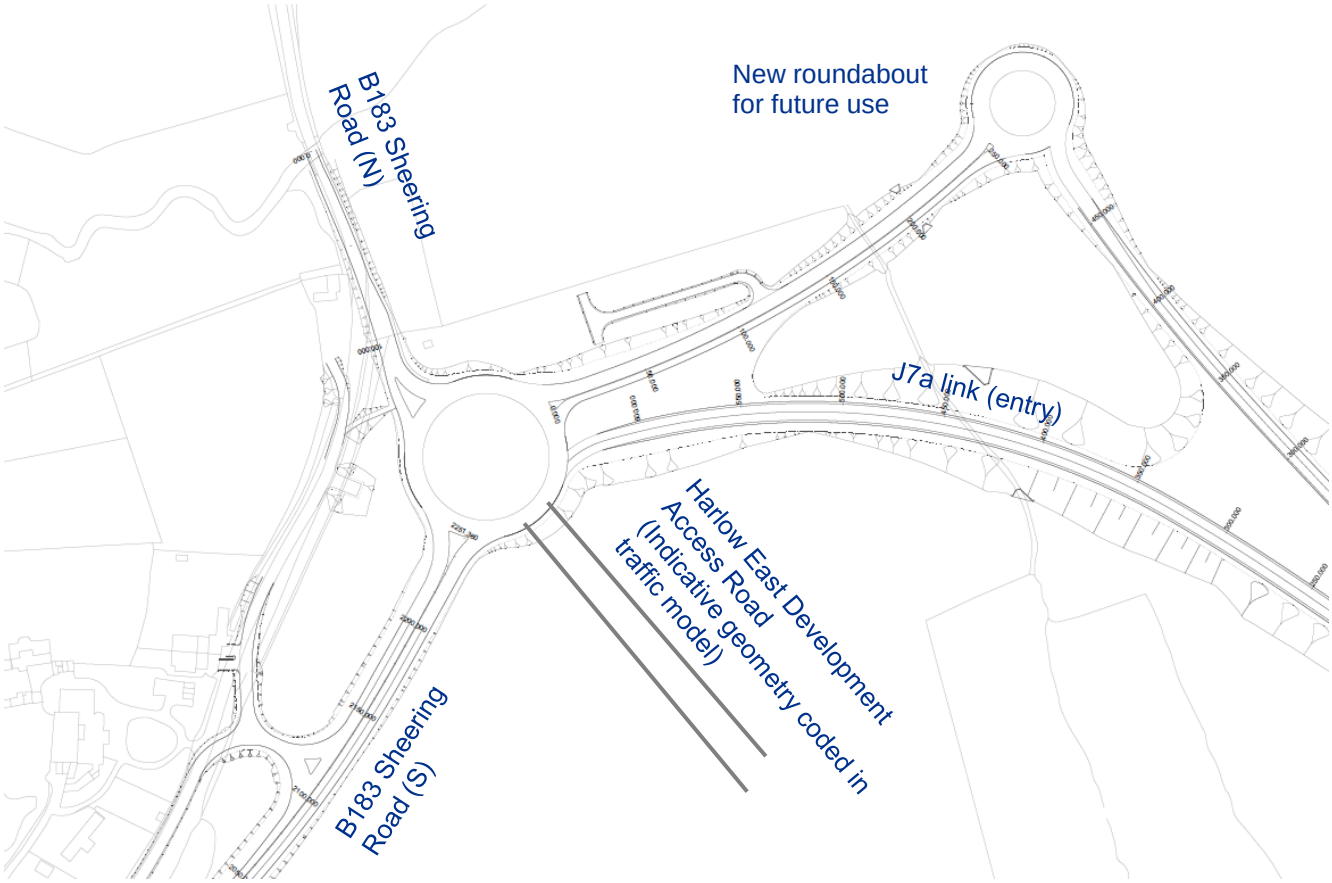
The highway design has been updated since Stage 2 - a screenshot is provided below. The changes are concentrated on the following areas:

- The J7a link entry and exit alignments have moved to the south
- A smaller roundabout was introduced to the northeast, for future use
- The Harlow East Development Access Road was removed from the scope of the scheme design

At this stage as there is no traffic flows reported from the Harlow Strategic Model from the proposed smaller roundabout to the northeast, the J7a link exit was modelled as one-way eastbound only.

Although the Harlow East Development Access Road design was removed from the scope of the scheme design for this stage (Stage 3), Essex County Council requested that the access road is included in the modelling. The design parameters included in the modelling are identical to those coded in Stage 2 and are based on first principles, industry standards and best practice.

**Figure 2.2 : Site 2 Proposed Design**




The (updated) flows that have been coded in the traffic models are summarised in the table below.

**Table 2.6 : Site 2 Sheering Road Roundabout Do Something Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 - Sheering Rd (N) | 3 - J7a Link | 4 - Harlow East Access | 5 - Sheering Rd (S) | 1 - Sheering Rd (N) | 3 - J7a Link | 4 - Harlow East Access | 5 - Sheering Rd (S) |
| | Sheering Road North-J7a Link-Harlow East Access - Do Something (DS) 2021 | | | | | | | |
| **1 - Sheering Rd (N)** | 0 | 197 | 11 | 486 | 0 | 172 | 8 | 287 |
| **3 - J7a Link** | 240 | 0 | 23 | 1220 | 303 | 0 | 28 | 1111 |
| **4 - Harlow East Access** | 7 | 19 | 0 | 55 | 10 | 21 | 0 | 18 |
| **5 - Sheering Rd (S)** | 300 | 669 | 16 | 0 | 404 | 970 | 41 | 0 |
| | Sheering Road North-J7a Link-Harlow East Access - Do Something (DS) 2036 | | | | | | | |
| **1 - Sheering Rd (N)** | 0 | 423 | 20 | 558 | 0 | 259 | 16 | 298 |
| **3 - J7a Link** | 332 | 0 | 51 | 1342 | 420 | 0 | 75 | 1357 |
| **4 - Harlow East Access** | 12 | 69 | 0 | 123 | 20 | 47 | 0 | 39 |
| **5 - Sheering Rd (S)** | 325 | 901 | 34 | 0 | 356 | 1173 | 77 | 0 |

Coding the above demand traffic flows in the junction models returned the modelling results as show in the table below.

**Table 2.7 : Site 2 Proposed Design (Do Something) Modelling Results**

| Junction Performance Results | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | Q (PCU) | Delay (s) | RFC | LOS | Q (PCU) | Delay (s) | RFC | LOS |
| | Sheering Road North-J7a Link- Harlow East Access - Do Something (DS) 2021 | | | | | | | |
| 1 - Sheering Rd (N) | 1.1 | 5.23 | 0.52 | A | 0.7 | 4.66 | 0.4 | A |
| 3 - J7a link (entry) | 3.3 | 7.48 | 0.77 | A | 2.4 | 5.57 | 0.71 | A |
| 4 - Harlow East Access | 0.2 | 10.02 | 0.2 | B | 0.1 | 7.03 | 0.09 | A |
| 5 - Sheering Rd (S) | 1 | 3.35 | 0.5 | A | 2.7 | 6.33 | 0.73 | A |
| | Sheering Road North-J7a Link- Harlow East Access - Do Something (DS) 2036 | | | | | | | |
| 1 - Sheering Rd (N) | 5.2 | 17.62 | 0.84 | C | 1.2 | 6.94 | 0.55 | A |
| 3 - J7a link (entry) | 10.3 | 20.69 | 0.92 | C | 10.7 | 20.12 | 0.92 | C |
| 4 - Harlow East Access | 2.2 | 37.85 | 0.71 | E | 0.4 | 13.08 | 0.3 | B |
| 5 - Sheering Rd (S) | 2 | 5.23 | 0.66 | A | 6.2 | 13.09 | 0.86 | B |

The results are generally acceptable in the Do Something (DS) 2021 scenario with the worst RFC being 0.77 on the J7a link; the junction therefore operates within capacity in the scheme opening year.

In the Do Something (DS) 2036 scenario, the RFC of the J7a link marginally exceeds the theoretical 0.90 RFC threshold, indicating that the junction is near capacity with reduced but acceptable resilience in the scheme design year.

## 2.4 Site 4 – B183 Gilden Way / Sheering Road / Harlowbury Access Road (Churchgate Roundabout)

### 2.4.1 Existing layout (Do Nothing) modelling results

The existing layout is shown below with the modelling results from the Do Nothing modelling following that.

**Figure 2.3 : Site 4 Existing Layout**

The Do Nothing (Future Base) traffic flows are summarised in the table below:

**Table 2.8 : Site 4 Churchgate Roundabout Future Base Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 - Gilden Way (E) | 2 - Sheering Road | 3 - Gilden Way (W) | 4 - Harlowbury Access | 1 - Gilden Way (E) | 2 - Sheering Road | 3 - Gilden Way (W) | 4 - Harlowbury Access |
| | **Churchgate Roundabout – Do Nothing 2021** | | | | | | | |
| **1 - Gilden Way (E)** | 0 | 29 | 1038 | 26 | 0 | 31 | 660 | 16 |
| **2 - Sheering Road** | 45 | 0 | 208 | 6 | 53 | 0 | 116 | 7 |
| **3 - Gilden Way (W)** | 549 | 160 | 0 | 72 | 838 | 167 | 0 | 85 |
| **4 - Harlowbury Access** | 16 | 4 | 96 | 0 | 27 | 3 | 62 | 0 |
| | **Churchgate Roundabout – Do Nothing 2036** | | | | | | | |
| **1 - Gilden Way (E)** | 0 | 105 | 1397 | 81 | 0 | 57 | 715 | 52 |
| **2 - Sheering Road** | 102 | 0 | 308 | 26 | 83 | 0 | 164 | 32 |
| **3 - Gilden Way (W)** | 701 | 154 | 0 | 217 | 1059 | 175 | 0 | 272 |
| **4 - Harlowbury Access** | 54 | 46 | 309 | 0 | 83 | 13 | 204 | 0 |

The above geometric layout and flows were coded in the traffic model and the results are presented in the table below:

**Table 2.9 : Site 4 Future Base Modelling Results**

| | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | Q (PCU) | Delay (s) | RFC | LOS | Q (PCU) | Delay (s) | RFC | LOS |
| | **Churchgate Roundabout (existing) – Do Nothing 2021 (without J7a)** | | | | | | | |
| **1 - Gilden Way (E)** | 1.5 | 4.49 | 0.59 | A | 0.6 | 2.87 | 0.38 | A |
| **2 - Sheering Road** | 0.4 | 4.5 | 0.26 | A | 0.2 | 3.2 | 0.15 | A |
| **3 - Gilden Way (W)** | 0.7 | 3.11 | 0.42 | A | 1.4 | 4.3 | 0.59 | A |
| **4 - Harlowbury Access** | 0.1 | 3.42 | 0.11 | A | 0.1 | 4.02 | 0.1 | A |
| | **Churchgate Roundabout (existing) – Do Nothing 2036 (without J7a)** | | | | | | | |
| **1 - Gilden Way (E)** | 12.1 | 26.68 | 0.94 | D | 0.9 | 3.52 | 0.47 | A |
| **2 - Sheering Road** | 1.8 | 14.14 | 0.65 | B | 0.3 | 4.06 | 0.26 | A |
| **3 - Gilden Way (W)** | 1.5 | 4.7 | 0.6 | A | 4.9 | 10.88 | 0.83 | B |
| **4 - Harlowbury Access** | 0.7 | 5.78 | 0.42 | A | 0.6 | 6.74 | 0.38 | A |

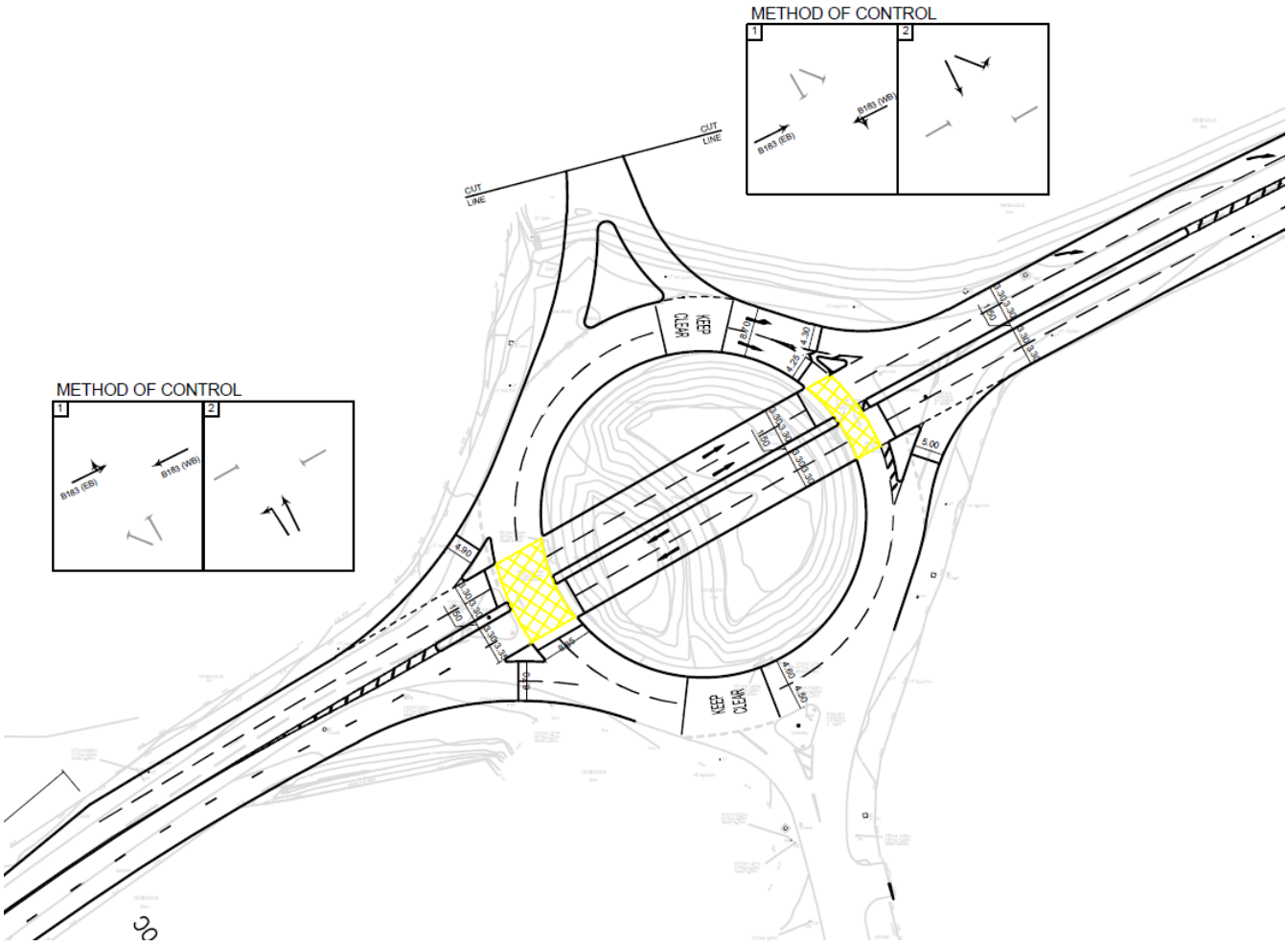
The modelling results predict that in the Do Nothing 2036 scenario (without the scheme), the eastern arm of the roundabout would exceed the theoretical 0.90 RFC threshold, operating near to capacity with reduced but acceptable resilience.

### 2.4.2 Proposed layout (Do Something) modelling results

The proposed junction layout and design rationale is described in detail in Section 3.2 of the Stage 2 report. During Stage 3 however it was agreed that the proposed layout would be implemented as part of the proposed J7a scheme in 2021, rather than within five to seven years of the opening year (2021) of J7a as reported in Stage 2.

The proposed design for Churchgate Roundabout is shown below:

**Figure 2.4 : Site 4 Proposed Design**



The (updated) flows that have been coded in the traffic models are summarised in the table below.

**Table 2.10 : Site 4 Churchgate Roundabout Do Something Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 - Gilden Way (E) | 2 - Sheering Road | 3 - Gilden Way (W) | 4 - Harlowbury Access | 1 - Gilden Way (E) | 2 - Sheering Road | 3 - Gilden Way (W) | 4 - Harlowbury Access |
| | **Churchgate Roundabout – Do Something (DS) 2021** | | | | | | | |
| **1 - Gilden Way (E)** | 0 | 51 | 1638 | 95 | 0 | 45 | 1289 | 67 |
| **2 - Sheering Road** | 23 | 0 | 112 | 7 | 28 | 0 | 66 | 11 |
| **3 - Gilden Way (W)** | 893 | 85 | 7 | 121 | 1339 | 84 | 7 | 160 |
| **4 - Harlowbury Access** | 62 | 8 | 160 | 0 | 70 | 4 | 107 | 0 |
| | **Churchgate Roundabout – Do Something (DS) 2036** | | | | | | | |
| **1 - Gilden Way (E)** | 0 | 59 | 2008 | 139 | 0 | 66 | 1488 | 112 |
| **2 - Sheering Road** | 48 | 0 | 153 | 14 | 34 | 0 | 107 | 27 |
| **3 - Gilden Way (W)** | 1087 | 112 | 13 | 188 | 1517 | 98 | 10 | 224 |
| **4 - Harlowbury Access** | 117 | 40 | 177 | 0 | 116 | 13 | 170 | 0 |

Coding the above demand traffic flows in the junction models returned the modelling results as show in Table 2.11 below.

The results should be read by referring to the diagram in Figure 2.5, which shows the “Item” number from the table as links in the diagram.

**Figure 2.5 : Site 4 Proposed Model Layout**

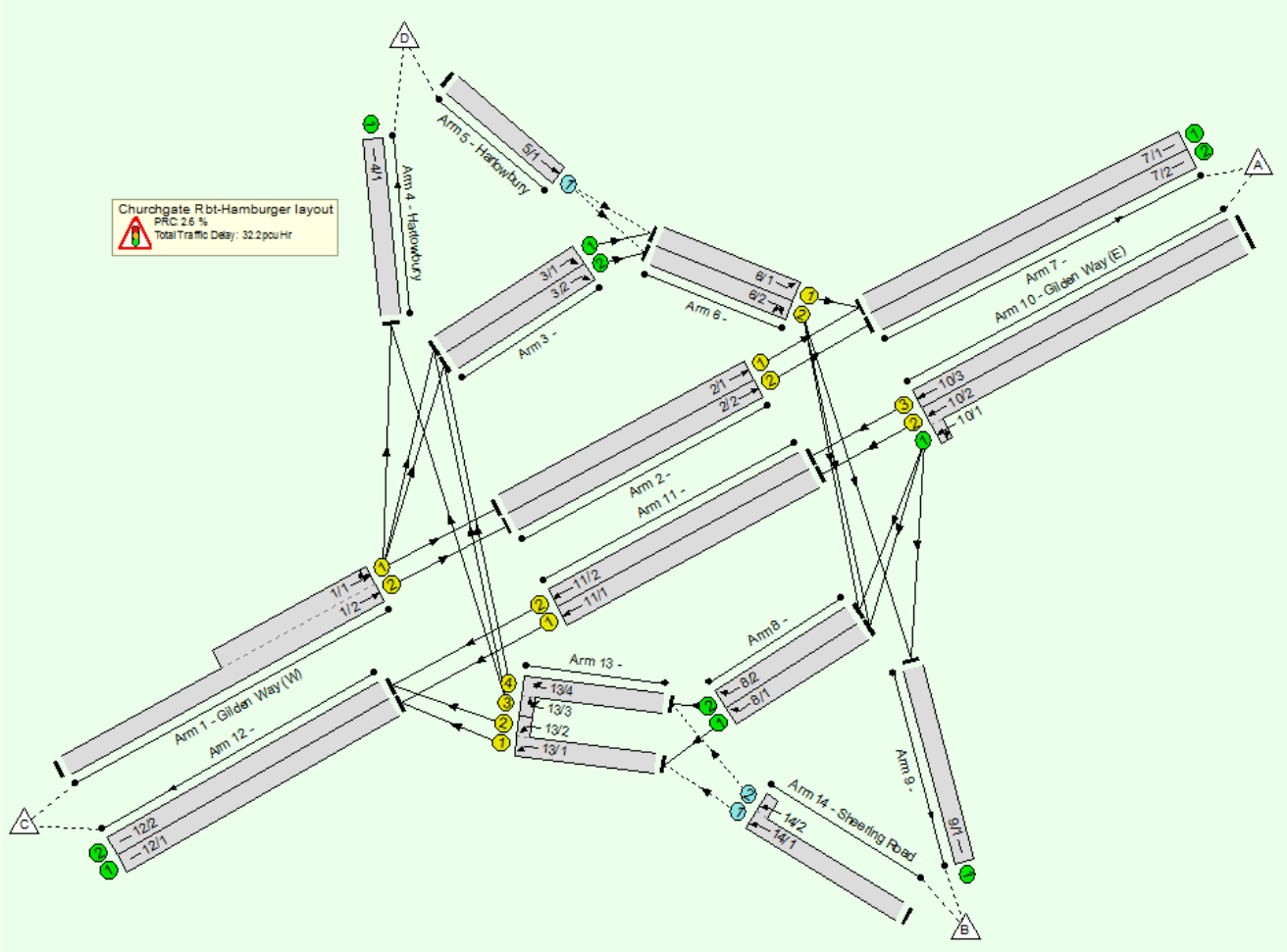



**Table 2.11 : Site 4 Proposed Design (Do Something) Modelling Results**

| Site 4 – Hamburger layout | | Do Something DS 2021 AM peak | | | Do Something DS 2036 AM peak | | | Do Something DS 2021 PM peak | | | Do Something DS 2036 PM peak | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Item** | **Lane Description** | **Deg Sat (%)** | **Av. Delay Per PCU (s/pcu)** | **Mean Max Queue (pcu)** | **Deg Sat (%)** | **Av. Delay Per PCU (s/pcu)** | **Mean Max Queue (pcu)** | **Deg Sat (%)** | **Av. Delay Per PCU (s/pcu)** | **Mean Max Queue (pcu)** | **Deg Sat (%)** | **Av. Delay Per PCU (s/pcu)** | **Mean Max Queue (pcu)** |
| 1/2+1/1 | Gilden Way (W) Ahead & Left | 54.9 : 54.9% | 8.1 | 5.5 | 74.8 : 74.8% | 12.5 | 9.6 | 80.2 : 80.2% | 9.6 | 10.2 | 87.7 : 87.7% | 13.2 | 13.4 |
| 2/1 | Ahead | 27.5% | 3.5 | 0.7 | 37.0% | 2.3 | 0.3 | 45.7% | 2.8 | 0.6 | 43.6% | 2.8 | 1.1 |
| 2/2 | Ahead | 39.5% | 4.0 | 2.0 | 50.1% | 3.0 | 5.0 | 55.9% | 3.4 | 4.6 | 60.0% | 4.6 | 8.0 |
| 3/1 | Circulatory | 1.2% | 0.9 | 0.0 | 15.7% | 1.1 | 0.1 | 5.3% | 1.0 | 0.0 | 10.7% | 1.0 | 0.1 |
| 3/2 | Circulatory | 4.3% | 1.0 | 0.0 | 8.6% | 1.0 | 0.0 | 6.8% | 1.0 | 0.0 | 10.5% | 1.0 | 0.1 |
| 4/1 | To Harlowbury | 10.3% | 0.9 | 0.1 | 10.7% | 1.0 | 0.1 | 9.0% | 0.9 | 0.0 | 13.5% | 1.0 | 0.1 |
| 5/1 | Harlowbury Ahead | 23.7% | 2.4 | 0.2 | 34.7% | 3.2 | 0.3 | 18.9% | 2.4 | 0.1 | 24.1% | 2.7 | 0.2 |
| 6/1 | Left | 20.2% | 22.4 | 1.1 | 95.1% | 65.8 | 12.1 | 50.3% | 23.0 | 1.8 | 71.1% | 24.0 | 2.9 |
| 6/2 | Right | 58.7% | 31.7 | 4.6 | 85.9% | 53.0 | 8.7 | 63.9% | 38.7 | 4.6 | 76.0% | 43.0 | 6.8 |

| Site 4 – Hamburger layout | | Do Something DS 2021 AM peak | | | Do Something DS 2036 AM peak | | | Do Something DS 2021 PM peak | | | Do Something DS 2036 PM peak | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Lane Description | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
| 7/2 | Gilden Way EB | 23.8% | 1.1 | 0.2 | 30.2% | 1.2 | 0.2 | 35.4% | 1.3 | 0.3 | 36.2% | 1.3 | 0.3 |
| 8/1 | Circulatory | 8.1% | 1.0 | 0.0 | 8.8% | 1.0 | 0.0 | 4.7% | 1.0 | 0.0 | 5.6% | 1.0 | 0.0 |
| 8/2 | Circulatory | 4.9% | 1.0 | 0.0 | 6.0% | 1.0 | 0.0 | 2.9% | 0.9 | 0.0 | 4.0% | 1.0 | 0.0 |
| 9/1 | To Sheering Rd | 6.7% | 0.9 | 0.0 | 15.7% | 1.0 | 0.1 | 10.1% | 0.9 | 0.1 | 20.9% | 1.1 | 0.1 |
| 10/2+ 10/1 | Gilden Way (E) Ahead & Left | 74.3 : 74.3% | 13.5 | 12.0 | 88.4 : 88.4% | 21.1 | 18.4 | 56.2 : 56.2% | 8.5 | 6.8 | 77.5 : 77.5% | 13.9 | 12.8 |
| 10/3 | Gilden Way (E) Ahead | 68.5% | 12.0 | 10.6 | 71.6% | 12.8 | 11.8 | 50.3% | 8.1 | 6.4 | 60.7% | 10.6 | 8.6 |
| 11/1 | Ahead | 61.2% | 4.8 | 1.4 | 72.5% | 10.2 | 4.1 | 42.9% | 4.1 | 1.5 | 48.7% | 4.8 | 1.9 |
| 11/2 | Ahead | 71.7% | 6.5 | 10.0 | 81.4% | 12.7 | 11.9 | 50.2% | 4.6 | 4.9 | 58.9% | 5.7 | 7.3 |
| 12/1 | Gilden Way WB | 41.9% | 1.6 | 0.4 | 53.0% | 2.0 | 0.6 | 35.1% | 1.4 | 0.3 | 41.4% | 1.6 | 0.4 |
| 12/2 | Gilden Way WB | 47.4% | 1.6 | 0.4 | 54.2% | 1.9 | 0.6 | 37.4% | 1.4 | 0.3 | 44.9% | 1.6 | 0.4 |
| 13/1+1 3/2 | Ahead | 34.8 : 34.8% | 41.6 | 2.1 | 69.5 : 69.5% | 35.6 | 6.6 | 52.2 : 52.2% | 40.3 | 2.6 | 76.9 : 76.9% | 46.6 | 5.6 |
| 13/4+1 3/3 | Right | 0.0 : 25.9% | 19.4 | 1.8 | 0.0 : 80.5% | 34.1 | 8.8 | 0.0 : 51.2% | 32.9 | 3.0 | 0.0 : 84.6% | 52.1 | 7.4 |
| 14/1+1 4/2 | Sheering Road | 2.5 : 2.5% | 1.7 | 0.0 | 36.5 : 36.5% | 1.8 | 0.3 | 11.5 : 11.5% | 1.1 | 0.1 | 23.9 : 23.9% | 1.3 | 0.2 |

The results above show Degrees of Saturation below 90% for all Gilden Way approaches across all Do Something scenarios. Queue lengths in the internal ahead links (arms 2 and 11) can be contained within the available storage (approximately 9 PCUs per lane or 18 PCUs per direction).

Although the left turn link from the Harlowbury Access Road towards Gilden Way eastbound is predicted to operate at a Degree of Saturation of 95%, it is not a critical link and traffic would need to wait behind the access road give way line. In order to prevent any potential blocking issues, it is proposed that 'Keep Clear' markings and yellow box markings are implemented on the circulatory carriageway as indicated on the proposed layout (refer to Figure 2.4).

## 2.5 Site 5 – B183 Gilden Way / London Road Roundabout

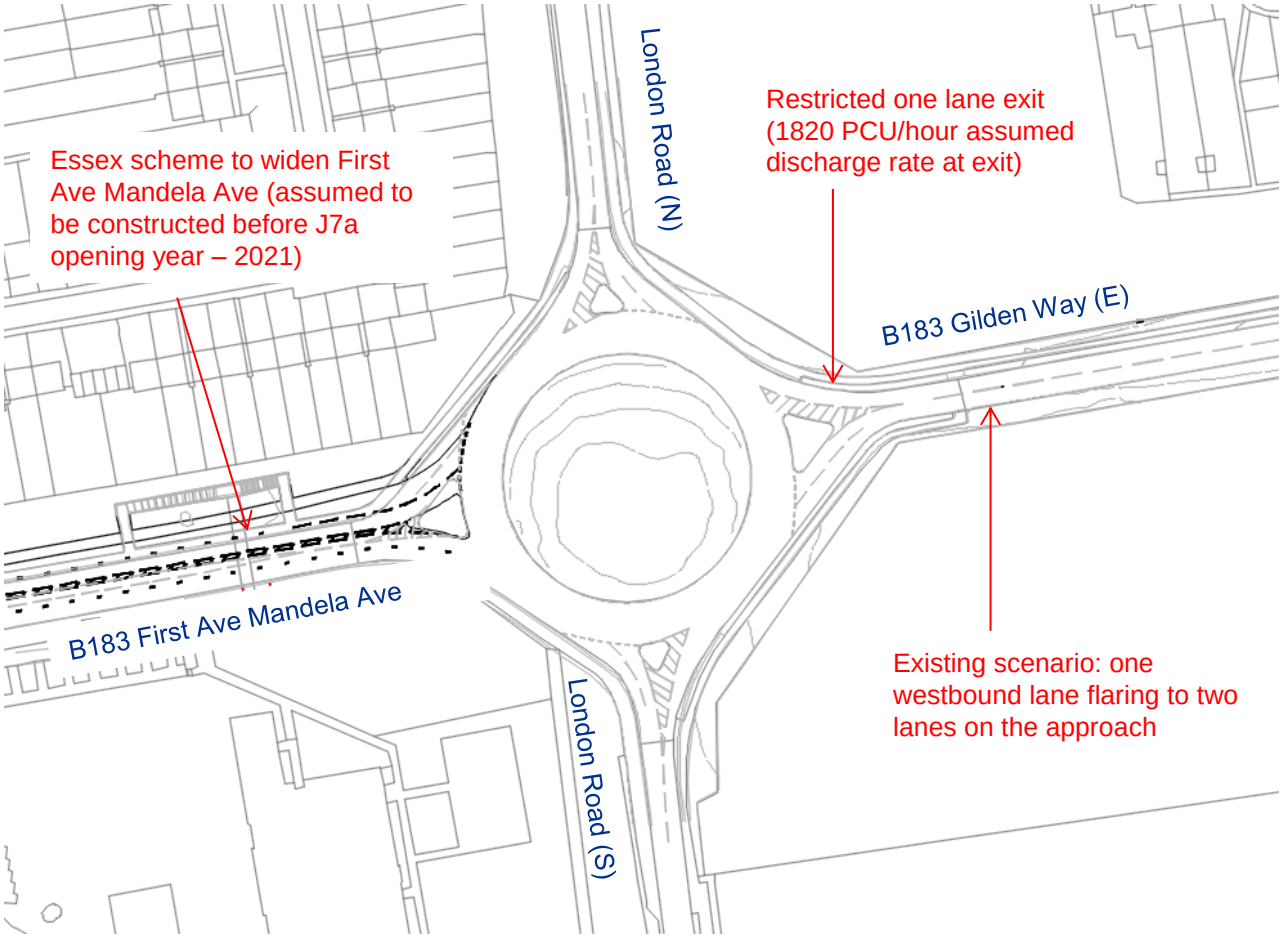
### 2.5.1 Existing layout (Do Nothing) modelling results

The London Road Roundabout is where the proposed scheme along the B183 corridor / Gilden Way ties in to the existing infrastructure. The western arm (B183 First Avenue Mandela Avenue) is also subject to change from the current layout as part of a separate scheme managed by Essex County Council.

We were informed that this is a committed scheme that will be implemented before the proposed J7a scheme opening year (2021) and therefore it was considered in both the Do Nothing and Do Something scenarios.

The modelled layout is shown below with the modelling results from the Do Nothing modelling following that.

**Figure 2.6 : Site 5 Existing / Modelled Layout**




Both the Do Nothing models for 2021 and 2036 were updated with the flows below.

**Table 2.12 : Site 5 London Road Roundabout Future Base Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 – London Rd (N) | 2 – Gilden Way (E) | 3 – London Rd (S) | 4 – First Avenue (W) | 1 – London Rd (N) | 2 – Gilden Way (E) | 3 – London Rd (S) | 4 – First Avenue (W) |
| | **London Road Roundabout – Do Nothing 2021** | | | | | | | |
| 1 – London Rd (N) | 0 | 7 | 2 | 250 | 0 | 6 | 2 | 187 |
| 2 – Gilden Way (E) | 21 | 0 | 53 | 1123 | 9 | 0 | 23 | 710 |
| 3 – London Rd (S) | 4 | 36 | 0 | 137 | 2 | 34 | 0 | 122 |
| 4 – First Avenue (W) | 249 | 655 | 125 | 0 | 258 | 933 | 131 | 0 |
| | **London Road Roundabout – Do Nothing 2036** | | | | | | | |
| 1 – London Rd (N) | 0 | 7 | 2 | 264 | 0 | 7 | 2 | 193 |
| 2 – Gilden Way (E) | 245 | 37 | 59 | 1673 | 65 | 1 | 33 | 984 |
| 3 – London Rd (S) | 21 | 41 | 0 | 129 | 2 | 30 | 0 | 144 |
| 4 – First Avenue (W) | 227 | 942 | 138 | 47 | 239 | 1374 | 131 | 22 |

The modelling results are presented below.

**Table 2.13 : Site 5 Future Base Modelling Results**

| | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | Q (PCU) | Delay (s) | RFC | LOS | Q (PCU) | Delay (s) | RFC | LOS |
| | **London Road Roundabout (existing layout) – Do Nothing 2021** | | | | | | | |
| 1 – London Rd (N) | 0.4 | 5.08 | 0.28 | A | 0.3 | 5.6 | 0.25 | A |
| 2 – Gilden Way (E) | 4.8 | 13.49 | 0.83 | B | 1 | 4.51 | 0.5 | A |
| 3 – London Rd (S) | 0.3 | 5.91 | 0.24 | A | 0.2 | 4.08 | 0.16 | A |
| 4 – First Avenue (W) | 0.8 | 2.49 | 0.43 | A | 1.3 | 3.12 | 0.55 | A |
| | **London Road Roundabout (existing layout) – Do Nothing 2036** | | | | | | | |
| 1 – London Rd (N) | 0.6 | 7.06 | 0.37 | A | 0.5 | 8.91 | 0.35 | A |
| 2 – Gilden Way (E) | 455.5 | 978.88 | 1.43 | F | 2.9 | 8.76 | 0.74 | A |
| 3 – London Rd (S) | 0.5 | 7.97 | 0.31 | A | 0.3 | 5.26 | 0.22 | A |
| 4 – First Avenue (W) | 1.6 | 3.77 | 0.6 | A | 3 | 5.68 | 0.75 | A |

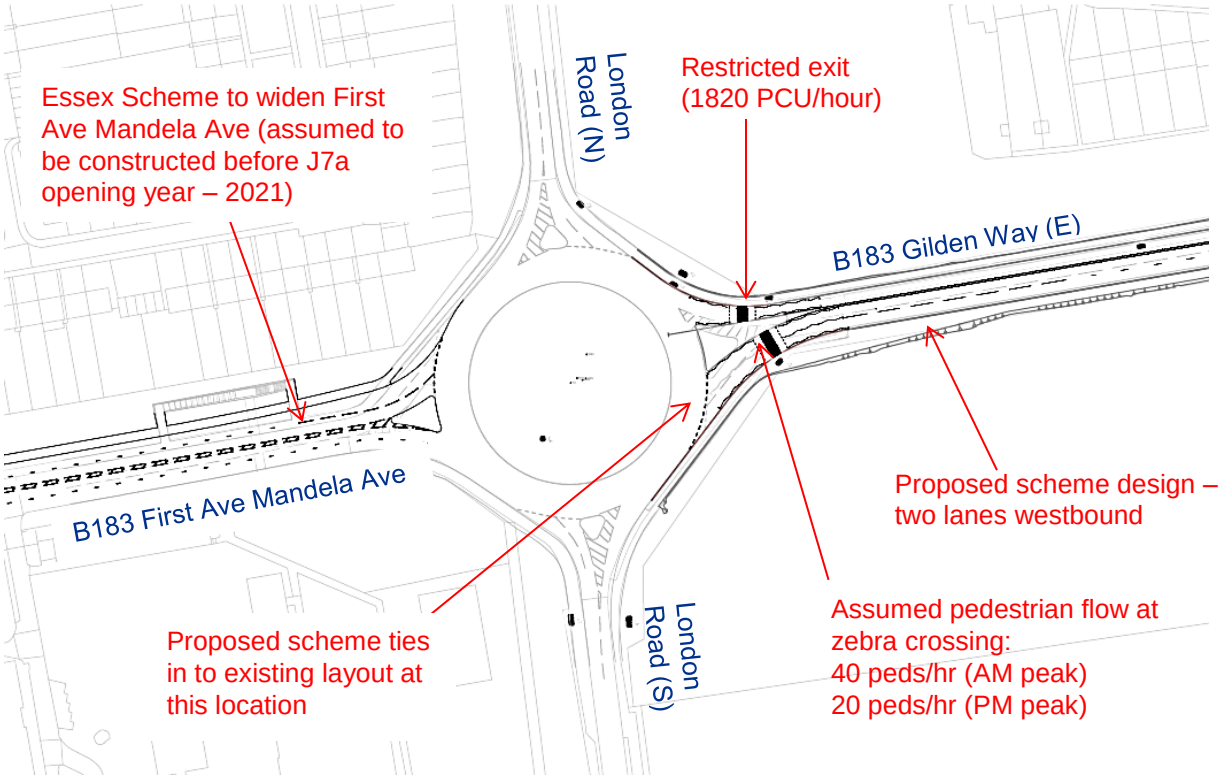
The above results show that the junction will be over capacity in the Do Nothing 2036 AM scenario, with Gilden Way (E) having a RFC over 1.0 in the AM peak hour, resulting in long queues and delays.

This essentially shows that the junction would require improvements before 2036 to accommodate predicted traffic volumes as a result of the planned growth in the local area.

### 2.5.2 Proposed layout (Do Something) modelling results

The proposed junction layout and design rationale is described in detail in Section 3.3 of the Stage 2 report The screenshot below and the notes in red capture the main elements of the proposed design.

**Figure 2.7 : Site 5 Proposed Design**




The (updated) flows that have been coded in the traffic models are summarised in the table below.

**Table 2.14 : Site 5 London Road Roundabout Do Something Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 – London Rd (N) | 2 – Gilden Way (E) | 3 – London Rd (S) | 4 – First Avenue (W) | 1 – London Rd (N) | 2 – Gilden Way (E) | 3 – London Rd (S) | 4 – First Avenue (W) |
| | **London Road Roundabout – Do Something (DS) 2021** | | | | | | | |
| 1 – London Rd (N) | 0 | 10 | 2 | 200 | 0 | 9 | 2 | 161 |
| 2 – Gilden Way (E) | 83 | 130 | 53 | 1695 | 11 | 73 | 30 | 1369 |
| 3 – London Rd (S) | 9 | 49 | 0 | 117 | 2 | 36 | 0 | 119 |
| 4 – First Avenue (W) | 207 | 911 | 125 | 0 | 216 | 1380 | 125 | 135 |
| | **London Road Roundabout – Do Something (DS) 2036** | | | | | | | |
| 1 – London Rd (N) | 0 | 11 | 2 | 262 | 0 | 51 | 2 | 195 |
| 2 – Gilden Way (E) | 104 | 432 | 56 | 1802 | 22 | 185 | 54 | 1502 |
| 3 – London Rd (S) | 14 | 62 | 0 | 114 | 2 | 39 | 0 | 133 |
| 4 – First Avenue (W) | 180 | 1111 | 140 | 15 | 197 | 1620 | 113 | 0 |

**Table 2.15 : Site 5 Proposed Design Modelling Results**

| | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | Q (PCU) | Delay (s) | RFC | LOS | Q (PCU) | Delay (s) | RFC | LOS |
| | **Site 5 (Proposed design) - Do Something 2021** | | | | | | | |
| 1 – London Rd (N) | 0.4 | 6.42 | 0.29 | A | 0.6 | 11 | 0.36 | B |
| 2 – Gilden Way (E) | 8.2 | 14.66 | 0.90 | B | 2.3 | 5.19 | 0.70 | A |
| 3 – London Rd (S) | 0.7 | 14.51 | 0.43 | B | 0.4 | 7.96 | 0.27 | A |
| 4 – First Avenue (W) | 1.2 | 3.31 | 0.56 | A | 3.8 | 6.88 | 0.80 | A |
| | **Site 5 (Proposed design) - Do Something 2036** | | | | | | | |
| 1 – London Rd (N) | 1.3 | 15.55 | 0.56 | C | 10.3 | 144.45 | 0.99 | F |
| 2 – Gilden Way (E) | 158 | 203.51 | 1.13 | F | 113.8 | 208.72 | 1.13 | F |
| 3 – London Rd (S) | 1.8 | 32.94 | 0.66 | D | 5.8 | 118.8 | 0.92 | F |
| 4 – First Avenue (W) | 2.4 | 5.43 | 0.71 | A | 142.6 | 249.77 | 1.15 | F |

The traffic modelling results predict that the junction will operate at capacity in the scheme opening year (DS 2021) with the highest RFC the B183 Gilden Way arm at 0.90. However the junction will need to be improved between 2021 and 2036, as the modelling predicts that all of the arms in 2036 PM peak period exceed the theoretical 0.90 RFC threshold.

Further design improvements suggested for this junction are provided in Chapter 4, after considering the VISSIM microsimulation modelling results.

## 2.6 Site 6 – A414 / B183 First Avenue Roundabout

Site 6 is outside the proposed J7a scheme and highway design scope for this project, as referred to in Section 2.5.1. However, given that this junction is a key junction in relation to the B183 corridor and the A414 route, it was agreed to include it within the assessments (local modelling in JUNCTIONS and LINSIG, and VISSIM microsimulation modelling).

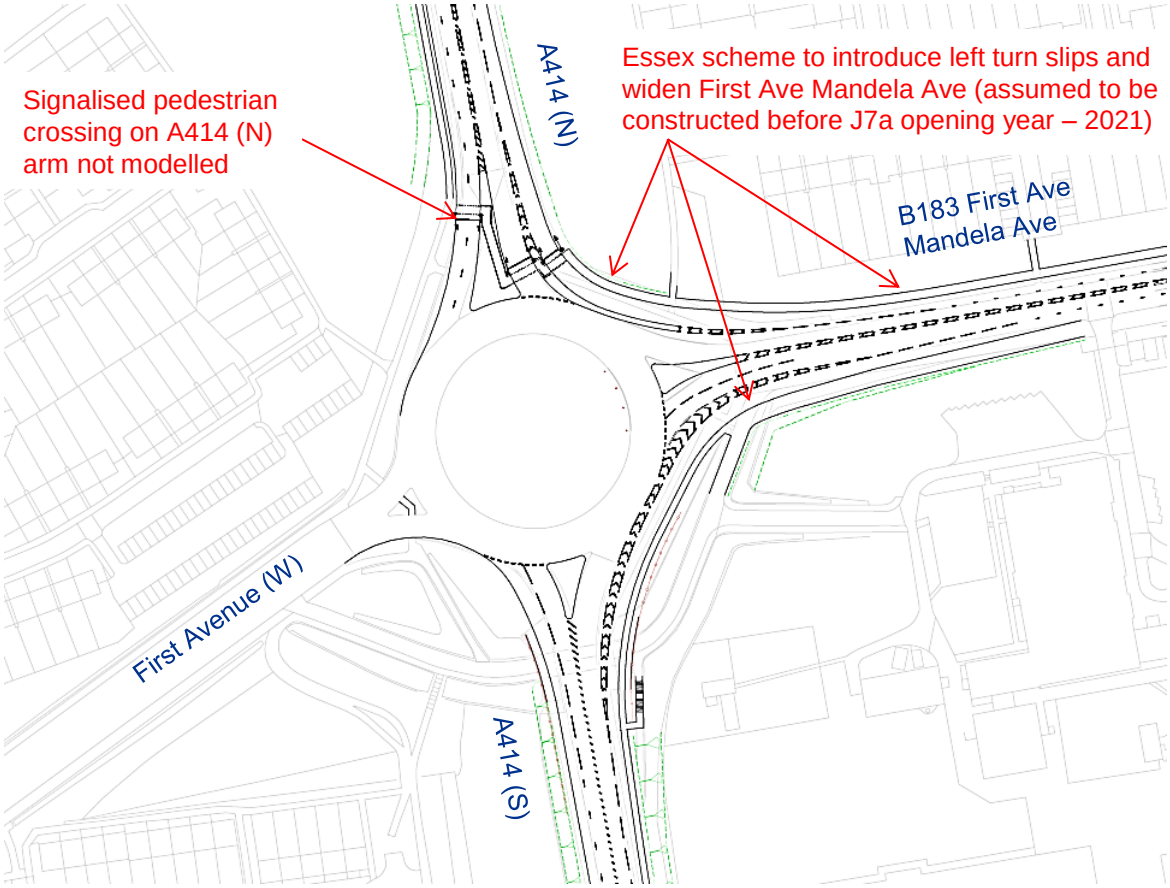
### 2.6.1 Existing layout (Do Nothing) modelling results

The layout modelled for the Do Nothing scenarios is shown below. The junction layout will change from the current layout as part of a separate scheme managed by Essex County Council.

We were informed that this is a committed scheme that will be implemented before the proposed scheme opening year (2021) and therefore it was considered in both the Do Nothing and Do Something scenarios.

The modelled layout is shown below with the modelling results from the Do Nothing modelling following that.

**Figure 2.8 : Site 6 Existing / Modelled Layout**




Both the Do Nothing models for 2021 and 2036 were updated with the flows below.

**Table 2.16 : Site 6 A414 / B183 First Avenue Roundabout Future Base Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 – A414 (N) | 2 – B183 First Ave Mandela Ave | 3 – A414 (S) | 4 – First Avenue (W) | 1 – A414 (N) | 2 – B183 First Ave Mandela Ave | 3 – A414 (S) | 4 – First Avenue (W) |
| | A414 / B183 First Avenue Roundabout – Do Nothing 2021 | | | | | | | |
| 1 – A414 (N) | 0 | 89 | 532 | 271 | 0 | 217 | 557 | 247 |
| 2 – B183 First Ave Mandela Ave | 200 | 0 | 535 | 787 | 105 | 0 | 437 | 504 |
| 3 – A414 (S) | 681 | 461 | 0 | 396 | 594 | 578 | 0 | 289 |
| 4 – First Avenue (W) | 267 | 478 | 233 | 0 | 188 | 535 | 348 | 0 |
| | A414 / B183 First Avenue Roundabout – Do Nothing 2036 | | | | | | | |
| 1 – A414 (N) | 0 | 194 | 687 | 323 | 0 | 382 | 862 | 183 |
| 2 – B183 First Ave Mandela Ave | 439 | 0 | 680 | 1003 | 365 | 0 | 608 | 393 |
| 3 – A414 (S) | 973 | 563 | 0 | 246 | 707 | 770 | 0 | 423 |
| 4 – First Avenue (W) | 226 | 593 | 104 | 0 | 147 | 621 | 181 | 0 |

Coding the above geometric parameters and flows returned the following traffic modelling results for the Do Nothing scenarios.

**Table 2.17 : Site 6 Future Base Modelling Results**

| | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | Q (PCU) | Delay (s) | RFC | LOS | Q (PCU) | Delay (s) | RFC | LOS |
| | **Site 6 (initial design) – Do Nothing 2021** | | | | | | | |
| **1 - A414 (N)** | 1.6 | 6.64 | 0.61 | A | 2.2 | 9.3 | 0.69 | A |
| **2 - B183 First Ave Mandela Ave** | 1.5 | 4.99 | 0.59 | A | 0.6 | 3.37 | 0.38 | A |
| **3 - A414 (S)** | 4.6 | 10.15 | 0.82 | B | 2.1 | 4.85 | 0.68 | A |
| **4 - First Avenue (W)** | 3.3 | 11.49 | 0.77 | B | 4.4 | 14.02 | 0.82 | B |
| | **Site 6 (initial design) – Do Nothing 2036** | | | | | | | |
| **1 - A414 (N)** | 3.3 | 10.92 | 0.77 | B | 12.1 | 40.28 | 0.95 | E |
| **2 - B183 First Ave Mandela Ave** | 7.6 | 18.17 | 0.89 | C | 1 | 4.17 | 0.49 | A |
| **3 - A414 (S)** | 152.6 | 248.99 | 1.18 | F | 9.3 | 16.84 | 0.91 | C |
| **4 - First Avenue (W)** | 7.5 | 28.38 | 0.89 | D | 15.9 | 56.66 | 0.97 | F |

The Do Nothing results in 2021 indicate that the junction operates within capacity.

The modelling however predicts that in 2036 in the AM peak hour the junction operates over capacity with the A414 (S) arm (A414 northbound approach) operating at a RFC above 1.0, meaning the junction operates with no resilience.

The modelling also predicts that in 2036 in the PM peak hour the junction operates near capacity with three out of the four approaches operating at a RFC above 0.90, meaning the junction operates with very little if any resilience.

This essentially shows that the junction would require improvements before 2036 to accommodate predicted traffic volumes as a result of the planned housing and/or retail developments in the local area.

### 2.6.2 Proposed layout (Do Something) modelling results

The proposed junction layout and design rationale, together with the intervention timeline (partial signalisation of the roundabout to be introduced by 2028) is described in detail in Section 3.4 of the Stage 2 report.

Due to the junction being outside of the proposed scheme design and highway design scope for Stage 3, there is no proposed design layout drawing for the partial signalisation of the roundabout. Therefore the geometry, position of stop lines and intergreens were assumed, based on the above design of the priority roundabout (refer to Figure 2.8) and are based on first principles, industry standards and best practice.

The (updated) flows that have been coded in the traffic models are summarised in the table below.

**Table 2.18 : Site 6 A414 / B183 First Avenue Roundabout Do Something Traffic Flows**

| Traffic Flows from Strategic Model (PCU per hour) | AM | | | | PM | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 – A414 (N) | 2 – B183 First Ave Mandela Ave | 3 – A414 (S) | 4 – First Avenue (W) | 1 – A414 (N) | 2 – B183 First Ave Mandela Ave | 3 – A414 (S) | 4 – First Avenue (W) |
| | A414 / B183 First Avenue Roundabout – Do Something (DS) 2021 | | | | | | | |
| 1 – A414 (N) | 0 | 273 | 552 | 276 | 0 | 382 | 618 | 220 |
| 2 – B183 First Ave Mandela Ave | 576 | 0 | 568 | 887 | 328 | 0 | 634 | 846 |
| 3 – A414 (S) | 678 | 406 | 0 | 293 | 776 | 825 | 0 | 4 |
| 4 – First Avenue (W) | 205 | 635 | 136 | 0 | 45 | 729 | 150 | 0 |
| | A414 / B183 First Avenue Roundabout – Do Something (DS) 2036 | | | | | | | |
| 1 – A414 (N) | 0 | 370 | 615 | 349 | 0 | 689 | 780 | 214 |
| 2 – B183 First Ave Mandela Ave | 497 | 0 | 693 | 1018 | 576 | 0 | 693 | 628 |
| 3 – A414 (S) | 966 | 485 | 0 | 230 | 743 | 619 | 0 | 242 |
| 4 – First Avenue (W) | 166 | 687 | 152 | 0 | 99 | 734 | 177 | 0 |

Coding the above demand traffic flows in the junction models returned the modelling results as show in the table below.

**Table 2.19 : Site 6 Proposed Design Modelling Results**

| Site 6 – Signalised roundabout | | Do Something DS 2021 AM peak | | | | Do Something DS 2036 AM peak | | | | Do Something DS 2021 PM peak | | | | Do Something DS 2036 PM peak | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | Lane Description | De-mand Flow (PCU) | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) | De-mand Flow (PCU) | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) | De-mand Flow (PCU) | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) | De-mand Flow (PCU) | Deg Sat (%) | Av. Delay Per PCU (s/pcu) | Mean Max Queue (pcu) |
| 1/1 | A414 North Arm S/B Left | 273 | 14.7 % | 1.1 | 0.1 | 370 | 19.9 % | 1.2 | 0.1 | 382 | 20.5 % | 1.2 | 0.1 | 689 | 37.0 % | 1.5 | 0.3 |
| 1/2+1/3 | A414 North Arm S/B Ahead | 828 | 68.6 : 71.7 % | 16.5 | 5.0 | 964 | 77.9 : 80.9 % | 19.4 | 6.8 | 838 | 89.7 : 89.7 % | 30.3 | 8.0 | 994 | 87.0 : 87.1 % | 23.5 | 7.9 |
| 2/1 | Ahead | 525 | 59.7 % | 11.1 | 4.0 | 612 | 69.4 % | 13.9 | 5.3 | 798 | 81.4 % | 13.9 | 6.9 | 717 | 81.8 % | 17.8 | 7.4 |
| 2/2 | Ahead Right | 652 | 68.7 % | 10.7 | 4.0 | 712 | 74.8 % | 14.0 | 5.4 | 906 | 85.6 % | 14.5 | 7.5 | 813 | 85.9 % | 18.7 | 7.5 |
| 4/1 | B183 Gilden Way W/B Left | 568 | 28.1 % | 1.2 | 0.2 | 693 | 34.3 % | 1.4 | 0.3 | 634 | 31.4 % | 1.3 | 0.2 | 693 | 34.3 % | 1.4 | 0.3 |
| 4/2 | B183 Gilden Way W/B Ahead | 1463 | 87.0 % | 8.9 | 5.9 | 1515 | 92.9 % | 15.7 | 9.1 | 1174 | 70.1 % | 3.9 | 2.4 | 1204 | 74.6 % | 4.9 | 2.9 |
| 5/1 | Ahead | 541 | 27.9 % | 1.3 | 0.2 | 625 | 32.2 % | 1.4 | 0.2 | 569 | 29.3 % | 1.3 | 0.2 | 674 | 34.7 % | 1.4 | 0.3 |
| 5/2 | Ahead Right | 423 | 21.0 % | 1.1 | 0.1 | 491 | 24.4 % | 1.2 | 0.2 | 419 | 20.7 % | 1.1 | 0.1 | 497 | 24.4 % | 1.2 | 0.2 |
| 7/1 | A414 South Arm N/B Left Ahead | 771 | 84.9 % | 22.0 | 9.8 | 942 | 103.1 % | 104.5 | 34.8 | 554 | 54.5 % | 10.1 | 4.3 | 834 | 87.0 % | 22.3 | 10.6 |
| 7/2 | A414 South Arm N/B Ahead | 606 | 62.1 % | 12.9 | 5.7 | 739 | 75.3 % | 16.5 | 8.3 | 1051 | 96.3 % | 39.7 | 19.0 | 770 | 74.7 % | 14.6 | 7.7 |
| 8/1 | Ahead | 551 | 87.5 % | 31.9 | 8.4 | 639 | 99.2 % | 76.4 | 18.3 | 493 | 96.4 % | 68.7 | 12.2 | 449 | 79.8 % | 25.9 | 5.6 |
| 8/2 | Ahead Right | 636 | 89.5 % | 32.7 | 9.8 | 728 | 100.0 % | 77.9 | 21.4 | 573 | 99.2 % | 83.0 | 16.3 | 522 | 82.7 % | 27.3 | 7.0 |
| 8/3 | Right | 552 | 87.3 % | 33.6 | 8.8 | 497 | 76.8 % | 25.5 | 6.8 | 328 | 63.9 % | 20.7 | 3.7 | 447 | 79.2 % | 27.0 | 6.1 |
| 10/1 | First Avenue E/B Ahead Left | 976 | 66.2 % | 3.6 | 1.2 | 1005 | 72.6 % | 5.0 | 2.9 | 924 | 67.4 % | 4.3 | 2.3 | 1010 | 73.5 % | 5.1 | 2.4 |
| 11/1 | Ahead | 502 | 26.9 % | 1.3 | 0.2 | 712 | 37.0 % | 1.5 | 0.3 | 550 | 29.4 % | 1.4 | 2.9 | 721 | 38.6 % | 1.6 | 0.3 |
| 11/2 | Right Ahead | 857 | 43.1 % | 1.6 | 0.4 | 914 | 46.0 % | 1.7 | 0.4 | 854 | 43.0 % | 1.6 | 0.4 | 812 | 40.8 % | 1.5 | 0.3 |
| 11/3 | Right | 301 | 16.3 % | 1.2 | 0.1 | 322 | 17.4 % | 1.2 | 0.1 | 525 | 28.4 % | 1.4 | 0.2 | 405 | 21.9 % | 1.2 | 0.1 |

The modelling results show that there are no links over a Degree of Saturation of 90% in the Do Something (DS) 2021 AM peak hour, however there are queuing on the internal links at the A414 northbound junction that would cause blocking issues.

In the Do Something (DS) 2021 PM peak hour the modelling predicts similar blocking back issues on the internal links, with some links predicted to operate with a Degree of Saturation above 90%. This means the junction is operating at capacity with little or no resilience.

The modelling results predict that the junction is operating over capacity (Degree of Saturations >100%) for the Do Something (DS) 2036 AM peak hour, with no resilience. In the PM peak hour for the Do Something (DS) 2036 scenario, the modelling predicts no link to be over 90% Degree of Saturation, but queuing on the internal links causing blocking issues still remains. This means the junction is operating at capacity with little or no resilience.

The worst performing links are the A414 northbound approach (nearside lane) as well as the corresponding internal links on the gyratory by the A414 northbound approach. The estimated queue lengths in the latter link also suggest that there will be blocking back to the roundabout entry upstream (B183 westbound).

Further design improvements suggested for this junction are provided in Chapter 4, after considering the VISSIM microsimulation modelling results.

# 3. Network Microsimulation (VISSIM) Modelling

## 3.1 Introduction

PTV's VISSIM microsimulation software package version 7 has been used to simulate the Do Nothing and proposed network for the M11 J7a schemes. VISSIM models each vehicle individually, including driver behaviour characteristics, and provides a visual representation of the interaction between vehicles, assisting in the assessment of the road network operation, providing detailed assessment on impact that one junction has on others, in terms of queuing and blocking back, and platooning of traffic.

This chapter provides an update to the VISSIM assessment of the network and junctions following the release of the Variable Demand Model (VDM) traffic flow from the Harlow Strategic model. Please refer to the Stage 2 report (reference B3553F05/REP/47) for the junction design development details. Sections 2.2 of that report also describes in detail the modelling scenarios, which are similar for this design stage

The VISSIM modelling results presented in this chapter are based on the latest highway design freeze and no additional enhancement measures have been included in the assessed.

Figure 3.1 presents the extent of the network modelled in VISSIM for the Do Nothing scenarios and the extent of the Proposed Network is shown in Figure 3.2.

**Figure 3.1 : Extent of the Do Nothing VISSIM Network**

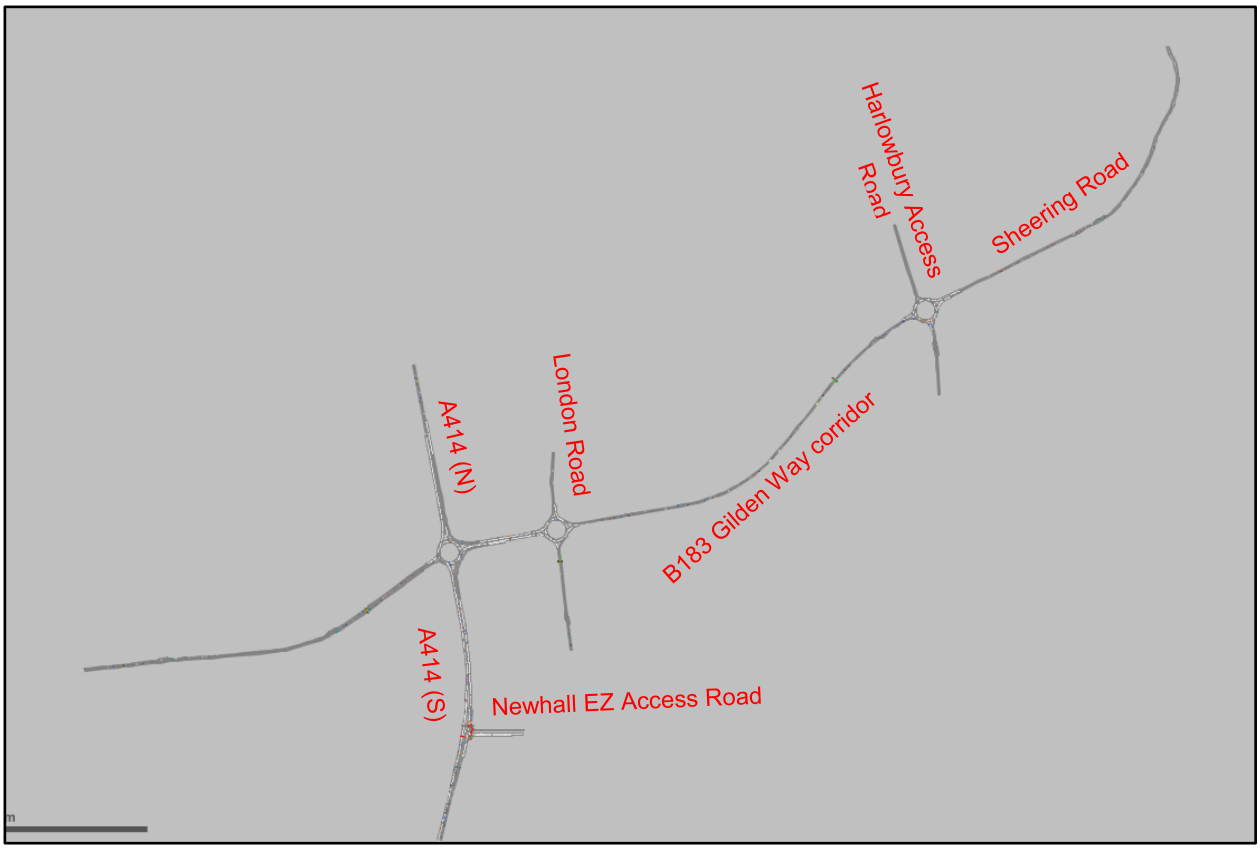
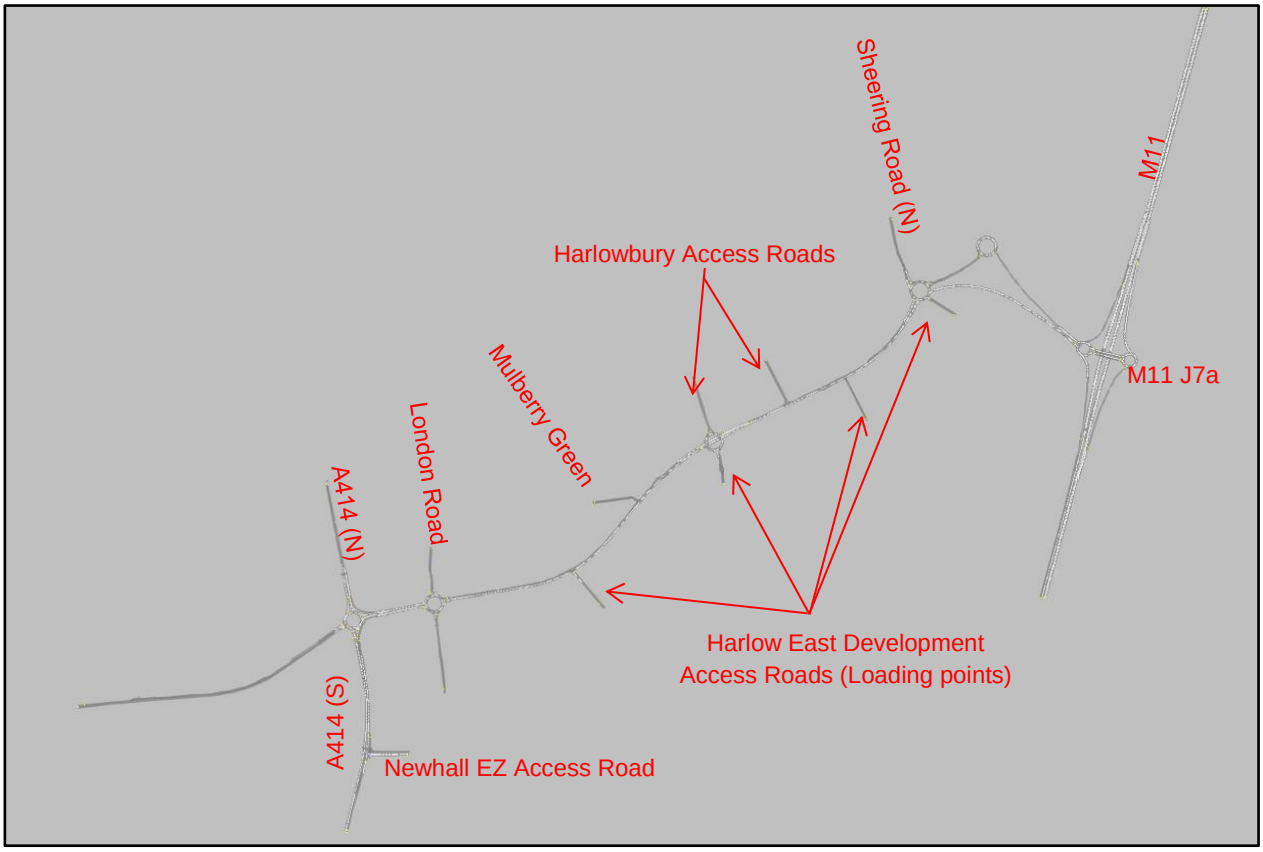


**Figure 3.2 : Extent of the Do Something VISSIM Network**



## 3.2 Operational Analysis – Visual Assessment in VISSIM

### 3.2.1 2021 Do Nothing Network

AM Peak Assessment

The model shows that the network performs reasonably well in the AM peak of the 2021 Do Nothing scenario with the roundabouts at Site 4 and Site 5, both operating within capacity as shown in Figure 3.3.

**Figure 3.3 : Sites 4 & 5 operating within capacity – Future Base 2021 AM Peak**

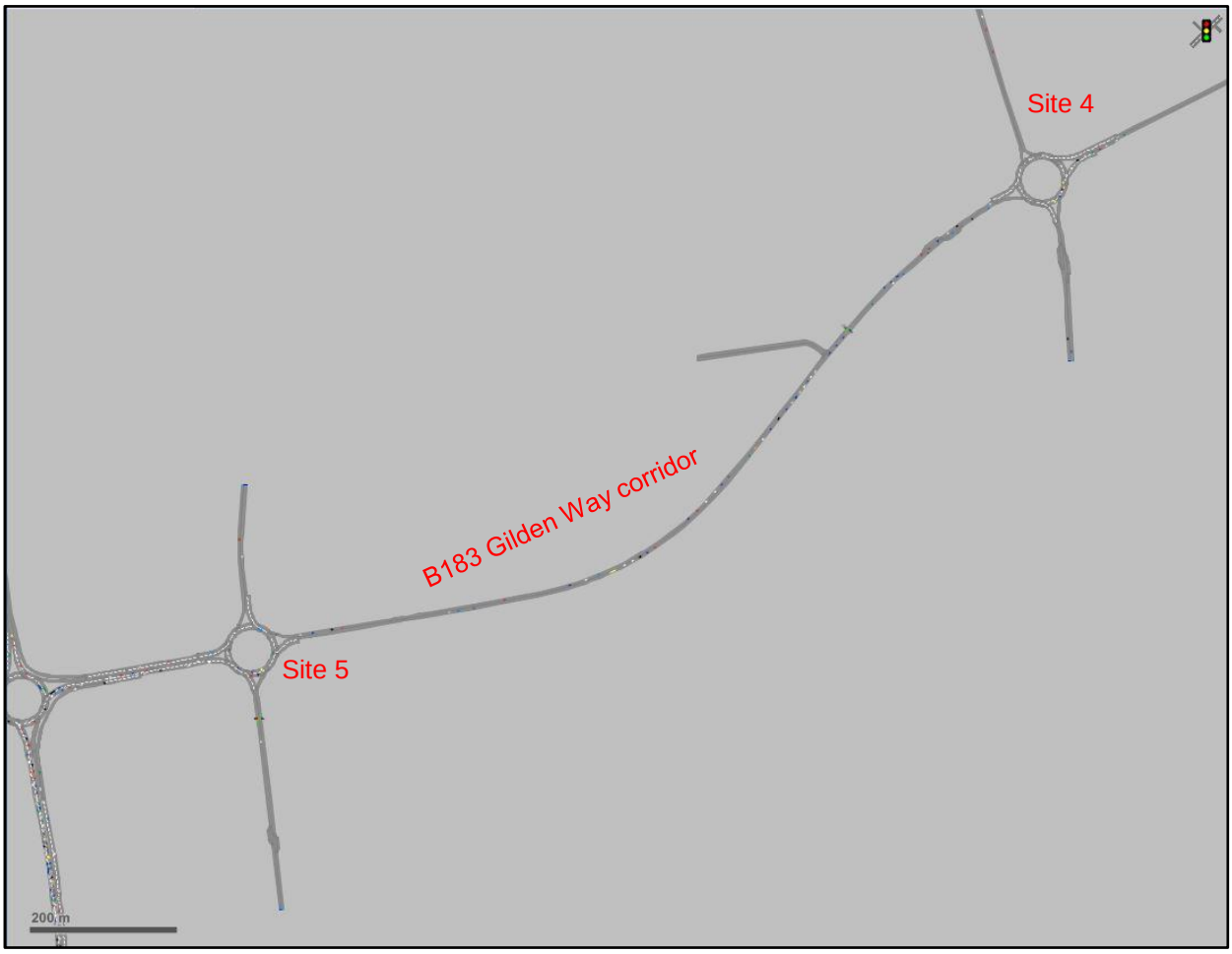
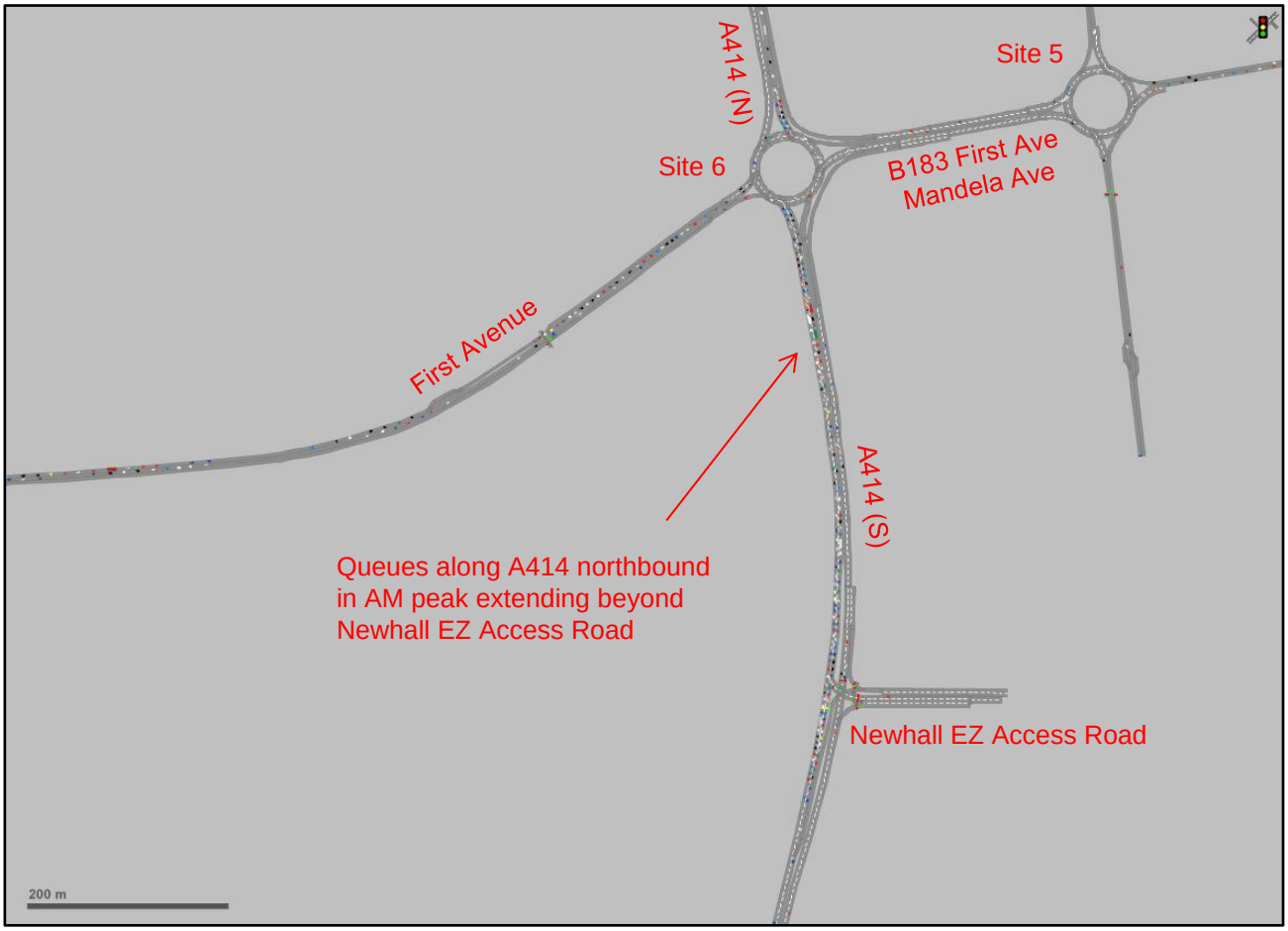



Figure 3.4 shows the traffic conditions at the A414 / First Avenue Roundabout (Site 6). The First Avenue, A414 (N) and B183 First Avenue Mandela Avenue approaches are operating within capacity with no significant delays.

However, the A414 northbound approach would experience significant delays with queues extending beyond the junction of A414 / Newhall EZ Access Road as traffic struggles to find gaps to discharge into the roundabout.

**Figure 3.4 : Delays and queues on A414 northbound – Do Nothing 2021 AM Peak**



PM Peak Assessment

Similar to the AM peak, the roundabouts at Site 4 and Site 5 both operate within capacity in the PM peak as shown in Figure 3.5.

**Figure 3.5 : Sites 4 & 5 operating within capacity – Do Nothing 2021 PM Peak**

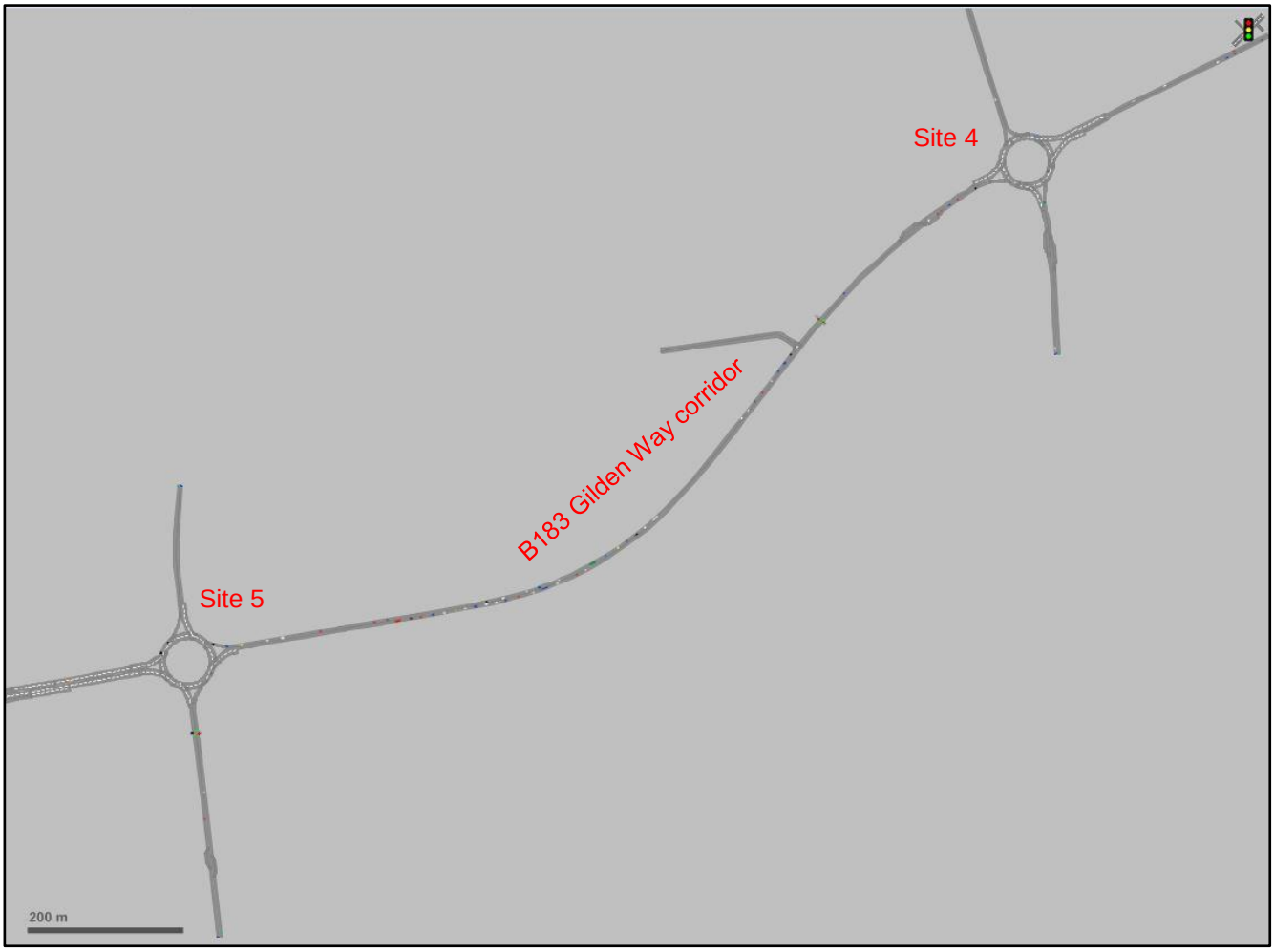
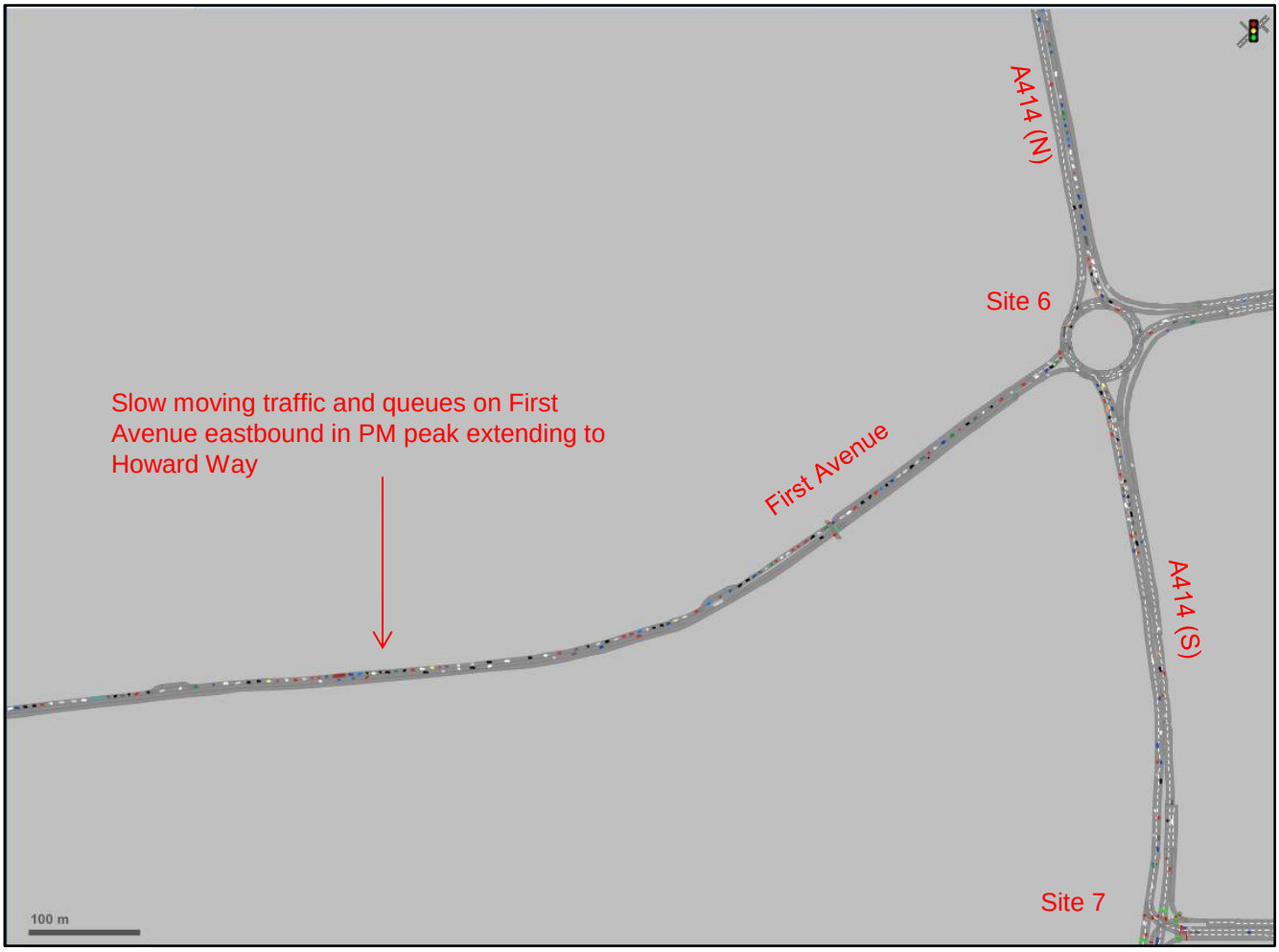


Figure 3.6 shows the traffic conditions at the A414 / First Avenue Roundabout (Site 6). It shows that the First Avenue eastbound approach to the A414 experience significant queueing and delays with queues extending to the First Avenue / Howard Way roundabout.

**Figure 3.6 : Delays and queues on First Avenue eastbound – Do Nothing 2021 PM Peak**




### 3.2.2 2021 Do Something Network

The following changes were incorporated in the VISSIM network:

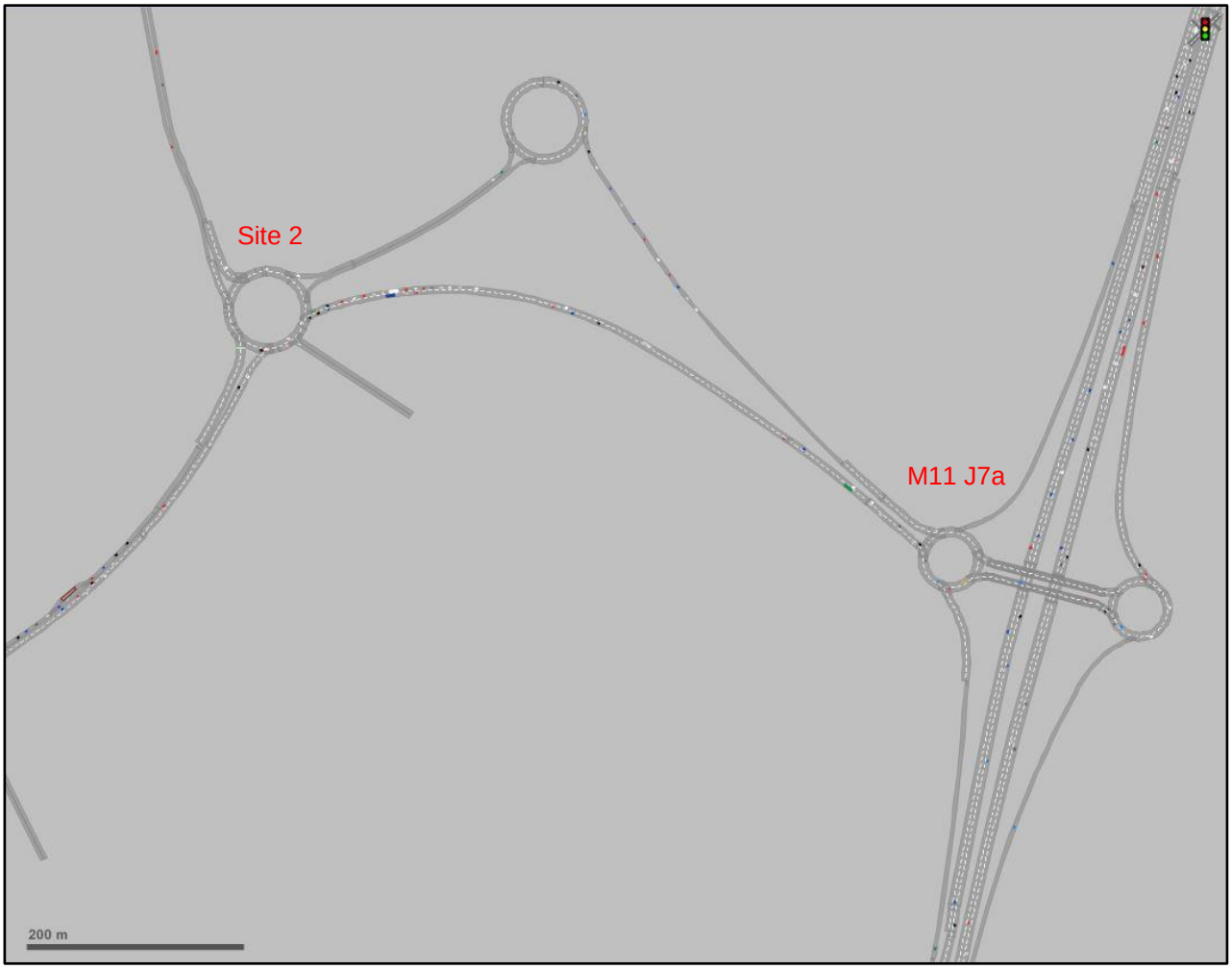
- Completion of the M11 J7a proposed scheme;
- A new roundabout at Sheering Road (Sheering Road Roundabout, Site 2), including a fifth arm related to the Harlow East Development;
- Upgrading three arm Churchgate Roundabout to four arms and having a two-lane section 65m long in the eastbound direction;
- Upgrading the existing single lane to two lanes on westbound entry to the London Road Roundabout (Site 5);
- Widening the A414 / B183 First Avenue Roundabout (Site 6) and signalisation of the north and south arms at the roundabout;
- Extending A414 northbound exit lanes to two lanes for approximately 200m from A414 / B183 First Avenue Roundabout; and
- Three additional access / egress points were added for the proposed Harlow East Development.

Three more junctions or traffic loading points along the B183 corridor / Gilden Way were included in the VISSIM modelled network. These junctions, one signal controlled and two 'left-in left-out' arrangements were requested by Essex County Council to be added to the VISSIM network to reflect potential access / egress points related to the Harlow East Development and Harlowbury Development. To further allow for potential access to the Harlow East Development, Essex County Council also requested that a fifth arm be added to the proposed Sheering Road Roundabout (Site 2).

AM Peak Assessment

Figure 3.7 shows that the network performs reasonably well at the proposed M11 J7a junction and at the new Sheering Road Roundabout (Site 2).

**Figure 3.7 : M11 J7a and Sheering Road Roundabout Site 2 – Do Something 2021 AM Peak**




Figures 3.8 to 3.10 provide a comparison of the junction performance at Sites 4, 5 and 6 between the Do Nothing and Do Something scenarios for the 2021 AM peak. They show that although traffic flows has increased on the B183 corridor / Gilden Way due to planned housing and/or retail developments in the local area, and the introduction of J7a, the Churchgate Roundabout (Site 4) and London Road Roundabout (Site 5) would still perform at acceptable levels with only small increases in queues on the eastbound and westbound approaches to these roundabouts.

Figure 3.10 shows that the delays and queues on the A414 northbound approach to the A414 / B183 First Avenue Roundabout (Site 6) has significantly reduced with the junction modifications in the proposed scenario. However, there appears to be a slight increase in delays on the westbound approach due to the introduction of signals to the roundabout.

**Figure 3.8 : Churchgate Roundabout (Site 4) – 2021 AM Peak Do Nothing vs Do Something**

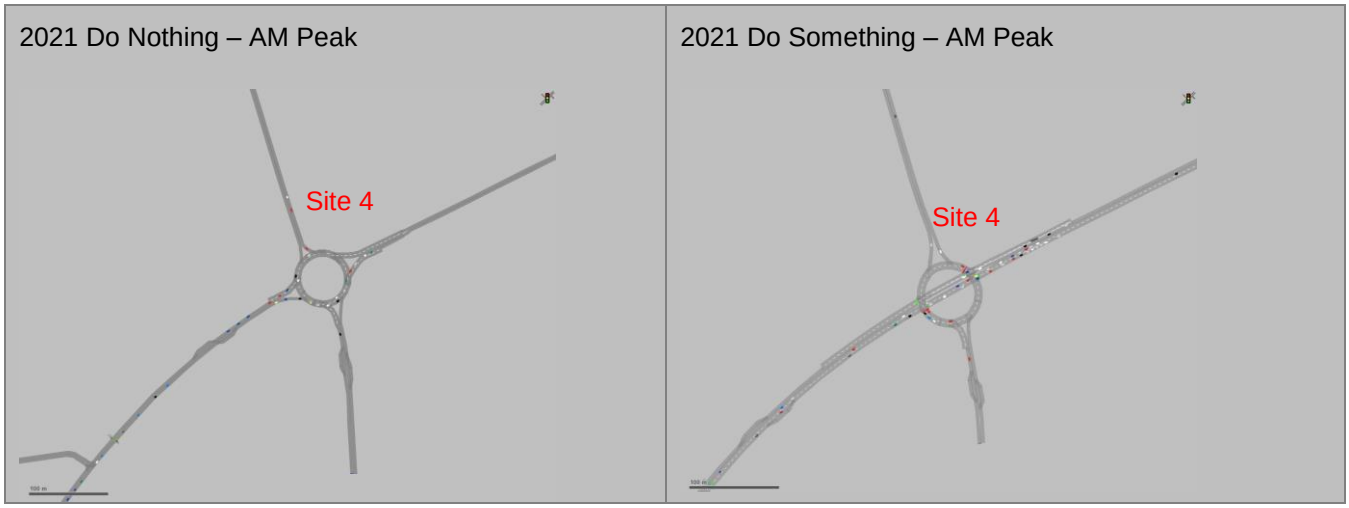



**Figure 3.9 : London Road Roundabour (Site 5) – 2021 AM Peak Do Nothing vs Do Something**

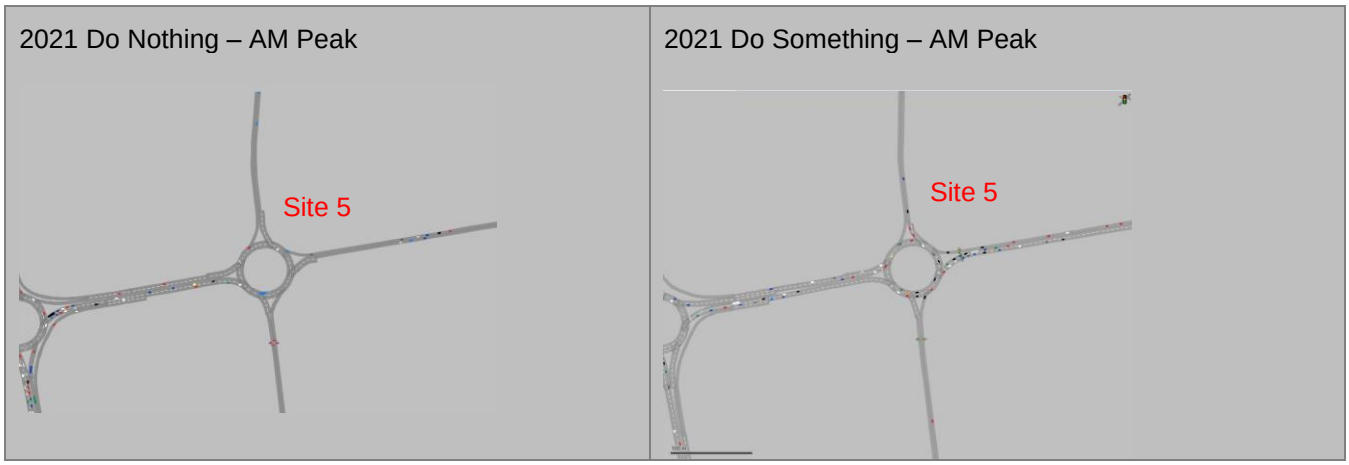
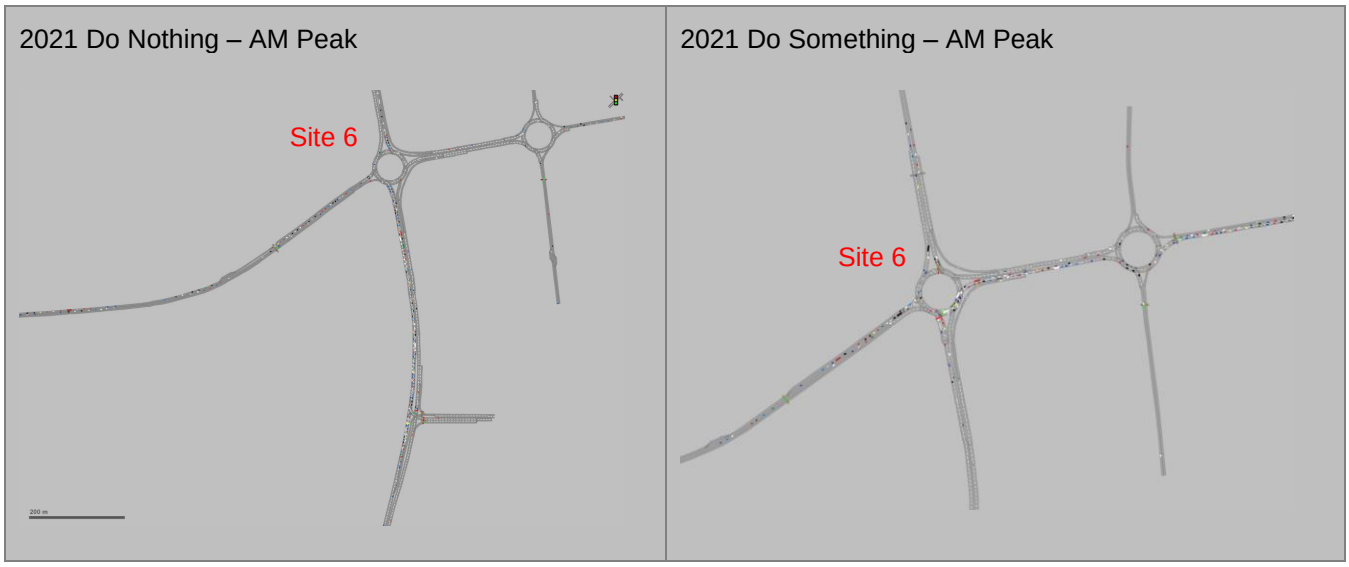


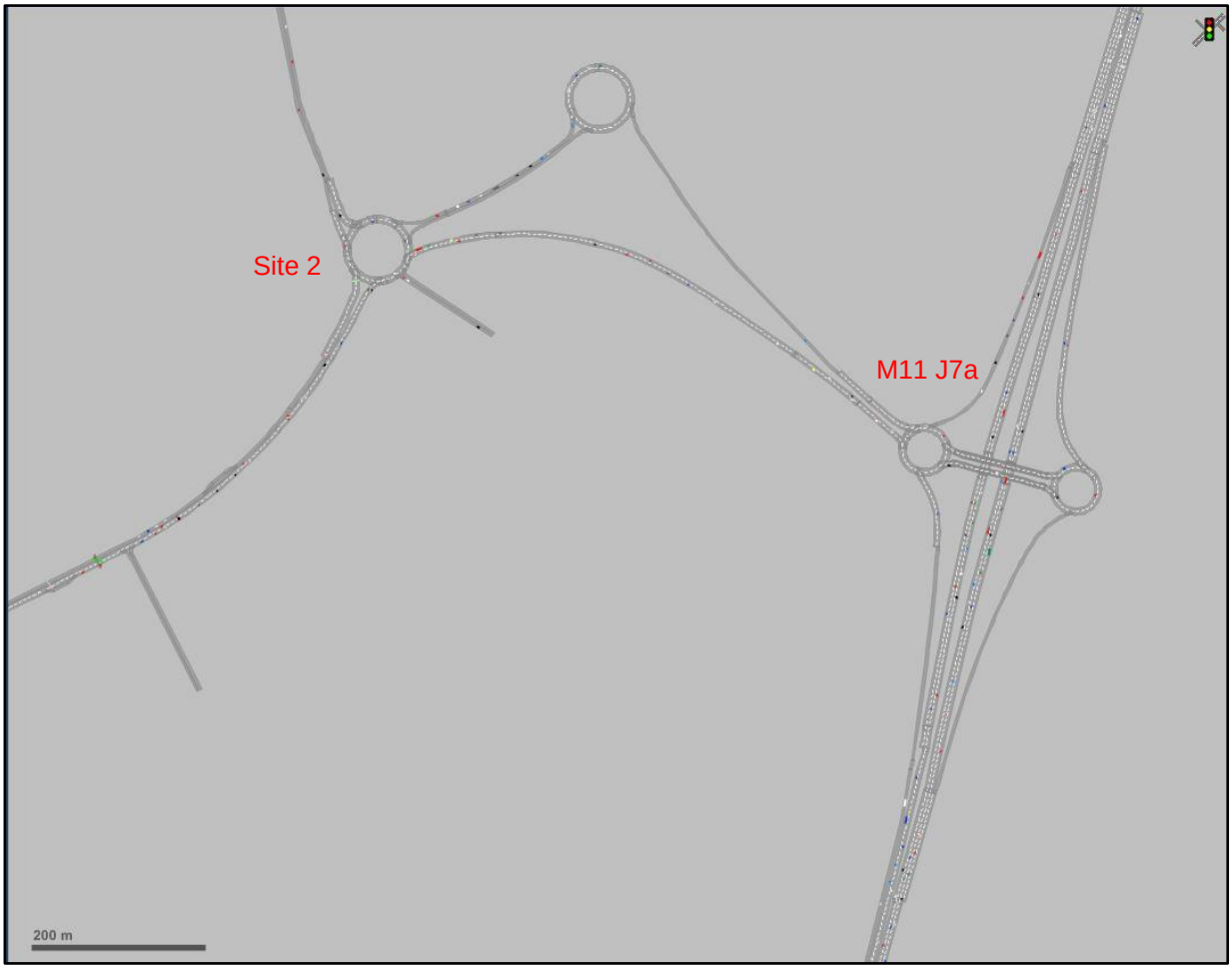

**Figure 3.10 : : A414 / B183 First Avenue Roundabout (Site 6) – 2021 AM Peak Do Nothing vs Do Something**



PM Peak Assessment

Similar to the AM peak, Figure 3.11 shows that the network performs reasonably well at the proposed M11 J7a junction and at the new Sheering Road roundabout (Site 2).

**Figure 3.11 : M11 J7a and Sheering Road Roundabout (Site 2) – Proposed 2021 PM Peak**




Figures 3.12 to 3.14 provide a comparison of the junction performance at Sites 4, 5 and 6 between the Do Nothing and Do Something scenarios for the 2021 PM peak. They show that the Churchgate Roundabout (Site 4) still performs at acceptable level. There would be increase queueing on London Road southbound at Site 5 due to increased eastbound flow travelling to the M11 J7a junction.

Figure 3.14 shows that the A414 / B183 First Avenue Roundabout (Site 6) performs better in the proposed scenario with reduced queueing on the eastbound and northbound approaches to the roundabout.

**Figure 3.12 : Churchgate Roundabout (Site 4) – 2021 PM Peak Do Nothing vs Do Something**

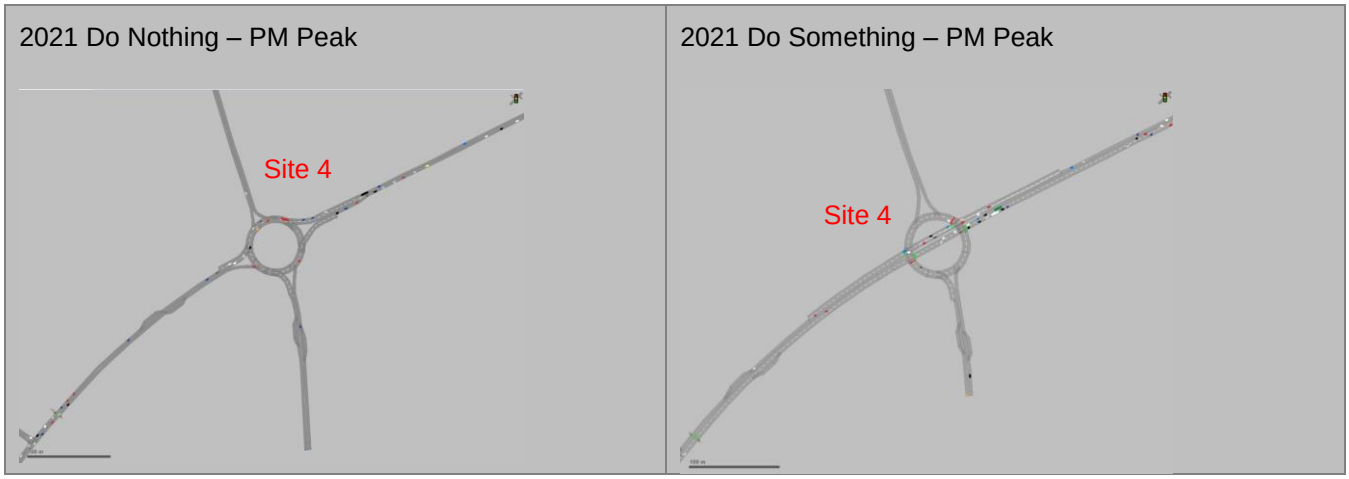
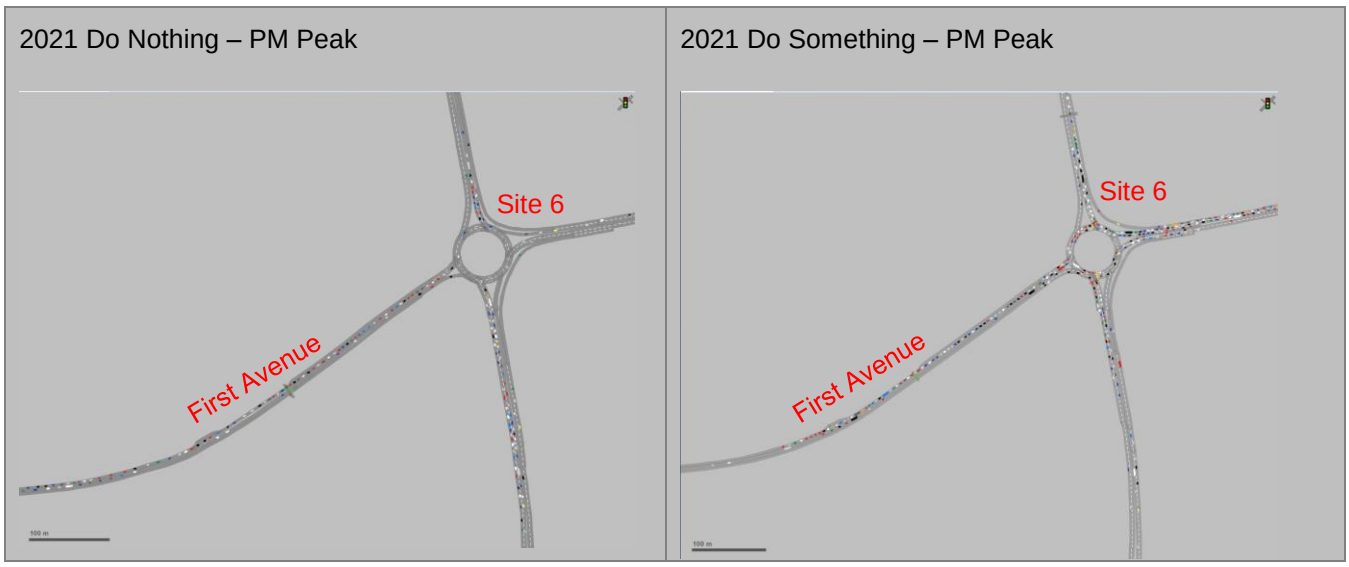



**Figure 3.13 : London Road Roundabout (Site 5) – 2021 PM Peak Do Nothing vs Do Something**

**Figure 3.14 : A414 / B183 First Avenue Roundabout (Site 6) – 2021 PM Peak Do Nothing vs Do Something**



### 3.2.3 2036 Do Nothing Network

AM Peak Assessment

The A414 / B183 First Avenue Roundabout (Site 6) is oversaturated in the 2036 Do Nothing year network with high levels of delays on the A414 northbound and B183 westbound approaches.

A slow moving westbound queue extending from Site 6 to Site 4 is formed as a result of the delays at Site 6. Traffic on London Road northbound and Sheering Road northbound also struggle to exit the roundabouts at Site 4 and Site 5 due to the exit blocking by the westbound queue.

**Figure 3.15 : A414 / B183 First Avenue Roundabout (Site 6) – 2036 AM Peak Do Nothing**

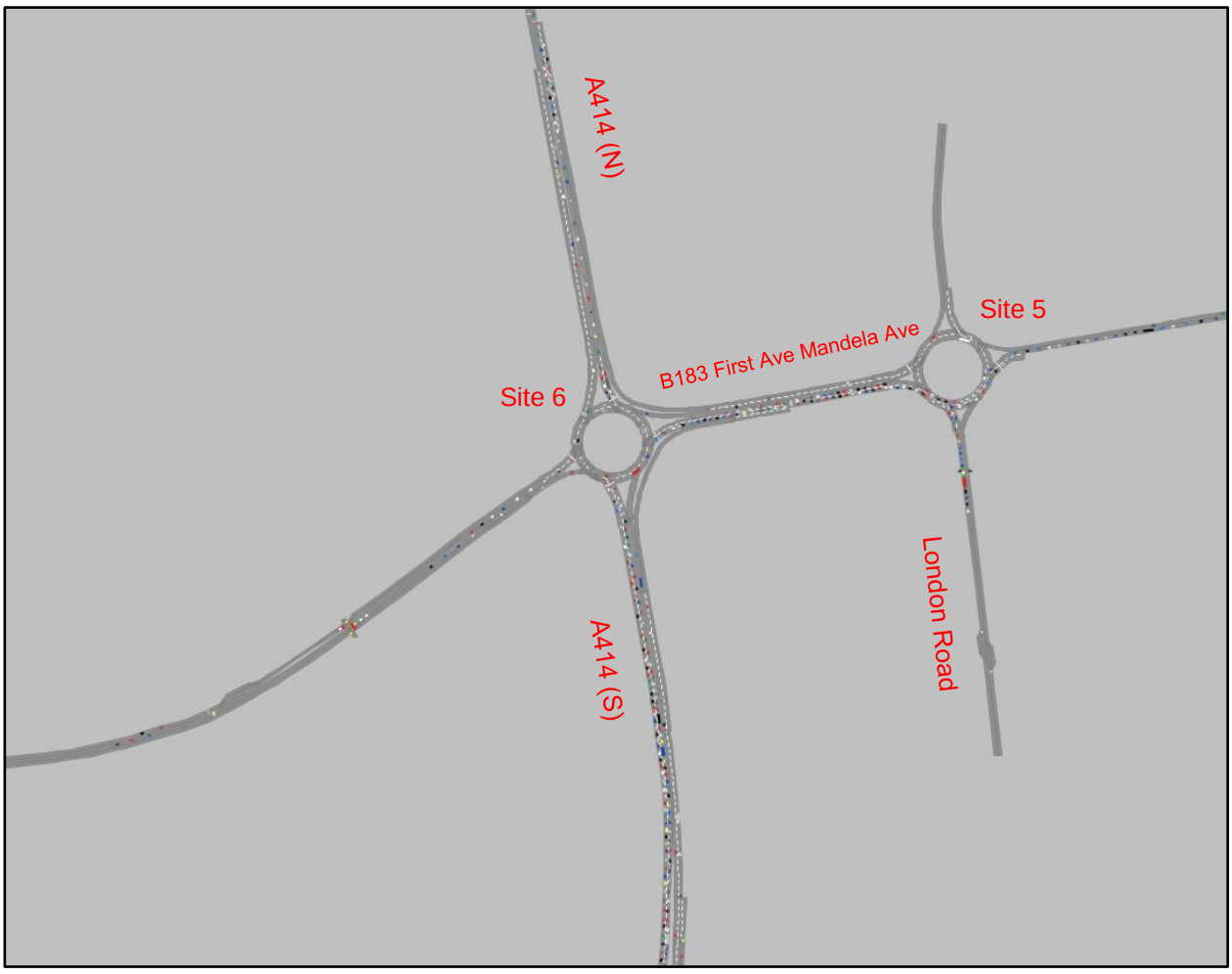
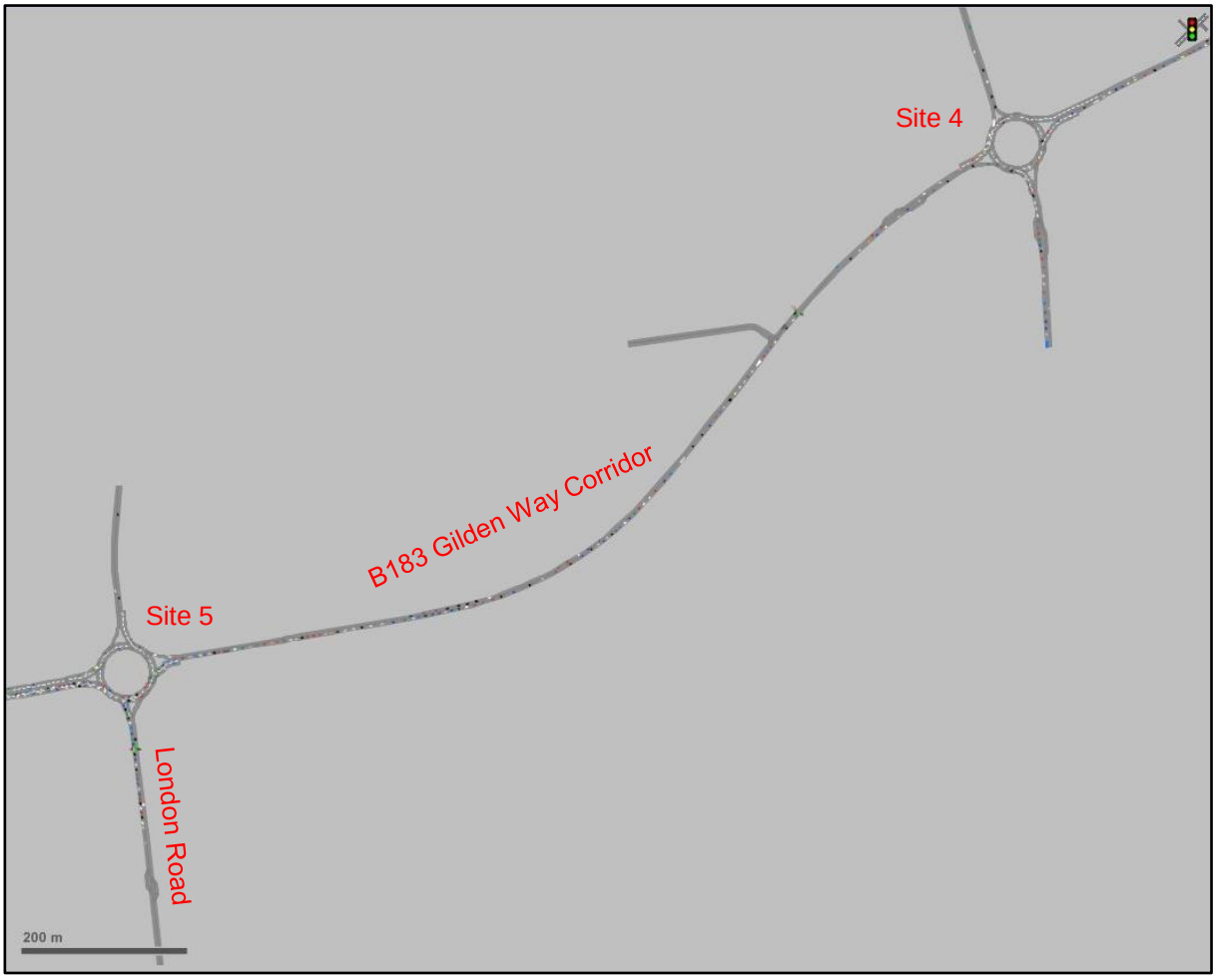


**Figure 3.16 : Slow moving westbound queue along B183 Corridor – 2036 AM Peak Do Nothing**



PM Peak Assessment

Similar to the AM peak, the A414 / B183 First Avenue Roundabout (Site 6) is operating over capacity under the 2036 Do Nothing network with high levels of delays on the A414 northbound, First Avenue eastbound and A414 southbound approaches as shown in Figure 3.17.

**Figure 3.17 : A414 / B183 First Avenue Roundabout (Site 6) – 2036 PM Peak Do Nothing**

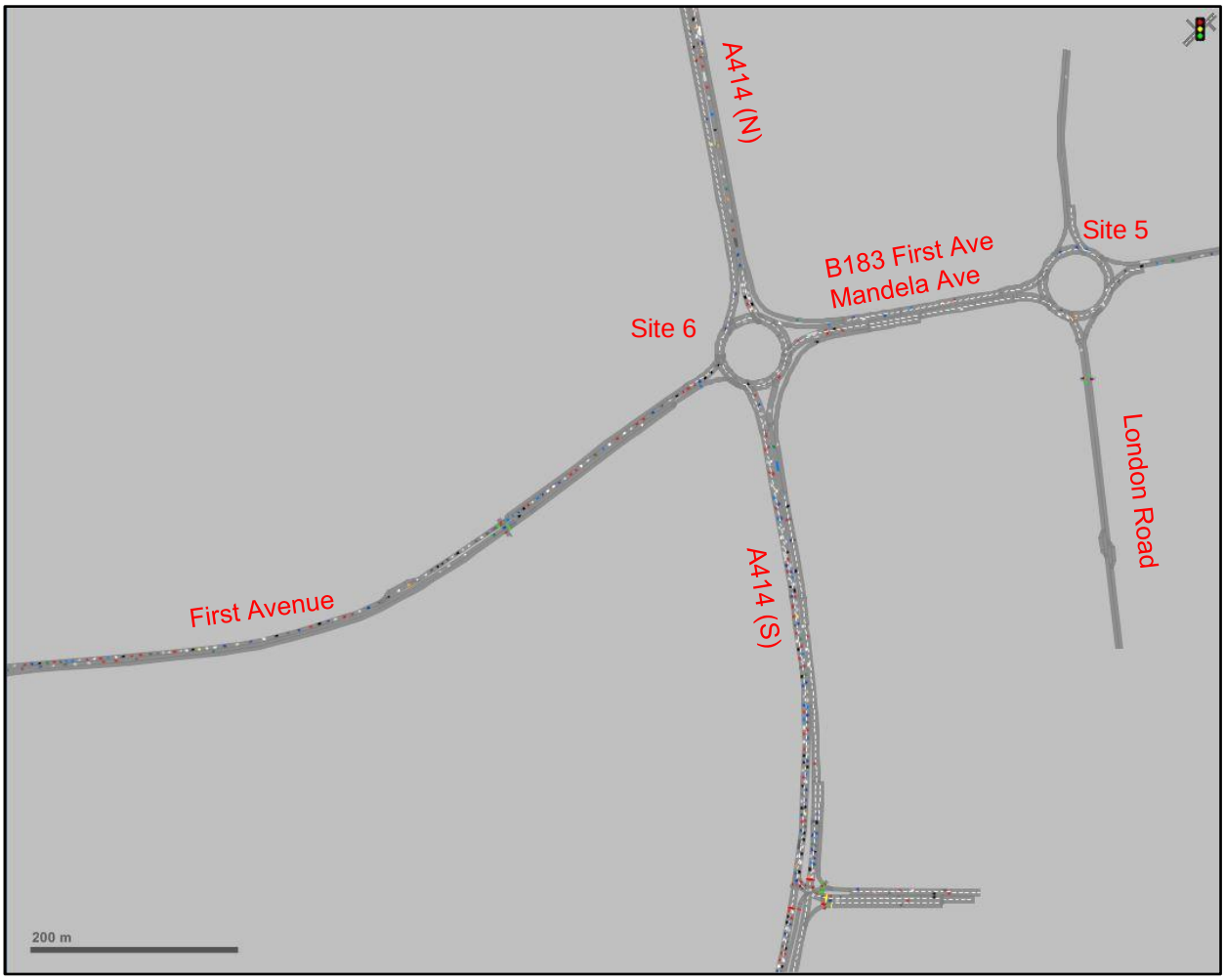
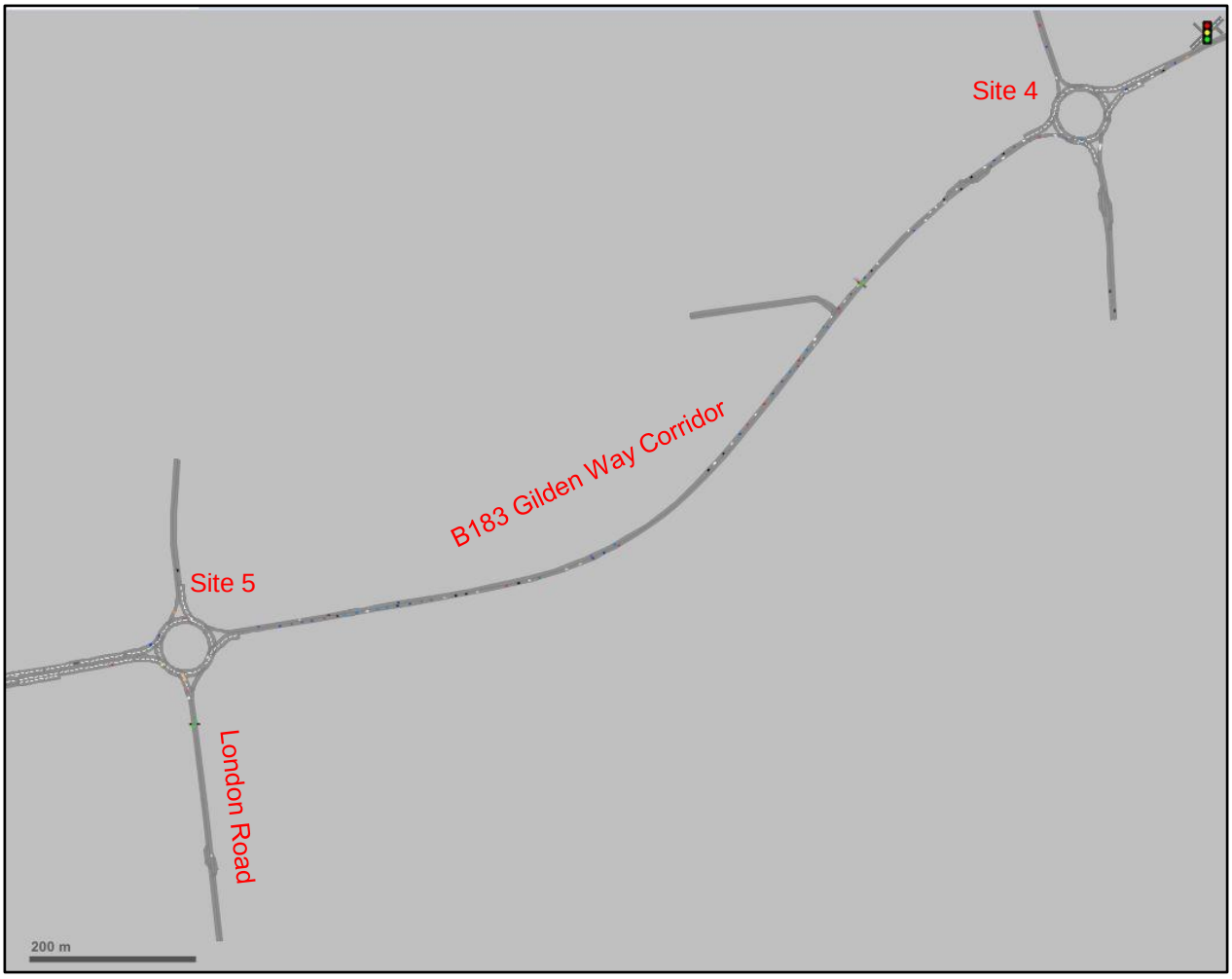


**Figure 3.18 : Sites 4 & 5 operating within capacity – Do Nothing 2036 PM Peak**



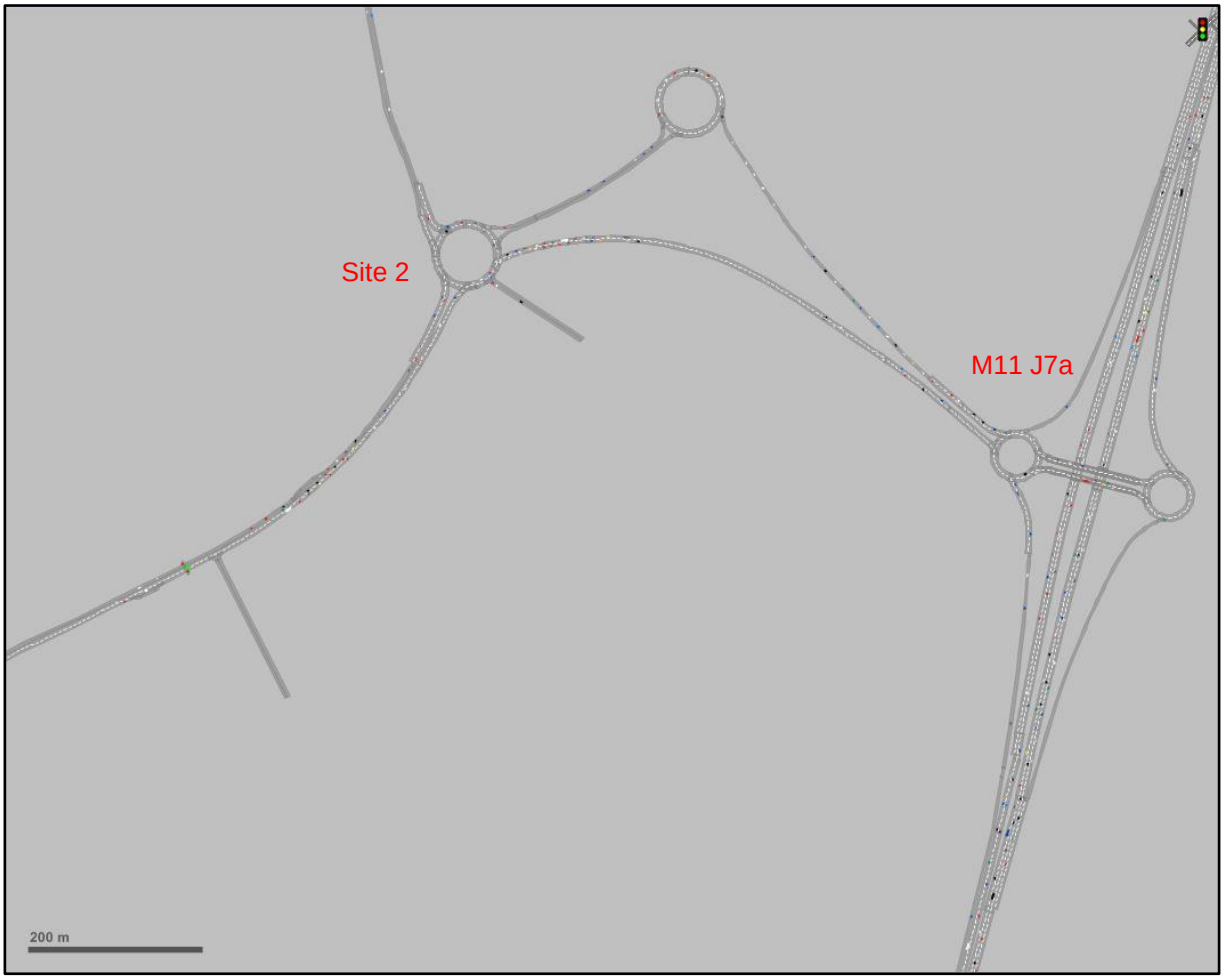

### 3.2.4 2036 Do Something Network

Please refer to Section 3.2.2 for details of the network changes applied to the Do Something VISSIM network.

<u>AM Peak Assessment</u>

Figure 3.19 shows that the network performs reasonably well at the proposed M11 J7a junction and at the new Sheering Road Roundabout (Site 2).

**Figure 3.19 : M11 J7a and Sheering Road Roundabout (Site 2) – Proposed 2036 AM Peak**




Figures 3.20 to 3.22 provide a comparison of the junction performance at Sites 4, 5 and 6 between the Do Nothing and Do Something scenarios for the 2036 AM peak. Figure 3.20 shows that the proposed Hamburger layout at Churchgate Roundabout (Site 4) would still operate within capacity.

In order to tie in with the frozen highway design for Gilden Way, one lane has been assumed on the eastbound approach to the new signalised T-junction at the Harlow East Development access / egress east of Site 5 (loading point 4). The model indicates that this arrangement will cause significant delays to eastbound traffic with queues extending to the A414 / B183 First Avenue Roundabout as shown in Figure 3.21. More detailed assessment and further improvements to reduce congestion at this junction needs to be considered as part of any planning application specific to the Harlow East Development.

Traffic from London Road southbound also struggles to exit the roundabout at Site 5 due to this exit blocking from the development access and from the pedestrian crossing located immediately on the eastern arm exit of Site 5.

Figure 3.22 indicates that Site 6 remains oversaturated in the 2036 Do Something scenario with long queues on the A414 southbound and First Avenue eastbound approaches.

**Figure 3.20 : Churchgate Roundabout (Site 4) – 2036 AM Peak Do Nothing vs Do Something**

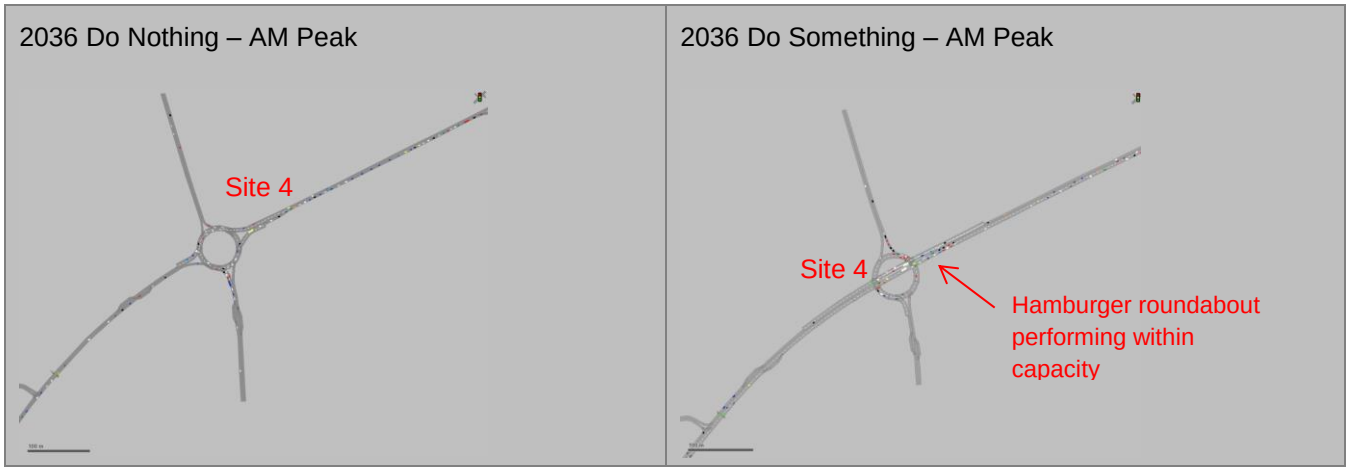



**Figure 3.21 : London Road Roundabout (Site 5) – 2036 AM Peak Do Nothing vs Do Something**

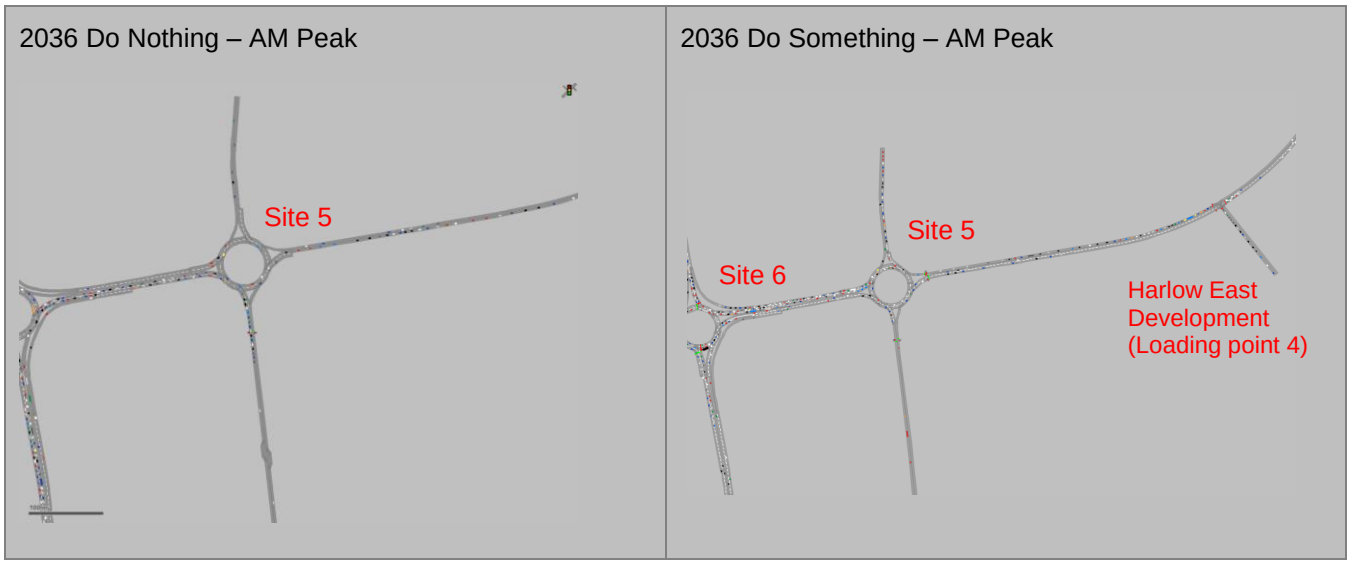
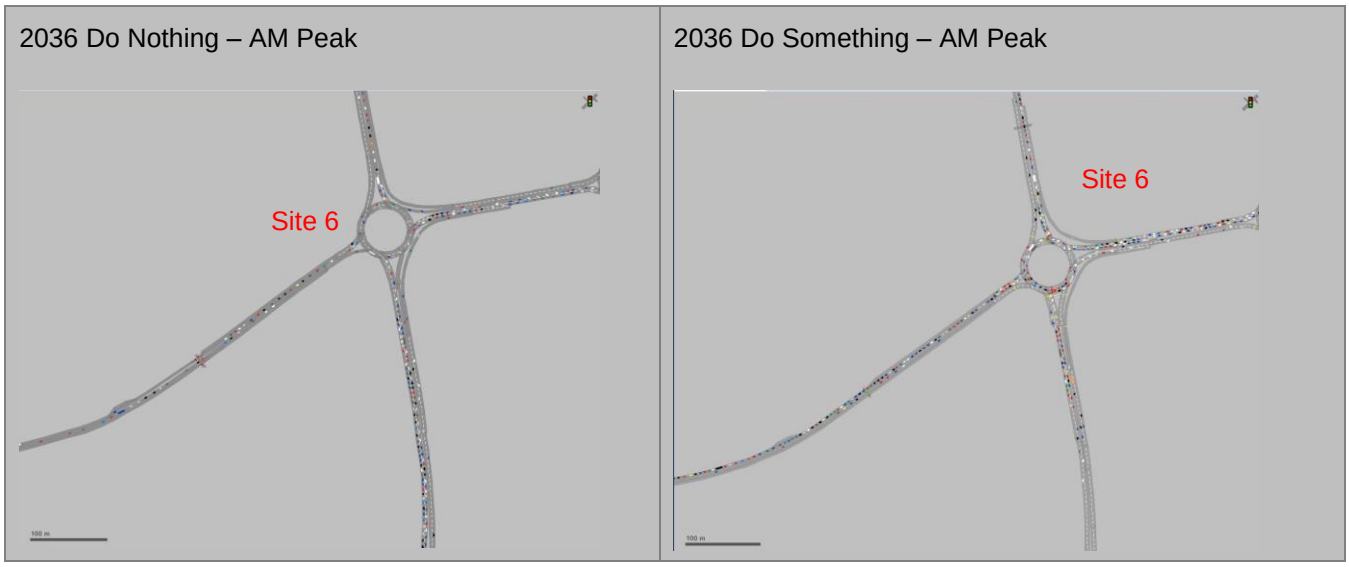


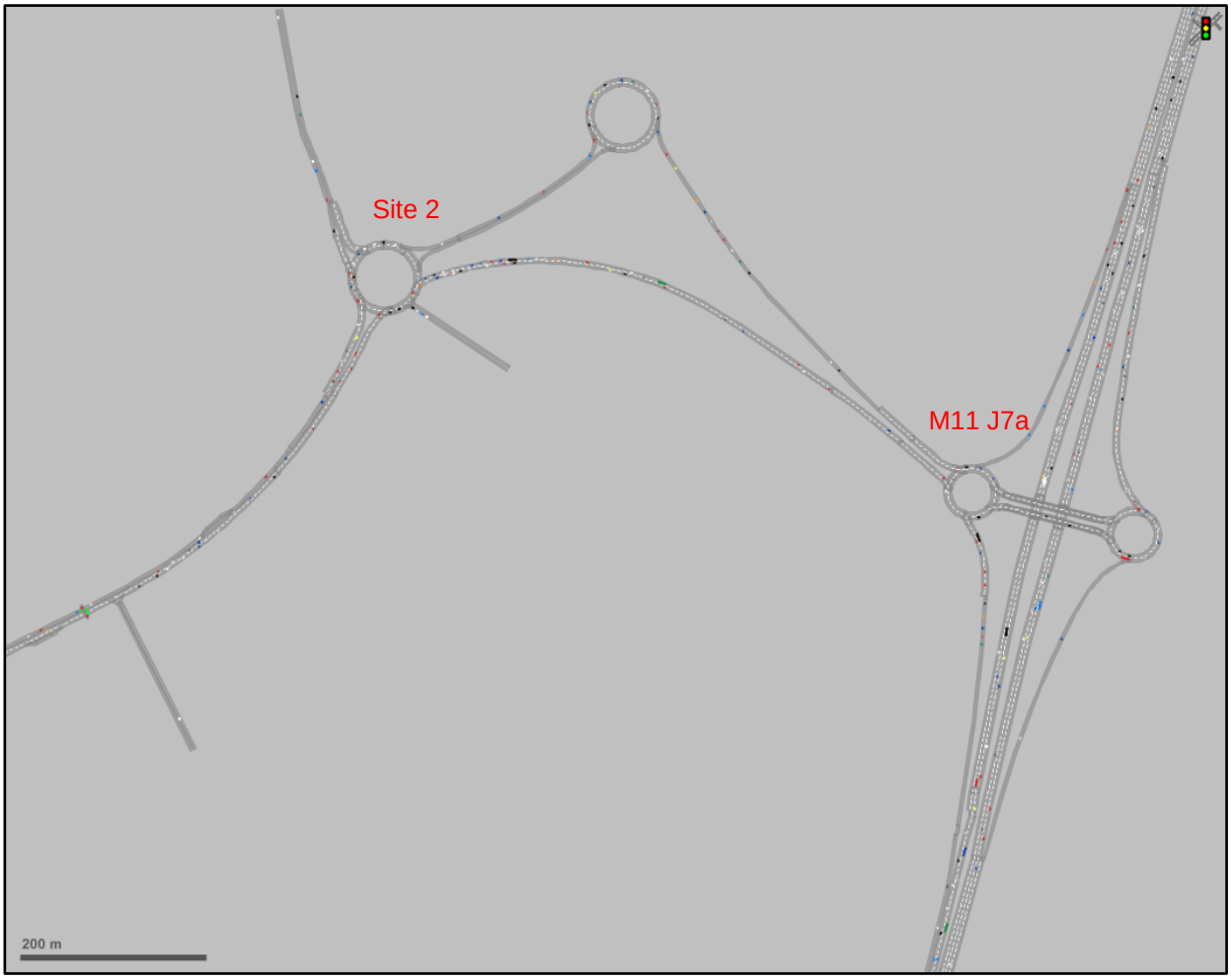

**Figure 3.22 : A414 / B183 First Avenue Roundabout (Site 6) – 2036 AM Peak Do Nothing vs Do Something**



PM Peak Assessment

Similar to the AM peak, Figure 3.23 shows that the network performs reasonably well at the proposed M11 J7a junction and at the new Sheering Road Roundabout (Site 2).

**Figure 3.23 : M11 J7a and Sheering Road Roundabout (Site 2) – Do something 2036 PM Peak**




Figures 3.24 to 3.26 provide a comparison of the junction performance at Sites 4, 5 and 6 between the Do Nothing and Do Something scenarios for the 2036 PM peak. Figure 3.24 shows that the proposed hamburger layout with traffic signals at Site 4 (Churchgate Roundabout) is operating within capacity.

Similar to the AM peak results, the model indicates that Site 6 remains oversaturated and the proposed new junction at the Harlow East Development (Loading point 4) will cause significant delays to eastbound traffic in the PM peak. More detailed assessment and further improvements to reduce congestion at these junctions need to be considered as part of any planning application specific to the Harlow East Development.

**Figure 3.24 : Churchgate Roundabout (Site 4) – 2036 PM Peak Do Nothing vs Do Something**

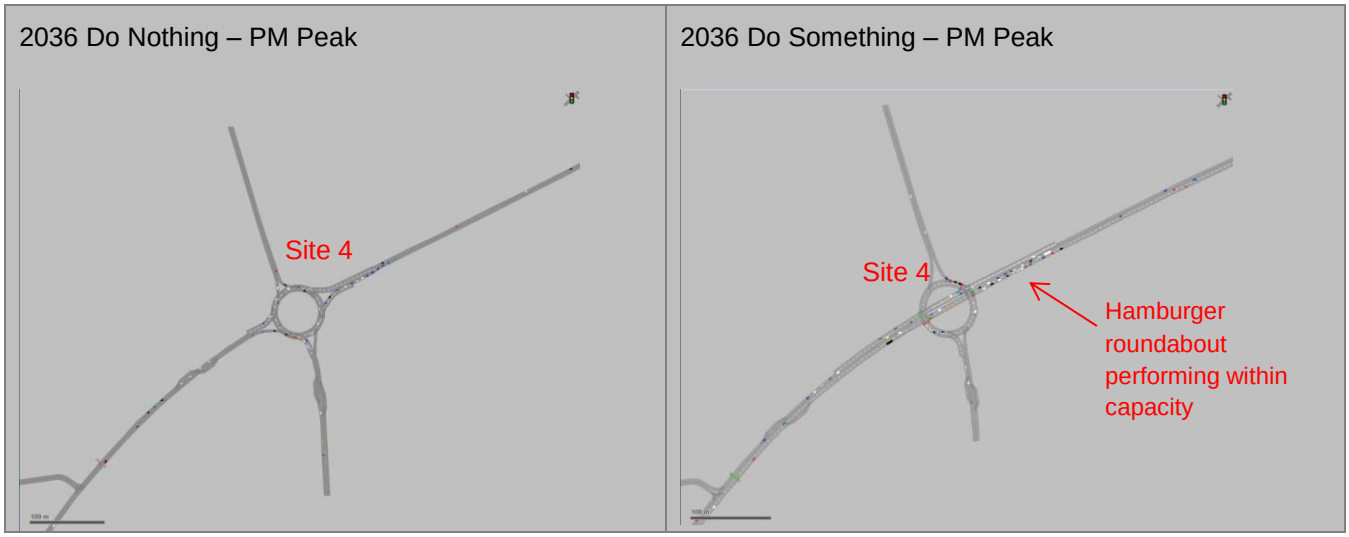



**Figure 3.25 : London Road Roundabout (Site 5) – 2036 PM Peak Do Nothing vs Do Something**

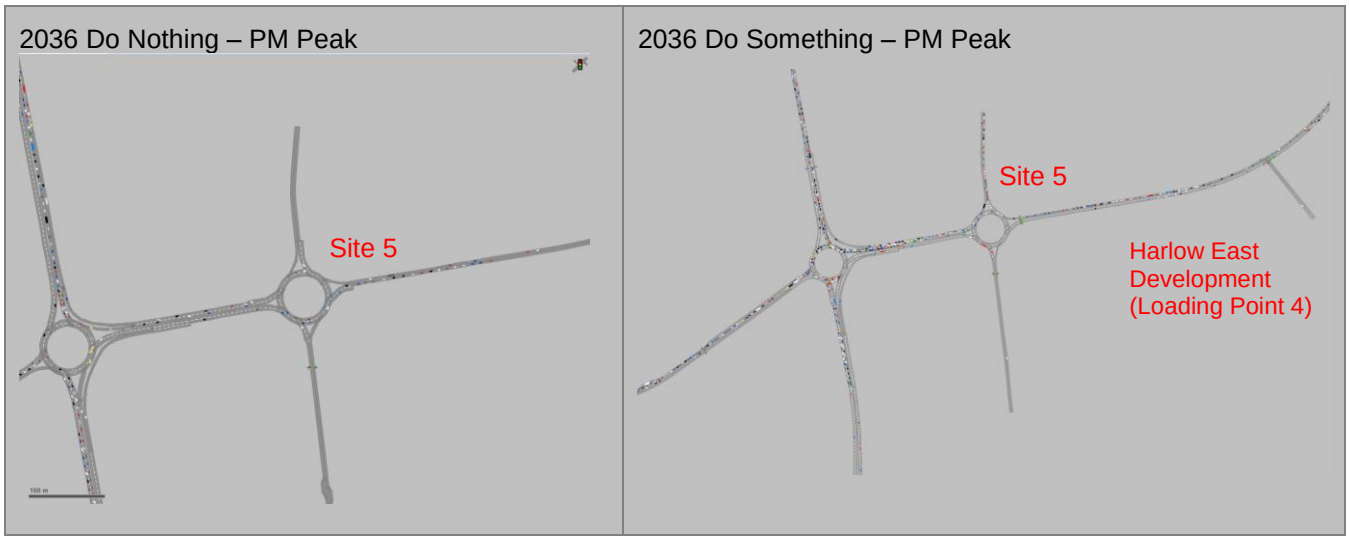
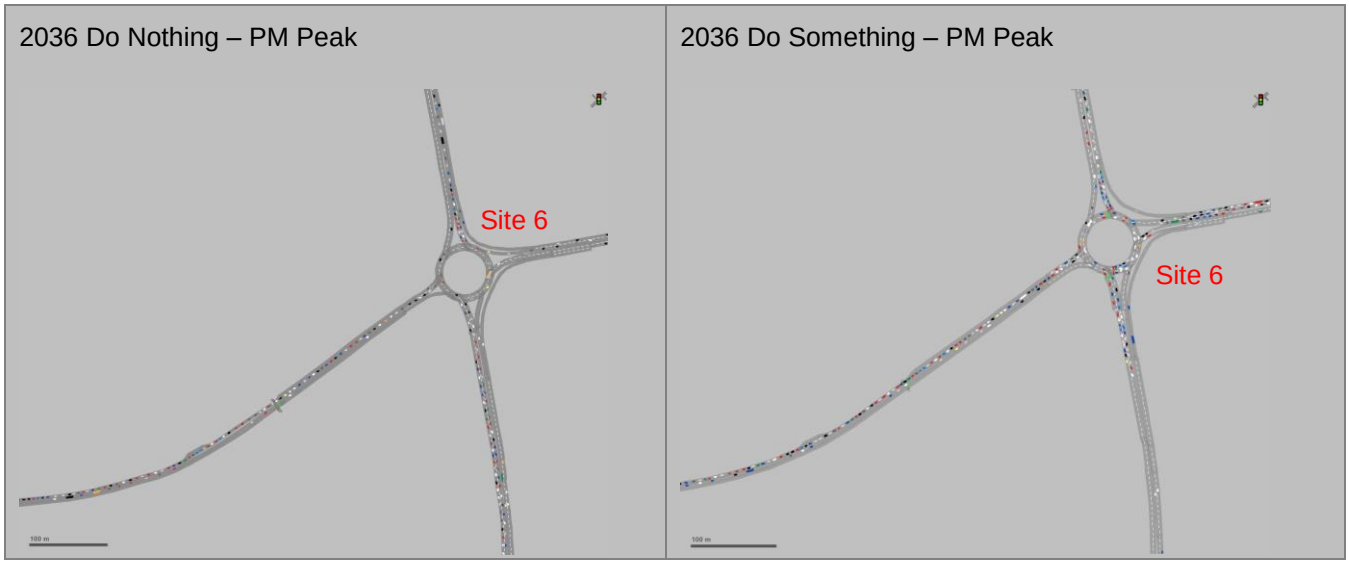



**Figure 3.26 : A414 / B183 First Avenue Roundabout (Site 6) – 2036 PM Peak Do Nothing vs Do Something**



## 3.3 Operational Analysis - Network Journey Times

In order to assess the network and junction performance in VISSIM, journey time information has been extracted from the models. These are provided in Appendix A.

Each model was run for five seeds and the output data collected for journey times along the A414 and B183 corridors

Running the model with different seeds is required to test the sensitivity of the models towards daily flow fluctuations. The results presented in Appendix A are the average of the five seeds model runs.

# 4. Considerations for the next design stage

Based on the junction and network assessment in Chapters 2 and 3, some potential further network improvements have been identified that could possibly improve junction capacities and overall network performance.

The improvement measures to be considered in the next design stage at each site are listed in Table 4.1 below:

**Table 4.1 : Potential Improvements to be considered at each site in the next design stage**

| Site | Potential Improvements to be considered in the next design stage |
|---|---|
| 1 | N/A (Proposed junction layout is fit-for-purpose in the long term) |
| 2 | N/A (Proposed junction layout is fit-for-purpose in the long term) |
| 4 | N/A (Proposed junction layout is fit-for-purpose in the long term) |
| 5 | Consider an additional lane for eastbound traffic between London Road and new signalised T-junction at the Harlow East Development (Loading point 4)<br><br>Consider local widening and introduction of traffic signals at the roundabout |
| 6 | Consider removing eastbound bus lane on First Avenue<br><br>Further widening of the roundabout to provide more storage space for traffic queueing at the internal stop lines on the gyratory |

# Appendix A. VISSIM Network Journey Times