Princes Risborough

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Princes Risborough Relief Road Additional Modelling
2 August 2022

Princes Risborough

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1. Introduction

1.1 Preamble

Jacobs is framework consultant to the Transport for Buckinghamshire Alliance (TfB) between Ringway Jacobs and Buckinghamshire Council (BC), and were appointed to test new transport modelling scenarios as part of evidence for the Transport Assessment of the new Relief Road stage 1 of works at Princes Risborough, being undertaken by Stantec.

1.2 Background and scope of study

The Masterplan for Princes Risborough includes new housing and employment development to the south west of Princes Risborough, between Lower Icknield Way (B4009) and the A4010. Previous studies, including work undertaken by Jacobs, have demonstrated that a new road is required to facilitate the development. Both the masterplan and infrastructure phasing require the development and road scheme to be split into phases. The masterplan was split into seven development parcels and the road split into three sections.

Jacobs has undertaken four previous studies in relation to the Princes Risborough strategy which included testing several scenarios to understand the impact of the different infrastructure phasing and developments.

In 2020, Stantec, on behalf of BC, undertook a Transport Assessment to evaluate the impact of the first section of the relief road between Picts Lane and north of the Summerleys Road bridge. The alignment of this section was designed by Stantec and Jacobs updated the model network to test the impacts of the relief road in three new scenarios known as DS Stantec 1, Stantec 2 and Stantec 3.

BC has recently (July 2022) requested Jacobs to undertake similar modelling to test new transport modelling scenarios for current applications as part of evidence for the Transport Assessment of the new Relief Road stage 1 of works at Princes Risborough, being undertaken by Stantec. The new scenarios are known as DS Stantec 4 and Stantec 5.

2. Modelling methodology, results and analysis

2.1 Overview

The modelling platform used for the assessment is the existing VISUM Model used in previous assessments, which has a 2013 base year and 2033 forecast year. The suitability of this model to be used as part of the Transport Assessment was confirmed by Stantec after carrying out a comparison between the VISUM Base year model outputs and the observed data used to validate and calibrate the model in 2013 against current observed traffic data collated in 2020.

This chapter provides a summary of the development of the modelling scenarios, the outputs and analysis thereon. Each scenario is considered in turn and includes description of the network and demand changes applied to existing model forecasts in order to develop the new scenarios and a review of any significant reassignment. Additionally, data and model outputs from the scenarios developed in this commission and DM scenario have been extracted directly from the model and shared with Stantec and BC as part of separated packages of data for each scenario produced under this commission. These packages of data have included:

- Turning flows for junctions within the model
- Link flows from key locations
- DoS at signals under Summerleys road bridge
- Forecast journey times on A4010 North Bound (NB) and South Bound (SB)
- Forecast queuing

2.2 Strategic modelling methodology

Work for the Princes Risborough Town Plan included the creation of 2033 models for do minimum and do something scenarios. All new developments in the study area were created as new zones independent of the existing developments in Princes Risborough. To create intermediate development and infrastructure scenarios for this study, some of the existing 2033 do something scenarios have been modified. Previous reports provide additional detail on the development of the strategic model (Preliminary Phasing Strategy Modelling (2017)).

2.3 Do Something scenarios developed

Two additional scenarios have been considered in this modelling to build on the knowledge gained from previous studies and to test the impact of the latest relief road General Arrangement designed by Stantec (included in Appendix A). These have been designed as scenarios DS Stantec 4 and Stantec 5. These are summarised in Table 2.1 together with the previous DS Stantec 1, Stantec 2 and Stantec 3. As with previous modelling, a single future year of 2033 was modelled.

Table 2.1: 2033 infrastructure and development scenarios considered in this report

Scenario	Status	Infrastructure	Development
DS Stantec 1	Completed in 2020	As 2033 Do Minimum, with addition of relief road section 1, as latest GA drawing (included in Appendix A).	Same as 2033 Do Minimum.

Scenario	Status	Infrastructure	Development
DS Stantec 2	Completed in 2020	Same as DS Stantec 1.	Same as DS Stantec 1 plus parcel 4 within the Princes Risborough Masterplan development (412 homes).
DS Stantec 3	Completed in 2020	As DS Stantec 1 plus full relief road, and development access points for new development.	As previous modified Scenario 8 plus Land at Princes Risborough Station (essentially, this includes all 7 parcels of the Princes Risborough Masterplan, Princes Estate Expansion, Poppy Road and the B4009 Hypnos relocation site).
DS Stantec 4	Completed in 2022	As Stantec 2 plus access for Masterplan development.	As DS Stantec 2, with new 1100 home masterplan development.
DS Stantec 5	Completed in 2022	As DS Stantec 4 with no connection between Summerleys Road and relief road.	Same as DS Stantec 4.

2.3.1 Do Something Stantec 1

Network changes

The Do Something Stantec 1 scenario serves to simulate a proxy for a year of opening assessment and is modified based upon the network in the Do Minimum Scenario (2033). The scenario has been coded in line with the latest General Arrangement drawing of the Princes Risborough Relief Road (PRRR). The inclusion of the latest design for Phase 1 of the relief road is the only network improvement, with none of the strategic developments included.

Based on the General Arrangement drawing, the following network changes have been made from the Do Minimum scenario (illustrated in Figure 1):

- Picts Lane / Shootacre Lane – Two-Way Yield junction coding has been simplified
- Proposed 4-way signalised junction with Southern Link Road (new relief road), coded with two pocket lanes SB and NB for right turn, 24 m long each.
- Summerleys Road bridge replaced with a proposed new bridge, with no traffic lights underneath.
- Summerleys Road / New relief road junction – proposed two-way yield junction with 30 m long pocket lane SB for right turn

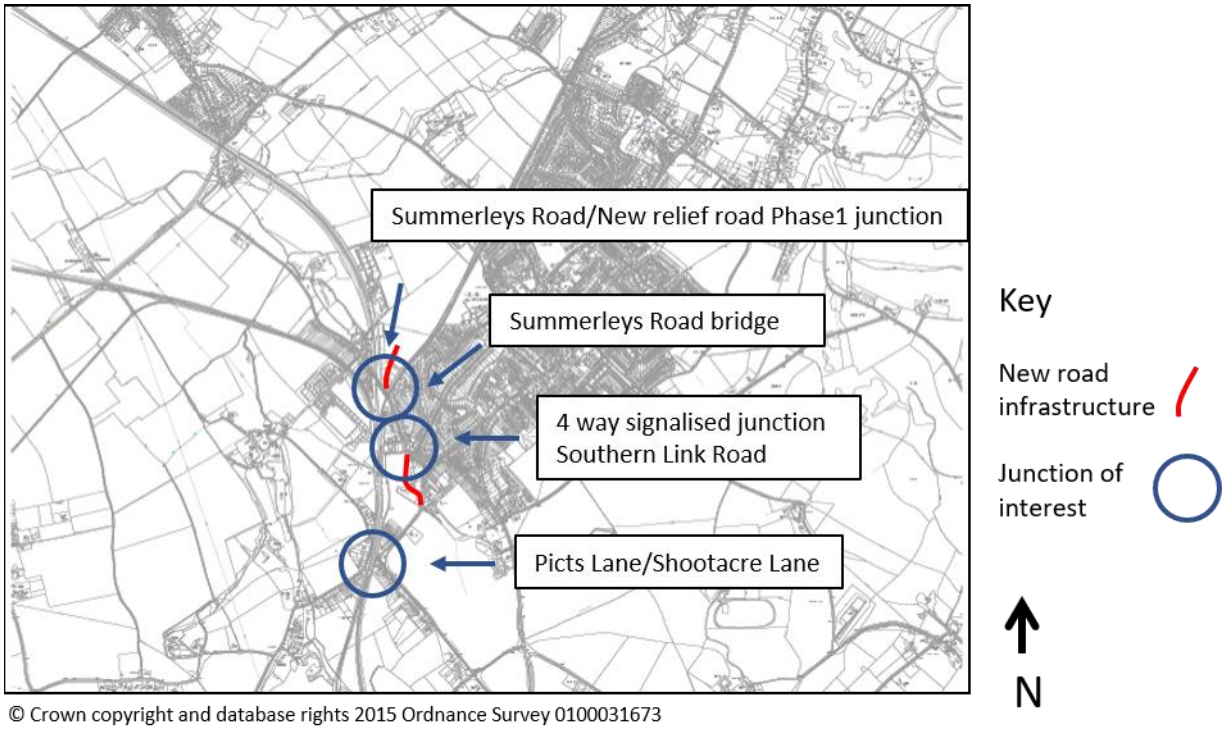

Figure 1. DS Stantec 1 configuration

Demand changes

Stantec scenario 1 does not include any changes to the trip matrices, therefore the demand is the same as the Do Minimum Scenario (2033).

Analysis of traffic reassignment

The following figures show the flow difference between the Do Minimum and the Stantec scenario 1 models. Roads labelled in red depict areas where the flow of traffic is greater in the Stantec 1 model than the Do Minimum model, and roads labelled in green a decrease.

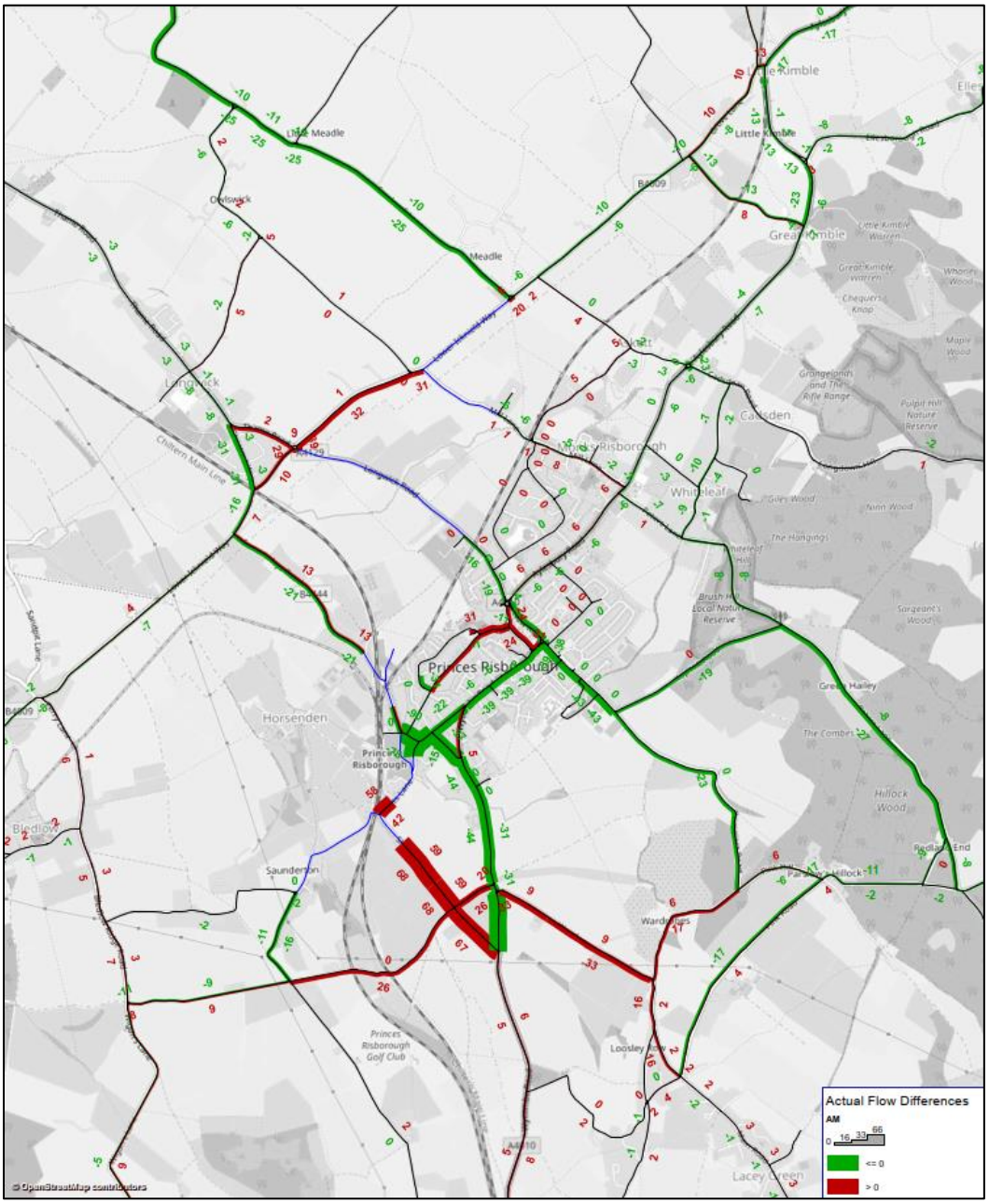

Figure 2. Actual flow differences between DM and Stantec 1 - AM peak

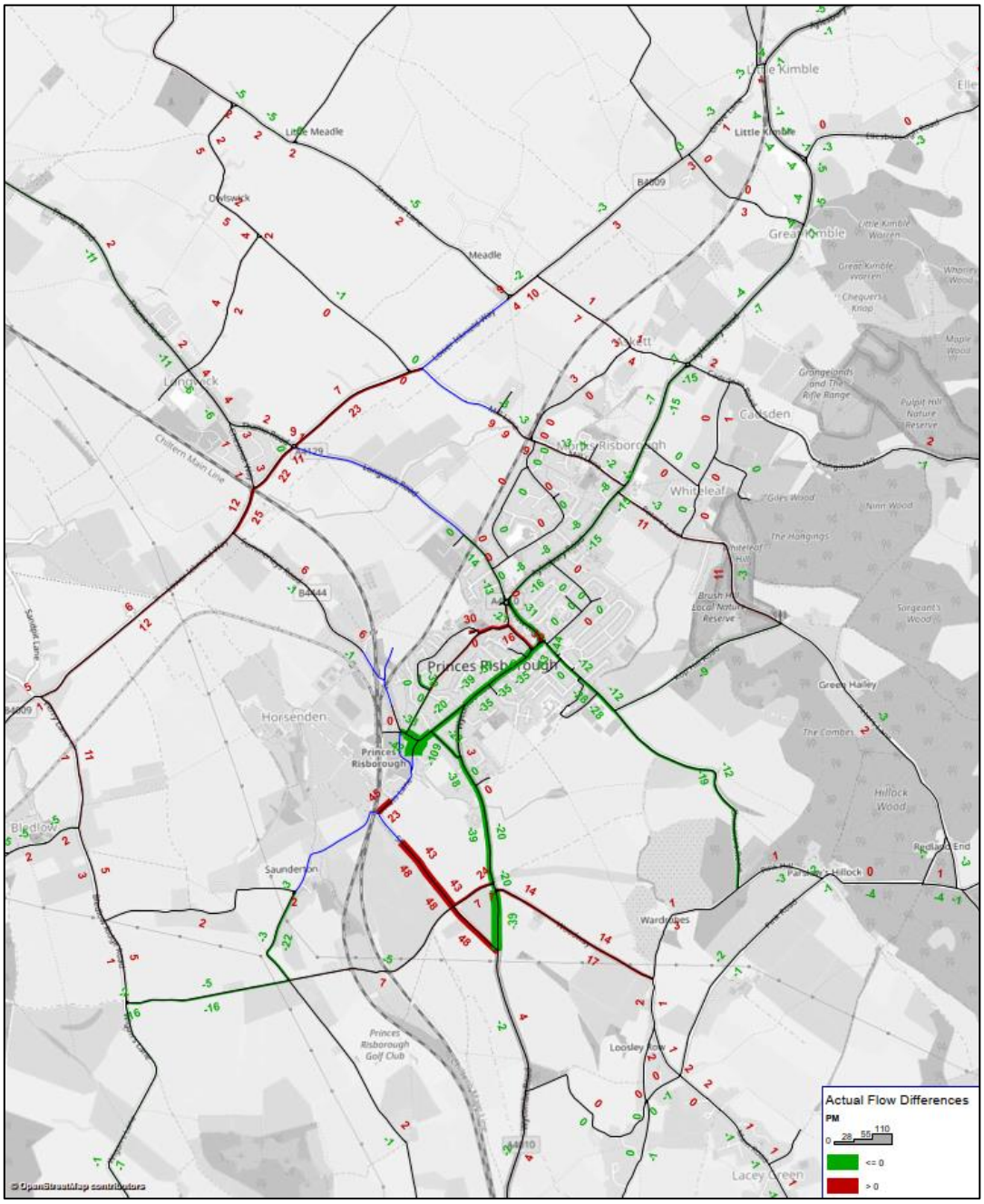

Figure 3. Actual flow differences between DM and Stantec 1 - PM peak

In the images above, links shown in blue denote points where the comparison network doesn't have an identical link in the reference network (due to new links in the comparison network) thus the model does not show a flow difference as there are no flows in the comparison network.

In both the AM and the PM models there are increases in traffic flow on Picts Lane and Shootacre Lane, this is a result of the junction improvements at the Picts Lane/Shootacre Lane intersection and the addition of the Southern Link Road. Subsequently, there is a reduction in traffic flow on the adjacent A4010 as some of the traffic has been reassigned onto the link road.

The inclusion of the Southern Link Road along with the addition of the Summerleys Road bridge has also instigated an increase in traffic flow on Summerleys Road.

2.3.2 Do something Stantec 2

Network changes

Do Something Stantec 2 Scenario is based on Stantec1, but with updated trip matrices, to reflect the addition of the parcel 4 development of 412 dwellings from the Princes Risborough Masterplan. The network is therefore the same as the Stantec 1 scenario, with the exception of access points for the new development. The development is illustrated below, along with the other changes introduced in Stantec 1.

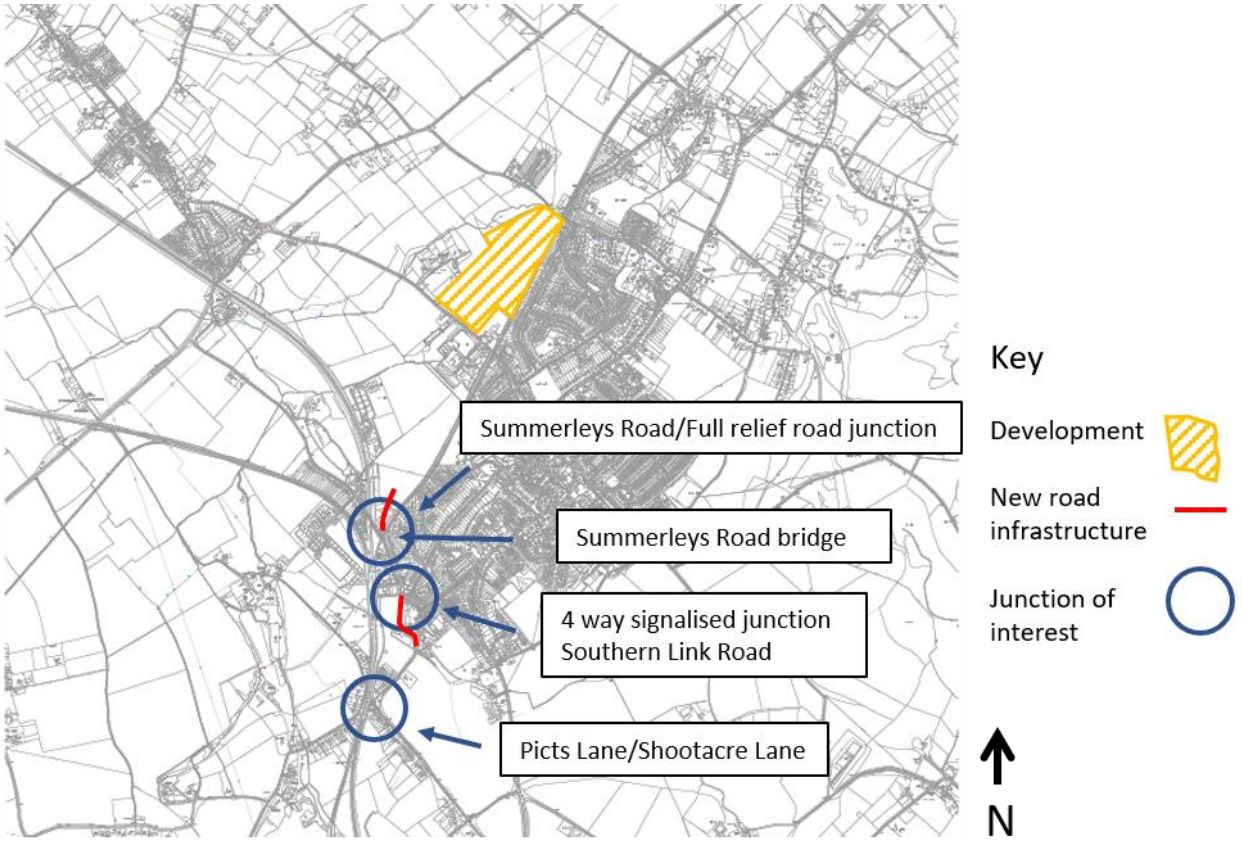

Figure 4. Scenario DS Stantec 2 configuration

Demand changes

The Stantec scenario 2 trip matrices were produced using the existing scenario 1 matrices with the addition of the trip generation for the 412 new dwellings. The demand model was rerun with this development added. The following tables show the trip ends for the new development; trip ends for all other zones were largely unchanged.

Table 2.2: Expansion area 4 development AM trip ends

Development	Car Origin	Car Destination	LGV Origin	LGV Destination	HGV Origin	HGV Destination
Parcel 4	161	63	3	5	2	3

Table 2.3: Expansion area 4 development PM trip ends

Development	Car Origin	Car Destination	LGV Origin	LGV Destination	HGV Origin	HGV Destination
Parcel 4	86	170	0	0	0	0

Analysis of traffic reassignment

The following figures display the flow difference between the Stantec scenario 2 models and the Stantec scenario 1 models. Roads labelled in red denote areas in which the traffic flow in Stantec 2 is greater than the traffic flow in Stantec 1.

Figure 5. Stantec scenario 1 from Stantec scenario 2 AM actual flow difference

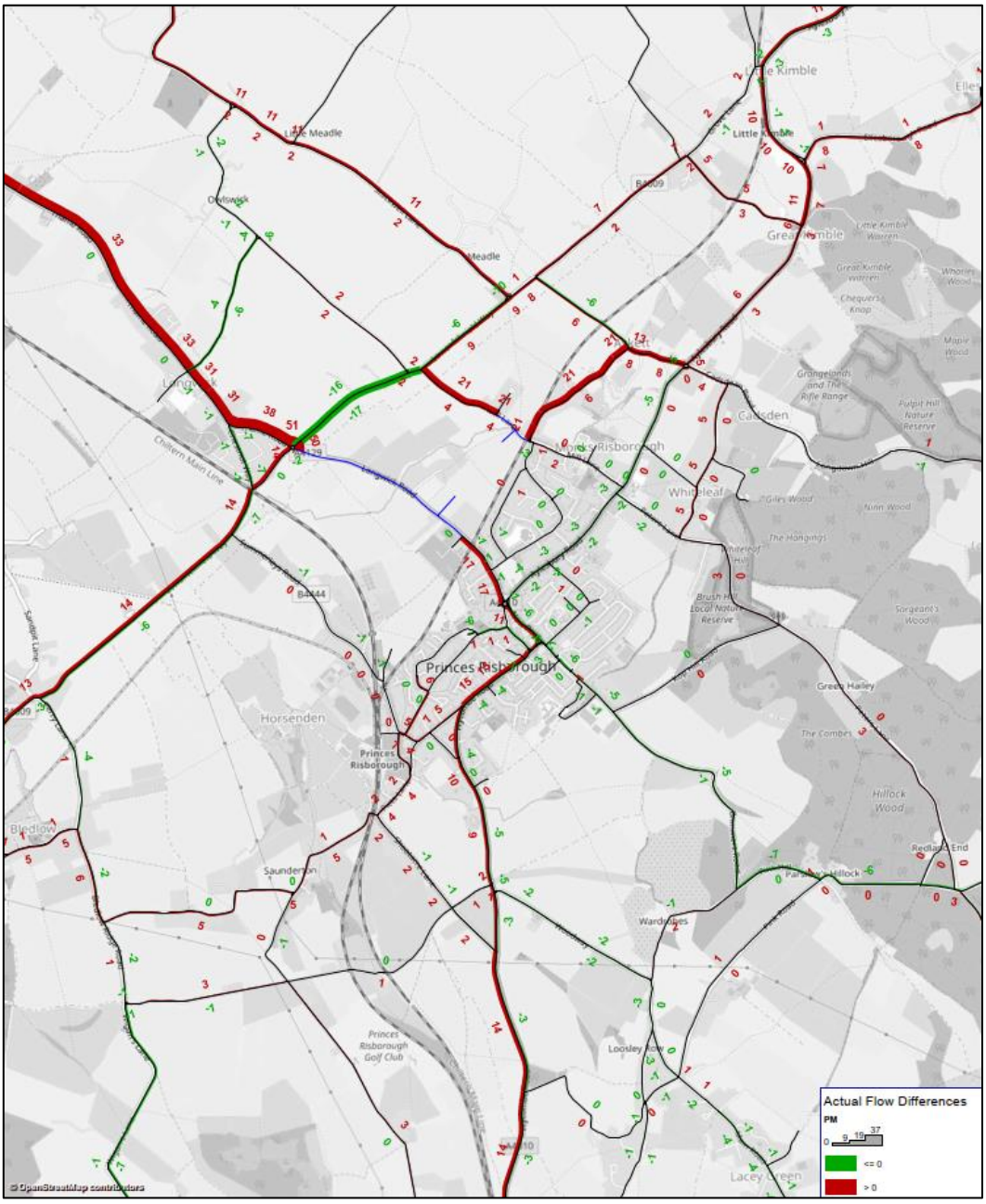

Figure 6. Stantec scenario 1 from Stantec scenario 2 PM actual flow difference

There are no network differences between the scenario 1 and 2 models aside from the addition of the Expansion area 4 development, therefore the only differences in the traffic flows are a result of the addition of the new development trips. The flow differences in the figures are consistent with just the addition of trips generated by the new development, and are relatively small. The number of vehicles using the phase 1 relief road in this scenario is not significantly different from that in scenario 1. The largest change in the two-way flows on the phase 1 relief road is around 12 in the AM peak and 6 in the PM peak.

2.3.3 Do Something Stantec 3

Network changes

Do Something Stantec 3 scenario is coded in line of General Arrangements drawing of the full PRRR and simulate the longer-term growth. The modelled is based on the existing Modified Scenario 8 (created as part of the Princes Risborough Phasing Tests 2019) and includes the full relief road as well as a new link between

A4010 and Picts Lane (known as Culverton Link). The network also includes the addition of development at Land at Princes Risborough Station, which is facilitated by adding a centroid connector to the end of the existing Station Approach link.

The same list of network changes in Stantec 1 to the southern section of the relief road have been made to this scenario, with the addition of Culverton Link and the remaining sections of the relief road. Figure 7 illustrates the infrastructure in this scenario.

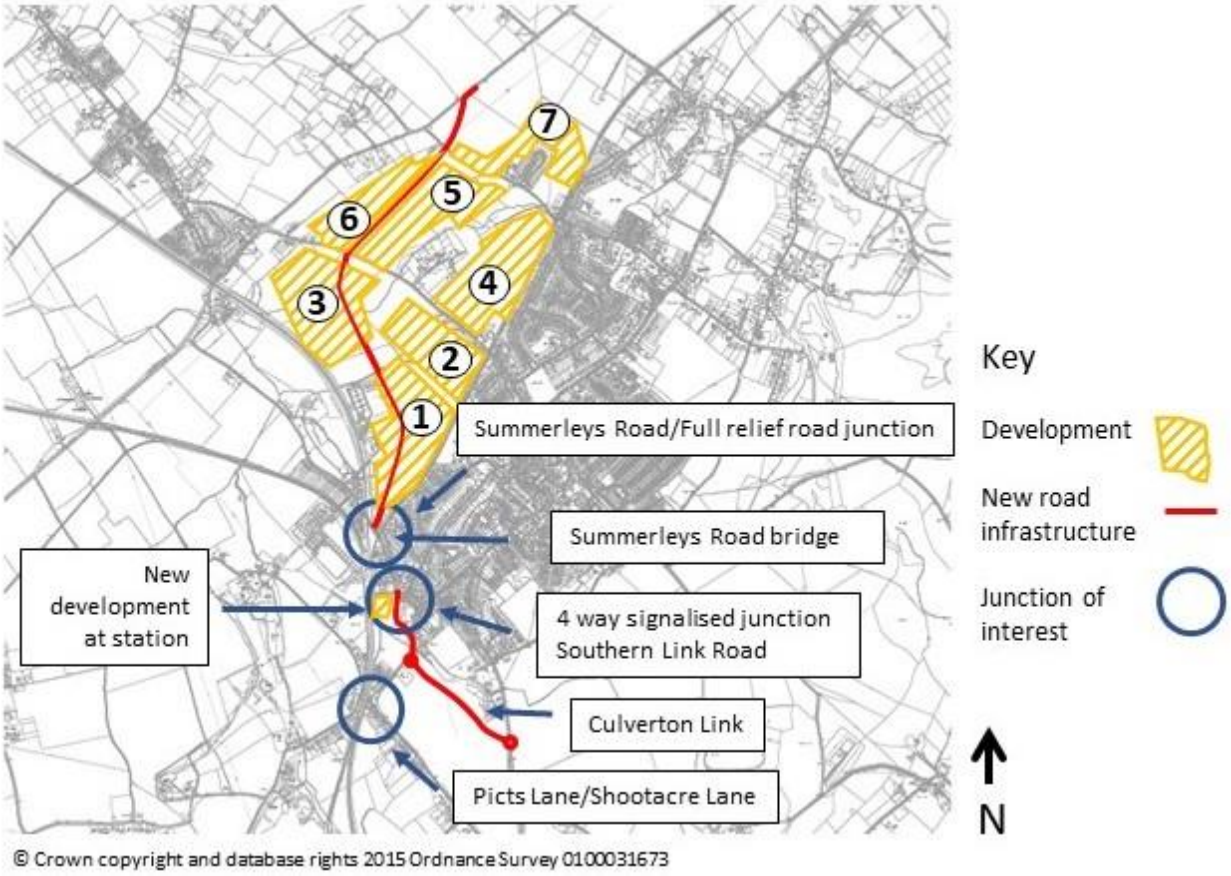

Figure 7. Scenario DS Stantec 3 configuration

Demand changes

The Stantec scenario 3 trip matrices were produced using the existing Modified scenario 8 trip matrices with the addition of the new development at Princes Risborough Station. They therefore include the addition of the expansion area developments.

Trip generation for these expansion areas have been developed using trip rates obtained from Princes Risborough Transport Assessment and from TRICS. The applied trip rates are detailed in the following tables.

Table 2.4: TRICS trip rates

Land Use	Unit	Quantity	Origin			Destination			Two way		
			AM	PM	12H	AM	PM	12H	AM	PM	12H
TRICS Dwellings rate data	Dwellings	1	0.401	0.208	2.489	0.173	0.412	2.312	0.574	0.62	4.801
TRICS Office rate data	sqm	100	0.363	2.584	10.282	2.946	0.253	10.17	3.309	2.837	20.452
TRICS Schools rate data	Pupils	1	0.26	0.072	0.855	0.308	0.014	0.855	0.568	0.086	1.709
TRICS B2 rate data	sqm	100	0.271	0.746	4.001	0.407	0	4.135	0.678	0.746	8.136

Table 2.5: Trip rates from Transport Assessment

Land Use	Unit	Quantity	Origin			Destination			Two way		
			AM	PM	12H	AM	PM	12H	AM	PM	12H
Thame Road (OS parcels 6232 and 7428)	Dwellings	1	0.33	0.17	2.2	0.12	0.32	2.16	0.45	0.51	4.36
Thame Road (Rose Farm)	Dwellings	1	0.405	0.163	2.361	0.149	0.333	2.296	0.554	0.496	4.657

The total trip generation is therefore as summarised below:

Table 2.6. Stantec 3 new development trip generation

Development	Dwellings	Employment B1 (m^2)	Employment B2 (m^2)	Schools (pupils)	AM Peak O	AM Peak D	PM Peak O	PM Peak D
Expansion Block 1	370	0	0	480	273	212	112	159
Expansion Block 2	380	0	0	0	152	66	79	157
Expansion Block 3	450	0	0	0	180	78	94	185

Development	Dwellings	Employment B1 (m^2)	Employment B2 (m^2)	Schools (pupils)	AM Peak O	AM Peak D	PM Peak O	PM Peak D
Expansion Block 4	470	0	0	0	188	81	98	194
Expansion Block 5	400	0	0	240	223	143	100	168
Expansion Block 6	270	0	0	0	108	47	56	111
Expansion Block 7	160	0	0	0	64	28	33	66
Expansion Block 5 Employment	0	1000	0	0	4	29	26	3
Princes Estate Expansion	0	10000	12000	0	69	343	348	25
Land off Poppy Road	60	0	0	0	24	10	12	25
Thame Road (OS parcels 6232 and 7428)	43	0	0	0	14	5	7	14

In addition, the development at land at Princes Risborough Station consists of 45 new dwellings and 300 - 400 sqm of convenience retail space. However, it was assumed that only the 45 new dwellings would generate new trips as the convenience retail land uses were assumed to all be pass-by trips already in the model.

Table 2.7: Princes Risborough Station development AM trip ends

Development	**Car Origin**	**Car Destination**	**LGV Origin**	**LGV Destination**	**HGV Origin**	**HGV Destination**
Land at Princes Risborough Station	18	7	0	1	0	0

Table 2.8: Princes Risborough Station development PM trip ends

Development	**Car Origin**	**Car Destination**	**LGV Origin**	**LGV Destination**	**HGV Origin**	**HGV Destination**
Land at Princes Risborough Station	**9**	**19**	**0**	**0**	**0**	**0**

A nearby donor zone with similar land use properties was used to calculate the origin and destination proportions of trips travelling from and to the new zone. The matrices were subsequently re-furnessed before they were imported into the Stantec scenario 3 model.

Analysis of traffic reassignment

The figures below show the actual flow difference between the Do Minimum scenario and the Stantec scenario 3 models. Roads labelled in red denote areas in which the traffic flow in Stantec 3 is greater than the traffic flow in Do Minimum (and green a decrease).

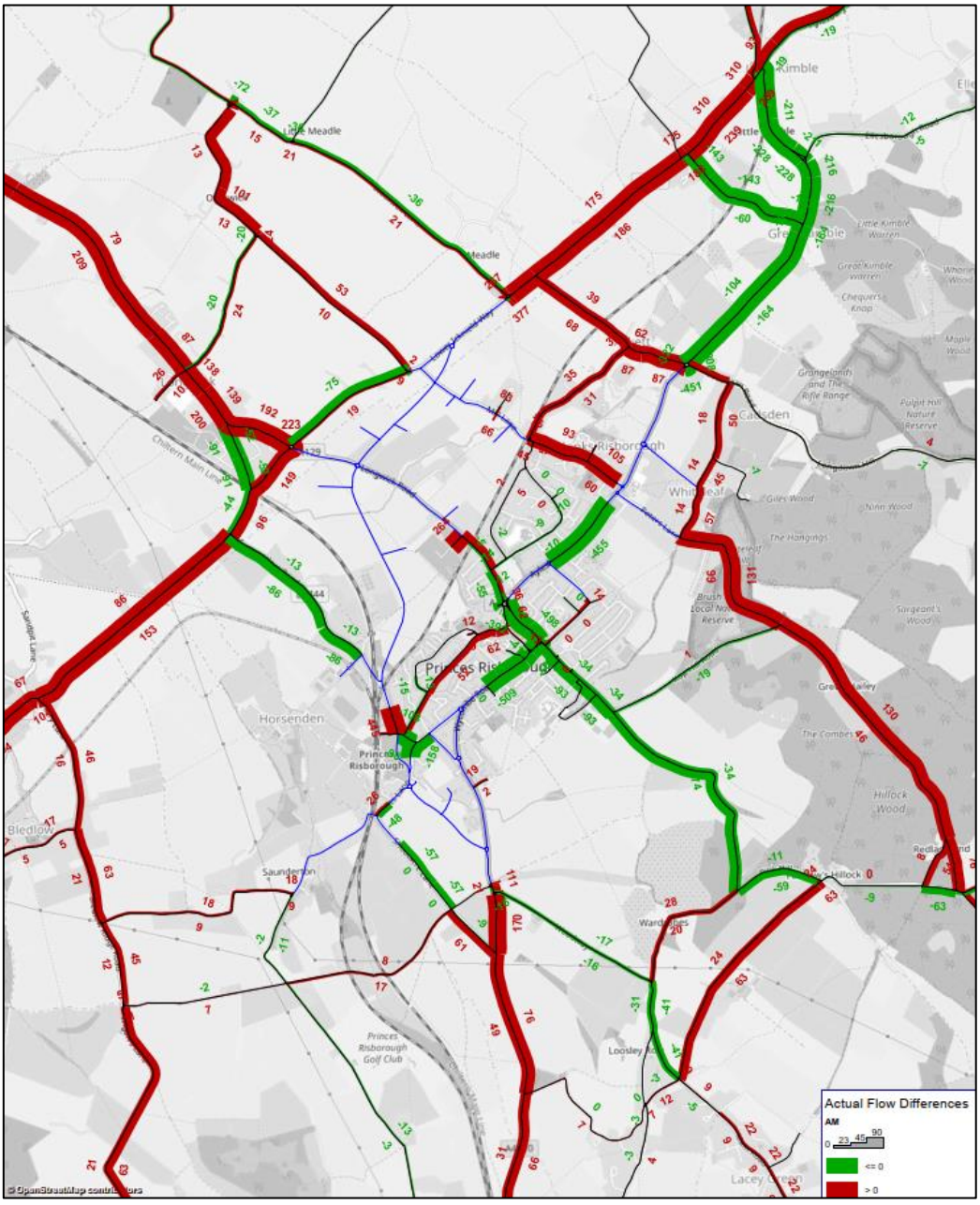

Figure 8. Actual flow differences between DM and Stantec 3 - AM peak

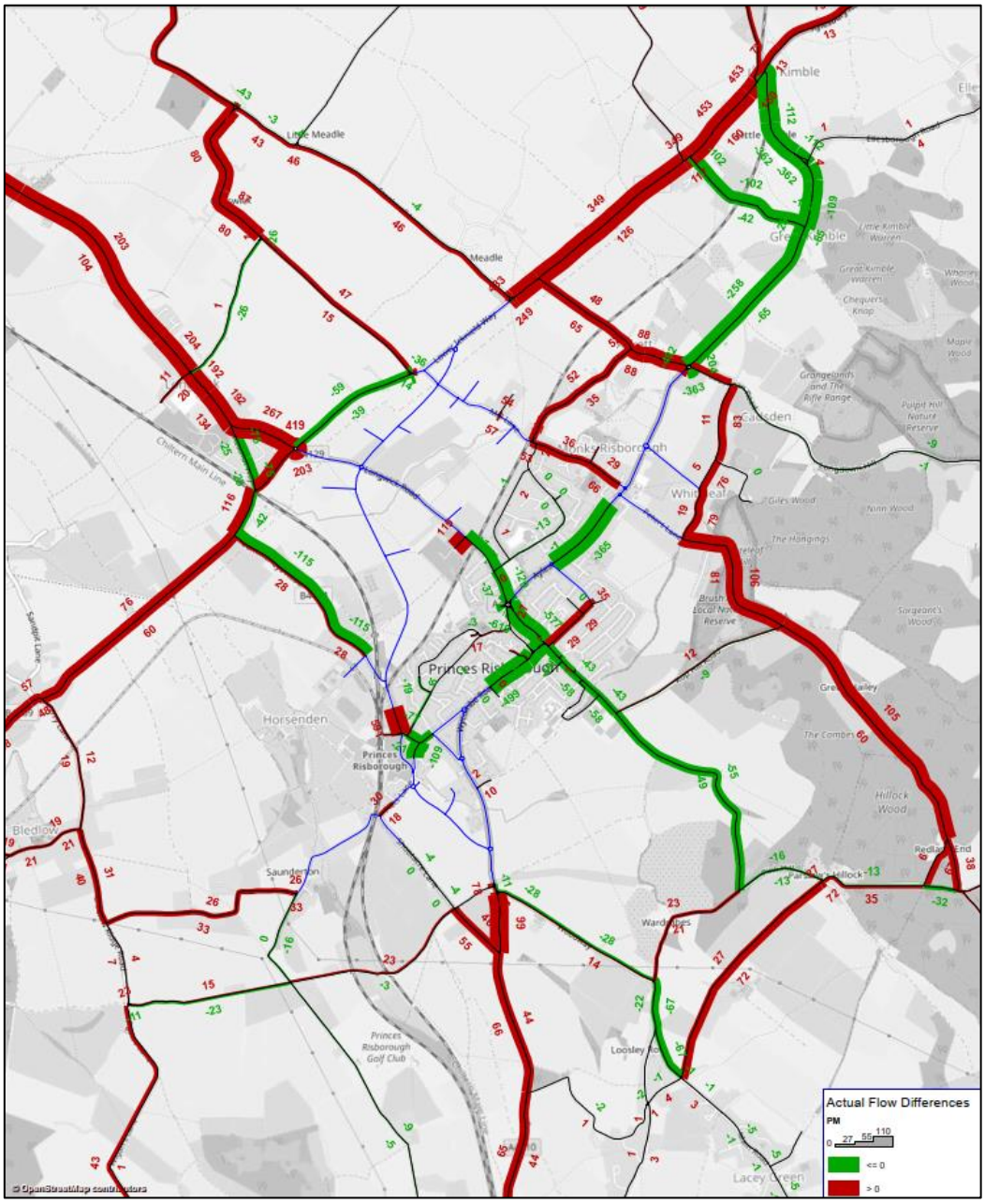

Figure 9: Actual flow differences between DM and Stantec 3 - PM peak

The flow difference figures show that the A4010 will experiment a significant reduction in traffic, with some of the links showing a reduction as great as 500 vehicles in a single direction. Summerleys Road is also expected to show a reduction in the number of vehicles in both peak hours, although this flow reduction is slightly different in the AM and PM peak. While the PM peak hour will experiment a substantial decrease in traffic flow of 115 vehicles in the westbound direction, the eastbound traffic will see a minimal increase of 28. This is suggesting the majority of the vehicles heading to Lower Icknield Way from the south-east, would use the new relief road after the railway bridge. This traffic re-assignment is not as great in the AM peak time, although contrary to the evening peak, both directions are expected to experience a traffic decrease.

The figures also show an increase in traffic flow along Lower Icknield Way, as result of vehicles choosing to take the relief road.

2.3.4 Do Something Stantec 4

Network changes

The Do Something Stantec 4 Scenario is based on Stantec 2, but with updated trip matrices, to reflect the addition of 1100 dwellings from the Princes Risborough Masterplan. The network is therefore the same as the Stantec 2 scenario, with the addition of access points for the new developments and it partially includes the relief road. The development traffic is loaded into either the relief road or Longwick Road. Links shown in red below are those added to the network from Stantec 2.

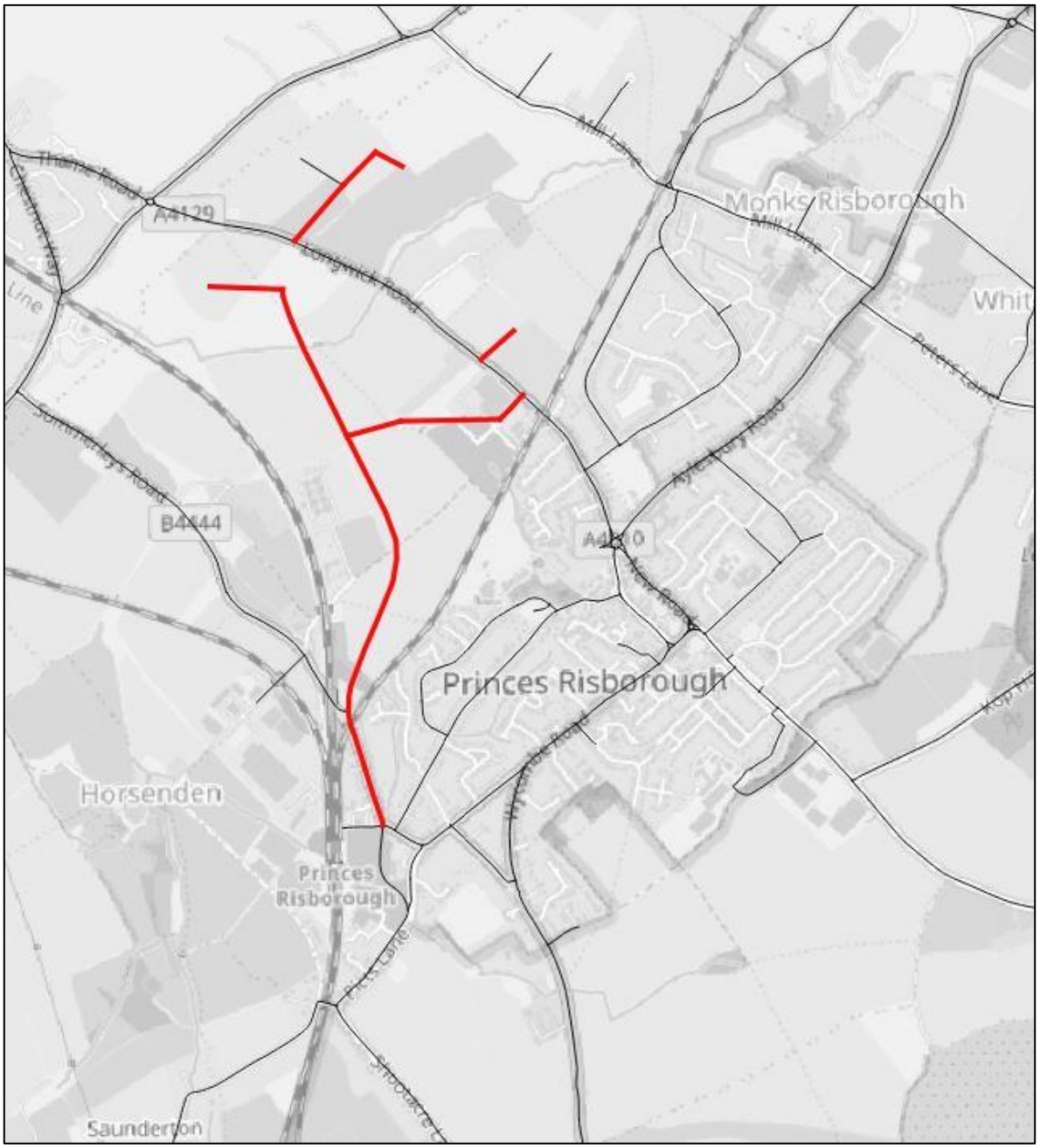

Figure 10. Scenario DS Stantec 4 configuration

Demand changes

The Stantec Scenario 4 demand is similar to the existing Stantec 2 demand with the addition of the new 1100 dwellings masterplan development. The Do Something Stantec 4 trip matrices were based on the existing Do Something Stantec 3 matrices but with updated quantum for each development. The suggested quantum is summarised in Table 2.9.

The trip generation for these expansion areas has been developed using trip rates obtained from TRICS. The same trip rates were also used for DS Stantec 3 scenario. The applied trip rates are detailed in Table 2.4.

The total trip generation is summarised below:

Table 2.9. Stantec 4 new development trip generation

Development	Dwellings	Employment B1 (m^2)	Employment B2 (m^2)	Schools (pupils)	AM Peak O	AM Peak D	PM Peak O	PM Peak D
Expansion Block 1	370	0	0	480	273	212	112	159
Expansion Block 2	190	0	0	0	76	33	40	79
Expansion Block 3	350	0	0	0	140	61	73	144
Expansion Block 4	412 (Bloors)	0	0	0	165	71	86	170
Expansion Block 5	190	0	0	0	106	68	48	80

Analysis of traffic reassignment

The figures below show the actual flow difference between the Do Minimum scenario and the Stantec scenario 4 models. Roads labelled in red denote areas in which the traffic flow in Stantec 4 is greater than the traffic flow in Do Minimum (and green a decrease). Also, links shown in blue denote points where the comparison network doesn't have an identical link in the reference network (due to new links in the comparison network) thus the model does not show a flow difference as there are no flows in the comparison network.

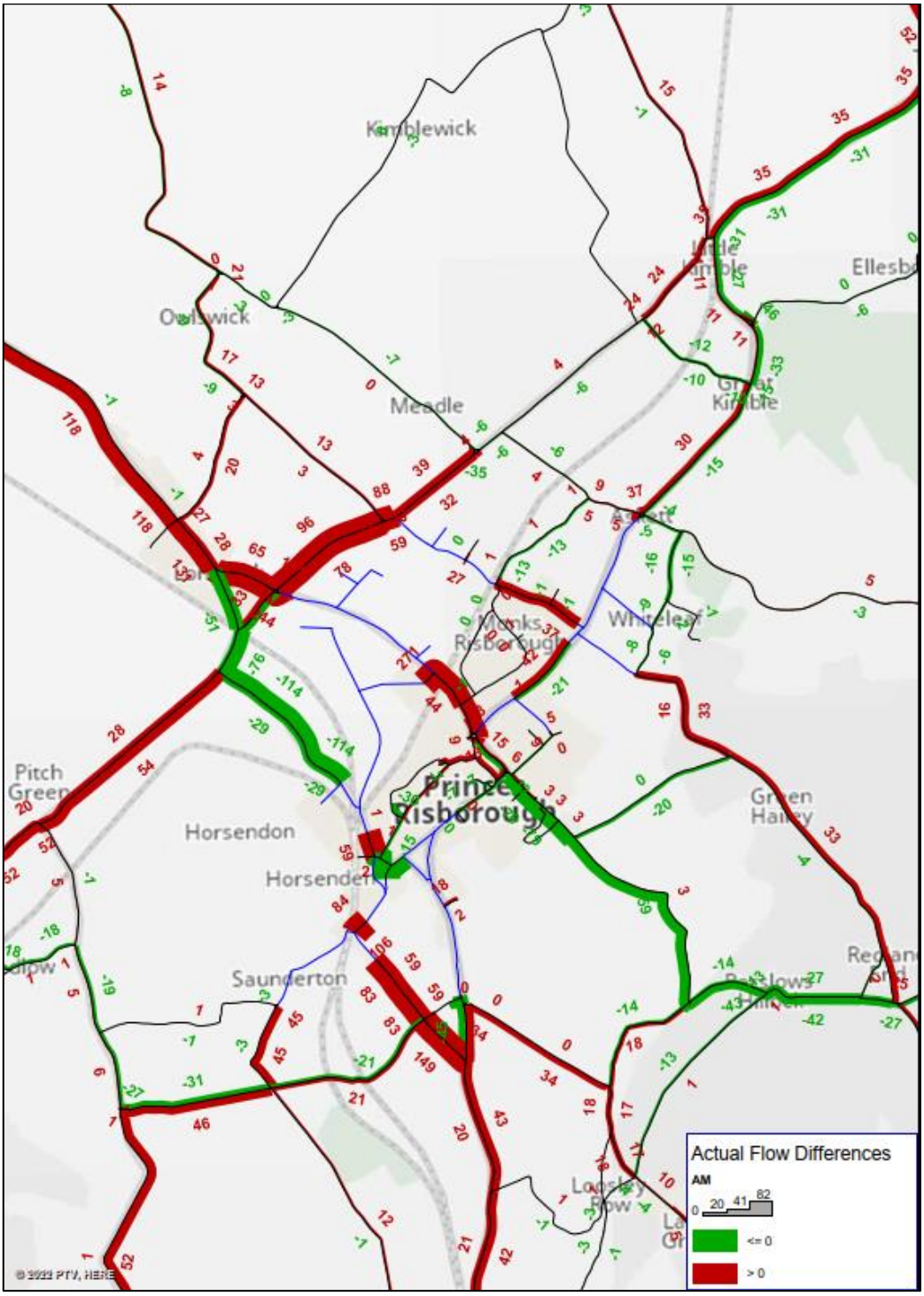

Figure 11. Actual flow differences between DM and Stantec 4 - AM peak

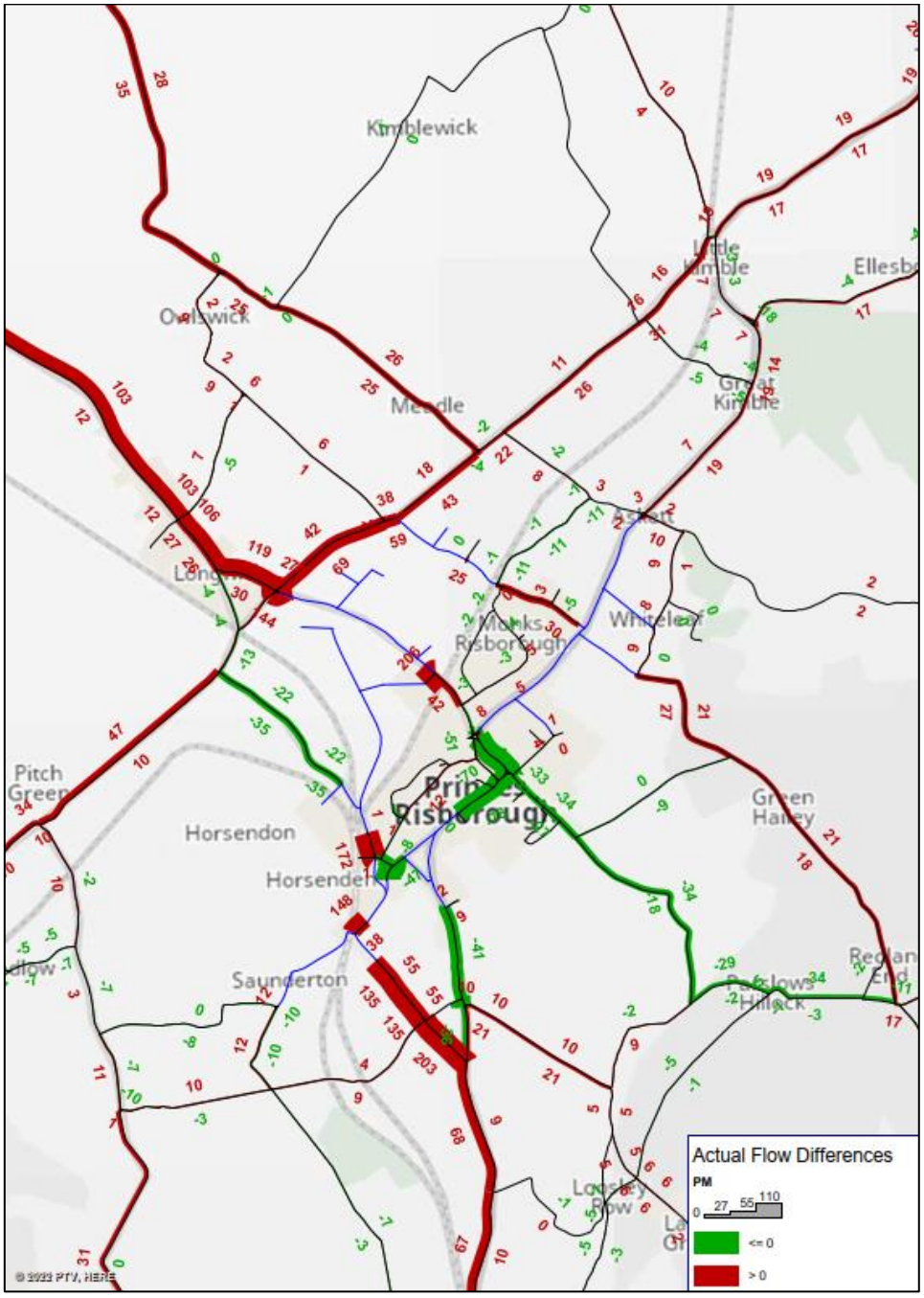

Figure 12. Actual flow differences between DM and Stantec 4 - PM peak

Stantec 4 scenario has an extra 1100 dwellings compared to the DM scenario and this is reflected in the actual flow differences plot where the majority of the network experiences traffic increases in both the AM and the PM peak.

Notably, there are increases in traffic flow on Picts Lane and Shootacre Lane. This is a result of the junction improvements at the Picts Lane/Shootacre Lane intersection and the addition of the Southern Link Road. Subsequently, there is a reduction in traffic flow on the adjacent A4010 as some of the traffic has been reassigned onto the link road. Although the link road is incomplete, a new connection between the link road and Longwick Road, facilitated by the additional masterplan site provides an alternative route between Lower Icknield Way and the A4010. The amount of reassignment is not large, given that the new route is somewhat convoluted, however, its effects are seen in the decrease in traffic flows on Summerleys Road and the A4010 north of Shootacre Lane, from which routes traffic reassigns, and the increase on Shootacre Lane and

southern parts of the relief road. Some of the increases noted on those roads will also be due to the additional trips generated by the development.

2.3.5 Do Something Stantec 5

Network changes

Do Something Stantec 5 Scenario is based on Stantec 4, but it includes a shorter part of the relief road. Compared to DS Stantec 4, DS Stantec 5 does not have the connection between the relief road and Summerley Road.

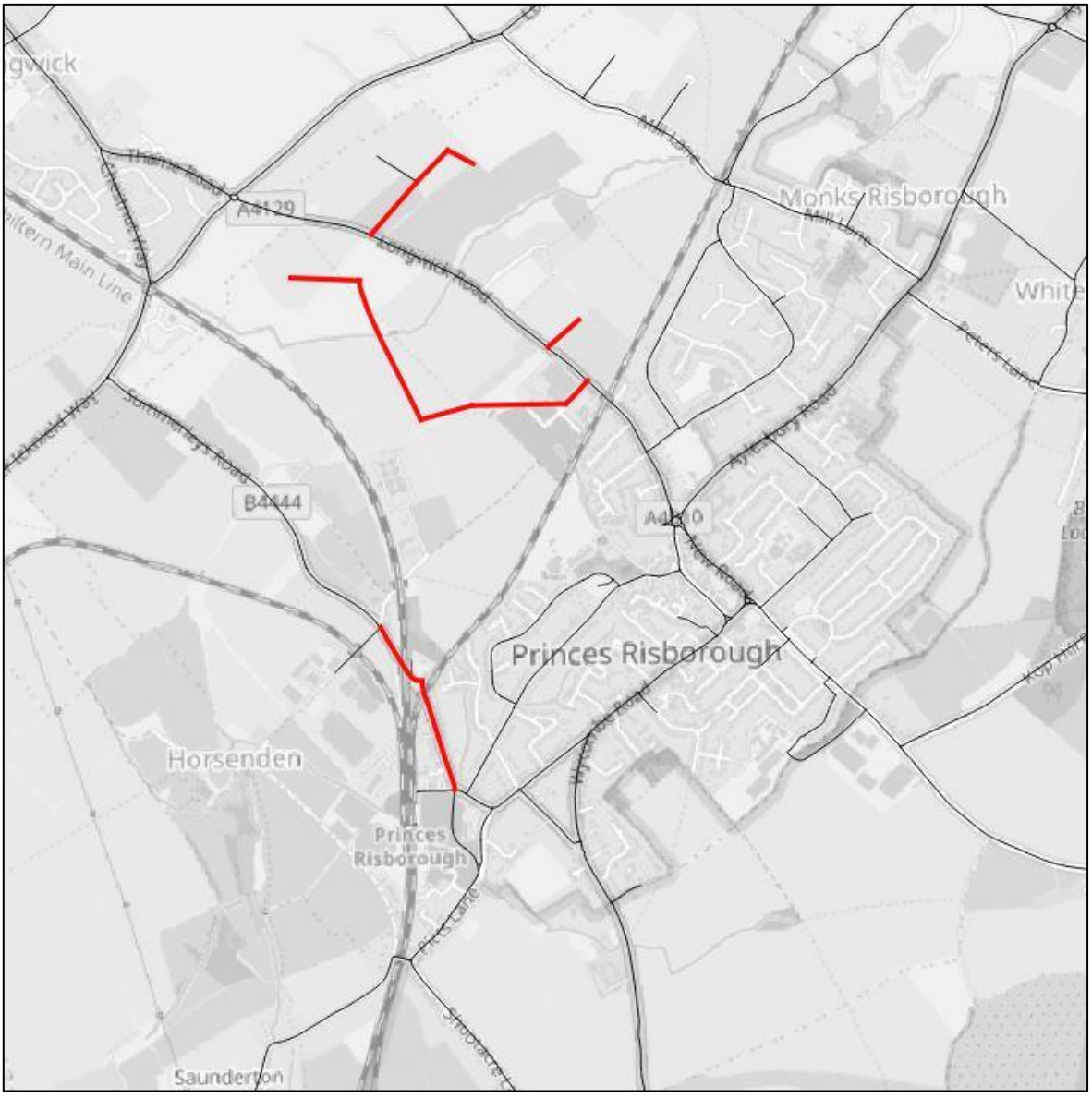

Figure 13. Scenario DS Stantec 5 configuration

Demand changes

The demand of the DS Stantec 5 scenario is identical to the demand of the DS Stantec 4 scenario.

Analysis of traffic reassignment

The figures below show the actual flow difference between the Do Minimum scenario and the Stantec scenario 5 models. Roads labelled in red denote areas in which the traffic flow in Stantec 5 is greater than the traffic flow in Do Minimum (and green a decrease). Also, links shown in blue denote points where the comparison network doesn't have an identical link in the reference network (due to new links in the comparison network) thus the model does not show a flow difference as there are no flows in the comparison network.

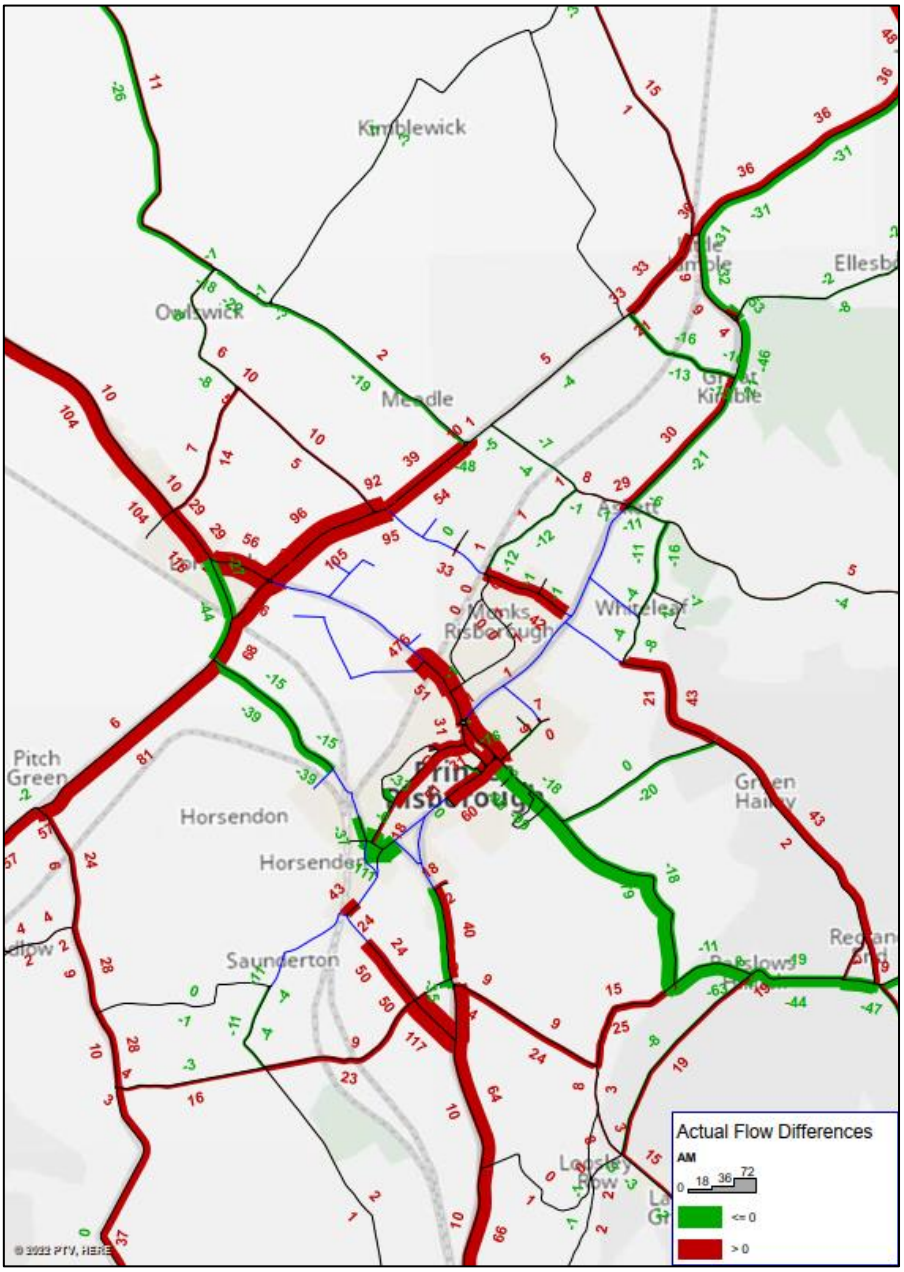

Figure 14. Actual flow differences between DM and Stantec 5 - AM peak

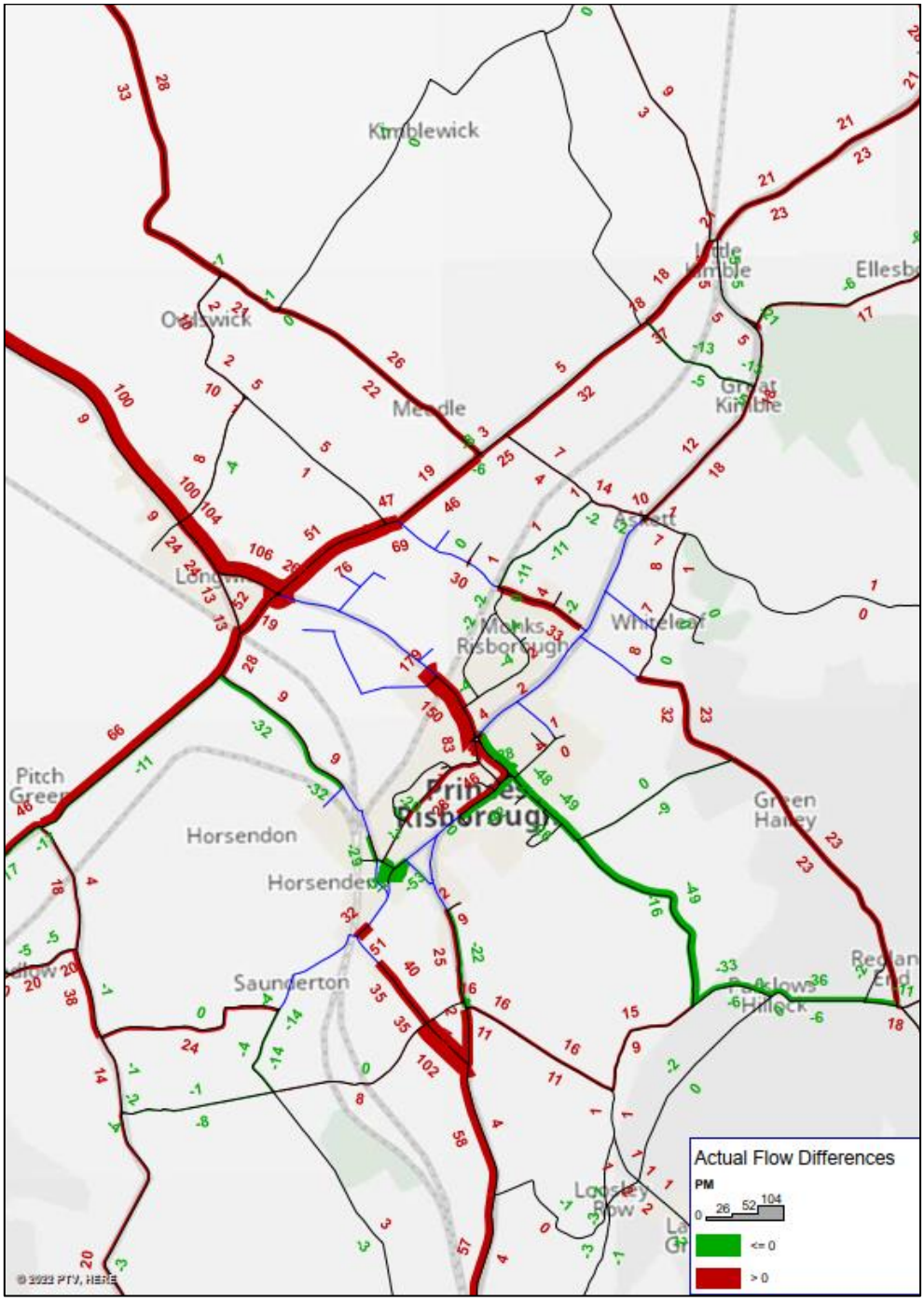

Figure 15. Actual flow differences between DM and Stantec 5 - PM peak

The traffic reassignment in the Stantec 5 scenario in comparison to the Stantec 4 scenario is affected by not having a connection to Summerleys Lane at the southern end of the relief road. This means that the reassignment effects seen in scenario 4, i.e. reassignment of traffic away from Summerleys Road and A4010 on to Shootacre Lane does not happen. It also means that all of the new masterplan development has access via Longwick Road.

Appendix A. General Arrangement Drawing

Latest Southern Princes Risborough Relief Road General Arrangement drawing


EXISTING WATERCOURSE
SUMMERLEYS ROAD (B4444)
5.4m CARRIAGEWAY
2.0m FOOTWAY
3.5m SHARED FOOTWAY / CYCLEWAY
3.50m RIGHT TURN LANE
EXISTING NETWORK RAIL STRUCTURE NAJ2 98 SUMMERLEYS ROAD, B4444 BRIDGE
NORTHMILL
2.0m FOOTWAY
PROPOSED UNCONTROLLED PEDESTRIAN CROSSING
FOOTWAY ALIGNMENT TO DISCOURAGE PEDESTRIANS FROM CROSSING SUMMERLEYS ROAD AT THE WIDEST SECTION OF THE BELLMOUTH
EXISTING SIGNAL CONTROLLED SINGLE LANE NETWORK RAIL STRUCTURE PRA 14 SUMMERLEYS ROAD (B4444) BRIDGE TO BE REPLACE WITH NEW BRIDGE
PROPOSED VERGE. NO FOOTPATH FROM FIRS COURT NORTH UNDER RAILWAY BRIDGE
PROPOSED UNCONTROLLED PEDESTRIAN CROSSING
6.5m CARRIAGEWAY
3.5m SHARED FOOTWAY / CYCLEWAY
2.0m FOOTWAY
EXISTING WATERCOURSE
2.5m PARKING LAYBY
3.5m SHARED FOOTWAY / CYCLEWAY
MILTON GARDENS
9.75m CARRIAGEWAY
NETWORK RAIL PRINCES RISBOROUGH STATION CAR PARK
R20.0m
MANOR PARK AVENUE
STATION APPROACH
21.6m
6.2m
7.3m
EXISTING PERPENDICULAR PARKING BAYS ADJACENT TO STATION ROAD
STATION ROAD (B4444)
PROPOSED 4 WAY SIGNALISED JUNCTION
9.75m CARRIAGEWAY
3.5m SHARED FOOTWAY / CYCLEWAY
2.0m FOOTWAY
6.5m CARRIAGEWAY
2.0m FOOTWAY
R100.0m
3.5m SHARED FOOTWAY / CYCLEWAY
PICTS LANE
R6.0m
6.0m
PROPOSED TURNING HEAD AT THE END OF PICTS LANE
EXISTING WATERCOURSE
PROPOSED PRIVATE DRIVEWAY ACCESS FROM PICTS LANE TO RESIDENTIAL PROPERTIES
3.5m
R80.0m
R150.0m
GOODEARL PLACE
PICTS LANE
CHAIRMAKERS CLOSE
6.5m CARRIAGEWAY
HORSENDEN LANE
EXISTING NETWORK RAIL STRUCTURE NAJ2 96 HORSENDEN LANE (SAUNDERTON CHURCH - PICTS LANE) BRIDGE
PICTS LANE
7.2m
7.5m CARRIAGEWAY
R50.25m
BLEDLOW ROAD
6.5m CARRIAGEWAY
R525.0m
EXISTING SHOOTACRE LANE KERBLINE AND FOOTWAY RETAINED
EXISTING 1.3m FOOTWAY
SHOOTACRE LANE

NOTES:

1. DO NOT SCALE THIS DRAWING. IF IN DOUBT PLEASE REQUEST FURTHER INFORMATION.
2. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT CONTRACT DRAWINGS, CONSTRUCTION DETAILS AND SPECIFICATIONS.

Mark	Revision	Date	Drawn	Chkd	Appd

SCALING NOTE: Do not scale this drawing - any errors or omissions shall be reported to Stantec without delay.
UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty to this is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Drawing Issue Status
S0 - WORK IN PROGRESS

PRINCES RISBOROUGH SOUTHERN ROAD LINK PRELIMINARY ROAD LAYOUT

DRAFT

Client
Buckinghamshire Council
Balfour Beatty

Stantec
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READING
Tel: 01189 500 761

Date of 1st Issue	Designed	Drawn
15.05.2020	-	MJP
A0 Scale	Checked	Approved
1:1000	CMB	DTH

Drawing Number	Revision
PRSRL-STN-PH1-XX-SK-C-0007	P01

File Location: \\pba.int\cbh\projects\46146 - princes risborough relief road\200 - design (all drawings)\201 - all pba drawings\2000 - civils\cad\dwgs\prsrl-stn-ph1-xx-sk-c-0007.dwg