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A628 Dodworth Road / Pogmoor Road Inter Peak VISSIM Model

Project number	Client	Subject	Date
60550593	Barnsley Metropolitan Borough Council	Pogmoor VISSIM Inter Peak Modelling	October 2018
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1. Executive Summary

This report details the results from an Inter Peak (IP) assessment in VISSIM of the proposed gyratory at Pogmoor Road / Broadway / A628. This assessment is an extension of the "A628 Dodworth Road Pogmoor Junction Study" undertaken in December 2017; which assessed junction improvements using VISSIM and LinSig in the AM and PM peak only.

Traffic flows for this assessment were obtained from the Barnsley Transport Model (BTM); a WebTAG compliant SATURN model with a calibrated and validated base year of 2014. The traffic flows were cordoned from two BTM model scenarios:

- 2034 IP Do Minimum (DM) with Claycliffe Link, existing layout at Pogmoor Road / Broadway / A628; and
- 2034 IP Do Something (DS) with Claycliffe Link and proposed gyratory.

There is no validated pre-existing base Inter Peak VISSIM model. Therefore the DM VISSIM Inter Peak model was created by amending the AM Peak DM model, created for the December 2017 assessment. The DS model was created by amending the DS AM Peak model from December 2017 and updating the gyratory scheme to reflect the current design.

Three Inter Peak scenarios were modelled in VISSIM as follows:

- **DM:** DM network with 2034 DM traffic demand;
- **DS1:** DS network with 2034 DS traffic demand – to assess the proposed gyratory with demand response; and
- **DS2:** DS network with 2034 DM traffic demand – to assess the proposed gyratory if travel demand is unchanged**.**

Conclusion: The assessment concluded that in both DS scenarios the proposed scheme reduces average delay per vehicle and increases the average vehicle speed.

1.1 Report Structure

This report contains the following sections:

- **Modelling Methodology and Assumptions:** summarises the methodology of this assessment.
- **Traffic Flows:** discusses the BTM traffic flows; detailed matrices provided in **Appendix A**.
- **VISSIM Model and Scenarios:** details the scenarios modelled in VISSIM.
- **Model Results:** presents modelling results.
- **Summary and Conclusion:** concludes the report.

2. Modelling Methodology and Assumptions

This section of the report sets out modelling methodology and lists assumptions.

Overview
• No base model was developed for the Inter Peak and therefore model validation against existing traffic conditions has not been undertaken. • The Inter Peak model represents an average Inter Peak hour (10:00 – 16:00). • Traffic flows have been obtained from Barnsley Transport Model (BTM) IP scenarios; no comparison has been made with observed Inter Peak traffic flows. • BTM turning proportions may differ from observed turning proportions.
Traffic Flows
• See Traffic Flows (page 3).
Traffic Signals
• No observed Inter Peak signal timings were collected. All signal timings have been reviewed within the model simulation and manually optimised. • Pedestrian demand has been assumed to be the same as AM Peak pedestrian demand after 9am.
Public Transport
• Bus frequency retained from AM Peak model.
Model Calibration
• The model simulation was observed in all scenarios and model outputs were reviewed for errors. • The key adjustments in all scenarios were to signal timings. A series of tests were undertaken to identify timings which reduced journey times and improved capacities. This reflects the behaviour of adaptive signal control, which would automatically react to changes in flow demand and attempt to optimise operation.

3. Traffic Flows

This section of the report summarises traffic flows used in this assessment. Detailed analysis is provided in **Appendix A.**

Traffic flows were based on two cordoned matrices from the Barnsley Transport Model (BTM) 2034 Inter Peak model. Two model scenarios were extracted, as set out below:

- 2034 IP Do Minimum (DM) with Claycliffe Link, existing layout at Pogmoor Road / Broadway / A628; and
- 2034 IP Do Something (DS) with Claycliffe Link and proposed Gyratory.

The cordoned BTM matrices were mapped to the VISSIM model, and converted from PCUs (Passenger Car Units) to vehicles.

The BTM model represents an average Inter Peak hour between 10:00 and 16:00. No comparison has been made between existing observed flows and turning proportions in the study area against the forecast BTM flows.

The average Inter Peak hour does not include Horizon Community College start and end times; therefore the model will not include flows to or from Horizon Community College. No additional development traffic flows have been added because future developments and traffic growth are included within the BTM flow forecasting.

To understand change in traffic demand the DM and DS matrices were compared; the differences at M1 J37 and Pogmoor Road / Broadway / A628 are summarised below:

- **M1 J37**: flows at the junction increase by 10%. The largest increases are to and from Barnsley (A628 West arm of the junction), inbound flows to Barnsley increase by 20% and from Barnsley by 10%.
- **Pogmoor Road / Broadway / A628**: flows at the junction increase by 13%. All traffic movements see an increase in demand, with the exception of: Pogmoor Road to Broadway (35% decrease -54 PCU) and Pogmoor Road to A628 East (20% decrease -70 PCU). The largest increases in flow are for movements from A628 East to Pogmoor Road (30% increase 130 PCU) and A628 East to A628 West (42% increase 170 PCU).

4. VISSIM Model and Scenarios

This section of the report provides an overview of the VISSIM model used in this assessment.

No base model was developed for the Inter Peak; the DM and DS Inter Peak VISSIM models were developed from the existing AM Peak DM and DS VISSIM models.

The DS gyratory scheme was updated in accordance with the latest available design (shown in **Appendix B**); which has been refined since the AM Peak DS VISSIM model was developed in December 2017.

With the proposed gyratory in place BTM forecasts increased flows and different turning proportions at M1 J37 and at Pogmoor Road / Broadway / A628. As a result, the performance of the proposed gyratory scheme has been tested using both the DM and DS BTM flows. Three Inter Peak scenarios were modelled in VISSIM as follows:

- **DM:** DM network with 2034 DM traffic demand;
- **DS1:** DS network with 2034 DS traffic demand – to assess the proposed gyratory with demand response; and
- **DS2:** DS network with 2034 DM traffic demand – to assess the proposed gyratory if travel demand is unchanged**.**

5. Model Results

This section of the report shows model results; as is standard practice all outputs are based on 10 random seed runs.

5.1 Network Performance Results

The following Network Performance Evaluation statistics have been analysed:

- **Latent Demand** – This is the number of vehicles that could not be added into the network from vehicle inputs during the simulation. A reduction in latent demand indicates that the option provides greater capacity.
- **Average Delay per Vehicle**.
- **Average Speed** (m.p.h.) – Higher average speeds are a positive indication of reduced delay and less congestion in the network

Figure 1 - IP Latent Demand

Latent demand is negligible in all scenarios; all vehicles are able to enter the network. This demonstrates that the network can accommodate BTM forecast Inter Peak demand.

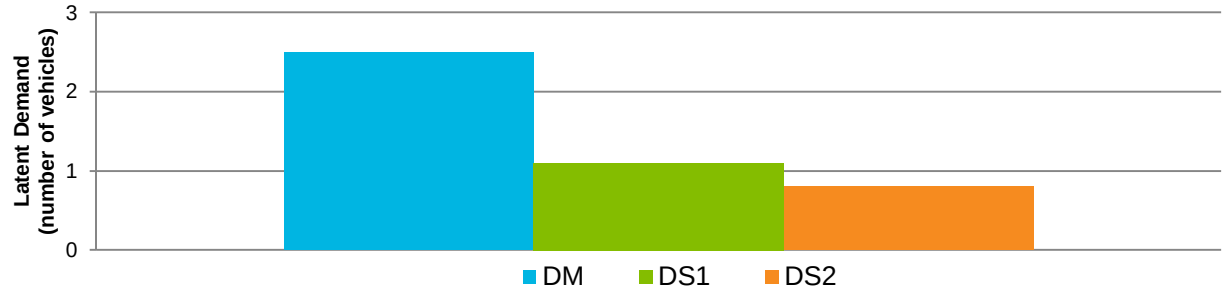


Figure 2 - IP Average Delay per Vehicle

Average delay per vehicle declines from the DM to DS1 by 16%, despite an increase in travel demand in DS1. If traffic demand is unchanged (DM v DS2) average delay per vehicle falls by 29%.

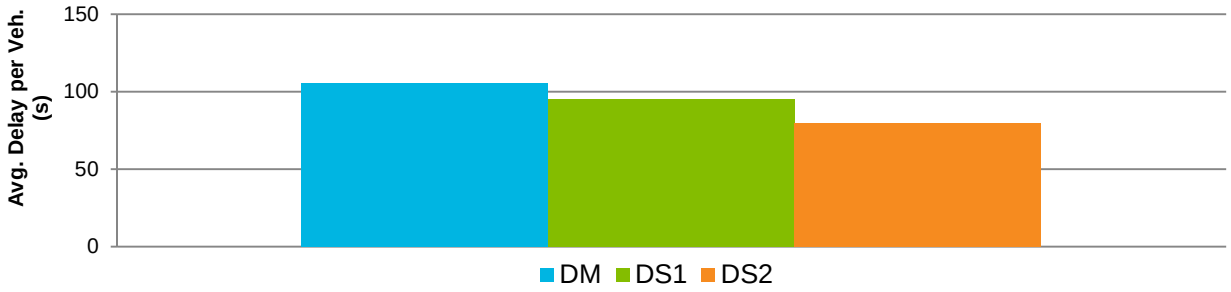
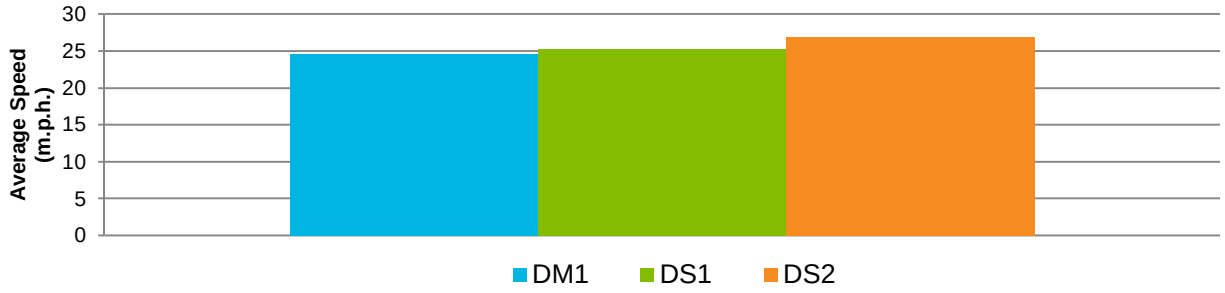


Figure 3 - IP Average Speed

Average vehicle speed increases from the DM to DS1 by 6%, and by 12% in DS2 if traffic demand is unchanged. Average vehicle speed heat maps are shown in **Appendix C.**



5.2 Journey Times

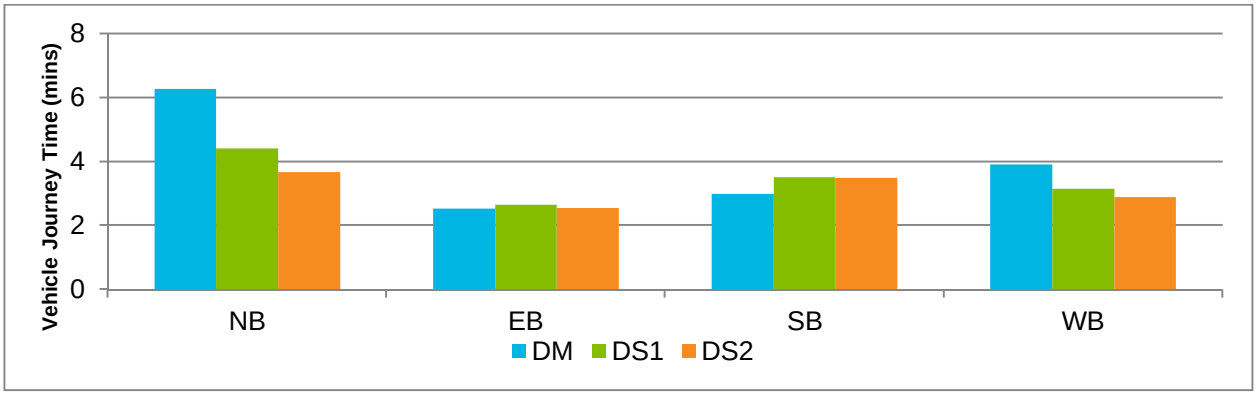
Journey Time data from the VISSIM models has been collected for the following sections shown in **Figure 4**;

- Pogmoor Road southbound to Broadway;
- Broadway northbound to Pogmoor Road;
- A628 eastbound; and
- A628 westbound.

Figure 4 - Journey Time Sections



Figure 5 - Journey Times



Northbound: Journey times decrease by 30% in DS1 & 40% DS2.

Eastbound: Journey times increase marginally in DS1 (note demand for this movement increases in DS1 by 40%, 172 PCU), and change negligibly in DS2.

Southbound: Journey times increase by circa 30 seconds, as vehicles are routed around the gyratory. This increase in journey time is offset by improved journey times overall; demonstrated by network statistics which show an increase in average speed and a reduction in average delay per vehicle.

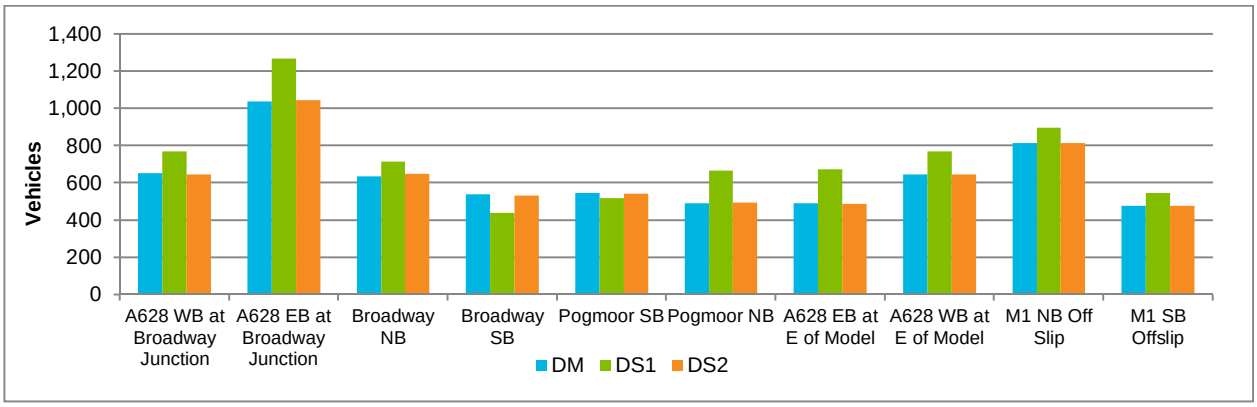
Westbound: Journey times decrease by 19% in DS1 and 25% in DS2.

5.3 Link Flows

Link flows have been extracted from the VISSIM models to assess the vehicle throughput in each scenario.

There is no difference in link flow between DM and DS2; because these scenarios have the same vehicle demand. DS1 in general has higher flows than DM, with the exception of Pogmoor Road southbound and Broadway southbound.

Figure 6 - Vehicle Link Flows



6. Summary and Conclusion

AECOM have developed Do Minimum and Do Something Inter Peak VISSIM models, these models were developed using the corresponding AM Peak VISSIM models. No validated Inter Peak base model was developed. The design of the gyratory scheme has been refined since the December 2017 assessment was undertaken; the Inter Peak DS VISSIM model incorporates the current preferred design shown in **Appendix B**.

Inter Peak traffic demand was obtained from the average hour Inter Peak Barnsley Transport Model. No comparison has been undertaken between existing observed Inter Peak flows and BTM forecast Inter Peak flows.

Three scenarios were modelled as follows:

- **DM:** DM network with 2034 DM traffic demand;
- **DS1:** DS network with 2034 DS traffic demand – to assess the proposed gyratory with demand response; and
- **DS2:** DS network with 2034 DM traffic demand – to assess the proposed gyratory if travel demand is unchanged**.**

The modelling results conclude that the gyratory reduces vehicle delay and increases average speed over the network as a whole in both DS scenarios.

Appendix A - Traffic Matrices

Appendix A shows traffic demand at M1 J37 and at Pogmoor Road / Broadway / A628 in two separate matrices:

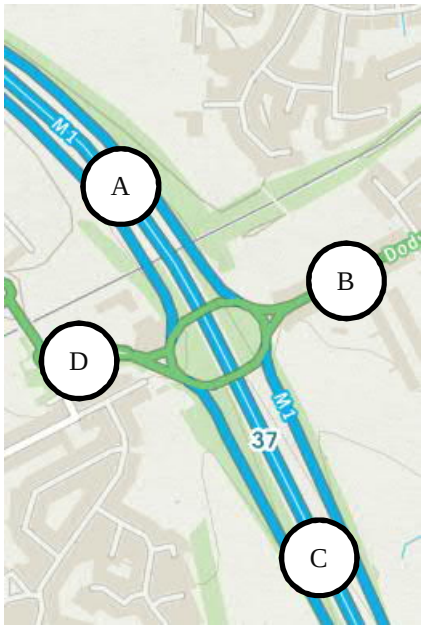
- Do Minimum (DM) matrix; and
- Do Something (DS) matrix.

M1 J37 Traffic Matrix

The figure below shows the DM and DS Saturn zones for M1 J37. The flows are shown in PCUs.

The matrices show the following:

- Matrix A: DM Saturn flows;
- Matrix B: DS Saturn Flows;
- Matrix C: (B-A); and
- Matrix D: % difference between B and A.



BTM forecasts a 10% increase in traffic at M1 37 junction as a result of increased capacity provided by the proposed Pogmoor Road Gyratory. The largest absolute differences in flow are into Barnsley and from Barnsley (arm B). These key differences have been highlighted in green in matrices C and D below.

(A) SATURN DM PCUs

	A	B	C	D	
A	0	319	0	175	494
B	342	0	475	452	1269
C	0	288	0	576	864
D	218	473	383	0	1074
	560	1080	857	1203	3700

(B) SATURN DS PCUs

	A	B	C	D	
A	0	374	0	192	566
B	396	0	504	491	1391
C	0	383	0	565	948
D	217	553	395	0	1164
	613	1309	899	1248	4068

(C) Absolute Difference B-A in PCUs

	A	B	C	D	
A	0	55	0	18	72
B	54	0	29	39	122
C	0	95	0	-11	84
D	-1	80	12	0	91
	53	229	41	45	368

(D) % Difference (C/A*100)

	A	B	C	D	
A	0%	17%	0%	10%	15%
B	16%	0%	6%	9%	10%
C	0%	33%	0%	-2%	10%
D	0%	17%	3%	0%	8%
	9%	21%	5%	4%	10%

Pogmoor Road / Broadway / Dodworth Road Traffic Matrix

Error! Reference source not found. figure below shows the junction arms for the DM and DS traffic matrices for Pogmoor Road / Broadway / Dodworth Road.



The matrices show the following:

- Matrix A: DM Saturn flows;
- Matrix B: DS Saturn Flows;
- Matrix C: (B-A); and
- Matrix D: % difference between B and A.

BTM forecasts a 13% increase in traffic through the Pogmoor Road / Broadway / Dodworth junction. With the exception of Pogmoor Road; all approaches to the junction see an increase in demand. The largest increase from an approach arm is Dodworth West.

There is a reduction in traffic travelling to Broadway from Pogmoor Road and Dodworth West. Demand travelling to Dodworth East, Dodworth West and Pogmoor Road increases.

(A) SATURN DM PCUs

	A	B	C	D	E	
A	0	37	0	154	339	551
B	25	0	0	34	458	518
C	0	0	0	0	0	0
D	146	44	0	0	472	662
E	320	408	0	352	0	1080
	514	489	0	540	1269	2812

(B) SATURN DS PCUs

	A	B	C	D	E	
A	0	53	0	100	339	492
B	38	0	0	53	557	648
C	0	0	0	0	0	0
D	183	51	0	0	494	729
E	447	580	0	282	0	1309
	668	685	0	435	1391	3178

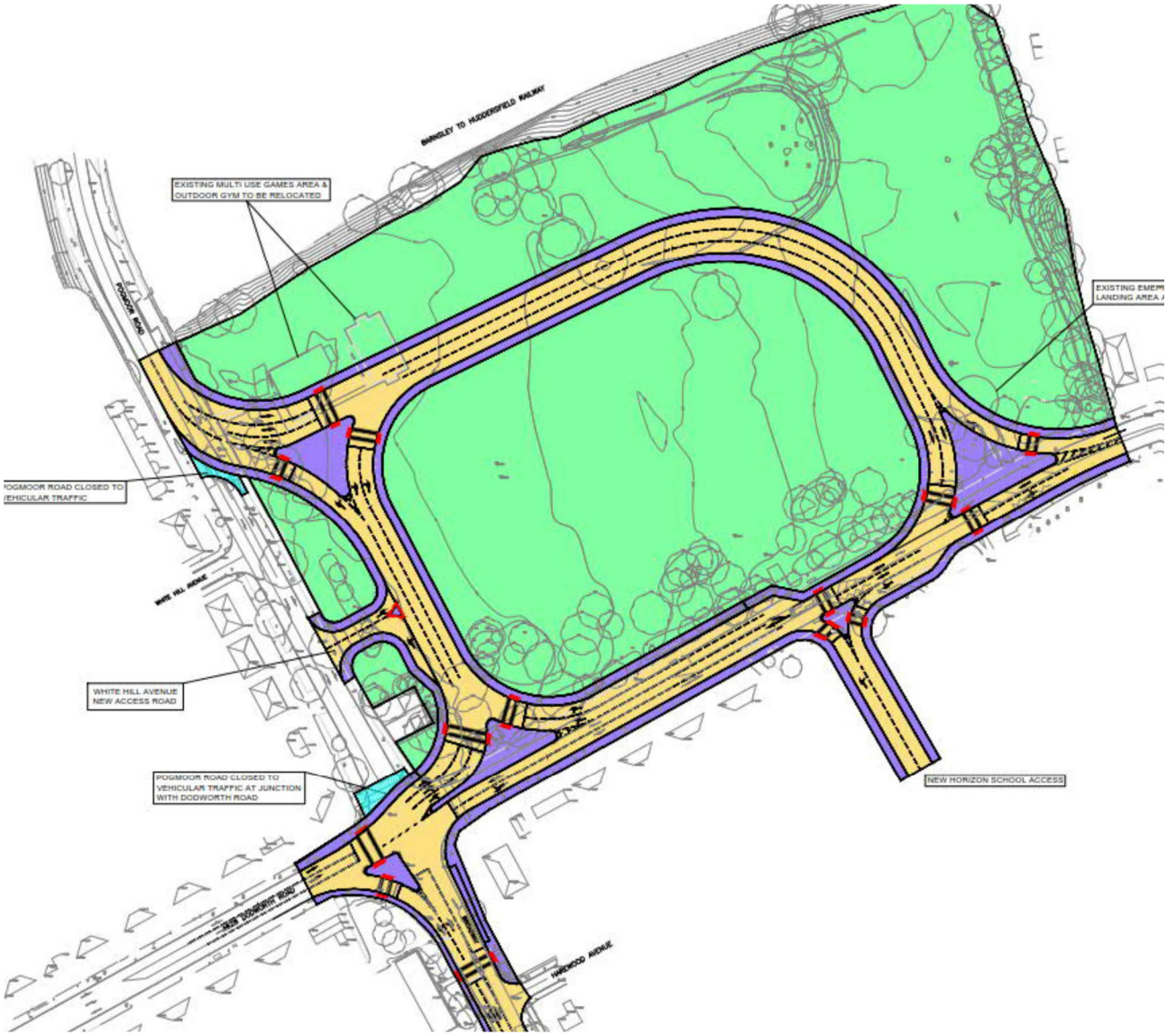
(C) Absolute difference B-A in PCUs

	A	B	C	D	E	
A	0	16	0	-54	1	-59
B	12	0	0	19	99	130
C	0	0	0	0	0	0
D	37	7	0	0	22	66
E	127	172	0	-70	0	229
	154	195	0	-105	122	366

(D) % Difference (A/A*100)

	A	B	C	D	E	
A	0%	44%	0%	-35%	0%	-11%
B	48%	0%	0%	54%	22%	25%
C	0%	0%	0%	0%	0%	0%
D	26%	16%	0%	0%	5%	10%
E	40%	42%	0%	-20%	0%	21%
	30%	40%	0%	-19%	10%	13%

Appendix B - Proposed Scheme



Appendix C 3 Average Speed Vehicle Heat Maps (mph)

DM Average Speed Heat Map (mph)



DS1 Average Speed Heat Map (mph)



DS2 Average Speed Heat Map (mph)

