APPENDIX D: DUNDRUM ABTA JUNCTION ASSESSMENT REPORT

dlr Comhairle Contae County Council

BARRY & PARTNERS consulting engineers

SYSTRA

DUNDRUM ABTA JUNCTION ASSESSMENT REPORT

IDENTIFICATION TABLE	
Client/Project owner	Dún Laoghaire Rathdown County Council
Project	Dundrum ABTA
Type of document	Report
Date	08/06/2023
Number of pages	66

APPROVAL					
Version	**Name**		**Position**	**Date**	**Modifications**
1	Author 1	Srivaran Kallahalli	Senior Consultant	12/05/2023	
	Author 2	Josh Noon	Principle Consultant	06/06/2023	
	Checked by	Diarmuid Bailey	Associate	07/06/2023	
	Approved by	Andrew Archer	Director	08/06/2023	
2	Author				
	Checked by				
	Approved by				

TABLE OF CONTENTS

1.	**INTRODUCTION**	**7**
1.1	BACKGROUND	7
1.2	MODEL STUDY AREA	7
1.3	MODEL SPECIFICATION	8
1.4	VEHICLE CLASSIFICATION	9
1.5	MODEL ASSIGNMENT	9
1.6	NETWORK DEVELOPMENT	9
1.7	ZONING SYSTEM	9
1.8	DRIVING BEHAVIOUR PARAMETERS	11
1.9	SPEED PARAMETERS	11
1.10	SIGNAL DATA	12
1.11	CONVERGENCE	12
1.12	RANDOM SEED CRITERIA	12
2.	**MODEL CALIBRATION AND VALIDATION**	**13**
2.2	DATA COLLECTION	13
2.3	MODEL CALIBRATION	14
2.4	MODEL VALIDATION	16
2.5	LINK VALIDATION	16
2.6	JOURNEY TIME VALIDATION	16
2.7	NETWORK PERFORMANCE ANALYSIS	21
2.8	SUMMARY	22
3.	**DEMAND MATRIX DEVELOPMENT**	**23**
3.1	OVERVIEW	23
3.2	NTA EAST REGIONAL MODEL	23
3.3	FORECAST GROWTH STRATEGIES	23
3.4	MATRIX ADJUSTMENT	23
3.5	LOCAL DEVELOPMENT	24
3.6	FUTURE YEAR SCENARIOS	25
4.	**TANEY CROSS JUNCTION - OPTION TESTING**	**27**
4.1	OVERVIEW	27

4.2	SCENARIO 1	30
4.3	SCENARIO 2	32
4.4	SCENARIO 3	34
4.5	SCENARIO 3A	36
4.6	TANEY CROSS SUMMARY	38
5.	WYCKHAM WAY JUNCTIONS	39
5.1	BACKGROUND	39
5.2	DEMAND SCENARIOS	40
5.3	SANDYFORD ROAD/OVEREND AVENUE & DUNDRUM BYPASS/WYCKHAM WAY	41
5.4	WYCKHAM WAY/ BALLINTEER ROAD JUNCTION	48
5.5	WYCKHAM WAY/BALLINTEER AVENUE JUNCTION	54
5.6	WYCKHAM WAY JOURNEY TIME	60
5.7	WYCKHAM WAY SUMMARY	61
A.	CALIBRATION COUNTS	63
A.1	2022 AM PEAK SUMMARY	63
A.2	2022 PM PEAK SUMMARY	64

Table of Figures

Figure 1.1 VISSIM Model Area 8
Figure 1.2 2019 Base VISSIM Model Zoning System 10
Figure 1.3 VISSIM model Signalised Junctions 12
Figure 2.1 Location of JTCs 13
Figure 2.2 Location of ATCs 14
Figure 2.3 Calibration Process 15
Figure 2.4 Journey time validation routes 17
Figure 3.1 Future Year Growth Development 24
Figure 4.1 Taney Cross Junction 27
Figure 4.2 Taney Cross Journey Time Routes 29
Figure 4.3 Taney Cross - Scenario 1 30
Figure 4.4 Taney Cross Scenario 2 32
Figure 4.5 Taney Cross - Scenario 3 34
Figure 4.6 Turning Counts (08:00 – 09:00) – 08/03/2022 36
Figure 4.7 Taney Cross - Scenario 3a 36
Figure 5.1 Wyckham Way Junction Traffic Flows 40
Figure 5.2 Proposed change to the Sandyford Road/Wyckham Way junction 41
Figure 5.3 Wyckham Way/Dundrum Bypass junction 42
Figure 5.4 Proposed change to Wyckham Way/Dundrum Bypass junction 43
Figure 5.5 Journey times routes - Wyckham Way/Dundrum Bypass junction 44
Figure 5.6 Do Nothing and Do Something queues for Wyckham Way/Dundrum Bypass junction – Core Growth 46
Figure 5.7 Do Nothing and Do Something queues for Wyckham Way/Dundrum Bypass junction – High Growth 47
Figure 5.8 Wyckham Way/Ballinteer Road junction 48
Figure 5.9 Proposed design for Wyckham Way/Ballinteer Road junction 49
Figure 5.10 Journey times routes - Wyckham Way/Ballinteer Road Junction 50
Figure 5.11 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Road junction – Core Growth 52
Figure 5.12 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Road junction – High Growth 53
Figure 5.13 Wyckham Way/Ballinteer Avenue 54
Figure 5.14 Proposed design for Wyckham Way/Ballinteer Avenue 55
Figure 5.15 Journey times routes - Wyckham Way/Ballinteer Avenue Junction 56
Figure 5.16 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Avenue junction – Core Growth 58
Figure 5.17 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Avenue junction – High Growth 59
Figure 5.18 Wyckham Way Journey Time Route 60

List of Tables

Table 1.1 Model Specification 8
Table 1.2 VISSIM Model Zone Locations 10
Table 2.1 TII PAG Unit 5.1 Calibration Acceptability Guidelines 15
Table 2.2 Flow and GEH calibration results 16
Table 2.3 Flow and GEH validation results 16
Table 2.4 TII PAG Unit 5.1 Validation Acceptability Guidelines 17
Table 2.5 Journey time validation routes 18
Table 2.6 2022 AM journey time validation 19
Table 2.7 2022 PM Journey Time validation 20
Table 2.8 2022 Base VISSIM Model Network Performance 22
Table 3.1 Development within the study area 24
Table 3.2 Development Trips 25
Table 3.3 Future year demand 26
Table 4.1 Model Scenarios 28
Table 4.2 Journey Time results for Scenario 1 31
Table 4.3 Journey time results for Scenario 2 33
Table 4.4 Scenario 3 journey time results 35
Table 4.5 Scenario 3a journey time results 37
Table 5.1 Journey time results – AM Peak Core Demand 44
Table 5.2 Journey time results – AM Peak High Demand 44
Table 5.3 Journey time results Wyckham Way/Ballinteer Road – AM Peak Core Demand 50
Table 5.4 Journey time results Wyckham Way/Ballinteer Road – AM Peak High Demand 50
Table 5.5 Journey time results Wyckham Way/Ballinteer Ave – AM Peak Core Demand 56
Table 5.6 Journey time results Wyckham Way/Ballinteer Ave – AM Peak High Demand 56
Table 5.7 Wyckham Way Corridor Journey time results – AM Peak Core Demand 60
Table 5.8 Wyckham Way Corridor Journey time results – AM Peak High Demand 60

1. INTRODUCTION

1.1 Background

1.1.1 SYSTRA Ltd and JB Barry & Partners, have been commissioned by Dún Laoghaire-Rathdown County Council (DLRCC) to assist them in developing an Area Based Transport Assessment (ABTA) for Dundrum and its environs.

1.1.2 As part of the ABTA recommendations, a number of junction changes have been proposed across the Dundrum network aimed at improving safety and accessibility for pedestrians and cyclists.

1.1.3 The purpose of this report is to provide detail on the microsimulation modelling carried out to examine the impacts of the proposed junction changes on road network performance. This report should be read in conjunction with the Dundrum ABTA Report.

1.1.4 The following sections outline the VISSIM model specification and parameters. Then:

- **Chapter 2** provides an overview of the base model calibration and validation in-line with guidance;
- **Chapter 3** outlines the future demand scenarios developed to test the junction changes;
- **Chapter 4** presents the results of testing multiple options for Taney Cross junction; and
- **Chapter 5** outlines the results of testing junction changes along the Wyckham Way corridor.

1.2 Model Study Area

1.2.1 The VISSIM study area extent is shown in the Figure 1.1. The key junctions included in the VISSIM model are;

- Dundrum Road/Taney Cross Junction;
- Dundrum Bypass/Wyckham Way Junction;
- Sandyford Road/Overend Avenue;
- Wyckham Way/Wyckham Place Junction; and
- Ballinteer Avenue/Wesley school Junction.

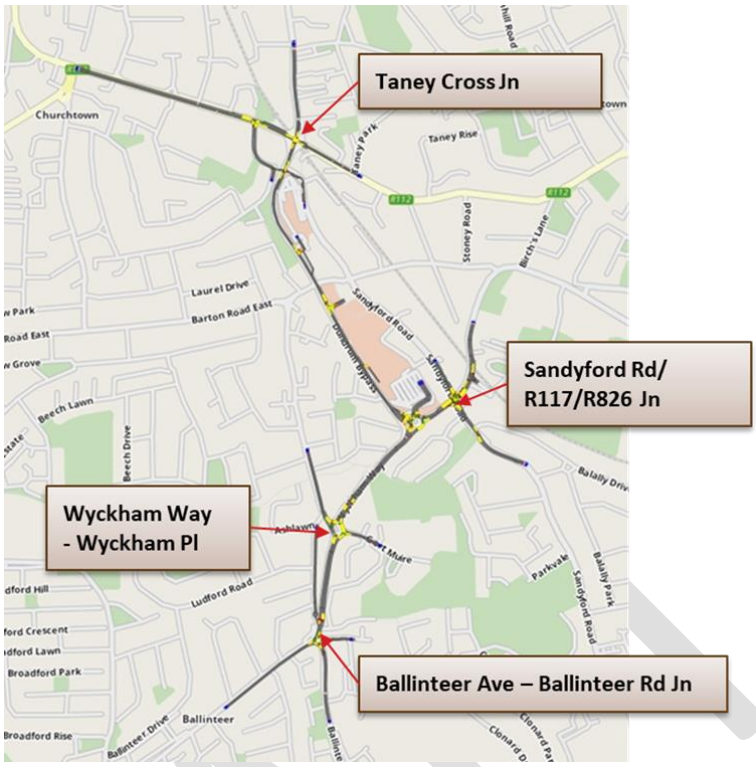


Figure 1.1 VISSIM Model Area

1.3 Model Specification

1.3.1 AM and PM peak hour models were built for the Dundrum ABTA modelling. The model focused on a three-hour timeframe, which included a one-hour warmup period, the peak hour itself, and a one-hour cooling-down period. The calibration, validation, and all relevant model outputs were derived from the peak hour segment.

1.3.2 The hourly matrices were constructed separately for light vehicles (cars, motorcycles, and LGVs) and heavy vehicles (OGV1 and OGV2). The peak traffic hours were identified as 08:00 to 09:00 and 17:15 to 18:15. A warm-up period was implemented to simulate traffic flow and ensure that the peak hour was adequately congested for accurate model outputs. Similarly, a post-peak period was included to allow vehicles to clear the model, ensuring that all necessary outputs were completed.

1.3.3 The VISSIM model has been developed to the specifications shown in Table 1.1 below.

Table 1.1 Model Specification

PARAMETER	SPECIFICATION
Base Year	2022
Modelling Time Periods	AM (07:00 – 10:00) & PM (16:15 – 19:15)

PARAMETER	SPECIFICATION
Peak Hour	AM (08:00 – 09:00) & PM (17:15 – 18:15)
Vehicle Classes	Light and heavy vehicles
VISSIM Version	2022.00.07

1.4 Vehicle Classification

1.4.1 Vehicles in VISSIM are aggregated into vehicle classes for assignment and assessment purposes. Four vehicle classes were used in the Dundrum model;

- Cars;
- Light Goods Vehicles (LGVs);
- Heavy Goods Vehicles (HGVs); and
- Busses.

1.5 Model Assignment

1.5.1 Traffic was assigned to the VISSIM network using the 'dynamic assignment' feature. Dynamic Assignment allows vehicles pick their preferred route through the network as opposed to a static network which locks the path a vehicle must take between Origin and Destination.

1.5.2 Demand is defined by an Origin Destination matrix for each vehicle class with both a warm up matrix, to allow traffic to build up on the network ahead of the assessment period, and an assignment matrix, covering trips within the assessment period, assigned to the network.

1.6 Network Development

1.6.1 The network was developed to represent the 2022 road network within the study area. This was developed using a topographical map of the corridor and further informed through online imaging, such Google Maps, Google Streetview and Bing Maps.

1.7 Zoning System

1.7.1 Each entry and exit point from the study area network was defined as a zone to provide loading and unloading points for the network.

1.7.2 The Dundrum VISSIM model included a total of 16 zones outlined in Figure 1.2 and Table 1.2 below.

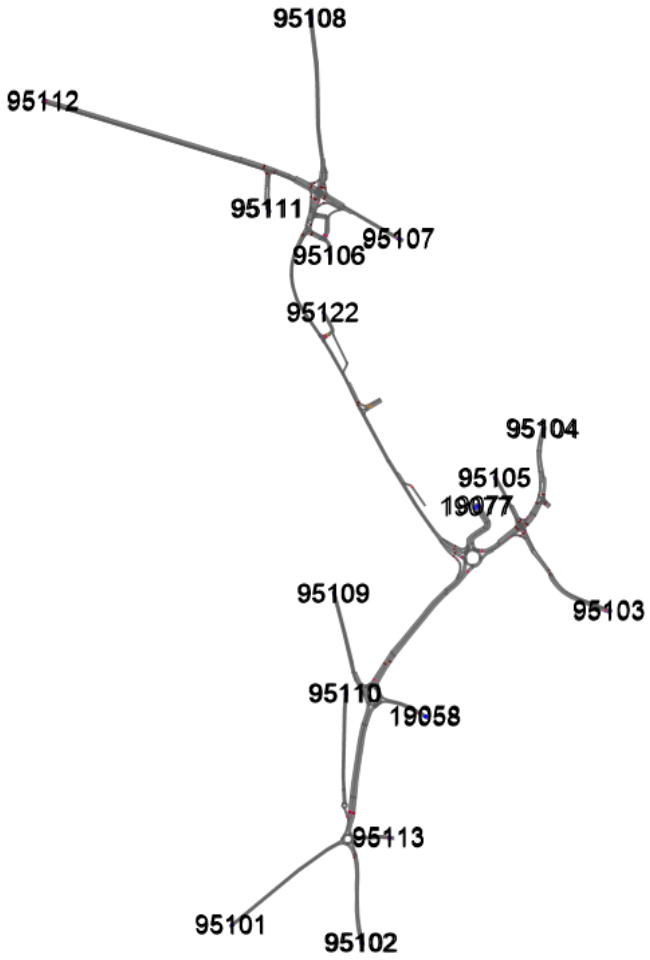


Figure 1.2 2019 Base VISSIM Model Zoning System

Table 1.2 VISSIM Model Zone Locations

VISSIM ZONE	LOCATION
19058	Wyckham Place
19077	Dundrum Town Centre Shopping Centre
95101	Ballinteer Ave
95102	Ballinteer Road
95103	Sandyford Rd South
95104	Overend Ave

VISSIM ZONE	LOCATION
95105	Sandyford Rd North
95106	Main Street
95107	Taney Road
95108	Dundrum Road
95109	Ballinteer Road
95110	Ballinteer Road
95111	Sweetmount Avenue
95112	Church Road Upper
95113	Wesley School
95122	Old Dundrum Shopping Centre

1.8 Driving Behaviour Parameters

1.8.1 VISSIM has a default set of driving behaviour parameters that are used when building the model network. They contain various parameters which impact the car following, lane change and vehicular reactions to traffic signals. The behaviours are associated to different link types so all vehicles travelling along a specific link display the same driving behaviour properties.

1.8.2 As the study area is entirely within an urban environment, the default Urban Driving behaviours within VISSIM were applied.

1.9 Speed Parameters

1.9.1 Speed distributions define a range free-flow speeds at which vehicles will attempt to travel in the model if not impeded by other vehicles on the network. Distributions are defined for each speed limit, providing a maximum and minimum speed for any particular speed limit.

1.9.2 The speed distributions are applied within the model based on several factors including carriageway type, vehicle type and defined speed limits. Speed distributions were adjusted based off observed journey time data. On approaches to junction, around sharp bends and on roundabouts, a reduced speed area was applied.

1.10 Signal Data

1.10.1 There is five signalised junctions within the modelled network. DLRCC provided SCATS data, including green times and staging information, which was incorporated into the VISSIM model.

- Site 1 – Churchtown Road / Sweetmount
- Site 2 – Dundrum Road / Taney Cross
- Site 3 – Dundrum Bypass / Main Street
- Site 4 – Overend Ave / Balally Luas station
- Site 5 – Sandyford Road / Wyckham Way

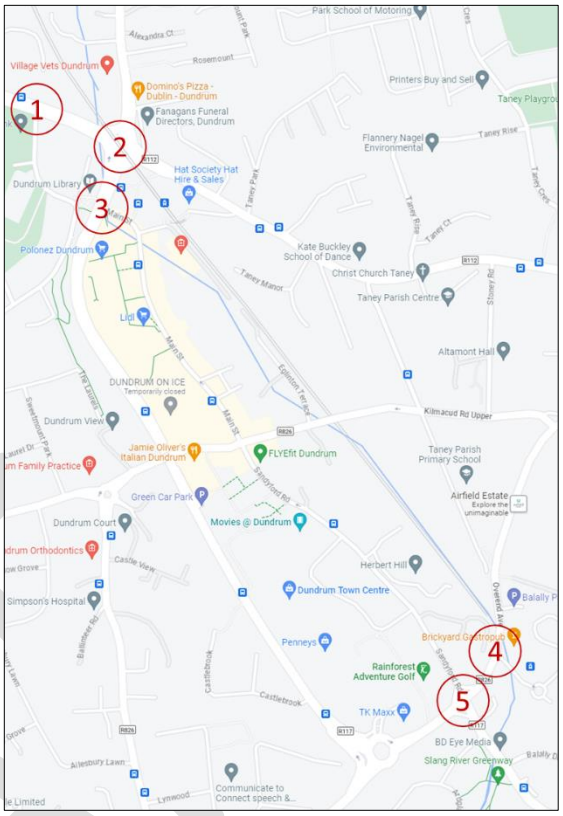


Figure 1.3 VISSIM model Signalised Junctions

1.11 Convergence

1.11.1 Transport for London's (TfL) traffic Modelling Guidelines[1] suggests that Convergence will be deemed to have been satisfactorily achieved when 95% of travel times on all paths change by less than 20% for at least four consecutive assignment iterations. The model period showed 100% of travel times on all paths change by less than 20% for at least four consecutive iterations. This is considered an acceptable level of convergence for microsimulation.

1.11.2 Once the convergence was achieved, the model was run using multiple random seeds, based on the finalised cost and path files.

1.12 Random Seed Criteria

1.12.1 The stochastic nature of micro-simulation models means that by simply changing the random seed number, the sampling of values from specified distributions is changed and this will create different model results. VISSIM uses random seeds to vary traffic conditions, including the pattern in which vehicles are released into the network. This is designed to represent daily variations between traffic conditions. Without this variation, the model would not reflect the variability that exists in actual traffic conditions.

1.12.2 The model was run for 10 random seeds to be consistent with industry guidance and for the purpose of the assessment.

[1] Developed by TfL in 2010 and is deemed a best practice guidance manual for VISSIM modelling

2. MODEL CALIBRATION AND VALIDATION

2.1.1 This section outlines the results of the 2022 Base year VISSIM model in terms of calibration and validation. The model has been calibrated and validated in-line with Transport Infrastructure Ireland (TII) Project Appraisal Guidelines (PAG) Unit 5.1.

2.2 Data Collection

2.2.1 Count data was gathered in 2022 in multiple locations within the study area. Two types of traffic counts were collected;

- Junction Turning Counts (JTC) – Counts taken over a 12 hour period (07:00-19:00) on three consecutive days collecting the turning information for different vehicle types at each junction; and
- Automatic Traffic Counts (ATC) – Counts taken over seven consecutive 24 hour periods capturing movements along a link by vehicle type.

2.2.2 15 JTCs were collected at the locations shown in Figure 2.1 below as part of the Dundrum ABTA. Note only counts relevant to the VISSIM model area were used during calibration and validation.

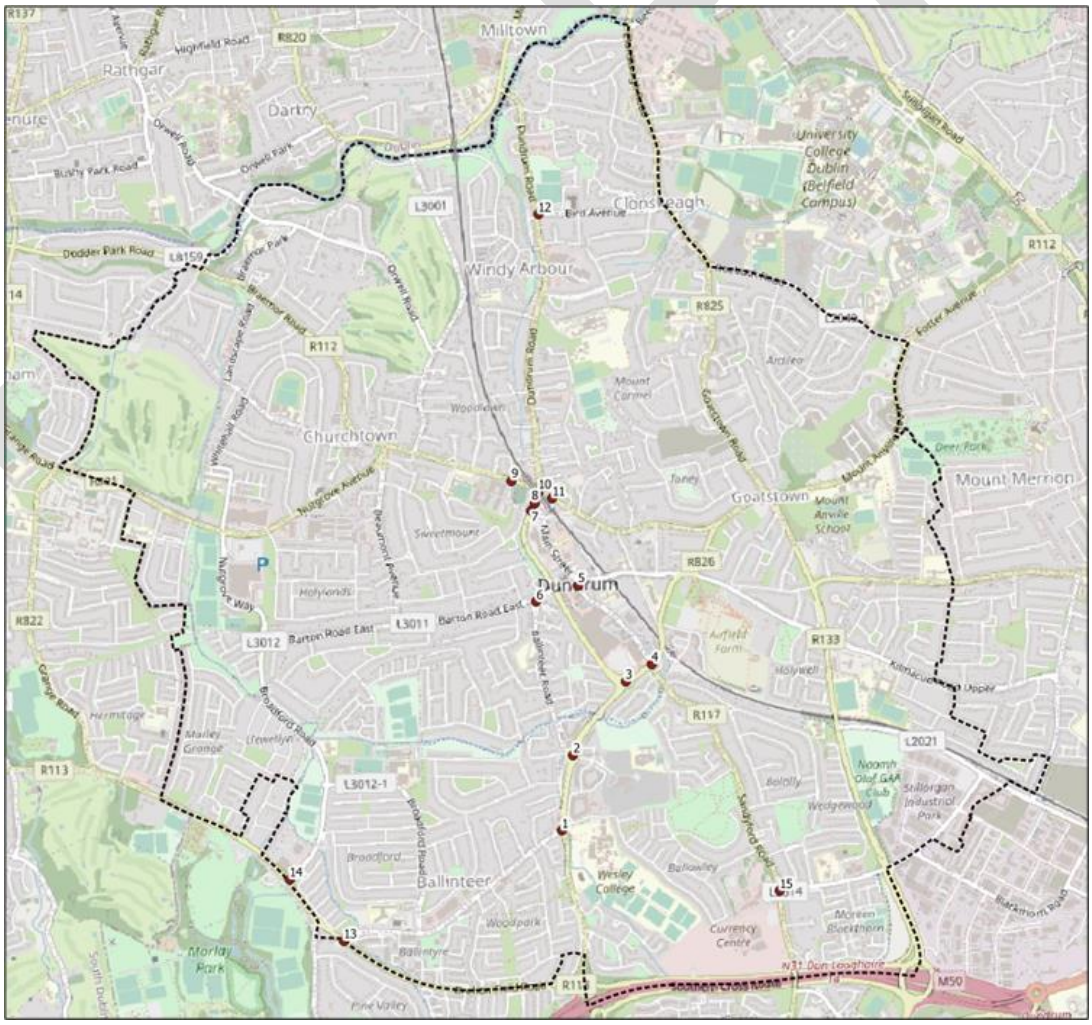


Figure 2.1 Location of JTCs

2.2.3 11 ATCs were collected at the locations shown in Figure 2.2 below.

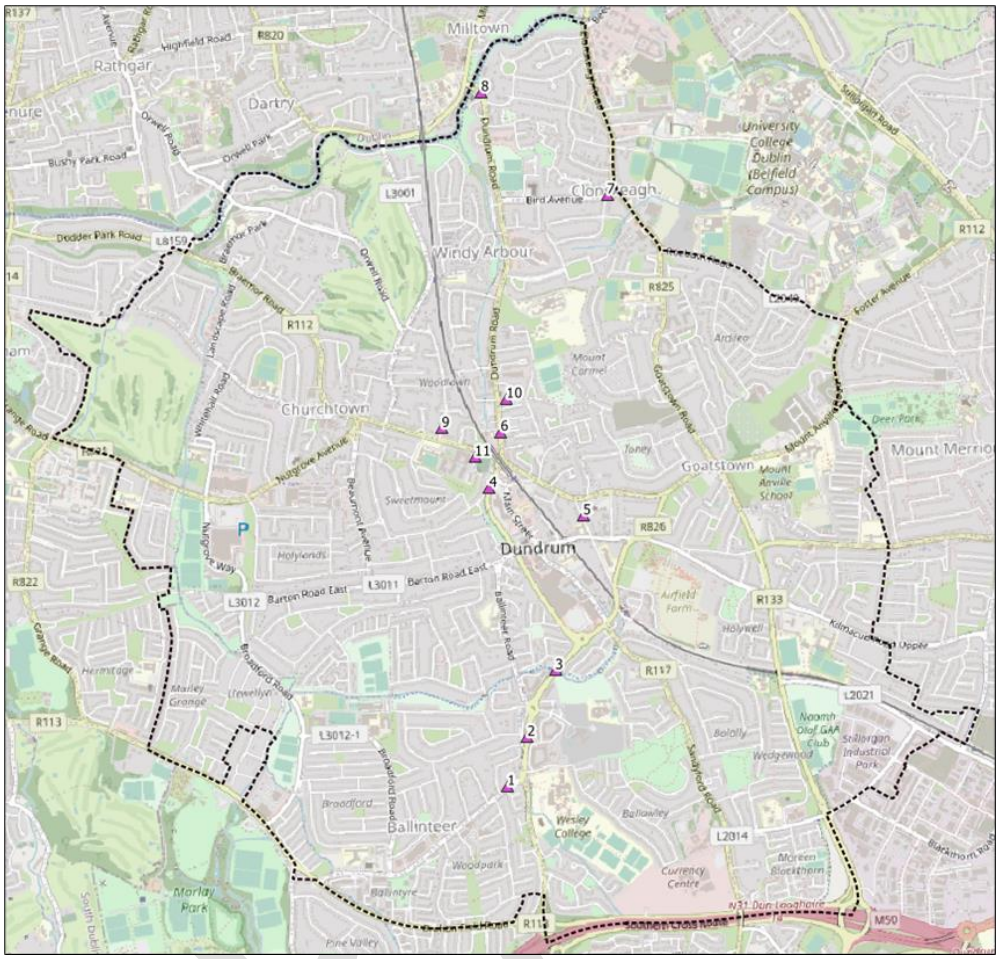


Figure 2.2 Location of ATCs

2.3 Model Calibration

2.3.1 Calibration of a VISSIM model is an iterative process that ensures the model reflects existing conditions, as provided by observed data, by adjusting model inputs and parameters. The main emphasis of the calibration is to ensure that during the modelled periods:

- Vehicle behaviours at the main junctions is modelled accurately, and,
- Traffic volumes on junction turning movements are modelled accurately.

2.3.2 The calibration process involves refining the network set up and behavioural characteristics to achieve a match between observed and modelled data.

2.3.3 Not all commissioned JTCs where used in the calibration process due to the coverage area of the VISSIM model. Traffic data used in the calibration included counts from the available surveys at the following junctions;

- Taney cross / Dundrum Road Junction (combined data for sites 7-11);
- Dundrum Bypass / Wyckham Way Roundabout;
- Sandyford Road / Overend Avenue Junction;

- Wyckham Way / Wyckham Place Roundabout; and
- Ballinteer Avenue / Wesley School Roundabout.

2.3.4 Calibration was performed in an iterative process that involved making changes to the model, assigning demand and then assessing performance against observed data. This process is shown in Figure 2.3 below.

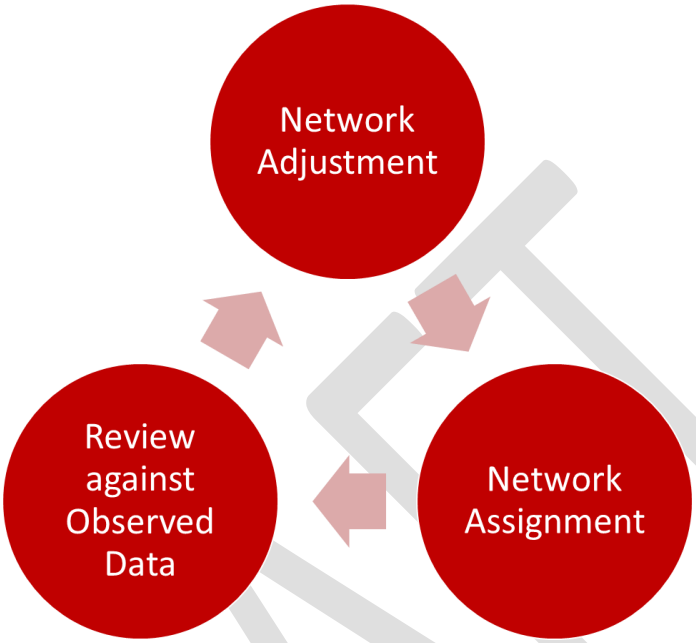


Figure 2.3 Calibration Process

2.3.5 Network assignment used 10 seeds with the average of the runs used for assessment against observed data.

2.3.6 This calibration loop continued until flows and turning movements met PAG criteria set out in Table 2.1 below.

Table 2.1 TII PAG Unit 5.1 Calibration Acceptability Guidelines

CATEGORY	CRITERIA AND MEASURES	ACCEPTABILITY GUIDELINE
Flow	Modelled flows within 15% for links with observed flows of 3,600 – 7,200 vehicles per hour (vph)	> 85% of cases
	Modelled flows within 100 vph for links with observed flows <700 vph	> 85% of cases
	Modelled flows within 400 vph for links with observed flows > 2,700	> 85% of cases
GEH	GEH[2] < 5	> 85% of routes

[2] The Geoffrey E. Havers (GEH) statistic is a standard way of comparing observed and modelled flows and is used to remove the bias that exists when comparing flows of different magnitudes using percentages.

2.3.7 For link flows, numerical and percentage differences between modelled and observed flows together with the GEH statistic were assessed. The criteria were applied to both link flows and turning flows.

2.3.8 The results of the calibration assessment are shown in Table 2.2 below.

Table 2.2 Flow and GEH calibration results

	GEH <5	GEH <7	GEH <10	FLOW PASS
AM	86%	96%	97%	93%
PM	100%	100%	100%	100%

2.3.9 The results of the 2022 base turn calibration demonstrate that the VISSIM modelled flows represent a good match to observed turning movements in the AM with 86% of movements meeting GEH criteria and 93% meeting Flow criteria. The PM shows an excellent match with 100% of movements meeting the GEH and Flow criteria.

2.3.10 The full turn calibration results are provided, for reference, within Appendix A.

2.4 Model Validation

2.4.1 Validation assesses the accuracy of the model by comparing traffic flows from the model with independent traffic data not used in the model building process. For this model, validation was carried out against ATC and journey time data.

2.5 Link Validation

2.5.1 Link validation checks were carried out using the ATC data gathered within the modelled area as they were unused in the calibration process. This validation followed the same criteria as defined in Table 2.1 for calibration.

2.5.2 The results of the validation are provided in Table 2.3 below.

Table 2.3 Flow and GEH validation results

	GEH <5	GEH <7	GEH <10	FLOW PASS
AM	95%	100%	100%	100%
PM	90%	95%	95%	85%

2.5.3 The results of the validation show a good match to count data for both the AM and PM.

2.6 Journey Time Validation

2.6.1 Journey time validation was undertaken to ensure that travel times and delays along links and at junctions across the study area are accurately represented in the model. The validation was based on a comparison of modelled and observed journey times. In total, 14 routes have been identified for the validation of the 2022 base year VISSIM model.

2.6.2 Routes were validated against TII PAG criteria as defined in Table 2.4 below.

Table 2.4 TII PAG Unit 5.1 Validation Acceptability Guidelines

CATEGORY	CRITERIA AND MEASURES	ACCEPTABILITY GUIDELINE
Journey Times	Modelled journey times within 15% of observed (or within 1 minute if greater than 15%)	> 85% of routes

2.6.3 Diagrams of the routes are provided in Figure 2.4 and listed below in Table 2.5.

Figure 2.4 Journey time validation routes

2.6.4 TomTom GPS journey time data for the month of March 2022 has been used for the purposes of undertaking journey time validation in VISSIM.

2.6.5 The data from TomTom has been further analysed to exclude weekends, Mondays and Fridays for the majority of roads within the modelled area, for the AM and PM peak hours.

Table 2.5 Journey time validation routes

ROUTE REFERENCE	ROUTE	DISTANCE (M)
1	Dundrum Road to Dundrum Bypass / Wyckham Way Roundabout	1,193.1
2	Dundrum Bypass / Wyckham Way Roundabout to Wyckham Pl / Wyckham Way Roundabout	478.7
3	Wyckham Pl / Wyckham Way Roundabout to Ballinteer Road	580.8
4	Ballinteer Road to Wyckham Pl / Wyckham Way Roundabout	530.9
5	Wyckham Pl / Wyckham Way Roundabout to Dundrum Bypass / Wyckham Way Roundabout	409.0
6	Dundrum Bypass / Wyckham Way Roundabout to Dundrum Road	1,235.5
7	Dundrum Road to Ballinteer Road	2,255.5
8	Ballinteer Road to Dundrum Road	2,186.8
9	Sandyford Road to Dundrum Bypass / Wyckham Way Roundabout	426.4
10	Dundrum Bypass / Wyckham Way Roundabout to Sandyford Road	449.7
11	Churchstreet Upper to Taney cross	520.2
12	Taney cross to Churchstreet Upper	518.0
13	Overend Ave to Dundrum Bypass / Wyckham Way Roundabout	395.4
14	Dundrum Bypass / Wyckham Way Roundabout to Overend Ave	391.8

2.6.6 The observed journey time routes have been compared to the modelled journey times. All travel times have been weighted by the number of vehicles making the journey and have utilised an

acceptance criterion of 15% of the average, or within 1 minute for routes exceeding 3km, for 85% of routes.

2.6.7 The results have been provided in Table 2.6 and Table 2.7 for the AM and PM peak respectively.

Table 2.6 2022 AM journey time validation

ROUTE REFERENCE	ROUTE	OBS (S)	MOD (S)	%	<15%
1	Dundrum Road to Dundrum Bypass / Wyckham Way Roundabout	282.2	309.3	9.6%	Y
2	Dundrum Bypass / Wyckham Way Roundabout to Wyckham Pl / Wyckham Way Roundabout	54.9	62.3	13.3 %	Y
3	Wyckham Pl / Wyckham Way Roundabout to Ballinteer Road	90.5	96.0	6.0%	Y
4	Ballinteer Road to Wyckham Pl / Wyckham Way Roundabout	85.3	76.0	10.9 %	Y
5	Wyckham Pl / Wyckham Way Roundabout to Dundrum Bypass / Wyckham Way Roundabout	63.1	71.5	13.3 %	Y
6	Dundrum Bypass / Wyckham Way Roundabout to Dundrum Road	314.1	282.9	9.9%	Y
7	Dundrum Road to Ballinteer Road	427.6	461.5	7.9%	Y
8	Ballinteer Road to Dundrum Road	462.5	429.1	7.2%	Y
9	Sandyford Road to Dundrum Bypass / Wyckham Way Roundabout	171.6	159.6	7.0%	Y
10	Dundrum Bypass / Wyckham Way Roundabout to Sandyford Road	117.7	129.9	10.4 %	Y
11	Churchstreet Upper to Taney cross	136.5	137.7	0.8%	Y

ROUTE REFERENCE	ROUTE	OBS (S)	MOD (S)	%	<15%
12	Taney cross to Churchstreet Upper	211.2	215.1	1.8%	Y
13	Overend Ave to Dundrum Bypass / Wyckham Way Roundabout	111.2	126.1	13.4 %	Y
14	Dundrum Bypass / Wyckham Way Roundabout to Overend Ave	118.4	118.9	0.5%	Y

Table 2.7 2022 PM Journey Time validation

ROUTE REFERENCE	ROUTE	OBS (S)	MOD (S)	%	<15%
1	Dundrum Road to Dundrum Bypass / Wyckham Way Roundabout	254.3	273.8	7.7%	Y
2	Dundrum Bypass / Wyckham Way Roundabout to Wyckham Pl / Wyckham Way Roundabout	55.9	59.6	6.7%	Y
3	Wyckham Pl / Wyckham Way Roundabout to Ballinteer Road	99.9	87.4	12.5 %	Y
4	Ballinteer Road to Wyckham Pl / Wyckham Way Roundabout	83.8	92.8	10.7 %	Y
5	Wyckham Pl / Wyckham Way Roundabout to Dundrum Bypass / Wyckham Way Roundabout	38.5	43.1	12.0 %	Y
6	Dundrum Bypass / Wyckham Way Roundabout to Dundrum Road	202.2	201.6	0.3%	Y
7	Dundrum Road to Ballinteer Road	410.0	419.1	2.2%	Y

ROUTE REFERENCE	ROUTE	OBS (S)	MOD (S)	%	<15%
8	Ballinteer Road to Dundrum Road	324.5	340.3	4.9%	Y
9	Sandyford Road to Dundrum Bypass / Wyckham Way Roundabout	110.1	106.1	3.6%	Y
10	Dundrum Bypass / Wyckham Way Roundabout to Sandyford Road	92.2	99.5	7.9%	Y
11	Churchstreet Upper to Taney cross	104.1	118.1	13.4 %	Y
12	Taney cross to Churchstreet Upper	175.3	155.4	11.3 %	Y
13	Overend Ave to Dundrum Bypass / Wyckham Way Roundabout	127.0	136.2	7.2%	Y
14	Dundrum Bypass / Wyckham Way Roundabout to Overend Ave	90.6	94.6	4.4%	Y

2.6.8 The journey time validation results demonstrate that overall, 100% of modelled journey times validate to the observed journey times in both the AM and PM peak.

2.7 Network Performance Analysis

2.7.1 Network performance indicators provide a high-level indication of overall network efficacy and a basis for comparison of forecast year model scenarios. These include average delay per vehicle, average speed per vehicle and the Latent demand during the peak hour, and are shown in Table 2.8 for the AM and PM peak.

Table 2.8 2022 Base VISSIM Model Network Performance

	AM PEAK			PM PEAK		
Key Indicators	Average Delay (S)	Average Speed (KMPH)	Latent Demand (Number)	Average Delay (S)	Average Speed (KMPH)	Latent Demand (Number)
Base	139.8	14.5	152	99.3	17.9	11

2.7.2 The results demonstrate average delays that in both the AM and PM peak models are taking around 2 minutes 20 seconds and 1 minute 39 seconds. The PM peak model is showing a higher average network speed and lower latent demand.

2.7.3 From the network performance results, it is evident that both peaks are operating consistently well and without any significant congestion occurring.

2.8 SUMMARY

2.8.1 Overall, the 2022 base VISSIM model matches observed traffic count and journey time information well, and achieves the calibration and validation criteria set out in TII's PAG. As such, the model is a robust tool for assessing the impact of the junction changes proposed as part of the Dundrum ABTA.

3. DEMAND MATRIX DEVELOPMENT

3.1 Overview

3.1.1 To test the scenarios in the relevant future year of 2030, demand matrices were developed using a combination of sources;

- NTA's East Regional Model (ERM) – a multi-modal strategic model covering the east of the country; and
- Local Development – the number of additional trips generated by proposed developments along the route in place by 2030.

3.2 NTA East Regional Model

3.2.1 The East Regional Model is part of the NTA's Regional Modelling System (RMS) for Ireland that allows for the appraisal of a wide range of potential future transport and land use alternatives. The RMS comprises the National Demand Forecasting Model (NDFM); five large-scale, detailed, multi-modal regional transport models; and, a suite of Appraisal Modules. The five regional models comprising the RMS are focussed on the travel to-work areas for Dublin (represented by the aforementioned East Regional Model (ERM)), for Cork (represented by the South West Regional Model (SWRM)), for Limerick (represented by the Mid-West Regional Model (MWRM)), for Galway (represented by the West Regional Model (WRM)) and for Waterford (represented by the South East Regional Model (SERM)).

3.2.2 The key attributes of the five regional models include; full geographic coverage of each region, detailed representations of all major surface transport modes including active modes, road and public transport networks and services, and of travel demand for five time periods (AM, 2 Inter-Peaks, PM and Off-Peak). The RMS encompasses behavioural models calibrated to 2017 National Household Travel Survey data that predict changes in trip destination and mode choice in response to changing traffic conditions, transport provision and/or policies which influence the cost of travel[3].

3.3 Forecast Growth Strategies

3.3.1 Two 2030 strategies were developed for the VISSIM LAM testing;

- Core Scenario – includes traffic growth from a scenario including the delivery of the GDA Strategy along with local planned development; and
- High Growth Scenario – assuming no change in existing demand plus growth from local development.

3.4 Matrix Adjustment

3.4.1 The 'Core' scenario aims to reflect future travel patterns as a result of measures included in the GDA Transport Strategy. This includes schemes aimed at reducing vehicular travel and supporting a shift to sustainable modes in-line with latest policy and Climate Action Goals.

[3] Further details on the NTA's RMS can be found at https://www.nationaltransport.ie/planning-and-investment/transport-modelling/regional-modelling-system/

3.4.2 To determine future year travel demand in the 'Core' scenario, the ERM was applied to extract a growth factor for traffic between 2022 and 2030 with relevant GDA Transport Strategy measures in place. The process applied is shown in Figure 3.1 below.

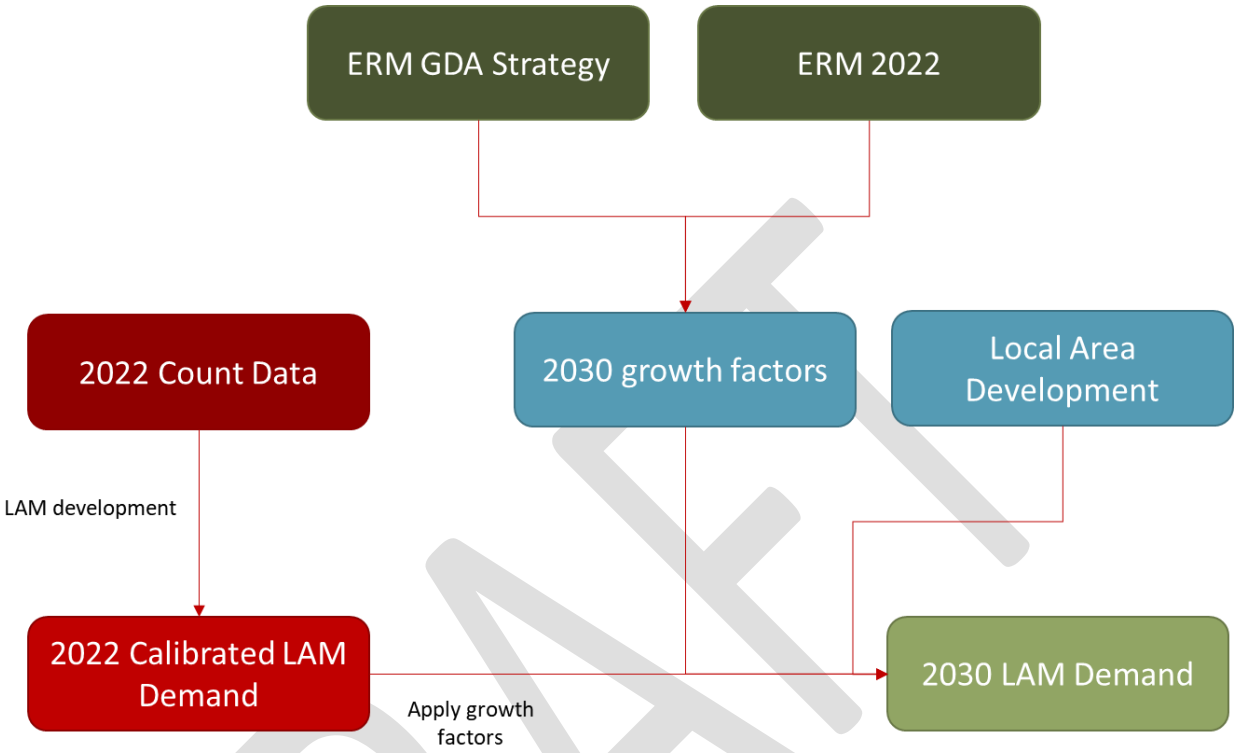


Figure 3.1 Future Year Growth Development

3.4.3 The growth factors derived from the ERM indicate a reduction of 26% of road traffic trips within the study area from the 2030 GDA Strategy scenario.

3.5 Local Development

3.5.1 Local development will play a key role in the performance of the road network, with new developments adding additional traffic to the junctions. Forecast development assumed for the study area is outlined in Table 3.1 below;

Table 3.1 Development within the study area

DEVELOPMENT	DESCRIPTION	QUANTUM
1. Dundrum Central SHD	Residential	977 (940 apartments, 17 duplex apartments and 20 no. two and three storey houses)
	Non- Residential	3,889 sqm restaurant, retail, cafe, medical unit, childcare, and community centre

DEVELOPMENT	DESCRIPTION	QUANTUM
2. Dundrum Village SHD	Residential	881 new apartments
	Non- Residential	3,424.7 sqm retail (including 2,028 sqm foodstore), 523.1 sqm Creche, 403.5 sqm café / restaurant 107.4 sqm Commercial Plant / Ancillary
3. Marmalade Lane	Residential	628no. Apartments
	Non- Residential	creche, gym, and residential amenities
4. Walled Garden	Residential	116 Apartments

3.5.2 TRICS[4] was used to estimate the likely trip generation from these planned developments within the study area and the resultant trip numbers are outlined in Table 3.2 below.

Table 3.2 Development Trips

TIME PERIOD	DEVELOPMENT TRIPS
AM	547
PM	534

3.6 Future Year Scenarios

3.6.1 A combination of the base calibrated demand, matrix adjustments from the ERM and the proposed local development traffic have been used to develop the 'Core' and 'High' demand scenarios.

3.6.2 The results of this process are outlined in Table 3.3. In summary:

- The 'Core' Scenario assumes the reduction of existing demand by 26% as a result of the GDA Strategy measures ***PLUS*** trips generated by new developments in the study area (net reduction in demand in the future year is 16%).

[4] TRICS is a database of trip rates for developments used in Ireland and the UK for transport planning purposes, specifically to quantify the trip generation of new developments

- The 'High' Demand Scenario assumes no reduction in existing demand ***PLUS*** additional trips generated by new developments in the study area (net increase in demand in the future year is 10%).

Table 3.3 Future year demand

	CORE DEMAND		HIGH DEMAND	
SCENARIO	**AM**	**PM**	**AM**	**PM**
Calibrated Demand	5,650	5,460	5,650	5,460
GDA Strategy (-26%)	-1,469	-1,420		
Development Traffic	547	534	547	534
New Demand	**4,728**	**4,574**	**6,197**	**5,994**
Difference	**-16%**	**-16%**	**+10%**	**+10%**

4. TANEY CROSS JUNCTION - OPTION TESTING

4.1 Overview

4.1.1 Situated at the North End of Dundrum Major Town Centre, Taney Cross is a large signalised junction between the R117 Dundrum Bypass and R112 Taney Road. The junction is shown in Figure 4.1 below, and includes the following:

- Left-turn slip lanes on all approach arms; and
- 3 lanes at the stop line on all approach arms.

Figure 4.1 Taney Cross Junction

4.1.2 In general, a junction layout of this size, with slip lanes of this nature is not favourable for pedestrians or cyclists due to:

- Longer crossing distances and requirement to make crossings in two-stages;
- Interaction between pedestrians and vehicles at the filter lights; and
- Generally higher vehicle speeds through the left-turn slip lanes.

4.1.3 The existing layout is therefore not conducive to safe and efficient pedestrian and cycle movements. The Design Manual for Urban Roads and Streets (DMURS) states the following:

"Left turning slips (left) generally offer little benefit in terms of junction capacity and increase the number of crossings pedestrians must navigate. They also allow vehicles to take corners at higher speeds, exposing pedestrians and cyclists to greater danger. Where a large number of turning movements occur, left turning lanes (right) with tighter corner radii should be used ."

4.1.4 Taney Cross is located at a critical point in the network on access to Main Street from the north. It is located in close proximity to the proposed civic space on Waldemar Terrace and the bus interchange planned to support the delivery of BusConnects.

4.1.5 In line with latest junction design guidance, it is therefore recommended as part of the Dundrum ABTA that Taney Cross junction is upgraded to reallocate road space for walking, cycling and public transport, including:

- Removal of left-turn filter lanes on all arms.
- Provision of cycle priority through the junction.
- Reducing carriageway widths in so far as possible to reduce crossing distances for pedestrians.
- Improved public realm and a more comfortable environment for pedestrians and cyclists at the junction.
- Provide bus priority measures, including bus lanes.

4.1.6 Four scenarios were tested for the Taney Cross junction and worked off the principle of stripping the junction back to the minimum requirement for operation (i.e. 1 lane for each arm) before adding in additional capacity to find a balance between the functionality of the junction for car and the needs of active users.

4.1.7 The scenarios tested are shown in Table 4.1 below with further details provided in the following sections.

Table 4.1 Model Scenarios

SCENARIOS	DESCRIPTION
Do Nothing	Calibrated base model with future year demand.
Scenario 1	Single lane approach for all arms.
Scenario 2	Scenario 1 + Additional right turn lane for all arms.
Scenario 3	Scenario 2 + Additional left lane on approach from Dundrum Bypass.
Scenario 3a	Scenario 3 + ban of right turn traffic from Taney Road to Dundrum Road and Dundrum Bypass to Taney Road.

4.1.8 All scenarios include the following measures recommended as part of the Dundrum ABTA:

- Conversion of Main Street to 1-way westbound at its northern end and rationalisation of the junction with Dundrum Bypass.
- Creation of a Bus Gate allowing buses to travel from Main Street onto Churchtown Road Upper.
- The provision of layover spaces along Churchtown Road Upper to support the bus interchange and roll-out of BusConnects.

Further details on each of these measures is provided in the Dundrum ABTA Report.

4.1.9 Journey time analysis for the routes illustrated in Figure 4.2 was undertaken to compare the various scenarios for Taney Cross under the 'Core' demand and understand the impact on the road network.

Figure 4.2 Taney Cross Journey Time Routes

4.2 Scenario 1

4.2.1 As outlined previously, Scenario 1 focused on reallocating as much road space as possible to sustainable modes. Figure 4.3 illustrates the proposed layout with a single approach arm in each direction (additional lanes on Churchtown Road Upper relate to bus layover). This would significantly reduce crossing distances for pedestrians and cyclists, and provide more space for public realm improvements.

4.2.2 Due to the single lane entry on all approach arms, the traffic signals need to operate on four separate phases with each arm getting its own turn to go along with an all-red pedestrian phase. This has been coded into the VISSIM model with an assumed 120 second cycle time.

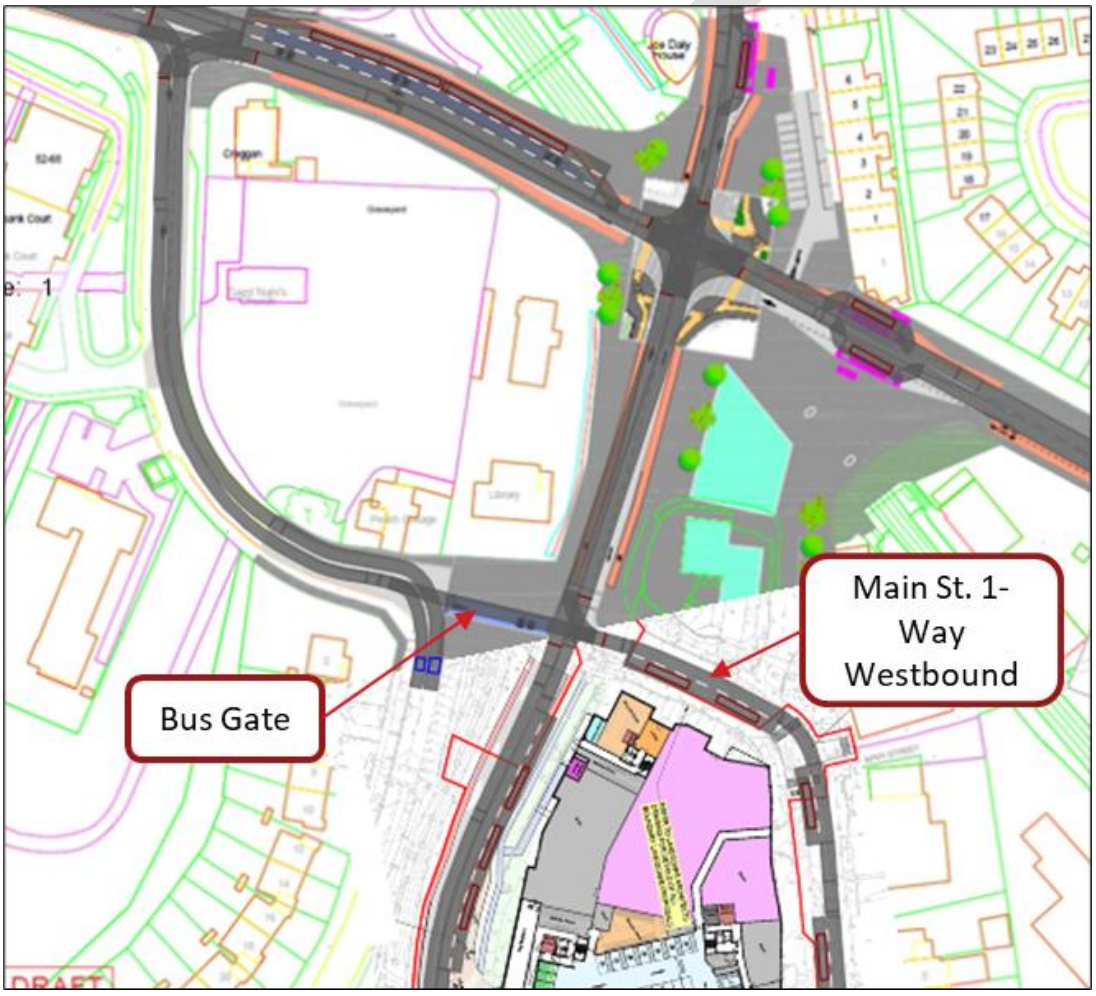


Figure 4.3 Taney Cross - Scenario 1

Journey Time Results

4.2.3 Journey times were extracted from the model for the routes illustrated in Figure 4.2 and the results are presented in Table 4.2 below.

Table 4.2 Journey Time results for Scenario 1

JOURNEY TIMES RESULTS (MINUTES) - SCENARIO 1								
Path	AM				PM			
	Base[5]	DN[6]	DS 1[7]	% Change (vs DN)	Base	DN	DS 1	% Change (vs DN)
Dundrum Road (Southbound)	4.9	5.6	4.6	-18%	4.6	4.9	6.4	30%
Dundrum Bypass (Northbound)	4.9	5.7	51.1	795%	3.1	3.2	31.6	890%
Churchtown Rd Upper (East Bound)	2.3	2.4	8.5	246%	2	2.2	7.3	231%
Taney Road (Westbound)	3.7	4.3	6.5	49%	2.5	2.5	5.4	114%

4.2.4 Scenario 1 represents a significant reduction in vehicular capacity when compared to the existing layout and this is reflected in the modelling results. Dundrum Bypass experiences an increase in journey times of approximately 45 minutes (795%) in the AM peak when compared to the Do Nothing scenario.

4.2.5 Journey times also increase significantly on the Churchtown Road Upper approach arm in both the AM and PM peaks. Overall, the VISSIM model essentially breaks down in this scenario. There are approximately 3,000 vehicles who are unable to join the model network due to the extent of the queuing and delay.

4.2.6 Whilst this option would allow for substantial improvements for active travel at the junction, it is considered unfeasible due to the high levels of congestion and delay for private vehicle users and bus users.

[5] Base = existing junction layouts and calibrated base year demand
[6] Do Nothing (DN) = existing junction layouts with forecast traffic demand
[7] DS1 = Scenario 1

4.3 Scenario 2

4.3.1 Scenario 2 builds on Scenario 1 aiming to provide some additional road capacity whilst still providing space for active mode improvements. One of the main issues with Scenario 1 was the inefficient signal phasing with each arm getting its own green time. With a single lane entry on all approaches, it is not possible to give opposing arms green time together as right turners are likely to block through traffic if they cannot make a turn against heavy opposing flows.

4.3.2 In order to address this, Scenario 2 looks at reintroducing right-turn lanes on all approaches. This provides space for right-turning vehicles to stack at the junction without blocking through movements. In this scenario, highest volume movements (e.g. North-South & East-West) can operate together in a single phase. This is a much more efficient signal operation with enhanced green time for major traffic movements.

4.3.3 In Scenario 2, all movements north-south (and vice versa) go together in a single phase. Through movements are then held back with a short green time given to allow right turners to clear the junction. Then all movements east-west (and vice versa) are given green time, with a similar clearing phase at the end to allow right turn vehicles to go.

Figure 4.4 Taney Cross Scenario 2

Journey Time Results

4.3.4 Journey times were extracted from the model for the routes illustrated in Figure 4.2 and the results are presented in Table 4.3 below.

Table 4.3 Journey time results for Scenario 2

JOURNEY TIMES RESULTS (MINUTES) - SCENARIO 2								
Path	AM				PM			
	Base	DN	DS 2	% Change (vs DN)	Base	DN	DS 2	% Change (vs DN)
Dundrum Road (Southbound)	4.9	4.1	4.7	13%	4.6	4.9	3.6	-26%
Dundrum Bypass (Northbound)	4.9	6.2	12.7	104%	3.1	3.2	4.2	34%
Churchtown Rd Upper (East Bound)	2.3	2.0	5.8	196%	2.0	2.1	5.6	163%
Taney Road (Westbound)	3.7	2.5	2.2	-11%	2.5	2.5	2.1	-17%

4.3.5 The journey time results indicate that the addition of a right turn flare to each arm of the junction provides substantial improvements to performance when compared to Scenario 1. In particular, Dundrum Bypass (northbound) experiences the greatest improvement with a reduction in delays from 51 minutes to just under 13 minutes in the AM peak. Similarly, Churchtown Road Upper (Eastbound) also experiences significant reductions in journey times when compared to Scenario 1.

4.3.6 However, the level delay on both the Dundrum Bypass and Churchtown Road Upper arms is still very high in this scenario. There is a doubling of journey times along Dundrum Bypass (Northbound) with increases of over 6 minutes in the AM peak. This suggests substantial levels of queuing and congestion remain on this arm in Scenario 2, impacting on bus operation and general traffic.

4.4 Scenario 3

4.4.1 The results in Scenario 2 indicated a significant level of queuing and delay, particularly on the Dundrum Bypass arm. Analysis of traffic count information highlighted a high volume of left-turning vehicles from Dundrum Bypass to Churchtown Road Upper in the AM peak. In total, approximately 650 vehicles were recorded travelling left or straight from the Dundrum Bypass arm.

4.4.2 Therefore, in order to provide additional capacity to support this movement, Scenario 3 introduces a dedicated left-turn lane on the Dundrum Bypass arm as illustrated in Figure 4.5

Figure 4.5 Taney Cross - Scenario 3

Journey Time Results

4.4.3 Journey times for Scenario 3 were extracted from the model for the routes illustrated in Figure 4.2, and the results are presented in Table 4.4 below.

Table 4.4 Scenario 3 journey time results

JOURNEY TIMES RESULTS (MINUTES) - SCENARIO 3								
Path	AM				PM			
	Base	DN	DS 3	% Change (vs DN)	Base	DN	DS 3	% Change (vs DN)
Dundrum Road (Southbound)	4.9	5.6	4.4	-21%	4.6	4.9	3.4	-31%
Dundrum Bypass (Northbound)	4.9	5.7	7.3	29%	3.1	3.2	7.3	130%
Churchtown Rd Upper (East Bound)	2.3	2.4	5.7	135%	2.0	2.2	5.7	161%
Taney Road (Westbound)	3.7	4.3	2.1	-53%	2.5	2.5	2.1	-19%

4.4.4 The addition of the left-turn lane on Dundrum Bypass has significantly improved its performance with journey times reducing by over 5 minutes in the AM peak.

4.4.5 The largest increases in journey times in Scenario 3 are along Churchtown Road Upper. There is very limited scope to include additional vehicular capacity on this arm due to:

- The location of the proposed bus layover spaces on the northern side of Churchtown Road Upper approaching Taney Cross; and
- The bridge structure which limits the possibility for widening the carriageway.

4.4.6 Overall, Scenario 3 performs substantially better than Scenario 1 and 2 in terms of balancing the impact on journey times and delay whilst retaining sustainable transport priority measures.

4.5 Scenario 3a

4.5.1 After reviewing the results from Scenario 3, further refinement was investigated to improve the environment for pedestrians and cyclists at the junction. The Taney Road crossing is very important as it connects Dundrum Road to Main Street and a proposed new civic space. As such, it is likely that this crossing will experience significant footfall.

4.5.2 Analysis of traffic survey information was undertaken to understand vehicle movements through Taney Cross and the results are illustrated in Figure 4.6. The results suggest relatively low volumes of traffic turning right from Dundrum Bypass (58 vehicles) and Taney Rd (68 vehicles) in the AM peak.

4.5.3 Scenario 3a investigated the potential to reduce crossing widths on Dundrum Bypass and Taney Rd by banning right-turn movements and removing associated lanes (illustrated in Figure 4.7).

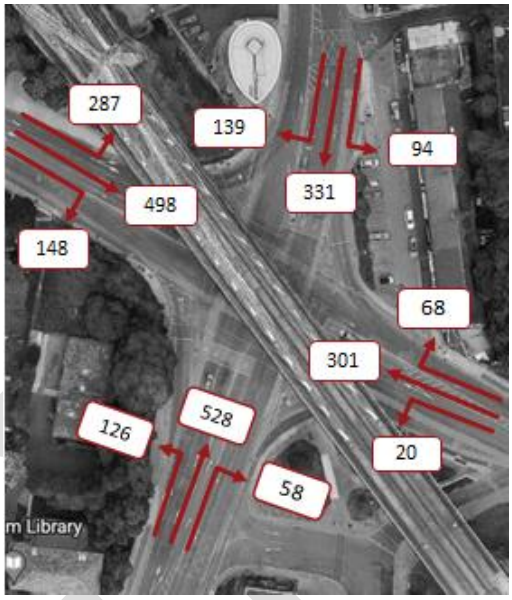


Figure 4.6 Turning Counts (08:00 – 09:00) – 08/03/2022

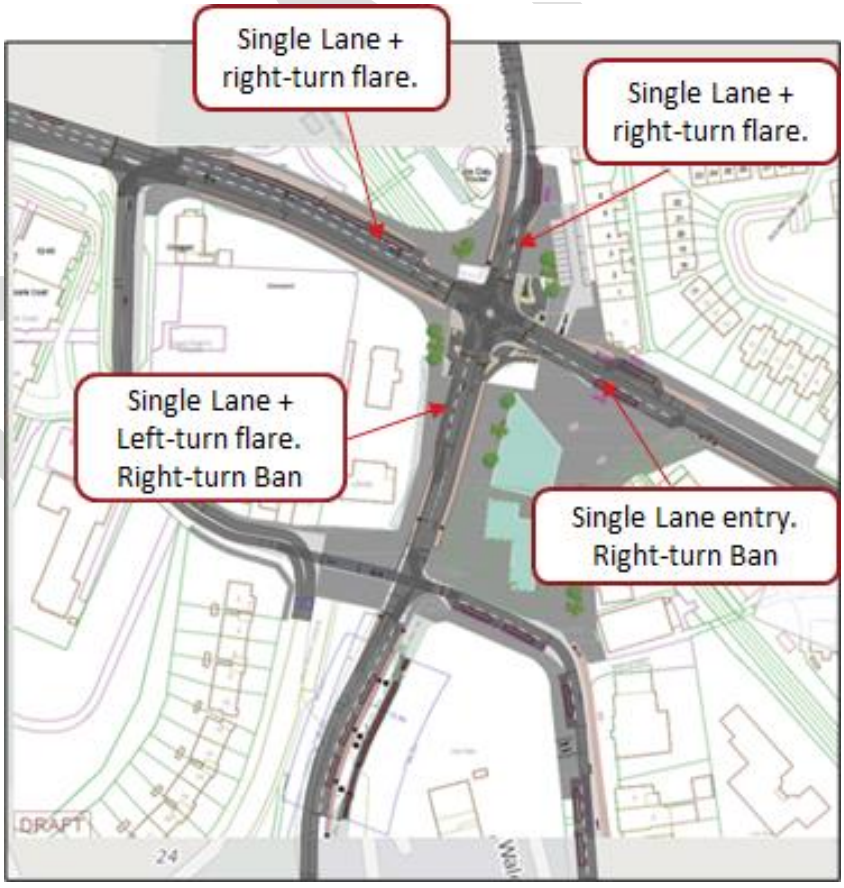


Figure 4.7 Taney Cross - Scenario 3a

Journey Time Results

4.5.4 Journey times for Scenario 3a were extracted from the model for the routes illustrated in Figure 4.2, and the results are presented in Table 4.5.

Table 4.5 Scenario 3a journey time results

JOURNEY TIMES RESULTS (MINUTES) - SCENARIO 3A								
Path	AM				PM			
	Base	DN	DS 3	% Change (vs DN)	Base	DN	DS 3	% Change (vs DN)
Dundrum Road (Southbound)	4.9	5.6	3.4	-38%	4.6	4.9	3.6	-27%
Dundrum Bypass (Northbound)	4.9	5.7	8.0	40%	3.1	3.2	3.3	5%
Churchtown Rd Upper (East Bound)	2.3	2.4	5.9	141%	2.0	2.2	5.1	133%
Taney Road (Westbound)	3.7	4.3	2.1	-52%	2.5	2.5	2.0	-20%

4.5.5 The benefit of removing the right turn traffic allows for the reduction in the number of lanes at the stop line, along with providing additional green time to other movements. The journey time results are relatively similar to Scenario 3, with improvements on the Dundrum Bypass arm in the PM peak.

4.5.6 Overall, the analysis indicates a journey time increase of just over 2 minutes on the Dundrum Bypass arm in the AM peak with very minor changes in the PM. Again, the most heavily impacted arm is Churchtown Road Upper with increases in journey time of around 3.5 minutes in the AM and 2.9 minutes in the PM peak. As noted previously, there is very little additional traffic capacity that can be added to this arm due to constraints at the bridge and bus layovers.

4.6 Taney Cross Summary

4.6.1 The previous sections have outlined the results of testing various options for Taney Cross aimed at balancing the needs for vehicular traffic as well as pedestrian, cyclists and public transport.

4.6.2 Overall, the modelling analysis suggests that scenario 3a performs best of the options tested. It facilitates:

- A significant reduction in crossing distances for pedestrians on all arms, particularly Taney Road which reduces from 5 traffic lanes plus 2 left-turn slip lanes currently, to 2 lanes of traffic in the proposed design. Taney Road is an extremely important pedestrian link connecting Dundrum Road to Main Street and the proposed civic space.
- Provision of cycle infrastructure through the junction to provide enhanced safety for cyclists.
- Removal of left-turn slip lanes on all arms which will reduce crossing distances and improve safety at the junction.
- Introduction of bus layovers on Churchtown Road and the delivery of bus priority from this arm through the junction.

4.6.3 The modelling analysis indicates that the proposed reduction in vehicular capacity as a result of these changes will impact on the road network performance. Dundrum Bypass and Churchtown Road Upper will experience increases in journey times and queuing as a result of the changes.

4.6.4 In terms of Dundrum Bypass, a similar level of stop line capacity is proposed as the ban on right-turn traffic to Taney Road removes the need for a right-turn lane. The main impact on the Dundrum Bypass arm is the removal of the left-turn slip lane which is in-line with latest design guidance to improve safety for pedestrians and cyclists.

4.6.5 Churchtown Road Upper will see a reduction in stop line capacity under the proposed design in Scenario 3a. This reduces from currently 3 lanes plus a left-turn slip lane, to 2 lanes in the proposed design. There is limited scope to provide additional capacity for vehicles on this arm due to the locations of the proposed bus layover and the Luas bridge structure.

4.6.6 It should be noted that the impacts of the reduction in capacity on road network performance is likely to be overestimated in the model as:

- **Fixed Traffic Signal Timings**: the model uses fixed traffic signals and phasing at the junction. These timings have been modified during testing to improve network performance, however, in reality Taney Cross would be controlled by a traffic control system such as SCATS. Therefore, the traffic signals would be able to adapt to vehicular flows and improve capacity which hasn't been reflected in the modelling.
- **Fixed Traffic Demand:** All the modelled scenarios have been tested using the same fixed future demand. As such, this doesn't include for any mode share impacts due to the wider proposed Dundrum ABTA measures e.g. a shift to more walking and cycling. It also doesn't account for vehicle re-routing that would likely occur to avoid potential congestion at Taney Cross when overall capacity is reduced.

5. WYCKHAM WAY JUNCTIONS

5.1 Background

5.1.1 Wyckham Way is a heavily trafficked dual-carriageway connecting Dundrum Major Town Centre to Ballinteer Road and the M50. There are currently three roundabouts located along the route:

- at the junction with Dundrum Bypass,
- at the junction with Ballinteer Road and
- at the junction with Ballinteer Avenue.

5.1.2 Whilst segregated cycle facilities are already provided along this corridor, the roundabouts are not pedestrian or cyclist friendly due to:

- Lack of formal, signalised crossing points on all arms;
- Large junction size with substantial crossing distances; and
- High traffic speeds particularly during uncongested times.

5.1.3 Wyckham Way is a key link for pedestrian and cyclists with a large number of residences, existing and planned, on both sides of the road along with access to both existing and planned schools. To provide a safer environment for pedestrians and cyclists, and encourage active travel along the corridor, it is therefore recommended as part of the Dundrum ABTA to upgrade the roundabouts to signalised junctions.

5.1.4 The benefits of traffic signals are:

- Dedicated crossings on all arms for pedestrians and cyclists with their own traffic signal phase completely separate from vehicular traffic;
- Significant reduction in the junction footprint when compared to the existing roundabouts leading to reduced crossing distances;
- Reduced traffic speeds along the corridor as vehicles may need to stop at the signals even during uncongested periods;
- Overall better control of traffic movements along the corridor, including the potential for bus priority measures at a later stage if required; and
- The signal timings can be altered to respond to heavily congested conditions allowing access from all arms of the junctions and providing more priority for local traffic flows than the present roundabouts can facilitate.

5.1.5 The Dundrum ABTA also recommends upgrades to the Sandyford Road/Overend Avenue junction including:

- Removal of left-turn slip lanes
- Continuation of cycle facilities through the junction providing priority for cyclists and removing the conflict that currently exists particularly with left-turning vehicles.
- Reducing carriageway widths in so far as possible to reduce crossing distances for pedestrians.

- Reallocation of road space to provide improved public realm and a more comfortable environment for pedestrians and cyclists at the junction

5.1.6 The following sections provide an overview of results from modelling the signalisation of the Wyckham Way roundabouts and the proposed changes to the Sandyford Road/Overend Avenue junction. The results focus on journey time changes along with average and maximum queue lengths along the corridor for the AM peak hour.

5.2 Demand Scenarios

5.2.1 As outlined in previously in Section 3.3, two future growth scenarios were developed for testing junction changes. Traffic flow volumes entering key junctions along the Wyckham Way were extracted for both the 'Core' and 'High' demand scenarios and the results are presented in Figure 5.1.

Figure 5.1 Wyckham Way Junction Traffic Flows

5.2.2 In general, the 'Core' scenario represents a reduction in general traffic volumes as a result of wider demand management measures proposed as part of the GDA Transport Strategy. The 'High' growth scenario represents existing demand with additional traffic generated by proposed

developments in Dundrum. This is reflected in the Wyckham Place arm which experiences the highest levels of traffic growth due to the proposed residential developments at this location. The results in this section have been presented for both the 'Core' and 'High' demand scenarios.

5.3 Sandyford Road/Overend Avenue & Dundrum Bypass/Wyckham Way

Junction Changes

5.3.1 The results for these two junctions have been presented together due to their proximity and the likelihood of congestion at one impacting on the other. The proposed changes to the Sandyford Road / Overend Avenue junction are illustrated in Figure 5.2. The main changes include:

- Removal of the left-turn slip lanes on Sandyford Road (North), Sandyford Road (South) and Wyckham Way arms.
- Removal of left turn lane on the Overend Avenue arm.
- Provision of cycle priority through the junction.

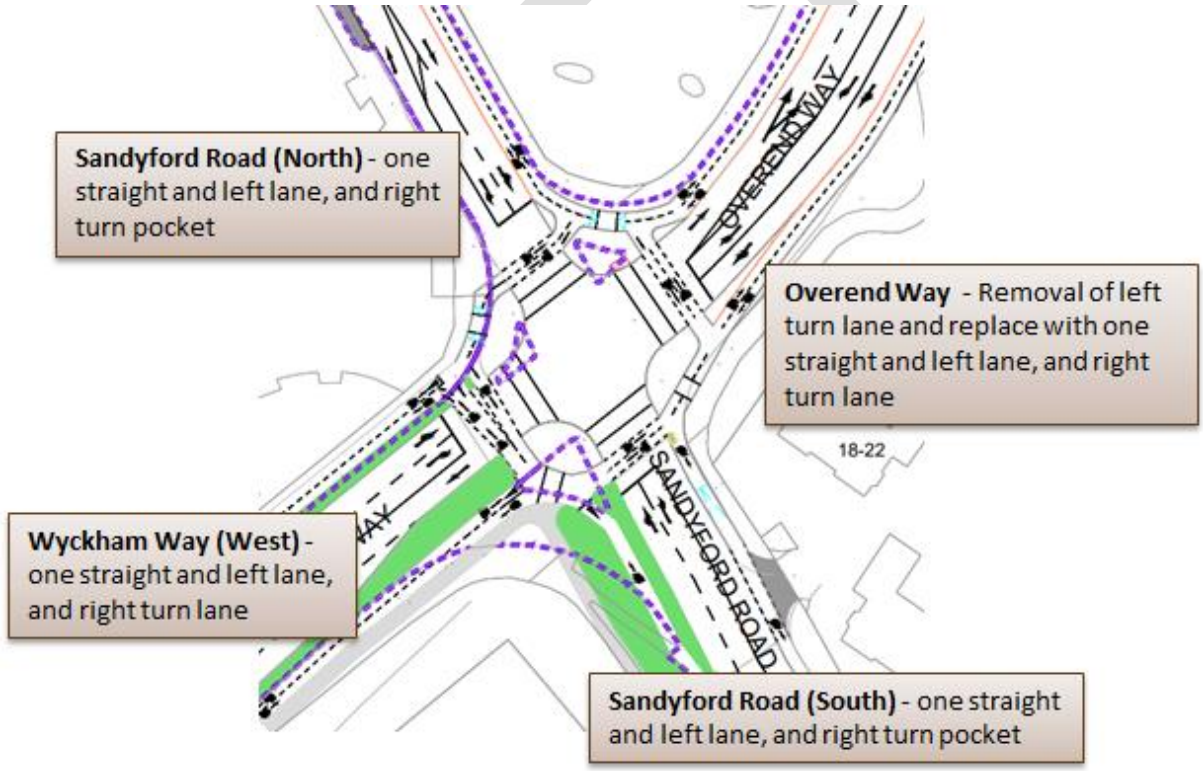


Figure 5.2 Proposed change to the Sandyford Road/Wyckham Way junction

5.3.2 The Wyckham Way/Dundrum Bypass serves as one of the main access points to Dundrum Shopping Centre for vehicular traffic as well as access to the Dundrum Bypass for traffic bypassing the town centre to access north Dundrum. The existing layout for this junction is shown in Figure 5.3 below.

Figure 5.3 Wyckham Way/Dundrum Bypass junction

5.3.3 It is proposed to replace the roundabout with a signalised junction consisting of;

- **Wyckham Way (Southbound)** – two lanes on approach, with both lanes serving straight on and the outside lane serving both straight and right turns;
- **Wyckham Way (Northbound)** – two lanes on approach, both providing straight over movements and removal of the left turn slip with left turns catered for by the inside lane;
- **Dundrum Bypass** – single lane on approach providing for movements to Wyckham Way Northbound and Southbound, with a long inside flare providing for movements to the shopping centre and Wyckham Way northbound; and
- **Shopping Centre** – two lanes, one providing for Wyckham Way northbound and Southbound and the second providing for Wyckham Way Southbound and the Dundrum Bypass.

5.3.4 The proposed layout is as shown in Figure 5.4 below.

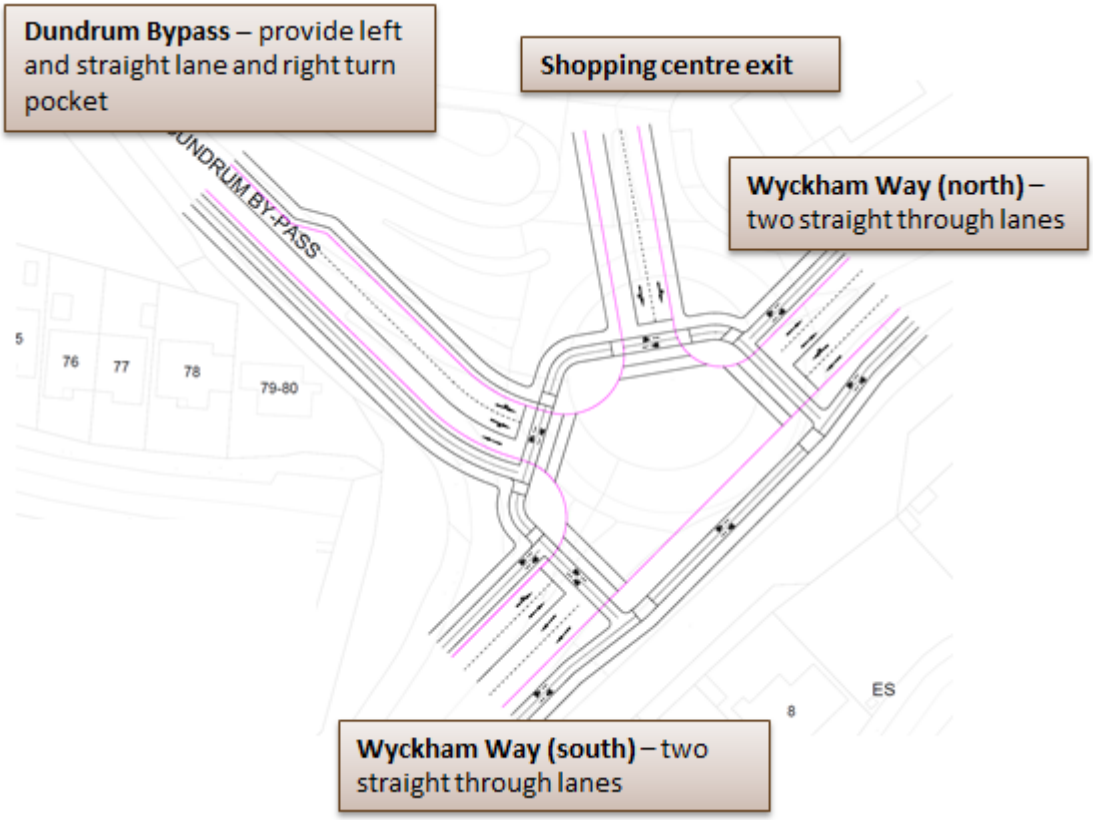


Figure 5.4 Proposed change to Wyckham Way/Dundrum Bypass junction

Journey Time Results

5.3.5 The journey time results for sections on entry to each of the junctions outlined above are provided in Table 5.1 and Table 5.2 for the AM peak 'Core' and 'High' demand scenarios. The 'Core' scenario results indicate very minor changes in journey times across the majority of the junction arms. Although the proposed junction changes reduce capacity at the Sandyford Road/Overend Avenue junction, this scenario includes a reduction in traffic volumes of around 25% when compared to the base.

5.3.6 In the 'High' demand scenario, there are larger increases in journey times across the junctions. The Sandyford Road arm experiences a 1.6 minute (80%) increase in journey time primarily due to the removal of the left-turn slip lane.

5.3.7 There are also increases in journey times along Dundrum Bypass (1.8 minutes) and Wyckham Way (2.5 minutes) as a result of the proposed junction changes.

Table 5.1 Journey time results – AM Peak Core Demand

Route	Distance (m)	Do Nothing (mins)	Do Something (mins)	Change (mins)	% Change
JT 1	1,100	4.9	4	-0.9	-18%
JT 2	250	1.5	1.6	0.1	7%
JT 3	310	2	1.5	-0.5	-25%
JT 4	120	1	0.8	-0.2	-20%
JT 5	180	1.5	3.7	2.2	147%

Table 5.2 Journey time results – AM Peak High Demand

Route	Distance (m)	Do Nothing (mins)	Do Something (mins)	Change (mins)	% Change
JT 1	1,100	5.3	7.1	1.8	34%
JT 2	250	1.4	1.7	0.3	21%
JT 3	310	2	3.6	1.6	80%
JT 4	120	1	0.8	-0.2	-20%
JT 5	180	1.4	3.9	2.5	179%

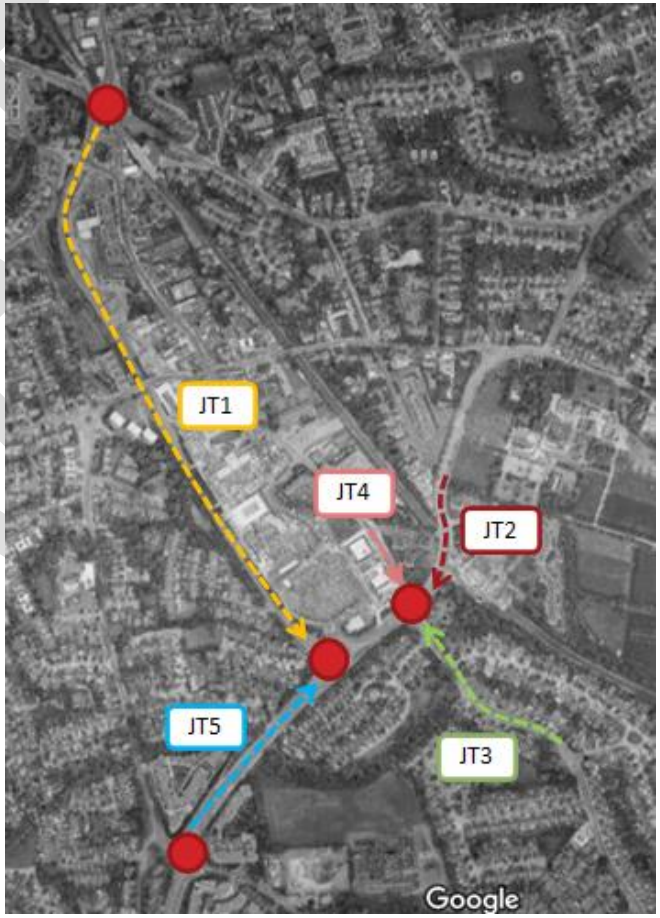


Figure 5.5 Journey times routes - Wyckham Way/Dundrum Bypass junction

Queue Length Results

Figure 5.6 and Figure 5.7 below illustrate the change in Average and Maximum Queue lengths on each junction arm for the 'Core' and High' demand scenarios respectively. In summary:

'Core' Demand Scenario:

- Maximum queues at the junctions increase moderately on most arms, with a larger increase of approx. 100m on the northbound Wyckham Way arm and a minor decrease on the Southbound Dundrum Bypass.
- The increase on the Wyckham Way, while notable, does not encroach on other major junctions upstream.
- Average queues for the peak hours at both junctions increases slightly, but increases are not significant enough to impact neighbouring roads or access areas.
- The change in queuing does not lead to substantial increases in delays on any arms other than the northbound Wyckham Way, which has an increased journey time of 2.2 minutes.

'High' Demand Scenario:

- In the 'High' growth scenario, the Do Nothing queue lengths are more severe than the 'Core' growth. In the Do Something scenario, these maximum queues increase on all arms, with the maximum queue length on the Northbound Wyckham Way extending back almost as far as the Wyckham Way/Ballinteer Road Junction.
- The longest maximum queue is on the Dundrum Bypass at 390m in the Do Nothing which increases to 480m in the Do Something scenario.
- At the Sandyford/Overend Avenue junction, the largest queueing is experienced on the Sandyford Road arm. The maximum queue here increases from 285m to 330m in the Do Something scenario.
- Overall, queuing increases in general across all arms due to the proposed junction changes which is reflected in the increases in journey times presented in Table 5.2. However, the average queueing on each arm does not extend back to interfere with any other local junctions or access points.

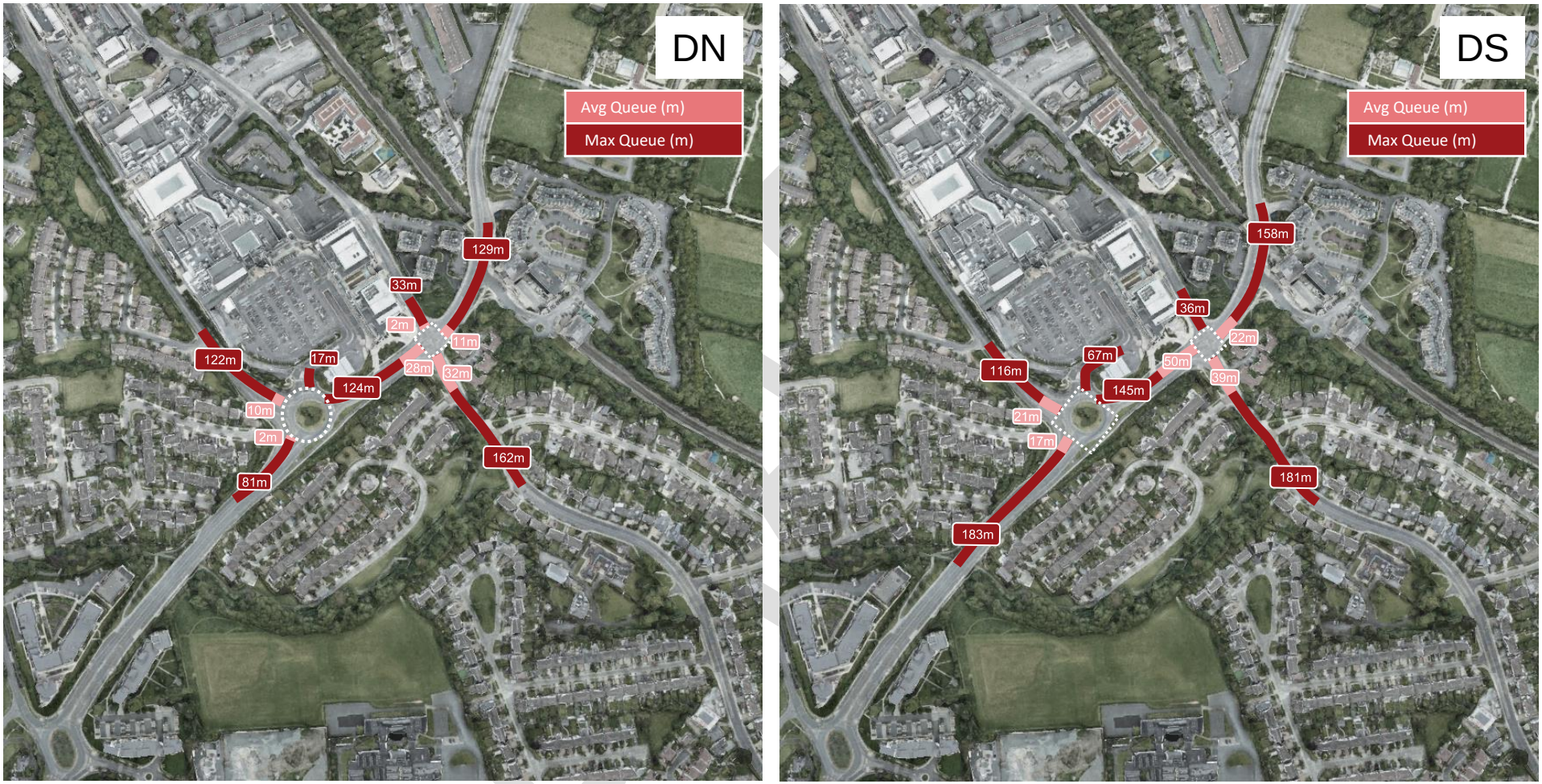


Figure 5.6 Do Nothing and Do Something queues for Wyckham Way/Dundrum Bypass junction – Core Growth

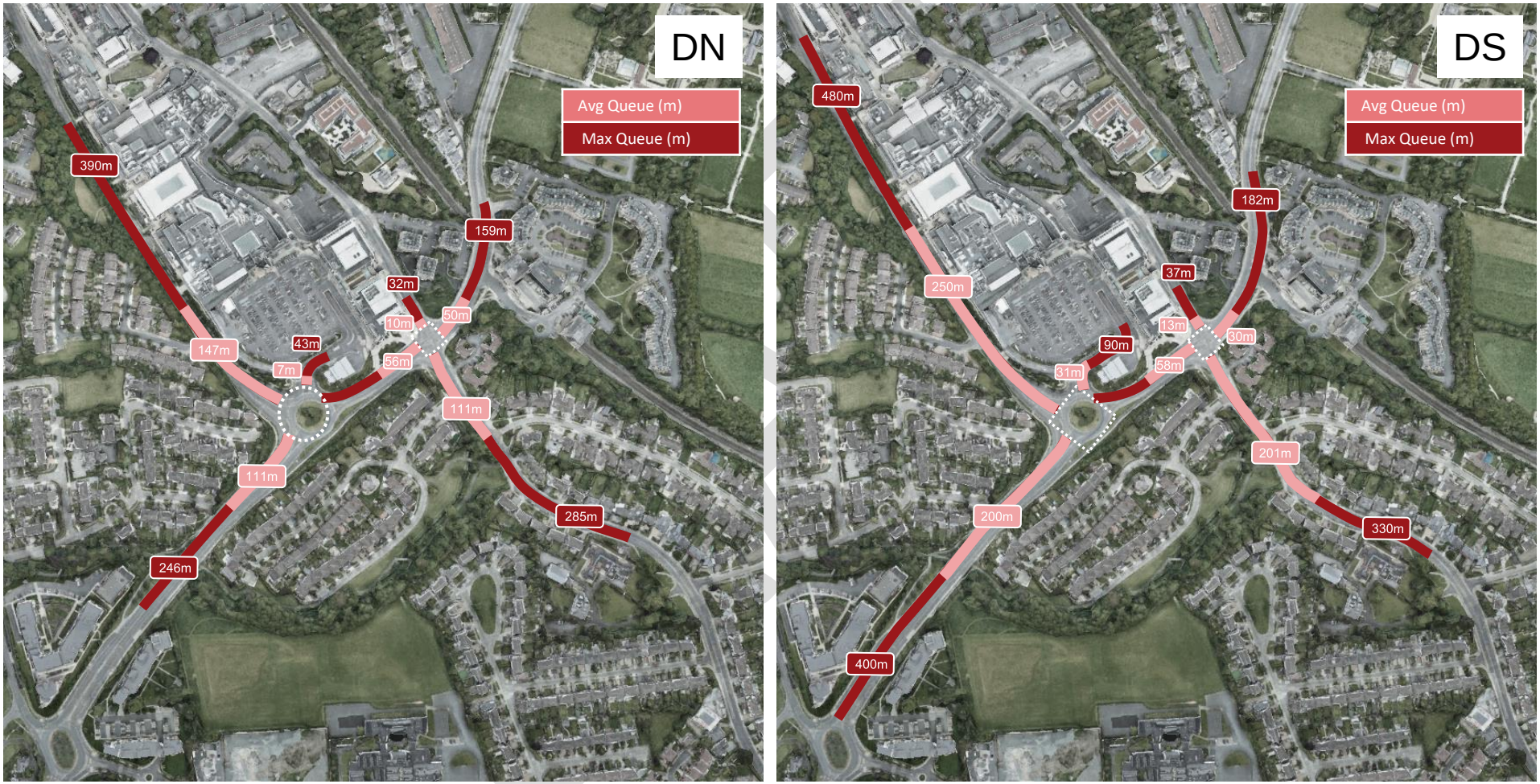


Figure 5.7 Do Nothing and Do Something queues for Wyckham Way/Dundrum Bypass junction – High Growth

5.4 Wyckham Way/ Ballinteer Road Junction

5.4.1 The Wyckham Way/Ballinteer Road junction sits to the south of Dundrum and provides access to the Wyckham Place apartment complex as well as a large residential area along the Ballinteer Road. The junction is shown in Figure 5.8 below.

Figure 5.8 Wyckham Way/Ballinteer Road junction

5.4.2 It is proposed to replace the roundabout with a signalised junction consisting of;

- **Wyckham Road (Southbound)** – two straight through lanes, with the inside lane providing for left turn movements and short right turn flare into Ballinteer Road;
- **Wyckham Road (Northbound)** – two straight through lanes with the inside lane providing for left turn movements and short right turn flare into Wyckham Place;
- **Ballinteer Road** – One lane providing for left and straight movements and a right turn flare providing for right turn movements; and
- **Wyckham Place** – Single lane providing for all movements.

5.4.3 The proposed junction layout is shown in Figure 5.9 below.

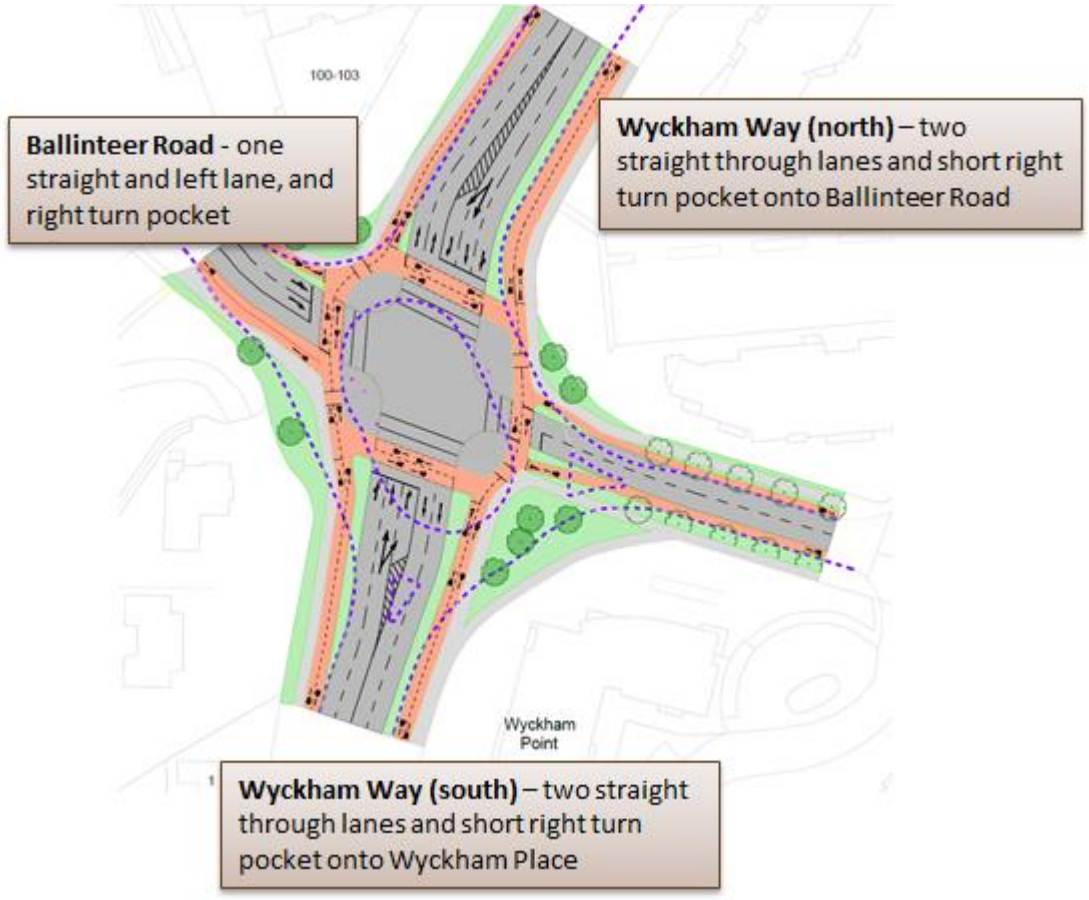


Figure 5.9 Proposed design for Wyckham Way/Ballinteer Road junction

Journey Time Results

5.4.4 The journey time results for sections on entry to each of the junction arms are provided in Table 5.3 and Table 5.4 for the AM peak 'Core' and 'High' demand scenarios. In summary:

- In general, journey time increases across both the 'Core' and 'High' demand scenarios are experienced on all arms, with the exception of Ballinteer Road in the 'Core' scenario. This is primarily due to the conversion of the junction from a high capacity roundabout with poor pedestrian/cycle facilities to a traffic signal controlled junction accommodating the safe movement of all transport modes. Whilst large in percentage terms, the actual increase ranges from between 30 to 90 seconds.
- The increases are slightly larger on the Wyckham place arm (JT2). This is reflective of the additional growth in traffic at this location due to the planned developments. This delay could be reduced through greater optimisation of the traffic signals.

Table 5.3 Journey time results Wyckham Way/Ballinteer Road – AM Peak Core Demand

Route	Distance (m)	Do Nothing (mins)	Do Something (mins)	Change (mins)	% Change
JT 1	430	1	1.6	0.6	60%
JT 2	115	0.4	3	2.6	650%
JT 3	370	0.8	1.7	0.9	113%
JT 4	245	3.3	2	-1.3	-39%

Table 5.4 Journey time results Wyckham Way/Ballinteer Road – AM Peak High Demand

Route	Distance (m)	Do Nothing (mins)	Do Something (mins)	Change (mins)	% Change
JT 1	430	1	1.6	0.6	60%
JT 2	115	0.4	3.2	2.8	700%
JT 3	370	0.8	2.2	1.4	175%
JT 4	245	3.3	4.7	1.4	42%

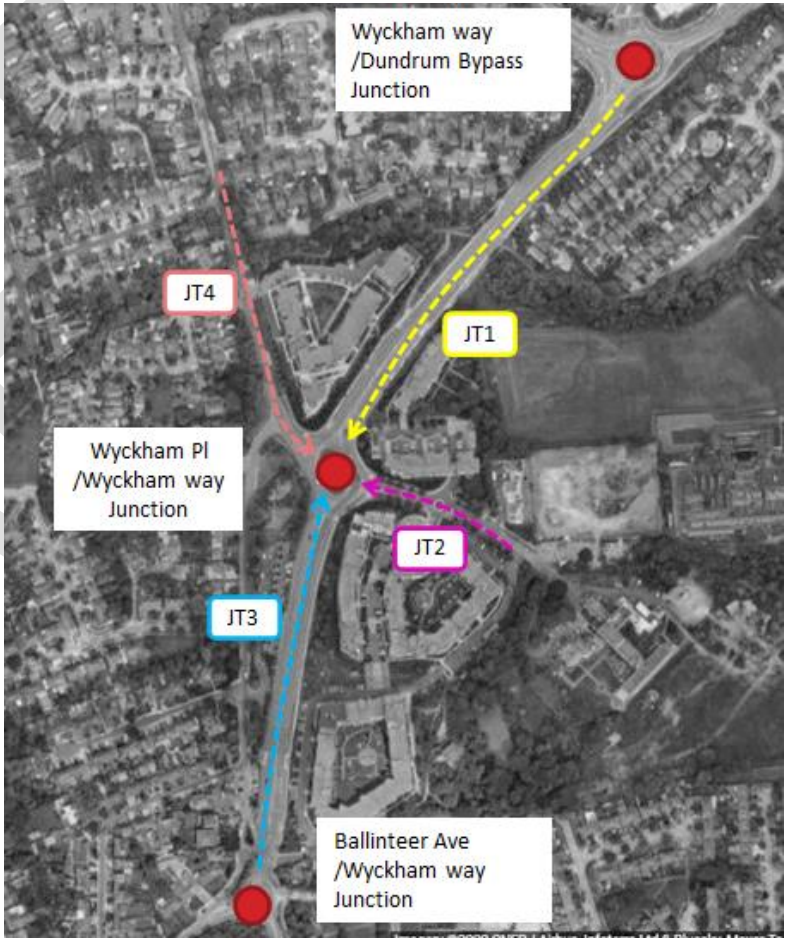


Figure 5.10 Journey times routes - Wyckham Way/Ballinteer Road Junction

Queue Length Results

5.4.5 Figure 5.11 and Figure 5.12 below illustrate the change in Average and Maximum Queue lengths on each junction arm for the 'Core' and High' demand scenarios respectively. In summary:

'Core' Demand Scenario:

- The results indicate relatively minor queuing in the Do Nothing scenario with the largest maximum queue on Ballinteer Road of 87m.
- These maximum queues increase between the Do Nothing and the Do Something scenarios but remain minimal on all arms. The largest increase is on Ballinteer Road (100m), however, this represents maximum queuing throughout the peak hour and the average queue on this arm is much smaller at only 32m.

'High' Demand Scenario:

- There is very little change in queuing on the Wyckham Way arms in the 'High' growth scenario between the Do Nothing and Do Something. The maximum queue does increase by 116m on the southern arm, however, the average queue only increases by 30m.
- The 'High' Growth scenario results in longer queues on the Ballinteer Road in the Do Nothing when compare to the 'Core' scenario – average queues of 191m and a maximum of 248m. This queuing increases by a relatively small amount in the Do Something scenario – 26m increase in average queue length (approx. 4 cars).
- The Wyckham Place arm experiences increases in maximum queueing between the Do Nothing and Do Something of 73m. This is reflective of the additional traffic demand entering the junction from this arm in the future scenario due to new developments.
- Whilst the queuing does increase on most arms, this is relatively minor with no impact on downstream junctions. This is reflected in the average increases in journey times of between 30 and 90 sections at this junction.

Figure 5.11 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Road junction – Core Growth

Figure 5.12 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Road junction – High Growth

5.5 Wyckham Way/Ballinteer Avenue Junction

5.5.1 The Wyckham Way / Ballinteer Ave junction sits at the southern end of the Wyckham Way close to the M50 providing access to Wesley College and the large residential areas off Ballinteer Avenue. The junction is shown in Figure 5.13 below.

Figure 5.13 Wyckham Way/Ballinteer Avenue

5.5.2 It is proposed to replace the roundabout with a signalised junction consisting of;

- **Wyckham Way (Southbound)** – two lanes, one providing for straight on and left turn movements and the second right turn movements;
- **Wyckham Way (Northbound)** – one lane on approach providing for straight on and left turn movements with a right turn flare providing for right turn movements;
- **Ballinteer Avenue** – One lane providing for left and straight movements and a right turn flare providing for right turn movements; and
- **Wesley College** – Single lane providing for all movements.

5.5.3 The proposed junction design is shown in Figure 5.14 below.

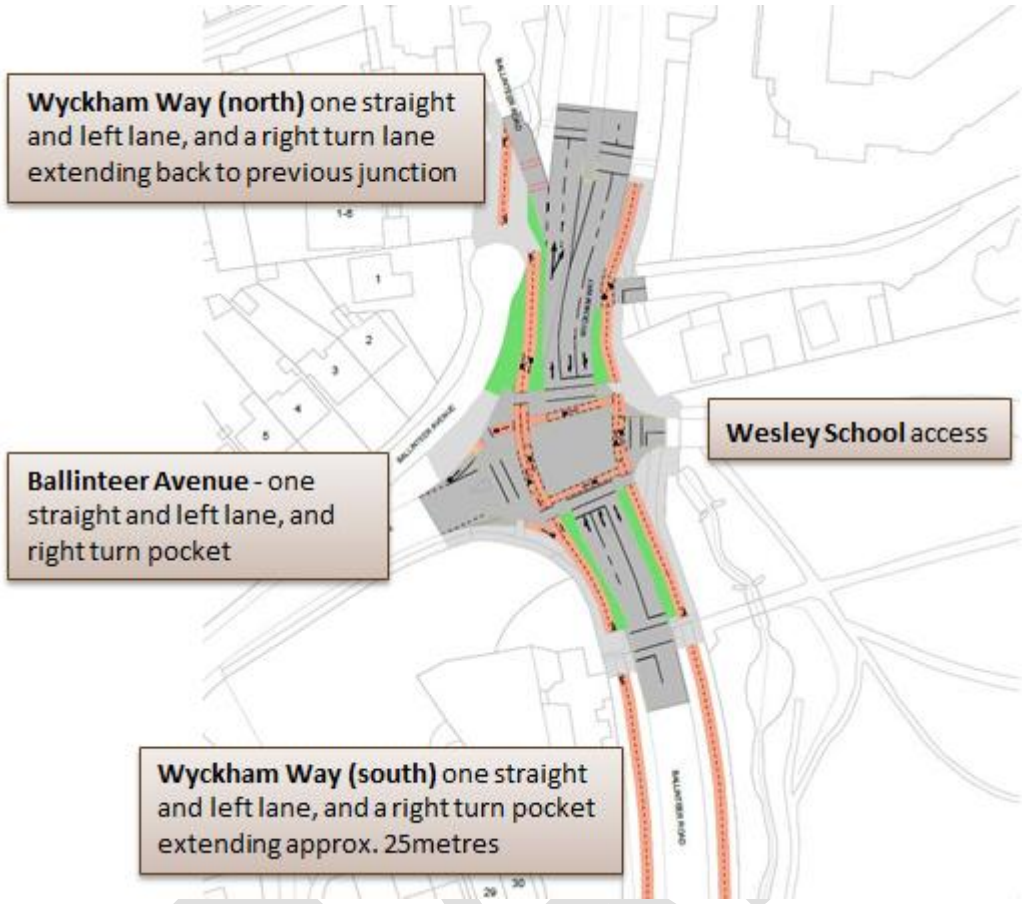


Figure 5.14 Proposed design for Wyckham Way/Ballinteer Avenue

Journey Time Results

5.5.4 The journey time results for sections on entry to each of the junction arms are provided in Table 5.5 and Table 5.6 for the AM peak 'Core' and 'High' demand scenarios. In summary:

- In general, the journey time increases in both the 'Core' and 'High' demand scenarios are relatively minor across most of the arms.
- The largest increase in the 'Core' scenario is at the exit to Wesley College (2.3 minutes). However, given the lack of delay on other arms it is likely that the signal timings could be further adjusted to give more priority to this movement.
- In the 'High' growth scenario, the largest increase in journey times are on Wyckham Way and Ballinteer Avenue arms of between 90 and 100 seconds.

Table 5.5 Journey time results Wyckham Way/Ballinteer Ave – AM Peak Core Demand

Route	Distance (m)	Do Nothing (mins)	Do Something (mins)	Change (mins)	% Change
JT 1	395	1	1.1	0.1	10%
JT 2	100	0.5	2.8	2.3	460%
JT 3	200	0.7	0.8	0.1	14%
JT 4	365	4.2	4.4	0.2	5%

Table 5.6 Journey time results Wyckham Way/Ballinteer Ave – AM Peak High Demand

Route	Distance (m)	Do Nothing (mins)	Do Something (mins)	Change (mins)	% Change
JT 1	395	1.1	2.6	1.5	136%
JT 2	100	3.8	4.1	0.3	8%
JT 3	200	0.7	1.1	0.4	57%
JT 4	365	4.7	6.4	1.7	36%

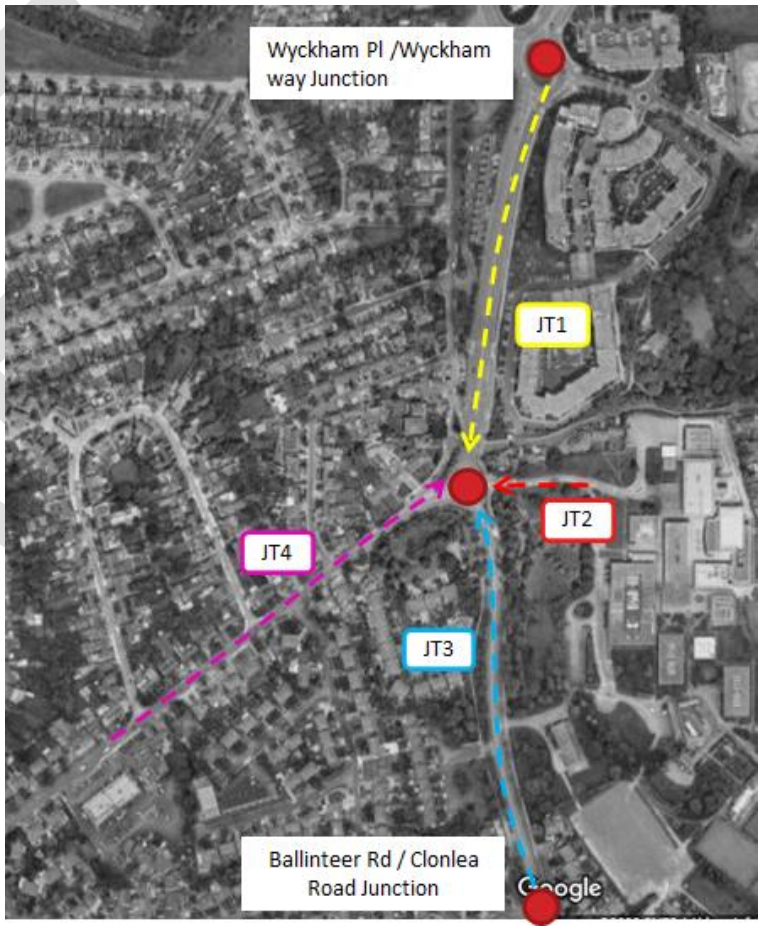


Figure 5.15 Journey times routes - Wyckham Way/Ballinteer Avenue Junction

Queue Length Results

5.5.5 Figure 5.16 and Figure 5.17 below illustrate the change in Average and Maximum Queue lengths on each junction arm for the 'Core' and High' demand scenarios respectively. In summary:

'Core' Demand Scenario:

- The results indicate minor increases in maximum and average queuing on the Wyckham Way (South) and Ballinteer Avenue arms between the Do Nothing and Do Something scenarios.
- The maximum queue on the Wyckham Way (North) arm increase by 70m, however, this doesn't have any knock-on impact on upstream junctions or accesses.
- The largest increase in average queuing between the Do Minimum and Do Something scenario is on the Wesley College access. This is reflected in the journey time increases in Table 5.5. However, as stated previously, it is likely that this queuing could be reduced through an optimisation of the signal timings.

'High' Demand Scenario:

- Under the 'High' growth scenario, maximum queuing along Ballinteer Avenue increases by 37m between the Do Nothing and Do Something whilst the average queue increases by 97m. This increase is reflected in the journey time increases along this route of 1.7 minutes.
- On the Wyckham Way arms, there are very minor changes in average queue lengths between the Do Nothing and Do Something scenarios. There are more significant increases in maximum queue lengths on both arms, however, they do not extend back to impact on any downstream junctions.
- The Wesley College arm has an increase in average queue of 60m and maximum queue of 40m in the Do Something scenario, however, the change in journey time as a result of this increase is small (Table 5.6). The implementation of a vehicle actuated traffic control system may be able to provide additional green time, for example at school drop off, to assist this entrance during busy periods.

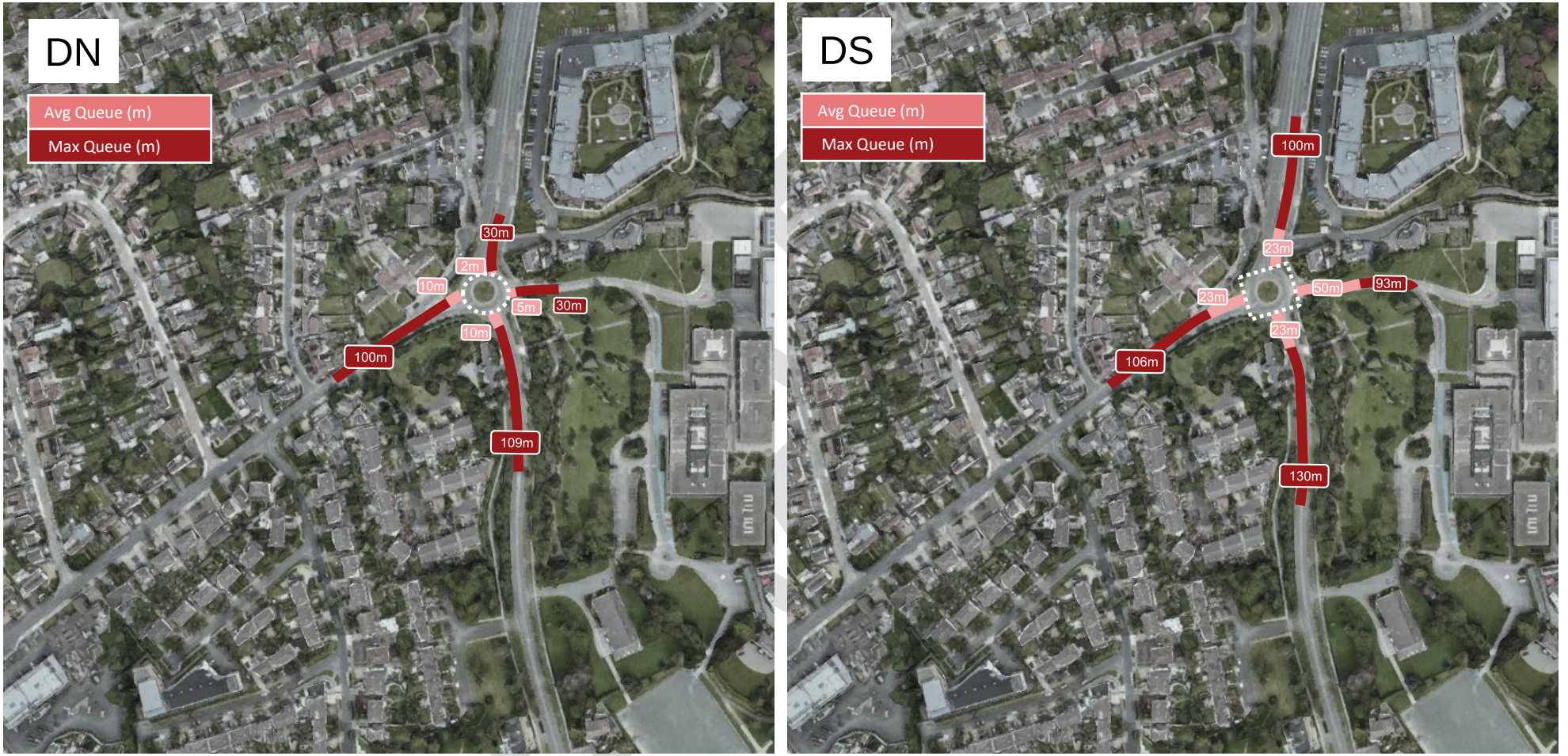
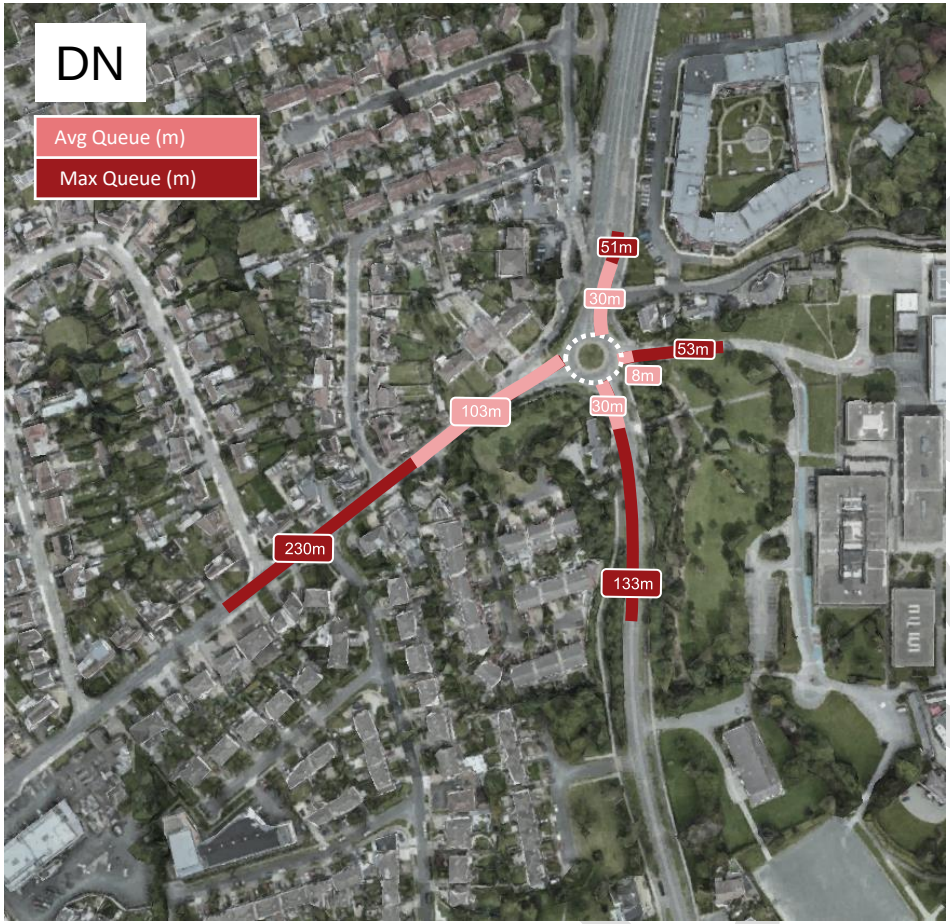


Figure 5.16 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Avenue junction – Core Growth



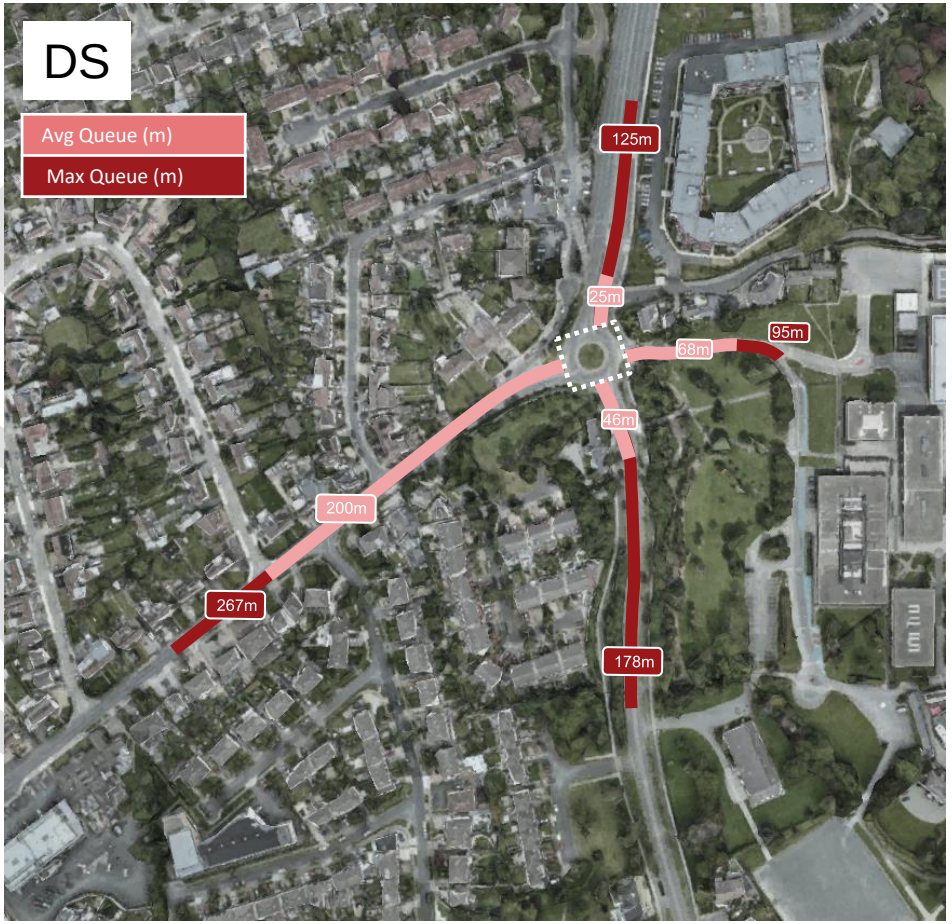


Figure 5.17 Do Nothing and Do Something queues for Wyckham Way/Ballinteer Avenue junction – High Growth

5.6 Wyckham Way Journey Time

5.6.1 Analysis was undertaken on journey times along the Wyckham Way corridor as a whole for the AM peak (route illustrated in Figure 5.18) and the results are presented in Table 5.7 and Table 5.8.

Table 5.7 Wyckham Way Corridor Journey time results – AM Peak Core Demand

Route	Do Nothing (mins)	Do Something (mins)	Change (mins)
Southbound	4.9	5.3	0.4
Northbound	5.4	8.7	3.3

Table 5.8 Wyckham Way Corridor Journey time results – AM Peak High Demand

Route	Do Nothing (mins)	Do Something (mins)	Change (mins)
Southbound	4.9	9.3	4.4
Northbound	5.4	9.9	4.5

Figure 5.18 Wyckham Way Journey Time Route

5.6.2 The results indicate that the proposed junction changes along Wyckham Way will lead to an overall increase in journey time along the route. The increases are larger in the 'High' demand scenario due to the increased traffic volume in this scenario. In summary:

- **Southbound direction:** Overall journey time increases range from 24 seconds in the 'Core' scenario to 4 minutes 24 seconds in the 'High' demand scenario.
- **Northbound direction:** Overall journey time increases range from 3 minutes 18 seconds in the 'Core' scenario to 4 minutes 30 seconds in the 'High' demand scenario.

5.7 Wyckham Way Summary

5.7.1 The previous sections have outlined the modelling results at each of the four junction changes proposed as part of the Dundrum ABTA. In summary:

- The proposed network enhancements along Wyckham Way will provide a step change in facilities for those travelling by walking and cycling, significantly improving safety.
- The proposed designs retain the same number of trafficked lanes on Wyckham Way, whilst introducing enhanced active travel facilities.
- The provision of signal-controlled junctions incorporating dedicated crossing facilities will result in an overall increase in journey time along the Wyckham Way in both the 'Core' and 'High' Demand scenarios. This will also lead to some increased congestion and queuing along the corridor.
- Whilst Wyckham Way experiences longer journey times, traffic clears the network during the modelled period. The model also likely overpredicts the impact of delay on the network as it does not reflect the implementation of demand responsive signals at these locations.
- In general, traffic signals will be better able to respond than roundabouts to over congested conditions. The signal timings can be altered to respond allowing access from all arms of the junctions and providing more priority for local traffic flows than the present roundabouts can facilitate.

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

A diverse group of results-oriented people, we are part of a strong team of professionals worldwide. Through client business planning, customer research and strategy development we create solutions that work for real people in the real world.

For more information visit www.systra.co.uk

Birmingham – Newhall Street
5th Floor, Lancaster House, Newhall St,
Birmingham, B3 1NQ
T: +44 (0)121 393 4841

Birmingham – Edmund Gardens
1 Edmund Gardens, 121 Edmund Street,
Birmingham B3 2HJ
T: +44 (0)121 393 4841

Dublin
2nd Floor, Riverview House, 21-23 City Quay
Dublin 2,Ireland
T: +353 (0) 1 566 2028

Edinburgh – Thistle Street
Prospect House, 5 Thistle Street, Edinburgh EH2 1DF
United Kingdom
T: +44 (0)131 460 1847

Glasgow – St Vincent St
Seventh Floor, 124 St Vincent Street
Glasgow G2 5HF United Kingdom
T: +44 (0)141 468 4205

Glasgow – West George St
250 West George Street, Glasgow, G2 4QY
T: +44 (0)141 468 4205

Leeds
100 Wellington Street, Leeds, LS1 1BA
T: +44 (0)113 360 4842

London
3rd Floor, 5 Old Bailey, London EC4M 7BA United Kingdom
T: +44 (0)20 3855 0079

Manchester – 16th Floor, City Tower
16th Floor, City Tower, Piccadilly Plaza
Manchester M1 4BT United Kingdom
T: +44 (0)161 504 5026

Newcastle
Floor B, South Corridor, Milburn House, Dean Street, Newcastle, NE1 1LE
United Kingdom
T: +44 (0)191 249 3816

Perth
13 Rose Terrace, Perth PH1 5HA
T: +44 (0)131 460 1847

Reading
Soane Point, 6-8 Market Place, Reading,
Berkshire, RG1 2EG
T: +44 (0)118 206 0220

Woking
Dukes Court, Duke Street
Woking, Surrey GU21 5BH United Kingdom
T: +44 (0)1483 357705

Other locations:

France:
Bordeaux, Lille, Lyon, Marseille, Paris

Northern Europe:
Astana, Copenhagen, Kiev, London, Moscow, Riga, Wroclaw

Southern Europe & Mediterranean: Algiers, Baku, Bucharest,
Madrid, Rabat, Rome, Sofia, Tunis

Middle East:
Cairo, Dubai, Riyadh

Asia Pacific:
Bangkok, Beijing, Brisbane, Delhi, Hanoi, Hong Kong, Manila, Seoul, Shanghai, Singapore, Shenzhen, Taipei

Africa:
Abidjan, Douala, Johannesburg, Kinshasa, Libreville, Nairobi

Latin America:
Lima, Mexico, Rio de Janeiro, Santiago, São Paulo

North America:
Little Falls, Los Angeles, Montreal, New-York, Philadelphia, Washington

A. CALIBRATION COUNTS

A.1 2022 AM PEAK SUMMARY

Junction	Description	Modelled	Count	% Difference	GEH	
Ballinteer Ave/Ballinteer Rd Jn	Wyckham Way N to Wyckham Way N	1	4	-75%	1.90	Pass
	Wyckham Way N to Wesley College	151	117	29%	2.94	Pass
	Wyckham Way N to Ballinteer Rd	616	633	-3%	0.68	Pass
	Wyckham Way N to Ballinteer Ave	274	230	19%	2.77	Pass
	Wesley College to Wyckham Way N	118	86	37%	3.17	Pass
	Wesley College to Wesley College	0	0	0%	0.00	Pass
	Wesley College to Ballinteer Rd	18	26	-31%	1.71	Pass
	Wesley College to Ballinteer Ave	20	44	-55%	4.24	Pass
	Ballinteer Rd to Wyckham Way N	838	699	20%	5.01	Fail
	Ballinteer Rd to Wesley College	6	39	-85%	6.96	Pass
	Ballinteer Rd to Ballinteer Rd	0	0	0%	0.00	Pass
	Ballinteer Rd to Ballinteer Ave	21	29	-28%	1.60	Pass
	Ballinteer Ave to Wyckham Way N	232	316	-27%	5.07	Pass
	Ballinteer Ave to Wesley College	24	56	-57%	5.06	Pass
	Ballinteer Ave to Ballinteer Rd	119	81	47%	3.80	Pass
	Ballinteer Ave to Ballinteer Ave	0	0	0%	0.00	Pass
Wyckham Way/Wyckham Pl	Wyckham Way N to Wyckham Way N	0	0	0%	0.00	Pass
	Wyckham Way N to Wyckham Place	20	16	25%	0.94	Pass
	Wyckham Way N to Wyckham Way S	566	572	-1%	0.25	Pass
	Wyckham Way N to Ballinteer Rd	30	130	-77%	11.18	Fail
	Wyckham Place to Wyckham Way N	36	37	-3%	0.17	Pass
	Wyckham Place to Wyckham Place	0	0	0%	0.00	Pass
	Wyckham Place to Wyckham Way S	89	64	39%	2.86	Pass
	Wyckham Place to Ballinteer Rd	17	25	-32%	1.75	Pass
	Wyckham Way S to Wyckham Way N	807	734	10%	2.63	Pass
	Wyckham Way S to Wyckham Place	32	19	68%	2.57	Pass
	Wyckham Way S to Wyckham Way S	0	0	0%	0.00	Pass
	Wyckham Way S to Ballinteer Rd	342	277	23%	3.69	Pass
	Ballinteer Rd to Wyckham Way N	163	245	-33%	5.74	Pass
	Ballinteer Rd to Wyckham Place	0	21	-100%	6.48	Pass
	Ballinteer Rd to Wyckham Way S	391	337	16%	2.83	Pass
	Ballinteer Rd to Ballinteer Rd	0	0	0%	0.00	Pass
Unnamed Rd/Wyckham Way/Dundrum Bypass	Shopping centre to Unnamed Rd	0	0	0%	0.00	Pass
	Shopping centre to Wyckham Way E	47	24	96%	3.86	Pass
	Shopping centre to Wyckham Way W	36	25	44%	1.99	Pass
	Shopping centre to Dundrum Bypass	20	8	150%	3.21	Pass
	Wyckham Way E to Shopping centre	113	32	253%	9.51	Pass
	Wyckham Way E to Wyckham Way E	0	2	-100%	2.00	Pass
	Wyckham Way E to Wyckham Way W	315	422	-25%	5.57	Fail
	Wyckham Way E to Dundrum Bypass	174	157	11%	1.32	Pass
	Wyckham Way W to Shopping centre	102	86	19%	1.65	Pass

	Wyckham Way W to Wyckham Way E	586	699	-16%	4.46	Fail
	Wyckham Way W to Wyckham Way W	3	2	50%	0.63	Pass
	Wyckham Way W to Dundrum Bypass	0	281	-100%	23.71	Fail
	Dundrum Bypass to Shopping centre	28	19	47%	1.86	Pass
	Dundrum Bypass to Wyckham Way E	130	110	18%	1.83	Pass
	Dundrum Bypass to Wyckham Way W	265	273	-3%	0.49	Pass
	Dundrum Bypass to Dundrum Bypass	0	0	0%	0.00	Pass
Overend Ave/Sandyford Rd/Wyckham Way	Wyckham Rd E to Sandyford Rd S	140	146	-4%	0.50	Pass
	Wyckham Rd E to Wyckham Rd W	291	313	-7%	1.27	Pass
	Wyckham Rd E to Sandyford Rd N	59	55	7%	0.53	Pass
	Sandyford Rd S to Wyckham Rd E	178	177	1%	0.08	Pass
	Sandyford Rd S to Wyckham Rd W	287	274	5%	0.78	Pass
	Sandyford Rd S to Sandyford Rd N	101	109	-7%	0.78	Pass
	Wyckham Rd W to Wyckham Rd E	453	443	2%	0.47	Pass
	Wyckham Rd W to Sandyford Rd S	231	285	-19%	3.36	Pass
	Wyckham Rd W to Sandyford Rd N	73	104	-30%	3.30	Pass
	Sandyford Rd N to Wyckham Rd E	11	17	-35%	1.60	Pass
	Sandyford Rd N to Sandyford Rd S	71	39	82%	4.31	Pass
	Sandyford Rd N to Wyckham Rd W	26	33	-21%	1.29	Pass
Dundrum Rd/Taney Rd/Churchtown Rd	Dundrum Rd N to Churchtown Rd E	84	89	-6%	0.54	Pass
	Dundrum Rd N to Dundrum Rd S	315	300	5%	0.86	Pass
	Dundrum Rd N to Churchtown Rd W	109	124	-12%	1.39	Pass
	Churchtown Rd E to Dundrum Rd N	54	66	-18%	1.55	Pass
	Churchtown Rd E to Dundrum Rd S	24	18	33%	1.31	Pass
	Churchtown Rd E to Churchtown Rd W	320	278	15%	2.43	Pass
	Dundrum Rd S to Dundrum Rd N	498	456	9%	1.92	Pass
	Dundrum Rd S to Churchtown Rd E	33	41	-20%	1.32	Pass
	Dundrum Rd S to Churchtown Rd W	160	109	47%	4.40	Pass
	Churchtown Rd W to Dundrum Rd N	274	258	6%	0.98	Pass
	Churchtown Rd W to Churchtown Rd E	456	455	0%	0.05	Pass
	Churchtown Rd W to Dundrum Rd S	158	135	17%	1.90	Pass

A.2 2022 PM PEAK SUMMARY

Junction	Description	Modelled	Count	% Difference	GEH	
Ballinteer Ave/Ballinteer Rd Jn	Wyckham Way N to Wyckham Way N	0	6	-100%	3.46	Pass
	Wyckham Way N to Wesley College	88	73	21%	1.67	Pass
	Wyckham Way N to Ballinteer Rd	663	675	-2%	0.46	Pass
	Wyckham Way N to Ballinteer Ave	315	315	0%	0.00	Pass
	Wesley College to Wyckham Way N	108	66	64%	4.50	Pass
	Wesley College to Wesley College	0	0	0%	0.00	Pass
	Wesley College to Ballinteer Rd	23	29	-21%	1.18	Pass
	Wesley College to Ballinteer Ave	21	27	-22%	1.22	Pass
	Ballinteer Rd to Wyckham Way N	779	747	4%	1.16	Pass
	Ballinteer Rd to Wesley College	5	17	-71%	3.62	Pass
	Ballinteer Rd to Ballinteer Rd	0	0	0%	0.00	Pass

	Ballinteer Rd to Ballinteer Ave	44	51	-14%	1.02	Pass
	Ballinteer Ave to Wyckham Way N	270	264	2%	0.37	Pass
	Ballinteer Ave to Wesley College	3	19	-84%	4.82	Pass
	Ballinteer Ave to Ballinteer Rd	69	68	1%	0.12	Pass
	Ballinteer Ave to Ballinteer Ave	0	0	0%	0.00	Pass
Wyckham Way/Wyckham Pl	Wyckham Way N to Wyckham Way N	0	1	-100%	1.41	Pass
	Wyckham Way N to Wyckham Place	55	43	28%	1.71	Pass
	Wyckham Way N to Wyckham Way S	809	827	-2%	0.63	Pass
	Wyckham Way N to Ballinteer Rd	161	170	-5%	0.70	Pass
	Wyckham Place to Wyckham Way N	44	30	47%	2.30	Pass
	Wyckham Place to Wyckham Place	0	0	0%	0.00	Pass
	Wyckham Place to Wyckham Way S	14	38	-63%	4.71	Pass
	Wyckham Place to Ballinteer Rd	9	18	-50%	2.45	Pass
	Wyckham Way S to Wyckham Way N	772	723	7%	1.79	Pass
	Wyckham Way S to Wyckham Place	43	57	-25%	1.98	Pass
	Wyckham Way S to Wyckham Way S	0	0	0%	0.00	Pass
	Wyckham Way S to Ballinteer Rd	290	217	34%	4.58	Pass
	Ballinteer Rd to Wyckham Way N	180	199	-10%	1.38	Pass
	Ballinteer Rd to Wyckham Place	23	14	64%	2.09	Pass
	Ballinteer Rd to Wyckham Way S	242	192	26%	3.39	Pass
	Ballinteer Rd to Ballinteer Rd	0	0	0%	0.00	Pass
Unnamed Rd/Wyckham Way/Dundrum Bypass	Shopping centre to Unnamed Rd	0	7	-100%	3.74	Pass
	Shopping centre to Wyckham Way E	168	132	27%	2.94	Pass
	Shopping centre to Wyckham Way W	208	206	1%	0.14	Pass
	Shopping centre to Dundrum Bypass	47	55	-15%	1.12	Pass
	Wyckham Way E to Shopping centre	123	77	60%	4.60	Pass
	Wyckham Way E to Wyckham Way E	0	0	0%	0.00	Pass
	Wyckham Way E to Wyckham Way W	391	486	-20%	4.54	Pass
	Wyckham Way E to Dundrum Bypass	161	138	17%	1.88	Pass
	Wyckham Way W to Shopping centre	145	193	-25%	3.69	Pass
	Wyckham Way W to Wyckham Way E	531	437	22%	4.27	Pass
	Wyckham Way W to Wyckham Way W	0	0	0%	0.00	Pass
	Wyckham Way W to Dundrum Bypass	322	323	0%	0.06	Pass
	Dundrum Bypass to Shopping centre	102	60	70%	4.67	Pass
	Dundrum Bypass to Wyckham Way E	140	195	-28%	4.25	Pass
	Dundrum Bypass to Wyckham Way W	431	353	22%	3.94	Pass
	Dundrum Bypass to Dundrum Bypass	0	0	0%	0.00	Pass
Overend Ave/Sandyford Rd/Wyckham Way	Wyckham Rd E to Sandyford Rd S	165	131	26%	2.79	Pass
	Wyckham Rd E to Wyckham Rd W	351	342	3%	0.48	Pass
	Wyckham Rd E to Sandyford Rd N	75	112	-33%	3.83	Pass
	Sandyford Rd S to Wyckham Rd E	44	73	-40%	3.79	Pass
	Sandyford Rd S to Wyckham Rd W	268	270	-1%	0.12	Pass
	Sandyford Rd S to Sandyford Rd N	125	104	20%	1.96	Pass
	Wyckham Rd W to Wyckham Rd E	301	300	0%	0.06	Pass
	Wyckham Rd W to Sandyford Rd S	346	301	15%	2.50	Pass

	Wyckham Rd W to Sandyford Rd N	192	156	23%	2.73	Pass
	Sandyford Rd N to Wyckham Rd E	37	60	-38%	3.30	Pass
	Sandyford Rd N to Sandyford Rd S	71	75	-5%	0.47	Pass
	Sandyford Rd N to Wyckham Rd W	59	92	-36%	3.80	Pass
Dundrum Rd/Taney Rd/Churchtown Rd	Dundrum Rd N to Churchtown Rd E	91	92	-1%	0.10	Pass
	Dundrum Rd N to Dundrum Rd S	446	382	17%	3.15	Pass
	Dundrum Rd N to Churchtown Rd W	115	152	-24%	3.20	Pass
	Churchtown Rd E to Dundrum Rd N	43	52	-17%	1.31	Pass
	Churchtown Rd E to Dundrum Rd S	57	43	33%	1.98	Pass
	Churchtown Rd E to Churchtown Rd W	407	332	23%	3.90	Pass
	Dundrum Rd S to Dundrum Rd N	414	416	0%	0.10	Pass
	Dundrum Rd S to Churchtown Rd E	36	59	-39%	3.34	Pass
	Dundrum Rd S to Churchtown Rd W	237	224	6%	0.86	Pass
	Churchtown Rd W to Dundrum Rd N	142	149	-5%	0.58	Pass
	Churchtown Rd W to Churchtown Rd E	361	339	6%	1.18	Pass
	Churchtown Rd W to Dundrum Rd S	183	183	0%	0.00	Pass