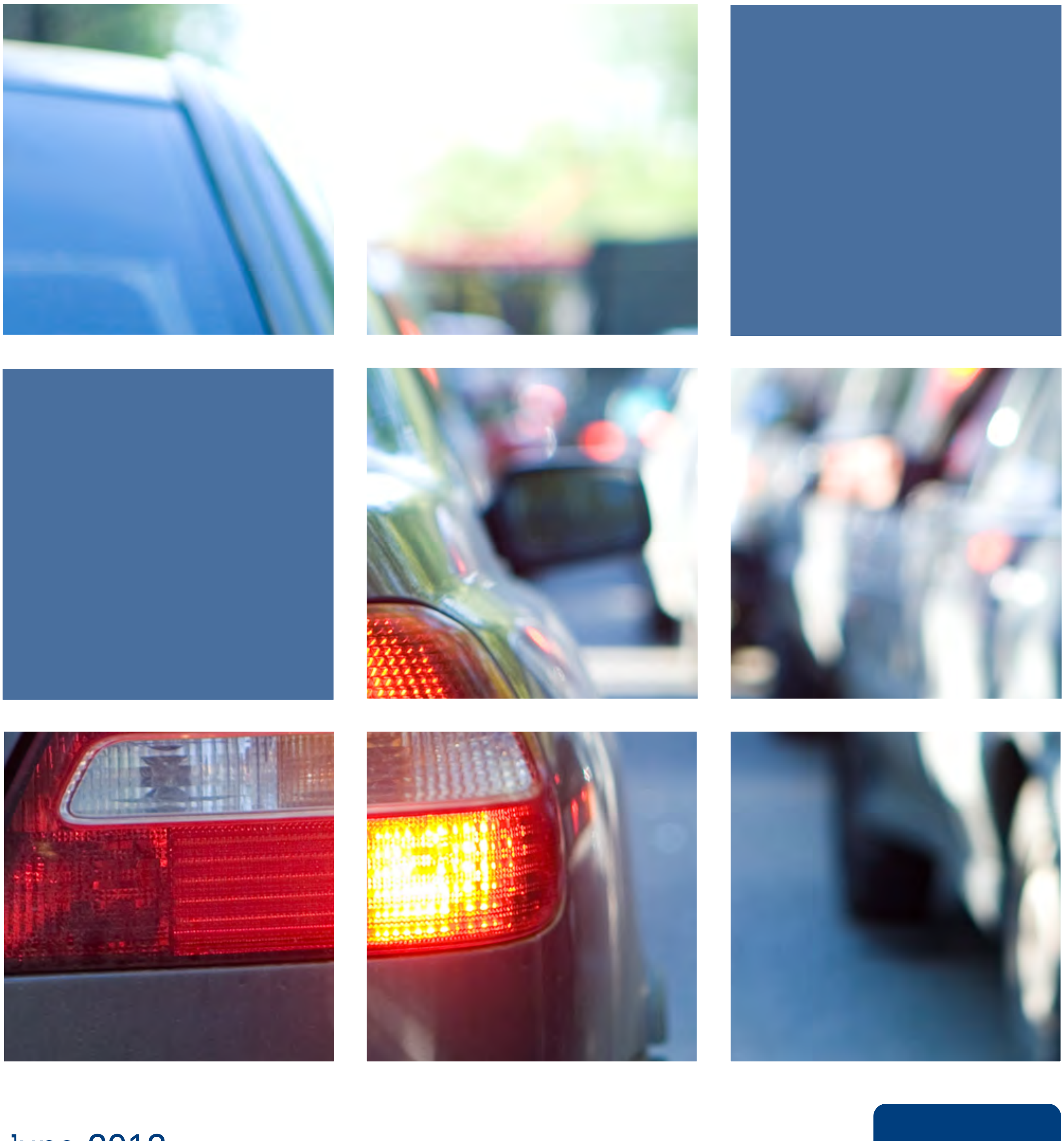
Comhairle Contae County Council

Review of Glenamuck Local Area Plan

Traffic Modelling Report



June 2013

RPS

RPS

Review of Glenamuck LAP

Traffic Modelling Report

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1 INTRODUCTION

1.1 CONTEXT

The existing Glenamuck Local Area Plan was published in 2007. It sets out a plan for major development within the Glenamuck/Kiltiernan area, served by a proposed new Glenamuck District Distributor Road (GDDR) and Glenamuck Link Distributer Road (GLDR).

Traffic modelling work undertaken by the NTA in 2006 was used to inform the design of the GDDR/GLDR, and to demonstrate (as part of the LAP process) that this level of transport infrastructure provision is necessary and appropriate for the proposed quantum of development planned within the LAP area.

The Glenamuck LAP is now due for statutory review. Given the significant changes that have occurred in Ireland over the last five years, DLRCC's transport planning section appointed RPS to develop a cost-effective method of updating the previous modelling work, in order to assess whether the existing Glenamuck LAP transportation infrastructure design remains appropriate.

Many changes have taken place since the previous 2006 modelling work:

- Changes in the national and regional prospects for growth in demography, employment and income
- The collapse of the property market, which has been particularly pronounced with regard to apartments in high-density blocks.
- Significant rises in real fuel price, and uncertain prospects for further rises in future
- Completion of some major transport infrastructure projects (including M50 and the extension of the Green Line to Brides Glen)
- Substantial cuts to government programmes of future investment in transport
- Changes in proposed levels and timing of development in the surrounding areas of DLR
- Changes in proposed access arrangements for planned nearby development at Park and at Cherrywood
- A new direction for transport policy, typified by the Smarter Travel policy agenda, which seeks to limit car travel and encourage walking and cycling, and embodied in the draft 2030 vision strategy for the Greater Dublin Area
- Improvements to the NTA model from the 2001-based version used in the 2006 modelling work
- The 2011 Census, detailed results from which will be released over the course of 2012.
- Static or declining traffic levels (analysis of data from the NRA permanent traffic counter at Fassaroe suggests that traffic in the N11 corridor has been declining by around 1.75% per annum since early 2008)

This is a time of considerable uncertainty; with new Census results in preparation and little available in the way of credible economic forecasts to indicate when the national economy will return to a pattern of sustainable growth.

1.2 APPROACH

In the light of this, the approach taken was to develop a “sketchplan” modelling tool that DLRCC can use through the LAP review process, to assess the sensitivity of projected levels of road congestion to various factors.

The tool combined a highly localised SATURN model, covering the LAP area, with a spreadsheet to generate alternative demand matrices corresponding to:

- alternative planning inputs
- alternative levels of PT provision
- alternative assumptions on growth in background traffic.

1.3 STRUCTURE OF THIS REPORT

Section 2 of this report describes the development of the local SATURN model.

Section 3 presents the calculations embodied in the demand spreadsheet.

Section 4 sets out the forecasting scenarios used.

Section 5 describes the future year traffic model runs that were undertaken to inform the LAP process.

Section 6 describes the results of the static junction analysis

Section 7 describes the public transport and slow mode recommendations from the study.

Section 8 describes the proposed implementation plan for the transportation strategy

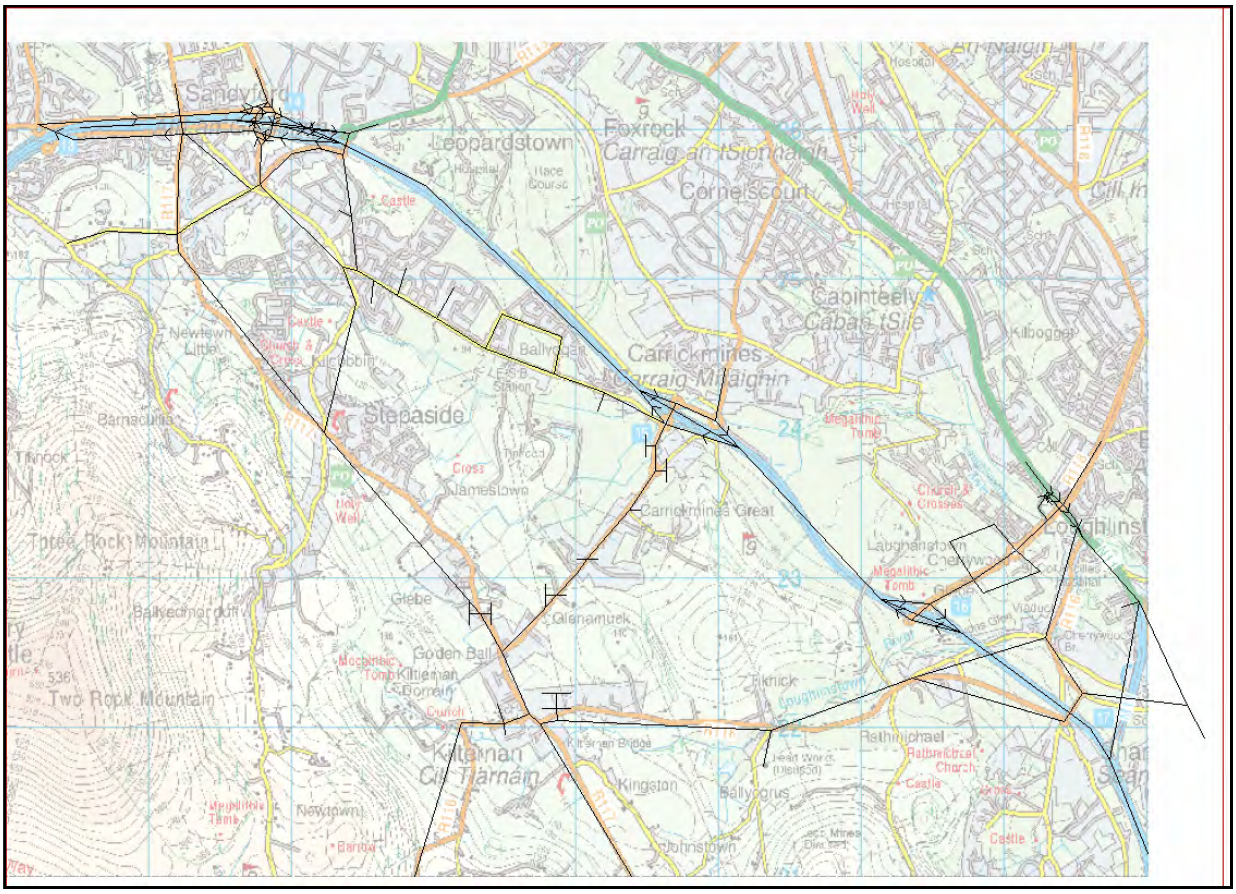
2 SATURN MODEL

2.1 SCOPE

The starting point for SATURN modelling was the local area highway model used in the 2006 NTA modelling work. The 2007 forecast was used as the basis for the new model. The model includes two user classes – HCVs and light vehicles – and covers the AM peak period 08:00-09:00. Scheduled bus services are separately coded into the model along fixed routes.

The network was cordoned down to the area shown in Figure 2.1, so as to include the LAP area, the various M50/M11 junctions that traffic may use to access the LAP area, and the routes between the LAP area and these junctions. The model was extended slightly to the south-east, to include routes to and from the M11 via the Loughlinstown roundabout.

Figure 2.1 – Network Extent – Base Year Model



2.2 BASE YEAR MODEL DEVELOPMENT

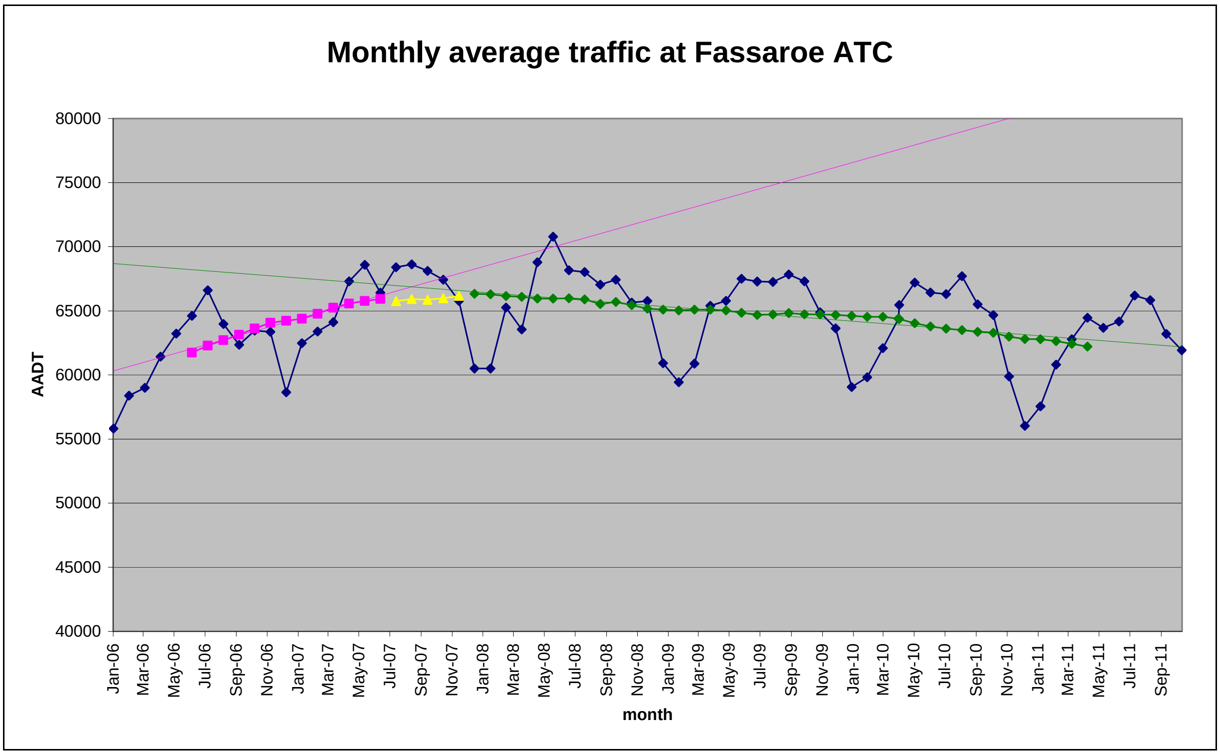
The network was updated to 2012, ensuring that the base year model corresponds with what is on the ground at present. In particular, work along the Ballyogan Road has resulted in a greater number of signalised junctions than had been foreseen in 2006, and the layout of the M50 Sandyford junction as built is not exactly as was modelled in 2006. Cherrywood access roads that are not yet built were removed from the base year network.

The zoning system within the LAP area was revised in order to tie in more closely with the system of land parcels and land uses proposed within the LAP, and the proposed system of access roads by which new land use will connect to the road network. The zone south of Kiltiernan was split in order to better reflect traffic levels along the Ballycorus Road.

For the base year model, it was necessary to connect each LAP zone to the existing road network, even where it is planned that the future connection will be made of via the proposed distributor road.

Data from the NRA permanent traffic counter at Fassaroe was used to estimate a recent trend in traffic levels. Traffic in the area is estimated to have declined by around 6% between October 2009 and the nominal base of the model at May 2012.

Figure 2.2 – Recent Traffic Trend



Available count data dating from October 2009 was taken from modelling work for the Cherrywood SDZ. These counts were factored down to May 2012 traffic levels, and coded in to the SATURN model in the form of turning movements.

Modelled base year trip-end totals for the zones representing the LAP area were taken from the demand spreadsheet.

A matrix estimation procedure was used to generate a base year matrix that is as close as possible to the cordoned matrix from which the model started, whilst matching the count data acceptably closely and being consistent with the modelled trip-ends for the LAP area.

Tables 2.1 and 2.2 list the counts used and demonstrate the level of fit to the count data for both user classes. The measure of fit used is a GEH statistic, which reflects both relative and absolute differences between modelled flows and count flows. NRA Project Appraisal Guidance suggests an acceptability threshold such that the GEH statistic should be less than 5 at more than 85% of sites.

In the current model, the GEH statistic is less than 5 at 81 out of 82 count sites (99%) and is between 5 and 6 at the remaining site, indicating that the modelled flows are a very good match to the available data.

Table 2.1 – Fit to Count Data - Cars

Count No.	Nodes			Estimated Flow	Target Flow	Difference	% Difference	GEH Statistic	XA
1	5440	5311	5310	98.0	98.0	0.0	-0.02	0.00	1.025
2	5440	5311	5446	18.0	18.0	0.0	0.00	0.00	4.220
3	5440	5311	5450	65.0	65.0	0.0	-0.01	0.00	0.567
4	5450	5311	5440	10.7	10.7	0.0	0.01	0.00	0.637
5	5450	5311	5310	1407.6	1421.3	13.8	0.97	0.37	5.000
6	5450	5311	5446	464.8	464.9	0.1	0.02	0.00	3.190
7	5446	5311	5450	27.0	27.0	0.0	-0.01	0.00	0.440
8	5446	5311	5440	0.6	8.0	7.4	92.25	3.55	5.000
9	5446	5311	5310	62.0	62.0	0.0	-0.02	0.00	1.211
10	5310	5311	5446	241.8	241.3	-0.5	-0.21	0.03	0.725
11	5310	5311	5450	901.4	900.0	-1.4	-0.16	0.05	1.321
12	5310	5311	5440	17.1	17.0	0.0	-0.21	0.01	0.944
13	5357	5029	9734	705.3	706.0	0.7	0.10	0.03	5.000
14	9738	5357	5358	265.1	265.1	0.0	0.00	0.00	0.304
15	9734	5029	5357	1897.8	1876.7	-21.1	-1.12	0.48	0.645
16	5311	5310	5309	336.1	335.8	-0.3	-0.09	0.02	0.899
17	5311	5310	5355	1231.5	1241.4	9.9	0.80	0.28	2.277
18	5355	5310	5311	967.8	968.0	0.2	0.02	0.01	0.924
19	5355	5310	5309	179.2	179.0	-0.2	-0.09	0.01	1.834
20	5309	5310	5355	388.5	389.5	1.0	0.26	0.05	5.000
21	5309	5310	5311	192.4	189.2	-3.2	-1.69	0.23	2.004
22	5353	5358	5357	705.3	706.0	0.7	0.10	0.03	1.194
23	5310	5309	5308	515.2	515.3	0.1	0.01	0.00	1.054
24	5357	5358	5308	580.9	578.7	-2.2	-0.38	0.09	1.012
25	5357	5358	5353	1508.4	1564.0	55.7	3.56	1.42	5.000
26	5354	5355	5059	148.0	148.0	0.0	0.00	0.00	2.900

Count No.	Nodes			Estimated Flow	Target Flow	Difference	% Difference	GEH Statistic	XA
27	5354	5355	5310	258.0	258.0	0.0	0.00	0.00	0.492
28	5310	5355	5059	1488.5	1485.2	-3.3	-0.23	0.09	0.812
29	5310	5355	5356	131.5	131.6	0.1	0.10	0.01	0.384
30	5059	5355	5356	297.7	407.0	109.3	26.86	5.82	5.000
31	5059	5355	5310	889.0	889.0	0.0	0.00	0.00	1.269
32	5317	9584	9581	70.1	41.2	-28.9	-70.11	3.87	0.200
33	5317	9584	9582	346.8	346.4	-0.4	-0.12	0.02	2.221
34	5317	9584	5378	75.2	74.7	-0.5	-0.68	0.06	1.877
35	5378	9584	5317	38.4	39.0	0.6	1.47	0.09	0.384
36	5378	9584	9581	119.2	121.0	1.8	1.47	0.16	1.167
37	5378	9584	9582	310.5	314.7	4.1	1.32	0.23	4.961
38	9583	9584	5378	81.5	81.0	-0.6	-0.71	0.06	4.009
39	9583	9584	5317	79.9	79.9	0.0	-0.03	0.00	0.579
40	9583	9584	9582	355.0	354.5	-0.5	-0.14	0.03	0.811
41	9582	9584	5378	141.9	141.1	-0.9	-0.61	0.07	0.283
42	9582	9584	5317	152.0	107.1	-44.9	-41.98	3.95	0.200
43	9582	9584	9581	255.1	255.1	0.0	-0.01	0.00	0.442
44	9581	9582	9763	29.1	29.1	0.0	0.01	0.00	0.357
45	9581	9582	5157	92.4	92.2	-0.2	-0.19	0.02	0.580
46	9581	9582	9584	116.6	116.3	-0.3	-0.28	0.03	5.000
47	9584	9582	9763	249.9	251.3	1.4	0.54	0.09	1.049
48	9584	9582	5157	762.4	764.0	1.6	0.21	0.06	0.973
49	5157	9582	9584	374.4	369.0	-5.4	-1.47	0.28	3.187
50	5157	9582	9763	65.9	65.0	-0.9	-1.38	0.11	2.246
51	9763	9582	5157	24.0	24.0	0.0	-0.18	0.01	1.620
52	9763	9582	9584	58.1	90.0	31.9	35.48	3.71	5.000
53	9582	5157	5003	600.4	601.9	1.6	0.26	0.06	2.053
54	9582	5157	9583	278.4	279.9	1.5	0.55	0.09	0.430
55	5003	5157	9583	68.0	68.0	0.0	-0.01	0.00	0.932
56	5003	5157	9582	440.3	440.0	-0.3	-0.07	0.02	3.751
57	5398	5378	9584	21.0	21.0	0.0	-0.05	0.00	0.377
58	5158	5378	5398	112.0	113.0	0.9	0.84	0.09	3.852
59	5158	5378	9584	448.5	453.9	5.4	1.19	0.25	0.914
60	9584	5378	5158	300.1	297.3	-2.8	-0.94	0.16	0.477
61	5378	5158	5408	7.6	7.6	0.0	-0.01	0.00	1.151
62	5378	5158	5377	210.2	210.2	-0.1	-0.03	0.00	4.065
63	5378	5158	5378	82.2	76.2	-6.0	-7.87	0.67	0.200

Count No.	Nodes			Estimated Flow	Target Flow	Difference	% Difference	GEH Statistic	XA
64	5377	5158	5378	468.3	468.3	0.0	0.00	0.00	0.591
65	5408	5158	5377	0.4	1.0	0.6	62.57	0.00	5.000
66	5408	5158	5378	10.0	6.0	-4.0	-65.87	1.40	0.200
67	5029	9734	9735	240.9	240.9	0.0	0.00	0.00	0.351
68	5029	9734	9736	775.7	775.7	-0.1	-0.01	0.00	0.699
69	5029	9734	9750	69.4	69.4	0.0	0.01	0.00	0.431
70	9750	9734	5029	54.0	54.0	0.0	0.00	0.00	0.674
71	9750	9734	9735	33.0	33.0	0.0	0.00	0.00	1.477
72	9750	9734	9736	27.0	27.0	0.0	-0.01	0.00	2.320
73	9736	9734	9750	37.6	71.0	33.4	47.11	4.54	5.000
74	9736	9734	5029	1463.0	1463.0	0.0	0.00	0.00	0.780
75	9736	9734	9735	110.0	110.0	0.0	0.00	0.00	1.348
76	9735	9734	9736	22.1	35.0	13.0	37.02	2.43	5.000
77	9735	9734	9750	50.0	50.0	0.0	-0.01	0.00	0.963
78	9735	9734	5029	332.3	332.3	0.0	0.00	0.00	0.646
79	9563	9565	-	3902.1	3902.0	-0.1	0.00	0.00	0.580
80	9565	9563	-	3599.3	3599.0	-0.3	-0.01	0.01	2.385
81	5191	9736	-	4284.8	4285.0	0.2	0.01	0.00	0.751
82	9736	5191	-	1919.2	1919.2	0.0	0.00	0.00	0.694

Table 2.2 – Fit to Count Data - HGVs

Count No.	Nodes			Estimated Flow	Target Flow	Difference	% Difference	GEH Statistic	XA
1	5440	5311	5310	3.0	3.0	0.0	-0.01	0.00	1.189
2	5440	5311	5446	4.0	4.0	0.0	0.08	0.00	3.044
3	5440	5311	5450	113.8	98.6	-15.2	-15.40	1.47	0.200
4	5450	5311	5440	9.3	9.3	0.0	0.08	0.00	2.729
5	5450	5311	5310	19.0	19.0	0.0	-0.01	0.00	0.664
6	5450	5311	5446	0.0	14.0	14.0	99.99	5.29	5.000
7	5446	5311	5450	1.3	7.0	5.7	81.29	2.79	5.000
8	5446	5311	5440	54.7	49.1	-5.7	-11.57	0.79	0.200
9	5446	5311	5310	76.1	76.0	-0.1	-0.11	0.01	1.021
10	5310	5311	5446	25.1	6.2	-18.9	-302.87	4.77	0.200
11	5310	5311	5450	111.0	111.1	0.1	0.07	0.01	2.270
12	5310	5311	5440	16.7	16.7	0.0	-0.02	0.00	0.558
13	5357	5029	9734	97.0	96.5	-0.5	-0.57	0.06	3.972

Count No.	Nodes			Estimated Flow	Target Flow	Difference	% Difference	GEH Statistic	XA
14	9738	5357	5358	44.0	44.0	0.0	-0.01	0.00	0.359
15	9734	5029	5357	1.6	11.0	9.4	85.13	3.73	5.000
16	5311	5310	5309	39.4	39.3	-0.1	-0.36	0.02	4.901
17	5311	5310	5355	12.1	12.1	-0.1	-0.52	0.02	0.200
18	5355	5310	5311	76.1	76.0	-0.1	-0.11	0.01	1.019
19	5355	5310	5309	18.4	28.1	9.7	34.67	2.02	5.000
20	5309	5310	5355	51.5	51.3	-0.2	-0.40	0.03	2.970
21	5309	5310	5311	67.4	67.4	0.1	0.08	0.01	3.649
22	5353	5358	5357	0.1	6.0	5.9	97.67	3.34	5.000
23	5310	5309	5308	5.2	6.0	0.8	13.53	0.34	5.000
24	5357	5358	5308	113.7	113.7	0.0	0.01	0.00	2.829
25	5357	5358	5353	22.7	22.7	0.0	-0.02	0.00	0.307
26	5354	5355	5059	18.5	47.0	28.5	60.54	4.97	5.000
27	5354	5355	5310	40.5	49.0	8.5	17.45	1.28	5.000
28	5310	5355	5059	30.1	50.2	20.2	40.16	3.18	5.000
29	5310	5355	5356	12.8	12.9	0.1	0.63	0.02	3.205
30	5059	5355	5356	6.8	7.7	0.9	11.43	0.33	5.000
31	5059	5355	5310	14.4	14.4	-0.1	-0.40	0.01	0.959
32	5317	9584	9581	12.8	12.3	-0.5	-3.97	0.14	0.200
33	5317	9584	9582	9.8	9.8	0.0	0.11	0.00	1.445
34	5317	9584	5378	6.6	6.6	0.0	0.01	0.00	2.786
35	5378	9584	5317	18.4	18.6	0.2	0.87	0.04	1.247
36	5378	9584	9581	17.0	17.0	0.0	0.07	0.00	0.282
37	5378	9584	9582	25.9	28.0	2.2	7.69	0.42	5.000
38	9583	9584	5378	8.9	8.0	-0.9	-11.09	0.31	0.200
39	9583	9584	5317	4.2	6.0	1.8	30.14	0.80	5.000
40	9583	9584	9582	12.8	11.0	-1.8	-15.97	0.51	0.200
41	9582	9584	5378	31.1	31.1	0.0	0.02	0.00	4.492
42	9582	9584	5317	3.4	3.4	0.0	0.00	0.00	1.392
43	9582	9584	9581	40.6	40.6	-0.1	-0.18	0.01	1.126
44	9581	9582	9763	3.7	5.0	1.3	26.32	0.00	5.000
45	9581	9582	5157	7.5	6.0	-1.5	-24.63	0.57	0.200
46	9581	9582	9584	17.0	17.0	0.0	0.00	0.00	4.189
47	9584	9582	9763	29.9	29.9	0.0	0.00	0.00	0.825
48	9584	9582	5157	31.0	31.0	0.0	-0.14	0.01	4.208
49	5157	9582	9584	6.0	6.0	0.0	0.01	0.00	4.821
50	5157	9582	9763	3.7	11.0	7.3	66.37	2.69	5.000

Count No.	Nodes			Estimated Flow	Target Flow	Difference	% Difference	GEH Statistic	XA
51	9763	9582	5157	11.0	11.0	0.0	0.00	0.00	0.817
52	9763	9582	9584	23.6	23.6	0.0	-0.07	0.00	0.467
53	9582	5157	5003	22.9	17.5	-5.5	-31.37	1.22	0.200
54	9582	5157	9583	33.9	37.0	3.1	8.38	0.52	5.000
55	5003	5157	9583	15.8	15.2	-0.6	-3.64	0.14	0.200
56	5003	5157	9582	18.1	12.0	-6.1	-51.30	1.58	0.200
57	5398	5378	9584	28.4	28.4	0.0	0.00	0.00	2.483
58	5158	5378	5398	22.6	28.6	6.0	20.85	1.18	5.000
59	5158	5378	9584	74.5	74.5	0.0	0.01	0.00	1.887
60	9584	5378	5158	5.1	5.1	0.0	-0.01	0.00	4.184
61	5378	5158	5408	3.1	9.0	5.9	66.10	2.42	5.000
62	5378	5158	5377	75.0	75.0	0.0	0.01	0.00	0.206
63	5378	5158	5378	5.0	5.0	0.0	0.01	0.00	1.320
64	5377	5158	5378	5.0	5.0	0.0	0.00	0.00	0.838
65	5408	5158	5377	17.8	27.0	9.2	33.99	1.94	5.000
66	5408	5158	5378	414.0	414.0	0.0	0.00	0.00	0.375
67	5029	9734	9735	221.3	221.4	0.0	0.00	0.00	0.740
68	5029	9734	9736	239.0	239.0	0.0	0.00	0.00	1.893
69	5029	9734	9750	249.5	249.5	0.0	0.00	0.00	1.538
70	9750	9734	5029	3.0	3.0	0.0	-0.01	0.00	1.189
71	9750	9734	9735	4.0	4.0	0.0	0.08	0.00	3.044
72	9750	9734	9736	113.8	98.6	-15.2	-15.40	1.47	0.200
73	9736	9734	9750	9.3	9.3	0.0	0.08	0.00	2.729
74	9736	9734	5029	19.0	19.0	0.0	-0.01	0.00	0.664
75	9736	9734	9735	0.0	14.0	14.0	99.99	5.29	5.000
76	9735	9734	9736	1.3	7.0	5.7	81.29	2.79	5.000
77	9735	9734	9750	54.7	49.1	-5.7	-11.57	0.79	0.200
78	9735	9734	5029	76.1	76.0	-0.1	-0.11	0.01	1.021
79	9563	9565	-	25.1	6.2	-18.9	-302.87	4.77	0.200
80	9565	9563	-	111.0	111.1	0.1	0.07	0.01	2.270
81	5191	9736	-	16.7	16.7	0.0	-0.02	0.00	0.558
82	9736	5191	-	97.0	96.5	-0.5	-0.57	0.06	3.972

2.3 FUTURE YEAR NETWORKS

The future year model contains additional zones to allow for development at Park and Cherrywood.

The model is suitable for use in testing both changes to infrastructure within the LAP area, and changes to the key junctions which limit capacity for traffic to and from the LAP area.

3 DEMAND SPREADSHEET

3.1 SCOPE

The inputs to the demand spreadsheet are as shown in Figure 3.1. This section of the report explains these values and how they were used to generate a future year highway demand matrix for use in the SATURN model.

Figure 3.1 – Demand Inputs Used for Initial Model Test

Glenamuck LAP - Sketchplan Model - Demand Inputs

1) Development Quanta

Land Parcel	Residential Units	Employment Places	Retail Gross Floor Area	Education Places
1a	0	4249	0	0
1b	0	1551	0	0
2	300	0	0	0
3	20	0	0	0
4	0	0	0	0
5a	0	1241	0	0
5b	0	1510	0	0
5c	0	549	0	0
6a	19	0	0	0
6b	650	0	0	0
7&8&9	80	0	0	0
10	2	0	0	0
11a	0	198	0	0
11b	0	0	0	0
12	440	0	0	0
13a	0	0	3900	0
14	40	0	0	0
15	0	0	0	0
16a	1	0	0	0
16b	249	0	0	0
17	10	0	0	0
18	20	0	0	0
19	0	0	0	0
20a&b	500	0	0	0
21	0	94	2955	0
22	0	63	1995	0
23a	100	0	0	0
23b	0	0	0	0
24a	0	0	0	0
24b	0	0	0	0
25a	0	0	0	0
25b	0	0	0	0
26a	0	0	0	0
26a	0	0	0	0
26b	0	0	0	0
27b	0	0	0	0
28	15	0	0	0
29a	80	0	0	0
29b	15	0	0	0
30	135	0	0	0
31a&b	350	0	0	0
TOTAL	3026	9455	8850	0

2) Background Traffic Growth

Future Year	2022
Background growth multiplier	100%
Park development multiplier	100%
Cherrywood development multiplier	100%
LAP area development multiplier	100%

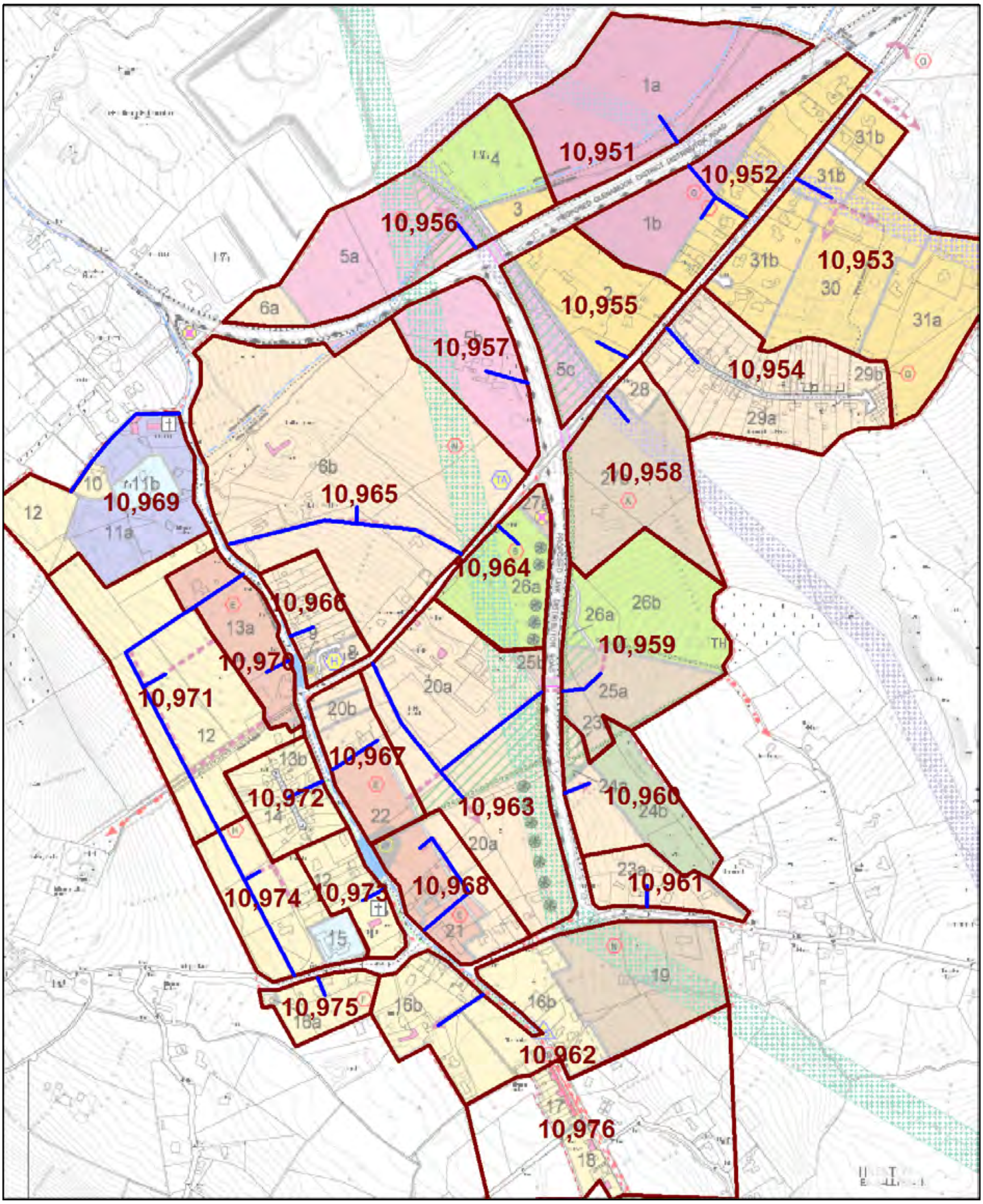
3) Indicative Level of Public Transport Provision

Walk speed	5 kph
Luas Headway	7.5 mins
Luas Speed multiplier	1.0
Shuttle bus headway	60 mins
Direct bus headway	30 mins
Shuttle bus fare	€ 2
Direct bus fare	€ 5
Bus Time Multiplier	1.0

The output from the spreadsheet was a future year highway matrix, in a format readable by SATURN.

Figure 3.2 shows how the LAP area was divided into model zones, and how these zones relate to the land parcels defined in the LAP. In most cases, each land parcel was allocated to a single zone. In a few cases, land parcels were split between two zones, where it seems likely that access arrangements will differ. The blue lines on the diagram indicate assumed access routes, based on the outline access roads shown in the LAP. The extent of zone 10976 is nominal, reflecting the possibility of extending the previous LAP area southward.

Figure 3.2 – Model Zoning in LAP Area



3.2 LAND USE

The spreadsheet contained base year numbers of dwellings, and estimated base year figures for employment, retail floor area, and education places. These were based on Geodirectory data which gives a distribution of residential and commercial addresses between the zones of the model, and were informed by the assumptions made in the earlier NTA modelling work.

The future levels of land-use development corresponding to any proposed variation of the LAP could be input by the user at the level of land parcels.

Table 3.2 presents, at model zone level, the land-use figures corresponding to the base year situation, the existing LAP (prior to any amendment), and one option for amending the LAP that is currently under consideration by DLRCC.

3.3 TRIP GENERATION RATES

All-modes rates of trip generation were taken from analysis of the previous NTA modelling work. From the run of the full NTA model, comparing the difference in land use inputs with the difference in trip numbers output, the following rates were obtained.

Table 3.1 – Trip generation rates (AM peak)

Land use data	Generation (trips per hour)	Attraction (trips per hour)
Residential (rate per unit)	0.733	0
Employment (rate per person)	0	0.772
Retail (rate per sqm)	0	0
Education (rate per place)	0	1

The difference between the two sets of trip numbers were fully explained by the difference in residential and employment land use inputs.

It was hypothesised that the number of retail trips in the AM peak hour 08:00-09:00 is minimal, and that this would be a significant factor at other times of day.

The NTA model inputs had zero values for education places. A nominal rate and number of education places were inserted to reflect the presence of two existing primary schools within the LAP area.

Table 3.2 – Land Use Inputs

Zone	Residential Units			Employment Persons			Retail GFA			Education Places		
	Current	Increment – Existing LAP	Increment –Amended LAP	Current	Increment – Existing LAP	Increment – Amended LAP	Current	Increment – Existing LAP	Increment - Amended LAP	Current	Increment - Existing LAP	Increment - Amended LAP
10,951	0	0	0	0	4249	4249	0	0	0	0	0	0
10,952	0	200	322	12	1551	0	0	0	0	0	0	0
10,953	18	710	710	0	0	0	0	0	0	0	0	0
10,954	206	139	139	4	0	0	0	0	0	0	0	0
10,955	72	239	300	12	549	0	0	0	0	0	0	0
10,956	6	57	272	0	1241	0	0	0	0	0	0	0
10,957	1	0	163	4	1510	0	0	0	0	0	0	0
10,958	1	22	22	0	0	0	0	0	0	0	0	267
10,959	0	0	0	4	0	0	0	0	0	0	0	0
10,960	1	53	53	0	0	0	0	0	0	0	0	0
10,961	1	94	94	0	0	0	0	0	0	0	0	0
10,962	39	290	290	8	0	0	0	0	0	0	0	0
10,963	22	581	581	0	0	0	0	0	0	0	0	0
10,964	0	0	0	0	0	0	0	0	0	0	0	0
10,965	0	951	951	0	0	0	0	0	0	0	0	0
10,966	10	117	117	0	0	0	0	0	0	0	0	0
10,967	22	78	78	8	63	63	0	1995	1995	0	0	0
10,968	7	74	74	12	94	94	0	2955	2955	0	0	0
10,969	7	66	66	16	198	198	0	0	0	30	30	30
10,970	1	0	0	8	0	0	0	3900	3900	0	0	0
10,971	1	355	355	0	0	0	0	0	0	0	0	0
10,972	3	59	59	0	0	0	0	0	0	0	0	0
10,973	32	77	77	4	0	0	0	0	0	0	0	0
10,974	15	149	149	4	0	0	0	0	0	30	30	30
10,975	3	76	76	4	0	0	0	0	0	0	0	0
10,976	0	44	44	16	0	0	0	0	0	0	0	0
LAP Total	**468**	**4429**	**5036**	**114**	**9455**	**4604**	**0**	**8850**	**8850**	**60**	**60**	**327**

3.4 MODAL SPLIT

The number of future year highway trips will depend on the level of public transport service and level of provision for soft modes. However, exact specification of future bus services and footpath routes are normally considered to be details that are decided as part of a planning application, rather than features of a Local Area Plan.

The approach taken was therefore to sketch out a nominal pattern of public transport routes, and relate mode share to indicative levels of PT service to a single typical destination.

The LAP area is currently served by two bus routes – the 44 which runs from Kiltiernan via Stepaside in the direction of Dundrum, and the 63 which runs from Kiltiernan via Carrickmines in the direction of Dun Laoghaire.

In the 2012 base year, there is a Luas service at the nearby Ballyogan Wood stop just north of the Park development. For trips to and from locations outside the LAP area, a non-highway mode share of 60% was assumed to be achievable for development that is directly adjacent to the Luas stop, falling in a linear fashion with walking distance until reaching a 0% non-highway share at a walking time of 50 minutes (4.17km at an assumed walk speed of 5km per hour).

In the future year, this non-highway mode share was assumed to be increased by the provision of two well-marketed bus services:

- Direct buses (based on the 44 service to Dundrum)
- A system of shuttle buses connecting with the Luas at Ballyogan Wood (based on an assumption that the 63 service could be diverted).

Within the spreadsheet, the level of Public Transport service is specified by the user in the form of:

- a frequency for each of these services (in the form of headway – the number of minutes between services in the peak hour),
- nominal bus fares,
- a multiplier on bus times (set to 1 if bus lanes are to be provided to maintain existing speeds, less than 1 if speed can be increased above base year speeds by a higher level of investment, and greater than 1 in proportion to highway times if buses are left to mix with regular traffic)
- headway of the Luas service, allowed representation of possible future increases in frequency
- a multiplier on Luas speed, reflected possible future scope for a faster Metro-style service.

The spreadsheet then estimates for each zone of the model, a corresponding increase in public transport mode share, on the basis that:

- mode share is determined by whichever of the three options – direct bus, shuttle to the Luas – walk to the Luas – offers the lowest generalised cost for each zone
- walk time and wait time have a weighting factor of 2.0 relative to in-vehicle time
- average wait time is 0.4 times headway
- no interchange penalty or crowding penalty applies.

In the initial test scenario, the Public Transport inputs were as shown in Figure 3.1. On this basis non-highway mode shares range from 40% in zones 10951 and 10952, that are an estimated 17 minutes walk from the Luas, to around 30% in zones 10971 and 10976, that benefit from the direct bus.

The spreadsheet also took account of slow modes (walking and cycling) based on the proximity of each zone to other zones by applying known modal splits for these modes based on distance travelled.

The resulting highway mode shares were assumed to apply equally to trip generations and attractions from each zone.

3.5 FUTURE YEAR TRIP ENDS

Zones of the model were categorised in three ways:

- LAP area zones, which are allocated future year trip numbers based on land use, generation / attraction rates and mode shares as described above
- External development zones – representing the growth poles at Park and Cherrywood. Benchmark trip generation and attraction numbers for these zones were taken from other studies; the spreadsheet included an option for the proportion of this benchmark level of demand which is assumed to apply in any given scenario.
- Background zones, which were allocated an underlying level of background trip end growth.

3.6 BACKGROUND GROWTH

The principal determinants of change in traffic levels are considered to be:

- Population – other things being equal, each 1% increase in the population of an area will tend to increase traffic in proportion.
- Fuel price – research[1] suggests that each 1% increase in fuel price will tend to decrease traffic by around 0.3%
- Income – when household income rises, people tend to travel further, even if total numbers of trips made change little. Depending on context, each 1% increase in income may increase traffic by around 0.8%.
- Attractiveness of alternative modes - evidence suggests that real public transport fares have tended to rise over time, contributing to the rise in levels of car traffic
- Employment – rising employment increases peak hour travel but may reduce interpeak travel.

Within the GDA model, the standard forecasting assumption is that the various observable trend factors (such as changes in fuel prices, PT fares, income growth, take-up of cycling etc) tend to largely offset each other, and can thus be neglected. This leads to a model where land use development is the real driver, and overall traffic levels relate primarily to population and employment changes in each area.

For this study, we therefore take the Core scenario to be one in which background traffic growth rates follow population growth in DLR county as a whole. In current Regional Planning Guidance, growth from a 2006 Census base is projected to 2016 and 2022. On the assumption that 2012 is linearly intermediate between 2006 and 2016 (preliminary 2011 Census results suggest that this is not unreasonable), projected population growth to 2022 is therefore taken as 13.75%, with employment

[1] See for example “Review of income and price elasticities of demand for road traffic”, Daniel Graham and Stephen Glaister, Centre for Transport Studies, Imperial College, London

increasing in proportion. This is therefore taken as the rate of background traffic growth in the study area for this scenario.

The spreadsheet includes options for varying the rate and interpolating/extrapolating to earlier or later years.

For the High traffic growth scenario, we assume that:

- the same rate of population-related growth applies
- recent fuel price increases are short-term fluctuations, and in the longer term fuel price increases are offset by the development of more fuel-efficient vehicles (including some level of use of electric vehicles powered by non-oil-derived electricity)
- current depressed economic conditions are offset by strong economic growth in the latter part of the decade, giving a long-term rate of income growth of 2% per annum, leading to a 17% increase in overall traffic over the Core scenario
- the current unemployment rate of around 14% nationally is halved, leading to a 7% increase in peak hour traffic but reductions in interpeak traffic.

Combining these effects, existing or background traffic within the model is assumed to grow by an extra 25% above the Core scenario levels.

Note that within this structure, changes in numbers of trips to and from the development are not dependent on these scenario assumptions, but are related to assumed rates of completion and occupation of the land use changes forming part of the Local Area Plan.

The number of possible scenarios is large, and more extreme cases could easily be devised. However it is considered that this approach gives a range within which it is sensible to plan.

3.7 MODELLING EXTERNAL DEVELOPMENTS

Benchmark trips from external development zones were taken from the SATURN model developed by RPS for DLRCC to look at highway infrastructure options for the Cherrywood SDZ. These are shown in Figure 3.3 and 3.4.

The spreadsheet applied a Furness process to factor up the base year matrix so as to match the future year trip ends. Thus for most zones of the model, the assumption was that the pattern of trip origins and destinations is close to that in the base year, with the levels of trip-making increased to reflect the impact of anticipated levels of land-use.

For the external development zones where there is zero traffic in the base year, the trip distribution was borrowed from a nearby zone which has non-zero base year flows. So in Fig 3.4, the trip distribution from the two zones connecting to the west junction (which doesn't exist in the base year) is taken to be the same as for the east junction (which does exist in the base model). Similarly, trips to/from the proposed Cherrywood link road over the motorway were taken to resemble trips from the zone north of the Carrickmines interchange, except that trips to/from M50 south are set to zero, as these are assumed to use the Laughanstown interchange instead.

Figure 3.3 – Benchmark Trips (PCU) – Park and Cherrywood North

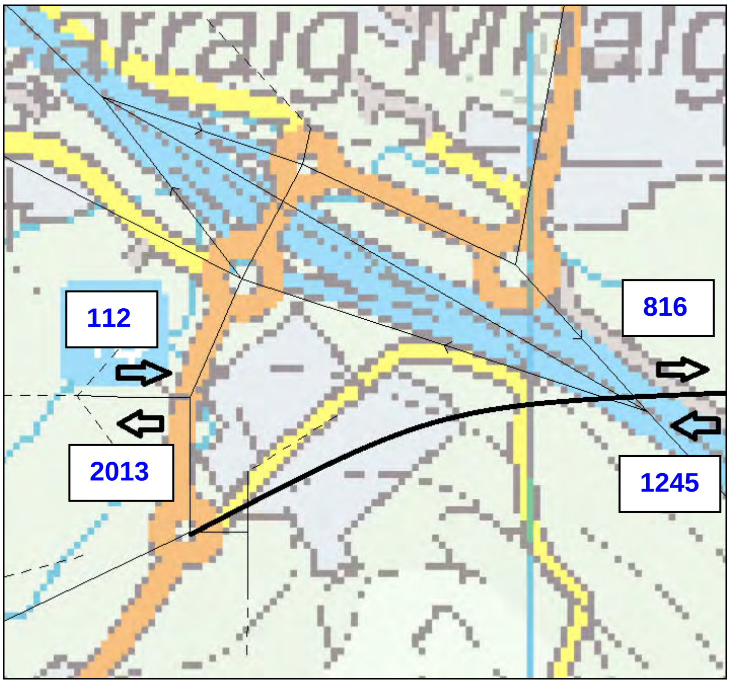
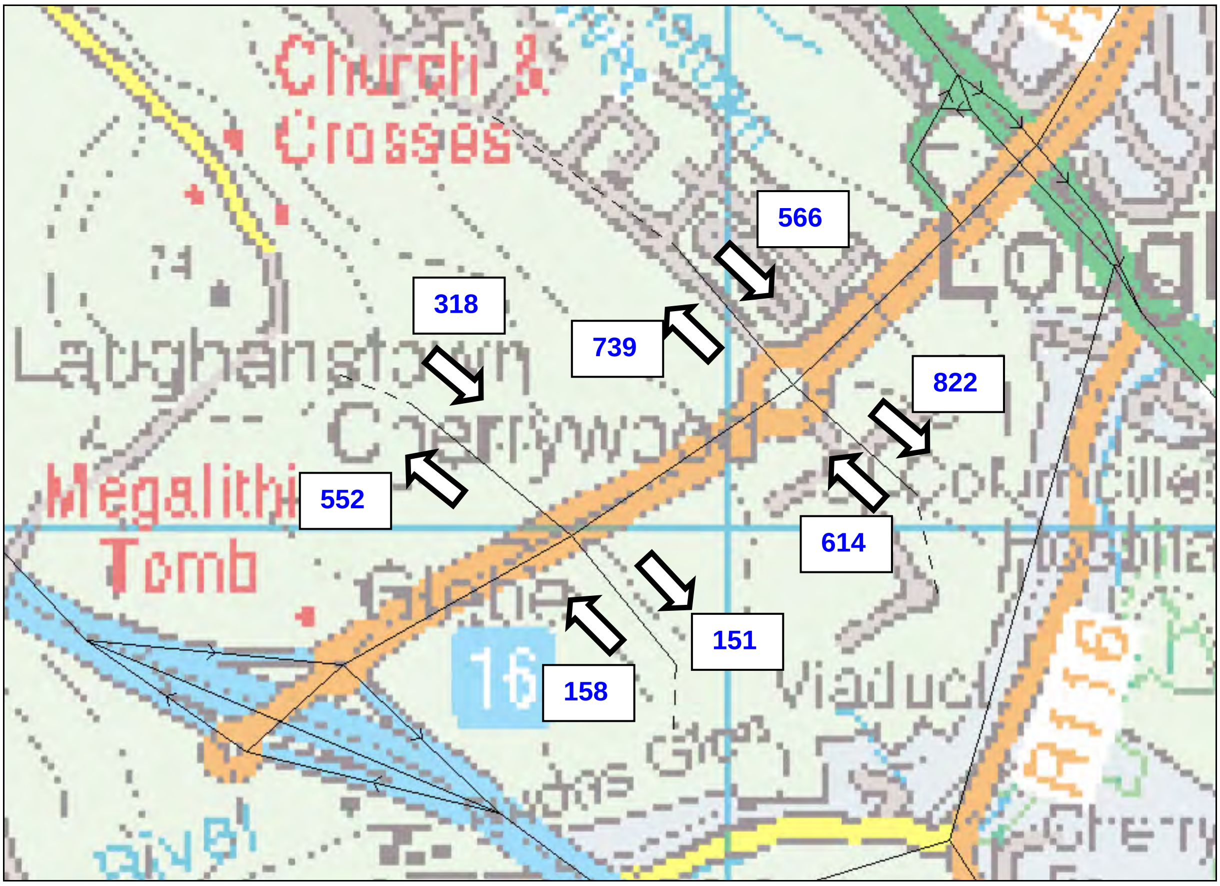


Figure 3.4 – Benchmark Trips (PCU) – Cherrywood South



3.8 COMPARISON OF FUTURE GROWTH ASSUMPTIONS TO 2005 NTA MODEL

The 2005 modelling work undertaken by the NTA used a complex process, combining runs of the full GDA model with runs of a local area highway model. But the modelled levels of demand in 2022 can be considered to be based on the planning data inputs – projected population and employment levels in each zone.

Subject to confirmation with NTA, those projected levels of growth envisage the population of DLR County growing by 27.5% between 2007 and 2022. Current RPG has population growth of 13.75% between 2012 and 2022. The sketchplan model starts from estimated 2012 traffic levels, which are (based on observed trends from the nearest permanent automatic traffic counter) around 8% below 2007 levels.

Thus, insofar as population change can be taken as a guide to traffic change, our current expectation is that 2022 will be only around 4.5% above 2007 levels (0.92 x 1.137) – a substantial drop compared with the earlier projection, reflecting the impacts of the recession.

Clearly the future remains uncertain. Nevertheless, given current prospects for economic growth and fuel prices – unforeseeable in 2005 - we believe that the current sketchplan model offers a substantially more realistic projection of future traffic levels than the earlier work.

4 FORECASTING SCENARIOS

4.1 STRUCTURING THE ISSUE

Good practice is to make a clear distinction between **options** – ways of solving the transport problems of the study area, whose merits are to be considered – and **scenarios** – external circumstances that may come about, and to which the preferred option should be shown to be robust.

For this study, an **option** for the LAP area was defined by a combination of:

- development quanta for each land parcel
- highway infrastructure within & in the immediate vicinity of the LAP area
- level of bus service provision that is to be specified as some form of planning condition.

Each **scenario** was defined by:

- assumptions on rate of background traffic growth
- assumptions on level of development occurring in Park and Cherrywood by the modelled year
- assumptions on external infrastructure and characteristics of Luas service.

A core ("most likely" or "central case") scenario was agreed and used to test a range of options. Then in a second model run, the emerging preferred option was sensitivity-tested against a plausible scenario representing a future condition with higher traffic growth.

4.2 CORE SCENARIO

The core scenario tested was as follows:

- Forecast year 2022
- Population growth rate over this ten-year period as in RPG (multiplier=100%)
- No net effect from income growth, fuel price increases etc (the assumption in the GDA model)
- Luas service remains constant, with any increase in capacity met by lengthening of trams (future headway = 7.5 minutes, speed multiplier = 1.0)
- No M50 widening
- Cherrywood development at 50% of benchmark level by modelled year
- Park development 100% complete by modelled year.

4.3 HIGH TRAFFIC GROWTH SCENARIO

For reasons outlined in Section 3.6, the high traffic growth scenario tested represented a combined growth in background traffic of 25% compared with the Core Scenario, due to:

- A 17% increase in overall background traffic due to strong economic growth in the second half of the decade

- A 7% increase in peak hour background traffic due to a reduction in unemployment levels.

5 SATURN MODEL RUNS - RESULTS

5.1 CORE SCENARIO

Results from the Core Scenario model runs are presented below. A number of indicators from the model run results were used to compare the various options;

- The total delay across the network (expressed as PCU-hours) as summarised in the global network statistics
- The delay and blocking back at junctions and the volume / capacity (V/C) ratio for each link, illustrated diagrammatically
- Queue lengths diagrams and modelled layout at key junctions, namely:
  1. Enniskerry Road / GDDR
  2. GDDR / GLDR
  3. Golf Lane Roundabout[2]
  4. GLDR / Glenamuck Road
  5. GLDR / Ballycorus Road
  6. Park Development Access Junction

5.1.1 Option 0 - Do-Minimum

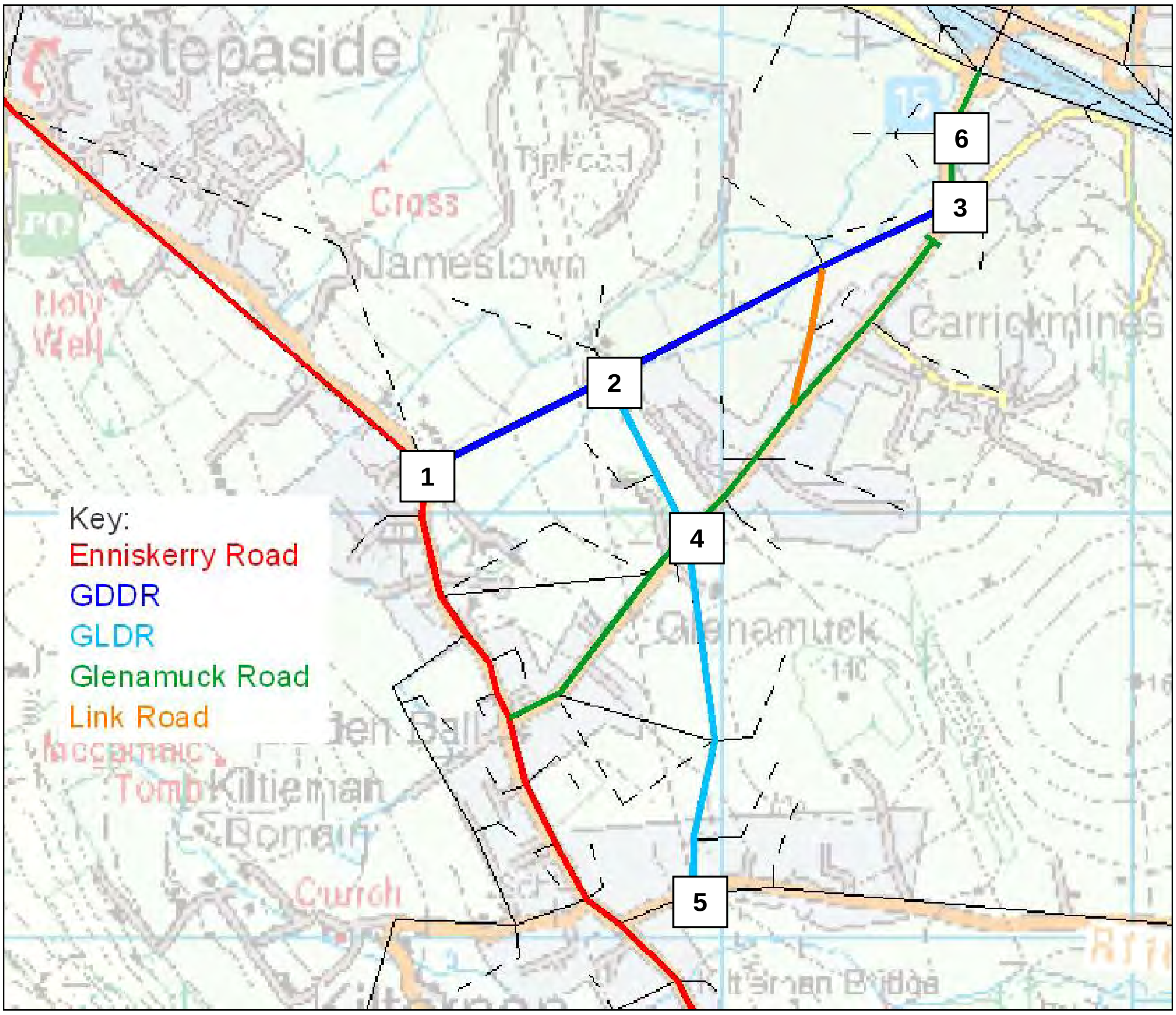
The assumptions for the Do Minimum option of the Core Scenario are summarised thus:

- Development quanta as in previous LAP
- GDDR/GLDR as published
- No Cherrywood link road - traffic from the north access to Cherrywood negotiates the M50 Carrickmines Interchange.
- PT frequencies as in previous NTA modelling work – no shuttle bus, direct bus service with 24 minute headway (2.5 per direction per hour)
- Bus lanes assumed to be provided at key locations to maintain base year bus speeds.

The basic road infrastructure layout for the Do Minimum Option and the key junctions numbered above are outlined in Figure 5.1, below.

[2] Upgraded to signalised junction in Option 3

Figure 5.1 – Road Infrastructure Layout – Do Minimum Option



Network Statistics

Table 5.1 – Network Statistics – Do Minimum Option

Simulation Totals:		This Time Period	Next time Period	Total	Units
Transient Queues		424.6	38.5	463.1	PCU-Hours
Over-Capacity Queues		1123.2	333.7	1457.0	PCU-Hours
Link:	Free Flow Time	1727.2	67.1	1794.3	PCU-Hours
	Delays	122.2	3.6	125.9	PCU-Hours
	Cruise Time	1849.4	70.7	1920.2	PCU-Hours
Total Travel Time		3397.2	443.0	3840.2	PCU-Hours
Travel Distance		122781.9	4128.3	126910.2	PCU-kms
Overall Average Speed		36.1	9.3	33.0	KPH
Fuel Consumption		11847.3	878.9	12635.2	Litres

The global network statistics for the Do Minimum option run are summarised in Table 5.1, above. The total delay across the network is the sum of the transient queues, over-capacity queues and link delays which, for the Do Minimum option, is 2046 PCU-hours.

The total travel time across the entire network is 3840 PCU-Hours, with an overall travel distance of 126910 PCU-kms, an overall average speed of 33.0 KPH and a total fuel consumption of 12635 litres.

Junction Delay

Figure 5.2 – Junction Delays and Blocking Back on Do Minimum Network

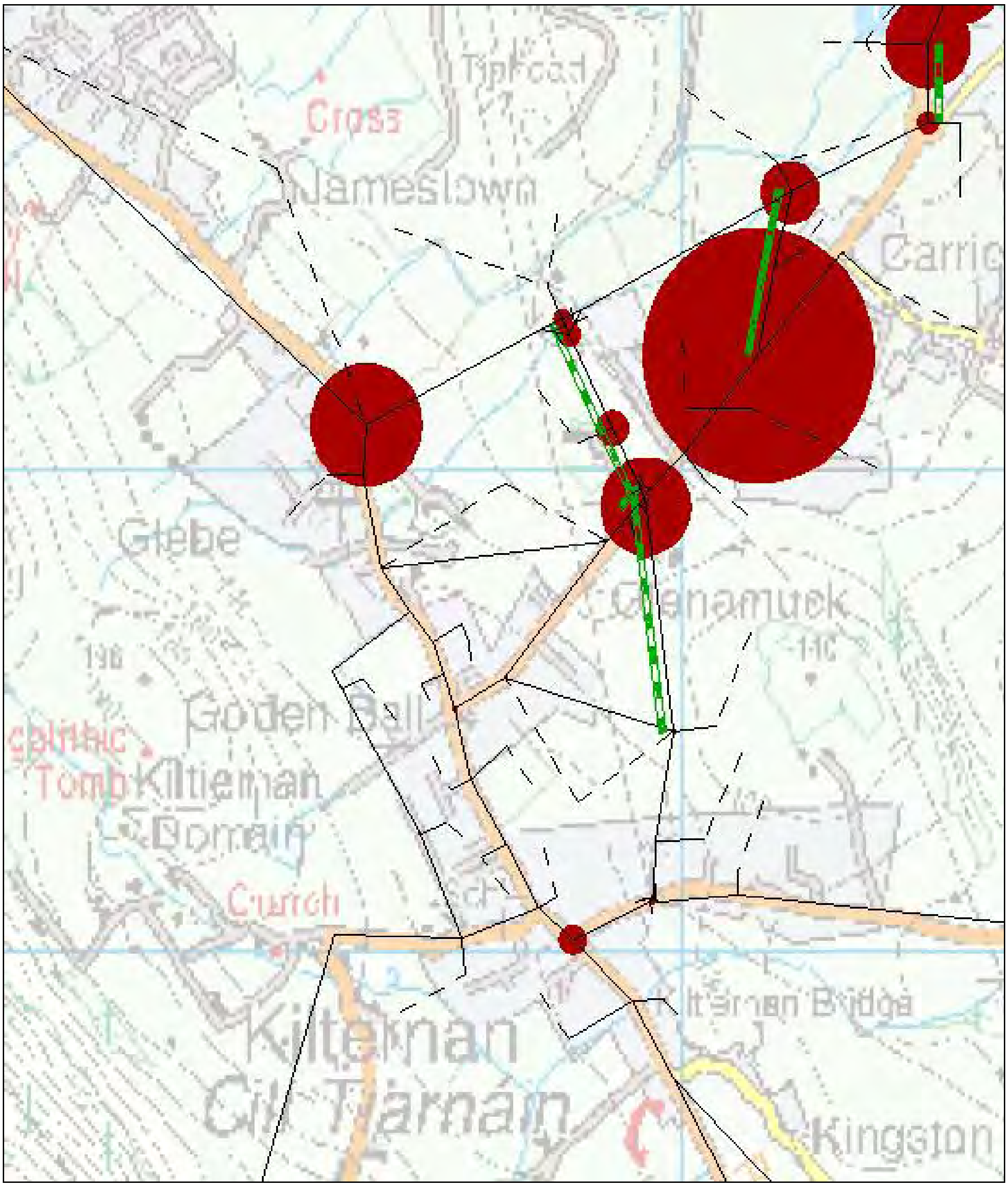


Figure 5.2, above, illustrates the delay at each junction on the Do Minimum network whereby a larger radius of red circle represents a greater delay. The level of blocking back is represented by the green lines.

The diagram indicates significant delays at a number of junctions on the network, particularly at the proposed Glenamuck Road / Link Road (between GDDR and Glenamuck Road) junction (~540 seconds), the proposed Enniskerry Road / Glenamuck District Distributor Road (GDDR) junction (~260 seconds), the proposed GDDR / Link Road junction, the proposed Glenamuck Road / Glenamuck

Local Distributor Road (GLDR) junction (~110 seconds) and the Enniskerry Road / Ballycorus Road junction (~60 seconds).

The significant predicted delay at the Glenamuck Road / Link Road junction is most likely due to the large volume of opposed traffic turning right on to the Link Road from the northern arm of the Glenamuck Road.

Further, less significant, delays are evident along a number of other internal junctions within the LAP area.

Significant delays are also evident around the Park development at the Carrickmines Interchange southern roundabout (~50 seconds) and the Park development access junction (~200 seconds).

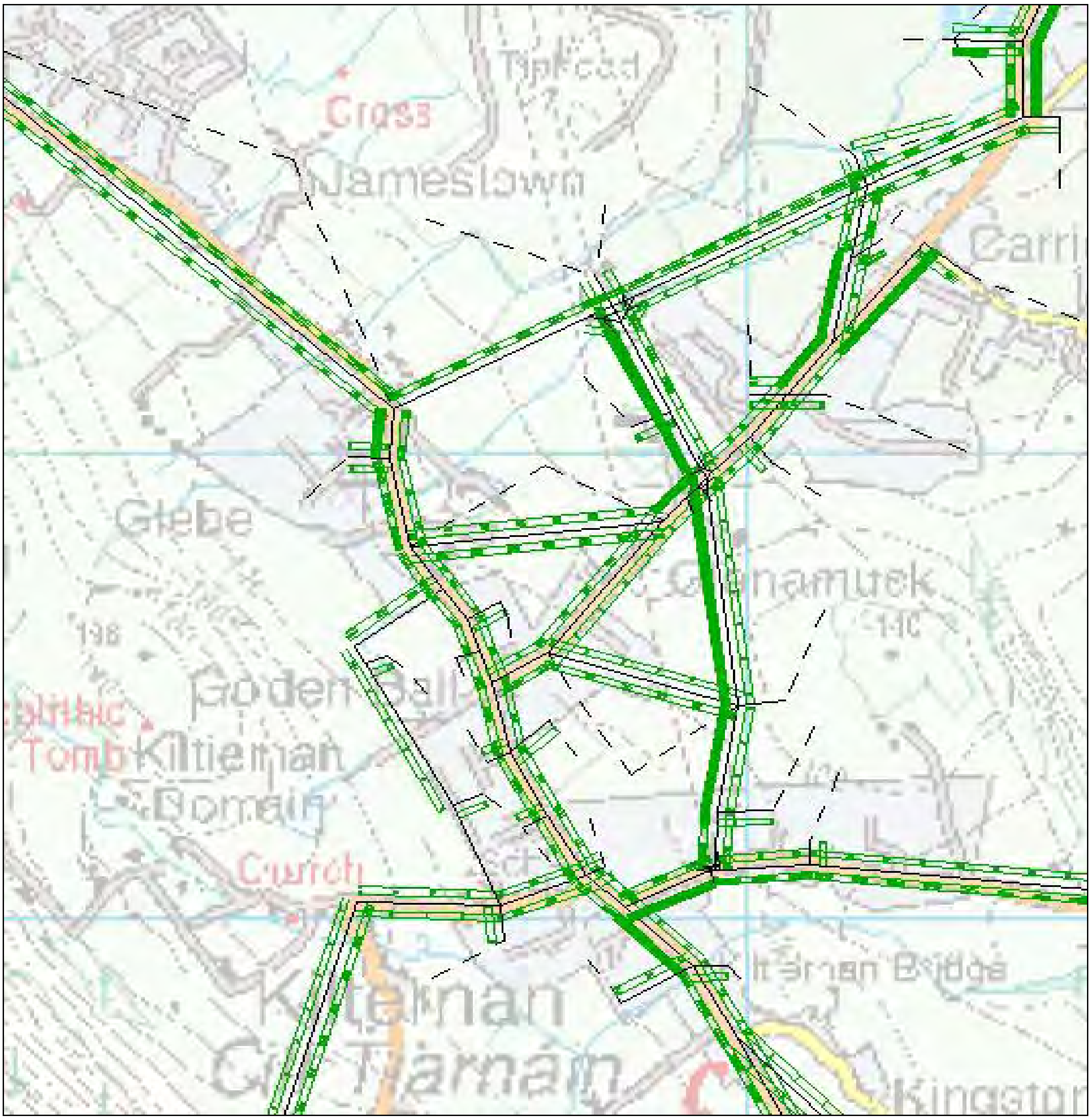
Significant levels of blocking back are evident on the Link Road between the GDDR and Glenamuck Road and along the length of the GLDR.

Volume / Capacity Ratio

Figure 5.3 indicates the links on the Do Minimum network that have capacity issues. The diagram illustrates the V/C ratio on each link and varies by intensity, whereby a solid line indicates a high V/C ratio, with decreasing levels of fill representing decreasing V/C ratios.

The diagram indicates that under the Do Minimum option, a number of key links on the network will experience significant capacity issues, including the existing Glenamuck Road, the GLDR as well as a number of the new internal link roads within the LAP area.

Figure 5.3 – Do Minimum Option – V/C Ratios



Queue Length Diagrams

Figures 5.4 – 5.9 illustrate the modelled layout and predicted average queue lengths at the six key junctions in the LAP area listed in Section 5.1.

Figure 5.4 – Do Minimum Modelled Layout & Predicted Queue Lengths at Junction 1 - Enniskerry Road / GDDR Junction

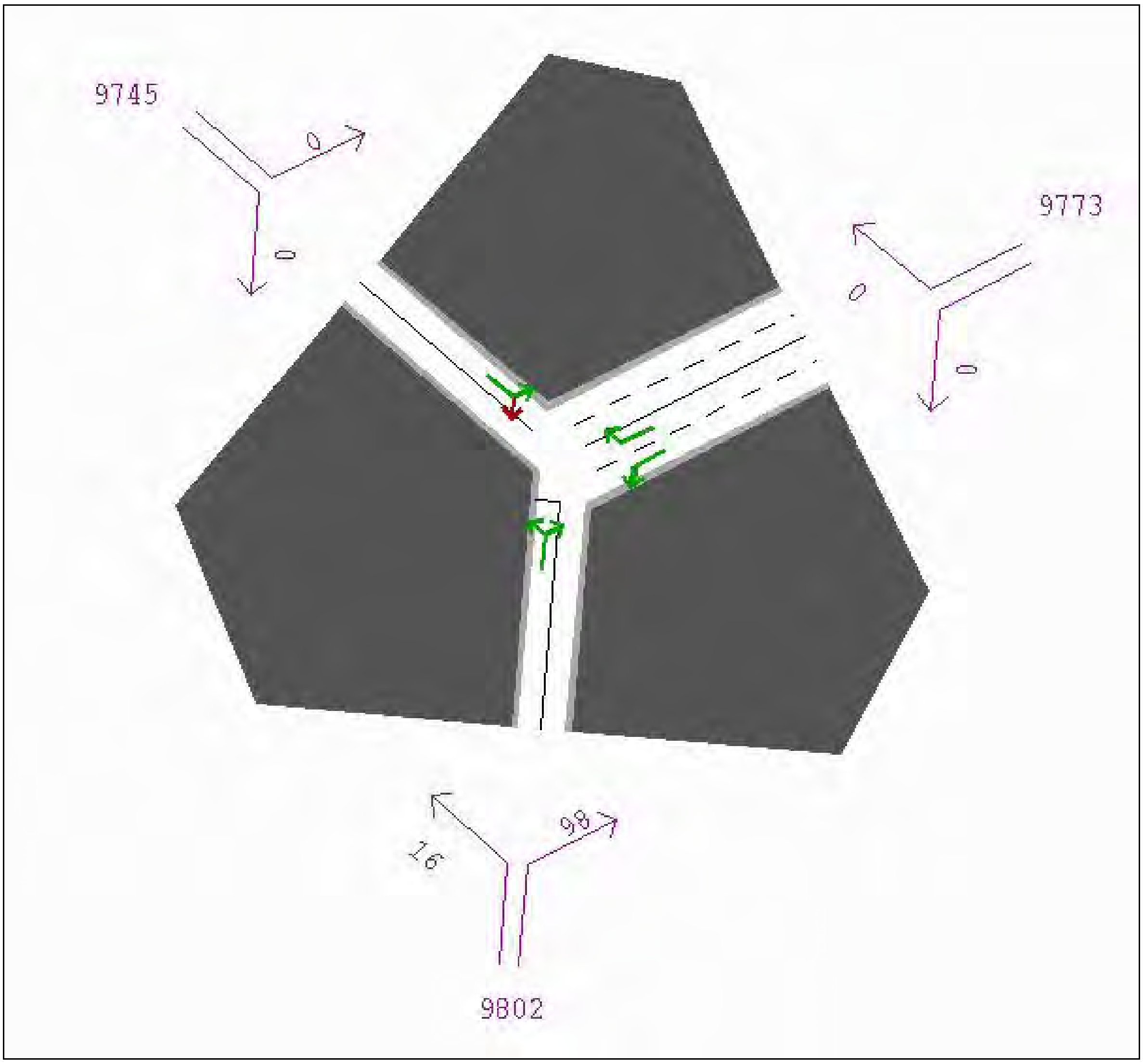


Figure 5.4 illustrates the modelled layout of the Enniskerry Road / GDDR signalised junction which was as specified in the original Glenamuck District Distributor Road Preliminary Design Report (2006). The diagram indicates a significant predicted average queue of 98 PCUs for vehicles turning right from the existing Enniskerry Road on to the GDDR and 16 PCUs for vehicles turning left on to Enniskerry Road.

Figure 5.5 – Do Minimum Modelled Layout & Predicted Queue Lengths at Junction 2 - GDDR / GLDR Junction

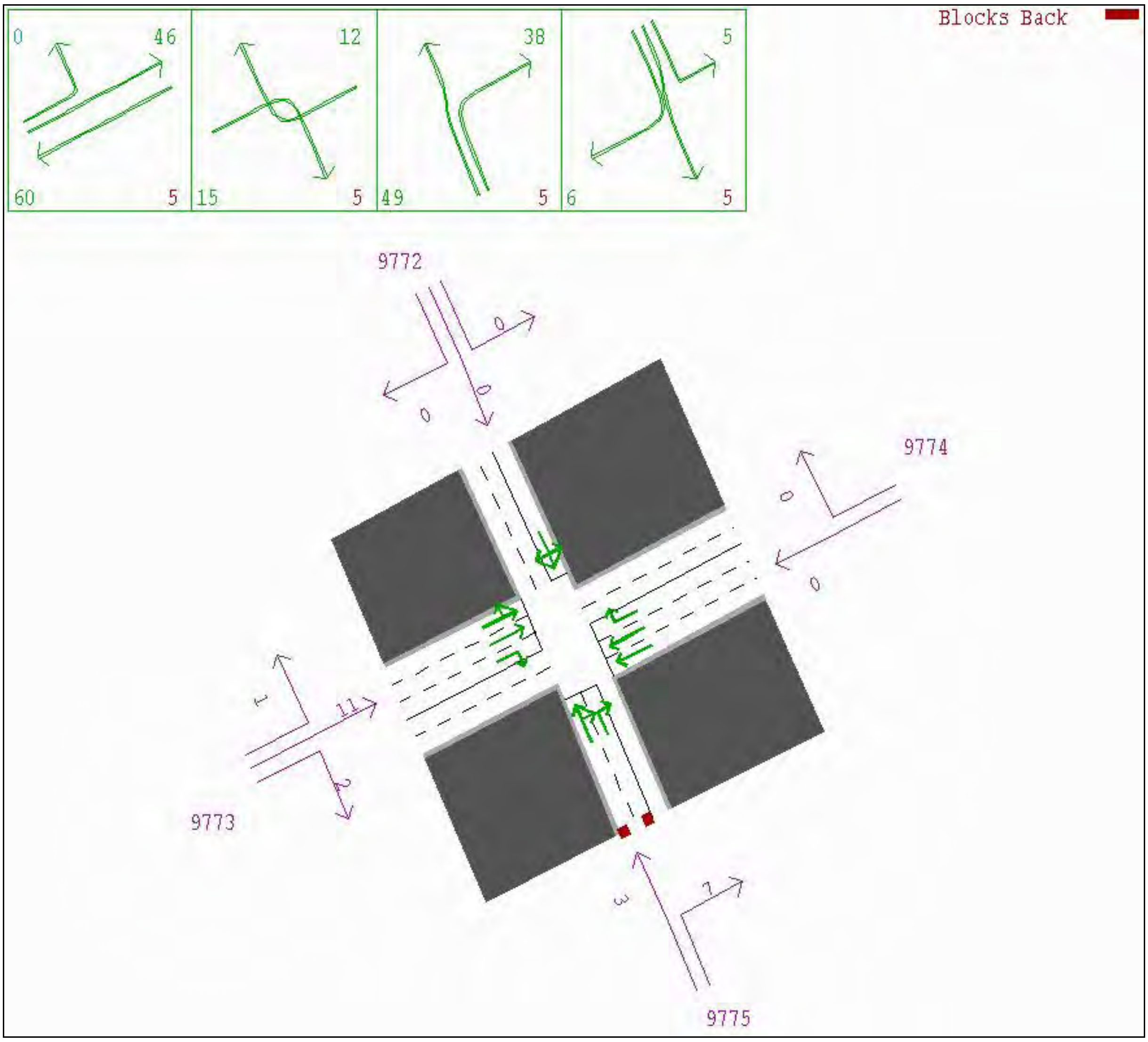


Figure 5.5 illustrates the modelled layout of the proposed GDDR / GLDR signalised junction which was modelled as specified in the original Glenamuck District Distributor Road Preliminary Design Report (2006). The left-turns from the GLDR to GDDR West and from GDDR East to the GLDR were modelled as slip lanes and therefore do not appear on the junction diagram.

The diagram indicates an average queue of 11 PCUs for vehicles moving straight through the junction from GDDR West to GDDR East and an average queue of 7 PCUs for vehicles turning right from GLDR to GDDR East. The diagram also indicates that blocking back is predicted to occur along the GLDR arm of the junction.

Figure 5.6 – Do Minimum Modelled Layout & Predicted Queue Lengths at Junction 3 – Golf Lane Roundabout at Carrickmines Interchange

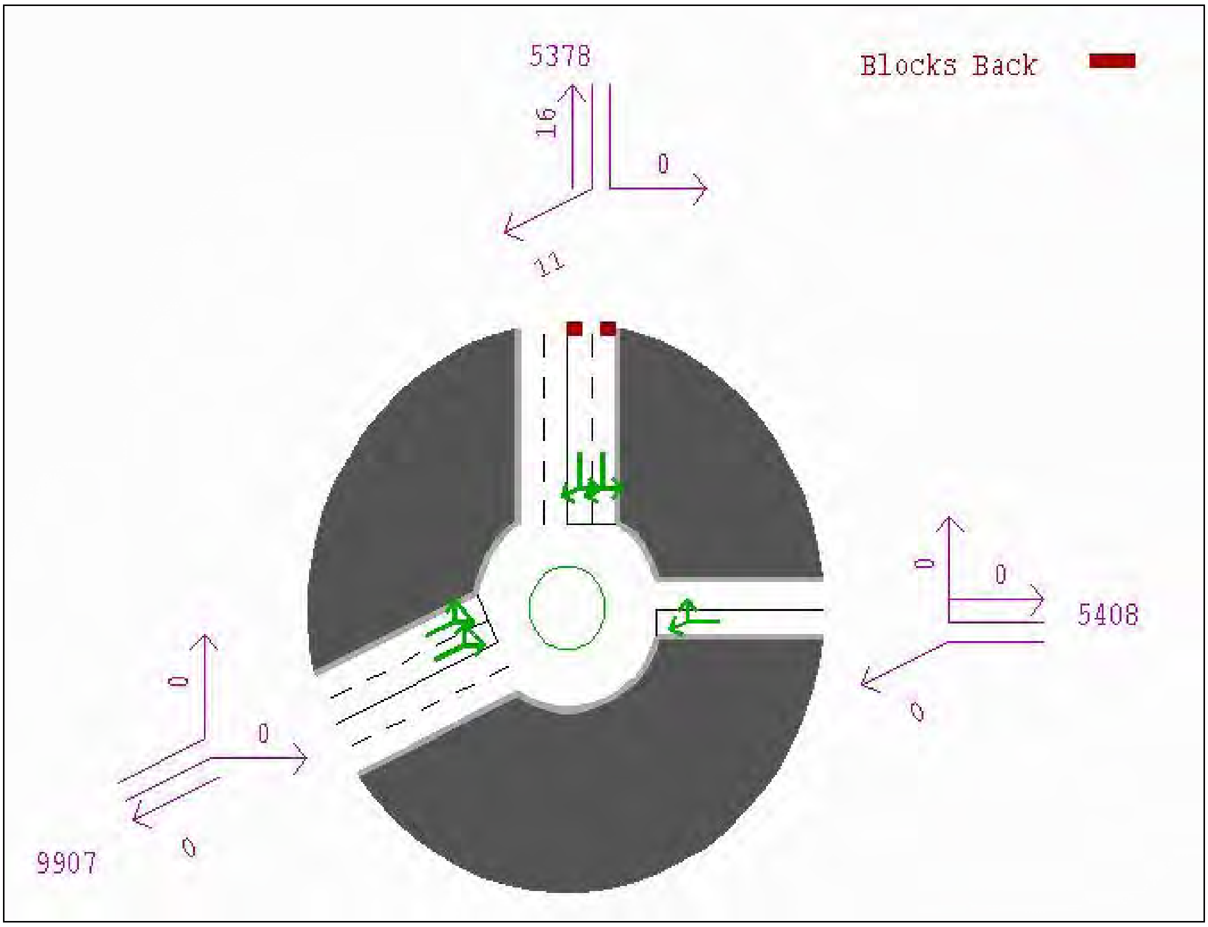


Figure 5.6 illustrates the modelled layout of the proposed Golf Lane Roundabout which was modelled as specified in the original Glenamuck District Distributor Road Preliminary Design Report (2006).

The diagram indicates significant predicted average queues of 11 PCUs for vehicles turning right from Glenamuck Road on to the GDDR and 16 PCUs for vehicles making the U-turn back on to Glenamuck Road in order to access the Park development via the left-in, left-out junction further North (Junction 6). Blocking back is also predicted to occur on the Glenamuck Road arm of the roundabout.

Figure 5.7 – Do Minimum Modelled Layout & Predicted Queue Lengths at Junction 4 - Glenamuck Road / GLDR Junction

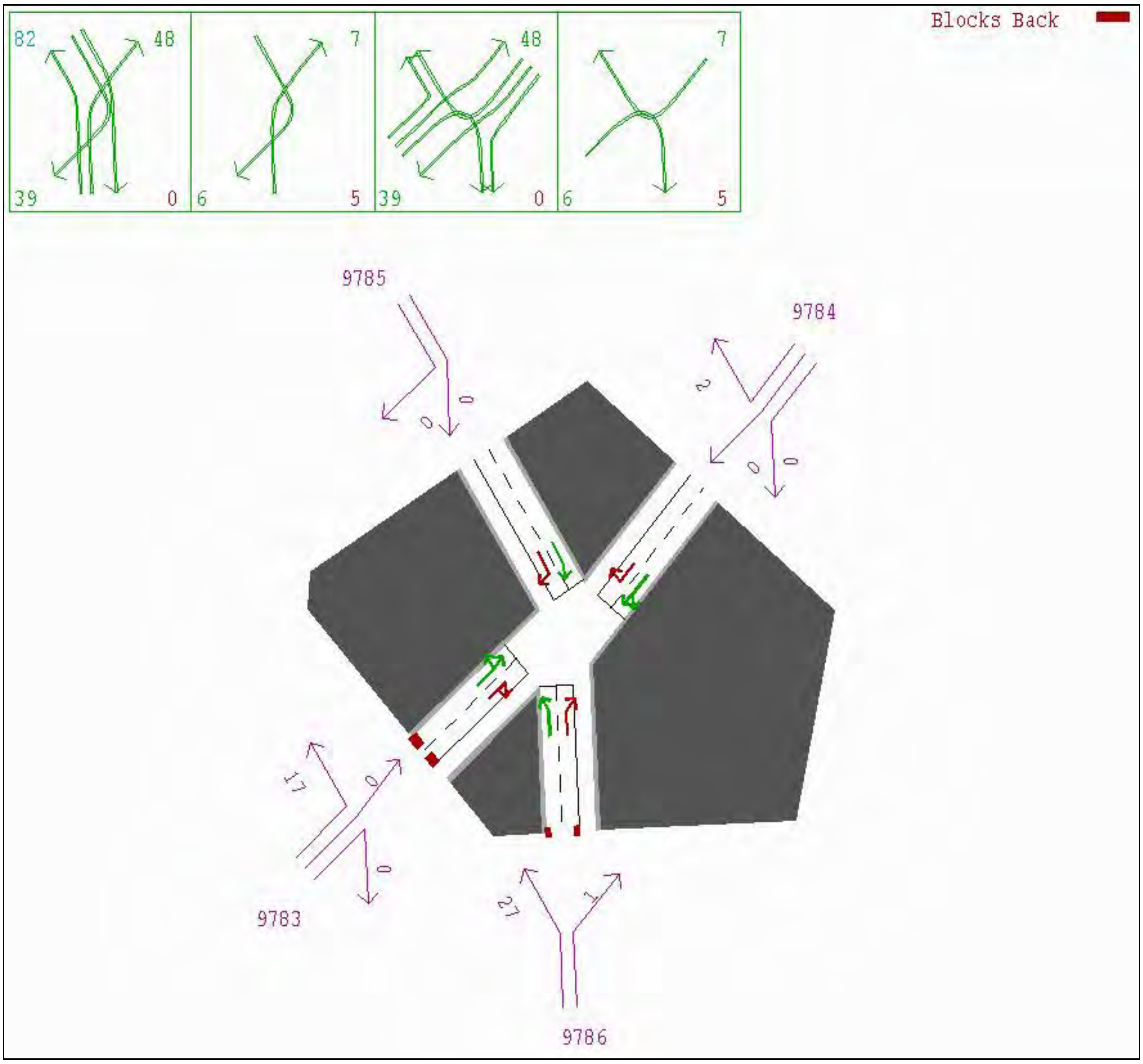


Figure 5.7, above, illustrates the modelled layout of the proposed Glenamuck Road / GLDR signalised junction, which was modelled as specified in the original Glenamuck District Distributor Road Preliminary Design Report (2006). The left-turns from GLDR south to Glenamuck Road southwest and from Glenamuck Road northeast to GLDR south were modelled as slip lanes and therefore do not appear on the junction diagram.

The diagram indicates significant average queues of 17 PCUs for vehicles turning on to GLDR north from Glenamuck Road southwest and 27 PCUs for vehicles travelling straight-through the junction from GLDR south to GLDR north.

The diagram also indicates that blocking back is predicted to occur on the Glenamuck Road southeast and GLDR south arms of the junction.

Figure 5.8 – Do Minimum Modelled Layout & Predicted Queue Lengths at Junction 5 - GLDR / Ballycorus Road Junction

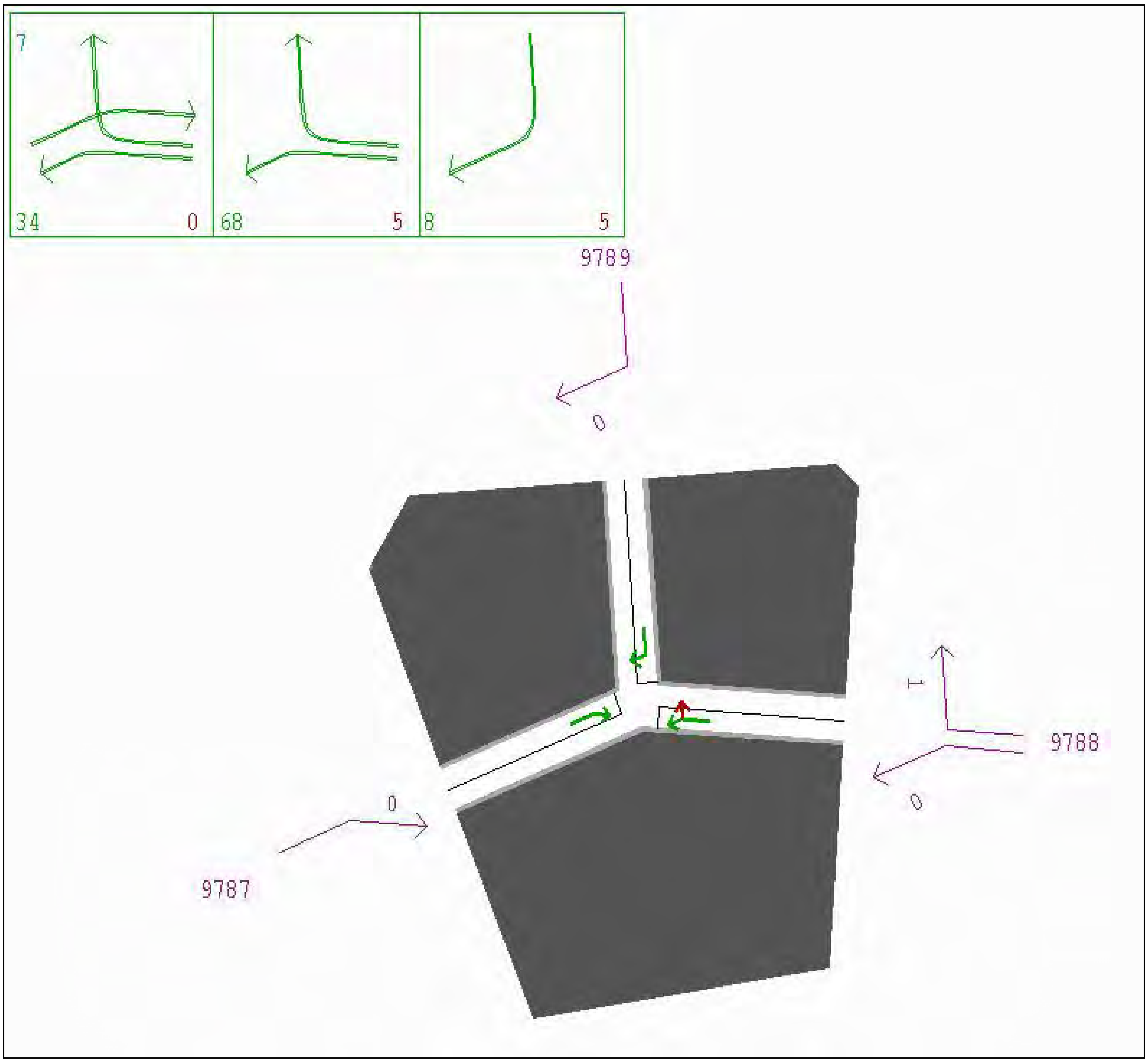


Figure 5.8, above, illustrates the modelled layout of the proposed GLDR / Ballycorus Road signalised junction, which was modelled as specified in the original Glenamuck District Distributor Road Preliminary Design Report (2006). The left-turns from GLDR to Ballycorus Road east and from Ballycorus Road west to GLDR south were modelled as slip lanes and therefore do not appear on the junction diagram.

The diagram indicates that significant queues and blocking back are not predicted to occur on any arm of the junction.

Figure 5.9 – Do Minimum Modelled Layout & Predicted Queue Lengths at Junction 6 - Park Development Access Junction

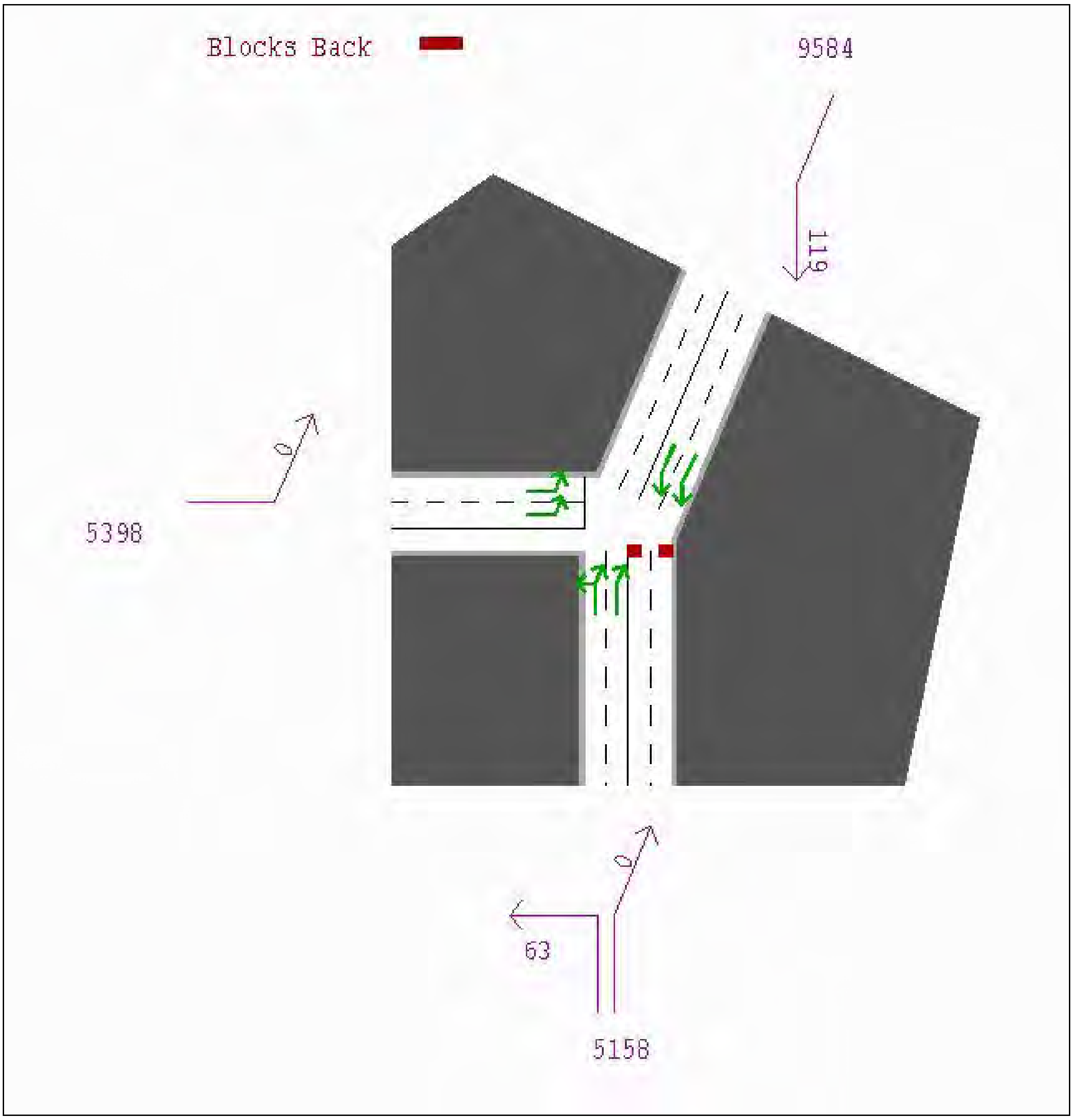


Figure 5.9 illustrates the modelled layout of the Park development access junction, which was modelled as per the existing layout. The diagram indicates significant average queues of 63 PCUs for traffic turning into the Park development and 119 PCUs for traffic travelling straight through the junction from Glenamuck Road north to Glenamuck Road south. This southbound traffic is delayed by blocking-back from Junction 3 (outlined previously, which is located immediately south of this junction).

Note that this Do-Minimum option assumes full development of the Park site without amendments to the access junction.

5.1.2 Option 1 – Current thinking for LAP area

As Option 0 but with:

- Revised development quanta (to reflect the Dun Laoghaire Rathdown County Development Plan)
- Extension of GLDR to Enniskerry Road
- Staggered junction of GLDR with existing Glenamuck Road

Network Statistics

Table 5.2 – Network Statistics – Option 1

Simulation Totals:		This Time Period	Next time Period	Total	Units
Transient Queues		419.1	10.4	429.5	PCU-Hours
Over-Capacity Queues		501.7	164.3	666.0	PCU-Hours
Link:	Free Flow Time	1667.5	21.2	1688.6	PCU-Hours
	Delays	137.2	1.8	139.0	PCU-Hours
	Cruise Time	1804.7	23.0	1827.7	PCU-Hours
Total Travel Time		2725.5	197.7	2923.2	PCU-Hours
Travel Distance		120214.1	1243.8	121457.9	PCU-kms
Overall Average Speed		44.1	6.3	41.5	KPH
Fuel Consumption		10651.4	305.4	10956.8	Litres

The global network statistics for the Option 1 model run are summarised in Table 5.2, above. The total delay across the network is the sum of the transient queues, over-capacity queues and link delays which, for Option 1, is 1235 PCU-hours. This represents a decrease of 812 PCU-hours (40%) compared to the Do Minimum option, and a 13% saving in total fuel consumption within the modelled area.

Table 5.2 also indicates decreases in total travel time (917 PCU-Hours) and travel distance (5452 PCU-kms) as well as an increase in overall average speed from 33 KPH to 41.5 KPH compared to the Do Minimum option network.

In general, the difference in network statistics for the Option 1 network indicate compared to the Do Minimum network indicate that Option 1 represents a more efficient network.

Junction Delay

Figure 5.10, below, illustrates the delay at each junction on the Option 1 network whereby a larger radius of red circle represents a greater delay. The level of blocking back is represented by the green lines.

Figure 5.10 – Junction Delays and Blocking Back on Option 1 Network

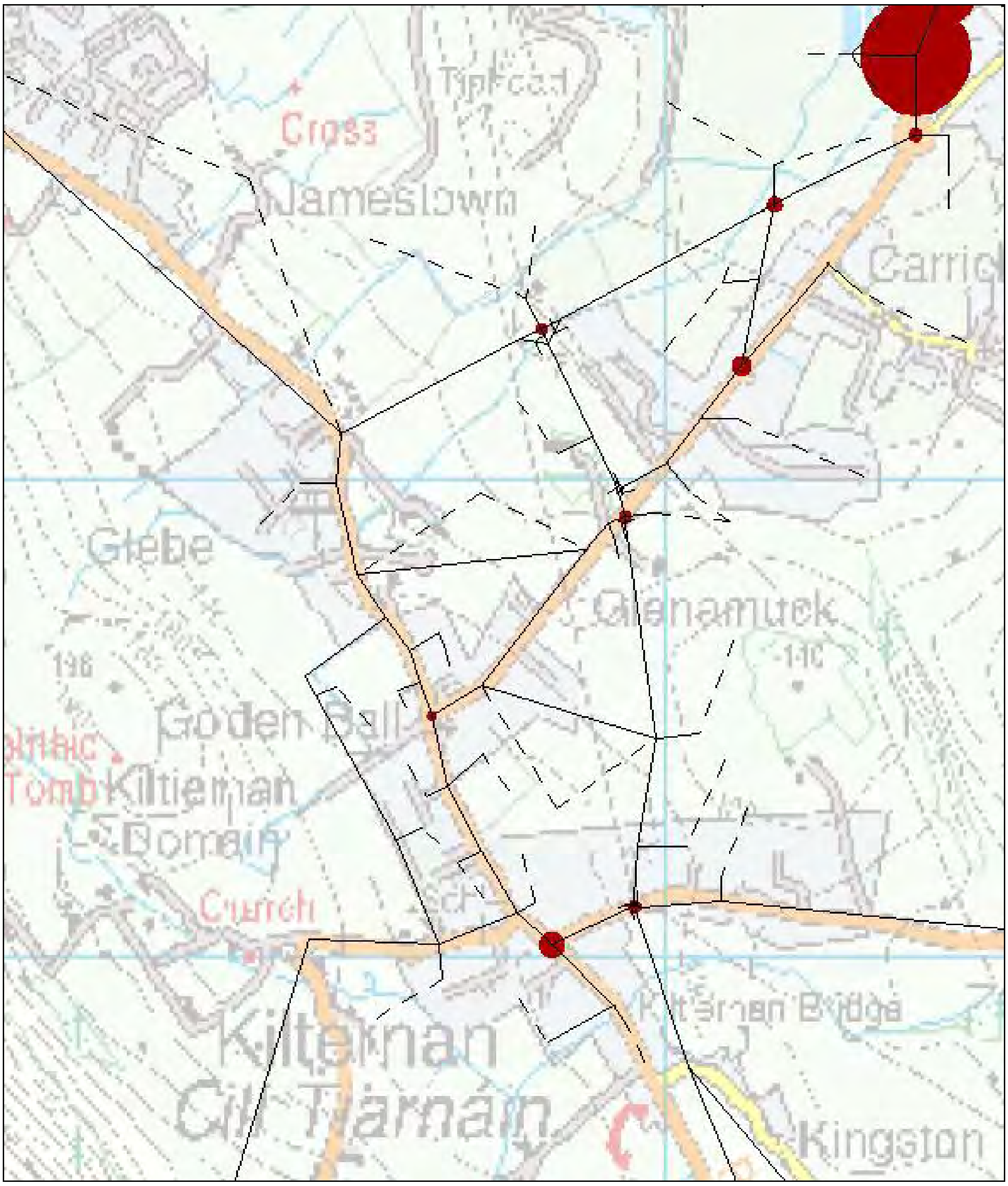


Figure 5.10 indicates a reduction in the number of junctions predicted to experience significant delays in Option 1, compared with the Do Minimum option. With Option 1, only the Park development access junction is predicted to experience an excessive delay (~270 seconds).

Several junctions within the LAP area, which were predicted to experience significant delays in the Do Minimum Option, such as the Enniskerry Road / GDDR junction, the GLDR / Glenamuck junction and the Glenamuck Road / Link Road junction, are all predicted to experience much shorter delays with

Option 1. The longest predicted delays within the LAP area occur at the Link Road / Glenamuck Road junction (45 seconds) and at the Enniskerry Road / Ballycorus Road junction (61 seconds).

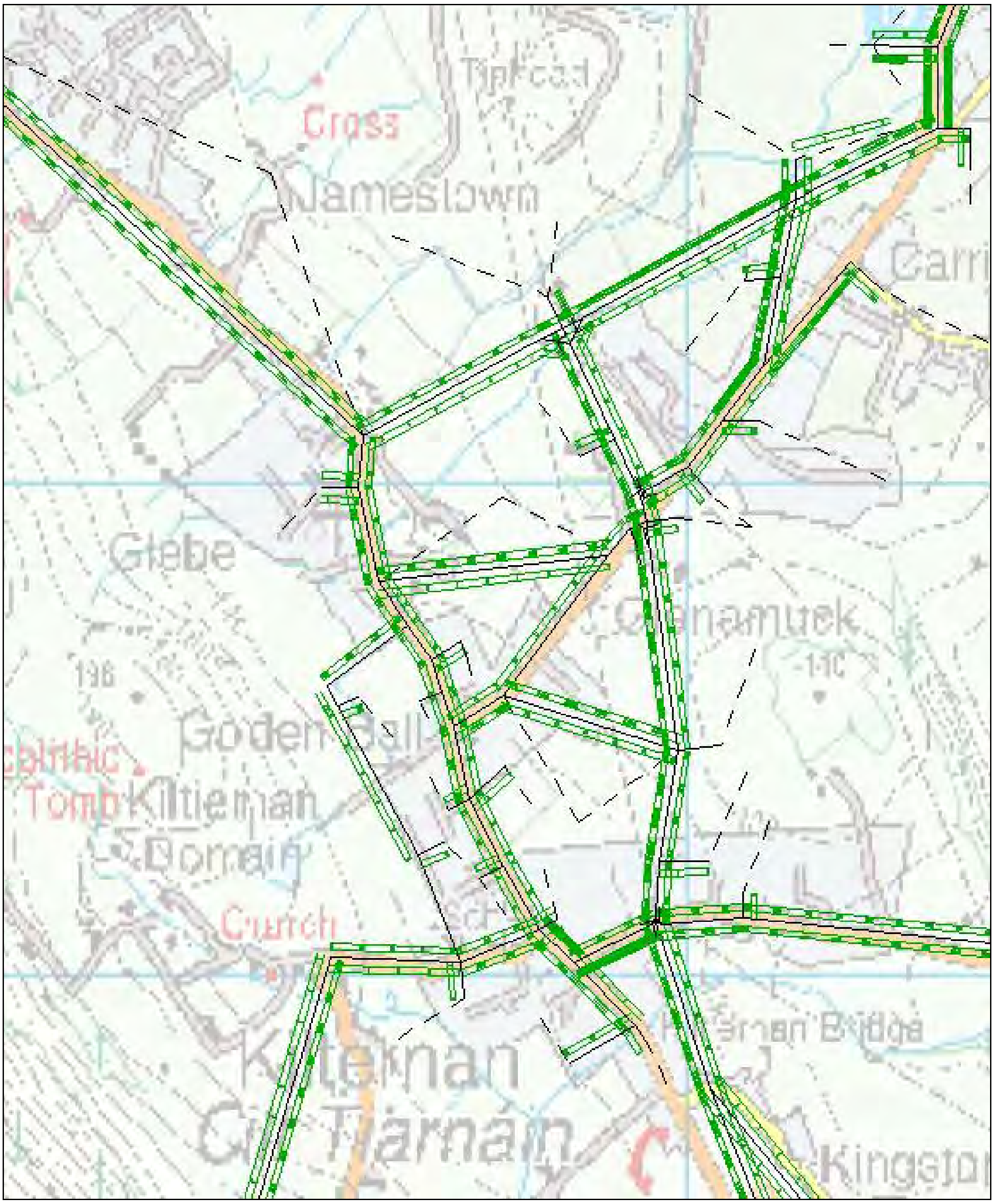
This reduction in significant delays within the LAP area is likely due to two factors; the extension of the GLDR south to Enniskerry Road, allowing traffic to bypass Kiltiernan village and the re-designation of several land parcels within the LAP area from commercial / office to residential in the revised LAP, which would reduce the level of trip attraction within the LAP area.

Figure 5.10 also indicates that significant blocking back is not predicted to occur at any point on the Option 1 network.

Volume / Capacity Ratio

Figure 5.11 indicates the links on the Option 1 network that have capacity issues. The diagram illustrates the V/C ratio on each link and varies by intensity, whereby a solid line indicates a high V/C ratio, with decreasing levels of fill representing decreasing V/C ratios.

Figure 5.11 – Option 1 Network – V/C Ratios



The diagram indicates that, with Option 1, the number of links in the network experiencing capacity issues will reduce significantly. Most of the links on the network with high V/C ratio are in and around the vicinity of the Park development, which is to be expected somewhat as Option 1 does not include the upgrading of the access arrangements for the development.

The capacity issues on the links within the LAP area that were evident in the Do Minimum option are not present with Option 1.

Queue Length Diagrams

Figures 5.12 – 5.17 illustrate the modelled layout and predicted average queue lengths at the six key junctions in the LAP area listed in Section 5.1.

Figure 5.12 – Option 1 Modelled Layout & Predicted Queue Lengths at Junction 1 - Enniskerry Road / GDDR Junction

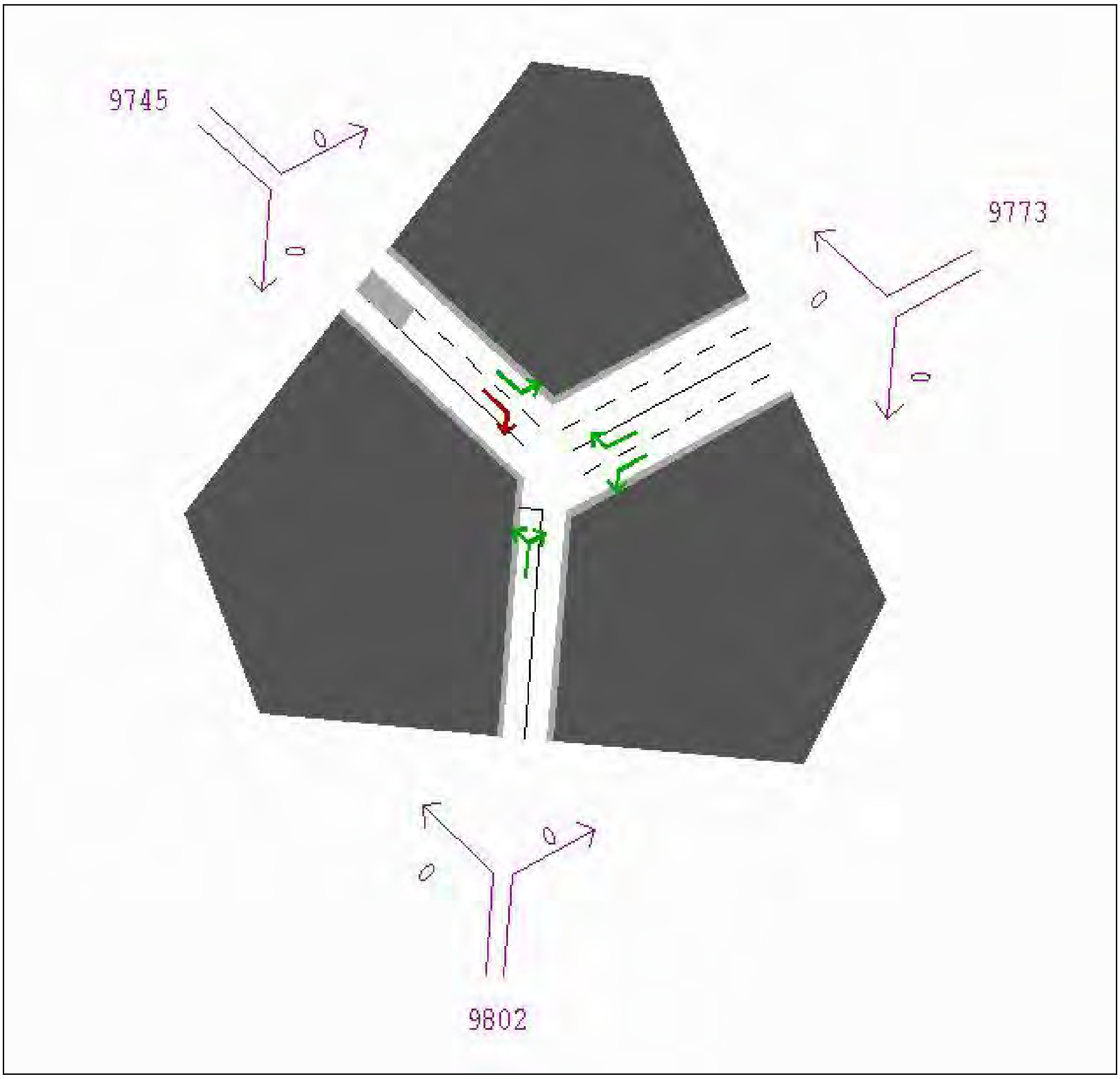


Figure 5.12 indicates that the significant average queues that were predicted for the Enniskerry Road / GDDR junction in the Do Minimum option are not present in Option 1. The predicted average queues at the junction are zero on all arms and blocking back is not predicted to occur.

Figure 5.13 – Option 1 Modelled Layout & Predicted Queue Lengths at Junction 2 - GDDR / GLDR Junction

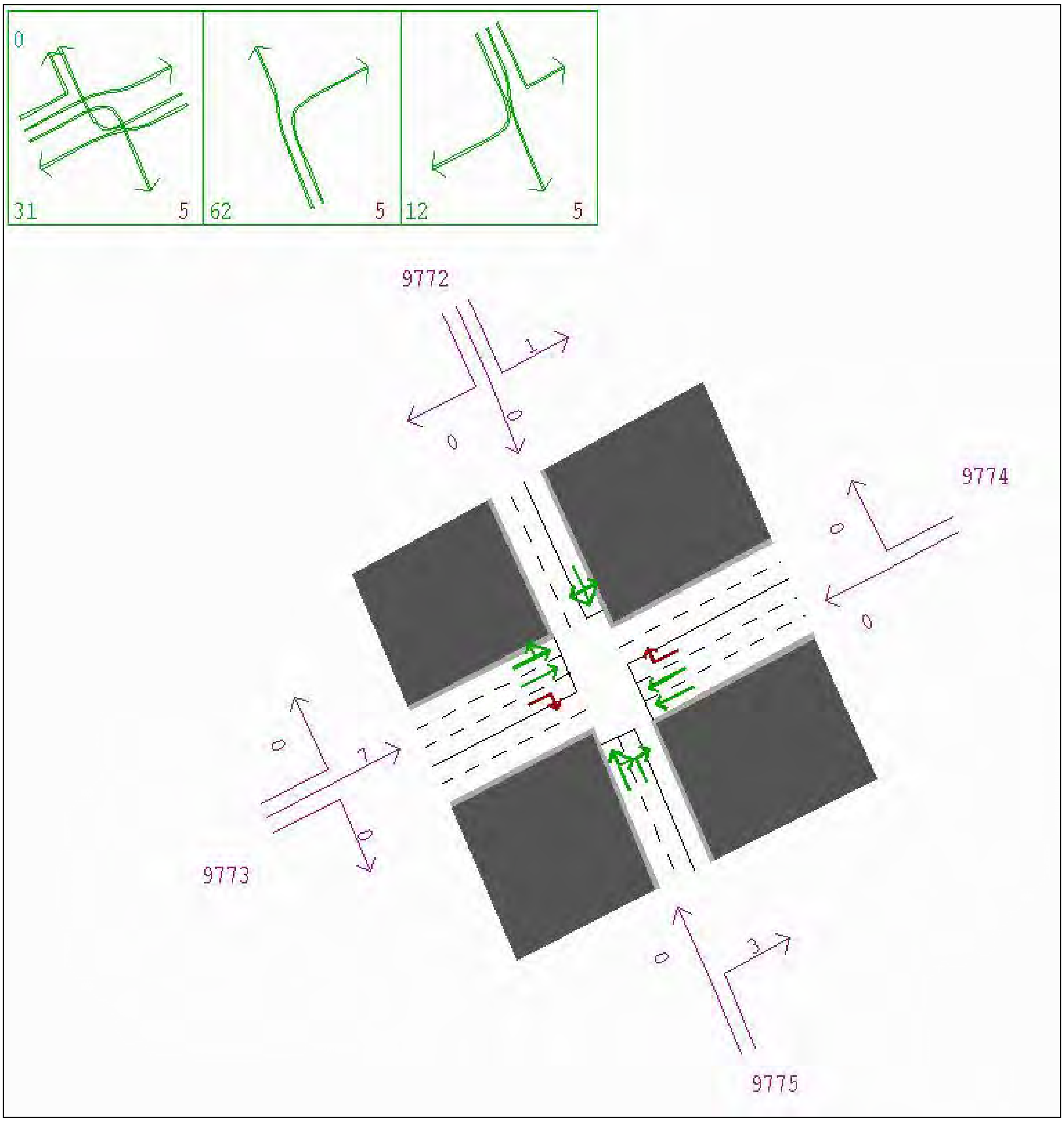


Figure 5.13 indicates that there are no significant average queues predicted to occur at Junction 2 in Option 1. There is a predicted average queue of 7 PCUs for traffic moving straight-through the junction from GDDR west to GDDR east, this is a reduction of 4 PCUs compared with the Do Minimum option.

The diagram also shows that the predicted average queue for traffic turning right from the GLDR to GDDR east is reduced by more than half to 3 PCUs when compared with the Do Minimum Option.

Blocking back is not predicted to occur on any of the arms at the junction.

Figure 5.14 – Option 1 Modelled Layout & Predicted Queue Lengths at Junction 3 – Golf Lane Roundabout at Carrickmines Interchange

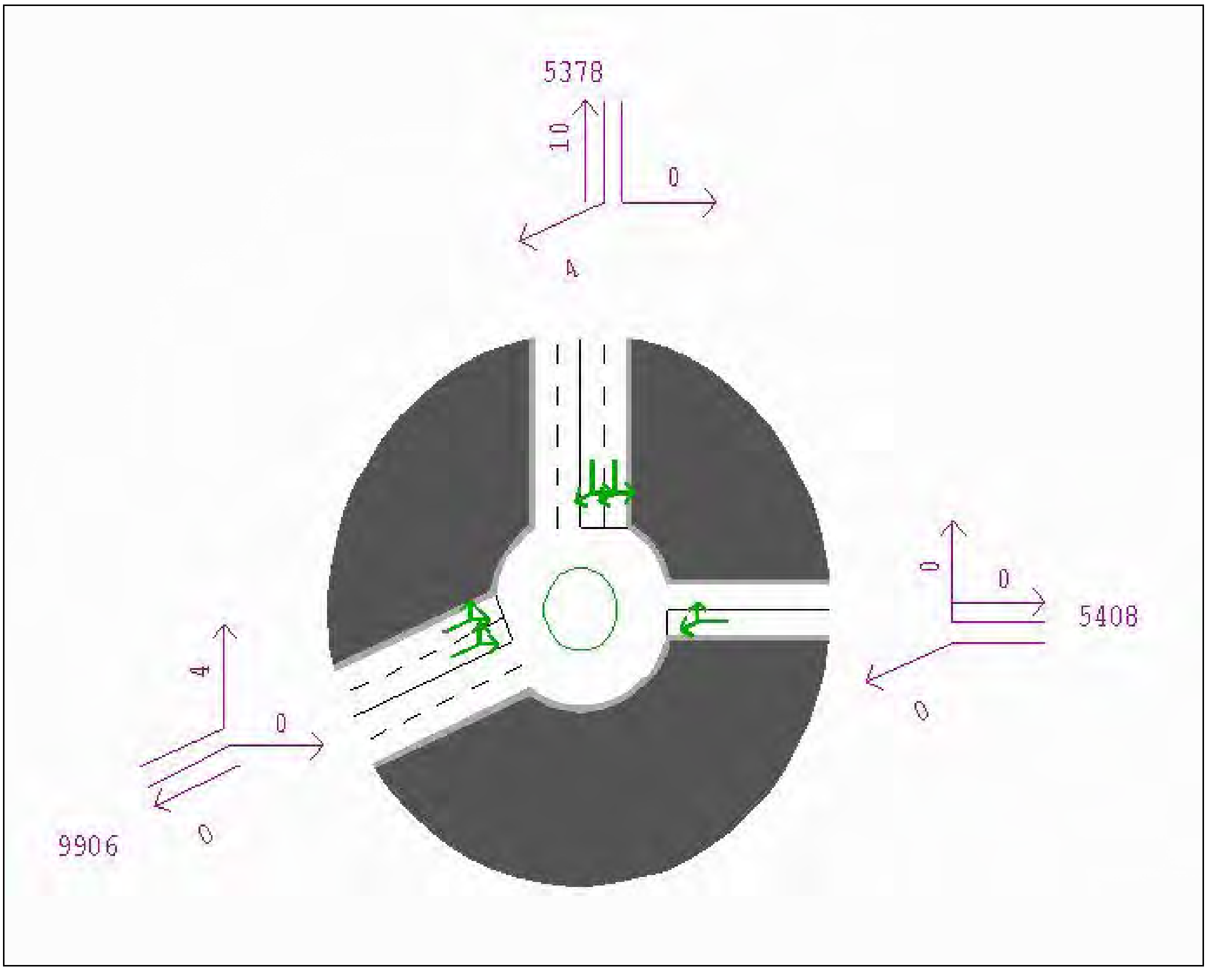
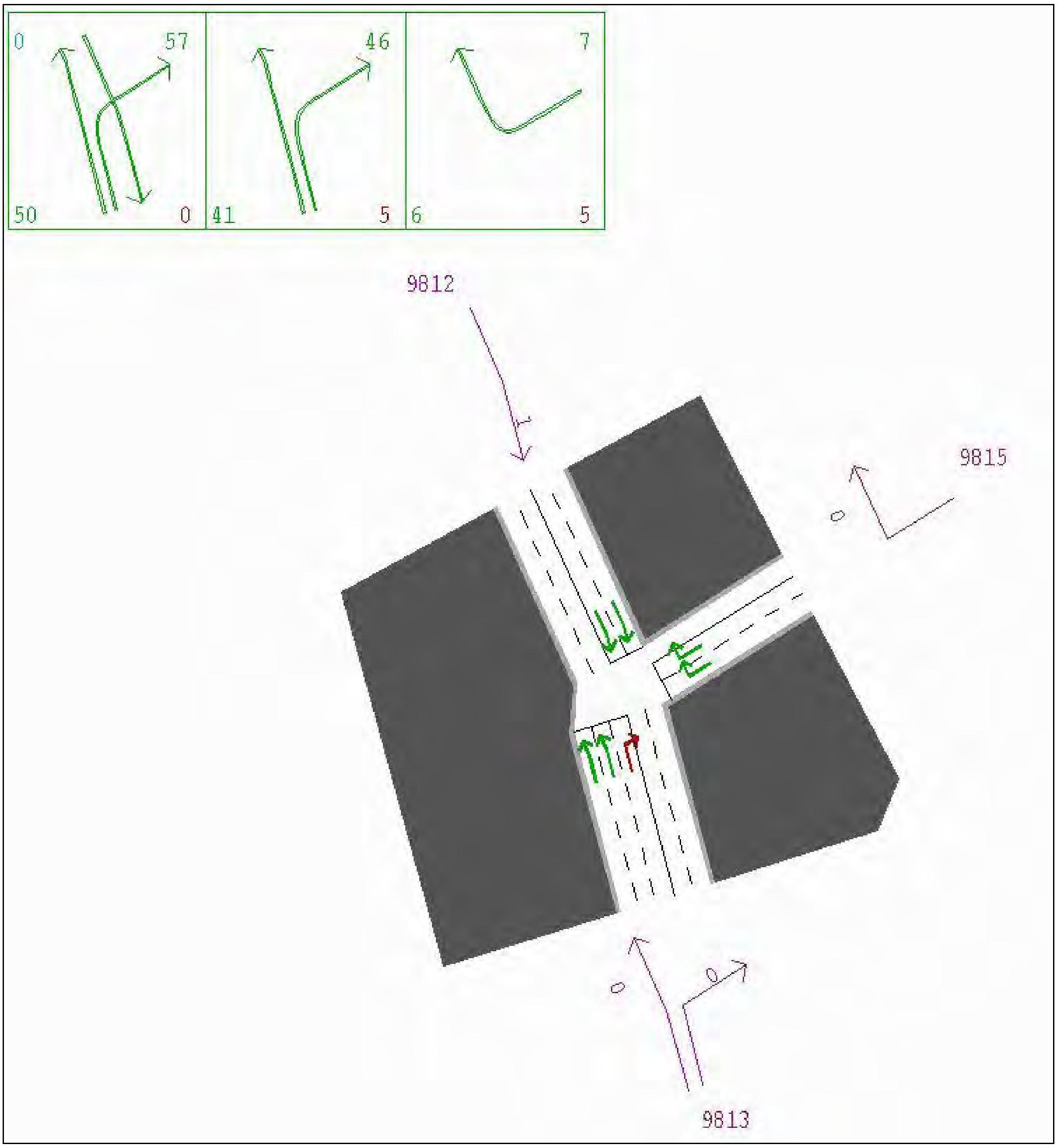


Figure 5.14 indicates a significant predicted average queue of 10 PCUs for traffic making the U-turn at the roundabout back on to Glenamuck Road to access the left-in left-out junction at Park. This represents a decrease compared with the Do Minimum option. The predicted significant queuing and blocking back that was evident on the Glenamuck Road arm of the roundabout in the Do Minimum option, is not evident in Option 1.

Figure 5.15a – Option 1 Modelled Layout & Predicted Queue Lengths at Junction 4a - GLDR / Glenamuck Road Junction Northern Stagger



In Option 1 the Glenamuck Road / GLDR junction is implemented as a stagger junction, as opposed to a crossroad layout in the Do Minimum option. Figure 5.15a illustrates the revised layout at the northern stagger of the junction, which was modelled as specified in the Glenamuck – Kiltiernan Local Road Improvements Preliminary Design Report (2008). The left turn from GLDR north to Glenamuck Road and from Glenamuck Road to GLDR south are modelled as slip lanes and therefore do not appear in the junction diagram.

Figure 5.15a indicates that significant queuing and blocking back are not predicted to occur at the northern stagger of the junction in Option 1.

Figure 5.15b – Option 1 Modelled Layout & Predicted Queue Lengths at Junction 4b - GLDR / Glenamuck Road Junction Southern Stagger

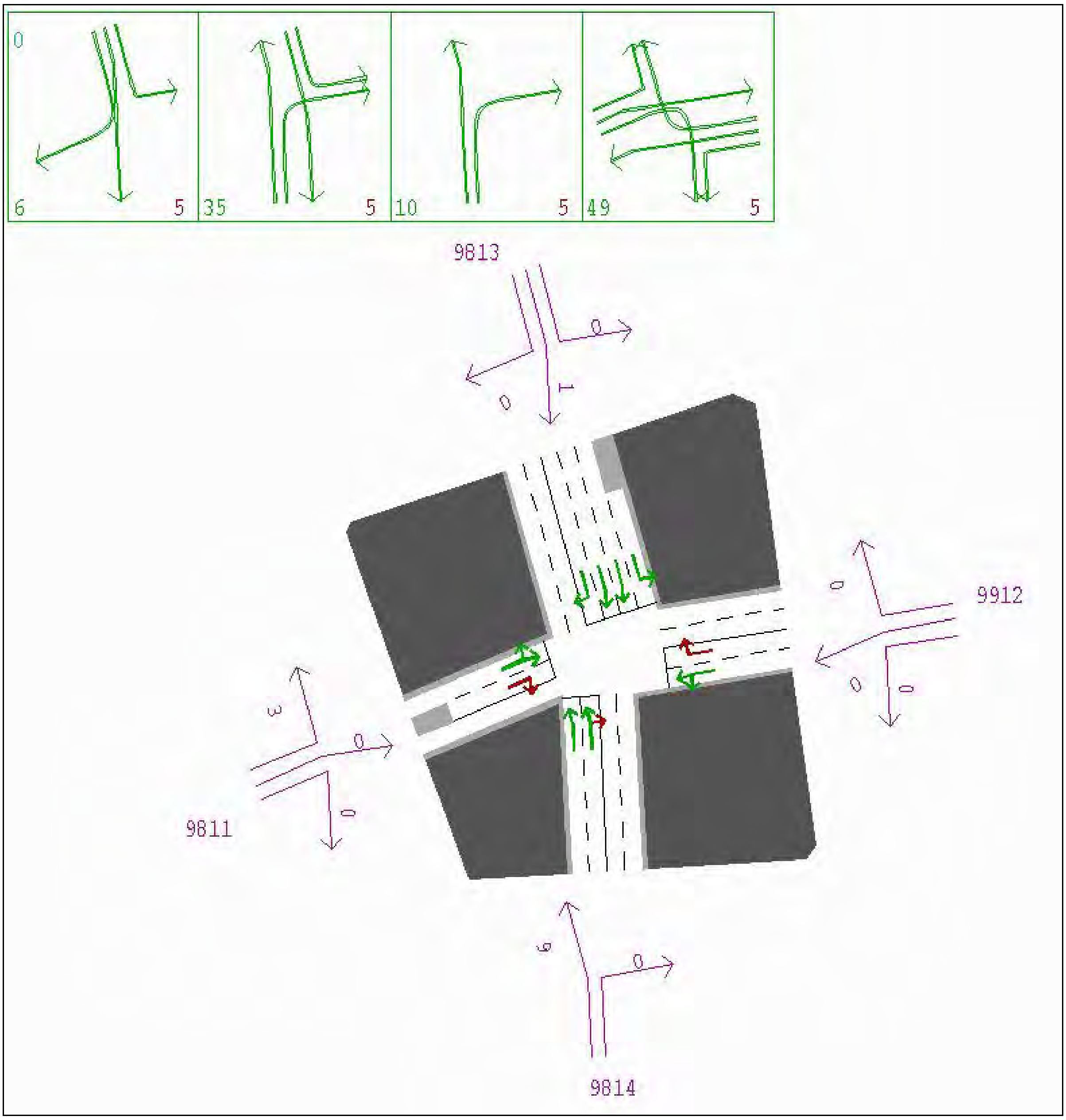


Figure 5.15b illustrates the revised layout at the southern stagger of the GLDR / Glenamuck Road junction, which was modelled as specified in the Glenamuck – Kiltiernan Local Road Improvements Preliminary Design Report (2008), with an additional arm added to provide access to a proposed school. The left turn from GLDR south to Glenamuck Road is modelled as a slip lane and therefore does not appear in the junction diagram.

The diagram indicates that the significant queuing and blocking back that was evident at the junction in the Do Minimum option is not present in Option 1. While queuing is still predicted to occur on the southern arm of the GLDR, the average predicted queue of 9 PCUs is a significant reduction compared to the 27 PCUs predicted in the Do Minimum option. The predicted queue of 17 PCUs for traffic turning from Glenamuck Road on to the GLDR North that was present in the Do Minimum option is reduced to 3 PCUs in Option 1.

Figure 5.16 – Option 1 Modelled Layout & Predicted Queue Lengths at Junction 5 - GLDR / Ballycorus Road Junction

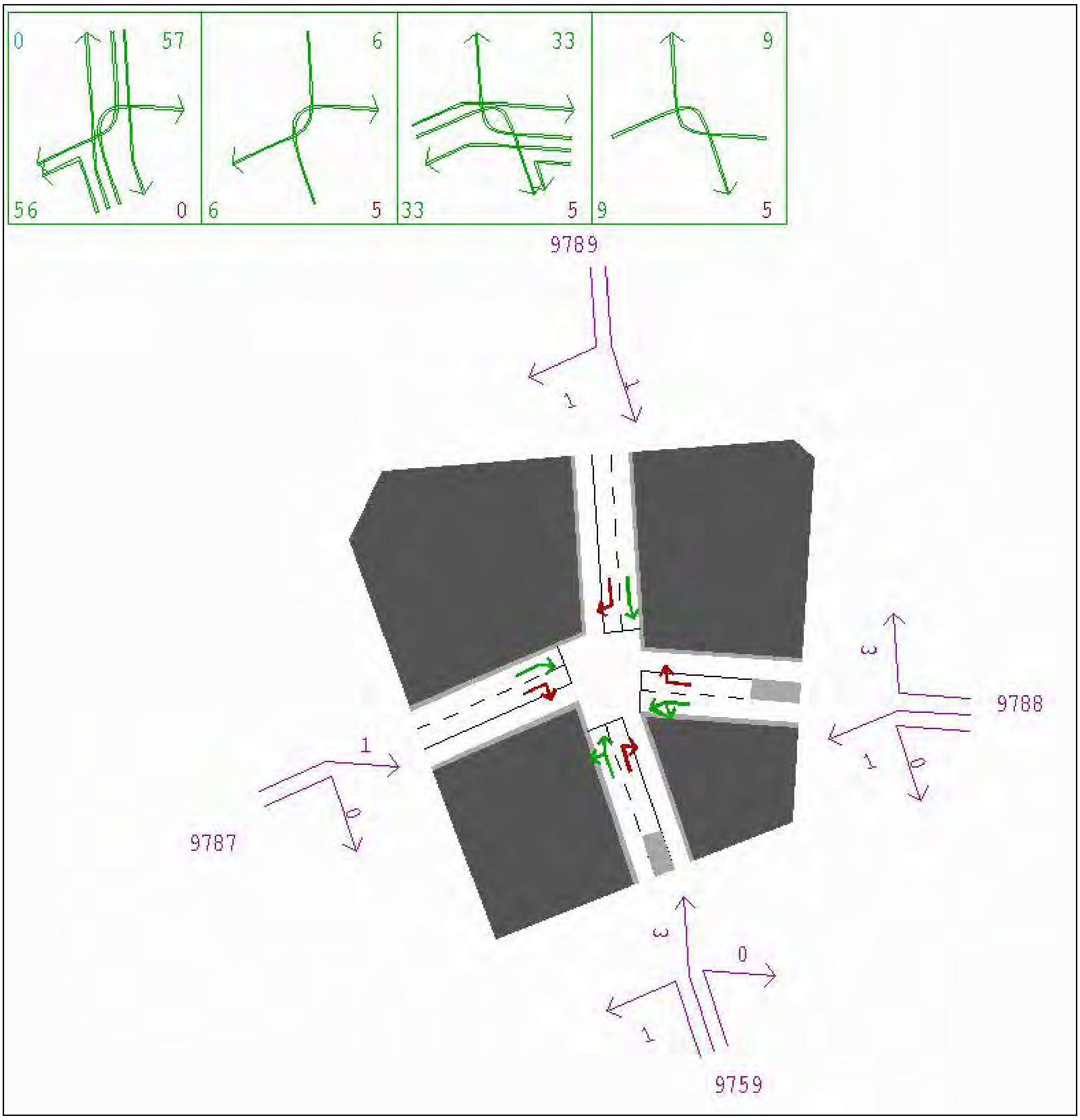


Figure 5.16 illustrates the revised layout at the GLDR / Ballycorus Road junction, which has been upgraded to a signalised crossroad in Option 1. The left-turns from GLDR to Ballycorus Road east and from Ballycorus Road west to GLDR south were modelled as slip lanes and therefore do not appear on the junction diagram.

The diagram indicates that, as with the Do Minimum option, significant average queues and blocking back are not predicted to occur at the junction in Option 1.

Figure 5.17 – Option 1 Modelled Layout & Predicted Queue Lengths at Junction 6 - Park Development Access Junction

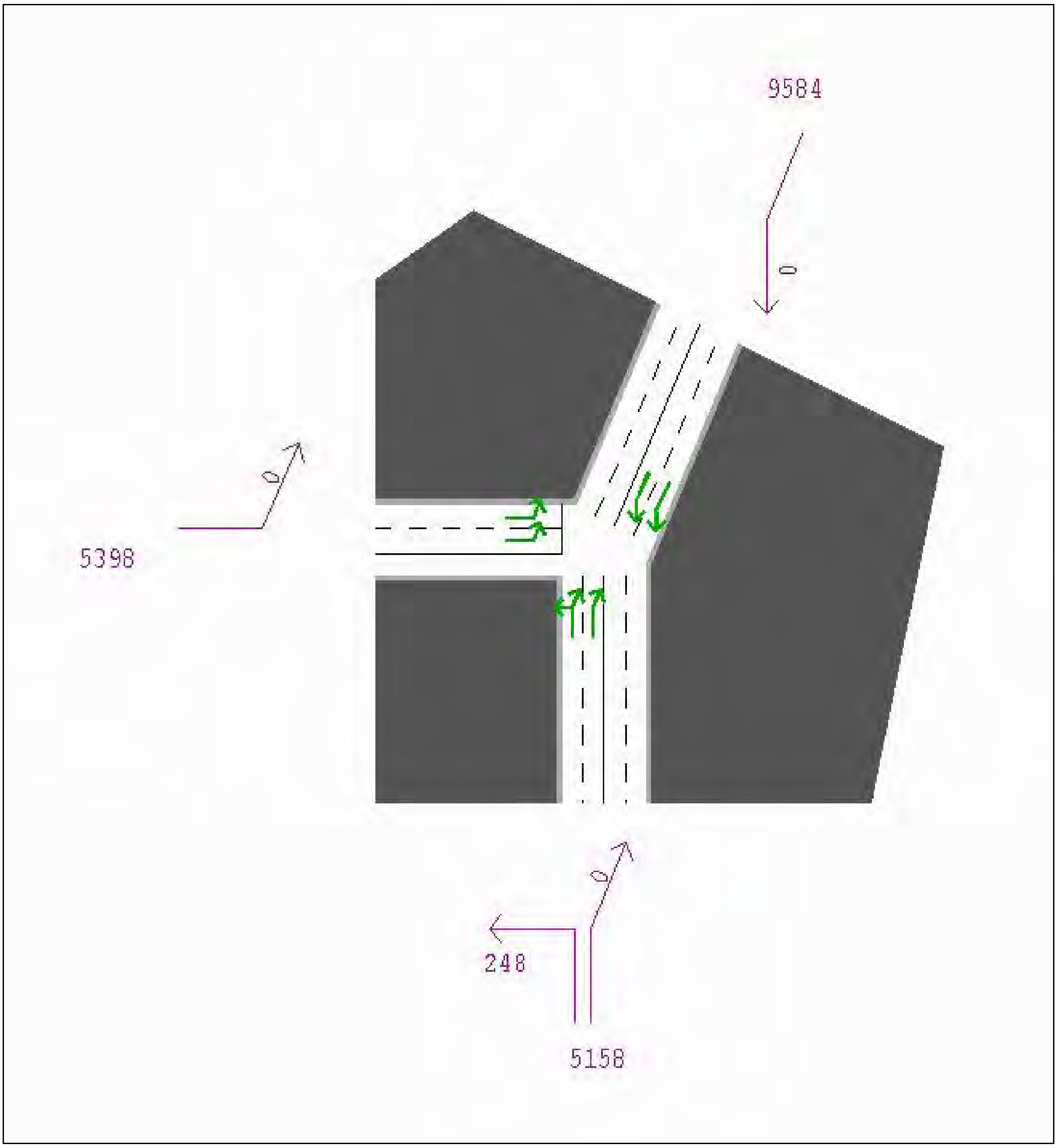


Figure 5.17 indicates that significant queuing is evident at the Park development access junction in Option 1. This predicted queue represents a significant increase compared with the Do Minimum option. This is likely due to the decrease in junction delays within the LAP area making the route via the GDDR and GLDR more “attractive” to traffic in the assignment leading to more significant traffic volumes approaching the access junction along the southern arm.

5.1.3 Option 2 - Cherrywood/Park Infrastructure

As Option 1 but with

- Include Link over motorway from north side of Cherrywood SDZ
- Upgrade existing Golf Lane Roundabout to Traffic Light controlled T-junction with multiple lanes. Include traffic light controlled junction to Park Developments (full access).
- Include for Park Developments link north to Ballyogan Rd.

Network Statistics

The global network statistics for the Option 2 model run are summarised in Table 5.3, below. The total delay across the network is the sum of the transient queues, over-capacity queues and link delays which, for Option 2, is 876 PCU-hours. This represents a decrease of 359 PCU-hours compared to Option 1 and a decrease of 1170 PCU-hours (57%) compared to the Do Minimum option.

Table 5.3 also indicates reductions in fuel consumption (364 litres) and total travel time (326 PCU-Hours) and an increase in overall average speed, from 41.5 KPH to 47.4 KPH, indicating an improvement in efficiency of the Option 2 network compared to Option 1 and, therefore, a further improvement compared to the Do Minimum network.

Table 5.3 – Network Statistics – Option 2

Simulation Totals:		This Time Period	Next time Period	Total	Units
Transient Queues		471.8	10.6	482.4	PCU-Hours
Over-Capacity Queues		224.2	40.4	264.5	PCU-Hours
Link:	Free Flow Time	1707.1	14.5	1721.6	PCU-Hours
	Delays	127.5	1.1	128.6	PCU-Hours
	Cruise Time	1834.6	15.7	1850.2	PCU-Hours
Total Travel Time		2530.5	66.7	2597.2	PCU-Hours
Travel Distance		122392.1	775.7	123167.9	PCU-kms
Overall Average Speed		48.4	11.6	47.4	KPH
Fuel Consumption		10469.1	123.7	10592.8	Litres

Junction Delay

Figure 5.18, below, illustrates the delay at each junction on the Option 2 network whereby a larger radius of red circle represents a greater delay. The level of blocking back is represented by the green lines.

Figure 5.18 – Junction Delays and Blocking Back on Option 2 Network

The diagram indicates that a significant delay of ~100 seconds is predicted to occur at the former Golf Lane Roundabout at Carrickmines Interchange, (which has been upgraded to a signalised junction and is henceforth referred to as the GDDR / Cherrywood Link Road junction). The delay at the main Park development access junction on Glenamuck Road is significantly reduced to ~15 seconds in Option 2.

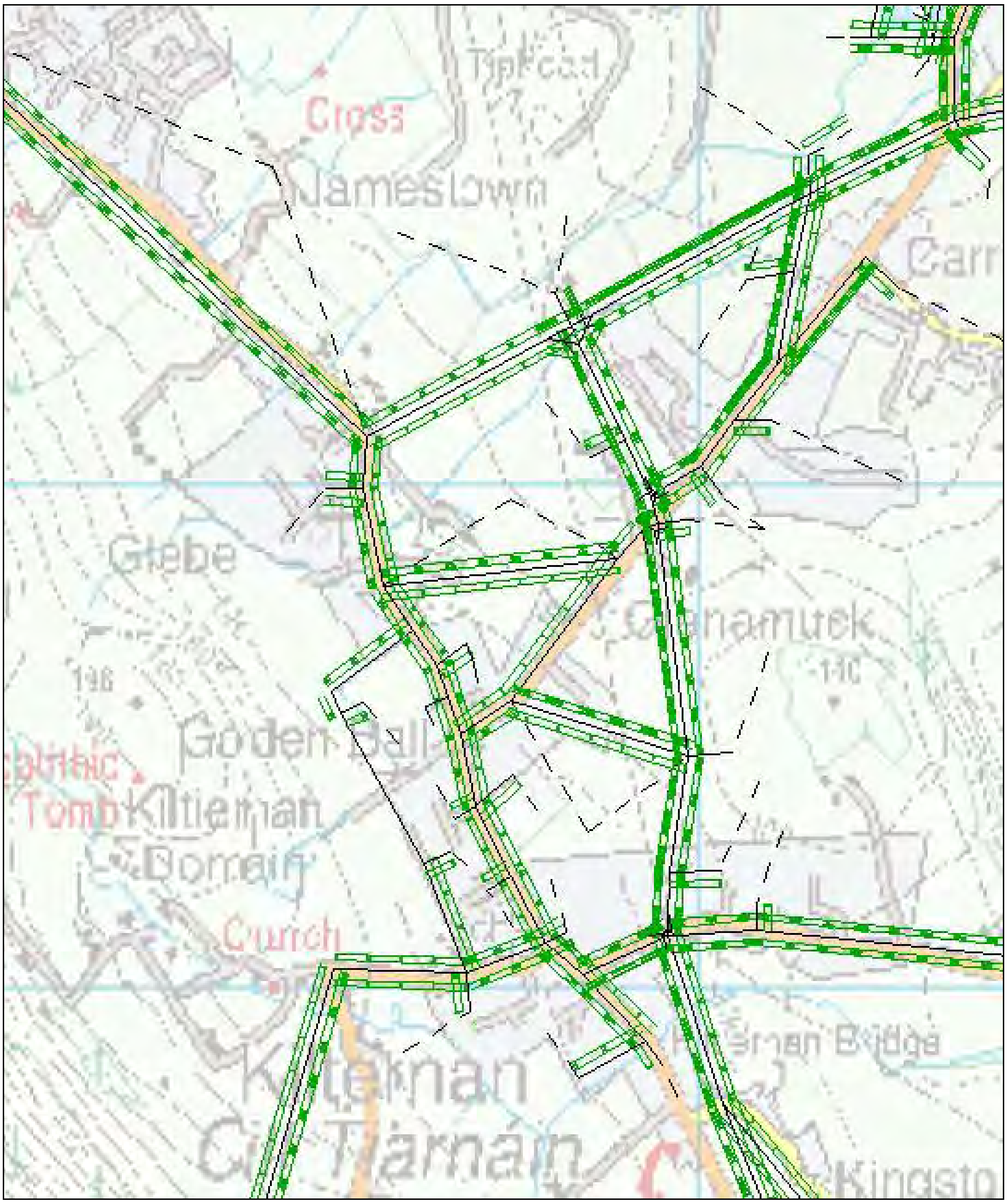
Some minor delays are predicted within the LAP area, the most significant (~40 seconds) of which occurs at the Link Road / Glenamuck Road junction. Other delays on the network as a whole are in line with those predicted for both the Do minimum option and Option 1.

There is no evidence of significant blocking back occurring on the Option 2 network.

Volume / Capacity Ratio

Figure 5.19 indicates the links on the Option 2 network that have capacity issues. The diagram illustrates the V/C ratio on each link and varies by intensity, whereby a solid line indicates a high V/C ratio, with decreasing levels of fill representing decreasing V/C ratios.

Figure 5.19 – Option 2 Network – V/C Ratios



The diagram indicates that, as with previous options high V/C ratios are predicted in and around the Park development, despite the provision of new access infrastructure in Option 2. Within the LAP area, there do not appear to be significant capacity issues predicted.

Queue Length Diagrams

Figures 5.20 – 5.25 illustrate the modelled layout and predicted average queue lengths at a number of key junctions in the LAP area.

Figure 5.20 – Option 2 Modelled Layout & Predicted Queue Lengths at Junction 1 - Enniskerry Road / GDDR Junction

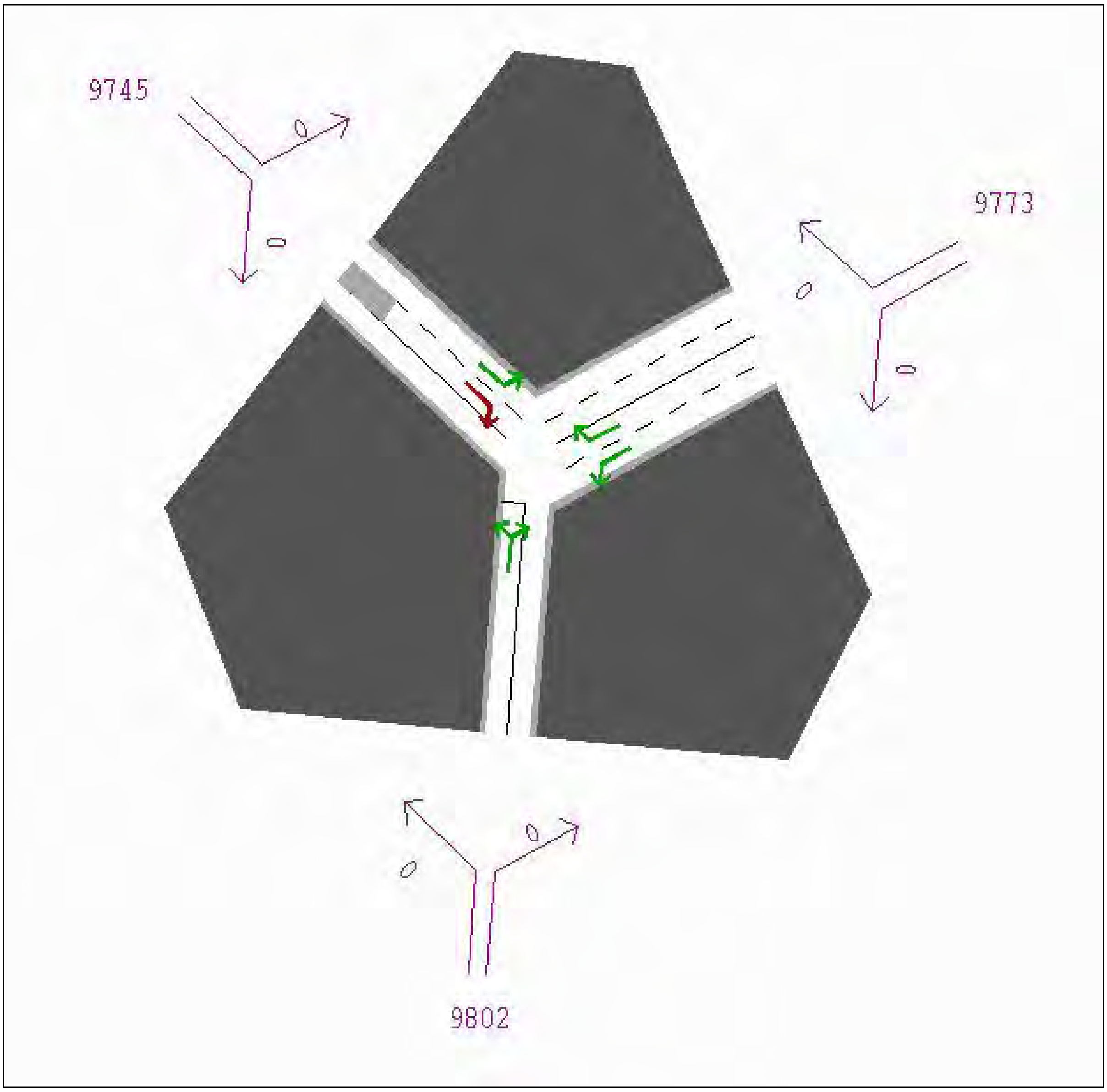


Figure 5.20, indicates that queuing and blocking back are not predicted to occur at the Enniskerry Road / GDDR junction in Option 2. This is consistent with the results of the Option 1 model run and, again, represents a significant improvement compared to the Do Minimum option.

Figure 5.21 – Option 2 Modelled Layout & Predicted Queue Lengths at Junction 2 - GDDR / GLDR Junction

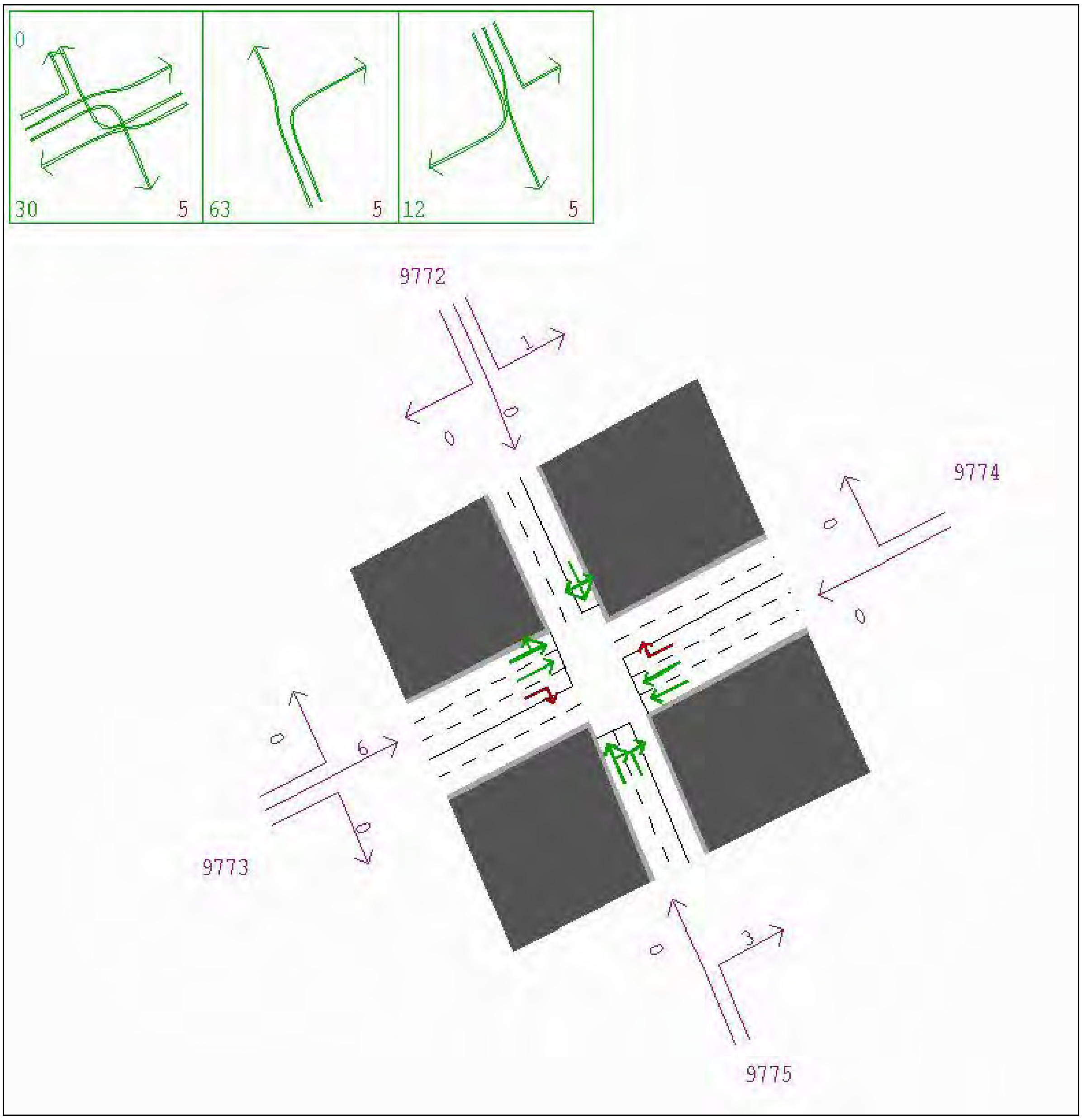


Figure 5.21 indicates that there are no significant average queues predicted to occur at Junction 2 in Option 2. There is a predicted average queue of 6 PCUs for traffic moving straight-through the junction from GDDR west to GDDR east, this is consistent with Option 1. While the predicted average queue for traffic turning right from the GLDR to GDDR remains at 3 PCUs as in Option 1.

Blocking back is not predicted to occur at this junction in Option 2.

Figure 5.22 – Option 2 Modelled Layout & Predicted Queue Lengths at Junction 3 - GDDR / Cherrywood Link Road junction

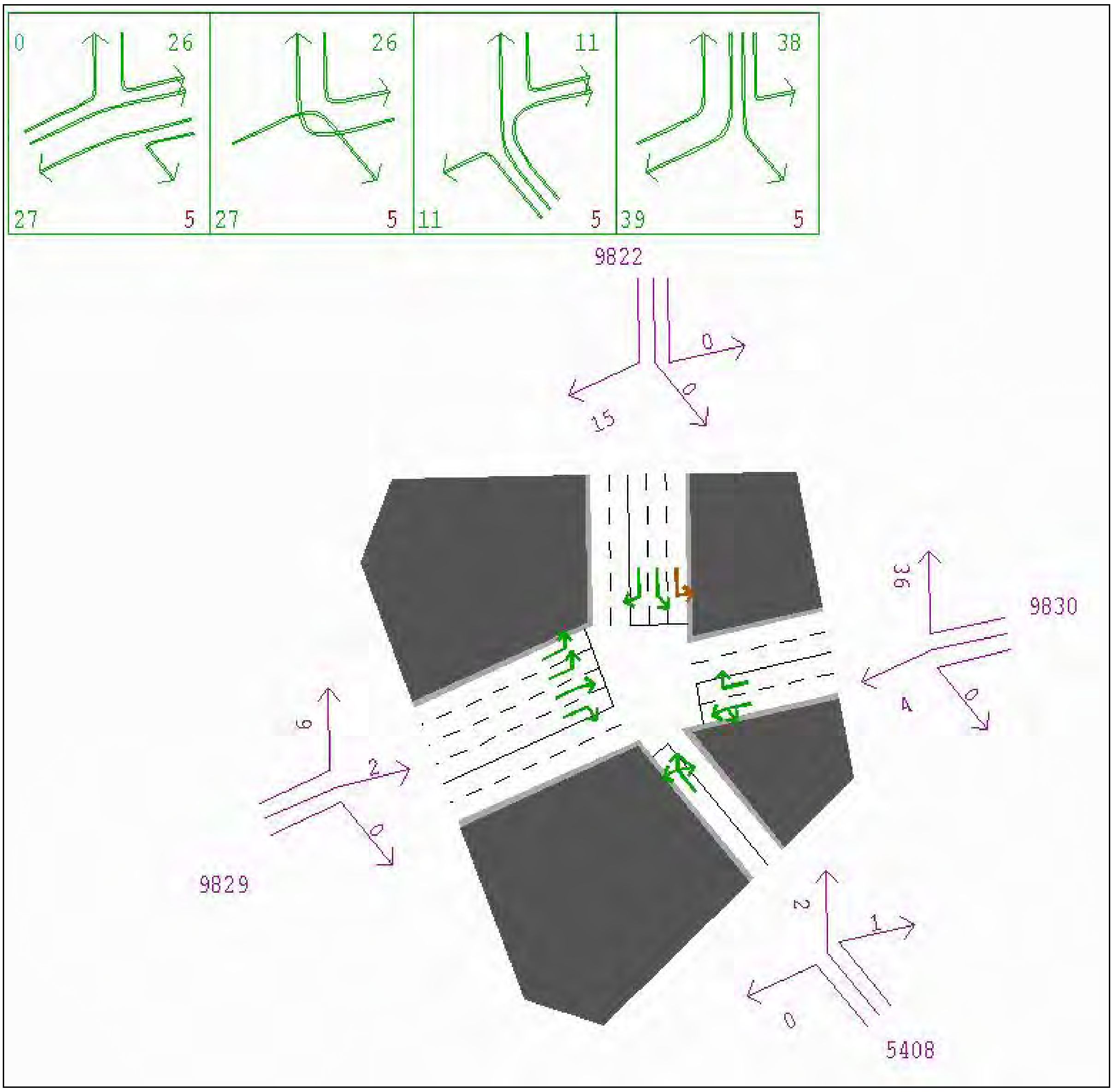


Figure 5.22 illustrates the upgraded layout of the former Golf Lane Roundabout at Carrickmines, which, in Option 2, has been converted to a signalised junction to tie in with the Cherrywood Link Road.

The diagram indicates a significant predicted average queue for traffic turning right from the Cherrywood Link Road to Glenamuck Road.

Figure 5.23a – Option 2 Modelled Layout & Predicted Queue Lengths at Junction 4a - GLDR / Glenamuck Road Junction Northern Stagger

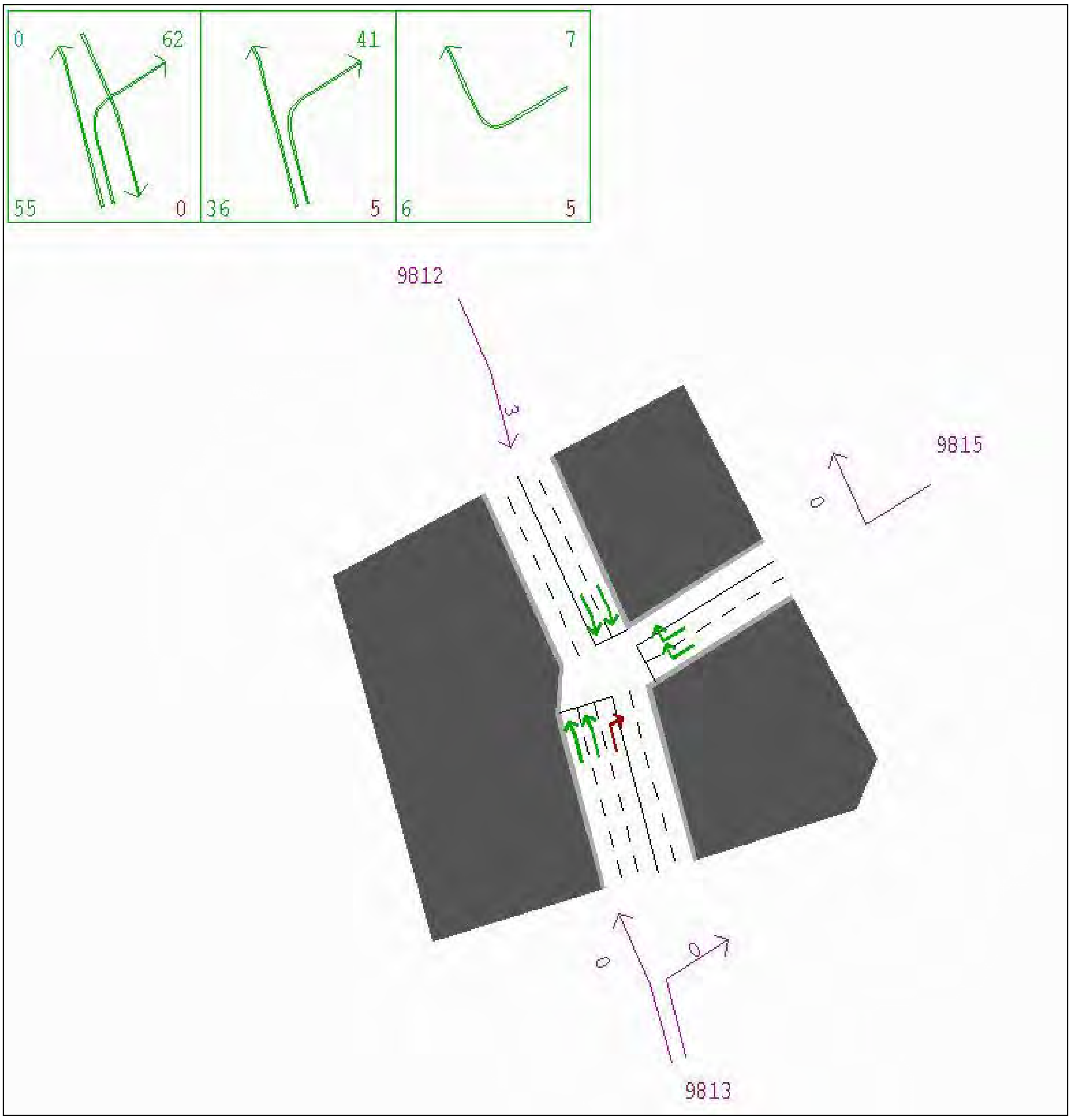


Figure 5.23a indicates that significant queuing and blocking back are not predicted to occur at the northern stagger of junction 4 in Option 2.

Figure 5.23b – Option 2 Modelled Layout & Predicted Queue Lengths at Junction 4b - GLDR / Glenamuck Road Junction Southern Stagger

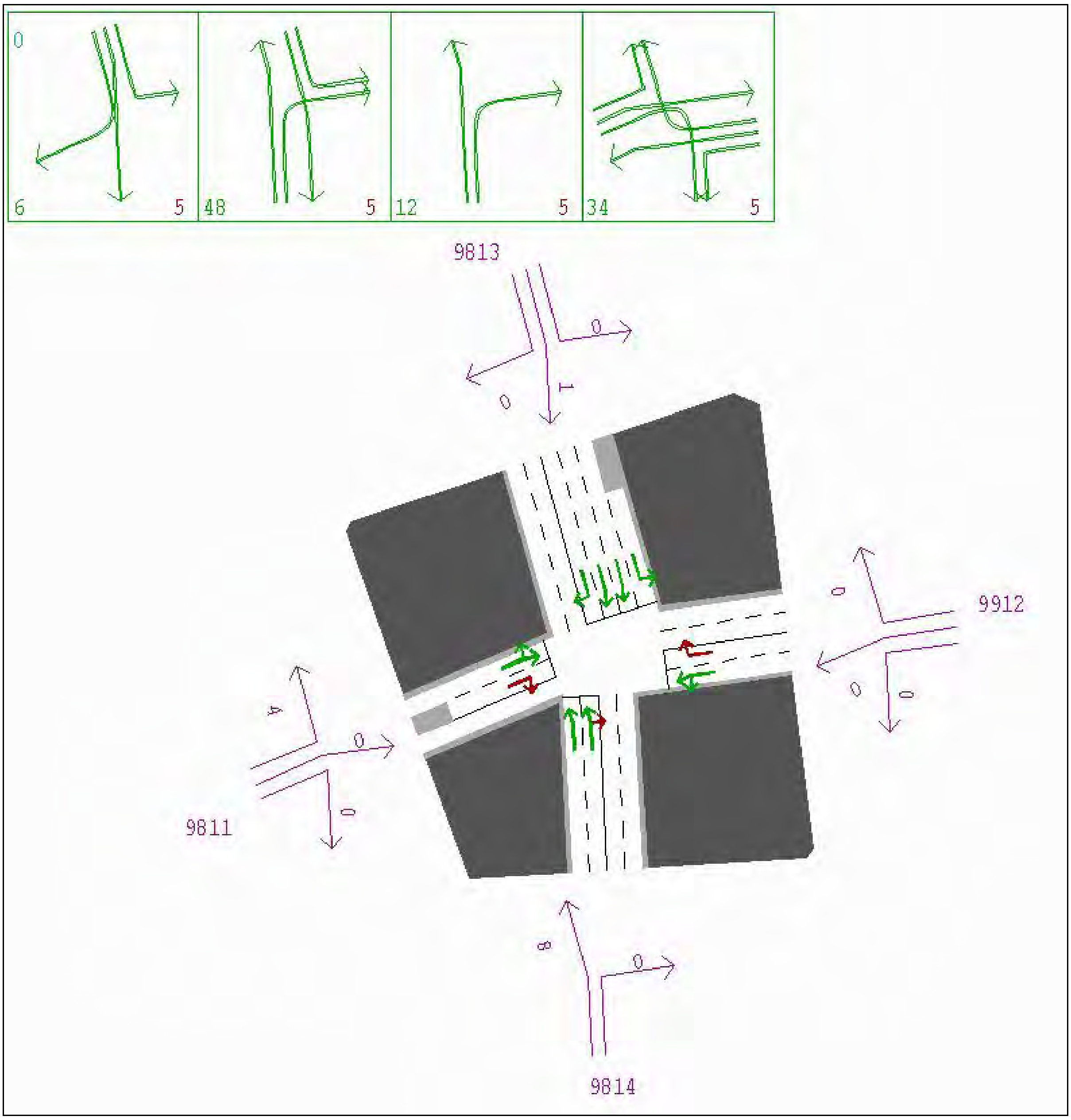


Figure 5.23b indicates that significant queuing and blocking back are not predicted to occur at the southern stagger of junction 4 in Option 2. The relatively minor predicted average queues for traffic turning left from Glenamuck Road on to GLDR north and travelling straight-through the junction from GLDR south to GLDR north are consistent with those that were evident in Option 1.

Figure 5.24 – Option 2 Modelled Layout & Predicted Queue Lengths at Junction 5 - GLDR / Ballycorus Road Junction

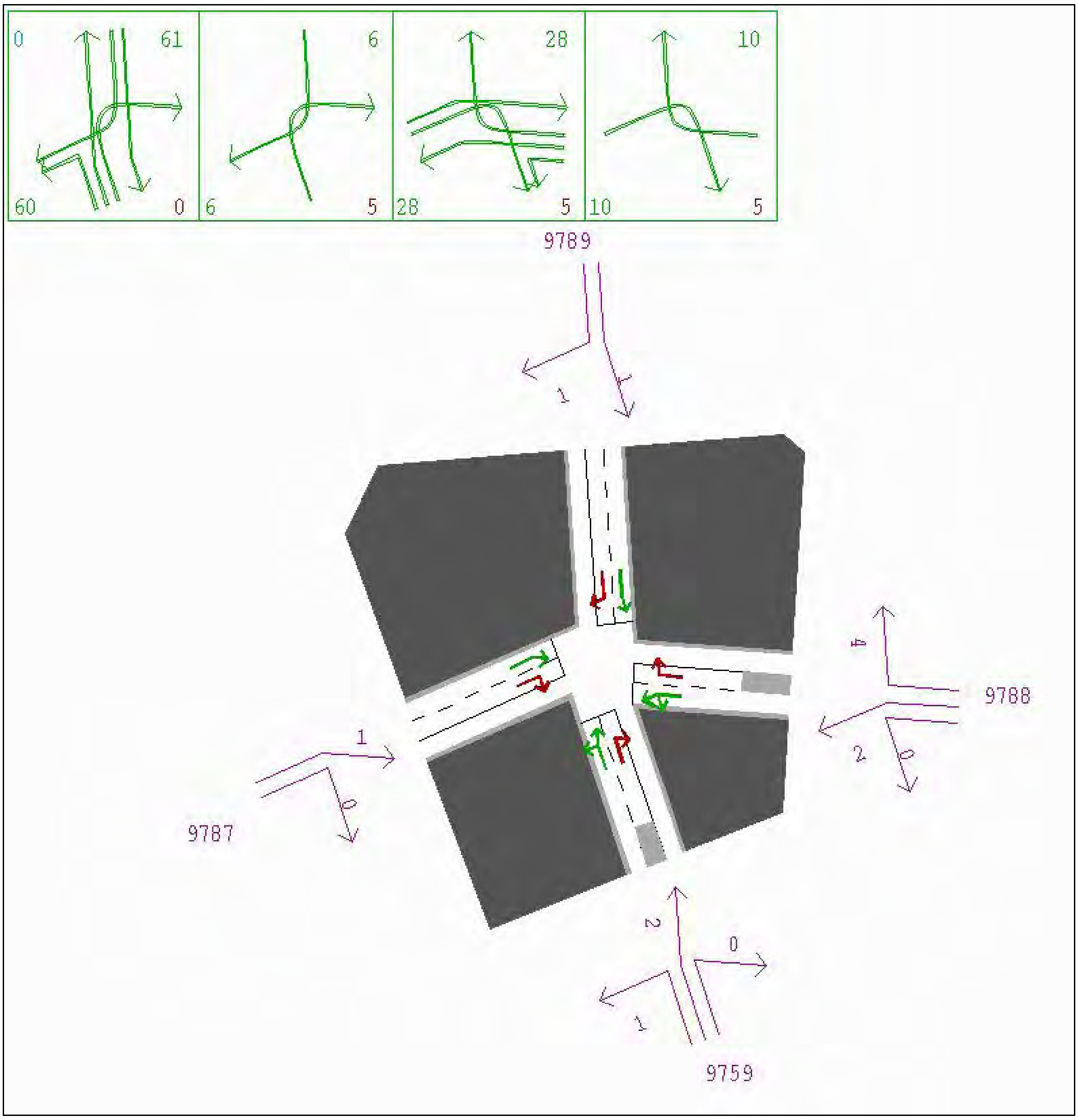


Figure 5.24 indicates that significant average queues and blocking back are not predicted to occur on any arm at Junction 5 in Option 2. The relatively minor predicted average queues at this junction are consistent with those that were evident in Option 1.

Figure 5.25 – Option 2 Modelled Layout & Predicted Queue Lengths at Junction 6 - Park Development Access Junction

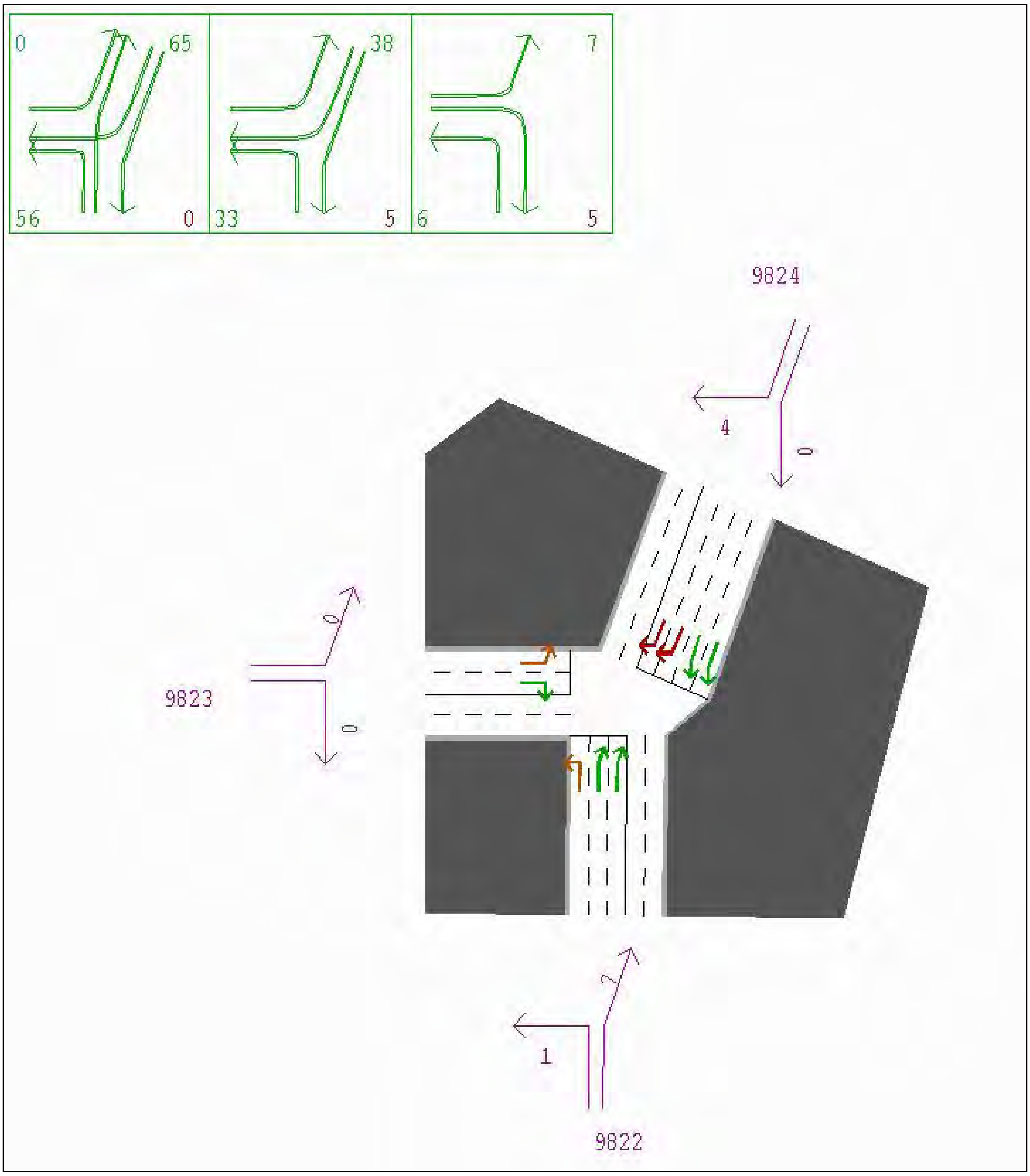


Figure 5.25 illustrates the upgraded layout of the Park Development Access junction, which, in Option 2, has been converted to a signalised junction. The diagram indicates an average queue of 4 PCUs for traffic turning right into the Park development from Glenamuck Road north and 7 PCUs for traffic travelling straight-through the junction from Glenamuck Road north to south.

The significant average queue of 248 PCUs for traffic turning left into the Park development from Glenamuck Road south, which was evident in Option 1, is not predicted to occur in option 2. This is most likely due to the upgraded access arrangements at this junction as well as the development of a subsequent access junction for the development on Ballyogan Road as part of the completed Park development proposals that were incorporated into Option 2.

5.1.4 Option 3 – Test scope for reduction in standard

As Option 2 but with

- dual carriageway section of GDDR reduced to a single carriageway

Network Statistics

The global network statistics for the Option 3 model run are summarised in Table 5.4, below. The total delay across the network is the sum of the transient queues, over-capacity queues and link delays which, for Option 3, is 876 PCU-hours. This is consistent with the value of 876 PCU-hours in Option 2 and is therefore a lower total compared to both the Do Minimum option and Option 1.

Table 5.4 also indicates a consistency between the Option 2 and Option 3 networks in terms of total travel time, travel distance and average speed. While there is a minor increase in total fuel consumption compared to Option 2, Option 3 still represents a significant improvement compared to the Do Minimum and Option 1 networks.

Table 5.4 – Network Statistics – Option 3

Simulation Totals:		This Time Period	Next time Period	Total	Units
Transient Queues		471.0	10.6	481.6	PCU-Hours
Over-Capacity Queues		224.2	40.4	264.6	PCU-Hours
Link:	Free Flow Time	1707.1	14.5	1721.6	PCU-Hours
	Delays	127.5	1.1	128.7	PCU-Hours
	Cruise Time	1834.6	15.6	1850.2	PCU-Hours
Total Travel Time		2529.8	66.6	2596.5	PCU-Hours
Travel Distance		122395.5	773.5	123169.1	PCU-kms
Overall Average Speed		48.4	11.6	47.4	KPH
Fuel Consumption		10488.3	123.5	10611.9	Litres

Junction Delay

Figure 5.26, below, illustrates the delay at each junction on the Option 3 network whereby a larger radius of red circle represents a greater delay. The level of blocking back is represented by the green lines.

Figure 5.26 – Junction Delays and Blocking Back on Option 3 Network

The diagram indicates that, the reduced capacity on the GDDR due to the reduction in the number of lanes is predicted to result in increased delays at junctions along the road; specifically, the GDDR / Cherrywood Link Road junction (~100 seconds). A delay of ~40 seconds is also predicted at the Glenamuck Road / Link Road junction.

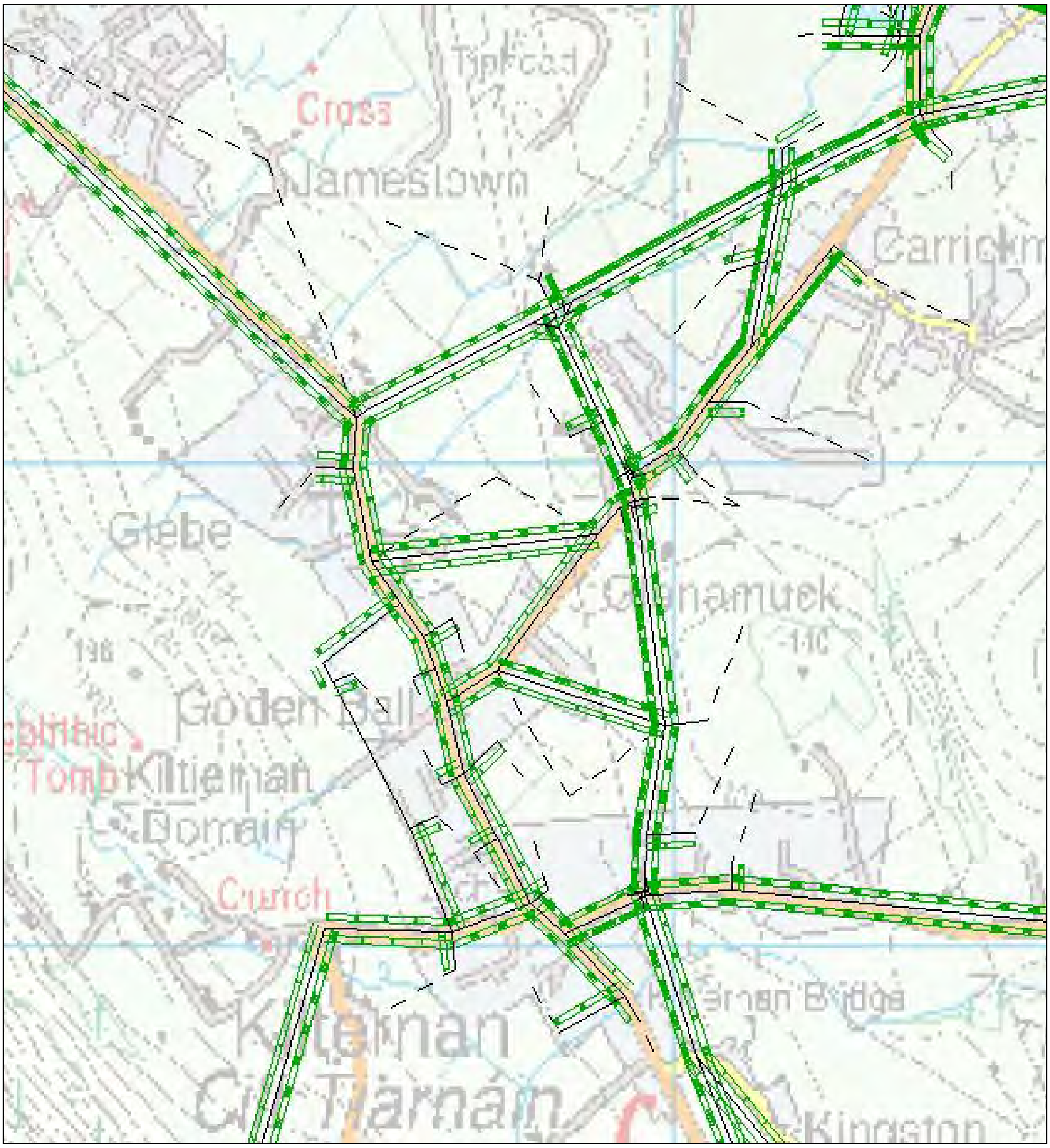
The diagram also indicates that blocking back is not evident on the Option 3 network.

Volume / Capacity Ratio

Figure 5.27 indicates the links on the Option 3 network that have capacity issues. The diagram illustrates the V/C ratio on each link and varies by intensity, whereby a solid line indicates a high V/C ratio, with decreasing levels of fill representing decreasing V/C ratios.

The diagram shows that, while the reduced capacity along the GDDR itself does not appear to result in a significantly high V/C ratio, the various link roads and access roads off it will experience slight capacity issues as a result.

Figure 5.27 – Option 3 Network – V/C Ratios



Queue Length Diagrams

Figures 5.28 – 5.33 illustrate the modelled layout and predicted average queue lengths at a number of key junctions in the LAP area.

Figure 5.28 – Option 3 Modelled Layout & Predicted Queue Lengths at Junction 1 - Enniskerry Road / GDDR Junction

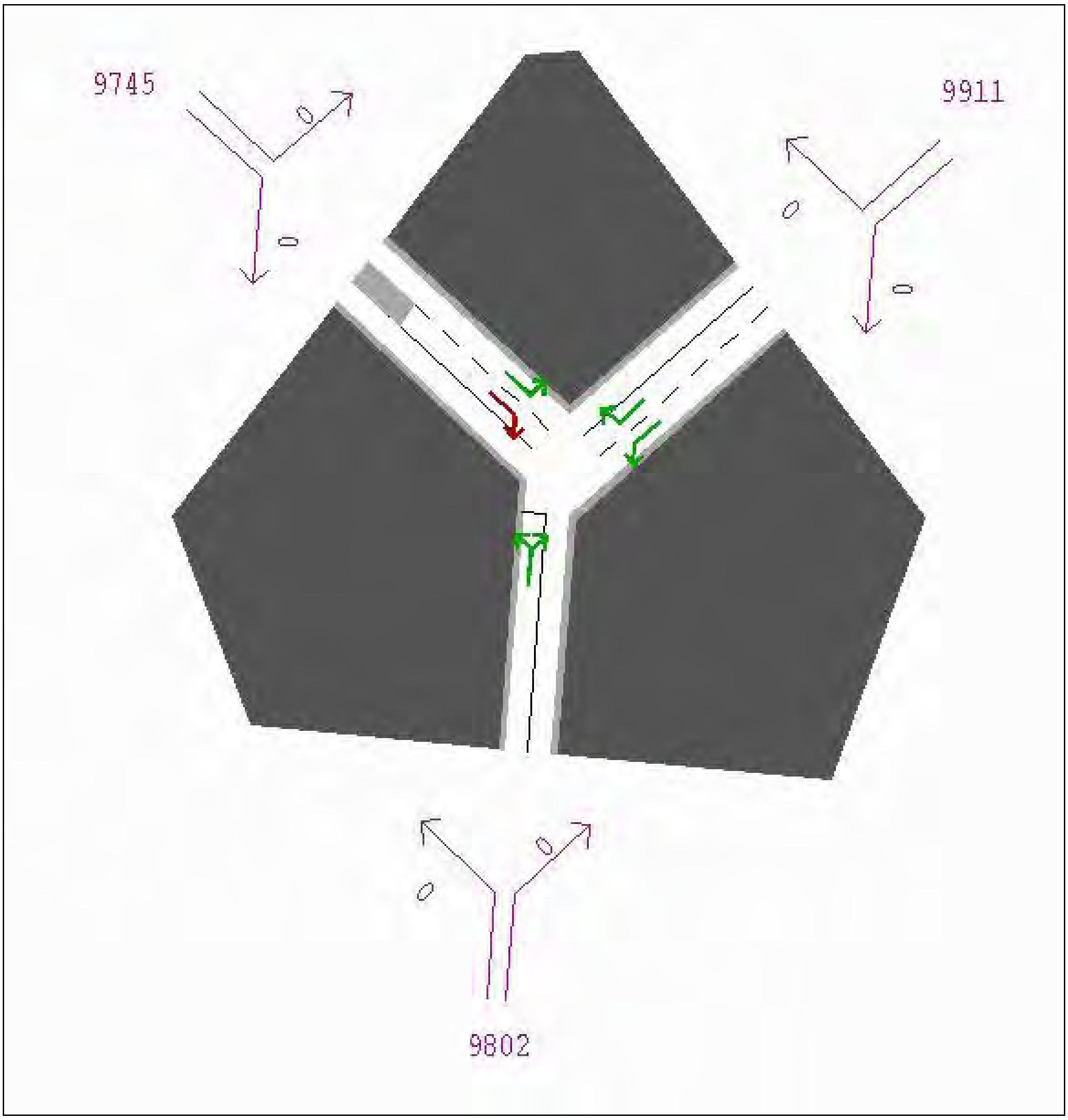


Figure 5.28 indicates that queuing and blocking back are not predicted to occur at the Enniskerry Road / GDDR junction in Option 3. This is consistent with the results of the Option 1 and 2 model runs and, again, represents a significant improvement compared to the Do Minimum option.

Figure 5.29 – Option 3 Modelled Layout & Predicted Queue Lengths at Junction 2 - GDDR / GLDR Junction

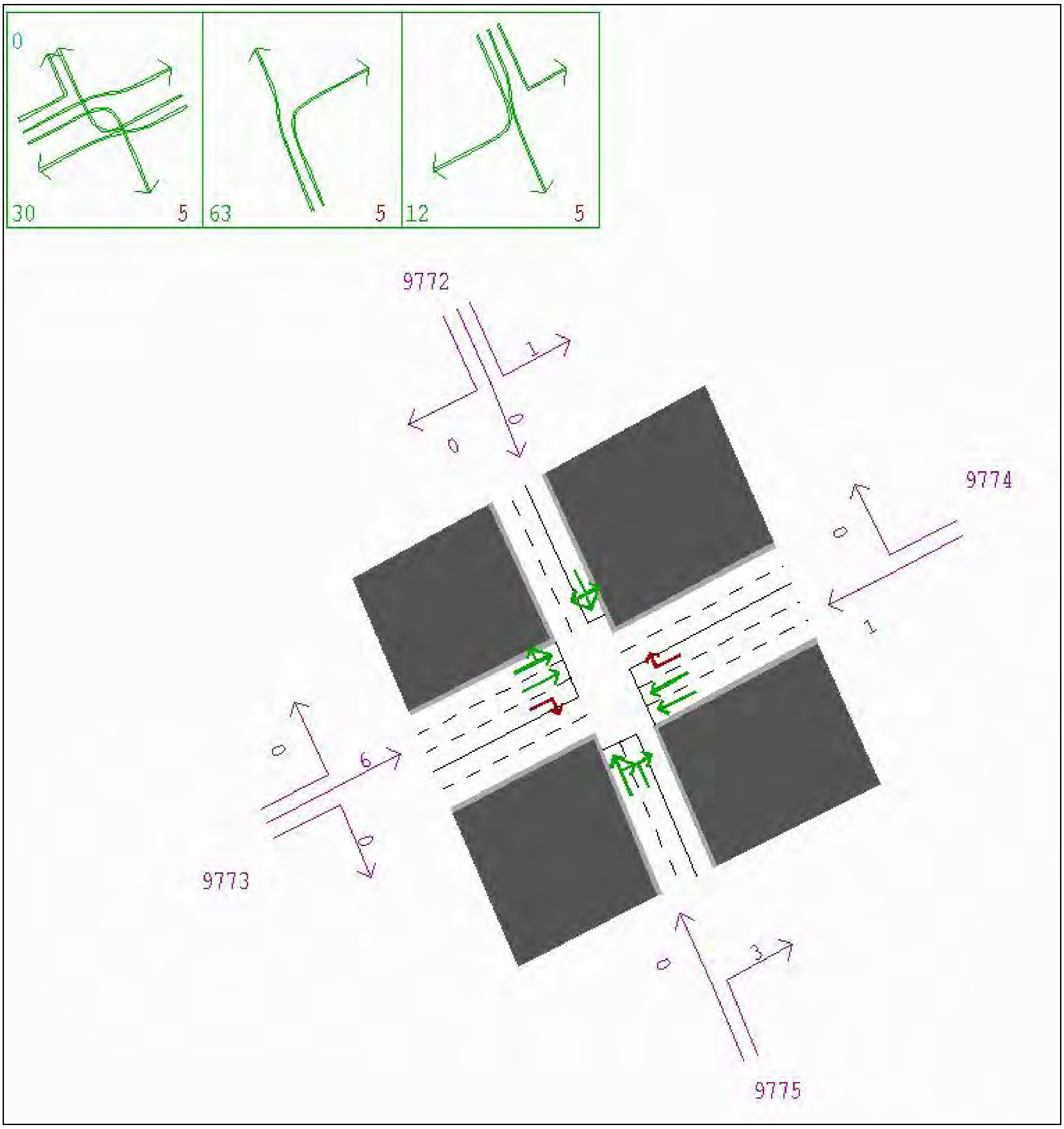


Figure 5.29 indicates that there are no significant average queues predicted to occur at Junction 2 in Option 3. There is a predicted average queue of 6 PCUs for traffic moving straight-through the junction from GDDR west to GDDR east, this is consistent with Option 2. While the predicted average queue for traffic turning right from the GLDR to GDDR remains at 3 PCUs as in Option 2.

Blocking back is not predicted to occur at this junction in Option 3.

Figure 5.30 – Option 3 Modelled Layout & Predicted Queue Lengths at Junction 3 - GDDR / Cherrywood Link Road junction

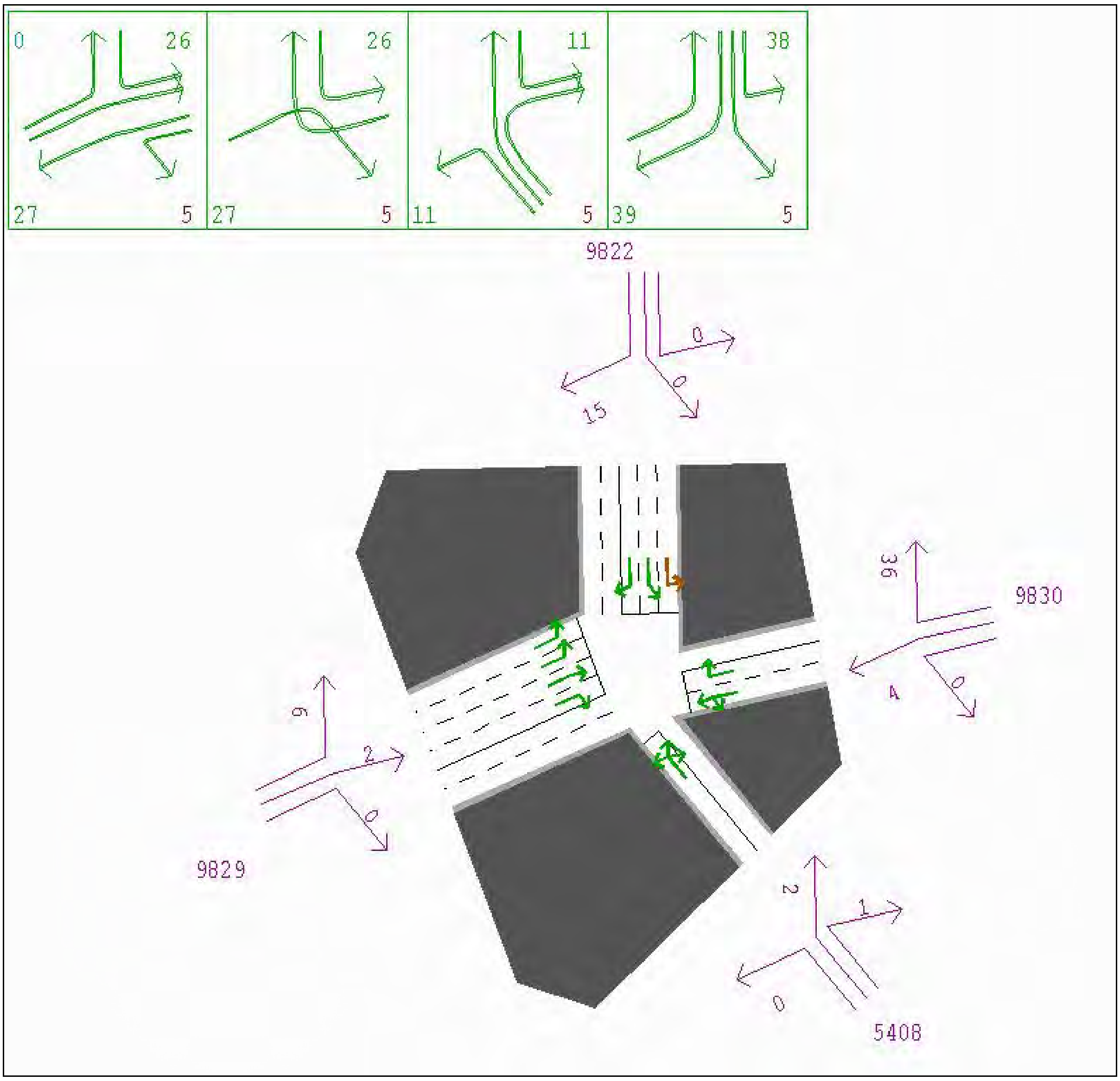


Figure 5.30 indicates that the reduction of the GDDR to one lane in part will not have an adverse impact on this junction, with predicted queues similar to those outlined for Option 2 in Figure 5.22.

The diagram indicates that blocking back is not predicted to occur at the junction in Option 3.

Figure 5.31a – Option 3 Modelled Layout & Predicted Queue Lengths at Junction 4a - GLDR / Glenamuck Road Junction Northern Stagger

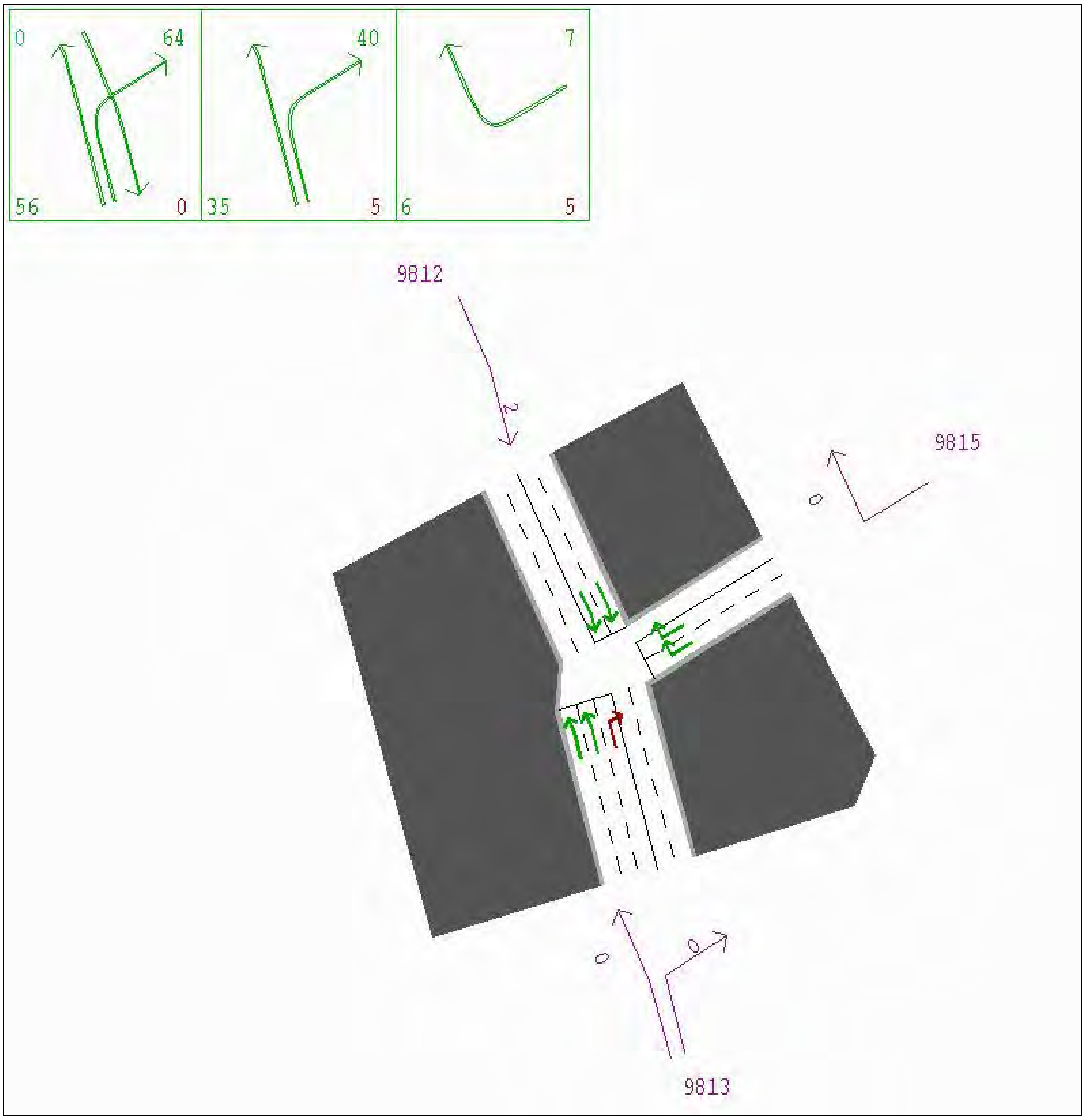


Figure 5.31a indicates that significant queuing and blocking back are not predicted to occur at the northern stagger of Junction 4 in Option 3.

Figure 5.31b – Option 3 Modelled Layout & Predicted Queue Lengths at Junction 4b - GLDR / Glenamuck Road Junction Southern Stagger

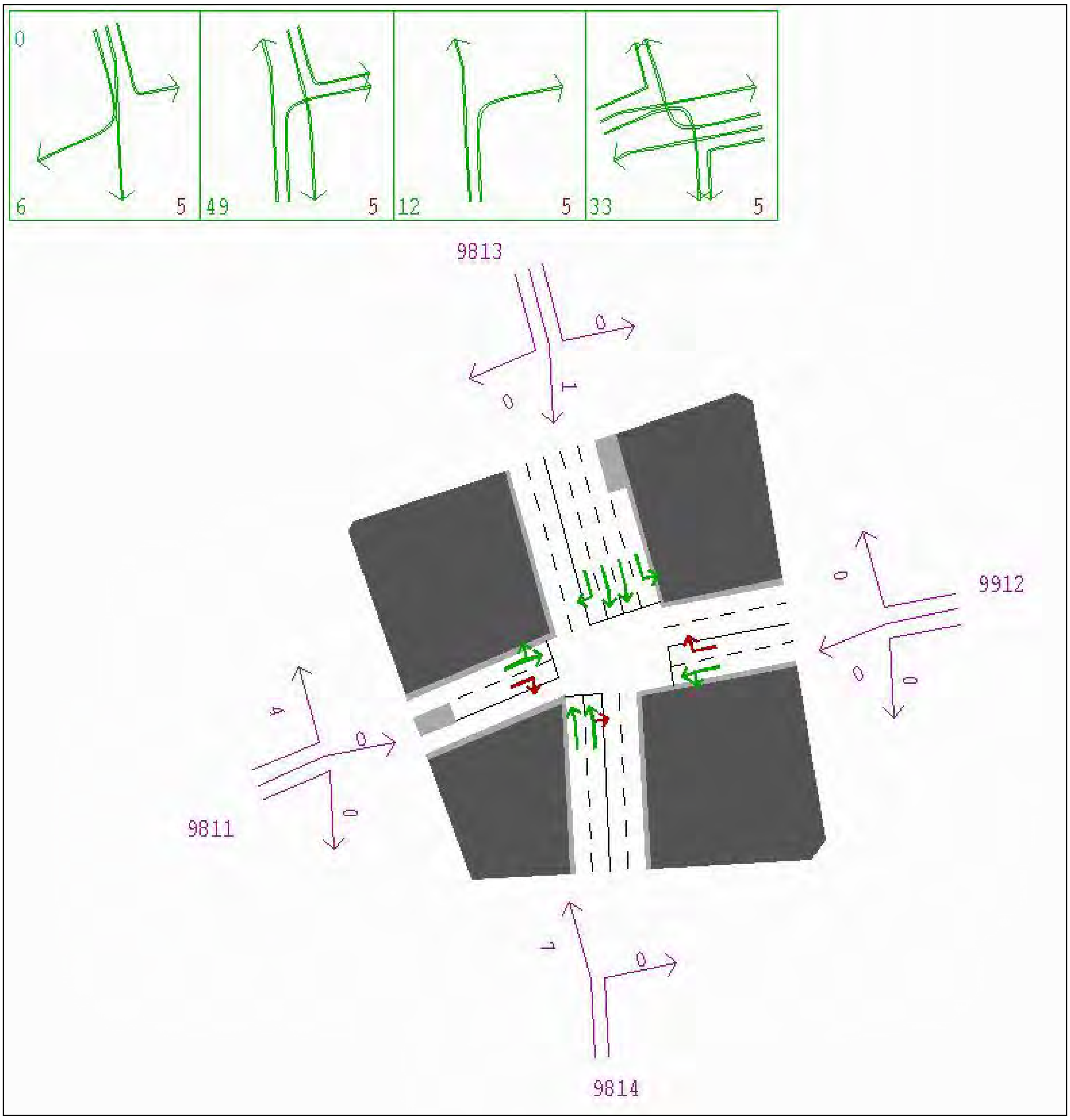


Figure 5.31b indicates that significant queuing and blocking back are not predicted to occur at the southern stagger of junction 4 in Option 3. The relatively minor predicted average queues for traffic turning left from Glenamuck Road on to GLDR north and travelling straight-through the junction from GLDR south to GLDR north are consistent with those that were evident in Option 2.

Figure 5.32 – Option 3 Modelled Layout & Predicted Queue Lengths at Junction 5 - GLDR / Ballycorus Road Junction

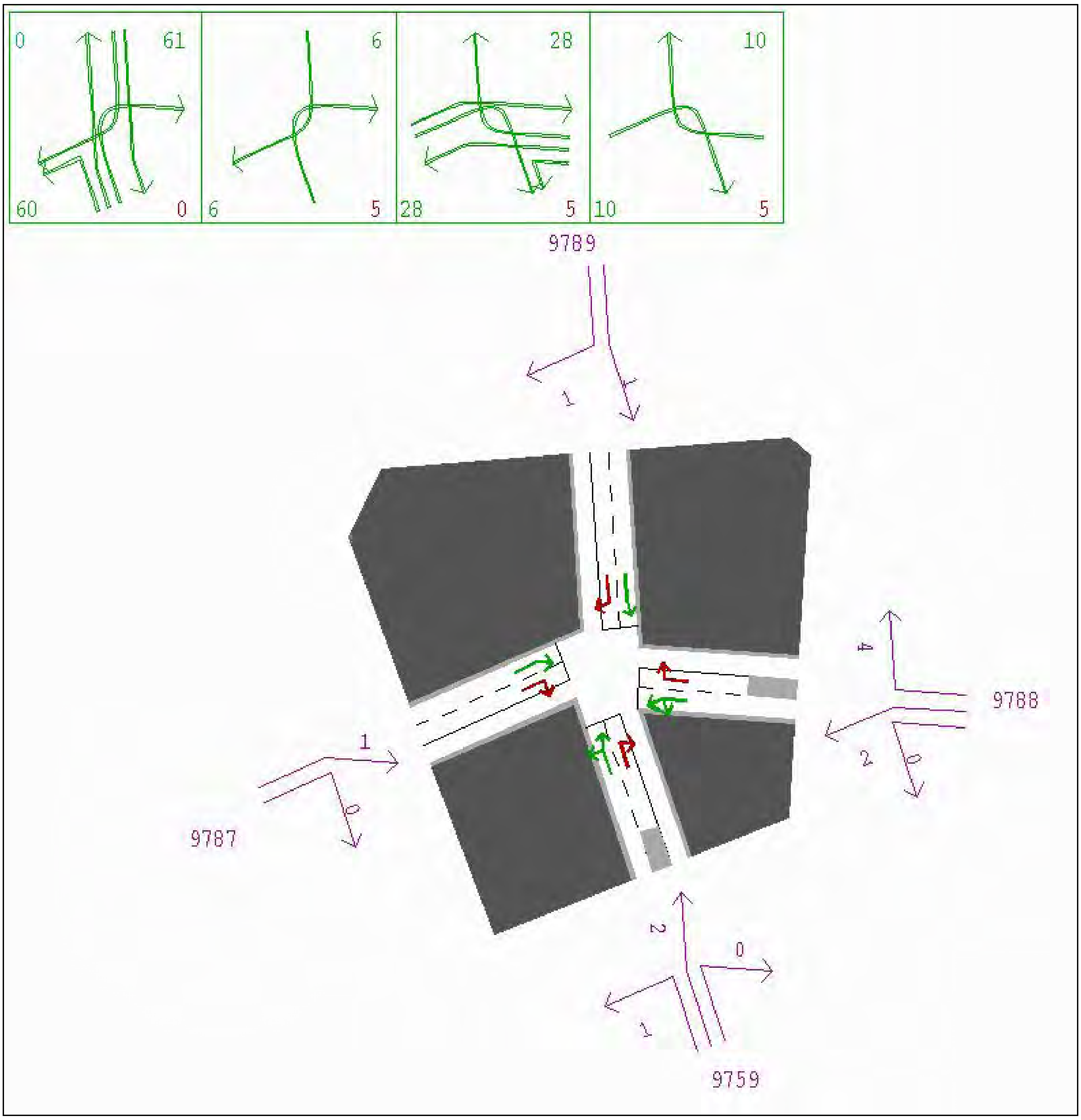


Figure 5.32 indicates that significant average queues and blocking back are not predicted to occur on any arm at Junction 5 in Option 3.

Figure 5.33 – Option 3 Modelled Layout & Predicted Queue Lengths at Junction 6 - Park Development Access Junction

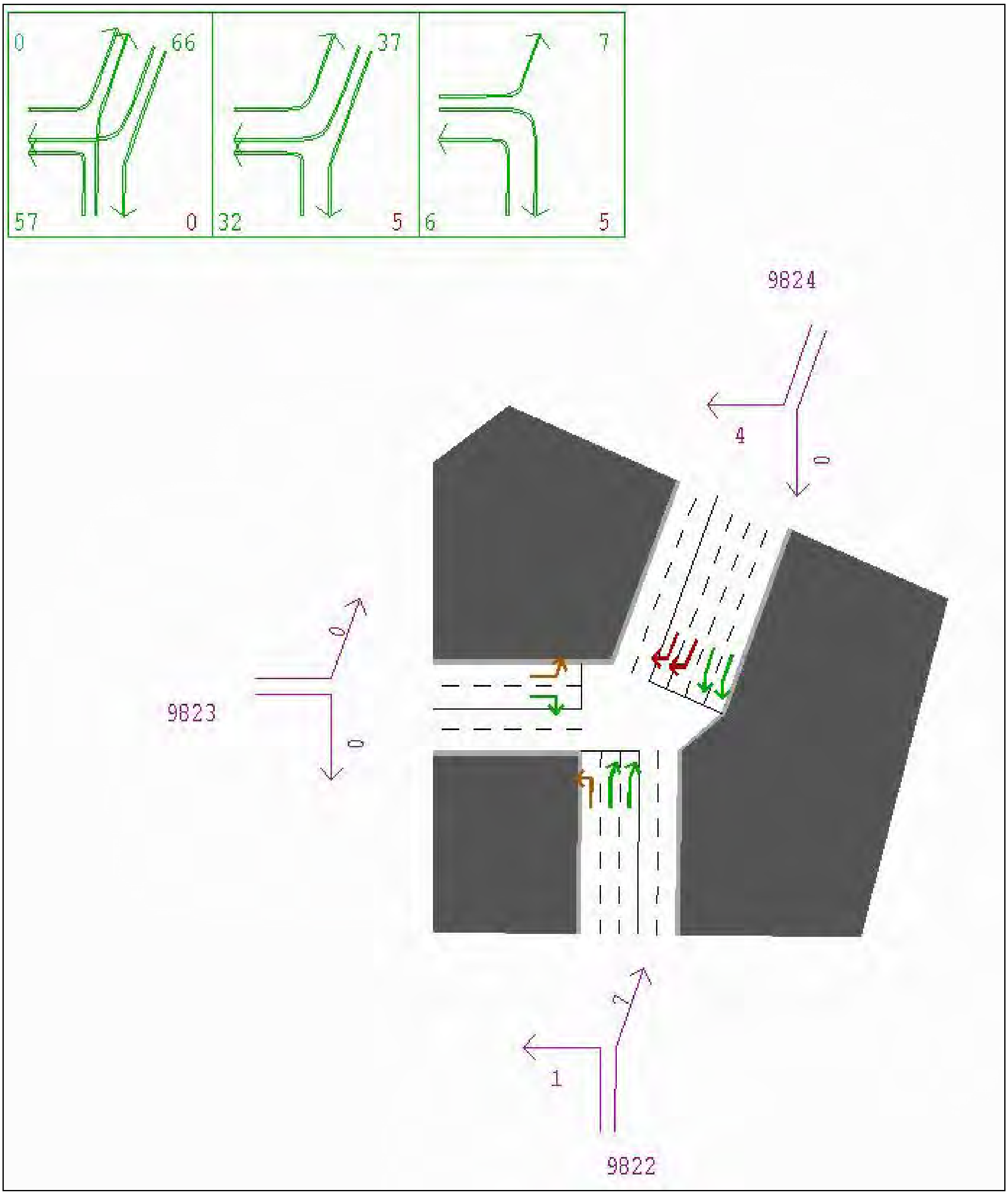


Figure 5.33 indicates that an average queue of 4 PCUs for traffic turning right into the Park development from Glenamuck Road north and 7 PCUs for traffic travelling straight-through the junction from Glenamuck Road north to south.

The average queues at this junction are not significantly different from those evident for Option 2.

Option 3a – Removal of Link Road Sensitivity Test

A sensitivity analysis was undertaken whereby the Option 3 network was amended so that the Link road from GDDR to Glenamuck Road was reduced to an access junction only on the GDDR side.

Figure 5.34, below, illustrates the delay at each junction for the Option 3a network, as well as the level of blocking back (red circle radii and green lines, as before).

Figure 5.34 – Junction Delays and Blocking Back on Option 3a Network

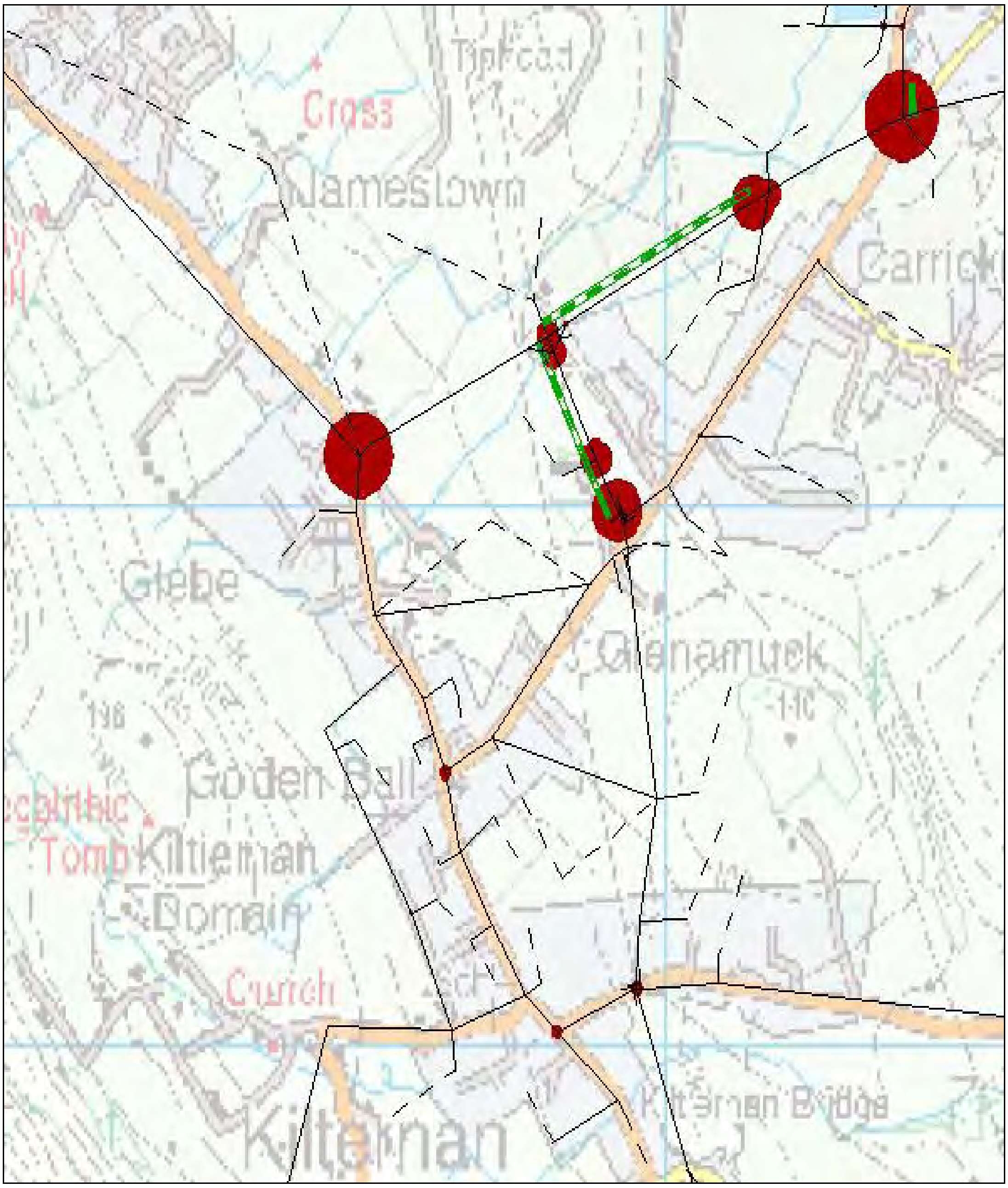


Figure 5.34 indicates that significant delays are predicted to occur at a number of junctions within the LAP area for Option 3a, namely; the Enniskerry / GDDR, GDDR / GLDR and GLDR / Glenamuck Road junctions. Furthermore, significant blocking back is predicted to occur along the northern half of the GLDR and on the GDDR between the junctions with the GLDR and the Link Road to Glenamuck Road.

An investigation of origin and destination of traffic flows on key links on the network indicated a significant re-assignment of traffic within the LAP area as a result of the removal of the link between the GDDR and Glenamuck Road. The land parcels at the northeastern end of Glenamuck Road are designated for high-density development and therefore generate a significant number of outbound trips during the AM peak hour. The Link Road between the GDDR and Glenamuck Road represents the shortest route out of the LAP area to the north (and to the M50 in particular) for this traffic.

In Option 3, 38% of traffic on the Link Road originates in the development zones in the direct vicinity, however, when the Link Road is removed, this traffic has no choice but to travel via the GLDR to reach the GDDR. The result of this is increased delay at the GLDR / Glenamuck Road junction.

In Option 3, a significant proportion (74%) of the northbound traffic on the GLDR travelled via the Link Road, in order to reach the GDDR with only 26% actually travelling as far as the GLDR / GDDR junction. When the Link Road is removed, all of this northbound traffic must travel via the GLDR / GDDR junction, or find an alternative. This, combined with the effect of the additional traffic from the Glenamuck Road that now uses the GLDR / GDDR junction, results in increased delay at the GLDR / GDDR junction and therefore a re-assignment of 37% of northbound traffic from the GLDR to the Enniskerry Road.

In Option 3, all of the traffic travelling north along the Enniskerry Road originates within the LAP area. When the Link Road is removed, additional traffic from the GLDR re-assigns and travels via the Enniskerry Road; however, all of the original LAP area traffic still uses this route as well. This results in increased delay at the GDDR / Enniskerry Road junction.

Furthermore, a significant volume of traffic from development zone 10965, which travelled via the GLDR to reach the GDDR in Option 3, will re-assign to use the Enniskerry Road when the Link Road is removed, further exacerbating the delay at the GDDR / Enniskerry Road junction.

5.1.5 Option 4 – LAP Area Infrastructure

As Option 1 plus:

- Reduction of the GDDR and GLDR to single carriageway standard, with additional lanes at junctions.
- Removal of bus gate at the eastern end of Glenamuck Road East and the full reinstatement of the road back into the existing Golf Lane roundabout.
- Conversion of Glenamuck Road East to a bus gate only in both directions, resulting in significantly restricted access to/from the GLDR/Glenamuck East junction.
- No Cherrywood Link Road or upgraded Park access infrastructure
- Removal of the Link Road between Glenamuck Road East and the GDDR, with development lands between Glenamuck Road East and the GDDR accessed from the GDDR via Junction 7, which is designated a development driven access point.
- Internal road linkages (development driven) between development zones north of the GDDR and the Park development, including link to Ballyogan Road.

Option 4 is proposed to be independent of the development of Cherrywood and future/potential upgrades of the existing Golf Lane Roundabout and Park access junctions. This option supports the development of the LAP independently of other proposed upgrades and developments, which may become necessary in time, eg, Cherrywood Development SDZ and the potential upgrades of the existing Golf Lane Roundabout and access to the Park development. Also, Option 4 excludes the proposed link road between Glenamuck Road East and the GLDR. The introduction of a bus only gate on Glenamuck Road East and the continuation of the full junction of Glenamuck Road East at Golf Lane Roundabout are measures which balance the need for this link road.

<u>Network Statistics</u>

The global network statistics for the Option 4 model run are summarised in Table 5.5, below. The total delay across the network is the sum of the transient queues, over-capacity queues and link delays which, for Option 4, is 857.4 PCU-hours; this represents a decrease of 18.6 PCU-Hours (2%), compared with the Option 2 and 3 networks. The results also outline a decrease in Total Travel Time, Travel Distance and Fuel Consumption, while Overall Average Speed increases slightly, compared to Options 2 and 3.

Compared to Option network, Option 4 also represents a more efficient network, with queue statistics reduced and network efficiencies improved.

Table 5.5 – Network Statistics – Option 4

Simulation Totals:		This Time Period	Next time Period	Total	Units
Transient Queues		394.9	8.6	403.6	PCU-Hours
Over-Capacity Queues		264.5	53.1	317.7	PCU-Hours
Link:	Free Flow Time	1663.0	19.5	1682.4	PCU-Hours
	Delays	134.6	1.5	136.1	PCU-Hours
	Cruise Time	1797.6	21.0	1818.6	PCU-Hours
Total Travel Time		2457.1	82.8	2539.8	PCU-Hours
Travel Distance		119701.7	1154.0	120855.7	PCU-kms
Overall Average Speed		48.7	13.9	47.6	KPH
Fuel Consumption		10283.8	163.5	10447.3	Litres

Junction Delay

Figure 5.35, below, illustrates the delay at each junction on the Option 4 network whereby a larger radius of red circle represents a greater delay. The level of blocking back is represented by the green lines.

Figure 5.35 Junction Delays and Blocking Back on Option 4 Network

Figure 5.35 indicates a minor delay at Junction 3 (Golf Lane Roundabout) represents a decrease compared to the same location at Option 3, albeit it with a different layout (roundabout vs. signalised junction) and with the Cherrywood Link Road removed. This is likely due to a combination of the removal of the Cherrywood Link Road in this option, coupled with the inclusion of the internal development driven link road through the development zones north of the GDDR and the Park development, which offers an alternative route option for traffic that had no option but to travel through this junction in previous option model runs. Elsewhere, the removal of the link road between Glenamuck Road East and the GDDR does not have as adverse an effect in the Option 4 model run

as it did in the Option 3a network model run. This, again, may be attributable to the alternative route option available in the Option 4 network, which reduces the congestion at the Golf Lane roundabout.

Figure 5.35 also indicates that blocking back is not evident on the Option 4 network.

Volume / Capacity Ratio

Figure 5.36, below, indicates the links on the Option 4 network that have capacity issues. The diagram illustrates the V/C ratio on each link and varies by intensity, whereby a solid line indicates a high V/C ratio, with decreasing levels of fill representing decreasing V/C ratios.

Figure 5.36 - Option 3 Network – V/C Ratios

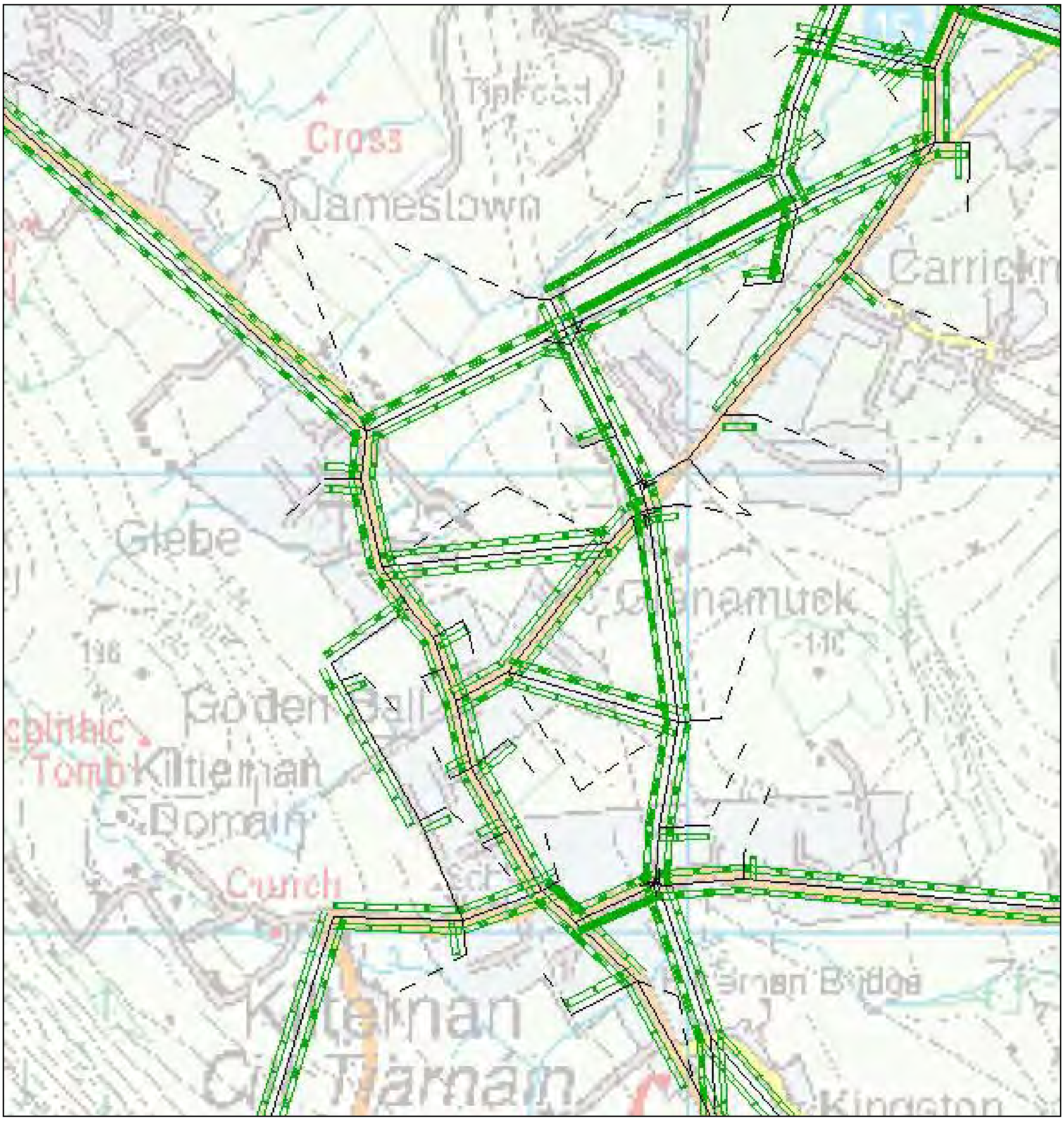


Figure 5.36 indicates that several key links on the Option 4 network have a high volume to capacity ratio, namely, the GDDR between Junctions 2 and 7 and the M50 off-slip at Carrickmines Interchange. This is comparable with the results for the Option 3 model run.

Queue Length Diagrams

Figures 5.37 to 5.42 illustrate the modelled layout and predicted average queue lengths at a number of key junctions in the LAP area.

Figure 5.37 – Option 4 Modelled Layout & Predicted Queue Lengths at Junction 1 - Enniskerry Road / GDDR Junction

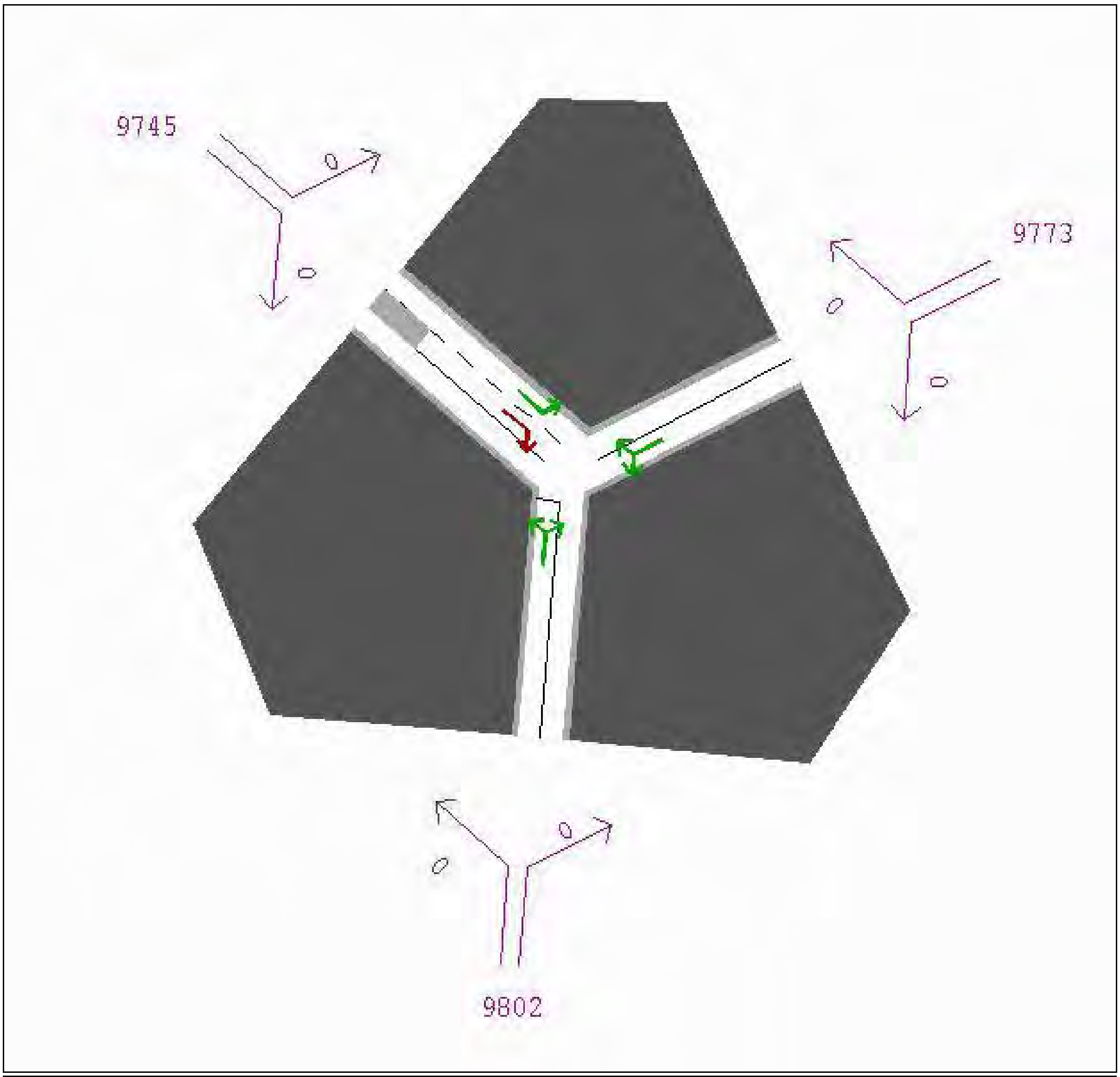


Figure 5.37 indicates that queuing and blocking back are not predicted to occur at the Enniskerry Road / GDDR junction in Option 4. This is consistent with the results of the Option 3 model run.

Figure 5.38 – Option 4 Modelled Layout & Predicted Queue Lengths at Junction 2 - GDDR / GLDR Junction

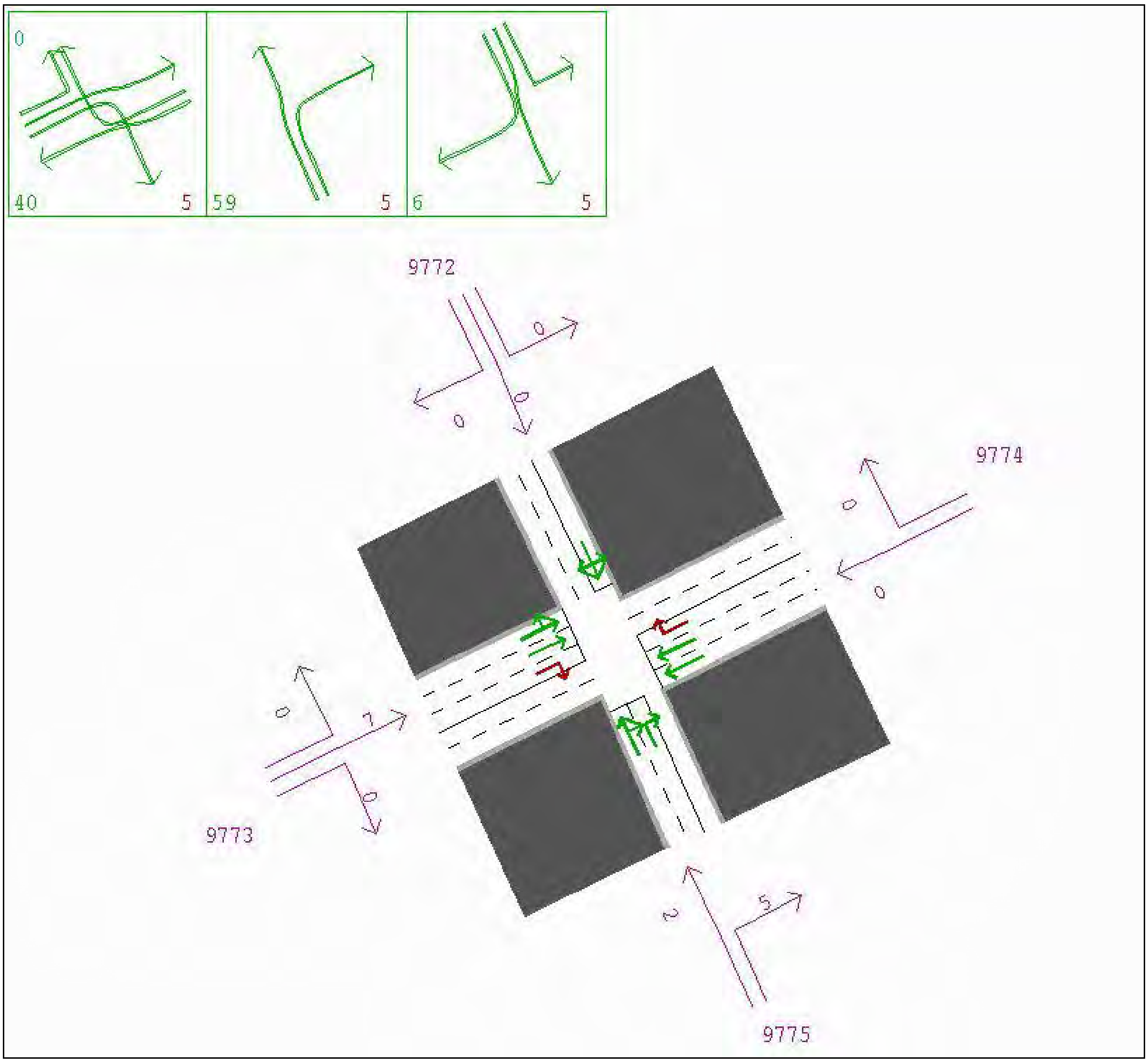


Figure 5.38 indicates that there are no significant average queues predicted to occur at Junction 2 in the Option 4 model run. There is a predicted average queue of 7 PCUs for traffic moving straight-through the junction from GDDR west to GDDR east, this is consistent with Option 3. While the predicted average queue for traffic turning right from the GLDR to GDDR is 5 PCUs and travelling straight-on from the GLDR to the development zones north of the GDDR is 2 PCUs. Both predicted queues represent an increase of 2 PCUs compared with the Option 3 model run. This additional queuing is likely due to the implementation of the bus gate at Junction 4 (GLDR / Glenamuck Road East junction), which prevents traffic travelling north along the GLDR from accessing Glenamuck Road East, as it would have done in Option 3 to access the (now removed) Link Road between Glenamuck Road East and the GDDR. The new internal link road that runs through the development lands north of the GDDR, through the Park development and connects to Ballyogan Road may also contribute to the additional queuing on the GLDR arm of Junction 2 as it gives traffic an alternative route to access both the park development and development zone 10951, which was previously only accessible via Junction 7 on the GDDR.

Figure 5.39 – Option 4 Modelled Layout & Predicted Queue Lengths at Junction 3 – Golf Lane Roundabout

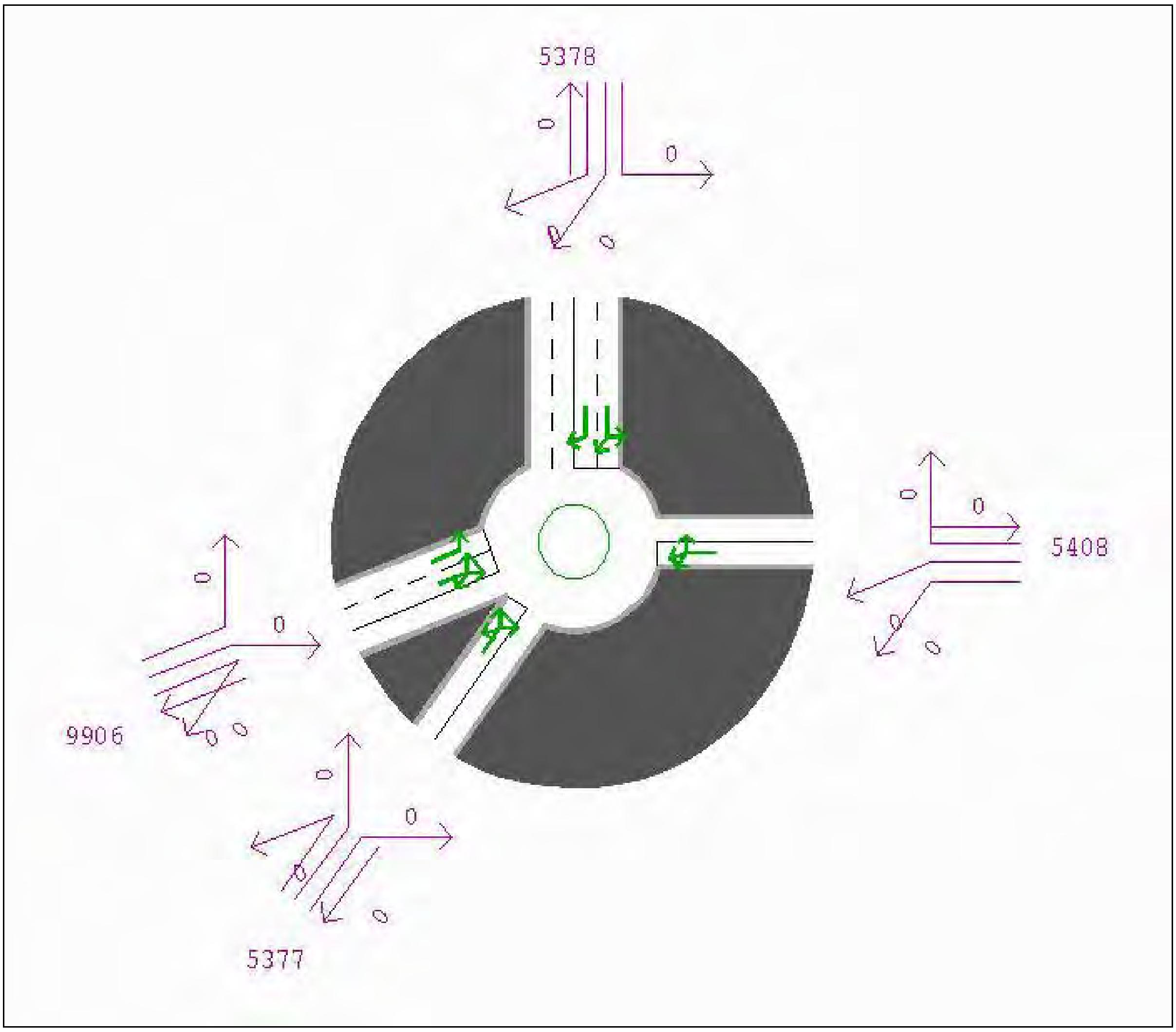


Figure 5.39 indicates that queuing is not predicted to occur at Junction 3 in the Option 4 model run. This contrasts with the Option 3 model run where significant queuing was predicted to occur at this location, albeit, with a different layout (signalised junction). The reduction in queuing at this location is likely due to a number of factors including the removal of the Cherrywood Link Road in this Option run as well as the inclusion of alternative access points to the Park development via Junctions 2 and 7, the net result of which is a 44% reduction in the total volume of traffic entering the junction, compared to the Option 3 model run.

Figure 5.40a – Option 4 Modelled Layout & Predicted Queue Lengths at Junction 4a - GLDR / Glenamuck Road Junction Northern Stagger.

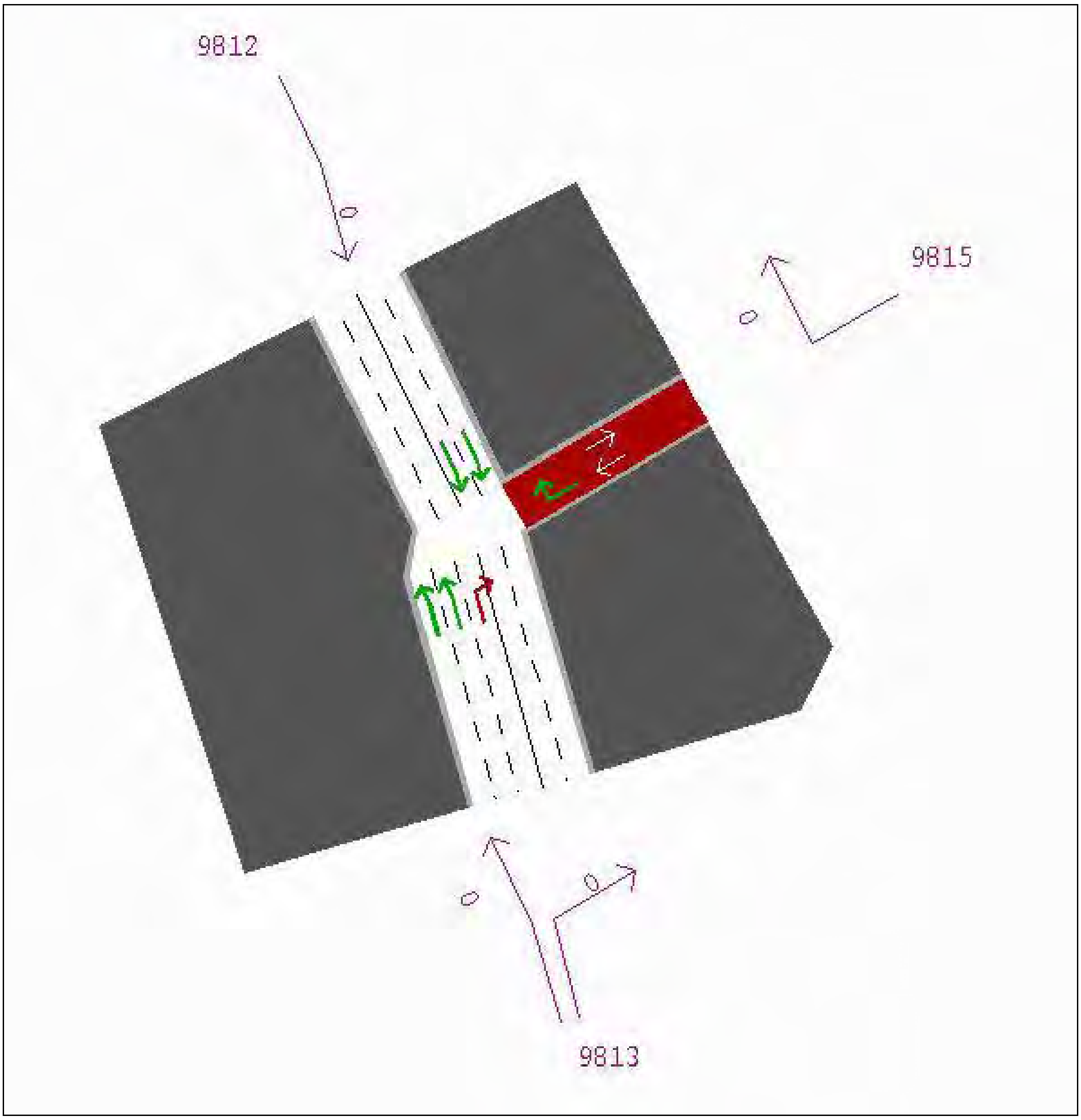


Figure 5.40a shows the modelled layout of the northern stagger of the junction between the GLDR and Glenamuck Road East. While the junction will in fact be signalised, it has been modelled as a priority junction, since the traffic lights will only be activated by buses turning via the bus gate on the minor arm of the junction. To replicate the effect of the delays that the activation of the bus gate will cause to other traffic, additional intergreen time was added to the southern stagger of the junction (Junction 4b), as this is still modelled as a signalised junction. Figure 5.40a indicates that queuing is not predicted to occur at Junction 4a in the Option 4 model run.

Figure 5.40b – Option 4 Modelled Layout & Predicted Queue Lengths at Junction 4b - GLDR / Glenamuck Road Junction Southern Stagger

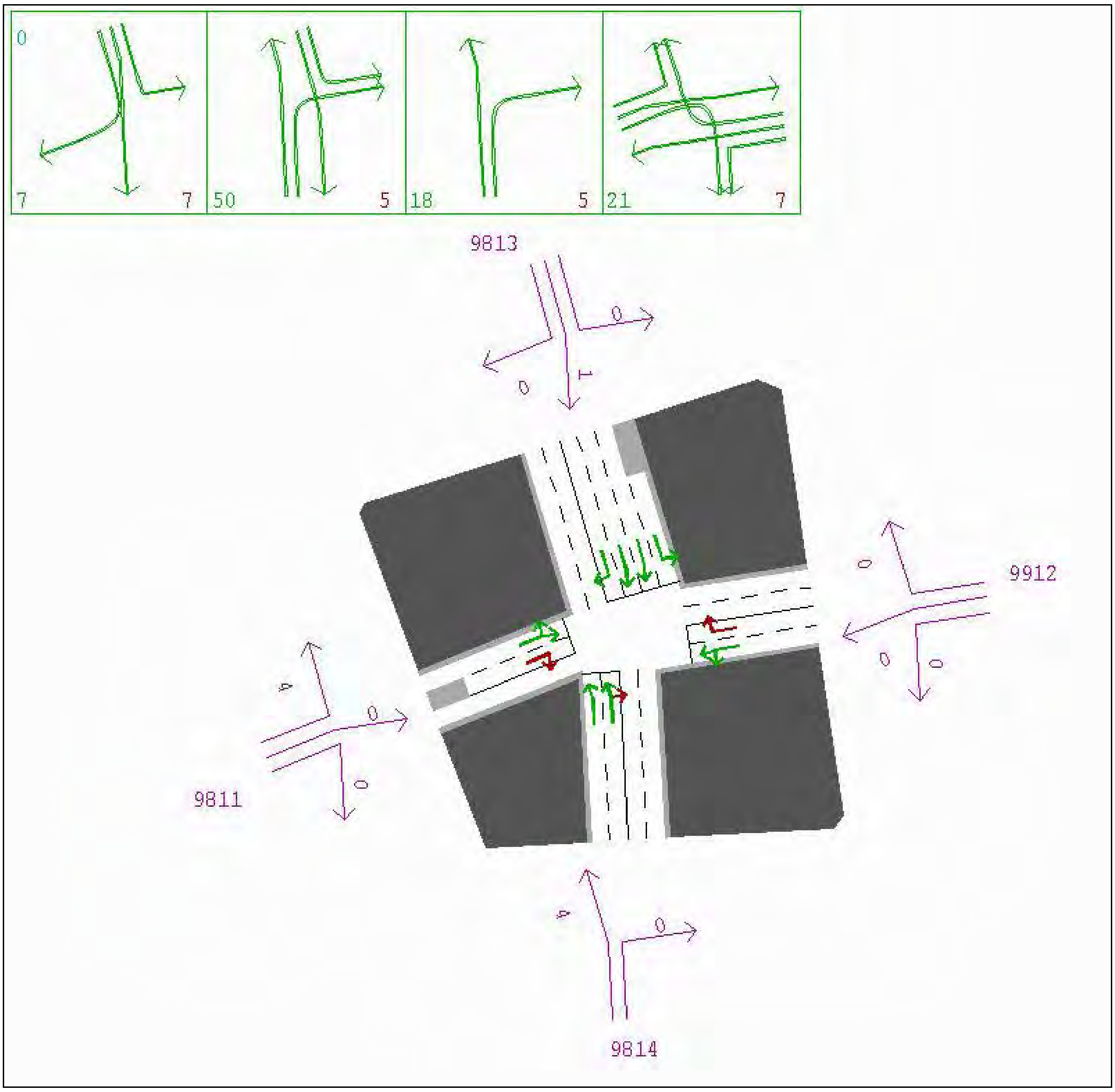


Figure 5.40b indicates that significant queuing and blocking back are not predicted to occur at the southern stagger of junction 4 in Option 4. The relatively minor predicted average queue for traffic turning left from Glenamuck Road on to GLDR north is consistent with the predicted queue that was evident in the Option 3 model run, while the predicted queue length of 4 PCUs for vehicles travelling straight-through the junction from GLDR south to GLDR represents a decrease of 3 PCUs by comparison.

Figure 5.41 – Option 4 Modelled Layout & Predicted Queue Lengths at Junction 5 - GLDR / Ballycorus Road Junction

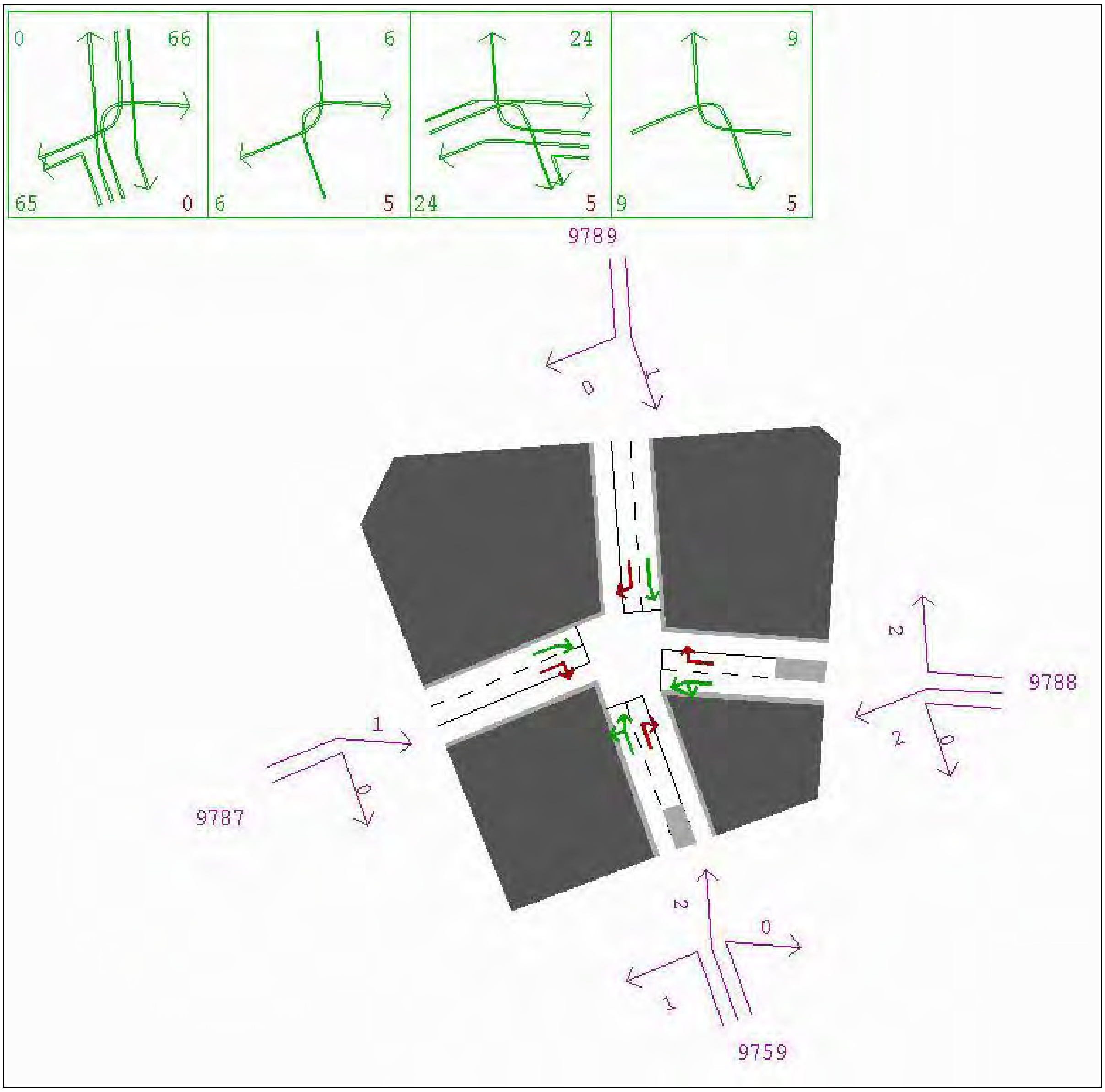


Figure 5.41 indicates that, similar to the Option 3 model run, significant average queues and blocking back are not predicted to occur on any arm at Junction 5 in the Option 4 model run.

Figure 5.42 – Option 4 Modelled Layout & Predicted Queue Lengths at Junction 6 - Park Development Access Junction

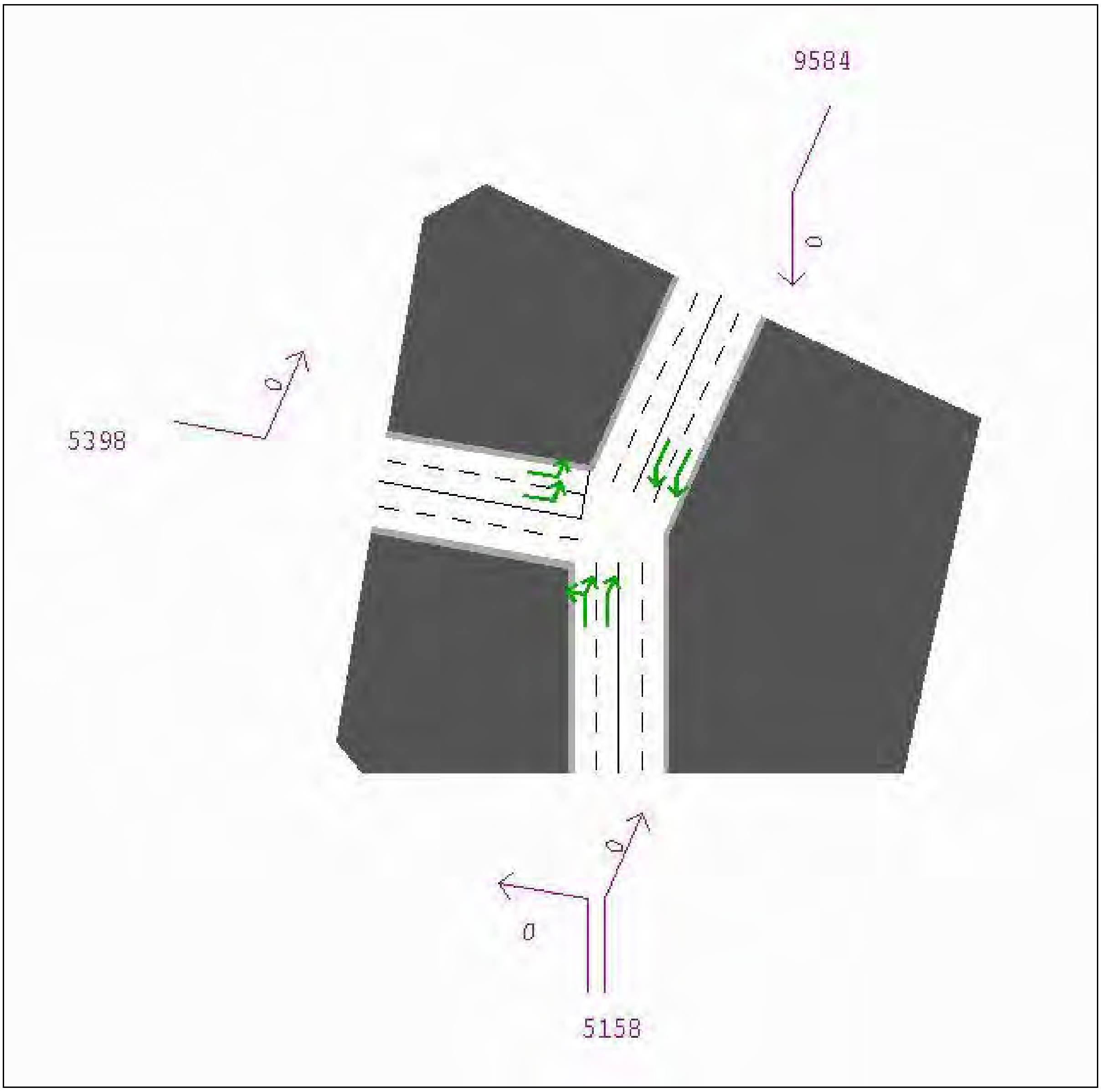


Figure 5.42 indicates that queuing is not predicted to occur at Junction 6 in the Option 4 model run. This is an improvement on the Option 3 model run, which predicted an average queue of 4 PCUs for traffic turning right into the Park development from Glenamuck Road north and 7 PCUs for traffic travelling straight-through the junction from Glenamuck Road north to south, albeit with a different (signalised junction) layout. The reductions in queue lengths at this junction are likely due to the additional alternative access junctions to the Park development that are present in the Option 3 model run.

5.2 HIGH TRAFFIC GROWTH SCENARIO

Option 4 represents a satisfactory transportation infrastructure proposal which, based on the analysis for the Core Scenario, performs well and meets the transportation needs of the proposed Glenamuck LAP development. It also represents a scenario, which can be considered independent from adjacent developments which will become necessary in time but which will be implemented based on their own merits and are not dependent on the development of the Glenamuck LAP per se. Such developments include The Park and Cherrywood, which will generate their own transportation infrastructure needs.

For the High Traffic Growth Scenario, only the emerging preferred Option from the Core Scenario model runs (Option 4) was tested. Results from the High Traffic Growth Scenario model run are presented below.

Junction Delay

Figure 5.43, below, illustrates the delay at each junction on the Option 4 network whereby a larger radius of red circle represents a greater delay. The level of blocking back is represented by the green lines.

Figure 5.43 – Junction Delays and Blocking Back on Option 4 Network – High Traffic Growth Scenario

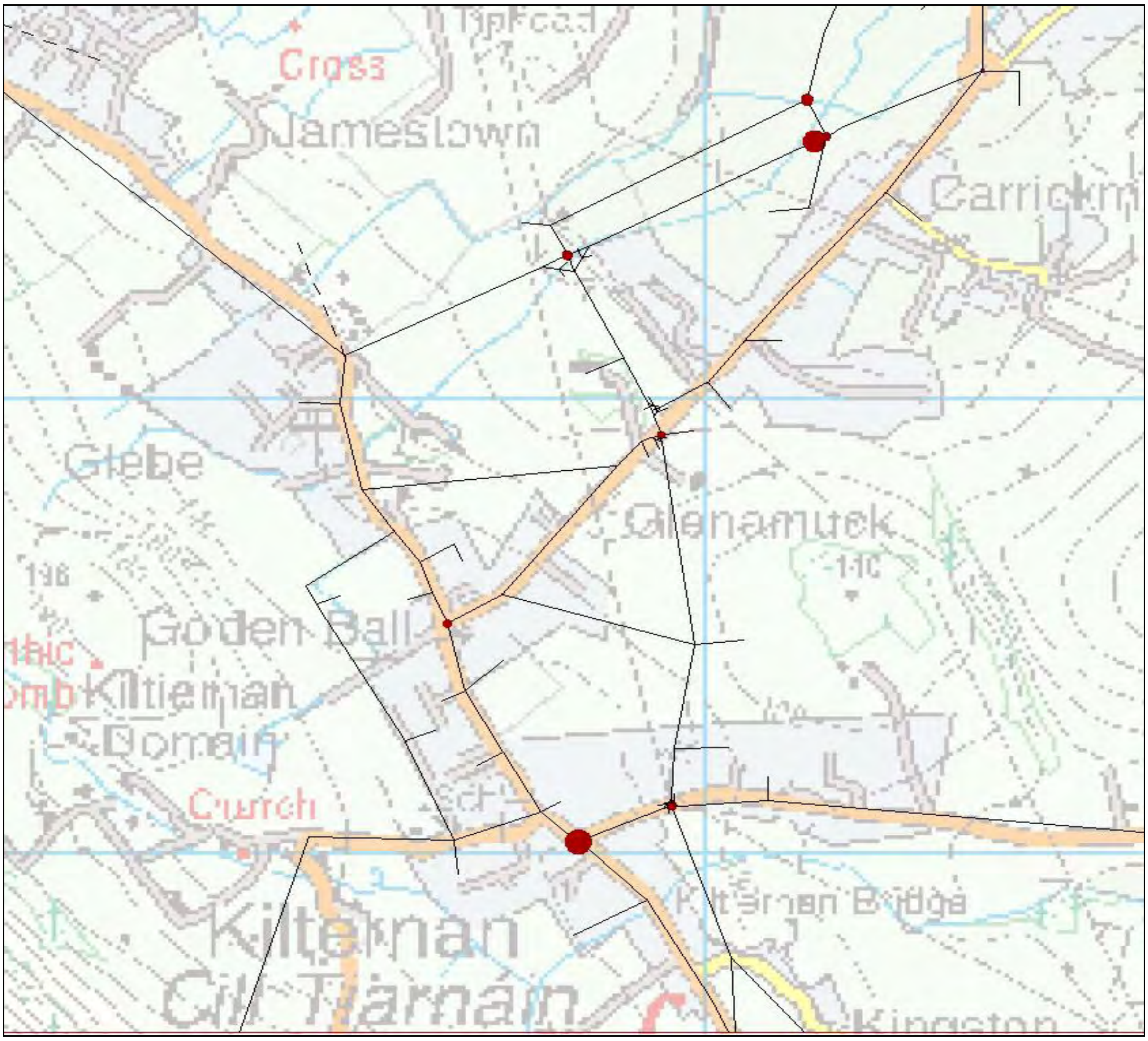


Figure 5.43 indicates that the High Traffic Growth scenario is predicted to result in a slight increase in delay at the development junctions on the GDDR, compared to the Core Scenario Option 4 model run. Blocking back is not predicted to occur on the Option 4 network. The overall impact of the higher traffic growth in this scenario on the LAP appears to be quite minimal.

Queue Length Diagrams

Figures 5.44 – 5.49 illustrate the modelled layout and predicted average queue lengths at a number of key junctions in the LAP area.

Figure 5.44 – High Traffic Growth Scenario Modelled Layout & Predicted Queue Lengths at Junction 1 - Enniskerry Road / GDDR Junction

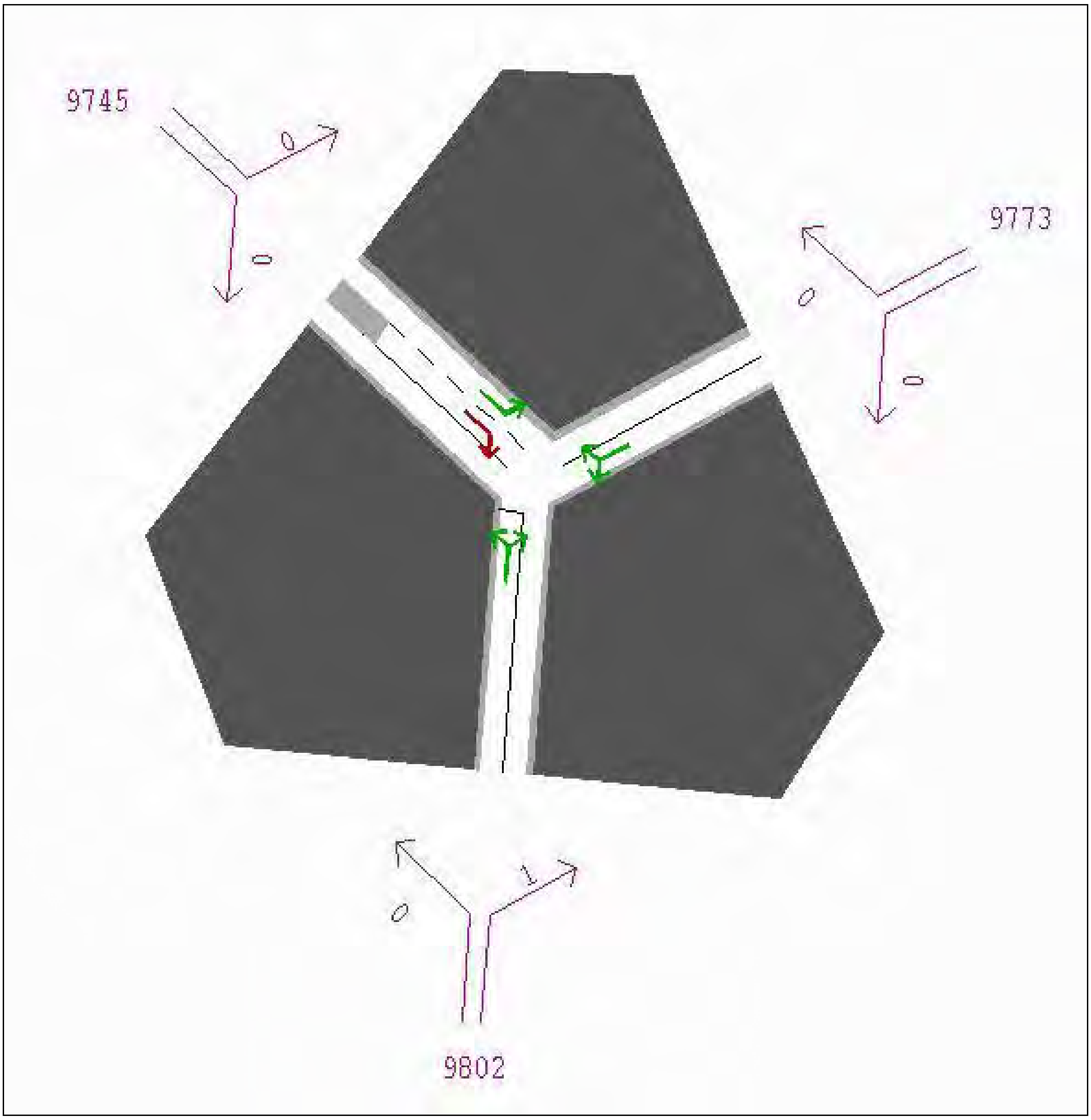


Figure 5.44 indicates that significant queuing and blocking back are not predicted to occur at Junction 1 under the High Traffic Growth Scenario.

Figure 5.45 – High Traffic Growth Scenario Modelled Layout & Predicted Queue Lengths at Junction 2 - GDDR / GLDR Junction

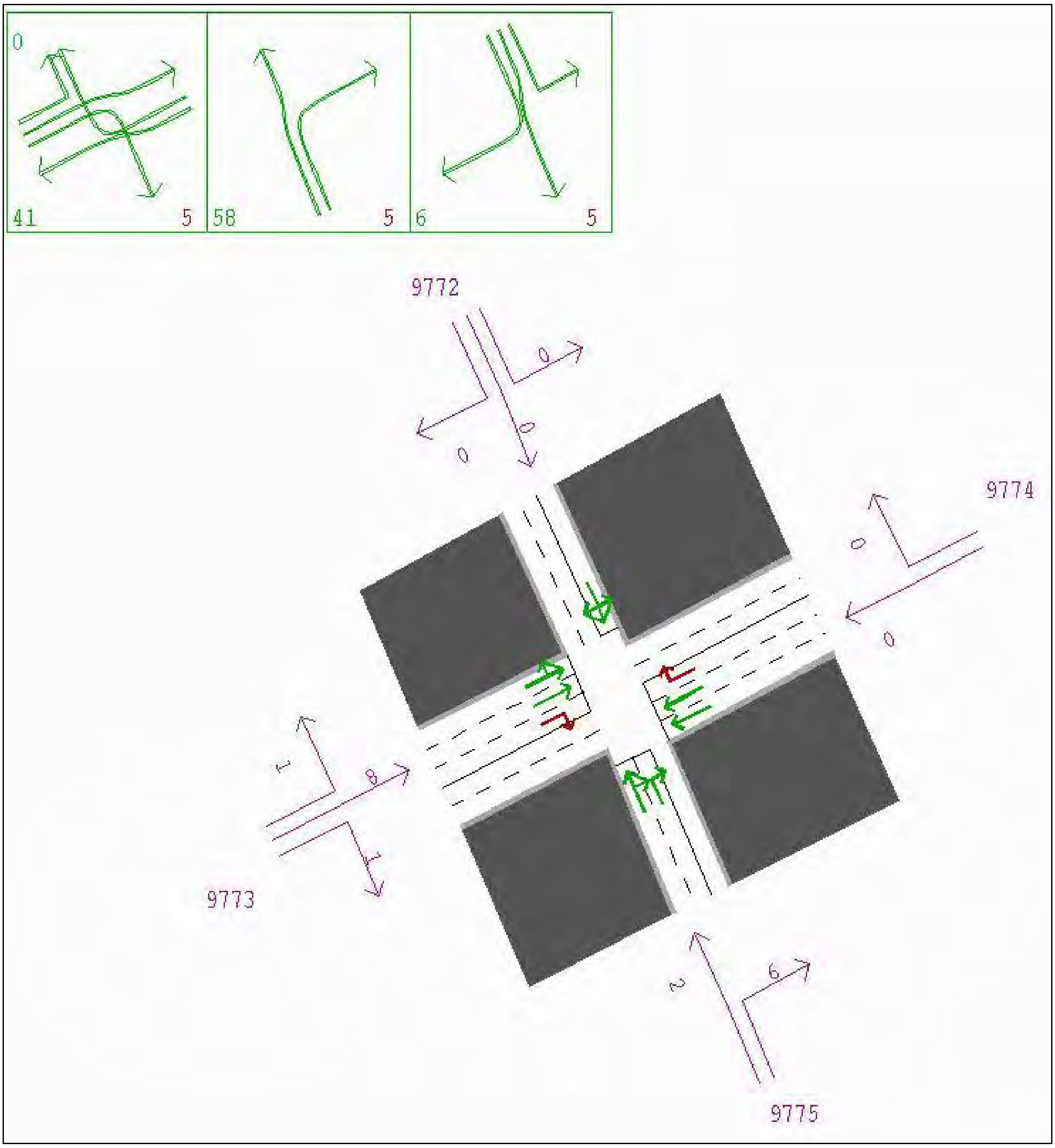


Figure 5.45 indicates that the predicted average queue for traffic travelling straight-through the junction from GDDR west to GDDR east is 8 PCUs. This represents a nominal increase compared to the Core Scenario. For traffic turning right from the GLDR to GDDR east, the predicted average queue is 56 PCUs. This is, again, a minor increase compared to the Core Scenario. As with the Core Scenario, blocking back is not predicted to occur at the junction.

Figure 5.46 – High Traffic Growth Scenario Modelled Layout & Predicted Queue Lengths at Junction 3 – Golf Lane Roundabout

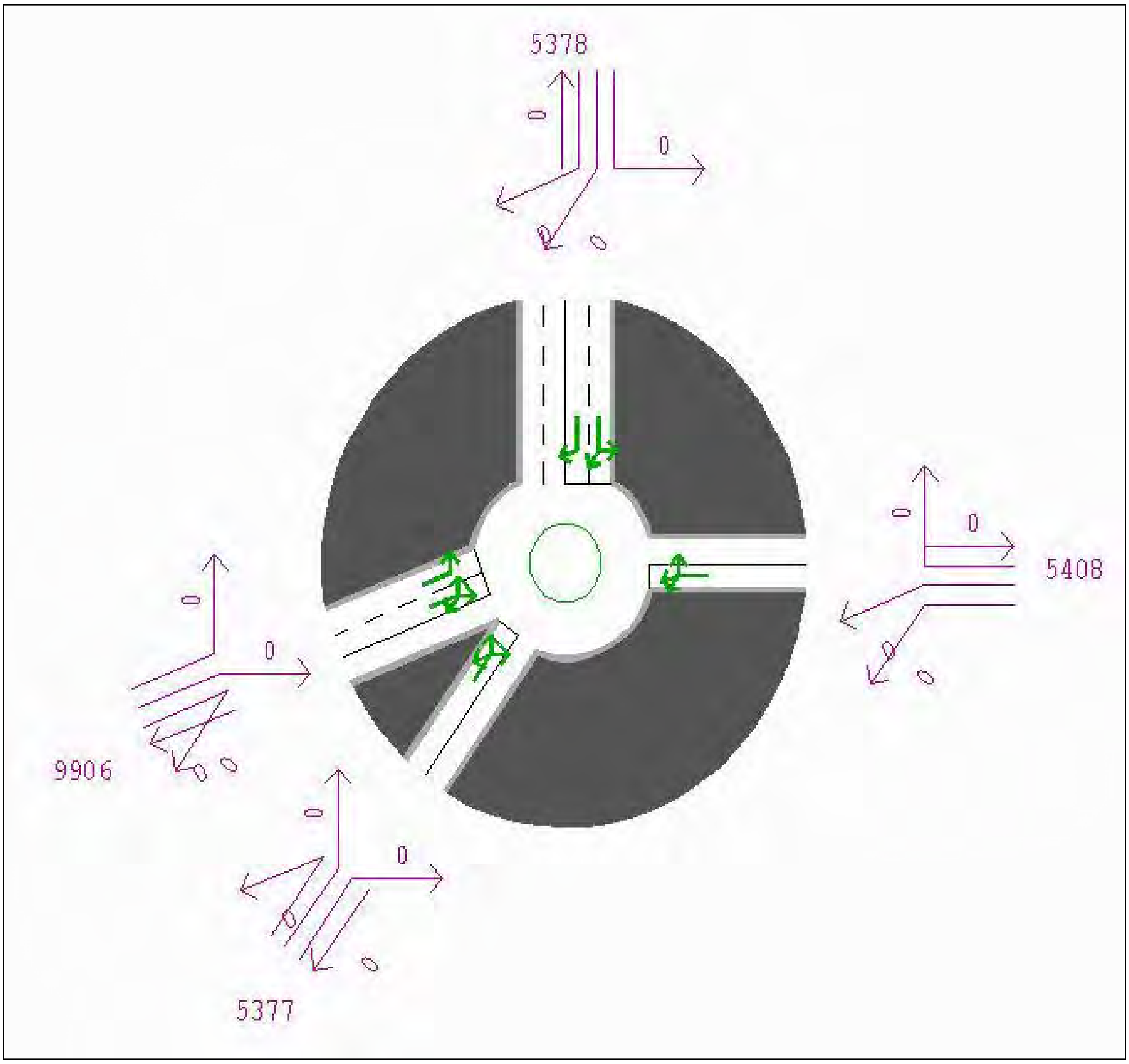


Figure 5.46 indicates that queuing and blocking back are not predicted to occur at Junction 3 in the High Traffic Growth model run.

Figure 5.47a – High Traffic Growth Scenario Modelled Layout & Predicted Queue Lengths at Junction 4a - GLDR / Glenamuck Road Junction Northern Stagger

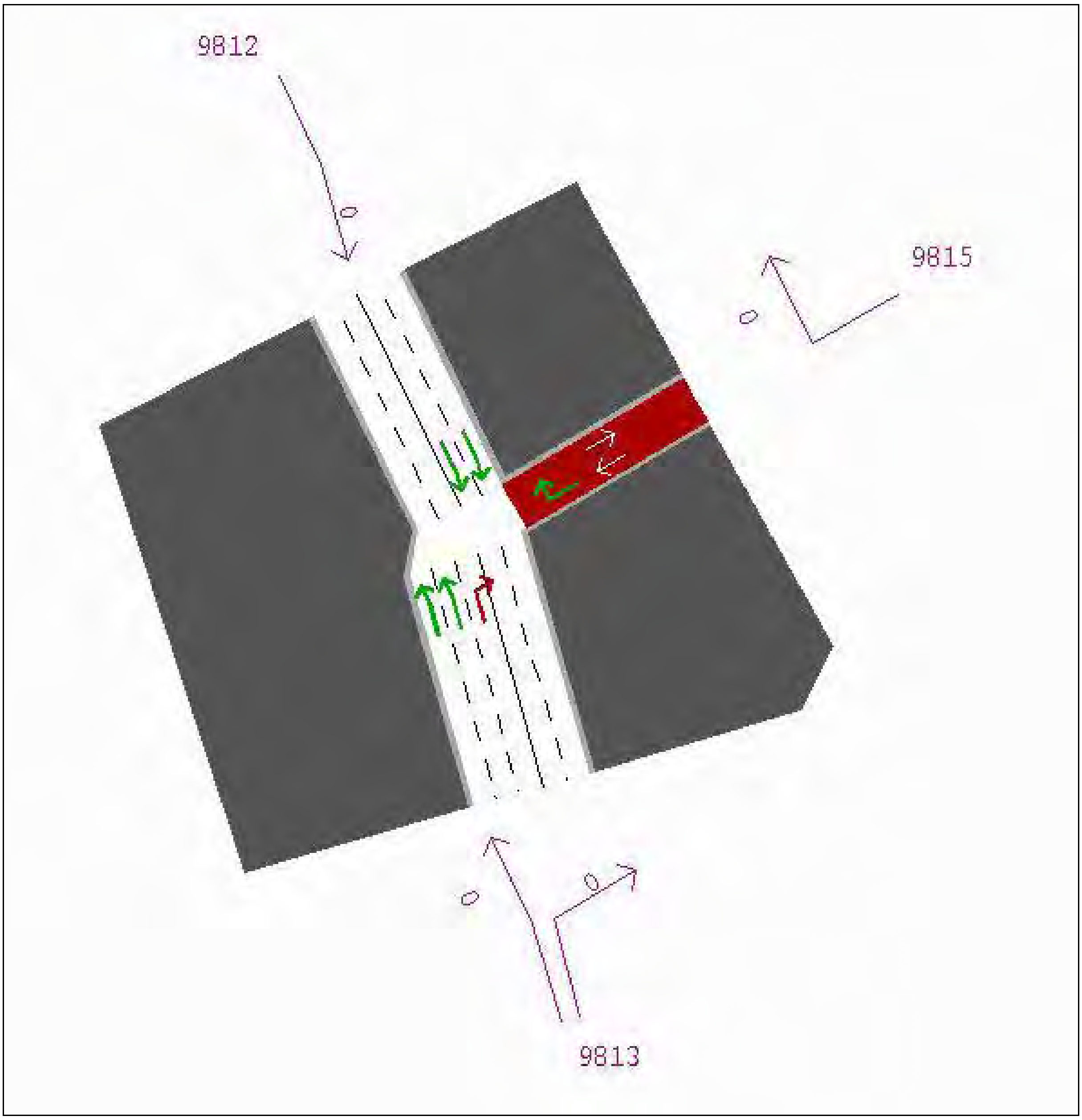


Figure 5.47a shows the modelled layout of the northern stagger of the junction between the GLDR and Glenamuck Road East. As with the Core Scenario, the junction has been modelled as a priority junction, since the traffic lights will only be activated by buses turning via the bus gate on the minor arm of the junction. To replicate the effect of the delays that the activation of the bus gate will cause to other traffic, additional intergreen time was once again added to the southern stagger of the junction (Junction 4b),

Figure 5.47a indicates that queuing and blocking back are not predicted to occur at the northern stagger of Junction 4 in the High Traffic Growth Scenario.

Figure 5.47b – High Traffic Growth Scenario Modelled Layout & Predicted Queue Lengths at Junction 4b - GLDR / Glenamuck Road Junction Southern Stagger

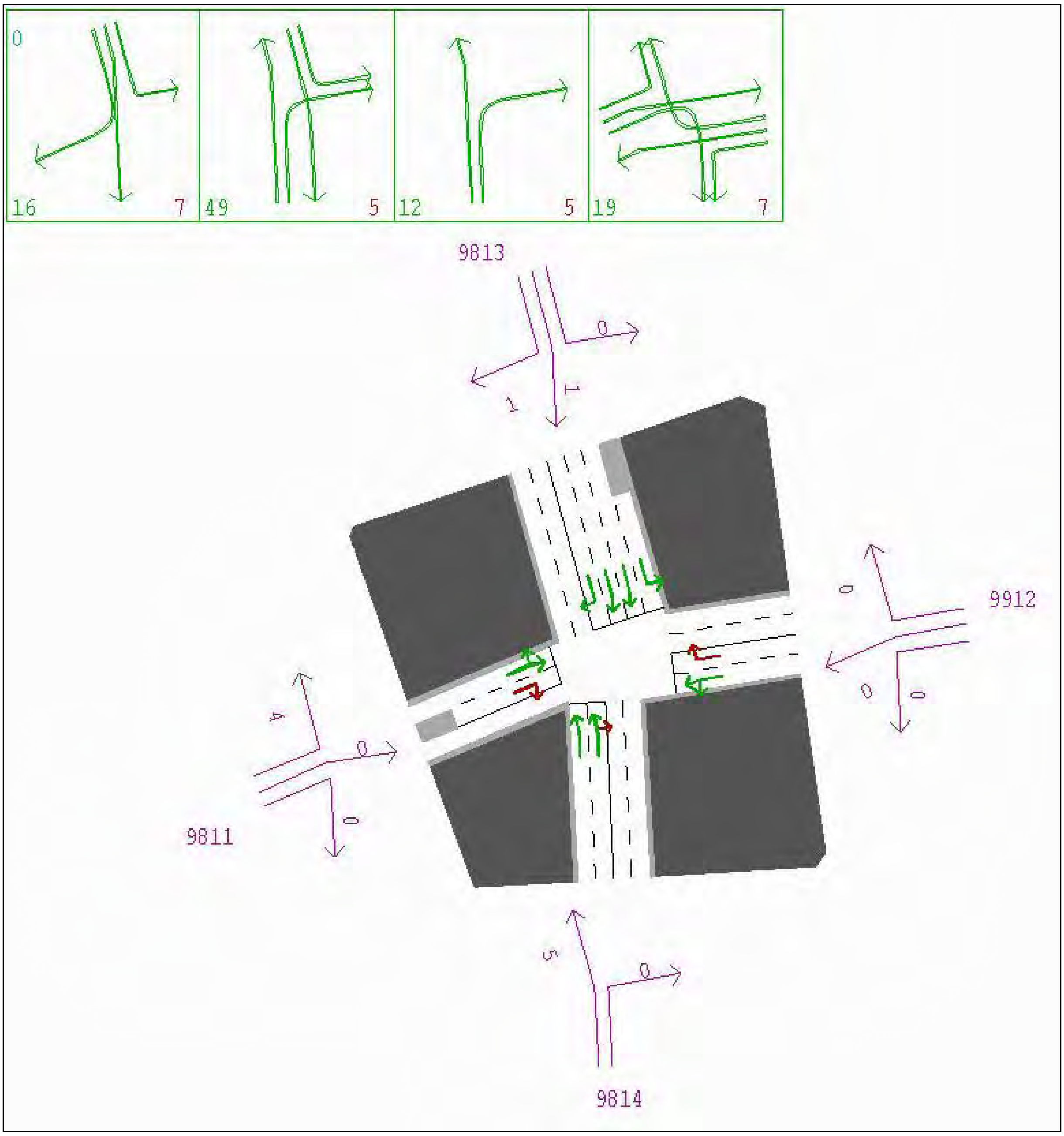


Figure 5.47b indicates that significant queuing and blocking back are not predicted to occur at the southern stagger of Junction 4 in the High Traffic Growth Scenario. This is consistent with the result of the Core Scenario Option 4 model run at this junction.

Figure 5.48 – High Traffic Growth Scenario Modelled Layout & Predicted Queue Lengths at Junction 5 - GLDR / Ballycorus Road Junction

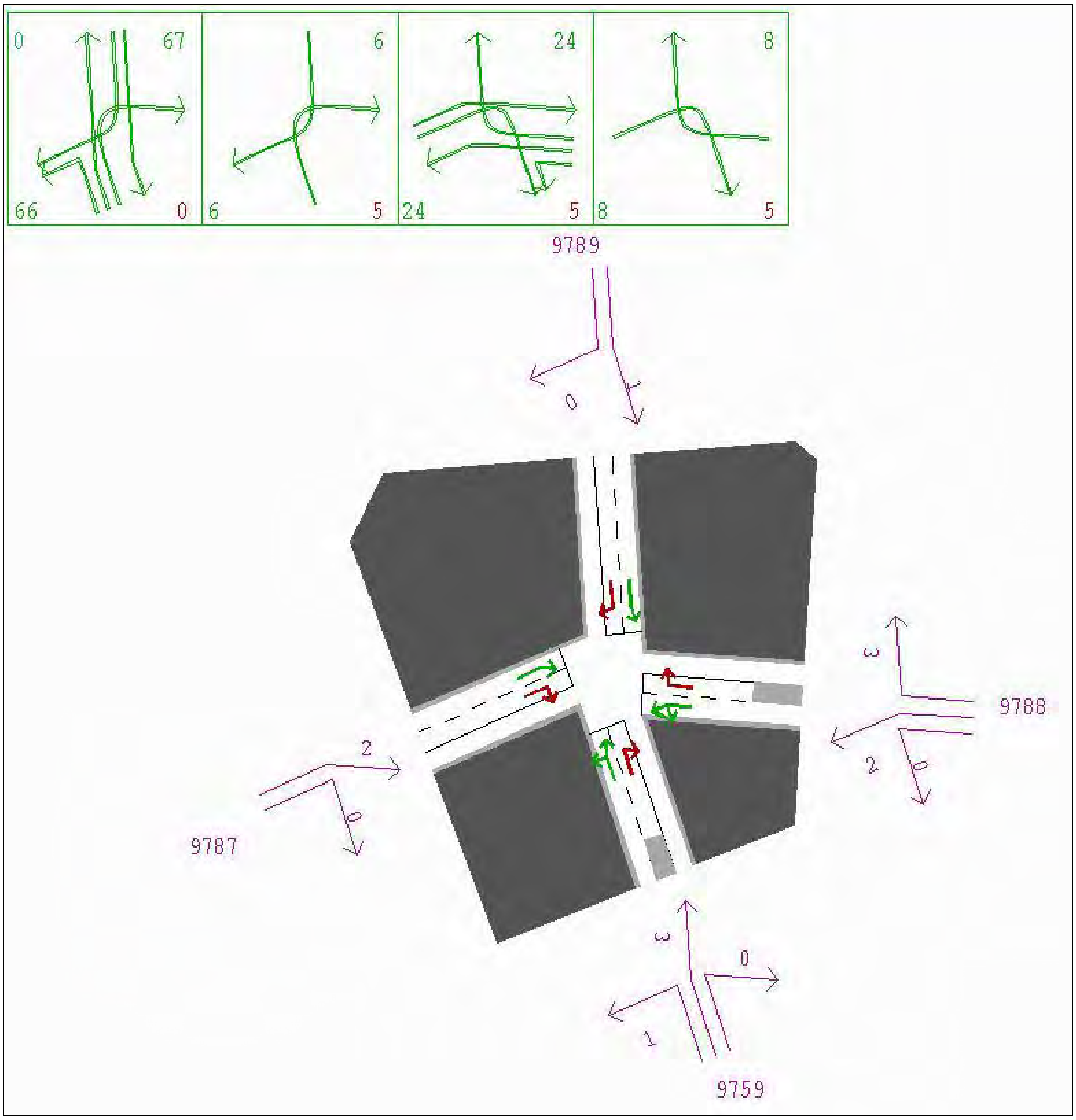


Figure 5.48 indicates that, despite minor increases in average queue lengths compared to the Core Scenario model run, significant average queues and blocking back are not predicted to occur on any arm at Junction 5 in the High Growth Scenario.

Figure 5.49 – High Traffic Growth Scenario Modelled Layout & Predicted Queue Lengths at Junction 6 - Park Development Access Junction

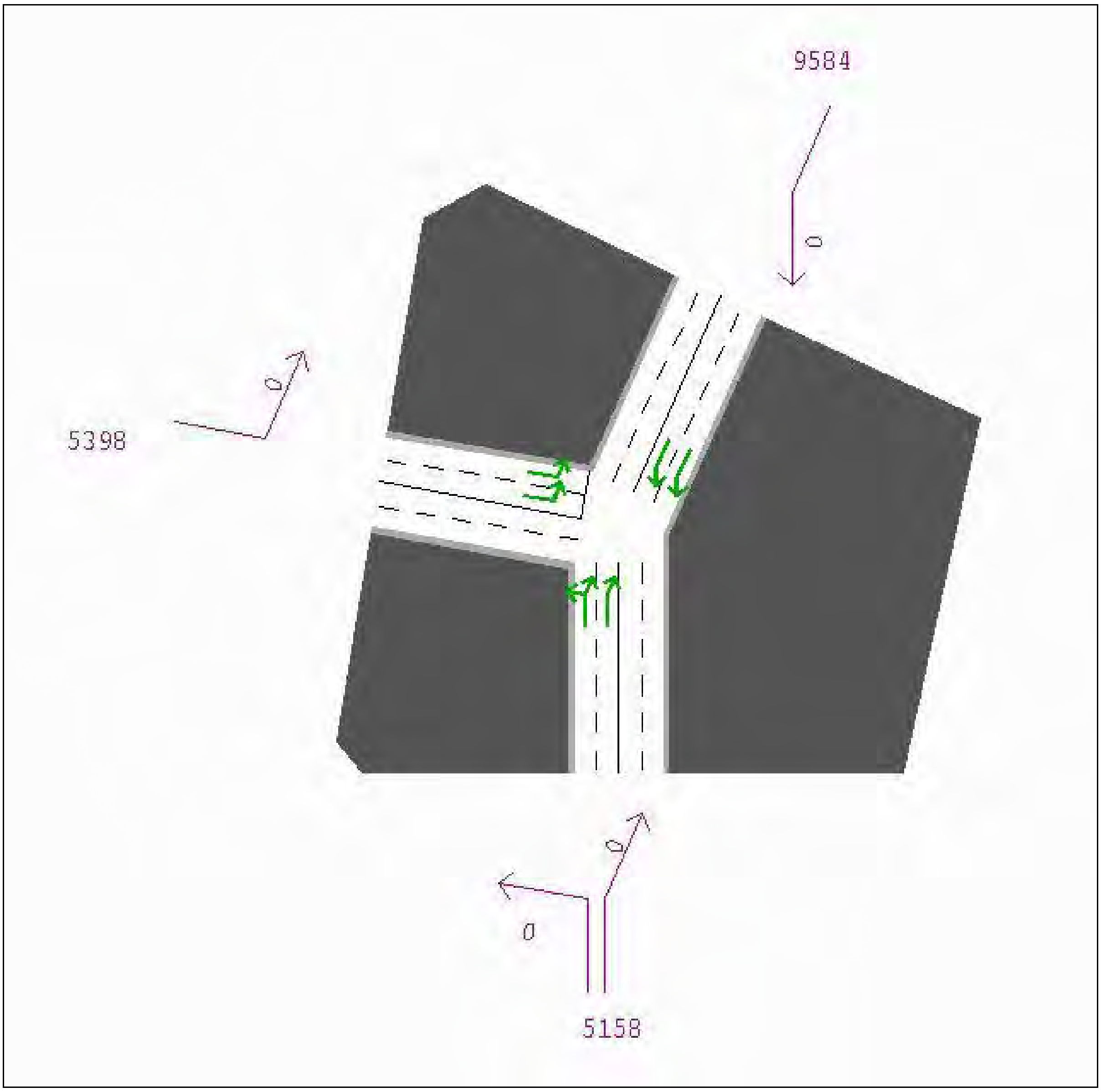


Figure 5.49 indicates that significant queuing and blocking back are not predicted to occur at this junction in the High Traffic Growth Scenario.

5.3 SUMMARY

Core Scenario

For the Core Scenario, five options were tested.

The Do Minimum (Option 0) network assumed development quanta as in the previous LAP, the implementation of the GDDR as previously published, No development of the Cherrywood Link Road, PT frequencies as in the previous NTA modelling work and the provision of bus lanes at key locations.

The results of the Do Minimum model run indicated:

- Significant predicted delays at a number of junctions within the LAP area as well as in the vicinity of the Park development access junction.
- Significant capacity issues along the GLDR and in the vicinity of the Park development
- Significant levels of queuing and blocking back at a number of key locations in and around the LAP area, notably, the Enniskerry Road / GDDR, GDDR / GLDR, Golf Lane Roundabout at Carrickmines Interchange, GLDR / Glenamuck Road and Park development access junctions.

The Option 1 network amended the Do Minimum network to include; revised development quanta (to reflect the updated Dun Laoghaire Rathdown County Development Plan), an extension of the GLDR south to connect to Enniskerry Road and a staggered junction with the existing Glenamuck Road.

The results of the Option 1 model run indicated:

- A significant reduction in the total overall network delay and an improvement in other overall network statistics such as fuel consumption, travel time and average speed when compared to the Do Minimum option
- A significant reduction in the predicted delay at all junctions within the LAP area
- A significant increase in the predicted delay, queuing and blocking back at the Park access development junction.

The Option 2 network amended the Option 1 network to include the implementation of the Cherrywood Link Road and upgrade of the Golf Lane roundabout and The Park access junctions.

The results of the Option 2 model run indicated

- A further reduction in the total overall network delay, compared with both the Do Minimum option and Option 1 as well as an improvement in other overall network statistics such as fuel consumption, travel time and average speed when compared to both the Do Minimum option and Option 1
- A significant reduction in the predicted delay at the Park development access junction on Glenamuck Road
- No significant adverse impacts on junction delays, V/C ratios or queuing within the LAP area.

The Option 3 network amended the layout of the GDDR, reducing it from dual carriageway to single carriageway.

The results of the Option 3 model run indicated:

- Comparable network statistics to the Option 2 model run
- A slight increase in delays at a number of junctions within the LAP area.

A sensitivity test of option 3 was undertaken whereby the link road between the GDDR and the Glenamuck Road was omitted but retaining a development driven access junction to serve adjacent development lands. The resultant impact on the network was a significant increase in delays and queuing at several junctions within the LAP area.

The Option 4 network tested the ability of the LAP network to function independently of other proposed infrastructure upgrades in the vicinity of the LAP area, such as the Cherrywood Link Road and the Park Development access upgrade. It also included internal road linkages between the development zones north of the GDDR, the Park development and Ballyogan Road. Also, Option 4 excludes the proposed link road between Glenamuck Road East and the GLDR. The introduction of a bus only gate on Glenamuck Road East and the continuation of the full junction of Glenamuck Road East at Golf Lane Roundabout are measures which balance the need for this link road.

The results of the Option 4 model run indicated:

- A reduction in total overall network delay, compared to the Option 3 model run, as well as a decrease in Total Travel Time, Travel Distance and Fuel Consumption. Overall Average Speed increased slightly, compared to Option 3.
- No significant adverse impacts on junction delays, V/C ratios or queuing within the LAP area.

<u>High Traffic Growth Scenario</u>

The High Traffic Growth Scenario assumed an increase in background traffic growth of 25% compared with the Core Scenario.

For this scenario, only the emerging preferred option from the Core Scenario model runs (Option 4) was tested.

The results of the Option 4 model run for the High Traffic Growth Scenario indicated:

- A minor increase in queuing at a number of junctions within the LAP area compared to the Core Scenario model run.

5.4 SATURN MODEL RUNS – CONCLUSION

Core Scenario and Options Tested

The conclusion of the SATURN analysis suggests that the proposed LAP networks in Options 1, 2 and 3 perform well in catering for the predicted development traffic generation in the future year core scenario, albeit with improvements to key junctions outside of the LAP Area, specifically, the upgrading of the existing Golf Lane Roundabout to a signalised junction that incorporates the Cherrywood Link Road and the upgraded access to the existing Park Development to signal control. Reduction of the GDDR to a single carriageway has little adverse impact on traffic flow and distribution provided that key junctions along its route do not have a reduction in their capacities.

A sensitivity test of the Option 3 network, whereby the link road between the GDDR and the Glenamuck Road was reduced to a cul de sac on the GDDR side, was carried out. This omission resulted in considerable re-assignment of LAP generated traffic to the proposed network. This re-assignment resulted in additional development traffic accessing key proposed junctions and resulted in a significant negative impact in terms of delays and queuing.

Option 4 was developed in order to address issues identified from previous analyses, namely;

- Analysis to confirm if GDDR would function satisfactorily as a single carriageway between the proposed junctions
- Analysis of an alternative traffic management arrangement to balance the transportation benefits derived from the Link Road between the Glenamuck Road East and the GDDR by the introduction of a bus only gate on Glenamuck Road East and the retention of the full junction of Glenamuck Road East at Golf Lane Roundabout .
- Need for the Glenamuck LAP transportation provisions to be somewhat independent of other adjacent developments, ie the implementation of the LAP would not be contingent per se on future upgrades on local infrastructure outside of the plan area, eg The Park and Cherrywood in particular.
- Identification of provision for key bus priority measures to be included in the plan at this stage.

Thus Option 4 was developed to consist of the following key elements. As Option 1 plus:

- Reduction of the GDDR and GLDR to single carriageway standard, with additional lanes at junctions.
- Removal of bus gate at the eastern end of Glenamuck Road East and the full reinstatement of the road back into the existing Golf Lane roundabout.
- Conversion of Glenamuck Road East to a bus gate only in both directions, resulting in significantly restricted access to/from the GLDR/Glenamuck East junction.
- No Cherrywood Link Road or upgraded Park access infrastructure
- Removal of the Link Road between Glenamuck Road East and the GDDR, with development lands between Glenamuck Road East and the GDDR accessed from the GDDR via Junction 7, which is designated a development driven access point.
- Internal road linkages (development driven) between development zones north of the GDDR and the Park development, including link to Ballyogan Road.

The Option 4 network was shown to be able to cater for the predicted development traffic generation in the future year core scenario. The effect of the omission of the link road between the GDDR and the Glenamuck Road, which caused significant negative impacts on the Option 3 network, is mitigated in this Option by the additional route choice resulting from:

- the implementation of the bus gate at the northern stagger of the GLDR / Glenamuck Road junction,
- the removal of the bus gate at the eastern end of Glenamuck Road (at the Golf Lane Roundabout) and
- the inclusion in the network of the internal road linkages between the development zones north of the GDDR, the Park development and Ballyogan Road.

The Option 4 model run demonstrated that the proposed transportation infrastructure and alternative traffic management proposals performed well in terms of the statistical performance of the network. The proposal presents reasonable infrastructure to support the development of the LAP lands relatively independently of other developments and on the basis that the proposals had reduced in overall scale and cost, it was concluded that this option represented a preferred option to be brought forward for further analysis in detail.

High Traffic Growth Scenario

The adverse impact of the higher rate of background traffic growth within the LAP area is limited on Option 4.

This suggests that Option 4 proposed road network within the LAP area is robust and that the proposals have adequate reserve capacity to cater for a higher background traffic growth scenario.

Detailed Analysis

In Section 6 of this report, more detailed static analyses of the proposed key junctions within the LAP area are carried out to rigorously test the design provisions, typically number of entry and exit lanes to be provided, and determine the optimum junctions layouts.

6 TRAFFIC ANALYSIS

6.1 PREDICTED TRAFFIC FLOWS

Future year peak hour traffic flows have been estimated using the outputs from the SATURN modelling exercise. As Option 4 is identified as the preferred option, the link flows and junction turning movements from this model run are used in the analysis of both the Core Scenario and the High Traffic Growth Scenarios.

The predicted AM peak hour turning movements for the Option 4 network for the Core Scenario and High Traffic Growth Scenario are outlined below in Drawings TR003 and TR004, below, respectively.

6.2 PROPOSED ROAD NETWORK

In order to meet the predicted traffic flows, a proposed road network has been developed using Mx road design package. Drawing JU-00 contained in Appendix A illustrates the proposed road layout to be tested in this analysis.

This drawing illustrates the long term design requirements for the proposed transportation infrastructure without showing provisions for future development driven accesses or links. The designs required to facilitate access to particular developments will be developed by the proposed developers and will be designed to meet the particular development requirements. Such design proposals will be subject to planning and associated traffic impact assessments. Drawings TR003 and TR004 indicate the outline locations of proposed development led junctions, accesses and links.

This design layout shown on Drawing JU-00 is significantly in excess of the infrastructure provisions that will enable the Glenamuck LAP development to commence. Chapter 8 discusses in more detail, the approach taken to the implementation strategy for the provision of the transportation infrastructure. For analysis purposes, it is the long term proposals that are subject to analysis in this section of the report.

6.3 LINK CAPACITY ANALYSIS

Although link capacity and level of service (LOS) is a critical element of road design, it is noted in urban situations, where roads are often highly trafficked, it is the junctions that ultimately determine the capacity of the road network, not the links. In this respect, junction capacity analysis is seen as the critical element of the road network analysis and is contained in Section 6.3. For completeness, however, the various link capacities are nonetheless examined below.

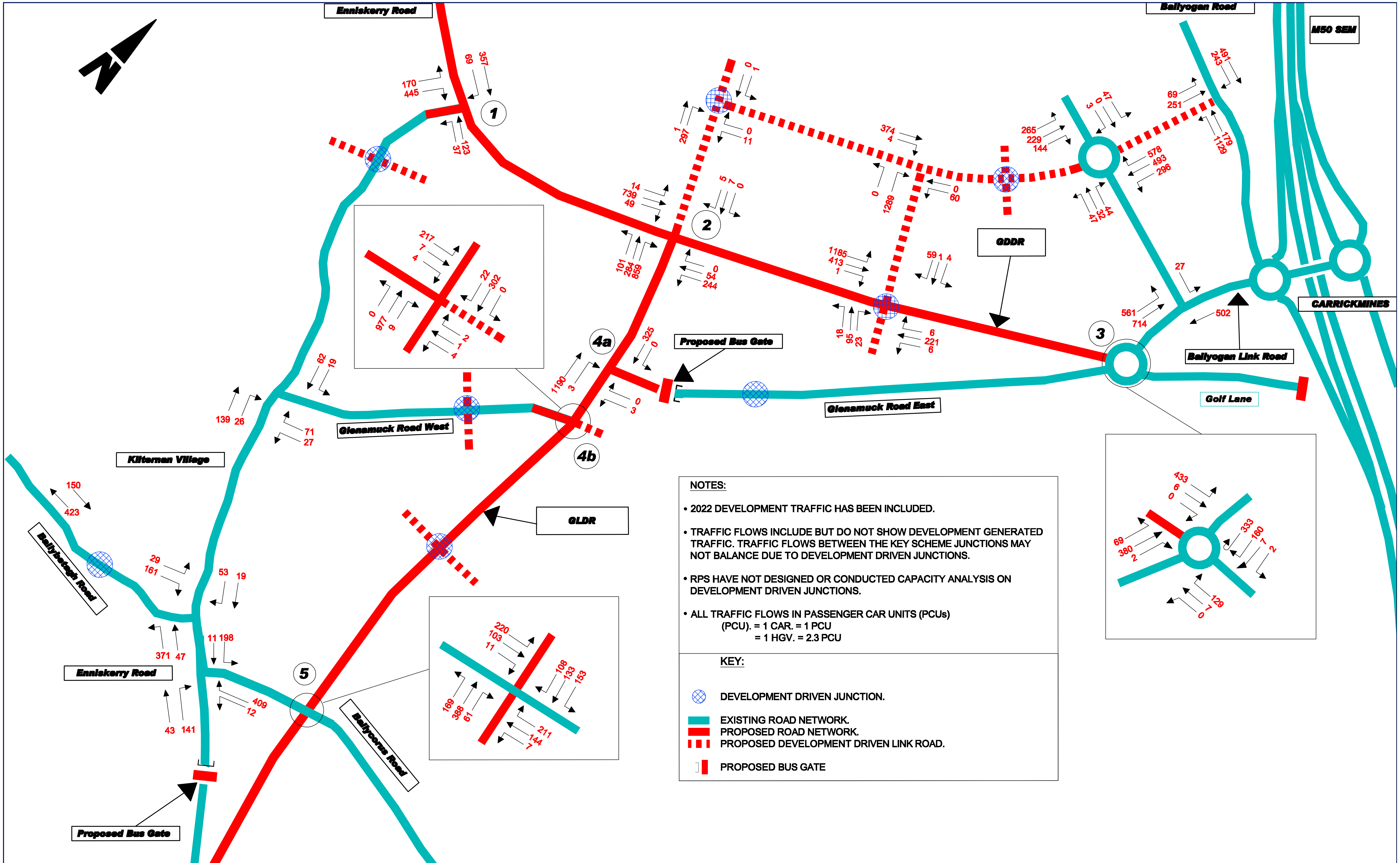
Based on the DMRB, Volume 5, TA 79/99, ‘Determination of Urban Road Capacity’ the capacity of the GDDR, GLDR and Glenamuck Road are estimated for the Option 4 network. From TA 79/99, the GDDR and GLDR are classed as ‘Urban All-Purpose Road’ (UAP1). The maximum traffic flows (link capacity) which can be accommodated on a road (link) are expressed in vehicles per hour (one-way flow on a single lane) for an average carriageway width. The degree of saturation on the road (link) is calculated by using a ratio of flow on the road versus the capacity of the road (RFC value). This Ratio of Flow to Capacity (RFC) is expressed as a percentage representing how saturated a link is.

The peak RFC value for each link is shown below in Table 6.1. The link capacity analysis in Table 6.1 below is a theoretical exercise to illustrate the general capacity of the road network provided between the proposed junctions on the scheme.

Table 6.1 Urban Link Capacity Analysis

Link	Capacity (one-way)	Core Scenario		High Traffic Growth Scenario	
		Max. One-way flow	RFC (%)	Max. One-way flow	RFC (%)
GDDR (single - 7m carriageway)	1,440	802	56%	1032	72%
GLDR (single - 7m carriageway)	1,440	986	69%	1018	71%
Glenamuck Road West (single - 6.1m carriageway)	900	228	25%	203	23%
Glenamuck Road East (single - 6.7m carriageway)	1,090	451	41%	450	41%

The link capacity calculations indicate that the proposed road infrastructure will provide significant reserve capacity on the network in both the Core and High Traffic Growth Scenarios. It is noted that the maximum one-way flows are decreased by approximately 20% to 30% compared to the traffic flows analysed in 2006 for the Core Scenario.



NOTES:

- 2022 DEVELOPMENT TRAFFIC HAS BEEN INCLUDED.
- TRAFFIC FLOWS INCLUDE BUT DO NOT SHOW DEVELOPMENT GENERATED TRAFFIC. TRAFFIC FLOWS BETWEEN THE KEY SCHEME JUNCTIONS MAY NOT BALANCE DUE TO DEVELOPMENT DRIVEN JUNCTIONS.
- RPS HAVE NOT DESIGNED OR CONDUCTED CAPACITY ANALYSIS ON DEVELOPMENT DRIVEN JUNCTIONS.
- ALL TRAFFIC FLOWS IN PASSENGER CAR UNITS (PCUs)
  (PCU). = 1 CAR. = 1 PCU
  = 1 HGV. = 2.3 PCU

KEY:

DEVELOPMENT DRIVEN JUNCTION.
EXISTING ROAD NETWORK.
PROPOSED ROAD NETWORK.
PROPOSED DEVELOPMENT DRIVEN LINK ROAD.
PROPOSED BUS GATE

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No.	Date	Drn. Chk.	Amendment / Issue	App
F02	May '13	KD	Final Issue	MN

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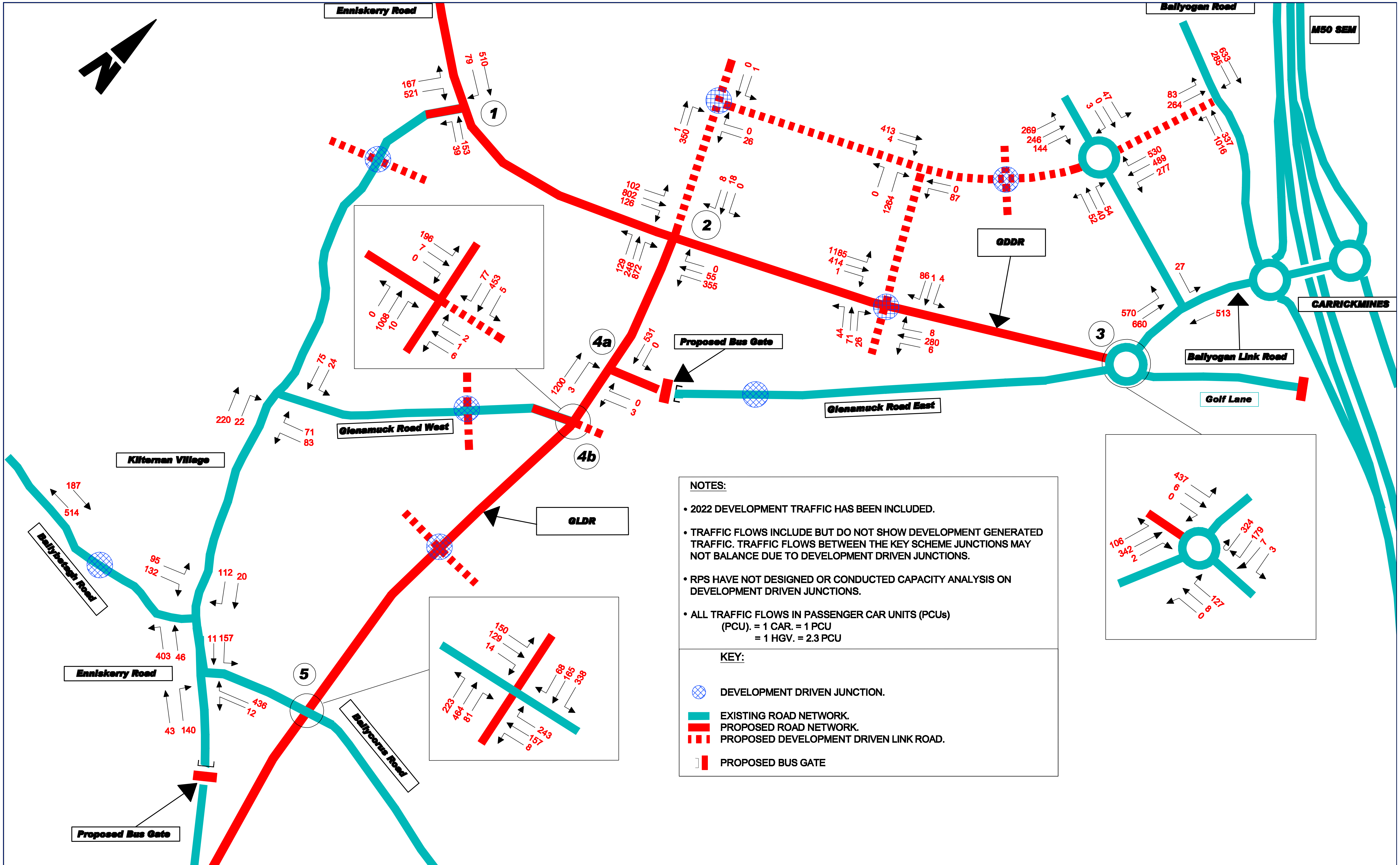
Date	May '13
Scale	- @ A1 / - @ A3

Project: **REVIEW OF GLENAMUCK LAP**

Title: **Core Traffic Growth Scenario Modelled AM Peak Hour Traffic Flows**
Design Year 2022

Job No.	File Ref.	Drg. No.	Rev.
MDT0598	MDT0598TR0003.dwg	TR0003	F02



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- 2022 DEVELOPMENT TRAFFIC HAS BEEN INCLUDED.
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- RPS HAVE NOT DESIGNED OR CONDUCTED CAPACITY ANALYSIS ON DEVELOPMENT DRIVEN JUNCTIONS.
- ALL TRAFFIC FLOWS IN PASSENGER CAR UNITS (PCUs) (PCU). = 1 CAR. = 1 PCU
  = 1 HGV. = 2.3 PCU

KEY:

- DEVELOPMENT DRIVEN JUNCTION.
- EXISTING ROAD NETWORK.
- PROPOSED ROAD NETWORK.
- PROPOSED DEVELOPMENT DRIVEN LINK ROAD.
- PROPOSED BUS GATE

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Project
REVIEW OF GLENAMUCK LAP

Title
High Traffic Growth Scenario
Modelled AM Peak Hour Traffic Flows
Design Year 2022

Job No.	File Ref.	Drg. No.	Rev.
MDT0598	MDT0598TR0004.dwg	TR0004	F02

6.4 JUNCTION CAPACITY ANALYSIS

Junction capacity analysis is undertaken for a number of new / upgraded junctions within the LAP area to inform the junction design process.

Analysis is undertaken at the following junctions:

1. Enniskerry Road / GDDR – Junction 1
2. GDDR / GLDR – Junction 2
3. Golf Lane Roundabout – Junction 3
4. GLDR / Glenamuck Road Stagger – Junctions 4a and 4b.
5. GLDR / Ballycorus Road – Junction 5

Junctions 2 and 4 have been assessed to accommodate future access arms to serve the development lands, although these have not been shown in the junction layout drawings. These accesses are development driven and it is expected that the design of junctions 2 and 4 will be upgraded as and when adjacent development is planned to take place. Other development driven access junctions within the proposed road network will be also developed as part of the normal planning process.

The AM peak hour turning movements from Option 4 SATURN model run are used to test each junction for the Core Scenario. These turning movements are illustrated in drawing TR003, above.

As a validation exercise, the junctions are also tested using the turning movements from the high traffic growth scenario. These turning movements are illustrated in drawing TR004, above.

6.4.1 Junction Modelling Software Used

Three junction modelling software suites are used to analyse the junctions:

- PICADY - which is used to model priority controlled junctions
- ARCADY - which is used to model roundabouts
- LinSig Version 2 - which is used to model signal controlled junctions

Model outputs:

- Degree of Saturation (Sat.) or Ratio of Flow to Capacity (RFC) is a statement of the degree of saturation of the link at a junction. The degree of saturation, ‘Sat/RFC’, is a measure of link flow to capacity quoted as a percentage, whereby 90% (or 0.90) for LINSIG and 85% (or 0.85) for PICADY is considered to be at capacity and anything over these values is considered over capacity.
- A signalised junction is at its most efficient when it operates as close to the maximum degree of saturation without going over it using the minimum cycle time available.

- The lower the cycle time the more benefit pedestrians and cyclists experience at a signalised junction, as the pedestrian crossings will be run once every cycle thus reducing the delay for crossing.

- PRC is the Practical Reserve Capacity measurement for the junction. The PRC is calculated from the maximum degree of saturation on a link and is a measure of how much additional traffic could pass through the junction while maintaining a maximum degree of saturation.

- If the PRC becomes negative, this indicates that the degree of saturation on the links is over 85% (PICADY) or 90% (LINSIG) and the junction is experiencing capacity problems.

- In LINSIG the 'Q (PCU)' represents the mean maximum queue in PCUs on the link at the beginning of the green period, which will occur in the modelling period. The Mean Max Queue is the sum of three components: Uniform Queuing, Oversaturated Queuing and Random Queuing.

- In PICADY the 'Max Q' represents the maximum predicted queue of vehicles that will occur during the analysed peak hour.

- Note: PCU = Passenger Car Units. Passenger car units allow for differences in the amount of interference to other traffic according to the type of vehicle. PCUs are used to represent the traffic flow in LINSIG analysis. For example, Car = 1 PCU, HGV = 2.3 PCUs, 1 PCU = 5.5m - 6.0m in length.

6.4.2 Junction 1 – Enniskerry Road / GDDR

The proposed Enniskerry Road / GDDR junction is proposed as a three-arm, priority controlled, ghost-island junction and is modelled using PICADY. The major arms are Enniskerry Road Northwest and the GDDR, the minor arm is Enniskerry Road South. The modelled junction layout is illustrated in Drawing JU-01, in Appendix A.

Core Scenario

The results of PICADY junction capacity analysis for the Core Scenario are summarised in Table 6.2, below:

Table 6.2 PICADY Results for Capacity Analysis of Enniskerry Road / GDDR Junction – Core Scenario AM Peak Hour

Arm	RFC	Max Q (No. Of Veh.)	Delay (Min. / Veh.)
GDDR	-	-	-
Enniskerry Road South	**1.230**	**54.9**	**241.0**
Enniskerry Road Northwest	0.114	0.1	6.0

Table 6.2 indicates that the Enniskerry Road / GDDR junction is predicted to operate above practical capacity during the AM Peak hour for the Core Scenario. Significant queuing and delays are predicted to occur on the Enniskerry Road South arm of this junction.

While the overall traffic flows into this junction in the Core Scenario are lower than the traffic flows analysed in 2006, where the junction was shown to operate below practical capacity, the number of vehicles turning right from Enniskerry Road South to the GDDR in the AM peak hour is far greater (+79%). This high proportion of right turning traffic is causing the Enniskerry Road South arm to operate above practical capacity during the AM peak hour.

A high-level PM peak hour analysis was undertaken for the Core Scenario using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction was predicted to operate comfortably below practical capacity for these indicative PM peak hour flows, with no significant queuing or delays predicted to occur.

High Traffic Growth Scenario

The results of PICADY junction capacity analysis for the High Traffic Growth Scenario are summarised in Table 6.3, below:

Table 6.3 PICADY Results for Capacity Analysis of Enniskerry Road / GDDR Junction – High Traffic Growth Scenario AM Peak Hour

Arm	RFC	Max Q (No. Of Veh.)	Delay (Min. / Veh.)
GDDR	-	-	-
Enniskerry Road South	**1.586**	**152.7**	**599.0**
Enniskerry Road Northwest	0.133	0.2	6.0

Table 6.3 indicates that the Enniskerry Road / GDDR junction is predicted to operate above practical capacity during the AM Peak hour in the High traffic Growth Scenario. Significant queuing and delays are predicted to occur on the Enniskerry Road South arm of the junction.

As with the Core Scenario, the overall traffic flows into this junction in the High Traffic Growth Scenario are lower than the traffic flows analysed in 2006, however, once again, the number of vehicles turning right from Enniskerry Road South to the GDDR in the AM peak hour is far greater (+109%). This high proportion of right turning traffic is causing the Enniskerry Road South arm to operate above practical capacity during the AM peak hour.

A high-level PM peak hour analysis was undertaken for the High Traffic Growth Scenario using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction would operate below practical capacity for these indicative PM peak hour flows, with no significant queuing or delays predicted to occur.

Proposed Mitigation

While the PICADY analysis has indicated that the proposed GDDR / Enniskerry Road junction is predicted to operate above practical capacity, these capacity issues can be overcome by the introduction of traffic signal control at the junction.

6.4.3 Junction 2 – GDDR / GLDR

This junction has been identified as a future access point to the lands immediately to the north of the junction. As such, the proposed immediate-term 'T' junction geometric layout and lane configuration for the junction (as shown in drawing JU-02) has been designed to accommodate a future fourth arm (i.e. land/space is set aside for the accommodation of right turn lanes etc) as it is assumed that this junction will, at some point, be converted from a three-arm T-junction into a crossroads with the addition of the access road arm. It is also assumed that the access road itself will eventually link to the

Park development and on to Ballyogan Road and this has been represented in the Option 4 SATURN model.

Core Scenario

The precise make-up of the future development of the lands immediately to the north of the junction is not known at this time. The predicted development flows from the Option 4 SATURN model run have been used to estimate future development flows and this junction has been assessed to include future development traffic. The junction was modelled as a signal-controlled crossroads using LinSig, with a cycle time of 120 seconds chosen.

The results of LinSig junction capacity analysis are summarised in Table 6.4, below:

Table 6.4 LinSig Results for Capacity Analysis of GDDR / GLDR Junction – Core Scenario AM Peak Hour

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
1/1	GDDR West - Ahead / Left	0.763	24.8	49.9
1/2	GDDR West – Right	0.407	1.9	78.7
2/1	GLDR - Right / Ahead	0.750	34.2	36.1
2/2	GLDR – Left	0.089	1.3	10.3
3/1	GDDR East – Ahead	0.056	1.4	37.0
3/2	GDDR East – Left	0.160	1.5	3.0
3/3	GDDR East – Right	0.000	0.0	0.0
4/1	Development Access - All Movements	0.094	0.4	68.4
Cycle Time = 120 Seconds		**PRC = 18.0%**		

The results outlined in Table 6.4 indicate that the junction is predicted to operate below practical capacity during the AM Peak hour in the Core Scenario. While there are some significant predicted queues on the GLDR and GDDR arms, the average predicted delays for vehicles on these arms lane are less than the 120 second cycle time. This indicates that the queue will disperse within each cycle period. The PRC value of 1.2% represents a vast increase compared with the 2008 analysis.

A high-level PM peak hour analysis was undertaken, using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction operated below practical capacity for the indicative PM peak hour flows, with any queuing that occurs discharging within one cycle period.

High Traffic Growth Scenario

The predicted traffic flows from the High Traffic Growth Scenario SATURN model run are used to test the traffic capacity of this junction. As with the Core Scenario, this junction was modelled as a signal-controlled crossroads using LinSig and a cycle time of 120 seconds was chosen.

The results of LinSig junction capacity analysis are summarised in Table 6.6, below:

Table 6.6 LinSig Results for Capacity Analysis of GDDR / GLDR Junction – High Traffic Growth Scenario AM Peak Hour with Development

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
1/1	GDDR West - Ahead / Left	0.833	30.8	51.2
1/2	GDDR West - Right	0.774	5.7	97.6
2/1	GLDR - Right / Ahead	0.843	36.8	45.0
2/2	GLDR - Left	0.119	1.9	11.8
3/1	GDDR East - Ahead	0.052	1.4	34.6
3/2	GDDR East - Left	0.241	2.6	3.9
3/3	GDDR East - Right	0.000	0.0	0.0
4/1	Development Access - All Movements	0.203	0.9	70.7
Cycle Time = 120 Seconds		**PRC = 6.7%**		

The results outlined in Table 6.6 indicate that the junction is predicted to operate below practical capacity during the AM Peak hour in the High Traffic Growth Scenario. The queues that are predicted to occur at the junction are shown to discharge within one cycle period.

The PRC of 6.7% represents an increase of 5.4%, compared with the 2008 analysis, with the same cycle time.

A high-level PM peak hour analysis was undertaken, using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction operated below practical capacity for the indicative PM peak hour flows, with a cycle time of 120 seconds required. Any queuing that occurred was predicted to discharge within one cycle period.

The LinSig analysis has indicated that the proposed signalised crossroads layout for the junction can adequately cater for the predicted Option 4 traffic flows. Nonetheless, it is acknowledged that this junction will be re-analysed, with accurately predicted development traffic flows, as part of a Traffic Impact Assessment for any proposed developments accessing onto the GDDR at this location.

6.4.4 Junction 3 - Golf Lane Roundabout

Golf Lane Roundabout is a four-arm junction and was modelled using ARCADY. The modelled junction layout is illustrated in Drawing JU-03, in Appendix A. In this case, the assumed long term solution consists of the existing Golf Lane roundabout remaining in operation with the GDDR added as an additional link and with the existing junction arrangement with Glenamuck Road East retained. For the purposes of the development of the Glenamuck LAP area this proposal is feasible due to the introduction of the proposed bus gate on Glenamuck Road East and the introduction of the proposed internal development led road links north of the GDDR. These provisions have the effect of reducing significantly the traffic assignment to this junction.

<u>Core Scenario</u>

The results of ARCADY junction capacity analysis for the Core Scenario are summarised in Table 6.7, below:

Table 6.7 ARCADY Results for Capacity Analysis of Golf Lane Roundabout – Core Scenario AM Peak Hour

Arm	RFC	Max Q (No. Of Veh.)	Delay (Min. / Veh.)
Glenamuck Road North	0.223	0.3	1.8
Golf Lane	0.178	0.2	4.8
Glenamuck Road South	0.380	0.6	3.6
GDDR	0.590	1.4	7.8

The results outlined in Table 6.7 indicate that the roundabout is predicted to operate below practical capacity during the AM Peak hour in the Core Scenario. Significant queuing and delays are not predicted to occur at the roundabout.

A high-level PM peak hour analysis was undertaken for the Core Scenario using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the roundabout operated below practical capacity for these indicative PM peak hour flows, with no significant queuing or delays occurring.

<u>High Traffic Growth Scenario</u>

The results of ARCADY junction capacity analysis for the High Traffic Growth Scenario are summarised in Table 6.8, below:

Table 6.8 ARCADY Results for Capacity Analysis of Enniskerry Road / GDDR Junction – High Traffic Growth Scenario AM Peak Hour

Arm	RFC	Max Q (No. Of Veh.)	Delay (Min. / Veh.)
Glenamuck Road North	0.228	0.3	1.8
Golf Lane	0.178	0.2	4.8
Glenamuck Road South	0.381	0.6	3.6
GDDR	0.577	1.3	7.8

The results outlined in Table 6.8 indicate that the roundabout is predicted to operate below practical capacity during the AM Peak hour in the High Traffic Growth Scenario. Significant queuing and delays are not predicted to occur at the roundabout.

A high-level PM peak hour analysis was undertaken using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the roundabout operated below practical capacity for these indicative PM peak hour flows, with no significant queuing or delays occurring.

6.4.5 Junction 4 – GLDR / Glenamuck Road Staggered Junction

The northern section of the proposed stagger junction will be signal-controlled. However, since the minor arm of this section of the junction (Glenamuck Road East) is designated as a bus gate in the Option 4 SATURN model, the junction will operate on a demand basis; with the straight-through movements receiving constant green until a turning stage is initiated by an approaching bus or an all-red stage is initiated by a pedestrian push-button.

Since a LinSig model cannot accurately model such an irregular signal sequence, the northern section of the stagger was modelled within LinSig as a priority-controlled junction. To replicate the effect of the delays that the activation of the bus gate / pedestrian stages will cause to other traffic, additional intergreen time was added to the southern section of the junction, as this is still modelled as a signal-controlled junction.

The southern section of the proposed stagger junction has been identified as a future access point to the lands immediately to the east. As such, the proposed immediate-term 'T' junction geometric layout and lane configuration for the southern stagger of the junction (as shown in drawing JU-04) has been designed to accommodate a future fourth arm (i.e. land/space is set aside for the accommodation of right turn lanes etc) as it is assumed that this junction will, at some point, be converted from a three-arm T-junction into a crossroads with the addition of the access road arm.

Core Scenario

The precise make-up of the future development of the lands immediately to the east of the junction is not known at this time. The predicted development flows from the Option 4 SATURN model run have been used to estimate future development flows and the southern section of the junction has been assessed to include future development traffic. The section of the junction was therefore modelled as a signal-controlled crossroads using LinSig, with a cycle time of 90 seconds chosen.

The results of LinSig junction capacity analysis are summarised in Tables 6.9 and 6.10, below:

Table 6.9 LinSig Results for Capacity Analysis of GLDR / Glenamuck Road East Northern Stagger – Core Scenario AM Peak Hour

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
1/1	GLDR North - Left Ahead	0.080	0.0	0.5
2/1	Glenamuck Road East - Right	0.000	0.0	0.0
2/2	Glenamuck Road East - Left	0.005	0.0	2.8
3/1	GLDR South – Ahead	0.293	0.2	0.6
3/2	GLDR South - Right	0.003	0.0	1.7

Table 6.10 LinSig Results for Capacity Analysis of GLDR / Glenamuck Road West Southern Stagger – Core Scenario AM Peak Hour

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
4/1	Development Access – Left / Ahead	0.017	0.1	37.8
4/2	Development Access – Right	0.025	0.1	64.6
5/1	GLDR South – Ahead / Right	0.660	11.1	30.2
5/2	GLDR South – Ahead / Left	0.664	11.1	30.4
6/1	Glenamuck Road West – Right	0.014	0.1	38.3
6/2	Glenamuck Road West – Ahead / Left	0.785	7.1	63.7
9/1	GLDR North – Left / Ahead	0.140	2.1	14.2
9/2	GLDR North – Ahead	0.147	2.1	14.7
9/3	GLDR North – Right	0.145	0.7	50.1
Cycle Time = 90 Seconds		**PRC = 14.7%**		

The results outlined in Tables 6.9 and 6.10 indicate that both sections of the staggered junction are predicted to operate below practical capacity during the AM Peak hour in the Core Scenario. Any queuing that occurs at either section of the junction disperses within one cycle period.

The PRC value obtained in the analysis represents an increase of 6.6% for the southern section, when compared to the analysis undertaken in 2008.

A high-level PM peak hour analysis was undertaken for the Core Scenario using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction operated below practical capacity for the indicative PM peak hour flows, with any queuing that occurs discharging within one cycle period.

High Traffic Growth Scenario

The results of LinSig junction capacity analysis are summarised in Tables 6.11 and 6.12, below:

Table 6.11 LinSig Results for Capacity Analysis of GLDR / Glenamuck Road East Northern Stagger – High Traffic Growth Scenario AM Peak Hour

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
1/1	GLDR North - Left Ahead	0.154	0.1	0.5
2/1	Glenamuck Road East - Right	0.000	0.0	0.0
2/2	Glenamuck Road East - Left	0.005	0.0	3.1
3/1	GLDR South – Ahead	0.296	0.2	0.6
3/2	GLDR South - Right	0.004	0.0	2.5

Table 6.12 LinSig Results for Capacity Analysis of GLDR / Glenamuck Road West Southern Stagger – High Traffic Growth Scenario AM Peak Hour

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
4/1	Development Access – Left / Ahead	0.025	0.2	39.2
4/2	Development Access – Right	0.025	0.1	64.6
5/1	GLDR South – Ahead / Right	0.662	11.4	29.5
5/2	GLDR South – Ahead / Left	0.666	11.5	29.7
6/1	Glenamuck Road West – Right	0.000	0.0	0.0
6/2	Glenamuck Road West – Ahead / Left	0.762	6.4	63.5
9/1	GLDR North – Left / Ahead	0.251	3.9	14.3
9/2	GLDR North – Ahead	0.258	4.0	15.2
9/3	GLDR North – Right	0.464	2.3	58.3
Cycle Time = 90 Seconds		**PRC = 18.1%**		

The results outlined in Tables 6.11 and 6.12 indicate that both sections of the staggered junction are predicted to operate below practical capacity during the AM Peak hour in the High Traffic Growth

Scenario. While there are some significant predicted queues on the GLDR South arm of the southern section of the stagger, the average predicted delay for vehicles on this arm is less than the overall cycle time for the junction, indicating that the queues will disperse within one cycle period.

A high-level PM peak hour analysis was undertaken for the High Traffic Growth Scenario, using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction operated below practical capacity for the indicative PM peak hour flows, with any queuing that occurs discharging within one cycle period.

6.4.6 Junction 5 – GLDR / Ballycorus Road

The proposed GLDR / Ballycorus Road junction is a four-arm signal-controlled crossroads and was modelled using LinSig. The modelled junction layout can be seen in Drawing JU-05, in Appendix A.

Core Scenario

A cycle time of 90 seconds was chosen. Pedestrian 'walk with traffic' signals are incorporated into the model.

The results of LinSig junction capacity analysis are summarised in Table 6.13, below.

Table 6.13 LinSig Results for Capacity Analysis of GLDR / Ballycorus Road Junction – Core Scenario AM Peak Hour

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
1/1	GLDR North – Ahead	0.166	2.2	19.4
1/2	GLDR North – Right	0.114	1.4	12.6
1/3	GLDR North – Left	0.236	1.5	8.7
2/1	Ballycorus Road East – Left / Ahead	0.446	3.8	42.6
2/2	Ballycorus Road East – Right	0.496	4.9	38.5
3/1	GLDR South – Right	0.062	0.7	11.7
3/2	GLDR South – Ahead / Left	0.701	12.5	28.8
4/1	Ballycorus Road West – Right	0.029	0.2	32.0
4/2	Ballycorus Road West – Ahead	0.303	2.4	39.7
4/3	Ballycorus Road West – Left	0.494	4.0	24.3
Cycle Time = 90 Seconds		**PRC = 28.5%**		

The results outlined in Table 6.13 indicate that the junction is predicted to operate below practical capacity during the AM Peak hour in the Core Scenario. While there are significant predicted queues on the GLDR South arm of the junction, the average predicted delay for vehicles on this arm is less than the overall cycle time for the junction, indicating that the queues will disperse within one cycle period. The PRC value of 28.5% represents an increase of 25.4%, compared to the 2006 analysis, albeit with a longer cycle time.

A high-level PM peak hour analysis was undertaken for the Core Scenario using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction operated below practical capacity for the indicative PM peak hour flows, with any queuing that occurs discharging within one cycle period.

High Traffic Growth Scenario

A cycle time of 90 seconds was chosen. Pedestrian 'walk with traffic' signals are incorporated into the model.

The results of LinSig junction capacity analysis are summarised in Table 6.14, below:

Table 6.14 LinSig Results for Capacity Analysis of GLDR / Ballycorus Road Junction – High Traffic Growth Scenario AM Peak Hour

Link	Arm – Movement	Deg. Sat.	MMQ (PCUs.)	Delay (Sec. / PCU)
1/1	GLDR North – Ahead	0.190	2.6	17.8
1/2	GLDR North – Right	0.067	0.8	10.7
1/3	GLDR North – Left	0.506	3.4	10.0
2/1	Ballycorus Road East – Left / Ahead	0.599	4.6	52.2
2/2	Ballycorus Road East – Right	0.686	6.7	50.7
3/1	GLDR South – Right	0.078	0.9	10.3
3/2	GLDR South – Ahead / Left	0.803	16.7	31.4
4/1	Ballycorus Road West – Right	0.045	0.3	36.4
4/2	Ballycorus Road West – Ahead	0.466	3.4	47.5
4/3	Ballycorus Road West – Left	0.362	2.7	24.4
Cycle Time = 90 Seconds		**PRC = 12.1%**		

The results outlined in Table 6.14 indicate that the junction is predicted to operate below practical capacity during the AM Peak hour in the High Traffic Growth Scenario. While there are significant predicted queues on the GLDR South arm of the junction, the average predicted delay for vehicles on this arm is less than the overall cycle time for the junction, indicating that the queues will disperse within one cycle period.

The PRC value obtained in the analysis represents an increase of 9% compared to the Core Scenario analysis.

A high-level PM peak hour analysis was undertaken for the High Traffic Growth Scenario using traffic flows synthesised by reversing the AM peak hour flows. This analysis indicated that the junction operated below practical capacity for the indicative PM peak hour flows, with any queuing that occurs discharging within one 90 second cycle period.

6.5 SUMMARY OF TRAFFIC ANALYSIS

Capacity analysis was undertaken at the five key junctions within the LAP area for both the Core Scenario and the High Traffic Growth Scenario, using the assigned traffic flows from the Option 4 SATURN model run.

High-level PM peak hour analyses were also undertaken for both scenarios, using traffic flows synthesised by reversing the AM peak hour flows.

Analysis was undertaken using ARCADY for roundabouts, PICADY for priority-controlled junctions and LinSig for signal-controlled junctions.

The GDDR / GLDR and GLDR / Glenamuck Road junctions were assessed with access arms to proposed adjacent development lands in place. Development flows were determined from the SATURN model outputs; however, it is proposed that these junctions be reassessed in the future when the type and scale of the local developments are more accurately defined.

The outcomes of the various capacity analyses at the various junctions are summarised in Table 6.15, below:

Table 6.15 Summary of Capacity Analysis Results

Junction	Core Scenario		High Traffic Growth Scenario	
	AM Peak	PM Peak	AM Peak	PM Peak
Enniskerry Road / GDDR	✘	✔	✘	✔
GDDR / GLDR	✔	✔	✔	✔
Golf Lane Roundabout	✔	✔	✔	✔
GLDR / Glenamuck Road	✔	✔	✔	✔
GLDR / Ballycorus Road	✔	✔	✔	✔

The Enniskerry Road / GDDR junction is predicted to operate above practical capacity in the AM peak hour in both scenarios. It is likely that this junction will need to be upgraded to signal-control.

All other junctions are predicted to operate below practical capacity during both peak hours for both the Core and High Traffic Growth Scenarios.

7 PUBLIC TRANSPORT & SLOW MODES

7.1 OVERVIEW

The proposed road infrastructure outlined in this report has been designed to cater for high levels of traffic flow. These traffic flows derived from the SATURN model are dependent on inherent assumptions about modal split based on the availability and proximity of public transport facilities within the LAP area (outlined in Section 3.4).

While the junction and link capacity analysis indicate that the proposed LAP road network will have adequate capacity to cater for the predicted traffic flows, failure to provide adequate public transport measures may lead to a much higher-than-planned private car modal share, which in turn could lead to congestion, queuing and delays on the LAP road network.

It is recommended that a primary objective of this LAP be to improve access to existing and proposed future public transport infrastructure through measures including bus priority and shuttle bus services to Luas. The design of the scheme has taken into account this future public transport provision in the Glenamuck Area by the provision for future bus prioritisation measures.

7.2 PUBLIC TRANSPORT PROVISION

Smarter Travel policy calls for the implementation of more radical bus priority measures as well as greater use of feeder bus services to and from Luas stations. In keeping with this policy, and to ensure that the modal split targets outlined in the traffic modelling exercise are realised, the design of the proposed road infrastructure has taken into account this future public transport provision in the LAP Area.

7.2.1 Junction Requirements

The junction requirements for the proposed LAP road infrastructure are complex. The complexities arise mainly from the need to provide strategically located junctions to meet traffic needs and the allocation of road space and infrastructure for future public transport provision (bus lanes and bus priority) and the provision of high quality pedestrian and cyclist infrastructure.

7.2.2 Bus Lanes/Bus Priority

The proposed LAP road infrastructure has been designed to accommodate future 3.0 to 3.5m wide bus lanes at the approaches to key junctions by the provision for future widening to accommodate these additional lanes. The bus priority measures would give buses priority at these key junctions facilitating reduced bus journey times and punctual and reliable bus services. Adequate space has been set aside to accommodate these facilities. The proposed junction and scheme layouts are shown in Drawings JU-01 to JU-05, in Appendix A.

This study has identified the need for bus services. These services are likely to be provided on existing roads, eg, Enniskerry Road and Glenamuck Road to serve the proposed developments. The transportation measures provide for the installation of two key bus gates. These will be bus only and will not permit the passage of general traffic. These bus gates are proposed on the southern end of Enniskerry Road which will permit busses travelling to and from Enniskerry to serve Kilternan. The other key bus gate will be located near the western end of Glenamuck Road East. This will be a key traffic management feature as well as a bus priority measure as the northern staggered junction at the GLDR will be closed to general traffic to/from Glenamuck Road East. The traffic light controls at the staggered junction will be configured to give priority to busses travelling on Glenamuck Road.

7.3 PEDESTRIAN AND CYCLIST INFRASTRUCTURE

The proposed LAP road infrastructure provides for both pedestrian and cyclist requirements. Each junction caters for the movements of both pedestrian and cyclists, with minimal delay (wait time) experienced by pedestrians at junctions.

Provision is made at each junction for pedestrian/cyclist crossing facilities in the form of signalised pedestrian crossings either with a full pedestrian/cyclist stage or as 'walk-with-traffic' signals. Refuge islands will be provided on all junctions except at Junction 1 (Enniskerry Road / GDDR). Continuous footpaths and cycle lanes are provided along both sides of the GDDR and GLDR. Minimum footpath and cycleway widths provided are to be 2.0m. These provisions at junctions are illustrated in Drawings JU-00 to JU-05, in Appendix A.

8 TRANSPORTATION INFRASTRUCTURE IMPLEMENTATION STRATEGY

8.1 LONG TERM FORECASTING

This review of the transportation needs of the Kiltiernan/Glenamuck Local Area Plan undertaken in this study is essentially a long term forecast of the likely transportation effects and associated testing of the adequacy of proposed infrastructure to cater for these effects. A notional design year of 2022 has been chosen for the analysis and the assumption is made that the full development of all zoned lands within the LAP will occur by 2020 (within the lifetime of this revised LAP). This is a highly unlikely scenario and in reality, full implementation of the LAP will probably be some decades hence.

The proposed roads infrastructure in terms of proposed road cross-section and capacity provisions (ie, number of lanes) required at each junction are in fact long term predicted requirements. Such enhancements of the capacity of the infrastructure are not likely to be required for a significantly long period of time and their implementation at the early stages of the development of the area would not be necessary to cater for the early stage traffic demands.

As the LAP area develops, there will be increasing demand for the implementation of the essential elements of the proposed roads and transportation infrastructure and a phased or staged delivery of the infrastructure is entirely plausible. Timing of the development of lands in conjunction with the development of the transport infrastructure will be essential to the ultimate success of the LAP.

8.2 MINIMUM ESSENTIAL (CORE) ROADS INFRASTRUCTURE

The Traffic Modelling Review of the transportation aspects of the Kiltiernan/Glenamuck LAP identifies the necessary road infrastructure required for the sustainable development of the whole area. Also identified is a need for a regional bus service and also a local feeder bus service to the LUAS stop at Ballyogan Wood.

In terms of the road infrastructure, the study suggests that an essential minimum provision of a new distributor road system will need to be provided for lands to be developed in a sensible and sustainable manner. This minimum essential (core) level of road infrastructure consists of (see Drawing No. PA0003 in Appendix B).

(a) GDDR (Glenamuck District Distributor Road - (primary link road)) - single carriageway from Enniskerry Road to Southern Roundabout at Carrickmines

(b) GLDR (Glenamuck Link Distributor Road – (primary link road)) - single carriageway from Enniskerry Road to GDDR

(c) Junction of GDDR and GLDR

(d) Staggered junction between GLDR and the existing Glenamuck Road

(e) Junction of GLDR and Ballycorus Road

(f) Junction of Enniskerry Road and GDDR

The provision of this core infrastructure will provide a sustainable minimum level of transportation to service the development of lands associated with the Kiltiernan/Glenamuck LAP area.

To facilitate the provision of this level of new road infrastructure at the locations shown on the plan drawings, it will also be necessary to include for the underground diversion of the existing ESB 220kV double circuit overhead cables between the GDDR and south of Ballycorus Road.

8.3 OTHER KEY TRANSPORT AND ASSOCIATED ELEMENTS

Other roads infrastructure, to be given consideration as the on-going development of lands in this part of South Dublin takes place includes:

- Golf Lane Roundabout Upgrade to multi-lane signalised junction
- Upgrade to existing access junction to The Park development
- Upgrade of the GDDR and GLDR junctions to multi-turning lane arrangements on a phased basis as development in the area progresses
- Development generated accesses and road links as illustrated in the TR001 and TR002
- Improvements to the existing Glenamuck Road including pedestrian footway improvements
- Junction Improvements, e.g. Glenamuck Road/Enniskerry Road
- Traffic signalisation elsewhere in LAP area
- Other specific road realignments within existing road infrastructure
- Bus services and local priority measures

8.4 PHASING OF DEVELOPMENT

The phasing of development and the implementation of both the core infrastructure and the other key transport elements will, in all likelihood progress as developments are proposed and planned by either individuals or groups of developers. The initial emphasis will need to be focused on the core road infrastructure elements and the implementation of this or parts of this that will provide adequate access to relevant land areas and distribution of development generated traffic.

It is envisaged that DLRCC will implement the construction of the core roads infrastructure in all or on a phased basis consistent with the development of lands in accordance with the provisions of the LAP.

8.5 IMPLEMENTATION STRATEGY

Giving consideration to the current economic situation in Ireland and the significant constraints currently in place it is proposed that the provision of transportation infrastructure be split between the (i) minimum core level of infrastructure and (ii) other/additional transportation needs which will accrue at some point in the future as and when the development of the lands progresses.

This minimum core infrastructure would consist of roads elements shown on Drawing no. PA0003. Also illustrated on this drawing is the area of land required to implement the minimum core roads infrastructure.

As time passes and the development of the LAP lands and other areas in the wider environs takes place, it is likely that other road infrastructure improvements, both within and outside of the LAP area boundary may become necessary. Within the LAP area, the core infrastructure would require upgrading. These improvements would include junction upgrades to multi-lane facilities as illustrated on Drawing PA0004, in Appendix B. These long term future improvements would need to be procured either as key elements of individual planning applications or by alternative funding sources.

The minimum lands required for the core infrastructure are shown on Drawing PA0003 as the red line. The lands bounded by the green line on Drawing PA0004 indicate the minimum lands required for the full longer-term implementation of the transport elements associated with the full development of the Kiltiernan/Glenamuck LAP. It is recommended that this green line boundary be protected in the LAP as a form of building set back line to ensure the lands can be retained for future road and junction improvement schemes. The acquisition of this additional land would not be necessary until such time as the need for the various supplementary upgrade schemes becomes clear.