Optimising Capacity

Kilbowie / Hardgate Implementation Plan

Report for West Dunbartonshire Council

November 2011

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Document Control

Project Title:	Kilbowie / Hardgate Implementation Plan
MVA Project Number:	C3990000
Document Type:	Report
Directory & File Name:	G:\Contracts\Contracts Live\C3990000_Kilbowie STAG Part 2\11. Supplementary Analysis\Implementation Plan V1.2.Doc

Document Approval

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Distribution

Issue	Date	Distribution	Comments
1	23/11/2011	Dougie McDonald	Internal Draft for Review
2	23/11/2011	West Dunbartonshire Council	Client Draft for Review

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Summary

Introduction

MVA was commissioned by West Dunbartonshire Council to undertake a STAG appraisal of the Kilbowie / Hardgate area of Clydebank. This work led to the identification of a preferred solution which involved construction of an amended Kilbowie Roundabout which included at-grade priority for east-west traffic on A82 Great Western Road (also known as a 'hamburger roundabout') and the relocation of the Duntocher Road / Great Western Road junction to the west of the roundabout as shown below.

An Implementation Plan was requested to assist West Dunbartonshire Council in the development of a cohesive programme of works to ensure the resolution of problems in the Kilbowie / Hardgate area over the short to medium term.

It serves two main functions which are to:

- assess the scope for measures that can be implemented in the short-term to improve operational performance of the network considering phased implementation of the preferred option from the STAG appraisal; and
- assess the longevity of the preferred option by reviewing forecast network performance 10 years after the assumed implementation date of 2013.

Short-term Measures

Three new options were considered in light of the potential requirement for phased implementation. The first involved amendments to the southbound lanes on Kilbowie Road approaching Kilbowie Roundabout as illustrated in the following figure.

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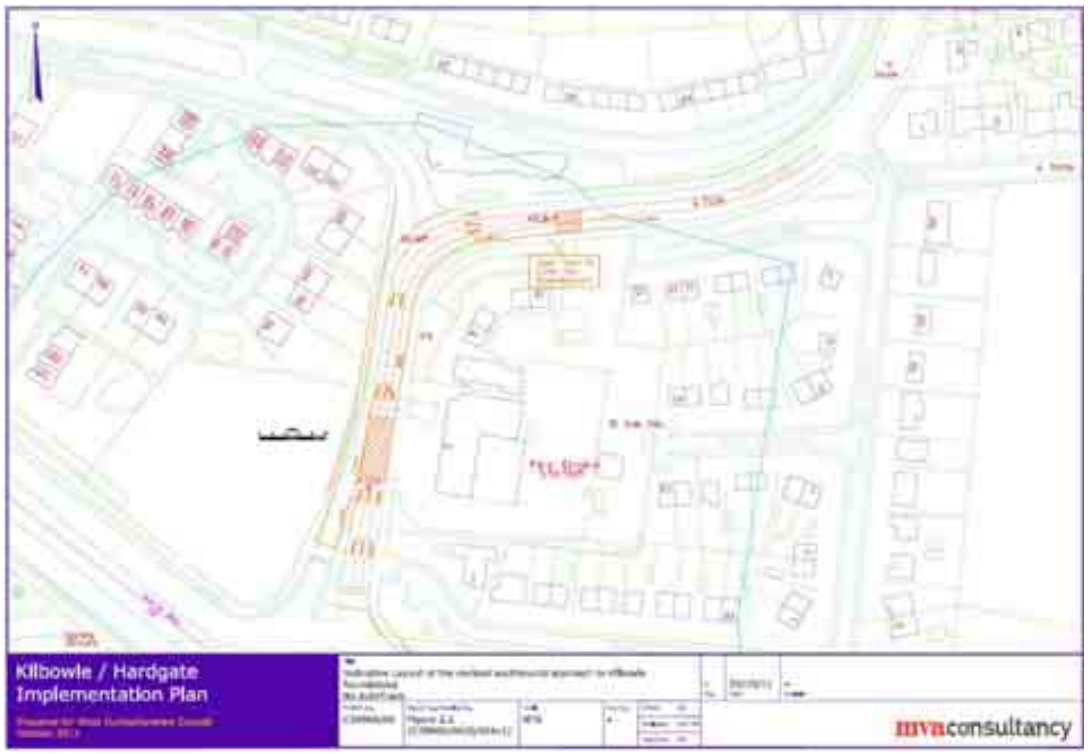


The second option would involve construction of the relocated Duntocher Road junction in advance of the hamburger roundabout as illustrated below.

The third solution combined both these interventions.

These three options along with two variants of the preferred option from the STAG appraisal were consequently assessed using an existing VISSIM micro-simulation model. The model test scenarios were defined as:

- **A**. Kilbowie Road amendments only;
- **B**. Duntocher Road relocation only;
- **C**. Duntocher Road relocation and Kilbowie Road amendments;
- **D**. Duntocher Road relocation and hamburger roundabout; and
- **E**. Duntocher Road relocation and hamburger roundabout (banned right turn from Great Western Road to Duntocher Road).

We concluded that Test D is the preferred solution on operational and environmental grounds. It remains that it should be maintained as the priority for implementation should sufficient funding be available to do so.

If insufficient funding is available to take forward this solution at this time then we found that there is merit in taking forward Test C as an interim measure. It offers benefits over Test B in that it displays a more beneficial impact on network performance and will deliver benefits for traffic on both Great Western Road and Kilbowie Road.

Test C also represents a useful 'stepping stone' towards the delivery of Test D in that it will provide the relocated Duntocher Road junction aspect of this scheme which would allow the hamburger roundabout to be implemented at a later date when funding becomes available.

Test A offers some benefits but these are predicted to be minor in line with the scale of the intervention. We have consequently concluded that it is likely to be more economical to implement this scheme as part of Test C where the costs will be a marginal increase relative to the construction of the relocated Duntocher Road junction.

Test E causes major problems in the AM peak and we recommend that it shouldn't be considered further.

Longevity of Options

Following the conclusions of the assessment of short-term measures we identified three options to be tested for the longer term, as follows:

- **C**. Duntocher Road relocation and Kilbowie Road amendments;
- **D**. Duntocher Road relocation and hamburger roundabout; and
- **F**. Duntocher Road relocation and hamburger roundabout with Kilbowie Road amendments.

All the tests have been assessed for a low growth and high growth scenario for the forecast year of 2023. The results have been compared with the 2013 Do Minimum scenario to enable an understanding of the relative performance of the network 10 years after implementation of the scheme to be developed.

We concluded from the analysis that Test F offers the greatest potential to continue to deliver an improved level of network performance 10 years after implementation of the

scheme. However, this is within the context of an already congested network and the findings would suggest that further intervention would be required at this stage to improve network performance should high levels of traffic growth be experienced.

It is clear that the network will struggle to cope with high growth and performance could deteriorate below the 2013 Do Minimum situation if this occurs. As such, there will be a likely need for additional interventions at this point to ensure the ongoing operational efficiency of the network.

In particular, there may be a need for measures at Hardgate Roundabout, especially if high traffic growth is experienced, as the modelling suggests that it will begin to act as a more significant pinch-point over time.

Recommendations for Delivery

Our key conclusions and recommendations for delivery are as follows:

Short Term (2011 – 2013)

Recommendations

1. The construction of a Hamburger Roundabout along with the relocation of the Duntocher Road junction at Kilbowie Roundabout remains the priority for implementation and should be taken forward just now if it can be delivered within available funding allocations.

2. If this solution is not deliverable, the relocation of Duntocher Road along with amendments to the southbound lanes on Kilbowie Road should be implemented as an interim measure with a view towards implementing the Hamburger Roundabout at the earliest possible opportunity.

Action: Select preferred option for implementation, prepare a work programme for delivery, develop a detailed design of the preferred option and assemble a funding package.

Long Term (2013 – 2023)

Recommendations

1. Network performance 10 years after implementation will be optimised by the implementation of the Hamburger Roundabout and Duntocher Road relocation along with amendments to the southbound lanes on Kilbowie Road. We consequently recommend that this intervention should be put in place at the earliest possible opportunity to ensure long-term network performance is as efficient as possible.

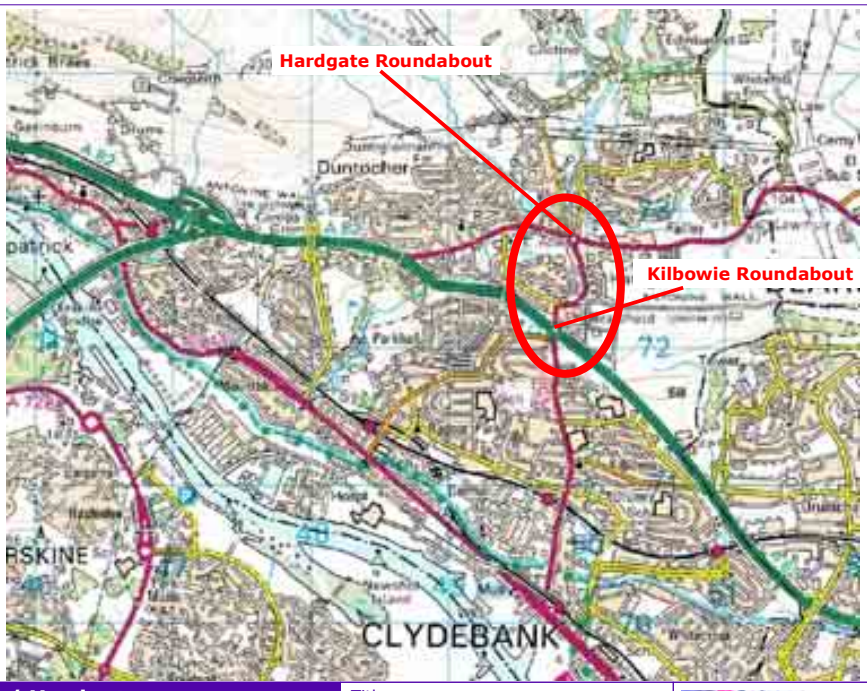
2. Even with this intervention in place there is nonetheless likely to be a need for further intervention by 2023 in order to maintain operational efficiency of the network, especially if high traffic growth conditions are experienced.

Action: Take forward STAG Part 2 appraisal of 'long-term' options originally identified through the initial appraisal with a view towards identifying and developing a suitable solution for implementation prior to 2023.

1 Introduction

1.1 Overview of Previous Work

1.1.1 MVA was commissioned by West Dunbartonshire Council to undertake a STAG appraisal of the Kilbowie / Hardgate area of Clydebank. This area is a focal point on the transport network being strategically located between Glasgow, Clydebank, Bearsden / Milngavie, the Erskine Bridge and Dumbarton. Conflicting traffic movements have led to problems of congestion, queuing and delays occurring around Hardgate Roundabout and Kilbowie Roundabout which are strategically located at the centre of this area as shown in Figure 1.1.



Kilbowie / Hardgate Implementation Plan
Prepared for West Dunbartonshire Council
October 2011

Title
Study Area

Ordnance Survey

Project No.
C3990000

Figure
1.1

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Figure 1.1 Study Area

1.1.2 Moreover, there was a perception that removal of tolls from the Erskine Bridge had led to increased traffic problems in this area. West Dunbartonshire Council therefore wanted to undertake a STAG appraisal to understand the cause of the problems in the area and to identify potential solutions for appraisal.

1.1.3 The STAG appraisal found that there were a number of options worthy of detailed STAG Part 2 appraisal which fell into the categories of 'short-term' and 'long-term' options. As problems were already being experienced on the ground we recommended that appraisal of the 'short-term' measures be taken forward as a priority to allow implementation of a suitable option to relieve the situation. We also recommended that the 'long-term' options be taken forward for detailed appraisal as well but that this work should follow that on the 'short-term' options. This approach was deemed to be both pragmatic and proportionate utilising the inherent

flexibility within STAG. In March 2011, we prepared a STAG report that set out the findings of our appraisal of the 'short-term' options for the Kilbowie / Hardgate area.

1.1.4 Our appraisal was undertaken in a manner which ensured consistency with all key policy documents including the Scottish Government's Purpose, National Transport Strategy, SPT's Regional Transport Strategy and West Dunbartonshire's Local Transport Strategy.

1.1.5 This work led to the identification of a preferred solution which involved construction of an amended Kilbowie Roundabout which included at-grade priority for east-west traffic on A82 Great Western Road (also known as a 'hamburger roundabout') and the relocation of the Duntocher Road / Great Western Road junction to the west of the roundabout. This option is illustrated in Figure 1.2 and is presented in detail in Appendix A.

Figure 1.2 Preferred Solution

1.1.6 West Dunbartonshire Council consequently re-commissioned MVA Consultancy to develop an Implementation Plan for the preferred solution.

1.2 Purpose of the Implementation Plan

1.2.1 The Implementation Plan was requested to assist West Dunbartonshire Council in the development of a cohesive programme of works to ensure the resolution of problems in the Kilbowie / Hardgate area over the short to medium term.

1.2.2 It serves two main functions which are:

- to assess the scope for measures that can be implemented in the short-term to improve operational performance of the network and to consider phased implementation of the preferred option from the STAG appraisal; and
- to assess the longevity of the preferred option by reviewing forecasted network performance 10 years after the assumed implementation date of 2013.

1.2.3 To undertake this work we have developed and refined outline designs for options and assessed their operational impact using the existing VISSIM micro-simulation model originally utilised for the STAG appraisal. This model was an updated sub-area model based upon the Clydebank Transport Model 2004. The forecast year was 2013 with a 2008 base year. All options were compared to a 2013 Do Minimum scenario to identify their impacts.

1.2.4 The following chapters set out the findings of this analysis and provide recommendations on taking forward measures for delivery.

2 Short-term Measures

2.1 Development of Short-term Measures

Kilbowie Road Southbound Lane Amendments

2.1.1 Through the STAG appraisal analysis and associated consultation it was identified that there is a particular capacity constraint on the southbound approach to Kilbowie Roundabout on Kilbowie Road. In particular, the introduction of a southbound bus lane between Hardgate Roundabout and Kilbowie Roundabout was perceived as having had a negative impact upon network performance in the vicinity. The existing road layout is shown in Figure 2.1.

Kilbowie / Hardgate Implementation Plan Prepared for West Dunbartonshire Council October 2011	Title **Kilbowie Road Existing Layout**		
	Project No. C3990000	Figure **2.1**	mvaconsultancy

Figure 2.1 Kilbowie Road Existing Layout

2.1.2 Due to high traffic volumes at peak periods the existence of the bus lane can inhibit the ability for general traffic to distribute into the appropriate lanes at the roundabout. As Kilbowie Roundabout is signalised this reduces the volumes able to cross the stop line during the green phase and contributes to congestion, queuing and delays on Kilbowie Road.

2.1.3 West Dunbartonshire Council has outlined a strong desire to maintain the existing bus lane but are also keen to review whether the road network layout can be amended to improve its overall performance. As such, we examined the scope to provide an additional southbound lane for general traffic on the approach to Kilbowie Roundabout to enable the bus lane to be maintained in its current format whilst providing additional capacity for vehicles weaving and merging into the appropriate lane before the signal stop line.

2.1.4 Our analysis identified that with minor realignment of the road there is scope for an additional lane to be provided. We have developed an outline design for this intervention as illustrated in Figure 2.2 and is presented in detail in Appendix A.

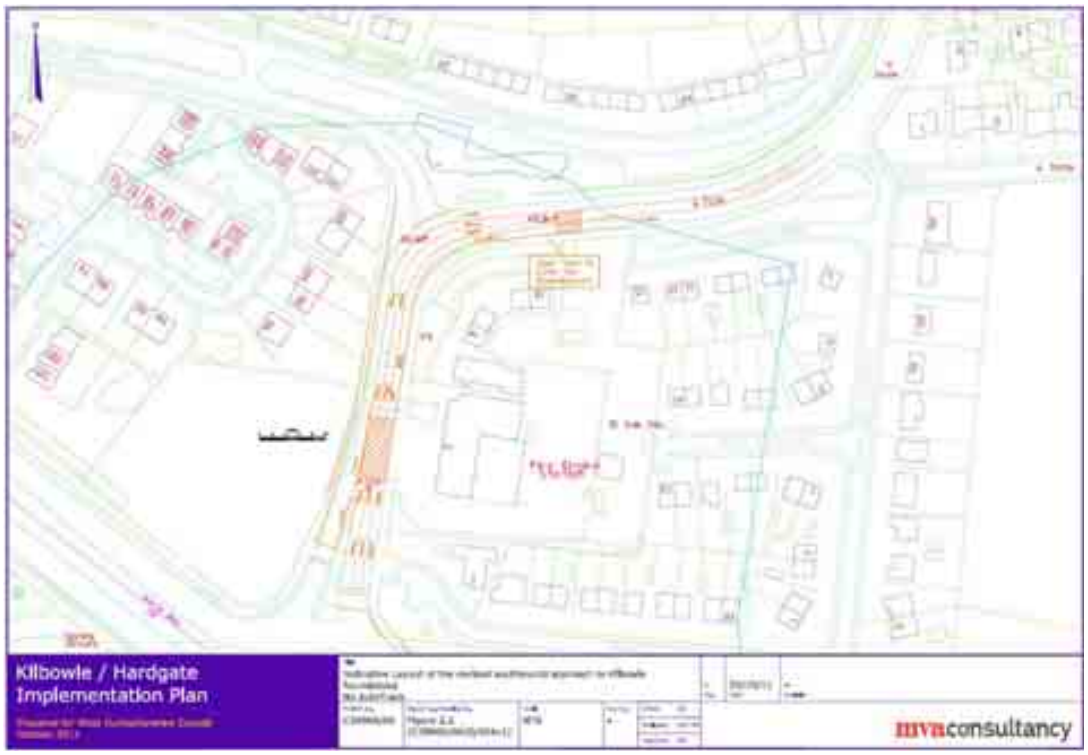


Figure 2.2 Kilbowie Road Southbound Lane Amendments

2.1.5 This has been designed to encourage traffic to distribute into the appropriate lane as they approach the bend to allow smooth transition into their desired lane at the Kilbowie Roundabout stop line. Right turning vehicles are signed into the offside lane whilst straight and left turners are signed into the new middle lane and the bus lane continues to occupy the nearside lane.

2.1.6 The lane widths and alignments have been designed to ensure all appropriate standards defined by the Design Manual for Roads and Bridges (DMRB) are complied with and that they are capable of accommodating the anticipated composition of traffic. Figure 2.3 shows the lane and footway widths at their narrowest point and this is set out in detail in Appendix A.

2.1.7 This realignment has been tested for the swept path of large vehicles using Autotrack. For the purposes of this assessment we used the largest standard vehicle available as means of a 'worst case scenario' test. The results are illustrated in Figure 2.4 which shows the northbound lane and middle lane southbound whilst Figure 2.5 shows the bus lane and offside lane southbound. Both drawings are shown in detail in Appendix A.

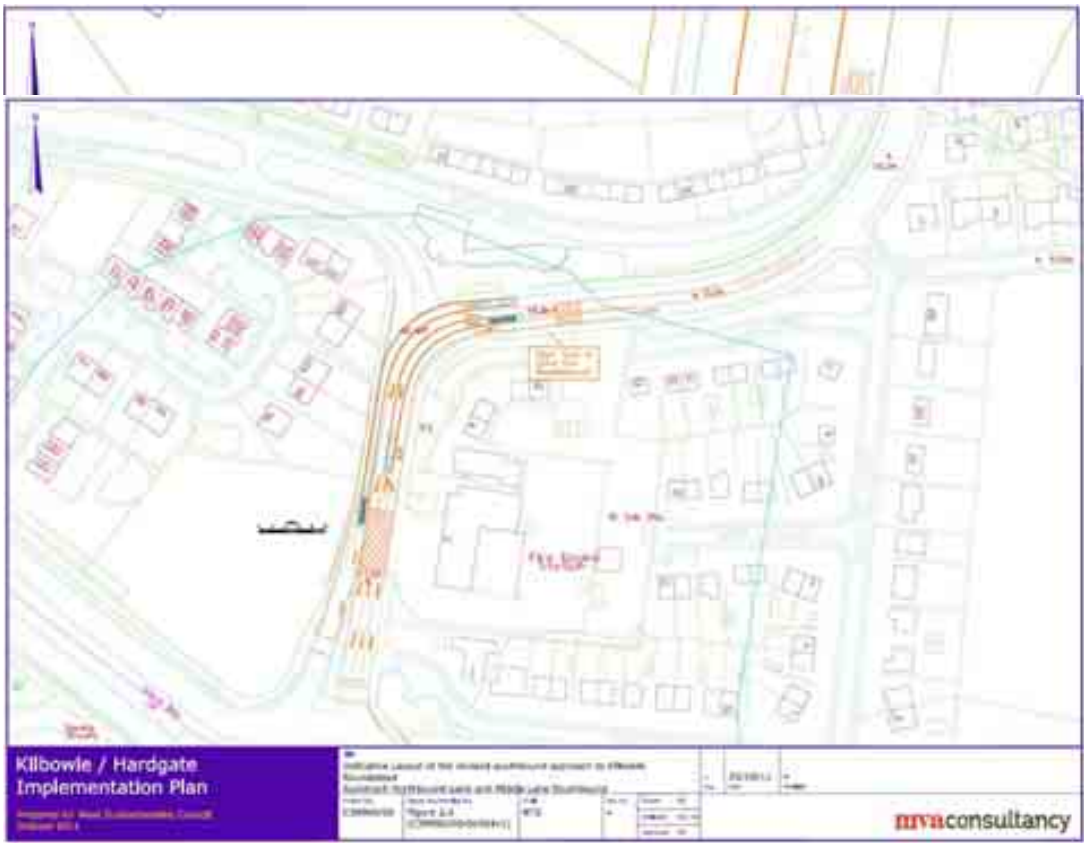


Figure 2.4 Kilbowie Road Realignment Swept Path Analysis 1

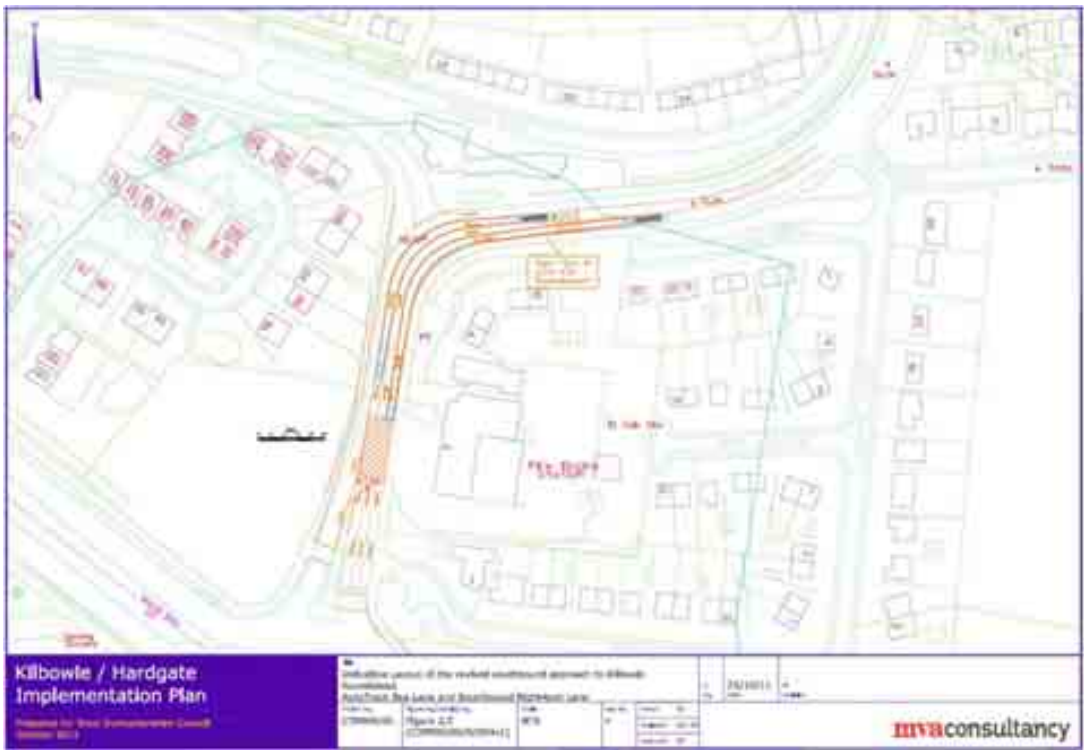


Figure 2.5 Kilbowie Road Realignment Swept Path Analysis 2

2.1.8 It can be seen that the alignment is capable of accommodating these vehicles although there is slight encroachment over the lane markings for southbound vehicles in each of the three lanes as they take the bend at the junction with Milton Douglas Road. This is most pronounced for vehicles in the bus lane. However, it is deemed that in practicality this is unlikely to present a safety issue as the encroachment is minimal and the likelihood of vehicles of this size using Kilbowie Road is minor. In addition, in the event that vehicles of this size do use Kilbowie Road, vehicles are unlikely to position themselves in an area where conflicts could occur.

2.1.9 On this basis, we concluded that the realignment of Kilbowie Road to provide an additional southbound lane is feasible and it was consequently taken forward for operational testing.

Phased Implementation of Preferred Option

2.1.10 West Dunbartonshire Council has outlined a desire to implement a solution at Kilbowie Roundabout at the earliest opportunity due to the nature and extent of the congestion, queuing and delays that are currently occurring. On this basis they asked us to consider the phased implementation of the preferred solution from the STAG appraisal.

2.1.11 Phased implementation would offer benefits in that it would require lower levels of capital expenditure at the one time and would enable payments to be spread over a number of years making the solution easier to deliver.

2.1.12 We consequently assessed the scope to phase implementation and concluded that this could be achieved by construction of the relocated Duntocher Road junction in advance of the 'hamburger roundabout'. An outline design for this intervention is shown in Figure 2.6 and is presented in detail in Appendix A.

Figure 2.6 Duntocher Road Relocation

2.1.13 This approach is deemed to be technically feasible and was consequently taken forward for operational testing.

Combined Option

2.1.14 Finally, we identified that West Dunbartonshire Council may wish to undertake the Duntocher Road relocation as part of the phased implementation of the preferred solution alongside the lane amendments on Kilbowie Road. As such, we have produced a composite design of these options as illustrated in Figure 2.7 which is presented in detail in Appendix A.

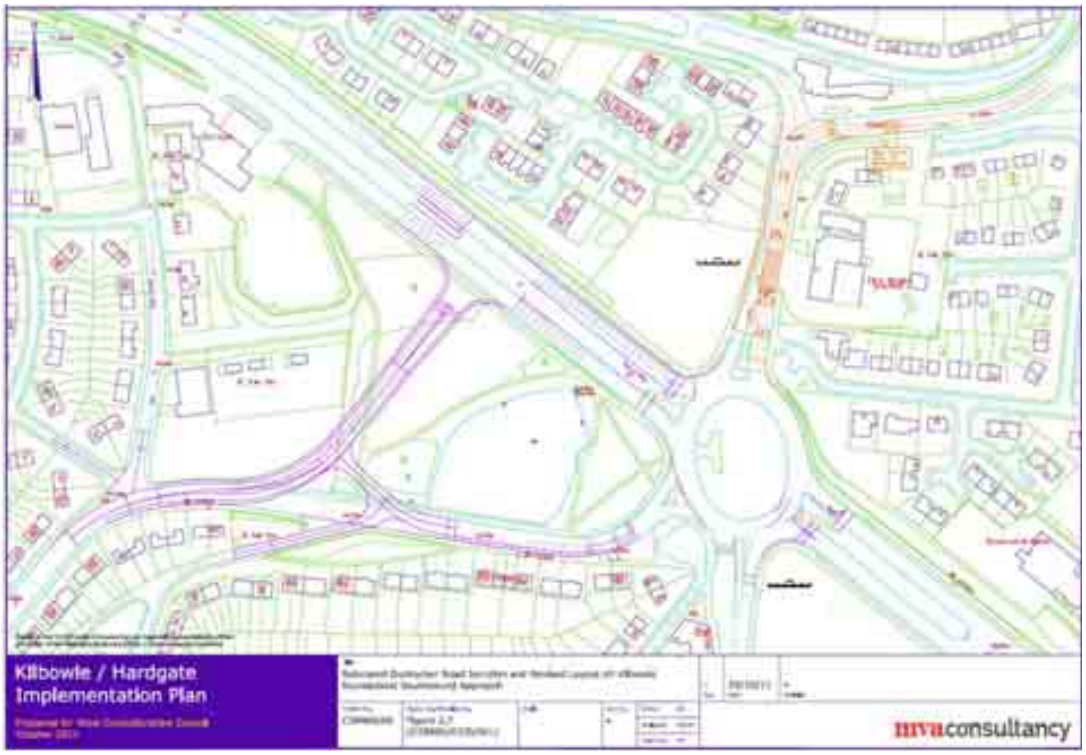


Figure 2.7 Duntocher Road Relocation and Kilbowie Road Lane Amendments

2.1.15 This option was taken forward for assessment of operational performance alongside each of its individual components.

2.2 Operational Appraisal

2.2.1 These options have been assessed for the operational impact on the network using the VISSIM micro-simulation model. As these have been identified as short-term measures they have been assessed for a forecast year of 2013 and compared with a 2013 Do Minimum scenario.

2.2.2 The model test scenarios have been defined as follows:

- **A**. Kilbowie Road amendments only;
- **B**. Duntocher Road relocation only;
- **C**. Duntocher Road relocation and Kilbowie Road amendments;

- **D**. Duntocher Road relocation and hamburger roundabout; and
- **E**. Duntocher Road relocation and hamburger roundabout (banned right turn).

2.2.3 Test D represents the preferred option from the STAG appraisal whilst Test E is variation of this option where right turns are banned from Great Western Road to Duntocher Road to assess if this is likely to have a beneficial impact upon network performance.

2.2.4 The following sections set out the findings of the operational appraisal.

Journey Times

2.2.5 We assessed journey times on key routes through the Kilbowie / Hardgate area. Route A traces the route between the Erskine Bridge and the Bearsden area. Figure 2.8 shows a comparison of journey times on this route in the AM peak.

Legend

A – Erskine Bridge

B – A82 / A810

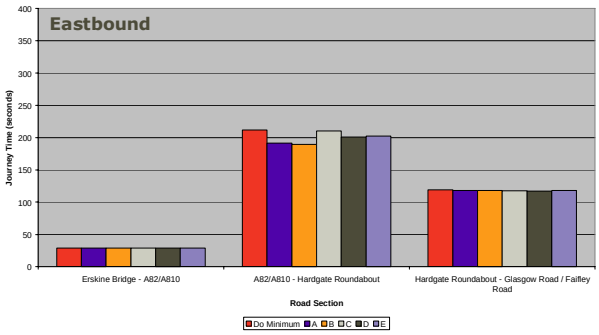
C – Hardgate Roundabout

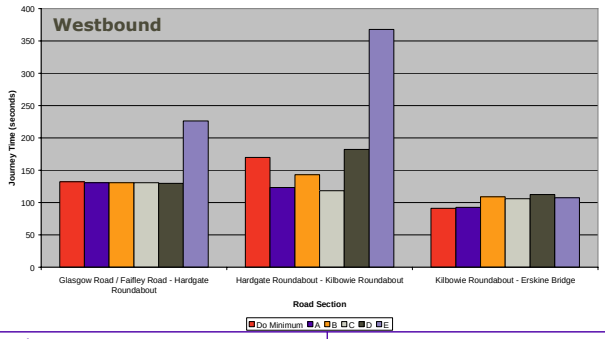
D – Glasgow Road / Faifley Road

E – Kilbowie Roundabout

Eastbound

Westbound





Kilbowie / Hardgate Implementation Plan
Prepared for West Dunbartonshire Council
October 2011

Title
AM Route A Journey Times

Project No.
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Figure
2.8

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Figure 2.8 AM Route A Journey Times

2.2.6 In the eastbound direction the most noticeable difference is between the A82 / A810 junction and Hardgate Roundabout. Here Test A and B offer the greatest benefits whilst all scenarios offer a reduction in overall journey time in comparison to the Do Minimum scenario.

2.2.7 In the westbound direction it is noticeable that Test E has a significant adverse affect on journey times between Glasgow Road / Faifley Road and Kilbowie Roundabout. This is caused by increased flows on the circulatory at Kilbowie Roundabout which has a knock-on effect on the ability for southbound traffic on Kilbowie Road to join Kilbowie Roundabout. The best

performing tests are A and C where the additional lane on Kilbowie Road helps to reduce journey times on this section. Test D leads to a slight increase in journey times as there is improved provision for traffic on Great Western Road which has a small adverse impact on southbound traffic on Kilbowie Road.

2.2.8 Route B represents the through route on Great Western Road between the Erskine Bridge and Drumry Roundabout. Figure 2.9 shows a comparison of journey times on this route in the AM peak.

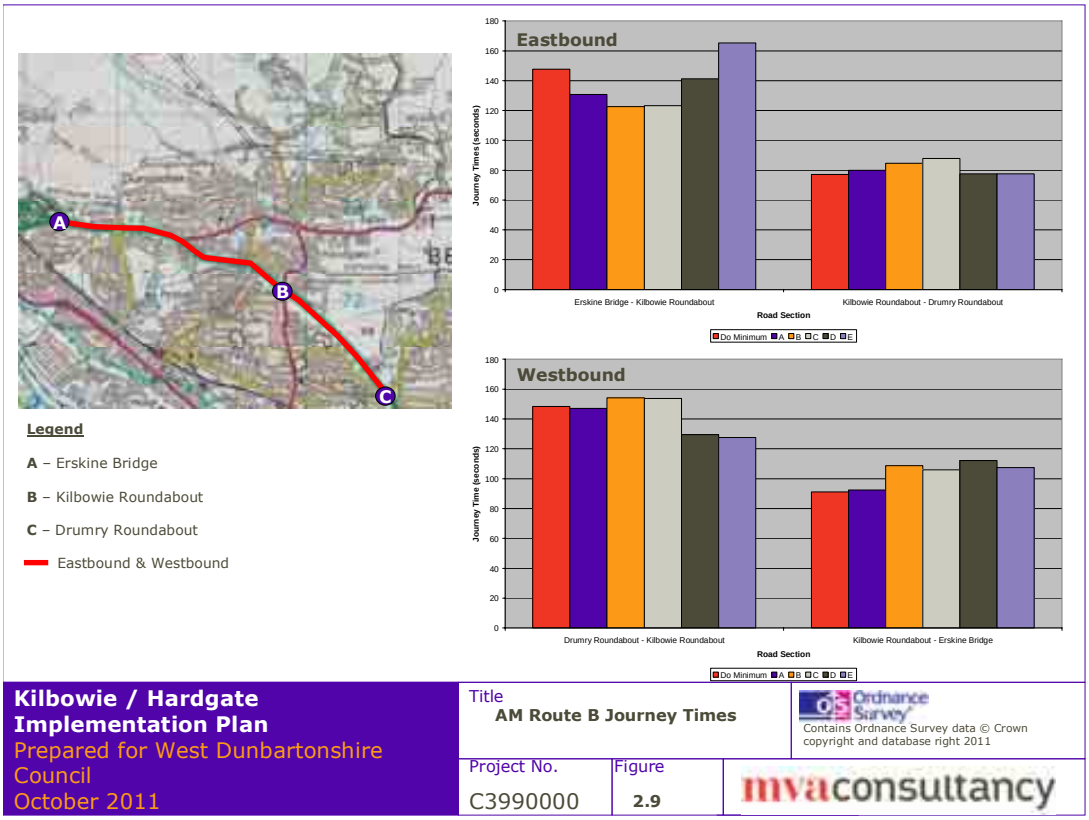

Figure 2.9 AM Route B Journey Times

2.2.9 Eastbound journey times are improved under all test scenarios with the exception of Test E where the additional traffic using Kilbowie Roundabout causes delays to through traffic on Great Western Road. The improved provision for traffic on Kilbowie Road delivered in Test A slightly increases the journey time between Kilbowie Roundabout and Drumry Roundabout whereas this impact is slightly more pronounced in Test B due to the delay caused by an additional junction on Great Western Road. Test C compounds these impacts leading to a slightly larger increase on journey time over this section. However, the reductions in journey time between the Erskine Bridge and Kilbowie Roundabout outweigh the increase between Kilbowie Roundabout and Drumry Roundabout in Tests A, B and C creating a positive impact overall.

2.2.10 In the westbound direction, only Test E offers a reduction in journey time in comparison to the Do Minimum. However, this is achieved at the expense of a significant increase in journey times for eastbound traffic. Tests A and D offers a comparable journey time to the Do Minimum whilst B and C increase journey times as a new junction on Great Western Road is introduced.

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2.2.11 A summary of the total journey times in each direction in the AM peak is shown in Figure 2.10.

2.2.12 Tests A, B and C all have total journey times less than the Do Minimum on three out of the four routes whilst Tests D and E have two journey times that are less and two that are more than the Do Minimum.

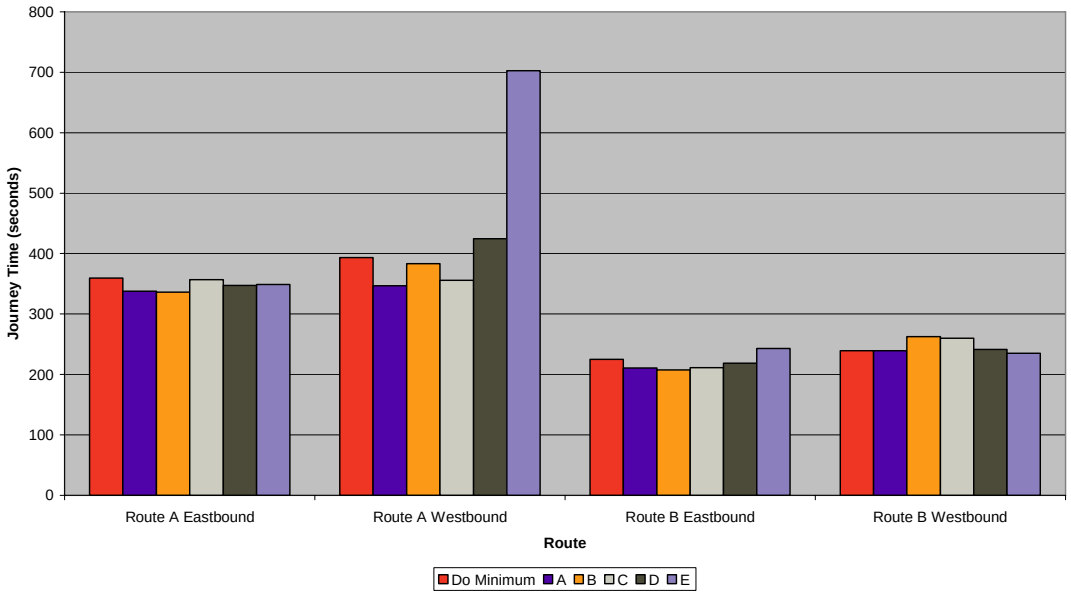


Figure 2.10 AM Total Journey Times

2.2.13 Test A creates the largest net saving in journey time across these routes in comparison to the Do Minimum followed by Tests C and B respectively. Test D leads to a small net increase in journey times on these routes whilst there is a substantial increase created by Test E due to the affect it has on Route A westbound.

2.2.14 Figure 2.11 shows analysis of journey times on Route A in the PM peak.

Legend

A – Erskine Bridge

B – A82 / A810

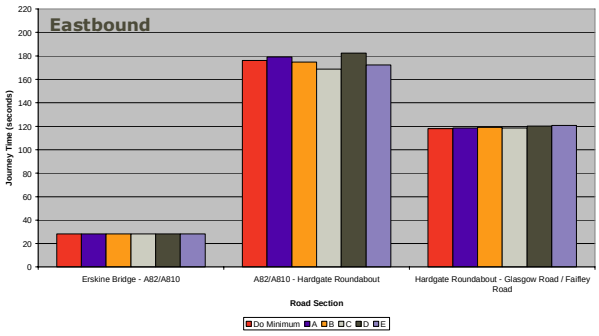
C – Hardgate Roundabout

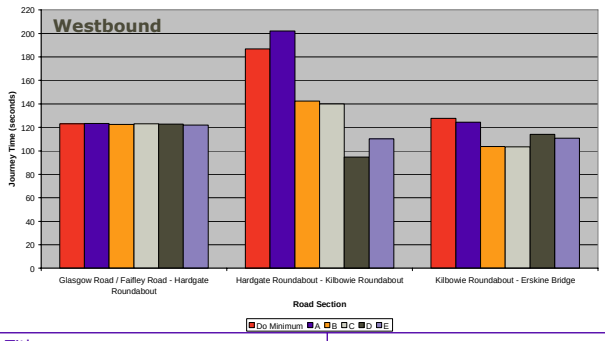
D – Glasgow Road / Faifley Road

E – Kilbowie Roundabout

Eastbound

Westbound





Kilbowie / Hardgate Implementation Plan
Prepared for West Dunbartonshire Council
October 2011

Title
PM Route A Journey Times

Project No.
C3990000

Figure
2.11

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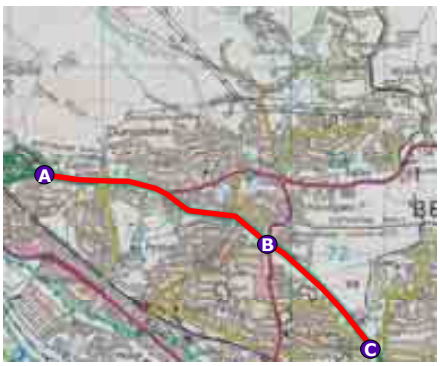
Figure 2.11 PM Route A Journey Times

2.2.15 Eastbound journey times are fairly consistent across tests with Tests C and E showing a marginal reduction in comparison to the Do Minimum journey time. Tests A and D lead to a slight increase in journey time whilst Test B maintains a consistent time with the Do Minimum.

2.2.16 Westbound journey times vary the most between tests on the section between Hardgate Roundabout and Kilbowie Roundabout. The greatest reduction in journey time is achieved by Test D followed by Test E whereas Tests B and C both have a similar impact on journey times in relation to the Do Minimum. Test A leads to a slight increase in comparison to the Do Minimum journey time.

2.2.17 Figure 2.12 shows journey times on Route B in the PM peak.



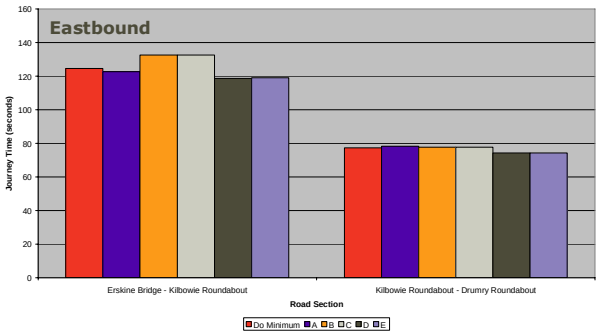
Legend

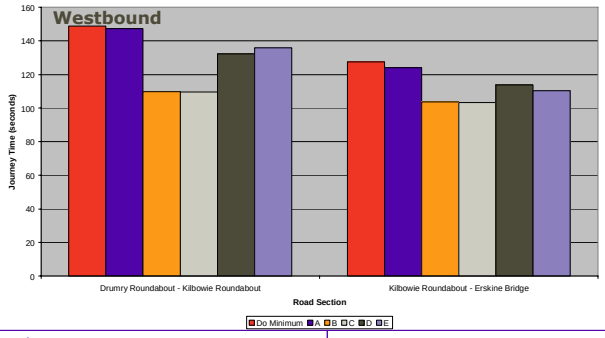
A – Erskine Bridge

B – Kilbowie Roundabout

C – Drumry Roundabout

Eastbound & Westbound





Kilbowie / Hardgate Implementation Plan
Prepared for West Dunbartonshire Council
October 2011

Title
PM Route B Journey Times

Project No.
C3990000

Figure
2.12

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Figure 2.12 PM Route B Journey Times

2.2.18 In the eastbound direction Test D and E have a positive impact on journey times relative to the Do Minimum. Tests B and C create an additional junction on Great Western Road leading to a slight increase in journey times on Great Western Road. Test A has a negligible impact upon journey times.

2.2.19 All tests lead to a reduction in westbound journey times in comparison to the Do Minimum. The greatest reduction is achieved by Tests B and C whilst Test A has the smallest impact.

2.2.20 A summary of the total journey times in each direction in the PM peak is shown in Figure 2.13.

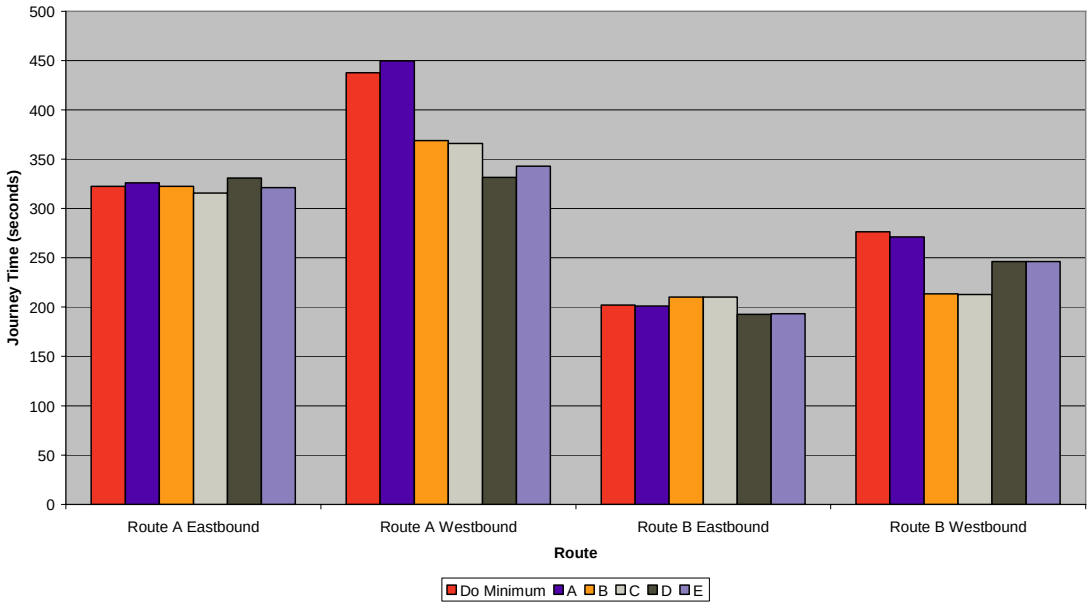


Figure 2.13 PM Total Journey Times

2.2.21 Tests B, C, D and E all create a similar net saving in journey times across the four routes in comparison to the Do Minimum. Test A has the least impact on PM peak journey times on these routes creating a very small net increase relative to the Do Minimum.

Queues

2.2.22 Modelled queues at Hardgate Roundabout and Kilbowie Roundabout have been assessed to identify the difference between the tests and Do Minimum scenario.

2.2.23 Figure 2.14 shows the average queue lengths at Hardgate Roundabout in the AM peak.

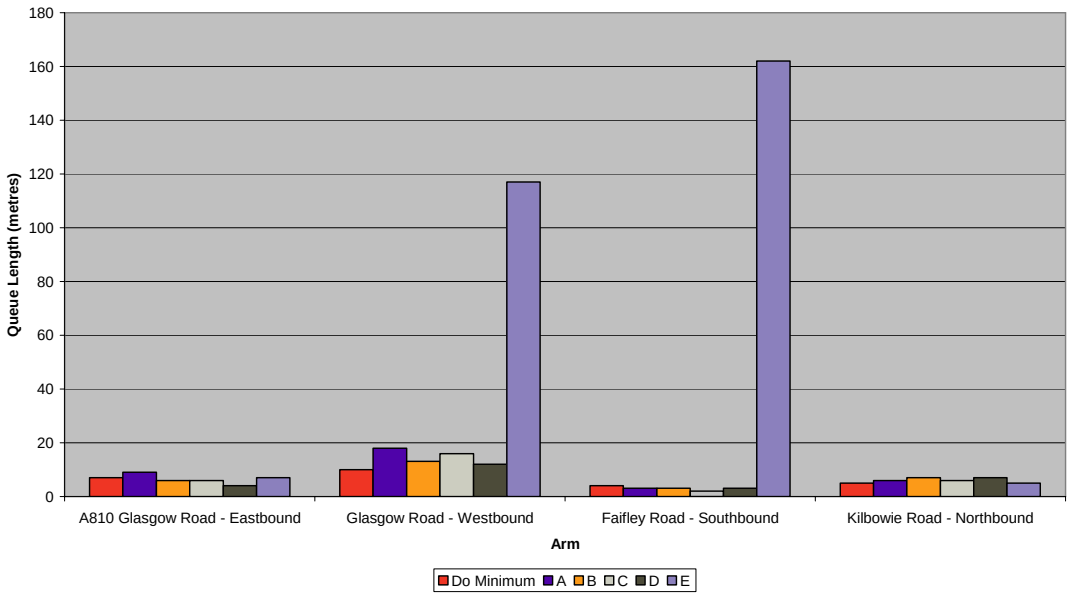


Figure 2.14 AM Average Queue Lengths – Hardgate Roundabout

2.2.24 All tests have a minimal impact on queuing at Hardgate Roundabout in the AM peak with the exception of Test E which has a significant adverse affect on queues on Glasgow Road westbound and Faifley Road. This is caused by blocking back from Kilbowie Roundabout created by the additional circulatory traffic as a result of the banned right turn onto Duntocher Road.

2.2.25 Figure 2.15 shows average queue lengths at Kilbowie Roundabout in the AM peak.

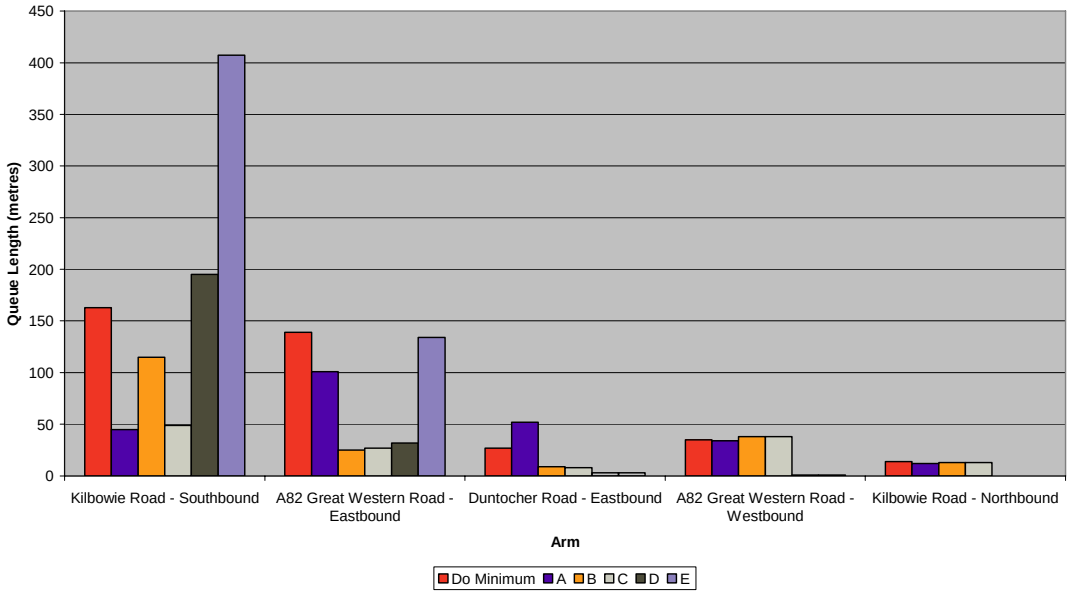


Figure 2.15 AM Average Queue Lengths – Kilbowie Roundabout

2.2.26 It can be seen that Test E has a negative impact on queues on Kilbowie Road southbound which is consistent with the problems observed at Hardgate Roundabout. Test D creates a slight increase in queuing on Kilbowie Road southbound but has a significant beneficial impact on queuing on Great Western Road, Duntocher Road and Kilbowie Road northbound. Test A significantly reduces queues on Kilbowie Road southbound whilst Test B offers a large reduction in queuing on Great Western Road eastbound and Duntocher Road. Test C combines these impacts creating a large reduction against the Do Minimum on all three arms.

2.2.27 Figure 2.16 shows average queue lengths at Hardgate Roundabout in the PM peak.

2.2.28 Test C has the largest beneficial impact on queuing at Hardgate Roundabout in the PM peak with a noticeable reduction in the queue length on Glasgow Road eastbound in particular. Tests A, B and E also have a beneficial impact on overall levels of queuing whilst Test D has a negligible impact relative to the Do Minimum.

2.2.29 It is noticeable that levels of queuing at Hardgate Roundabout are considerably higher in the PM peak than they are in the AM peak across all scenarios with the exception of Test E.

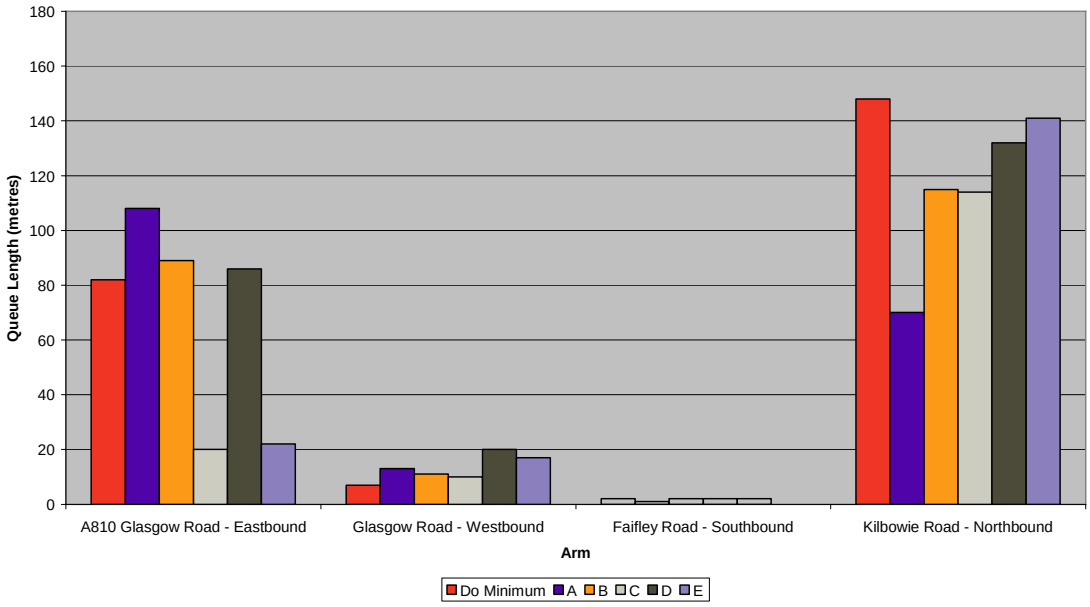


Figure 2.16 PM Average Queue Lengths – Hardgate Roundabout

2.2.30 Figure 2.17 shows average queue lengths at Kilbowie Roundabout in the PM peak.

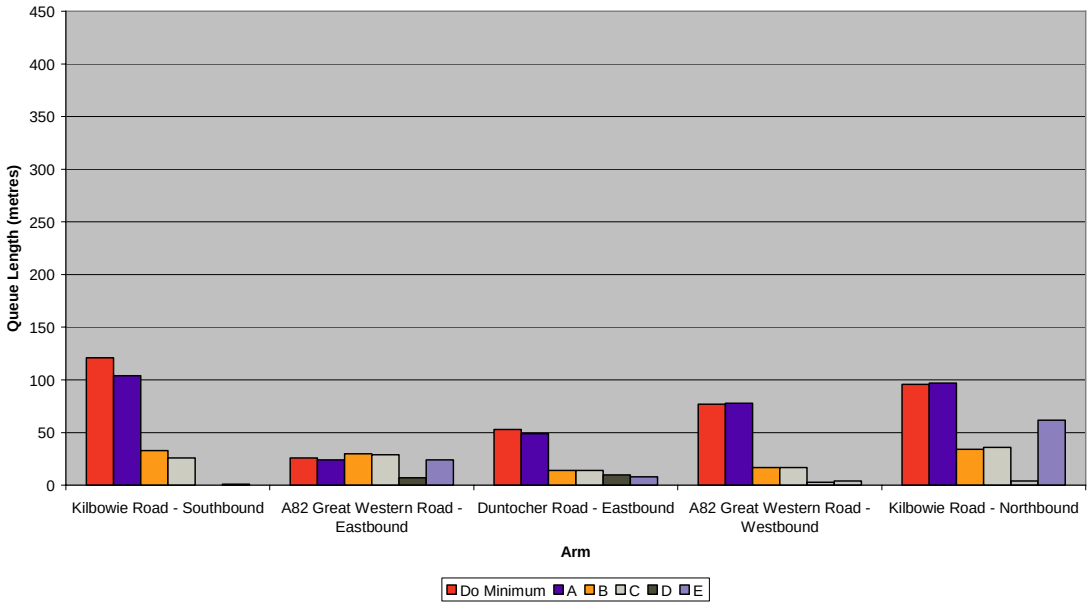


Figure 2.17 PM Average Queue Lengths – Kilbowie Roundabout

2.2.31 All tests reduce overall queuing at Kilbowie Roundabout in comparison to the Do Minimum although Test A has a much smaller impact than the others. The largest total reduction in queuing is created by Test D whilst Tests B, C and E all create a smaller but similar reduction in total levels of queuing. Test D and E can be seen to practically eliminate queuing on Kilbowie Road southbound. Overall, it can be seen that levels of queuing in the PM peak are considerably lower across all scenarios than in the AM peak.

Network Performance

2.2.32 Analysis of key network statistics has been undertaken to understand the overall network performance of the tests relative to the Do Minimum scenario.

2.2.33 Figure 2.18 shows average speed for all vehicles by time period.

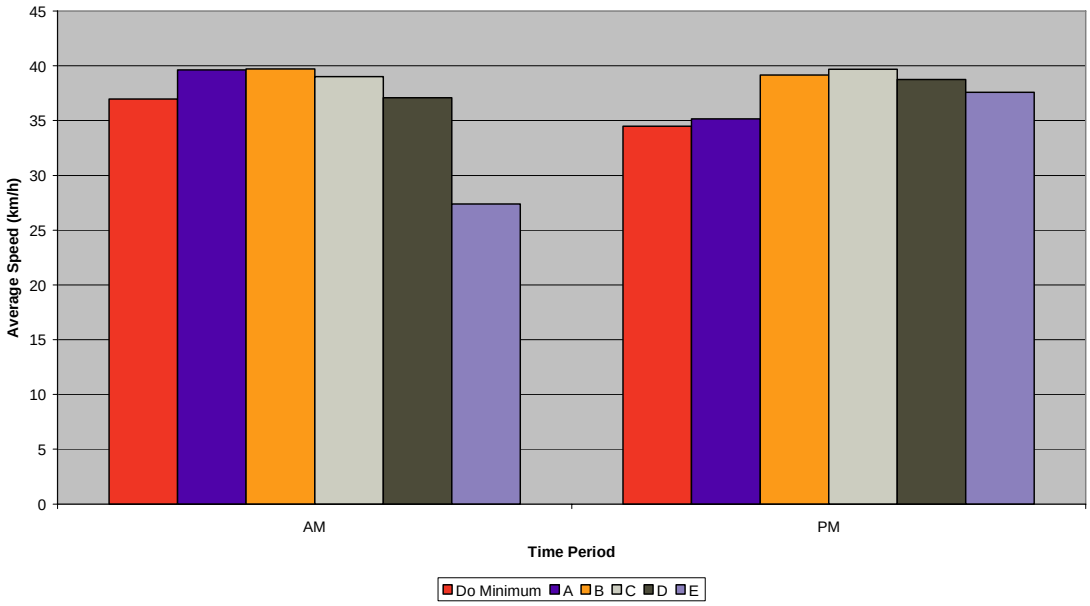


Figure 2.18 Average Speed – All Vehicles

2.2.34 In the AM peak it can be seen that average speeds increase under Tests A, B and C whilst they remain constant under Test D. Consistent with the problems observed in the journey time and queue analysis, Test E leads to a large reduction in average speed per vehicle.

2.2.35 All tests lead to an increase in average speed on the network in the PM peak. The largest increase is created by Test C whilst Test A offers the smallest increase.

2.2.36 Figure 2.19 shows average total delay per vehicle by time period.

2.2.37 It can be seen that Test E leads to a substantial increase in average total delay per vehicle in the AM peak. Tests A, B and C lead to a sizeable reduction in delay in the AM peak whilst Test D also offers a slight improvement over the Do Minimum scenario.

2.2.38 In the PM peak all tests create a reduction in average delay per vehicle relative to the Do Minimum with the most substantial reduction achieved by Test D. The smallest impact is delivered by Test A with only a marginal improvement in average delay compared to the Do Minimum.

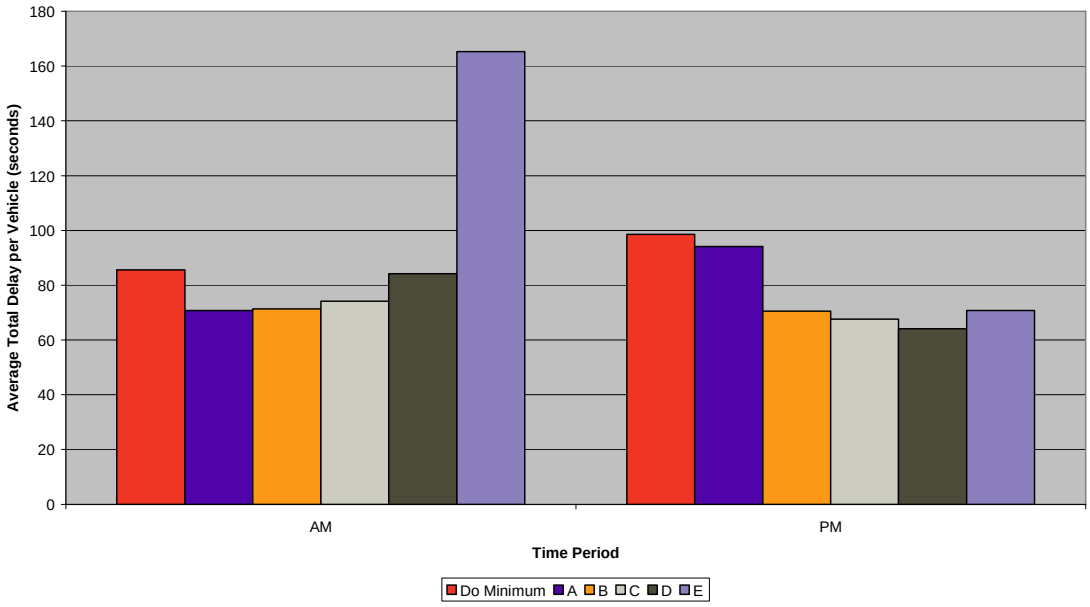


Figure 2.19 Average Total Delay per Vehicle

Conclusions of Operational Appraisal

2.2.39 Overall, the most consistently best performing scenario is Test D (Duntocher Road relocation and hamburger roundabout) which confirms the findings of the STAG appraisal.

2.2.40 Whilst Test E (Duntocher Road relocation and hamburger roundabout - banned right turn) offers some benefits it also creates significant adverse impacts in the AM peak period.

2.2.41 Tests A, B and C all offer benefits over the Do Minimum scenario with Test C (Duntocher Road relocation and Kilbowie Road amendments) slightly outperforming the other two tests. Test A (Kilbowie Road amendments only) offers minor improvements compared to the Do Minimum but this is to be expected given the scale of the intervention. Test B (Duntocher Road relocation only) outperforms Test A but does not offer the overall network benefits that Test C does.

2.3 Emissions Appraisal

Global Air Quality

2.3.1 The total change in Carbon Dioxide (CO_2) equivalent has been calculated based upon outputs from the micro-simulation model. The forecasted absolute and monetised change, discounted over a 60 year appraisal period, in global emissions for each option relative to the Do Minimum scenario is summarised in Table 2.1.

Table 2.1 Carbon Dioxide Equivalent Emission Impacts

	Do Min	A	B	C	D	E
CO_{2e} (tonnes/year)	7,705	7,696	7,551	7,557	7,032	7,274
Discounted value over 60 years (£k, 2002 prices)	5,980	5,973	5,860	5,864	5,458	5,645
Difference from Do Minimum (£k, 2002 prices)		-7	-120	-115	-522	-335
% Difference from Do Minimum		-0.1	-2	-2	-9	-6

2.3.2 All options offer a reduction in CO_2 equivalent emissions relative to the Do Minimum although this is marginal in the case of Test A. The largest benefit is forecasted from Test D.

Local Air Quality

2.3.3 As per the STAG appraisal, the key area affected by the proposals is the Kilbowie / Hardgate area and we have carried out an assessment of local emissions in the vicinity. Our previous analysis suggested that there are around 2,600 households within 50m either side of the affected road network which is equivalent to a population of around 6,000 people. The predicted emissions affecting this area are shown in Table 2.2.

Table 2.2 Local Emissions Impacts

	Do Min	A	B	C	D	E
PM_{10} (kg/year)	498	497	488	488	455	472
Difference from Do Minimum		-1	-10	-10	-43	-26
% Difference from Do Minimum		-0.2	-2	-2	-9	-5
NOx (kg/year)	13,475	13,530	13,344	13,281	12,444	12,731
Difference from Do Minimum		55	-131	-194	-1,031	-744
% Difference from Do Minimum		0.4	-1	-1	-8	-6

2.3.4 It can be seen that all options will lead to a reduction in PM_{10} with Test D delivering the greatest benefit. All options also lead to a reduction in NOx with the exception of Test A with Test D again creating the largest benefit.

2.4 Indicative Costs

2.4.1 The estimated construction costs of the options in both 2011 and 2002 prices, with and without optimism bias at 44%, are set out in Table 2.3.

Table 2.3 Estimated Construction Costs (£k)

Option	2011 Construction Cost	2011 Construction Cost + Optimism Bias	2002 Construction Cost	2002 Construction Cost + Optimism Bias
A. Kilbowie Road amendments only	£91k	£131k	£72k	£103k
B. Duntocher Road relocation only	£943k	£1,358k	£743k	£1,070k
C. Duntocher Road relocation and Kilbowie Road amendments	£1,034k	£1,490k	£815k	£1,174k
D/E. Duntocher Road relocation and hamburger roundabout[1]	£1,519k	£2,188k	£1,197k	£1,724k

1. The marginal costs of banning the right turn movement in Test E are assumed to be negligible in the context of the wider scheme implementation

2.4.2 It should be noted that these costs **do not** provide any allocation for public utility diversions or land acquisition costs.

2.5 Conclusions

2.5.1 We have concluded that Test D (Hamburger Roundabout and Duntocher Road relocation) is the preferred solution on operational and environmental grounds. It remains then that it should be maintained as the priority for implementation should sufficient funding be available to do so.

2.5.2 In the event that insufficient funding is available to take forward this solution at this time then we have identified that there is merit in taking forward Test C (Duntocher Road relocation and Kilbowie Road amendments) as an interim measure. It is deemed to offer benefits over Test B (Duntocher Road relocation only) in that it displays a more beneficial impact on network performance and will deliver benefits for traffic on both Great Western Road and Kilbowie Road rather than favouring one over the other.

2.5.3 Test C also represents a useful 'stepping stone' towards the delivery of Test D in that it will provide the relocated Duntocher Road junction aspect of this scheme which would allow the hamburger roundabout to be implemented at a later date when funding becomes available.

2.5.4 Test A (Kilbowie Road amendments only) offers some benefits but these are predicted to be minor in line with the scale of the intervention. We have consequently concluded that it is likely to be more economical to implement this scheme as part of Test C where the costs will be a marginal increase relative to the construction of the relocated Duntocher Road junction.

2.5.5 Test E (Duntocher Road relocation and hamburger roundabout - banned right turn) causes major problems in the AM peak and we recommend that it shouldn't be considered further.

3 Longevity of Options

3.1 Overview

3.1.1 Following the completion of the Kilbowie / Hardgate STAG appraisal it was identified that there would be merit in undertaking supplementary analysis to test the potential longevity of the preferred option through assessment of anticipated network performance 10 years post implementation.

3.1.2 A VISSIM micro-simulation model was used to assess options with a modelled 2013 forecast year of opening. As such, there is a need to develop a 2023 forecast year scenario to assess network performance in relation to 2013.

3.2 Development of 2023 Growth Factors

3.2.1 The existing Kilbowie Transport Model has a base year of 2008 and forecast year of 2013 which was determined as being appropriate for the purposes of the STAG appraisal.

3.2.2 In developing the 2013 forecast year, no changes to the 2008 base year network were identified. Anticipated traffic growth was estimated using demand forecasts from the national transport model, the Transport Model for Scotland (TMfS). Growth factors were determined for light and heavy vehicles from 2008 to 2013. The growth factors are based on the national travel demand in TMfS, which reflects the strategic nature of the A82 in the area.

3.2.3 In preparing a 2013 forecast year we carried out analysis of traffic count data from 2004, 2008 and 2011 which indicated no historic growth in traffic. It was concluded that this may be due to network constraints or other factors such as underlying population trends. However, it was concluded that applying the TMfS growth factors rather than historical trends would provide the most appropriate basis for a robust assessment of the options.

3.2.4 Given the lack of evidence of a discernible trend in traffic growth we concluded that it would also be inappropriate to use observed trend growth for the development of growth factors for a 2023 forecast year. On this basis we have focussed upon forecast growth as predicted by TMfS and the Scottish Trip End Program (STEP) – the Scottish equivalent of TEMPRO.

3.2.5 This has identified a range of potential growth factors as summarised in Table 3.1. However, STEP is not capable of producing growth factors for HGVs and they are consequently omitted.

Table 3.1 2013 – 2023 Traffic Growth Factors

Vehicle Type	Data Source	AM	Interpeak	PM
Lights	TMfS	1.149	1.161	1.136
	STEP	1.039	1.048	1.058
Heavies	TMfS	1.254	1.254	1.254
	STEP	N/A	N/A	N/A

3.2.6 We therefore adopted the growth factors in Table 3.1 for development of 2023 matrices under a **low growth (STEP)** and **high growth (TMfS)** scenario. For clarity, these are both the same in the case of heavies where TMfS rates are used.

3.2.7 On this basis, options have been tested under both a 2023 low growth and 2023 high growth scenario to understand how network performance would be impacted by changes in the level of traffic growth.

3.3 Operational Appraisal

3.3.1 As per the short-term measures, we have assessed the longevity of options through the operational impact on the network using the VISSIM micro-simulation model. Following the conclusions of Chapter 2 we identified three options to be tested as follows:

- **C**. Duntocher Road relocation and Kilbowie Road amendments;
- **D**. Duntocher Road relocation and hamburger roundabout; and
- **F**. Duntocher Road relocation and hamburger roundabout with Kilbowie Road amendments.

3.3.2 Test C and D emerged as preferred solutions from Chapter 2 whilst Test F is a hybrid of these solutions which includes the construction of the hamburger roundabout and relocated Duntocher Road junction alongside the amendments to lanes on Kilbowie Road.

3.3.3 All the tests have been assessed for a low growth (**LG**) and high growth (**HG**) scenario for the forecast year of 2023. The results have been compared with the 2013 Do Minimum scenario to enable an understanding of the relative performance of the network 10 years after implementation of the scheme to be developed. This enables an assessment of whether the scheme is likely to offer benefits relative to the performance of the network 10 years previously which provides an indication of the longevity of the solution.

3.3.4 The following sections set out the findings of the operational appraisal.

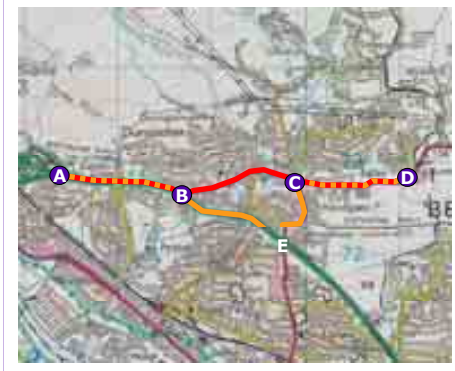
Journey Times

3.3.5 We assessed journey times on the same key routes through the Kilbowie / Hardgate area that were considered in the assessment of the short-term measures. Route A traces the route between the Erskine Bridge and the Bearsden area with Figure 3.1 showing a comparison of journey times on this route in the AM peak.

3.3.6 In the eastbound direction Test D/LG and F/LG both deliver journey times comparable with the 2013 Do Minimum whereas Test C/LG exhibits a slight increase in journey times. In the High Growth scenario none of the tests produce comparable journey times to the 2013 Do Minimum with Test D/HG showing the lowest increase. Test F/HG creates a large increase in journey times for eastbound traffic approaching Hardgate Roundabout due to the improved traffic flow on Kilbowie Road.

3.3.7 In the westbound direction Test C/LG creates a reduction in journey time relative to the 2013 Do Minimum whilst Tests D/LG and F/LG lead to a slight increase. In the high growth scenario there is a large journey time increase under Test D/HG due to the traffic volumes on

Kilbowie Road. Test C/HG creates a smaller but still significant increase in westbound journey times but Test F/HG leads to a reduction relative to the 2013 Do Minimum. This can be attributed to improved traffic flow on Kilbowie Road which has a knock-on effect on eastbound traffic as highlighted above.



Legend

A – Erskine Bridge

B – A82 / A810

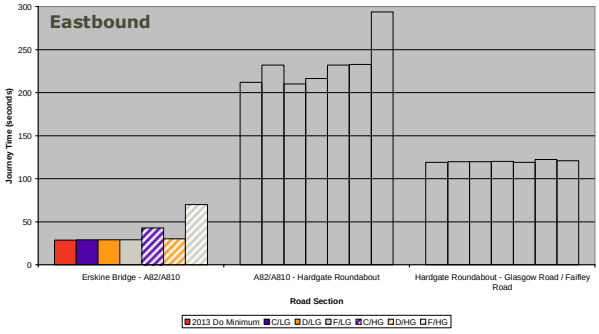
C – Hardgate Roundabout

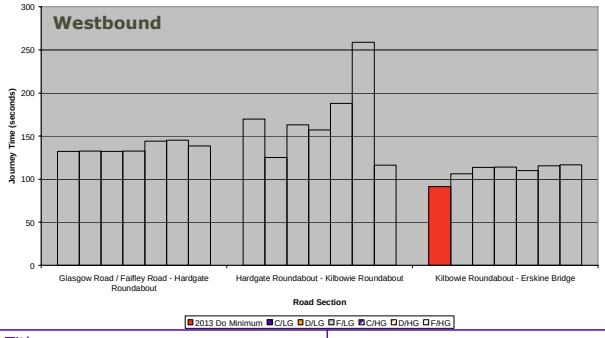
D – Glasgow Road / Faifley Road

E – Kilbowie Roundabout

Eastbound

Westbound





Kilbowie / Hardgate Implementation Plan
Prepared for West Dunbartonshire Council
October 2011

Title
2023 AM Route A Journey Times

Project No.
C3990000

Figure
3.1

mvaconsultancy

Figure 3.1 2023 AM Route A Journey Times

3.3.8 Route B represents the through route on Great Western Road between the Erskine Bridge and Drumry Roundabout. Figure 3.2 shows a comparison of journey times on this route in the AM peak.

3.3.9 Eastbound journey times are lower than the 2013 Do Minimum under Test C/LG and comparable with them in Tests D/LG and F/LG. However, all tests exhibit an increase in eastbound journey times in the High Growth scenario with the largest increase being created by Test F/HG which can again be attributed to improved traffic flow on Kilbowie Road along with high levels of flow on Great Western Road.

3.3.10 In the westbound direction, journey times under Tests D/LG and F/LG are comparable with the 2013 Do Minimum whereas Test C/LG creates an increase due to high traffic flows through Kilbowie Roundabout. This impact is exacerbated in the Test C/HG scenario with a large increase in westbound journey times relative to the 2013 Do Minimum occurring. However, Tests D/HG and F/HG perform well even with increased traffic flows which each exhibiting similar journey times to the 2013 Do Minimum.

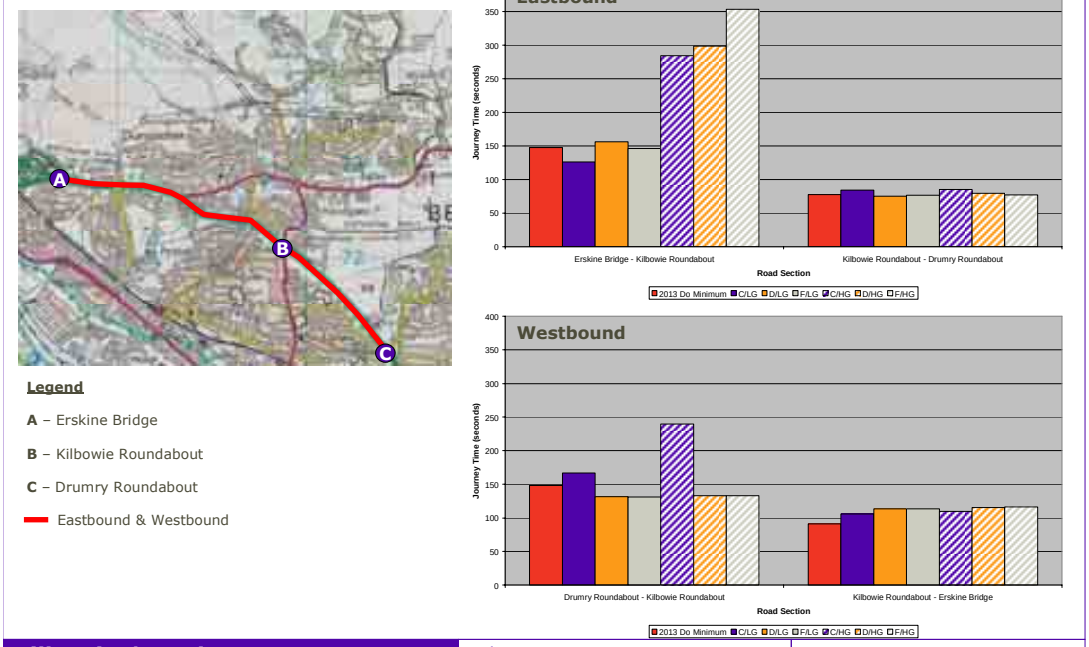


Figure 3.2 2023 AM Route B Journey Times

3.3.11 A summary of the total journey times in each direction in the AM peak is shown in Figure 3.3.

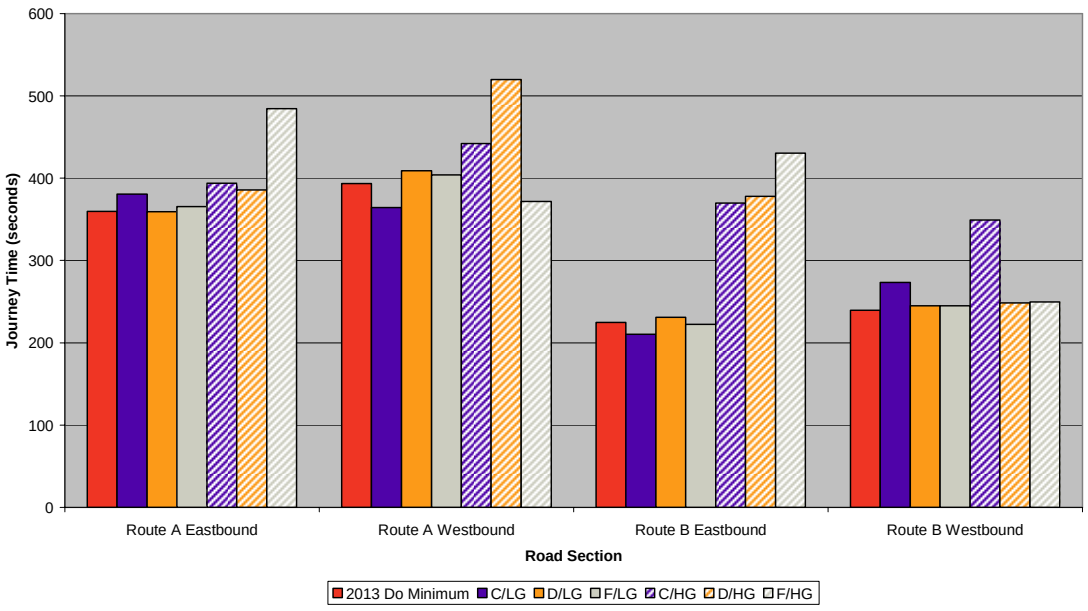


Figure 3.3 2023 AM Total Journey Times

3.3.12 In the Low Growth scenario all tests deliver journey times broadly in line with the 2013 Do Minimum network. All tests lead to an increase in journey times in the High Growth scenario

with the most noticeable impact on Route B eastbound. However, Test D/HG and F/HG slightly outperform Test C/HG illustrating the benefits of the introduction of the Hamburger Roundabout.

3.3.13 Figure 3.4 shows analysis of journey times on Route A in the PM peak.

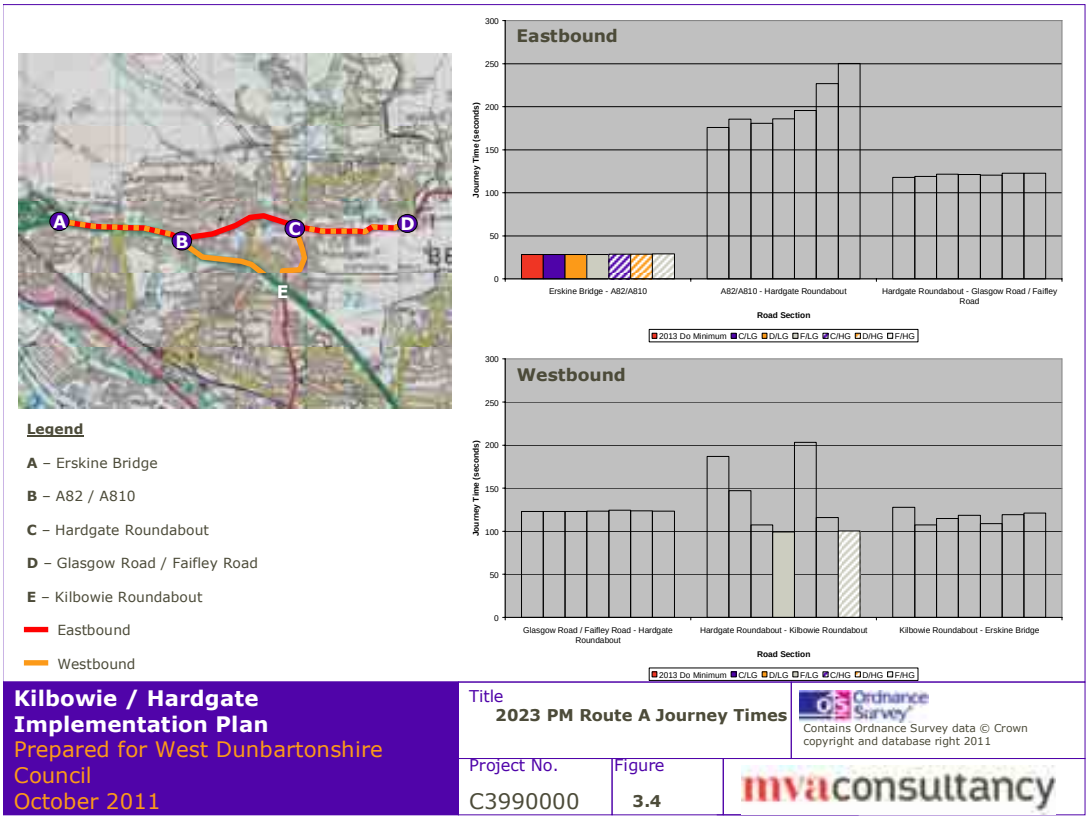


Figure 3.4 2023 PM Route A Journey Times

3.3.14 In the eastbound direction all tests create a small and comparable increase in journey times in the Low Growth scenario. However, in the High Growth scenario Test F/HG creates a larger increase in journey times than the others due to the improved traffic flow on Kilbowie Road and the affect it has on traffic at Hardgate Roundabout. The smallest increase is delivered by Test C/HG as it does the least to improve traffic flow on Kilbowie Road.

3.3.15 Westbound journey times are reduced under all tests in the Low Growth scenario in comparison with the 2013 Do Minimum. The largest reduction is created by Test F/LG followed closely by Test D/LG. In the High Growth scenario there is also a reduction in journey times offered by Tests D/LG and F/LG with the latter again creating the largest improvement. Test C/HG creates a westbound journey time comparable with the 2013 Do Minimum. These gains can be attributed to the improved flow for southbound traffic on Kilbowie Road delivered by the options.

3.3.16 Figure 3.5 shows journey times on Route B in the PM peak.

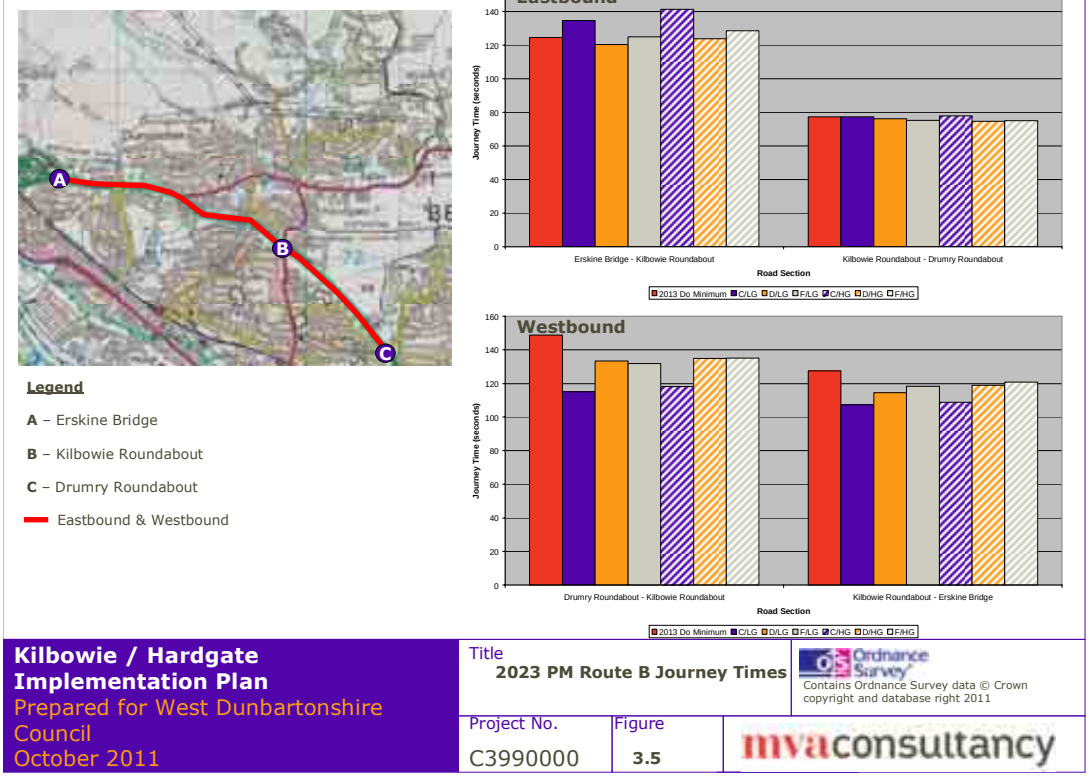


Figure 3.5 2023 PM Route B Journey Times

3.3.17 In the eastbound direction Tests D/LG and F/LG create comparable journey times to the 2013 Do Minimum whereas Test C/LG leads to a small increase. In the High Growth scenario Tests D/HG and F/HG are again seen to perform well and still offer journey times that are comparable with the 2013 do Minimum. Test C/HG leads to a slightly larger increase than that observed in the Low Growth scenario.

3.3.18 Westbound journey times are reduced by all tests in the Low Growth scenario with Test C/LG have the greatest impact whereas Tests D/LG and F/LG create a smaller but comparable savings. This pattern is replicated in the High Growth scenario with all tests still presenting a journey time saving relative to the Do Minimum albeit smaller than that in the Low Growth scenario.

3.3.19 A summary of the total journey times in each direction in the PM peak is shown in Figure 3.6.

3.3.20 In the Low Growth scenario all tests create an overall reduction in journey times with Test D/LG and F/LG delivering the greatest impact. The High Growth scenario leads to a decrease in the total journey time savings delivered with Test D/HG offering the greatest saving relative to the 2013 Do Minimum.

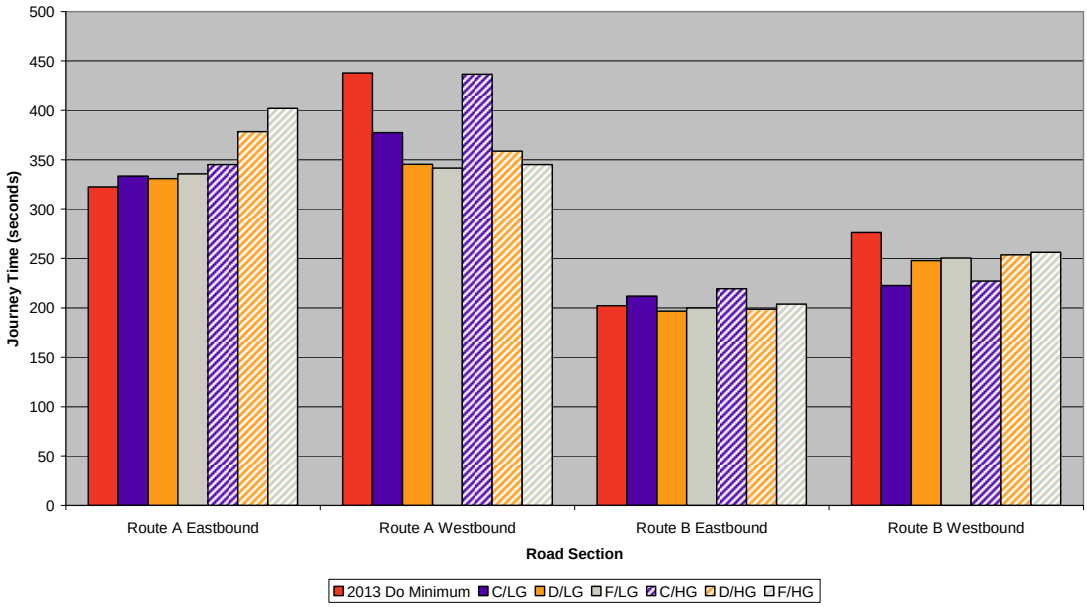


Figure 3.6 2023 PM Total Journey Times

Queues

3.3.21 Modelled queues at Hardgate Roundabout and Kilbowie Roundabout have been assessed to identify the difference between the tests and the 2013 Do Minimum scenario.

3.3.22 Figure 3.7 shows the average queue lengths at Hardgate Roundabout in the AM peak.

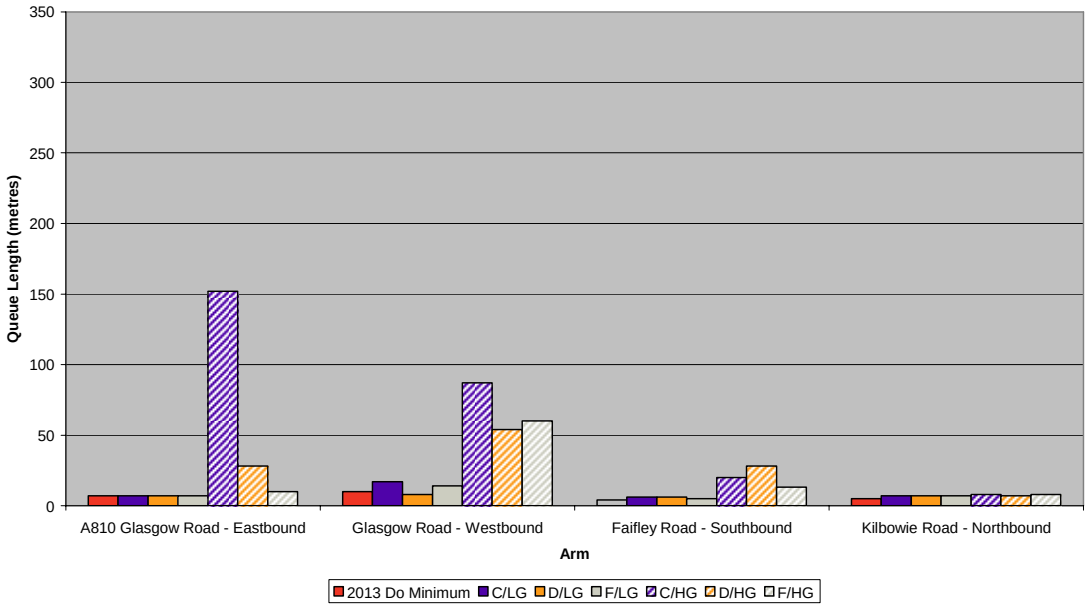


Figure 3.7 2023 AM Average Queue Lengths – Hardgate Roundabout

3.3.23 In the Low Growth scenario all the tests have a negligible impact upon levels of queuing observed at Hardgate Roundabout.

3.3.24 However, in the High Growth scenario Test C/HG is seen to create a large increase in queues on A810 Glasgow Road as it does not offer the network performance improvements at

Kilbowie Roundabout that Test D/HG and F/HG do. Nonetheless, the latter two tests also lead to an increase in overall queuing in the High Growth scenario but this is considerably lower than Test C/HG with the best performing option being Test F/HG.

3.3.25 Figure 3.8 shows average queue lengths at Kilbowie Roundabout in the AM peak.

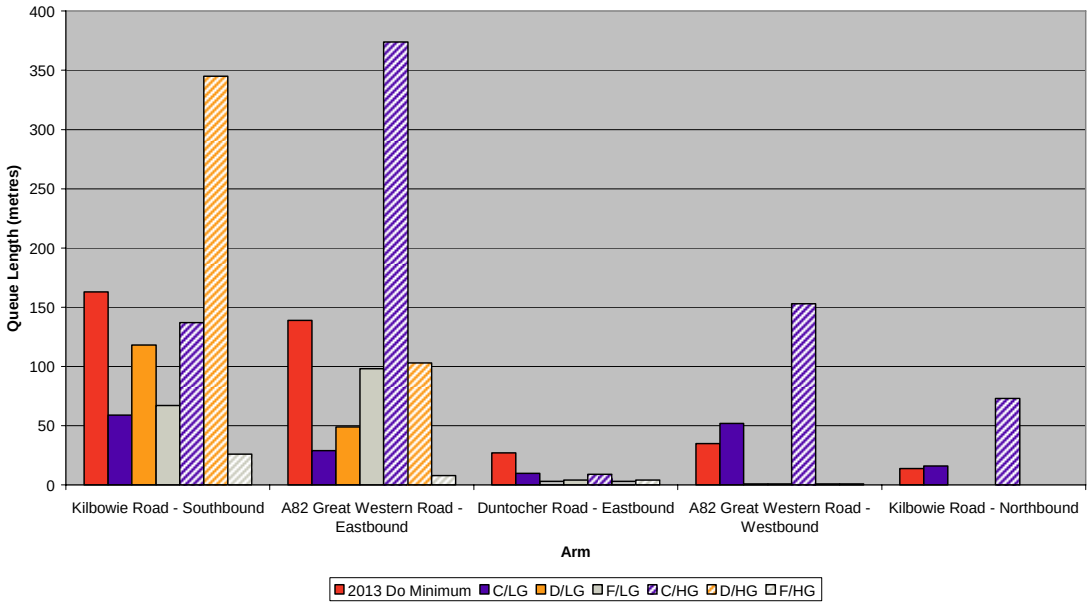


Figure 3.8 2023 AM Average Queue Lengths – Kilbowie Roundabout

3.3.26 It can be seen that all tests perform well in the Low Growth scenario with all three offering similar total reductions in queuing relative to the 2013 Do Minimum.

3.3.27 However, in the High Growth scenario Test C/HG creates a large overall increase in queuing particularly on Great Western Road. Test D/HG has a significant negative impact on queuing on Kilbowie Road southbound as it doesn't include any additional capacity on this section of the network. Test F/HG creates a large reduction in queuing levels at Kilbowie Roundabout but this can be attributed to the fact that the improved traffic flow on Kilbowie Road creates additional problems for traffic at Hardgate Roundabout resulting to an increase in queuing at this location.

3.3.28 Figure 3.9 shows average queue lengths at Hardgate Roundabout in the PM peak.

3.3.29 Tests C/LG and F/LG create a small reduction in total queuing in comparison to the 2013 Do Minimum whereas Test D/LG increases the overall level of queuing due to the impact it has on queues on Kilbowie Road northbound. This is created by the improved traffic flow on Kilbowie Road southbound which improves east-west flows on A810 Dumbarton Road / Glasgow Road and prevents northbound traffic on Kilbowie Road joining the roundabout.

3.3.30 The High Growth scenario leads to a sizeable increase in total queuing from all tests with Test C/HG creating the smallest increase. These impacts are more evenly distributed across the arms than under the Low Growth scenario as the levels of traffic are such that no one flow dominates over the others.

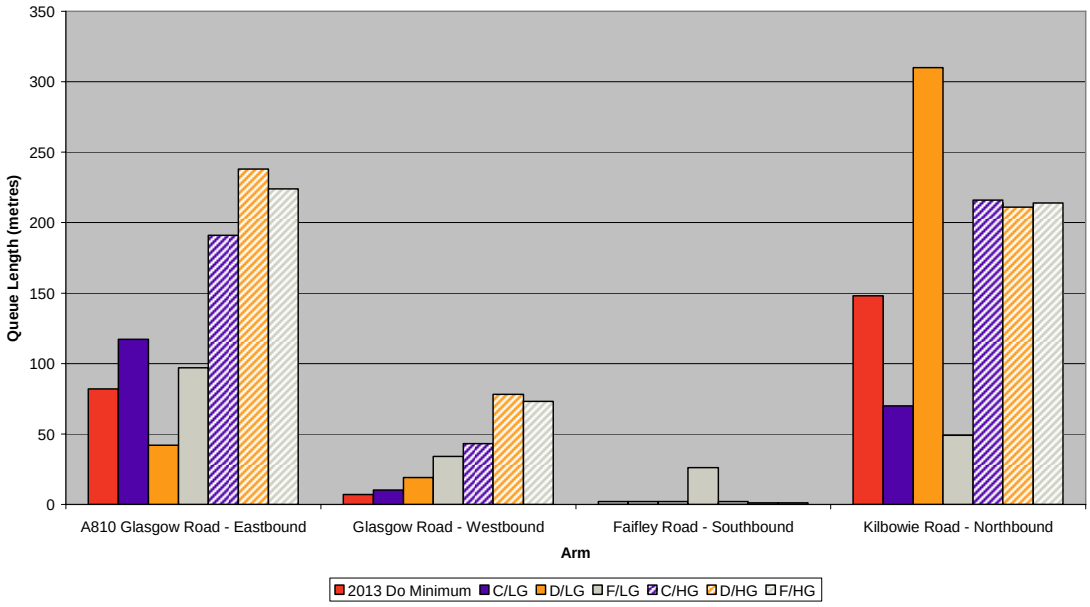


Figure 3.9 2023 PM Average Queue Lengths – Hardgate Roundabout

3.3.31 In addition, it is noticeable that levels of queuing at Hardgate Roundabout are significantly higher in the PM peak than the AM peak which is representative of the higher eastbound traffic flows on the A810 Dumbarton Road / Glasgow Road in this time period. This has a corresponding impact upon levels of queuing at Kilbowie Roundabout which are considerably lower than they are in the AM peak as illustrated in Figure 3.10.

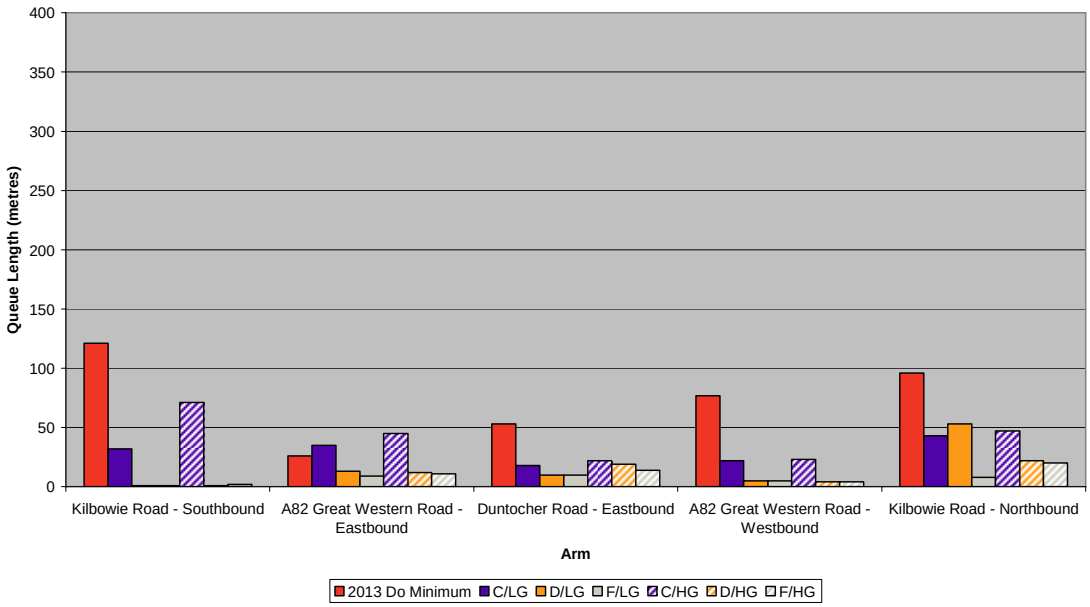


Figure 3.10 2023 PM Average Queue Lengths – Kilbowie Roundabout

3.3.32 All tests create a reduction in total queuing at Kilbowie Roundabout in the PM peak period under both the Low Growth and High Growth scenario. The largest reduction is created by Test F/LG although Test F/HG also performs well. Test D/HG is seen to create a larger decrease in queuing than Test D/LG which is indicative of the increased problems across all arms at Hardgate Roundabout in this scenario.

Network Performance

3.3.33 Analysis of key network statistics has been undertaken to understand the overall network performance of the tests relative to the 2013 Do Minimum scenario.

3.3.34 Figure 3.11 shows average speed for all vehicles by time period.

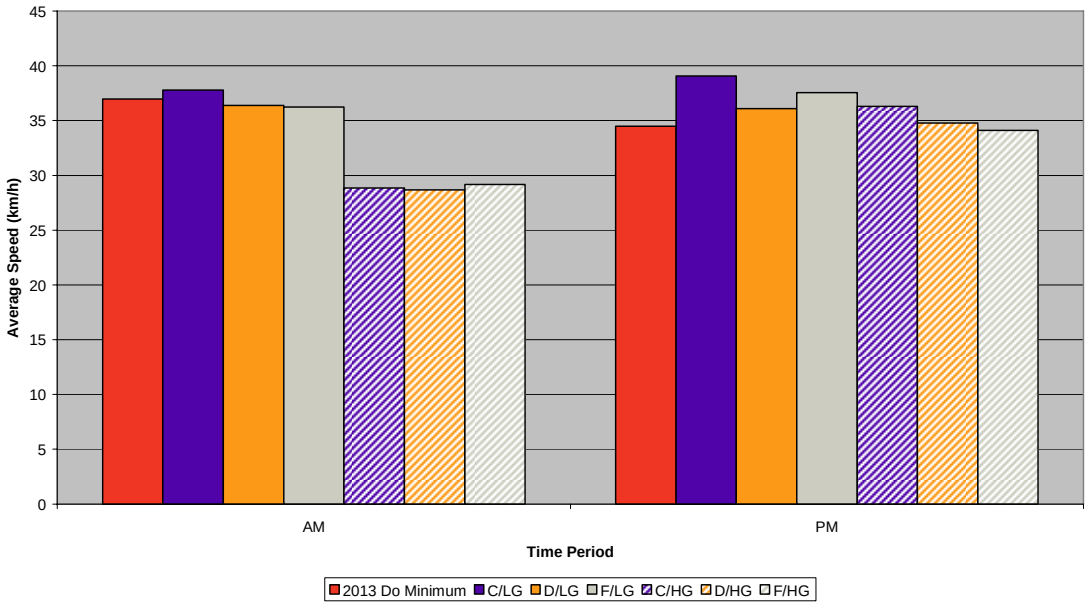


Figure 3.11 2023 Average Speed – All Vehicles

3.3.35 In the AM peak it can be seen that Test C/LG leads to a small increase in average speed whilst there is a slight decrease created by Tests D/LG and F/LG. However, all tests exhibit a sizeable and comparable decrease in average speed in the High Growth scenario.

3.3.36 In the PM peak, the average speed relative to the 2013 Do Minimum increases under each test in the Low Growth scenario with Test C/LG creating the largest increase. In addition, even with High Growth both Tests C/HG and D/HG provide an increase in average speeds whilst Test F/HG leads to a similar average speed to the 2013 Do Minimum.

3.3.37 Figure 3.12 shows average total delay per vehicle by time period.

3.3.38 It can be seen that total delay per vehicle decreases in the AM peak under Test C/LG whilst it remains broadly comparable with the 2013 Do Minimum under Tests D/LG and F/LG. All tests create a sizeable increase in delay in the High Growth scenario with Test F/HG slightly outperforming the other tests.

3.3.39 In the PM peak there is a reduction in delay relative to the 2013 Do Minimum in all of the Low Growth scenario tests. Test F/LG leads to the largest decrease in delay followed closely by Test C/LG. The level of delay is also reduced in the High Growth scenario with all tests leading to a reduction against the 2013 Do Minimum.

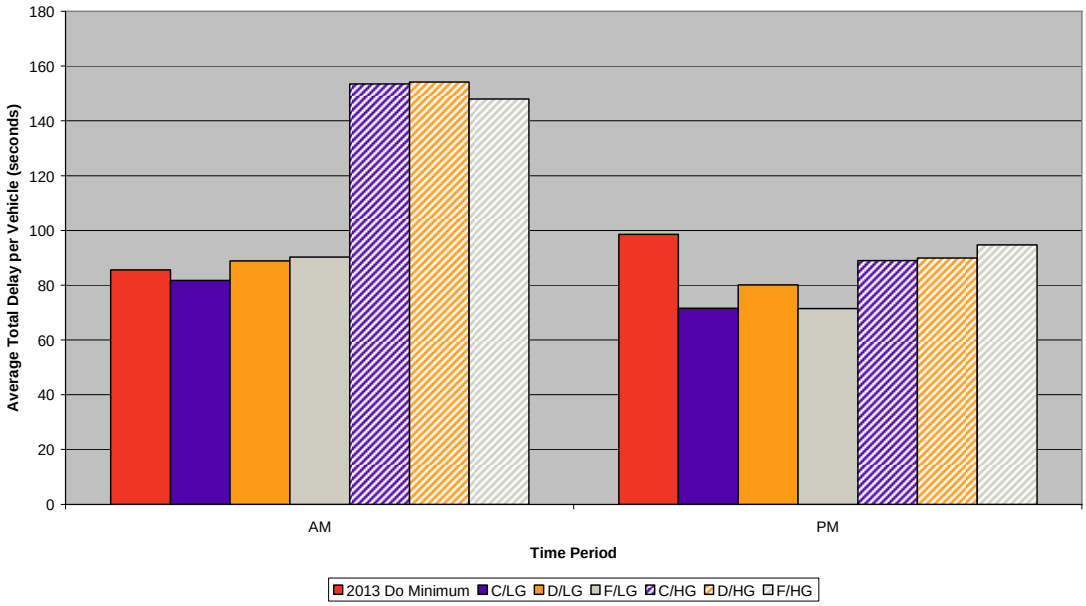


Figure 3.12 2023 Average Total Delay per Vehicle

Conclusions of Operational Appraisal

3.3.40 Overall, the analysis has found that all of the options are likely to offer benefits in comparison to the 2013 Do Minimum under a Low Growth scenario. However, Test C/LG does not offer the same level of improvement in overall network performance as the other tests. It is also evident that Test F/LG slightly outperforms Test D/LG across all indicators.

3.3.41 Whilst some indicators suggest better network performance in High Growth scenario rather than the Low Growth scenario this is due to more widespread problems throughout the network with particular issues emerging at Hardgate Roundabout. Overall, it is clear that the network in the Kilbowie / Hardgate area would struggle to cope with High Growth conditions. Nonetheless, Test F/HG was found to be the best performing option offering a slight improvement over 2013 Do Minimum network performance. It is also clear that the network is more resilient to high traffic growth in the PM peak than it is in the AM peak.

3.4 Emissions Appraisal

Global Air Quality

3.4.1 The total change in Carbon Dioxide (CO_2) equivalent has been calculated based upon outputs from the micro-simulation model. The forecasted absolute and monetised change, discounted over a 60 year appraisal period, in global emissions for each option relative to the Do Minimum scenario is summarised in Table 3.2. To enable a fair comparison, all options have been assessed for a forecast year of 2023.

Table 3.2 2023 Carbon Dioxide Equivalent Emission Impacts

	2013 Do Min	C/LG	D/LG	F/LG	C/HG	D/HG	F/HG
CO_{2e} (tonnes/year)	7,183	7,673	7,095	7,072	8,459	7,868	7,765
Discounted value over 60 years (£k, 2002 prices)	4,923	5,259	4,863	4,847	5,798	5,393	5,322
Difference from Do Minimum (£k, 2002 prices)		336	-60	-76	875	470	399
% Difference from Do Minimum		7	-1	-2	18	10	8

3.4.2 It can be seen that both Test D/LG and Test F/LG lead to a reduction in CO_2 equivalent emissions relative to the 2013 Do Minimum. In the High Growth scenarios all tests lead to an increase in CO_2 equivalent with this impact being minimised by Test F/HG.

Local Air Quality

3.4.3 Our assessment of local air quality covers the same area as that undertaken for the short-term measures. This is focussed upon the Kilbowie / Hardgate area where it is estimated that there are around 2,600 households within 50m either side of the affected road network which is equivalent to a population of around 6,000 people. The predicted emissions affecting this area are shown in Table 3.3.

Table 3.3 2023 Local Emissions Impacts

	2013 Do Min	C/LG	D/LG	F/LG	C/HG	D/HG	F/HG
PM_{10} (kg/year)	448	478	441	440	527	490	483
Difference from Do Minimum		30	-7	-8	79	42	35
% Difference from Do Minimum		7	-2	-2	18	9	8
NOx (kg/year)	11,538	12,897	11,913	11,913	13,328	12,811	12,308
Difference from Do Minimum		1,359	375	375	1,790	1,273	770
% Difference from Do Minimum		12	3	3	16	11	7

3.4.4 All tests show an increase in NOx emissions relative to the 2013 Do Minimum with the increase being minimised by Test F in both the Low Growth and High Growth scenario. There is a slight reduction in PM_{10} in the Low Growth scenario created by Test D/LG and F/LG.

However, growth in PM_{10} emissions is evident in all of the High Growth tests with this impact being minimised by Test F/HG.

3.5 Indicative Costs

3.5.1 The estimated construction costs of the options in both 2011 and 2002 prices, with and without optimism bias at 44%, are set out in Table 3.4.

Table 3.4 Estimated Construction Costs (£k)

Option	2011 Construction Cost	2011 Construction Cost + Optimism Bias	2002 Construction Cost	2002 Construction Cost + Optimism Bias
C. Duntocher Road relocation and Kilbowie Road amendments	£1,034k	£1,490k	£815k	£1,174k
D. Duntocher Road relocation and hamburger roundabout	£1,519k	£2,188k	£1,197k	£1,724k
F. Duntocher Road relocation and hamburger roundabout with Kilbowie Road amendments	£1,610k	£2,319k	£1,269k	£1,827k

3.5.2 It should be noted that these costs **do not** provide any allocation for public utility diversions or land acquisition costs.

3.6 Conclusions

3.6.1 In terms of the longevity of options we have concluded from the analysis that Test F (Duntocher Road relocation and hamburger roundabout with Kilbowie Road amendments) offers the greatest potential to continue to deliver an improved level of network performance 10 years after implementation of the scheme. However, this is within the context of an already congested network and the findings would suggest that further intervention would be required at this stage to improve network performance should high levels of traffic growth be experienced.

3.6.2 It is clear that the network will struggle to cope with high growth and performance could deteriorate below the 2013 Do Minimum situation if this occurs. As such, there will be a likely need for additional interventions at this point to ensure the ongoing operational efficiency of the network.

3.6.3 In particular, there may be a need for measures at Hardgate Roundabout, especially if high traffic growth is experienced, as the modelling suggests that it will begin to act as a more significant pinch-point over time.

4 Recommendations for Delivery

4.1 Key Recommendations

4.1.1 Based on the analysis set out in the previous chapters our key conclusions and recommendations for delivery are as follows:

Short Term (2011 – 2013)

Recommendations

1. The construction of a Hamburger Roundabout along with the relocation of the Duntocher Road junction at Kilbowie Roundabout remains the priority for implementation and should be taken forward just now if it can be delivered within available funding allocations.

2. If this solution is not deliverable, the relocation of Duntocher Road along with amendments to the southbound lanes on Kilbowie Road should be implemented as an interim measure with a view towards implementing the Hamburger Roundabout at the earliest possible opportunity.

Action: Select preferred option for implementation, prepare a work programme for delivery, develop a detailed design of the preferred option and assemble a funding package.

Further Information: If funding allocations do not allow the implementation of the Hamburger Roundabout at this time, there is scope to carry out phased implementation of this option by constructing the relocated Duntocher Road junction in advance along with amendments to the southbound lanes on Kilbowie Road. The Hamburger Roundabout could then be implemented at a later date when funding allows but we would recommend that this should be carried out at the earliest possible opportunity to maximise the value for money of the scheme.

If both the Hamburger Roundabout and Duntocher Road relocation are implemented together then there is likely to be less requirement for amendments to the southbound lanes on Kilbowie Road. However, this intervention would still be beneficial if it were implemented alongside this scheme and has been found to improve network performance in the long-term. Therefore, consideration should be given implementing this measure at the same time as the main intervention given the marginal additional cost it would incur.

Long Term (2013 – 2023)

Recommendations

3. Network performance 10 years after implementation will be optimised by the implementation of the Hamburger Roundabout and Duntocher Road relocation along with amendments to the southbound lanes on Kilbowie Road. We consequently recommend that this intervention should be put in place at the earliest possible opportunity to ensure long-term network performance is as efficient as possible.

4. Even with this intervention in place there is nonetheless likely to be a need for further intervention by 2023 in order to maintain operational efficiency of the network, especially if high traffic growth conditions are experienced.

Action: Take forward STAG Part 2 appraisal of 'long-term' options originally identified through the initial appraisal with a view towards identifying and developing a suitable solution for implementation prior to 2023.

Further Information: The analysis in this report highlights that Hardgate Roundabout could increasingly become a pinch-point on the network over time and that this effect is exacerbated under high traffic growth conditions. On this basis, the STAG Part 2 appraisal of 'long-term' options could benefit from consideration of potential additional options to improve operational efficiency at Hardgate Roundabout.

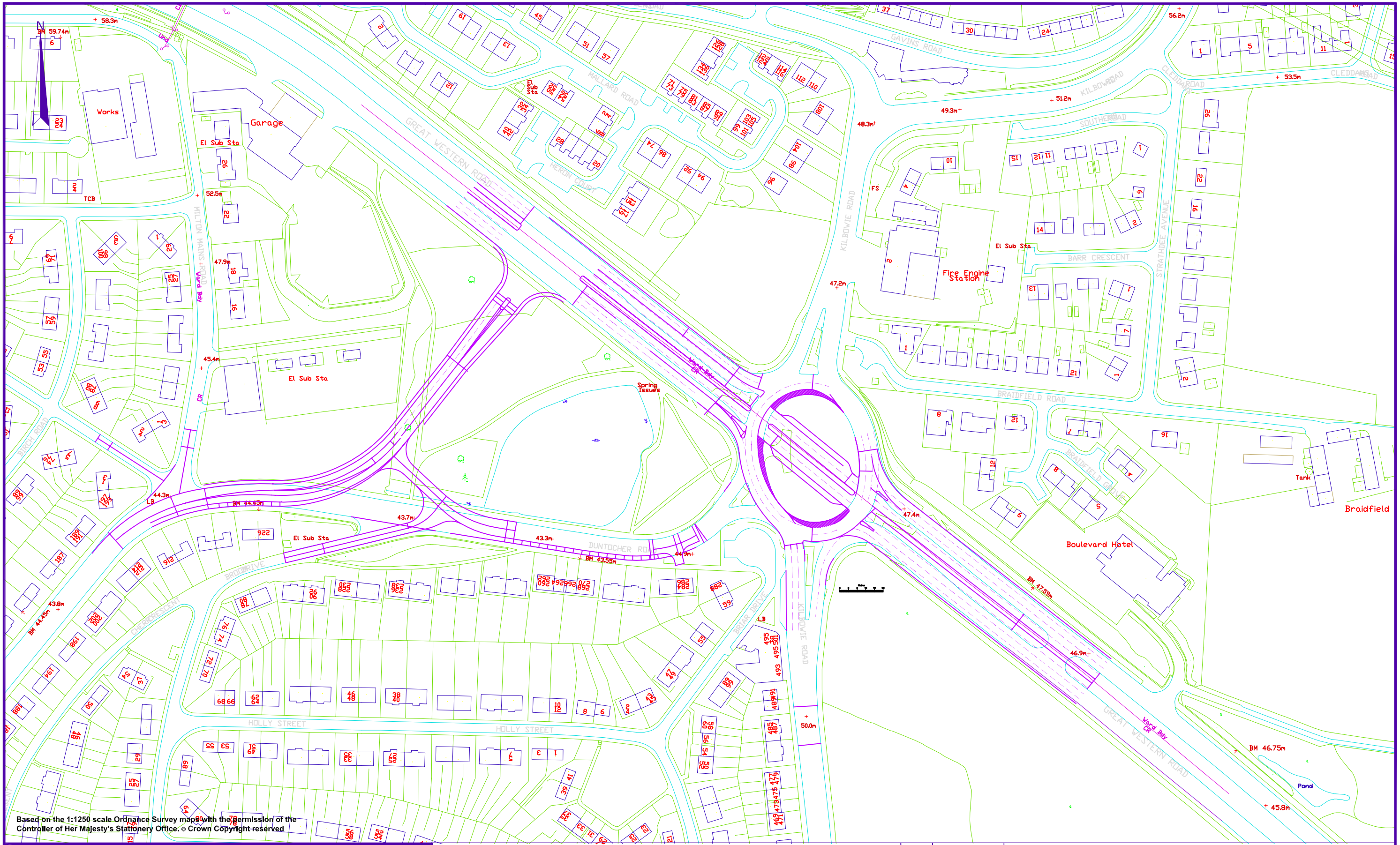
4.1.2 We have concluded that the aforementioned recommendations represent the most cost effective, efficient and proportionate response to the observed and forecast problems in the Kilbowie / Hardgate area. The purpose of taking forward an intervention that could be delivered in the short-term was to facilitate swift relief to the problems that are currently being experienced on the network in this vicinity. This will enable operational performance to be improved whilst strategic planning is undertaken for a long-term option which can then be built into relevant plans, strategies and funding programme.

4.1.3 The findings of the analysis presented in this report supports this approach as it has shown that the proposed interventions will improve current network performance but that there will likely be a need for further intervention in the longer term as the impact of traffic growth reduces the benefits delivered.

4.1.4 Potential long-term solutions were identified through the STAG appraisal and included a range of grade separated junction and bypass proposals. At this time we deem that an intervention of this scale would be inappropriate on the basis that the network problems can be resolved by a smaller scale intervention which can be delivered more quickly and at a lower capital cost.

4.1.5 As outlined above, we nonetheless recommend that long-term solutions should be appraised in detail to allow a preferred option to be identified ready for implementation in the future as required.

Appendix A – AutoCAD Drawings



Kilbowie / Hardgate Implementation Plan

Prepared for West Dunbartonshire Council
October 2011

Title
East - West at grade priority at Kilbowie Roundabout with relocated Duntocher Road Junction

No.	Date	Revision
-	25/10/11	-

Project No.	Figure No./Drawing No.	Scale	Rev No.		
C39900/00	Figure 1.2 (C39900/07/D/001)		-	Drawn	GS
				Designed	GS/AK
				Approved	AK

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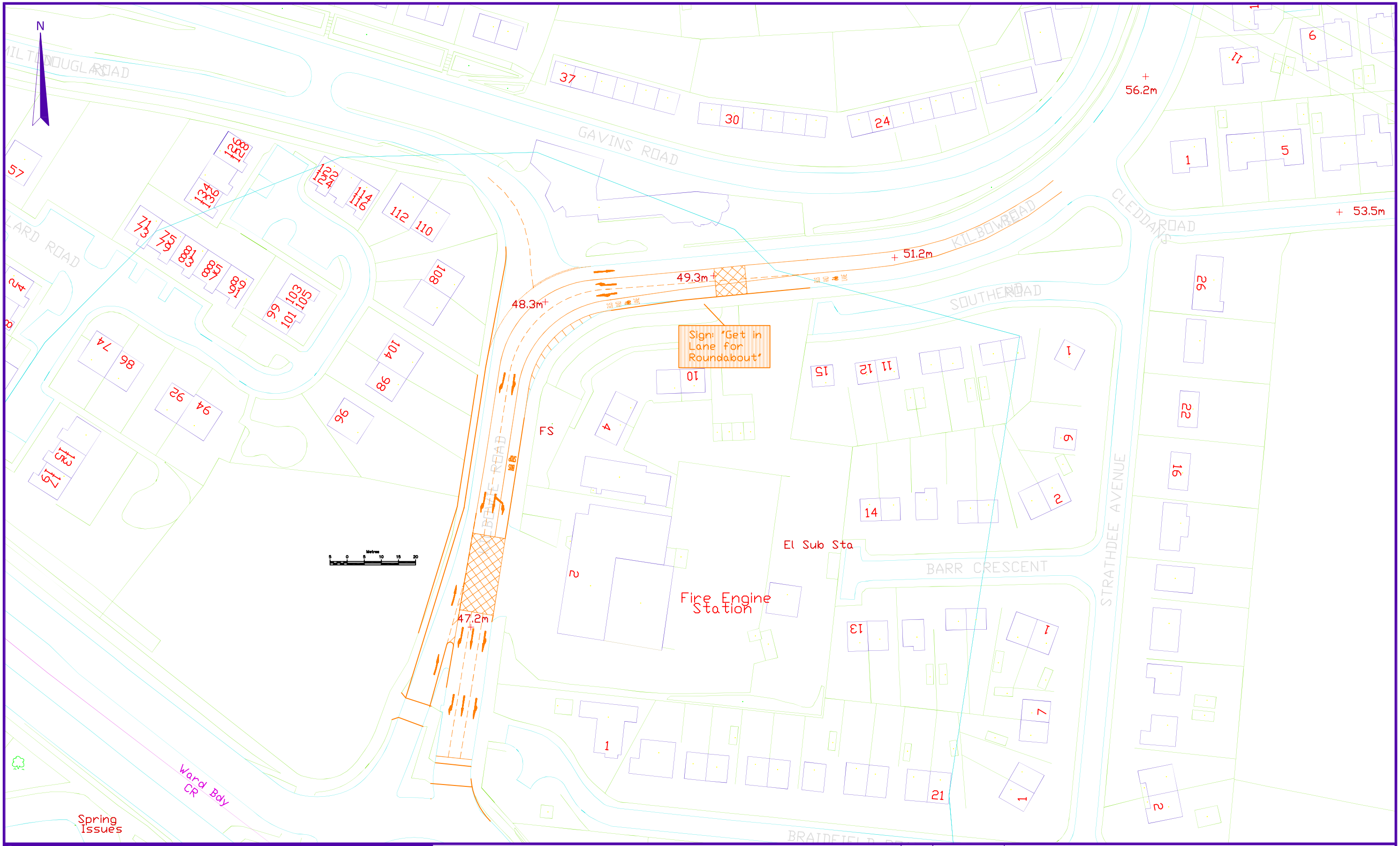

Kilbowie / Hardgate Implementation Plan

Prepared for West Dunbartonshire Council
October 2011

Title: Indicative Layout of the revised southbound approach to Kilbowie Roundabout No AutoTrack				- No.	25/10/11 Date
Project No. C39900/00	Figure No./Drawing No. Figure 2.2 (C39900/00/D/004v1)	Scale NTS	Rev No. -	Drawn GS	- Revision
				Designed GS / AK	
				Approved GS	

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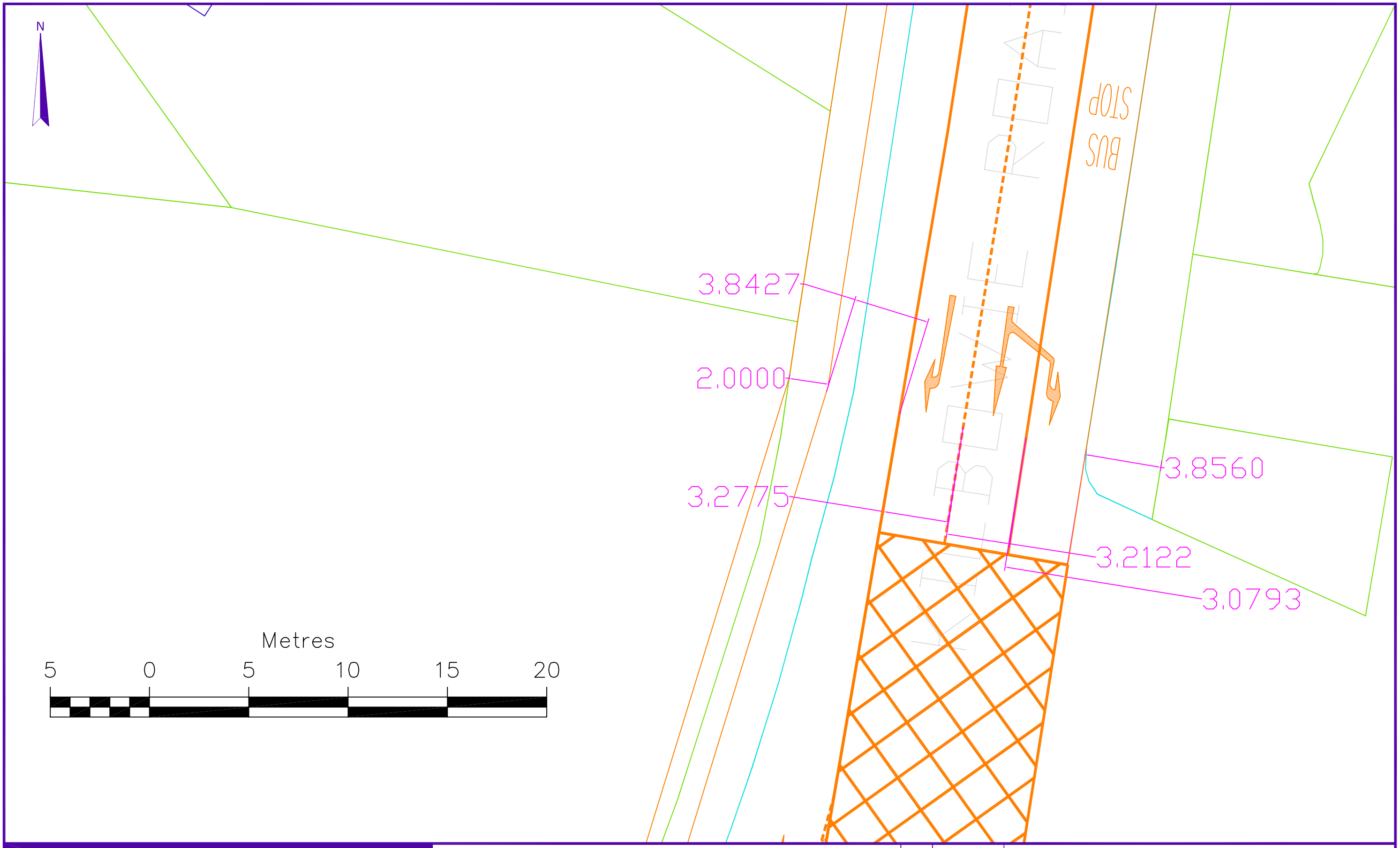

Kilbowie / Hardgate Implementation Plan

Prepared for West Dunbartonshire Council
October 2011

Title: Indicative Layout of the revised southbound approach to Kilbowie Roundabout Lane Widths and No AutoTrack					- No.	25/10/11 Date	- Revision
Project No.: C39900/00	Figure No./Drawing No.: Figure 2.3(C39900/00/D/003v1)	Scale: NTS	Rev No.: -	Drawn GS Designed GS / AK Approved GS			

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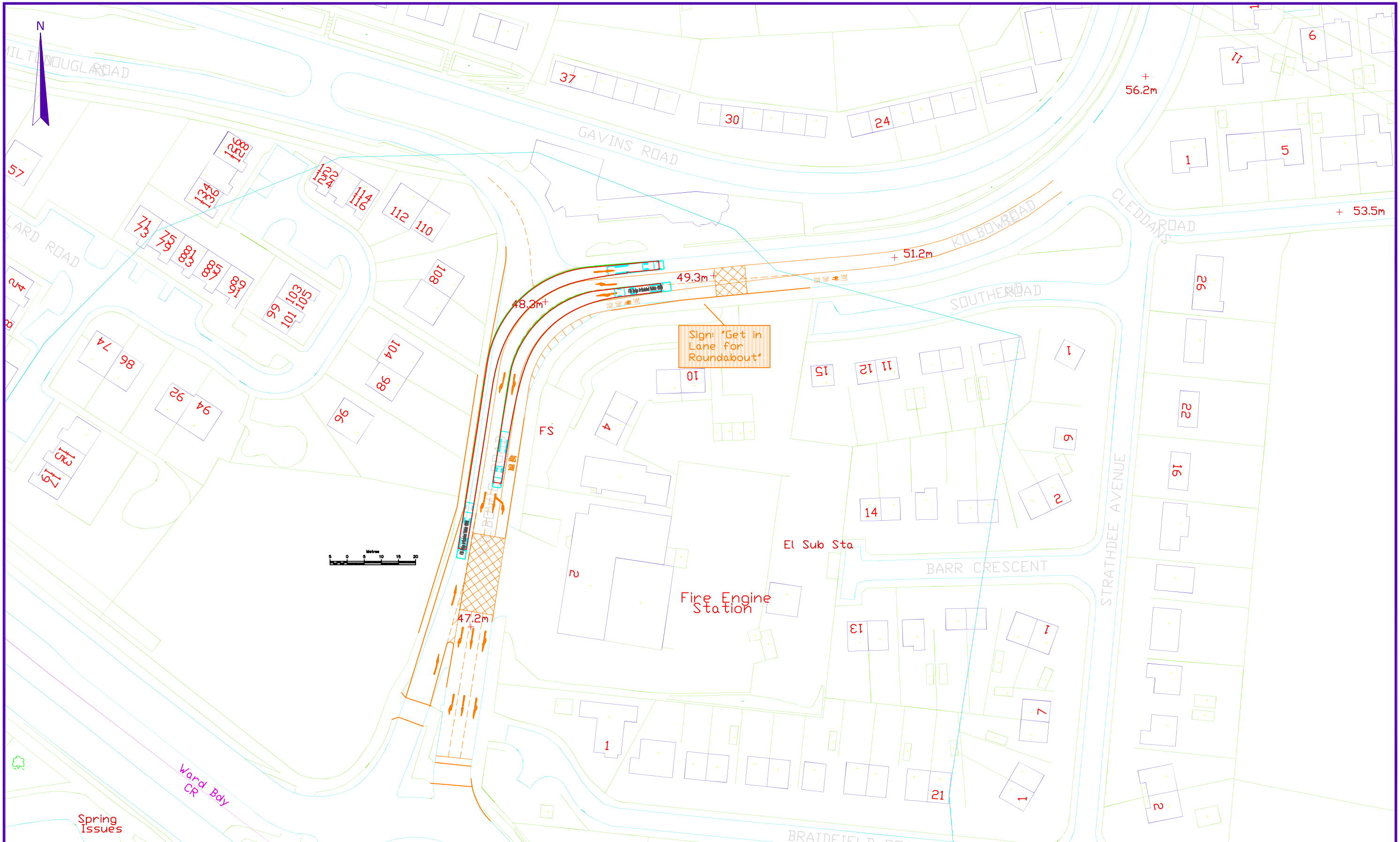

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Title: Indicative Layout of the revised southbound approach to Kilbowie Roundabout Autotrach Northbound Lane and Middle Lane Southbound				- No.	25/10/11 Date
Project No. C39900/00	Figure No./Drawing No. Figure 2.4 (C39900/00/D/004v1)	Scale NTS	Rev No. -	Drawn GS Designed GS / AK Approved GS	- Revision

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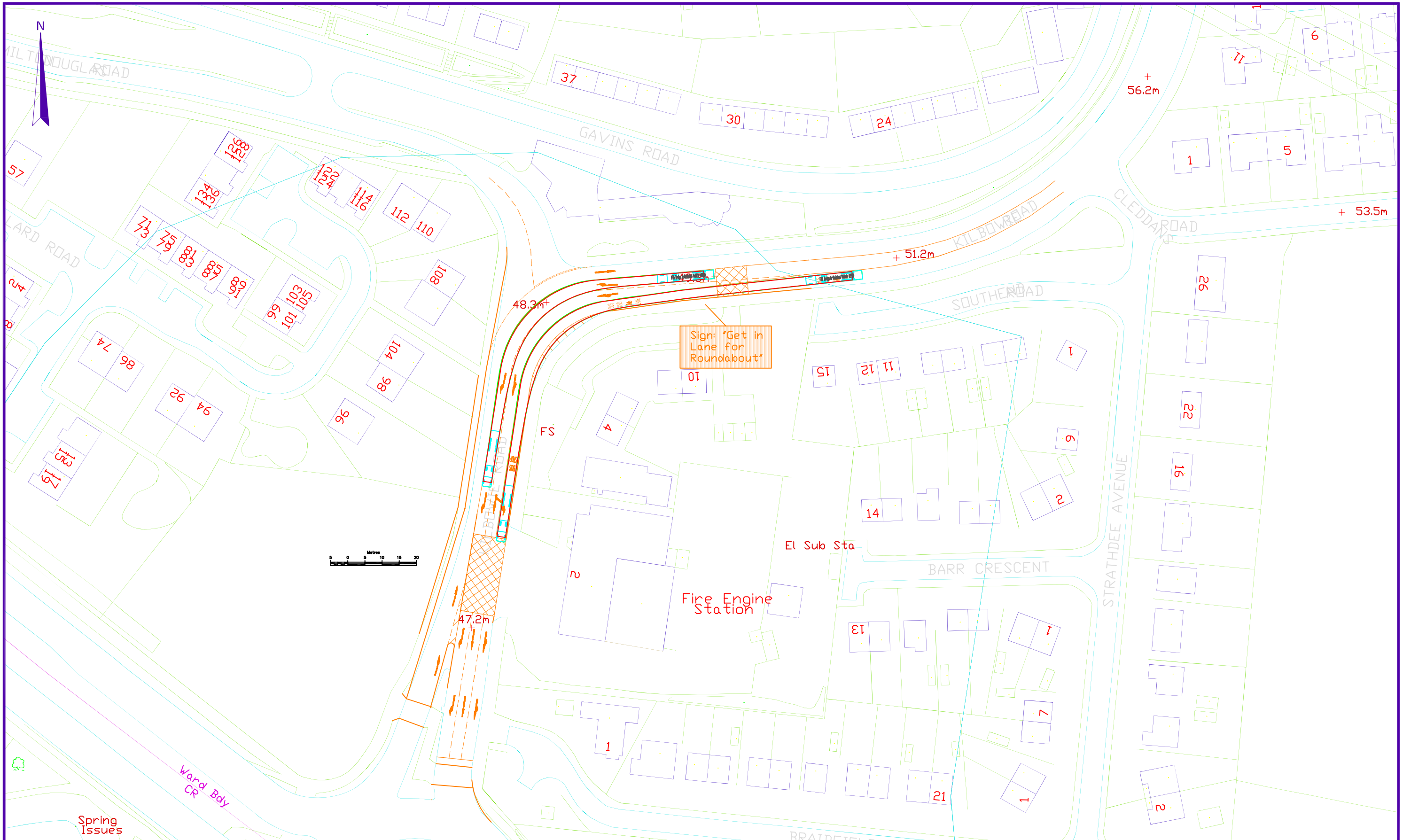

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Title: Indicative Layout of the revised southbound approach to Kilbowie Roundabout AutoTrack Bus Lane and Southbound Right-turn Lane				- (No.)	25/10/11 (Date)	- (Revision)
Project No.: C39900/00	Figure No./Drawing No.: Figure 2.5 (C39900/00/D/004v1)	Scale: NTS	Rev No.: -	Drawn: GS Designed: GS / AK Approved: GS		

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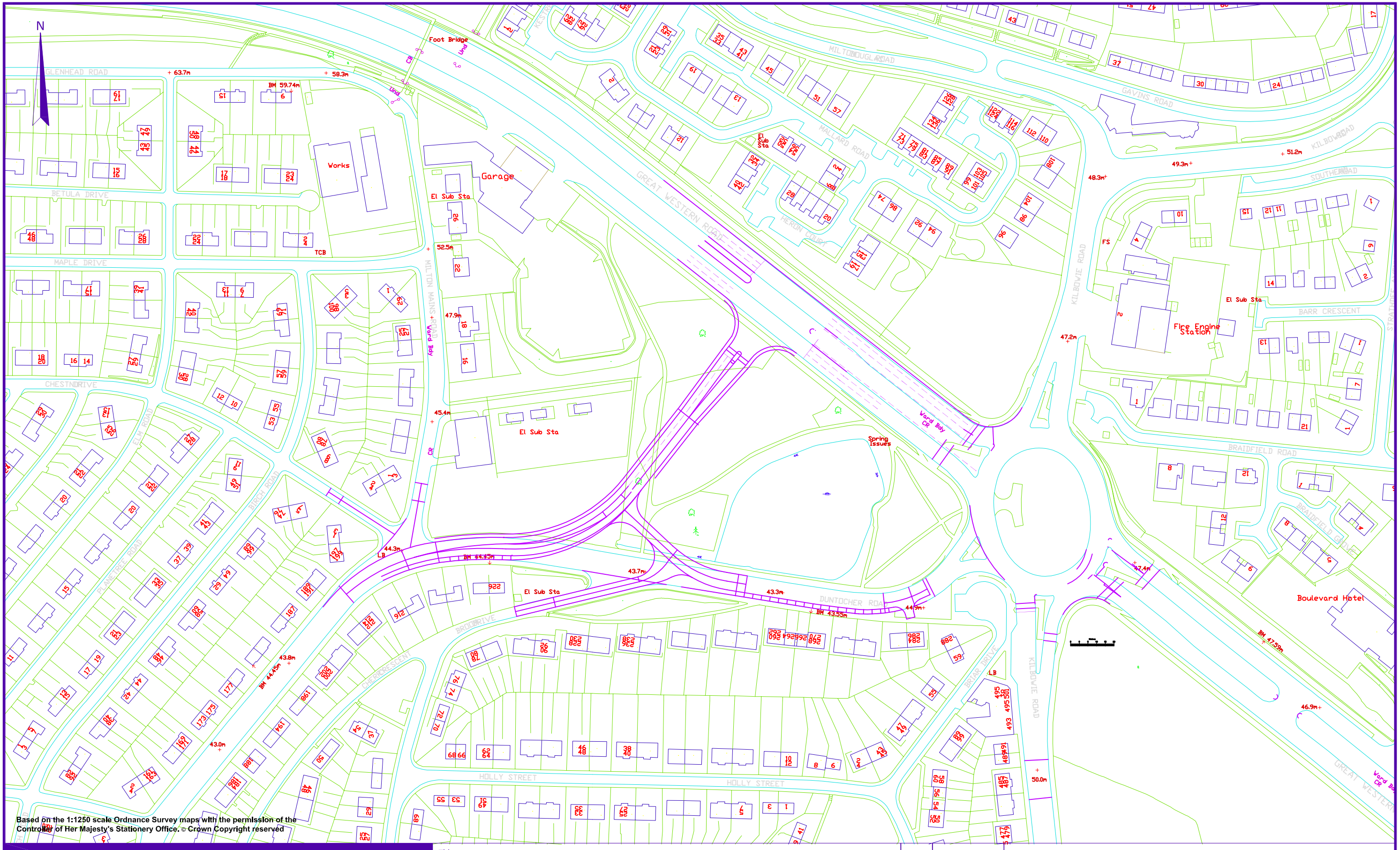

Kilbowie / Hardgate Implementation Plan

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Title: Relocated Duntocher Road Junction				- No.	25/10/11 Date	- Revision
Project No. C39900/00	Figure No./Drawing No. Figure 2.6 (C39900/07/D/001)	Scale	Rev No. -	Drawn GS		
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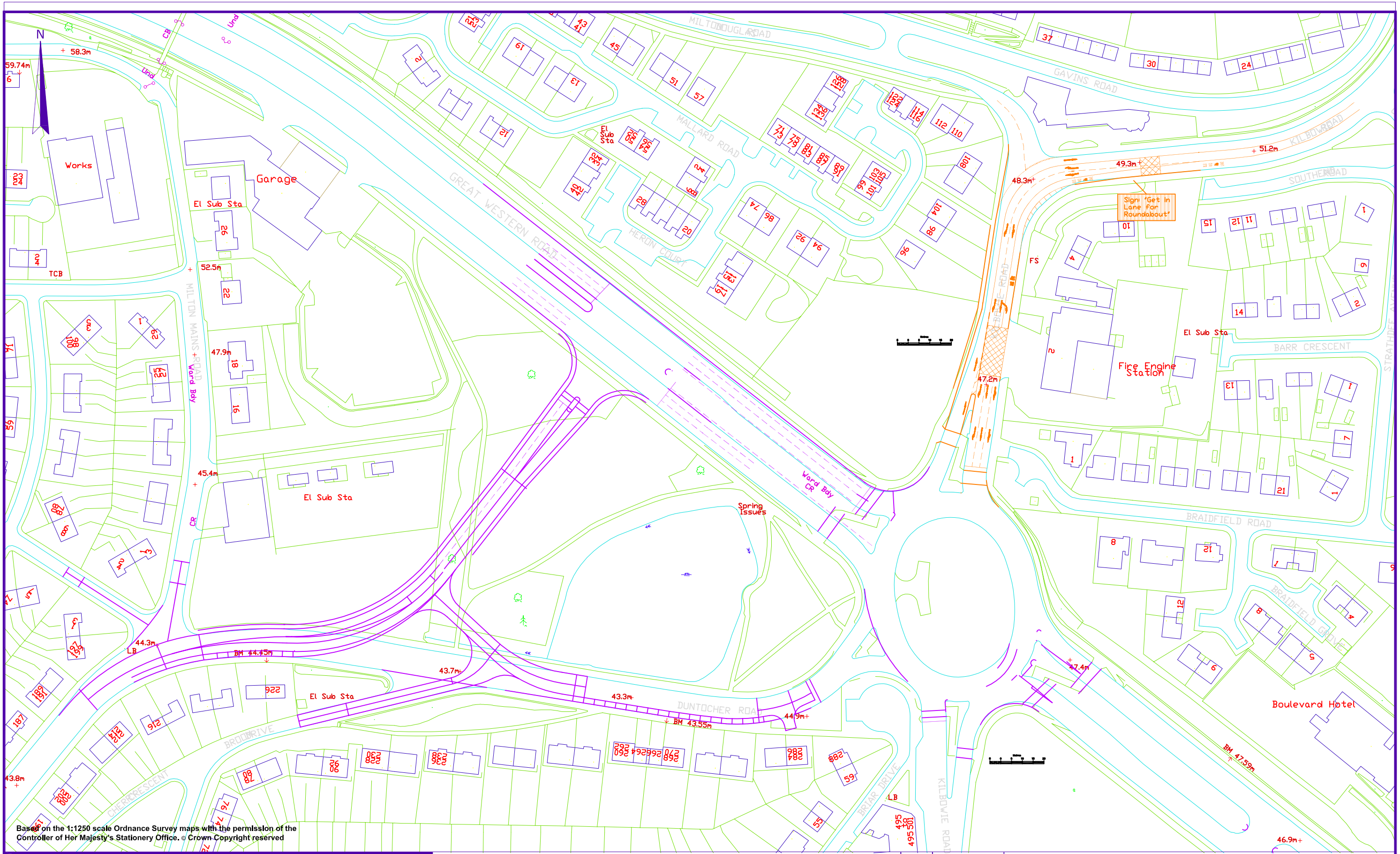

Kilbowie / Hardgate Implementation Plan

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October 2011

Title: Relocated Duntocher Road Junction and Revised Layout ofr Kilbowie Roundabout Southbound Approach				- No.	25/10/11 Date	- Revision
Project No. C39900/00	Figure No./Drawing No. Figure 2.7 (C39900/07/D/001)	Scale	Rev No. -	Drawn GS Designed GS/AK Approved AK	mvaconsultancy	

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