SECTION 12 TRAFFIC

12.1 INTRODUCTION

12.1.1 Background

This section of the Environmental Impact Statement has been prepared by WSP and reviews the impact of the continued waste recovery activities and backfilling of the quarry void on the local road network. Information obtained from earlier traffic studies undertaken by WSP on behalf of Roadstone Dublin Ltd. has been utilised in preparing this traffic impact assessment.

12.1.2 Scope of Work

This traffic impact assessment provides a description of the local road network and an estimation of the likely traffic generated by the proposed waste recovery facility, assesses the impact of the generated traffic upon the local road network and identifies any necessary mitigation measures.

An on-site review of the application site and surrounding road network was undertaken on Friday 14 November 2008. The site visit included initial inspections of traffic flow patterns and the geometry and layout of the local network.

Traffic count data and traffic speed surveys were commissioned by WSP in 2007, and have been utilised in undertaking the traffic impact assessment. An assessment of the likely traffic generated by the proposed facility has been determined from data provided by Roadstone Dublin Ltd.

12.1.3 Difficulties Encountered in Compilation

No difficulties were encountered in the compilation of this section.

12.2 RECEIVING ENVIRONMENT

12.2.1 Local Road Network

The application site is located at Fassaroe Avenue, Bray, Co. Wicklow, approximately 0.5 km west of the M11 motorway that links north Wicklow with Dublin City. The location of the site is indicated on Sketch EIS/01 in Appendix 12.1

Fassaroe Avenue from the roundabout junction at Berryfield Road to its entrance with the existing construction materials production facility is a private road under the ownership of Roadstone Dublin Ltd. In addition to servicing Roadstone's site, Fassaroe Avenue also provides access to 9 No. residential properties.

Fassaroe Avenue from the roundabout junction at Kilbride Road to its entrance with Roadstone Dublin's facility is approximately 930metres long. The prevailing width of the carriageway is 6.0 to 7.0metres, although the road does widen locally near the roundabout and plant entrance, and a pinch point of 4.5metres exists to the south of 'Sandiacre' (the general layout of the road can be discerned from Figure 12.1).

A series of ramps incorporating road narrowing have been implemented along the road. The ramps are round topped with a shallow entry/exit slope. Concrete blocks spaced at 3.5 to 4.0metres act as the road narrowing, with priority afforded to vehicles approaching Roadstone Dublin's landholding. The spacing of the features varies from 50metres to 220metres, depending on their proximity to residential entrances.

There are 9 No. residential properties situated on the southern side of Fassaroe Avenue. Travelling westwards from the roundabout, the first two properties of 'Sandiacre' and 'Kilvaragh' are located 160metres and 180metres respectively from the roundabout. The entrances to these properties are gated and recessed from the road edge. However, visitors to these properties must park on the roadside until access to the properties is permitted. Visibility from these entrances is restricted by the alignment of the property hedge lines.

Three accesses to residential property are located 380m ('Cedar Brook' / 'Ivrea Glenora'), 700m ('Treescape') and 820m (Fassaroe House + 3 other properties) respectively from the roundabout. Whilst each of these accesses are gated, the gate is setback a sufficient distance from the road

edge to allow a vehicle to park off of the carriageway whilst awaiting entry. Visibility from these entrances is satisfactory.

12.2.2 Traffic Volumes and Traffic Speed Surveys

The existing traffic volumes associated with the Fassaroe Roadstone Plant have been determined from two sources.

(i) From traffic information provided by Roadstone Dublin for the years 2006,2007,2008
(ii) From Automatic Traffic Count Data from 2007

Information provided by Roadstone Dublin Ltd.
Information on existing traffic volumes along Fassaroe Avenue was obtained from a detailed analysis of sales / weighbridge information gathered by Roadstone Dublin – these provided an indirect measure of HGV and light vehicle traffic accessing the Fassaroe facility.

Roadstone Dublin Ltd gathered weighbridge data over a 3 year period, from 2006 to 2008 and provided it to WSP for the purposes of this study. The number of dockets issued for loads of readymix concrete and/or loads of imported sand identifies the numbers of HGVs accessing and egressing the site. Each docket is the equivalent of 1 HGV accessing the site.

A maximum and an average number of daily HGV trips to and from the Fassaroe aggregate / concrete plants have been established through the assessment of the daily figures obtained for each of the assessment years.

Table 12.1 summarises the existing daily number of HGV trips to and from the Fassaroe facility:

		Daily HGV Movements			
		Loads RMC	Loads Sand	Total	Total
					In and Out
2006	Max	216	25	241	482
	Average	102	25	127	253
2007	Max	184	25	209	418
	Average	98	25	123	245
2008	Max	168	25	193	386
	Average	81	25	106	212
3 yr average	Max	189	25	214	429
	Average	93	25	118	237

Table 12.1 Daily HGV Trips Associated with Fassaroe Aggregate / Concrete Plant

The number of vehicles accessing the retail shop was attained by reviewing sales dockets issued for items purchased over the same 3 year period. Each sales docket was taken to be the equivalent of 1 motorcycle, car or light van.

As with the HGV traffic, a maximum and an average number of daily trips associated with the retail shop was established from the data obtained during the 3 assessment years. In order to ensure a conservative assessment, the figure obtained for vehicles associated with the retail shop was increased by a further 20%. This increase accounts for any discrepancy for vehicles associated with visits to the shop but which did not result in the issue of a sales docket (those visiting the shop without buying).

A TRICS assessment was undertaken to establish a trip rate for the 5 No. private houses along Fassaroe Avenue. The TRICS assessment identified that each house would generate a total of 6 trips in a 24 hour period. In order to ensure a robust analysis all of these trips have been included within the calculation of vehicle trips during existing opening hours at the site.

Table 12.2 below summarises the existing number of trips related to the shop travelling to and from the Fassaroe facility daily:

		Daily Motorcycle/Car/Light Van Movements					
		Loads	Residential	Staff	Visitors	Total	Total
		Shop	5 No	10No	20%		In and Out
2006	Max	161	15	10	32	218	436
	Average	93	15	10	19	137	274
2007	Max	188	15	10	38	251	501
	Average	105	15	10	21	151	303
2008	Max	207	15	10	41	273	547
	Average	102	15	10	20	147	294
3 yr average	Max	185	15	10	37	247	495
	Average	100	15	10	20	145	290

Table 12.2 Daily Trips Associated with the Fassaroe Retail Shop

The information in Tables 12.1 and 12.2 has been combined and from this information an hourly flow has been calculated which represents the levels of traffic flow on Fassaroe Avenue based on the hours of operation of the Fassaroe Plant (08.00 – 18.00hours).

Table 12.3 details a maximum and an average hourly flow for Fassaroe Avenue.

	HGV	Car	Total (PCU)
Max	36	41	131
Average	20	24	74

Table 12.3: Hourly Two-way Traffic based on the hours of operation of the Fassaroe Plant

Information obtained from Traffic Count Data
To determine the existing volumes and speeds of traffic on Fassaroe Avenue, automatic traffic counters were installed at two locations on the road for a period of 10 days from Friday 4th May to Monday 14th May 2007. These counters recorded the volume of flow per direction, the vehicle classification (i.e. cars or Heavy Commercial Vehicles) and the speed of traffic flows in hourly intervals. In order to verify the speed flows, an additional radar speed survey was conducted at site 1 on Thursday 26th April 2007. Full details of the traffic surveys are contained in Appendix 12.2. Table 12.4 and 12.5 summarise the traffic volumes and speeds from these surveys.

Direction of flow	Period of Day (*)	Motor Cycles, Cars and Light Vans	Heavy Commercial Vehicles
Northbound traffic	Plant operational hours: 6:00am to 6:00pm	424	81
	24hour day	455	83
Southbound traffic	Plant operational hours: 6:00am to 6:00pm	482	87
	24hour day	517	90
Total Flows	Plant operational hours: 6:00am to 6:00pm	906	168
	24hour day	972	173

Table 12.4 Traffic Volumes on Fassaroe Avenue

Automated Traffic Counters				
Direction of flow	Posted Speed Limit (km/h)	Mean Speed Limit (km/h)	85%ile Speed Limit (km/h)	Proportion Exceeding posted limit
Site 1: Northbound	25	34.1	41.0	90.86%
Site 1: Southbound	25	34.6	42.5	88.76%
Site 2: Northbound	25	34.3	40.7	93.13%
Site 2: Southbound	25	38.3	44.6	97.00%
Average	25	35.3	42.2	92.44%
Radar Speed Surveys				
Site 1: Northbound	25	32.5	40.0	84.4%
Site 1: Southbound	25	31.3	38.0	79.2%
Average	25	31.9	39.0	81.8%

(*) Traffic Flows averaged over 4 working days from Tues 8th May to Fri 11th May 2007. Mon 7th May was a bank holiday.

Table 12.5 Traffic Speeds on Fassaroe Avenue

The results of the traffic survey contained in Table 12.4 indicate that the average two way traffic flows on Fassaroe Avenue for the operational hours of the quarry for a typical working day is 906 motorcycles / car / light vans, and 168 Heavy Commercial Vehicles. This equates to on average 76 motorcycles / car / light vans per hour and 14 Heavy Commercial Vehicles per hour.

The results of the traffic survey indicate that on average 66 motorcycles / car / light vans visit the established site operations and residential properties outside of the hours of 6:00am to 6:00pm, whilst on average only 5 Heavy Commercial Vehicles accessed the site outside of these operational hours each day. Whilst these figures indicate that traffic flows outside of the operational hours are minimal, it is noted that heavier volumes of Heavy Commercial Vehicles do sometimes occur during busy commercial periods.

Comparison of Traffic Information
The information provided by Roadstone Dublin, indicates the average traffic flow associated with the Fassaroe sand processing and concrete production facilities was a two-way flow of 548 vehicles, and a maximum two-way flow of 919 vehicles during the hours of operation. This compares well with the two-way flow of 906 vehicles obtained from the Automatic Traffic Count Data.

2007 Traffic Speeds
The results of the automated traffic count surveys indicate that the mean (average) speed for vehicles at the two survey sites was 35.3 km/h (22 mph) and the 85%ile speed was 42.2km/h (26 mph). The results of the radar speed surveys are comparable to the automated traffic count surveys with the mean speeds of vehicles recorded at 31.9 km/h (20 mph) and the 85%ile speed recorded at 39.0km/h (24 mph).

From the results of the speed surveys and on site observation, it is recognised that the traffic calming features contribute to a reduction in speed on the road; however a significant proportion of vehicles exceed the posted speed limit.

Following this a number of additional traffic calming measures where proposed for Fassaroe Avenue. The proposed traffic calming measures involved the following improvements to the layout of the existing feature;

- Replacing the concrete blocks with two narrowing kerb lines of 8 metres length or greater
- Installing reflective bollards at the entries to the narrowing (recently completed)
- Implementing "yield" signing and lining on the approaches to the feature (recently completed).

The provision of these improvements is expected to assist in reducing the traffic speeds upon the road to a more appropriate speed of 30 km/hr.

Berryfield Roundabout
The southern end of Fassaroe Avenue joins a 4 arm roundabout junction with Berryfield Lane, Fassaroe Lane and Berryfield Avenue. The inscribed circle diameter of this roundabout is 40m which includes dual circulatory lanes.

During on-site observations it was established that traffic volumes on the roundabout are low and that almost all traffic entered or exited the roundabout via Fassaroe Lane and the N11 (to the north). The traffic flows at this location have been conservatively estimated based on these observations and the types of land uses along each of the arms of the roundabout.

Given the number of residences along Berryfield Avenue, the traffic flows have been estimated at 5 vehicles entering the roundabout and 5 vehicles returning within a peak hour. These outbound and return trips have been assumed to arrive and depart via Fassaroe Lane.

Similarly, given the type and scale of development on Berryfield Lane, traffic flows have been conservatively estimated at 10 vehicles arriving and departing during a peak hour. Again, it has been assumed that these vehicles all enter and exit the roundabout via the Fassaroe Lane arm. Traffic entering via the Fassaroe Lane arm has therefore been estimated as the sum of traffic arriving at each of the other 3 arms of the junction.

Full details of the traffic flows into and out of each arm are outlined in full in the ARCADY outputs contained in Appendix 12.3 of this report.

12.3 IMPACT OF THE SCHEME

All new development can result in an increase in traffic flows on the surrounding road network. The increased volumes of traffic directly affect all road users and the surrounding local environment.

Possible effects to road users include: -

- Increased journey times for vehicular traffic;
- Increased difficulty in crossing roads for pedestrians / cyclists;
- Increased risk of accidents for all road users.

Increased traffic volumes on the road network may also result in significant impacts on the wider community and on the environment in terms of:

- Increased Noise
- Vibration
- Reduced Air Quality

This section of the EIS deals with the traffic generated by the proposed development and by the backfilling and restoration of the former quarry in particular. Specifically it addresses the distribution and assignment of traffic generated by these activities and the impacts it will have on the surrounding road network.

12.3.1 Evaluation Methodology

The methodology employed in the determining the impact of the proposed development upon the local road network involves the following elements;

- Obtain estimate for volume of additional traffic Generated by quarry backfilling works
- Compare generated traffic to that for existing Fassasroe aggregate / concrete plant
- Determine additional traffic movements due to Remediation Works
- Assess impact of this increase upon local road network.

12.3.2 Potential Impacts

Traffic Generation

The proposed backfilling operations at the Fassaroe Plant entail the importation of 620,000 tonnes of material required to fill the void. This translates to a total of 31,000 HGV movements at 20 tonnes per load to fill the quarry void.

Taking that there are 50 working weeks in the year, and 5.5 working days per week this gives a total of 2,750 working hours per year. This is based on a 10 hour period during the operational hours of the Fassaroe site, in which importing of material is likely to occur.

Roadstone Dublin Ltd defined a scenario where it would be possible to fill the void at Fassaroe in a two year period. Although it is likely that it will take significantly longer to fill this void, as a result of depressed market demand at the present time, the two year scenario has been taken as a worst case scenario.

From the information above, it is possible to obtain an average hourly HGV trip rate to and from the former quarry associated with the backfilling / restoration activities. This gives a figure of 6 HGV movements both into and out of the site per hour on average.

However, it is likely that this average figure will be exceeded during busy periods of the year. It was therefore necessary to obtain a maximum number of hourly trips for the backfilling operations.

A maximum figure has been arrived at by applying a variation factor of 1.8 to the average number of trips associated with the backfilling activity. This factor has been derived from the difference between the maximum HGV trips and average HGV trips observed over the 3 year period between 2006 and 2008. The variation between the average HGV trips and maximum daily HGV trips is outlined in Table 11.1 above.

As such, the maximum predicted flow associated with the backfill operations is 10 vehicles per hour, or 20 movements into and out of the quarry. This traffic flow is equivalent to 100 vehicle movements in and out of the site per day, the same level as that allowed by Wicklow County Council in its recent grant of planning permission for the waste recovery facility (Ref. No. 08/1258 dated 4 March 2009).

Combined Traffic on Fassaroe Avenue
The traffic levels associated with the Fassaroe Plant, the proposed backfilling activities and the residences along Fassaroe Avenue have been combined to obtain a 'worst case scenario' to be tested. Table 12.6 below summarises the total trips along Fassaroe Avenue in this 'worst case' peak hour scenario:

	HGV	Car	Total (Veh/hr)	Total (PCU)
Max	56	41	97	182
Average	31	24	55	102

Table 12.6 Total Vehicle Movements per hour on Fassaroe Avenue involving the Worst Case Scenario traffic from Fassaroe Plant coinciding with Existing Residential Traffic

A comparison of this 'worst case scenario' predicted hourly flow against the existing observed flows for 2006, 2007 and 2008 indicates that in the maximum scenario, the increase in HGV traffic will be 20No. vehicles in an hour period and an increase of 11No. HGVs in the average scenario. The predicted volume of cars will remain the same as the existing scenario.

Impact upon Fassaroe Avenue
The quarry restoration works will result in an increase in traffic volumes upon Fassaroe Avenue. In the worst case scenario this increase in traffic volumes will result in an additional 20No. HGV vehicles during the peak hour period. This will result in a total two-way flow of 97 No. vehicles, or 1.5 vehicles a minute, during the worst case scenario.

The capacity threshold for existing rural roads is set out in table C4.2, Chapter 4 of the NRA's RT180 "Geometric Design Guidelines". Table C4.2 indicates that for a 6.5m wide carriageway with zero passing distances greater than 450m, the two way capacity flow is 650 pcu/hr (Passenger Car Units) for a level of service C road.

The estimated maximum hourly two way flow upon Fassaroe Avenue is 182 pcu/hr, which gives the road a ratio of flow to capacity of 0.28. Whilst the capacity of this link has been reduced due to the implementation of traffic calming features, it is clearly evident from the above assessment and onsite observations that the capacity of Fassaroe Avenue is adequate for the maximum generated traffic flows.

As noted previously, the traffic speeds obtained from the traffic surveys indicates that the 85th percentile speed upon Fassaroe Avenue is 39 km/hr and in excess of the speed limit signs erected along this road. The increase in the traffic flows is unlikely to reduce this traffic speed and hence mitigation measures to ensure that this prevailing speed is reduced should be implemeneted.

Impact upon Berryfield Roundabout
An assessment was undertaken of the existing Berryfield Roundabout to determine whether any adverse effects such as queuing or delay would be brought about as a result of the waste recovery activities at Fassaroe.

For the "worst case scenario" as defined above, the roundabout was analysed using the TRL junction analysis program ARCADY. The flow estimates as described above were applied to the each of the other arms of the junction in order to undertake the analysis. The Ratio of Flow to Capacity (RFC) and the amount of delay was determined from this computer analysis.

If the RFC is 0.85 or greater the junction is said to be over capacity however, in the instances where this happens, if the delays are deemed to be acceptable and over a short period it can be taken that the junction is operating sufficiently well for an urban environment.

Table 12.7 summarises the result of this junction analysis:

	Worst Case Scenario		
Arm	**Maximum RFC**	**Maximum Queue (vehicles)**	**Delay (secs)**
Fassaroe Avenue (to quarry)	0.056	0.1	4.2
Berryfield Lane	0.011	0.0	3.6
Fassaroe Lane (to N11)	0.056	0.1	3
Berryfield Avenue	0.006	0.0	4.2

Table 12.7 ARCADY Analysis for Berryfield Roundabout

Table 12.7 illustrates that the junction operates effectively in the worst case scenario. The RFC values are low on each arm and there is minimal queuing and delay observed. The existing Berryfield Roundabout is sufficiently sized to cater for the extent of traffic that could potentially be generated by the Fassaroe waste recovery facility in the worst case scenario.

Full details of the analysis are contained in Appendix 12.3 of this report.

Impact upon Private Entrances
As described above, the proposed backfilling / restoration operations will introduce additional traffic onto Fassaroe Avenue. In the worst case scenario, the total number of movements travelling along Fassaroe Avenue, including residential trips, is 97 vehicles in the hour. This equates to less that 2 vehicles per minute. As such, there is adequate opportunity in even the worst case scenario for vehicles to enter and exit the residential properties without undue delay.

As noted previously, the entrances to both Sandiacre and Kilvaragh are gated and are set back an insufficient distance from the road edge to allow visitors to park off of the road. Visibility from these entrances is also restricted to less than 5m from a 2m set-back due to the location of the hedge lines and the alignment of the road this leads to a potential safety issue for vehicles exiting these properties.

Whilst it is acknowledged that mirrors have been placed to assist with visibility at these entrances, it is recommended that permanent improvements be made to the alignment at these accesses to improve visibility and safety.

The increase in traffic movements upon Fassaroe Avenue will increase the possibility of an accident occurring for a vehicle exiting these entrances. In order to mitigate against this it is proposed to locally realign the road and provide for a buffer zone outside these properties, thus improve the visibility from these properties. These mitigation measures are discussed in more detail within section 12.4 of this report.

12.3.2 Do-Nothing Scenario
Activity and production volumes at the existing aggregate processing and concrete production facilities at Fassaroe has reduced significantly in recent months (early 2009) on account of the economic downturn. In the do-nothing scenario over the short-to-medium term therefore, the expected volume of traffic along Fassaroe Avenue is expected to reduce significantly.

12.4. MITIGATION MEASURES

12.4.1 Proposed Measures
There are two proposed elements of mitigation proposed for the facility. These measures can be divided into two sections

1. Improvements to Traffic Calming Measures upon Fassaroe Avenue
2. Local Realignment of Fassaroe Avenue to provide improved visibility from private residential dwellings.

These two elements of the proposed mitagtion are detailed in more details below;

Improvements to Traffic Calming Measures upon Fassaroe Avenue
As noted above, the existing prevailing 85th percentile speed upon Fassaoroe Avenue is 39 km/hr, and it would be more appropriate to have a prevailing speed of 30 km/hr. A number of measures previously recommended in this regard have recently been implemented including

- Installation of reflective bollards at the entries to the narrowing and
- Implementing "yield" signing and lining on the approaches to the feature.

In line with earlier recommendations, consideration will also be given to replacing concrete blocks with two narrowing kerb lines of 8 metres length or greater

Local Realignment of Fassaroe Avenue to provide Improved Visibility
In order to improve the visibility from the residences at 'Sandiacre' and 'Kilvaragh', it is proposed to locally realign Fassaroe Avenue locally. This widening involves creating a 2.0m wide buffer along the frontage of these two properties and realigning the road locally to provide for a 7.0m carriageway. This realignment involves the removal of the existing hedge and trees upon the opposite side of the carriageway, however can be accommodated without the need for third party lands, details of this local realignment is detailed upon Drawing no WSP 20010200/100/001 Rev A, included in Appendix 12.1.

The provision of this local road realignment will significantly improve the visibility splays at these entrances, and provide visibility splays in excess of 50m from both entrances. This visibility splay is more than sufficient for a speed of 30 kph.

12.4.2 Residual Impacts

The mitigation elements will assist in reducing the traffic speeds and will improve the visibility from the existing residential dwellings, thus improving the road safety for all users. However all development have some traffic associated with it and this will result in some residual, albeit minor impact.

12.5 INTERACTIONS

The principal environmental interactions with traffic are noise and air quality. These impacts are assessed separately in Sections 7 and 8 of this EIS.

REFERENCES

RT180 (1977, Revised 1986), *Geometric Design Guidelines (Classification, Alignment, Cross-Section),* National Roads Authority, Ireland

PLATES

Plate 12.1 Existing road hump and road narrowing on Fassaroe Avenue

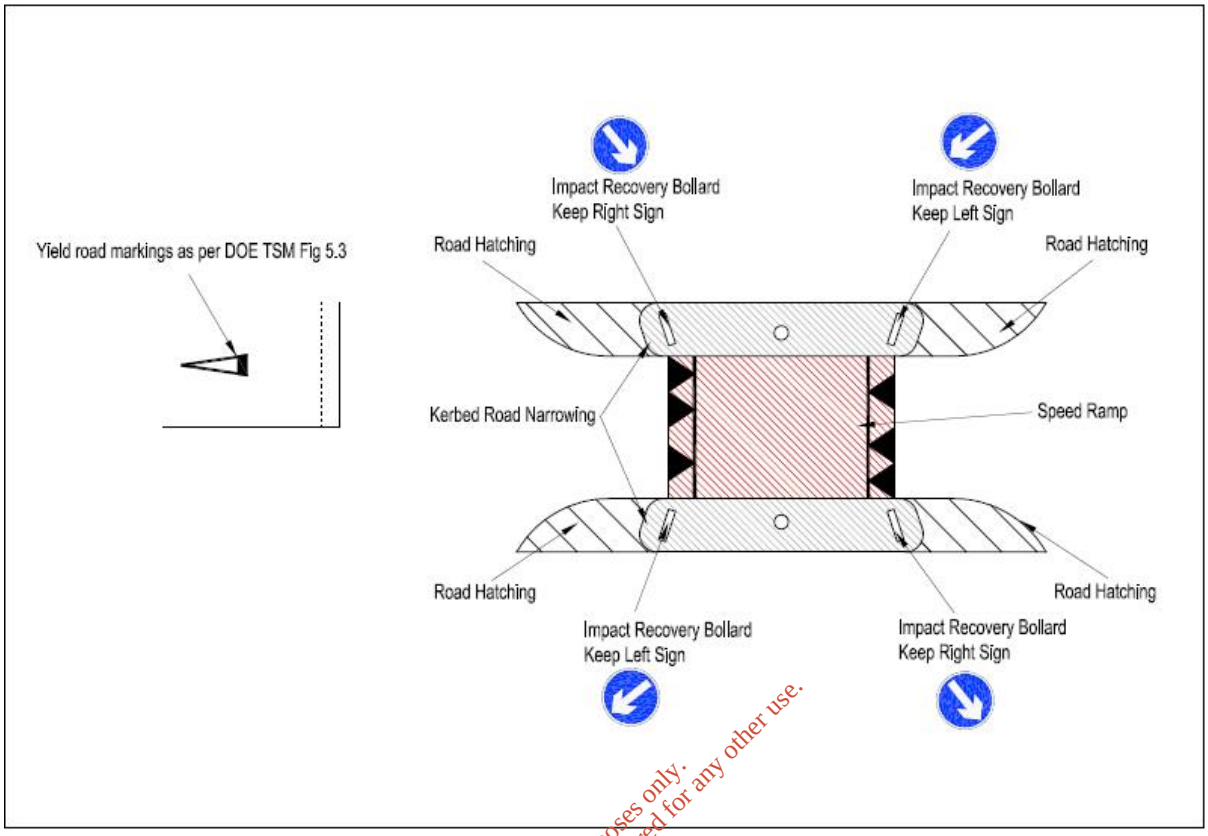

Plate 12.2 Details of Proposed Improvements to Traffic Calming

APPENDIX 12.1

SKETCHES

Ordnance Survey Ireland Licence No. EN 0004508 © Government of Ireland

F:\WSPIPROJECTS\20010200 FASSAROE PLANT TRAFFIC STUDY\DRAWINGS & MAPPING\WSP RECORD DRAWINGS\08-11-26 REALIGN AT RESIDENCES.DWG

WSP

TITLE:

Site Location Map

Fassaroe Plant Traffic Assessment

FIGURE No:

Sketch EIS/01

APPENDIX 12.2

TRAFFIC SURVEY DATA

Count On Us
TRANSPORTATION DATA COLLECTION

33710 - FASSAROE
APRIL 2007
SPEED SURVEYS

DATE : THURSDAY 26th APRIL 2007 TIME : 13:45 to 17:45

SITE : FASSAROE LANE SPEED LIMIT : 25 KM/H

NORHTBOUND STATISTICS					
Average Speed (km/h)	32.5		Maximum Speed (km/h)		60
Median Speed (km/h)	32.0		Minimum Speed (km/h)		16
85 %ile (km/h)	40.0		Number Speeding	130	84.4%

NORTHBOUND SPEEDS (km/h)							
24	34	28	18	37	36	32	26
22	32	25	26	26	22	27	33
28	34	32	29	38	28	27	60
35	30	26	16	32	32	33	45
31	36	41	33	24	39	32	29
31	52	34	26	23	26	37	42
28	34	24	27	33	32	40	33
24	30	18	28	28	25	31	31
28	28	37	28	32	34	35	36
30	36	45	36	25	41	35	29
41	34	35	29	27	29	40	47
37	40	24	25	32	24	20	43
35	46	60	39	39	29	31	53
33	30	40	25	32	29	27	41
44	37	23	33	32	27	36	17
33	27	35	40	27	36	23	39
44	26	32	36	23	42	34	24
32	27	40	29	37	33	45	26
57	29	31	19	34	26	32	39
28	44						

Count On Us
TRANSPORTATION DATA COLLECTION

33710 - FASSAROE
APRIL 2007
SPEED SURVEYS

DATE : THURSDAY 26th APRIL 2007 TIME : 13:45 to 17:45

SITE : FASSAROE LANE SPEED LIMIT : 25 KM/H

SOUTHBOUND STATISTICS					
Average Speed (km/h)	31.3		Maximum Speed (km/h)		56
Median Speed (km/h)	31.0		Minimum Speed (km/h)		18
85 %ile (km/h)	38.0		Number Speeding	103	79.2%

SOUTHBOUND SPEEDS (km/h)							
23	29	32	40	22	36	38	30
38	31	20	27	27	35	31	30
41	56	34	25	27	38	33	21
24	29	33	18	30	31	34	35
43	26	28	19	21	25	28	28
20	38	32	35	30	34	36	25
27	28	18	33	33	42	32	33
35	33	36	35	41	25	35	28
35	27	38	33	24	38	43	39
19	25	41	31	32	46	35	27
37	18	34	23	31	35	41	37
39	26	31	18	43	25	33	39
28	31	34	19	35	29	20	34
36	25	44	36	30	31	26	36
31	27	24	29	40	37	31	34
32	20	29	30	19	34	26	42
30	42						

APPENDIX 12.3

ARCADY RESULTS

TRL TRL VIEWER 3.1 AD f:\WSPI\Projects\20010200 Fassaroe Plant Traffic Study\Data\08-11-13 Berryfield Rounda

ARCADY 6

ASSESSMENT OF ROUNDABOUT CAPACITY AND DELAY

Analysis Program: Release 4.0 (FEBRUARY 2006)

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Run with file:-
"f:\WSPI\Projects\20010200 Fassaroe Plant Traffic Study\Data\08-11-13 Berryfield Roundabout.vai"
(drive-on-the-left) at 11:10:05 on Friday, 14 November 2008

FILE PROPERTIES

RUN TITLE: Fassaroe Plant CFI - Berryfield Roundabout
LOCATION: Fassaroe, Co Wicklow
DATE: 13/11/08
CLIENT: Roadstone Dublin Ltd
ENUMERATOR: iepxc017 [ZW0175BRM1UK]
JOB NUMBER: 20010200
STATUS: Clarification of Fur
DESCRIPTION:

INPUT DATA

ARM A - Fassaroe Avenue
ARM B - Berryfield Lane
ARM C - Fassaroe Lane
ARM D - Berryfield Avenue

GEOMETRIC DATA

ARM	V (M)	E (M)	L (M)	R (M)	D (M)	PHI (DEG)	SLOPE	INTERCEPT (PCU/MIN)
ARM A	3.00	6.00	30.00	10.00	40.00	30.0	0.591	25.325
ARM B	3.00	4.00	30.00	10.00	40.00	30.0	0.512	18.749
ARM C	3.50	7.00	30.00	20.00	40.00	30.0	0.668	30.545
ARM D	2.75	3.50	20.00	6.00	40.00	30.0	0.451	15.299

V = approach half-width L = effective flare length D = inscribed circle diameter
E = entry width R = entry radius PHI = entry angle

TRAFFIC DEMAND DATA

(Only sets included in the current run are shown)

ARM	FLOW SCALE(%)
A	100
B	100
C	100
D	100

TIME PERIOD BEGINS 12.45 AND ENDS 14.15

TRL TRL VIEWER 3.1 AD f:\WSPI\Projects\20010200 Fassaroe Plant Traffic Study\Data\08-11-13 Berryfield Rounda

LENGTH OF TIME PERIOD - 90 MINUTES.
LENGTH OF TIME SEGMENT - 15 MINUTES.

DEMAND FLOW PROFILES ARE SYNTHESISED FROM TURNING COUNT DATA

DEMAND SET TITLE: Fassaroe Plant CFI - Berryfield Roundabout

ARM	NUMBER OF MINUTES FROM START WHEN FLOW STARTS TO RISE	TOP OF PEAK IS REACHED	FLOW STOPS IFALLING	RATE OF FLOW (VEH/MIN) BEFORE PEAK	AT TOP OF PEAK	AFTER PEAK
ARM A	15.00	45.00	75.00	0.61	0.92	0.61
ARM B	15.00	45.00	75.00	0.13	0.19	0.13
ARM C	15.00	45.00	75.00	0.80	1.20	0.80
ARM D	15.00	45.00	75.00	0.06	0.09	0.06

DEMAND SET TITLE: Fassaroe Plant CFI - Berryfield Roundabout

TIME	FROM/TO	ARM A	ARM B	ARM C	ARM D
12.45 - 14.15					
	ARM A	0.000	0.000	1.000	0.000
		0.0	0.0	49.0	0.0
		(0.0)	(0.0)	(58.0)	(0.0)
	ARM B	0.000	0.000	1.000	0.000
		0.0	0.0	10.0	0.0
		(0.0)	(0.0)	(5.0)	(0.0)
	ARM C	0.766	0.156	0.000	0.078
		49.0	10.0	0.0	5.0
		(58.0)	(5.0)	(0.0)	(0.0)
	ARM D	0.000	0.000	1.000	0.000
		0.0	0.0	5.0	0.0
		(0.0)	(0.0)	(0.0)	(0.0)

QUEUE AND DELAY INFORMATION FOR EACH 15 MIN TIME SEGMENT

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
12.45-13.00									
ARM A	0.61	15.96	0.038		0.0	0.0	0.6		0.07
ARM B	0.13	17.35	0.007		0.0	0.0	0.1		0.06
ARM C	0.80	21.04	0.038		0.0	0.0	0.6		0.05
ARM D	0.06	14.80	0.004		0.0	0.0	0.1		0.07

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
13.00-13.15									
ARM A	0.73	15.94	0.046		0.0	0.0	0.7		0.07
ARM B	0.15	17.25	0.009		0.0	0.0	0.1		0.06
ARM C	0.96	21.04	0.045		0.0	0.0	0.7		0.05
ARM D	0.07	14.70	0.005		0.0	0.0	0.1		0.07

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
13.15-13.30									
ARM A	0.90	15.92	0.056		0.0	0.1	0.9		0.07
ARM B	0.18	17.12	0.011		0.0	0.0	0.2		0.06
ARM C	1.17	21.04	0.056		0.0	0.1	0.9		0.05
ARM D	0.09	14.57	0.006		0.0	0.0	0.1		0.07

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
13.30-13.45									
ARM A	0.90	15.92	0.056		0.1	0.1	0.9		0.07
ARM B	0.18	17.12	0.011		0.0	0.0	0.2		0.06
ARM C	1.17	21.04	0.056		0.1	0.1	0.9		0.05
ARM D	0.09	14.57	0.006		0.0	0.0	0.1		0.07

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
13.45-14.00									
ARM A	0.73	15.94	0.046		0.1	0.0	0.7		0.07
ARM B	0.15	17.25	0.009		0.0	0.0	0.1		0.06
ARM C	0.96	21.04	0.045		0.1	0.0	0.7		0.05
ARM D	0.07	14.70	0.005		0.0	0.0	0.1		0.07

TIME	DEMAND (VEH/MIN)	CAPACITY (VEH/MIN)	DEMAND/ CAPACITY (RFC)	PEDESTRIAN FLOW (PEDS/MIN)	START QUEUE (VEHS)	END QUEUE (VEHS)	DELAY (VEH.MIN/ TIME SEGMENT)	GEOMETRIC DELAY (VEH.MIN/ TIME SEGMENT)	AVERAGE DELAY PER ARRIVING VEHICLE (MIN)
14.00-14.15									
ARM A	0.61	15.96	0.038		0.0	0.0	0.6		0.07
ARM B	0.13	17.35	0.007		0.0	0.0	0.1		0.06
ARM C	0.80	21.04	0.038		0.0	0.0	0.6		0.05
ARM D	0.06	14.80	0.004		0.0	0.0	0.1		0.07

QUEUE AT ARM A

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
13.00	0.0
13.15	0.0
13.30	0.1
13.45	0.1
14.00	0.0
14.15	0.0

QUEUE AT ARM B

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
13.00	0.0
13.15	0.0
13.30	0.0
13.45	0.0
14.00	0.0
14.15	0.0

QUEUE AT ARM C

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
13.00	0.0
13.15	0.0
13.30	0.1
13.45	0.1
14.00	0.0
14.15	0.0

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QUEUE AT ARM D

TIME SEGMENT ENDING	NO. OF VEHICLES IN QUEUE
13.00	0.0
13.15	0.0
13.30	0.0
13.45	0.0
14.00	0.0
14.15	0.0

QUEUEING DELAY INFORMATION OVER WHOLE PERIOD

ARM	TOTAL DEMAND		* QUEUEING * DELAY *		* INCLUSIVE QUEUEING * DELAY *	
	(VEH)	(VEH/H)	(MIN)	(MIN/VEH)	(MIN)	(MIN/VEH)
A	67.2	44.8	4.4	0.07	4.4	0.07
B	13.7	9.1	0.8	0.06	0.8	0.06
C	87.8	58.5	4.4	0.05	4.4	0.05
D	6.9	4.6	0.5	0.07	0.5	0.07
ALL	175.5	117.0	10.0	0.06	10.0	0.06

* DELAY IS THAT OCCURRING ONLY WITHIN THE TIME PERIOD.
* INCLUSIVE DELAY INCLUDES DELAY SUFFERED BY VEHICLES WHICH ARE STILL QUEUEING AFTER THE END OF THE TIME PERIOD.
* THESE WILL ONLY BE SIGNIFICANTLY DIFFERENT IF THERE IS A LARGE QUEUE REMAINING AT THE END OF THE TIME PERIOD.

END OF JOB

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