



SEVERN ROAD RESOURCE RECOVERY CENTRE

CHAPTER 6- TRAFFIC ASSESSMENT

Viridor

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INTRODUCTION

- 6.1 This Chapter considers the possible environmental impacts that might be derived from the traffic and transport movements associated with the construction of a Resource Recovery Centre (RRC) which will incorporate a Materials Recovery Facility (MRF) and an Energy from Waste (EfW) facility at the former SEVALCO site, Severn Road, Avonmouth, Bristol.
- 6.2 The facility will be constructed as a merchant facility that will operate on a purely commercial basis, albeit that the facility is likely to form an integral component of the region's waste management programmes by reducing the amount of waste that will otherwise be disposed of via landfill. Indeed, the West of England Partnership recognises the need for such a facility and has identified the Avonmouth industrial area as a preferred location¹.
- 6.3 The applicant envisages that the proposed EfW facility will process up to 350,000 tonnes of waste per annum and this will be transported to the site in heavy goods vehicles via the existing road network.
- 6.4 The proposed MRF will be a specialist plant that separates, processes, and stores recyclable material, with capacity to sort some 150,000 tonnes of material per annum. Waste delivered to the MRF that cannot be recycled and is suitable for incineration will be sent to the EfW facility. This is likely to equate to some 60,000 tonnes every year and will be sent to the EfW facility as an internal waste transfer: this figure being included within the aforementioned input to the EfW.
- 6.5 Incorporated within the proposals are localised highways improvements, including to the existing site access and the A403-Severn Road/A403-Chittening Road junction, which have been designed to safely and efficiently accommodate development traffic in a manner that avoids disturbance to existing traffic movements on the main roads.

¹ Outline Business Case: PFI Credit Support for Waste Treatment Facilities, The West of England Partnership, October 2008

Site Location

- 6.6 The application site is situated approximately 6 kilometres north of junction 18a of the M5 Motorway and 9.3 kilometres south of Junction 1 of the M48 Motorway. The site comprises approximately 8.3 hectares of land that is developed as part of the former 'SEVALCO' site'. The plant, which historically operated across two parcels of land that were separated by Severn Road, is located approximately 230 metres east of the junction that is formed where the A403-Severn Road meets with the A403-Chittening Road. The location of the application site is shown on Drawing 6/1.
- 6.7 All SEVALCO operations have ceased and the site has lain derelict for almost a year, although the site has not been cleared of any structures. The application site is now within the ownership of the applicant, who intends to clear and redevelop the site to accommodate the proposed development.
- 6.8 Existing vehicular access is taken from Severn Road in the form of two priority T-junctions located south of the junction with A403-Chittening Road. Both junctions incorporate a bridge structure over an existing drainage channel and junction visibility appears to be within acceptable limits.
- 6.9 The area surrounding the application site is characterised by heavy industrial land-uses, although it is noteworthy that residential areas exist in the locality of Avonmouth and Severn Beach railway stations, and the village of Pilning north of the site. The village of Hallen also lies some 1.8 kilometres southeast of the application site, although it is noteworthy that a 7.5 tonne weight limit applies to the road through Hallen.

Methodology

- 6.10 This assessment has been prepared in accordance with the document entitled 'Guidance on Transport Assessment' (DfT 2007), which provides the necessary guidelines on which to assess the traffic and transportation impacts of new development. In this way, the assessment of traffic impacts has been undertaken following various scoping meetings with Bristol City Council, being the local highway authority.
- 6.11 Indeed, a preliminary scoping meeting was held on 7th July 2008 and attended by Frank Cashmore as representative of Bristol City Council, and Stuart Choak and Jonathan Bevan of SLR Consulting Limited, representing the applicant. The purpose of the meeting was to inform the local highway authority of the intention to submit an application for a redevelopment of the site and to identify the likely scope of any assessment. Notes from the meeting are included at Appendix 6/1.
- 6.12 Following the above meeting the scheme underwent a series of evolutions and, wanting to keep the local highway authority apprised of the situation and to offer them the opportunity to raise any additional concerns, a meeting was arranged on the 3rd July 2009. This meeting was attended by Miss Jane Woodhouse who had since replaced Frank Cashmore, and Stuart Choak of SLR Consulting Limited.

- 6.13 At the meeting, Miss Woodhouse commented on the need for any assessment to take account of the cumulative affects of the development and thereby to consider the traffic generation associated with the committed Deep Sea Container Port and Cabot Park planning applications.
- 6.14 Miss Woodhouse also suggested that the proposals to signalise the A403-Severn Road/A403-Chittening Road junction would, subject to a road safety audit, be likely to be viewed positively by the authority given the benefits afforded by the scheme towards road safety and speed reduction.
- 6.15 This assessment duly incorporates the comments made during the scoping exercise.

Accessibility by a Choice of Transport Modes

- 6.16 This assessment will review the provision and quality of existing transport infrastructure for all modes of travel and an assessment will be made of the accessibility of the site against what might be considered to be a realistic standard of provision for the type of development being prepared.
- 6.17 The accessibility of the application site by non-car modes of travel will be assessed against the following three criteria:-
- the proximity of the nearest serviced interchanges to the application site and the opportunities for interconnecting links between the site and these interchanges;
 - the frequency of services available from the transport interchanges; and;
 - the destinations served by the services.
- 6.18 The accessibility of the site by car will be considered by reference to its geographical location in the context of infrastructure serving the immediate locality, as well as the wider area.

Traffic Effects

- 6.19 The baseline traffic growth situation will be modelled with consideration to consented developments in the vicinity, which would account for all traffic growth in the area. The assessment would assess the development impacts against the change in the current operation of junctions local to the application site.
- 6.20 In agreement with the local highway authority, the study area road network considered by this assessment will include the following junctions and interconnecting links:
- The proposed site access onto Severn Road;
 - The A403-Severn Road / A403-Chittening Road priority T-junction;
 - The St. Andrews Gate Roundabout; and
 - The Redwick Crossroads.

- 6.21 A qualitative assessment of the environmental impacts of site traffic will also be undertaken, having particular regard to impacts caused by heavy goods vehicles (HGVs).

Road Safety

- 6.22 The potential effects of the calculated development traffic flows in the context of highway safety will be undertaken with regard to the historical pattern of accidents occurring within the agreed study area.
- 6.23 Based on the existing pattern of accidents, an evaluation will be undertaken to establish if the calculated development traffic flows would lead to an abnormal safety risk.

DEVELOPMENT PROPOSALS

Application Details

- 6.24 The proposed development of the site is shown on the plan at Appendix 6/2, although the main features pertinent to transport and highways are summarised below:
- A 'Materials Recovery Facility' that has the capacity to process up to 150,00 tonnes of waste per annum;
 - An Energy from Waste Facility with capacity to process up to 350,000 tonnes of waste per annum; and
 - Ancillary offices and welfare facilities

Incorporated Highway Improvements

- 6.25 Incorporated within the development proposals are improvements to the site access, the geometry of Severn Road adjacent to the application site, and plans to signalise the A403-Severn Road / A403-Chittening Road junction. The proposed highway improvements are shown at Drawing 6/2.
- 6.26 The site access shall be improved so as to ease two-way movements by heavy goods vehicle traffic. To this end, the southernmost site access, located 245-metres southeast of the junction of A403- Severn Road / A403-Chittening Road, will be improved to provide 15-metre radii. The proposals have also been designed to provide visibility in accordance with TD42/95, which requires visibility over 160 metres from a 4.5-metre set-back position.
- 6.27 Complimentary of the proposed improvements to the site access are proposals to widen the carriageway of Severn Road between the proposed site access and the A403-Severn Road / A403-Chittening Road junction, to provide a 7.3-metre carriageway. This is commensurate to accommodating two-way heavy goods vehicle traffic and is the traditional industrial estate standard. Forward visibility would also be improved through easement of the existing road alignment.
- 6.28 Under the proposals, the applicant also intends to signalise the existing priority T-junction comprising A403-Severn Road and A403-Chittening Road. However, it is noteworthy that, in consideration of the extant use of the application site, and the similarities in potential trip generation with the proposed development, the development proposals could be accommodated by the existing junction layout, both in capacity and safety terms. Nevertheless, the applicant is aware of the issues relating to excessive vehicle speeds, which are seen as contributory factors to accidents involving vehicles over-turning on nearby parts of the network, and consequently the applicant proposes the improvements as a wider community benefit.
- 6.29 In respect of the junction layout, it is proposed that a flared two-lane approach would be provided on the A403-Chittening Road approach; the nearside lane being for the left-turn onto the A403-Severn Road and the short off-side lane

being for the right turn onto Severn Road, towards the application site. Single lane approaches would be provided on both Severn Road approaches and a Pelican crossing would be incorporated within the signal phasing over Severn Road (towards the application site) in order to tie-in with the National Cycle Route.

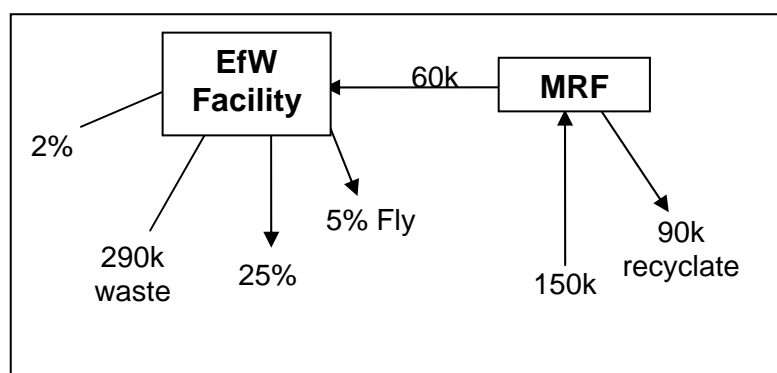
- 6.30 Vehicle swept-path analysis has been undertaken using the AutoTRACK software to simulate movements at the improved junction by an FTA Design 16.5 metre articulated vehicle, which would be the largest vehicle likely to visit the development. The results are shown at Drawing 6/3 which demonstrates that the junction geometry is commensurate with movements by such movements.
- 6.31 As part of the scoping process, the local highway authority have been issued within a copy of the proposed junction improvements and, following their comments, a number of minor geometric changes have been in order to further satisfy the authority.
- 6.32 A review of the existing highway boundary indicates that all improvements could be accommodated within either the existing limits of the adopted highway or within land under the applicant's control.

Operational Details

- 6.33 In respect of the general operation of the EfW, it is anticipated that the facility will handle some 350,000 tonnes of waste every year. Of this, however, 290,000 tonnes will be delivered directly and 60,000 tonnes will be received as an internal transfer from the proposed MRF.
- 6.34 Of the 290,000 tonnes of waste that will be delivered directly to the EfW, it is anticipated that 230,000 tonnes will be delivered in bulk from waste transfer stations located throughout the region. The remaining 60,000 tonnes is expected to be received by way refuse collection vehicles (RCVs) collecting from the kerbside. It is noteworthy that waste delivered by RCVs will comprise a diverted trip since such traffic movements already take place on the wider road network.
- 6.35 Additional inputs are required for disposal of waste within the EfW and this comprises the delivery of lime which is used in the incineration process. Lime input is typically equivalent to 2.5% of the waste input and so, in the case of the proposed development, equates to approximately 9,000 tonnes per annum.
- 6.36 Residual non-combustible material in the form of Fly Ash and Incinerator Bottom Ash (IBA) will remain as an output of the facility. IBA is a non-hazardous by-product which will be exported from the site for use as an aggregate within the construction industry. The exact proportion of IBA is highly dependant on the waste input. However, typically 25% of the input waste can be assumed as a rigorous estimate of IBA output. Therefore, in the case of the proposed development, the assessment assumes approximately 90,000 tonnes of IBA will be exported from the site annually.

- 6.37 Fly ash is considered a hazardous material due to its alkaline content and is typically produced at a ratio of around 5% of the waste input. With this in mind, the assessment assumes that 18,000 tonnes of Fly Ash will be exported from the site to landfill sites capable of handling hazardous waste, each year.
- 6.38 The MRF is anticipated to process up to 150,000 tonnes of waste per annum and it is expected that 60,000 tonnes would not be recyclable and so would be transferred to the EfW facility for disposal. Consequently, the MRF is expected to output 90,000 tonnes of sorted material from the site annually.
- 6.39 For ease, the operation of the proposed development, comprising the EfW facility and MRF, can be usefully summarised by Figure 1 below.

Figure 1



- 6.40 In respect of operating times, the EfW facility and MRF will be a 24-hour waste operation, albeit the majority of deliveries will be between the hours of 06:00 and 19:00hours.
- 6.41 In terms of staff numbers, the EfW facility is expected to employ 40 members of staff. Of these, 16 will be day workers who will arrive between 07:00 and 08:00 hours, and depart between 16:00 and 17:00 hours. The remaining staff will be shift workers who will be split into three shifts of 8. The shifts are expected to start at 07:00, 14:00 and 22:00 with the workers arriving on site in the thirty minutes before the start of the shift.
- 6.42 The MRF will employ 25 members of staff, arriving between 05:00 and 06:00 and departing between 17:00 and 18:00.
- 6.43 On this basis, the majority of staff movements will occur outside of the busiest times on the road network.

Car Parking

- 6.44 Relevant car parking standards are contained within Chapter 9 of The West of England Joint Local Transport Plan (JLTP). In it, car parking standards are expressed as maxima and relate to individual classifications of land use. However, given the sui generis land use of the Facility, no values are expressed and, as such, there are no standards on which to assess the development proposals.

- 6.45 Nevertheless, car parking provision has been assessed on a need basis and the level of car parking reflects the number of staff and visitors that would be likely to be on site at any one time. In the absence of any predefined standard, this approach reflects the aspirations of local and national policy, which is to avoid an over provision of car parking spaces whilst ensuring there would be no adverse impact to the public highway. 79 car parking spaces are proposed (4 of these would be for blue badge holders).

BASELINE REVIEW

Accessibility by Road

- 6.46 Bristol City Council is the local highway authority for the majority of roads within the study area road network. However, South Gloucestershire Council have responsibility for the network in vicinity of the Redwick Crossroads located north of the application site. In addition, the Highways Agency is responsible for the maintenance of the A403 commencing at the St. Andrew's Gate Roundabout and east towards the M5 Motorway.
- 6.47 The existing highway network within the vicinity of the application site is illustrated on Drawing 6/4, however, for convenience, the salient components of the study area road network are described below.
- 6.48 The application site currently receives access via two priority T-junctions that connect onto Severn Road southeast of the priority T-junction that connects the A403-Severn Road with the A403-Chittening Road. The two site access junctions were traditionally used in relation to the servicing of the former SEVALCO site and, as such, would have been likely to accommodate heavy goods vehicle movements.
- 6.49 Both junctions appear to have acceptable levels of visibility from a 4.5 metre set-back, although the most southern access would benefit from increased junction radii if it were to accommodate two-way HGV traffic movements.
- 6.50 Severn Road, from which access to the application site is provided, is a two-way single lane carriageway road that runs roughly on a northwest/southeast alignment and connects with the A403-Severn Road/A403-Chittening Road in the north and Hallen Road to the south. The road is subject to a 50mph speed limit, is without street lighting and lined by soft verges.

Photograph 1 – Severn Road (Looking South)



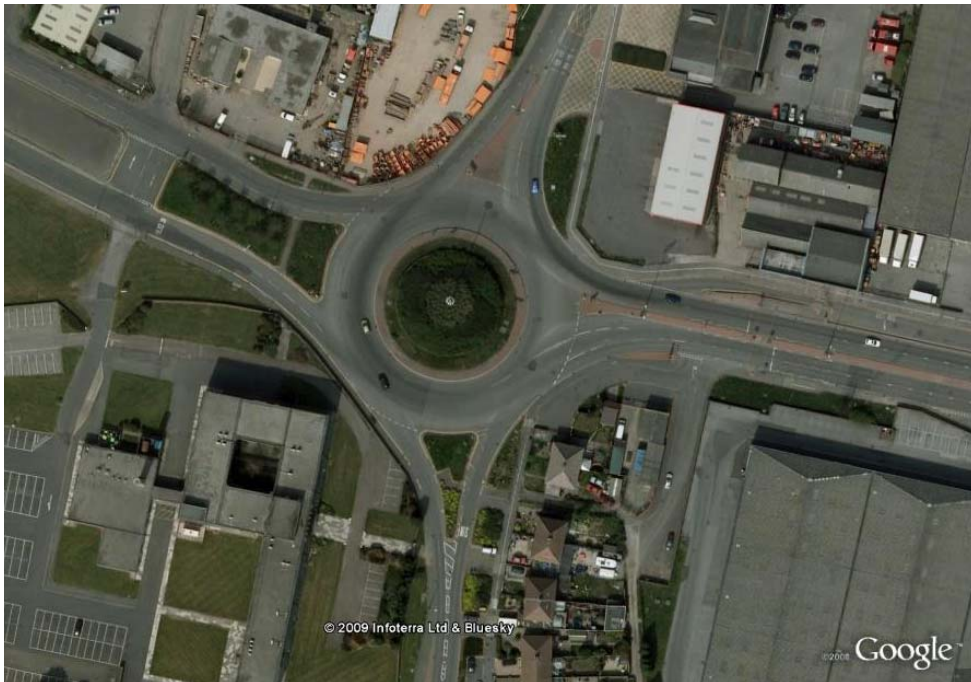
- 6.51 Severn Road connects with the A403-Severn Road / A403-Chittening Road at a priority T-junction some 245-metres northwest of the proposed site access. At this location, Severn Road connects with the main road on the corner of a 90 degree bend and so adequate visibility from Severn Road is achieved. However, forward visibility through the bend is restricted by over-grown vegetation in the highway verge. This is the responsibility of the local highway authority and should be trimmed back regularly.
- 6.52 The speed limit through this section of the A403 has recently been reduced to 50mph in order to address vehicles travelling at excessive speeds.

Photograph 2 – A403 Severn Rd / A403 Chittening Road Junction



- 6.53 South of the above priority T-junction, the A403 connects the A403-Chittening Road with Crowley Way, McLaren Road and King Road Avenue in the form of a roundabout. This junction has recently been upgraded to a traffic signal controlled junction and the predominant traffic movements appear to be between Chittening Road and Crowley Way.

Photograph 3 – St. Andrew’s Gate Roundabout



- 6.54 North of the application site, the A403 connects with the B46064-Redwick Road at a traffic signal controlled four-arm junction. At this location the A403 is a dual carriageway road that flares to three lanes on approach to the junction. Redwick Road approaches are provided as wide single lane approaches. The junction appears to be illuminated to modern standards.

Photograph 4 – Redwick Crossroads



Accessibility by Non-Car Modes

- 6.55 The nearest bus stop to the application site is located at the junction of the A403-Severn Road / A403-Chittening Road, which is within the desirable maximum walk distance of 400 metres. This bus stop is serviced by the 41 and 40A bus services that are operated by First Buses.
- 6.56 These services operate between Avonmouth and Cherry Gardens via Shirehampton, Bristol City Centre and Kingswood. The weekday services commence 06:13 and cease at 23:03. After 19:00 hours the 41 service ceases.
- 6.57 Irrespective of the fact that the application site is accessible by bus, the likely scenario is that staff will travel by the private car because of the shift patterns of working and the associated concerns of personal safety during night time travelling.
- 6.58 A branch of the National Cycle Route lies within 300 metres of the site thus accessing the site by bike is possible. Even though the site is not ideally located to residential areas where staff would be likely to travel from, pavements are broadly in place for pedestrians.
- 6.59 Consequently, this assessment robustly assumes that all staff travel would occur as single occupancy car trips, irrespective of the fact that some would trips would be shared. Therefore, no further consideration of the non-car accessibility credentials of the site is deemed necessary.

Rail Access for the Transportation of Waste

- 6.60 The nearest railway line is located some 650 metres west of the application site and this line provides access to the wider national network via Bristol.
- 6.61 Nevertheless, the economic case for delivering waste from the local region means that rail is not economically viable, and the fact that waste would need to be collected in a central location with access onto the rail network in order to bring waste to the site is likely to negate any environmental benefits that would be gained from using rail transport. Furthermore, the opportunity to utilise rail as a means of transporting waste is limited by the lack of opportunity to create a branch line into the application site.
- 6.62 Consequently, all waste would be delivered to the site by the existing road network since this is the most cost effective option that would be broadly neutral in environmental terms when considered against rail.

Summary of Accessibility

- 6.63 Overall, the application site is well located in respect of the strategic and high capacity road network from which traffic movements associated with the proposed development will primarily originate. The opportunities to travel to the application site by non-car modes are limited by virtue of the geographical location of nearby population centres and the type of development being applied for. As such, the primary mode of travel for staff is assumed to be by car.
- 6.64 Therefore, with reference to the above, the primary consideration for this assessment is whether or not development related traffic would detrimentally affect the operation of surrounding road network.

Existing Traffic Flows

- 6.65 Traffic surveys were undertaken at the priority T-junction that comprises the A403-Severn Road and A403-Chittening Road on 26th June 2008: this being a typical weekday in a week unaffected by school or bank holidays. Supplementary surveys were undertaken at the St. Andrew's Gate Roundabout and Redwick Crossroads junction on 24th February 2009.
- 6.66 A seven day automatic traffic count was also carried out on the A403, near to the junction with the A403-Severn Road / A403-Chittening Road, between 26th June and 2nd July 2008.
- 6.67 A copy of the survey results is provided at Appendix 6/3 whereas a summary of the weekday flows is shown in the table below.

**Table 6/1
Traffic Survey Results**

Link	Time Period	Two-Way Flow		
		Total	HGV	HGV Composition
A403 North of Site	07:30 – 08:30 AM Peak	514	71	13.8%
	16:30 – 17:30 PM Peak	326	42	12.9%
A403 South of Site	07:30 – 08:30 AM Peak	306	79	25.8%
	16:30 – 17:30 PM Peak	583	85	14.6%
Severn Road	07:30 – 08:30 AM Peak	167	23	13.8%
	16:30 – 17:30 PM Peak	141	9	6.4%

- 6.68 The survey results have been assessed for the volume of traffic entering the agreed study area network in order to provide an indication of the times when the network is at its busiest. The results indicated two pronounced peak

hours and these have been adopted as the basis for assessment. They are as follows:-

- AM Peak – 07:30 to 08:30hours; and
- PM Peak – 17:00 to 18:00hours.

6.69 Traffic flow diagrams for the above peak hours are contained at Appendix 6/4 and these also show traffic volume and composition for each movement at the aforementioned junctions.

Base Traffic Flows

6.70 In agreement with the local highway authority, the potential impact of the proposed development has been considered against a baseline condition which is inclusive of committed development traffic flows, which are not reflected within surveyed data. To this end, the agreed traffic flows of the Deep Sea Container Port and of the Cabot Park development have been applied to the surveyed traffic demand. Traffic flows of committed development are shown on the diagrams included at Appendix 6/5.

6.71 In consideration of the fact that the trip purposes of vehicles travelling on the road network within the Avonmouth industrial area are exclusively connected with the operation of the industrial area, such that journeys can be summarised to be have one of the following purposes;

- Travel to work (i.e. commuting from home);
- Travel for work (i.e. travelling to a meeting or other destination for the purpose of work); or
- The distribution of goods.

6.72 Given that accepted traffic theory suggests that such trip types are a function of the size and type of development from which they originate, traffic generation from Avonmouth is assumed to remain broadly constant over time, save for any increase in the size of usable floor area or changes in the type of use. Consequently, traffic growth could only occur as a result of consented developments, which have been considered within this report.

6.73 Based on the above, the baseline traffic flow conditions, including consented developments, are shown for each peak hour on the diagrams contained within Appendix 6/6.

Highway Capacity

Introduction

6.74 Baseline capacity tests have been undertaken at the key junctions in the network to gain an understanding of the existing operation of the network. Capacity assessment of the existing site accesses has not been undertaken as this assessment has robustly ignored the existing trip generating potential of the extant use of the site.

A403-Severn Road / A403-Chittening Road Junction

- 6.75 The priority T-junction linking Severn Road with Chittening Road has been assessed using PICADY 5.
- 6.76 PICADY is the industry standard modelling tool for the assessment of capacity at non-roundabout give-way junctions. It uses accepted empirical formulae derived from known relationships between junction geometry and traffic demand to determine the operating capacity of a junction, and the program provides numerous measurements within its output. The most prominent of these measurements are the ratio of flow to capacity (RFC) and the queue length.
- 6.77 The RFC is provided as an indicator of a junction's performance against capacity shown on a numerical scale where '1' represents capacity. Therefore, where an RFC of less than '1' is returned, the junction is calculated to be within capacity. Conversely, where an RFC of greater than '1' is calculated, junction capacity is calculated to be breached.
- 6.78 The detailed model output is contained at Appendix 6/7 of this report, although the key measurements are summarised in the table below.

**Table 6/2
Capacity Results – A403-Severn Road / A403-Chittening Road**

Junction Approach	AM Peak		PM Peak	
	RFC	Max Q	RFC	Max Q
Severn Road	0.232	0.30	0.263	0.35
A403 Severn Road / Chittening Road	0.176	0.24	0.238	0.38

- 6.79 The ratio of flow to capacity (RFC) is typically deemed unacceptable after reaching a threshold of 0.85, i.e. when the junction is more than 85% saturated. However, the table above indicates that the highest RFC reached is 0.263, showing that the junction is operating well within capacity. Queues are insignificant at less than 1 car length.

St. Andrew's Gate Roundabout

- 6.80 Capacity analysis of the St. Andrew's Gate Roundabout has been undertaken with the use of TRANSYT, the industry standard tool for the assessment of signalised roundabouts. For accuracy, however, the input parameters used within the TRANSYT model prepared and submitted by Peter Evans Partnership in support of the Bristol Deep Sea Container Port has been used as the basis of this assessment, since this model has been accepted by the relevant authorities.
- 6.81 The detailed model output is contained at Appendix 6/8 of this report, although the key measurements are summarised in the table below

Table 6/3
Capacity Results – St. Andrew's Gate Rdbt

Link No	Link Description	AM Peak		PM Peak	
		Degree of Saturation (%)	Queue (pcu)	Degree of Saturation (%)	Queue (pcu)
11	Crowley Way	79	15	56	7
12	Crowley Way	21	2	12	1
13	Circulatory at Crowley Way	25	1	49	2
14	Circulatory at Crowley Way	45	2	20	1
21	Circulatory at McLaren Road	51	9	35	3
22	Circulatory at McLaren Road	20	2	9	0
23	McLaren Road	89	8	39	2
31	Circulatory at King Rd Ave.	5	0	2	0
32	Circulatory at King Rd Ave.	86	14	70	6
33	King Road Ave.	81	5	63	8
41	St. Andrews Rd	5	0	2	0
42	St. Andrews Rd	38	6	51	11
43	Circulatory at St Andrews Rd	52	2	65	3

- 6.82 Interpreting from the above results, the current signal controlled roundabout is shown to operate within capacity limits under the baseline scenario, inclusive of committed development in the area. Indeed, the above modelling results indicate that the junction would operate with around 10% reserve capacity in the weekday morning peak, and 30% in the evening peak hour. Queuing at

the junction is also indicated to be around the operational minimum and is therefore acceptable.

Redwick Crossroads

- 6.83 The operation of the Redwick Crossroads has been considered using the LINSIG software, which is the industry standard software for the assessment of operational capacity of isolated or small networks of signal-controlled junctions.
- 6.84 Numerous measurements are provided in the output but the most meaningful relate to the Degree of Saturation (DoS), Mean Max Queue (MMQ) and Practical Reserve Capacity (PRC). The degree of saturation is provided for each link in the junction and is a measurement of the amount of capacity being used and is represented as a percentage. The mean max queue provides an indication of the most typical extent of queuing on each link and is represented in Passenger Car Units (PCU's), where one PCU is equivalent to one car. The practical reserve capacity is a measure of the junction's total performance, where a positive figure indicates the junction operates with reserve capacity. A negative figure less than -10% suggests that junction would be broadly at capacity. A negative figure more than -10% indicates that junction capacity would be breached.
- 6.85 For accuracy, signal controller specification for the junction was obtained from South Gloucestershire Council and the relevant parameters such as inter-greens, phases and stages have been adopted within the model. The detailed model output is contained at Appendix 6/9 of this report, although the key output measurements are summarised in the table below

**Table 6/4
Baseline Capacity Results – Redwick Crossroads**

Junction Approach	AM Peak		PM Peak	
	Deg. Sat (%)	Mean Max Q (PCUS)	Deg. Sat (%)	Mean Max Q (PCUS)
Severn Road West	50.8	17	48.1	19
Redwick Road North	57.3	6	47.8	4
Severn Road East	56.7	19	31.6	11
Redwick Road South	53.2	4	48.2	3
PRC	57.2 @ 120 seconds		86.8 @ 120 seconds	

- 6.86 The results indicate that the junction would operate within acceptable levels in the baseline traffic scenario, having a worst-case PRC of 57.2%. This is suggestive of the junction being able to accommodate almost twice the current levels of traffic before capacity would be breached. With the junction operating well within capacity limits, queuing at the junction is not significant and is likely to be around the operational minimum.

Section Conclusion

- 6.87 In consideration of the above, it is considered that the existing road network would operate well within capacity limits, without unacceptable delays or queuing, under baseline traffic flow conditions.

Highway Safety

- 6.88 Personal injury accident data has been obtained from Bristol City Council for the study area road network for the most recent 5-year period available: this being 1st January 2004 to 31st December 2008.
- 6.89 A copy of the data is included in Appendix 6/10 and the locations and severities of each accident are shown on Drawing 6/5 . However, by way of summary, there were a total of 53 accidents and of, these, 42 were unrelated to any junction considered by this assessment. The remaining 11 incidents have undergone a detailed evaluation and a summary is provided below.
- 6.90 Accident data has not been assessed for the Redwick Crossroad junction as this lies beyond the local authority area. However, given the modern standards to which the junction is designed, having street lighting, wide lanes and good inter-visibility, accident rates are considered likely to be well within acceptable limits. Furthermore, as demonstrated later in this report, the level of impact arising as a result of the proposed development at this junction would not be so great as to effect any discernable or material worsening of the existing safety performance of the junction.

A403-Severn Road / A403 Chittening Road

- 6.91 Over the study period, six accidents occurred at the junction comprising the A403-Chittening Road and Severn Road. Of these, five were classified as resulting in slight injury, with the remaining accident resulting in a serious injury.
- 6.92 Review of the accident causations suggests that excessive speed may be a contributory factor, with some of the accidents involving vehicles losing control or straying into the opposite side of the carriageway. However, it is noteworthy that one accident involved a moped losing control on a wet drain cover. Another accident involved a rear end collision between two heavy goods vehicles.
- 6.93 In view of the above, it is concluded that, whilst the severity and frequency of accidents at the junction is within acceptable limits, speed is a contributory factor that could be addressed. Indeed, within the studied time period, the local highway authority reduced speed limits within the vicinity of the junction and the effects of this improvement are not accurately reflected in the results.

St. Andrew's Gate Roundabout

- 6.94 A total of five accidents occurred at the St. Andrew's Gate roundabout over the five-year study period. This equates to an average accident rate of 1 per year which, considering that all accidents were classified as resulting in only slight injury, is usually considered to be within acceptable limits of safety.
- 6.95 Nevertheless, of the five accidents, the majority were a result of vehicles failing to give-way to circulatory traffic prior to the junction's recent upgrade to traffic signal-control junction. And given that the junction has recently been upgraded, the frequency of such accidents will be further reduced and, consequently, it is concluded that there is not a safety deficiency at the junction.

Section Conclusion

- 6.96 In consideration of the above, it is concluded that there are no clusters of accidents that is suggestive of a deficiency in the highway network that results in an unsatisfactory safety risk.
- 6.97 Nevertheless, comments made in the scoping of this reports suggests that there is a wider issue of vehicles travelling at excessive speeds which occasionally results in vehicles over-turning, which has not be illustrated in the above data.

TRIP GENERATION

Existing Trip Generation

- 6.98 Currently the site is derelict and so does not generate any traffic movements, with the exception of the occasional security van. However, the site has an extant use and would have, until recently, generated a noteworthy quantum of light and heavy vehicle movements.
- 6.99 However, this assessment robustly ignores the potential trip generation of the extant use, which would be significant in the context of the development proposals. Indeed, it is considered that the calculated development traffic associated with the proposals would be largely, if not entirely, offset by the trip generation potential of the extant use.
- 6.100 Consequently, this assessment provides a robust and hypothetical evaluation of traffic impacts that is beyond worst-case. The purpose of the approach is to demonstrate that the impact of the proposals would be acceptable even under a hypothetical worst-case scenario. It does not, therefore, preclude or reduce the significance of an assessment against a baseline situation including extant traffic flows.

Future Trip Generation

Heavy Goods Vehicle Trips

- 6.101 As previously identified, the development proposals comprise a MRF with a capacity of circa 150,000 tonnes per annum and an Energy from Waste Facility that would process up to 350,000 tonnes of waste per annum,
- 6.102 However, 60,000 tonnes of waste delivered to the MRF is anticipated to be unrecyclable and will therefore be diverted to the EfW as an internal transfer. And, consequently, the net input to the EfW would be 290,000 tonnes. In addition, the balance of the input to the MRF, being 90,000 tonnes, would be processed and exported from the MRF annually.
- 6.103 The trip generations of the EfW and MRF have been calculated on a first principles basis, taking account of the input and output of the facilities, the delivery times, and typical vehicle payloads. In this respect, delivery of waste to the EfW will occur in either Refuse Collection Vehicles (RCVs) with 8 tonne average payloads, or articulated Bulker vehicles with payloads of circa 20 tonnes. The proportion of RCVs and HGVs has been provided by the applicant. Inputs to the MRF have been assumed to take place in RCVs whereas processed material would be exported in articulated Bulker vehicles.
- 6.104 In respect of Lime input, and IBA and Fly Ash output, the assessment assumes vehicle payloads of 20 tonnes.
- 6.105 Furthermore, taking on board the intended working hours, together with bank holidays, it is assumed that the proposed developments would receive

deliveries of waste over a 275 day working year. Exported from the EfW would occur over a 265 day working year. The resultant development trip generations are summarised below.

**Table 6/5
Resource Recovery Centre Trip Generation (Vehicles)**

		Annual Tonnage	Ave. Veh. Payload	Annual Trips	Daily Trips
Municipal Waste	RCVs	58,000	8	7,250	26
	HGVs	232,000	20	11,600	42
Lime Input	HGV	8,750	20	438	2
Fly Ash	HGV	17,500	20	875	3
Incinerator Bottom Ash	HGV	87,500	20	4,375	17
MRF Input	RCV	150,000	8	18,750	71
MRF Output	HGV	90,000	20	7,500	28
Total					189

- 6.106 For the purposes of consistency, the above trip generation has been converted to PCU equivalents assuming 1.9 PCUs per refuse collection vehicle and 2.9 PCUs per articulated goods vehicle. The resultant daily trip generation of the combined MRF and EfW is provided in PCUs in the table below.

**Table 6/6
Net Development Trip Generation (PCUs)**

	IN	OUT	TOTAL
MRF	49	49	99
EfW Facility	186	186	371
Total	235	235	470

Timings of Vehicle Movements

- 6.107 Heavy goods vehicles (i.e. Bulkers) are expected to arrive evenly throughout the day and this assessment robustly assumes that 1/10th of all HGV traffic would arrive in each hour. Whilst this naturally over-estimates the daily trip generation, the assumption implicitly allows for the fact that some trips may arrive earlier or depart later than the average situation.
- 6.108 For RCV's associated, with the EfW, the TRICS database has been used to ascertain their likely arrival/departure profile. However, whilst the database does not hold any information on EfW facilities, the profile of RCV movements associated with landfill sites has been used. The TRICS output is included with all traffic calculations in Appendix 6/11.
- 6.109 Based on the above, a typical daily profile of traffic movements associated with the development proposals has been generated and is shown in the table below. The daily profile below is shown in PCUs.

Table 6/7
Daily HGV Demand Profile (PCUs)

Time	HGV		RCV		TOTAL		
	In	Out	In	Out	In	Out	2-Way
00:00	0	0	3	2	3	2	5
01:00	0	0	5	5	5	5	9
02:00	0	0	6	6	6	6	12
03:00	0	0	5	6	5	6	11
04:00	0	0	7	6	7	6	13
05:00	0	0	4	5	4	5	9
06:00	0	0	6	6	6	6	12
07:00	31	31	16	12	48	43	91
08:00	31	31	17	18	49	49	98
09:00	31	31	17	18	48	49	97
10:00	31	31	14	15	46	47	92
11:00	31	31	18	17	49	49	97
12:00	31	31	12	13	43	44	87
13:00	31	31	17	16	48	47	95
14:00	31	31	20	18	51	50	100
15:00	31	31	13	15	44	46	90
16:00	31	31	4	6	35	37	72
17:00	31	31	0	1	31	32	64
18:00	31	31	0	0	31	31	62
19:00	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0
21:00	0	0	0	0	0	0	0
22:00	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0

Staff Vehicle Trips

- 6.110 The proposed development would employ 40 staff as part of the EfW facility and 25 staff would be connected with the MRF. These would arrive in the 30-minutes proceeding and after the operational working hours.
- 6.111 Considering the limited opportunities to travel to the site via non-car transport modes, it would be reasonable to assume that all staff would travel to the site by car. However, whereas it is probable that some people would combine their journey to work through car sharing, bus or cycle, this assessment is based on a worst case situation that journeys to work would be single occupancy car trips. The daily profile of staff trips is shown below in Table 6/13.

Table 6/8
Daily Staff Trip Profile

Resultant Daily Staff Trip Profile			
Time	In	Out	Two-Way
00:00			0
01:00			0
02:00			0
03:00			0
04:00			0
05:00	25		25
06:00	10		10
07:00	16	10	26
08:00			0
09:00			0
10:00			0
11:00			0
12:00			0
13:00	10		10
14:00		10	10
15:00			0
16:00		16	16
17:00		25	25
18:00			0
19:00			0
20:00			0
21:00	10		10
22:00		10	10
23:00			0

*shift worker numbers rounded for robustness.

Trip Distribution & Assignment

- 6.112 The assessment assumes for simplicity that 50% of EfW and MRF deliveries would be from the north and 50% from the south, via the M5 Motorway. .
- 6.113 In terms of staff vehicles, the assessment assumes that 40% will arrive from the north, 40% from the south and 20% from the east via Hallen. This reflects the broad distribution of traffic at the A403-Severn Road / A403-Chittingen Road junction.
- 6.114 The assessment is therefore based on flows being assigned in the following proportions.

**Table 6/9
Assumed Trip Generation**

Origin / Destination	HGV Distribution		Staff / Light Vehicle Trips
	RCVs	HGVs	
Severn Road	0%	0%	20%
A403 North	50%	50%	40%
A403 South (& to M5)	50%	50%	40%

Total Development Trips

- 6.115 The daily profiles of heavy goods vehicles and staff trips have been combined in order to provide an indication of the overall impact of the proposed development. The resultant peak hour development trips are provided at Appendix 6/12.
- 6.116 In addition, the calculated development trips have been combined with the baseline traffic flows for the opening and horizon year scenarios in order to provide an indication of traffic flows with the development in place. These are shown on the network flow diagrams contained at Appendix 6/13.

LIKELY SIGNIFICANT IMPACTS

Traffic Flow Increase

- 6.117 The impact of the proposed development has been considered in the context of the net increase in traffic flows on each approach to the junctions within the agreed study area road network. Appendix 6/14 provides the resultant traffic increases.
- 6.118 In summary, it can be seen that the proposed development would result in an increase in traffic of around 2% at the Redwick Crossroads and broadly 1% at the St. Andrew's Gate Roundabout. Such increases are well within the day-to-day traffic flow variation and would be indiscernible to the operation of the road network, both in highway safety and capacity terms. Furthermore, this level of impact ignores the extant trip attraction potential of the application site, which would be likely to further reduce the impact of development trips.

Environmental Impacts

- 6.119 The guidelines for the Environmental Assessment of Road Traffic (IEA, 1993) suggest two broad rules to define where there would be a need for an environmental impact analysis. These are as follows:-
- Highway links where traffic flows will increase by more than 30% (or the number of HGVs will increase by more than 30%); or
 - Sensitive areas where traffic flows will increase by 10% or more.
- 6.120 In agreement with the local highway authority, there are three sensitive areas within the study area road network and these are listed below. The areas that are considered sensitive for reasons of capacity or local disturbance include:
- the signalled controlled St Andrews Gate roundabout south of the site;
 - the signal controlled Redwick Crossroads north of the site; and
 - the priority T-junction linking Severn Road with Chittening Road.
- 6.121 The results provided in the previous sections of the report demonstrate that the proposed development would not result in traffic increases of more than 10% within any potentially sensitive areas or, at all other locations, the traffic increases would be less than the 30% threshold. Consequently, it is determined that there is no requirement to undertake a full environmental impact analysis of road traffic.
- 6.122 Nevertheless, further analysis has been undertaken to assess the impact of the development proposals in respect of the operating capacities of the junctions listed above.
- 6.123 As part of the proposals, the priority T-junction linking Severn Road and Chittening Road will undergo improvements and will become signalised. Therefore, this junction will be assessed as a signalised junction. Further details are provided in the subsequent section.

Capacity Assessment

6.124 Given that traffic flows on Severn Road are nominal, and considering the fact that the overwhelming proportion of trips would be turning left into the site, a movement that has no effect on capacity, operational assessment of the proposed site access is not deemed necessary.

A403-Severn Road / A403-Chittening Road Signal Junction

6.125 Based on the traffic flows outlined within the previous section of this report, the industry standard tool LINSIG has been used in order to establish the capacity performance of the proposed signalisation of the A403-Severn Road / A403-Chittening Road junction.

6.126 The full output of the capacity assessment is included at Appendix 6/15 although details of the calculated practical reserve capacity (PRC) and queue lengths set out in the table below.

Table 6/10
'With Development' Capacity Results – A403-Severn Road / A403-Chittening Road

Junction Approach	AM Peak		PM Peak	
	Deg. Sat (%)	Mean Max Q (PCUS)	Deg. Sat (%)	Mean Max Q (PCUS)
Chittening Road South	70.0	19	67.2	22
Severn Road West	78.0	22	60.7	14
Severn Road East	75.7	9	64.4	7
PRC	15.4 @ 120 seconds		33.7 @ 120 seconds	

6.127 On the basis of the above, the proposed junction would operate well within capacity thresholds, with a worst case degree of saturation of 78%. This is suggestive of the junction being able to accommodate around 15% more traffic before nearing capacity limits.

6.128 Consequently, on this basis, the above results indicate that the proposed junction improvements will operate well below capacity.

St Andrews Gate Roundabout

6.129 The calculated 'with development' traffic flows have been input to the Transyt junction model of the St. Andrew's Gate roundabout in order to confirm its ability to accommodate any increase in traffic flows. The detailed output is included at Appendix 6/16, whereas the results are summarised below.

Table 6/11
'With Development' Capacity Results – St. Andrew's Gate Rdbt

Link No	Link Description	AM Peak		PM Peak	
		Degree of Saturation (%)	Queue (pcu)	Degree of Saturation (%)	Queue (pcu)
11	Crowley Way	79	15	56	7
12	Crowley Way	21	2	12	1
13	Circulatory at Crowley Way	25	1	49	2
14	Circulatory at Crowley Way	45	2	20	1
21	Circulatory at McLaren Road	51	9	35	3
22	Circulatory at McLaren Road	20	2	9	0
23	McLaren Road	89	8	39	2
31	Circulatory at King Rd Ave.	5	0	2	0
32	Circulatory at King Rd Ave.	86	14	70	6
33	King Road Ave.	81	5	63	8
41	St. Andrews Rd	5	0	2	0
42	St. Andrews Rd	38	6	51	11
43	Circulatory at St Andrews Rd	52	2	65	3

6.130 Review of the above results indicates that the junction would continue to operate within acceptable thresholds of capacity with development traffic in place. Indeed, very little change occurs to the junction's operation as a result of development traffic because all additional traffic movements occur on links which have reserve capacity. Consequently, even under a hypothetical worst case scenario, which ignores the significance of extant traffic flows from the application site, the development impact at the junction would be within acceptable limits.

Redwick Crossroads Signal Junction

6.131 Based on the traffic flows outlined above, the LINSIG model of the Redwick Crossroads have been updated to reflect traffic demand inclusive of the proposed development. The detailed results are included at Appendix 6/17 of this Chapter, although the most salient outputs are summarised in the table below.

Table 6/12
'With Development' Capacity Results – Redwick Crossroads

Junction Approach	AM Peak		PM Peak	
	Deg. Sat (%)	Mean Max Q (PCUS)	Deg. Sat (%)	Mean Max Q (PCUS)
Severn Road West	51.1	17	48.8	19
Redwick Road North	57.3	19	47.8	4
Severn Road East	56.7	4	31.9	11
Redwick Road South	57.6	4	48.2	3
PRC	56.3 @ 120 seconds		84.4 @ 120 seconds	

6.132 On the basis of the above, it is evident that the proposed crossroads would be capable of accommodating the calculated trip generation associated with the proposed development, operating at worst with degree of saturation of 57.6%. This means that the junction will, with a great degree of confidence, operate well under capacity with no foreseeable queuing problems. Indeed, the extent of queuing at the junction has been assessed to ensure that vehicles do not queue back beyond the provided storage areas, thereby ensuring the efficient operation of the junction.

Section Summary

6.133 On the basis of the above results, it is evident that the proposed development will have no significant impact in terms of capacity on the key junctions in the highway network, with all junctions working with reserve capacity and no significant queuing or driver delay expected.

6.134 This is especially true of the nominal impacts that have been calculated at the trunk road and this is exclusive of any allowance for the extant trip generation potential of the application site, which would be likely

Road Safety Impacts

6.135 A review of personal injury accidents within the study area network has been undertaken at the section entitled 'Baseline Review'. It was concluded that the salient point for this assessment was whether the development proposals would be likely to materially worsen the existing safety risk on any part of the study area road network.

6.136 Having regard to the trip generations calculated within the section of the report entitled 'Future Trip Generation', it is concluded that the trip generation associated with the proposed development would not materially or discernibly worsen the existing safety record of the highway network,. Therefore, the development proposals are considered to be well within acceptable highway safety limits.

Impact during Construction Phase

Context

- 6.137 Construction of the facility is anticipated to commence in 2011 and end in 2013, although it is anticipated that earth moving operations will be undertaken prior to this date. The main elements of construction on the site are summarised below:
- earth moving operations and ground-works;
 - construction of building foundations and below ground elements;
 - construction of building steel structure and facades;
 - installation of mechanical equipment;
 - site ground-works and landscaping; and
 - testing and commissioning.
- 6.138 Construction of the proposed developments will require imports of construction materials, machinery and plant to accord with these elements. The following sections assess the likely volumes of traffic associated with these activities and the impact that these will cause on the adjacent transport network.

Trip Generation

- 6.139 Based on the construction operations detailed above and an anticipated commencement date of 2011, construction traffic will access the site over a 2 year period, with peak construction vehicle movements to occur in 2012.
- 6.140 All access to the construction works will take place from the proposed access junction which will be included in the preliminary phase of the overall construction contract. It is envisaged that all traffic will be routed from the M5.
- 6.141 The number of HGV trips associated with the full construction phase will depend on the successful contractor's preferred construction methods. However, based on previous experience, it is considered that there would be on average up to 50 HGV trips (100 movements) per day associated with the construction. However, the level of trip generation could reduce depending on certain construction methods such as the use of a mobile concrete batching facility on site.
- 6.142 It is estimated that there would be approximately 200 construction personnel, and given the location of the site all staff would be expected to arrive by mini bus provided by the contractor. Senior staff are likely to arrive by car.
- 6.143 Based on these figures, the overall number of trips generated with the construction phase of the development will amount to less than the operational phase. As already shown in capacity assessments, the operational traffic has no adverse effects on the network, therefore it is not deemed necessary to carry out assessment work in relation to the construction phase of the development.

MITIGATION & RESIDUAL IMPACT

Mitigation Measures

Highway Improvements

- 6.144 The incorporated highway improvements have been designed to accommodate the proposed development in the most efficient and safe manner possible, mitigating any existing adverse impacts that may have otherwise been pursuant.
- 6.145 Furthermore, the improvements to the A403-Severn Road / A403-Chittingen Road junction provide a wider community benefit and resolve a speed and safety problem which is unrelated to the existing or proposed development of the application site.

Environmental Measures

- 6.146 The applicant would employ appropriate measures to ensure that waste is not deposited on to the surrounding highway network. All imports and exports would either be sheeted or enclosed within waste collection vehicles that are specifically designed to contain and transport waste.

Staff Travel Plan

- 6.147 In order to further mitigate the already negligible traffic impact of the proposed development during the operational phase, a travel plan will be prepared which will be aimed at encouraging staff to travel to and from the development using sustainable non-car travel modes.
- 6.148 As part of the Plan, a Travel Plan Coordinator (TPC) will be appointed who will have the responsibility for inducting new staff to the travel plan and highlighting to them the health and environmental benefits associated with travelling to work by modes other than car.
- 6.149 The TPC will provide copies of the travel plan to all members of staff and updated versions will be provided if and when required. The TPC will also be responsible for maintaining a database of all staff addresses, contact details and work patterns. The TPC will regularly review this database to identify where opportunities exist for staff to share their journey to work through car sharing. This will be supplemented by details of web based car share clubs such as www.2carshare.com and www.nationalcarshare.co.uk which will be provided within the Plan. This will increase the potential for staff to car share with employees of any business located nearby.
- 6.150 Car sharers will also be guaranteed a lift home in case of emergency or if the driver of the car share vehicle is required to leave work outside of the agreed hours. This will allay fears amongst potential car sharers of being stranded.

Residual Impacts

6.151 Taking into account all the factors assessed in this report and the mitigation measures outlined above, a final analysis of the impacts resulting from the development proposals has been undertaken and is summarised in the table below.

**Table 6/13
Summary of Impacts**

Potential Impact	Impact Duration	Significance	Mitigation	Residual Impact
Highway and Junction Capacity	Permanent	Minor Adverse	Relocation and improvement of access to more safely accommodate traffic without impediment to trunk road traffic.	Insignificant
Driver Delay	Permanent	Minor Adverse	N/A	Minor Adverse
Road Safety	Permanent	Minor Adverse	Relocation and improvement of access junction.	Minor Beneficial
Pedestrian / Cyclist Amenity	Permanent	No Impact	N/A	No Impact
Detritus on Highway Network	Permanent	Moderate	Good management practice	Insignificant
Construction Impacts	Permanent	No Impact	N/A	No Impact
Public Rights of Way	Permanent	No Impact	N/A	No Impact

Overall, therefore, it is considered that the development proposals would have an insignificant impact in traffic and transport terms.

SUMMARY & CONCLUSIONS

6.152 The Chapter has been prepared to assess the traffic and transport impacts of the proposed materials recovery facility (MRF) and Energy from Waste Facility (collectively known as the Severn Road Resource Recovery Centre), located on land in Avonmouth, near Bristol. The report is summarised as follows.

- The development proposals comprise to process 350,000 tonnes of waste per annum associated with the EfW facility and 150,000 tonnes with the MRF.
- The existing site access junction will be improved to accord with current highway standards.
- Alongside the development, junction improvements are proposed comprising the signalisation of the Severn Road / Chittering Road junction, in order to improve safety as a wider community benefit.
- The proposed development is unlikely to attract a significant number of non-car trips due to the type of use and its geographical location in the context of local employment catchment areas and the proximity to non-car infrastructure. Therefore this assessment robustly assumes that all staff trips will result in a new car trip although, in reality, this is unlikely given the propensity to car share.
- The existing safety record of the highway network has been reviewed and it has been concluded that there is no pattern of accidents that is suggestive of a highway layout deficiency that leads to unacceptable safety risks. Furthermore, the impact of development traffic would be immeasurably small. Consequently, the proposed development is acceptable from a highway safety perspective.
- The trip attraction potential of the development has been considered on a first principles basis and the traffic flow increases do not justify full environmental impact assessment.

6.155 With regard to the above, it is considered that the development proposals would not discernibly or materially worsen the existing operation of the highway network and that all highway improvements meet the required design standards. By virtue of this, the development proposal is acceptable in traffic and transport terms.