Persimmon Homes,
Taylor Wimpey and
Barratt Homes

Waterfront Barry

Transport Assessment

08/7365

ISSUE REVISION A

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Transports Assessment 08/7365

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1 INTRODUCTION

1.1 Background

Arup has been appointed to act on behalf of a development consortium comprising Persimmon Homes, Taylor Wimpey and Barratt Homes, to provide traffic and transportation advice for a mixed-use redevelopment scheme at Waterfront Barry. The location of the redevelopment scheme in relation to the wider area is illustrated on Figure 1.1.

This Transport Assessment forms part of a suite of documents in support of a planning application. This assessment will investigate the local transportation conditions, including the highway network, public transport system and the facilitation of cyclist and pedestrian movement, in association with the proposed waterfront redevelopment scheme.

In developing this Transport Assessment two Technical Workshops were held with officers from the Vale of Glamorgan Council on the 5 March and 9 April 2008 during which agreement was reached on key assumptions and methodology; copies of meeting minutes are included in Appendix A. The scope of this Transport Assessment has been the subject of on-going consultation with the Vale of Glamorgan. A copy of the subsequent Scoping Report is included in Appendix A. Following this, technical data involving trip rates and junction assessments has been submitted to the Vale of Glamorgan Council. Comprehensive comments have subsequently been received and addressed in the final methodology of the assessment.

This version of the Transport Assessment is 'Issue Revision A'. The revised version has been prepared following a review of the previous version of the Transport Assessment which was submitted in August 2009. The review was undertaken by Capita Symonds on behalf of the Vale of Glamorgan and a meeting was held on 26th February 2010 to discuss the findings of the review and to discuss the way forward. The review and minutes of the meeting are also included in Appendix A. Following the meeting Arup submitted a revised chapter 6 the contents of which were agreed by Capita Symonds and approved by the Vale of Glamorgan. This 'Issue Revision A' version of the Transport Assessment therefore supersedes the previous 'Issue' version as the document in support of the Planning Application 2009/00946/OUT.

The Transport Assessment has been produced in accordance with current best practice, including Planning Policy Wales Technical Advice Note 18 and the Department of Transport's Guidance on Transport Assessments.

A description of the associated transportation impacts on air quality and noise is included in the Environmental Statement document that accompanies the outline planning application.

1.2 Report Structure

The report is structured as follows:

- Chapter 2 briefly describes the existing site conditions and characteristics;
- Chapter 3 outlines the history of the Waterfront Barry development to date;
- Chapter 4 sets out the policy context for the development;
- Chapter 5 describes the masterplan and transport strategy;
- Chapter 6 details the trip making methodology, and subsequent trip rates;
- Chapter 7 presents the highway assessment for the development;
- Chapter 8 presents the parking assessment;
- Chapter 9 presents the rail assessment;
- Chapter 10 presents the bus assessment;
- Chapter 11 contains the walking and cycling assessment;

- Chapter 12 considers other travel issues;
- Chapter 13 details the outline travel plan; and
- Chapter 14 presents the findings and recommendations of the report.

2 EXISTING SITE

2.1 Site Description

The proposed development site consists of several areas of previously developed brownfield land, covering a total area of approximately 43 hectares. The area is split into four sites, known as:

- West Pond;
- South Quay;
- Arno Quay; and
- East Quay.

The sites are situated around the former No.1 Dock in Barry, as illustrated in Figure 2.1. Also illustrated is 'The Mole' area of Waterfront Barry, a potential development site that has also been considered within this report.

West Pond and South Quay are adjacent to one another and together form the largest area of the development; the area is bounded by the mainline and steam railway lines, No.1 Dock, and Barry Island.

Arno Quay, the most northern site is bounded to the south by No. 1 Dock and to the north by Ffordd y Mileniwm, between the Gladstone Bridge and retail access roundabouts.

East Quay is bounded to the south and west by No. 1 Dock, to the east by Cory Way and to the north by Ffordd y Mileniwm at the Cory Way/Ffordd y Mileniwm roundabout.

Barry Town Centre is situated approximately 1km north/northwest of the former No.1 Dock. The development sites are therefore within a convenient walking distance of the town centre. The town centre is separated from the waterfront area by the Vale of Glamorgan Railway Line and the existing retail area which was constructed during the early stages of the waterfront regeneration in 2002.

Existing infrastructure provides a number of links between the waterfront area and the town centre. Further details on this infrastructure, and the well established rail network, is provided in subsequent chapters of this report.

2.2 Transport Networks

There is a well established transport network currently serving the area surrounding the development site. Each mode of transport is explored in detail as part of the assessment chapters in this report; the key features of the existing network are summarised below.

2.2.1 Highway Network

There is a well established highway network surrounding the development site; however, there is currently no highway network within the sites.

The A4055, (Broad Street), provides a northeast-southwest route through Barry linking up with Harbour Road to the southwest of the town and ultimately leading to Barry Island. Urban in nature with on-street parking in places, the A4055 through Barry is a single carriageway road that is subject to a 30 mph speed limit.

Earl Crescent adjoins Harbour Road via a mini-roundabout in Barry Island and provides a route to the southern boundary of the West Pond/South Quay site. To the east, the A4055 forms a district distributor road that links Barry, Dinas Powys and Penarth to Cardiff Bay. The speed limit along the A4055 varies between 30, 40 and 60 mph.

Figure 2.2: Ffordd y Mileniwm, Barry

Ffordd y Mileniwm forks off the A4055 at the Gladstone Road/Cardiff Road roundabout to form an east/west spine road through the waterfront area. The road is urban in nature, single carriageway and subject to a 30 mph speed limit. It provides the main vehicular route to the site and is intersected by a number of roundabouts that serve the waterfront retail area and some residential clusters. Ffordd y Mileniwm provides the eastern approach of a 4 armed roundabout located on the north eastern boundary of the West Pond/South Quay part of site.

The A4055 provides access to Pontypridd Road to the north-west of the waterfront, then onto Waycock Road and eventually onto the A48, which provides access to other parts of the Vale of Glamorgan and Bridgend.

The primary route to the north west of Barry is the A4050 which connects to the A4232 at Culverhouse Cross, providing a route to the M4 Motorway. The A4050 is a good quality single carriageway that is subject to a 50 mph speed limit between Culverhouse Cross and the South Wales Golf Centre at Wenvoe. The road bounds the northern edge of Barry, where it is subject to a 40 mph limit and links to the A4226 which continues towards Cardiff Airport. The A4050 continues in a south westerly direction where it joins the A4055 at the Ship Gyratory adjacent to Barry Island.

The highway network around Barry is relatively busy and in some areas congestion can sometimes be observed. Particularly during network peak hours, congestion occurs at the Merrie Harrier, Biglis roundabout, Waycock Cross and Palmerston Road junctions.

Further details on the highway network are provided as part of the traffic analysis in Chapter 7. Appendix B provides a detailed description of each junction and link considered in the assessment work.

2.2.2 Rail Network

The Waterfront area is well connected by rail; the development site is within close proximity of three train stations. Conveniently situated on the Vale of Glamorgan Line, Barry has good connections with Cardiff Central Railway Station which forms a rail hub for the South Wales area. It serves as a link to key destinations along the South Wales Main Line and Valley Lines, as well as other key nationwide destinations such as London, Bristol and Nottingham.

Figure 2.3: Rail service at Barry Station

Although the rail stations in Barry are within close proximity of the development sites, in some cases access to the stations is not direct, with the rail line itself creating a barrier to easy access. The rail connections around South Wales are displayed in Figure 2.4.

The existing rail provision relevant to the development site is discussed in more detail in Chapter 9.

2.2.3 Bus Network

The location of Barry is such that it is already well connected to areas within South East Wales by a substantial network of bus services. There are a number of bus services that currently operate on Ffordd y Mileniwm, and consequently, there are number of bus stops within close proximity of the development site.

Figure 2.5: Well used bus service along Ffordd y Mileniwm

The majority of existing bus services serve the town itself and destinations towards Cardiff. There are relatively few services that travel to the largely rural areas west of Barry.

Chapter 10 assesses the existing bus provision relevant to the development site in more detail.

2.2.4 Cycle Network

Cycle conditions within the immediate vicinity of the development have benefited from the previous waterfront regeneration scheme; primarily the provision of a segregated cycle/footway along Ffordd y Mileniwm.

Figure 2.6: Segregated cycleway/footway along Ffordd y Mileniwm

The level of cycle infrastructure provision reduces with distance from the waterfront area, with much of the existing infrastructure in Barry providing no dedicated facilities for cyclists.

A more detailed breakdown of the existing cycle conditions is provided in Chapter 11.

2.2.5 Pedestrian Network

Pedestrian facilities in the waterfront area have been improved during the previous waterfront regeneration schemes. Consistent footway links are provided around the area, providing a network of well lit paths. Pedestrians are afforded pelican and zebra crossings towards the eastern end of the waterfront area, but there is a lack of formalised crossings in the waterfront itself.

The development site is linked to Barry Island via an informal route and relatively steep steps through West Pond/South Quay to Clive Road. This route is inconsistently lit and the surfacing is in poor condition.

Elsewhere Barry has a well established network of footways of varying width and quality that follow the alignment of existing highways.

Figure 2.7: A typical footway in Barry (Windsor Road)

This existing network of pedestrian facilities is linked to the more recent waterfront network via a series of bridges and subways. These connections have been further improved by the construction of a footbridge off Thomson Street crossing the railway line.

The pedestrian conditions are discussed in more detail in Chapter 11 of this report.

2.3 Accident Assessment

Accident data for the most recent period (2005-2009 inclusive) were obtained from the Vale of Glamorgan Council. This information was incorporated into a GIS database and filtered for the junctions and links which have been considered in the capacity analysis exercise (see section 7). The accidents were then graded by severity: slight, serious and fatal and plotted by location on a map of Barry. Accidents occurring within the area but not on junctions or links considered in the capacity analysis have been plotted as black dots.

The resulting plot is included as Figure 2.8 and it is apparent that over the five year period the distribution of accidents is generally even over the study area, with the majority of accidents occurring around junctions.

The accidents are sorted by links and junctions as set out in the capacity analysis and then summarised in Tables 2.1-2.3. The rates were calculated based on DMRB 13.1.3.2 and compared to the average rates for the road / junction of the same type.

Table 2.1: Link and junction combined accident summary

Link and Junction	Location	Number of accidents 2005 - 2009				Accident Rate		Comments
		Total	Slight	Serious	Fatal	Avg	Calc	
L1	A48	-	-	-	-	0.293	-	No accident data available
L2	Port Road (A4050)	-	-	-	-	0.293	-	No accident data available
L3	Barry Docks Link Road (A4231)	26	17	6	3	0.293	0.21	Recent improvement to Palmerston Road junction
L4	Port Road (A4050)	35	30	5	0	0.844	0.19	-
L5	Palmerston Road	7	7	0	0	0.844	0.55	-
L6	Barry Road	2	2	0	0	0.844	0.20	-
L7	Buttrills Road	4	3	1	0	0.844	0.35	-
L8	Ty-Newydd Road	4	4	0	0	0.844	0.59	-
L9	Barry Road	2	1	1	0	0.844	0.14	-
L11	Cardiff Road (A4055)	16	15	1	0	0.844	0.44	-
L12	Gladstone Road (A4055)	38	32	6	0	0.844	0.95	Accident rate marginally above average with obvious clusters at intermediate junctions, no proposed alterations.
L13	Broad Street (A4055)	13	10	3	0	0.844	0.19	-
L14	Leckwith Road (B4267)	-	-	-	-	0.844	-	No accident data available
L15	Pontypridd Road (B4266)	14	13	1	0	0.844	0.20	-
L18	Broad Street (A4055)	8	7	1	0	0.844	0.47	-
L22	Barry Island Link Road	-	-	-	-	0.844	-	No accident data available
L23	Ffordd y Mileniwm	1	0	1	0	0.844	0.28	-
L30	Cardiff Road (A4055)	13	12	1	0	0.293	0.30	Accident rate marginally above average, proposed signalised junction at Biglis could help reduce localised traffic speeds, no proposed alterations along link
L31	Cardiff Road (A4055)	27	23	4	0	0.293	0.26	-
L32	Cardiff Road (A4055)	10	10	0	0	0.844	0.19	-
L33	Barry Road (A4055)	2	2	0	0	0.844	0.06	-
L34	Colcot Road	26	25	1	0	0.844	-	No traffic flow information

Table 2.2: Link only accident summary

Link	Location	Number of accidents 2005 - 2009				Accident Rate		Comments
		Total	Slight	Serious	Fatal	Avg	Calc	
L10	Cardiff Road (A4055) underpass	0	0	0	0	0.297	0.00	-
L16	Waycock Road (A4226)	-	-	-	-	0.174	-	No accident data available
L17	Harbour Road (A4055)	2	2	0	0	0.297	0.19	-
L19	Hood Road	1	1	0	0	0.297	0.27	Negligible, one accident
L20	Gladstone Bridge (B4294)	3	3	0	0	0.297	0.37	-
L21	Earle Crescent	0	0	0	0	0.297	0.00	-
L24	Ffordd y Mileniwm	3	3	0	0	0.297	0.38	Accident rate above average, no proposed alteration along link
L25	Ffordd y Mileniwm	1	0	1	0	0.297	0.13	-
L26	Ffordd y Mileniwm	0	0	0	0	0.297	0.00	-
L27	Ffordd y Mileniwm	0	0	0	0	0.297	0.00	-
L28	Ffordd y Mileniwm	0	0	0	0	0.297	0.00	-
L29	Ffordd y Mileniwm	2	2	0	0	0.297	0.37	Accident rate above average, change in junction operation at Wimbourne Road will reduce localised vehicle speeds

Table 2.3: Junction only accident summary

Junction	Location	Number of accidents 2005 - 2009				Accident Rate		Comments
		Total	Slight	Serious	Fatal	Avg	Calc	
J1	Sycamore Cross	-	-	-	-	-	-	No accident data available
J2	Culverhouse Cross	-	-	-	-	-	-	No accident data available
J3	Merrie Harrier Junction	21	20	1	0	2.46	4.20	Accident rate above average, recent junction improvements implemented
J4	Dinas Powys - Murch Crossroads	2	2	0	0	3.51	0.40	-
J5	Biglis Roundabout	8	7	1	0	4.44	1.60	Proposed signalised junction improvements that would reduce localised vehicle speeds and improve pedestrian / cycle facilities.
J6	Port Road / Barry Docks Link Road	3	3	0	0	2.83	0.60	Proposed dedicated lefts at junction reducing conflict points at roundabout.
J7	Waycock Cross	2	2	0	0	3.27	0.40	-
J8	Harbour Road / Station Approach / Paget Road, Mini	1	1	0	0	0.07	0.20	Accident rate above average, proposed junction operation change to signals that would improve pedestrian / cycle facilities.
	Harbour Road/Station Approach / Paget Road, Priority	0	0	0	0	0.71	0.00	Proposed junction operation change to signals that would improve pedestrian / cycle facilities.
J9	Ship gyratory, Harbour Rd / Nicholas Rd	5	4	1	0	0.54	1.00	Accident rate above average, irregular junction arrangement, no proposed alteration
	Ship gyratory, Harbour Rd / Broad St	3	1	2	0	0.87	0.60	-
	Ship gyratory, The Parade / Harbour Rd	4	4	0	0	0.10	0.80	Accident rate above average, no proposed alteration
J10	Gladstone Bridge Roundabout	5	5	0	0	3.21	1.00	-
	Dock View Road Gyratory	1	1	0	0	0.65	0.20	-
J11	Buttrills Road/Barry Road	2	1	0	1	1.47	0.40	-
J12	Barry Road /Ty Newydd Road	6	6	0	0	0.95	1.20	Accident rate above average, recent change in junction operation to roundabout
J13	Gladstone Road / Cardiff Road/Ffordd Y Mileniwm	4	4	0	0	1.69	0.80	-
J14	Palmerston Road/Cardiff Road	8	8	0	0	1.81	1.60	-
J15	Vere Street / Cardiff Road / Gladstone Risen roundabout	3	3	0	0	0.47	0.60	Accident rate above average, recent junction improvements implemented
	Gladstone Road / Holton Road	0	0	0	0	1.02	0.00	-
J16	Wimbourne Road / Ffordd Y Mileniwm	3	3	0	0	1.39	0.60	Proposed junction operation change to a roundabout
J17	Cory Way / Ffordd Y Mileniwm	2	2	0	0	0.56	0.40	-
J18	Subway Road / Ffordd Y Mileniwm	1	1	0	0	0.90	0.20	-
J19	Y Rhodfa / Ffordd Y Mileniwm/Clos Tynaid Glo	1	1	0	0	0.43	0.20	-

J20	Retail/Morrisons/Ffordd Y Mileniwm	1	1	0	0	1.84	0.20	-
J21	Gladstone Bridge/Ffordd y Mileniwm	1	1	0	0	0.58	0.20	Junction improvements proposed
J22	Plymouth Road/Earl Crescent	0	0	0	0	0.05	0.00	Proposed junction operation change to signals to tie in with Paget Road Station Road junction
J23	Hood Road / Broad Street / Island Road	2	2	0	0	3.11	0.40	-
J24	Barons Court	20	17	3	0	-	-	No traffic flow data available, recent change in junction operation to signals

Tables 2.1-2.3 show rates above the national average in red and rates within a reasonable limit or below the national average in green. As part of the capacity assessment detailed in section 7 mitigation works are proposed for several junctions, additionally two other junctions (Junctions 3 and 15) have had recent modifications (during the period 2004-2009) which is likely to improve the accident rate at these locations, for the remainder of junctions no alterations are proposed accident rates would be expected to stay in line with the traffic flow.

Over the five year period there were a total of 369 accidents within the study area, the accidents comprised of 324 slight, 41 serious and 4 fatal accidents with 69% occurring at junctions.

Full records of the accidents are included as Appendix C.

Section 7.11 includes comment on the impact of the development traffic on accidents across the considered network.

2.4 Summary

This section has provided a brief introduction to the existing transportation conditions around the development site. As part of the initial assessment, some key transportation points have been identified:

Key challenges

- there are no direct vehicular links provided through the development sites;
- several junctions experience queuing during busy peak periods;
- no bus service operates through the West Pond/South Quay area;
- there is a lack of formal crossing places in the waterfront area;
- existing pedestrian links to Barry Island are unlit and sub-standard; and
- existing links between the West Pond/South Quay site and Barry and Barry Island rail stations are indirect.

Key strengths/opportunities

- development sites are within comfortable walking distance of existing Town Centre;
- the sites benefit from recent pedestrian/cycleway improvements as part of on-going waterfront redevelopment;
- nearby waterfront retail area reduces potential need to travel by private car;
- there is an opportunity to utilise the high quality rail links nearby, reducing the need to use the private car; and
- the site has convenient links to the strategic highway network.

The main movement considerations to/from and around the Waterfront Development are illustrated in Figure 2.9.

3 DEVELOPMENT HISTORY

3.1 Introduction

The Waterfront Barry project has evolved over a number of years prior to the current development masterplan. The complex nature of this development justifies a section setting out the development history, in order to enable an understanding of how the Waterfront Barry scheme has been devised. This chapter discusses the previous stages of the Waterfront development.

3.2 Outline Planning Application in 1994

The Waterfront Barry local area was formerly referred to as Barry No.1 Dock. The Barry Joint Initiative proposed a major redevelopment of the Barry No.1 Dock. An outline planning application was submitted in February 1994. The mixed-use proposal comprised approximately 77 hectares of residential, retail, commercial and leisure units.

As part of the development the site was divided into 14 zones, with each zone comprising an individual land use. It was proposed that the construction of the Barry Docks redevelopment scheme would proceed in phases, with the initial phases focusing on the central area of the site.

The proposal included significant highway improvements, as access into the Barry No.1 Dock was of a poor standard. As part of the highway strategy, a new primary access road was proposed from Cardiff Road to the east and was to be known as the Barry Marine Access Road. In addition, it was proposed that two further access routes be created in the Barry area; one being an extension of Gladstone Road, west of the town centre and the other from Harbour Road at Barry Island. It was proposed that these would link to form a ‘spine road’; an east-west by-pass around the town centre that would also provide an additional link to Barry Island.

3.3 Outline Planning Consent in 1997

A revised development proposal by The Barry Joint Initiative was submitted in October 1996. Revisions were made to the type and size of individual land uses which necessitated revised traffic forecasts.

The 1996 report compared traffic forecasts for the original 1994 proposals with the revised 1996 proposals and forecast a reduced rate of traffic generation. It was suggested that the revised proposals would not have an adverse impact on the proposed infrastructure works, which could therefore, could remain unchanged. This issue was discussed with officers from the Vale of Glamorgan during the pre-submission stage.

Officers from the Vale of Glamorgan requested detailed assessment of two critical junctions, which was provided using the traffic data submitted as part of the previous assessment. However, the 1996 proposals introduced new development options including the ‘Wales Transport Experience’ and a Steam Railway, which were considered in detail within the 1996 application material.

Following the analysis of traffic flows on the critical links in the network, it was established that traffic flows were reduced when compared to the previous proposals, so no further junction analysis was required. It was concluded that the existing infrastructure proposals both on and off site were adequate to accommodate the revised development proposals.

Outline planning permission for the development of Barry No.1 Dock was subsequently granted in May 1997. Since consent many of the highway improvement aspects of the development proposals have been completed, and include the following:

- the Gladstone Road extension;
- the ‘Barry Marine Access Road’ (Ffordd y Mileniwm); and
- the proposed spine road through Waterfront Barry, which also forms part of main collector road Ffordd y Mileniwm.

Access to each of the individual development zones is provided by a roundabout or priority junction located along Ffordd Y Mileniwm. The proposed link from the spine road to Harbour Road to provide an additional route to Barry Island has not progressed beyond the initial proposal phase.

3.4 Revised Proposals in 2001

Grosvenor Waterside (the property development subsidiary of Associated British Ports Holdings PLC) proposed a series of changes to the development plans in September 2001. Although the revised proposals fell within the footprint of the existing outline consent, the development density was increased with the number of proposed houses rising from 1,000 units to 2,000 units. Arup was commissioned by Grosvenor Waterside to undertake a new study to assess the impact of the revised proposals.

As part of the assessment, it was observed that the spine road had become a highly attractive route for traffic accessing the town centre. Traffic flows on the spine road were observed to be considerably higher than previously forecast. It was anticipated that there would be an even split between the spine road and the existing route, however it was apparent that more car users travelled along the spine road route.

It was expected that the proposed additional link to Barry Island along the spine road would initially be the most attractive route for traffic between Barry Island and the town centre, eastern Barry and beyond. However, use of the spine road as a through route was anticipated to decline as development in the area progressed and flows on the route increased. It was understood that the continued use of Harbour Road for access to Barry Island and Waterside would be important in realising the full regenerative benefits of the area. The points of access for the Waterfront area following development were forecast to be near capacity, although the anticipated conditions were not thought to be a threat to the viability of the development.

The Grosvenor Waterside study recognised that a sustainable approach to transport provision is essential to enable efficient travel conditions at the Waterfront as it develops. The report asserted that there was potential to increase the market share of commuter travel by public transport, and demonstrated that the revised development proposals were acceptable from a transportation viewpoint.

3.5 Traffic Aspects Position Statement in 2003

The necessity for this Transport Assessment arises from the recommendations made in a position statement written by Arup in October 2003. The document entitled *Waterfront Barry – Traffic Aspects: Position Statement* outlined previous transportation work whilst assessing transportation issues that still need to be resolved.

It highlighted the importance of the proposed highway network and associated junctions between Barry Island and the Waterfront in providing an alternative route to the Waterfront to Harbour Road and thus offers relief to junctions on the wider Barry network. Subsequently, it was deemed critical to assess the capacity of the link road proposals, and further investigate the options for changing the Paget Road/Harbour Road junction.

3.6 Summary

The site has a significant history of development including an outline planning consent for a mixed use development. Previous applications and studies indicate some key precedents of importance:

- the strategic role of the road through the site connecting Ffordd y Mileniwm to Barry Island;
- the need to ensure a sustainable approach to transport provision particularly for commuters; and
- the sensitivity of the surrounding area to increased traffic levels.

4 POLICY CONTEXT

4.1 National Policy

4.1.1 Wales Transport Strategy (2008)

The Wales Transport Strategy (WTS): One Wales – Connecting the Nation, was published in April 2008 and is a key document in developing an effective transport strategy for Wales. The document outlines how the transport policy approach is more responsive in its delivery of the Welsh Assembly Government wider policy agenda, and has attempted to be flexible to reflect different regional circumstances.

The four main regions in Wales are each represented by regional transport consortia, which have been created through partnerships between neighbouring Local Authorities. The application site falls within the Vale of Glamorgan, which is part of the South East Wales Transport Alliance known as SEWTA.

The stated goal of the document is for Wales to promote sustainable transport networks that safeguard the environment while strengthening Wales' economic and social life. The transport strategy identifies a series of high-level outcomes and sets out the steps to their delivery, including:

- achieving a more effective and efficient transport system;
- achieving greater use of the more sustainable and healthy forms of travel;
- minimising demands on the transport system; and
- to reduce the impact of transport on greenhouse gas emissions.

According to the WTS, coastal areas west of Barry are among those that do not have good access to jobs and shopping areas. Improving access to jobs is a key aspiration within the SEWTA region.

4.1.2 National Transport Plan (2010)

The National Transport Plan (NTP) sits alongside Regional Transport Plans in delivering the Wales Transport Strategy. The Wales Transport Strategy outlined five strategic priorities for NTP. Those are:

- Reducing greenhouse gas emissions and other environmental impacts.
- Integrating local transport.
- Improving access between key settlements and sites.
- Enhancing international connectivity.
- Increasing safety and security.

The NTP takes forward the process of delivering integration and also sets out solutions to transport issues along the main movement corridors in Wales.

The proposals set out in this document relevant to the development site are:

- Creating additional platforms at Pontypridd, Caerphilly and Barry, with work starting by 2014;
- Introduce additional half-hourly services on the Vale of Glamorgan Line, which will facilitate improved access to Cardiff Airport, after Network Rail's Cardiff Area Resignalling Scheme is completed in 2014; and
- Introduce a high-quality, express bus service between Cardiff and Cardiff Airport, and, working with the local authority, take forward safety improvements on the A4226 Five Mile Lane.

4.1.3 Planning Policy Wales (2002)

Planning Policy Wales (PPW), published in March 2002, sets the context for sustainable land use planning for the Welsh Assembly Government.

Chapter 8 (Transport) affirms that the Assembly Government's Transport Framework will be linked to the Wales Spatial Plan and provide the context for Local Transport Plans.

One objective of the Plan is to achieve sustainable accessibility and to:

"Extend choice in transport and secure accessibility in a way which supports sustainable development by encouraging the establishment of an integrated transport system which is safe, efficient, clean and fair."

This document promotes new development in locations accessible to public transport, walking and cycling. In particular the Welsh Assembly Government sets out its aim within PPW to achieve the doubling of the cycle network in Wales by 2012.

PPW also provides guidance on levels of car parking provision, which is considered to be a major influence on the choice of means of transport and the pattern of development. It sets out that Local Authorities should ensure that new developments provide lower levels of parking than have generally been achieved in the past. Minimum parking standards are no longer appropriate.

PPW states that when determining a planning application for development that has transport implications, Local Planning Authorities should take into account the following issues:

- the impacts of the proposed development on travel demand;
- the level and nature of public transport provision;
- accessibility by a range of different transport modes;
- the willingness of a developer to promote travel by public transport, walking or cycling, or to provide infrastructure or measures to manage traffic, to overcome transport objections to the proposed development (payment for such measures will not, however, justify granting planning permission to a development for which it would not otherwise be granted);
- the environmental impact of both transport infrastructure and the traffic generated; and
- the effects on the safety and convenience of other users of the transport network.

4.1.4 Technical Advice Note 18 (2007)

Technical Advice Note (TAN) 18 was published in March 2007 in support of PPW. The document sets out the Assembly Government's objectives on planning with regard to transport issues. TAN 18 acknowledges that:

'by guiding the location of new development, reducing the need to travel, and promoting transport choices which are less polluting, land-use planning can contribute to long term environmental improvement.'

TAN 18 states that in order to meet sustainable development policy objectives, Councils should be:

- promoting a resource and travel efficient settlement pattern;
- ensuring new development is located where there is, or will be, good access by public transport, walking and cycling thereby minimising the need for travel and fostering social inclusion; and
- encouraging the location of development near other related uses to encourage multi-purpose trips.

4.1.5 Wales Spatial Plan (2004)

The Wales Spatial Plan (WSP) was adopted in November 2004 and sets out the planning agenda at a spatial level. There are five guiding themes which set out the 'The National Framework':

- building sustainable communities;
- promoting a sustainable economy;
- valuing our environment;
- achieving sustainable accessibility; and
- respecting distinctiveness.

The WSP highlights the need to plan regions around strong integrated transport systems, and that new developments should be highly accessible by public transport. It also suggests that brownfield sites should be scoped for reuse.

4.1.6 Manual for Streets (2007)

The Manual for Streets, published March 2007, gives new advice for the design of residential streets in England and Wales. The key recommendations include:

- increased consideration should be given to the 'place' function of streets. This function is essentially what distinguishes a street from a road, where the main purpose is to facilitate movement;
- prioritise the needs of pedestrians and cyclists;
- residential street design should naturally encourage low traffic speeds, ideally without having to rely on vertical or horizontal deflection measures. The design speed should normally be a maximum of 20 mph; and
- parking can be allocated to individual properties (in-curtilage or otherwise), but unallocated parking provides a common resource that helps to ensure space is used efficiently. Footway parking should be avoided.

4.1.7 A Walking and Cycling Action Plan for Wales 2009-2013

The Welsh Assembly Government has produced a Walking and Cycling Action Plan published in December 2008. This document sets out the Assembly Government's aim to increase levels of walking and cycling and to reduce car use, particularly for short journeys.

The core objectives of the action plan are to:

- *improve the health and well-being of the population through increased physical activity;*
- *improve the local environment for walkers and cyclists;*
- *encourage sustainable travel as a practical step in combating climate change;*
- *increase levels of walking and cycling through promotion of facilities; and*
- *ensure that walking and cycling are prioritised in crosscutting policies, guidance and funding*

The plan details aims and strategies to achieve these through policy, infrastructure and involvement with local authorities and non-government organisations. The plan also sets out clear targets and means of monitoring these. Of particular relevance to Waterfront Barry are the targets for travel to school and non-recreational adult journeys:

Travel to School

Walking: increase the percentage of children who walk to school to match the UK National Average; and

Cycling: to triple the percentage of children cycling to school in Wales.

Non-recreational journeys

Walking: increase number of people who walk to work to 20%; and

Cycling: to triple the percentage of adults whose main mode of travel to work is cycling.

4.2 Regional Policy

4.2.1 Final Draft Regional Transport Plan (2008)

The Final Draft Regional Transport Plan was released by SEWTA in December 2008.

The RTP vision is:

A modern, accessible, integrated and sustainable transport system for South East Wales which increases opportunity, promotes prosperity for all and protects the environment; where walking, cycling, public transport, and sustainable freight provide real travel alternatives.

SEWTA lists specific core activities that are critical to achieving its vision:

- developing innovative walking, cycling and Smarter Choices programmes;
- continuing investment in the regional rail system;
- improving the quality of bus services across the region;
- developing better public transport integration; and
- making better use of the regional road system.

4.2.2 SEWTA Rail Strategy Study (2006)

SEWTA completed a Rail Strategy Study in 2006 to set out high level aims to improve rail services in the region over the period 2009-2018. The strategy was designed to make better use existing services in the SEWTA area to achieve the regional and social objectives. The influence of this strategy on Waterfront Barry is detailed in Chapter 9.

4.2.3 SEWTA Bus Strategy Study (2006)

SEWTA completed a Bus Strategy study in 2006 to set out high level regional aims to improve bus services in the region. The study considered the network and infrastructure on which services operate and barriers to successful operation, networks and routes for commercial subsidised and flexible services are considered. Consideration is given to the creation of a network that better serves the population and encourages modal shift. The major aims of the strategy are:

- *"modal shift to buses, through providing safe, attractive and reliable alternatives to the car;*
- *economic growth and prosperity through addressing spatial exclusion; and*
- *reductions in social exclusion"*

4.2.4 Wales Route Utilisation Strategy, Network Rail (2008)

The Route Utilisation Strategy (RUS) for Wales was published by Network Rail in November 2008 and covers the whole rail network in Wales and some parts of England. The strategy recognises the growth in demand across Wales, and predicts a sustained passenger growth in the future.

Option No.15B highlights the potential need for an additional Vale of Glamorgan Line station in the future, which may entail switching one of the Barry Island services to become a second Vale of Glamorgan service whilst maintaining the four trains per hour between Barry and Cogan station.

An additional bay platform at Barry station in combination with the Cardiff Area Signalling Renewal works would allow a shuttle service to run between Barry station and Barry Island, retaining the three trains per hour currently serving Barry Island.

The Vale of Glamorgan Council has recently confirmed secured funding for both of these measures.

4.2.5 Walking and Cycling Strategy for South East Wales (2006)

SEWTA published the *Draft Walking and Cycling Strategy for South East Wales* in March 2006. This document sets out the ambitions of SEWTA for future cycling and walking provision in the region. The principle vision of the document is:

"To maximise the levels of walking and cycling, including their contribution to the prosperity, accessibility and well being of the people in South East Wales, and the protection of the environment."

Two of the eight aims of the document include:

- *to treble the number of cycling trips made by 2011; and*
- *to make walking and cycling attractive and practical travel options, through the provision of high quality infrastructure and information.*

The Strategy identifies two objectives that support development, which contribute to walking and cycling provision in South East Wales:

- Objective HQI (2) promotes the development of walking and cycling links to employment sites, service establishments and leisure facilities; and
- Objective HQI (3) promotes the development of the national cycle network.

4.2.6 Parking Guidelines Revised Edition 1993, Standing Conference on Regional Policy in South Wales

The current adopted guidance on parking standards for residential land uses in the Vale of Glamorgan is the 1993 South Wales Parking Guidelines document. The document details the appropriate level of parking for residential land uses. The standards vary according to the property size and requirement for visitors parking. A summary of the relevant South Wales parking guidelines are provided in Appendix D.

4.2.7 2001 Addendum to South Wales Parking Guidelines (1993)

The current adopted guidance on parking standards for non-residential land uses in the Vale of Glamorgan is the 2001 addendum to the South Wales Parking Guidelines 1993, which outlines guidelines on recommended parking provision for new developments. A summary of the relevant South Wales parking guidelines are provided in Appendix D.

4.2.8 County Surveyors Society (CSS) Wales – Parking Standards (2008)

The CSS Wales Parking Standards have been prepared by the County Surveyors Society on behalf of the 22 Welsh Unitary Authorities, in an attempt to achieve a common approach to the provision of vehicle parking facilities associated with new development and change of use schemes. The guidelines operate using a zoning system containing six zone levels; with zone 1 representing a city centre and zone 6 a rural hamlet.

The zoning system is based on the availability of alternative transport options, and will be determined on a Local Authority to Local Authority basis during discussions with local planners and local highways officers. A summary of the relevant CSS guidelines is provided in Appendix E.

It is understood from Council officers that the Vale of Glamorgan Council is currently considering these standards for adoption as a replacement for the South Wales Parking Guidelines, however at present the standards have not been adopted and the Barry Waterfront area has yet to be assigned a zone by the council.

4.3 Local Policy

4.3.1 Local Development Plan

The Vale of Glamorgan Council is preparing a new Local Development Plan (LDP), which will provide the development strategy and policy framework for the Vale over a fifteen-year period, from 2011 to 2026. Upon adoption the LDP will replace the Adopted Unitary Development Plan 1996 – 2011.

The Draft Preferred Strategy (DPS) (December 2007) completed a six week consultation between 16 January 2008 and 27 February 2008. The strategy sets out key strategic objectives for the Plan. Objective 6 of the Draft Strategy sets out:

"To reduce the need for Vale residents to travel to meet their daily needs and enabling them greater access to sustainable forms of transport."

The DPS and Initial Sustainability Appraisal (ISA) were both endorsed by Cabinet on the 25th March 2009 and subsequently Planning Committee on the 2nd April 2009 and Scrutiny Committee (Economy and Environment) on 21st April 2009. The two documents will now be used as a basis for the preparation of the Deposit Draft Plan.

4.3.2 Unitary Development Plan (2005)

The Vale of Glamorgan Unitary Development Plan 1996-2011 (UDP) was adopted on 18 April 2005 and constitutes the development plan for the authority. The UDP acknowledges that transportation issues are fundamental to many areas of planning policy in the Vale of Glamorgan. UDP Policy 2 sets out that development proposals will be favoured which are:

"…located to minimise the need to travel, especially by car and help to reduce vehicle movements or which encourage cycling, walking and the use of public transport".

In relation to the proposed development that forms the basis for this Transport Assessment, Policy 'Tran 1' sets out that land will be protected for the development of the Waterfront Barry to Cardiff Link. The UDP states that:

"The purpose of the Waterfront Barry to Cardiff Link Road is twofold: firstly to provide a link between the major development at Barry Docks and the trunk road motorway network via the A4231 and also to Cardiff and Cardiff Bay via the A4055; and secondly to alleviate traffic congestion and improve road safety on the A4055 through Dinas Powys."

In addition, part of the spatial strategy focuses on concentrating development opportunities in the urban areas of 'the waterfront strip' from Penarth to Rhoose, with particular emphasis on the regeneration of Waterfront Barry.

The plan also contains a section on recommended parking provision for developments in the Vale of Glamorgan area, which includes recommended cycle parking. A copy of the cycle parking guidelines is provided in Appendix F.

4.3.3 Local Transport Plan (2000)

The Vale of Glamorgan's Local Transport Plan (LTP) was adopted in August 2000 and highlights the Council's primary objectives for transport whilst providing a robust set of policies for the implementation of a more integrated approach to transport. It will ultimately be replaced by the impending Regional Transport Plan (introduced above) once it has been adopted.

The LTP specifically refers to development at Waterfront Barry and states:

"The reuse of brownfield land such as at Waterfront Barry is an ideal opportunity to develop housing close to local facilities and also provide a range of leisure, retail and employment uses within easy reach of peoples homes. Waterfront Barry will also incorporate provision of cycle routes".

4.3.4 Barry Waterfront Development Principles – (2009)

The Barry Waterfront Development Principles document has been prepared by the Vale of Glamorgan Council, and outlines the development principles for the remaining sites of Barry Waterfront. The document was adopted in June 2009.

In outlining the key planning and transportation requirements, the document states:

"The Council is seeking a sustainable new urban quarter….respond positively to the existing waterfront development, Barry Town Centre, the water and Barry Island. This will only be achieved if linkages are improved between all the areas allowing the free flow of traffic and pedestrian movements within and beyond the waterfront area."

Among the principles that the Council considers critical to the success of development at the remaining waterfront sites is 'movement and accessibility'. The document states:

"The pedestrian, cycle and public transport network which provide for safe sustainable transport links within and adjoining the development must provide safe access to the existing train stations…in accordance with Manual For Streets…secure and covered cycle parking must be provided on site to serve the development"

Also relevant to this report, the document states that the outline planning application for the waterfront will need to be accompanied by a detailed Transport Assessment, which will cover the necessary improvements to transport infrastructure required as a result of the development.

4.4 Vale of Glamorgan UDP - Supplementary Planning Guidance

4.4.1 Barry Development Guidelines

The Vale of Glamorgan UDP Supplementary Planning Guidance (SPG) will be used as a material consideration in determining planning applications and appeals.

The 'Barry Development Guidelines' SPG (as amended 2006) assists the Council, private landowners and developers in formulating and reviewing proposals for the built environment. In relation to this proposed development, the SPG states that:

"A new access road has been constructed to The Waterfront and via the Gladstone Link road to the west of the Town Centre. A new link road is also proposed to connect The Waterfront with Barry Island."

4.4.2 Sustainable Development – A Developer's Guide

The 'Sustainable Development' SPG (2006) provides guidance regarding a wide range of sustainability issues in order to raise awareness of how the development of land can contribute towards sustainability.

The SPG section 'Transport and Movement' identifies that:

"Individual developments should provide easy and safe movement for all modes of transport, especially pedestrians and cyclists, and connect to existing routes beyond the immediate development. Similarly, development proposals must give consideration to public transport provision and access and if appropriate contributions for either the provision of a new service or the upgrading of an existing public transport service may be sought through legal agreements."

4.4.3 Planning Obligations

The 'Planning Obligations' SPG (1996-2011) provides guidance regarding the Vale of Glamorgan Council's planning policy for identifying and implementing planning obligations for interested parties. The guidance explains that:

"Planning obligations are a legal tool that Local Authorities may use to seek contributions from developers to mitigate negative development impacts and facilitate development that might otherwise not occur."

The guidance includes specific mention of transport measures, provision for sustainable transport and financial contributions in connection with the provision of transport related infrastructure or services. Appendix VI of the document sets out details of a sustainable transport formula that is applied to developments in excess of 10 dwellings. The document also suggests the use of section 106 agreements to secure funding for transport improvements.

Sections 17 and 18 of Appendix VI set out the requirement for developments in excess of 100 residential units or 1000m^2 Gross Floor Area to have a Travel Plan.

4.5 Summary

This chapter has set the policy context against which this Transport Assessment should be considered. Several key policy documents have been found to be relevant to this report, that directly relate to the development sites at Waterfront Barry. The main points of relevance are:

- the developer must promote travel by public transport, walking and cycling and not create a development which is reliant on the private car;

- the development will need to extend choice of transport and accessibility;
- improving access to jobs and shopping areas is a key aspiration for the SEWTA region within the Wales Transport Strategy; which states that the coastal areas west of Barry are currently failing to meet this aspiration;
- the development site is located near good bus and rail links, and walking and cycling provision, which is favourable according to the Wales Spatial Plan;
- the development should consider the high level aims set out in the SEWTA Rail Strategy;
- the development should accord with the adopted parking guidelines for the Vale of Glamorgan (and consider the CSS Wales Parking standard);
- the development should enhance links with Barry Island and Barry Town Centre;
- the Transport Assessment should consider improvements required as a result of the development;
- a new access road is seen as an essential improvement in the Waterfront area according to the Unitary Development Plan; and
- Waterfront Barry is a brownfield site, which as the Local Transport Plan highlights is ideal for developing housing close to local facilities.

5 THE MASTERPLAN AND THE TRANSPORT STRATEGY

5.1 Proposed Land Use

The proposed development will form part of the wider regeneration of Barry Waterfront and will comprise the following units distributed over the three development areas of Arno Quay (AQ), East Quay (EQ), and West Pond/South Quay (WP/SQ), as shown in Table 5.1:

Table 5.1: Schedule of Development

Land use	WP/SQ	AQ	EQ	The Mole	Total
Apartments (no. of units)	314	94	46	40	494
Affordable Apartments (no. of units)	75	23	12	10	120
Houses (no. of units)	983	18	150	35	1186
Affordable Houses (no. of units)	244	5	36	9	294
Food Store and Petrol Filling Station (gross floor area m^2)	6,503				6,503 m^2
Hotel (gross floor area m^2)	3,498				3,498 m^2
Office (gross floor area m^2)	3,447				3,447 m^2
A1 Retail (gross floor area m^2)	2,323				2,323 m^2
A3 Food and Drink (gross floor area m^2)	1,686		130		1,816 m^2
Leisure (gross floor area m^2)				4,000	4,000 m^2
Primary School (gross floor area m^2)	2,760				2,760 m^2
Marina (parking spaces)				195	195

The illustrative masterplan is shown in Figure 5.1. It is envisaged that the construction of the development will take place in a phased manner with completion by around 2020.

There are a number of important design points to note in respect of the masterplan:

- a mixed use development is proposed including employment, residential, retail, leisure and education. This will minimise the need to travel, promote community development and increase local diversity and vitality;
- the residential development will be designed with a higher than average number of dwellings per hectare allowing more people to live within walking distance of communal facilities;
- the layout of the development and quality of the public realm will encourage walking and cycling journeys; and
- an assumption of the construction of 50 apartments, 44 houses , 4000 m^2 of leisure facilities and a Marina on the area adjacent to the West Pond site known as 'The Mole' (identified in Figure 2.1) has been made, since this site is closely associated with the development sites.

5.2 Transport Strategy

5.2.1 Vision

The vision for the waterfront is of a vibrant mixed use development, a development that is a place for recreation as well as being a place where people will choose to shop, live and work. A high quality and well connected pedestrian network will help to create a safe and attractive environment, encouraging a range of street activities. The development will be accessible by a

variety of transport modes and will be an amenity for all those who live, work and visit Barry. The provision of a high frequency and high capacity public transport service and dedicated cycle/pedestrian routes will act to integrate the development with Barry Island and the town centre. The development will utilise the existing high quality rail links within South Wales. The development will provide the opportunity to create a unique environment in Barry and enhance the town's profile as a vibrant, desirable place for future generations to live.

5.2.2 Objectives

The overarching objective is to develop a package of transportation measures which will encourage people to live, work and visit within a new sustainable urban quarter of Barry. The measures must both serve the needs of the development and be fully compatible with the strategy for the transport networks of Barry and its environs. The general transport objectives in relation to the Waterfront can be summarised as follows:

- to improve the connectivity between the development site, Barry Island and the town centre;
- to provide a new road link through to Barry Island which will:
    - provide route choice for those living in the development;
    - provide an alternative route for travel to and from Barry Island; and
    - provide a more direct route for buses;
- to provide an area-wide travel plan to ensure significantly more journeys are completed on foot, by bicycle and public transport compared with other similar sized developments;
- to deliver high quality public transport links and stops to minimise car dependency, such that most homes are within 5 minutes walk of frequent public transport services and local neighbourhood services;
- to deliver appropriate transport infrastructure before residents move in;
- to ensure the layout of development gives priority to walking, cycling and public transport journeys;
- to enhance access to the existing rail links in the area; and
- to minimise the impact of freight and construction traffic on local communities.

Given these objectives, an ambitious transport strategy has been developed, which aims to encourage sustainable mode choice among residents, employees and visitors to the development. The key elements include:

- high quality street design and a connected highway network;
- efficient and effective public transport services and facilities;
- direct and convenient walking and cycling routes and facilities;
- management measures for construction and deliveries; and
- measures to manage travel demand and promote innovation.

More detail on each element is provided later in this document. However, flexibility will be built into the strategy to ensure innovations in transport can be accommodated and upgrades to the infrastructure are facilitated as new technologies emerge.

6 TRIP MAKING

6.1 Introduction

The critical issue for implementing a successful transport strategy for the development is the amount of trip making that will occur, the distribution of this trip making and the mode of travel. These aspects are considered below.

6.2 Trip Generation

6.2.1 Person Trip Rates

The TRICS database has been used to establish trip generation rates for each of the land uses in the development. Average weekday Person Trip Rates have been extracted from the multi-modal data in TRICS for developments similar to those proposed for the development. Average trip rates are considered appropriate as a result of the sustainable location of the site from which residents, employees and visitors will have a range of transport options. These transport facilities and the localised improvements proposed in connection with Waterfront Barry are detailed in sections 9-11. It is considered that these facilities combined with a comprehensive Travel Plan for the development will result in trip rates at or below the level of observed average trip rates for comparable developments elsewhere.

The proposed trip rates have been the subject of previous discussion and consultation with the Vale of Glamorgan. A summary is provided in the Table 6.1 below and further details are provided in Appendix G.

Table 6.1: Person Trip Rate Summary

Landuse	Units	AM Peak Hour		PM Peak Hour		12 Hour Total	
		Arr	Dep	Arr	Dep	Arr	Dep
Apartments	per unit	0.113	0.438	0.314	0.131	1.730	2.011
Houses	per unit	0.239	0.940	0.650	0.402	4.410	4.793
Affordable Apartments	per unit	0.180	0.431	0.414	0.234	2.876	3.147
Affordable Houses	per unit	0.237	0.886	0.619	0.356	4.924	5.030
Food Store with PFS	per 100 m^2 GFA	5.802	3.947	12.016	12.861	131.680	125.805
Hotel	per 100 m^2 GFA	0.380	0.838	0.786	0.474	7.821	7.793
Offices	per 100 m^2 GFA	2.052	0.175	0.264	1.835	9.530	9.140
A1 Retail	per 100 m^2 GFA	9.490	8.792	8.573	8.971	110.921	109.476
A3 Retail	per 100 m^2 GFA	0.882	0.529	6.421	4.108	57.812	56.302
Leisure	per 100 m^2 GFA	0.925	0.607	2.613	2.302	21.119	20.717
Primary school	per 100 m^2 GFA	25.823	6.203	0.728	1.392	47.975	46.328

The trip rates for the AM and PM peak periods have been taken as 0800-0900 and 1700-1800 from TRICS as representative highway peak hours.

Due to the lower number of multi-modal surveys within the TRICS database compared with vehicle-only surveys, only a small number of the surveys have been excluded in order to ensure a maximum sample size. These exclusions remove sites in Greater London, sites significantly smaller than the proposed development, and those in 'out of town' locations. A comparison with vehicle only TRICS surveys for more specifically selected sites is provided later in this chapter.

Person trip rates are not presented for the Marina land use, as it is assumed that the vast majority of trips to the Marina will be undertaken by car. Details of the trip generation for the Marina land use (which is not anticipated to be significant during highway peak hours) are given in section 6.2.3.

6.2.2 Modal Split

Inevitably the development will attract a number of car users, however it is also anticipated that a significant proportion of trips will be made by other modes. The transport strategy sets out a number of objectives to ensure the provision of high quality access links to the development by public transport, walking and cycling. Therefore, based on the information contained in TRICS the likely weekday modal splits are outlined in Table 6.2.

Table 6.2: Modal Split Summary

Landuse	AM Peak Hour					PM Peak Hour				
	Vehicle Occupancy (person per vehicle)	Vehicle Occupants (%) (driver and passengers)	Public Transport (%)	Cyclists (%)	Pedestrians (%)	Vehicle Occupancy	Vehicle Occupants (%)	Public Transport (%)	Cyclists (%)	Pedestrians (%)
Apartments	1.195	54	4	3	38	1.310	54	4	3	38
Houses	1.482	77	3	2	18	1.372	83	2	2	13
Affordable Apartments	1.425	53	7	2	38	1.311	52	4	1	44
Affordable Houses	1.672	54	6	0	41	1.270	66	1	4	29
Food Store with PFS	1.199	86	2	1	11	1.541	92	1	0	7
Hotel	1.297	61	9	1	29	1.401	57	4	1	38
Offices	1.076	80	10	2	9	1.091	75	11	2	12
A1 Retail	1.196	60	0	1	40	1.283	72	2	1	24
A3 Retail	1.133	71	0	0	29	1.660	84	1	0	14
Leisure	1.222	79	1	2	18	1.774	85	1	1	12
School	1.283	41	0	0	58	1.268	78	0	0	22
Marina	-	100	0	0	0	-	100	0	0	0

6.2.3 Vehicle Trips

The audit of existing conditions in Chapter 2 underlines the potential for the development to utilise and enhance the existing public transport network. It has also been determined that there is a developing network of high quality cycle/pedestrian routes in the South East Wales area which can be linked to the development proposals.

Through discussions with Vale of Glamorgan officers it has become apparent that the vehicular network around Barry is under increasing pressure from traffic growth and, inevitably, the proposed Waterfront Barry development will increase this further. Private car use continues to be the dominant form of transport in the UK, and whilst the Waterfront Barry scheme has been developed to stimulate a modal shift away from the private car, it is necessary to fully consider the impact of additional vehicular traffic.

Consequently, the impact of vehicular traffic on the highway network requires a more detailed analysis to ensure that the development can be accommodated without a significant impact on the surrounding area.

The vehicle trip rates calculated from the TRICS multi-modal data are given in Table 6.3.

Table 6.3: TRICS Multi-modal Vehicle Trip Rates

		AM Peak Hour		PM Peak Hour	
Landuse		**Arr**	**Dep**	**Arr**	**Dep**
Apartments	per unit	0.051	0.200	0.131	0.054
Houses	per unit	0.124	0.486	0.393	0.243
Affordable Apartments	per unit	0.067	0.160	0.163	0.092
Affordable Houses	per unit	0.076	0.284	0.320	0.184
Food Store with PFS	per 100 sqm GFA	4.177	2.843	7.064	7.718
Hotel	per 100 sqm GFA	0.178	0.394	0.322	0.194
Offices	per 100 sqm GFA	1.522	0.130	0.182	1.268
A1 Retail	per 100 sqm GFA	4.750	4.401	4.812	5.036
A3 Retail	per 100 sqm GFA	0.471	0.412	3.103	2.246
Leisure	per 100 sqm GFA	0.598	0.393	1.255	1.106
School	per 100 sqm GFA	8.337	2.003	0.446	0.852
Marina	per parking space	0.047	0.031	0.049	0.063

As mentioned above, the multi-modal data in TRICS is based on a limited dataset; therefore, in order to ensure robustness, the following checks have been undertaken on the vehicle trip rates:

- comparison with local sites; and
- comparison with TRICS vehicle-only survey data.

The comparative assessment shows that the TRICS multi-modal trip rates are robust and representative – further details are provided in Appendix G.

6.2.4 Food Superstore

The nearby 5,745 m^2 GFA Morrisons food store, which includes a 12 bay petrol filling station, provides an apparently useful comparison to the proposed food store and petrol station on the Barry Waterfront site, as detailed in Appendix G. However a retail assessment of the area included as Appendix H (Nathaniel Litchfield and Partners, August 2009), concludes that the store is currently significantly overtrading against the benchmark for a store of this size.

Table 1c of the report indicates that the store is currently trading at a level of 158% against a benchmark of 100% (implied total turnover compared to benchmark turnover). The opening of a new store on the Barry Waterfront site will clearly have an effect on the existing Morrisons store and it is therefore forecast that trade at the Morrisons store will decrease to 117% as detailed in Table 5c of the report. The number of vehicular trips will be directly related to the trade level, Table 6.4 presents a comparison of the trip rates for the combined food superstore and petrol filling station to that of multi-modal vehicle rates and vehicle only average trip rates from the TRICS database.

Table 6.4: Comparison of vehicle trip rates for Food superstore with PFS per 100m^2 GFA

		AM Peak Hour		PM Peak Hour	
Scenario	**Trading Level against benchmark**	**Arr**	**Dep**	**Arr**	**Dep**
Existing Morrisons	158%	6.179	4.804	8.755	9.330
Future Morrisons	117%	4.576	3.557	6.483	6.909
TRICS Multi-modal	N/a	4.177	2.843	7.064	7.718
TRICS Vehicle only	N/a	4.147	2.808	7.632	7.945

The comparison table indicates that there is a good level of correlation between a Morrisons store trading at 117% of benchmark level and both sets of TRICS data. In order to adopt a robust

approach the highest trip generation (shaded orange) from each of the three scenarios will be used to estimate the vehicular trip generation of the proposed store and associated petrol filling station.

It is worth noting at this stage that if the level of trading at Morrisons (and therefore the associated trip generation) drops as forecast by the retail assessment the level of base traffic on the network would be lower. However in order to consider a scenario that is robust but not overly complex no adjustment has been made to base flows.

6.2.5 Comparison with vehicle-only trip rate

Following the submission of the trip rate data to the Vale of Glamorgan in July 2008 comments were received to the effect that the trip rates were not representative of the considered sites and in many cases the vehicular trip rate underestimated the generation of the proposed land uses. The intention of this comparison was to highlight that average TRICS vehicle-only rates compared well with the multi-modal vehicle trip rates.

However, in order to further increase the robustness of the vehicular traffic impact assessment the multi-modal and average vehicle-only trip rates have been compared. In all cases where the initial vehicle-only trip rate was higher than the comparable figure for multi-modal trip rates (21 out of 44 cases) it has been used. Thus the pre-adjustment vehicle trip rates are highlighted orange in Table 6.5. These increases from using vehicle-only trip rates were generally small with the exception of the hotel and office land uses.

Table 6.5: Vehicle trip rates, a comparison of multi-modal and vehicle only

			AM Peak Hour		PM Peak Hour	
Landuse	**Quantum**	**Vehicle Trip Rate Type**	**Arr**	**Dep**	**Arr**	**Dep**
Apartments	per unit	Multi-modal	0.051	0.200	0.131	0.054
		Vehicle only	0.041	0.143	0.118	0.067
Houses	per unit	Multi-modal	0.124	0.486	0.393	0.243
		Vehicle only	0.153	0.335	0.338	0.200
Affordable Apartments	per unit	Multi-modal	0.067	0.160	0.163	0.092
		Vehicle only	0.039	0.077	0.118	0.071
Affordable Houses	per unit	Multi-modal	0.076	0.284	0.320	0.184
		Vehicle only	0.127	0.233	0.347	0.136
Food Store with PFS*	per 100 sqm GFA	As 6.2.4	4.576	3.557	7.632	7.945
Hotel	per 100 sqm GFA	Multi-modal	0.178	0.394	0.322	0.194
		Vehicle only	0.300	0.455	0.322	0.258
Offices	per 100 sqm GFA	Multi-modal	1.522	0.130	0.182	1.268
		Vehicle only	1.437	0.243	0.418	1.360
A1 Retail	per 100 sqm GFA	Multi-modal	4.750	4.401	4.812	5.036
		Vehicle only	3.755	3.313	5.969	6.441
A3 Retail**	per 100 sqm GFA	Multi-modal	0.471	0.412	3.103	2.246
Leisure	per 100 sqm GFA	Multi-modal	0.598	0.393	1.255	1.106
		Vehicle only	0.633	0.407	0.914	0.934
School	per 100 sqm GFA	Multi-modal	8.337	2.003	0.446	0.852
		Vehicle only	4.938	3.933	0.484	0.960
Marina***	per parking space	Vehicle only	0.047	0.031	0.049	0.063

* Trip rates for Food superstore with PFS detailed in section 6.2.4

** No suitable vehicle only survey sites

*** Vehicle only trip rate for Marina

6.2.6 Trip Generation Adjustments

Not all development related trips will be 'new' trips on the local network. For all new large mixed-use developments, there is an element of adjustment to the theoretical number of car-based trips travelling on the local highway network due to the generation of linked, pass-by and internal trips. Internal trips are those which will not emerge onto the local highway network as a result of the

origin and destination of the trip being within the development site such as a trip from a residential property to the food superstore. Linked and pass-by trips are described in Section 4.64 of the Department for Transport *"Guidance on Transport Assessment"* (2007) as:

- *"**Pass-by trips** - these are trips that are already present on the road network directly adjacent to the point(s) of access to the site, which will turn into the site. This type of trip is likely to be relevant only where the site is located on a major arterial route within an urban area. If it can be clearly demonstrated that there will be a proportion of true 'pass-by' trips that were already on the network, then these can be deducted from the calculated generation for the development.*
- ***Linked trips** - these are trips that will have multiple destinations within the proposed development site. Examples include trips to food and non-food retail, between both the development site and existing adjacent sites or between the development site and an established town centre. Where there is a high probability that there will be a proportion of linked trips between two uses on a development, it is customary only to 'count' those trips once for the development as a whole, and not effectively double-count them by attributing two visits and departures affecting the sections of highway network being assessed."*

The proportion of resultant trips on the external highway network is calculated in the following manner:

Resultant new trips = 100% × (1-% Linked trips) × (1-% Pass-by trips) × (1-% internal trips)

Each of these issues has been investigated and discussed with the Vale of Glamorgan in order to set an appropriate level of reduction to theoretical car traffic on the road network.

- **Residential -** almost all trips will be new primary trips. Most weekday peak hour trips will be journey to work, or linked to the journey to work. Assuming 100% new primary trips will avoid the possibility of double counting residential trips elsewhere. Assumptions: 0% Pass-by, 0% Linked, 0% Internal.
- **Food Store -** many trips will be transferred from other nearby retail sites (particularly Morrisons accounting for the forecast change in trading detailed in section 6.2.4) or occur as a result of passing traffic on what will be a strategic route to Barry Island and large areas of Barry Waterfront. TRICS research report 95/3: "Traffic and Parking at Food Retailing" Table 2.9 suggests that, from observations at six stores, an average of 39% of trips to out of centre food superstores during a weekday peak hour are non-primary. This finding is further supported by a study of four Sainsburys stores ("A before and after study of four new Sainsbury Foodstores", MacIver and Dickenson, Traffic Engineering and Control, July 1992), which found that a significant proportion of trips are diverted or pass-by. Considering the results presented for the Thursday PM peak hour the average sum of diverted and pass-by trips of 40% corresponds well to the TRICS report finding. For the purpose of this work a more conservative approach has been adopted. Vehicle occupancy at the Morrisons and nearby retail site was surveyed during the peak periods, and found to average 1.98. This is noticeably higher than the vehicle occupancy extracted from the TRICS multi-modal data, suggesting that local conditions result in higher occupancy. As such, the vehicle occupancy for the proposed food store and retail landuses has been assumed to be an average between the TRICS value and that observed. An allowance for internal trips has also been made; at present the three food superstores in Barry serve a population of some 48,000 ie. an approximate catchment of 16,000 residents each. With 2,094 housing units at an average household size of 2.0 as much as 26% of trade might therefore be expected to come from the residents of the development, so for the purpose of this work a more conservative approach has been adopted. Assumptions: 35% Pass-by, 0% Linked, 20% Internal.
- **Other Retail** – The retail offering of Barry Waterfront is situated at the district centre of the development and adjacent to the food retail superstore, and the retail units are therefore well situated for pass-by trips on the link road to Barry Island but also cross visitation from the

superstore and nearby places of employment. TRICS research report 95/2 Table 3.4 shows that the proportion of non-primary trips between the two non-food retail sites considered was 57%. For the purpose of this work a more conservative approach has been adopted. Assumptions: 15% Pass-by, 10% linked, 25% Internal.

- **Hotel –** The proposed hotel is of a relatively modest scale, and it is envisaged that many of the trips will be linked to other land uses in the local vicinity, in particular the office/employment and leisure uses. Assumptions: 0% Pass-by, 20% Linked, 30% Internal.
- **Office -** most of the trips will be new primary trips, but given the mixed use nature of the proposed development, a proportion of the trips are likely to be internal to the development. Assumptions: 0% Pass-by, 0% Linked, 20% Internal.
- **Leisure/A3 uses -** most trips will be from the local area or linked trips to other land uses. Assumptions: 0% Pass-by, 30% Linked, 30% Internal.
- **Primary School** – any school provided within the development will be primarily to cater for demand created as a result of the housing within the Barry Waterfront development. Thus trips to the school will have a high proportion of walking and cycling journeys, and vehicle trips are likely to be linked to other journey purposes such as parents completing the journey to school as part of a journey to work or shopping trip. The average trip distance to primary schools in England and Wales is 2.41 km (source: *http://www.walktoschool.org.uk/media-faq.php?show=50#50*). Assumptions: 0% Pass-by, 40% Linked, 50% Internal.
- **Marina -** It has been assumed that all trips to the Marina will be new trips. Assumptions: 0% Pass-by, 0% Linked, 0% Internal
- **Visitors** – the trip rates used account for all trips to and from developments based on the land use. This number will therefore account for all incidental visitors to homes (friends, maintenance, and deliveries), businesses (visitors, cleaners, and deliveries), retail (deliveries, maintenance), schools (part-time workers, variations in staffing, non-routine parental visits). Assumptions: Included in trip rates for other landuses, no unique trips assumed, ie. all visitors have a purpose accounted for in a landuse or background traffic growth.

Table 6.6 summarises the adjustments made to trip rates related to pass-by, linked and internal trips.

Table 6.6: Adjustments to Trip Rates with summary reduction

Landuse	Pass-by	Linked	Internal	Resultant New Trips External to Development Boundary
Residential	0%	0%	0%	100.0%
Food Store with PFS	35%	0%	20%	52.0%
Hotel	0%	20%	30%	56.0%
Offices	0%	0%	20%	80.0%
A1 Retail	15%	10%	25%	57.4%
A3 Retail	0%	30%	30%	49.0%
Leisure	0%	30%	30%	49.0%
Primary School	0%	40%	50%	30.0%
Marina	0%	0%	0%	100.0%

As a check on the total effect of these adjustments the total proportion of non-primary trips has been calculated for the AM and PM peak hour. In this case non-primary trips are the result of

adjustments for pass-by and linked trips. The proportion of resulting non-primary trips is 13% in the AM peak hour and 16% in the PM peak hour. This level of non-primary trips represents a robust set of assumptions appropriate for the comprehensive mixed use development proposed at Barry Waterfront.

In addition to the above assumptions further consideration has been given to the proportion of public transport trips to and from the site. As set out in the transport strategy objectives, a high standard of public transport provision will be provided at the development – which will be a step change of improvement above that which typically occurs at similar type developments.

The TRICS multi-modal data gives a modal share of between 3% and 7% to public transport for residential land uses. Given the proposed accessibility to rail and bus services in the development a 10% 'target' for public transport is proposed. For the residential areas, the modal splits have been adjusted to an average between the TRICS rate and the 'target' rate, resulting in modal shares for public transport of typically between 6 and 8%.

These adjustments should be considered valid as this development will reduce the need to travel, and encourage sustainable travel patterns through the provision of a Travel Plan. The targets will form the overarching aim of the site Travel Plan.

Following these adjustments Table 6.7 summarises the final vehicle trip rates, resultant external trips and trip generation

Table 6.7: Resultant vehicular trip rates, external trip proportions and trip generation by land use

	Trip Rates				Resultant external trips (%)	Trip Generation			
	AM Peak Hour		PM Peak Hour			AM Peak Hour		PM Peak Hour	
Landuse	Arr	Dep	Arr	Dep		Arr	Dep	Arr	Dep
Apartments	0.049	0.188	0.123	0.063	100.0%	24	93	61	31
Houses	0.146	0.465	0.374	0.231	100.0%	174	552	444	274
Affordable Apartments	0.065	0.155	0.153	0.087	100.0%	8	19	18	10
Affordable Houses	0.121	0.272	0.324	0.172	100.0%	36	80	95	51
Food Store with PFS	4.576	3.557	7.632	7.945	52.0%	155	120	258	269
Hotel	0.300	0.455	0.322	0.258	56.0%	6	9	6	5
Offices	1.522	0.243	0.418	1.360	80.0%	42	7	12	38
A1 Retail	4.750	4.401	5.969	6.441	57.4%	63	59	80	86
A3 Retail	0.471	0.412	3.103	2.246	49.0%	4	4	28	20
Leisure	0.633	0.407	1.255	1.106	49.0%	12	8	25	22
School	8.337	3.933	0.484	0.960	30.0%	69	33	4	8
Marina	0.047	0.031	0.049	0.063	100.0%	9	6	10	12
*Difference from individual elements occur as a result of rounding					**Total**	**602**	**988***	**1,039***	**826**

6.2.7 Resultant Trip Generation

Taking the above factors into account, the resultant trip generation for each section of the proposed development areas is summarised in Tables 6.8 to 6.11.

Table 6.8: Resultant Vehicle Trip Generation Summary

Location	AM Peak Hour		PM Peak Hour	
	Arr	Dep	Arr	Dep
East Quay	30	90	77	46
Arno Quay	9	31	23	13
West Pond/South Quay	532	825	882	719
The Mole	30	42	57	47
Total	**602***	**988**	**1,039**	**826***

*Difference from individual elements occur as a result of rounding

Table 6.9: Pedestrian Generation Summary

Location	AM Peak Hour		PM Peak Hour	
	Arr	Dep	Arr	Dep
East Quay	17	48	27	16
Arno Quay	7	24	18	10
West Pond/South Quay	319	449	262	190
The Mole	9	20	18	12
Total	**351**	**540**	**324**	**226**

Table 6.10: Cycle Generation Summary

Location	AM Peak Hour		PM Peak Hour	
	Arr	Dep	Arr	Dep
East Quay	1	4	4	2
Arno Quay	1	2	1	1
West Pond/South Quay	11	28	29	19
The Mole	1	2	2	1
Total	**14**	**35**	**36**	**23**

Table 6.11: Public Transport Generation Summary

Location	AM Peak Hour		PM Peak Hour	
	Arr	Dep	Arr	Dep
East Quay	5	14	9	5
Arno Quay	2	5	4	2
West Pond/South Quay	42	97	68	48
The Mole	2	5	4	2
Total	**50**	**121**	**83**	**58**

6.3 Trip Distribution & Assignment

6.3.1 External Gravity Model

As stated earlier, the vehicular traffic requires more detailed analysis and thus to fully assess the impact of vehicular traffic on the highway network, the trip generation calculated in section 6.2 requires distribution across the external highway network in order to fully understand the impact on the area.

As requested by the Vale of Glamorgan Council and agreed during the scoping process (see 9th April meeting minutes, Appendix A), the vehicle trips generated by the development have been distributed across the external network using a Gravity Model. This method of trip distribution has been selected in preference to the 2001 census journey to work data due to the age of the census data, and the changing employment and development situation in the area surrounding the development.

From analysis of the 2001 Journey to Work Census data it is apparent that the vast majority of trips to and from Barry lie within an area bounded by Bristol to the east, Monmouth to the north and Swansea to the west. Accordingly these locations will form the boundaries of the gravity model and therefore the outer boundary for origins/destinations of all proposed additional Waterfront Barry trips.

TEMPRO version 5.3 datasets were used to give historical, present and future data on population and employment in the considered areas. TEMPRO is a software program issued by the Department for Transport which includes planning data projections for all areas of the United Kingdom. In the case where zoning is finer than that of TEMPRO (only applicable to Cardiff and Barry) the population and jobs have been proportioned according to the 2001 Census data with adjustments from local planning data for developments in future years.

The zoning of the gravity model is relatively fine (ie. small zones) in close proximity to the development, with Barry and Cardiff split into multiple zones. Further afield towns and whole unitary authorities form other zones. The population and job data for each zone has been obtained from TEMPRO. The distance from each zone to Waterfront Barry has been taken from what is judged to be the centroid in terms of population and jobs for each zone.

The gravity model has been calibrated using 2001 TEMPRO data to closely match the 2001 Census, and then updated using 2020 TEMPRO data and major known developments such as those agreed during the scoping exercise to provide the basis for the future year distribution. The resulting trip attractions are outlined in Table 6.12. The output and suitability of the gravity model has been approved by the Vale of Glamorgan Council.

Table 6.12: Gravity Model Trip Attractions

Zone Number	Zone Name	Trip Attraction	
		From Barry	To Barry
1	Blaenau Gwent Unitary Authority	0.7%	0.5%
2	Bridgend Unitary Authority (excluding 3 and 4)	1.1%	1.0%
3	Bridgend	2.2%	0.8%
4	Leisure and Commercial development, Llanilid (film studios)	0.4%	0.1%
5	Bristol	1.9%	0.6%
6	Caerphilly Unitary Authority (excluding 7)	2.1%	1.8%
7	Caerphilly	0.8%	0.7%
8	Cardiff North	12.5%	9.8%
9	Cardiff South	16.5%	4.0%
10	Merthyr Tydfil Unitary Authority (excluding 12)	0.3%	0.3%
11	Merthyr Tydfil	0.4%	0.3%
12	Monmouthshire Unitary Authority	1.0%	0.5%
13	Neath	0.4%	0.3%
14	Newport Unitary Authority (excluding 16)	1.2%	0.3%
15	Newport	2.6%	1.3%
16	Port Talbot	0.4%	0.3%
17	Rhondda Cynon Taff Unitary Authority (excluding 19)	3.5%	2.9%
18	Pontypridd	0.9%	0.5%
19	Swansea Unitary Authority	1.9%	1.0%
20	The Vale of Glamorgan Unitary Authority (excluding 22-30)	1.6%	0.9%
21	Barry West	7.3%	21.3%
22	Barry East	11.5%	26.4%
23	Barry Central	16.9%	14.8%
24	Barry Island	2.3%	2.8%
25	Dinas Powys	0.9%	1.5%
26	Llantwit Major	1.5%	0.6%
27	St. Athan Defence Technical College	1.2%	0.3%
28	Penarth	2.0%	2.2%
29	Rhoose	1.7%	1.0%
30	Neath Port Talbot Unitary Authority	0.6%	0.3%
31	Torfaen Unitary Authority (excluding 32)	0.7%	0.4%
32	Cwmbran	0.9%	0.5%

The development traffic to and from the 32 zones has been assigned to the highway network using the ten strategic routes indicated on Figure 6.1 in the proportions detailed in Appendix I. Traffic has been assigned to these routes by considering possible routes to each zone, journey time, existing junction/route capacity and future junction/route capacity in an iterative process.

The development related traffic flows for the AM and PM peak hours are shown on Figures 6.2 and 6.3 respectively.

Barry Island through Traffic

Since the proposed development includes a new highway link from Powell Duffryn Way/Ffordd Y Mileniwm through to Barry Island, it is important to consider the reassignment of the existing Barry Island traffic, once the new link is in place.

The existing traffic counts at the Ship Gyratory reveal the current usage of Harbour Road; the only existing highway access to Barry Island. The 2006 counts have been factored using NRTF central growth to 2008 figures, as given in Table 6.13 below.

Table 6.13: Existing Vehicle Trips To/From Barry Island

Peak Hour	From Barry Island	To Barry Island
Weekday AM	265	205
Weekday PM	261	322

Due to the direct nature of the proposed main link through the development it is assumed that all vehicles heading to areas to the east of Barry Town Centre will use the new link. Traffic travelling west from Barry Island will continue to use Harbour Road. Traffic heading to the town centre will use a combination of the two routes.

As such, using the existing travel information from the 2001 Census for the Barry Island output area, the following percentage splits have been used.

Table 6.14: Distribution of Barry Island Traffic

Direction of travel	West of Town Centre	Town Centre	East of Town Centre
Journey To Work from Barry Island	21%	14%	65%
Journey To Work to Barry Island	40%	15%	45%

6.3.2 Internal trip distribution

The proposed spine road will have a number of junctions serving the areas along it. As well as the function of external junctions it will be important to verify the operation of these internal junctions. To do this requires an understanding of internal movements and also the consideration of additional pass-by and internal trips.

The land use elements have been grouped into zones, according to their location on the masterplan and the point at which they join the spine road. Total arrivals and departures for each zone have been established using the trip rates detailed in section 6.2.3, and an associated matrix of movement was derived using a matrix estimation technique informed by the number of arrivals and departures. The matrix of movement has been distributed across the internal network using manual assignment based on where each zone joins the spine road.

A schematic model, which includes the different land use zones, is illustrated in Figure 6.4 and 6.5, to show how traffic is distributed across the internal network for the 2020 AM and PM peaks respectively.

7 HIGHWAY ASSESSMENT

7.1 Introduction

This section considers the impact of four traffic flow situations on the capacity of the local network, namely the:

- 2008 Existing Situation – using observed traffic count data;
- 2020 Base Situation – consisting of the observed traffic flows factored to 2020 levels and committed developments;
- 2020 Development Situation – consisting of the base flows and the traffic generated by the development;
- 2020 with Barry Island peak tourism - this flow scenario is based on the 2020 PM Peak Base situation with the addition of further traffic to and from Barry Island, in order to investigate the effect on peak traffic from tourism movements to and from Barry Island; and
- 2020 Development with Barry Island peak tourism – this flow scenario is based on the 2020 with Barry Island peak tourism with the addition of development traffic in order to assess the impact of development traffic when tourism increases the base level of traffic.

The aim of the modelling exercise is to compare traffic conditions before and after completion of the development. By doing this, it is possible to assess the impact that the development may have on the surrounding road network and to gain a better understanding of mitigation measures that would be required.

The situations have been tested for a typical weekday morning and evening peak hour period using ARCADY, PICADY, or LINSIG (software used for junction capacity modelling) as appropriate.

Junction capacity in the above software packages is measured as the Ratio of Flow to Capacity (RFC), which is a measure of the volume of traffic making a turning movement at the junction divided by the capacity of that movement; ascertained from the geometric measurements of the junction. The generally agreed operational capacity of a junction is at a ratio of 0.85, or 85% for roundabouts and priority junctions and 0.90, or 90% for traffic signals. Junctions can still operate within capacity with an RFC value of up to 1 (100%), however as practical capacity is approached delays will increase.

Interaction between the junctions has been considered as a result of the predicted queues; several of the junctions are located close to one another, as a result of which excessive queues may affect the operation of adjacent junctions. The maximum queues forecast to occur on each arm of junctions has been monitored for this reason.

A link assessment has also been completed for each scenario using the guidance provided in TA79/99.

Several of these junctions have not been fully tested having been eliminated from this requirement at the scoping stage by agreement with the Vale of Glamorgan as a result of the development having only minor effect on them. In these cases the percentage increase in traffic passing through the junction as a result of the development has been quantified. These junctions are:

- Sycamore Cross (junction 1);
- Culverhouse Cross (junction 2); and
- Barons Court (junction 24)

7.2 Existing Situation Assessment – 2008

7.2.1 Existing Highway Network

The scoping process identified a total of 24 junctions and 33 links within Barry (described in Appendix B in detail) and the surrounding area for which the development impact was to be considered. The relevant junctions and links are highlighted on Figure 7.1 and 7.2 respectively.

7.2.2 Existing Traffic Flows

In order to understand the pattern of existing traffic movements on the network, recent traffic count information was obtained from the Vale of Glamorgan for these junctions. This method was discussed and agreed with the Vale of Glamorgan during a meeting on 5 March 2008 (refer to Appendix A). In addition, a series of classified turning movement counts was carried out by Arup in order to augment existing traffic count data. Further details of the traffic data collected are contained in Appendix J.

It should also be noted that some of the older data was normalised to 2008 levels using TEMPRO adjusted NRTF 'central' growth factors where appropriate; however, all traffic data is sufficiently recent to meet guidance regarding the acceptability of counts to be used for this type of capacity analysis.

From these surveys the peak hours were identified as being 08:30-09:30 and 16:30-17:30. The resulting 2008 existing situation traffic flows for the AM and PM peak hours are shown on Figures 7.3 and 7.4 respectively.

Generally the individual traffic counts show reasonable consistency between junctions with only small discrepancies. An exception to this was the PM peak westbound flow between junctions 8 and 9 (see Figure 7.1). The original junction counts have a mismatch of 143 vehicles. To ensure a robust assessment traffic flows at junction 9 have been factored up to match those approaching from junction 8 (404 vehicles). It is these adjusted flows that are presented on Figure 7.1.

7.2.3 Capacity Analysis

Base models were built using the appropriate software for the typical weekday morning and evening peak hours. The results for all junctions are summarised in Table 7.4. In order to present this information in the most concise manner, each scenario has been given a capacity rating from 1-4, where 1 represents that the junction is within capacity, and 4 is over theoretical capacity. These levels are designated according to the largest RFC value on any one arm of the junction as illustrated in Table 7.1.

The traffic models used in the assessment of the local highway network where reviewed by Capita Symonds as part of the review of the original Transport Assessment (August 2009), in light of comments made regarding the model a number of changes have been made to the traffic models, these changes are detailed in a technical note included as Appendix Q.

Table 7.1: Junction capacity classification

1 - Within Capacity	**2 -** Approaching Practical Capacity	**3 -** Over Practical Capacity, Approaching Theoretical Capacity	**4 -** Over Theoretical Capacity
Priority RFC <0.75 Signals RFC <0.80	Priority RFC >0.75, <0.85 Signals RFC >0.80, <0.90	Priority RFC >0.85, <1.00 Signals RFC >0.90, <1.00	Priority RFC >1.00 Signals RFC >1.00

Queuing at junctions has been classified in a similar manner based on the length of the calculated queue as illustrated in Table 7.2:

Table 7.2: Junction capacity classification

1 – Minor Queuing	**2 –** Significant queuing	**3 – Major queues**	**4 –** Severe queues
<20 vehs	20-49 vehs	50-99 vehs	>100 vehs

A more complete junction summary, and full model output, is provided as Appendix K. The key points are summarised below:

- the majority (17/21) of the assessed junctions operate within practical capacity in both the AM and PM existing peak hours;
- three junctions exceed practical capacity:
  - Merrie Harrier (No. 3) – AM and PM
  - Biglis roundabout (No. 5) - PM only
  - Waycock Cross (No. 7) – AM only
- one junction exceeds theoretical capacity:
  - Palmerston Road signals (No. 14)

7.3 Base Situation Assessment – 2020

7.3.1 Base Highway Network

There are programmed improvements to the Merrie Harrier and Waycock Cross Junctions. Drawings of the programmed improvements have been received from The Vale of Glamorgan Council and are included as Appendix L.

Merrie Harrier: The proposed works to the Merrie Harrier signalised junction are aimed at providing improved facilities for buses, cyclists and pedestrians whilst increasing available capacity through the installation of new signal equipment. Initial phases of this work have already been completed.

Waycock Cross: The proposed works to the junction involve a re-siting of the roundabout to the north. The revised junction will have improved capacity on all approach arms. The improvement proposals arise from existing traffic conditions and proposals for the Defence Technical College development at RAF St Athan to the west of Barry.

7.3.2 Base Traffic Flows

It was agreed during the scoping process that 2020 would represent a suitable future year for analysis. The traffic flows were factored to 2020 levels, again using TEMPRO adjusted NRTF central growth factors to represent the future year scenario without the development in place. The 2020 base traffic flows for the AM and PM peaks are shown on Figures 7.5 and 7.6 respectively.

There are currently no major committed developments in the Barry urban area. The application of NRTF central growth and adjustments to the gravity model will account for developments in the wider area such as Penarth Heights and RAF St. Athan.

7.3.3 Capacity Analysis

The results of the analysis for each junction and link are shown in Table 7.2 and detailed in Appendix K. The key points are summarised below:

- future year traffic growth would be sufficient to have a significant effect on the operation of the existing road junctions in the study area. The level of junctions operating within practical capacity in all time periods drops to 9 out of 21 assessed junctions;
- 11 junctions are forecast to exceed practical capacity:
  - Merrie Harrier signals (No. 3) – PM only;
  - Murch Crossroads (No. 4) – PM only;
  - Biglis Roundabout (No. 5) – AM only;

- Port Road/Barry Docks Link Road roundabout (No. 6) – PM only;
- Waycock Cross (No. 7) – PM only;
- Dock View Road gyratory (No. 10) – AM only;
- Gladstone Road/Cardiff Road/Ffordd y Mileniwm roundabout (No. 13) – PM only;
- Vere Street, Hilary Rise and Gladstone Road mini roundabout (No. 15) – PM only;
- Wimbourne Road/Ffordd y Mileniwm (No. 16) – PM only;
- Cory Way/Ffordd y Mileniwm roundabout (No. 17) – PM only; and
- Broad Street/Hood Road (No. 23) – PM only.

- four junctions now exceed theoretical capacity in one or both of the peak hours:
  - Merrie Harrier signals (No. 3) – AM only;
  - Biglis Roundabout (No. 5); – PM only;
  - Dock View Road gyratory (No. 10) – PM only; and
  - Palmerston Road signals (No. 14) – AM and PM.

It is clear from the difference between the 2008 and 2020 base assessments that traffic growth in isolation has resulted in a significant number of junctions operating over capacity.

It is unlikely that these situations would be allowed to develop to such a severity; in order to mitigate these effects it is expected that the Vale of Glamorgan would look to provide a series of junction improvements in order to offset the worst of these effects to at least a nil-detriment level.

Should traffic conditions degrade to this extent it is considered that a number of journeys would switch mode (to public transport, walking or cycling) as a result of increased journey times and costs using the private car.

7.4 Development Situation Assessment – 2020

7.4.1 Development Highway Network

It is proposed that a new spine road will serve the main development of consisting of West Pond, and South Quay linking from the location of the existing four arm roundabout at the north east corner of the site to Earl Crescent at the south east edge of the application site. There are a series of junctions serving the development along this road, marked i-ix on Figure 5.1. The alignment of the spine road through the development is illustrated in Figure 7.7.

The existing roundabout at the north east corner will be replaced by a four arm signalised junction in the same position (junction i), which will provide additional capacity and control of traffic movements as well as improving pedestrian conditions by the provision of controlled crossings on all arms.

T-junctions (junction ii and iv) will serves the buildings to either side of the road including the proposed school. These junctions are expected to experience lower demand.

The main access to the West Pond residential area and the retail/petrol filling station will be from a centrally located four arm signalised junction (junction v). This junction will accommodate significant turning movements and provide controlled pedestrian crossings on all arms.

At the southern end of the site a four arm signalised junction (junction viii) provides access to the South Quay area.

Finally a priority junction (junction ix) provides vehicular access to a small residential area to the west of the spine road.

The two smaller development sites (Arno Quay and East Quay) to the east of the main development area will be served by the existing roundabouts located on Ffordd y Mileniwm.

7.4.2 Development Traffic Flows

The development traffic flows were obtained by adding the trips generated by the development site, as detailed in Chapter 6, to the 2020 base traffic flows. The development traffic flows for the AM and PM peaks are shown on Figures 7.8 and 7.9 respectively.

7.4.3 Capacity Analysis

The results of the analysis for each junction and link are shown in Table 7.4 and detailed in Appendix K. The key points are summarised below:

- the development traffic further exacerbates the situation, however six junctions continue to operate within practical capacity in the AM and PM peak periods:
  - Ship Gyratory (No. 9)
  - Butrills Road/Barry Road staggered junction (No. 11)
  - Barry Road/Ty Newydd Road/Cemetery Road roundabout (No. 12)
  - Subway Road/Ffordd y Mileniwm (No. 18)
  - Plymouth Road/Earl Crescent Roundabout (No. 22); and
  - Hood Road signals, No. 23 (previously over capacity in the 2020 without development scenario);
- the following two exceed practical capacity:
  - Harbour Road/Station Approach/Paget Road Roundabout (No. 8) – PM only;
  - Vere Street, Hilary Rise and Gladstone Road mini roundabout (No. 15) – PM only
- several additional junctions now exceed the theoretical capacity, in total 13 junctions exceed theoretical capacity they are:
  - Merrie Harrier signals (No. 3) – AM only;
  - Murch Crossroads (No. 4) – PM only;
  - Biglis Roundabout (No. 5) – AM and PM;
  - Port Road/Barry Docks Road link Road roundabout (No. 6) – AM and PM;
  - Waycock Cross roundabout (No. 7) – PM only;
  - Dock View Road Gyratory (No. 10) – PM only;
  - Gladstone Road/Cardiff Road/Ffordd y Mileniwm roundabout (No. 13) – AM and PM;
  - Palmerston Road signals (No. 14) – AM and PM;
  - Wimbourne Road/Ffordd y Mileniwm (No. 16) – AM and PM;
  - Cory Way/Ffordd y Mileniwm roundabout (No. 17) – PM only;
  - Y Rhodfa/Ffordd y Mileniwm/Clos Tynaid Glo roundabout (No. 19) – PM only;
  - Morrisons/Ffordd y Mileniwm (No. 20) – AM and PM; and
  - Gladstone Bridge/Ffordd y Mileniwm roundabout (No. 21) – PM only

It is notable that the majority of the impacts lie close to the site where the additional traffic is focused.

For those junctions which it was agreed with the Vale of Glamorgan to exclude from detailed analysis, the percentage increase at each of these junctions as a result of the increased in traffic related to Barry Waterfront has been quantified for the AM and PM peak hours:

Barons Court: AM 3%, PM 4%

Sycamore Cross: AM 5%. PM 5%

Culverhouse Cross: AM 7%, PM 7%

7.5 Tourism Traffic Assessment 2020

The Vale of Glamorgan has previously requested that a weekend peak hour be modelled in order to account for the peak conditions which could occur on a warm summer day when the attractions of a rejuvenated Barry Island might draw significant numbers of visitors. For several reasons it is not considered appropriate to undertake such an assessment:

- the requirement for a weekend base scenario was not stated at the scoping stage of the project;
- the nature of the attractions on Barry Island means that such events are intermittent occurrences largely dependent on weather conditions. As such the gathering of reliable traffic data across the size of network considered would not be feasible;
- the consortium of the Waterfront Barry scheme is in no way responsible for the operation/management of traffic travelling to Barry Island, which is an existing problem that will be eased by the provision of a second link to Barry Island; and
- it is anticipated that the worst case in terms of development traffic is not the weekend but the PM peak hour which has already been assessed. During the weekend many elements (residential, offices, schools and some retail) will have lower trip generation and less distinct peak periods.

For these reasons it is not deemed relevant to provide a weekend peak hour. Instead a PM peak hour traffic scenario with additional tourism based traffic has been assessed. It is considered that this is the case in which traffic generation from the Waterfront development would cause the greatest influence on a scenario involving significant tourism trips.

7.5.1 Tourism Traffic Flows

It is considered that a doubling of the traffic to and from Barry Island in the PM peak period is a representative assumption for a PM peak with tourism traffic. The additional number of traffic movements is summarised in Table 7.3.

Table 7.3: Additional tourism- related trips to Barry Island in PM peak hour

Trips	IN	OUT
Existing PM Peak	409	470
Tourism to Barry Island	205	235
TOTAL	**614**	**705**

In a scenario where traffic conditions are notoriously bad and the weather is good, it would be anticipated that local visitors would travel to Barry Island by walking, cycling or rail. The construction of cycle and pedestrian facilities through the Waterfront development should help to further encourage this. For this reason it has been assumed that all trips arise from beyond the extents of the considered network and enter in equal proportions at three points:

- **Barons Court:** Traffic from Cardiff or the East
- **Culverhouse Cross:** Traffic from locations served by the M4

- **Sycamore Cross:** Traffic from the Vale of Glamorgan travelling on the A48

This traffic has been assigned onto the PM 2020 network for two scenarios:

- PM 2020 without development, without Barry Island link road, with tourism; and
- PM 2020 with development, with Barry Island link road, with tourism.

The traffic has been assigned to the network by three direct routes corresponding to the point of entry:

- From Barons Court via the A4055 and onto Ffordd y Mileniwm reaching Barry Island via the new link road through the Waterfront development.
- From Culverhouse Cross via Port Road (A4050) turning at the roundabout (Junction 6) to remain on Port Road to Waycock Cross before travelling on Pontypridd Road, St. Nicholas Avenue and Harbour Road to Barry Island.
- From Sycamore Cross through Waycock Cross and then following the same route as ii to Barry Island.

The resulting distribution of tourism trips is included as Figures 7.10 and 7.11 for the considered scenarios.

7.5.2 PM 2020 without development, without Barry Island link road, with tourism Capacity Analysis

The results of the analysis for each junction and link are shown in Table 7.4 and detailed in Appendix K. In summary as might be anticipated the additional tourism traffic causes further issues on the highway network, with six additional junctions operating over theoretical capacity in comparison to the 2020 PM 'Base' scenario:

- Merrie Harrier Signals (No. 3)
- Murch Crossroads (No. 4)
- Port Road/Barry Docks Link Road Roundabout (No. 6)
- Wimbourne Road/Ffordd Y Mileniwm Priority T-junction (No. 16)
- Cory Way/Ffordd Y Mileniwm Roundabout (No. 17)
- Broad Street / Hood Road Signals (No. 23)

Queues on all junctions affected by the tourism traffic increase, and in some cases this change is quite significant, for example at Murch Crossroads.

The effects of the tourism traffic are broadly what would be expected – congestion increases throughout the area, intensifying closer to Barry Island. The level of queuing forecast would make the operation of the network unstable with the possibility of severe issues on Ffordd y Mileniwm as queuing occurs and interacts between adjacent junctions.

7.5.3 PM 2020 with development, with Barry Island link road, with tourism Capacity Analysis

The results of the analysis for each junction and link are shown in Table 7.4 and detailed in Appendix K. Five additional junctions operate over theoretical capacity in comparison to the 2020 PM without development, without Barry Island link road, with tourism scenario:

- Waycock Cross Roundabout (No. 7)
- Harbour Road / Earl Crescent Priority (No. 8)
- Gladstone Road/Cardiff Road/Ffordd Y Milemiwm (No. 13)
- Y Rhodfa/Ffordd Y Mileniwm/Clos Tynaid Glo Roundabout (No. 19)
- Retail/Morrisons/Ffordd Y Mileniwm Roundabout (No. 20)

- Gladstone Bridge/Ffordd Y Mileniwm Roundabout (No. 21)

The presence of the Barry Island link road in the 'with development' scenario provides a second route to Barry Island which would not be constructed in the near future without the development. This route eases congestion at Gladstone Bridge Roundabout (No. 10) and provides improved potential for traffic management measures to and from the Barry Island car park areas.

Therefore whilst overall capacity in the peak hour is decreased by the presence of the Waterfront Barry development, it is considered that overall resilience of the local highway network is improved in the case of significant tourism related traffic movements.

7.5.4 Event Management Strategy

The future for tourism on Barry Island seems somewhat uncertain; however should the Council, planning policy and interested parties look to achieve a growth in tourism on Barry Island it is anticipated that an event management plan would be implemented at times of high demand. The objective of such a plan would be to ease traffic conditions for tourists, residents and workers in the area and provide clear guidance on how to travel to Barry Island. Without this it is inevitable that congestion would occur – a slow journey to the Island will in itself affect the viability of tourist attractions.

Such an event management plan is not the focus of this Transport Assessment, nor the responsibility of the Waterfront Barry development. However the Council may wish to consider the following strategies:

- the use of Variable Message Signs to implement a temporary routeing strategy, which can be used to direct visitors to the least congested routes, to available parking as well as Park and Ride sites or to existing public transport corridors;
- the promotion of public transport by the council and attraction providers as the primary means of reaching Barry Island could help achieve a notable modal shift. Barry Island benefits from a railway station which has frequent services to the local area; and
- event-specific junction operating plans may be used automatically at signalised junctions and manually at other junctions (for example the closing of minor arms at priority junctions) to create extra capacity for through traffic and avoid severe congestion.

It is considered that the implementation of such measures by the Council or attraction providers, combined with the development-related mitigation measures would help to significantly ease the situation discussed in section 7.5.2.

Table 7.4: Junction Capacity Summary

Junction		2008 Existing		2020 Base		2020 with Dev't		2020 PM Tourism	
		AM	PM	AM	PM	AM	PM	Without Dev't	With Dev
3	Merrie Harrier Signals Junction	3	2	4	3	4	3	4	4
4	Murch Crossroads	1	1	2	3	3	4	4	4
5	Biglis Roundabout	1	3	3	4	4	4	4	4
6	Port Road/Barry Docks Link Road Roundabout	1	2	2	3	4	4	4	4
7	Waycock Cross Roundabout	3	2	1	3	2	4	3	4
8	Harbour Road/Station Approach/Paget Road Roundabout	1	1	1	1	1	1	1	1
	Harbour Road / Earl Crescent Priority	1	1	1	1	1	3	1	4
9	Harbour Road/Nicholas Road (Ship gyratory) Priority	1	1	1	1	1	1	1	1
	Harbour Road/Broad Street (Ship gyratory) Priority	1	1	1	1	1	1	1	2
	The Parade / Harbour Road Mini Roundabout	1	1	1	1	1	1	1	2
10	Gladstone Bridge Roundabout	1	1	1	2	2	2	3	2
	Dock View Road Gyratory	1	2	3	4	3	4	4	4
11	Buttrills Road/Barry Road Staggered Junction	1	1	2	1	2	1	1	1
12	Barry Road/Ty Newydd Road/Cemetery Road Roundabout	1	1	1	1	1	1	1	1
13	Gladstone Road/Cardiff Road/Ffordd Y Milemiwm	1	2	2	3	4	4	3	4
14	Palmerston Road/Cardiff Road Signals Junction	4	2	4	4	4	4	4	4
15	Vere Street/Cardiff Road/Gladstone Road - Mini Roundabout	1	1	1	3	1	3	3	3
	Cardiff Road/Holton Road/Gladstone Rise - Priority T-junction	1	1	1	1	1	1	1	1
16	Wimbourne Road/Ffordd Y Mileniwm Priority T-junction	1	1	1	3	4	4	4	4
17	Cory Way/Ffordd Y Mileniwm Roundabout	1	2	1	3	2	4	4	4
18	Subway Road/Ffordd Y Mileniwm Priority left in / left out	1	1	1	1	1	1	1	1
19	Y Rhodfa/Ffordd Y Mileniwm/Clos Tynaid Glo Roundabout	1	1	1	2	2	4	3	4
20	Retail/Morrisons/Ffordd Y Mileniwm Roundabout	1	1	2	1	4	4	2	4
21	Gladstone Bridge/Ffordd Y Mileniwm Roundabout	1	1	1	2	2	4	3	4
22	Plymouth Road/Earl Crescent Roundabout	1	1	1	1	1	1	1	1
23	Broad Street / Hood Road Signals	1	2	1	3	1	2	4	4

1 - Within Capacity	**2 -** Approaching Practical Capacity	**3 -** Over Practical Capacity, Approaching Theoretical Capacity	**4 -** Over Theoretical Capacity
Priority RFC <0.75 Signals RFC <0.80	Priority RFC >0.75, <0.85 Signals RFC >0.80, <0.90	Priority RFC >0.85, <1.00 Signals RFC >0.90, <1.00	Priority RFC >1.00 Signals RFC >1.00

Table 7.5: Maximum modeled queue lengths on a single arm (veh rounded up)

Junction		2008 Existing		2020 Base		2020 with Dev't		2020 PM Tourism	
		AM	PM	AM	PM	AM	PM	Without Dev't	With Dev
3	Merrie Harrier Signals Junction	2	2	3	2	4	2	3	3
4	Murch Crossroads	2	2	2	2	2	3	3	4
5	Biglis Roundabout	1	1	1	3	2	4	1	4
6	Port Road/Barry Docks Link Road Roundabout	1	1	1	2	2	4	2	4
7	Waycock Cross Roundabout	1	1	1	1	1	2	1	3
8	Harbour Road/Station Approach/Paget Road Roundabout	1	1	1	1	1	1	1	1
	Harbour Road / Earl Crescent Priority	1	1	1	1	1	1	1	2
9	Harbour Road/Nicholas Road (Ship gyratory) Priority	1	1	1	1	1	1	1	1
	Harbour Road/Broad Street (Ship gyratory) Priority	1	1	1	1	1	1	1	1
	The Parade / Harbour Road Mini Roundabout	1	1	1	1	1	1	1	1
10	Gladstone Bridge Roundabout	1	1	1	1	2	1	1	1
	Dock View Road Gyratory	1	1	1	2	1	2	2	2
11	Buttrills Road/Barry Road Staggered Junction	1	1	1	1	1	1	1	1
12	Barry Road/Ty Newydd Road/Cemetery Road Roundabout	1	1	1	1	1	1	1	1
13	Gladstone Road/Cardiff Road/Ffordd Y Milemiwm	1	1	1	1	2	4	2	4
14	Palmerston Road/Cardiff Road Signals Junction	2	2	3	2	4	4	3	4
15	Vere Street/Cardiff Road/Gladstone Road - Mini Roundabout	1	1	1	1	1	1	1	1
	Cardiff Road/Holton Road/Gladstone Rise - Priority T-junction	1	1	1	1	1	1	1	1
16	Wimbourne Road/Ffordd Y Mileniwm Priority T-junction	1	1	1	1	1	3	1	4
17	Cory Way/Ffordd Y Mileniwm Roundabout	1	1	1	1	1	4	2	4
18	Subway Road/Ffordd Y Mileniwm Priority left in / left out	1	1	1	1	1	1	1	1
19	Y Rhodfa/Ffordd Y Mileniwm/Clos Tynaid Glo Roundabout	1	1	1	1	1	3	1	4
20	Retail/Morrisons/Ffordd Y Mileniwm Roundabout	1	1	1	1	2	2	1	3
21	Gladstone Bridge/Ffordd Y Mileniwm Roundabout	1	1	1	1	1	4	1	4
22	Plymouth Road/Earl Crescent Roundabout	1	1	1	1	1	1	1	1
23	Broad Street / Hood Road Signals	1	1	1	2	1	1	3	3

1 – Minor Queuing	**2 –** Significant queuing	**3 – Major queues**	**4 –** Severe queues
<20 vehs	20-49 vehs	50-99 vehs	>100 vehs

7.6 Mitigation Measures

7.6.1 Introduction

The analysis has shown that the forecast growth in background traffic and the additional traffic generated by the development will exacerbate capacity problems, resulting in a number of junctions exceeding their practical and/or theoretical capacity. This will result in significant queues and delays to all road users, which is clearly undesirable to the local authority, consortium as well as future residents and visitors to Barry Waterfront. The local highway network is a key asset and is therefore important to the success of the proposed development. In order to minimise the impact on the highway network a number of junction improvement schemes have been identified and assessed.

For those junctions where improvements are proposed the aim is to achieve a “nil detriment” effect on the highway network in comparison to the 2020 ‘Base’ conditions within the extents of current highway land. The funding of the proposed improvements are subject to ongoing Section 106 of the Highways Act negotiations with the Vale of Glamorgan Council.

Where nil detriment cannot be achieved and only minor improvements with marginal capacity benefits are possible the Vale of Glamorgan has suggested that resources would be better allocated to improvements which encourage sustainable transport to the development such as those measures detailed in section 11.4. Whilst the Consortium understand and are committed to the need for sustainable travel (evidenced by the commitment to a range of improvements schemes outlined in sections 9-11), they remain of the opinion that a more comprehensive range of improvements to tackle both existing and future congestion should be undertaken to maintain the best possible operation of the highway network. Therefore the level of mitigation works presented here follows the requests of the Vale of Glamorgan Council, with a final comparison with that previously presented in an earlier version of the TA which assumed a greater number of mitigation schemes.

The consortium’s preferred approach would be for the Council to undertake works to offset the significant effects of traffic growth between 2008 and 2020 in order to achieve nil-detriment in comparison with existing conditions, The consortium would then undertake works, where possible within highway land, to achieve a nil-detriment situation in comparison with a ‘without development’ scenario.

Table 7.6 below, summarises the operation of the existing junctions, with green boxes representing junctions that operate within practical capacity, and red boxes representing junctions that operate over practical capacity.

Table 7.6: Summary of junctions operating over practical capacity in 2020 with and without Waterfront Barry

No.	Junction	2020 without Waterfront Barry	2020 with Waterfront Barry
3	Merrie Harrier Signals Junction		
4	Murch Crossroads		
5	Biglis Roundabout		
6	Port Road/Barry Docks Link Road Roundabout		
7	Waycock Cross Roundabout		
8	Harbour Road/Station Approach/Paget Road Roundabout		
	Harbour Road/Earl Crescent Priority		
9	Harbour Road/Nicholas Road (Ship gyratory) Priority		
	Harbour Road/Broad Street (Ship gyratory) Priority		
	The Parade/Harbour Road Mini Roundabout		
10	Gladstone Bridge Roundabout		
	Dock View Road Gyratory		
11	Buttrills Road/Barry Road Staggered Junction		
12	Barry Road/Ty Newydd Road/Cemetery Road roundabout		
13	Gladstone Road/Cardiff Road/Ffordd Y Milemiwm		
14	Palmerston Road/Cardiff Road Signals Junction		
15	Vere Street/Cardiff Road/Gladstone Road - Mini Roundabout		
	Cardiff Road/Holton Road/Gladstone Rise - Priority T-junction		
16	Wimbourne Road/Ffordd Y Mileniwm Priority T-junction		
17	Cory Way/Ffordd Y Mileniwm Roundabout		
18	Subway Road/Ffordd Y Mileniwm Priority left in/left out		
19	Y Rhodfa/Ffordd Y Mileniwm/Clos Tynaid Glo Roundabout		
20	Retail/Morrisons/Ffordd Y Mileniwm Roundabout		
21	Gladstone Bridge/Ffordd Y Mileniwm Roundabout		
22	Plymouth Road/Earl Crescent roundabout		
23	Broad Street / Hood Road Signals		

Details of possible mitigation measures are assessed in Appendix K and discussed below.

7.6.2 Port Road/Barry Docks Link Road Roundabout

In order to improve capacity at the Port Road/Barry Docks Link Road roundabout consideration could be given to remodelling the existing roundabout to increase capacity by the provision of dedicated left turn lanes to all three arms of the roundabout. The proposed design is contained wholly within existing highway land.

An outline design for these improvements is shown on Figure 7.12. Tables 7.7 and 7.8 illustrate that the operational efficiency of the Port Road/Barry Docks junction is improved to a nil detriment level as a result of the proposed changes, and consequently the queue lengths are reduced.

Table 7.7: Impact of junction improvements on operational efficiency

2020 without Development		2020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
2	**3**	**4**	**4**	**1**	**2**

Table 7.8: Impact of junction improvements on queue lengths

2020 without Development		020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
1	**2**	**2**	**4**	**1**	**1**

7.6.3 Harbour Road/Station Approach Road/Paget Road & Plymouth Road/Earl Crescent

In order to improve capacity at the junctions consideration could be given to replacing the existing priority and roundabout complex of junctions with two linked signal controlled junctions. These arrangements will improve the capacity of the junctions whilst introducing controlled pedestrian crossings over two of the arms, and improving the level of traffic control afforded to the highway authority. The proposed design is contained wholly within existing highway land.

An outline design for these improvements is shown on Figure 7.13. Tables 7.9 and 7.10 illustrate that the operational efficiency of the Harbour Road/Station Approach Road/Paget and Plymouth Road/Earl Crescent junctions are improved to a level approaching nil detriment as a result of the proposed changes.

Table 7.9: Impact of junction improvements on operational efficiency

2020 without Development		2020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
1	**1**	**1**	**3**	**1**	**2**

Table 7.10: Impact of junction improvements on queue lengths

2020 without Development		2020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
1	**1**	**1**	**1**	**1**	**1**

7.6.4 Wimbourne Road/Ffordd y Mileniwm

Consideration could be given to replacing the existing priority junction with a roundabout to improve the capacity for vehicles exiting Wimbourne Road, and those turning right from Ffordd y Mileniwm into Wimbourne Road. The proposed design is contained wholly within existing highway land.

An outline design for these improvements is shown on Figure 7.14. Tables 7.11 and 7.12 illustrate that the operational efficiency of the Wimbourne Road/Ffordd y Mileniwm junction is improved to a nil detriment level as a result of the proposed changes, and consequently the queue lengths are reduced.

Table 7.11: Impact of junction improvements on operational efficiency

2020 without Development		2020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
1	**3**	**4**	**4**	**1**	**2**

Table 7.12: Impact of junction improvements on queue lengths

2020 without Development		2020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
1	**1**	**1**	**3**	**1**	**1**

7.6.5 Gladstone Bridge/Ffordd y Mileniwm

In order to improve capacity at the junction consideration could be given to remodelling the existing roundabout to increase capacity, with all arms slightly realigned and an increased circulatory diameter. The proposed design is contained wholly within existing Highway land.

An outline design for these improvements is shown on Figure 7.15. Tables 7.13 and 7.14 illustrate that the operational efficiency and queue lengths at the Gladstone Bridge/Ffordd y Mileniwm junction are improved as a result of the proposed changes. Whilst the improvements do not achieve nil detriment they do represent a significant improvement and enable the junction to operate within theoretical capacity in the with-development scenario.

Table 7.13: Impact of junction improvements on operational efficiency

2020 without Development		2020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
1	**2**	**2**	**4**	**2**	**3**

Table 7.14: Impact of junction improvements on queue lengths

2020 without Development		2020 with Development			
Without Improvement		Without Improvement		With Improvement	
AM	**PM**	AM	PM	AM	PM
1	**1**	**1**	**4**	**1**	**1**

7.7 Summary of External Highway Junctions

The improvements and their impacts have been outlined above, and to provide a comparable overview to the before mitigation results in Table 7.2, the results are summarised in Table 7.15 overleaf, which displays the operational efficiency of the junctions in the 2020 with development scenario with and without the outline mitigation works. Table 7.16 presents a comparison to Table 7.6, giving a simplified summary of junctions that operate within practical capacity, and junctions that operate above practical capacity with and without mitigation measures.

It is apparent from the table that the mitigation measures outlined in this section could provide improvement to the operation of the considered highway network. At the request of the Vale of Glamorgan Council only significant measures capable of achieving a notable improvement, ideally to the level of nil detriment in comparison to the 2020 without development scenario, have been considered. In addition these measures would improve the control of traffic and in several cases an improved opportunity for pedestrians to cross roads

Elsewhere significant capacity issues will remain in the peak periods, however the Vale of Glamorgan has long term aspirations to tackle several of these via more strategic highway schemes.

Table 7.15: Junction operational efficiency with and without mitigation measures

Junction		Without mitigation						With mitigation	
		2008 Existing		2020 Base		2020 with Dev't		2020 with Dev't	
		AM	PM	AM	PM	AM	PM	AM	PM
3	Merrie Harrier Signals Junction	3	2	4	3	4	3		
4	Murch Crossroads	1	1	2	3	3	4		
5	Biglis Roundabout	1	3	3	4	4	4		
6	Port Road/Barry Docks Link Road Roundabout	1	2	2	3	4	4	**1**	**2**
7	Waycock Cross Roundabout	3	2	1	3	2	4		
8	Harbour Road/Station Approach/Paget Road Roundabout	1	1	1	1	1	1	**1**	**2**
	Harbour Road/Earl Crescent Priority	1	1	1	1	1	3		
9	Harbour Road/Nicholas Road (Ship gyratory) Priority	1	1	1	1	1	1		
	Harbour Road/Broad Street (Ship gyratory) Priority	1	1	1	1	1	1		
	The Parade/Harbour Road Mini Roundabout	1	1	1	1	1	1		
10	Gladstone Bridge Roundabout	1	1	1	2	2	2		
	Dock View Road Gyratory	1	2	3	4	3	4		
11	Buttrills Road/Barry Road Staggered Junction	1	1	2	1	2	1		
12	Barry Road/Ty Newydd Road/Cemetery Road Roundabout	1	1	1	1	1	1		
13	Gladstone Road/Cardiff Road/Ffordd Y Milemiwm	1	2	2	3	4	4		
14	Palmerston Road/Cardiff Road Signals Junction	4	2	4	4	4	4		
15	Vere Street/Cardiff Road/Gladstone Road - Mini Roundabout	1	1	1	3	1	3		
	Cardiff Road/Holton Road/Gladstone Rise - Priority T-junction	1	1	1	1	1	1		
16	Wimbourne Road/Ffordd Y Mileniwm Priority T-junction	1	1	1	3	4	4	**1**	**2**
17	Cory Way/Ffordd Y Mileniwm Roundabout	1	2	1	3	2	4		
18	Subway Road/Ffordd Y Mileniwm Priority left in/left out	1	1	1	1	1	1		
19	Y Rhodfa/Ffordd Y Mileniwm/Clos Tynaid Glo Roundabout	1	1	1	2	2	4		
20	Retail/Morrisons/Ffordd Y Mileniwm Roundabout	1	1	2	1	4	4		
21	Gladstone Bridge/Ffordd Y Mileniwm Roundabout	1	1	1	2	2	4	**2**	**3**
22	Plymouth Road/Earl Crescent Roundabout	1	1	1	1	1	1		
23	Broad Street / Hood Road Signals	1	2	1	3	1	2		

Junctions with Mitigation measures

1 – Within Capacity	**2 -** Approaching Practical Capacity	**3 -** Over Practical Capacity, Approaching Theoretical Capacity	**4 -** Over Theoretical Capacity
Priority RFC <0.75 Signals RFC <0.80	Priority RFC >0.75, <0.85 Signals RFC >0.80, <0.90	Priority RFC >0.85, <1.00 Signals RFC >0.90, <1.00	Priority RFC >1.00 Signals RFC >1.00

Table 7.16: Summary of Junction operation with and without mitigation measures

Junction		2020 without Waterfront Barry	2020 with Waterfront Barry without Mitigation	2020 with Waterfront Barry and Mitigation
3	Merrie Harrier Signals Junction			
4	Murch Crossroads			
5	Biglis Roundabout			
6	Port Road/Barry Docks Link Road Roundabout			
7	Waycock Cross Roundabout			
8	Harbour Road/Station Approach/Paget Road Roundabout			
	Harbour Road/Earl Crescent Priority			
9	Harbour Road/Nicholas Road (Ship gyratory) Priority			
	Harbour Road/Broad Street (Ship gyratory) Priority			
	The Parade/Harbour Road Mini Roundabout			
10	Gladstone Bridge Roundabout			
	Dock View Road Gyratory			
11	Buttrills Road/Barry Road Staggered Junction			
12	Barry Road/Ty Newydd Road/Cemetery Road roundabout			
13	Gladstone Road/Cardiff Road/Ffordd Y Milemiwm			
14	Palmerston Road/Cardiff Road Signals Junction			
15	Vere Street/Cardiff Road/Gladstone Road - Mini Roundabout			
	Cardiff Road/Holton Road/Gladstone Rise - Priority T-junction			
16	Wimbourne Road/Ffordd Y Mileniwm Priority T-junction			
17	Cory Way/Ffordd Y Mileniwm Roundabout			
18	Subway Road/Ffordd Y Mileniwm Priority left in/left out			
19	Y Rhodfa/Ffordd Y Mileniwm/Clos Tynaid Glo Roundabout			
20	Retail/Morrisons/Ffordd Y Mileniwm Roundabout			
21	Gladstone Bridge/Ffordd Y Mileniwm Roundabout			
22	Plymouth Road/Earl Crescent roundabout			
23	Broad Street / Hood Road Signals			

7.8 Comparison to effects of previous nil-detriment approach

Table 7.17 is presented in order to compare the effect of this strategy with that adopted in the initial version of the Transport Assessment (August 2009), in which a more comprehensive package of junction mitigation measures was proposed. The table compares the junction capacity results for the 2020 'with development' scenario. It is acknowledged that traffic generation related to the site has increased marginally as a result of this revised Transport Assessment and traffic model parameters have been revised in some cases; however, it is considered that the previous results remain comparable and indicate the improved junction capacity that a more comprehensive package of mitigation works could achieve.

With a greater level of mitigating works as previously proposed junctions are forecast to operate over theoretical capacity 11 scenarios, a reduced set of mitigating works increases the number of scenarios where junctions operate over capacity to 14. The number of junctions operating over practical capacity also reduces marginally. These differences in junction capacity represent potentially increased congestion, delays and queuing. The consortium are therefore of the opinion that where possible improvements should be made to the modelled junctions in order to achieve the best available operation of the local highway network.

Table 7.17: Comparison of junction mitigation strategies for 2020 with development scenario

	Junction	2020 with Dev't Vale of Glamorgan requested mitigation As Table 7.15		2020 with Dev't Comprehensive mitigation as August 2009 TA (previous traffic flow results)	
		AM	PM	AM	PM
3	Merrie Harrier Signals Junction	4	3	4*	4*
4	Murch Crossroads	3	4	4	4
5	Biglis Roundabout	4	4	4	4
6	Port Road/Barry Docks Link Road Roundabout	1	2	1	1
7	Waycock Cross Roundabout	2	4	4*	4*
8	Harbour Road/Station Approach/Paget Road Roundabout	1	2	1	1
	Harbour Road/Earl Crescent Priority				
9	Harbour Road/Nicholas Road (Ship gyratory) Priority	1	1	1	1
	Harbour Road/Broad Street (Ship gyratory) Priority	1	1	1	1
	The Parade/Harbour Road Mini Roundabout	1	1	1	1
10	Gladstone Bridge Roundabout	2	2	1	1
	Dock View Road Gyratory	3	4	3	4
11	Buttrills Road/Barry Road Staggered Junction	2	1	2	2
12	Barry Road/Ty Newydd Road/Cemetery Road Roundabout	1	1	1	1
13	Gladstone Road/Cardiff Road/Ffordd Y Milemiwm	4	4	2	1
14	Palmerston Road/Cardiff Road Signals Junction	4	4	4	4
15	Vere Street/Cardiff Road/Gladstone Road - Mini Roundabout	1	3	1	3
	Cardiff Road/Holton Road/Gladstone Rise - Priority T-junction	1	1	1	1
16	Wimbourne Road/Ffordd Y Mileniwm Priority T-junction	1	2	1	2
17	Cory Way/Ffordd Y Mileniwm Roundabout	2	4	2	2
18	Subway Road/Ffordd Y Mileniwm Priority left in/left out	1	1	1	1
19	Y Rhodfa/Ffordd Y Mileniwm/Clos Tynaid Glo Roundabout	2	4	2	2
20	Retail/Morrisons/Ffordd Y Mileniwm Roundabout	4	4	3	3
21	Gladstone Bridge/Ffordd Y Mileniwm Roundabout	2	3	1	2
22	Plymouth Road/Earl Crescent Roundabout	1	1	1	1
23	Broad Street / Hood Road Signals	1	2	1	2

* These junctions have been modelled with committed improvement schemes since the initial version of the TA resulting in improved capacity without development related mitigation.

Junction with proposed mitigation works Transport Assessment Rev A and August 2009 TA

Additional junctions with proposed mitigation works August 2009 TA

7.9 Internal junctions

The junctions illustrated in the Masterplan, Figure 5.1, have been assessed to ensure efficient operation of the internal network. The junctions have been modelled using the flows on the internal network illustrated previously in Figures 6.2 and 6.3. For the purpose of establishing a local Heavy Goods Vehicle (HGV) proportion, the existing HGV proportions using Harbour Road have been assumed throughout the internal junctions, except for the supermarket service access where a higher proportion has been used. Table 7.18 summarises the results, with the model outputs being provided in Appendix K.

These results represent an initial test of internal junctions for information, and are not strictly the subject of the outline application, but are provided here for information subject to further detailed design. In the case of signalised junctions [i], [v] and [viii] there are differences in the assumed

operation of the pedestrian crossings from that indicated on Figure 7.7. The detailed design and operation of these junctions will be the subject of a separate planning application.

Table 7.18: Internal junction assessment summary

Junction	AM		PM	
	Operational efficiency	Queue	Operational efficiency	Queue
Junction [i] - 100s cycle AM, 120s cycle PM	1	1	3	2
Junction [ii]	1	1	1	1
Junction [iv]	1	1	1	1
Junction [v] - 120s cycle	1	2	3	2
Junction [viii] - 120s cycle	1	1	3	2
Junction [ix]	1	1	1	1

1 – Within Capacity	**2 –** Approaching Practical Capacity	**3 –** Over Practical Capacity, Approaching Theoretical Capacity	**4 –** Over Theoretical Capacity
Priority RFC <0.75 Signals RFC <0.80	Priority RFC >0.75, <0.85 Signals RFC >0.80, <0.90	Priority RFC >0.85, <1.00 Signals RFC >0.90, <1.00	Priority RFC >1.00 Signals RFC >1.00

Minor Queuing	Significant queuing	Major queues	Severe queues
<20 vehs	20-49 vehs	50-99 vehs	>100 vehs

7.10 Link Assessment

The link assessment is based on Design Manual for Roads and Bridges (DMRB) Advice Note TA 79/99, and has been carried out on the main routes in Barry detailed within this report.

The table included as Appendix M displays the results of the link capacity assessment. The table indicates that the main corridor running through the southern areas of Barry and the waterfront are approaching and/or exceeding the design capacity.

The tourism scenario also shows that some links are exceeding the design capacity. It is argued that this is to be expected, and is likely to happen with or without the Waterfront development. It is considered that the tourism scenario is unlikely to be a regular occurrence, and it would be undesirable to design the highway network for such rare occasions.

7.11 Impact of development on accidents in the local highway network

It is anticipated that as a consequence of the increased traffic volumes on the highway network there will be an associated minor increase in the predicted rate of accidents across the highway network. This is typical of all scenarios in which traffic increases, as historical evidence indicates a link between traffic volumes and accidents.

However in the majority of cases the observed accident record across the network has been below the COBA predicted rates and this is likely to continue to be the case.

The proposed mitigation measures have been designed in accordance with relevant standards and as such safety considerations have been central to the design of the works. A Road Safety Audit Stage 1 (included as Appendix N, with the related designers response included as Appendix O) has been undertaken for the mitigation measures and the points raised in this report

will be considered in detailed design work. In several cases the proposed works are comprehensive and will provide the opportunity to greatly improve the safety record, particularly for vulnerable users, at key junctions across the considered area.

7.12 Summary

The analysis demonstrates the impacts of the development proposals on the road network and, where necessary and feasible within current highway land boundaries, suggestions for junction mitigation works have been proposed to mitigate the effects of traffic associated with the proposed development. It should be noted that the Waterfront Barry consortium have no responsibility for the growth in base traffic but acknowledge the impacts of the development which may require a contribution; this will be the subject of negotiation based on the results and analysis presented in this Transport Assessment.

The approach to mitigation works presented in this revised version of the Transport Assessment is at the request of the Vale of Glamorgan Council. The Consortium understand the reasons for this approach but considers that, where possible, a wider programme of mitigation works to offset the impacts of traffic growth and that of the development remains valid and would improve the operation of the local highway network for all users.

Further to this it should be noted that whilst proposals for the construction of higher capacity road links to Cardiff Airport are no longer being progressed by the Welsh Assembly Government, the recently published National Transport Plan does include reference to improvements on Five Mile Lane A4226 as a named scheme:

"*…and take forward safety improvements on the A4226 Five Mile Lane"*

The National transport Plan also states an objective to:

"Introduce a high-quality, frequent bus service between Cardiff and Cardiff Airport"

It is likely that both of these improvements would have significant benefits for Waterfront Barry both in improving access to the A48 and M4 via Five Mile Lane and also offering an improved bus service which should result in modal shift and therefore improvement in local highway conditions.

8 PARKING ASSESSMENT

8.1 Introduction

The provision of parking influences transport mode choice. It is essential that the proposed development provides a suitable amount of parking. This chapter compares the proposed number of parking spaces for both cars and bicycles with appropriate regional standards.

8.2 Existing Situation

The existing parking in Barry Waterfront is shared between surface car parking in the retail areas, unallocated public spaces and dedicated off-street parking within residential curtilages.

The level of car parking in the existing waterfront area can be described as generous, with high levels of parking provision. The surface car parking in the Morrisons retail area has no time restrictions, allowing visitors to use it as a free public car park. There is a barrier at the entrance to the remaining retail units, which is locked an hour after closing of the units.

Current cycle parking provision in the vicinity of the site is generally low. Cycle parking is located in key locations such as the town centre and areas of major retail however cycle stands are generally uncovered and low in number.

Figure 8.1: Surface car parking at Morrisons

Within Barry there is a mixture of on-street parking and traffic regulation orders.

Figure 8.2: On-street parking in Barry

8.3 Development Proposals

Parking demand is mainly influenced by the type and function of land use and the quality of the public transport system. Where appropriate, parking policy can be aimed at controlling supply so as to induce appropriate shifts in the modal share in favour of sustainable modes. Parking controls, including pricing, can be used to influence vehicle ownership. The management of the amount and type of parking is therefore an important means of influencing overall levels of traffic demand.

Consequently, parking forms an important element of the transport strategy for Waterfront Barry and a comprehensive plan is proposed which seeks to:

- reduce dependence on the car;
- reduce, where possible, environmental damage caused by cars, particularly in residential areas;
- control the allocation of parking; and
- reduce, where possible, competition for road space between residents and other users.

8.4 Car Parking Guidance

It is proposed that maximum car parking standards will be imposed within the site to ensure compliance with the outline Travel Plan (described in Chapter 13), which supports the ambitions of current planning policy to reduce the dependence on the private car.

The proposed number of spaces for each area is compared with the South Wales and CSS parking standards. The Supplementary Planning Guidance "Barry Development Guidelines" suggests developers should consult the South Wales Parking Guidelines. However since this guidance was written (2006) it is understood that the Council, in common with other authorities in Wales, is considering adopting the CSS standards, making the consideration of these standards increasingly important. The CSS standards are generally lower and account for the location of the site in determining the appropriate level of parking.

8.4.1 Parking Guidelines Revised Edition 1993, Standing Conference on Regional Policy in South Wales

The current adopted guidance on parking standards for residential land uses in the Vale of Glamorgan is the 1993 South Wales Parking Guidelines document. The document details the appropriate level of parking for residential land uses. The standards vary according to the property size and requirement for visitors parking. A summary of the relevant South Wales parking guidelines is provided in Appendix D.

8.4.2 2001 Addendum to South Wales Parking Guidelines (1993)

The current adopted guidance on parking standards for non-residential land uses in the Vale of Glamorgan is the 2001 addendum to the South Wales Parking Guidelines 1993, which outlines guidelines on recommended parking provision for new developments. A summary of the relevant South Wales parking guidelines is provided in Appendix D.

8.4.3 CSS Wales Parking Standards 2008

The CSS Wales Parking standards contain definitions for development types through six zone levels: 1 represents a city centre and 6 a rural hamlet. For the purposes of this assessment it is considered that the location of the development would be most suited to the zone 2 standards, the definition being:

''The centre of towns which local people regard as their destination for most activity which is not met within their own local community, or an area immediately adjacent to the City Core (Zone 1). The area has a full range of retail activity and many commercial businesses, all within walking distance. The area is the focus of the local bus network and is likely to contain a railway station.

Built density is high with little private car parking. There are significant parking restrictions and substantial amounts of off-street car parking available to the public."

A summary of the CSS Parking guidelines and sustainability reduction calculation is included in Appendix E.

The CSS standards are calculated through the application of a basic standard which is then adjusted dependant on the sustainability 'points' of a development based on accessibility to local facilities and public transport services. Due to the scale of the site development parcel areas have been grouped into the following larger areas for the purpose of sustainability related parking reductions:

- West Pond residential comprising WP1-13 — 9 points
- West Pond commercial — 10 points
- South Quay comprising SQ1-8 — 10 points
- South Quay comprising SQ9-12 — 10 points
- South Quay comprising SQ13-19 — 8 points
- Arno Quay comprising AQ1 — 8 points
- East Quay residential comprising EQ1-6 — 7 points
- East Quay commercial — 7 points

For the purpose of the sustainability adjustment exercise, it has been assumed that public transport for the development will operate consistently between 0700 and 1900 at a 15 minute frequency, and that the cycleway follows the edge of No. 1 Dock.

8.4.4 Residential Car Parking Assessment

Table 8.1 summarises the proposed parking provision for each of the four residential areas. A full breakdown by plot area corresponding to Figure 8.3 is provided as Appendix P.

Table 8.1: Comparison of proposed residential car parking against standards

Area	Houses	Apartments	Proposed Spaces	Standards	
				South Wales	CSS
West Pond	536	160	1,048	1,424	1,136
South Quay	691	229	1,225	1,870	1,308
East Quay	186	58	290	522	419
Arno Quay	23	117	131	222	192
TOTAL	**1,436**	**564**	**2,694**	**4,038**	**3,055**

The total proposed number of residential parking spaces is 2,694. This represents 88% of the CSS standard (of 3,055 spaces) by means of the assessment detailed here.

West Pond has 88 fewer spaces than the CSS standard, South Quay 83 fewer, Arno Quay 61 fewer and East Quay 129 fewer.

The proposed numbers of parking spaces therefore fall within the standard and it is considered that the difference will not be an operational issue as a result of housing units which are modestly sized, leading to lower than typical occupancy and areas of unallocated parking which will reduce the number of redundant spaces.

8.4.5 Commercial Parking Assessment

Tables 8.2 summarises the proposed parking provision for each of the commercial elements of the site. Each of the building plots is marked on Figure 8.3.

Table 8.2: Comparison of proposed commercial car parking with standards

Commercial Areas	Site	GFA (m²)	Proposed Spaces	Standards	
				South Wales	CSS
Plot A (B1 Office)	WP	757	21	22	15
Plot A (B1 Office)	WP	599		18	12
Plot C (Hotel, 100 bedrooms)	WP	3,498	28	105	72
Plot C (B1 Office)	WP	1,589	17	46	32
Plot H (B1 Office)	WP	279	5	10	5
Plot H (B1 Office)	WP	223	4	7	4
Plot F (A3 Food/Drink)	WP	130	0	8	6
Plot F (A3 Food/Drink)	WP	130	0	8	6
Plot G (A3 Food/Drink)	WP	356	0	20	30
Plot G (A3 Food/Drink)	WP	520	0	30	44
Plot E (PFS, 12 service bays)	WP	70	12	36	16
Plot D (A1 Supermarket)	WP	6,503	591	654	327
Plot D (A1 Retail)	WP	2,323	0	78	56
South Quay (A3 Food/Drink)	SQ	293	0	18	28
South Quay (A3 Food/Drink)	SQ	130	2	8	7
South Quay (A3 Food/Drink)	SQ	130	2	8	7
East Quay (Office)	EQ	130	10	8	3
TOTAL		**17,657**	**688**	**1,006**	**670**

Assumptions

I. It is assumed that the hotel contains 100 bedrooms.

II. It is assumed that there are 5 hotel staff on duty at any one time

III. 12 service bays in the Petrol Filling Station have been assumed. In the South Wales Parking Standards, 'Garages and Service Stations' has been applied for the Petrol Filling Station (PFS) proposal. From the CSS Parking Standards, 'Petrol Filling Station' has been applied for the proposed PFS. From the South Wales Parking Standards the 'Garages and Service Stations' category has been used.

The total proposed number of commercial parking spaces is 692 (including the 12 service bays as part of the Petrol Filling Station). This represents 103% of the CSS parking standards which was calculated as 670 spaces by means of the assessment detailed here.

The provision varies against the standards across the different sites but overall this is a very close match. The major disparity is in the Food Superstore car park, however it is considered that parking durations may be longer than those of an isolated supermarket as a result of linked trips to the surrounding district centre (primarily the A1 uses) and waterfront amenity leading to higher accumulations at peak periods.

8.5 Car Parking Location and Style

Parking will be provided in a variety of styles. The majority of residential parking for houses will be allocated on-street or on-plot spaces. There will also be additional unallocated spaces. Residential parking for apartments will be in allocated spaces located close to the apartments.

Parking for commercial elements of the site will be primarily located at the large surface car park located adjacent to the food superstore site in West Pond from which linked trips will inevitably be made to the surrounding retail and leisure facilities. Buildings designated for offices, retail and commercial uses to the west and north of the food supermarket have further areas of parking.

Commercial development remote from the district centre will have modest allocations of nearby parking. It is anticipated that this would be used in combination with unallocated on-street parking.

Disabled parking in preferential locations and of suitable dimensions will be designated in line with the CSS Wales Parking Standards at the following levels:

- Employment premises: 5% of total capacity
- Shopping, leisure, recreational premises and public open space: 6% of total capacity

8.6 Parking Management and Enforcement

Parking will be managed using conventional management techniques such residents' permits, and waiting and loading restrictions.

The inset parking bays along the through roads will be subject to a time restriction during peak hours; elsewhere double yellow lines will prohibit parking along the through roads outside the unallocated parking bays.

The retail area will also have a time restriction, and will be barrier controlled outside trading hours. In common with other supermarkets it is anticipated that free parking of a limited duration (say two hours) would be provided by the supermarket operator thus enabling linked trips to be undertaken around the district centre.

A combination of design and enforcement will be required to manage the parking. The method of enforcement will be further considered at the detailed design stage. A decision will be made on whether to use the local authority, private parking management company, or a combination of both. Good enforcement will maximise the number and turnover of available spaces and discourage illegal and/or dangerous parking.

Careful detailing of the urban environment will be important in restricting inappropriate parking by the use of planting, street furniture (for example bollards or kerbing features) and clearly designated parking areas.

8.7 Cycle Parking Provision

Short stay and long stay cycle parking have been separately considered. Short stay parking addresses the needs of customers or visitors to a development, whereas long stay parking is applicable to the needs of staff or residents.

Cycle parking standards are outlined in the Vale of Glamorgan UDP (see Appendix F) and also the CSS Wales Parking Standards (for apartments only). Further guidance for residential development is also provided by the Code for Sustainable Homes. This guidance awards 'sustainability points' for high levels of safe, weatherproof and secure cycle parking provision to the following levels:

- 1/2 bedroom dwellings storage for 1 cycle
- 3 bed dwellings storage for 2 cycles
- 4 bed dwellings storage for 4 cycles

Points are awarded if 50% of the development properties provide this level of cycle parking and doubled if 95% of properties have this level.

There is currently no confirmed cycle parking schedule for the development; the provision will be guided by a combination of these standards in order to provide a suitable level of parking

8.7.1 Residential Cycle Parking Provision

Table 8.3 summarises the different cycle parking standards for each of the four residential areas. A full breakdown by plot area corresponding to Figure 8.3 is provided as Appendix P.

Table 8.3: Summary of standards for residential cycle parking

Area	Houses	Apartments	Standards		
			Code for Sustainable Homes	VoG UDP Standards	CSS (apartments only)
West Pond	536	160	1,232	696	34
South Quay	691	229	1,639	920	50
East Quay	186	58	478	244	12
Arno Quay	23	117	209	140	24
TOTAL	**1,436**	**564**	**3,558**	**2,000**	**120**

8.7.2 Commercial Cycle Parking Provision

The provision of cycle parking at commercial elements of the development has yet to be established; however the Vale of Glamorgan has requested that the provision meets the standards set out in the Unitary Development Plan 1996-2011.

Table 8.4: Commercial Cycle Parking according to Vale of Glamorgan UDP standards

Commercial Areas	Site	GFA (sq m)	UDP Cycle parking requirement
Plot A (B1 Office)	WP	757	2
Plot A (B1 Office)	WP	599	2
Plot C (Hotel, 100 bedrooms)	WP	3498	10
Plot C (B1 Office)	WP	1589	4
Plot H (B1 Office)	WP	279	1
Plot H (B1 Office)	WP	223	1
Plot F (A3 Food/Drink)	WP	130	1
Plot F (A3 Food/Drink)	WP	130	1
Plot G (A3 Food/Drink)	WP	353	2
Plot G (A3 Food/Drink)	WP	520	3
Plot E (PFS, 8 service bays)	WP	70	0
Plot D (A1 Supermarket)	WP	6503	13
Plot D (A1 Retail)	WP	2323	6
South Quay (A3 Food/Drink)	SQ	293	2
South Quay (A3 Food/Drink)	SQ	130	1
South Quay (A3 Food/Drink)	SQ	130	1
East Quay (Office)	EQ	130	1
TOTAL		**17,657**	**51**

Assumptions

I. Hotel occupancy of 2 persons per room has been assumed with a provision to accommodate 5% of capacity with cycle parking.

II. A3 uses have been considered under the 'recreational and community use' category which states that "cycle parking required to cater for the maximum expected useage of the facility assuming that 5% of all people using the facility will travel by bicycle". The total people multi-modal accumulation from the A3 trip rate has been used to calculate the maximum estimated accumulation.

Cycle parking may be grouped together at the district centre to create a clear cycle parking area for the variety of land uses situated there. The location and style of cycle parking should also consider whether the likely users are long stay (employees) or short stay (shoppers and visitors). The provision for short stay cycle parking will primarily be through the provision of Sheffield style stands.

8.8 Parking Summary

Overall the proposed car parking provision is lower than the CSS Wales Parking Standard; however it is anticipated that in line with TAN 18 guidance the standards will be adopted as a maximum. In this case the difference is generally modest and is considered unlikely to pose a problem due to the sustainable nature of the development, modest residential unit sizes and the forecast quantity of linked trips in the district centre.

The proposed outline Travel Plan actively commits the consortium to encourage a modal shift towards the use of sustainable transport within the development. This plan includes specific initiatives based on increasing the use of car sharing, public transport, walking and cycling for both residential and commercial developments.

The sustainability points awarded through the CSS Wales Parking Standard have allowed the required number of spaces to be reduced. The high standard of the public transport network within and around the site is the main reason these reductions can be applied.

The required number of cycle parking spaces for residential properties vary greatly depending on the standard applied. The consortium proposes to apply the Vale of Glamorgan UDP standards as a minimum and to ensure this provision meets the requirements of level 3 in the Code for Sustainable Homes. Provision of dedicated storage space will make cycling an attractive option for many journeys.

For non-residential land uses parking provision will be in line with the levels set out in the Vale of Glamorgan UDP.

Public transport, walking and cycling offer a genuine alternative to the car for the Waterfront development with a resultant reduction in car use. For these reasons the levels of parking proposed are considered suitable.

9 RAIL ASSESSMENT

9.1 Access by Rail

9.1.1 General

The Barry area benefits from good railway network infrastructure. There are currently three stations in Barry all of which are situated on the Vale of Glamorgan Line. Due to the recent re-opening of a further section of the rail line for passenger transport, the Vale of Glamorgan Line has effectively become a loop between the South Wales Main Line at Bridgend and Cardiff Central (the major rail hub in the South Wales area) railway stations.

Several rail lines radiate from Cardiff Central, serving key destinations nationwide, as shown in Figure 2.9. These include:

- South Wales Mainline, serving Swansea to the west and Newport, Bristol and London to the east;
- Valley Lines, serving areas such as Merthyr Tydfil and Aberdare; and
- Cross country lines, serving key areas such as Nottingham and Newcastle.

The frequency of services on the Vale of Glamorgan Line means that these areas are conveniently accessible by rail. The details of service frequencies are expanded below as part of assessing the railway stations specifically relevant to Barry.

The location of the stations and lines are shown on Figure 9.1.

9.1.2 Barry Island Station

A single track line branches off the main Vale of Glamorgan Line at Barry station to serve Barry Island station, a journey of around five minutes in duration. The unstaffed station is located approximately 500m south east of the development site, accessed via Earl Crescent under the railway line. It currently operates from a single platform, and has shelter, seating, CCTV, real time service information boards and a public telephone.

Services running between Barry Island and Cardiff Central have a journey duration of approximately 30 minutes, with some trains continuing on to Aberdare, Pontypridd and Merthyr Tydfil.

Table 9.1 summarises the frequency of services at Barry Island station.

Table 9.1: Rail services at Barry Island

Route	Frequency		Journey Time
	Mon - Sat	Sun	
Barry Island – Cardiff Central	05:56, 06:26, 06:56 3 per hour until 19:26 then 19:56, 20:56, 22:56	Approximately 2 trains per hour from 08:56 to 22:56	28 minutes
Cardiff Central – Barry Island	05:25, 05:55, 06:25, 06:55 then 3 per hour until 18:55 then 19:25, 20:20, 21:25, 22:55, 23:59	Approximately 2 trains per hour from 08:25 to 22:25	30 minutes

Table 9.1 illustrates that Barry Island is served by a high frequency of trains that operate at convenient times for commuters and day travellers towards Cardiff, thus providing residents of Barry and visitors with an excellent alternative means of travel to the private car.

9.1.3 Barry Station

Barry station is the town's main station serving the town centre area. It is served by trains running between Cardiff Central and Bridgend/Barry Island along the Vale of Glamorgan Line. The station

is located off Broad Street, overlooking the eastern border of the development site. The station is separated from the site by the railway line itself, rail sidings and a steep scrubland bank - a distance of approximately 200m. Access to the station from the site is via Hood Road, which provides an access under the railway line onto Broad Street.

The station is staffed part time, from early morning to approximately 1300 Monday to Friday, and 1400 on Saturdays. Barry Station is afforded basic, but adequate facilities, including a small confectionary/refreshment stall, ticket office, seating, waiting room, public telephone and public toilets.

A convenient level of transport interchange is available with a taxi rank located within the station car park and buses calling nearby on Broad Street. In addition a car park area of approximately 130 spaces is situated adjacent to the station offering a park and ride facility at Barry station. As Figure 9.2 shows, the car park is generally well used.

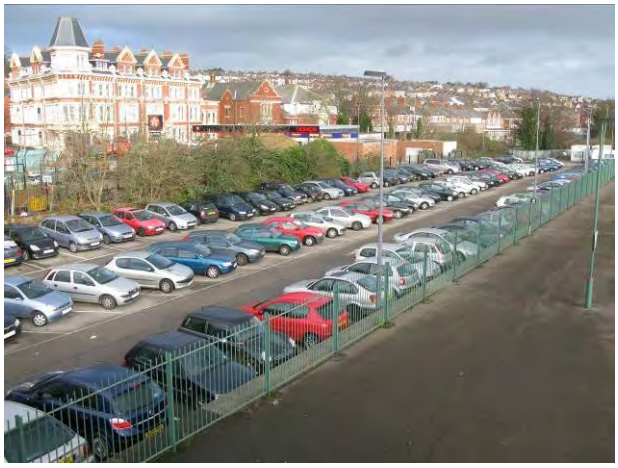


Figure 9.2: Parking at Barry Station

Table 9.2 provides information on train services from Barry station.

Table 9.2: Rail services at Barry station

Route	Frequency			Journey Time
	Mon - Fri	Sat	Sun	
Barry – Cardiff Central	06:00 every 15 mins until 19:30 then 2 per hr until 23:36	06:00 every 15 mins until 19:30 then 2 per hr until 23:15	3 within 2 hr period from 09:19 until 23:25	24 minutes
Cardiff Central – Barry	05:25 every 15 mins until 19:41 then 2 per hr until 23:30	05:25 every 15 mins until 18:55 then 2 per hr until 23:20	3 within 2 hr period from 08:25 until 22:25	24 minutes
Barry – Bridgend	1 per hr from 06:05 until 23:05	1 per hr from 06:05 until 22:05	1 every 2 hrs from 09:05 until 21:05	34 minutes
Bridgend – Barry	1 per hr from 05:42 until 22:51	1 per hr from 05:42 until 22:42	1 every 2 hrs from 09:42 until 21:42	32 minutes

Table 9.2 illustrates that there is a very high frequency of trains between Cardiff and Barry, enabling passengers to conveniently connect to the wider rail network. Following the reopening of passenger rail between Barry and Bridgend in 2005, there are now good links to the west of Barry, with a good frequency of service. Bridgend is a main stop for South Wales Main Line and Valley Line services. It is anticipated that following the completion of signalling work in 2014 the service frequency to Bridgend will increase to every 30 minutes.

9.1.4 Barry Docks

Barry Docks is the third station in Barry, and is a basic unstaffed station located approximately 1.5km east of the main Westpond/South Quay development area but within 600m of the East Quay development site. It is well placed to serve the large residential area situated immediately north of the station, County Hall to the southwest, as well as the working docks area to the south.

The station was re-furbished in 2008 to provide facilities including a shelter, limited seating, real time service information boards and CCTV. Access to the station platforms is via a ramped approach from a pedestrian underpass.

In terms of frequency, services mirror the service frequency at Barry station, as trains pass through Barry Docks to access Barry station. Table 9.3 provides a summary.

Table 9.3: Rail services at Barry Docks

Route	Frequency			Journey Time
	Mon - Fri	Sat	Sun	
Barry – Cardiff Central	06:04 every 15 mins until 19:30 then 2 per hr until 23:41	06:04 every 15 mins until 19:30 then 2 per hr until 23:19	3 within 2 hr period from 09:24 until 23:30	20 minutes (36 on Sundays)
Cardiff Central – Barry	05:25 every 15 mins until 19:41 then 2 per hr until 23:30	05:25 every 15 mins until 18:55 then 2 per hr until 23:20	3 within 2 hr period from 08:25 until 22:25	19 minutes (35 on Sundays)
Barry – Bridgend	1 per hr from 06:00 until 23:00	1 per hr from 06:00 until 22:00	1 every 2 hrs from 09:01 until 21:00	39 minutes
Bridgend – Barry	1 per hr from 05:42 until 22:51	1 per hr from 05:42 until 22:42	1 every 2 hrs from 09:42 until 21:42	36 minutes

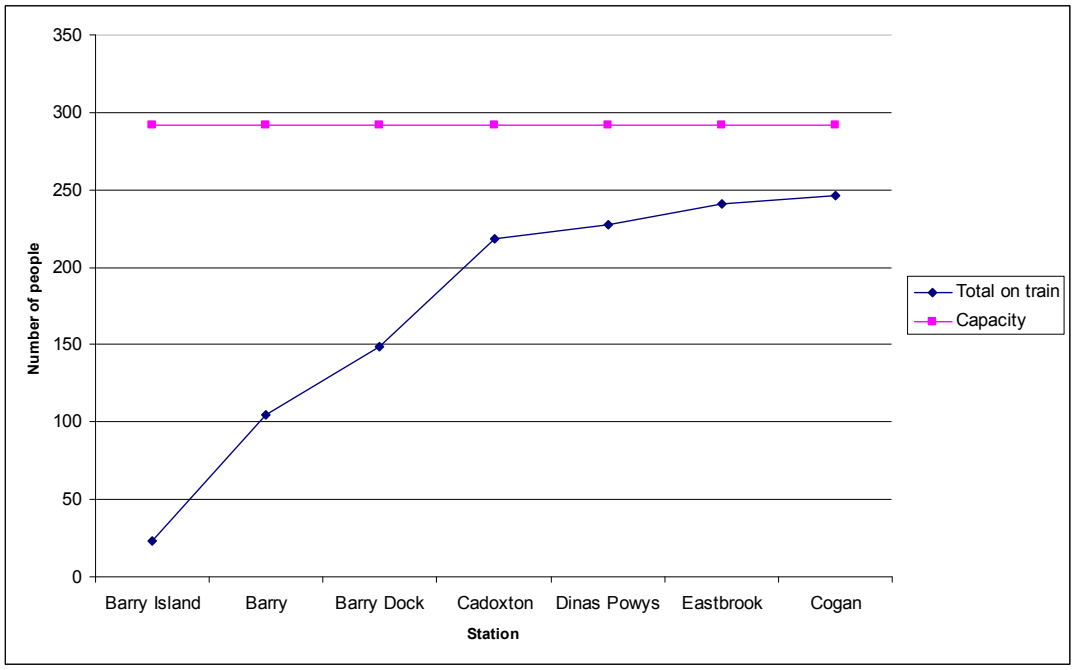
It is also convenient to travel between Barry Docks and Barry Island, on the frequent service from Cardiff Central.

9.1.5 Capacity and Patronage

The majority of trains that serve Barry are four carriages in length with a capacity of between 70 and 75 passengers per carriage. The capacity of each train is therefore between 280 and 300 passengers per train.

A study carried out by the Vale of Glamorgan Council allows the accumulation of passengers on trains running from Barry Island towards Cardiff City Centre to be determined as far as Cogan Station (information was unavailable for the Cardiff portion of the line within Cardiff Unitary Authority). From this it has been possible to gauge the patronage on the Vale of Glamorgan section of the service. The study was carried out on a typical weekday during November 2007. Figure 9.3 illustrates the results.

Figure 9.3: Patronage and capacity on the Vale of Glamorgan Line



The graph shows the accumulation of passengers on the peak hour train that departs from Barry Island at 07:56.

It is clear that the Barry Island service is an attractive option for travellers commuting to the Cardiff area, and whilst there is no information that explicitly illustrates that the passengers from Barry are travelling to Cardiff, it is reasonable to assume that this is the case for the majority of passengers.

It is also evident from this graph that there is spare capacity on the existing rail service on the Vale of Glamorgan section of the line, even on the most heavily used train. It suggests that whilst the service is well used, the line presently has capacity to cope with an increase in patronage in the Barry area, even on the busiest services.

The other major development in the area, RAF St. Athan Defence Technical College, is not anticipated to create significant rail demand at peak hours as a result of the distance from the railway stations and the proposal for an express bus service to Cardiff (in connection with Cardiff Airport) which it is considered will offer a faster public transport service from that development.

9.2 Future Plans and Initiatives

The South East Wales Transport Alliance (SEWTA) has recognised the importance of investing in rail services to encourage a modal shift away from the private car, and has subsequently carried out the SETWA 2009-2018 Rail Strategy Study. The study has been carried out with the aim of developing a number of additional services that will be pursued in tandem with Network Rail's major re-signalling renewal projects in the region.

The Strategy includes the following high level aims relevant to the Vale of Glamorgan Line and Barry:

- reliability and capacity improvements;
- additional rolling stock;
- station improvements; and
- frequency enhancements.

Improvements to Barry station are part of a five year improvement plan which includes an enhancement of the park and ride facility, which is observed to be nearing capacity at peak times.

The Strategy puts forward high level proposals that will improve what is a well used rail network in the Vale of Glamorgan area. It is clearly an attractive, well used mode of transport that will be further enhanced as part of pursuing the objectives set out by the Strategy.

Further to this the Vale of Glamorgan has recently announced several transport schemes related to the local rail service. Following the Network Rail re-signalling works (scheduled for completion in 2014) the frequency of the Vale of Glamorgan line service to Bridgend will be increased to a half hourly frequency. An additional platform will also be constructed at Barry Station; this 'turnback' facility will allow trains to terminate at Barry station and improve service reliability.

9.3 Development Proposals

The consortium has minimal influence on improvements to the rail network; however there are opportunities to increase the attractiveness of the service by improving the routes between the development and the stations. The existing conditions and proposals for improvements are detailed in section 11.4.

As Figure 9.4 demonstrates, all areas of the development are within 15 minutes walking time from a rail station, with the majority being within 10 minutes. Improved access to the rail stations will make rail travel to and from the development a more attractive way of travel, and help provide genuine competition to the private car.

The Travel Plan (proposals for which are outlined in section 13 of this report) provides an additional tool that complements the development proposals. Additional information will be made available to new residents and at the retail/office/leisure uses to raise the profile of rail travel in the area.

9.4 Summary

The development proposals will dovetail with the SEWTA rail initiatives to significantly improve the rail conditions around the development site. It is particularly important that direct routes are created between the development and the local railway stations.

Planned improvements to the rail service frequency and an enhanced rail service experience will make rail trips more attractive and convenient for many of the existing trips which are currently made using the private car.

These proposals will encourage rail trips from the development site, and assist in creating a modal shift away from the private car.

10 BUS ASSESSMENT

10.1 Access by Bus

10.1.1 General Services

The Vale of Glamorgan has a substantial network of bus services that connect the settlements in the county. Barry is currently well served by bus services that run between Barry and key areas in South East Wales, including Cardiff City Centre and Llandough Hospital. The development site is well placed to take advantage of the services that currently run along Ffordd y Mileniwm and to Barry Island. Table 10.4 overleaf summarises the bus services which are illustrated graphically on Figure 10.1.

Table 10.1 illustrates that there are a high number of services linking Barry to Cardiff. However, bus linkage between Barry and areas to the west including Bridgend are limited, with only one bus service running to the west from bus stops located in close proximity to the application site. Buses are generally best suited to serving local communities and areas not on the national rail network. Journey times from Barry to Cardiff by train is around 20 minutes but the same journey by bus takes at least 45 minutes. For this reason it is anticipated that commuters would choose rail for longer journeys east and westbound.

Table 10.1: Bus services around the Barry Area

Service	Route	Days of Operation	Direction	Frequency of Service					First Departure Weekday	Last Departure Weekday	Service Operator
				Weekday			Saturday	Sunday			
				Early Morning	Daytime	Evening (post 18:00)					
90	Culverhouse Cross – Barry Waterfront	Mon – Sat	Barry – Culverhouse Cross	1 per hr	1 per hr	1 per hr	1 per hr	-	07:05	19:05	Veolia Transport
			Culverhouse Cross - Barry	1 per hr	1 per hr	1 per hr	1 per hr	-	07:38	19:40	
93	Cardiff – Penarth – Dinas Powys – Barry	Mon-Fri	Cardiff - Barry	2 per hr	2 per hr	1 per hr	-	-	07:20	18:36	Cardiff Bus
			Barry - Cardiff	1 per hr	90 mins	1 per hr			08:09	18:32	
94	Cardiff –Penarth – Sully – Barry	Mon - Sun	Cardiff - Barry	2 per hr	2 per hr	1 per hr	2 per hr	1 per hr	07:10	23:00	Cardiff Bus
			Barry - Cardiff	2 per hr	2 per hr	1 per hr	2 per hr	1 per hr	07:59	22:00	
95	Cardiff – Dinas Powys – Barry – Barry Island	Mon - Sun	Cardiff - Barry	1 per hr	3 per hour	1 per hr	3 per hour	4 services	07:27	23:20	Cardiff Bus/EST Bus
			Barry - Cardiff	1 per hr	3 per hour	1 per hr	3 per hour		05:00	23:33	
96	Cardiff – Culverhouse Cross – Barry	Mon - Sun	Cardiff - Barry	1 per hr	2 per hr	1 per hr	2 per hr	1 per hr	07:40	22:45	Cardiff Bus
			Barry - Cardiff	1 per hr	2 per hr	1 per hr	2 per hr		06:47	22:48	
97	Barry Town Circular (Via Gibbonstown – King Square – Barry Hospital)	Mon - Sat	Clockwise	1 per hr	2 per hr	-	2 per hr	-	07:45	17:45	Cardiff Bus
			Anticlockwise	2 per hr	2 per hr	-	2 per hr	-	07:40	17:10	
98	Barry Town Circular (Via King Square – Morrisons – Barry Hotel)	Mon - Sat	Anticlockwise	2 per hr	2 per hr	-	2 per hr	-	07:52	17:21	Cardiff Bus
X91	Cardiff – Barry – Cardiff International Airport – St Athan – Llantwit Major)	Mon - Sun	Cardiff – Llantwit Major	1 per hr	1 per hr	1 per hr	1 per hr	1 per 2hrs	05:10	18:20	Cardiff Bus
			Llantwit Major – Cardiff	2		1 per hr			06:37	19:41	
88A/88B	Barry – Sully – Penarth – Llandough Hospital	Mon – Sun	Clockwise	1 per hr	1 per hr	-	1 per 1.5hr	1 per 1.5hr	07:18	18:00	First Cymru
B1	Barry Town Circular (Via Garden Suburb – Waterfront – Town Centre)	Mon-Fri	Clockwise	1 per hr	1 per hr	-	-	-	06:55	17:36	EST Bus
B3	Barry Island Circular (Via Garden Suburb – The Knap – Waterfront)	Mon - Sat	Anticlockwise	1 per hr	1 per hr	-	1 per hr	-	07:29	18:29	
X45	Cardiff to Llantwit Major (via Barry)	Mon Sat	Cardiff to Llantwit Major	1 per hr	1 per hr	-	-	-	08:00	19:00	

			Llantwit Major to Cardiff	1 per hr	1 per hr	-	-	-	07:00	17:40	

10.2 Future Plans and Initiatives

SEWTA has developed a Bus Strategy for the region, with a view to further enhancing bus services in South East Wales. The Strategy identifies Barry as one of the fourteen principle transport hubs, and the Barry to Cardiff corridor as one of the more heavily used corridors in the region; particularly for trips to work.

Within the SEWTA Bus Investments Programme Study, the existing Dinas Powys to Cardiff corridor is identified as having limitations, with specific reference being made to the Merrie Harrier Junction and the delays often experienced there.

The Vale of Glamorgan is carrying out further improvements at Merrie Harrier, as part of a more extensive bus scheme; the detailed design drawings of the Merrie Harrier junction improvement are available in Appendix L. Works on the initial phase of the scheme were completed in July 2008, and ultimately it is understood that a 400m long bus lane will be provided on the eastern approach lane to the Merrie Harrier junction. It is considered that these works will have important implications for the proposed Waterfront Barry development in improving journey times and providing a more efficient commuter bus corridor between Barry and Cardiff.

10.3 Development Proposals

10.3.1 Diversion of Existing Cardiff Bus Service 95

The aim is to provide a safe, reliable and convenient bus service which will operate at times to meet the needs of users of the proposed development, catering for peak period demand and integrating with the existing bus network.

Meetings with the main bus operator in the area, Cardiff Bus, were held on 26 August 2008 and 6 April 2010. At both meetings Cardiff Bus confirmed an interest in diverting the existing 95 bus route to operate along the Barry Island link road through the middle of the main West Pond site and the district centre area. This diversion is illustrated on Figure 10.2. The outline details of the service frequency and operating hours are detailed in Table 10.2

Table 10.2: Service 95 operating hours and frequency

Service	Days of operation	Frequency	Hours of operation
Diverted 95	Mon-Sun	3 per hour during weekday daytime	Approx 0500-2330

The revised route would offer Cardiff Bus advantages in terms of journey times and patronage. It is therefore anticipated that this alteration could be made upon completion of the Barry Island link road without the need for financial support.

The proposed service 95 diversion would alter the service provision at four existing stops, however in all cases these stops would still be served by other existing services:

- St Nicholas Road (Ship Gyratory) which serves some residential areas, the Knap and Romilly Park; the stop itself is served by No.96 (2 per hour) in addition there are other routes serving the immediate area;
- Park Avenue (Ship Gyratory) stop is also served by No.96 (2 per hour) and No.X45 (1 per hour); and
- Two stops along Broad Street including Barry Rail Station are well served by No.93/94 (4 per hour), No.96 (2 per hour), No.X45 (1 per hour) and other local services.

Therefore despite the proposed diversion of the 95 service existing customers would still be well served. In a meeting with Cardiff Bus it was confirmed that in the case of diversion of the 95 service they considered that adequate bus capacity and frequency along Broad Street would still be offered by other current services.

To confirm the capacity for the additional demand a patronage survey was carried out by Arup along route 95, between Barry Island and Palmerston Road, on a typical weekday in March 2010, during the AM peak hour. Passengers were counted at key stops along the route to determine the spare capacity of the service and travel patterns of customers. Figure 10.3 shows the cumulative observed occupancy starting ("S") on Palmerston Road outside Waitrose at 07:51 and completing a full loop to Barry Island, arriving at 08:12 ("E"). The service then left Barry Island at 08:15 ("S") and returning to Palmerston Road finishing at 08:50 ("E").

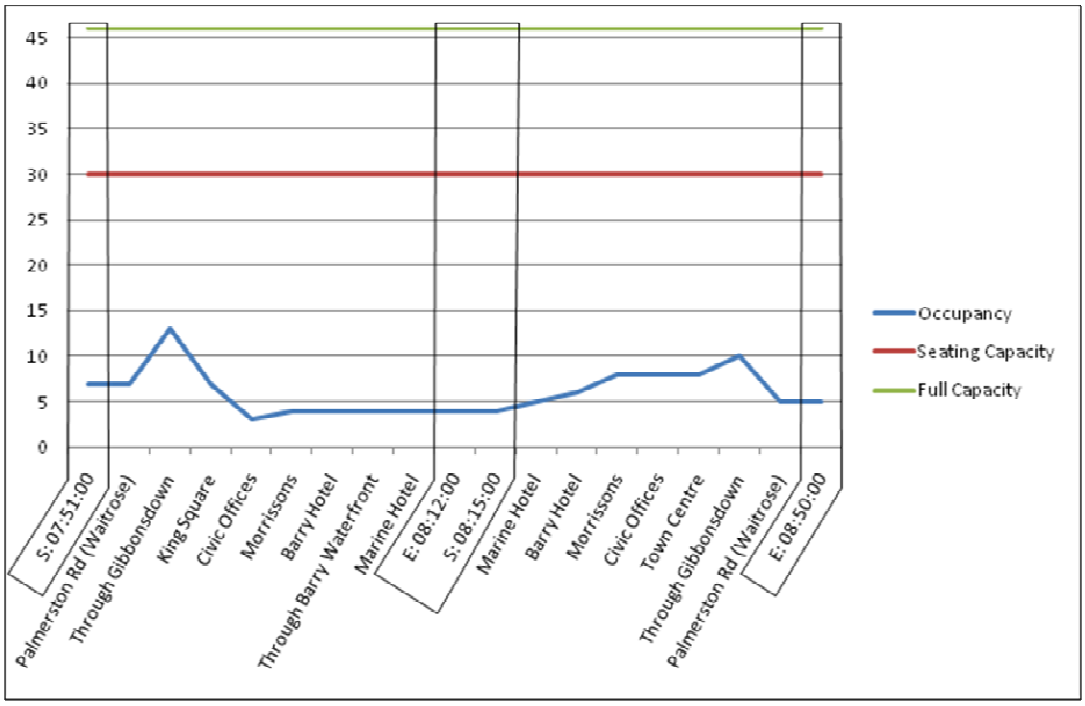


Figure 10.3: Route 95 Patronage Survey, AM Peak

The service vehicle has a seating capacity for 30 people with an additional standing capacity of 15. The graph shows highest activity through Gibbonsdown with 13 passengers at its peak; through the section of proposed diversion there is a flat occupancy of just 4 passengers, with a turnover of passengers on the Island. It is clear that the service has spare, comfortable, seated capacity which could serve the proposed development.

10.3.2 Provision of a 'South Quay Link' Bus service

The combination of a diverted service 95, and existing services 88A/B and 90 on Ffordd y Mileniwm would serve the majority of the Waterfront development areas with bus based public transport. However some areas of the South Quay site (scheduled for the latter phases of the development) will not be within the desirable 400m walking distance of a frequent bus service. To maintain a good level of service throughout the site a 'link' bus service will be provided upon occupation of the first dwelling in South Quay beyond 400m walking distance of any existing regular bus service.

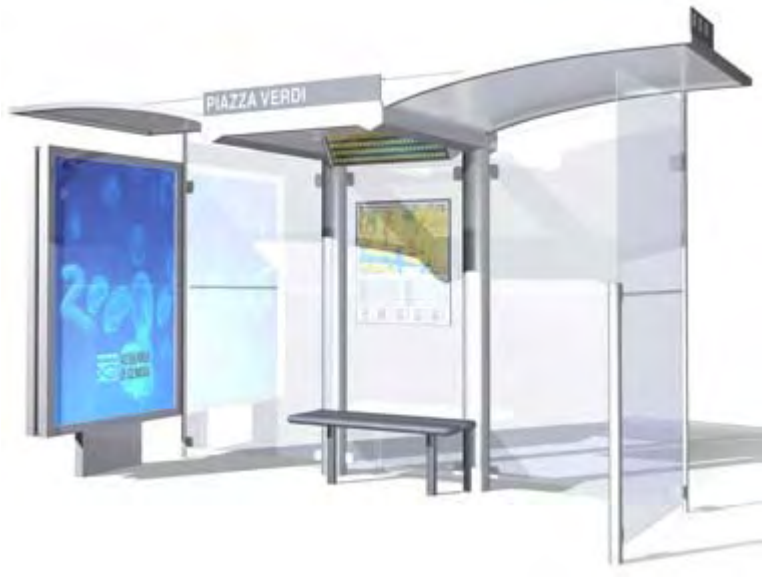
This service would operate at a frequency matching that of the main service operating through the Barry Waterfront development and, where possible, act to encourage interchange to this service by operating a complimentary timetable that allows ease of interchange.

The requirement for this proposal may however be negated in the fullness of time as local bus routes evolve. In particular the potential to provide a link between South Quay and Clive Road would enable the existing bus services to operate on a continual route serving both South Quay and Barry Island areas.

10.3.3 Accessibility of Bus Services

The combination of the two proposed routes will ensure that the development will have a convenient level of bus provision, with users able to utilise stops within the development. Figure

10.4 illustrates the locations of the stops that will serve to ensure convenient access to the improved bus service. Figure 10.5 illustrates that all elements of the development site are within five minutes walking distance of a bus stop. The proposed bus stops will provide travel information, lighting, shelter and signing to ensure a positive passenger experience, such as that illustrated in Figure 10.6.



Source: Adshel

Figure 10.6: Example of a high quality bus shelter with seating and real time information

As the link road is being constructed as a single carriageway with dedicated on street parking, there is sufficient width for the installation of bus laybys adjacent to the school square. At this location, where boarding and alighting times are likely to be longer, buses and coaches will be able to pull off the main link road to pick up passengers, reducing the delay for other road users.

10.4 Summary

The proposal to provide a high frequency bus services will cater for peak and interpeak demand from the proposed development. The attractiveness of the bus services will be further enhanced by the strategic location of the bus stops; which will provide a convenient level of interchange within the proposed development.

By providing a frequent bus service from the outset of the development, more people will be encouraged to use the service initially, before other travel habits have been established. A marketing strategy will encourage use of the service, and assist modal shift from the private car.

11 WALKING AND CYCLING ASSESSMENT

11.1 Introduction

This chapter of the Transport Assessment considers walking and cycling within the site and in the surrounding area. Walking and cycling is considered to have a key transport role for Waterfront Barry and particular attention has been given to the walking and cycling routes to local facilities and railway stations.

Consideration is given to the existing conditions for walking and cycling and the proposals which will encourage these modes of transport for residents, employees and visitors to Waterfront Barry.

11.2 Existing Pedestrian Conditions

The quality of existing pedestrian facilities is discussed within the Vale of Glamorgan Local Transport Plan Progress Report (2005), which states the following with regard to walking facility provision:

- the percentage of pedestrian crossings with facilities for disabled people increased from 56% in 2002 to 67% in 2005;
- the percentage of customers satisfied with the condition of roads in 2005 was 38%, while the percentage of customers satisfied with the condition of pavements in 2005 was 43%;
- the percentage of street lights that do not work has fallen from 1.5% in 1999 to 0.7% in 2005; and
- the percentage of footpaths and other rights of way which were signposted as they leave a road rose from 56% in 2003 to 58% in 2005.

Figure 11.1: Pedestrians and cyclists using the waterside path

A thematic map, included as Figure 11.2, has been produced using GIS software to identify the accessibility of Barry by walking from the application site. The thematic accessibility map supports this assessment and has been prepared by measuring the distance from the centre of the application site to 156 locations within the Barry area. In order to provide robust estimated walking times, the calculations include the measurement of total ascent. Walking times have been calculated using the widely accepted Naismith's Rule, which is commonly associated with walking calculations. This assumes a walking speed of 5km per hour plus 1 minute per 10m of elevation gain. The map accounts for constraints including physical barriers and route elevations. The accessibility map visually demonstrates that the application site is situated within walking distance of key locations within Barry. The isochrones indicate that the site is within 15 minutes of the main shopping areas and transport interchanges of Barry.

It is however also evident that the railway line forms a barrier to movement which in some cases prevents direct pedestrian routes. This is apparent for pedestrians accessing Barry Station from the West Pond area via Hood Road.

Safe pedestrian facilities are provided immediately to the east/northeast of the site in the form of a segregated footway. Consistent footway links are provided around the waterfront area that provides pedestrians with a network of paths that benefit from street lighting and dropped kerbs at crossing points. There is also a cycle/footway provided along the waterside, suitable for leisure use.

There are basic crossing facilities along the western part of Ffordd y Mileniwm, with dropped kerbs and tactile paving ensuring a basic standard of safe crossing facilities. Further east towards Cardiff Road there are pelican and zebra crossing facilities but in the waterfront area itself there is an absence of formal crossings. Elsewhere most of the streets in Barry have adjacent footways which are of varying quality and width.

11.2.1 Future Walking Initiatives

The Council is currently undertaking work on the preparation of a Walking Strategy, which has become subject to a delay due to a lack of resources. Therefore the Local Transport Plan is given the most significant weight in identifying local walking strategies and initiatives. The Local Transport Plan acknowledges that walking is an important form of transport in its own right and in the integration of all other modes. It also recognises the importance of walking for recreational activity in the UK. Policy 16 states that the Council will endeavour to maintain and provide a safe and convenient network of pedestrian routes throughout the Vale of Glamorgan.

11.2.2 Development Proposals

Walking is particularly important for shorter journeys, which is emphasised by the following statistics obtained from the Institute of Highways and Transport Document 'Guidelines for Providing for Journeys on Foot', which shows what proportion of journeys are undertaken on foot:

- 80% of journeys less than 1 mile;
- 50% of all school journeys;
- 33% of all shopping journeys;
- 25% of leisure journeys; and
- 12% of commuter journeys.

In addition to these statistics, it is important to consider the importance of walking routes to public transport services. Since all public transport trips will involve walking at the beginning and end of a trip, the walking routes to public transport stops are themselves important in encouraging journeys by public transport. This requirement is considered in depth in section 11.4.

Walking also has proven benefits to health and in creating a vibrant development; consequently significant importance has been placed on providing high quality pedestrian facilities.

Internal access proposals

The masterplan has been developed with high priority afforded to pedestrian permeability. The proposed link road will include footways on both sides with sufficient width to cater for frontage activity. Dedicated at-grade crossings will be provided at the proposed signalised junctions along the main link road.

The sites will be connected by a network of footways that will provide a safe accessible community feel to the residential areas of the scheme (see Figure 2.9). The footways will share space with cyclists and motor vehicles within the housing areas to provide a 'street' feel, as advocated in the Department for Transport's Manual for Streets document. Pedestrian shortcuts will be provided between culs de sacs, allowing local trips to be faster for pedestrians.

Figure 11.3: Example of a good quality pedestrian/cycle route between residential areas

Uncontrolled crossings will be situated in convenient locations around the development sites, and will have dropped kerbs to cater for disabled users. Pedestrian desire lines have also been considered to ensure that safe convenient routes are available to pedestrians wanting to access the retail, school and office facilities.

11.3 Access by Bicycle

11.3.1 Existing Cycling Conditions

Cycling conditions within the immediate vicinity of the development site are relatively good providing safe and convenient cycle routes to other areas within Barry. Since the application site is located within the wider development area of Barry Waterfront, it is afforded access to the cycle infrastructure installed during the initial phases of the scheme.

A segregated cycle/footway is provided along the majority of Ffordd y Mileniwm, running along the northern side of the road from the roundabout situated at the north eastern corner of the application site to the Ffordd y Mileniwm/Cardiff Road roundabout. This link forms part of the proposed National Cycle Network (NCN) Route 88. When fully completed, this route will link NCN Route 4 at Margam Park near Bridgend, through the Vale of Glamorgan to NCN Route 8 in Cardiff Bay.

There are no cycleways or other notable cycle facilities extending beyond the Ffordd y Mileniwm/Cardiff Road roundabout with the exception of advanced cycle stop lines at the Palmerston Road/Cardiff Road signalised junction.

There is currently a lack of convenient and secure cycle parking facilities in Barry, in particular at the three Barry train stations.

A thematic accessibility map, included as Figure 11.4, has been produced using GIS software to identify the accessibility of Barry from the application site by cycling. Cycling times have been calculated assuming an average 16km/h speed[1] and adding 8m of distance per metre of total ascent[2]. In addition, the map takes into account routes inaccessible to cyclists including the access point to Barry Island via the steps to the south east of the application site. Therefore the map accounts for constraints including physical barriers and route elevations. The map visually demonstrates that the application site is situated in a sustainable location for cycling trips to the surrounding area. The entire Waterfront area, as well as the majority of town centre shopping facilities and Barry Island, lies within a short five minute ride, and within 10 minutes nearly all commercial and employment sites within the Barry urban area can be reached. Within 20 minutes

[1] Allen P et al, Operational Analysis of Uninterrupted Bicycle Facilities, Transportation Research Record, 1998
[2] Scarf P and Grehan P, An empirical basis for route choice in cycling, Journal of Sports Sciences, September 2005

all residential areas of Barry can be reached. The figure clearly illustrates the key role which cycling could assume in the town's transport.

11.3.2 Cycling Policy and Future Initiatives

The Vale of Glamorgan Unitary Development Plan identified that in 2005, just 1.3% of non-walking trips, are made by bicycle, of which 56% are less than five miles in distance. The Vale of Glamorgan Council has set out its objective to double the number of cycle trips from 2002 to 2012 to reflect national policy. This target is identified within many local level planning policy documents, including the Cycling Strategy (1997). In addition, the Strategy sets out that cycle routes should be identified and safeguarded within the UDP. The UDP identifies a new Barry to Wenvoe/Cardiff route and UDP Policy ENV27 states that development should have a high level of accessibility for cyclists.

In accordance with Local Transport Plan Policy LTP15, the LTP Progress Report identifies the ambition to implement the initiatives set out by Sustrans which recently completed a feasibility study for the provision of a National Cycle Network (NCN) route through the Vale of Glamorgan. It is understood from Council planning officers that the feasibility study mirrors many of the proposals set out in the 1997 Cycling Strategy. The Council confirms that it will seek to influence and incorporate cycle friendly infrastructure within major development projects and schemes. Specific to the application site, it is understood that the feasibility study recommends the cycle route through the Vale of Glamorgan should form part of the internal infrastructure of the proposed development.

11.3.3 Development Proposal

It is envisaged that cycling will be a key mode for trips within the development and to other destinations in Barry. As Figure 11.4 illustrates, much of Barry is within an acceptable cycling distance from the development sites.

Internal Links

There is a good level of permeability throughout the site by the combination of the road network and across a parkland area on South Quay to the step free route to Barry Island.

In addition to the internal street design, there is a dedicated cycleway that will run along the western edge of the former No. 1 Dock to provide both commuter and leisure cyclists with an attractive alternative route to busy roads. The waterfront setting of this cycle route will provide an attractive link for cyclists wishing to access the cycleway along Ffordd y Mileniwm.

Figure 11.5: Attractive waterside cycle/pedestrian route

Cycle Parking Provision

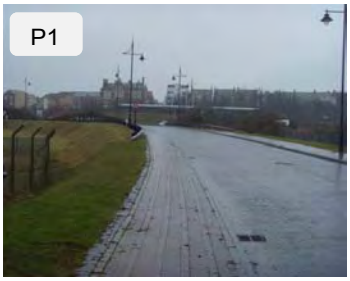
It is proposed that adequate cycle parking provision be included within the site to ensure compliance with the outline Travel Plan. The proposed cycle parking spaces are based on the CCS Wales Parking Standards.

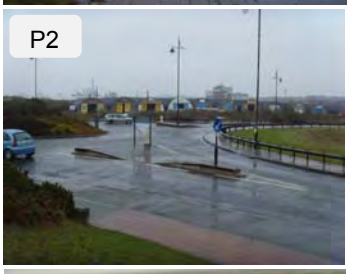
Sheffield Cycle Parking Stands are recommended for the development; each stand accommodates two cycle parking spaces. Where possible these stands should be covered to ensure bicycles are protected from inclement weather. With large areas of cycle parking it may also be possible to provide lockers for the storage of cycle equipment; this is particularly desirable at places of employment.

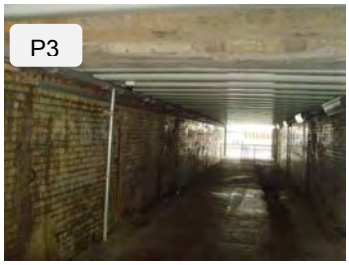
11.4 Sustainable Routes Audit and Proposals

Following initial analysis of the Barry Waterfront sites, five routes identified as A-E on Figure 11.6 were recognised as being important sustainable transport links, connecting the proposed Barry Waterfront development to the surrounding area. An audit was undertaken on each of the routes in March 2010 to assess the existing condition of these routes and to identify how the design and development of Waterfront Barry can maximise sustainable travel by walking and cycling in the area. This section presents the findings of the audit, together with photographs of existing conditions. The locations of these photographs are indicated on Figure 11.6. In order to improve existing conditions for sustainable travel, proposals are given for improvement works. The consortium will contribute towards these works at a level to be agreed with the Vale of Glamorgan Council as part of a section 106 offer.

11.4.1 Route A







Key destinations: Barry Docks Council Offices, Ffordd y Mileniwm and existing Waterfront retail area, Barry Docks Station, Dock View Road/Barry Town centre.

Route users: Pedestrians and cyclists

Existing conditions:

A good quality footway exists along Cory Way, from the proposed site access into East Quay to the existing roundabout with Ffordd y Mileniwm *[P1].* A splitter island on Ffordd y Mileniwm provides an uncontrolled pedestrian crossing for users wishing to access Barry Docks offices Barry Docks railway station *[P2].*

Users are required to cross the Barry Docks Offices access road via an uncontrolled crossing in order to access the railway line underpass to Barry Docks railway station. The two uncontrolled crossings at the Ffordd y Mileniwm/Cory Way junction are of an adequate standard, although landscaping of the roundabout makes visibility at the crossing poor. The underpass is currently poorly lit, and has a rundown appearance, though existing CCTV is visible *[P3].* A ramp provides access from the underpass to Barry Docks station for pedestrians and disabled users. There is currently no cycle parking provision at the station.

Also notable in this area is the recently completed Thompson Street footbridge *[P5]*, which provides a link over the rail line between Dock View Road and Heol Y Llongau, off Ffordd y Mileniwm. This bridge provides a more direct route from East Quay to Dock View Road via Ffordd y Mileniwm.

Example facility

(source: Cycling England)

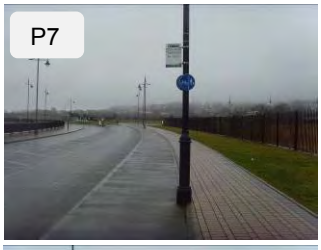
Proposed improvements:

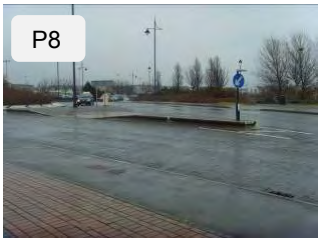
Internal footways will be linked to the existing footway along Cory Way, and an additional non-mandatory cycleway will provide cycle facilities along this route. To improve visibility at the crossing near the Ffordd y Mileniwm/Cory Way roundabout, the central island landscaping will be revised.

The standard of the underpass will be enhanced with improved lighting and cosmetic improvements to surfacing and walls. Cycle parking facilities will be provided at the Barry Docks Station in the form of 10 Sheffield Stands.

It is important to link into the existing foot/cycleway along Ffordd y Mileniwm and the new Thompson Street footbridge. A footway and cycle link will egress from the north of the public realm area of East Quay, and a Toucan crossing will be provided across Ffordd y Mileniwm.

11.4.2 Route B





Key destinations: Existing Ffordd y Mileniwm retail area, Barry Town Centre, Holton Road, Broad Street.

Route users: Pedestrians, Cyclists

Existing conditions:

Uncontrolled crossings with dropped kerbs and tactile paving provide crossing points across Hood Road onto the existing footway/cycleway along Ffordd y Mileniwm *[P6].* The existing footway and cycleway, which is segregated from the main carriageway, is of a good standard, and well sign-posted *[P7].* An uncontrolled crossing with dropped kerbs and tactile paving is provided across the access to Ffordd Sealand. The footway/cycleway continues along Ffordd y Mileniwm to the Gladstone Bridge roundabout, where uncontrolled crossings provide access to the existing Barry Waterfront retail area *[P8].*

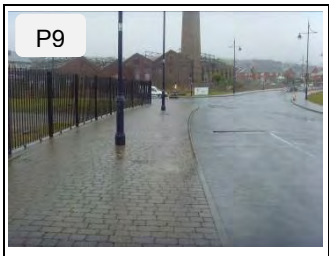
A further footway of a good standard exists across Gladstone Bridge, providing good pedestrian and cycle access from Ffordd y Mileniwm to Broad Street, Holton Road and beyond. Uncontrolled crossings and splitter islands provide crossing points over the three arms of the Gladstone Bridge/Broad Street roundabout.

Example facility

Proposed improvements:

Footway/cycleways out of West Pond will link into the existing provision along Ffordd y Mileniwm. Cycle parking facilities will be provided within West Pond in accordance with best practice, to encourage users of the retail and office land uses to cycle.

11.4.3 Route C



Key destinations: Broad Street, Barry railway station.

Route users: Pedestrians, Cyclists

Existing conditions:

Direct access to Barry station from the West Pond area is impeded by the railway line. An existing route is available along Powell Duffryn Way, Hood Road and Broad Street. A good quality footway currently serving the Steam Railway access adjoins Powell Duffryn Way at the Ffordd y Mileniwm roundabout. The footway runs alongside Powell Duffryn Way *[P9]* and continues along Hood Road, and underneath the existing railway adjacent to the road via an underpass. An uncontrolled crossing with dropped kerbs and tactile paving provides a crossing point for pedestrians wanting to cross Hood Road to access the underpass *[P10].* The underpass is currently poorly lit.

An established footway of varying standard runs along Broad Street to Barry Station *[P11].* No cycle parking facilities currently exist at Barry Station.

Proposed improvements:

Footway access from the West Pond area will connect to the existing footway at the Steam Railway access. The existing subway will be subject to improvements works and improvement of the footway. The uneven footway along Broad Street will be replaced and general improvements will be made to the standard and provision for pedestrians on the route to Barry railway station. Cycle parking facilities will be provided at Barry Station.

11.4.4 Route D

Key destinations: Barry Island, Barry Island Station, The Knap

Route users: Pedestrians, Cyclists

Existing conditions:

A vehicular access exists into the southern access of West Pond, an overflow area for the Barry Island car park. The access is off a gentle slope which does not include a footway leading up to the Clive Road junction *[P12].* A footway runs along Paget Road to the Harbour Road Junction, but no pedestrian crossings are provided onto Harbour Road. Good quality footway is provided along Harbour Road to Barry Island railway station, and a zebra crossing provides easy access to the wider Barry Island area from Harbour Road *[P13].*

Proposed improvements:

This area will be extensively revised as part of the proposals, all roads will have footways running adjacent to them and pedestrian crossing facilities will be improved at the junctions with Plymouth Road and Station Approach Road.

	Additionally cycle parking will be provided at Barry Island station.

11.4.5 Route E

Key destinations: Clive Road steps, Barry Island, Barry Island Rail Station

Route users: Pedestrians

Existing conditions:

An existing route exists between the West Pond and South Quay site, from the current roundabout with Ffordd y Mileniwm to a set of steps leading onto Clive Road. The pathway is poorly lit and of poor quality with uneven surfacing *[P14].* The steps leading to Clive Road are also poor in quality and unsuitable for users who are mobility impaired *[P14].* The lower steps are constructed by metal sheeting, which may be slippery in wet conditions. The upper half is constructed of concrete, but is steep and narrow in nature. An uncontrolled crossing is provided across Clive Road and there are traffic management measures in place along Clive Road outside Clive Road School *[P15].* It is possible to access Barry Island Station from Clive Road through the residential areas of Barry Island. A pathway through the park adjacent to Plymouth Road connect to a bridge over the existing rail line linking to Harbour Road *[P16].*

Example facility, London

Proposed improvements:

Due to the nature and gradient of the land between South Quay and Clive Road (a height difference of approximately 10.75m over a 45m distance), it is considered that upgrading the existing steps represents the most suitable improvement works.

Provision of a DDA compliant route would require construction of a ramped route ideally at a gradient of 1 in 20 in addition to a stepped route. The height gain required is significant and guidance suggests such a ramp would be over 150m in length at minimum standards or over 250m of preferred gradient. It is questionable whether a ramp of this length would represent a practical or attractive route over other alternative routes to wheelchair users.

It is therefore considered that the existing alternative route to Barry Island via Paget Road would remain preferable for the mobility impaired. For this reason it is recommended that the route via a stepped route is upgraded in line with the Department for Transport Guidance 'Inclusive Mobility'.

11.4.6 Summary

The combination of existing facilities and the proposals detailed in this chapter will create a safe and direct network of walking and cycle routes for residents, employees and visitors to Barry Waterfront as well as the wider community. The provision of these facilities will help promote walking and cycling as the natural choices for journeys within the town and encourage a greater number of people to use these modes of transport. In addition to the residents of the Waterfront development, the existing residents of Barry Island will also have a suitable connection onto the area's cycle network in preference to Harbour Road.

Where possible within the development priority or shorter routes have been included for pedestrians and cyclists. The dedicated crossings provide safe routes across the main link road and the side roads are designed to allow pedestrians and cyclists freedom of movement within the sites.

The proposed cycle parking provides for cyclists travelling to the proposed employment, retail and leisure facilities within the development sites as well for residents. This will maximise the potential for the Waterfront Barry to be successful as a destination for pedestrians and cyclists.

By encouraging walking and cycling within the development, the proportion of car trips can be reduced as some car users will walk or cycle to a nearby destination which they would otherwise have driven to.

12 OTHER TRAVEL CONSIDERATIONS

12.1 Deliveries and Servicing

The operational needs of the development will require servicing, especially the proposed food retail store, so provisions will be incorporated into the design.

- key routes through the development will be designed to accommodate large articulated vehicles, especially access to the food retail and Petrol Filling Station;
- refuse vehicles will need to access the minor, residential areas of the development; infrastructure will be designed to suit; and
- service vehicles are expected to access the site predominantly at times that do not coincide with network peak periods.

Figure 12.1-12.3 illustrates swept path analysis for the vehicles described to access the relevant areas of the development. The analysis will be completed in greater detail during the detailed design of the Barry Island link road, which is anticipated to be constructed as part of a preliminary package of facilitating works.

12.2 Construction Traffic

It is anticipated that construction of the Waterfront development will commence in 2010 and works would proceed in a phased manner commencing with an initial phase of earthworks, infrastructure and remediation.

At times several areas of the sites will be progressed concurrently by different members of the consortium.

The approach route of construction traffic to the site has yet to be established by agreement with the local authority but the most appropriate routes would be those which are of an adequate standard for HGVs and ensure that they reach the strategic road network efficiently whilst minimising impact on the surrounding community. In the latter stages of construction this will include new residents of the Waterfront development.

It is suggested that three routes could be considered for construction traffic access from the site:

- to the A4232 at Culverhouse Cross via Ffordd y Mileniwm, Barry Docks Link Road and Wenvoe;
- to the A4232 at Culverhouse Cross via Pontypridd Road, Waycock Cross, Port Road and Wenvoe; and
- to the A4232 at Ferry Road Interchange via Ffordd y Mileniwm, Cardiff Road and the A4055 through Dinas Powys.

Each of these routes differ in impact, distance, congestion and access issues; however it is suggested that, dependant on the destinations of construction traffic, the route which will have the lowest impact is to the A4232 at Culverhouse via Ffordd y Mileniwm, Cardiff Road, Barry Docks Link and the A4050 via Wenvoe.

The level of construction related vehicle movements will vary significantly proportional to the level of construction activity; however, the following estimated numbers of movements are representative:

HGV movements: 30-35 deliveries a day (60-70 two way movements)

Staff/LGV movements: 90-180 LGVs travelling to the site daily (180-360 two way movements)

It is anticipated that the site will be operational up to six days a week for typical construction hours. The exact operation of the site and the construction hours are likely to vary over the construction period, and working hours will also be required to adhere to any relevant conditions.

Deliveries will generally be spread across the working day but the arrival and departure of staff are likely to form significant peaks at the beginning and end of the working day.

In order to minimise construction-related impact on the surrounding highway network a construction management plan will need to be adopted, with measures such as:

- agreed working hours and periods during which HGVs can access the site;
- temporary pedestrian and cycle routeing strategies; and
- pre-determined waiting areas for delivery vehicles.

The construction management plan should be made in conjunction with, and agreed by, the Vale of Glamorgan Council in advance of works commencing.

12.3 Provision for Mobility Impaired Persons

The development will be designed to be accessible to all members of the community and in accordance with the Disability Discrimination Act 2005. This is relevant to the provision of facilities for the disabled, those with pushchairs or small children and encumbered by baggage.

Examples of the areas that will be subject to these considerations are:

- Main entrances to buildings with level thresholds or suitable provision for wheelchairs;
- Limiting the gradient of ramps to acceptable levels and providing level rest areas to enable wheelchair access;
- Dropped kerbs at all crossings;
- High quality bus facilities that allow a step free access to vehicles; and
- Provision of disabled parking spaces to the appropriate levels and dimensions, located in preferential locations close to the main entrances of residential, commercial and employment developments.

13 OUTLINE TRAVEL PLAN

13.1 Overview

13.1.1 Definition of a Travel Plan

Travel Plans provide the framework within which a developer actively commits to providing a development that encourages modal shift towards the use of sustainable transport.

Travel Plans set achievable targets for developers and developments to pursue, whilst realising a noticeable modal shift away from single-occupancy car journeys to more sustainable modes, including car sharing, public transport, private coach/bus services, cycling and walking. The Plan sets out a defined timescale and means by which the targets will be met.

13.1.2 Benefits of Travel Plans

Travel Plans aim to benefit employers, employees, the local residential community and the environment, by supporting national policy in the objective to provide sustainable development.

The proportion of individuals travelling to work by car has increased in recent years. Over 80% of car journeys to work are driver only. A modest reduction in single occupancy car trips would result in a significant reduction in peak period traffic congestion. For example if every car commuter used an alternative to the car on just one working day per week, car usage levels would reduce by 20% and parking could be released for more economically beneficial land use by short stay shoppers and visitors.

It is considered that a modal shift away from the reliance on the private car would also result in a reduction in road traffic accidents, reduced stress, healthier lifestyles, greater work productivity, environmental protection, improved access for employees/visitors/deliveries and the reduction of social exclusion through the provision of choice between modes of transport.

There are a number of benefits arising from the proposed initiatives that accrue to residents and visitors of the proposed development, including:

- increased social interaction between individuals travelling to/from the services and facilities within the proposed development. This is relevant to employees working at the site, who, for example, car share or use the local bus service. The effect of increased social interaction can relieve the stress of travel, create a friendlier social environment and increase communication between residents/visitors;
- improved the fitness, health and productivity of those cycling or walking to/from the site. The British Medical Association report *Cycling: Towards Health and Safety* found that regular cyclists are healthier and take fewer days off sick than the average employee. This has benefits for both employees and employers;
- considerable savings on travel costs can be made by using modes other than driving. For example, the annual savings on fuel for a car sharer travelling 10 miles to work with two others can be over £300 per year;
- improved accessibility to the site to reduce potential levels of congestion. This can lead to reduced stress for residents and visitors and an overall rise in reliability and punctuality of employees/school pupils; and
- reduced congestion on local roads and improving local air quality. This will benefit the local community, demonstrating that the development tenants have a responsible attitude to the environmental and social impact of traffic in the local neighbourhood.

13.1.3 Objectives, Goals and Targets for the Travel Plan

The overall objective of the Waterfront Barry Travel Plan is to achieve a situation where residents, workers and visitors can make intelligent travel decisions based on high quality information and a diverse choice of transport modes. The Travel Plan objectives can be summarised as follows:

- to minimise the environmental impact of the travel demand generated by the development through raising travel awareness amongst residents and workers, whilst encouraging them to use sustainable modes of transport;
- to improve the choice of transport modes available to residents, visitors and employees;
- to provide pupils with safe routes to school; and
- to manage site deliveries so that conflicts with pedestrians and other vehicles can be minimised.

The Travel Plan will target achieving the modal split illustrated in Figure 13.1 as an average of all trips to and from the development.

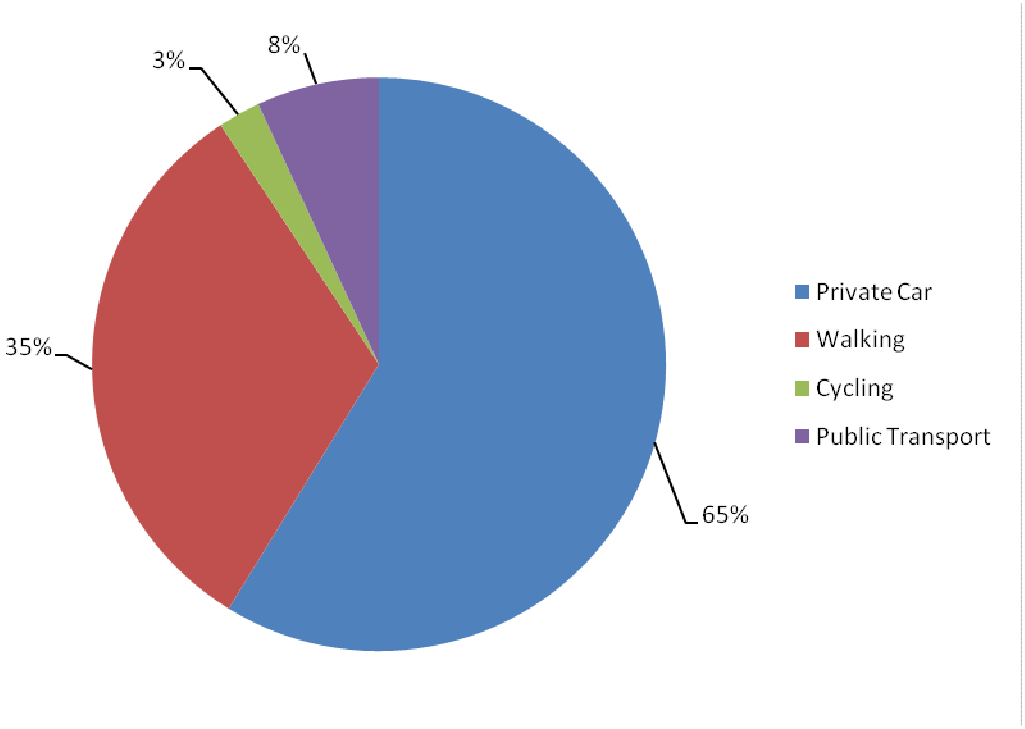


Figure 13.1: Modal Share Targets for Waterfront Barry

Car Sharing

Car sharing is when two or more people share a car for their journey to/from work. It promotes sustainable travel patterns by increasing car occupancy, with a consequential reduction in car movements. It also provides an opportunity for social interaction. Car sharing should be encouraged by:

- providing a guaranteed ride home from work;
- advertising the cost savings of car sharing on notice boards and intranet;
- designating prime car parking space locations for car sharers; and
- participating in the newly-established car sharing database for South East Wales, www.sewtacarshare.com.

Walking

In order to encourage walking a number of initiatives are recommended:

- raising awareness of the health benefits of walking on community notice boards and through providing residents with transport information leaflets;

- displaying information such as a map of recommended walking routes to work, with appropriate distances and times attached, on a central community notice board and through providing residents with transport information leaflets;
- providing clear pedestrian signposting; and
- ensuring that walkways in the vicinity of the site are well-lit and well-maintained, to provide safe and attractive walking routes through the site.

Cycling

The development should incorporate covered and lit cycle parking provision, as close as possible to the facility entrances, with dedicated and secure parking for residents, visitors and workers. It is also desirable to provide showering/changing and locker facilities within places of employment.

Other initiatives that could further promote cycling include:

- displaying information for cyclists, such as potential cycle routes and the health benefits of cycling, on a central community notice board and through providing residents with transport information leaflets; and
- establishing a Bicycle User Group (BUG) within centres of employment, i.e. staff wishing to improve cycle facilities and encourage others to cycle, for example through a 'Bike Buddy' scheme, where employees who wish to start cycling to and from work can be matched with experienced cyclists living nearby who can advise on safe routes, safe cycling, how to mend a puncture and so on. To encourage membership, discounts could be arranged with local cycle shops for BUG members.

Public Transport

To maximise the use of public transport, it must be ensured that the local community is aware of the local public transport network and the benefits of using it. This could include the following initiatives:

- providing a high quality bus-based public transport service operating from the outset of the development at a regular frequency;
- issuing public transport information packs to residents and workers, providing information on stops, frequencies, routes and costs from the home postcode of residents or individual workers (Personalised Travel Planning);
- displaying real-time information on community notice boards and through providing residents with transport information leaflets, in relation to the timing and routes of public transport services;
- advertising the benefits of public transport, such as not needing to own a second car;
- offering interest-free loans for public transport season tickets to residents;
- negotiating season ticket discounts with Cardiff Bus and other operators for residents and promotional discounts for public transport-using visitors; and
- promoting the use of public transport to visitors and prospective residents by indicating bus routes on site location maps within the proposed development.

Residential Initiatives

A "Sustainable Travel Pack" will be provided to each householder as they receive their keys from the developer. The idea of this pack is to raise awareness of the availability of more sustainable forms of transport. The pack could include the following information:

- journey times by a variety of modes to key destinations in the surrounding area, to indicate that some journeys could be undertaken more quickly using non-car modes (this could

include providing the walking and cycling accessibility maps prepared by Arup as part of this application);

- details of safe, direct walking and cycling routes;
- the location of local bus stops and the provision of relevant fare and timetable information;
- information on other alternatives to single occupancy car journeys; and
- the financial, health and environmental benefits of sustainable travel.

In addition to the above, all new dwellings will have the ability to connect to the internet to enable shopping to be ordered directly online, as well as for access to real-time public transport information.

13.1.4 Implementation and Management of the Travel Plan

Essential to the formulation and successful implementation of a Travel Plan will be the understanding of the travel patterns of residents and employees of the Waterfront Barry development, although it will be difficult to predict their travel behaviour before the development is in place. Equally important is the involvement and co-operation of third parties to ensure effective delivery of measures; early and continued consultation with The Vale of Glamorgan Council will be essential to the successful implementation of the Travel Plan.

The following measures are proposed for implementation prior to the occupation of the first phase of the development:

- completion and agreement of a comprehensive Travel Plan covering all aspects of the Waterfront Barry development;
- establishment of a Travel Plan budget;
- appointment of a Travel Plan Coordinator;
- the provision of high quality travel information to all residents and employees of the development prior to joining, for all modes, including car parking, which could indicate the difference in cost between driving and the equivalent cost by bus;
- co-operation with the local authority/SEWTA Travel Plan Coordinators to develop Personalised Journey Planning for residents and employees; and
- production of a travel information package detailing public transport and cycle/pedestrian links to/from the site and ensuring all residents and workers receive a copy. Booklets could be made available to the public via libraries, exhibition centres and community centres.

Quantifiable, realistic and deliverable targets should be identified once the residents and specific companies to occupy the office and leisure elements of the development are known. Development of the initial targets would be the responsibility of the Travel Plan Coordinator, in consultation with prospective employers, and would be subject to periodic reviews once the development is underway.

The Travel Plan is a living document that will evolve over time as additional information becomes available and as the travel habits of employees and visitors change.

Travel Plan Coordinator

For the successful operation of the Travel Plan, it is essential to ensure that someone has responsibility for the coordination and implementation of the Travel Plan measures. This role could be fulfilled by a Travel Plan Coordinator whose key responsibilities would include the collection of data from annual travel surveys of site employees; obtaining and maintaining commitment and support from developers, prospective employers and their staff; securing funding to develop and implement new initiatives; and maintaining close liaison with The Vale of Glamorgan Council.

The responsibilities involved, covering perhaps two days per month, could be assumed by a member of the site management team, who would have the opportunity for day-to-day contacts with businesses within the development to form a partnership to implement and develop measures appropriate to the site.

Consultation and Travel Patterns of Residents, Staff and Visitors

It is recommended that regular surveys be undertaken (i.e. annually or bi-annually) to establish the existing travel patterns of residents and staff at the development. These surveys should identify the following:

- modal split;
- details of origin and destination;
- reasons for choosing a particular mode;
- changes that would encourage use of more sustainable modes; and
- usual travel patterns to and from work.

The travel survey will enable modal share targets to be modified over time, and new initiatives to be developed to achieve these targets.

It is important that the results of travel surveys are communicated to residents and employees/employers of the area to establish shared ownership of transport issues in the development and encourage sustainable transport.

14 RECOMMENDATIONS AND SUMMARY

14.1 Introduction

Due to the mixed use nature and existing transport infrastructure the transportation issues are complex. This report has assessed the impact of the development on the existing infrastructure, and recommended mitigation measures to ensure the development and surrounding areas are served by an efficient transportation network. This chapter summarises the recommendations, by outlining a Transport Implementation Strategy for the proposed development.

14.2 Transport Implementation Strategy

The objective of the transport strategy for Waterfront Barry is to:

- develop a package of transportation measures which will encourage people to visit, work and live within the development;
- serve the wider needs of the community by improving connectivity between Barry Island, the Waterfront, the town centre and wider locations; and
- be compatible with the transport strategy for the area.

The measures include improvements to a wide range of transport infrastructure, covering all modes of transport and these are summarised in Table 14.1. There are also a variety of transport improvements proposed by the Vale of Glamorgan Council, the Welsh Assembly Government, Network Rail and local public transport operators which will improve the transport provision in the area; these are summarised in Table 14.2.

Table 14.1: Transport Implementation Strategy related to Waterfront Barry

Strategic Issues	Strategic elements
Travel Plan	
Transport Strategy – The Transport Plan is the overarching plan for movement to, from and within the development. All other transport elements will form part of the Travel Plan.	A Travel Plan Coordinator will be appointed to complete a Travel Plan prior to the occupation of the first buildings. There will be an ongoing role for the management of the Travel Plan.
Modal Share – The Travel Plan is key in ensuring a sustainable modal split and encouraging modal shift.	The development will offer a range of travel modes and the Travel Plan will act to publicise and encourage the use of these.
Targets – The Travel Plan will set targets which will subsequently be monitored.	Targets will be set and then monitored. These targets should be realistic and achievable but once achieved should be regularly updated in order to strive for an increasingly sustainable transport situation.

Strategic Issues	Strategic elements
Local Road Access	
Access to the site – the strategy recognises the existing lack of vehicular access into the West Pond/South Quay area.	New access points will be provided off the existing Ffordd y Mileniwm and Earl Crescent.
Vehicular access through site – provision needs to be put in place to allow vehicles to use West Pond/South Quay as an alternative route to Barry Island.	A new link road will be provided through the site that will allow vehicles to access the facilities within the development as well as providing an alternative route to Barry Island.
Site access roads – the internal roads need to minimise vehicular conflict with pedestrians and cyclists.	The new link road will be bordered by footways, and dedicated crossings will be provided at strategic locations. Internal roads deviating off the main road will be designed according to the Manual for Streets to encourage access by walking or cycling. Crossings, both controlled and uncontrolled will aid permeability of the road and lessen severance effects of the link road.
External Road System	
Over capacity junctions - analysis has indicated that several key junctions are operating above capacity at peak periods and mitigation measures are required.	Mitigation measures have been designed and tested at a variety of junctions in the tested network. These junctions operate above capacity as a result of increased traffic resulting from the growth in base traffic, Waterfront Barry traffic or a combination of the two. The funding of mitigation will be the subject of discussion between the consortium and the Local Authority.
Public Transport	
Lack of direct bus services – there is no bus service directly serving the development sites	The 95 bus service that links Barry Island to Cardiff will be diverted to run through the site. Upon occupation of the more distant areas of South Quay a 'South Quay link' service will be provided.
Direct access to rail stations – access to rail stations from the development sites is not convenient.	The design of the Masterplan and proposal of external improvement works to the 'sustainable links' routes will improve the routes to the railway stations and improve the personal security and utility of these routes for all users. Access to Barry station will be improved by provision of internal routes and existing routes on Broad Street. Access to Barry Docks Station will be improved by routes through public spaces in East Quay and the provision of a Toucan crossing on Ffordd y Mileniwm. Completion of the spine road and remodelling of the gateway junctions at Barry Island will provide improved access to the Barry Island train station.
Walking and cycling	
External linkage – the development site must be integrated with existing external pedestrian and cycle facilities	Footways bordering the main road through the site will follow the connection onto the Ffordd y Mileniwm, linking up with the existing segregated

	footway/cycleway. The consortium propose a wide range of improvements along five identified 'sustainable links' to key destinations such as Barry Town centre, neighbouring residential areas and railway stations. The proposed measures include improvement works to underpasses, footway surfaces and facilities for cycle parking.
Internal infrastructure – the development sites should afford pedestrians and cyclists adequate facilities to safely navigate around the sites	The masterplan has been developed to ensure pedestrian permeability. Uncontrolled crossings are provided at convenient locations, and a street feel will be created by allowing pedestrians, cyclists and vehicles to move between different areas of the development.
Internal facilities – facilities must be provided that encourage walking and cycling within the site	Seating areas and public cycle parking facilities are provided at a number of locations within the development sites to facilitate walking and cycling within the site and create a vibrant development.

Table 14.2: Planned Transport Improvements in the area surrounding Waterfront Barry

Strategic Issues	Strategic elements
External Road system	
Over Capacity Junctions	The Vale of Glamorgan Council has planned improvements to the Waycock Cross and Merrie Harrier junctions.
Public Transport	
Bus Priority Measures	The improvements to the Merrie Harrier junction will include the provision of segregated bus lanes on the approach to the junction.
Walking and Cycling	
Barry Walking Infrastructure	It is envisaged that the findings of the recently completed walking strategy will be implemented to create an improved environment for walking trips in Barry.

14.3 Summary

The transportation impact of the proposed Waterfront Barry development has been assessed within this Report. The provision of appropriate transport access and the minimising of adverse impacts is a key element of the proposals, and where appropriate mitigation measures have been recommended as part of the assessment process.

Encouraging sustainable travel habits from the outset is an integral part of the scheme, exampled by the walking and cycling access provision, improved pedestrian access to the rail stations and the proposed bus service. However, it has also been necessary to ensure that the surrounding highway network can accommodate the inevitable additional traffic likely as a result of the waterfront development. Subsequent road improvement schemes are also suggested to minimise the impact of additional traffic on the efficiency of the road network.

Since the need for mitigation measures arises to a large extent as a result of significant base traffic growth by 2020 it is not appropriate for the consortium to propose mitigation in isolation.

The implementation of these measures, and where appropriate contributions towards them, will be the subject of negotiation with the Vale of Glamorgan Council.

The Waterfront Barry development is ideally situated to take advantage and enhance the sustainable transport infrastructure of Barry. It is anticipated that these high quality connections, particularly the railway stations, will be attractive to new residents and businesses and offer journey times to external destinations that can rival the private car. Internally it is anticipated that the layout and design of the development will encourage internal walking and cycling trips, particularly to local facilities.