Appendix A
Scoping Report,
Meeting Minutes, and
Transport Assessment
Review in Chronological Order


| Prepared by | John Smith |
| :--- | :--- |
| Date of circulation | 21 November 2007 |
| Date of next meeting | TBA |


| Job title | Job number | Date of Meeting |
| :--- | :--- | :--- |
| Waterfront, Barry | 122374 | 21 November 2007 |

1. Action
2. Arup explained that the original intention of the meeting was to determine the overall strategy of Transport Assessments on the entire project and to scope the Arno Quay proposal with a view of moving this development forward as quickly as possible. However, the consortium is now currently revisiting its strategy for development and it is possible that it may wish that other areas are developed first. VoG indicated that whilst accepting that the first development of around 200 units could, in principle, be considered in isolation, they would then want the transport impact for the remainder of the development to be looked at as a whole rather than a piece-meal approach. This would require an understanding of the development context and numbers, together with the proposed masterplan layout, particularly the link to Barry Island. A sphere of influence regarding the off-site highway network needs to be discussed and agreed. It was noted that the previous transportation work for Barry Waterfront is old and will need to be modified to take into account current flows. The VoG indicated that recent traffic data may be available for Five Miles Lane, the St Athan area and Dinas Powys. There is not a suitable traffic model currently available for the Barry area and it was recognised that any further roadside interview surveys that could commence now would not be available until the summer, too late for use on the current study.
3. Arup explored the possibility of the initial 200 unit development taking place away from Arno Quay e.g. East Quay or West Pond. VoG suggested that this may be possible although there was a planning condition to the previous consent which stated that no development should take place on West Pond until the link to Barry Island was implemented.
4. VoG indicated that whilst car traffic issues had been the main point of discussion, the public transport element is also key. There are currently capacity issues on the rail network north of Queen Street in Cardiff and at Cogan junction. The Queens Street issue is programmed to be resolved (by 2013), as is Cogan junction (due by 2010/11). Bus routes will need to be considered together with priority measures. No targets have been suggested for modal share.
5. It was noted that other schemes could have an impact on the traffic flows in the long term, e.g. Dinas Powys Bypass, Airport Access Road, but benefit from these schemes could not be taken into account in TA's prepared at this stage.
6. The strategy for taking forward the TA work was discussed. A working group should be established of around seven individuals consisting of members from VOG Highways and Planning (2-3 individuals), together with Arup Transport Planner and PM and a representative from the consortium and HMA.

Whilst work could be progressed on the off-site elements based on the overall development numbers, it was stressed that the proposed masterplan road layout is key to moving forward the on-site movement strategy.

| Job title | Job number | Date of Meeting |
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| Waterfront, Barry | 122374 | 21 November 2007 |

## Action

It was suggested that a meeting for the working group be arranged for 23 weeks time, which could tie-in with stakeholder meetings. VoG will advise who will attend from themselves. However, the masterplan road VoG layout/movement strategy will require the higher level agreement of Rob Quick, Rob Thomas and Miles Punter.

| Job title | Waterfront Barry | Job nı $1223$ |  |
| :---: | :---: | :---: | :---: |
| Meeting name \& number | TA Meeting 02 | File re |  |
|  |  | 6.30 |  |
| Location | VOG Offices, Barry | Time |  |
|  |  | 3 pm | 9 December 2007 |
| Purpose of meeting |  |  |  |
| Present | Rob Quick - VoG <br> Paul Gay - VoG <br> Vicky Abrahams - VOG <br> David Peake - WPM <br> Ron Das - HMA <br> John Smith - Arup | mas - |  |
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|  |  | $\text { nes }-\mathrm{H}$ |  |
|  |  | Wrigh |  |
|  |  |  |  |
| Apologies |  |  |  |
| Circulation |  | Those present |  |  |
|  | Phil Stokes - Persimmon John Penaluna - Barratt Stuart Watkins - Arup Nic Downs - HMA | lips Villia | Wimpey <br> LP |

John Smith
13 December 2007

TBA

| Job title | Job number | Date of Meeting |
| :--- | :--- | :--- |
| Waterfront, Barry | 122374 | 9 December 2007 |

1. Arup outlined the issues that they would like to discuss, summarised as
follows:-

- On-site Movement Strategy
- Off-site Highway Issues
- Initial Development Phase

2. Arup and HMA summarised the initial strategy for site movement for West Pond and East Quay. The strategy involved developing a 7.3m wide principal road which links the existing termination of Ffordd-yMileniwm (to the north-east of West Pond) to Paget Road (in the extreme south). The precise alignment of this road has yet to be decided, an indicative layout showing a possible alignment was presented. A secondary street network will distribute traffic to the remainder of West Pond and South Quay, tertiary roads will then link into these streets. The proposals are in line with the Manual for Streets, roads are to typically include longitudinal parking bays on each side of the road. The primary roads and specific secondary streets would be used as bus routes to facilitate public transport. The proximity of three train stations adjacent to the site offers a rare opportunity for rail public transport utilisation. In addition, the use of cycleways are being considered, the primary cycle routes may vary from the primary vehicular to utilise the dock edge and POS areas.

The VoG were encouraged by the intent for a primary route linking Ffordd y Mileniwm to Barry Island, however, the strategic objectives and alignment need to be discussed further in terms of location and proximity to commercial areas. Furthermore, the Manual for Streets principles and layout options need to be presented and discussed to ensure agreement with planners and highway engineers. It was suggested and agreed that a transportation workshop should be arranged to take this element forward, this should be scheduled early in the New Year.
3. Regarding the off-site network improvements, Arup have asked for any additional traffic data that the Vale of Glamorgan may have around Barry, VoG to respond. Arup previous studies had identified a need to assess Buttrills Road, Ty-Newydd Road, Wimborne Road and Palmerstown Junction. A copy of draft S106 requirements also suggested that Weycock Cross and Biglis Roundabout would also need to be examined. Arup outlined a sphere of influence extending to the A4226 to the north of Barry and the A4231 to the east. VoG suggested that the impact on the wider network should be considered, exploring what happens to traffic as it moves outside of Barry. It was agreed that Arup would produce a TA Scoping report for the development for VoG to consider. VoG pointed out that Arup had been working on other schemes in the general area, albeit for other clients.

Arup asked if there were nearby committed developments that would need to be considered, VoG indicated that the only two major developments in the area were at Penarth Heights and Rhoose, both some distance from the site.

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4. Arup and Persimmon explained that the 200 unit allocation discussed at the last meeting may stay at Arno Quay or be moved to East Quay, there were advantages and disadvantages with each option. It was also queried whether more than 200 units could be developed without the need to consider the wider network in its entirety. VoG suggested that it was possible that even 200 residential units would need consideration of the off-site network. The potential for a mixed use initial development was also explored, possibly a mixed hotel, commercial and smaller (50 unit) apartment development on Arno Quay. VoG indicated that such a development, in principle, may be taken forward in isolation as traffic flows will be mixed, with less effect on peak time journeys.

Barratt, Persimmon, Taylor Wimpey<br>Waterfront Barry<br>Transport Assessment Scoping Statement

Document ref 07/7360

# Barratt, Persimmon, Taylor Wimpey 

## Waterfront Barry

# Transport Assessment Scoping Statement 

January 2008

This report takes into account the particular instructions and requirements of our client.
It is not intended for and should not be relied upon by any third party and no


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## 1 Introduction

Arup has been appointed on behalf of a consortium comprising Barratt, Persimmon and Taylor Wimpey to provide traffic and transportation advice in support of a series of planning applications for mixed use development at the Waterfront Barry. It is envisaged that planning applications will be submitted for each of the three individual sites that will collectively form part of the comprehensive Barry Waterfront masterplan.

The masterplan is currently being prepared by Holder Mathias Architects and will be progressively informed by a series of workshops involving members of the project team and officers from Vale of Glamorgan Council (VoG).

This Scoping Statement relates to traffic and transportation issues and has been prepared following two meetings with VoG officers on $20^{\text {th }}$ November and $7^{\text {th }}$ December 2007.

The purpose of this Scoping Statement is to set out the development proposals and identify, in general terms, the assumptions and issues that will need to be addressed in detailed Transport Assessments.

## 2 The Sites

The three sites are shown in Figure 1. They collectively surround the Barry No. 1 Dock and lie to the north and west of the operational docks. Barry town centre is situated further to the north and Barry Island lies to the south.

The sites can be characterised individually as follows:

- Arno Quay, the smallest of the sites, is located within the north quay and is bounded to the north by Ffordd Y Mileniwm. Access is in the form of a cul-de-sac, Y Rhodfa, which links to Ffordd $Y$ Mileniwm via a roundabout.
- East Quay is positioned at the eastern end of the dock. It is served to the east via Cory Way, a road that connects to Ffordd Y Mileniwm via a roundabout.
- West Pond/South Quay forms the largest of the development sites and lies to the south and west of the dock. It is partially encircled by the local rail network and incorporates a swathe of land running along the northern extremity of Barry Island. Routes of access extend from the north via Powell Duffryn Way and the south via Earl Crescent.


## 3 Development Proposals

The masterplan encompassing all three of the sites is currently at a formative stage. It is anticipated that the mix of land uses apportioned to individual sites will be determined at a later stage, following further dialogue with VoG.

The masterplan is underpinned by the planning policy imperative to ensure that the various land uses are effectively integrated with transport infrastructure in creating sustainable patterns of development. This will be achieved through creating communities that can function as places where people can work, live and relax, thereby reducing any necessity for journeys across a wider area.

The approach taken in developing the masterplan is founded on giving maximum encouragement to walking and cycling within the layout of the developments. The inclusion of high quality pedestrian and cycle routes will play an important role in connecting the developments to their surroundings and taking full advantage of the close proximity of three local rail stations. As a result, access to public transport will be integral to the design process in how it will facilitate linkages to the rail stations and accommodate a number of bus routes.

## 4 Key Issues and Assumptions

Following a site inspection and discussions with VoG, a number of issues have been identified for more detailed consideration during the preparation of Transport Assessments. These are discussed below along with confirmation of the key assumptions.

### 4.1 Existing Traffic Data

Initial discussions have indicated that little traffic data is held by VoG on the surrounding network of roads. Previous studies undertaken by Arup on Barry Waterfront also date from several years ago and are unlikely to include data that could form an appropriate basis for assessment.

Confirmation is awaited from VoG on whether relevant traffic data can be obtained. There may be scope however, to draw upon other studies undertaken by Arup in and around Barry subject to copyright restrictions. VoG have also drawn attention to the work of the Welsh Assembly Government at Weycock Cross as a possible source of information.

Depending on the extent and quality of the traffic data currently available, it is likely to be necessary to undertake supplementary traffic surveys at selected junctions.

### 4.2 Committed Development

The VoG has advised that the following committed development should be accounted for within the analysis of traffic impact:

- Penarth Heights - proposed 377 residential units; and
- Land north of Rhoose - a UDP allocation for 600 residential units.


### 4.3 Planned Development

The intention is to construct new mixed use development that will maximise the potential of the site location in enabling journeys to be made by a range of transport modes.

The layout design will place an emphasis on the principles of 'Manual for Streets' in facilitating a choice of direct and attractive routes for pedestrians and cyclists that are aligned with key desire lines and take advantage of the attractiveness associated with a waterfront location. In particular, new and improved routes to the three nearby rail stations will be created to ensure that rail travel can assume a pivotal role in catering for travel across the wider sub-region. This will be supplemented by a road network that allows bus services to route through the site, with priority features included as appropriate.

With the exception of the primary linkage to Barry Island that would be incorporated within the West Pond element of the development, roads will be designed to achieve typical speeds of $20 \mathrm{~m} . \mathrm{p} . \mathrm{h}$. as part of creating a safe environment that prioritises the needs of pedestrians and cyclists. This will provide better scope for effective integration with the existing built-up areas and offer the levels of accessibility that are a necessary part of sustainable development.

### 4.4 Study Area

Discussions with VoG has highlighted how the scope of the analysis will need to extend to the wider network to account for travel to sub-regional destinations, such as Cardiff City Centre. Specific reference has been made by VoG to existing congestion on the following parts of the network:

- Sycamore Cross (1)
- Culverhouse Cross (2)
- Merry Harrier (3)
- Dinas Powys (4)

These locations have been illustrated in Figure 2 as junctions 1-4.
In order to identify the magnitude of cumulative traffic increases on the wider network, the Transport Assessment will include a quantification of traffic impact at each of these junctions.

Capacity assessments will not be undertaken at junctions 1-4 on account of the sustainability credentials of the development proposals, which will facilitate high quality accessibility to public transport services and include road layout designs that minimise vehicle speeds in favour of prioritising the needs of more vulnerable road users. This approach is intended to minimise any reliance on the private car for journeys and, accordingly, will dilute the level of traffic impact across the wider network.

The remainder of the junctions shown in Figure 2, numbered $5-14$, will all be subjected to capacity assessments to identify the local network implications of the additional development traffic. These include the junctions that connect Barry to the wider highway network, which are identified as junction $5-7$ in Figure 2:

- Biglis Roundabout (5)
- Port Road/Barry Docks Link Road (6)
- Weycock Cross (7)

The capacity assessments on these junctions will inform the conclusions that can be drawn on traffic impact across the wider network.

The remaining local junctions, numbered 8 - 14 in Figure 2, are internal to Barry and form the basis of the assessment of impact on the immediate network:

- Harbour Road/Station Approach (8)
- Harbour Road/St. Nicholas Road (9)
- Broad Street/Gladstone Road (10)
- Buttrills Road/Barry Road (11)
- Barry Road/Ty Newydd Road (12)
- Cardiff Road/Wimbourne Road (13)
- Palmerston Road/Cardiff Road (14)

It will also be necessary to assess individual development access points for each of the sites.

Discussions with VoG have confirmed that this scope of analysis will apply to development in excess of 200 residential units or alternative land uses with an equivalent level of traffic impact.

### 4.5 Trip Generation

On account of the mix of land uses that are envisaged for the developments, it is anticipated that trip generation will consist of the following:

- New trips;
- Pass-by trips;
- Linked trips;
- Diverted trips; and
- Transferred trips

In quantifying the breakdown between these various types of trips, it will be important to have full regard for the enhanced potential for journeys to be made by walking, cycling and public transport as part of the development proposals. Assumptions will need to be identified as part of ongoing discussions with VoG and reflect any refinements that are made to the content of the masterplan.

It is recognised that the element of new trips attributed to private vehicles will assume particular importance in the context of traffic impact on the surrounding highway network. These will be calculated through reference to comparable sites within the TRICS 2007(b) database to ensure a robust basis for analysis.

### 4.6 Trip Distribution/Assignment

The trip distribution pattern of development trips will consist of those trips that are undertaken internally within the site and those trips that are external to the site.

It is anticipated that the encouragement afforded to walking and cycling through the design of the development layouts will enable a high proportion of the internal trips to be made on foot or by cycle. The accessibility of public transport services will also have a significant bearing on external trips by reducing reliance on private vehicles. Modal split assumptions will therefore need to appropriately reflect these development characteristics.

The assignment of trips to specific routes will be important in assessing the impact of the private vehicle element of trip generation across the highway network. It is intended that this will be informed by an analysis of existing travel to work patterns in Barry drawn from the 2001 census ward data. Once the origins and destinations of travel to work journeys have been identified, it will be possible to assign trips across the network to reflect recent travel patterns. This exercise will enable conclusions to be drawn on the overall level of impact across the sub-regional highway network, as requested by VoG and reflected in the defined study area.

It will important for all assumptions and routing assignments to be agreed through discussion with VoG. This will also need to include a basis for assessing the level of existing trip transfer that could arise as a consequence of the new road linkage to Barry Island that would be achieved as part of the West Pond/South Quay development.

### 4.7 Scenario Testing

The Transport Assessment will assess the implications of the following scenarios on the highway network:

- Existing situation
- Existing situation + proposed development (opening year)
- Existing situation + proposed development (+ 15 years)


### 4.8 Highway Capacity Assessment

The basic assumptions are as follows:
Method of Capacity Assessment: ARCADY, PICADY and TRANSYT
Modelling Periods: Weekday AM/PM peak periods (08:00-09:00 and 17:00-18:00) and Saturday peak period (14:00-15:00)

Any capacity problems that might result from the development proposals will be identified and ways of mitigating the problems will be discussed.

### 4.9 Accessibility

The site offers considerable scope for travel by sustainable transport modes, being within convenient walking/cycle distance of Barry town centre, the Ffordd Y Mileniwm retail park
and three rail stations. The design of the development layout will also facilitate the diversion of local bus services through the site.

The Transport Assessment will consider the quality of the existing public transport, pedestrian and cycling services and facilities in the context of accessibility improvements that will be delivered as part of the development proposals.

### 4.10 Travel Plan

In addition to promoting public transport, walking and cycling an outline travel plan will be devised to both support these proposals and augment them with complementary initiatives.

## 5 Summary

The above points summarise the main assumptions and issues that will be addressed in the Transport Assessments. At this stage they should be regarded as part of a working document that will be refined in the light of further discussions with VoG.

It is expected that the Transport Assessments will be broadly based on the following structure:

- Introduction
- Background
- Policy Context
- Report Structure
- Existing Situation - Transport Evaluation
- Site Description
- Existing Conditions
- Proposed Development
- Proposed Access Arrangement
- Car Parking
- Trip Making
- Trip Generation
- Trip Distribution/Assignment
- Impact Assessment
- Junction Capacity
- Scenario Testing
- Results of Assessment
- Sustainable Transport
- Accessibility
- Travel Plan Framework
- Transport Implementation Strategy
- Conclusions/Recommendations

| Job title | Waterfront Barry | Job number <br> 122374 |
| :--- | :--- | :--- |
| Meeting name \& number | Highways Workshop | File reference |
|  |  | 9.30 |
| Location |  | Time \& date |
|  |  | 14.00 | 5 March 2008

Apologies

Circulation
Those present
Andrew Carey - Persimmon
Will Phillips - Taylor Wimpey
Nic Downs - HMA
Simon Brewster - Soltys Brewster

John Penaluna - Barratt<br>Gareth Williams - NLP<br>Ron Das - HMA<br>Chris Tuthill - Atkins

Job title Job number Date of Meeting
Waterfront Barry 122374 March 2008

1. The meeting took the form of an interactive workshop; the following is a summary of the issues discussed.
2. Arup summarised the development proposals consisting of mixed commercial of around $320,000 \mathrm{ft}^{2}$ and 2,000 residential units. The commercial elements will probably include a food store, hotel, offices, retail and possible leisure and other employment. The residential element will mostly be housing with some apartments. The site is divided up into Arno Quay, East Quay, West Pond and South Quay. The phasing of the development will probably involve West Pond, then South Pond, followed by Arno and East Quay. The initial development will include a connection through to Paget Road in the south west.
3. HMA summarised the masterplanning process to date, emphasising sustainability, permeability and connectivity of the development. The evolution of the masterplanning process was summarised including the key development nodes, constraints, connectivity, transport links and potential alignments for the main link and through to West Pond.
4. The layout and form of the link was discussed at length, VOG emphasised that it would act as a local distributor road for an improved connection to Barry Island. The road will be particularly important at peak tourist periods, VOG are intending to re-sign roads in the area to direct traffic to the island along that route. HMA and the consortium emphasised that they do not want a similar road the one formed along North Quay. VOG planning department concurred with this view. After much debate, the following was agreed in principle

- Road to generally follow the original horizontal alignment.
- Road to be designated and designed for 30mph.
- Road width to be 7.3 m .
- Additional width for parking bays installed all along the route, resulting in the total road width increasing to around 11.3 m or more to accommodate parallel bays.
- Junctions to be formed preferably with traffic signal crossroads in preference to large roundabouts.
- Pedestrian crossings to the emphasised, using traffic signal controls and or plateau ramps as appropriate.
- Number and location of junctions / intersections onto this route to be the subject of design development by the Consortium, taking into account relevant highways criteria.

5. The potential for changing the existing Hood Road/Ffordd-y-Mileniwm to a t-junction or crossroads was discussed; the VOG had no objection in principle. Such a proposal and the details for the new road further west would result in consistency of junction form along the route between Gladstone Road junction and Paget Road.
6. The proposals for Manual for Street design for the remainder of the development was discussed including a hierarchy of street types with the development, relatively narrow roads and parking bays along the streets. Such proposals are being implemented on other developments in South Wales and England. VOG suggested incorporating a narrower road along South Quay to slow traffic down. However, roads into the proposed marina and superstore areas would need to be wider to

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incorporate HGV movements.
7. The off-site transportation elements were also discussed. Arup have been collating information supplied/surveyed by VOG encompassing some 26 junctions in the area. Arup will be assessing the development impact on the junctions outlined in the scoping study, with the addition of Baron's Court. For the Baron's Court and Culverhouse Cross junctions, the assessment will take the form of reviewing the percentage increase in traffic levels. The remaining junctions, including Merrie Harrier, will be modelled using ARCADY, PICADY, or LINSIG as appropriate.

The TA input will also include public transport considerations including buses and trains together with cycling and pedestrian provision.
8. Arup would like to maintain technical dialogue with specialists from the Vale of Glamorgan. They intend producing a note during w/c $10^{\text {th }}$ March and would like a further meeting to discuss off-site related issues during $\mathrm{w} / \mathrm{c} 17^{\text {th }}$ March. It was also suggested that a further on-site and off-site highways related meeting be arranged in one month's time to discuss further the proposals for the roads around the development as the masterplan develops.


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that comparison should also be made with the study of sites undertaken for the Bay Pointe development at Cardiff International Sports Village. BB also stated that he has concerns over the overall resulting traffic generation, and that no allowance has been made for the 'Mole' area, which is outside the development boundary but would need to be accessed through the site, however the proposed development in this area is not yet fixed. It was felt that the range of trip rates should be considered as a sensitivity test.
More detail regarding the trip generation assumptions and comparisons with local sites to be supplied by Arup
4. Trip Distribution

The gravity model was discussed and it was agreed that use of TEMPRO data was appropriate, and that the model calibrates well against 2001 Census data. In order to ease comprehension, the number of zones should be reduced from 32 before traffic assignment is undertaken. It was agreed that 2020 would be a sensible future year for assessment, but that it would be most appropriate to undertake the initial impact assessment again current traffic levels. VoG to supply any recent information regarding the developments at Llanilid and St Athan to help develop the future year situation.

Traffic assignment should take into account the link capacity and nature of the routes.
5. Barry Island Traffic

Four previously considered options for the Barry Island junction were tabled by VoG (copies of these are to be provided to Arup). These
emphasised the importance of the through route to Barry Island, the Causeway becoming secondary. They also highlighted the issues around land ownership and space restrictions, especially considering footways and cycle provisions - CPO may be required.

The principles for reassigning Barry Island traffic outlined in the Technical Note were agreed, but it was felt that the assessment needed to include sensitivity tests to consider the situation on a busy summer evening with full use of the leisure facilities.
6. Junction Modelling/Existing Conditions

Junction capacity assessments have been carried out using existing flows for the majority of the junctions to be considered - a summary sheet was tabled. There is still some minor work outstanding on this but it should be completed shortly.

Site observations generally match the results, highlighting the key existing problem junctions of Merrie Harrier, Waycock Cross, and Palmerston Road, particularly in the AM Peak.

It was noted however that there are a number of improvements for these junctions which are at various stages of development.
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122374
9 April 2008

Merrie Harrier - Transport Grant money allocated for improvements this year including bus lane from Dinas Powys and improved signal control. Waycock Cross - Southern end of Five Mile Lane improvements and will be remodelled for the Development at St Athan - design underway. Palmerston Road - VoG have considered a new southern link

VoG to supply information on these junction improvements
It was agreed that the junction assessments would not be undertaken for Baron's Court, Culverhouse Cross and Sycamore Cross but level of traffic impact at these junctions will be assessed.

## 7. Other Travel Modes

Rail
The existing capacity issues on the Rail network were discussed.
Improvements are identified in the Sewta Rail Strategy, though it would be difficult to influence the programme of these improvements. The lack of spare capacity could influence the desired modal split.

## Bus

Opening the Battery Hill/Dock Road link to the south-east of the development site could improve the bus operation significantly. This is to be investigated further.

Walking/Cycling
A cycling route away from the main through highway link was preferred by VoG, but further discussions suggested with John Marks (VoG). Utility cycling to areas within Barry will be important to improve the modal share, along with improving linkages to Barry Island.

## 8. Next Meeting

It was agreed that the next meeting should be around early-mid May, dates to be agreed. Arup to provide further information regarding trip generation, development impact, and transport strategy one week before meeting to allow consideration by VoG.


## CAPITA SYMONDS

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Author

Issue Record

| Rev | Date | Description/Comments | Author/ Prepared by: | Approved for issue by: |
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## Appendices

Appendix A Additional Information

## 1 Introduction

1.1 In November 2009, Capita Symonds were appointed by the Vale of Glamorgan Council to undertake an audit of the Transport Assessment (TA) for Barry Waterfront. The Transport Assessment was produced by Arup on behalf of the development consortium comprising of Persimmon Homes, Taylor Wimpey and Barratt Homes.
1.2 During the audit Arup were contacted and further information requested. This is attached as Appendix A.
1.3 A chapter by chapter audit of the Transport Assessment is provided.

## 2 Chapter 1 Introduction

2.1 The introduction provides background information and describes the report structure. Following submission of a scoping report in January 2008, two Technical Workshops were held with Vale of Glamorgan Officers on the 5th March and 9th April 2008 during which agreement was reached on key assumptions and methodology. Following this, technical notes were submitted to the Vale of Glamorgan Council with data on trip rates and junction assessment. The Vale of Glamorgan Council provided comments on these and this audit includes how the comments have been addressed.

## 3 Chapter 2 Existing Site

3.1 The development site is split into four sites

- West Pond;
- South Quay;
- Arno Quay;
- East Quay
3.2 West Pond and South Quay are situated next to each other and are often treated as a single site within the Transport Assessment.
3.3 An accident assessment of the area is provided utilising accident data from 2002 to 2006. Accident locations have been plotted and information provided on accident type and severity for accidents within the study area. More recent data is now available and should be used.
3.4 TAN 18 refers to 'Guidelines for Traffic Impact Assessment' 1994 by The Institution of Highways \& Transportation, which states:
'consideration may also be given to the effect of the development traffic impact on the prevailing level of road accidents over a wider study area.'

An analysis of recent accident history has been provided but no analysis of the impact of the development is given nor proposed specific accident improvement proposals. This should be provided.

## 4 Chapter 3 Development History

4.1 Details of the history of the development site are provided including:

- Outline Planning application in 1994;
- Outline Planning Consent in 1997;
- Revised Proposals in 2001;
- Traffic Aspects Position Statement in 2003
4.2 Since outline planning consent, highway aspects of the development proposal have been completed including:
- Gladstone Road extension;
- Barry Marine Access Road (Ffordd y Mileniwm)
- Barry Waterfront spine road, which also forms part of the main collector road Ffordd y Mileniwm
4.3 The TA identifies that the spine road has become an attractive route for accessing the town centre. It was anticipated that there would be an even split between the spine road and existing route but has become apparent that more car users travel along the spine road.


## Chapter 4 Policy Context

5.1 The TA correctly identifies the following relevant national, regional and local policy documents.

## National Policy

- Planning Policy Wales (2002)
- Technical Advice Note 18 (2007)
- Wales Transport Strategy (2008)
- Wales Spatial Plan (2004)
- Manual for Streets (2007)
- A Walking and Cycling Action Plan for Wales 2009-2013


## Regional Policy

- Final Draft Regional Transport Plan (2008)
- SEWTA Rail Strategy Study (2006)
- SEWTA Bus Strategy Study (2006)
- Wales Route Utilisation Strategy, Network Rail (2008)
- Walking and Cycling Strategy for South East Wales (2006)
- 2001 Addendum to South Wales Parking Guidelines (1993)
- County Surveyors Society (CSS) Wales - Parking Standards (2008)


## Local Policy

- Local Development Plan
- Unitary Development Plan
- Local Transport Plan (2000)
- Barry Waterfront Development Principles (2009)
- Supplementary Planning Guidance
5.2 The Vale of Glamorgan UDP Supplementary Planning Guidance Planning Obligations is considered to be a relevant local policy document and should be specifically referred to.
$6 \quad$ Chapter 5 The Masterplan and the Transport Strategy
6.1 The land uses for each of the development areas and the Mole development is quantified. For The Mole, an assumption of 50 apartments, 44 houses, $4000 \mathrm{~m}^{2}$ of leisure facilities and a marina has been made.
6.2 It is envisaged that construction will be in a phased manner with completion in approximately 2020.
6.3 A Transport Strategy and Objectives for the development are outlined in accordance with relevant policy documents.

7 Chapter 6 Trip Making

## Introduction

7.1 Trip making is fundamental to the impact of the development site and a key element of a Transport Assessment.
7.2 The scoping report of January 2008 identified the intention to use TRICS and include for;

- new trips;
- pass-by trips;
- linked trips,
- diverted trips and
- Transferred trips.
7.3 In April 2008 a technical note was submitted that summarised the proposed trip generation assumptions. At the technical workshop of April 2008, the Vale of Glamorgan Council Officers expressed concerns over the overall trip generation rates and stated they were unable to provide further comments until further information was received. A scoping document update and reissue was requested. The technical note on trip generation was resubmitted in July 2008 and in October 2008 the Vale of Glamorgan Council prepared an Appraisal Report (by R W Bertram) on Arup's trip generation assumptions. Several issues were raised and Arup responded by summarising the issues raised and outlining how they intended to action each issue. This audit includes consideration of the Vale of Glamorgan Council's concerns and how they have been addressed in the Transport Assessment. The major concerns are summarised below:
- TRICS rates are average weekday, which will understate maximum weekday
- It is not agreed that the comparison undertaken of the TRICS multi-modal data is representative of the Waterfront Barry.
- It is not agreed that TRICS multi-modal trip rates compare well with the vehicle only surveys.
- 2008 base traffic networks are not agreed
- None of the traffic situations considered take into account Barry Island's trip generating capability.
- Several junctions are overcapacity


## Trip Generation

7.4 The following method has been adopted to calculate trip generation from the development sites

- Extract person trip rates from TRICS multi-modal surveys.
- Extract modal splits of vehicles, public transport, cycle and walking from TRICS.
- Calculate resulting trip rates by mode
- Compare the resulting vehicle trip rate with a vehicle trip rate direct from TRICS vehicle only surveys.
- Use the highest Vehicle trip rate.
7.5 Table 6.1 of the TA summarises the person trip rates for each land use by time period. They are extracted from TRICS and it is stated that they exclude sites significantly smaller than the proposed development, sites in Greater London and those in 'out of town' locations. The numbers in the table have been checked for accuracy and are consistent with those in TRICS.
7.6 The number of survey sites in the TRICS database is low for Multi-Modal surveys and this is acknowledged in the report. Average trip rates are used which implies that there is a $50 \%$ possibility that the average will be exceeded.
7.7 The modal splits based on TRICS, are correctly shown in Table 6.2 of the TA and are consistent with the TRICS data provided in Appendix $G$ of the TA.
7.8 The TA provides a comparison of the vehicle trip rates with some local sites. Table 7.1 below shows which local sites are used to compare each land use.

| Land Use | Site Comparison |
| :--- | :--- |
| Apartments | Bay Pointe Study, Ffordd Sealand, Y Rhodfa |
| Houses | Ffordd Sealand, Clos Tynaid Glo |
| Affordable Apartments | No comparison |
| Affordable Houses | No comparison |
| Food Store | Morrisons |
| Hotel | No comparison |
| Offices | No comparison |
| A1 Retail | Mixed Retail opposite Morrisons |
| A3 Retail | Mixed Retail opposite Morrisons |
| Leisure | No comparison |
| Primary School | No comparison |
| Petrol Filling Station | No comparison |
| Marina | No comparison |

Table 7.1 Trip Rate Comparisons
7.9 Apart from Bay Pointe, each site provides a comparison of an observed traffic count with the trip rates. Bay Pointe provides a comparison of trip rates used in a Bay Pointe study with the trip rates used in the Barry Waterfront TA.
7.10 Generally a reasonable correlation is achieved apart from the PM peak arrivals for Bay Pointe and Y Rhodfa where the Waterfront trip rate is lower by 34\% and 28\% respectively. These trip rates are summarised in Table 7.2 along with the number of trips generated from the 564 apartments proposed for the development site.

| Site | Apartments Trip Rate <br> (vehicles per 100 units) | No. of Trips <br> (564 Apartments) |
| :---: | :---: | :---: |
| Waterfront | 0.131 | 74 |
| Bay Pointe | 0.197 | 111 |
| Y Rhodfa | 0.182 | 103 |

Table 7.2 Apartment Vehicle Trip Rates
7.11 Trip generation rates are provided separately for the food store and petrol filling station. If these are added together and compared with observed traffic flows from Morrisons and its petrol filling station (PFS), significant differences occur. The differences are shown in Table 7.3

|  | AM |  | PM |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Arrive | Depart | Arrive | Depart |
| Morrisons (inc PFS) | 355 | 276 | 503 | 536 |
| Trip rates applied to a 5745m2 food store <br> and 8 pump PFS | 275 | 196 | 458 | 526 |
|  | Difference | 80 <br> $(23 \%)$ | 80 <br> $(29 \%)$ | 45 <br> $(9 \%)$ | | 10 |
| :---: |
| $(2 \%)$ |

Table 7.3 Food store and PFS trip rate comparison
7.12 The trip rates from multi-modal surveys are further compared against vehicle only surveys within TRICS and the highest used. For both the multi-modal and vehicle only trip rates, the number of sites used in the database is low The number of sites used and the number of sites in TRICS data base is shown in Table 7.3.

|  | Multi-modal Sites |  | Vehicle only sites |  |
| :---: | :---: | :---: | :---: | :---: |
|  | No. of sites used | No. of sites in database | No. of sites used | No. of sites in database |
| Apartments | 4 | 29 | 9 | 33 |
| Houses | 47 | 71 | 9 | 83 |
| Affordable Apartments | 11 | 21 | 5 | 31 |
| Affordable Houses | 7 | 8 | 4 | 11 |
| Food Store | 13 | 8 | 9 | 23 |
| Hotel | 13 | 27 | 16 | 46 |
| Offices | 27 | 45 | 11 | 49 |
| A1 Retail | 5 | 16 | 5 | 39 |
| A3 Retail | 9 | 16 | Not known | 54 |
| Leisure | 12 | 20 | Not known | 81 |
| Primary School | 2 | 4 | 6 | 39 |
| Petrol Filling Station | - | - | 3 | 36 |
| Marina | - | - | 2 | 46 |

Table 7.3 Multi-modal and Vehicle Only Trip Generation Sites.
7.13 Reduction to the trip rates have been made for the following reasons:

- Pass-by trips - a trip that is already present on the network adjacent the site and turns into the site.
- Linked trips - a trip that has multiply destinations within the development site. These trips are not assigned to the external network in the TA so the whole of the trip is within the development site. Not all linked trips will be internal so some should also be assigned to the external network
- Internal trips - a trip within a single origin and destination both within the development site.
7.14 For the food store and retail trip rates, a $30 \%$ reduction for pass-by trips has been applied based on findings from before-and-after studies. The proposed food store site isn't located particularly close to an existing road with a significant traffic flow, so pass-by trips are likely to be lower than average.
7.15 A linked trip reduction of $20 \%$ has been assumed for both the food store and retail based on studies into cross-visitation at co-located retail stores. Reducing each site by $20 \%$ effectively removes these trips from the network altogether. The purpose of a linked trip reduction, as stated in the TA, is to avoid double-counting of multiple destination trips. They still, however, need to be counted once. It is likely that this applies to all other land uses linked trip reductions.
7.16 The TRICS Research Report 95/2 concludes that "The proportion of trips generally accepted to be non-primary is $30 \%$ ". A non-primary trip is defined as a multi-purpose trip that calls into the development en-route and hence would include both pass-by trips and linked trips. For the food store and retail sites, the TA assumes $50 \%$ nonprimary trips, which does not provide a robust scenario.
7.17 The combination of these assumptions results in 58\% of West Pond and South Quay traffic travelling wholly within the development site. This is considered to be excessive.
7.18 For residential vehicle trips a further reduction of between $3 \%$ and $7 \%$ has been applied for modal shift towards public transport, which is deemed acceptable.
7.19 The resultant trip generation for vehicles, pedestrians, cycles and public transport is then calculated and have been checked for accuracy.
7.20 It is considered that the trip generation rates contain a number of assumptions that err towards the low side and that there is a significant possibility that trip generation rates will be higher than stated in the TA. Table 7.4 below summarises the potential underestimates in vehicle trip rates.

| Land Use | Potential Inaccuracy in Trip Rates |
| :--- | :--- |
| Apartments | Average generation rate used <br> Low number of multi-modal and vehicle only database sites <br> Poor correlation with Bay Pointe and Y Rhodfa sites |
| Houses | Average generation rate used <br> Low number of vehicle only database sites |
| Affordable <br> Apartments | Average generation rate used <br> Low number of multi-modal and vehicle only database sites <br> No comparison against existing sites |
| Affordable Houses | Average generation rate used <br> Low number of multi-modal and vehicle only database sites <br> No comparison against existing sites |
| Food Store | Average generation rate used <br> Low number of multi-modal and vehicle only database sites <br> Poor correlation with Morrison site when combined with petrol <br> filling station <br> Due to its location, the 30\% pass-by trips likely to be <br> overestimated <br> Linked trip assumption overestimated <br> Excessive number of non-primary trips |
| Hotel | Average generation rate used <br> Low number of multi-modal and vehicle only database sites <br> No comparison against existing sites <br> Linked trip assumption overestimated |
| Offices | Average generation rate used <br> Low number of vehicle only database sites <br> No comparison against existing sites |
| A1 Retail | Average generation rate used <br> Low number of multi-modal and vehicle only database sites <br> 30\% pass-by trips likely to be overestimated <br> Linked trip assumption overestimated |
| A3 Retail | Average generation rate used <br> Low number of multi-modal and vehicle only database sites <br> 30\% pass-by trips likely to be overestimated <br> Linked trip assumption overestimated |
| Leisure | Average generation rate used <br> Low number of vehicle only database sites <br> No comparison against existing sites <br> Linked trip assumption overestimated |
|  | Average generation rate used <br> Low number of vehicle only database sites <br> No comparison against existing sites |


| Land Use | Potential Inaccuracy in Trip Rates |
| :--- | :--- |
|  | Linked trip assumption overestimated |
| Petrol Filling Station | Average generation rate used <br> Low number of vehicle only database sites <br>  <br>  <br>  <br> No comparison against existing sites <br> Poor correlation with Morrison site when combined with food <br> store <br> Linked trip assumption overestimated |
| Marina | Average generation rate used <br> Low number of vehicle only database sites <br> No comparison against existing sites |

Table 7.4 Potential underestimates in vehicle trip generation

## Trip Distribution and Assignment

7.21 An external gravity model was developed to assess the distribution of development traffic across the external network. A technical note on its proposed development was prepared in March 2008 and discussed at a technical workshop in April 2008. The use of a gravity model is considered to be appropriate for the purpose of this assessment.
7.22 The model is a simple form of gravity model that uses distances, employment data and population data for journeys to Barry. It is split into 32 zones and calibrated against 2001 census data. The calibration process involved adjustments of population, employment and distance constants until an acceptable fit is achieved against the 2001 census data. The average deviation for journeys to Barry from each zone was +/- $0.9 \%$ with a maximum deviation of $+/-4.5 \%$. For journeys from Barry, the average deviation was +/- $1.1 \%$ with a maximum deviation of $5.3 \%$. Future year forecasts of population and employment using TEMPRO data and local major developments were produced and used in the gravity model to give a future year distribution forecast.
7.23 The resulting distribution is given in Table 6.10 of the TA. The calibration results and final trip distribution indicate a suitable distribution has been achieved.
7.24 The trip generation and distribution were then used to assign traffic along 10 routes shown in Figure 6.1 of the TA. Development traffic has been assigned to these routes based on journey times and route capacity. The resulting development flows are given in Figures 6.2 and 6.3 of the TA. These figures have been analysed to calculate the split of development traffic on routes in the area and are shown in Table 7.5 below.

|  | Barry Island / <br> Park Avenue | St Nicholas <br> Ave | Gladstone <br> Bridge | Ffordd y <br> Mileniwm |
| :--- | :---: | :---: | :---: | :---: |
| AM peak <br> (outbound) | $6 \%$ | $38 \%$ | $20 \%$ | $37 \%$ |
| PM peak <br> (inbound) | $5 \%$ | $38 \%$ | $19 \%$ | $37 \%$ |

Table 7.5 Development Traffic Distribution
7.25 The existing traffic has been redistributed due to the effects of the new highway link between Ffordd $Y$ Mileniwm and Barry Island. From analysis of the traffic flow diagrams it can be seen that the reassignments shown in Table 7.6 have been
applied. The traffic flows shown are for the existing situation and exclude development trips.


Table 7.6 New Highway link Reassignment - Existing Without development traffic
7.26 On a two way basis, in the AM peak 70\% of Harbour Rd trips reassign to the new link road. In the PM peak 50\% reassign.
7.27 A matrix estimation technique has been used to calculate traffic flows on the internal highway network. The development trip rates were used to derive flows on each side road. The matrix estimation technique then calculates individual turning movements.
7.28 Further information on the trip assignment has recently been received and is currently being checked.
$8 \quad$ Chapter 7 Highway Assessment
8.1 Four traffic flow scenarios have been considered:

- 2008 Existing Situation
- 2020 Base Situation
- 2020 Development Situation
- 2020 Development Situation with Barry Island peak tourism
8.2 TAN 18 refers to 'Transport Assessment and Implementation: A Guide' 2005 by the Scottish Executive which states:
'Design dates for appraisal should generally be for shortly after opening, within a year, especially for retail and employment uses, or on completion of the development in the cases where the development is large and phased over a long period of time (e.g. large residential developments).....Some developments and their infrastructure requirements will be of such significance that a longer term design date may be demanded.'

Chapter 5 'The Masterplan and The Transport Strategy' of the TA states that the phased construction should be completed 'by around 2020'. If completion is set at 2020, then its use as the design year is acceptable.
8.3 Junction capacity assessments of key junctions are undertaken to compare traffic conditions with and without the development.

## Existing Situation - 2008 Traffic Flows

8.4 Figures 7.3 and 7.4 of the TA show traffic flow diagrams of the existing AM and PM situations. These have been checked for consistency. Small discrepancies occur in many places due to a number of potential reasons such as counts being undertaken on different days. However, in the PM peak hour the westbound traffic flow on Harbour Rd west of Earl Crescent is 404. At the next junction on Harbour Road, The Parade, the flow reduces to 261. It would be expected that these two flows would be similar. The base counts were undertaken between 2003 and 2008. Earlier counts were growthed to 2008 using TEMPRO adjusted NRTF. This is deemed acceptable unless the Vale of Glamorgan Council are aware of any nearby significant developments

## Base Situation - 2020 Traffic Flows

8.5 The existing situation traffic flows have been factored by TEMPRO adjusted NRTF central growth to obtain 2020 levels. The factor used is similar to the latest National Transport Model (NTM) forecasts for Barry and is therefore acceptable.
8.6 No allowances have been made for specific development sites. It is assumed that the NRTF factor and adjustments to the gravity model account for developments in
the wider area. It is considered that this is an acceptable approach as there are no major committed developments that are likely to have an impact in the vicinity of the Waterfront unless the Vale of Glamorgan Council identify otherwise. Figures 7.5 and 7.6 of the TA show the resulting traffic flows.

## Development Situation - 2020 Traffic Flows

8.7 The development situation traffic flows were produced by applying the new highway link reassignment to the 2008 base traffic flows, factoring them to 2020 levels using TEMPRO adjusted NRTF and adding in development trips.

## Tourism Traffic Flows

8.8 Tourism traffic flows have been calculated by doubling traffic to and from Barry Island in the weekday PM peak period. The additional trips have been assigned to the network in equal proportions via Barons Court, Culverhouse Cross and Sycamore Cross. Figure 7.10 of the TA shows the resulting PM peak tourism flows with development trips added. No surveys during the tourist period have been provided to give confidence in the scale of factoring. However a comparison of previous surveys undertaken by Capita Symonds on the Barry Island causeway has been undertaken as part of the audit. The doubling of traffic to account for tourism is deemed acceptable

## Capacity Analysis

8.924 junctions have been identified for assessment in the scoping process and capacity analysis has been undertaken for each junction apart from Barons Court, Sycamore Cross and Culverhouse Cross. Percentage increases due to development traffic are provided for these junctions.
8.10 The geometry and traffic flows input to the capacity models have been checked and the following discrepancies are noted:
8.11 3 Merrie Harrier Junction

Phase D does not have an intergreen with phase B
8.12 4 Dinas Powys - Murch Crossroads Different staging and phasing have been used for the AM and PM peak periods.
8.13 5 Biglis Roundabout

Arm A approach half width is input as 5.83 m . A value of 3.65 m is more realistic.
8.14 10 Broad St / Gladstone Rd

Arm C approach half width is input as 6.63 m . A value of 3.65 m is more realistic.
8.15 13 Gladstone Rd / Cardiff Rd / Ffordd y Mileniwm

Arm A approach half width is input as 3.94 m . A value of 3.65 m is more realistic.
Arm A entry width is input as 7.63 m . A value of 7.3 m is more realistic.
8.16 14 Palmerstone Rd / Cardiff Rd

The saturation flows for left and right turning links are high and the same as straight ahead movements.

### 8.17 17 Cory Way / Ffordd y Mileniwm

Arm A entry width is input as 6.26 m . A value of 4 m is more realistic.
Arm B entry width is input as 6.08 m . A value of 5.4 m is more realistic.
8.18 23 Hood Road / Broad St /Island Rd

The intergreen times for pedestrian phase $G$ ending to opposing traffic phases starting vary. The intergreen should be the same for each phase. The same applies to pedestrian phases H and I .
The all red traffic pedestrian stage runs every other cycle. No evidence is provided to support this.
The predicted queues on link 4/1, in all scenarios, will block traffic entering link 4/2 increasing predicted queues and delays.

## Capacity Analysis Results

8.19 Capacity at junctions has been classified from 1-4 based on the Ratio of Flow to Capacity (RFC) as shown in Table 8.1.

|  | 1 Within <br> Capacity | 2 Approaching <br> Practical <br> Capacity | 3 Over Practical <br> Capacity, Approaching <br> Theoretical Capacity | 4 Over <br> Theoretical <br> capacity |
| :--- | :---: | :---: | :---: | :---: |
| Priority <br> Junction | $<0.75$ | $>0.75<0.85$ | $>0.85<1$ | $>1$ |
| Signal <br> Junction | $<0.8$ | $>0.8<0.9$ | $>0.9<1$ | $>1$ |

Table 8.1 Junction Capacity Classification
8.20 A summary of the junction capacities for 2020 with and without the waterfront development is shown below in Table 8.2. RFCs are based on the maximum of any arm in either peak hour.

|  | Junction | Without <br> Dev. | With Dev. | With Dev <br>  <br> Tourism |
| :---: | :--- | :---: | :---: | :---: |
| 3 | Merrie Harrier Signals Junction | 4 | 4 | 4 |
| 4 | Murch Crossroads | 3 | 4 | 4 |
| 5 | Biglis Roundabout | 4 | 4 | 4 |
| 6 | Port Road / Barry Docks Link Road <br> Roundabout | 3 | 4 | 4 |
| 7 | Waycross Cross Roundabout | 4 | 4 | 4 |
| 8 | Harbour Rd / Station Approach / Paget Rd <br> Roundabout | 1 | 1 | 1 |
|  | Harbour Rd / Earl Crescent Priority | 1 | 3 | 4 |


|  | Junction | Without Dev. | With Dev. | $\begin{gathered} \hline \text { With Dev } \\ \& \\ \text { Tourism } \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: |
| 9 | Harbour Rd / Nicholas Rd (Ship Gyratory) Priority | 1 | 1 | 1 |
|  | Harbour Rd / Broad St (Ship Gyratory) Priority | 1 | 1 | 1 |
|  | The Parade / Harbour Road Mini Roundabout | 1 | 1 | 1 |
| 10 | Gladstone Bridge Roundabout | 1 | 1 | 1 |
|  | Dock View Road Gyratory | 4 | 4 | 4 |
| 11 | Buttrills Rd/ Barry Rd / Staggered Junction | 2 | 2 | 2 |
| 12 | Barry Rd / Ty Newydd Rd / Cemetery Rd Roundabout | 1 | 1 | 1 |
| 13 | Gladstone Rd / Cardiff Rd / Ffordd y Mileniwm | 2 | 3 | 4 |
| 14 | Palmerstone Rd / Cardiff Rd Signals | 4 | 4 | 4 |
| 15 | Vere St / Cardiff Rd / Gladstone Rd Mini Roundabout | 3 | 3 | 3 |
|  | Cardiff Rd / Holton Rd / Gladstone Rd Priority Junction | 1 | 1 | 1 |
| 16 | Wimbourne Rd / Ffordd y Mileniwm Priority Junction | 1 | 4 | 4 |
| 17 | Cory Way / Ffordd y Mileniwm Roundabout | 2 | 4 | 4 |
| 18 | Subway Rd / Ffordd y Mileniwm Priority Junction | 1 | 1 | 1 |
| 19 | Y Rhodfa / Ffordd y Mileniwm / Clos Tynaid Glo Roundabout | 2 | 4 | 4 |
| 20 | Retail / Morrisons / Ffordd y Mileniwm Roundabout | 2 | 4 | 4 |
| 21 | Gladstone Bridge / Ffordd y Mileniwm Roundabout | 2 | 4 | 4 |
| 22 | Plymouth Rd/Earl Crescent Roundabout | 1 | 1 | 1 |
| 23 | Broad St / Hood Rd Signals | 4 | 2 | 2 |

Table 8.2 Summary of Junction Capacity in 2020 with and without development
8.21 Table 8.2 shows that nine junctions experience a reduction in capacity due to the development and one junction gains an increase. This suggests that the new
highway link between Ffordd y Mileniwm and Barry Island alone does not offer significant benefits to existing traffic.
8.22 It is difficult to draw any conclusions from the 'tourism and development' scenario. It is difficult to assess the impact of the development without a 'tourism without development' scenario which is required.

## Mitigation Measures

8.23 The Barry Waterfront Development Principles document (2009) states that an outline planning application would need to be accompanied by a detailed Transport Assessment covering necessary improvements to the transport infrastructure required as a result of the development. Details of possible mitigation measures are provided and assessed in the TA. With regards to the mitigation measures the TA also states "However, it should be noted that this is not a commitment by the consortium to provide them on the basis that many of the junctions will experience congestion problems without the development in place in 2020." There is clearly a need to provide off site works and a commitment should be given.
8.24 Table 8.3 identifies which junctions have improvements identified in the TA along with the capacity classifications shown in Table 8.2.

|  | Junction | Without <br> Dev. | With Dev. | With Dev <br>  <br> Tourism | Improvement <br> Identified |
| :--- | :--- | :---: | :---: | :---: | :---: |
| 3 | Merrie Harrier Signals Junction | 4 | 4 | 4 |  |
| 4 | Murch Crossroads | 3 | 4 | 4 |  |
| 5 | Biglis Roundabout | 4 | 4 | 4 | Yes |
| 6 | Port Road / Barry Docks Link Road <br> Roundabout | 3 | 4 | 4 | Yes |
| 7 | Waycross Cross Roundabout | 4 | 4 | 4 |  |
| 8 | Harbour Rd / Station Approach / Paget <br> Rd Roundabout | 1 | 1 | 1 |  |
| Harbour Rd / Earl Crescent Priority | 1 | 3 | 4 |  |  |
| 5 | Harbour Rd / Nicholas Rd (Ship <br> Gyratory) Priority | 1 | 1 | 1 |  |
| Harbour Rd / Broad St (Ship Gyratory) <br> Priority | 1 | 1 | 1 |  |  |
| The Parade / Harbour Road Mini <br> Roundabout | 1 | 1 | 1 |  |  |
| 10 | Gladstone Bridge Roundabout | 1 | 1 | 1 |  |


|  | Junction | Without Dev. | With Dev. | With Dev <br> \& Tourism | Improvement Identified |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Dock View Road Gyratory | 4 | 4 | 4 |  |
| 11 | Buttrills Rd / Barry Rd / Staggered Junction | 2 | 2 | 2 |  |
| 12 | Barry Rd / Ty Newydd Rd / Cemetery Rd Roundabout | 1 | 1 | 1 |  |
| 13 | Gladstone Rd / Cardiff Rd / Ffordd y Mileniwm | 2 | 3 | 4 | Yes |
| 14 | Palmerstone Rd / Cardiff Rd Signals | 4 | 4 | 4 | Yes |
| 15 | Vere St / Cardiff Rd / Gladstone Rd Mini Roundabout | 3 | 3 | 3 |  |
|  | Cardiff Rd / Holton Rd / Gladstone Rd Priority Junction | 1 | 1 | 1 |  |
| 16 | Wimbourne Rd / Ffordd y Mileniwm Priority Junction | 1 | 4 | 4 | Yes |
| 17 | Cory Way / Ffordd y Mileniwm Roundabout | 2 | 4 | 4 | Yes |
| 18 | Subway Rd / Ffordd y Mileniwm Priority Junction | 1 | 1 | 1 |  |
| 19 | Y Rhodfa / Ffordd y Mileniwm / Clos Tynaid Glo Roundabout | 2 | 4 | 4 | Yes |
| 20 | Retail / Morrisons / Ffordd y Mileniwm Roundabout | 2 | 4 | 4 | Yes |
| 21 | Gladstone Bridge / Ffordd y Mileniwm Roundabout | 2 | 4 | 4 | Yes |
| 22 | Plymouth Rd / Earl Crescent Roundabout | 1 | 1 | 1 |  |
| 23 | Broad St / Hood Rd Signals | 4 | 2 | 2 |  |

Table 8.3 Junctions with Possible Improvements
8.25 Merrie Harrier and Waycock Cross already have improvements programmed but no assessments of these improvements are provided. Traffic flows from the proposed Defence Technical College and Aerospace Business Park at St Athan, should be taken into account at the latter junction. Table 8.3 shows that of the other junctions that are over capacity with the development, improvements are provided. There are three exceptions however, Murch Crossroads, which gets more congested with development traffic but has no proposed improvement. Dock View Rd gyratory and Vere St / Cardiff Rd / Gladstone Rd Mini Roundabout are over capacity both with and without the development.
8.26 Mitigation measures are provided for the following junctions:
8.27 5. Biglis Roundabout Figure 7.11

Consideration is given to replacing the roundabout with a signal controlled junction and a capacity assessment has been undertaken. The analysis shows however that the junction will remain over capacity both with and without the development
8.28 6 Port Rd / Barry Docks Roundabout Figure 7.12

The TA provides a remodelled existing roundabout with the provision of dedicated left turn lanes to all three arms of the roundabout. However, there are insufficient exit merge lengths shown on the diagram.
8.29 8 Harbour Rd / Station Approach / Paget Rd Figure 7.13

A drawing showing the replacement of the existing priority and roundabout junctions with signal controlled junctions is provided. The following comments are made.

- The road markings shown on Figure 7.13 on Paget Road (south) approach at Harbour Road/Station Approach Road do not match the turning movements on links $6 / 1$ and $6 / 2$ in the LINSIG analysis. The drawing shows inside lane left turn only, outside lane straight ahead and right turn. The links in LINSIG indicate inside lane left turn and straight ahead and outside lane right turn.
- There are pedestrian crossing facilities shown on Figure 7.13 on the Station Approach Road/Harbour Road/Paget Road junction. No pedestrian crossing facilities at this junction have been included in the LINSIG analysis of this junction.
- The staging arrangement for Paget Road/Plymouth Road junction does not match the LINSIG analysis. No pedestrian stage is shown on the drawing.
- The saturation flows within the LINSIG analysis for left and right turning links are excessive. It would be expected the saturation flows for links which solely have left or right turning traffic would be around 1600, irrespective of saturation flow calculated from geometry.
- The Paget Road (south) approach to the Paget Road/Plymouth Road junction indicates right turning traffic turn right by giving way to opposing traffic. The right turn information indicates there is enough room to store 2 right turning vehicles without blocking other traffic on this approach. The geometry on the drawing indicates 1 right turning vehicle would block other traffic on this approach. The LINSIG analysis should be re-run with any right turning vehicle blocking other traffic on this approach.
- The LINSIG analysis indicates this junction is overcapacity in 2020 with the development and tourism. The queues will be longer than indicated as traffic will be prevented from entering the correct lane due to the queue of traffic in an adjacent lane.
8.30 13 Gladstone Rd / Cardiff Rd / Ffordd y Mileniwm Figure 7.14

Figure 7.14 of the TA shows a remodelling of the existing roundabout with a dedicated straight ahead lane for westbound traffic. The following comments are made:

- Arm A approach half width is input as 3.94 m . A value of 3.65 m is more realistic.
- Arm A entry width is input as 7.63 m . A value of 7.3 m is more realistic.


### 8.31 14 Palmerstone Road / Cardiff Rd Figure 7.15

Figure 7.15 of the TA shows a remodelling of the existing signal controlled junction with additional through lanes provided. The following comments are made:

- The staging diagram shown on the drawing does not match the layout or LINSIG.
- There is a left turn arrow in the inside lane of link $1 / 1$ but nowhere to turn left.
- The saturation flows for left and right turning links are high and the same as straight ahead movements.
- It will be very difficult for traffic to enter Dow Corning across three lanes of stationary traffic.
- The capacity analysis shows the junction to remain over capacity both with and without the development.
8.32 16 Wimbourne Rd / Ffordd y Mileniwm Figure 7.16

Figure 7.16 shows a replacement of the existing priority junction with a roundabout.
8.33 17 Cory Way / Ffordd y Mileniwm Figure 7.17

Figure 7.17 shows a remodelling of the existing roundabout with the north eastern arm realigned. The following comments are made

- Arm A entry width is input as 6.26 m . A value of 4 m is more realistic.
- Arm B entry width is input as 6.08 m . A value of 5.4 m is more realistic.
8.34 19 Y Rhodfa / Ffordd y Mileniwm Figure 7.18

Figure 7.18 shows a slight realignment of the eastern arm. The entry width increases by approximately 1 m and increases the flare length. The capacity analysis shows a reduction of 45 vehicles in the PM with development scenario due to the realignment. It is difficult to envisage that this minor improvement will reduce queuing to such an extent. The major traffic movement is straight ahead which has a single lane exit so the additional entry width will not be able to be utilised.
8.35 20 Retail / Morrisons / Ffordd y Mileniwm Figure 7.19.

Figure 7.19 shows slight realignments of the western and eastern arms. There are small increases to the entry widths and flare lengths. The capacity analysis shows a reduction of 27 vehicles in the PM with development scenario due to the realignment. It is difficult to envisage that this minor improvement will reduce queuing to such an extent. The major traffic movement is straight ahead which has a single lane exit so the additional entry width will not be able to be utilised.
8.36 21 Gladstone Bridge / Ffordd y Mileniwm Figure 7.20 Figure 7.20 shows slight realignments of all arms. There are small increases to the entry widths and flare lengths. The capacity analysis shows a reduction of 94 vehicles in the PM with development scenario due to the realignment. It is difficult to envisage that this minor improvement will reduce queuing to such an extent. The exit widths would prevent the utilisation of increased entry width.

## Internal Junctions

8.37 The proposed internal junctions of the development have been assessed for capacity and the following comments are made:

Internal South Quay Junction. Figure 7.7

- The saturation flows for left and right turning links are high and the same as straight ahead movements.
- The staging used in the LINSIG analysis is incorrect. In stage 1 the right turns are giving way to the opposing traffic, indicating the right turns either give way or are controlled by indicative arrows. The second stage has fully signalled right turns. Either the right turns are give way, controlled by indicative arrows or are fully signalled. They cannot be controlled by a mixture of all three.
- In the 2020 AM Peak Period the queue on $1 / 1$ is 10 vehicles (approximately 60 metres). This lane measures 35 metres, therefore traffic entering the adjacent lane to this link will be blocked by this queue of traffic, increasing the queues and delays predicted by LINSIG. In the 2020 PM peak period, the queue on link $1 / 1$ is 20 vehicles (approximately 120 metres) and the queue on link $3 / 1$ is 9.8 vehicles (approximately 60 metres). Again this will prevent traffic entering adjacent lanes, increasing the queues and delays predicted by LINSIG.
8.39 Central West Pond Junction Figure 7.7
- The LINSIG analysis indicates pedestrian crossings at this junction. However, no pedestrian crossings are being run within the LINSIG analysis.
- The staging used in the LINSIG analysis is incorrect. In stage 1 the right turns are giving way to the opposing traffic, indicating the right turns either give way or are controlled by indicative arrows. The second stage has fully signalled right turns. Either the right turns are give way, controlled by indicative arrows or are fully signalled. They cannot be controlled by a mixture of all three.
- In the 2020 AM Peak Period the queue on $3 / 1$ is 10.8 vehicles (approximately 66 metres) this lane measures 50 metres, therefore traffic entering the right turn lane will be blocked by this queue of traffic, increasing the queues and delays predicted by LINSIG. In the 2020 PM Peak Period queue on link $1 / 1$ is 20.9 vehicles (approximately 126 metres). This link measures approximately 50 metres. Again this will prevent traffic entering the adjacent right turn lane, increasing the queues and delays predicted by LINSIG.
8.40 Internal Northern Junction Figure 7.7
- The LINSIG analysis does not run pedestrian phase J
- The staging used in the LINSIG analysis is incorrect. In stage 1 the right turns are giving way to the opposing traffic, indicating the right turns either give way or are controlled by indicative arrows. The second stage has fully signalled right turns. Either the right turns are give way, controlled by indicative arrows or are fully signalled. They cannot be controlled by a mixture of all three.
- In the 2020 AM Peak Period the queue on $2 / 1$ is 8.3 vehicles (approximately 50 metres) this lane measures 40 metres and the queue on link $4 / 1$ is 16.4 (approximately 100 metres), therefore traffic entering adjacent lanes to these links will be blocked by this queue of traffic, increasing the queues and delays predicted by LINSIG. In the 2020 PM Peak Period queue on link $2 / 1$ is 22.4 vehicles (approximately 135 metres) and the queue on link $4 / 1$ is 16.3 vehicles (approximately 100 metres). Again, this will prevent traffic entering adjacent lanes, increasing the queues and delays predicted by LINSIG.


## $9 \quad$ Chapter 8 Parking Assessment

9.1 The parking assessment compares the number of parking spaces for both cars and cycles with appropriate regional parking standards.
9.2 A description of the existing situation is provided with levels of car parking provision being classed as generous and levels of cycle parking provision being classed as low.
9.3 Two parking standards are considered, the South Wales Parking Guidelines 1993 and the 2008 CSS Wales Parking Standards. The 2001 Addendum to the South Wales Parking Guidelines is used for non residential land uses.
9.4 The Supplementary Planning Guidance Barry Development Guidelines provides some car parking guidelines and states "These guidelines should be read in conjunction with the Parking Guidelines published by the Standing Conference on Regional Policy in Wales." The TA, however, anticipates that the Council may adopt CSS standards in the near future.
9.5 A residential car parking comparison of the two standards against the proposed number of spaces is given in Table 8.1 of the TA. This shows that in all cases the proposed number of spaces fall below both the South Wales and CSS guidance. The maximum number of parking spaces set in the standards is 3,055 spaces. In total, 2,694 spaces are proposed. This is a matter for consideration by the Planning Authority.
9.6 A commercial car parking comparison of the two standards against the proposed number of spaces is given in Table 8.2 of the TA. This shows that the number of spaces for the supermarket falls between the two standards. Plot H office sites have a number of spaces equal to the lower CSS standards. All other sites are below the two standards.
9.7 Three standards have been identified for residential cycle parking provision. These are the Code for Sustainable Homes, the Vale of Glamorgan Unitary Development Plan and CSS Wales Parking Standards. The TA states that there is currently no confirmed cycle parking schedule for the development and the provision will be guided by a combination of these standards in order to provide a suitable level of parking. It is considered that the Code for Sustainable Homes Level 3 would be the appropriate standard for this development. A similar position is adopted for commercial cycle parking provision. Consultation with the Vale of Glamorgan Council's Cycling Officer is required to ensure that sufficient provision, in locations to encourage cycling, is provided. It is felt that the UDP standard for commercial cycle parking would be the most appropriate in this case.

## 10 Chapter 9 Rail Assessment

10.1 A general description of the existing rail network infrastructure is provided along with summaries of rail frequency at the three Barry Railway Stations. Sufficient spare capacity in passenger accumulation at stations towards Cardiff is also shown. However, the proposed Defence Technical College and Aerospace Business Park at St Athan have not been taken into account.
10.2 Future Plans and Initiatives are outlined based on SEWTA 2009-2018 Rail Strategy Study. Improvements to Barry Station are part of a five year improvement plan which includes an enhancement of the park and ride facility.
10.3 The development proposals centre on improving pedestrian links to the rail stations. The TA states "The consortium will enter into dialogue with the Vale of Glamorgan Council, as landowner, to progress the provision of a cycleway/footway link across the existing railway sidings situated south of the Powell Duffryn Way / Hood Road junction." The impact of not being able to provide this crossing should be discussed. Improvements to the gateway junctions and adjacent footways are also cited as improving pedestrian links.
10.4 It is considered that this is a reasonable approach.

## 11 Chapter 10 Bus Assessment

11.1 The existing bus services and frequencies in Barry are identified and shown in Table 10.1 and Figure 10.1 of the TA.
11.2 The development proposals include the provision of strategic high quality stops within the development that limit bus stop access times to within 5 minutes. Talks have been held with Cardiff Bus indicating that it would be desirable to divert bus route 95 through the site providing a 15 minute weekday service for the development.
11.3 The assessment does not cover the effect that diverting bus routes will have on existing routes. It is also possible that subsides may be required to facilitate evening services. The impact on existing and proposed subsides should be assessed.

## 12 Chapter 11 Walking and Cycling Assessment

12.1 A description of the existing pedestrian and cycle facilities is provided. It is noted that the site is segregated from the town centre and Barry Train Station by the railway line and the crossing points are identified. Isochrones are produced indicating that the site is within 15 minutes walk time of the main shopping areas and transport interchanges.

## Walking

12.2 The development proposals include footways on both sides of new highways and dedicated at-grade crossings at proposed signal junctions. The development sites will be connected by a network of footways and pedestrian shortcuts provided between dead end streets. Connections will be made with existing pedestrian links
around the waterfront area. A connection over the disused railway to the north of West Pond will be explored in partnership with the Council.
12.3 The TA recognises the importance of providing good links to existing pedestrian facilities. Some of the existing facilities are not of a high standard, such as the rail crossings to the north of the site and the steps to Barry Island at the southern end of the site. Consideration could be given to enhancement of these facilities.

## Cycling

12.4 A waterside route along No. 1 Dock is proposed in combination with the internal street design of the development. This will link into the dedicated cycleway along Ffordd y Mileniwm. The TA states that "Cyclists would also benefit from the at-grade crossing of the disused rail line providing a more direct route to Barry Station" The rail line north of West pond is a live rail line and an at-grade crossing would not be acceptable. Improvements to links into Hood Road should be considered.
12.5 It is felt that links into Hood Road and Barry Island should be further enhanced to provide improved connections with the existing network. Off site works such as secure storage at rail stations would also offer significant benefits to the development site and should be considered.

## 13 Chapter 12 Other Travel Considerations

## Deliveries and Servicing

13.1 The TA identifies the need to incorporate key routes through the development, designed to accommodate large service and refuse vehicles. At present there has been no swept path analysis undertaken for the highway proposals. Changes to the highway layout could have a significant impact on other analyses undertaken such as capacity analysis. It needs to be demonstrated that the proposed highway network and junction improvements can accommodate large vehicles.

## Construction Traffic

13.2 The TA proposes that a Construction Management Plan will need to be developed and adopted. Details of this need to be provided and agreed.

## 14 Chapter 13 Outline Travel Plan

14.1 The following measures are proposed for implementation upon occupation of the first phase of development.

- To appoint 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 Travel Plan Coordinators to develop Personalised Journey Planning for residents and employees; and
- produce a travel information package detailing public transport and cycle / pedestrian links to and from the site and ensure all residents and workers receive a copy. Booklets could be made available to the public via libraries, exhibition centres and community centres.
14.2 The definition of a Travel Plan is clearly set out and the potential benefits listed in a straightforward way. These include increased social interaction, improved health, reduced costs, increased accessibility and reduced congestion.
14.3 As an outline plan, the document sets overarching objectives which include minimising the environmental impact of travel, improving transport choices, providing safe routes to school and managing site deliveries to avoid pedestrian conflict. The document sets out possible initiatives for car sharing, walking, cycling, public transport and residential initiatives to be provided by the developer.
14.4 No quantitive targets have been set in the outline plan. As multi-modal split forecasts are available for the development, multi-modal targets should be identified at this stage. A firm commitment to produce a Travel Plan on occupation of the first phase of development should also be given.


## 15 Summary

15.1 The following summarises potential flaws or omissions from the Transport Assessment.
15.2 The accident assessment does not assess the impact of the development site. More recent accident data is available and should be used.
15.3 A number of optimistic assumptions result in low trip generation rates.

- The number of TRICS sites used is low
- Average TRICS rates have been used
- There are some poor correlations when comparing generation rates with existing sites
- Some land uses have not been compared with existing sites
- Non primary trips, pass by trips and linked trips are overestimated
15.4 There are some discrepancies between traffic flows on the traffic flow diagrams.
15.5 There is no assessment of a tourism only scenario to compare the tourism with development scenario against.
15.6 There are a number of technical comments on the capacity models.
15.7 There is no commitment to provide any mitigation measures. There is clearly a need to provide off site works and a commitment should be given.
15.8 The impact of not providing a rail crossing north of West Pond should be assessed.
15.9 The assessment does not cover the effect that diverting bus routes will have on existing routes. It is also possible that subsides may be required to facilitate evening services. The impact on existing and proposed subsides should be assessed.
15.10 The TA recognises the importance of providing good links to existing pedestrian facilities. Some of the existing facilities are not of a high standard, such as the rail crossings to the north of the site and the steps to Barry Island at the southern end of the site. Consideration could be given to enhancement of these facilities.
15.11 It is felt that cycle links into Hood Road and Barry Island should be further enhanced to provide improved connections with the existing network. Off site works such as secure storage at rail stations would also offer significant benefits to the development site and should be considered.
15.12 The TA proposes that a Construction Management Plan will need to be developed and adopted. Details of this need to be provided and agreed.
15.13 No analysis of large vehicles has been undertaken.
15.14 Multi-modal targets should be quantified in the Outline Travel Plan. A firm commitment to produce a Travel Plan on occupation of the first phase of development should also be given.
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| Project title | Barry Waterfront | $\begin{aligned} & \text { Job number } \\ & 122374-00 \end{aligned}$ |
| :---: | :---: | :---: |
| Meeting name \& number | Transport Assessment | File reference |
|  |  | 9-10 |
| Location | Vale of Glamorgan Council Docks Office, Barry | Time \& date |
|  |  | 093026 February 2010 |
| Purpose of meeting | To discuss matters arising following submission of | f Transport Assessment |
| Present | Yvonne Pritchard (Vale of Glamorgan Council) |  |
|  | Vicky Abraham (Vale of Glamorgan Council) |  |
|  | Tom Bevan (Vale of Glamorgan Council) |  |
|  | Tony Hodge (Vale of Glamorgan Council) |  |
|  | Richard Keogh (Persimmon Homes) |  |
|  | David Thomas (Taylor Wimpey) |  |
|  | Andy Cockett (Nathaniel Litchfield and Partners) |  |
|  | Jonathan Kinghorn (Arup) |  |
|  | John Smith (Arup) |  |
|  | Roddy Beynon (Arup) |  |
|  | David James (Capita Symonds) |  |
|  | Paul Turner (Capita Symonds) |  |
| Apologies | None |  |
| Circulation | Those present |  |

1. Introductions

Those present introduced themselves and their role in the project.

## 2. Context of the meeting in the planning process

VA set out the current status of the planning application and the reasons for the meeting.

It was confirmed that Capita review represents the council view but that the Highways department will also comment following approval by

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| :--- | :--- | :--- |
| Barry Waterfront | $122374-00$ | 26 February 2010 |

Capita. Concern was expressed by the Arup team that this could lead to a further set of issues. VoG officers suggested that it is likely this was unlikely and that it was primarily an approval process.
3. Transport objectives of Barry Waterfront Development

JK set out the transport context for Barry Waterfront, the importance of achieving sustainable transport and the role of the Transport Assessment in setting out the intention on how to achieve this.
4. Major points arising from Capita Symonds review of Transport Assessment

The following points were raised according the Capita Symonds review:
The review (15.2) identified that more recent accident data was now available and hence the accident section, including an assessment of the impact of the development site.

The review (15.3) considered the trip generation rates used in the Transport Assessment to be low. Arup explained that the trip rates used were intended to be representative of a sustainable mixed use development in a location well served by public transport. Arup also highlighted the use of average trip rates in other Transport Assessments for other recent developments in the Vale of Glamorgan including the St. Athan Defence Technical College.

Whilst this explanation was understood and accepted, Capita was of the opinion that the level of assumptions regarding pass-by, linked and internal trips was generally leading to a high number of trips not travelling on the external road network and without full details of why these assumptions were made.

The Transport Assessment should therefore include further details of improvements to be made for sustainable transport links to existing transport infrastructure as well as a justification for assumptions regarding linked, pass-by and internal trips. VoG asked for consideration of worst case scenario.

The review (15.4) suggested that in some cases there were discrepancies between traffic flows. Arup described the use of traffic counts at different times and that this approach had been agreed with the Vale of Glamorgan. Whilst it is agreed that the count on Harbour Road had a mismatch it is considered that this is not a critical link in the network, Arup to review the original traffic counts.

The review (15.5) requested a tourism only scenario to enable a comparison against the development + Tourism scenario. Arup queried the need for this given that the tourism scenario is not within the control of the consortium and that the construction of the link road through the site could only ease the current situation. It was agreed that the assessment could take the form of an estimate of traffic generation with

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a qualitative description of the likely impacts.
The review (15.6) includes detail and comment on the junction capacity model. Arup to review these comments and amend traffic models if appropriate.

The review (15.7) raised the issue of a lack of commitment to highway improvement measures. AC explained that the consortium is awaiting a viability report for the development.

The review (15.8) raised the need to consider the implications if the rail crossing north of West Pond cannot be provided. Capita suggested that Arup complete an audit of possible routes and improvement works to the existing route via Hood Road.

The review (15.9) raised the need to consider the effect of diverting existing bus services and subsides for evening services. Arup explained that other services operate on Broad Street and that Harbour Road has no population or destinations. VoG and Capita asked if Arup could investigate existing occupancy of the bus service which it is proposed to divert. Arup stated that the submitted Transport Assessment includes Vale of Glamorgan collected data on the occupancy of peak hour rail services to Cardiff .

The Capita review (15.10) raised the need to consider possible enhancements to routes to the three local train stations: Barry Docks, Barry and Barry Island. VoG and Capita asked for an audit of the routes to include the rail crossing to the north, Clive Road steps to Barry Island and cycle links to Hood Road and Barry Island (15.11). Arup emphasised that the construction of the link road itself (and associated footway provision) would improve pedestrian and cycle accessibility.

The review (15.12) raised the need to prepare a construction management plan. Arup outlined the existing detail already in the Transport Assessment and Environmental Impact Assessment and that at this stage it would be difficult to understand construction plans in sufficient detail to complete a construction management plan. Arup suggested that the Vale of Glamorgan could include this as a condition of planning permission. The council agreed this approach.

The review (15.13) raised the need to include analysis of large vehicles in the Transport Assessment. Arup confirmed that junctions have been designed to accommodate large vehicles.

The review (15.14) raised the need to set multi-modal targets for the development. Arup confirmed that the multi-modal targets would be those used in the trip generation chapter and that the included outline travel plan would be detailed and agreed prior to occupation of the first phase of the development.

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# VA suggested that the outline travel plan should include a budget. <br> Action <br> Arup 

Arup/Capita

Arup

Arup/Capita

Arup

Arup

Arup to calculate the travel demand of a tourism only scenario. No junction assessment will be completed for this scenario.

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|  |  |  |

To satisfy VoG requirement regarding worst case scenario, Arup will need to produce a technical note; separate from the Transport
Assessment, detailing the quantum of generated traffic should the multimodal target adjustment not be made. This will not include junction assessments.

There was commitment for Arup and Capita to maintain dialogue in Arup/Capita order to avoid aborted work.

Appendix B
Junction and Link
Description for Modelled Network

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline Juncion Number \& Junction Sylye \& Junction Am \& | \(\begin{gathered}\text { No. of } \\ \text { Lans }\end{gathered}\) \& Junction Descripion \& Photo \& Juncion Number \& Juncioo Style \& Junction Amm \& Lanes \& Juncion Descripion \& Photo \\
\hline 1 \& Staggered
cross roads \& \begin{tabular}{|l|}
\hline A- A48 east \\
\hline B- A226 south \\
\hline C- A88 west \\
\hline D- Unclasifified north \\
\hline
\end{tabular} \&  \& "Sycamore Cross" - Junction contains right and left
turning laneswithin the central reserve area of the staggered cross roads. Spitter islands provided along the centre of major road. \&  \& 7 \& \[
\begin{aligned}
\& \text { Uncontrolled } \\
\& \text { roundabout }
\end{aligned}
\] \&  \& \[
\begin{aligned}
\& 1 \\
\& \frac{2}{1}
\end{aligned}
\] \& "Waycock Cross" - Large landscaped central reseve means full roundabout is not visible from each approach arm. Petrol filling station situated on corner of Pontypridd Rd and the A4226 east arm. Bus stop located on the A4226 east exit arm of roundabout. \&  \\
\hline 2 \& \[
\begin{aligned}
\& \text { signalised } \\
\& \text { roundabout }
\end{aligned}
\] \& \begin{tabular}{|l|}
\hline \begin{tabular}{c} 
A - A48 northeast (Cowbridge \\
road west)
\end{tabular} \\
\hline B - A4232 east \\
\hline C - A4050 south (Port Road) \\
\hline D - A48 southwest \\
\hline E - A4232 northwest \\
\hline
\end{tabular} \& \[
\begin{aligned}
\& \hline 3 \\
\& \hline \frac{3}{3} \\
\& \hline \frac{3}{4} \\
\& \hline \frac{4}{3} \\
\& \hline
\end{aligned}
\] \& "Culverhouse Cross" - Large signalised roundabout where exit arms are not visible from entry stop lines. A48 travels underneath main circulatory area of junction. Central island is partly open, with heavilty landscaped areas that form the verges of the A48. \&  \& 8 \& \begin{tabular}{|l|} 
Mini i cundabout \\
\\
\hline Priofity J juncion \\
\hline
\end{tabular} \&  \& 2
2
2

2
2 \&  \&  <br>

\hline 3 \& $$
\begin{aligned}
& \text { Double signalised } \\
& \text { junction }
\end{aligned}
$$ \&  \& \[

$$
\begin{aligned}
& 2 \\
& 2 \\
& 2 \\
& 2 \\
& 2
\end{aligned}
$$

\] \&  \&  \& 9 \& | Prionty |
| :--- |
| Tiunction |
| Pinoily |
| Tiunction |
| Mini roundabout | \&  \&  \&  \&  <br>

\hline 4 \& $$
\begin{array}{|l|}
\hline \text { Signalised cross } \\
\text { roads }
\end{array}
$$ \&  \& \[

$$
\begin{aligned}
& 2 \\
& \frac{2}{1} \\
& 2 \\
& 2 \\
& 2
\end{aligned}
$$

\] \& "Murch Cross" - The main link road through Dinas Powys constitutes 2 of the 4 arms of the cross roads. Advanced cycle stop lines are provided on 3 of the 4 arms. A bus layby is situated approximately 30 m from exit arm of the A4055 travelling in a north eastern direction. \&  \& 10 \& | Roundabout |
| :--- |
|  |
| Gyrator | \&  \&  \& Eastern exit arm of Gladstone roundabout loops round to form eastern entry arm of roundabout. The loop has been considered as a gyratory, and provides the opposing flow for 2 side roads. but has good visibility. Two zebra crossings are situated on the gyratory part of the junction. \&  <br>

\hline 5 \& $$
\begin{aligned}
& \text { Uncontrolled } \\
& \text { roundabout }
\end{aligned}
$$ \&  \& \[

$$
\begin{aligned}
& 2 \\
& \frac{2}{2} \\
& \frac{2}{2} \\
& \hline
\end{aligned}
$$

\] \& "Biglis roundabout" - McDonalds fast food restaurant situated on edge of roundabout with the car park exit egressing onto western arm Central island landscaped, though adequate visibility around the circulatory is maintained. Splitter islands provided on al 4 arms. \&  \& 11 \& \[

$$
\begin{aligned}
& \begin{array}{l}
\text { Staggered } \\
\text { coross rads }
\end{array}
\end{aligned}
$$

\] \& | A - Barry Road East |
| :--- |
| B - Buttrills Road South |
| C - Barry Road West |
| D - East Walk North | \&  \&  \&  <br>

\hline 6 \& \[
$$
\begin{aligned}
& \text { Uncontrolled } \\
& \text { roundabout }
\end{aligned}
$$

\] \& | A - A4050 north (Port Rd) |
| :---: |
| B - A4231 south east (Barry |
| Docks Link Rd) |
| C - A4050 south west (Port |
| Rd) | \&  \&  \&  \& 12 \& Mini roundabout \& | A Cemetery Road North |
| :--- |
| B- Bara Pooad East |
| C- T-Newyd Road South |
| D. Barry Rood West | \&  \& Splitter islands present on each approach arm of

roundabout, which also has an over-run central
Trees are located along the centre line of
Cemetery Road. \&  <br>
\hline
\end{tabular}





J:1122000\122374-0014 Internal Project Datal4-40 Calculations|Transport|Link descriptions.xls



Appendix C
Accident Data

| ear | vear Code | Reference | Severity | Day | Date | nt | Time | Easting | Nortring Location | Chemer Deails |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }_{2}^{200}$ | ${ }_{776}^{746}$ | 11874 | jight | ${ }^{\text {Suncay }}$ Tuesdy |  |  | ${ }_{0}^{03825}$ | ${ }^{315450}$ |  |  |
|  | 746 | 11898 | Sligh | Thussay | 7 | 10 | 22:20 | 31070 |  |  |
| 2004 | 746 | 11885 | Slight | friday | 8 | 10 | 10.30 | 312070 |  |  |
| 200 | ${ }_{7} 76$ | 11898 | slight |  | 10 | 10 | 20:50 | 310410 | 167886 P Pontypridd Read, Barry oposiste junction with Salisury Road. | 12 TURNNS R RIGHT Collioed |
| 200 | ${ }^{7} 46$ | 11905 | Slight | Tuestay | 12 | 10 | 08,45 | 310970 | 168833 C Colot Read, Bary Road, Senere Read, Barry rundabout. |  |
|  | ${ }_{7} 76$ | 11007 | ght | Thursay | ${ }^{14}$ | 10 | ${ }^{18,15}$ | 310270 |  |  |
| ${ }^{2}$ |  | 12028 | Sigh | Friar | ${ }^{15}$ | 10 |  | 31970 |  | V Stoppea and V 2 ran inot the erar |
| ${ }_{2}^{2004}$ | ${ }_{766}$ | ${ }_{1}^{11933}$ | Siter |  | ${ }^{18}$ | 10 | ${ }_{1}^{13.25}$ | ${ }^{321200} 3$ |  |  |
|  |  |  |  |  | 20 |  |  |  |  |  |
| 2004 | ${ }^{746}$ | ${ }^{12037}$ | ight | Sunday | ${ }^{24}$ | 10 | 02:40 | ${ }^{314880}$ |  |  |
|  |  |  | Iibht | Tuestay | ${ }^{26}$ |  | 17:04 | 314910 |  |  |
| ${ }^{200}$ | ${ }_{7} 76$ | 12188 |  |  | ${ }^{27}$ | 10 | 0430 | ${ }^{311020}$ | 109860 Port Road, Barry junction with Peasanat View 1 St |  |
| 2004 | ${ }^{746}$ | 12046 | sight | friday | ${ }^{29}$ | 10 | 06:00 | ${ }^{314460}$ |  |  |
| ${ }^{2004}$ | ${ }_{7} 76$ | 12049 | ght | Sunday | ${ }^{31}$ | 10 | 20.10 | ${ }^{313050}$ |  |  |
| ${ }^{2004}$ | ${ }_{7} 746$ | 120097 | silit | fuesay |  | 11 | ${ }^{1830} 10$ | ${ }^{314470}$ |  |  |
| $\stackrel{2004}{2004}$ | ${ }_{7}^{746}$ | ${ }_{12056}^{12066}$ |  | ${ }_{\text {senturay }}^{\text {Saturday }}$ | ${ }_{6}^{6}$ | ${ }_{11}^{11}$ | ${ }^{19.40}{ }^{12130}$ | ${ }_{3}^{316810}$ |  |  |
| 2004 | 746 |  | ight | Thursay | 11 | 11 | ${ }_{18,17}$ | ${ }^{31342}$ | 168880 A2331 AARY DOCCKS LINK R RoA JUNCTION WTH Colob |  |
| 2004 |  | 12131 | ght | friday | ${ }^{12}$ | 11 | 17:45 | 310550 |  |  |
| 200 | ${ }_{746}$ |  |  | Monday | ${ }^{15}$ | 11 | 18.30 | 31020 | 168900 A0050 port rod west between weycock coss and |  |
| ${ }^{2020}$ | ${ }_{76} 7$ | ${ }_{121364}$ | ight | Monday | ${ }^{15}$ | 11 | 12:50 | ${ }^{312430}$ |  |  |
| ${ }^{2004}$ | ${ }^{746}$ | 121388 | ieght | Wednestar | ${ }^{17}$ | 11 | ${ }^{18,00}$ | 310920 |  |  |
| ${ }_{2}^{2004}$ | ${ }_{746} 7$ |  | Sill | vedinesay | ${ }_{17}^{18}$ |  | ${ }_{\text {11200 }}^{1105}$ | ${ }^{\text {313930 }}$ |  |  |
| ${ }_{2}^{2004}$ | ${ }_{7} 76$ | 12123 | sibit | fridar | 19 |  | 1230 | 311510 |  |  |
| ${ }_{2}^{2004}$ | ${ }_{7}^{746}$ | 122630 | Serious | ${ }^{\text {friday }}$ fentur | ${ }^{19}$ | ${ }_{11}^{11}$ | ${ }^{23,35}$ |  |  |  |
|  | ${ }_{746}$ |  | ehht | Sunday |  |  | 10.30 | 316400 |  |  |
| 2004 | ${ }_{7} 76$ | 12146 | ieght | Tuesday | ${ }^{23}$ | 11 | 16:45 | ${ }^{313430}$ |  |  |
| ${ }^{2004}$ | ${ }_{7} 76$ | 12188 | atal | Tuestay | ${ }^{30}$ | 11 |  |  |  |  |
| ${ }^{2004}$ | ${ }_{7} 76$ | 12182 | ight | Wednestav | 1 | 12 | 19:40 | 31250 | 170911 A A055 Poort road east, ROUNOABOUT JUnction with barl |  |
| ${ }^{202}$ | ${ }_{7} 76$ | ${ }^{122788}$ |  | Thursay |  |  | ${ }^{21.25}$ | 310500 |  | V1. colidee with ci in road |
| ${ }_{2}^{2004}$ | ${ }_{7}^{746}$ |  | Silight | saturay | 4 |  | ${ }_{10,55}^{15.50}$ | ${ }^{3111300}$ |  |  |
| 2004 | ${ }_{7} 76$ |  | siligt | saturday | 4 |  | 08.10 | 315440 |  |  |
| 2004 | ${ }_{7}^{776}$ |  |  |  | ${ }^{6}$ |  |  |  |  |  |
| 2004 | ${ }_{7}^{746}$ |  | slight | Truussay | 9 | 12 | ${ }^{1930}$ | 310770 |  | V1 TURNED INT S SDE STREET, V2 Follow |
| 2004 | ${ }_{7} 76$ | ${ }^{12262}$ | Slight | Thursay | 9 |  | ${ }^{22.05}$ | 311510 | 167900 Hotron roan, BaRR, APPROX 30 M From roundabout (SAVOV) | DRver of V1 Lost control And struck thafic sign, causing vehicie to flip. |
|  | $\xrightarrow{7766}$ | ${ }_{121264}^{1224}$ | Seirious | ${ }_{\text {friday }}^{\text {fiturday }}$ | 年10 |  | 15.00 <br> 0808 | ${ }^{311890}$ 312190 |  |  |
| ${ }^{2004}$ | ${ }^{746}$ | 12328 | Slight |  | 22 |  | 11:40 | 310730 | 167490 tifig Street, Barry 5 vars from the junction |  |
|  | ${ }_{7}^{776}$ |  | Silight |  | ${ }^{28}$ |  | ${ }^{10.20} 16$ | ${ }^{31339060}$ |  |  |
|  | ${ }^{746}$ |  |  |  |  |  | ${ }^{15.13}$ | ${ }^{311588}$ |  |  |
| ${ }_{2}^{2004}$ | ${ }_{746}$ | ${ }_{\text {12392 }}^{13784}$ | Sight | frider | ${ }_{\substack{30 \\ 31}}$ |  | ${ }^{15530}$ | ${ }^{\text {310960 }}$ 31317] |  |  |



| vear | Vear code | Reference | Severity | Day | Date | Month | Time | Easting | Northing Location | betais |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2005 |  | ${ }_{\text {coinchas }}^{5013709}$ | light | ${ }_{\text {friday }}^{\text {Sunday }}$ | ${ }_{26}^{24}$ |  | ${ }_{\text {13,10 }}^{13,56}$ | ${ }^{303320}$ |  |  |
| ${ }_{2005}$ | 776 | ${ }_{50133684}$ | Slight | Monday | ${ }_{27}$ |  | 18.00 | 310850 |  |  |
|  | ${ }_{76}$ |  | light |  |  |  |  | 31140 |  |  |
| 2005 | 746 | 50134466 | light | Thussay | ${ }^{30}$ |  | 11:00 |  |  |  |
| 2005 | 746 | 5013469 | Slight | friday |  |  | 11.51 | 313950 | OS 76 capoif f foad, BARRY 1 St Rd |  |
| 2005 | 746 | 50134468 | Slight |  | 1 |  | 01.10 | 316880 |  |  |
| ${ }^{2008}$ | 776 | 5013477 | Slight |  |  |  | 06.45 | 311360 |  |  |
| 20 | ${ }_{74}$ | 5013447 | ght |  |  |  | 11.54 | ${ }^{312}$ |  |  |
| ${ }^{2005}$ | 746 |  | ight | Saturay | 9 |  | ${ }^{13.00}$ | 311550 |  |  |
| ${ }_{2005}$ |  |  |  | Thussay | ${ }_{14}$ |  |  |  | 16770) | V1 LOST CONTROL AT RAB AND COLLIDED WITH LAMP POST |
| ${ }_{2005}$ | ${ }_{76} 7$ | ${ }_{501353886}$ | Slight | Friday | ${ }_{15}$ |  | ${ }^{14.00}$ | ${ }_{311470}$ |  | PEDESTRIAN CROSS ROAD STOPPED WAITING IN TRAFFIC, WHEN V1 BUMPED INTO REAR OF V2 |
| 2005 | 746 |  |  |  | 17 |  | 20.45 | 31059 |  |  |
|  | 776 | 5013542 | eit | Sunday | ${ }^{17}$ |  | 14.50 | ${ }^{312}$ |  |  |
|  | ${ }^{746}$ |  | slight |  | ${ }^{24}$ |  |  |  |  | V. ORV V.2 HAS Contravene a |
| 2005 | 776 | 501356 |  | Tuestay | 2 |  | 14.02 | 311580 |  |  |
| ${ }^{2003}$ | 746 |  | siligh | ssay | 4 |  | 15:16 |  | SWorth avenue W Mountor pact, enarit lis |  |
| ${ }_{2}^{2005}$ | ${ }_{7} 76$ | ${ }_{\text {coins }}^{501398}$ | Silent | friay | 5 |  | 1720 | ${ }^{3112096}$ |  |  |
|  | ${ }_{76} 7$ |  | Slight |  | 8 |  | ${ }_{19}{ }^{1200}$ | 312010 |  | V1 |
| 2005 | 746 | 501358 | Iight |  | ${ }^{8}$ |  | 08.20 | 315450 | 171590 MIL R RoAD J W MILBROOR R RAA, OINAS Powis |  |
| 2005 |  | 5013694 | eght |  | ${ }^{11}$ |  |  |  | E, BaRRY 1 St Rd: U 2 nd |  |
| 2005 | 776 | 50137751 | slight |  | 15 |  | 19.10 | 315060 | 168888 SUULY ROAD J W Coo road, PENARTH 1 st |  |
|  |  |  |  |  | ${ }^{16}$ |  |  |  |  |  |
| 2005 | ${ }_{7} 76$ | 5013777 | Slight |  | 17 |  | 0830 | 313010 | 1188610 FForod milenwm, BaRY, APPROACH ROUNDABOUT AT C CROIF F ROAD. |  |
|  | 776 | 50137985 | slight | Sunday | ${ }^{21}$ |  | 20.05 | 311480 |  | (e) |
| ${ }^{2005}$ | ${ }_{7} 76$ | 50139 | ight |  | ${ }^{24}$ |  | 21.15 |  | 1679000 S 23 STATION STRET, EARRY Y St Re: |  |
| ${ }_{2005}^{2005}$ | ${ }_{726} 7$ | ${ }_{5}^{50137399}$ | Siligt | Sauray | ${ }_{29}^{29}$ |  | ${ }_{\text {1720 }}^{12129}$ | ${ }_{3112729}$ |  |  |
| ${ }^{2005}$ | ${ }_{76} 7$ | ${ }_{50137161}$ | Fatal | Wednestay | ${ }^{31}$ |  | 19:25 | 311180 | 168800 BaRRY Ro, 8 BRRYY Y Strda U U 2nd Rd: |  |
|  |  |  |  |  | ${ }^{31}$ |  | 16:00 |  |  | 俍 |
| 2005 | 776 | 501376 | ieht | Thursar |  |  | 16.55 | 313930 |  |  |
|  |  | ${ }_{50137552}$ |  | sundar | ${ }^{4}$ |  | 16.45 | 311995 |  |  |
| ${ }_{2005}^{2005}$ | 776 77 | ${ }_{\text {coinch }}^{50137712}$ | Slibet | Ferinestay | ? |  | 20:40 | ${ }^{310970} 312500$ |  |  |
| 2005 | 746 | 50138356 | Serious | Wefnestar | ${ }^{14}$ |  | 20.50 | 311170 | 166730 Broad Stret, Barry, OUTSILE No. 73 1st Rd: |  |
| ${ }^{2005}$ | 776 | ${ }_{5}^{50138573}$ | dight | Weedestay | ${ }^{14}$ |  | 16.15 | 314460 |  |  |
|  |  |  |  |  | ${ }^{16}$ |  |  |  |  |  |
| ${ }_{2005}^{2005}$ | ${ }_{746} 7$ | ${ }_{5}^{50138833}$ | Slight |  | ${ }_{22}^{12}$ |  | 1620 <br> 18.50 | ${ }_{3}^{30171760}$ | 17. |  |
|  |  |  |  |  |  |  |  |  |  |  |
| 2005 | 776 | 5013814 |  |  | 26 |  | ${ }^{22} 38$ | 31550 | 173300 Poort road east, 20 M ERRES EAST T M MEvLLE |  |
|  |  | 50138976 | ibht |  |  |  |  |  |  |  |
| ${ }^{2005}$ | ${ }_{7} 76$ |  | Slight | friday | ${ }^{30}$ |  | ${ }^{1930}$ | 311500 |  |  |
| ${ }^{2005}$ | ${ }_{746}^{746}$ | ${ }_{\text {501382726 }}^{50}$ | $\mathrm{S}^{\text {silight }}$ | ${ }^{\text {unday }}$ Wentestay | 5 | ${ }_{10}$ | ${ }^{12288}$ | ${ }^{321250}$ |  |  |
| ${ }^{2005}$ | ${ }_{7} 76$ | ${ }_{5}^{50139235}$ | Slight | Wedenestar | 5 | 10 | 16:05 | ${ }^{311830}$ |  |  |
|  |  |  | sibht | nurs | 6 |  |  |  |  |  |
| ${ }_{2}^{2005}$ | ${ }_{726} 7$ | 5013985 | Slight | Thussay | 13 |  | 143 | ${ }_{\text {313560 }}^{31650}$ |  |  |
|  | 746 | ${ }_{50139773}$ | Slight | friday | 14 | 10 | 12:15 | 317410 |  | Mener in |
|  |  | 50190096 | Slight | Tuesday | 18 |  | 16.57 | 313150 |  |  |
|  |  | 501 | slight |  |  |  | 14.41 | 312780 |  |  |
| ${ }_{2005}^{2005}$ | ${ }_{7}^{776}$ |  | siligh | Thursay | ${ }_{20}^{20}$ | 10 | ${ }^{1030}$ | ${ }^{316479} 3$ |  |  |
| ${ }_{2005}^{2005}$ | ${ }_{746}$ | ${ }_{501406004}$ | silight | fridar | ${ }_{28}^{23}$ |  | ${ }^{1555}$ | 312080 | 1688530 cuass |  |
|  | 776 | ${ }_{50141322}$ | Slight | Sunday | ${ }^{30}$ |  |  |  |  |  |
| ${ }_{2}^{2005}$ | ${ }_{746} 7$ | ${ }_{50142112}$ | Slight | ${ }_{\text {Thussdy }}$ | 3 |  |  | ${ }^{312380}$ | ${ }^{1030650}$ |  |
|  | ${ }_{746}$ | ${ }_{50141325}$ | Slight | Sunday | ${ }^{6}$ | 11 | 17:29 | ${ }^{310330} 0$ |  |  |
| 2005 | 746 | 501418 | ieht | Thussay | 10 | 11 | 17:15 | 31129 | 167980 |  |
|  |  | 50141812 | Iight |  | 16 |  | 08.35 |  |  | (enticle |
| ${ }^{2005}$ | 776 | 500141952 | Slight | friday | ${ }_{18}^{18}$ |  | ${ }^{08.55}$ | ${ }^{312470}$ |  |  |
| ${ }^{2005}$ |  | ${ }_{501433664}$ | Slight | Tenussaray | ${ }_{24}^{23}$ |  | ${ }^{\text {176.55 }}$ | ${ }^{3152580}$ |  |  |
| 2005 | 746 | 5014226 | Slight | fridar | 25 | 11 | 08.20 | 311550 |  |  |
|  |  | 5014 |  |  | ${ }^{28}$ |  | ${ }^{08.48}$ |  |  |  |
| ${ }_{2}^{2005}$ | ${ }_{746}$ | ${ }_{50142751}$ |  |  | ${ }_{30}^{28}$ |  | ${ }_{\text {cose }}^{08.55}$ | ${ }_{314560}$ |  |  |
| 2005 | 746 |  |  | Thursa |  |  | 12:20 | 311300 |  |  |
| 2005 | 74 | 5012251 | Serious | Thussay | 1 |  | 05.00 | 31290 |  |  |
| ${ }_{2005}^{2005}$ | ${ }_{776} 7$ | 5012760 <br> 501400 | Serious | ${ }_{\text {frinday }}^{\text {friday }}$ | 2 |  | 17.00 |  |  |  |
| 2005 | 746 | 5014276 | Slight | Sunday |  |  | 1330 | 311540 |  |  |
| ${ }^{2005}$ | ${ }_{776}^{776}$ | ${ }_{501427328}$ | Slight | ${ }^{\text {Sunday }}$ Monday | ${ }_{5}^{4}$ |  | ${ }^{17706}$ | ${ }^{315450}$ 312190 |  |  |
| ${ }_{2}^{2005}$ | 7761 7 | 5012933, | Sligh | Thursay | 8 |  |  | ${ }^{312330}$ |  |  |
| ${ }^{2005}$ | 746 |  |  |  | ${ }^{19}$ |  | ${ }_{1510}$ | ${ }^{313320}$ |  |  |
| ${ }^{2005}$ | 746 | ${ }_{50143625}$ |  | Tuesday | ${ }_{20}^{20}$ |  | ${ }^{172720}$ | ${ }^{316975}$ |  |  |
|  |  |  |  |  | ${ }_{22}^{22}$ |  |  |  |  |  |
| 2005 | 746 | 50143885 | Slight | Sunday | 25 | 12 | 18.15 | 310310 |  |  |
| ${ }^{2005}$ | 746 | 5014331 | Slight |  |  |  |  |  |  |  |
| ${ }_{2005}^{2005}$ | ${ }_{776} 7$ | ${ }_{5014397}$ |  | Wedinestay | ${ }_{28}^{28}$ |  | 11.10 | ${ }^{3157500}$ |  |  |



| vear | vear code | Reference | Severity | Day | Date | Month | Time | Easting | Nortring |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }^{746}$ | 6015038 |  | enday |  |  |  | 31156 |  |  |
| ${ }_{2}^{2006}$ | ${ }^{7} 76$ | ${ }^{601542774}$ |  | Fritay | ${ }^{30}$ |  | ${ }^{\text {09,30 }}$ | ${ }^{317350}$ |  | (e) |
| ${ }_{2006}^{2006}$ | ${ }_{746} 7$ | ${ }_{60154356}$ |  | Weentesar |  |  | ${ }_{\text {20, }}^{134}$ | ${ }^{312380}$ |  |  |
|  | ${ }_{766}$ | 60154296 | St | Saturay | 8 |  | 17:30 | ${ }^{31190}$ |  |  |
|  |  |  |  |  |  |  | 1730 |  | AARYY ISt |  |
| ${ }^{2008}$ | 746 | ${ }_{6015332}$ | Sht | Monda | ${ }^{10}$ |  | 19.28 | ${ }^{314880}$ |  |  |
|  |  |  |  |  | ${ }^{18}$ |  |  |  |  |  |
| ${ }^{2008}$ | ${ }_{7} 76$ |  |  |  | ${ }^{21}$ |  |  | ${ }^{309}$ |  |  |
| ${ }^{200}$ | 746 | 60156135 |  | friday | ${ }^{21}$ |  | $06: 40$ |  |  |  |
| 200 | 746 |  | bt |  | ${ }^{26}$ |  |  | ${ }^{311360}$ | 330 Broan steet, BARY, UUNCTION WTH College road. 1 It |  |
| 2006 | 746 | 6015927 | Slight | Thussay | ${ }^{27}$ |  | 13.15 | ${ }^{310100}$ | 6600 Bron Y M Mo, THE ENAP, BARRY Is R Rd: |  |
| 200 |  | 6015435 |  | Thursay | 27 |  |  |  |  |  |
| 2006 | ${ }^{7} 76$ | ${ }^{6015531}$ |  | fridar | 4 |  | 15.28 | ${ }^{314160}$ |  |  |
| 200 | 76 | ${ }^{6}$ |  |  | 1 | . | 08.25 | 31199 |  |  |
| 2006 | 746 |  |  | Sturay | 1 | . |  | ${ }^{3102022}$ | 107250 |  |
| 2006 | ${ }_{7} 76$ | ${ }_{6015514}$ | Serius | Seduray | ${ }^{23}$ |  | ${ }^{183} 180$ | ${ }_{317395}$ |  |  |
| 2006 | ${ }_{76}$ | 6015692 | erious | Monday | ${ }^{28}$ |  | ${ }^{23} 0$ | ${ }^{311210}$ |  |  |
|  | 746 |  | 'it |  | 30 |  |  |  |  |  |
| 2006 | 746 | 6015654 |  | Wednestar | 6 |  | 17:55 | ${ }^{312460}$ |  |  |
| 2006 | 746 | 6115996 | erious | Thurstay | 7 |  | 16.50 | ${ }^{311810}$ |  |  |
| 2008 | ${ }_{7} 7$ | S665 |  | Ssay |  |  | O9.10 |  |  |  |
| ${ }_{2006}^{2006}$ | - 746 | ${ }_{6}^{601565737}$ | diour | ${ }_{\text {reray }}$ | 8 |  | ${ }^{11556}$ | ${ }_{312370}$ |  |  |
| 2006 | ${ }_{7} 76$ | ${ }_{6015648}$ | jous |  | 10 |  | ${ }_{2258}$ |  |  |  |
|  |  | 6015696 |  | Tuestay | ${ }^{12}$ |  | 08.99 | ${ }^{311}$ |  |  |
| 2006 | 746 |  | Slight |  | ${ }^{12}$ | 9 | 11:40 | 317390 | 171730 Worosworth avenue, Penarth ist Rd: U 2nd d da: |  |
| 2006 | 746 | 615697 | ght | friday | ${ }^{15}$ |  | 10:50 | ${ }^{312120}$ |  | EHHCEE ONE HAS LOST CONTROL ANO COLIDED WTH PAREE, UNATTENDED VEHCLE TWO. |
| ${ }^{2006}$ | ${ }_{776}^{776}$ |  | Slight | ${ }^{\text {saturay }}$ | ${ }_{2}^{16}$ |  | cie: | ${ }^{310960}$ |  |  |
| 2006 | 746 | 6015730 | slight | Monday | ${ }^{25}$ |  | 15.45 | ${ }_{312310}$ |  |  |
| 2006 | ${ }^{7} 46$ | 6015802 |  | Wednestay | ${ }^{27}$ |  | 18.00 | ${ }^{309880}$ |  |  |
| ${ }_{2006}^{2006}$ |  | ${ }^{\text {oushis }}$ |  |  | 2 |  |  | ${ }^{317390}$ |  |  |
| ${ }_{2}^{2006}$ | ${ }_{776}^{746}$ | ${ }_{601515851}^{6015}$ | Slight | Weestas | ${ }_{18}^{10}$ | ${ }_{10}^{10}$ | ${ }_{\text {1320 }}^{1320}$ | ${ }^{313000}{ }^{310830}$ |  |  |
|  |  |  |  |  | ${ }^{18}$ | 10 | 11:53 |  |  |  |
| 2006 | 746 | 6015 |  | Tuessay | ${ }^{24}$ | 10 | 09:45 | ${ }^{313670}$ |  |  |
| 2006 | 746 | 6015 |  | Tuestay |  |  | 08.00 |  | 171500 St Anorews MAOOR RoAD 1s 1 frd: U 2nd |  |
| 2006 | 746 | ${ }^{60159149}$ |  | Monday | ${ }^{30}$ | 10 | 15:53 | ${ }^{317360}$ |  |  |
| ${ }^{2006}$ | ${ }_{776}^{776}$ | ${ }_{\text {coish }}^{6019396}$ | eht | Trestay | ${ }^{31}$ | ${ }_{10}^{10}$ | ${ }_{19500}^{1950}$ | ${ }^{3144400}$ |  |  |
| 2006 | 746 | 6015938 | Slight | Wednestay | 8 | 11 | 07.50 | 310700 | 167290 |  |
|  | ${ }^{7} 46$ |  |  |  | 8 |  |  |  |  |  |
| 2006 | ${ }_{7} 76$ | ${ }_{60159866}$ | jight | Mondar | ${ }_{13}$ | 11 | ${ }_{1}^{0.350}$ | ${ }_{3118800}$ |  | (e) |
| 2006 |  |  |  |  |  |  | ${ }^{08.00}$ |  |  |  |
| 2006 | 746 | 61.60078 |  | Thussay | ${ }^{16}$ | 11 | 0830 | 310910 |  | VEHCLE ONE WHILS Pull |
| 2008 | 746 | 6015921 |  | Thussay | ${ }^{16}$ | 11 | 22.50 | 316550 |  |  |
| ${ }^{2006}$ | ${ }_{776}^{776}$ | ${ }_{6015150068}^{6019}$ | bt | ${ }_{\text {S }}^{\substack{\text { saturday } \\ \text { Sunday }}}$ | 18 19 19 | ${ }_{11}^{11}$ | ${ }^{165050}$ 2030 | ${ }^{310520}{ }^{31711}$ |  |  |
| 2006 | 746 | 6016187 |  | Thussday | ${ }^{23}$ | 11 | 10:45 | 311220 |  |  |
| ${ }^{2006}$ | 746 | ${ }^{60160189}$ |  | fridar | ${ }^{24}$ | 11 | 18.42 | ${ }^{316310}$ |  |  |
| 2006 | ${ }_{776}^{746}$ |  | Slile | ${ }^{\text {Thursay }}$ | 30 |  | ${ }^{113,35}$ | ${ }^{316750}{ }^{31729}$ |  |  |
| 200 |  | 6016 | light |  |  |  | 17:00 |  |  |  |
| 2006 | 746 | ${ }^{60160654}$ |  | Monday |  |  | 07.15 | ${ }^{314320}$ |  |  |
| ${ }_{2006}^{2006}$ | ${ }_{7} 76$ | ${ }_{6}^{60161200}$ |  | friday | ${ }_{8}^{8}$ | 12 | ${ }^{213} 20$ | ${ }^{310820}$ |  |  |
| 2006 | 746 | 60616043 | light | Weenestar | ${ }^{13}$ | 12 | ${ }^{\text {OP9, }}$ | ${ }^{315530}$ |  |  |
| ${ }^{2000}$ | ${ }^{746}$ | ${ }^{601612125}$ |  | Thurstay | ${ }^{14}$ |  | 09,45 | ${ }^{31222}$ |  |  |
| ${ }^{2006}$ | ${ }_{7}^{766}$ |  |  |  | ${ }_{21}^{20}$ |  | ${ }^{1620} 0$ | ${ }^{315630}$ |  |  |
| ${ }^{2006}$ | 746 | ${ }_{\substack{60101650}}^{6061505}$ | ifigt | fridar | ${ }^{22}$ |  | 10.05 | 33300 <br> 31380 |  |  |


| Vear | Vear Code | Reference | severity | Day | Date | Month | Time | Easting | Northing Location | Dener Detils |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 746 | 7012419 |  | Undar |  |  | 12:44 | 310710 |  |  |
| ${ }_{2007}^{2007}$ | 746 | ${ }_{\text {70162173 }}^{7012884}$ |  | ${ }^{\text {Mondar }}$ Wedestay | $\stackrel{8}{17}$ |  | ${ }_{\text {11:52 }}^{\text {11:45 }}$ | ${ }^{311040} 1010$ |  |  |
| 2007 | 746 | 7012246 |  | Thussday | ${ }^{18}$ |  | 10.50 | 312520 | 168710 GLAOSTONE ROAD, BARRY UUNCTION WTH EVEEARPS STRET, 1st |  |
| ${ }^{2007}$ | 746 | 701629 | Slibht | Tuestay | ${ }^{23}$ |  | 15:49 | 31529 | 170930 A0055 Carbiff Road, Dinas Powrs, Uuccton wit station | v1 DROVE INTO REAR OF V V2. |
|  | ${ }_{7} 76$ | ${ }^{0106322}$ |  | thussay | ${ }_{25}^{25}$ |  | ${ }^{13,45}$ | ${ }^{311720}$ | ${ }_{1}^{168070}$ |  |
| 2007 | ${ }_{746} 7$ | ${ }_{7} 70163123$ | frious | ${ }^{\text {Sunday }}$ | ${ }_{28}^{28}$ |  | ${ }^{00.02}$ | ${ }^{315850}{ }^{3}$ | ${ }^{1}$ |  |
| 2007 | 746 | ${ }^{70128886}$ |  |  | 29 |  | 07:00 | 31320 |  | V1 DROVE ETTO V2 WHHCC WAS PAREE A AND UNAT ENDED. |
| 2007 | 746 |  |  | Mon |  |  |  |  |  |  |
| 2007 | ${ }_{7} 76$ | 7016307 | bt |  | ${ }^{31}$ |  | 14.39 |  |  |  |
| 2007 | ${ }^{7} 4$ | 70163032 | St | Thussay |  |  | 15.30 | 312060 |  |  |
| ${ }^{200}$ |  |  |  | sday |  |  |  |  |  |  |
| ${ }^{2000}$ | 776 | ${ }^{2} 1622605$ | erious | saturay | 3 |  | ${ }^{2} 219$ | 310820 |  |  |
| \| 2000 |  | ${ }_{701636534}$ |  | Wenesar | 13 |  | 12.05 | ${ }_{3112590}$ |  |  |
| ${ }^{2007}$ | ${ }_{746}$ | ${ }_{70163351}$ | Silight | Weonessay | ${ }_{14}$ |  | 16:20 | 315080 |  |  |
|  |  | ${ }^{70160332}$ |  |  |  |  |  |  |  |  |
| 2007 | 776 | 7016350 | bt | Thussay | ${ }^{22}$ |  | $12: 15$ | 312090 | 168870 Barry foad, Barev 1 St Rd: U Und Rd: |  |
| ${ }^{2007}$ | 746 | 60388 | St |  |  |  |  |  |  |  |
| 2007 | ${ }^{746}$ | ${ }^{2016412}$ |  | Tuestay | 6 |  | 13:20 | 310310 |  |  |
| 2007 | ${ }_{7}^{746}$ | ${ }_{7}^{701645472}$ | lif | Fritay | 9 |  | ${ }^{15366}$ | ${ }^{31724} 1$ |  |  |
| 2007 | 746 | 7016457 | Slight | Wedesestar | ${ }^{14}$ |  | 22.00 | 31810 | 168810 Barry foad, Barry, W OrCchard orve ist Rd: |  |
|  |  |  |  | Tuestay |  |  |  |  |  |  |
| 2007 | ${ }_{776}^{776}$ | ${ }_{\text {7016478888 }}$ | Siligh |  | ${ }_{21}^{20}$ |  | ${ }_{\text {l }}^{17.71}$ | ${ }^{317284}$ |  |  |
| 2007 | 746 | 7016479 |  | fridar | ${ }^{23}$ |  | 08:09 | 30330 |  |  |
| 2007 | 776 |  | ht |  |  |  |  |  |  |  |
| ${ }^{2007}$ | ${ }_{7} 76$ | ${ }^{20165025}$ |  |  | ${ }^{28}$ |  | 16.16 | 310760 |  | Peobstran ran from bew wn parke cars into path of vehlil 1 |
| \| 2007 | 776 77 | ${ }_{70101653911}$ | light | Weenestay | 年 ${ }_{28}^{28}$ |  | ${ }_{\text {l }}^{\text {17.05 }}$ | ${ }^{3133500}$ |  | Pe |
| 2007 | 746 | 7016542 | Slight | Wednestay | 4 |  | 16:41 | 310370 |  |  |
|  |  |  |  | Wedenestay |  |  |  |  |  |  |
| 2007 | 776 | ${ }^{201655563}$ | Silight | Mondar | 9 |  | 17:00 | 311980 |  |  |
| 200 |  |  |  |  |  |  |  |  |  |  |
| 2007 | 776 | 7016559 | ht | Wedesestay | 11 |  | 21.50 | 314280 |  |  |
| 2007 | ${ }^{746}$ |  |  |  |  |  |  |  |  |  |
| 2007 | ${ }_{7}^{746}$ | ${ }^{20155616}$ | eht | friday | ${ }_{20}^{20}$ |  | ${ }^{15: 19}$ | ${ }^{310820}$ |  |  |
| ${ }^{2007}$ | 746 | ${ }_{70165625}$ | Silight | Sunday | 20 |  | 09:40 |  | 10, |  |
| 2007 | 746 | 70167331 | Slight | Thussay | ${ }^{26}$ |  | 22:20 | 313150 |  |  |
| ${ }^{2000}$ | 776 | ${ }^{20166}$ |  | Tuesay | 1 |  |  |  |  |  |
| ${ }^{20007}$ | 76 | 701663 |  | friar |  |  | ${ }_{12125}^{10,5}$ | ${ }^{30914}$ | ${ }^{16510}$ |  |
| 2007 | 746 | 7016647 |  | Wedesestar | 9 |  | $18: 30$ | 31712 |  |  |
| ${ }^{2007}$ | 776 | 7016684 |  | Saturay | ${ }^{12}$ |  | 1230 | 31540 | 171050 C CARDIFF F RoAD, OINAS Powrs ist Rdi U 2 nd |  |
| ${ }^{2007}$ | 746 | 70166883 |  | Sunday | ${ }^{13}$ |  | ${ }^{13: 00}$ | ${ }^{317360}$ |  |  |
| ${ }^{2007}$ | ${ }_{776}^{776}$ | ${ }_{7}^{7016657518}$ |  | ${ }^{\text {Wedrestay }}$ | 16 <br> 19 |  | ${ }_{13,15}^{12.36}$ | ${ }^{313037} 3$ |  |  |
| 2007 | 746 | ${ }^{2} 0166801$ | slight | Monday | ${ }^{21}$ |  | 10.00 | 310280 |  |  |
|  | 776 |  |  | Saturd | ${ }^{26}$ |  | 08:54 | 315460 |  |  |
| ${ }^{2007}$ | 776 | ${ }^{701657027}$ | Silibt | Eriusar | 1 |  | ${ }^{21.00}$ | ${ }^{316880}$ |  |  |
| ${ }_{2007}$ | 746 | ${ }^{20167613}$ |  | Monday |  |  | ${ }_{16,35}$ | 31240 |  | BOTH VEHCLLES TRAVELING IN OPPOSSTE DREECTIONS OVER A NARROW BRIOGE CROSSIIG AND COLISION OCCURRED. V1 HIT C1 1 R RoAD |
| 2007 | 746 | 7016770 |  | Wednestay | 6 |  | $16: 30$ | 30910 | 168360 Poort road West, BARRY Ist did A A2262 2nd |  |
| 200 | 776 | 7016723 |  | friday | 8 |  | 18.40 | ${ }^{31300}$ |  |  |
| 2008 | 776 | ${ }^{2} 71677385$ |  | Sunday | ${ }^{10}$ |  | 17:40 | ${ }^{310840}$ |  |  |
| 2007 | ${ }_{766}$ | 70167702 | Slight |  | ${ }_{12}$ |  | 15:05 | 312090 |  |  |
| 2007 | 746 | 7016757 |  | Friday | ${ }^{15}$ |  | 20:10 | 312620 |  |  |
| ${ }^{2000}$ | 776 | ${ }^{0} 7016$ |  |  | ${ }^{23}$ |  | 14.40 | ${ }^{316590}$ |  |  |
| ${ }_{2007}^{2007}$ | ${ }_{776} 7$ | ${ }_{7} 701681939$ |  | Weanestay | ${ }_{27}^{25}$ |  | ${ }_{15 \text { I20 }}$ | ${ }^{315080} 0$ | 1 169080 |  |
| 2007 | ${ }_{7} 76$ |  |  |  |  |  | 09:40 | 31970 | 168330 Holto R RD, BARRY Y St Rd: 82934 2nd Rdd: |  |
| ${ }^{2000}$ | 776 | ${ }^{2016827}$ | eht | Monday |  |  | 17:00 | 315310 |  |  |
| ${ }^{2007}$ | 776 77 |  |  | ${ }^{\text {Tuessay }}$ |  |  | 08,55, | ${ }_{3111880}$ |  |  |
|  |  |  |  |  |  |  | ${ }_{\text {1800 }}^{18.00}$ |  |  |  |





| ${ }^{2009}$ | Vear code | Reference | Severity |  | Date | Month | Time | Easting | Northing Loction | Deatis |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{2009}$ | ${ }_{7}^{746}$ | ${ }^{901855572}$ | ight | Tuestay |  |  | ${ }^{13.03}$ | ${ }^{314950}$ |  |  |
| ${ }_{2009}^{2009}$ | ${ }_{726} 7$ | 90185932 | light | ${ }_{\text {THestay }}^{\text {Thusday }}$ | ${ }_{8}^{6}$ |  |  |  |  |  |
| 2009 | ${ }_{766}$ | 90185938 |  | Thursay | ${ }^{15}$ |  | 18:00 | 311880 |  | TV |
|  | 746 |  | slight |  | ${ }_{22}$ |  | 08.37 |  |  |  |
| 2009 | 746 | 90186871 | slight | Thussay | ${ }^{22}$ |  | 17:15 | ${ }^{317290}$ |  |  |
|  | 746 |  | ight |  | ${ }^{26}$ |  | 15:30 |  |  |  |
| 2009 | 746 | 901855 | ght | Monday | ${ }^{26}$ |  | 13.45 | 311190 | 16 6500 Paget read, BaRRY SLAAND 1st tad U Und | Svehlie Ne |
|  |  |  |  |  |  |  |  |  |  |  |
| 2009 | ${ }^{7} 4$ | ${ }^{00186475}$ | emt | Uray | ${ }^{31}$ |  | 18.15 | 316610 | 169850 LONAMEAOOW DRVE J W Cross common road, OINAS |  |
| 209 | 76 |  | ghr |  |  |  |  |  |  |  |
| ${ }_{200}^{2009}$ | 76 | 83 | 隹 | diesta | 2 |  | ${ }^{2325}$ | 30910 | 16330 |  |
| ${ }_{2009}$ | ${ }_{7} 76$ | ${ }_{\text {90186657 }}$ | Slight | Saturday | 4 |  | 18.46 | ${ }_{311290}$ | $168570{ }^{\text {a }}$ |  |
| 2009 | 746 | 90188715 | ith | Statray | 7 |  | 1730 | 31390 |  |  |
|  | 746 |  | ght | Monday |  |  |  |  | Port road West, BRRRY Yst Rd: A0055 2 nd |  |
| 2009 | 746 | 90186 | ght | Monday | 9 |  | $16: 30$ | ${ }^{317360}$ |  |  |
| 2009 | 746 | ${ }^{00187321}$ | fht | Monday | ${ }^{16}$ |  | 16.50 | 311830 |  |  |
| 209 | ${ }_{7} 7$ | 878 | ghr | Thussay | ${ }^{26}$ |  | 17.00 |  | 188200 Colutee Roan istra: U 2n rad. |  |
| 209 | ${ }^{746}$ | ${ }^{90187402}$ | ght | Sunday |  |  | 19.00 | 311560 | 170250 A A050 Poort frad east istrad A0050 2nd | V2 INDICATED TO TURN RIGHT V1 COLLIDED INTO HIM FROM BEHIND. PASSENGER ENTERING TAXI HAS FALLEN WHEN TAXI HAS PULLED OFF BEFORE HE WAS INSIDE |
|  |  |  | 号 | vesar | ${ }^{3}$ |  |  |  | N- |  |
| 2009 | ${ }_{7} 76$ | ${ }_{90187699}$ | Silight | Truussay | 5 |  | ${ }_{1405}$ | ${ }_{312280}$ |  |  |
| 2009 | ${ }_{7} 7$ |  |  | Monday | 9 |  |  |  |  |  |
| 2009 | 746 | 9018728 | Bht | Thussay | ${ }_{12}$ |  | 15.30 | 312640 |  | V1 LOST Conirol |
|  |  |  | ght | iar |  |  |  | 310870 | Cot road, AARRY, OUSILDE No. 41 Is R Rd: |  |
|  | ${ }^{7} 76$ | ${ }^{901877885}$ | Fatal | friday | ${ }^{13}$ |  | ${ }^{23,20}$ | ${ }^{313456}$ |  |  |
| ${ }_{2009}^{2009}$ | ${ }_{7}^{746}$ |  | Sile | ${ }^{\text {Sunday }}$ Sunder | ${ }_{22}^{15}$ |  |  | ${ }^{311430}{ }^{31048}$ |  |  |
| 2009 | 746 | 18819 | ght | sunday | ${ }^{22}$ |  | 0130 | 31770 |  |  |
| 2008 | 746 | ${ }^{901888182}$ | slight | Monday | ${ }^{23}$ |  | 22.55 | ${ }^{309910}$ | 167099 Poorth C Castell, AARPY Y st R Rd: U 2nd |  |
| ${ }_{2009}^{2009}$ |  | coincisa |  |  | 23 <br> 24 <br> 1 |  |  | ${ }^{312370} 3$ |  |  |
| 2009 | 746 | ${ }_{90188531}$ | Slight | Weenessay |  |  | ${ }_{11: 45}$ | 30960 |  |  |
| 200 | 746 | 90188296 | ieht | Saturay |  |  | 15.50 | 31190 |  |  |
| 2009 | 746 | 901884 | sight | Tuestay |  |  | 15:20 | 312270 |  |  |
| 2009 | 746 | 9018882 |  | Thussay | 9 |  | 13.00 | ${ }^{312450}$ | 168830 GUUHREL STREET NEAR J W Holton Roan, BARRY |  |
| ${ }_{209}^{2009}$ |  |  | siligh | Monday | ${ }^{13}$ |  |  |  |  |  |
| ${ }_{2009}^{2009}$ | ${ }_{746}^{746}$ | cole 901888701 | Sirigh | Staturay | ${ }_{18}^{18}$ |  | ${ }_{\text {12,54 }}$ | ${ }_{312060}^{31160}$ |  |  |
| 2009 | 746 | 90188854 | slight | Mondar | 20 |  | ${ }_{1630}$ | 311270 |  | V2 Trave illw |
|  |  |  |  |  | ${ }_{28}^{20}$ |  |  |  |  |  |
| 2009 | 746 | ${ }_{90189546}$ | sight | Tuestay | 5 |  | $11: 15$ | 31530 |  |  |
|  | 746 | 901846 | eht |  | 6 |  |  | 316790 | Iff Road J W Relanos road, landough ist |  |
| 2009 | 746 | 901895 | ght | Thussay |  |  | 20:05 | 311920 | 166790 PYYMOUTH R ROAD J W FRIARS R RoAO, BARRY S SLAND |  |
| 20 |  |  |  | Tuestay | 12 |  |  | 316010 | 169220 South road w lleveon avenet, Sulir st |  |
| ${ }_{200}^{2009}$ | 746 <br> 77 | 90188818, | Silet | Stitaray | ${ }_{22}^{16}$ |  | ${ }^{12,46}$ | ${ }_{\substack{31650 \\ 31189}}$ |  | Vell |
| ${ }_{2009}^{2009}$ | ${ }_{7}^{766}$ |  |  |  | ${ }_{23}^{23}$ |  |  |  |  |  |
| 2009 | 746 | 9190020 | sight | Tuesday | ${ }^{26}$ |  | 18.25 | 311510 | 168230 GLAOSTONE R ROAD J W GLAOSTONE PRIMAR S SCHOOL, ARARY |  |
| ${ }_{2009}^{2009}$ | ${ }_{776}^{776}$ |  |  | TTusust | ${ }^{27}$ |  | ${ }^{10.55}$ | ${ }_{311810}^{31020}$ |  |  |
| 2009 | 746 |  |  | friday | ${ }^{29}$ |  | $21: 20$ | ${ }^{311080}$ |  |  |
|  |  |  |  | friday | 29 |  | $18: 13$ | ${ }^{312420}$ |  |  |



Appendix D
Extract from South Wales
Parking Guidelines

## South Wales Parking Standards - Extract of Applicable Standards

## Residential:

| General Purpose House and Flats | Residents | Visitors |
| :--- | :--- | :--- |
| One bedroom | 1 space per unit | 1 space per 3 to 5 units |
| Two bedrooms (GFA is $75 \mathrm{~m}^{2}$ or less) | 1.5 spaces per unit | 1 space per 3 to 5 units |
| Three bedrooms (GFA $<120 \mathrm{~m}^{2}$ ) | 2 space per unit | 1 space per 3 to 5 units |
| Three/four bedrooms (GFA is $120 \mathrm{~m}^{2}$ or more) | Minimum of 3 spaces | 1 space per 3 to 5 units |

## Commercial

| Type of Development | Operational Requirements | Non-Operational Requirements |
| :---: | :---: | :---: |
| New Offices up to 1,000 m ${ }^{2}$ | Included in non operational standard | 1 space per 25-35 m ${ }^{2}$ |
| New Offices over 1,001 m² | Included in non operational standard | 1 space per 30-40 m² |
| Supermarkets and Superstores (predominantly food - over $2000 \mathrm{~m}^{2}$ ) | Space to accommodate a minimum of 3 commercial vehicles | 1 space per $10 \mathrm{~m}^{2}$ |
| Garages and Service Stations | One car/lorry space for each car/lorry bay | 2 car/lorry spaces for each service bay. Plus a minimum of 5 waiting spaces where an automatic car wash is installed |
| Public houses or Licensed Clubs | with a minimum of 1 commercial vehicle bay | 1 space per $3-5 \mathrm{~m}^{2}$ of bar floor/ public floor area including servery plus, 1 space per 3 non-residential staff |
| Hotel | Minimum of 1 commercial vehicle bay | 1 space per guest bedroom, 1 space per staff bedroom plus 1 space per 3 nonresidential staff |
| Shops (up to $200 \mathrm{~m}^{2}$ ) | Space for 1 commercial vehicle to unload and manoeuvre | 1 space per $60 \mathrm{~m}^{2}$ (employees and shoppers) |
| Shops (201-1,000 m²) | Space for 2 commercial vehicles to unload and manoeuvre | 1 space for 20-40 m ${ }^{2}$ (employees and shoppers) |
| Shops (1001-2,000m²) | Space for 3 commercial vehicles to unload and manoeuvre | 1 space per 20-40 m ${ }^{2}$ (employees and shoppers) |

Appendix E
Extract from CSS Wales parking guidelines

CSS Wales Parking Standards 2008 - Extract of applicable standards

Residential: New Builds \& Conversions
Zones 2-6

| Type of Development | Residents | Visitors |
| :--- | :--- | :--- |
| Houses | 1 space per bedroom (max. 3 spaces) | 1 space per 5 units |
| Apartments | 1 space per bedroom (max. 3 spaces) | 1 space per 5 units |

Offices: Class B1 Business, A2 Financial \& Professional services
Zone 2\&3

| Type of Development | Requirement |
| :--- | :--- |
| Offices $\left(<1000 \mathrm{~m}^{2}\right)$ | 1 space per $35 \mathrm{~m}^{2}$ |
| Offices $\left(>1000 \mathrm{~m}^{2}\right)$ | 1 space per $60 \mathrm{~m}^{2}$ |

Shops (including shops, supermarkets and superstores)

| Type of Development | Operational | Non-Operational |
| :--- | :--- | :--- |
| Shops $\left(<200 \mathrm{~m}^{2}\right)$ | 1 commercial vehicle space | 1 space per $60 \mathrm{~m}^{2}$ |
| Shops and small supermarkets <br> $\left(201 \mathrm{~m}^{2}-1000 \mathrm{~m}^{2}\right)$ | 2 commercial vehicle spaces | 1 space per $40 \mathrm{~m}^{2}$ |
| Shops and small supermarkets <br> $\left(1001 \mathrm{~m}^{2}-2000 \mathrm{~m}^{2}\right)$ | 3 commercial vehicle spaces | 1 space per $40 \mathrm{~m}^{2}$ |
| Supermarkets and Superstores <br> $\left(\right.$ predominantly food $\left.>2000 \mathrm{~m}^{2}\right)$ | 3 commercial vehicle spaces | 1 space per $14 \mathrm{~m}^{2}$ |

Retail Warehousing and Garages
Zone 2-5

| Type of Development | Operational | Non-Operational |
| :--- | :--- | :---: |
| Petrol Filling Station | 1 space per petrol tanker | 4 spaces for ancillary use <br> (e.g. automatic car wash) |

## Hotels and Restaurants

Zones 2-4

| Type of Development | Operational | Non-Operational |
| :--- | :---: | :--- |
| Public Houses \& Licensed Clubs | 1 commercial vehicle space | 1 space per 3 non-resident <br> staff \& 1 space per $5 \mathrm{~m}^{2}$ of <br> public area including servery |
| Hotels | 1 commercial vehicle space | 1 space per 3 non-resident <br> staff \& 1 space per bedroom |

## Sustainability Points and Associated Reduction in Parking Requirements

According to the CSS parking standards, sustainability points will be awarded to developments that meet the criteria below for their proximity, in terms of walking distance to local facilities, public transport, cycle routes and the frequency of local public transport. Award of these sustainability points will result in a reduction in parking requirement as detailed below.

| Sustainability Criteria | Maximum Walking Distance | Single Sustainability Points |
| :--- | :--- | :--- |
| Local Facilities <br> Local facilities include a foodstore, <br> post office, health facility, school <br> etc. Access to two of these within <br> the same walking distance will <br> score single points, whereas <br> access to more than two of these <br> will double the points score. | 200 m | 300 pts |
| Public Transport | 800 m | 2 pts |
| Access to bus stop or railway <br> station | 400 m | 2 pt |
| Cycle Route | 800 m | 1 pts |
| Frequency of Public Transport <br> Bus or rail service within 800 m | 5 minutes | 1 pt |
| walking distance which operates |  |  |
| consistently between 7am and |  |  |
| 7pm. Deduct one point for service |  |  |
| which does not extend to these |  |  |
| times. |  |  |

## Sustainability Points: Reductions in Parking Requirements

| Land use | Sustainability Points | Parking Reduction |
| :--- | :--- | :--- |
| Residential | 10 pts | -2 spaces per dwelling |
|  | 7 pts | -1 space per dwelling |
| All other development <br> (excluding shops and retail warehouses) | 7 pts | $30 \%$ |
|  | 5 pts | $20 \%$ |

Appendix F
Cycle parking
Guidelines from Vale of Glamorgan UDP (2005)

## Cycle parking extract from Vale of Glamorgan UDP (2005)

| Land Use Type | Cycle Parking Guidelines |
| :--- | :--- |
| Shopping Developments <br> and Supermarkets | Staff and operational parking at one space per $500 \mathrm{~m}^{2}$ gross up to $4,000 \mathrm{~m}^{2}$ <br> Gross Floorspace Area |
| Recreational and <br> Community Uses | In addition to the car parking provision, cycle parking will be required to <br> cater in full for the maximum expected usage of the facility assuming that <br> $5 \%$ of all people using the facility will travel by bicycle |
| Offices | One space per $400 \mathrm{~m}^{2}$ Gross Floorspace Area |
| Residential High Density <br> Development | One space per dwelling unit |
| Industrial | One space per $500 \mathrm{~m}^{2}$ |
| Further Educational <br> Facilities | One stand per 10 students if car parking is allowed. One stand per 5 <br> students if car parking is not allowed |

Appendix G
Further Details of Trip
Rates and Calculation Process

## Appendix G1

## Trip Generation Technical Note

Note - The information contained in this Technical Note has been superseded by the methodology detailed in Chapter 6. This note is retained for the investigation and comparison of trip rates.

| Job title | Waterfront Barry | Job number |
| :--- | :--- | :--- |
|  |  | 122374 |
| cc | File reference |  |
|  |  | $4-70$ |
| Prepared by | Paul Carr x 26462 (Cardiff) | Date |
|  |  | April 2008/July 2008 |
| Subject | Trip Generation Summary - Revision A |  |

Subject Trip Generation Summary - Revision A

## 1. INTRODUCTION

This note has been prepared to summarise the proposed trip generation assumptions for the Waterfront Barry development. The trip generation has been estimated using multi-modal data from the TRICS 2008(a) database, using sites similar to the proposed development landuses.

This revision to the Technical Note provides further information regarding the TRICS sites used for the estimation, and comparison with local sites and TRICS vehicle-only data, summarising to the resultant development trip generation.

## 2. DEVELOPMENT MIX

The final development mix has yet to be determined, but the approximate current proposals are set out below, spread across the three development sites of Arno Quay, East Quay, and West Pond/South Quay.

- 380 Apartments;
- 1143 Houses;
- 120 Affordable Apartments;
- 359 Affordable Houses;
- 70,000 sq ft ( $6503 \mathrm{~m}^{2}$ ) Food Store;
- $30,000 \mathrm{sq} \mathrm{ft}\left(2787 \mathrm{~m}^{2}\right)$ Hotel;
- $50,000 \mathrm{sq} \mathrm{ft}\left(4645 \mathrm{~m}^{2}\right)$ Offices;
- $60,000 \mathrm{sq} \mathrm{ft}\left(5574 \mathrm{~m}^{2}\right)$ Retail A1-A5 \& Health, Nursery, Crèche;
- $90,000 \mathrm{sq} \mathrm{ft}\left(8361 \mathrm{~m}^{2}\right)$ Leisure;
- $20,000 \mathrm{sq} \mathrm{ft}\left(1858 \mathrm{~m}^{2}\right)$ Other Employment; and
- Primary School (assumed to be around $1500 \mathrm{~m}^{2}$ ).

Of this total, approximately 200 houses are proposed for East Quay, and approximately 150 apartments in Arno Quay. The proposed development on the adjacent site known as 'The Mole' has yet to be determined, and as such, a worst case situation of an additional 200 houses has been considered for this site.

## 3. TRICS PERSON TRIP RATES

Average weekday Person Trip Rates have been extracted from the multi-modal data in TRICS 2008(a) for developments similar to the proposed development. A summary is provided in the table below.

|  | 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 | per 100 sqm GFA | 5.688 | 3.575 | 11.793 | 12.432 | 138.741 | 137.665 |
| Hotel | per 100 sqm GFA | 0.380 | 0.838 | 0.786 | 0.474 | 7.821 | 7.793 |
| Offices | per 100 sqm GFA | 2.052 | 0.175 | 0.264 | 1.835 | 9.53 | 9.14 |
| Retail | per 100 sqm GFA | 9.490 | 8.792 | 8.573 | 8.971 | 110.921 | 109.476 |
| Leisure | per 100 sqm GFA | 0.925 | 0.607 | 2.613 | 2.302 | 21.119 | 20.717 |
| Other Employment | per 100 sqm GFA | 2.052 | 0.175 | 0.264 | 1.835 | 9.53 | 9.14 |
| School | per 100 sqm GFA | 25.823 | 6.203 | 0.728 | 1.392 | 47.975 | 46.328 |

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

## 4. TRICS MODAL SPLIT

The weekday Modal Splits from the TRICS multi-modal data are outlined below.

|  | AM Peak Hour |  |  |  |  | PM Peak Hour |  |  |  |  | 12 Hour Total |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Landuse | Vehicle Occupancy | Vehicle Occupants (\%) |  | $\begin{aligned} & \stackrel{\theta}{\partial} \\ & \frac{n}{y} \\ & \vdots \\ & 0 \end{aligned}$ | $\begin{aligned} & \text { O} \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | Vehicle Occupancy |  | 0 0 0 0 0 0 0 0 0 | 0 0 0 0 0 0 | $\begin{aligned} & \text { O} \\ & \frac{0}{E} \\ & \text { N } \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ |  |  |  | 0 0 0 0 0 0 |  |
| Apartments | 1.195 | 54 | 4 | 3 | 38 | 1.310 | 54 | 4 | 3 | 38 | 1.204 | 65 | 3 | 1 | 30 |
| Houses | 1.482 | 77 | 3 | 2 | 18 | 1.372 | 83 | 2 | 2 | 13 | 1.356 | 80 | 3 | 2 | 15 |
| Affordable Apartments | 1.425 | 53 | 7 | 2 | 38 | 1.311 | 52 | 4 | 1 | 44 | 1.274 | 52 | 5 | 1 | 41 |
| Affordable Houses | 1.672 | 54 | 6 | 0 | 41 | 1.270 | 66 | 1 | 4 | 29 | 1.415 | 63 | 4 | 3 | 31 |
| Food Store | 1.253 | 80 | 4 | 1 | 15 | 1.540 | 88 | 1 |  | 10 | 1.503 | 86 | 2 | 1 | 11 |
| Hotel | 1.297 | 61 | 9 | 1 | 29 | 1.401 | 57 | 4 | 1 | 38 | 1.364 | 52 | 10 | 1 | 37 |
| Offices | 1.076 | 80 | 10 | 2 | 9 | 1.091 | 75 | 11 | 2 | 12 | 1.124 | 66 | 7 | 1 | 26 |
| Retail | 1.196 | 60 | 0 | 1 | 40 | 1.283 | 72 | 2 | 1 | 24 | 1.243 | 67 | 1 | 1 | 31 |
| Leisure | 1.222 | 79 | 1 | 2 | 18 | 1.774 | 85 | 1 | 1 | 12 | 1.519 | 79 | 5 | 1 | 14 |
| Other Employment | 1.076 | 80 | 10 | 2 | 9 | 1.091 | 75 | 11 | 2 | 12 | 1.124 | 66 | 7 | 1 | 26 |
| School | 1.283 | 41 | 0 | 0 | 58 | 1.268 | 78 | 0 | 0 | 22 | 1.062 | 39 | 4 | 0 | 57 |

## 5. TRICS VEHICLE TRIP RATES

The resultant vehicle trip rates calculated from the TRICS multi-modal data are given in the table below.

|  |  | AM Peak Hour |  | PM Peak Hour |  | 12 Hour Total |  |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Landuse | per unit | 0.051 | 0.200 | 0.131 | 0.054 | 0.937 | 1.089 |
| Apartments | per unit | 0.124 | 0.486 | 0.393 | 0.243 | 2.608 | 2.834 |
| Houses | 0.067 | 0.160 | 0.163 | 0.092 | 1.181 | 1.292 |  |
| Affordable Apartments | per unit | 0.076 | 0.284 | 0.320 | 0.184 | 2.182 | 2.229 |
| Affordable Houses | per unit | Der | Arr | Dep | Arr | Dep |  |
| Food Store | per 100 sqm GFA | 3.623 | 2.285 | 6.735 | 7.099 | 79.836 | 79.217 |
| Hotel | per 100 sqm GFA | 0.178 | 0.394 | 0.322 | 0.194 | 2.964 | 2.953 |
| Offices | per 100 sqm GFA | 1.522 | 0.130 | 0.182 | 1.268 | 5.613 | 5.384 |
| Retail | per 100 sqm GFA | 4.750 | 4.401 | 4.812 | 5.036 | 60.130 | 59.347 |
| Leisure | per 100 sqm GFA | 0.598 | 0.393 | 1.255 | 1.106 | 11.052 | 10.842 |
| Other Employment | per 100 sqm GFA | 1.522 | 0.130 | 0.182 | 1.268 | 5.613 | 5.384 |
| School | per 100 sqm GFA | 8.337 | 2.003 | 0.446 | 0.852 | 17.742 | 17.132 |

## 6. COMPARISON WITH LOCAL SITES

### 6.1 Bay Pointe Study

As part of the planning application for the Bay Pointe development in Cardiff Bay, a study was undertaken by WSP covering the trip generation of a number of residential developments in the Cardiff and Barry area. The study observed the trip generation characteristics of seven sites between November 2006 and March 2007, consisting largely of apartments. The weighted average trip rates summarised in the study are given in the table below, with the TRICS Multi Modal Apartments rates listed for comparison.

|  | AM Peak Hour |  | PM Peak Hour |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: |
|  |  | Arr | Dep | Arr | Dep |
| Bay Pointe Trip Rate Study | Person Trip Rates | 0.107 | 0.329 | 0.279 | 0.133 |
|  | Vehicle Trip Rates | 0.035 | 0.211 | 0.197 | 0.086 |
| TRICS Multi Modal Sites <br> Apartments | Person Trip Rates | 0.113 | 0.438 | 0.314 | 0.131 |
|  | Vehicle Trip Rates | 0.051 | 0.200 | 0.131 | 0.054 |

### 6.2 Arup Studies

Further studies have been undertaken by Arup to allow additional comparison with local sites in the Waterfront area of Barry. Comparable residential sites were identified at Ffordd Sealand, Y Rhodfa, and Clos Tynaid Glo. In addition, the Morrisons supermarket, and the adjacent mixed retail development were surveyed in order to provide local comparison for the proposed foodstore and retail portions of the development.

### 6.2.1 Ffordd Sealand

The development off Ffordd Sealand to the west of Gladstone consists of 178 houses and 54 flats/apartments, accessed through a single highway connection. Due to the mix of residential houses and flats, a direct comparison of trip rates is not possible, so comparison has been made between the observed vehicle trips and the calculated vehicle trips using the TRICS multi-modal
trip rates in section 5.

|  | AM Peak Hour |  | PM Peak Hour |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Arr | Dep | Arr | Dep |
| Observed | 32 | 54 | 79 | 47 |
| TRICS rates | 25 | 97 | 77 | 46 |

### 6.2.2 Y Rhodfa

The development off Y Rhodfa to the south of Ffordd y Mileniwm consists of 303 flats/apartments. Comparison is made below between the observed vehicle trips and the calculated vehicle trips using the TRICS trip rates in section 5.

|  | AM Peak Hour |  | PM Peak Hour |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Arr | Dep | Arr | Dep |
| Observed | 22 | 44 | 55 | 43 |
| TRICS rates | 16 | 60 | 40 | 17 |

### 6.2.3 Clos Tynaid Glo

The development off Clos Tynaid Glo consists of 89 houses, 137 flats/apartments, and a 700 sqm GFA (approx) Doctors surgery/Pharmacy. Due to the mix of development types, a direct comparison of trip rates is not possible, so comparison has been made between the observed vehicle trips and the calculated vehicle trips using the TRICS trip rates, including the Doctors surgery/Pharmacy.

|  | AM Peak Hour |  | PM Peak Hour |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Arr | Dep | Arr | Dep |
| Observed | 75 | 65 | 77 | 59 |
| TRICS rates | 50 | 100 | 73 | 51 |

### 6.2.4 Morrisions

The Morrisons development consists of a 5745 sqm GFA (as measured from the Ordnance Survey Land-line digital mapping) food store, plus a petrol filling station (PFS). It was observed that approximately $75 \%$ of the PFS users were solely visiting the PFS and not visiting the adjacent retail or foodstore. This has been taken into account to allow comparison with the calculated foodstore vehicle trips using the TRICS trip rates above.

|  | AM Peak Hour |  | PM Peak Hour |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Arr | Dep | Arr | Dep |
| Observed (Total including PFS) | 355 | 276 | 503 | 536 |
| Observed (PFS exit) |  | 143 |  | 167 |
| Observed (without PFS sole visitors) | 248 | 169 | 378 | 411 |
| TRICS rates | 208 | 131 | 387 | 408 |

### 6.2.5 Mixed Retail

The mixed retail development north of Ffordd y Mileniwm consists of Halfords, Instore, Argos, and Focus stores, totalling 5112 sqm GFA (also measured from the OS Land-line mapping). Comparison is made below between the observed vehicle trips and the calculated vehicle trips using the TRICS trip rates above.

|  | AM Peak Hour |  | PM Peak Hour |  |
| :--- | :---: | :---: | :---: | :---: |
|  | Arr | Dep | Arr | Dep |
| Observed | 64 | 33 | 174 | 196 |
| TRICS rates | 243 | 225 | 246 | 257 |

It is difficult to predict the trips associated with retail units without knowing more about the nature of the shops they contain. The TRICS sites are the average of a wide range of store types and as such provide the best estimate of possible trips associated with the retail aspects of the development, as some units will likely have trip generation lower than average, and some higher than average. The trip generation rates should be reviewed once further information regarding the nature of the shops is available.

### 6.3 Local Site Comparison Summary

It can be seen that there is reasonable comparison between the locally observed vehicle trip generation and the TRICS multi-modal vehicle trip generation, particularly in the busier PM Peak.
Comparison with other local residential sites undertaken by WSP for the Bay Point Study in Cardiff, shows that the assumed person trip rates estimated using TRICS are slightly lower than those observed, while the vehicle trip rates are comparable.

It can thus be assumed that the TRICS multi-modal data accurately represents the existing situation in Barry Waterfront, and are appropriate for use with the new development.

## 7. COMPARISON WITH TRICS VEHICLE-ONLY SURVEYS

In order to provide further comparison, and to enable the likely range of vehicle trip generation, the proposed trip generation has been compared with vehicle-only trip generation from TRICS which provides a larger number of survey sites. Due to the larger number of survey sites, we can be more selective and restrict the sites to those that most closely resemble the proposed development.

The selected sites used to obtain the data below are restricted to:

- the most recent surveys,
- from Town Centre, Edge of Town Centre, Neighbourhood Centre areas,
- Weekdays only,
- with Removed Smaller sites (eg $<50$ units for residential, $<2000$ sqm for office and food retail).

The remaining sites were then reviewed to ensure that they were suitable, and removed if it was deemed appropriate. The table below compares the trip rates from the TRICS multi-modal data and the 15 th percentile, mean, and 85 th percentile of the vehicle-only trip rates.

AM Peak Hour

|  | Arrivals |  |  |  | Departures |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Multimodal | Vehicle Only |  |  | Multimodal | Vehicle Only |  |  |
|  |  | 15\% | Mean | 85\% |  | 15\% | Mean | 85\% |
| Apartments | 0.051 | 0.017 | 0.041 | 0.064 | 0.200 | 0.043 | 0.143 | 0.245 |
| Houses | 0.124 | 0.094 | 0.153 | 0.236 | 0.486 | 0.268 | 0.335 | 0.370 |
| Affordable Apm't | 0.067 | 0.027 | 0.039 | 0.054 | 0.160 | 0.040 | 0.077 | 0.117 |
| Affordable Houses | 0.076 | 0.082 | 0.127 | 0.175 | 0.284 | 0.204 | 0.233 | 0.259 |
| Food Store | 3.623 | 2.297 | 3.535 | 4.015 | 2.285 | 0.928 | 1.782 | 2.429 |
| Hotel | 0.178 | 0.090 | 0.300 | 0.672 | 0.394 | 0.141 | 0.455 | 0.844 |
| Offices | 1.522 | 0.411 | 1.437 | 2.312 | 0.130 | 0.075 | 0.243 | 0.416 |
| Retail | 4.750 | 1.675 | 3.755 | 6.572 | 4.401 | 0.946 | 3.313 | 6.119 |
| Leisure | 0.598 | 0.400 | 0.633 | 0.834 | 0.393 | 0.259 | 0.407 | 0.555 |
| Other Employment | 1.522 | 0.411 | 1.437 | 2.312 | 0.130 | 0.075 | 0.243 | 0.416 |
| School | 8.337 | 3.582 | 4.938 | 6.415 | 2.003 | 2.091 | 3.933 | 5.228 |

PM Peak Hour

|  | Arrivals |  |  |  | Departures |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Multimodal | Vehicle Only |  |  | Multimodal | Vehicle Only |  |  |
|  |  | 15\% | Mean | 85\% |  | 15\% | Mean | 85\% |
| Apartments | 0.131 | 0.049 | 0.118 | 0.191 | 0.054 | 0.030 | 0.067 | 0.086 |
| Houses | 0.393 | 0.272 | 0.338 | 0.420 | 0.243 | 0.129 | 0.200 | 0.303 |
| Affordable Apm't | 0.163 | 0.067 | 0.118 | 0.186 | 0.092 | 0.037 | 0.071 | 0.098 |
| Affordable Houses | 0.320 | 0.228 | 0.347 | 0.466 | 0.184 | 0.044 | 0.136 | 0.232 |
| Food Store | 6.735 | 5.051 | 6.671 | 8.059 | 7.099 | 5.603 | 7.880 | 9.502 |
| Hotel | 0.322 | 0.140 | 0.322 | 0.437 | 0.194 | 0.106 | 0.258 | 0.477 |
| Offices | 0.182 | 0.047 | 0.418 | 0.668 | 1.268 | 0.297 | 1.360 | 2.118 |
| Retail | 4.812 | 3.803 | 5.969 | 8.559 | 5.036 | 4.248 | 6.441 | 8.941 |
| Leisure | 1.255 | 0.829 | 0.914 | 1.006 | 1.106 | 0.717 | 0.934 | 1.210 |
| Other Employment | 0.182 | 0.047 | 0.418 | 0.668 | 1.268 | 0.297 | 1.360 | 2.118 |
| School | 0.446 | 0.125 | 0.484 | 0.801 | 0.852 | 0.664 | 0.960 | 1.256 |

The tables show that the multi-modal trip rates compare well with the more selective vehicle-only trip rates. The multi-modal residential trip rates tend to be slightly higher that the mean vehicle only rates, but lower that the 85 th percentile. The other landuse are broadly comparable to the mean trip rates. This further comparison shows that the TRICS multi-modal trip rates are representative of the trip rates from other sites.

## 8. TRIP TYPES AND REVISED MODAL SPLITS

### 8.1 Trip Types

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.

Food Store/Other Retail - Many trips will be transferred from other retail sites or linked to other journeys. Reference has been made to before-and-after studies by MacIver and Dickinson and earlier TRL findings to assume $30 \%$ pass-by trips to food and non-food retail. Further studies have suggested that co-located retail stores benefit from around $20 \%$ cross-visitation between the stores, reducing the overall number of trips further.

Hotel - Most of the trips will be linked to other landuses, including office/employment and leisure uses.

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 will likely be internal to the development or linked to other uses.

Leisure - Most trips will be from the local area or linked trips to other landuses.
Primary School - The vast majority of the trips associated with the proposed school will be from the new development, thus will have a high proportion of walking and cycling modes, and vehicle trips are likely to the linked to other journey purposes.

### 8.2 Revised Modal Splits

### 8.2.1 Public Transport

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

### 8.2.2 Retail Vehicle Occupancy

The vehicle occupancy at the Morrisons and Retail site was observed during the peak periods, and found to be 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.

## 9. RESULTANT TRIP GENERATION

Taking the factors discussed in the previous sections into account, the resultant vehicle trip generation for each section of the proposed development are summarised in the table below.

|  | AM Peak Hour |  | PM Peak Hour |  | 12 Hour Total |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Arr | Dep | Arr | Dep | Arr | Dep |
| East Quay | 24 | 93 | 75 | 46 | 489 | 541 |
| Arno Quay | 7 | 28 | 18 | 8 | 133 | 154 |
| West Pond/South Quay | 461 | 762 | 824 | 682 | 7262 | 7476 |
| The Mole | 24 | 93 | 75 | 46 | 498 | 541 |
| Total | $\mathbf{5 1 5}$ | $\mathbf{9 7 6}$ | $\mathbf{9 9 2}$ | $\mathbf{7 8 2}$ | $\mathbf{8 3 9 1}$ | $\mathbf{8 7 1 3}$ |

DOCUMENT CHECKING (not mandatory for File Note)

|  | Prepared by | Checked by | Approved by |
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| Name | Paul Carr | Steve Arthur | Jonathan Kinghorn |
| Signature |  |  |  |

Appendix G2
Gravity Model Technical
Note

| Job title | Waterfront Barry | Job number |
| :--- | :--- | :--- |
|  |  | 122374 |
| cc | Paul Carr | File reference |
|  |  | $4-70$ |
| Prepared by | Roddy Beynon x 26506 (Cardiff) | Date |
|  |  | 17 March 2008 |
| Subject | Gravity Model for Trip Distribution |  |

Subject Gravity Model for Trip Distribution

## 1. INTRODUCTION

In order to distribute trips generated by the Waterfront Barry development it is proposed to use a simple 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.

A gravity model will require a boundary which relates to the likely extent of trip attraction and generation and a zone system which divides the considered area in relation to the local highway network, employment and population.

## 2. GRAVITY MODEL EQUATION

The gravity model will take the form of the equation:

$$
T_{i j}=\frac{a \cdot J \times b \cdot P}{D^{\alpha}}
$$

Where:
$T_{i j}$ is the proportion of trips generated between Barry Waterfront and a given zone;
$J$ is the number of jobs;
$P$ is the population;
$a$ and $b$ are constants depending on the nature of the trips being considered (employment, retail, leisure)
$\alpha$ is the distance factor which will be tuned during calibration; and
$D$ is the distance between the Waterfront development and the centroid of the production/attraction zone. This distance will be taken as the dominant highway route in kilometres

It may prove appropriate to use variants on this equation to suit differing trip purposes such as retail, employment and shopping.

## 3. POPULATION AND EMPLOYMENT DATA

TEMPRO version 53 datasets will be 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.

## 4. EXTENTS AND ZONING OF GRAVITY MODEL

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 origins/destinations of all proposed additional Waterfront Barry trips.

The zoning of the model will be relatively fine in close proximity to the development with Barry and Cardiff split into multiple zones. Further afield towns and whole unitary authorities will form other zones.

The population and job data for each zone will be obtained from TEMPRO, the distance from each zone to Waterfront Barry will be taken from what is judged to be the centroid in terms of population and jobs for each zone.
In the case where zoning is finer than that of TEMPRO (only applicable to Cardiff and Barry) the population and jobs will initially be proportioned according to the 2001 Census data with adjustments from local planning data for developments in future years.

An initial investigation suggests that the following zones may be suitable:

1. Blaenau Gwent Unitary Authority
2. Bridgend Unitary Authority (excluding 2 and 3)
3. Bridgend
4. Leisure and Commercial development, Llanilid (film studios)
5. Bristol
6. Caerphilly Unitary Authority (excluding 6)
7. Caerphilly
8. Cardiff Unitary Authority (excluding 8 and 9)
9. Cardiff North
10. Cardiff South
11. Merthyr Tydfil Unitary Authority (excluding 11)
12. Merthyr Tydfil
13. Monmouthshire Unitary Authority
14. Neath
15. Newport Unitary Authority (excluding 15)
16. Newport
17. Port Talbot
18. Rhondda Cynon Taff Unitary Authority (excluding 18)
19. Pontypridd
20. Swansea
21. The Vale of Glamorgan Unitary Authority (excluding 21-29)
22. Barry West
23. Barry East
24. Barry Central
25. Barry Island
26. Dinas Powys
27. Llantwit Major
28. Metrix
29. Penarth
30. Rhoose
31. Torfaen Unitary Authority (excluding 31)
32. Cwmbran

## 5. GRAVITY MODEL CALIBRATION

In order to ensure that the gravity model is producing realistic distributions the model will be calibrated using both local knowledge and the 2001 journey to work Census data in order to obtain a best fit with the available parameters. These parameters will then be used for the 2008 base year and agreed future year scenarios.

## 6. TOPICS FOR DISCUSSION

- Suitability of chosen extents and zoning system
- Local planning data unaccounted for in TEMPRO
- Use of differing model variables by trip purpose
- Model calibration

DOCUMENT CHECKING (not mandatory for File Note)

|  | Prepared by | Checked by | Approved by |
| :--- | :--- | :--- | :--- |
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| Signature |  |  |  |

## Appendix G3

Barry Island Through
Traffic Technical Note

| Job title | Waterfront Barry | Job number |
| :--- | :--- | :--- |
|  |  | 122374 |
| cc | File reference |  |
|  |  | $4-70$ |
| Prepared by | Paul Carr x 26462 (Cardiff) | Date |
|  |  | 2 April 2008 |

Subject Barry Island Through Traffic

## 1. INTRODUCTION

The proposed development includes a new highway link from Powell Duffryn Way/Ffordd Y Mileniwm through to Barry Island. This note has been prepared to summarise the proposed assumptions regarding the reassignment of the existing Barry Island traffic, once this 'missing link' of the highway network is in place.

## 2. EXISTING CONDITIONS

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

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

## 3. ASSUMPTIONS

Due to the direct nature of the proposed main highway link through the development it is assumed that all traffic from Barry Island heading to the east of the town centre or to destinations further east, such as Cardiff, 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 are proposed.

|  | 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 | $40 \%$ | $15 \%$ | $45 \%$ |

DOCUMENT CHECKING (not mandatory for File Note)

|  | Prepared by | Checked by | Approved by |
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| Name | Paul Carr | Jonathan Kinghorn | Jonathan Kinghorn |
| Signature |  |  |  |

Appendix G4-16
TRICS Trip Rate Data
See disc on back cover

Appendix H
NLP Waterfront Barry
Retail Assessment

See disc on back cover

Appendix I
Details of traffic
distribution

|  | Assignment by Zone |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | ROUTE A | ROUTE B | ROUTE C | ROUTE D | ROUTE E | ROUTE F | ROUTE G | ROUTE H | ROUTE I | ROUTE J |  |
|  | Blaenau Gwent UA | The Crescent, Ebbw Vale |  | 40\% | 40\% | 20\% |  |  |  |  |  |  | 100\% |
|  | Bridgend UA | Pontycymer |  | 40\% | 40\% | 20\% |  |  |  |  |  |  | 100\% |
|  | Bridgend | Train station |  | 100\% |  |  |  |  |  |  |  |  | 100\% |
| 4 | Bristol | Train station |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
| 5 | Llanilid development | Llanilid |  | 40\% | 40\% | 20\% |  |  |  |  |  |  | 100\% |
| 6 | Caerphilly UA | Blackwood |  | 40\% | 40\% | 20\% |  |  |  |  |  |  | 100\% |
| 7 | Caerphilly | Train station |  | 40\% | 40\% | 20\% |  |  |  |  |  |  | 100\% |
|  | Cardiff South | Cardiff Prison |  |  | 20\% | 10\% | 70\% |  |  |  |  |  | 100\% |
|  | Cardiff North | Llanishen tax office |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
| 10 | Merthyr Tydfil UA | Aberfan |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
| 11 | Merthyr Tydfil | Train station |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
| 12 | Monmouthshire UA | Raglan |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
| 13 | Neath | Train station |  | 55\% | 30\% | 15\% |  |  |  |  |  |  | 100\% |
| 14 | Neath Port Talbot UA | Neath Train Station |  | 55\% | 30\% | 15\% |  |  |  |  |  |  | 100\% |
| 15 | Newport UA | Train station |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
| 16 | Newport | Train station |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
| 17 | Port Talbot | Train station |  | 55\% | 30\% | 15\% |  |  |  |  |  |  | 100\% |
| 18 | Rhondda Cynon Taff UA | Abercynon |  | 40\% | 40\% | 20\% |  |  |  |  |  |  | 100\% |
| 19 | Pontypridd | Train station |  | 40\% | 40\% | 20\% |  |  |  |  |  |  | 100\% |
| 20 | The Vale of Glamorgan UA | High St, Cowbridge | 30\% | 60\% | 5\% | 5\% |  |  |  |  |  |  | 100\% |
| 21 | Barry West | Pontypridd Road, Barry |  |  |  |  |  |  |  |  |  | 100\% | 100\% |
| 22 | Barry East | Pencoedtre Road, Barry |  |  |  |  |  | 10\% | 60\% | 30\% |  |  | 100\% |
| 23 | Barry Central | Gladstone Road, Barry |  |  |  |  |  |  |  | 100\% |  |  | 100\% |
| 24 | Barry Island | Station Approach Rd |  |  |  |  |  |  |  |  | 100\% |  | 100\% |
| 25 | Dinas Powys | Murch Cross |  |  |  |  | 100\% |  |  |  |  |  | 100\% |
| 26 | Llanwit Major | East St | 100\% |  |  |  |  |  |  |  |  |  | 100\% |
| 27 | St. Athan Development | Development centre | 100\% |  |  |  |  |  |  |  |  |  | 100\% |
| 28 | Penarth | Clock roundabout |  |  |  |  | 40\% | 60\% |  |  |  |  | 100\% |
| 29 | Rhoose | Airport | 100\% |  |  |  |  |  |  |  |  |  | 100\% |
| 30 | Swansea UA | Bus station |  | 55\% | 30\% | 15\% |  |  |  |  |  |  | 100\% |
| 31 | Torfaen UA | Rockhill Rd, Pontypool |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |
|  | Cwmbran | Central RA near one-way |  |  | 60\% | 30\% | 10\% |  |  |  |  |  | 100\% |

Appendix J
Traffic Count Data

## Traffic Count Summary

Full Traffic Count Data included as Appendix J on CD mounted on back cover For locations of junctions, see junction descriptions in Appendix B

| Count Location | Junction number | Count source | Count date |
| :---: | :---: | :---: | :---: |
| Sycamore Cross | 1 | Vale of Glamorgan | $1^{\text {st }}$ May 2007 |
| Merrie Harrier | 3 | Vale of Glamorgan | $13^{\text {th }}$ March 2007 |
| Redlands Rd | 3 | Vale of Glamorgan | $15^{\text {th }}$ March 2007 |
| Murch Cross Roads | 4 | Vale of Glamorgan | $6{ }^{\text {th }}$ April 2006 |
| Sully Rd South of Biglis | 5 | Vale of Glamorgan | $24^{\text {th }}$ January 2008 |
| A4055 East of Biglis | 5 | Vale of Glamorgan | $29^{\text {th }}$ January 2008 |
| Barry Rd North of Biglis | 5 | Vale of Glamorgan | $19^{\text {th }}$ November 2004 |
| Biglis | 5 | Vale of Glamorgan | $28^{\text {th }}$ June 2007 |
| Barry Docks Link Road | 6 | Vale of Glamorgan | $15^{\text {th }}$ February 2007 |
| Waycock Cross | 7 | Capita Symonds | $21^{\text {st }}$ July 2004 |
| Paget Road | 8 | Vale of Glamorgan | $10^{\text {th }}$ October 2006 |
| Parade Harbour Ship Gyratory | 9 | Vale of Glamorgan | $31^{\text {st }}$ January 2008 |
| Park Av Broad St | 9 | Vale of Glamorgan | $19^{\text {th }}$ February 2008 |
| St Nicholas Rd/Romilly Rd/Park Av | 9 | Vale of Glamorgan | $7{ }^{\text {th }}$ February 2008 |
| Broad Street - Gladstone Rd | 10 | Vale of Glamorgan | $16^{\text {th }}$ March 2006 |
| Gladstone Bridge Broad St | 10 | Vale of Glamorgan | $5^{\text {th }}$ February 2008 |
| Barry Rd - East Walk | 11 | Vale of Glamorgan | $14^{\text {th }}$ September 2007 |
| Buttrills Road | 11 | Vale of Glamorgan |  |
| Barry Rd Tynewydd Rd | 12 | Vale of Glamorgan | $17^{\text {th }}$ January 2008 |
| Cemetery rd Roundabout | 12 | Arup | $26^{\text {th }}$ February 2008 |
| Barry Dock Access Rd | 13 | Vale of Glamorgan | $24^{\text {th }}$ May 2007 |
| Palmerston Rd Cardiff Rd | 14 | Vale of Glamorgan | $22^{\text {nd }}$ May 2007 |
| Dow Corning access | 14 | Arup | $29^{\text {th }}$ July 2008 |
| Gladstone Rd Holton Rd | 15 | Vale of Glamorgan | $19^{\text {th }}$ September 2007 |
| Western Sq Vere St | 15 | Vale of Glamorgan | $18^{\text {th }}$ September 2007 |
| Mileniwm Way Atlantic Way | 16 | Vale of Glamorgan | $19^{\text {th }}$ June 2007 |
| Mileniwm Way Cory Way | 17 | Vale of Glamorgan | $21^{\text {st }}$ March 2006 |
| Subway Rd Dock Office | 18 | Vale of Glamorgan | $20^{\text {th }}$ November 2003 |
| Clos Tynaid Glo | 19 | Arup | $26^{\text {th }}$ February 2008 |
| Morrisons Roundabout | 20 | Vale of Glamorgan | $9{ }^{\text {th }}$ March 2006 |
| Morrisons Roundabout | 20 | Arup | $24^{\text {th }}$ March 2008 |
| Mileniwm Way Gladstone Bridge | 21 | Vale of Glamorgan | $26^{\text {th }}$ September 2007 |
| Plymouth Rd | a + 22 | Vale of Glamorgan | $26^{\text {th }}$ July 2004 |
| Hood Rd Tunnel | 23 | Vale of Glamorgan | $15^{\text {th }}$ April 2005 |
| Ffordd Sealand | N/A | Arup | $24^{\text {th }}$ March 2008 |

Appendix K
Capacity Analysis
Results
See disc on back cover

Appendix L
Improvements at the Merrie Harrier and Waycock Cross Junctions



TA79/99

|  |  |  |  |  | 2008 Base |  |  |  | 2020 Base |  |  |  | 2020 with Development |  |  |  | 2020 with Dev and tourism traffic PM |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Link | Type | Number | Carraigeway | Capacity/V | AM |  | PM |  | AM |  | PM |  | AM |  | PM |  |  |  |
| L1 | UAP1 | 2 | 10.5 | 2010 | 783 | 352 | 577 | 956 | 913 | 410 | 671 | 1111 | 913 | 410 | 671 | 1111 | 671 | 1111 |
| L2 | UAP1 | 2 | 12 | 2010 | 915 | 1169 | 1460 | 1208 | 1066 | 1362 | 1697 | 1405 | 1181 | 1675 | 2027 | 1563 | 2111 | 1657 |
| L3 | UAP1 | 3 | 12 | 2550 | 687 | 721 | 897 | 924 | 801 | 841 | 1043 | 1074 | 873 | 945 | 1153 | 1173 | 1153 | 1173 |
| L4 | UAP2 | 2 | 10 | 1650 | 974 | 688 | 879 | 1101 | 1135 | 802 | 1023 | 1280 | 1343 | 852 | 1128 | 1499 | 1222 | 1583 |
| L5 | UAP4 | 2 | 7 | 1140 | 318 | 97 | 289 | 141 | 370 | 113 | 336 | 164 | 375 | 117 | 340 | 171 | 340 | 171 |
| L6 | UAP3 | 2 | 8 | 1530 | 908 | 743 | 687 | 838 | 1059 | 866 | 799 | 974 | 1064 | 891 | 820 | 982 | 820 | 982 |
| L7 | UAP3 | 2 | 10 | 1620 | 508 | 297 | 298 | 405 | 592 | 346 | 347 | 471 | 629 | 412 | 410 | 516 | 410 | 516 |
| L8 | UAP3 | 2 | 10 | 1620 | 449 | 269 | 266 | 357 | 523 | 314 | 309 | 415 | 555 | 354 | 352 | 453 | 352 | 453 |
| L9 | UAP3 | 2 | 11.5 | 1620 | 569 | 522 | 522 | 581 | 663 | 608 | 607 | 676 | 703 | 640 | 644 | 718 | 644 | 718 |
| L10 | UAP3 | 2 | 10 | 1620 | 523 | 588 | 514 | 780 | 610 | 686 | 598 | 907 | 667 | 726 | 641 | 986 | 641 | 986 |
| L11 | UAP2 | 2 | 8 | 1550 | 888 | 1032 | 986 | 1241 | 1034 | 1202 | 1147 | 1443 | 1342 | 1342 | 1338 | 1766 | 1448 |  |
| L12 | UAP3 | 2 | 10 | 1620 | 436 | 344 | 355 | 456 | 508 | 401 | 413 | 531 | 508 | 401 | 413 | 531 | 413 | 531 |
| L13 | UAP4 | 2 | 12 | 1410 | 732 | 536 | 801 | 668 | 853 | 624 | 931 | 777 | 674 | 542 | 717 | 661 | 717 | 661 |
| L14 | UAP2 | 2 | 7.5 | 1470 | 343 | 655 | 668 | 369 | 400 | 764 | 777 | 429 | 405 | 776 | 788 | 437 | 788 | 437 |
| L15 | UAP2 | 2 | 8 | 1470 | 752 | 576 | 738 | 691 | 876 | 672 | 859 | 803 | 972 | 934 | 1139 | 935 | 1245 | 1060 |
| L16 | UAP1 | 2 | 5.5 | 1020 | 312 | 360 | 459 | 385 | 364 | 420 | 533 | 448 | 364 | 420 | 533 | 448 | 555 | 480 |
| L17 | UAP1 | 2 | 9 | 1550 | 205 | 265 | 322 | 404 | 238 | 309 | 374 | 470 | 321 | 447 | 485 | 621 | 591 | 746 |
| L18 | UAP3 | 2 | 12 | 1620 | 663 | 511 | 561 | 943 | 773 | 596 | 652 | 1097 | 617 | 550 | 575 | 914 | 575 | 914 |
| L19 | UAP2 | 2 | 7 | 1260 | 93 | 105 | 82 | 304 | 109 | 122 | 95 | 353 | 132 | 159 | 135 | 385 | 135 | 385 |
| L20 | UAP2 | 2 | 7 | 1260 | 783 | 480 | 708 | 623 | 913 | 559 | 823 | 725 | 909 | 738 | 983 | 882 | 983 | 882 |
| L21 | UAP3 | 2 | 9 | 1530 | 88 | 127 | 172 | 181 | 103 | 148 | 200 | 211 | 367 | 451 | 558 | 596 | 666 | 702 |
| L22 | UAP3 | 2 | 7 | 1300 |  |  |  |  |  |  |  |  | 605 | 811 | 1176 | 727 | 1275 | 854 |
| L23 | UAP3 | 2 | 9 | 1530 | 154 | 156 | 141 | 361 | 180 | 182 | 164 | 420 | 854 | 605 | 728 | 1176 | 838 | 1275 |
| L24 | UAP2 | 2 | 7.3 | 1470 | 847 | 508 | 768 | 1044 | 987 | 592 | 893 | 1214 | 1319 | 855 | 1209 | 1585 | 1318 | 168 |
| L25 | UAP2 | 2 | 7.3 | 1470 | 687 | 473 | 542 | 827 | 800 | 551 | 630 | 962 | 1137 | 797 | 935 | 1332 | 1045 | 1431 |
| L26 | UAP2 | 2 | 7.3 | 1470 | 723 | 427 | 703 | 841 | 842 | 498 | 817 | 978 | 1179 | 743 | 1122 | 1348 | 1232 | 1448 |
| L27 | UAP2 | 2 | 7.3 | 1470 | 754 | 497 | 714 | 893 | 879 | 579 | 830 | 1038 | 1216 | 824 | 1135 | 1408 | 1245 | 150 |
| L28 | UAP2 | 2 | 7.3 | 1470 | 702 | 635 | 683 | 917 | 818 | 740 | 794 | 1067 | 1167 | 937 | 1064 | 1375 | 1174 | 1474 |
| L29 | UAP2 | 2 | 7.3 | 1470 | 609 | 675 | 766 | 779 | 709 | 786 | 891 | 906 | 1058 | 983 | 1257 | 1176 | 1356 | 1286 |
| L30 | UAP1 | 2 | 12 | 2010 | 1022 | 932 | 1118 | 1208 | 1191 | 1086 | 1300 | 1405 | 1495 | 1221 | 1485 | 1725 | 1595 | 1824 |
| L31 | UAP1 | 2 | 7 | 1320 | 636 | 610 | 617 | 917 | 742 | 711 | 717 | 1066 | 890 | 750 | 765 | 1227 | 875 | 1326 |
| L32 | UAP3 | 2 | 7.5 | 2010 | 689 | 578 | 673 | 870 | 955 | 673 | 782 | 1012 | 1099 | 704 | 824 | 1163 | 933 | 1262 |
| L33 | UAP2 | 2 | 15 | 1650 | 1070 | 676 | 859 | 1070 | 1247 | 787 | 999 | 1244 | 1375 | 809 | 1029 | 1381 | 1139 | 1480 |

Key
Less than $80 \%$ capacity flow
eitween $80-90 \%$ capacity flow Exceeding 100\% capacity flow Link not constructed in this scenario

Appendix N
Road Safety Audit Stage 1

See disc on back cover

Appendix O
Designers Response to Road Safety Audit Stage 1

See disc on back cover

Appendix P
Car and Cycle Parking
Assessment

## P1 Residential Car Parking Assessment

Table P1: West Pond Residential Car Parking

| Area | Houses |  | Apartments | Proposed Spaces | Standards |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | South Wales |  | CSS |
| WP1 | 22 | 4- bed |  | 0 | 39 | 72 | 49 |
| WP2 | $\begin{aligned} & 15 \\ & 18 \end{aligned}$ | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 0 | 49 | 68 | 58 |
| WP3 | $\begin{aligned} & 33 \\ & 11 \\ & 2 \end{aligned}$ | $\begin{aligned} & 2-\text { bed } \\ & 3 \text { - bed } \\ & 4 \text { - bed } \end{aligned}$ | 27 | 105 | 124 | 102 |
| WP4 |  | $\begin{aligned} & 2-\text { bed } \\ & 3 \text { - bed } \end{aligned}$ | 0 | 74 | 98 | 85 |
| WP5 |  | $\begin{aligned} & 2-\text { bed } \\ & 3 \text { - bed } \end{aligned}$ | 21 | 83 | 114 | 92 |
| WP6 |  | $\begin{aligned} & 2-\text { bed } \\ & 3 \text { - bed } \end{aligned}$ | 0 | 80 | 111 | 97 |
| WP7 | $\begin{aligned} & 38 \\ & 9 \end{aligned}$ | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 25 | 94 | 119 | 96 |
| WP8 |  | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 0 | 103 | 121 | 105 |
| WP9 | $\begin{aligned} & 25 \\ & 11 \\ & 23 \end{aligned}$ | 2-bed <br> 3 - bed <br> 4-bed | 19 | 123 | 168 | 128 |
| WP10 | $\begin{array}{\|l} 26 \\ 13 \\ 9 \\ \hline \end{array}$ | 2-bed <br> 3 - bed <br> 4- bed | 0 | 65 | 104 | 80 |
| WP11 | 0 |  | 37 | 37 | 47 | 45 |
| WP12 | 55 | 4- bed | 0 | 110 | 179 | 121 |
| WP13 | 18 | 4- bed | 9 | 41 | 71 | 51 |
| WP DC Mixed Use | 0 |  | 22 | 45 | 28 | 27 |
| Sub-Total | 536 |  | 160 | 1048 | 1424 | 1136 |

Table P2: South Quay Residential Car Parking

| Area | Houses |  | Apartments | Proposed Spaces | Standards |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | South Wales |  | CSS |
| SQ1 | 11 | 3-bed |  | 24 | 45 | 55 | 43 |
| SQ2 | 0 |  | 82 | 77 | 103 | 99 |
| SQ3 | 9 | 2-bed | 38 | 48 | 65 | 57 |
| SQ4 | 14 18 9 | $\begin{aligned} & 2-\text { bed } \\ & 3 \text { - bed } \\ & 4-\text { bed } \end{aligned}$ | 0 | 56 | 95 | 50 |
| SQ5 | 14 18 9 | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \\ & 4-\text { bed } \end{aligned}$ | 0 | 59 | 95 | 50 |
| SQ6 | 14 18 9 | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \\ & 4-\text { bed } \end{aligned}$ | 0 | 59 | 95 | 50 |
| SQ7 | 18 9 | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \\ & 4-\text { bed } \end{aligned}$ | 0 | 59 | 95 | 50 |
| SQ8 | 14 18 7 | $\begin{aligned} & 2-\text { bed } \\ & 3 \text { - bed } \\ & 4 \text { - bed } \end{aligned}$ | 10 | 53 | 101 | 59 |
| SQ9 | 20 11 8 | $\begin{aligned} & \hline 2-\text { bed } \\ & 3-\text { bed } \\ & 4-\text { bed } \\ & \hline \end{aligned}$ | 7 | 57 | 95 | 56 |
| SQ10 | 19 11 10 | 2-bed <br> 3-bed <br> 4- bed | 0 | 69 | 91 | 48 |
| SQ11 | 20 11 6 | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \\ & 4-\text { bed } \end{aligned}$ | 7 | 55 | 89 | 54 |
| SQ12 | 5 7 11 | $\begin{aligned} & \hline 2-\text { bed } \\ & 3-\text { bed } \\ & 4-\text { bed } \end{aligned}$ | 2 | 27 | 64 | 31 |
| SQ13 | 20 11 6 | 2-bed <br> 3-bed <br> 4-bed | 7 | 56 | 89 | 71 |
| SQ14 | 19 11 10 | 2- bed <br> 3 - bed <br> 4-bed | 0 | 69 | 91 | 69 |
| SQ15 | 20 11 6 | 2-bed <br> 3-bed <br> 4-bed | 7 | 65 | 89 | 71 |
| SQ16 | 10 27 14 | 2 - bed 3 - bed 4 - bed | 0 | 83 | 124 | 103 |
| SQ17 | 28 17 11 | 2-bed <br> 3-bed <br> 4- bed | 0 | 72 | 123 | 96 |
| SQ18 \& 19 | 42 36 30 | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \\ & 4-\text { bed } \end{aligned}$ | 45 | 216 | 311 | 251 |
| Sub-Total | 69 |  | 229 | 1,225 | 1,870 | 1,308 |

Table P3: East Quay Residential Car Parking

| Area | Houses | Apartments | Proposed Spaces | Standards |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | South Wales | CSS |
| EQ1 | 14 2-bed <br> 15 3-bed <br> 18 4-bed | 24 | 88 | 147 | 119 |
| EQ2 | $\begin{array}{cc} \hline 16 & \text { 2-bed } \\ 15 & \text { 3-bed } \\ 10 & \text { 4-bed } \end{array}$ | 0 | 55 | 95 | 75 |
| EQ3 | $\begin{array}{cc} \hline 17 & \text { 2-bed } \\ 15 & \text { 3-bed } \\ 10 & \text { 4-bed } \end{array}$ | 0 | 42 | 94 | 76 |
| EQ4 | $\begin{array}{ll} \hline 16 & \text { 2-bed } \\ 18 & \text { 3-bed } \\ 6 & \text { 4-bed } \end{array}$ | 0 | 39 | 88 | 72 |
| EQ6 | 16 4-bed | 34 | 50 | 95 | 77 |
| Sub-Total | 186 | 58 | 290 | 522 | 419 |

Table P4: Arno Quay Residential Car Parking

| Area | Houses |  | Apartments | Proposed <br> Spaces | Standards |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  |  |  |  |  |  |  |
| AQ1 | 23 | 4-bed | 117 | 131 | 222 | 192 |
| Sub-Total | 23 |  | 117 | 131 | 222 | 192 |

## Assumptions

I.All proposed residential GFA's are below $75 \mathrm{~m}^{2}$. In the South Wales guidance there is only one standard stated for 4 bedrooms and this contains a GFA of above $120 \mathrm{~m}^{2}$. Due to this being the only standard for 4 bedrooms it has been used, despite the GFA being incorrect.
II.One bedroom apartments assumed

## P2 Residential Cycle Parking Assessment

Table P5: West Pond Cycle Parking

| Residential Parcel | Houses |  | Apartments | Code for Sustainable Homes | VoG UDP <br> Standards | CSS (apartments only) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| WP1 | 22 | 4- bed | 0 | 88 | 22 | - |
| WP2 | 15 18 | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 0 | 51 | 33 | - |
| WP3 | $\begin{aligned} & 33 \\ & 11 \\ & 2 \end{aligned}$ | 2-bed <br> 3 - bed <br> 4-bed | 27 | 90 | 73 | 6 |
| WP4 | $\begin{aligned} & 21 \\ & 27 \end{aligned}$ | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 0 | 75 | 48 | - |
| WP5 | $\begin{aligned} & 38 \\ & 9 \end{aligned}$ | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 21 | 71 | 68 | 5 |
| WP6 | $\begin{aligned} & 22 \\ & 32 \end{aligned}$ | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 0 | 86 | 54 | - |
| WP7 | $\begin{aligned} & 38 \\ & 9 \end{aligned}$ | $\begin{aligned} & 2-\text { bed } \\ & 3-\text { bed } \end{aligned}$ | 25 | 81 | 72 | 5 |
| WP8 |  | $\begin{aligned} & 2-\text { bed } \\ & 3 \text { - bed } \end{aligned}$ | 0 | 93 | 59 | - |
| WP9 | $\begin{aligned} & 25 \\ & 11 \\ & 23 \end{aligned}$ | 2-bed <br> 3-bed <br> 4-bed | 19 | 158 | 78 | 4 |
| WP10 | $\begin{aligned} & 26 \\ & 13 \\ & 9 \end{aligned}$ | 2-bed <br> 3-bed <br> 4- bed | 0 | 88 | 48 | - |
| WP11 | 0 |  | 37 | 37 | 37 | 8 |
| WP12 | 55 | 4-bed | 0 | 220 | 55 | - |
| WP13 |  | 4- bed | 9 | 72 | 27 | 2 |
| WP DC Mixed Use | 0 |  | 22 | 22 | 22 | 4 |
| Sub-Total | 536 |  | 160 | 1,232 | 696 | 34 |

Table P6: South Quay Cycle Parking

| Area | Houses | Apartments | Code for Sustainable Homes | VoG UDP <br> Standards | CSS (apartments only) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| SQ1 | 11 3-bed | 24 | 46 | 35 | 5 |
| SQ2 | 0 | 82 | 82 | 82 | 17 |
| SQ3 | 9 2-bed | 38 | 47 | 47 | 8 |
| SQ4 | $\begin{array}{ll} 14 & 2-\text { bed } \\ 18 & 3-\text { bed } \\ 9 & 4-\text { bed } \end{array}$ | 0 | 86 | 41 | - |
| SQ5 | 14 $2-$ bed <br> 18 $3-$ bed <br> 9 $4-$ bed | 0 | 86 | 41 | - |
| SQ6 | 14 2 - bed <br> 18 3 - bed <br> 9 4 - bed | 0 | 86 | 41 | - |
| SQ7 | 14 $2-$ bed <br> 18 $3-$ bed <br> 9 $4-$ bed | 0 | 86 | 41 | - |
| SQ8 | 14 $2-$ bed <br> 18 $3-$ bed <br> 7 $4-$ bed | 10 | 88 | 49 | 2 |
| SQ9 | 20 $2-$ bed <br> 11 $3-$ bed <br> 8 $4-$ bed | 7 | 81 | 46 | 2 |
| SQ10 | 19 $2-$ bed <br> 11 $3-$ bed <br> 10 $4-$ bed | 0 | 81 | 40 | - |
| SQ11 | 20 $2-$ bed <br> 11 $3-$ bed <br> 6 $4-$ bed | 7 | 73 | 44 | 2 |
| SQ12 | 5 2-bed <br> 7 3-bed <br> 11 4-bed | 2 | 65 | 25 | 1 |
| SQ13 | 20 2 - bed <br> 11 3 - bed <br> 6 $4-$ bed | 7 | 73 | 44 | 2 |
| SQ14 | 19 2-bed <br> 11 3 -bed <br> 10 4-bed | 0 | 81 | 40 | - |
| SQ15 | 20 $2-$ bed <br> 11 $3-$ bed <br> 6 $4-$ bed  <br> 10 $2-$ bed | 7 | 73 | 44 | 2 |
| SQ16 | 10 $2-$ bed <br> 27 3 -bed <br> 14 $4-$ bed | 0 | 120 | 51 | - |
| SQ17 | 28 $2-$ bed <br> 17 $3-$ bed <br> 11 $4-$ bed | 0 | 106 | 56 | - |
| SQ18 \& 19 | 42 $2-$ bed <br> 36 $3-$ bed <br> 30 $4-$ bed | 45 | 279 | 153 | 9 |
| Sub-Total | 691 | 229 | 1,639 | 920 | 50 |

Table P7: East Quay Residential Cycle Parking

| Residential Parcel | Houses | Apartments | Code for Sustainable Homes | VoG UDP <br> Standards | CSS (apartments only) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| EQ1 | $\begin{array}{cc} 14 & \text { 2-bed } \\ 15 & \text { 3-bed } \\ 18 & \text { 4-bed } \end{array}$ | 24 | 116 | 71 | 5 |
| EQ2 | $\begin{array}{ll} 16 & \text { 2-bed } \\ 15 & \text { 3-bed } \\ 10 & \text { 4-bed } \end{array}$ | 0 | 86 | 41 | - |
| EQ3 | $\begin{array}{cc} 17 & \text { 2-bed } \\ 15 & \text { 3-bed } \\ 10 & \text { 4-bed } \end{array}$ | 0 | 102 | 42 | - |
| EQ4 | $\begin{array}{ll} 16 & \text { 2-bed } \\ 18 & \text { 3-bed } \\ 6 & \text { 4-bed } \end{array}$ | 0 | 76 | 40 | - |
| EQ6 | 16 4-bed | 34 | 98 | 50 | 7 |
| Sub-Total | 186 | 58 | 478 | 244 | 12 |

Table P8: Arno Quay Cycle Parking

| Residential parcel | Houses | Apartments | Code for <br> Sustainable <br> Homes | VoG UDP <br> Standards | CSS <br> (apartments <br> only) |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| AQ1 | 23 | 4-bed | 117 | 209 | 140 | 24 |
| Sub-Total | 23 | 117 | 209 | 140 | 24 |  |

Appendix Q
Technical Note
documenting changes
to the traffic models used in Revision A

| Project title | Waterfront, Barry | Job number |
| :--- | :--- | :--- |
| cc |  | 122374 |
| Prepared by | Phillip Hardwick | File reference |
|  |  | $4-70$ |
| Subject | Transport Assessment Audit Response | Date |
|  |  | 7 April 2010 |

The purpose of this note is to provide a response to the technical points raised on the capacity analysis by Capita Symonds in their audit of the Transport Assessment, dated 26 ${ }^{\text {th }}$ January 2010.

Table 1 below outlines the Capita Symonds comment and the Arup response.
Table 1: Audit Review Technical Comments and Response

| Capita Comment <br> Number | Capita Comment | Arup Response |
| :--- | :--- | :--- |
| 8.11 | Merrie Harrier Junction - Phase D <br> does not have an intergreen with <br> Phase B. | There is no need for intergreen between phases <br> D and B, as ‘D' traffic should give-way to 'B' <br> traffic. However, this was not modelled in the <br> original model. |
| 8.12 | This has been corrected, along with the right <br> turn from Barry Road (E) - Phase B traffic- <br> now being modelled as an opposed movement. |  |
| Dinas Powys - Murch Crossroads - <br> Different staging and phasing have <br> been used for the AM and PM peak <br> periods. | Another correction is the addition of traffic <br> being able to turn right from both lanes on <br> Penlan Road. |  |
| The different staging and phasing that are <br> modelled in the AM and PM peak are <br> replicated from site observations. |  |  |
|  | A minor amendment has been made to the |  |
| give-ways on Murch Road and Millbrook |  |  |
| Road. Previously, Murch Road through and |  |  |
| right movements gave way to movements from |  |  |
| Millbrook Road, with Millbrook Road right |  |  |
| turn having priority. This has been amended so |  |  |
| that only the right turns from Millbrook Road |  |  |
| and Murch Road give way. |  |  |$|$


|  | approach half width is input as 6.63 m . A value of 3.65 m is more realistic. | in the base ARCADY model. The issue with this arm is that the half width is input as 7.40 m , rather than 3.65 m . However, there are optimistic half widths on the arms of this roundabout, as the presence of parked cars is reducing the usable carriageway width. Arm A (Gladstone Road N ) is input as 5.80 m , has been altered to 3.0 m with a 40 m flare. Arm D (Broad Street W ) is input as 6.10 m , has been altered to 3.0 m with a 50 m flare. |
| :---: | :---: | :---: |
| 8.15 | Gladstone Rd / Cardiff Rd / Ffordd y Mileniwm - Arm A approach half width is input as 3.94 m . A value of 3.65 m is more realistic. Arm A entry width is input as 7.63 m . A value of 7.3 m is more realistic. | These changes have been implemented although they are not large differences in absolute terms, but it will have a negative effect on the capacity of this arm. |
| 8.16 | Palmerston Rd / Cardiff Rd - Capita Symonds note high saturation flows for left and right turning movements. | These movements have been calculated on the physical characteristics of the highway based on RR67 formula, and as such are considered to be the most appropriate. However, the Palmerstone Road approach was entered as being 5.0 m in the model. This has been revised to 3.5 m as a more practical width, as the presence of vehicles parked on the sides of the road reduce the operating width of the carriageway. |
| 8.17 | Cory Way / Ffordd y Mileniwm Capita Symonds note that the entry widths for Arm A (6.26m) and Arm B $(6.08 \mathrm{~m})$ are an over estimate. | The suggestions of 4.0 m for Arm A and 5.4 m for Arm B have been adopted. |
| 8.18 | Hood Road / Broad Street / Island Road - The intergreen times for pedestrian phase $G$ ending to opposing traffic phases starting vary. The intergreen should be the same for each phase. The same applies to pedestrian phases H and I . The all red traffic pedestrian stage runs every other cycle. No evidence is provided to support this. The predicted queues on link $4 / 1$, in all scenarios, will block traffic entering link $4 / 2$ increasing predicted queues and delays. | The intergreen value used in the model between the conflicting pedestrian and traffic phases, in this instance, is dictated by the highest value as the pedestrian phases all run at the same time. Therefore, it is not critical that the values entered into the intergreen table differ. <br> Link $4 / 2$ has previously been modelled as a long lane, which was necessary in LinSig v2 in order to allow the right turning traffic to have their own stage. This is now modelled more accurately as a short lane in the latest version of the software, LinSig v3. Thus, new results have been obtained that would be more representative of the likely queue lengths. |
| 8.27 | Biglis Roundabout - Consideration is given to replacing the roundabout with a signal controlled junction and a capacity assessment has been undertaken. The analysis shows however that the junction will remain over capacity both with and without the development. | The Transport Assessment Revision A no longer proposes improvement works at this junction. Therefore, the comments are no longer relevant. |


|  |  |  |
| :---: | :---: | :---: |
| 8.28 | Port Rd / Barry Docks Roundabout Capita refer to insufficient merge lengths being shown on the improvement. | This layout has been amended to increase the merge length on Port Road northbound, the merge on Port Road westbound remains as originally shown. |
| 8.29 | Harbour Rd / Station Approach Rd / Paget Rd - The road markings shown on Figure 7.13 on Paget Road (south) approach at Harbour Road/Station Approach Road do not match the turning movements on links $6 / 1$ and $6 / 2$ in the LINSIG analysis. The drawing shows inside lane left turn only, outside lane straight ahead and right turn. The links in LINSIG indicate inside lane left turn and straight ahead and outside lane right turn. <br> There are pedestrian crossing facilities shown on Figure 7.13 on the Station Approach Road/Harbour Road/Paget Road junction. No pedestrian crossing facilities at this junction have been included in the LINSIG analysis of this junction. <br> The staging arrangement for Paget Road/Plymouth Road junction does not match the LINSIG analysis. No pedestrian stage is shown on the drawing. <br> The saturation flows within the LINSIG analysis for left and right turning links are excessive. It would be expected the saturation flows for links which solely have left or right turning traffic would be around 1600, irrespective of saturation flow calculated from geometry. <br> The Paget Road (south) approach to the Paget Road/Plymouth Road junction indicates right turning traffic turn right by giving way to opposing traffic. The right turn information indicates there is enough room to store 2 right turning vehicles without blocking other traffic on this approach. The geometry on the drawing indicates 1 right turning vehicle would block other traffic on this approach. The LINSIG analysis should be re-run with any right | The turning movements in the LinSig analysis have been revised to reflect the proposed layout. The revision of the analysis included inputting pedestrian phases that were previously omitted. Also, the suggested removal of the two car right turn storage at the Paget Road / Plymouth Road junction has been included in this revised analysis. The drawing has been updated to include these pedestrian phases in the staging diagram. <br> The saturation flows for left or right turning lanes have not been revised down, since it is considered that the RR67 calculation that utilises junction geometry to estimate saturation flow is a more accurate representation than "rule-of-thumb" values. <br> The revised analysis also has amended the cycle time to 80 seconds which has enabled all arms on the junction to operate under capacity. |
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|  | turning vehicle blocking other traffic on this approach. <br> The LINSIG analysis indicates this junction is overcapacity in 2020 with the development and tourism. The queues will be longer than indicated as traffic will be prevented from entering the correct lane due to the queue of traffic in an adjacent lane. |  |
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| 8.30 | Gladstone Road / Cardiff Road / Ffordd y Mileniwm - Arm A approach half width is input as 3.94 m . A value of 3.65 m is more realistic. Arm A entry width is input as 7.63 m . A value of 7.3 m is more realistic. | The suggested values of 3.65 m for the half width and 7.3 m for the entry width for Arm A have been adopted in the revised assessment. |
| 8.31 | Palmerstone Road / Cardiff Road The staging diagram shown on the drawing does not match the layout or LINSIG. <br> There is a left turn arrow in the inside lane of link $1 / 1$ but nowhere to turn left. <br> The saturation flows for left and right turning links are high and the same as straight ahead movements. <br> It will be very difficult for traffic to enter Dow Corning across three lanes of stationary traffic. <br> The capacity analysis shows the junction to remain over capacity both with and without the development. | This proposed improvement has been withdrawn. Therefore, the comments are no longer relevant. |
| 8.32 | Wimbourne Road / Ffordd y Mileniwm - Capita note the proposed replacement of a priority junction with a roundabout, but have no technical comments on the analysis. | N/A |
| 8.33 | Cory Way / Ffordd y Mileniwm Arm A entry width is input as 6.26 m . A value of 4 m is more realistic. Arm B entry width is input as 6.08 m . A value of 5.4 m is more realistic. | The suggestions of 4.0 m entry width for Arm A and a 5.4 m entry width for Arm B have been adopted. |
| 8.34 | Y Rhodfa / Ffordd y Mileniwm Figure 7.18 shows a slight realignment of the eastern arm. The entry width increases by approximately 1 m and increases the flare length. The capacity analysis shows a reduction of 45 vehicles in the PM with development scenario | This proposed improvement has been withdrawn. Therefore, the comments are no longer relevant. |


|  | due to the realignment. It is difficult to envisage that this minor improvement will reduce queuing to such an extent. The major traffic movement is straight ahead which has a single lane exit so the additional entry width will not be able to be utilised. |  |
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| 8.35 | Morrisons / Ffordd y Mileniwm Figure 7.19 shows slight realignments of the western and eastern arms. <br> There are small increases to the entry widths and flare lengths. The capacity analysis shows a reduction of 27 vehicles in the PM with development scenario due to the realignment. It is difficult to envisage that this minor improvement will reduce queuing to such an extent. The major traffic movement is straight ahead which has a single lane exit so the additional entry width will not be able to be utilised. | This proposed improvement has been withdrawn. Therefore, the comments are no longer relevant. |
| 8.36 | Gladstone Bridge / Ffordd y Mileniwm - Figure 7.20 shows slight realignments of all arms. There are small increases to the entry widths and flare lengths. The capacity analysis shows a reduction of 94 vehicles in the PM with development scenario due to the realignment. It is difficult to envisage that this minor improvement will reduce queuing to such an extent. The exit widths would prevent the utilisation of increased entry width. | After running a sensitivity test having reduced some of the entry widths to 7.3 m , the junction still operates within capacity. <br> A further sensitivity test has been undertaken whereby only a one lane approach (approx 3.65 m entry) has been modelled with no flare on all arms, with only the heaviest turning volume kept on each approach arm. This test shows that there is a benefit by implementing this proposal. |
| 8.38 | Internal South Quay Junction (Junction VIII) - The saturation flows for left and right turning links are high and the same as straight ahead movements. The staging used in the LINSIG analysis is incorrect. In stage 1 the right turns are giving way to the opposing traffic, indicating the right turns either give way or are controlled by indicative arrows. The second stage has fully signalled right turns. Either the right turns are give way, controlled by indicative arrows or are fully signalled. They cannot be controlled by a mixture of all three. In the 2020 AM Peak Period the queue on $1 / 1$ is 10 vehicles | The saturation flows have been calculated from RR67 and as such are considered the most appropriate. The latest analysis has amended the staging to ensure that right turning traffic does not run as a give way arrangement, but runs in its own stage. <br> This latest analysis has been done in LinSig V3 so the short right turn lanes can be modelled more accurately, thus Capita Symonds point raised regarding the issue of queue lengths is no longer relevant. |


|  | (approximately 60 metres). This lane measures 35 metres, therefore traffic entering the adjacent lane to this link will be blocked by this queue of traffic, increasing the queues and delays predicted by LINSIG. In the 2020 PM peak period, the queue on link $1 / 1$ is 20 vehicles (approximately 120 metres) and the queue on link $3 / 1$ is 9.8 vehicles (approximately 60 metres). Again this will prevent traffic entering adjacent lanes, increasing the queues and delays predicted by LINSIG. |  |
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| 8.39 | Central West Pond Junction (Junction V) | The analysis has been repeated, using LinSig V3 with the pedestrian stage called every second cycle. As with the previous junction, the staging has been reallocated to ensure no opposed right turn movements. <br> Since the analysis has been repeated in the latest version of LinSig, the short lane issue that has been raised is less of a problem as the input is more accurate defined. |
| 8.40 | Internal Northern Junction (Junction I) - The LINSIG analysis does not run pedestrian phase J <br> The staging used in the LINSIG analysis is incorrect. In stage 1 the right turns are giving way to the opposing traffic, indicating the right turns either give way or are controlled by indicative arrows. The second stage has fully signalled right turns. Either the right turns are give way, controlled by indicative arrows or are fully signalled. They cannot be controlled by a mixture of all three. In the 2020 AM Peak Period the queue on $2 / 1$ is 8.3 vehicles (approximately 50 metres) this lane measures 40 metres and the queue on link $4 / 1$ is 16.4 (approximately 100 metres), therefore traffic entering adjacent lanes to these links will be blocked by this queue of traffic, increasing the queues and delays predicted by LINSIG. In the 2020 PM Peak Period queue on link $2 / 1$ is 22.4 vehicles (approximately 135 metres) and the queue on link $4 / 1$ is 16.3 vehicles (approximately 100 metres). Again, this will prevent traffic | The pedestrian phase J now runs during the analysis. This analysis has been repeated in the latest version of LinSig to introduce short lanes for some of the turning movements and thereby more accurately model the junction. <br> This junction needs to run with opposed right turn movements with a subsequent dedicated phase. There are existing examples of this operation in the surrounding area such as the junction of Newport Road / City Road / Glossop Road in Cardiff, therefore are no reasons to believe that this operation is not appropriate for this junction. |


|  | entering adjacent lanes, increasing the <br> queues and delays predicted by <br> LINSIG. |  |
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As well as the changes document above, all the junctions assessed have been through an additional review process, to ensure that the models provide a robust analysis of the existing and likely future scenarios.

