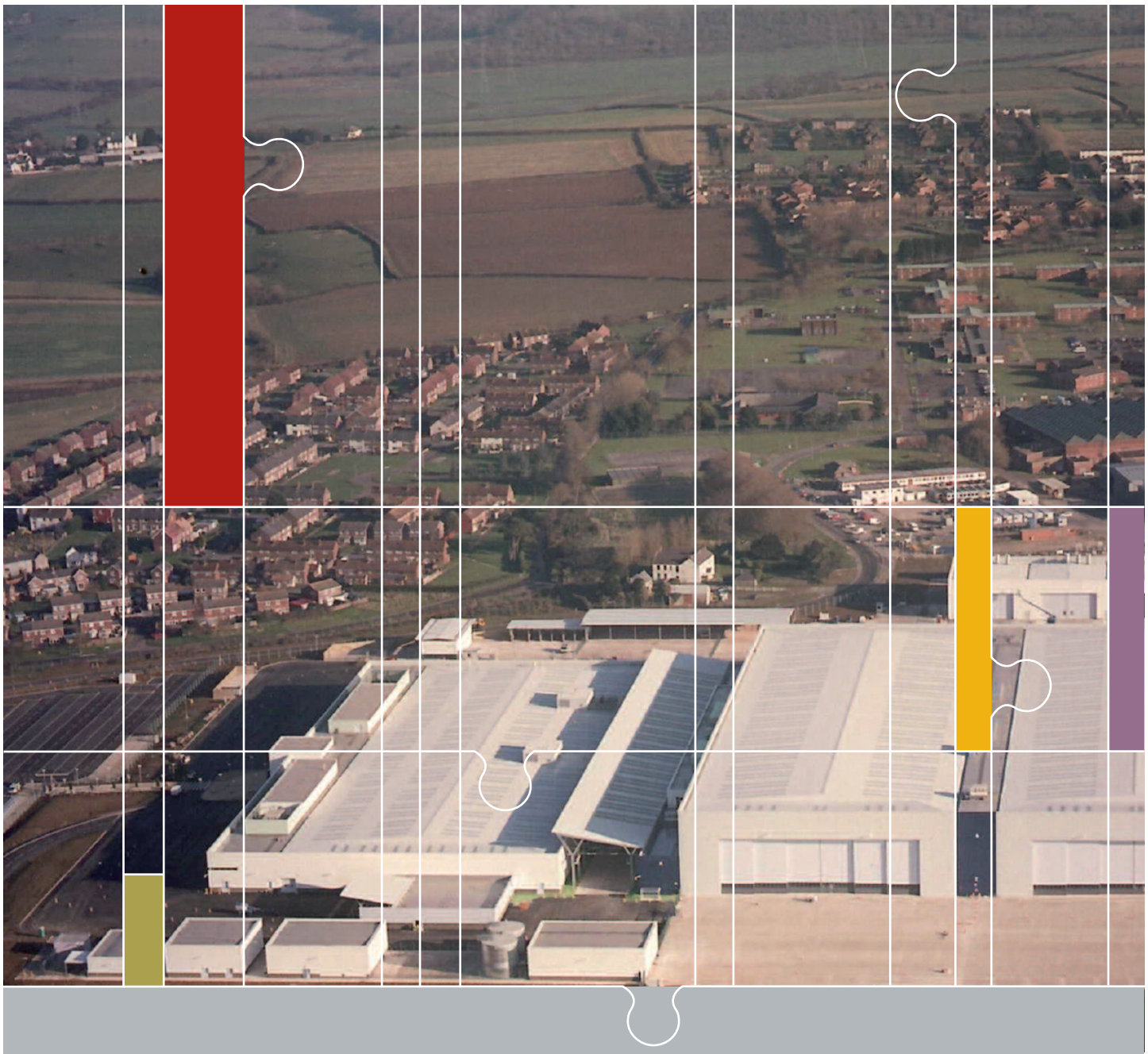

Defence Technical College and Aerospace Business Park - St Athan

Transport Assessment | May 2009

CAPITA SYMONDS

successful people, projects and performance

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Defence Technical College and Aerospace Business Park - St Athan

Transport Assessment

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C. Eglwys Brewis Road / St Athan Road
D. B4265 Eglwys Brewis Road / Boverton Signals
E. B4265 / West Gate
F. B4265 St Athan / Gileston
G. B4265 / Fontgary Road Junction
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1 B4265 / Northern Access Road Junction
2 Northern Access Road / Tremains Farm SFA
3 Northern Access Road / South West Picketston SFA
4 Northern Access Road / North of West Camp
5 Northern Access Road / Sport Facilities
6 Northern Access Road / Eglwys Brewis Road
7 Northern Access Road / ABP North
8 Northern Access Road / Gate 3 / Gate 2
9 Northern Access Road / Gate 2
10 Northern Access Road / Picketston Road
11 Northern Access Road / Picketston Close
12 Northern Access Road / Gate 1

Summary

The development proposals are for a world class Defence Technical College (DTC), together with an Aerospace Business Park (ABP) on land at and adjacent to the MoD St Athan site. The DTC and aerospace developments are major opportunities to bring employment to the Vale of Glamorgan in key industrial sectors. The development will not only provide employment opportunities for local people within the Vale of Glamorgan and beyond, but also improve the infrastructure and leisure facilities for residents.

The new Defence Technical College will be of international standing and will ensure UK military personnel continue to receive the very best training available. Technical training will be provided in a number of specialist skills including mechanical and aeronautical engineering, and communication/IT disciplines.

The additional re-development of the Aerospace Business Park will further build on South Wales' strong and successful aerospace industry and will both directly and indirectly create significant employment opportunities, attracting further investment into the area.

Access to the DTC site and part of the ABP development is proposed to be via a new Northern Access Road (NAR) which will link the B4265 at Llantwit Major to Eglwys Brewis.

The likely impact of the proposed development on the local highways and transportation infrastructure has been considered by a Transport Group consisting of representatives from the Welsh Assembly Government, Metrix, Defence Estates, Pell Frischmann, the Vale of Glamorgan Council (VoG) and Capita Symonds. This Transport Assessment is based on these regular discussions.

Traffic generation for the development has been based on a combination of the use of first principles, experience of other Ministry of Defence establishments and the analysis of the TRICS database. The DTC and ABP development traffic has been assigned onto the existing and proposed highway network using the SATURN model recently developed on behalf of WAG to review the options to improve access to Cardiff Airport. Traffic growth is taken into account within the model and includes the forecast expansion of Cardiff Airport.

Capacity analysis is based on the worst case scenarios of Monday – Thursday AM/PM and Friday PM peak periods.

Significant public transport proposals, linked to the key Travel Plans are proposed. These proposals, combined with improved walking and cycling facilities aim to generate sustainable travel to and from the site. This is enhanced by the mixture of employment, residential and leisure uses proposed as part of the development, to reduce travel to and from the site.

The Transport Assessment has been carried out in accordance with the 'Planning Policy Wales Technical Advice Note 18: Transport' 2007, based on 'Transport Assessment and Implementation: A Guide' 2005 by the Scottish Executive and the IHT 'Guidelines on Traffic Impact Assessment' 1994. The assessment takes into account the series of public consultations / workshop undertaken in 2008 / 2009, at which the community provided input into the design proposals, based on their local experience.

1.0 Existing Development

1.1 The St Athan site (Figure 1) opened as a training centre in 1938 and from this time until the present day, it has been the home of No 4 School of Technical Training (4STT). During World War II, there were some 5,000 trainee flight engineers on site at St Athan and between 1941 and 1951 around 22,000 British, Commonwealth and allied flight engineers trained and passed through St Athan.

1.2 From the mid 1950's to mid 1960's a Boy Entrant School operated at St Athan teaching youngsters a diverse range of practical skills including mechanical transport, welding, carpentry and draughting. Some 7,000 people completed their training at St Athan by the time the school was relocated in 1965.

1.3 A Driving Trainer School was established in the 1970s and trained approximately 4,000 personnel in a variety of skills, including motorway and night driving, before it closed in 1993. The Defence Aviation Repair Agency (DARA), latterly the Defence Support Group (DSG) was also located at the site to provide a one-stop shop for aircraft maintenance by combining RAF and RN aviation repair.

1.4 Working on military aircraft, such as Tornados and Sea Harriers, overhauling aero engines and providing manufacturing expertise, aircraft maintenance has been carried out at St Athan by some of the most highly qualified engineers and technicians in the world.

1.5 However, the planned cessation of DSG aircraft work at the site, has accelerated the need to identify and successfully encourage development opportunities at St Athan. The aim is to regenerate the site to:

- To achieve the comprehensive redevelopment and regeneration of the St Athan site as a whole
- To ensure the delivery of a centre of excellence for military training
- To support the aerospace and training sectors in Wales and to develop a viable aerospace business park;
- To retain and grow jobs within the sector and to increase engineering skills;
- To retain the airfield as a valued asset;
- To provide the new infrastructure necessary to the successful development of defence training and a viable aerospace business park as a centre of excellence.

The current population of West Camp, being a mixture of military, civilian and support staff, is approximately 850. In the remaining area, to be developed as part of DTC, there are currently 85 staff and 250 trainees within 4STT, with the total expected to rise to 400 by 2012. These staff and students will become part of DTC in 2014.

1.6 The aspirations of the proposed development are supported by the Vale of Glamorgan Adopted Unitary Development Plan 1996-2011 (UDP):

> *"EMP10 The RAF base at St Athan provides an important source of employment for the local economy. Appropriate expansion, within the boundaries shown on the Proposals Maps, will be supported, subject to environmental considerations."*

and the St Athan Development Brief July 2006:

> *"The site at St Athan meets the requirements for delivering a world-class Training Academy alongside the Welsh Assembly Government and WDA's proposals to create an Aerospace Centre of Excellence."*

Legislative Context

1.7 The content of the Transport Assessment (TA) is in accordance with the 'Planning Policy Wales Technical Advice Note 18: Transport' 2007, based upon 'Transport Assessment and Implementation: A Guide' 2005 by the Scottish Executive and the IHT 'Guidelines on Traffic Impact Assessment' 1994. The 'Guidelines on Traffic Impact Assessment' states that:

> *'Developers should submit transport assessments to accompany planning applications for major developments. The precise scope and content of each assessment will depend upon the scale, travel intensity and characteristics of the proposal. In general, assessments should as a minimum provide information on the likely modal split of journeys to and from the site, together with details of the measures proposed to improve access by public transport, walking and cycling and reduce the number and impacts of motorised journeys associated with the proposal.'*

Policy Context

1.8 This section of the TA sets out the transport related planning policy context at a national/regional and local level relevant to the proposed Defence Technical College and ABP at St Athan. The main documents that are considered key to this development are:

- People, Places, Futures: The Wales Spatial Plan – July 2008
- Wales Transport Strategy – One Wales, Connecting the Nation - April 2008
- South East Wales Regional Transport Plan – Final Draft December - 2008
- Manual for Streets – 2007
- Planning Policy Wales – March 2002
- Technical Advice Note 18: Transport – March 2007
- Addendum to 1993 South Wales Parking Guidelines – 1999
- Vale of Glamorgan Council Local Transport Plan 2001/2 to 2006/6 – August 2000
- Vale of Glamorgan Adopted Unitary Development Plan (1996 -2011) – April 2005
- St Athan Development Brief – July 2006
- Vale of Glamorgan UDP Supplementary Planning Guidance 'Sustainable Development' - 2006

National & Regional Policy

People, Places, Futures: The Wales Spatial Plan – July 2008

1.9 The Wales Spatial Plan (WSP) encompasses the elements required to deliver sustainable development. A statutory plan, it does not form part of the development plan framework, but provides the context and informs the preparation of both Local Development Plans and National and Regional Transport Plans.

1.10 The WSP identifies 3 Strategic Opportunity Areas (SOA) within the 'Capital Network' of South East Wales that will provide the focus for major employment led development with potential regional benefits from such sustainable development. St Athan is identified as an SOA site.

1.11 Paragraph 19.17 of the WSP recognises that *'improved transport for all is central to making the Capital Region work and to the regeneration of Valleys communities*'. Measures to alleviate congestion and investment to tackle transport bottlenecks are important, however road building in general is not recognised as a sustainable

solution to the pattern of traffic growth with the overall priority '*to make better use of the Area's existing transport infrastructure'.*

Wales Transport Strategy – 'One Wales - Connecting the Nation' - April 2008

1.12 The aim of 'One Wales' is to promote a sustainable development network to safeguard the environment and strengthen the economy and social life of Wales, through a stable and long term framework. The document is intended to feed into and inform national strategy and the Wales Spatial Plan and sets out the outcomes and strategic priorities for the National Transport Plan and Regional Transport Plans. 'One Wales' sets out the social, economic and environmental outcomes that the Welsh Assembly Government want to achieve. The strategic priorities identified are:

- *reducing greenhouse gas emissions and other environmental impacts;*
- *integrating local transport;*
- *improving access between key settlements and sites;*
- *enhancing international connectivity; and,*
- *increasing safety and security.*

South East Wales Transport Alliance – Regional Transport Plan – Final Draft (December 2008)

1.13 The aim of the Regional Transport Plan (RTP) is to improve regional transport within South East Wales and help deliver the social, economic and environmental objectives of the Wales Spatial Plan and the Wales Transport Strategy. The key transport challenges to be addressed are identified with the following specific priorities set out:

- *To improve access for all to services, facilities and employment, particularly by walking, cycling and public transport.*
- *To increase the proportions of trips undertaken by walking, cycling and public transport.*
- *Minimising demand on the transport system*
- *To develop an efficient, safe and reliable transport system with improved transport links between the 14 key settlements in South-East Wales and between South-East Wales and to the rest of Wales, the UK and Europe.*
- *To provide a transport system that encourages healthy and active lifestyles.*
- *To reduce significantly the emission of greenhouse gases and the impact of the transport system on local communities.*
- *To ensure developments are accessible by sustainable transport and make sustainable transport and travel planning an integral component of regeneration schemes.*
- *To make better use of the existing transport system.*

Manual for Streets - 2007

1.14 Manual for Streets (MfS) provides technical guidance to complement Planning Policy Wales and represents a strong Welsh Assembly Government *'commitment to the creation of sustainable and inclusive public spaces'*. MfS seeks to redress the balance for spaces dominated by motor vehicles and demonstrate that good design and giving greater priority to pedestrians and cyclists creates places that '*work for all members of the community*'.

Planning Policy Wales

1.15 With regard to transport, Planning Policy Wales encourages an integrated transport system which is safe, efficient, clean and fair. Planning Policy Wales states that:

> '…*ensuring that development is accessible by means other than the private car will help in meeting the Assembly Government's objectives for social inclusion. Encouraging cycling and walking will contribute to the aim of improving the levels of health in Wales.'*

1.16 Planning Policy Wales emphasises that land use planning can help to achieve the Assembly Government's objectives through a number of measures, including:

- *'reducing the need to travel, especially by private car, by locating development where there is good access by public transport, walking and cycling;*
- *locating development near other related uses to encourage multi-purpose trips and reduce the length of journeys;*
- *improving accessibility by walking, cycling and public transport;*
- *ensuring that transport is accessible to all, taking into account the needs of disabled and other less mobile people.'*

Technical Advice Note 18: Transport – March 2007 (TAN18)

1.17 TAN18 adopts a sustainable development approach, recognising that '*an efficient and sustainable transport system is a requirement for a modern, prosperous and inclusive society*'. TAN18 further recognises that the integration of land use planning and transport infrastructure has a key role to play in addressing the environmental aspects of sustainable development.

1.18 Major new generators of travel demand such as housing, employment, retailing, leisure and recreation should be located within existing urban areas or in other locations which are, or can be, well served by public transport, or can be reached by walking or cycling. Travel intensive and high density developments should be located at major public transport nodes, or near corridors well served by public transport. Transport Assessments should be used for major developments to appraise travel demand and impacts. They also provide the basis for Travel Plans that manage car use and promote the use of sustainable transport modes.

Addendum to 1993 South Wales Parking Guidelines – 1999

1.19 This document provides a guide to parking requirements according to land use and type of development and these guidelines are used by the Vale of Glamorgan Local Planning Authority when determining planning applications.

Local Policy

Vale of Glamorgan Adopted Unitary Development Plan (UDP) - April 2005

1.20 Part One of the UDP consists of strategic policies that reflect the overall aim to improve the quality of living in the Vale. Strategic policies 7 and 8 aim to provide an improved transport network incorporating both private and public and motorised/non-motorised transport; and, also to influence the location of development so that the opportunities available to use modes other than the private car. Policy 8 states that:

> *'Development will be favoured in locations which are highly accessible by means of travel other than the private car and which minimise traffic levels'*

1.21 Policy 8 is designed to provide opportunities to concentrate major generators of demand from travel in existing built up areas, where:

- *Access to public transport facilities; cycling and walking measures can be easily introduced/ improved;*
- *The close proximity of housing, employment opportunities, retail facilities and other services encourages a reduced trip length and encourages travel by means other than the private car; and*
- *Existing local and district facilities are located.*

1.22 Criterion vii) of Policy ENV27 refers to new development and requires new development to provide:

> '*A high level of accessibility, particularly for public transport, cyclists, pedestrians and people with impaired mobility'.*

1.23 Paragraph 5.1.9 of the UDP identifies the MoD base at St Athan as important to the local economy with policy EMP10 referring directly to the site and stating that:

> *'further appropriate developments in respect of RAF activity at the RAF St Athan base will be favoured provided there is no unacceptable impact upon local amenity'.*

1.24 The Council's transportation policy objectives for the UDP are:

- *To ensure that a balance is maintained between the need to facilitate the development of the local economy, environmental concerns and social considerations, in order to create a safe, efficient and equitable transport network for the Vale of Glamorgan;*
- *To maintain and improve access to employment and services;*
- *To ensure that developments are accessible by means of travel other than the private car;*
- *To encourage greater use of public transport, cycling and walking;*
- *To safeguard road lines and routes/sites of approved transport schemes;*
- *To improve the safety and convenience of all means of transport; and,*
- *To ensure adequate parking facilities are provided in accordance with the Council's approved parking guidelines.*

1.25 One of the aims of the UDP is to seek to stem the daily out migration of commuters in order to reduce travel distances, bearing in mind that many residents in the Vale of Glamorgan travel to Bridgend and Cardiff for employment. As a consequence, all the development plan allocations that would help generate additional employment within the Vale of Glamorgan seek to allow existing businesses and new inward investment to develop in order to provide more locally based employment. The development of the St Athan site is able to make a significant contribution towards this UDP objective.

Vale of Glamorgan Council Local Transport Plan (LTP) 2001/2 to 2006/6 – August 2000 (LTP)

1.26 The LTP seeks to draw together many of the different factors affecting transport in the Vale of Glamorgan, to provide an effective set of policies for the future and an appropriate five year implementation programme.

1.27 The LTP cross references to a number of the proposals and policies in the adopted UDP, including reference to the design of the Airport Access Road, and the three local highway improvement schemes of Llysworney Bypass, Gileston Old Mill, Boverton Relief Road in UDP Policy TRAN 2. In particular, the Local Transport Plan includes reference to Green Transport Plans, bus and rail initiatives plus cycling and walking measures.

St. Athan Development Brief – July 2006

1.28 The aim of the brief is to outline the proposals for the site and provide the basis for the consideration of any future planning applications. Included within this are details on how the access into the site will be provided and how access around the college site will work.

1.29 The brief states that initial work established that there is sufficient highway capacity on local infrastructure, however the development brief identifies that a full Transport Assessment needs to be undertaken that may identify a need for additional highway improvements to cater for the increased traffic flows.

'The developer will be required to enter into a S.106/S.278 agreement to mitigate any adverse highways impacts that are identified by the full Transport Assessment. It is important that the full Transport Assessment also covers the routes and mitigation measures for construction traffic generated by the proposals and this will be conditioned by any future planning application. The Training Academy and Aeronautical Business Park development at St Athan is to be connected to the B4265 via a new access road and junction. Traffic to and from the site will therefore be provided with direct and separate access onto the main road, thus providing a bypass for the nearby settlements of Llantwit Major and St Athan. As required with such military sites, an emergency access will continue to be made available on the eastern side of the site where an existing access into East Camp already exists.'

Vale of Glamorgan UDP Supplementary Planning Guidance 'Sustainable Development' - 2006

1.30 The purpose of this guidance is to raise the awareness of how the development of land can contribute towards sustainability. The guidance states that individual developments should provide:

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

1.31 The document also stresses the importance of convenient pedestrian and cycle facilities and identifies a transport hierarchy with priority given to pedestrians, then cyclists, then public transport and finally private motor vehicles. The guidance then

provides examples on how developers can ensure the needs of all transport users in the hierarchy are incorporated within an overall development.

Existing Conditions

1.32 To analyse the highway impact of the proposed DTC and ABP developments, extensive surveys of existing traffic conditions have been carried out in the vicinity of the St Athan site. This provides a clear quantifiable basis to assess the impact of the proposed developments on the adjacent junctions.

1.33 As agreed by the Transport Group, the following Junction Classified Counts (JCC's) have been undertaken in 2007/2008 (Appendix A) to show the existing traffic flow patterns and associated queues (Figure 2). The AM peak (0800-0900) and PM peak (1700-1800) hours surveys are summarised in Figures 4 and 5.

A. B4265/B4270 Llysworney / Llantwit Major Roundabout – 5th March 2008
B. B4265 Llanmaes / Llantwit Major Signals – 6th March 2008
C Eglwys Brewis Road / St Athan Road
D. B4265 Eglwys Brewis Road / Boverton Signals – 7th March 2008
E. B4265 / West Gate – 10th March 2008
F. B4265 St.Athan / Gileston – 7th March 2008
G. B4265 / Fontgary Road Junction – 7th March 2008
H. A4226 / B4265 BAMC / Tredogan Roundabout – 15th May 2008
I. A4226 / Cardiff Airport Roundabout adjacent to Model Farm – 28th April 2008
J. A4226 / B4266 Waycock Cross Roundabout – 15th February 2007
K. A48 / B4268 Pentre Meyrick Junction – 10th March 2008
L. East Gate / Cowbridge Road – 10th March 2008
M North Gate / Picketston Lane – 10th March 2008
N B4270 Llantwit Major Road / A4222 Roman Road – 10th March 2008
O A4222 Aberthin Road / Cardiff Road / Eastgate / St Athan Road – 10th March 2008
P A48 Bonvilston / Sycamore Cross – 10th March 2008
Q B4251 / B4270 Llysworney Junction – 14th February 2007
R B4265 / Batslays Junction – 14th February 2007

1.34 Capacity analysis has been undertaken at these existing junctions and the following proposed junctions (Drawing CG/002419/TA/007), based on predicted flows:

1 B4265 / Northern Access Road Junction
2 Northern Access Road / Tremains Farm SFA
3 Northern Access Road / South West Picketston SFA
4 Northern Access Road / North of West Camp
5 Northern Access Road / Sport Facilities
6 Northern Access Road / Eglwys Brewis Road
7 Northern Access Road / ABP North
8 Northern Access Road / Gate 3 / Gate 2
9 Northern Access Road / Gate 2
10 Northern Access Road / Picketston Road
11 Northern Access Road / Picketston Close
12 Northern Access Road / Gate 1

1.35 Detailed drawings at 1:500 scale are provided of all existing junctions analysed and are attached to each capacity analysis within Appendix N. Each proposed junction on the Northern Access Road is shown at 1:500 scale in Drawings CG/003622/PA/157 to 1514.

1.36 Existing bus patronage surveys have been undertaken on Wednesday 4th March 2009 in the peak hours. Comprehensive rail passenger demand and capacity data has been received from Arriva, the operator on the Vale of Glamorgan Line.

Design Year

1.37 TAN 18 refers to Annex A of the 'Transport Assessment and Implementation: A Guide' 2005 by the Scottish Executive' for general advice and guidance on the content of transport assessments. Annex A states:

> *'Design dates for appraisal should generally be for shortly after opening, within a year, especially for retail and employment uses…some developments and their infrastructure requirements will be of such significance that a longer term design date may be demanded".*

1.38 The SATURN Model, which extends across the highway network identified in Figure 3, has traffic forecasts for 2013 and 2028. The DTC development will be fully open in 2014, together with Phase 1 of ABP. The final Phase 3 of ABP will be completed in 2028. The 2013 network flows have been combined with the 2014 development flows to create an opening year scenario. The design year, based on the significance of this development, has been taken as 2028, when ABP will be fully developed. Capacity analysis of the junctions identified for assessment have been undertaken in the following periods:

- 2008 Weekday AM and PM peaks (to validate the base models)
- 2014 Opening year Weekday AM/PM and Friday PM peaks (with and without development)
- 2028 Design year Weekday AM/PM and Friday PM peaks (with and without development)

Traffic Growth

1.39 Within the SATURN model, background traffic growth has been based on central forecasts using NTEM. The figures used are attached in Appendix D.

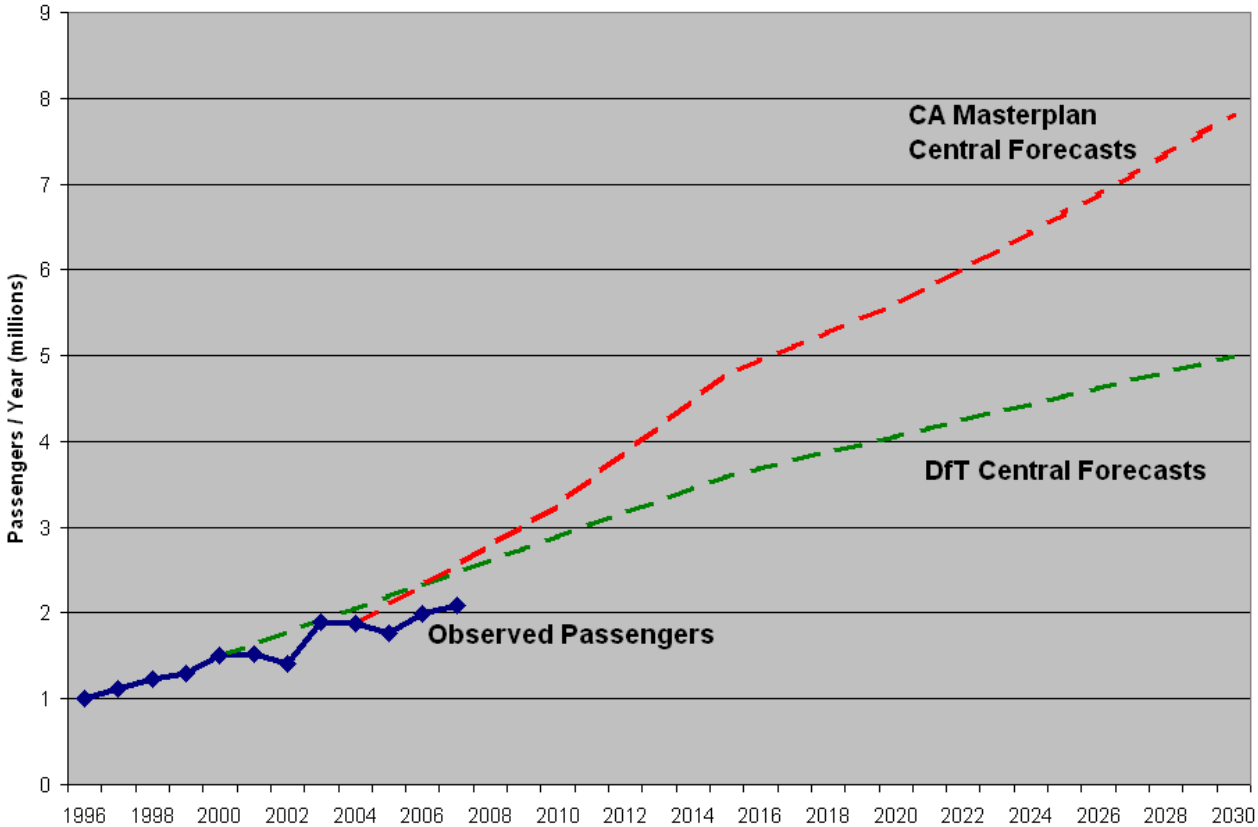
2.0 Committed Development

2.1 In addition to the central growth forecasts within the SATURN Model, committed / proposed development, based on those sites in the model area with planning status, have been taken into account. This includes Cardiff Airport (CA) growth forecasts.

2.2 Historic passenger growth figures at CA from 1996 to 2007 show an increase from 1.01 to 2.094 million passengers per year. Forecast figures also exist from the Department for Transport's (DfT) 2003 White Paper 'The Future of Air Transport' and the airport's own masterplan forecasts.

2.3 In both cases, the forecasts are central forecasts with similar catchment areas. However, they do have differing estimates of the share CA will capture of the underlying demand in its catchment. In 2030 the predicted number of passengers ranges between 5 and 7.8 million per year between the DfT and CA forecasts.

2.4 Based on Welsh Assembly Government advice and comparison with observed data, the DfT figures have been utilised. This equates to increases from 2.582 million passengers in 2008, rising to 3.46 million passengers in 2014 and 4.440 million passengers in 2024.



Cardiff Airport - Passenger Forecasts

2.5 The other developments taken into account are:

Table 2.1 Committed Developments 2014

	Location	Development	Size	Status
1	West of Maesteg Rd, Tondu	Housing	210 units	Granted, completion due 2009
2	Maendy Farm, Bryncethin	Housing	200 units	Granted, completion due 2009
3	Parc Derwen, Bridgend	Housing	750 units	Approved, 1500 units in total. Construction to start 2009, 50% assumed completed by 2013.
4	Broadlands, Bridgend	Housing	1250 units	Approved, up to 2000 houses already constructed
5	St David's 2, Cardiff	Mixed Use	163,220 m^2 GFA	Under construction, completion Autumn 2009
6	Penarth Heights, Penarth	Housing	377 units	Approved
7	White Farm, Barry	Housing	130 units	Granted
8	Dumballs Road, Cardiff	Mixed Use	2070 housing units 3670 m^2 GFA retail 45000 m^2 GFA offices	Outline permission granted
9	International Sports Village, Cardiff	Housing Hotel	1800 units 500 beds	Outline permission granted
10	Film Studios, Llanilid	Leisure	300 hectares	Granted. 10% assumed completed by 2013.
11	Arjo Wiggins Paper Mill Site, Cardiff	Housing Offices	900 units 4000 m^2 GFA	Outline permission granted
12	Thomson House, Park St, Cardiff	Housing	211 units	Outline permission granted
13	Radyr Sidings, Radyr	Housing	173 units	Under construction, completion by 2013
14	Bus Depot, Sloper Rd, Cardiff	Housing	183 units	Outline permission granted
15	Alfred Cook Works, Canal Wharf, Cardiff	Housing	247 units	Granted
16	Leckwith, Cardiff	Mixed Use	44000 m^2 GFA retail 150 housing units 4500 m^2 offices Sports Stadium / Leisure	Under construction, completion Spring 2010

Table 2.2 Committed Developments 2028

	Location	Development	Size	Status
1	Parc Derwen, Bridgend	Housing	750 units	1500 units approved, construction to start 2009. Final 50% assumed completed by 2028.
2	Film Studios, Llanilid	Leisure	300 hectares	Granted. Final 90% assumed complete by 2028.
3	Roath Basin, Cardiff	Housing	1010 units	Outline permission granted, new application submitted for variation of time, looking to extend to 15 years.
4	Driscoll Workshop, Tyndall St, Cardiff	Housing	622 units	Awaiting outline legal agreement
5	Mwyndy, Talbot Green	Mixed Use	216 housing units 33,000 m^2 NFA business park	Granted. Completion assumed between 2013 and 2028

Other Highway Improvements

2.6 The following proposed highway improvements have also been included in the SATURN Model:

Table 2.3 Do-Minimum Network Schemes

	Scheme	Description
1	M4 widening, Junctions 29-32	Widening of the M4 motorway north of Cardiff between Castleton and Coryton, from 2-lane to 3-lane. Currently under construction, completion scheduled for December 2009.
2	Coity Bypass, Bridgend	Associated with the Parc Derwen housing development in north-east Bridgend, connecting the A4061, Litchard to Heol Simonston, Brackla. Currently under construction, completion scheduled for 2009.
3	A4232 / Leckwith Interchange, Cardiff	Signalised roundabout improvement associated with the Cardiff City Football Stadium development. Completed in 2008, after the surveys for the CA model were undertaken.
4	M4 Junction 34A	New motorway junction associated with the proposed Llanilid Film Studio development. Timing uncertain, but is assumed to be between 2013 and 2028.
5	A4119 Mwyndy Interchange	Grade separated junction on the A4119 at Mwyndy, between Miskin and Talbot Green, associated with the proposed mixed use development at Mwyndy. The scheme includes a dedicated left-turn lane from M4 (west) to A4119 at Junction 34. Timing uncertain, but is assumed to be between 2013 and 2028.

2.7 Additionally, in March 2007 the Welsh Assembly Government provided the Vale of Glamorgan Council with Principal Road Grant Funding for preparation/design costs to undertake improvements to the A4226 Five Mile Lane as part of the Transport Settlement Grant for 2007/2008. A review of access improvements proposals for Cardiff Airport is also being carried out by the Welsh Assembly Government. However, any changes in flow due to the improvements and alternative route proposals have yet to be quantified as they are still being developed. Therefore, these studies are not included in this assessment of the highway network.

3.0 **Proposed Development** (Drg CG/002419/TA01 Rev D)

3.1 An assessment of alternative sites for the proposed Defence Technical College was undertaken by the Metrix in response to the invitation to negotiate the Defence Technical Review. An initial review of 50 possible MoD sites within the United Kingdom was undertaken. Due to lack of availability or inadequate size, 12 sites were removed from the selection process. A further 13 sites were identified as unsuitable, resulting in 25 sites being investigated in more detail. Based on criteria of existing facilities, the possibilities for development and expansion, security considerations, phasing and relocation issues and necessary investment, MoD St. Athan was identified by Metrix as the best potential core site location.

3.2 The availability of sites for a runway-related Aerospace Business Park is limited. In South Wales, there are only two possible sites: Cardiff Airport and MoD St Athan. Initial studies based on the proposed Red Dragon Super Hangar indicated that the proposed development could not be located at Cardiff Airport.

Defence Technical College

3.3 Currently, specialist training in aeronautical, electro mechanical engineering and communication/IT disciplines takes place at nine different sites across the UK.

3.4 The new Defence Technical College will bring technical training for each of the services Royal Navy, Army and Royal Air Force, together in one location for the first time. The benefits of this are considerable and will ensure that UK military personnel continue to receive the very best training available, whilst bringing together each of the services in one location will mean further benefits in terms of efficiency, shared learning and value for money.

3.5 The development of the new Defence Technical College will transform the current site which, particularly in the case of East Camp, is currently underutilised with many of the buildings at the end of their economic life or in need of significant investment. It is envisaged that there will be for transport assessment purposes, a potential maximum of 3,240 people living on site and working on site with a further 2,491 living off site, working on site. An additional 810 people are envisaged to visit the site / museum / church / hotel / leisure, generating a potential maximum DTC population total of approximately 7,017. This is a worse case scenario with a 6,500 population being envisaged,

Section 5 deals with population numbers in more detail and identifies the populations as modelled for this assessment.

3.6 Within the site, shops, public houses, restaurants, sports facilities and places of worship are proposed. This mixed use development profile will significantly reduce the traffic generation of the site.

3.7 The access arrangements, traffic generation and modal split for the DTC site that are stated in this report, have been provided by Metrix.

Service Families' Accommodation

3.8 Associated with DTC is the construction of 483 Service Families' Accommodation (SFA) properties by 2014 to provide family accommodation for military personnel during their stay. These will be located outside the security perimeter at the locations highlighted in Drawing CG/002419/TA01 Rev D. The split in the housing numbers between the sites is:

Tremains Farm – 169 units
North of West Camp – 59 units
Picketston South West – 83 units
Stadium / Golf Course – 172 units
Total = 483 units

The proposed dwellings will comprise mainly two storey detached and semi-detached dwellings with some three storey town houses. All the SFA sites lie close to the DTC to encourage travel to work on foot or by cycle and by means other than the private car.

Aerospace Business Park

3.9 The Aerospace Business Park will be a centre of excellence will complement the Defence Technical College. It will build upon the expertise of existing aerospace businesses in South Wales, such as GE Aircraft Engine Services and General Dynamics, and bring vital new jobs to the area. Currently, Britten-Norman, Lufthansa Resource Technical Training and S&C Thermofluids all operate on the site.

3.10 The Welsh Assembly Government's plan for the Aerospace Business Park is to offer the facilities and infrastructure needed for manufacturers, suppliers, service providers and trainers to the aerospace sector, with a particular focus on maintenance, repair and overhaul.

3.11 By 2014, the business park is expected to employ 798 staff (81,174 sqm GFA). This is forecast to increase to 1,526 employees (98,587 sqm GFA) in 2020 and to 2,303 employees (117,164 sqm GFA) in 2028 (Appendix B).

Sports Facilities

3.12 In the Picketston area, to the west of the Northern Access Road, the following sports facilities are proposed:

- A 25m eight lane swimming pool
- A sports centre incorporating 12 sport courts plus two squash courts
- A fitness suite with cardiovascular equipment and free weights area
- An eight lane floodlit athletics track

A cricket square (grass) with cricket nets (synthetic) and twelve outdoor sports pitches are also proposed:

- 1 rugby pitch (grass and floodlit)
- 4 rugby pitches (grass and unlit)
- 1 hockey pitch (synthetic and floodlit)
- 1 football pitch (synthetic and floodlit)
- 1 football pitch (grass and floodlit)
- 4 football pitch (grass and unlit)

3.13 These facilities will be used primarily by the DTC but will also be available at certain times, outside of core training hours, for public use. A 150 bed hotel is also proposed adjacent to these facilities for use by the public.

Additional Developments

3.14 A Military Museum is proposed, to be open on weekdays and the weekend. The museum is expected to be operated by up to 14 members of staff. It will be open to the public and will be fully accessible to a wide range of people including families, schools and military personnel. It will be situated on the perimeter of the DTC site but outside the security wire. The museum will have its own access and parking facilities off Eglwys Brewis Road, to enable access for the local community. The number of visitors per day is expected to be around 400, although special events may attract more visitors.

3.15 A new Church & World Faith building will be constructed close to the existing St.Brise Church, outside the security wire, for use by the wider community.

3.16 Proposals for the site include the preservation of the listed St.Brise Church on the south side of Eglwys Brewis Road.

3.17 A crèche and community facility are also proposed adjacent to the South West Picketston SFA site. Being located adjacent to the proposed housing, traffic generation for these sites should be minimal.

Construction

3.18 There is predicted to be a peak of 2,100 construction jobs in the third quarter of 2012. The employment figures are attached in Appendix L.

4.0 Access Proposals

4.1 The main access into the redeveloped site will be via a new Northern Access Road (NAR) to be built from the B4265 between Boverton and Llanmaes Traffic Signal Junctions and designed to Design Manual for Roads and Bridges (DMRB) standards (Drawing CG/003622/PA/131/rev A). Traffic to and from the site will therefore be provided with direct access onto the B4265, that bypasses both Llantwit Major and St Athan. The aerospace development will be served by the same new access road (via a separate entrance) from the B4265 and via a new Southern Access Road (Drawing CG/003622/PA/210/illustrative). The Southern Access Road will be constructed to serve ABP Phase 2 and 3. The sports facilities will be accessed via the NAR to enable use by the local community and to minimise the interaction between public and military vehicles. To reduce traffic movements through St Athan, all junctions to the DTC and the ABP North site from the NAR have been designed to prevent access by westbound vehicles. Furthermore, access eastbound to St Athan from the DTC & ABP junctions on the NAR will not be permitted (Drawing CG/003622/PA/100/rev A).

Defence Technical College

4.2 Drawing SA-C0XXX-MP-900-SB-X-004 P17 is the illustrative masterplan for the DTC development with the main accesses via three gates. Gates will provide both vehicular and pedestrian access to the restricted areas within the site.

Gate 1 (Drawing CG/003622/PA/134)

4.3 The main entrance will be utilised by trainees, military staff and visitors. The layout of this junction is designed to compliment and create a focal point for the existing St.Brise Church and its grounds, which have listed building status.

4.4 To reduce any increase in traffic flow in St Athan, the entrance to the site will only be accessible from the Eglwys Brewis Road eastbound carriageway. Traffic travelling from St Athan, westbound along the Eglwys Brewis Road will be unable to turn left into the DTC site through the design of the junction layout. It is envisaged a Traffic Regulation Order (TRO) will be in place to enforce this restriction. The DTC site exit only allows access onto the westbound carriageway of Eglwys Brewis Road. A central island will be provided to prevent vehicles turning right towards St Athan. Once again, a TRO is envisaged.

4.5 A circular route has been provided around the entrance to enable vehicles that proceed to the security gate without having collected a pass, to re-enter the site to visit the pass office. This circular movement has been engineered to prevent access to St Athan from the main gate.

4.6 The capacity of the Gate 1 junction is restricted by the gate itself and the time taken to proceed through the security barrier. On a Friday evening, the barrier could be used to control the flow of vehicles exiting onto the Eglwys Brewis Road and reduce the risk of congestion at the B4265 / NAR junction. Any queuing vehicles would remain within the site.

Gate 2 (Drawing CG/003622/PA/134)

4.7 Gate 2 is situated to the south of Eglwys Brewis Road, east of the proposed Receipt of Incoming Deliveries (RID) building. This gate will be used by service and delivery vehicles as well as military vehicles crossing to Picketston. Access to the Trainer's

Car Park (existing DSG Car Park), the Energy Centre and the RID will be via this junction.

4.8 Civilian Trainers will use the existing DSG Car Park and the new car park to the west of the RID. These vehicles together with Energy Centre delivery vehicles and deliveries to the RID, will use the Gate 2 junction but will not actually proceed into the secure part of the DTC site, thus ensuring that delays and congestion associated with security passes and escorted vehicles within the secure wire are removed.

Gate 3 (Drawing CG/003622/PA/134)

4.9 This is the entrance/exit to the Picketston site, located to the north of Eglwys Brewis Road opposite the Gate 2 entrance. This gate will accommodate DTC site and Facility Management staff traffic, with the latter using the car park proposed to the north of Eglwys Brewis Road.

4.10 Users of the Facility Management Car Park will have to cross the road to access East Camp through a pedestrian gate by Gate 2. A pedestrian bridge is proposed to cross the Northern Access Road adjacent to Gate 2 and the at grade signal controlled junction also includes a pedestrian phase to aid the movement of these staff.

4.11 All traffic wishing to enter Gate 2 or Gate 3 must approach on the Eglwys Brewis Road eastbound carriageway and then exit via the proposed off-slip towards Picketston. Vehicles will then filter right or left depending on their destination. Vehicles wishing to access Gate 2, the Energy Centre, RID or Trainer Car Parks must proceed southwards and cross the Eglwys Brewis Road.

4.12 The junction is designed to prevent traffic exiting from Gates 2 or 3 travelling towards St Athan and vice-versa. It is envisaged that the traffic signals and TRO's will enforce these restrictions.

Security

4.13 The average time taken to proceed through a security gate with a pass has been estimated at 10 seconds. If a vehicle approaches a barrier without a pass they will be instructed to proceed to the visitor parking area and obtain a pass from the Gatehouse. During heightened security the average time taken to enter the site could increase to 45 seconds depending on the vehicle/personal check carried out. However, as the threat increases, so does the Military and Military police guard service manning at the gates.

4.14 Entry to the Facility Management and Trainer Car Parks will be controlled via an electronic barrier using a touch pad or swipe card access, which is envisaged to take between 5 and 10 seconds per vehicle. Staff will then proceed on foot and access the site through one of the pedestrian turnstiles using a security swipe card. Current information about flow rates of passengers through turnstiles would indicate that in high volume areas a barrier system may accommodate 40 pedestrians per 60 seconds.

4.15 It is proposed that the Trainer Car Park has two separate entrances, to speed up the entry to the car park and reduce the risk of traffic congestion due to the numbers of vehicles arriving at the same time.

4.16 There will be no barriers at the entrances to the museum's or sports facilities' car parks.

Aerospace Business Park (Drawing 21/22/23)

4.17 The Aerospace Business Park is to be provided on two sites. To the north of the runway, the ABP North site will be accessed via the Northern Access Road. To the south of the runway, the ABP South site will be accessed from B4265 via a new Southern Access Road with a new bridge over the railway line. The Southern Access Road will be constructed for ABP Phase 2.

5.0 Population Numbers

Defence Technical College

5.1 All DTC traffic forecasts have been based on demand data, supplied by Metrix. The data identifies the numbers of trainees and military staff to be accommodated on the DTC site. The trainees are split into three categories Phase 2, Phase 3 and SAWT (Soldiers Awaiting Training). Phase 3 trainees and SAWT are more experienced trainees who have already completed Phase 2 training and are therefore older. Staff are split into two categories Training Staff and NPUs (Non-Project Units) and both categories include civilian personnel as well as military personnel.

5.2 Some Phase 3 trainees will live on site in the Single Living Accommodation (SLA) and others may live off site in SFA. Phase 3 trainees are more likely to have families and their own cars and are therefore more likely to go home at the weekends to see their partner and/or children. Those living in SLA are unlikely to leave the site during the week, due to their limited free time. This is as a result of the training day, dinner timetable and the quantity of coursework to be completed. Trainees are also expected to engage in sports and fitness activities on site, outside of training hours.

5.3 Phase 2 trainees are generally school leavers and will all live on site in SLA blocks. It is assumed that the majority of Phase 2 trainees do not have their own cars or spouses/children and are therefore more likely to remain on site at the weekends. Nevertheless their only significant movements will be on a Friday evening when leaving site or on a Sunday when returning to site. It is estimated that 60% will leave on a Friday.

5.4 Trainees will be instructed to return to site on a Sunday and will not arrive on Monday morning.

5.5 Non-civilian military and NPU staff will all be accommodated within SLA or SFA. Facilities Management (FM) staff will be employed to manage the day to day running of the site.

5.6 Due to the nature of forecasting exact numbers and the need to fix a population for assessment, allowing time for accurate and comprehensive modelling to be undertaken, the population figures used in the TA were those relevant at the time of modelling. There are slight variations between the population figures quoted in the Planning Application and the Transport Assessment in terms of type of population. These variations and the reasons for the difference are summarised in the following table:

Table 5.1: DTC Site Population Figures

	Max Total DTC Site Figures	Transport Assessment	Reasons for Difference
SLA	3240	3070	TA is actual population based on 5% of site being unused due to maintenance / trainee turnover
Live off & work on+SFA	1580	1512	TA is actual population based on 5% of site being unused due to maintenance / trainee turnover
FM staff	910	823	TA is based on 90% of total FM staff, who will be at work on a weekday
Site visitors	158	150	
Museum	337	348	

Churches	105	129	TA based on greater GFA and therefore is a worse case
Hotel / Leisure	210	364	
Live off site - work/visit on site	**3301**	**3326**	

5.7 In total, there will be approximately 2,750 students at the college. There will be an estimated 2,491 DTC workers, consisting of 910 FM staff and 1,580 workers who live off and work on site (including the SFA). Trainee population for the calculation of trip generation was increased by 15% to provide an upper ceiling for to the TA and ensure flexibility and robustness for the total population. This equates to a site population of 3,716 who live on site – work/train on site, made up of the requirement of 3,240 SLA units plus an additional on site population of 477, representing an upper ceiling for single living accommodation at the time of modelling. These, in addition to an additional 810 people who are envisaged to visit the site / museum / church / hotel / leisure, generate a DTC population total for the Transport Assessment of 7,017.

Aerospace Business Park

5.8 In terms of employment, it is currently envisaged that 798 jobs will be created on site in 2014, rising to 1,526 in 2020 and 2,303 in 2028.

5.9 However, changes to the employment profile of ABP have occurred since the SATURN assignments undertaken. Predicted traffic flows from the SATURN Model and therefore within the capacity analysis, overestimate the traffic generated from ABP in 2014, creating a worse case scenario. The differences in the estimated population figures, which result in a robust set of analyses, are summarised in the following table:

Table 5.2: Differences in ABP Population

		2014			2020			2028	
	ABP North	ABP South	Total	ABP North	ABP South	Total	ABP North	ABP South	Total
Actual	722	76	**798**	916	610	**1526**	1436	867	**2303**

		2014			2020			2028	
	ABP North	ABP South	Total	ABP North	ABP South	Total	ABP North	ABP South	Total
SATURN	1177	380	**1557**	1177	1025	**2202**	1580	960	**2540**

5.10 Therefore, analysis has been based on employment figures which are now predicted to be 48% in the opening year and 9% in 2028.

6.0 Patterns of Travel

Defence Technical College

6.1 The training day is split into two shifts, as shown Table 6.2. The training day starts at 8.25am and ends at 5.35pm. Training is only scheduled Monday through to Friday. There will be personnel based on site at the weekend, although no training activities are proposed. However, the movements generated at the weekend will be minimal and therefore only Sunday arrivals have been calculated.

6.2 The FM day is based on the 8am – 6pm training day and meal times. Breakfast time for the trainees is between 6.45am and 8.45am, lunchtime is 12 midday until 2pm and dinner is 5.35pm to 7.15pm. As a result of the meal times, the work is split between shifts and therefore the spread of traffic is greater than that of the trainers and trainees.

6.3 FM staff are required at the weekends to provide facilities for the personnel that remain on site at the weekends. Catering, retail and cleaning staff are reduced to 75% of the average weekday population. Other FM staff, such as office staff, are reduced to 25%.

6.4 It is assumed that approximately 10% of personnel in SFA go home at lunchtime.

6.5 Deliveries to DTC, including the RID, and movements to the Energy Centre are assumed to be Monday to Friday only.

6.6 Of the trainers and trainees who live on site, the following assumptions were made regarding the percentages that leave on an average weekend and people that remain on site for the weekend but go out for the evening, based on experience of other MoD sites:

	% Home at Weekend	% Stay on Site	% Out for night
Phase 2 trainees	60%	40%	30%
Phase 3 trainees & SAWT	60%	40%	25%
Metrix Trg Mil Staff	80%	20%	10%
NPU Mil Staff	80%	20%	10%

Table 6.1: Predicted DTC Movements at Weekends

Service Families' Accommodation

6.7 Those residents associated with the DTC have their patterns of work linked to the site. The remaining residents have their travel patterns based on TRICS data from 25 multi-modal sites within the TRICS 2008(b) database (Appendix C). This is a particularly robust approach as through the Travel Plan proposal Defence Estates have committed to these living in SFA not being eligible to use a car to journey to work unless operationally essential.

Aerospace Business Park

6.8 As the end users of the business park have yet to be confirmed, the patterns of work have been based on the following three sites from the TRICS 2008 (b) database (Appendix C):

- Cambridge Science Park (Ref: CA-02-B-01)
- St Mellons Business Park, Cardiff (Ref: CF-02-B-01)
- Oxford Business Park South (Ref: OX-02-B-01)

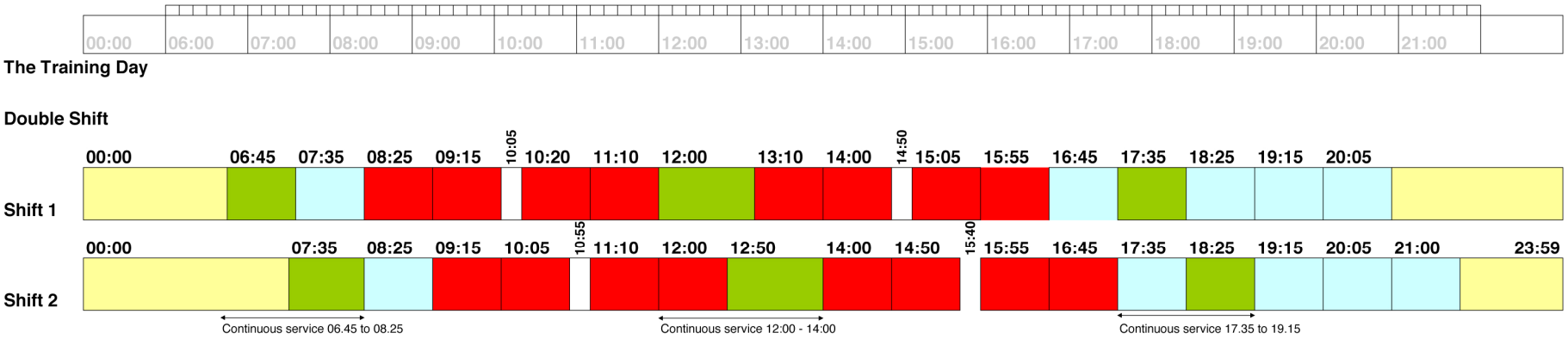


Table 6.2: DTC Training Day

Key
Yellow = Sleeping
Green = Eating
Red = Training
Blue = Own time

7.0 Transport Mode

Defence Technical College

7.1 No TRICS data for Ministry of Defence (MoD) sites exists, therefore the traffic forecasts for DTC have been supplied by the MoD and the Metrix Team who have experience of other such training facilities.

7.2 The personnel types have been split by category as each have different transport patterns. The living arrangements for each category of personnel are also identified:

- SLA (Single Living Accommodation) - Live and work/train on site
- SFA (Service Families Accommodation) – Live off site in SFA and work on site
- Live off, work on – Live off site (not in SFA) and work on site.

7.3 SFA residents will travel to the site daily. It is assumed that 60% of these linked trips will be via walking or cycling as all sites are within close proximity and as these are a means of exercise for military staff and trainees. The remaining 40% of trips to and from DTC – SFA will be assumed to be by vehicle. As noted previously however, Defence Estates have since committed to essential car use only from SFA as part of travel proposals.

7.4 All civilian staff will live off site and travel to DTC on a daily basis.

7.5 The modal choice and arrival/departure times of military personnel are controlled as they have to access the site via gated entrances. Therefore, restrictions on travel in the peak hour by car can be rigidly enforced enabling spreading of the finishing times on the Friday PM peak, should problems emerge on the highway network.

7.6 An estimation of the modal split of each type of personnel was calculated by Metrix Five transport modes were identified:

- Private Cars and Motorcycles (including LGVs)
- Heavy Goods Vehicles
- Site transport (minibus or coach laid on by MoD)
- Public Transport
- Walk and Cycle.

Students and MoD groups travelling from a long distance to the site will use the most effective means of travel, as follows:

a) Rail Tickets – the MoD uses an electronic pre-booking system for rail travel;
b) Bus/Coach Tickets;
c) Car sharing;
d) Flights;
then if these are not the most effective means of travel, hire and private vehicles will be used.

7.7 Car occupancy has been assumed to be 1.1 for movements of staff and trainees. Single car occupancy has been assumed for all other users which account for vehicle movements rather than people movements, e.g. DTC's White Fleet (a 30 vehicle mix of minibus's and 45 + 59 seater coaches, that have a primary use to transport trainees to/from field training) & Green Fleet (camouflaged vehicles) movements, Picketston traffic and deliveries (including the Energy Centre). For those vehicle movements on a weekend night out, it has been assumed that a large percentage of personnel will share taxis.

7.8 Site Transport is defined as transport specifically related to the DTC, not public transport. Training movements includes the movement of coaches (45 and 59 seater) transporting trainees to and from site.

7.9 FM staff have been split into two categories as each category has a different transport mode split. The FM company will provide a private minibus to transport a high percentage of the cleaners, cooks and retail staff to and from site. Other types of FM staff, all of which are likely to be local, will have to make their own way to site.

7.10 The modal splits are summarised in the following tables. This modal split does not take into account the proposed Travel Plan:

Table 7.1: Predicted Modal Split for DTC / SFA / ABP

	Transport Mode (%)				
	Car / Mcycle	Walk / Cycle	Site Transport	Public Transport	HGV
Gate 1: Live Off – Work On					
Phase 2 Trainees	40%		30%	30%	
Phase 3 Trainees & SAWT	40%	60%			
Phase 3 Lunch	40%	60%			
Metrix Trg Mil Staff	40%	60%			
Military Staff Lunch	40%	60%			
NPU Mil Staff	40%	60%			
NPU Mil Staff Lunch	40%	60%			
NPU Civilians	60%	10%		30%	
Site Visitors	90%			10%	
Church	100%				
Training			100%		
Gate 1: Live On – Home Weekend					
Phase 2 Trainees	40%		30%	30%	
Phase 3 Trainees & SAWT	90%			10%	
Metrix Trg Mil Staff	90%			10%	
NPU Mil Staff	80%			20%	
Gate 1: Live On – Friday Night Out					
Phase 2 Trainees	30%			70%	
Phase 3 Trainees & SAWT	30%			70%	
Metrix Trg Mil Staff	30%			70%	
NPU Mil Staff	30%			70%	
Gate 2					
Metrix Trg Civilians (DSG Car Park)	60%	10%		30%	
White & Green Fleet	100%				
Picketston	100%				
Energy Centre	20%				80%
Deliveries	50%				50%
Gate 3					
Training Mil Staff (CMS)	80%	20%			
Picketston Traffic			100%		
Gate 2 to 3	80%		20%		
Hire Cars	100%				
FM Staff	50%	10%		40%	
FM catering, Retail, & Cleaners	25%	5%	45%	25%	
FM Picketston	50%	10%		40%	

7.11 The following tables summarise the modal split for the 2014 baseline traffic forecasts for the Defence Technical College. The data has been considered for average weekday arrivals and departures to correspond with the working week and also

Sunday departures and Friday arrivals to take into account peak weekend movements:

Table 7.2: DTC predicted modal split for weekday arrivals & departures

Defence Technical College Predicted Modal Split	Average Weekday Arrivals 2014 Baseline	Average Weekday Departures 2014 Baseline
Cars, HGVs & Site Transport	2374	2342
Train	396	389
Bus	508	503
Car Passengers	237	234
Pedestrians & Cyclists	229	224
Taxis	41	40

Table 7.3: DTC predicted modal split for Sunday arrivals & Friday departures

Defence Technical College Predicted Modal Split	Sunday Arrivals 2014 Baseline	Friday Departures 2014 Baseline
Cars, HGVs & Site Transport	2219	3440
Train	389	826
Bus	422	945
Car Passengers	222	34
Pedestrians & Cyclists	117	287
Taxis	44	197

Service Families' Accommodation

7.12 The modal split has been based on multi-modal surveys of 25 multi modal residential sites within the TRICS database (Appendix C):

Table 7.4: SFA Modal Split

Aerospace Business Park	AM Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures
Drivers	67%	46%	63%	59%
Passengers	14%	29%	22%	25%
Pedestrians	14%	19%	10%	12%
PT Users	2%	4%	3%	2%
Cyclists	3%	2%	2%	2%
	100%	100%	100%	100%

7.13 As the TRICS database does not provide a split between train and bus passengers in terms of public transport users, the Method of Travel to Work for Resident Population (2005) information collected by the Office for National Statistics for area 014F which relates to post codes CF62 4JT/H (Eglwys-Brewis), has been used (Appendix D). Based on this information, the split in public transport between train and bus is 6% / 94%.

Aerospace Business Park

7.14 The modal split has been based on multi-modal surveys of three business parks within the TRICS database (Appendix C):

Table 7.5: ABP Modal Split

Aerospace Business Park	AM Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures
Drivers	81%	80%	73%	79%
Passengers	8%	9%	7%	9%

Pedestrians	4%	8%	10%	5%
PT Users	4%	0%	7%	4%
Cyclists	3%	3%	3%	3%
	100%	100%	100%	100%

7.15 As the TRICS database does not provide a split between train and bus passengers in terms of public transport users, the Method of Travel to Work in Daytime Population (2005) information collected by the Office for National Statistics for area 014F which relates to post codes CF62 4JT/H (Eglwys-Brewis), has been used (Appendix D). Based on this information, the split in public transport between train and bus is 10% / 90%.

7.16 The following table summarises the 2014 baseline traffic forecasts for ABP:

Table 7.6: ABP predicted split for weekday arrivals and departures

Aerospace Business Park Predicted Modal Split	Average Weekday Arrivals 2014 Baseline	Average Weekday Departures 2014 Baseline
Cars, HGVs & Site Transport	987	934
Train	1	2
Bus	26	22
Car Passengers	153	128
Pedestrians & Cyclists	107	114

8.0 Trip Generation

Defence Technical College

8.1 The trip generation for the DTC site is summarised in Appendix E:

- DTC Total Arrivals and Departures: Includes SFA-DTC / DTC-SFA linked trips and excludes impact of TP

8.2 This is a tabulation of the total movements to the DTC development, split by arrivals and departures. Movements to / from the adjacent SFA are included but the impact of the Travel Plan is excluded.

- DTC Total Arrivals and Departures: Includes SFA-DTC / DTC-SFA linked trips and impact of TP

8.3 Based on the previous tables, these figures take into account the impact of the Travel Plan.

8.4 The trip rates are split by mode by hour over the entire day for:

- Average Weekday Arrivals
- Average Weekday Departures
- Friday Departures
- Sunday Arrivals

Service Families' Accommodation

8.5 Trip generation has been based on average rate from the TRICS 2008 (b) database, utilising the most recent multi modal surveys of 25 private residential sites since 2000 between 83-700 households, excluding London, Northern Ireland and the Republic of Ireland (Appendix C).

Table 8.1: Residential Trip Generation (TRICS)

483 units	Arrive	Depart	Arrive	Depart	Total
	Rate per dwelling	Rate per dwelling	Trips	Trips	Trips
AM Peak	0.153	0.432	74	209	**283**
PM Peak	0.407	0.233	197	113	**310**

8.6 For comparison, the trip rate surveyed in 2008 from the 520 houses South of Rhoose Point, taken from 'Land North of Rhoose Point - Draft Transport Assessment' by Capita Symonds dated September 2008, shows that the figures used are robust:

Table 8.2: Trip Generation (Land North of Rhoose Point)

483 units	Arrive	Depart	Arrive	Depart	Total
	Rate per dwelling	Rate per dwelling	Trips	Trips	Trips
AM Peak	0.071	0.445	34	215	**249**
PM Peak	0.349	0.16	169	77	**246**

8.7 As Picketston Close is proposed to access onto the new Northern Access Road, a capacity assessment of the proposed junctions has been undertaken. To provide turning movements to and from Picketston Close, average trips rates from the TRICS 2008 (b) database have been used to calculate the traffic flows to and from the 26 semi detached houses.

Table 8.3: Picketston Close Trip Generation

26 units	Arrive	Depart	Arrive	Depart	Total
	Rate per dwelling	Rate per dwelling	Trips	Trips	Trips
AM Peak	0.153	0.432	4	11	**15**
PM Peak	0.407	0.233	11	6	**17**

8.8 The housing is proposed in the following locations (Drawing CG/002419/TA/01 Rev D):

Table 8.4: Location of dwellings and associated trip generation

	Units	AM Peak Arrivals	AM Peak Departures	PM Peak Arrivals	PM Peak Departures	Total
Accessed via Northern Access Road						
Tremains Farm	169	26	73	69	39	**207**
Picketston South West	83	13	36	34	19	**102**
North of West Camp	59	9	25	24	14	**72**
Sub Total	**307**	**48**	**134**	**127**	**72**	**381**
Accessed via Cowbridge Rd/St Athan Rd						
Stadium / Golf Course	172	26	74	70	40	**210**
Sub Total	**172**	**26**	**74**	**70**	**40**	**210**
Total	**483**	**74**	**208**	**197**	**112**	**591**

8.9 Based on the predicted modal split (Chapter 7) the following generation figures have been calculated:

Table 8.5: SFA Modal Split

	Units	AM Peak Arrivals	AM Peak Departures	PM Peak Arrivals	PM Peak Departures	AM Peak Arrivals	AM Peak Departures	PM Peak Arrivals	PM Peak Departures	Total
Total People	483	0.23	0.941	0.648	0.397	111	455	313	192	1070
Total vehicles	**483**	**0.153**	**0.432**	**0.407**	**0.233**	**74**	**209**	**197**	**113**	**592**
PSV	483	0.003	0.003	0.002	0.002	1	1	1	1	5
OGVs	483	0.003	0.003	0.001	0.001	1	1	0	0	4
Vehicle occupants	483	0.185	0.709	0.548	0.334	89	342	265	161	858
Passengers						15	134	68	49	266
Drivers						74	209	197	113	592
Pedestrians	483	0.032	0.175	0.068	0.048	15	85	33	23	156
PT users	483	0.004	0.036	0.019	0.006	2	17	9	3	31
Cyclists	483	0.008	0.02	0.013	0.009	4	10	6	4	24

8.10 Based on the Office for National Statistics split between train and bus passengers, the following generation figures have been calculated:

Table 8.6: SFA Modal Spilt

	AM Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures
Vehicles	74	209	196	112
Train	0	1	1	0
Bus	2	17	9	3
Car Passengers	15	134	68	49

Pedestrians / cyclist	20	94	39	27

8.11 The results are attached in Appendix G:

- SFA Total Arrivals and Departures: Includes SFA-DTC / DTC-SFA linked trips

8.12 This is a tabulation of the total movements to the SFA development, split by arrivals and departures. Movements to / from the adjacent DTC are included. The trip rates are split by mode by hour (between 0700-1900 hours) for:
- Average Weekday Arrivals
- Average Weekday Departures
- Average Sunday Arrivals

8.13 SFA - DTC linked movements (Appendix H - AM peak = 226 / PM peak = 243) are deducted from the DTC figures in the final total tables to avoid double counting. However, they are shown on the flows diagrams as arrivals and departures at both the SFA and DTC.

Aerospace Business Park

8.14 The calculation of traffic generation from the site has been based on the average of the most recent survey at Business Parks since 1993 with in excess of 1,000 employees (excluding Ireland) within TRICS 2008(b) (Appendix C).

8.15 To provide confidence in the figures used, a comparison has been undertaken with:

- TRICS 2008(b) – A Samsung Electronics Industrial Unit (21,841 sqm GFA) located in Billingham with 950 employees which was surveyed in October 2001 (ref: TV-02-C-01) (Appendix C).

- Traffic generation from DARA, which operated as a similar sized civilian aerospace business at the same location of the proposed ABP. The generation rates are based on 1950 employees and traffic surveys at the entrances to the site in 2001. Being a shared site, estimates of the percentage of DARA traffic arriving at each gate have had to be made, based on discussion with DARA:

Table 8.7: DARA Trip Generation

2001 Flows	AM Peak		PM Peak	
	Arrivals	Departures	Arrivals	Departures
90% West Gate Flows	453	45	42	324
50% North Gate Flows	84	2	2	51
50% East Gate Flows	242	28	30	196
Total	779	75	74	571
Rate per Employee	0.399	0.038	0.038	0.293

Table 8.8: Aerospace Business Park – Traffic Generation Rates

Reference	Type	Location	Size (sqm)	Employees	Date	AM Peak Arrivals	AM Peak Depart	AM Peak Arrivals	PM Peak Depart	AM Peak Arrivals*	AM Peak Arrivals*	PM Peak Arrivals*	PM Peak Depart*	Total*
Industrial Unit														
TV-02-C-01	Electronics	Billingham	21841	950	2001	0.129	0.0347	0.044	0.407	297	80	101	937	**1415**
Business Park														
CA-02-B-01	Science	Cambridge	118448	3780	2000	0.373	0.0246	0.0269	0.287	859	57	62	661	1639
CF-02-B-01	Mixed	Cardiff	12000	1056	2006	0.315	0.0417	0.032	0.248	725	96	74	571	1466
OX-02-B-01	Mixed	Oxford	33105	1792	2003	0.388	0.0379	0.0329	0.284	894	87	76	654	1711
Average						0.368	0.031	0.029	0.272	848	71	67	626	**1612**
DARA	Aerospace	St Athan		1950	2001	0.399	0.038	0.038	0.293	919	88	88	675	**1770**

* Based on 2303 employees in 2028

8.16 Based on these results, the average trips rates from three business parks have been used and these have been split between the two sites based on employee numbers.

Table 8.9 Aerospace Business Park: Traffic Generation By Year

Year	Employees	AM Peak Rate		PM Peak Rate		AM Peak Trips		PM Peak Trips	
		Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart
2014	798	0.368	0.031	0.029	0.272	294	25	23	217
2020	1526					562	47	44	415
2028	2303					848	71	67	626

Table 8.10: Aerospace Business Park Generation Split By Site

Year	AM Peak			PM Peak		
	Arrivals	Departures	Total	Arrivals	Departures	Total
2014–ABP North	266	22	288	20	195	215
2014–ABP South	28	2	30	2	20	22
Total	**294**	**25**	**319**	**22**	**215**	**236**
2028–ABP North	529	45	574	40	388	428
2028–ABP South	319	27	346	24	234	258
Total	**848**	**71**	**919**	**64**	**622**	**686**

8.17 Based on predicted modal split (Chapter 7) the following generation figures have been calculated:

Table 8.11: 2014 ABP Trip Generation

2014	ABP North				ABP South				Total
798 Staff	AM Peak	AM Peak	PM Peak	PM Peak	AM Peak	AM Peak	PM Peak	PM Peak	
	Arrivals	Depart	Arrivals	Depart	Arrivals	Depart	Arrivals	Depart	
Total People	**327**	**28**	**29**	**248**	**34**	**3**	**3**	**26**	**698**
Drivers	**266**	**22**	**21**	**196**	**28**	**2**	**2**	**21**	**559**
Passengers	**26**	**3**	**2**	**22**	**3**	**0**	**0**	**2**	**58**
Pedestrians	**13**	**2**	**3**	**12**	**1**	**0**	**0**	**1**	**34**
PT users	**13**	**0**	**2**	**11**	**1**	**0**	**0**	**1**	**29**
Cyclists	**9**	**1**	**1**	**7**	**1**	**0**	**0**	**1**	**19**

Table 8.12: 2028 ABP Trip Generation

2028	ABP North				ABP South				Total
2303 staff	AM Peak	AM Peak	PM Peak	PM Peak	AM Peak	AM Peak	PM Peak	PM Peak	
	Arrivals	Depart	Arrivals	Depart	Arrivals	Depart	Arrivals	Depart	
Total People	**651**	**56**	**57**	**493**	**392**	**34**	**34**	**297**	**2014**
Drivers	**529**	**45**	**42**	**391**	**319**	**27**	**25**	**236**	**1612**
Passengers	**52**	**6**	**4**	**43**	**31**	**3**	**3**	**26**	**168**
Pedestrians	**26**	**4**	**6**	**24**	**16**	**3**	**3**	**15**	**97**
PT users	**26**	**0**	**4**	**22**	**16**	**0**	**3**	**13**	**83**
Cyclists									

8.18 The proposal is to create an Aerospace Business Park consisting of different businesses, some of which will provide support for each other. In concentrating these developments together, not only is supply and demand easier, but the linked trips between the units remain on site. Therefore, 5% of the ABP generated traffic has been assumed to consist of linked trips within the developments and has been deducted.

8.19 The trip rates from TRICS have been split hourly between 0700-1900 hours and the results are attached in Appendix F:

- ABP with no GTP Total Arrivals and Departures: No reduction due to GTP or linked trips: 2014
- ABP with no GTP Total Arrivals and Departures: No reduction due to GTP or linked trips: 2028

8.20 These are tabulations of the total movements to the ABP development, split by arrivals and departures. The impact of the Travel Plan and linked trips within the site are excluded.

- ABP Total Arrivals and Departures: Includes 10% reduction due to GTP + 5% reduction due to linked trips: 2014
- ABP Total Arrivals and Departures: Includes 10% reduction due to GTP + 5% reduction due to linked trips: 2028

8.21 These are tabulations of the total movements to the ABP development, split by arrivals and departures. The impact of the Travel Plan and linked trips within the site are taken into account.

8.22 The trip rates are split by mode by hour over the entire day for:

- Average Weekday Arrivals
- Average Weekday Departures

8.23 Within the generation figures, a proportion of the traffic travelling to the proposed development will be existing traffic transferring to the new site instead of their existing works site. Of this transferred traffic, some will already be travelling on the links adjacent to the site. Detailed work has been undertaken in retail studies to quantify this figure, but minimal data exists with regard to employment sites. To provide a robust analysis, this transfer of existing trips has not been taken into account.

Sports Facilities

8.24 The sports facilities located at Picketston will be available to the public outside of the training day (0825 – 1715 hours). Due to a change over period between military and civilians being required, it is not envisaged that the facilities will be open to the public until 1800 hours. During the highway network peak hour periods, the majority of movements to the sports facilities will be pedestrian. Therefore, this development has not been taken into account in the peak hour capacity analysis, apart from some coach movements from DTC to Picketston

and sport facility employee movements, which are already included in the DTC figures.

Museum / Faith Centre / Hotel

8.25 A 6,514 sqm Museum, 547 sqm Faith Building and 150 bed hotel are proposed. Generation rates have been based on the TRICS 2008 (b) database (Appendix C) and are summarised in the following table. Traffic generation to / from St.Brise Church have not been assessed as although there are proposals for its restoration, the final use has not yet been decided.

Table 8.13: Trip Generation for Museum / Faith Centre / Hotel

	Arrivals				Departures			
	Museum	Faith	Hotel	Total	Museum	Faith	Hotel	Total
0800-0900	15	2	24	**41**	7	5	22	**34**
Dev Peak	55	29	39	**123**	49	24	33	**106**
1700-1800	4	3	35	**42**	22	2	29	**53**

Field Training Area

8.26 A Field Training Area (FTA) is proposed to be located to the east of the main DTC site. There is estimated to be a small number of vehicular movements between the main site and the FTA. The majority of these movements will be via landrovers, and undertaken outside the peak period. Therefore, these vehicular trips have not been taken into account in the capacity analysis.

Development Site

8.27 Both daily and peak hour arrival and departures for DTC, ABP and SFA are summarised in the following table:

Table 8.14: Daily and Peak Hour Arrival and Departures

People	Arrive (Weekday)			Depart (Friday)		
	0800-0900	1700-1800	24hr	0800-0900	1700-1800	24hr
Gate 1: Live Off – Work On	**316**	**3**	**996**	**5**	**319**	**1002**
Phase 2 Trainees						
Phase 3 Trainees & SAWT	43		138		67	138
Phase 3 Lunch			14			14
Metrix Trg Mil Staff	96		260		90	260
Military Staff Lunch			26			26
NPU Mil Staff	87		139		86	139
NPU Mil Staff Lunch			14			14
NPU Civilians	68		122		68	122
Site Visitors	20		150		6	150
Church	2	3	130	5	2	136
Training	0		3			3
Gate 1: Live On – Home Weekend					**819**	**1978**
Phase 2 Trainees					380	860
Phase 3 Trainees & SAWT					202	574
Metrix Trg Mil Staff					142	369
NPU Mil Staff					95	175
Gate 1: Live On – Friday Night Out						**737**
Phase 2 Trainees						430
Phase 3 Trainees & SAWT						239
Metrix Trg Mil Staff						46
NPU Mil Staff						22
Gate 2	**453**	**46**	**1237**	**11**	**487**	**1236**
Metrix Trg Civilians (DSG Car Park)	438		853		438	853
White & Green Fleet		22	97		22	97
Picketston	6	23	132	6	23	132
Energy Centre	2		16		1	16
Deliveries	7	1	139	5	3	138
Gate 3	**226**	**33**	**1064**	**24**	**270**	**1038**
Training Mil Staff (CMS)	10		35		15	35
Picketston Traffic	3	10	33	2	12	33
Gate 2 to 3	6	23	132	17	13	132
Hire Cars	5		40	5		40
FM Staff	144		360		193	365
FM catering, Retail, & Cleaners	21		394		3	363
FM Picketston	37		69		34	69
Total Defence Technical College	**995**	**82**	**3297**	**40**	**1895**	**5991**
ABP North - 2028 (0700-1900 hours)*	503	38	1777	43	369	1682
ABP South - 2028 (0700-1900 hours)*	303	23	1071	26	222	1014
Total ABP – 2028 (12 hour)*	**806**	**61**	**2848**	**69**	**591**	**2696**
Tremains Farm (0700-1900 hours)	26	69	441	73	39	459
Picketston SW (0700-1900 hours)	13	34	214	36	19	223
N of West Camp (0700-1900 hours)	9	24	151	25	14	157
Stadium/GolfCourse(0700-1900 hours)	26	70	453	74	40	472
Total SFA Accommodation (12 hour)	**74**	**197**	**1259**	**208**	**112**	**1312**
Total – 2028**	**2,281**	**508**	**9,717**	**597**	**2,978**	**12,302**

* 5% linked trips deducted from TRICS data ** 537 people who live in SFA but work on site are doubled counted

9.0 Travel Plan

9.1 A Travel Plan is a package of site-specific initiatives aimed at improving the availability and choice of travel modes to and from a development. These initiatives are designed to provide realistic alternatives to travel by car. A travel plan may also promote practices or policies that reduce the need for travel. The Welsh Assembly Government and MoD (examples of TPs at existing MoD sites have been obtained) are keen to develop and promote Travel Plans (TP) for the site to provide a basis for sustainable transport as the development progresses. Separate Travel Plans have been created for:

- Defence Technical College
- Aerospace Business Park
- Construction Traffic

9.2 Traffic is the fastest growing source of carbon dioxide, which contributes to global warming and other pollutants that have a detrimental effect on our health. Add to this stress, road rage, greater demand for car parking spaces and the health problems caused by a lack of exercise, the case for developing Travel Plans has never been stronger.

9.3 Whilst there is no single solution to combat these problems, a combination of individual measures implemented in the form of Travel Plans could have a very beneficial effect. In encouraging car free access to DTC and ABP, these Travel Plans will recommend a range of measures. Improvements to public transport information distribution, the provision of buses from the railway station, increased awareness of car share matching services and promotions to raise awareness of the health benefits of walking and cycling are all measures listed on the Travel Plan menus.

9.4 Travel Plans are essential for the new developments. A travel plan will not only reduce traffic congestion and alleviate car parking pressures, it will also improve recruitment and retention by facilitating access for employees by all modes of transport. The benefits to the health and well being of the local community and local environment will also help to maintain sustainable growth in the region.

Travel Plan Co-ordinators

9.5 Three Travel Plan Co-ordinators will be appointed, one for each Plan. These co-ordinators will oversee the development of the travel plan, liaising with departments, setting up steering groups and maintaining senior support and commitment. The Travel Plan Co-ordinators will have a budget for the setting up and promotion of these initiatives. Partnerships will be formed between the Travel Plan Co-ordinators, the Council, bus and train operators to progress the Travel Plans.

Target setting

9.6 The overall aim of the ABP and DTC Travel Plans will be to achieve a 15% and 20% reduction respectively, in the number of single occupant car trips arriving at the site by spring 2018, compared to the opening year.

9.7 The Making Travel Plans Work report published by DfT in 2002 reported that on average the 20 best performing Travel Plans in the UK achieved on average an 18% reduction in the number of journeys being made as a single driver. The Travel Plans studied by DfT were well established and had being subject to review, updates and improvements over a number of years, which facilitated the high modal spilt.

9.8 The following illustrates annual single car occupant reduction rates for the first four years of the Travel Plan.

Table 9.1: Travel Plan Targets

Date	DTC	ABP
Year 1	10% reduction	10% reduction
Year 2	10% reduction	10% reduction
Year 3	15% reduction	12% reduction
Year 4	20% reduction	15% reduction
Year 5	20% reduction	15% reduction

9.9 Best practice dictates that Travel Plan targets and objectives are set following consultation with users. In this instance this is not possible as the end users are not yet known. The targets for this Plan will need to be reviewed and if necessary changed following consultation with the users.

Travel Plan objectives

9.10 The initial objectives of this Travel Plan are adapted from the Welsh Assembly Governments Smarter Choices report that was published in 2007. It is understood that these objectives need to be refined following discussions with all stakeholders, however, it is felt they provide a good foundation upon which to develop a more site specific set of objectives.

- Give people better and more focussed information about their travel options
- Market and promote sustainable travel more effectively to encourage their use
- Make improvements to the way services are organised to ensure they appeal and cater for particular groups of potential users
- Target transport advice and services to particular groups
- Harness technology and facilities that reduce the need to travel

Travel Plan monitoring

9.11 Travel Plan monitoring is deemed as an integral part of a good Travel Plan. The standardised monitoring methodology needs to be relatively simple and straightforward, with a flexible approach if it is to be widely adopted.

9.12 There are different modal spilt targets for DTC and ABP, with different issues impacting on the Construction Travel Plan. Therefore, different travel plan measures and techniques will be employed at each. There will, however, be a co-ordinated approach to ensure that a consistent cohesive message is communicated across the whole site.

9.13 The Transport Assessment has been based on a worst case analysis of a 10% reduction and does not take into account the impact of the Travel Plan on SFA movements.. This reduction in vehicle trips has been associated with an increase in all other modes, split in the following proportions:

Table 9.2: Shift in Mode due to Travel Plan

	Train	Bus	Ped/cycle	Car Share
Defence Technical College	30%	10%	30%	30%
Aerospace Business Park	10%	10%	10%	70%

9.14 The predicted impact of the Travel Plans are summarised in Appendix I:

- 10% of DTC and ABP vehicular trips reduced due to GTP

9.15 The trip rates are split by mode by hour over the entire day for:
  - Average Weekday Arrivals
  - Average Weekday Departures
  - Friday Departures
  - Sunday Arrivals

9.16 Tables 9.2 and 9.3 illustrate how an overall reduction of single occupant car based journeys by 10% can be achieved to the DTC by increasing the modal spilt of the more sustainable transport modes:

- Increase train travel by 30%;
- Increase bus travel by 10%;
- Increase walking and cycling by 30%;
- Increase car sharing by 30%;

Table 9.3: DTC predicted modal split for weekday arrivals & departures

Defence Technical College Predicted Modal Split	Average Weekday Arrivals		Average Weekday Departures	
	2014 Baseline	With Travel Plan	2014 Baseline	With Travel Plan
Cars, HGVs & Site Transport	2374	2137	2342	2108
Train	396	467	389	459
Bus	508	532	503	526
Car Passengers	237	309	234	304
Pedestrians & Cyclists	229	300	224	294
Taxis	41	41	40	40

Table 9.4: DTC predicted modal split for Sunday arrivals & Friday departures

Defence Technical College Predicted Modal Split	Sunday Arrivals		Friday Departures	
	2014 Baseline	With Travel Plan	2014 Baseline	With Travel Plan
Cars, HGVs & Site Transport	2219	1997	3440	3096
Train	389	456	826	929
Bus	422	444	945	979
Car Passengers	222	288	34	138
Pedestrians & Cyclists	117	184	287	390
Taxis	44	44	197	197

9.17 The commuter profile of individuals using the ABP site differs to the DTC site and this behaviour is reflected in the mode distribution. Table 9.4 illustrates how an overall reduction of single occupant car based journeys by 10% can be achieved to the ABP by increasing the modal spilt of the more sustainable transport modes:

- Increase train travel by 10%;
- Increase bus travel by 10%;
- Increase walking and cycling by 10%;
- Increase car sharing by 70%;

Table 9.5: ABP predicted modal split for weekday arrivals & departures

Aerospace Business Park Predicted Modal Split	Average Weekday Arrivals		Average Weekday Departures	
	2014 Baseline	With Travel Plan	2014 Baseline	With Travel Plan
Cars, HGVs & Site Transport	987	888	934	840
Train	1	11	2	11
Bus	26	36	22	31
Car Passengers	153	222	128	193
Pedestrians & Cyclists	107	117	114	123

Total Site Generation

9.18 The total generation for the site is attached as Appendix J:

- Includes SFA-DTC / DTC-SFA linked trips: 2014
- Includes SFA-DTC / DTC-SFA linked trips: 2028

9.19 These are tabulations of the total movements to the DTC/SFA and ABP developments, split by arrivals and departures. The impact of the Travel Plan and linked trips within ABP are included. The SFA-DTC movements are included in both the SFA and DTC figures.

- SFA-DTC / DTC-SFA linked trips deducted from DTC: 2014
- SFA-DTC / DTC-SFA linked trips deducted from DTC: 2028

9.20 These are tabulations of the total movements to the DTC/SFA and ABP developments, split by arrivals and departures. The impact of the Travel Plan and

linked trips within ABP are included. The SFA-DTC movements are included only in the SFA figures.

9.21 The trip rates are split by mode by hour over the entire day for:

- Average Weekday Arrivals
- Average Weekday Departures
- Friday Departures
- Sunday Arrivals

9.22 The results are summarised in the following tables:

Table 9.6: 2014 Vehicle Movements

2014-Vehicles	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM Peak Arrive	704	704	704	704	704	-	353
PM Peak Depart	734	734	734	734	1151	-	-

Table 9.7: 2028 Vehicle Movements

2028-Vehicles	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
AM Peak Arrive	1175	1175	1175	1175	1175	-	353
PM Peak Depart	1079	1079	1079	1079	1496	-	-

10.0 Trip Distribution

10.1 The DTC and ABP development traffic has been assigned onto the existing and proposed highway network using the SATURN model recently developed on behalf of the Welsh Assembly Government to review the options to improve access to Cardiff Airport. The traffic counts in respect of the St Athan proposals and the Cardiff Airport Study have been carried out simultaneously to ensure consistency of approach and baseline traffic flows in future assessment years have been derived in both cases from the SATURN model created on behalf of the Welsh Assembly Government for the wider Cardiff Airport study. The extent of the model's highway network is summarised in Figure 3. The surveyed 2008 base flows contained in Figures 4 and 5 have been included in the model.

10.2 The origin – destination matrices used within SATURN for the developments have been based on a distribution pattern created via a gravity model for the site.

10.3 The gravity model is based on the home postcode of 1,684 DARA employees at MoD St. Athan in 2001. 26% lived to the immediate south in the Llantwit Major area. 18% lived to the north, 23% to the west, 23% to immediate east (St Athan/Barry) with 10% further east.

Table 10.1: DARA Postcode Data

Postcode	Respondents	Percentage
NP Codes	15	2%
LD Codes	2	0%
SA Codes + CF31 to 36	387	23%
CF37-48 inclusive, CF72, CF81-82	275	16%
CF1-4 inclusive, CF64, CF83	108	6%
CF5	39	2%
CF71	26	2%
CF61	435	26%
CF62	347	21%
CF63	50	3%
Total	1684	100%

10.4 Using three criteria of travel time, population and house prices, a gravity model has been produced to determine development traffic distribution. The postcode zones identified from the DARA postcode survey were used as a structure for the model.

10.5 The larger settlements within these zones were identified and information was gathered on the above criteria. Population data was obtained from the 2001 census. House price information was obtained from the BBC website which was based on figures provided by the Land Registry of England and Wales.

10.6 The underlying formula of the gravity model was adapted to suit non square matrices, with further adaptation of the formula to include weighting for both house prices and UDP housing allocations. Methods for optimising sensitivity parameters were also devised.

The gravity model was based on the following equation:

$T_j = A_j D_j e^{-\beta C_{ij}}$ where:

T_j = Number of trips between the site and Zone *j.*

D_j = Population of zone *j.*

A_j = Balancing Constraint

C = Journey Time

β = Controls the strength/weakness of Journey Time

10.7 Travel times were initially calculated using a web-based route planner but it was felt that the results produced were unrealistic. To ensure accurate travel times, various routes from the selected settlements were identified and journey times were recorded by driving these routes in the AM peak period. Central points within each zone were allocated as the route origin. Actual journey times from these points were compared with the web-based time. The percentage difference between the two times was applied to the other settlements within the zone and the web time was adjusted accordingly.

10.8 Traffic was assigned to competing routes using three different methods. Adaptations were required to standard formulas to enable more than two competing routes to be considered and optimising sensitivity parameters.

House Price

10.9 To take into account the effect of house prices the average house price for the entire study area was calculated. A house price factor for each zone was calculated based on how much the zone house price differentiated from the average. This factor was then applied to adjust the size of the zone population accordingly. In simple terms a high house price would reduce the size of the population, thus reducing the proportion of people travelling from that zone.

Beta Calibration

10.10 The beta value (β) can be a number between 0 and 1 which determines the strength/weakness of journey time. If the beta value is 0 the distribution is based on population only. The beta value was calibrated in an attempt to match the results produced by the post code survey. The results returned were within 80% of the postcode survey results.

The gravity model generated the following distribution pattern:

	DARA Postcode %age	Gravity Model Percentages			
		Web Route Planner Times	Diff	Actual Survey Times	Diff
A: Newport	1	1.0	**0.0**	0.1	**-0.9**
C: Bridgend / Ogmore / Blackmill / Porthcawl / Maesteg / Port Talbot	23	21.0	**-2.0**	27.7	**4.7**
D:Llantrisant / Pontypridd / Gilfach Goch / Porth / Treorchy / Abercynon	16	15.4	**-0.6**	5.2	**-10.8**
E: Caerphilly / Penarth / Cardiff Centre + Bay / Radyr / Llanishen / St Mellons	6	10.0	**4.0**	6.2	**0.2**
F: Ely	2	1.7	**-0.3**	2.8	**0.8**
G: Cowbridge	2	5.6	**3.6**	8.0	**6.0**
H: Llantwit Major	26	18.8	**-7.2**	24.2	**-1.8**
I:St Athan / Barry	21	24.5	**3.5**	23.0	**2.0**
J: Barry Island	3	2.1	**-0.9**	2.6	**-0.4**
	Goodness of Fit	**88.67%**		**80.49%**	

Table 10.2: Gravity Model Distribution

10.11 The Monday-Thursday flows have been assigned onto the average weekday SATURN Model on this basis.

10.12 For the Friday PM peak, the predicted increase in traffic generation numbers from DTC is 417 vehicles:

Table 10.3: PM Peak Departures From Development

Year	Monday-Thursday	Friday	Increase
2014	908	1325	417
2028	1171	1588	417

10.13 As the SATURN Model created to assess options to improve access to Cardiff Airport is based on an average weekday, modelled assignments of traffic specifically for a Friday, across the highway network being reviewed, has not been possible. This additional traffic has been assigned onto the network, based on first principles. As the significant majority of students will be from the east of the site, these students, leaving to travel home for the weekend, will turn left onto the B4265 from the NAR, left again at Waycock Cross and right onto the A48.

10.14 Analysis of a Friday using this manual assignment approach provides a worse case scenario as alternative routing is not taken into account. Furthermore, Automatic Traffic Count data contained in Appendix A and summarised in Table 10.4, highlights that the Friday PM peak is lower than the average weekday and therefore base Friday PM peak flows are lower than Monday-Thursday flows. This approach has been agreed with the Vale of Glamorgan as part of the Transport Group meetings.

Table 10.4 B4265 St Athan, adjacent to Batslays 20-26th March 2002:

	Monday	Tuesday	Wednesday	Thursday	Friday
1600-1700 hours					
Eastbound	469	468	437	441	345
Westbound	397	431	373	382	397
Total	**866**	**899**	**810**	**823**	**742**
1700-1800 hours					
Eastbound	349	364	301	355	310
Westbound	389	360	360	394	347
Total	**738**	**724**	**661**	**749**	**657**

10.15 The predicted peak hour traffic flows are summarised in Figures 6 – 15. The difference in turning movements between the with development and the no development scenario are summarised in Figures 16-19. AADT flows are summarised in Figures 20-24.

Service Families' Accommodation

10.16 The initial distribution patterns from the SATURN model have been based on SFA locations and numbers which have subsequently change, although the total number remains the same:

Table 10.5: Changes in SFA

	SATURN	Proposed
Picketston	106 units	-
Stadium / Golf Course	176 units	172 units
Tremains Farm	97 units	169 units
North of West Camp	51 units	59 units
Picketston South West	59 units	83 units
Total	483 units	483 units

10.17 The SFA figures, based on Select Link Analysis of the SATURN Model, have been manually reassigned to reflect the new distribution (Figures 8A-E / 9A-E/13A/14A).

Table 10.6: Manual Reassignment of SFA Trips – AM Peak

AM Peak	SATURN		Proposed	
	Arrive (Destination)	Depart (Origin)	Arrive (Destination)	Depart (Origin)
Picketston	15	45	0	0
Stadium/Golf Course	27	75	26	74
Tremains Farm	13	42	26	73
N of West Camp	8	23	9	25
Picketston SW	8	25	13	36
Total	71	210	74	208

Table 10.7: Manual Reassignment of SFA Trips – PM Peak

PM Peak	SATURN	Proposed

	Arrive (Destination)	Depart (Origin)	Arrive (Destination)	Depart (Origin)
Picketston	42	23	0	0
Stadium/Golf Course	70	40	70	40
Tremains Farm	40	20	69	39
N of West Camp	22	13	24	14
Picketston SW	24	13	34	19
Total	198	109	197	112

Aerospace Business Park

10.18 Changes to the employment profile of ABP have occurred since the SATURN assignments undertaken. Predicted traffic flows from the SATURN Model and therefore within the capacity analysis, therefore overestimate the traffic generated from ABP in 2014, creating a worse case scenario. The differences in the estimated population figures, which result in a robust set of analyses, are summarised in the following table:

Table 10.8: Differences in ABP Population

		2014			2020			2028	
	ABP North	ABP South	Total	ABP North	ABP South	Total	ABP North	ABP South	Total
TA	722	76	**798**	916	610	**1526**	1436	867	**2303**
SATURN	1177	380	**1557**	1177	1025	**2202**	1580	960	**2540**

SATURN Flows

10.19 Significant flow changes occur on the A4222 in Cowbridge in 2028 with the proposed development. These changes appear to be linked to the capacity of the signals at the eastern end of the High Street (A4222 / St Athan Road – Junction O). The increased flow on St Athan Road from the south that results from the development means that the signal optimising in the model responds by giving the north/south phase at the lights additional green time, at the expense of the east-west phase, so reducing the capacity of the latter. With additional traffic growth in 2028, the eastbound approach (from High Street) in the Do-Minimum PM Peak has 36 seconds green time giving a capacity of 560 pcus. With the development, this green time is reduced to 31 seconds, with a resultant capacity of 451 pcus.

10.20 Therefore, traffic leaving Cowbridge (High Street) heading east on the A48 towards Cardiff starts using an alternative route, heading west out of the town via the B4270 junction in order to access the Bypass at the western end of Cowbridge, and then turning east towards Cardiff, resulting in an increase in westbound movements at the A4222 / B4270 Llantwit Major Road – Junction N. An analysis of trips leaving the Cowbridge zone to A48 (east) shows in the Do-Minimum that in 2014, 100% use the most direct route, but by 2028 13% opt to use the longer route via the B4270 junction. With development, this proportion increases to 51%. As is often the case with congested situations, the effect is quite sensitive to small changes.

10.21 Predicted peak hour traffic flows on Eglwys Brewis Road are likely to be lower in reality as the SATURN Model has not taken into account the proposed increase to the red time on the Eglwys Brewis arm of the Boverton Signals, to reduce rat running. This change in signal timings is taken into account in Figures 22 and 24.

10.22 There is a predicted increase in AADT traffic on Cowbridge Road, north of St Athan with the proposed development, but only a small increase in traffic on this road, south of St Athan (which does not show in the AADT figures due to rounding). This is due to the re-routing of some traffic from the St Athan zone onto the Northern Access Road, and thus away from the southern section of this link.

11.0 Highway Impact - Junctions

11.1 Capacity Analysis

11.1.1 The extent of the network to be analysed in capacity terms has been agreed with the Vale of Glamorgan Council and extends to the junctions summarised in Chapter 1.

11.1.2 The highway impact of the development has been assessed based on Monday-Thursday AM/PM and Friday PM peak flows in 2008 (base), 2014 (opening year) and 2028 (design year) with both committed and proposed development, using assignment from the SATURN model. Capacity analysis of the base year has been undertaken to validate the capacity models used, against observed queue data.

11.1.3 There are currently 85 staff and 250 trainees within 4STT on the site, who will become part of DTC in 2014. The traffic generation of these existing 335 personnel has been included in the base traffic flow information collected and has not been removed from the network, when DTC opens. Therefore, some double counting has occurred, creating a worse case situation.

11.1.4 Weekend traffic flows are considerably lower than weekday flows, however there is an increase in flow on a Sunday evening when people are returning to site after the weekend. The impact of this increased demand on the existing public transport service has been assessed.

11.2 Highway Impact

11.2.1 Capacity analysis was undertaken to quantify the impact of the development on the adjacent highway network in terms of practical reserve capacity and queues.

11.2.2 Capacity analysis was undertaken for:

- 2008 AM and PM peaks (to validate the base models)
- Opening year (2014) AM and PM peaks
- 2028 AM and PM peaks (15 years after opening)

during the following observed network peak periods:

- Weekday AM peak – 08:00 – 09:00
- Weekday PM peak – 17:00 – 18:00

In addition, capacity analysis was undertaken for the Friday PM peak at specific junctions as, with the development in place it is expected that the traffic flows on particular routes from the site will increase significantly as personnel leave the area at the end of the week.

11.2.3 Future year assessments have been undertaken for the 'with development' and 'no development' scenarios.

11.2.4 The existing and proposed junctions assessed are summarised in Table 11.1:

Table 11.1: Junctions assessed (Figure 2 / Drawing CG/002419/TA07)

Existing junction ID	Junction
A	Llysworney / Llantwit Major R/A
B	Llanmaes Signals
C	Eglwys Brewis / St Athan
D	Boverton Signals
E	West Gate
F	St Athan / Gileston Junctions
G	Fontgary Road
H	BAMC R/A
I	Model Farm R/A
J	Waycock Cross
K	Pentre Meyrick
L	East Gate
M	North Gate
N	B4270 / A4222
O	Aberthin / St Athan Rd
P	Sycamore Cross
Q	Llysworney Junction
R	Batslays

Proposed Junction ID	Junction
J1	B4265/NAR
J2	Tremains Farm SFA
J3	SW Picketston SFA
J4	N of West Camp SFA
J5	Sports Facilities
J6	Eglwys Brewis Road
J7	ABP North
J8	Gate 2/3
J9	Gate 2/3
J10	Picketston Road
J11	Picketston Close
J12	Gate 1

Junction A – Llysworney/ Llantwit Major Roundabout (Figure A)

11.2.5 Capacity analysis has been undertaken at the Llysworney/ Llantwit Major Roundabout using ARCADY 6.

11.2.6 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2028
- 2028 with St Athan development
- 2028 with St Athan development uneven queuing (Arms A, C, D)

11.2.7 The results are summarised in Tables 11.2 to 11.7 and are attached in full as Appendix 2.

Table 11.2 Base 2008

Arm	AM peak			PM peak		
	Max RFC	MMQ	Surveyed Queues	Max RFC	MMQ	Surveyed Queues
B4270	0.134	0.2	0	0.230	0.3	0.2
B4265 East	0.313	0.5	0.1	0.376	0.6	0.1
Llantwit	0.192	0.2	0.1	0.110	0.1	0.2
B4565 West	0.109	0.1	0.1	0.075	0.1	0

*MMQ = Mean Max Queue

With modelled and observed queues being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.3 2014

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
B4270	0.141	0.2	0.391	0.6
B4265 East	0.308	0.4	0.279	0.4
Llantwit	0.159	0.2	0.099	0.1
B4565 West	0.120	0.1	0.135	0.2

Table 11.4 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
B4270	0.345	0.5	0.438	0.8
B4265 East	0.358	0.6	0.547	1.2
Llantwit	0.188	0.2	0.155	0.2
B4565 West	0.203	0.3	0.187	0.2

Table 11.5 2028

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
B4270	0.173	0.2	0.413	0.7
B4265 East	0.370	0.6	0.315	0.5
Llantwit	0.222	0.3	0.137	0.2
B4565 West	0.196	0.2	0.268	0.4

Table 11.6 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
B4270	0.343	0.5	0.447	0.8
B4265 East	0.439	0.8	0.604	1.5
Llantwit	0.240	0.3	0.185	0.2
B4565 West	0.356	0.6	0.356	0.5

Table 11.7 2028 with St Athan development uneven queuing (Arms A, C, D)

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Llysworney B4270	0.419	0.7	0.434	0.8
B4265 East	0.439	0.8	0.604	1.5
Llantwit	0.397	0.7	0.315	0.5
B4565 West	0.495	1.0	0.530	1.1

11.2.8 Capacity analysis indicates that there are no capacity problems in the scenarios tested at the Llysworney / Llantwit Major Roundabout.

Junction B - Llanmaes Signals (Figure B)

11.2.9 Capacity analysis has been undertaken at the Llanmaes Signals using LinSig V2.

11.2.10 The scenarios assessed were:

- Base 2008
- 2014
- 2014 with development
- 2028
- 2028 with development

11.2.11 The results are summarised in Tables 11.8 to 11.12 and are attached in full as Appendix 2.

Table 11.8 Base 2008

Link	Description	AM peak			PM peak		
		Deg Sat %	Surveyed Queues	MMQ (pcu)	Deg Sat %	Surveyed Queues	MMQ (pcu)
1/1	B4265 East Ahead	39.6	2	4.0	39.2	3	4.1
1/2	B4265 East Right	3.7	2	0.2	3.8	3	0.2
2/1	Llanmaes Right Left	12.3	1	1.0	23.5	2	1.7
3/1	B4265 West Right	32.6	0	1.9	45.4	0	3.5
3/2	B4265 West Ahead	38.8	3	3.4	35.4	3	3.1
3/3	B4265 West Ahead	2.1	1	0.2	2.2	1	0.2
4/1	Llantwit Left Right	51.7	4	5.3	42.6	3	3.6
5/1	B4265 east Ahead	46.2		3.7	43.3		3.2
5/2	B4265 east Left	8.6		0.9	15.3		1.0
8/1	Ahead	52.2		1.7	44.2		1.1
8/2	Left	8.2		0.1	7.5		0.1

PRC for signalled links: AM = 72.4, PM = 98.2

With modelled and survey queue lengths being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.9 2014

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ (pcu)	Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	73.6	10.4	55.8	6.8
1/2	B4265 East Right	32.0	1.6	10.3	0.5
2/1	Llanmaes Right Left	40.8	2.5	27.4	1.8
3/1	B4265 West Right	54.3	3.5	34.2	2.1
3/2	B4265 West Ahead	24.1	2.4	46.7	5.0
3/3	B4265 West Ahead	8.4	0.7	11.0	0.9
4/1	Llantwit Left Right	41.0	2.9	70.1	6.3
5/1	B4265 east Ahead	64.3	4.6	49.1	3.2
5/2	B4265 east Left	27.9	2.0	22.5	1.5
8/1	Ahead	31.0	0.6	69.9	2.1
8/2	Left	13.1	0.2	22.8	0.4

PRC for signalled links: AM = 22.2, PM = 28.3

Table 11.10 2014 with development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ (pcu)	Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	53.6	17.4	86.3	23.5
1/2	B4265 East Right	53.5	6.3	77.0	5.3
2/1	Llanmaes Right Left	57.3	10.2	55.0	3.7
3/1	B4265 West Right	76.3	11.6	53.5	3.6
3/2	B4265 West Ahead	64.3	27.9	28.6	4.6
3/3	B4265 West Ahead	4.9	0.8	3.9	0.4
4/1	Llantwit Left Right	75.8	17.0	60.8	4.7
5/1	B4265 east Ahead	43.1	3.8	68.5	5.2
5/2	B4265 east Left	11.7	0.7	26.1	1.4
8/1	Ahead	75.8	39.4	34.7	0.8
8/2	Left	13.6	0.2	8.0	0.1

PRC for signalled links: AM =18.0, PM = 4.3

Table 11.11 2028

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ (pcu)	Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	44.3	4.9	60.2	7.5
1/2	B4265 East Right	32.4	2.1	15.0	0.7
2/1	Llanmaes Right Left	44.7	2.8	37.5	2.3
3/1	B4265 West Right	49.1	4.0	36.2	2.2
3/2	B4265 West Ahead	43.0	4.3	51.6	6.1
3/3	B4265 West Ahead	7.5	0.6	10.7	0.9
4/1	Llantwit Left Right	40.3	2.8	73.2	6.0
5/1	B4265 east Ahead	51.5	3.3	51.0	3.3
5/2	B4265 east Left	15.5	0.9	27.0	1.6
8/1	Ahead	50.4	1.0	70.2	1.9
8/2	Left	12.4	0.2	21.0	0.3

PRC for signalled links: AM =74.7, PM = 23.0

Table 11.12 2028 with development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ (pcu)	Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	44.4	13.2	89.8	26.7
1/2	B4265 East Right	48.5	6.5	77.0	5.3
2/1	Llanmaes Right Left	60.0	10.3	61.7	4.3
3/1	B4265 West Right	86.9	16.6	58.9	4.0
3/2	B4265 West Ahead	74.0	35.2	34.7	5.9
3/3	B4265 West Ahead	4.9	0.8	5.0	0.5
4/1	Llantwit Left Right	85.6	19.7	57.8	4.4
5/1	B4265 east Ahead	37.9	3.2	71.7	5.7
5/2	B4265 east Left	8.3	0.4	27.8	1.6
8/1	Ahead	86.3	49.4	40.4	1.0
8/2	Left	14.2	0.2	8.8	0.1

PRC for signalled links: AM =3.5, PM = 0.2

11.2.12 Capacity analysis indicates that the junction is within its practical reserve capacity in both the AM and PM peak with the highest degree of saturation on any approach being less than 90%.

Junction C - Eglwys Brewis (St. Athan) Junction (Figure C)

11.2.13 Capacity analysis has been undertaken at the Eglwys Brewis priority junction using PICADY 5.

11.2.14 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.15 The results are summarised in Tables 11.13 to 11.16 and are attached in full as Appendix 2.

Table 11.13 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Eglwys Brewis Road to Cowbridge Road	0.211	0.27	0.299	0.42
Eglwys Brewis Road to St. Athan Road	0.112	0.089	0.145	0.17
St. Athan Road	0.163	0.23	0.163	0.22

Table 11.14 2014 with St Athan development Friday PM

Arm	PM peak	
	Max RFC	MMQ
Eglwys Brewis Road to Cowbridge Road	0.299	0.42
Eglwys Brewis Road to St. Athan Road	0.145	0.17
St. Athan Road	0.163	0.22

Table 11.15 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Eglwys Brewis Road to Cowbridge Road	0.248	0.33	0.320	0.47
Eglwys Brewis Road to St. Athan Road	0.143	0.17	0.173	0.21
St. Athan Road	0.206	0.34	0.196	0.29

Table 11.16 2028 with St Athan development Friday PM

Arm	PM peak	
	Max RFC	Mean Max Queue
Eglwys Brewis Road to Cowbridge Road	0.320	0.47
Eglwys Brewis Road to St. Athan Road	0.173	0.21
St. Athan Road	0.196	0.29

11.2.16 Capacity analysis indicates that there are no capacity problems in the scenarios tested at the Eglwys Brewis Junction.

Junction D - Boverton Signals (Figure D)

11.12.17 Capacity analysis has been undertaken at the Boverton Signals using TRANSYT 12.

11.2.18 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.19 The results are summarised in Tables 11.17 to 11.23 and are attached in full with the TRANSYT link diagrams for each as Appendix 2.

Table 11.17 Base 2008

Link	Description	AM peak			PM peak		
		Deg Sat	Surveyed Queues	MMQ	Deg Sat	Surveyed Queues	MMQ
10	B4265 Right turn to South	2	0	0	2	0	0
11	B4265 Eastbound	34	4	3	22	2	2
12	B4265 E/bound Left turn	2	0	0	4	1	0
13	B4265 Westbound storage	32	1	1	25	1	1
14	B4265 W/bound Left turn	24	0	1	23	0	1
15	Northbound arm	26	5	2	17	4	2
20	B4265 E/bound storage	54	4	7	36	3	2
21	B4265 E/bound Left turn	7	0	1	11	0	1
22	Picketston Lane	15	3	1	8	1	1
23	B4265 W/bound Right turn	1	0	0	2	0	0
24	B4265 W/bound straight	26	1	3	25	3	3
25	B4265 W/bound Left turn	23	3	2	25	3	2

With modelled and survey queue lengths being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.18 2014

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ	Deg Sat (%)	MMQ
10	B4265 Right turn to South	6	0	4	0
11	B4265 Eastbound	23	2	41	5
12	B4265 Eastbound Left turn	4	0	1	0
13	B4265 Westbound storage	42	1	56	1
14	B4265 Westbound Left turn	7	0	21	1
15	Northbound arm	40	4	10	1
20	B4265 Eastbound storage	46	4	42	2
21	B4265 Eastbound Left turn	9	0	2	0
22	Picketston Lane	9	1	2	0
23	B4265 Westbound Right turn	1	0	2	0
24	B4265 Westbound straight ahead	44	5	60	7
25	B4265 Westbound Left turn	5	0	29	3

Table 11.19 2014 with development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ	Deg Sat (%)	MMQ
10	B4265 Right turn to South	6	0	11	1
11	B4265 Eastbound	37	4	24	2
12	B4265 Eastbound Left turn	4	0	3	0
13	B4265 Westbound storage	57	1	67	1
14	B4265 Westbound Left turn	16	2	27	1
15	Northbound arm	42	4	24	3
20	B4265 Eastbound storage	62	8	40	3
21	B4265 Eastbound Left turn	10	1	6	0
22	Picketston Lane	7	1	11	1
23	B4265 Westbound Right turn	11	1	3	0
24	B4265 Westbound straight ahead	57	7	73	10
25	B4265 Westbound Left turn	21	2	35	3

Table 11.20 2028

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ	Deg Sat (%)	MMQ
10	B4265 Right turn to South	7	1	4	0
11	B4265 Eastbound	36	4	49	6
12	B4265 Eastbound Left turn	3	0	1	0
13	B4265 Westbound storage	54	1	65	1
14	B4265 Westbound Left turn	20	1	25	1
15	Northbound arm	43	4	16	2
20	B4265 Eastbound storage	57	8	55	4
21	B4265 Eastbound Left turn	9	0	3	0
22	Picketston Lane	10	1	2	0
23	B4265 Westbound Right turn	1	0	2	0
24	B4265 Westbound straight ahead	53	6	70	9
25	B4265 Westbound Left turn	24	2	34	3

Table 11.21 2028 with development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ	Deg Sat (%)	MMQ
10	B4265 Right turn to South	7	1	15	1
11	B4265 Eastbound	45	5	37	4
12	B4265 Eastbound Left turn	4	0	3	0
13	B4265 Westbound storage	65	2	81	3
14	B4265 Westbound Left turn	18	1	29	1
15	Northbound arm	49	5	27	3
20	B4265 Eastbound storage	72	11	56	4
21	B4265 Eastbound Left turn	11	1	7	0
22	Picketston Lane	8	1	11	1
23	B4265 Westbound Right turn	12	1	3	0
24	B4265 Westbound straight ahead	65	8	82	12
25	B4265 Westbound Left turn	24	2	38	4

Table 11.22 2014 Friday PM peak with development

Link	Description	PM peak	
		Deg Sat (%)	MMQ
10	B4265 Right turn to South	11	1
11	B4265 Eastbound	76	11
12	B4265 Eastbound Left turn	3	0

13	B4265 Westbound storage	70	1
14	B4265 Westbound Left turn	26	1
15	Northbound arm	12	1
20	B4265 Eastbound storage	88	11
21	B4265 Eastbound Left turn	6	0
22	Picketston Lane	11	1
23	B4265 Westbound Right turn	3	0
24	B4265 Westbound straight ahead	73	10
25	B4265 Westbound Left turn	35	3

Table 11.23 2028 Friday PM peak with development

Link	Description	PM peak	
		Deg Sat (%)	MMQ
10	B4265 Right turn to South	18	2
11	B4265 Eastbound	62	13
12	B4265 Eastbound Left turn	2	0
13	B4265 Westbound storage	58	12
14	B4265 Westbound Left turn	27	1
15	Northbound arm	42	7
20	B4265 Eastbound storage	73	13
21	B4265 Eastbound Left turn	6	0
22	Picketston Lane	17	2
23	B4265 Westbound Right turn	5	1
24	B4265 Westbound straight ahead	56	11
25	B4265 Westbound Left turn	26	4

11.2.20 Capacity analysis indicates that there are no capacity problems in the scenarios tested at the Boverton Signals.

Junction E – West Gate (Figure E)

11.2.21 Capacity analysis has been undertaken at the West Gate Junction using PICADY 5.

11.2.22 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2014 with St Athan development FRIDAY PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development FRIDAY PM

11.2.23 The results are summarised in Tables 11.24 to 11.29 and are attached in full as Appendix 2.

Table 11.24 Base 2008

Arm	AM peak			PM peak		
	Max RFC	Mean Max Queue	Observed MMQ	Max RFC	Mean Max Queue	Observed MMQ
West Gate	0.088	0.10	0	0.210	0.26	0.2
B4265 East	0.098	0.11	0	0.050	0.05	0

With modelled and survey queue lengths being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.25 2014

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
West Gate	0.200	0.25	0.346	0.52
B4265 East	0.021	0.02	0.042	0.04

Table 11.26 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
West Gate	0.240	0.31	0.402	0.66
B4265 East	0.023	0.02	0.047	0.05

Table 11.27 2028

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
West Gate	0.259	0.35	0.449	0.80
B4265 East	0.025	0.03	0.052	0.05

Table 11.28 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
West Gate	0.332	0.49	0.524	1.07
B4265 East	0.027	0.03	0.056	0.06

Table 11.29 Friday PM peak

Arm	2014		2028	
	Max RFC	MMQ	Max RFC	MMQ
West Gate	0.644	1.70	0.961	7.09
B4265 East	0.061	0.06	0.075	0.08

11.2.24 Capacity analysis indicates that there are no capacity problems in the scenarios tested at West Gate Junction.

Junction F – B4265 St Athan / Gileston Junction (Figure F and Drawing CG/003622/PA/350/illustrative)

11.2.25 Capacity analysis has been undertaken at the Gileston Junction using PICADY 5.

11.2.26 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.27 The results are summarised in Tables 11.30 to 11.36 and are attached in full as Appendix 2.

Table 11.30 2008 Base

Arm	AM peak			PM peak		
	Max RFC	MMQ	Observed MMQ	Max RFC	MMQ	Observed MMQ
B4265 (east)	0.348	0.79	0.1	0.407	1.04	0
Gileston Rd (south)	0.038	0.04	0.1	0.034	0.03	0
B4265 (west)	0.006	0.01	0	0.014	0.02	0
Gileston Rd (north)	0.606	1.50	1.55	0.330	0.49	0.3

With modelled and survey queue lengths being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.31 2014 Base

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
B4265 (east)	0.426	1.01	0.458	1.28
Gileston Road (south)	0.038	0.04	0.038	0.04
B4265 (west)	0.006	0.01	0.018	0.02
Gileston Road (north)	0.627	1.63	0.572	1.31

Table 11.32 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
B4265 (east)	0.513	1.85	0.631	2.72
Gileston Road (south)	0.055	0.06	0.045	0.05
B4265 (west)	0.007	0.01	0.022	0.03
Gileston Road (north)	1.040	17.43	0.658	1.84

Table 11.33 2014 with St Athan development Friday PM

Arm	PM peak	
	Max RFC	Mean Max Queue
B4265 (east)	**0.880**	10.06
Gileston Road (south)	0.068	0.07
B4265 (west)	0.034	0.05
Gileston Road (north)	1.245	25.67

Table 11.34 2028 Base

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
B4265 (east)	0.579	1.94	0.544	1.94
Gileston Road (south)	0.058	0.06	0.057	0.06
B4265 (west)	0.010	0.01	0.024	0.03
Gileston Road (north)	0.773	3.12	0.755	2.86

Table 11.35 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
B4265 (east)	0.677	3.67	0.643	3.01
Gileston Road (south)	0.086	0.09	0.057	0.06
B4265 (west)	0.011	0.01	0.024	0.03
Gileston Road (north)	1.213	37.79	0.786	3.30

Table 11.36 2028 with St Athan development Friday PM

Arm	PM peak	
	Max RFC	Mean Max Queue
B4265 (east)	**0.898**	11.96
Gileston Road (south)	0.103	0.11
B4265 (west)	0.038	0.05
Gileston Road (north)	1.614	53.42

11.2.28 The analysis indicates that Gileston Road (North) is overcapacity in 2014 and 2028 with development, as the RFC was over 0.90, which indicates problems with capacity which results in excessive queuing and delay. In the 2014 and 2028 Friday PM with development scenarios both the B4265 (east) and Gileston Road (north) are over capacity.

11.2.29 In order to overcome the identified problems, a signalised junction was designed to replace the existing priority junction. This signalised layout is shown in Drawing CG/003622/PA/350/illustrative

11.2.30 Capacity analysis of the signalised junction has been undertaken using LinSig V2.

11.2.31 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.32 The results are summarised in Tables 11.37 to 11.40 and are attached in full as Appendix 2.

Table 11.37 2014 with development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ (pcu)	Deg Sat (%)	MMQ (pcu)
1/1	B4265 (East) Right	34.8	3.2	33.4	1.9
1/2	B4265 (East) Ahead Left	51.5	9.5	29.9	4.4
2/1	Gileston Road (South) Left Ahead Right	2.3	0.2	6.1	0.5
3/1	B4265 (West) Left Ahead Right	57.7	9.7	55.8	10.7
4/1	Gileston Road (North) Right Left Ahead	57.6	8.0	56.9	5.5

PRC for signalled links: AM = 56.0, PM = 58.1

Table 11.38 2014 Friday PM with development

Link	Description	PM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 (East) Right	72.6	10.2
1/2	B4265 (East) Ahead Left	26.3	6.2
2/1	Gileston Road (South) Left Ahead Right	5.7	0.6
3/1	B4265 (West) Left Ahead Right	73.1	33.6
4/1	Gileston Road (North) Right Left Ahead	72.4	11.7

PRC for signalled links: PM = 23.2

Table 11.39 2028 with development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ (pcu)	Deg Sat (%)	MMQ (pcu)
1/1	B4265 (East) Right	44.8	4.2	43.9	2.1
1/2	B4265 (East) Ahead Left	54.3	10.5	34.3	5.2
2/1	Gileston Road (South) Left Ahead Right	3.6	0.3	4.4	0.3
3/1	B4265 (West) Left Ahead Right	64.8	12.2	69.5	15.2
4/1	Gileston Road (North) Right Left Ahead	64.7	8.7	66.4	6.8

PRC for signalled links: AM = 39.0, PM = 29.5

Table 11.40 2028 Friday PM with development

Link	Description	PM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 (East) Right	85.8	11.9
1/2	B4265 (East) Ahead Left	30.1	7.3
2/1	Gileston Road (South) Left Ahead Right	9.1	0.7
3/1	B4265 (West) Left Ahead Right	87.2	51.0
4/1	Gileston Road (North) Right Left Ahead	84.6	14.9

PRC for signalled links: PM = 3.2

11.2.33 The LinSig capacity analyses indicate that the proposed signals, even with all the additional Friday PM peak development traffic travelling through the junction, have a positive practical reserve capacity. Furthermore, this junction is one of the accidents cluster sites identified in Chapter 14. The proposed signalisation should improve the safety of the right turn manoeuvre, the movement involved in all the accidents recorded at this junction.

Junction G - Fontygary Road Junction (Figure G)

11.2.34 Capacity analysis has been undertaken at the Fontygary Road Junction using PICADY 5.

11.2.35 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2014 with St Athan development FRIDAY PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development FRIDAY PM

11.2.36 The results are summarised in Tables 11.41 to 11.47 and are attached in full as Appendix 2.

Table 11.41 2008 Base

Arm	AM peak			PM peak		
	Max RFC	MMQ	Obs MMQ	Max RFC	MMQ	Obs MMQ
Fontygary Rd (south) to B4265 (east)	0.054	0.06	0	0.049	0.05	0
Fontygary Rd (south) to B4265 (west)	0.347	0.53	0.28	0.175	0.21	0
B4265 (west)	0.156	0.18	0	0.281	0.39	0

With modelled and survey queue lengths being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.42 2014 Base

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Fontygary Rd (south) to B4265 (east)	0.116	0.13	0.091	0.10
Fontygary Rd (south) to B4265 (west)	0.215	0.27	0.107	0.12
B4265 (west)	0.112	0.13	0.178	0.21

Table 11.43 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Fontygary Rd (south) to B4265 (east)	0.158	0.19	0.123	0.14
Fontygary Rd (south) to B4265 (west)	0.458	0.83	0.168	0.20
B4265 (west)	0.172	0.21	0.365	0.57

Table 11.44 2014 with St Athan development Friday PM

Arm	PM peak	
	Max RFC	MMQ
Fontygary Rd (south) to B4265 (east)	0.176	0.21
Fontygary Rd (south) to B4265 (west)	0.171	0.20
B4265 (west)	0.365	0.57

Table 11.45 2028 Base

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Fontygary Rd (south) to B4265 (east)	0.160	0.19	0.119	0.13
Fontygary Rd (south) to B4265 (west)	0.279	0.38	0.138	0.16
B4265 (west)	0.135	0.16	0.263	0.36

Table 11.46 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Fontygary Rd (south) to B4265 (east)	0.235	0.30	0.176	0.21
Fontygary Rd (south) to B4265 (west)	0.572	1.31	0.204	0.25
B4265 (west)	0.207	0.26	0.457	0.83

Table 11.47 2028 with St Athan development Friday PM

Arm	PM peak	
	Max RFC	MMQ
Fontygary Rd (south) to B4265 (east)	0.279	0.37
Fontygary Rd (south) to B4265 (west)	0.210	0.26
B4265 (west)	0.457	0.83

11.2.37 Capacity analysis indicates that there are no capacity problems in the scenarios tested at Fontygary Road Junction.

Junction H - BAMC Junction (Figure H)

11.2.38 Capacity analysis has been undertaken at the BAMC Junction using ARCADY 6.

11.2.39 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2014 with St Athan development FRIDAY PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development FRIDAY PM

11.2.40 The results are summarised in Tables 11.48 to 11.54 and are attached in full as Appendix 2.

Table 11.48 2008 Base

Arm	AM peak			PM peak		
	Max RFC	MMQ	Observed MMQ	Max RFC	MMQ	Observed MMQ
A4226 (east)	0.224	0.3	0	0.300	0.4	0
CIA (south)	0.072	0.1	0	0.121	0.1	0
Dragonfly Drive	0.002	0.0	0	0.007	0.0	0
B4256 (west)	0.326	0.5	0	0.287	0.4	0
Tredogan Road	0.014	0.0	0	0.006	0.0	0

With modelled and survey queue lengths being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.49 2014 Base

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
A4226 (east)	0.277	0.4	0.279	0.4
CIA (south)	0.106	0.1	0.061	0.1
Dragonfly Drive	0.002	0.0	0.065	0.1
B4256 (west)	0.300	0.4	0.285	0.4
Tredogan Road	0.071	0.1	0.024	0.0

Table 11.50 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
A4226 (east)	0.379	0.6	0.310	0.4
CIA (south)	0.106	0.1	0.061	0.1
Dragonfly Drive	0.002	0.0	0.064	0.1
B4256 (west)	0.322	0.5	0.340	0.5
Tredogan Road	0.073	0.1	0.025	0.0

Table 11.51 2014 with St Athan development Friday PM

Arm	PM peak	
	Max RFC	Mean Max Queue
A4226 (east)	0.310	0.4
CIA (south)	0.061	0.1
Dragonfly Drive	0.064	0.1
B4256 (west)	0.622	1.6
Tredogan Road	0.030	0.00

Table 11.52 2028 Base

	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
A4226 (east)	0.322	0.5	0.306	0.4
CIA (south)	0.150	0.2	0.091	0.1
Dragonfly Drive	0.002	0.0	0.095	0.1
B4256 (west)	0.372	0.6	0.357	0.6
Tredogan Road	0.087	0.1	0.031	0.0

Table 11.53 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
A4226 (east)	0.430	0.8	0.336	0.5
CIA (south)	0.147	0.2	0.087	0.1
Dragonfly Drive	0.002	0.0	0.086	0.1
B4256 (west)	0.389	0.6	0.406	0.7
Tredogan Road	0.089	0.1	0.032	0.0

Table 11.54 2028 with St Athan development Friday PM

	PM peak	
	Max RFC	MMQ
A4226 (east)	0.336	0.5
CIA (south)	0.087	0.1
Dragonfly Drive	0.086	0.1
B4256 (west)	0.693	2.2
Tredogan Road	0.040	0.0

11.2.41 Capacity analysis indicates that there are no capacity problems in the scenarios tested at BAMC Junction.

Junction I – Model Farm Roundabout (Figure I)

11.2.42 Capacity analysis has been undertaken at the Model Farm Roundabout using ARCADY 6.

11.2.43 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2028
- 2028 with St Athan development

11.2.44 The results are summarised in Tables 11.55 to 11.59 and are attached in full as Appendix 2.

Table 11.55 Base 2008

Arm	AM peak			PM peak		
	Max RFC	Mean Max Queue	Observed MMQ	Max RFC	Mean Max Queue	Observed MMQ
A4226 East	0.329	0.5	0	0.598	1.5	0
Port Road	0.377	0.6	1	0.226	0.3	0.3
A4226 West	0.344	0.5	0.6	0.383	0.6	0.2

With modelled and survey queue lengths being similar, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.56 2014

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
A4226 East	0.353	0.5	0.641	1.8
Port Road	0.408	0.7	0.246	0.3
A4226 West	0.377	0.6	0.415	0.7

Table 11.57 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
A4226 East	0.439	0.8	0.602	1.5
Port Road	0.504	1.0	0.230	0.3
A4226 West	0.396	0.7	0.365	0.6

Table 11.58 2028

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
A4226 East	0.426	0.7	0.610	1.6
Port Road	0.522	1.1	0.293	0.4
A4226 West	0.474	0.9	0.409	0.7

Table 11.59 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
A4226 East	0.509	1.0	0.650	1.8
Port Road	0.593	1.4	0.299	0.4
A4226 West	0.495	1.0	0.452	0.8

11.2.45 Capacity analysis indicates that there are no capacity problems in the scenarios tested at Model Farm Roundabout.

Junction J – Waycock Cross (Figure J and Drawing CG/003622/PA/540/illustrative)

11.2.46 Capacity analysis has been undertaken at the Waycock Cross using ARCADY 6.

11.2.47 The scenarios assessed were:

- 2008
- 2014

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.48 The results are summarised in Tables 11.60 to 11.67 and are attached in full as Appendix 2.

Table 11.60 2008 Base

Arm	AM peak			PM peak		
	Max RFC	MMQ	Observed MMQ	Max RFC	MMQ	Observed MMQ
Port Road West (east)	0.625	1.6	7	0.788	3.6	5
Pontypridd Road	0.446	0.8	1.5	0.541	1.2	1.75
Port Road West (west)	0.943	11.5	4.5	0.712	2.4	1.75
Waycock Road	0.564	1.3	6.5	0.626	1.6	2

With modelled and survey queue lengths being similar in the AM and PM peak, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.61 2014

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Port Road West (east)	0.502	1.0	0.776	3.4
Pontypridd Road	0.477	0.9	0.542	1.2
Port Road West (west)	1.243	136.0	0.881	6.6
Waycock Road	0.670	2.0	0.619	1.6

Table 11.62 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Port Road West (east)	0.573	1.3	0.825	4.5
Pontypridd Road	0.524	1.1	0.583	1.4
Port Road West (west)	1.305	173.5	0.973	16.2
Waycock Road	0.672	2.0	0.658	1.9

Table 11.63 2028

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Port Road West (east)	0.613	1.6	0.840	4.9
Pontypridd Road	0.607	1.5	0.640	1.8
Port Road West (west)	1.558	327.2	1.138	78.8
Waycock Road	0.611	1.5	0.656	1.8

Table 11.64 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Port Road West (east)	0.726	2.6	0.863	5.8
Pontypridd Road	0.679	2.1	0.688	2.2
Port Road West (west)	1.630	374.6	1.229	125.5
Waycock Road	0.649	1.8	0.714	2.4

Table 11.65 Friday PM peak with development

Arm	2014		2028	
	Max RFC	MMQ	Max RFC	MMQ
Port Road West (east)	0.798	3.8	0.823	4.4
Pontypridd Road	0.583	1.4	0.688	2.2
Port Road West (west)	1.419	256.8	1.912	640.5
Waycock Road	0.560	1.3	0.625	1.6

The capacity analysis highlights capacity problems on the Port Road West arm, both with and without development. Therefore, to improve capacity at the junction, an offline roundabout proposal, which meets the appropriate standards and has sufficient capacity in the design year, has been designed (Drawing CG/003622/PA/540/illustrative).

Capacity analysis for the proposed roundabout has been undertaken and the results are summarised in the following tables:

Table 11.66 Waycock Cross New Junction: 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Port Road West (east)	0.827	4.5	0.796	3.8
Pontypridd Road	0.777	3.4	0.764	3.1
Port Road West (west)	0.831	4.7	0.608	1.5
Waycock Road	0.594	1.4	0.500	1.0

Table 11.67 Waycock Cross New Junction: Friday PM peak

	2028	
	Max RFC	MMQ
Port Road West (east)	0.796	3.8
Pontypridd Road	0.764	3.1
Port Road West (west)	0.776	3.4
Waycock Road	0.500	1.0

Capacity analysis indicates that there are no significant capacity problems in the scenarios tested for the proposed modified Waycock Cross Roundabout.

Junction K – Pentre Meyrick (Figure K)

11.2.49 Capacity analysis has been undertaken at the Pentre Meyrick using PICADY 5.

11.2.50 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2028
- 2028 with St Athan development

11.2.51 The results are summarised in Tables 11.68 to 11.72 and are attached in full as Appendix 2.

Table 11.68 2008 Base

Arm	AM peak			PM peak		
	Max RFC	Mean Max Queue	Observed MMQ	Max RFC	Mean Max Queue	Observed MMQ
Pentre Meyrick	0.436	0.76	1	0.443	0.74	1
A48 East	0.488	0.94	0	0.422	0.72	0
B4268	0.707	2.31	1	0.422	0.72	1

A48 West	0.309	0.44	1	0.477	0.90	0

With modelled and survey queue lengths being similar on all of the arms, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.69 2014

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
Pentre Meyrick	0.636	1.69	0.552	1.21
A48 East	0.386	0.62	0.629	1.65
B4268	0.622	1.60	0.536	1.14
A48 West	0.276	0.38	0.689	2.13

Table 11.70 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
Pentre Meyrick	0.618	1.57	0.593	1.42
A48 East	0.427	0.73	0.676	2.02
B4268	0.844	4.44	0.824	4.20
A48 West	0.673	1.99	0.757	2.94

Table 11.71 2028

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
Pentre Meyrick	0.627	1.62	0.637	1.69
A48 East	0.477	0.90	0.630	1.65
B4268	0.662	1.88	0.607	1.50
A48 West	0.354	0.54	0.688	2.11

Table 11.72 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
Pentre Meyrick	0.745	2.49	0.589	1.39
A48 East	0.422	0.72	0.564	1.26
B4268	0.636	1.69	0.731	2.56
A48 West	0.588	1.39	0.686	2.09

Capacity analysis indicates that there are no capacity problems in the scenarios tested.

Junction L – East Gate (Figure L)

11.2.52 Capacity analysis has been undertaken at the East Gate using PICADY 5.

11.2.53 The gate is to be closed to general use as part of the development, so the only scenario assessed was:

- 2008

11.2.54 The results are summarised in Table 11.73 and are attached in full as Appendix 2.

Table 11.73 Base 2008

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
RAF East Gate	0.081	0.09	0.244	0.32
Cowbridge Road North Straight ahead	0.106	0.20	0.091	0.18
Cowbridge Road North right turn	0.179	0.10	0.110	0.02

No queue length data was available to validate the base model.

11.2.55 Capacity analysis indicates that there are no capacity problems in the scenario tested.

Junction M – North Gate (Figure M)

11.2.56 Capacity analysis has been undertaken at the North Gate using PICADY 5.

11.2.57 Only the 2008 AM and PM peaks were assessed.

11.2.58 The results are summarised in Tables 11.74 are attached in full as Appendix 2.

Table 11.74 2008 Base

Arm	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Picketston Road (East)	0.002	0.00	0.011	0.01
South Access	0.056	0.06	0.054	0.06
Picketston Road (West)	0.009	0.01	0.040	0.04
North Access	0.019	0.02	0.018	0.02

11.2.59 Capacity analysis indicates that there are no existing capacity problems at North Gate junction.

Junction N - B4270 Llantwit Major Rd (Figure N)

11.2.60 Capacity analysis has been undertaken at the B4270 Llantwit Major Rd junction using PICADY 5.

11.2.61 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2028
- 2028 with St Athan development

11.2.62 The results are summarised in Tables 11.75 to 11.79 and are attached in full as Appendix 2.

Table 11.75 2008 Base

	AM peak			PM peak		
	Max RFC	MMQ	Observed MMQ	Max RFC	MMQ	Observed MMQ
B4270 L'wit Major Rd	0.741	2.71	2.17	0.413	0.69	1.17
Gibbet's Hill	0.041	0.06	0.08	0.068	0.12	0.00

With modelled and survey queue lengths being similar on all of the arms, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.76 2014 Base

	AM peak		PM peak	
	Max RFC	Mean Max Queue	Max RFC	Mean Max Queue
B4270 Llantwit Major Rd	0.588	1.39	0.259	0.35

Gibbet's Hill	0.000	0.00	0.000	0.00

Table 11.77 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**Mean Max Queue**	**Max RFC**	**Mean Max Queue**
B4270 Llantwit Major Rd	0.667	1.93	0.468	0.87
Gibbet's Hill	0.000	0.00	0.000	0.00

Table 11.78 2028 Base

	AM peak		PM peak	
	Max RFC	**Mean Max Queue**	**Max RFC**	**Mean Max Queue**
B4270 Llantwit Major Rd	0.899	6.69	0.389	0.63
Gibbet's Hill	0.000	0.00	0.000	0.00

Table 11.79 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**Mean Max Queue**	**Max RFC**	**Mean Max Queue**
B4270 Llantwit Major Rd	0.983	12.78	0.710	2.33
Gibbet's Hill	0.000	0.00	0.000	0.00

Note: Saturn Model has no right turns from Gibbet's Hill.

11.2.63 Capacity analysis indicates that there are no existing capacity problems at B4270 Llantwit Major Rd junction in any of the scenarios tested except the 2028 with and without development scenarios.

11.2.64 The difference between the RFCs for the 2028 with and without development scenarios is minor being only 0.084. Therefore, modification of the junction is not required.

Junction O Cardiff Road/ Aberthin Road (Figure O)

11.2.65 Capacity analysis has been undertaken at the Cardiff Road/ Aberthin Road junction using LinSig V2.

11.2.66 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2028
- 2028 with St Athan development

11.2.67 The results are summarised in Tables 11.80 to 11.84 and are attached in full as Appendix 2.

Table 11.80 2008 Base

Link	**Description**	**AM peak**			**PM peak**		
		Deg Sat	**MMQ**	**Observed MMQ**	**Deg Sat**	**MMQ**	**Observed MMQ**
1/1	A4222 Cardiff Road Ahead Right Left	83.7	10.0	4.42	67.5	7.2	5.67
2/1	St Athan Road Left	86.1	11.2	8.83	75.9	4.6	4.17

	Ahead Right						
3/1	A4222 Eastgate Left Ahead Right	83.8	9.9	4.50	71.3	7.0	5.50
4/1	Aberthin Road Right Left Ahead	82.6	11.6	9.75	69.0	5.0	3.00

PRC for signalled links: AM = 4.60, PM = 18.6

With modelled and survey queue lengths being similar on all of the arms, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.81 2014

Link	Description	AM peak		PM peak	
		Deg Sat	MMQ	Deg Sat	MMQ
1/1	A4222 Cardiff Road Ahead Right Left	44.4	6.9	47.5	8.6
2/1	St Athan Road Left Ahead Right	77.8	12.0	79.3	11.2
3/1	A4222 Eastgate Left Ahead Right	78.7	13.9	80.6	17.4
4/1	Aberthin Road Right Left Ahead	79.6	11.8	82.0	10.3

PRC for signalled links: AM = 13.0, PM = 9.8

Table 11.82 2014 with development

Link	Description	AM peak		PM peak	
		Deg Sat	MMQ	Deg Sat	MMQ
1/1	A4222 Cardiff Road Ahead Right Left	50.4	10.7	44.8	11.9
2/1	St Athan Road Left Ahead Right	82.7	20.8	88.6	23.6
3/1	A4222 Eastgate Left Ahead Right	80.9	20.3	87.9	28.8
4/1	Aberthin Road Right Left Ahead	82.1	23.8	87.6	18.0

PRC for signalled links: AM = 8.9, PM = 1.6

Table 11.83 2028

Link	Description	AM peak		PM peak	
		Deg Sat	MMQ	Deg Sat	MMQ
1/1	A4222 Cardiff Road Ahead Right Left	47.1	11.7	52.5	11.9
2/1	St Athan Road Left Ahead Right	88.7	24.1	93.8	24.2
3/1	A4222 Eastgate Left Ahead Right	88.4	27.2	92.2	32.8
4/1	Aberthin Road Right Left Ahead	87.1	20.9	92.5	24.0

PRC for signalled links: AM = 1.5, PM = -4.2

Table 11.84 2028 with development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ	Deg Sat (%)	MMQ
1/1	A4222 Cardiff Road Ahead Right Left	55.0	13.5	53.3	13.0
2/1	St Athan Road Left Ahead Right	99.0	34.4	97.4	33.3
3/1	A4222 Eastgate Left Ahead Right	98.1	32.5	97.9	29.8
4/1	Aberthin Road Right Left Ahead	97.7	32.2	96.8	27.6

PRC for signalled links: AM = -10.0, PM = -8.8

11.2.68 Capacity analysis indicates that there are no capacity problems predicted at the Cardiff Road/ Aberthin Road junction in any of the scenarios tested except the 2028 with and without development scenarios.

11.2.69 No improvements to the junction are proposed as this would just encourage increased rat running on St Athan Road between the development and the A48 with an associated impact on St Mary Church. In reality traffic will reassign onto other parts of the network once queues are encountered.

Junction P Sycamore Cross (Figure P and Drawing CG/002419/TA06)

11.2.70 Capacity analysis has been undertaken at Sycamore Cross junction using PICADY 5.

11.2.71 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.72 The results are summarised in Tables 11.85 to 11.91 and are attached in full as Appendix 2.

Table 11.85 2008 Base

	AM peak			PM peak		
	Max RFC	**MMQ**	**Observed MMQ**	**Max RFC**	**MMQ**	**Observed MMQ**
A48 (east)	0.224	0.29	0.67	0.151	0.18	1.25
A4226	0.803	3.45	3.17	0.460	0.84	0.42
A48 (west)	0.506	1.01	0.42	0.601	1.47	0.33
Sycamore Farm	0.329	0.48	1.92*	0.151	0.18	0.58

* Queue formed behind school bus

With modelled and survey queue lengths being similar on all of the arms, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.86 2014 Base

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
A48 (east)	0.351	0.53	0.232	0.30
A4226	0.747	2.79	0.569	1.29
A48 (west)	0.660	1.89	0.683	2.08
Sycamore Farm	0.315	0.45	0.323	0.47

Table 11.87 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
A48 (east)	0.358	0.55	0.277	0.38
A4226	0.794	3.54	0.627	1.63
A48 (west)	0.659	1.88	0.680	2.05
Sycamore Farm	0.362	0.54	0.374	0.58

Table 11.88 2014 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
A48 (east)	0.569	1.30
A4226	2.909	307.58
A48 (west)	0.679	2.05
Sycamore Farm	0.442	0.76

Table 11.89 2028 Base

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
A48 (east)	0.385	0.62	0.468	0.86
A4226	1.197	51.27	1.018	14.95
A48 (west)	0.644	1.72	0.677	2.01
Sycamore Farm	1.483	11.85	1.114	12.00

Table 11.90 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
A48 (east)	0.388	0.62	0.425	0.73
A4226	1.347	78.97	1.053	16.83
A48 (west)	0.674	1.95	0.681	2.05
Sycamore Farm	3.546	28.27	1.332	16.71

Table 11.91 2028 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
A48 (east)	0.638	1.69
A4226	7.445	416.87
A48 (west)	0.670	1.92
Sycamore Farm	2.127	32.03

11.2.73 Capacity analysis indicates that the junction is overcapacity in 2028 even without the development.

11.2.74 The development makes this situation only slightly worse in the Monday – Thursday PM peak (max 5 vehicle increase in the queue). There is a significant increase in queues in the Friday PM peak, but this is due to the additional 417 trainees leaving DTC having been manually assigned to the network and all turning right at the junction. In reality, this will not happen.

11.2.75 No improvement works at Sycamore Cross are proposed as the Friday PM peak impact attributable to the St Athan development is too infrequent and brief to justify development funded improvements.

Junction Q B4268 Llysworney Junction (Figure Q)

11.2.76 Capacity analysis has been undertaken at B4268 Llysworney junction using PICADY 5.

11.2.77 The scenarios assessed were:

- 2008
- 2014
- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.78 The results are summarised in Tables 11.92 to 11.98 and are attached in full as Appendix 2.

Table 11.92 2008 Base

	AM peak			PM peak		
	Max RFC	**MMQ**	**Observed Queue**	**Max RFC**	**MMQ**	**Observed Queue**
B4268 (north)	0.020	0.02	0.67	0.039	0.06	0.00
B4270 (east)	0.205	0.26	0.00	0.327	0.48	0.00
B4268 (south)	0.311	0.62	0.00	0.540	1.51	0.00
Minor Road (west)	0.026	0.03	0.00	0.036	0.04	0.00

With modelled and survey queue lengths being similar on all of the arms, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.93 2014 Base

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
B4268 (north)	0.000	0.00	0.000	0.00
B4270 (east)	0.245	0.32	0.524	1.08
B4268 (south)	0.586	1.87	0.256	0.52
Minor Road (west)	0.006	0.01	0.000	0.00

Table 11.94 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
B4268 (north)	0.000	0.00	0.000	0.00
B4270 (east)	0.391	0.64	0.542	1.17
B4268 (south)	0.753	4.04	0.572	2.07
Minor Road (west)	0.008	0.01	0.04	0.00

Table 11.95 2014 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
B4268 (north)	0.000	0.00
B4270 (east)	0.542	1.17
B4268 (south)	0.572	2.07
Minor Road (west)	0.004	0.00

NB Same data as 2014 with St Athan development

Table 11.96 2028 Base

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
B4268 (north)	0.000	0.00	0.000	0.00
B4270 (east)	0.320	0.47	0.532	1.12
B4268 (south)	0.812	5.06	0.381	0.88
Minor Road (west)	0.000	0.00	0.000	0.00

Table 11.97 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
B4268 (north)	0.000	0.00	0.000	0.00
B4270 (east)	0.469	0.87	0.537	1.14
B4268 (south)	0.922	10.25	0.706	3.26
Minor Road (west)	0.029	2.51	0.004	0.00

Table 11.98 2028 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
B4268 (north)	0.000	0.00
B4270 (east)	0.537	1.14
B4268 (south)	0.706	3.26
Minor Road (west)	0.004	0.00

NB Same data as 2028 with St Athan development

11.2.79 Capacity analysis indicates that there are no significant capacity problems at the B4268 Llysworney junction.

Junction R B4265 Batslays Junction (Figure R)

11.2.80 Capacity analysis has been undertaken at B4265 Batslays junction using PICADY 5.

11.2.81 The scenarios assessed were:

- 2008

- 2014
- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.82 The results are summarised in Tables 11.99 to 11.105 and are attached in full as Appendix 2.

Table 11.99 2008 Base

	AM peak			PM peak		
	Max RFC	**MMQ**	**Observed Queue**	**Max RFC**	**MMQ**	**Observed Queue**
B4265 (east)	0.002	0.00	0.00	0.000	0.00	0.00
Minor Road (south)	0.003	0.00	0.00	0.000	0.00	0.00
B4265 (west)	0.000	0.00	0.00	0.00	0.00	0.00
Minor Road (north)	0.005	0.00	0.08	0.014	0.01	0.00

With modelled and survey queue lengths being similar on all of the arms, the model provides a valid base from which to analyse the impact of additional development traffic and traffic growth.

Table 11.100 2014 Base

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
B4265 (east)	0.003	0.00	0.000	0.00
Minor Road (south)	0.003	0.00	0.000	0.00
B4265 (west)	0.000	0.00	0.000	0.00
Minor Road (north)	0.003	0.00	0.015	0.02

Table 11.101 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
B4265 (east)	0.613	2.57	0.051	0.08
Minor Road (south)	0.005	0.00	0.000	0.00
B4265 (west)	0.000	0.00	0.000	0.00
Minor Road (north)	0.094	0.10	0.588	1.39

Table 11.102 2014 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
B4265 (east)	0.065	0.11
Minor Road (south)	0.000	0.00
B4265 (west)	0.000	0.00
Minor Road (north)	0.806	3.64

Table 11.103 2028 Base (signals)

	AM peak		PM peak	
	Deg Sat	**MMQ**	**Deg Sat**	**MMQ**
B4265 (east) right turn	1.9	0.1	0.0	0
B4265 (east) ahead	38.6	4.5	43.3	5.4
Minor Road (south)	1.5	0.1	3.5	0.2
B4265 (west) ahead	40.9	6.5	36.8	5.6
B4265 (west) left	0.5	0.0	0.7	0.1

Table 11.104 2028 with St Athan development (signals)

	AM peak		PM peak	
	Deg Sat	**MMQ**	**Deg Sat**	**MMQ**
B4265 (east) right turn	58.8	5.3	10.6	0.4
B4265 (east) ahead	42.1	5.1	44.2	6.6
Minor Road (south)	16.0	0.8	58.8	6.1
B4265 (west) ahead	58.66	11.1	60.7	11.4
B4265 (west) left	10.5	1.1	0.8	0.1

Table 11.105 2028 with St Athan development Friday PM (signals)

	PM peak	
	Deg Sat	**MMQ**
B4265 (east)	14.2	06
B4265 (east) ahead	38.6	6.4
Minor Road (south)	82.3	10.0
B4265 (west)	83.4	29.2
B4265 (west) left	0.8	0.1

11.2.83 Capacity analysis indicates that there are no predicted queue problems at the B4265 Batslays junction.

Junction 1 NAR B4265 (Drawing CG/003622/PA/157)

11.2.84 Capacity analysis has been undertaken at the proposed B4265 NAR junction using LinSig V2.

11.2.85 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.86 The results are summarised in Tables 11.106 to 11.111 and are attached in full as Appendix 2.

Table 11.106 2014 with development AM peak

Link	Description	AM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	48.6	5.0
2/1	B4265 East Right	49.7	7.7
3/1	Llanmaes Right Left	49.3	3.6
4/1	B4265 West Right	29.7	3.9
5/1	B4265 West Ahead	35.5	0.7
9/1	B4265 West Ahead	35.5	5.0

PRC for signalled links: AM = 81.2

Table 11.107 2014 with development PM peak

Link	Description	PM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	63.5	11.4
2/1	B4265 East Right	17.1	1.7
3/1	Llanmaes Right Left	12.5	0.5
4/1	B4265 West Right	62.5	9.4
5/1	B4265 West Ahead	39.8	0.6
9/1	B4265 West Ahead	39.8	4.2

PRC for signalled links: PM = 41.8

Table 11.108 2014 Friday PM with development

Link	Description	PM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	60.7	10.4
2/1	B4265 East Right	17.1	1.7
3/1	Llanmaes Right Left	12.5	0.5
4/1	B4265 West Right	59.0	9.0
5/1	B4265 West Ahead	36.7	0.6
9/1	B4265 West Ahead	36.7	4.1

PRC for signalled links: PM = 48.3

Table 11.109 2028 with development AM peak

Link	Description	AM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	51.8	5.4
2/1	B4265 East Right	52.5	8.6
3/1	Llanmaes Right Left	49.3	3.8
4/1	B4265 West Right	36.1	5.1
5/1	B4265 West Ahead	46.6	1.0
9/1	B4265 West Ahead	46.6	7.0

PRC for signalled links: AM = 71.6

Table 11.110 2028 with development PM peak

Link	Description	PM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	66.0	11.7
2/1	B4265 East Right	16.8	1.7
3/1	Llanmaes Right Left	15.0	0.6
4/1	B4265 West Right	64.6	10.5
5/1	B4265 West Ahead	51.3	0.9
9/1	B4265 West Ahead	51.3	6.2

PRC for signalled links: PM = 36.3

Table 11.111 2028 Friday PM with development

Link	Description	PM peak	
		Deg Sat (%)	MMQ (pcu)
1/1	B4265 East Ahead	66.0	11.7
2/1	B4265 East Right	16.8	1.7
3/1	Llanmaes Right Left	15.0	0.6
4/1	B4265 West Right	64.6	10.5
5/1	B4265 West Ahead	51.3	0.9
9/1	B4265 West Ahead	51.3	6.2

PRC for signalled links: PM = 36.3

11.2.87 The results of the analysis shows that the junction will be within capacity in 2028 with the development.

Junction 2 Access to Tremains Farm)Drawing CG/003622/PA/158/rev A)

11.2.88 Capacity analysis has been undertaken at the access to Tremains Farm using PICADY 5.

11.2.89 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.90 The results are summarised in Tables 11.112 to 11.115 and are attached in full as Appendix 2.

Table 11.112 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Arm (south)	0.191	0.23	0.098	0.11
Major Arm (west)	0.037	0.04	0.076	0.08

Table 11.113 2014 with St Athan development FRIDAY PM

	PM peak	
	Max RFC	**MMQ**
Minor Arm (south)	0.131	0.15
Major Arm (west)	0.101	0.11

Table 11.114 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Arm (south)	0.198	0.25	0.102	0.11
Major Arm (west)	0.039	0.04	0.079	0.09

Table 11.115 2028 with St Athan development FRIDAY PM

	PM peak	
	Max RFC	**MMQ**
Minor Arm (south)	0.138	0.16
Major Arm (west)	0.106	0.12

11.2.91 Capacity analysis indicates that there are no predicted capacity problems at the access to Tremains Farm.

Junction 3 Access to Picketston South West (Drawing CG/003622/PA/159/rev A)

11.2.92 Capacity analysis has been undertaken at the access to Picketston South West using PICADY 5.

11.2.93 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.94 The results are summarised in Tables 11.116 to 11.119 and are attached in full as Appendix 2.

Table 11.116 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Arm (north)	0.093	0.10	0.052	0.05
Major Arm (east)	0.013	0.01	0.041	0.04

Table 11.117 2014 with St Athan development FRIDAY PM

	PM peak	
	Max RFC	**MMQ**
Minor Arm (north)	0.063	0.07
Major Arm (east)	0.041	0.04

Table 11.118 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Arm (north)	0.107	0.12	0.054	0.06
Major Arm (east)	0.014	0.01	0.042	0.04

Table 11.119 2028 with St Athan development FRIDAY PM

	PM peak	
	Max RFC	**MMQ**
Minor Arm (north)	0.066	0.07
Major Arm (east)	0.042	0.04

11.2.95 Capacity analysis indicates that there are no predicted capacity problems at the access to Picketston South West.

Junction 4 Access to North of West Camp (Drawing CG/003622/PA/159/rev A)

11.2.96 Capacity analysis has been undertaken at the access to North of West Camp using PICADY 5.

11.2.97 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.98 The results are summarised in Tables 11.120 to 11.123 and are attached in full as Appendix 2.

Table 11.120 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Arm (south)	0.064	0.07	0.038	0.04
Major Arm (west)	0.008	0.01	0.020	0.02

Table 11.121 2014 with St Athan development FRIDAY PM

	PM peak	
	Max RFC	**MMQ**
Minor Arm (south)	0.057	0.06
Major Arm (west)	0.027	0.03

Table 11.122 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Arm (south)	0.067	0.07	0.037	0.04
Major Arm (west)	0.008	0.01	0.021	0.02

Table 11.123 2028 with St Athan development FRIDAY PM

	PM peak	
	Max RFC	**MMQ**
Minor Arm (south)	0.056	0.06
Major Arm (west)	0.028	0.03

11.2.99 Capacity analysis indicates that there are no predicted capacity problems at the access to North of West Camp.

Junction 5 Access to sports facility and hotel (Drawing CG/003622/PA/1510/rev A)

11.2.100 Capacity analysis has been undertaken at the access to the sports facility and hotel using PICADY 5.

11.2.101 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.102 The results are summarised in Tables 11.124 to 11.127 and are attached in full as Appendix 2.

Table 11.124 2014 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Road (north)	0.073	0.08	0.077	0.08
Major Road (east)	0.000	0.00	0.030	0.03

Table 11.125 2014 with St Athan development FRIDAY PM

Arm	PM peak	
	Max RFC	**MMQ**
Minor Road (north)	0.091	0.10
Major Road (east)	0.030	0.03

Table 11.126 2028 with St Athan development

Arm	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Minor Road (north)	0.083	0.09	0.079	0.08
Major Road (east)	0.000	0.00	0.026	0.03

Table 11.127 2028 with St Athan development FRIDAY PM

Arm	PM peak	
	Max RFC	**MMQ**
Minor Road (north)	0.094	0.10
Major Road (east)	0.026	0.03

11.2.103 Capacity analysis indicates that there are no predicted capacity problems at the access to the sports facility and hotel.

Junction 6 NAR/ Eglwys Brewis Road (Drawing CG/003622/PA/1511/rev A)

11.2.104 Capacity analysis has been undertaken at the NAR/ Eglwys Brewis Road junction using PICADY 5.

11.2.105 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.106 The results are summarised in Tables 11.128 to 11.131 and are attached in full as Appendix 2.

Table 11.128 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Eglwys Brewis Road	0.350	0.53	0.092	0.10
NAR (West) right turn	0	0	0	0

Table 11.129 2014 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Eglwys Brewis Road	0.133	0.09
NAR (West) right turn	0	0

Table 11.130 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**Mean Max Queue**	**Max RFC**	**Mean Max Queue**
Eglwys Brewis Road	0.375	0.59	0.093	0.10
NAR (West) right turn	0	0	0	0

Table 11.131 2028 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Eglwys Brewis Road	0.137	0.16
NAR (West) right turn	0	0

11.2.107 Capacity analysis indicates that there are no predicted capacity problems at the NAR/ Eglwys Brewis Road junction.

Junction 7 NAR/ Aerospace Business Park North (Drawing CG/003622/PA/1511/rev A)

11.2.108 Capacity analysis has been undertaken at the NAR/ ABP North junction using LinSig V2.

11.2.109 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM

- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.110 The results are summarised in Tables 11.132 to 11.135 and are attached in full as Appendix 2.

Table 11.132 2014 with St Athan development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ	Deg Sat (%)	MMQ
1/1	NAR (East) Ahead	17.4	2.5	34.9	3.8
2/1	NAR (West) Ahead	47.9	8.5	11.9	1.0
3/1	ABP (displaced right turn) Ahead	48.3	7.3	17.9	0.8

PRC for signalled links: AM = 86.3, PM = 157.5

Table 11.133 2014 with St Athan development Friday PM

Link	Description	PM peak	
		Deg Sat (%)	MMQ
1/1	NAR (East) Ahead	61.1	9.8
2/1	NAR (West) Ahead	11.8	1.0
3/1	ABP (displaced right turn) Ahead	17.9	0.8

PRC for signalled links: PM = 47.2

Table 11.134 2028 with St Athan development

Link	Description	AM peak		PM peak	
		Deg Sat (%)	MMQ	Deg Sat (%)	MMQ
1/1	NAR (East) Ahead	21.8	3.2	35.9	3.9
2/1	NAR (West) Ahead	54.7	9.8	11.3	1.0
3/1	ABP (displaced right turn) Ahead	53.8	9.2	22.9	1.1

PRC for signalled links: AM = 64.4, PM = 151.0

Table 11.135 2028 with St Athan development Friday PM

Link	Description	PM peak	
		Deg Sat (%)	MMQ
1/1	NAR (East) Ahead	62.1	10.0
2/1	NAR (West) Ahead	11.7	1.0
3/1	ABP (displaced right turn) Ahead	22.9	1.1

PRC for signalled links: PM = 44.9

11.2.111 Capacity analysis indicates that there are no predicted capacity problems at NAR/ Aerospace Business Park North junction.

Junction 8 NAR/ Gate 3/ Gate 2 (Drawing CG/003622/PA/1512/rev A)

11.2.112 Capacity analysis has been undertaken at the NAR/ Gate 3/ Gate 2 junction using PICADY 5.

11.2.113 The scenarios assessed were:

- 2014 with St Athan development
- 2028 with St Athan development

11.2.114 The results are summarised in Tables 11.136 to 11.137 and are attached in full as Appendix 2.

Table 11.136 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	MMQ	Max RFC	MMQ
Offslip to NAR	0.403	0.66	0.415	0.70

Offslip to Gate 3	0.204	0.25	0.081	0.09

Table 11.137 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Offslip to NAR	0.412	0.69	0.095	0.10
Offslip to Gate 3	0.214	0.27	0.067	0.07

11.2.115 Capacity analysis indicates that there are no predicted capacity problems at NAR/ Gate 3/ Gate 2 junction.

Junction 9 – NAR/ Gate 2 (Drawing CG/003622/PA/1512/rev A)

11.2.116 Capacity analysis has been undertaken at the NAR/ Gate 2 junction using LinSig V2.

11.2.117 The scenarios assessed were:

- 2014 with St Athan development
- 2028 with St Athan development

No assessment for the Friday pm scenarios has been undertaken as no increase in traffic on a Friday is predicted from Gate 2.

11.2.118 The results are summarised in Tables 11.138 to 11.139 and are attached in full as Appendix 2.

Table 11.138 2014 with development

Link	**Description**	**AM peak**		**PM peak**	
		Deg Sat (%)	**MMQ (pcu)**	**Deg Sat (%)**	**MMQ (pcu)**
1/1	NAR W/B Ahead	38.8	1.7	64.4	3.5
2/1	From Gate 2 Ahead	0.0	0.0	0.0	0.0
2/2	From Gate 2 Left	3.1	0.1	65.9	3.4
3/1	NAR E/B Ahead	66.3	3.4	29.4	1.3
4/1	From Gate 3 Ahead Right	64.4	3.5	48.8	2.2

PRC for signalled links: AM = 35.8, PM = 36.5

Table 11.139 2028 with development

Link	**Description**	**AM peak**		**PM peak**	
		Deg Sat (%)	**Mean Max Queue (pcu)**	**Deg Sat (%)**	**Mean Max Queue (pcu)**
1/1	NAR W/B Ahead	44.7	2.0	71.1	4.1
2/1	From Gate 2 Ahead	1.7	0.1	6.7	0.3
2/2	From Gate 2 Left	3.1	0.1	68.1	3.6
3/1	NAR E/B Ahead	73.8	4.1	29.7	1.3
4/1	From Gate 3 Ahead Right	75.0	4.6	55.0	2.6

PRC for signalled links: AM = 20.0, PM = 26.6

11.2.119 Capacity analysis indicates that there are no predicted capacity problems at NAR/ Gate 2 junction.

11.2.120 The layout of the proposed junction includes a pedestrian crossing which will be a maximum of 8.2 metres wide in order to accommodate soldiers marching across the NAR to/from the sports facilities.

Derivation of width of pedestrian crossing required

11.2.121 3 abreast marching = width of 2000mm
Therefore, 4 abreast = (2000mm/3) * 4 = 2667mm

Therefore, the maximum width of pedestrian crossing required for bi-directional 4 abreast marching plus regular pedestrians on either side = 8234mm which is derived as follows:

300mm + 600mm + 300mm + 2667mm + 500mm + 2667mm + 300mm + 600mm + 300mm = 8234mm

Crossing time

11.2.122 Assumed marching speed = 5km/h (information provided by Pell Frischmann)

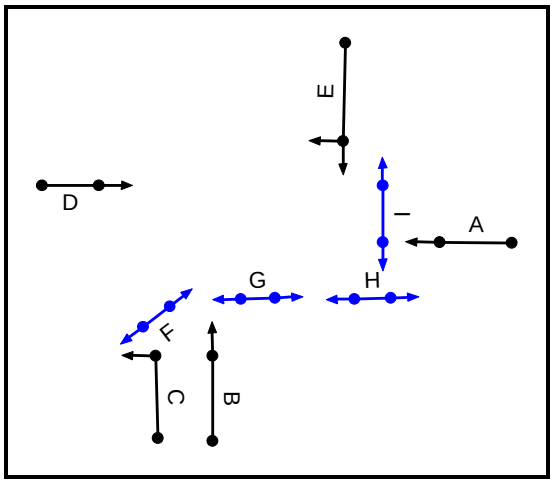
5km/h = 1.3885 m/s

Total green time for pedestrian crossing from LinSig Model is as follows:

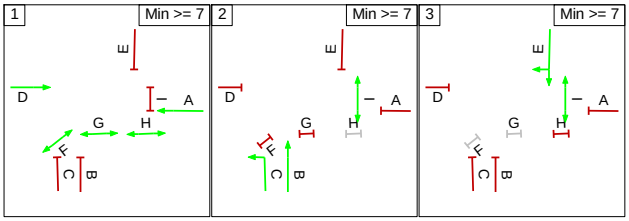
- 2014 AM with development = 23 seconds
- 2014 PM with development = 22 seconds
- 2028 AM with development = 23 seconds
- 2028 PM with development = 22 seconds

Traffic Signal Cycletime = 45 seconds

Phase Diagram – pedestrian crossing is Phase I



Stages Diagram – Phase I appears in Stage 2 and Stage 3



772 personnel are envisaged to cross within 20 minutes.
20 minutes = 1200 seconds
Therefore, 1200 seconds = 26 cycles (1200s ÷ 45s cycletime)

11.2.123 The personnel will be crossing the road in groups of 16 (4 abreast). Given the space required for the marching formation a group of 16 personnel plus regular pedestrians (based on Figure 1) will take up an area of 8234mm × 3000mm.

11.2.124 The NAR is approximately 12 metres wide in the location where the crossing is required. The personnel will have between 22 and 23 seconds to cross the road therefore if they march at a speed of 1.3885m/s the group of 16 can cover a distance of approximately 16 metres thus the entire group will be able to cross the road in the time allocated. This has been derived as follows:

Green time for Phase I = 22 seconds
Marching speed = 1.3885 m/s

Distance marched = 22 ÷ 1.3885 = 15.8 metres

11.2.125 Personnel in the back row of the group will be approximately 3 metres behind the personnel at the front of the group. Therefore, the personnel at the back of the group will enter the carriageway about 4 seconds after the start of green time at the pedestrian crossing (3m × 1.3885m/s = 4.2 seconds). This means that they will have about 18 seconds out of the 22 seconds green time to cross the road. Marching at a speed of 1.3885m/s the personnel will march a distance of 12.96 metres
(18 seconds ÷ 1.3885m/s = 12.96 metres) and therefore those marching in the back row will be able to cross the 12 metre wide road. Therefore the entire group of 16 will be able to cross in the time allocated.

11.2.126 As there are 26 cycles in 20 minutes, 416 personnel can cross the road i.e. 26 cycles × 16 personnel per group = 416 personnel. This assumes marching 4 abreast in one direction. Therefore, marching 8 abreast in one direction will enable all 772 personnel to cross the road using the pedestrian crossing within 20 minutes (26 cycles × 32 personnel = 832 personnel).

Junction 10 NAR/ Access to Picketston (Drawing CG/003622/PA/1513)

11.2.127 Capacity analysis has been undertaken at the NAR/ Access to Picketston junction using PICADY 5.

11.2.128 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development

- 2028 with St Athan development Friday PM

11.2.129 The results are summarised in Tables 11.140 to 11.143 and are attached in full as Appendix 2.

Table 11.140 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Access to Picketston	0.032	0.03	0	0
NAR (east) to Access	0.015	0.02	0	0

Table 11.141 2014 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Access to Picketston	0	0
NAR (east) to Access	0	0

Table 11.142 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Access to Picketston	0.005	0.01	0	0
NAR (east) to Access	0	0	0	0

Table 11.143 2028 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Access to Picketston	0	0
NAR (east) to Access	0	0

11.2.130 Capacity analysis indicates that there are no predicted capacity problems at the NAR/ Access to Picketston junction.

Junction 11 NAR/ Picketston Close (Drawing CG/003622/PA/1513)

11.2.131 Capacity analysis has been undertaken at the NAR/ Picketston Close junction using PICADY 5.

11.2.132 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.133 The results are summarised in Tables 11.144 to 11.147 and are attached in full as Appendix 2.

Table 11.144 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Picketston Close	0.025	0.03	0.013	0.01
NAR (South) to Picketston Cl	0.004	0	0.009	0.01

Table 11.145 2014 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Picketston Close	0.014	0.01
NAR (South) to Picketston Cl	0.009	0.01

Table 11.146 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Picketston Close	0.026	0.03	0.013	0.01
NAR (South) to Picketston Cl	0.004	0	0.009	0.01

Table 11.147 2028 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Picketston Close	0.013	0.01
NAR (South) to Picketston Cl	0.009	0.01

11.2.134 Capacity analysis indicates that there are no predicted capacity problems at the NAR/ Picketston Close junction.

Junction 12 NAR/ Gate 1 (Drawing CG/003622/PA/1513 to 1514)

11.2.135 Capacity analysis has been undertaken at the NAR/ Gate 1 junction using PICADY 5.

11.2.136 The scenarios assessed were:

- 2014 with St Athan development
- 2014 with St Athan development Friday PM
- 2028 with St Athan development
- 2028 with St Athan development Friday PM

11.2.137 The results are summarised in Tables 11.148 to 11.151 and are attached in full as Appendix 2.

Table 11.148 2014 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Gate 1	0	0	0	0
NAR (west) right turn	0.195	0.24	0.006	0.1

Table 11.149 2014 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Gate 1	0	0
NAR (west) right turn	0.006	0.1

Table 11.150 2028 with St Athan development

	AM peak		PM peak	
	Max RFC	**MMQ**	**Max RFC**	**MMQ**
Gate 1	0	0	0	0
NAR (west) right turn	0.204	0.25	0.006	0.1

Table 11.151 2028 with St Athan development Friday PM

	PM peak	
	Max RFC	**MMQ**
Gate 1	0	0
NAR (west) right turn	0.006	0.1

11.2.138 Capacity analysis indicates that there are no predicted capacity problems at the NAR/ Gate 1 junction. No queues are predicted for vehicles exiting at Gate 1 as the westbound flow on the Northern Access Road at this point is minor, being a similar level to the flows currently recorded on Eglwys Brewis Road at this location.

12.0 Highway Impact - Junctions

Link Capacity

12.1 The Northern Access Road is designed as a wide single two lane road (WS2), with 1 metre hard strips (Drawings CG/003622/PA165 and PA166). In accordance with TA 46/97 'Traffic Flow Ranges for Use in the Assessment of New Rural Roads', the recommended opening year AADT flows by road type are:

Table 12.1 Opening Year Economic Flow Ranges

Carriageway Standard	Opening Year AADT	
	Minimum	Maximum
S2	Up to 13,000	
WS2	6,000	21,000

12.2 In accordance with Figures 22 and 24 the maximum AADT on the NAR will be 9,200 vehicles in the opening year and 9,400 vehicles in 2028. Therefore, there is sufficient link capacity.

12.3 Is should be noted that TA 79/99 'Traffic Capacity of Urban Roads' sets the following maximum hourly vehicle capacity:

Table 12.2 Capacities of Urban Roads – One-way hourly flows in each direction

	Total Number of Lanes		
Road Type	**2**	**2**	**2-3**
	7.3m	**9.0m**	**10.0m**
UAP1	**1590**	**1860**	**2010**
UAP2	**1470**	**1550**	**1650**
UAP3	**1300**	**1530**	**1620**

Two-way single carriageway – Busiest Flow Direction (Assumes a 60/40 directional split)

UAP1 = High standard single / dual carriageway road carrying predominantly through traffic with limited access
UAP2 = Good standard single / dual carriageway road with frontage access and more than two side roads per km
UAP3 = Variable standard road carrying mixed traffic with frontage access, side roads, bus stops and at grade pedestrian crossings.

12.4 The Northern Access Road is a mixture of road type. For the majority of its length it has a 30 mph speed limit (UAP3), at grade crossing facilities with more than 2 side roads per km (UAP2 and 3), but restricted parking (UAP1 and UAP2) and bus stops in lay-bys (UAP1).

12.5 Maximum peak hour flows in 2028 on the Northern Access Road are:

Table 12.3: NAR Maximum Traffic Flows

	AM Peak	PM Peak
Monday - Thursday	809	872
Friday	809	1289

12.6 Therefore, at UAP3 standard, the NAR requires a minimum 9.0m. With provision for eight right turn ghost islands, the WS2 standard enables the link design to accommodate these, whilst providing a smooth alignment along the length of the NAR.

Minor Roads (Rat-Runs)

12.7 Via public consultation and associated workshops, plus detailed discussion with the Vale of Glamorgan Highways Department, existing and potential "rat running" routes to and from the site have been identified. A series of timed runs have been

undertaken to quantify the journey duration using these routes, compared to the classified roads that serve the site.

12.8 Predicted changes in flows on the B4268 / B4270 and St. Athan Road have been calculated and are summarised in Figures 16-19 However, traffic-flow changes on the myriad of minor roads between the A48 and the development site are difficult to estimate – but it is not envisaged that the proposed developments will significantly increase lorry numbers on these routes. Consequently, no improvements are currently proposed to existing minor roads (rat-runs) because improvements would just encourage their increased use, but it has been agreed with the Vale of Glamorgan that following the opening of the DTC, the actual rather than estimated effects of the development will be assessed on the adjacent minor roads. This review will be undertaken by the local highway authority and any appropriate traffic-management measures subsequently determined.

12.9 The proposals for the classified road system will add to its capacity to cope with increases in traffic at peak times. These include junction improvements to the A4050 / A4266 Waycock Cross Roundabout, as well the B4265 Gileston to Old Mill Link Improvement, as stated in the Vale of Glamorgan's Local Transport Plan 2001/2 – 2005/6:

> *'TRAN2 Land will be protected and provision made for the construction of local highway schemes including… Gileston Old Mill…considered necessary to alleviate existing environmental problems and for safety reasons'*
>
> *'7.113 One remaining section of the B4265 between Aberthaw and St Athan has a sharp bend and creates potential safety problems. The Gileston Old Mill scheme aims to improve the horizontal and vertical alignment of the carriageway at this point.'*

12.10 This significant improvement is shown on Drawing CG/003622/PA/420.

12.11 The design of the access junctions to the developments ensures that traffic through/from St Athan will not enter the DTC & ABP off Eglwys Brewis Road westbound, or leave right-out eastbound, thereby minimising the effects of development traffic within St Athan.

12.12 To reduce rat running on Eglwys Brewis Road between the B4265 and Gate 2/3, bus-friendly traffic calming is being reviewed. Proposals include increasing the red time on the Eglwys Brewis Road arm of the B4265 signals and installing transponders on buses to activate the signals. Traffic to DTC and ABP North will be signposted to the NAR junction. It will be quicker for traffic to access the DTC site via the NAR than Eglwys Brewis Road as Eglwys Brewis Road is the minor arm at a priority junction with NAR.

Road Extinguishments

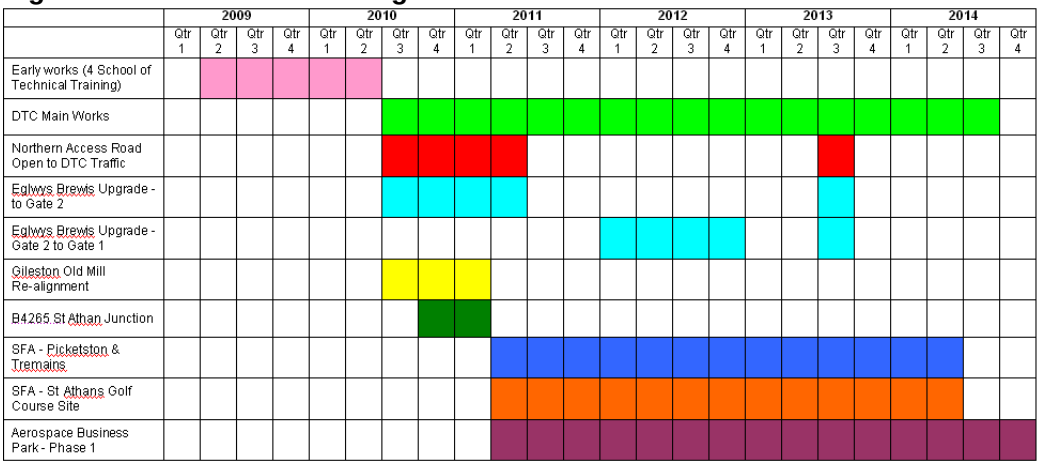
12.13 An extinguishment of driving is proposed for the railway bridge adjacent to Batslays, following construction of a wider replacement bridge to access ABP South. Part of the existing Eglwys Brewis Road will be improved by replacement with the Northern Access Road. The unaltered sections of Eglwys Brewis Road will connect into the Northern Access Road.

12.14 The possible extinguishment of High End Road has been discussed with both the public and the Vale of Glamorgan Council. With no significant support for the extinguishment, it is proposed to link the existing road to the Southern Access Road serving ABP South.

13.0 Construction Traffic

13.1 Figure 13.1 shows the proposed construction programme until the end of 2014 during which time construction traffic will have the greatest impact on the local environment.

Figure 13.1: Construction Programme



13.2 The hours of work during the demolition and construction phase will be:
- 0730-1900 hours: Monday to Friday
- 0800-1300 hours: Saturdays

Staff, Workforce & Visitors

13.3 The workforce trips onto site will arrive between 06:30 and 08:30 with a peak from 07:00 to 08:00. During Monday to Friday the workforce will depart site between 16:30 and 19:00 with a peak from 17:00 to 18:00. It is expected that visitors to the site will arrive/depart between 09:00 and 16:00.

13.4 The geographical split of local labour resources has been estimated at:
- 20% of labour from the west (Port Talbot / Swansea / West Wales)
- 15% from the north (Bridgend / western central valleys)
- 65% from the east (Cardiff / Newport / Bristol / M4-M5 corridors)

13.5 Predicted workforce, staff & visitor traffic flows for the construction period have been assessed and are attached as Appendix L where the figures are split by:
- Early Works (School of Technical Training (4SoTT), Utilities & Demolition)
- DTC
- SFA Picketston & Tremains
- SFA St Athan Golf Course Site
- ABP Phase 1
- ABP Phases 2 & 3
- Northern Access Road & Eglwys Brewis Upgrade
- Gileston Old Mill Re-alignment
- B4265 St Athan Junction
- Waycock Cross Phases 1 & 2

13.6 The estimated total construction labour workforce, staff & visitor figures peak at 2190 in quarter 3 of 2012 which equates to a total of 1270 one-way trips.

13.7 The figures have been based on 8 persons per public transport visit, on the basis that those arriving by public transport will be collected by a site bus from Llantwit Major

Railway Station or the bus stop on the B4265. Bus/van occupancy has been based on 6 people per vehicle.

Construction Traffic

13.8 In an attempt to reduce the impact of delivery vehicles the following Code of Conduct will be introduced:
- Deliveries vehicles will be given allocated delivery slots
- Drivers must not arrive >30 minutes prior to their allocated delivery time
- All deliveries must leave site immediately after being off loaded/reloaded
- No delivery vehicles to be parked on site overnight

13.9 Proposed routes from the East, West and North for construction traffic are shown in Drawing CG/002419/TA06. Routes will need to be agreed with the Vale of Glamorgan and signing will be used to highlight the agreed construction route to drivers. Based on experience elsewhere, the route will be adhered to, based on the threat and actual dismissal from the job.

13.10 The geographical split of deliveries by HGV & LGV >3.5 tonne has been estimated at:
- 15% from the west
- 5% from the north
- 80% from the east

13.11 The geographical split of deliveries by LGV <3.5 tonne has been estimated at:
- 15% from the west
- 10% from the north
- 75% from the east

13.12 Predicted material delivery traffic flows for the construction period have been assessed and are attached as Appendix K where the figures are also split by:
- Early Works (School of Technical Training (4SoTT), Utilities & Demolition)
- DTC
- SFA Picketston & Tremains
- SFA St Athan Golf Course Site
- ABP Phase 1
- ABP Phases 2 & 3
- Northern Access Road & Eglwys Brewis Upgrade
- Gileston Old Mill Re-alignment
- B4265 St Athan Junction
- Waycock Cross Phases 1 & 2

13.13 It is envisaged that the upgraded NAR will be constructed to full adoptable standard, enabling construction traffic to access the site from this new link. It is estimated that the NAR will open to DTC traffic at a haul road standard in the third quarter of 2010 (Appendix K). Prior to the NAR being created, construction vehicles will have to use Eglwys Brewis Road. Access to the site will initially be via the ABP North Gate and following sequential improvements to Eglwys Brewis Road, in two stages, access will then be provided to DTC Gate 2/3.

13.14 Prior to the NAR being open for use the highest quarter average of one way daily deliveries is 45 vehicles, split between 29 HGV (>3.5 tonne) and 16 LGV (<3.5 tonne). The highest quarter average of daily workforce, staff and visitors numbers is estimated at 362 with an estimated trip generation of 216.

13.15 Following opening of the NAR the highest quarter average of one way daily deliveries is 367 vehicles, split between 219 HGV (>3.5 tonne) and 148 LGV (<3.5 tonne). The

highest quarter average of daily workforce, staff and visitors numbers is estimated at 2190 with an estimated trip generation of 1270. Both these peaks occur in quarter 3 of 2012

13.16 The Vale of Glamorgan Council have been consulted with regards to pinch points and possible temporary and / or permanent measures to improve the western section of Eglwys Brewis Road. Traffic signals, laybys, footway and carriageway improvements have all been investigated. Current proposals as discussed at the Transportation Working Group are for:

- Edge strengthening and standardising the road width of Eglwys Brewis Road for 650m approx.
- Reinstatement of the lay by adjacent to the 5.0 m wide section of carriageway. The section of road at this point is sufficient straight for HGV drivers to identify other HGVs prior to the narrow section.
- Highway works adjacent to the existing pinch point of 'The Parwg', resulting in the carriageway being moved further away from this property. Footway works on the opposite side will be DDA compliant.

13.17 A site meeting with Vale of Glamorgan Highway Officers has been undertaken to discuss the detail of these proposals and they are summarised in Drawing CG/003622/PA/650.

Abnormal Loads

13.18 The most significant military vehicle proposed to access the site is a UK 1070F HET, a heavy equipment transporter. This vehicle is 23.5m long and weighs 44.9 tonne. A lay-by adjacent to Gate 2/3 is proposed, to provide a waiting area for such military vehicles prior to gaining access within the security perimeter. This will ensure delays to public vehicles are minimised.

14.0 **Road Safety**

14.1 Injury only road traffic accident statistics for the study area have been obtained from the Vale of Glamorgan Council for the 5 year period from July 2003 to May 2008. The area covered stretches from Pentre Meyrick in the north-west to Waycock Cross Roundabout in the south-east (Drawing CG/2419/TA05). The accident statistics are summarised below with full details attached in Appendix M.

14.2 The records have been examined for any patterns or factors that could have an impact on or from the proposed development traffic.

Table 14.1: Accidents by Year and Severity

	Jul-Dec 2003	2004	2005	2006	2007	Jan-May 2008	**Total**
Fatal	3	1	1	3	1		**9**
Serious	5	5	3	5	5	4	**27**
Slight	20	44	47	31	21	16	**179**
Total	**28**	**50**	**51**	**39**	**27**	**20**	**215**

14.3 In total 215 accidents have been reported in the five-year period, with 9 fatal accidents and a further 26 identified as serious. Casualties by severity are summarised in the following table:

Table 14.2: Total casualties by severity

Severity	**Casualties**
Fatal	9
Serious	28
Slight	287
Total	**324**

14.4 The statistics have been assessed in order to determine any clustering of accidents and common causes:

Cluster sites (Appendix M / Drawing CG/2419/TA05)

(1) Waycock Cross Roundabout (9 accidents) – all accidents were caused by driver error.

(2) A4226 outside Cwm Ciddy Tavern (Motel) and Ty-newydd Farm (7 accidents) – all accidents were caused by driver error. Six collisions occurred because of vehicles using motel and farm access points.

(3) A4226 Port Road adjacent to lay-by (5 accidents – 2 serious) – all accidents were caused by driver error. Both serious accidents were caused by vehicles travelling in the wrong carriageway; one was overtaking whilst the other was dazzled by the sun.

(4) A4226 outside farm entrance (5 accidents) – four of the accidents were caused by drivers failing to stop in time and so shunting the vehicle in front, possibly as a result of vehicles turning into farm access.

(5) A4226/B4265 Roundabout (4 accidents) - all accidents were caused by driver error but with no pattern. One driver exceeding the speed limit took a bend on the wrong side of the road, one driver was dazzled by the sun, one under-age driver had taken a vehicle without consent and one failed to stop at the roundabout.

(6) B4265/Fonmon Road junction (4 accidents – 1 fatal) – all accidents were caused by driver error. Three drivers failed to stop their vehicles in time. One fatal collision was due to the driver failing to judge the speed of a motorbike.

(7) B4265 T-junction to East Aberthaw (8 accidents) – all accidents were caused by driver error, six involving right turn manoeuvres which will not be increased due to the development and one young driver with two child passengers who lost control of the vehicle.

(8) B4265 T-junction to Llancadle (5 accidents – 1 fatal) – three accidents were caused by drivers failing to stop, one driver lost control of the vehicle and one fatal injury was caused by a pedestrian running across the road.

(9) B4265/Gileston Road cross-roads (7 accidents) – all accidents were caused by driver error during right turn manoeuvres.

(10) B4265 Eglwys Brewis Road/Boverton Signals (8 accidents) – six accidents were caused by driver error and two accidents resulted in pedestrians being struck, one of which was fatal.

(11) B4265/Llanmaes Road signalised cross-roads (5 accidents) – all accidents were caused by driver error involving right turn manoeuvres.

(12) B4270/minor road T-junction (4 accidents) – all accidents were caused by driver error.

(13) B4270/minor road T-junction leading to business park road (4 accidents) – three accidents caused by driver error, one skidding and another losing control. Fourth accident caused by vehicle fault, again driver lost control of the vehicle.

(14) B4270/minor road T-junction leading to business park (3 accidents) all accidents caused by driver error.

(15) A48/B4268 staggered T-junctions (4 accidents) - all accidents were caused by driver error.

(16) A48/A4226 staggered T-junctions (11 accidents) – all accidents were caused by driver error.

(17) St. Athan Road (3 accidents) – all accidents were caused by driver error on this narrow single carriage road.

(18) A4222 (10 accidents) – seven accidents involved pedestrians, one accident was a cyclist error and one accident was caused by a driver having a blackout/falling asleep.

(19) B4270/Church Road cross-roads (3 accidents) – all accidents were partly due to poor visibility at the junction.

(20) Cowbridge Road (4 accidents) – all accidents were caused by driver error but with no particular pattern.

Fatal Injury sites outside of clusters (Appendix M)

14.5 There were 6 fatal injuries during this period that have not been considered as part of a cluster.

14.6 Four of these accidents occurred at separate locations three along the A4226 and one on the B4270 and resulted in fatal injuries to motorbike riders. Two riders lost control of their vehicle and one rider collided with a vehicle when the driver pulled out of a junction into their path. The fourth rider had just completed an overtaking manoeuvre when he/she collided head on with a vehicle travelling in the wrong carriageway to avoid a collision in the other lane.

14.7 The other two fatalities were car drivers who lost control of their vehicles. No other vehicles were involved in either accident. Both were travelling in hours of darkness in fine weather with dry road surfaces.

Serious Injury sites outside of clusters (see Appendix M)

14.8 There were 17 serious injuries during this period that have not been considered as part of a cluster. These accidents were distributed around the network and no particular accident types occurred with sufficient frequency to be considered as potential problems.

Slight Injury sites outside of clusters (see Appendix M)

14.9 The remaining accidents were distributed around the network and no particular accident types occurred with sufficient frequency to be considered as potential problems.

Proposals

14.10 Improvement are proposed at both A4226 Waycock Cross Roundabout (9 accidents) and B4265/Gileston Road cross-roads (7 accidents). Signalisation of the latter should improve the safety of the right turn manoeuvre, the movement involved in all the accidents recorded at this junction.

14.11 Increased pedestrian crossing facilities are proposed on the B4265 adjacent to the development, a location where one pedestrian fatality has already occurred.

14.12 With regard to the proposed Gileston – Old Mill Link Improvement, this stretch of road has had two serious accidents in the last five years.

15.0 Internal Layout / Parking Provision

Internal Layout

15.1 The illustrative masterplan for DTC is attached as Drawing SA-C0XXX-MP-900-SB-X-004 P17. There will also be a cycle network within the site and a pool of cycles. The illustrative masterplans for ABP in Phase 1 (2014), Phase 2 (2020) and Phase 3 (2028) are attached as Drawings 21, 22 and 23 respectively.

Parking Provision

15.2 The locations of the car parks within DTC are shown on Drawing SA-C0XXX-MP-900-SB-X-004 P17. The provisional parking provision within DTC, based on the JSP Scale, is summarised in the following table:

Table 15.1: DTC Parking Provision

Location	Population	Spaces	Disabled Spaces	Motorcycle Spaces*	Bicycle
Trainees/Officers/ Junior+Senior Rank/Civilians	5730	2900	52	195	869
Public Sport	224	224	15	11	224
Main Gate	50	50	3	3	0
Faith / Worship	JSP	26	3	2	14
Museum	120	120	6	6	100
Medical / Dental	N/A	55	3	3	5
Hotel	150	150	9	8	30
Crèche	23	23	2	1	4
Community Centre	217	109	7	5	22
Commercial spaces		7			
Total		3664	100	234	1563

* Motorcycle parking has been calculated based on 5% of the total proposed parking provision.

15.3 The SFA locations allow for sustainable travel to the DTC. Therefore DTC site car parking passes will be issued to SFA residents on an "operational needs only" basis.

Proposed parking provision: ABP

15.4 Following discussion with the Vale of Glamorgan Council, the Wales Parking Standards 2008 are not to be used as they have not yet been adopted by the Council. Parking provision will be based on the 1999 Addendum to the 1993 South Wales Parking Guidelines, which states that parking standards should be taken to be maximum rather than the minimum.

15.5 Buildings are generally industrial, with some office. The South Wales Parking Guidelines (revised edition 1993) relating to industry and warehousing have an operational requirement for 10% of GFA and a car parking requirement of 1 space per 80 - 100 sq m.

15.6 There is also some office space proposed. The guidelines state that new offices with a Gross Floor Area (GFA) over 1001m^2 require 1 parking space per 30 – 40m^2.

15.7 The parking spaces at the front of the buildings will generally be arranged in a 90° design (as they are currently) and have minimum standard dimensions of 4.8m x 2.4m. There will be a minimum of 6m between rows of car parking spaces to allow adequate space for manoeuvring into and out of the car parking space.

15.8 The parking provision per unit is contained in Appendix B. In summary:

Table 15.2: ABP Parking Provision

Year	ABP North		ABP South		ABP (Total)	
	GFA (sqm)	Spaces	GFA (sqm)	Spaces	GFA (sqm)	Spaces
2014	59,409	616-895	21,765	227-331	81,174	843-1226
2020	60,297	627-912	38,290	387-565	98,587	1014-1477
2028	73,276	708-1034	43,888	436-640	117,164	1144-1674

15.9 On-street parking on the internal link roads will be controlled by double yellow lines to prevent parking where it is not desired. Two percent plus 6 spaces shall be provided for people with disabilities.

Parking Provision – SFA

15.10 The SFA parking provision is based on the South Wales Parking Guidelines (revised edition 1993) requirements for residential new builds in a non-central area, as summarised in the following table:

Table 15.3: Parking guidelines for residential new build

Type of Development		**No. of Spaces - Residents**	**No. of Spaces - Visitors**
General Purpose Houses and Flats	1 bedroom	1 per unit	1 per 3-5 units
	2 bedrooms (GFA< 75m^2)	1.5 per unit	1 per 3-5 units
	2 bedrooms (GFA 75m^2 – 120m^2)	2 per unit	1 per 3-5 units
	3 bedrooms (GFA<120m^2)	2 per unit	1 per 3-5 units
	3 and 4 bedrooms (GFA>120m^2)	Minimum 3 per unit	1 per 3-5 units
Elderly persons houses and flats (not wardened)		0.5 – 1 per unit	1 per 3-5 units

16.0 Public Transport - Rail

16.1 The Defence Technical College (DTC) and Aerospace Business Park (ABP) development at St Athan is forecast to significantly increase demand on the local public transport network. The likely passenger demand on the local rail network and a review of how any shortfall in capacity can be addressed has been undertaken, based on meetings with Arriva Trains Wales and Welsh Assembly Government (Transport & Strategic Regeneration).

Existing Train Service

16.2 Llantwit Major Railway Station provides modern interchange and park-and-ride facilities. It is situated on the Vale of Glamorgan (VOG) Line which links Cardiff and Bridgend calling at Grangetown, Cogan, Eastbrook, Dinas Powys, Cadoxton, Barry Docks, Barry, Rhoose and Llantwit Major. A free shuttle bus (Service 905) connects Rhoose Railway Station to Cardiff Airport.

16.3 The VOG line was re-opened to passenger traffic (previously freight only) on 10th June 2005 and carried over 225,000 passengers during the first year of operation. Current demand has been provided by Arriva, but due to confidentiality issues, is not included within the Transport Assessment. The service operates on an hourly frequency Monday to Saturday, reducing to 2-hourly on Sundays:

Table 16.1: Departure times TO Llantwit Major

From	Service	Mon to Sat	Sun
Cardiff	First	05:41	08:41
	Last	22:41 (21:41 Sat)	20:41
Bridgend	First	05:42	09:42
	Last	22:42	21:42

Table 16.2: Departure times FROM Llantwit Major

To	Service	Mon to Sat	Sun
Cardiff	First	05:56	09:56
	Last	22:56	21:56
Bridgend	First	06:22	09:22
	Last	23:22 (22:22 Sat)	21:22

16.4 Westbound and Eastbound trains arrive at Llantwit Major Railway Station at 22 and 56 minutes past the hour respectively. With trains arriving at a minimum of 26 minutes apart there is sufficient time for a single bus to link the railway station to the site and return for the following train.

16.5 The stations at Llantwit Major and Rhoose permit a maximum of 4 cars per train (4 x 23m). However other stations (Eastbrook) are limited to 4 x 20m stock, enabling a maximum provision of 276 seats per hour per direction with 4 x class 150 stock. Current operations comprise 2-car 150 Sprinter sets providing a capacity of 138 seats per hour per direction. Trains with double sets (4 car Sprinter or Pacer) include the 0742 Bridgend – Cardiff (4 car 150 sprinter unit) and 1741 Cardiff – Bridgend (4 car 143 pacer unit).

16.6 Cardiff can also be reached via Bridgend, for very little time penalty, which also offers direct mainline connections to eastward destinations such as London and Manchester as well as westbound destinations such as Swansea.

16.7 Initial capacity calculations assume all passengers are seated, however standing is considered acceptable on rail commuter routes over short distances to cope with peak demand. The ATOC (Association of Train Operating Companies) guidance has been used which defines overcrowding as occurring where train capacity exceeds

0.3 standing passenger per seat. The Passenger Charter commitment is for passengers not to have to stand for more than 20 minutes. The report highlights where standing is predicted to occur in the future.

Rail Forward Programme

16.8 In June 2008 the Welsh Assembly Government confirmed details of a £30m investment to improve the rail network of Cardiff and the Valleys Corridor including a commitment to strengthening the rail network to boost the economy. The planned investment included the following proposals to improve passenger capacity:

- The creation of an additional platform at Barry Station;
- Works to Cogan Junction to increase capacity, which would enable more than 1 train per hour to operate on the Vale of Glamorgan line in addition to existing service patterns.

16.9 These enhancements form part of the Welsh Assembly Government Rail Forward Programme announced in December 2008, which also includes the plan, subject to a business case and affordability, to increase the frequency of services on the Vale of Glamorgan Line to half hourly. This is also part of the draft Regional Transport Plan of the South East Wales Transport Alliance. The timing of any frequency enhancements have not been confirmed.

16.10 The Welsh Assembly Government working closely with Arriva Trains Wales, regularly reviews and monitors capacity on the rail network and funds train strengthening on a number of peak hour services to reduce overcrowding.

Passenger Growth Predictions

16.11 The Department for Transport (DfT) Wales Rail Planning Assessment (July 2007) refers to a 5% increase in patronage per year, between 1995/96 and 2005/06, from ticket sales data.

16.12 The following extract from the DfT Regional Transport Statistics (2008 edition) notes a compound patronage growth rate of 40% (average 3.42% increase in patronage per year) between 1995 and 2005 in Wales:

Table 16.3: Regional rail patronage growth index 1995/96 = 100

Origin	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07[1]
Wales	100	102	105	105	115	118	127	130	136	138	140	153

[1] A new methodology was applied to the 2006/07 data to improve the accuracy of the dataset. This had the effect of increasing the number of journeys so when making comparisons between 2006/07 and earlier years, exercise caution.

16.13 Over a longer period growth of around 2% per annum is evident but in the last 10 years rail patronage has grown at a faster rate.

16.14 An annual growth rate of 4.0% may be considered as realistic for forecasting future growth and has been used to calculate a 6-year growth multiplier of 1.224 and a 19-year growth multiplier of 1.894 to correspond with the proposed opening of the DTC facility in 2014 and completion of the ABP in 2028. These have been applied to the existing patronage figures provided by Arriva Trains Wales for the period 18th May to 13th December 2008.

16.15 Finally the DTC figures of additional patronage from the new developments have been added to provide an estimate of the total passengers expected to use this service in the future. It has been assumed that as a result of the DTC and ABP developments there will be an extensive increase in use of rail transport, for

passengers boarding/alighting at Llantwit Major. It has been assumed that there will be extensive use of rail transport especially for junior trainees. The Ministry of Defence controls how their personnel, particularly junior ranks travel. Students at DTC will be entitled to HM Forces Rail Cards and therefore a significant number will travel home or elsewhere by train at weekends. Therefore, there is confidence in the modal split by rail which has been provided by DTC.

Table 16.4: Increase in Rail Patronage

2014-Train	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
Arrive	499	499	499	499	499	-	448	2943
Depart	493	493	493	493	972	-	-	2944
AM Peak Arrive	189	189	189	189	189	-	85	1030
PM Peak Depart	199	199	199	199	350	-	-	1146

16.16 The data has been presented in order to show the significant DTC flows. Outside of the hours referenced additional patronage from both the development and general growth does not significantly affect the existing capacity provision. Full details are provided in Appendix J.

16.17 Of the 2,350 students attending the DTC, approximately 95% will live on site during their course. The courses will last various durations and students are permitted to leave site at weekends. It is forecast that 60% of the resident students will travel at weekends.

16.18 Peak student arrivals will therefore be on Sunday evening and departures on Friday evening. Other military personnel, teaching & facilities staff and ABP commuter employees will tend to travel during the traditional Monday to Friday AM and PM peak hours. Therefore the data has been organised into four time periods: Monday to Friday AM peak arrivals (daily commuters); Monday to Thursday PM peak departures (daily commuters); Friday PM peak departures (which comprises both the daily commuting passengers and trainees returning home for the weekend or at the end of their course); Sunday PM peak arrivals (trainees returning to DTC after weekend leave).

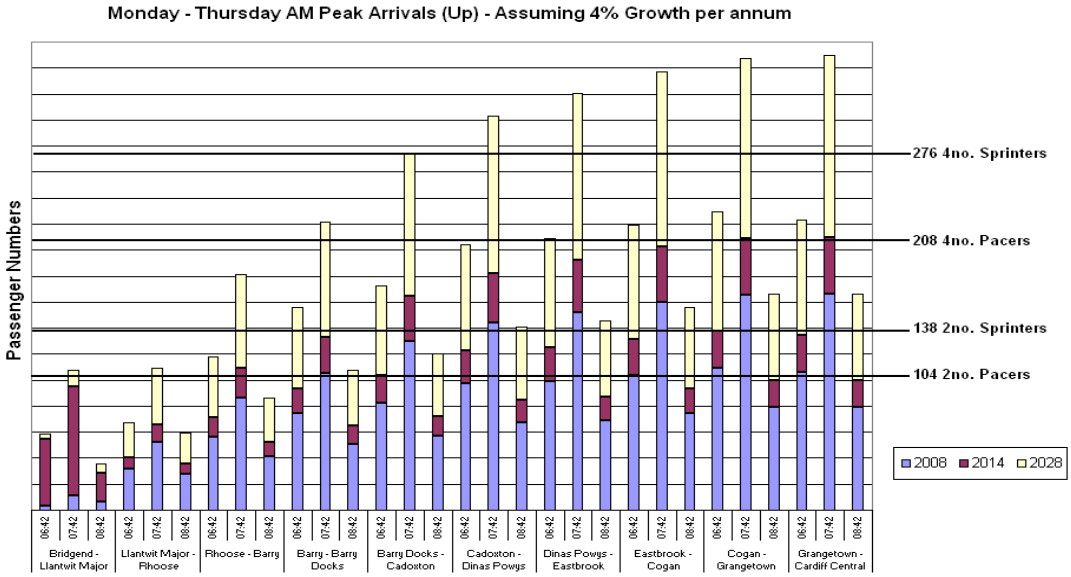
16.19 The proposed development commuting personnel traffic has been distributed through the network on the basis of details of the Defence Aviation Repair Authority (DARA) employees. This has been adjusted by removing or reducing values for postcodes to close to use rail travel. The home postcode of 1,684 DARA employees at RAF St. Athan in 2001 has been summarised in the following table:

Table 16.5: Distribution

Area covers…	**Postcode**	**Respondents**		**Direction of Travel Home**
Newport, Tredegar, Ebbw Vale	NP Codes	15	1%	Eastbound (Up)
	LD Codes	2	0%	n/a
Porthcawl, Bridgend, Swansea, Neath	SA Codes plus CF31 to 36	387	23%	Westbound (Down)
Pontyclun, Pontypridd, Treherbert. Aberdare, Ystrad Mynach, Merthyr Tydfil	CF37-48, CF72, CF81-82	275	16%	30% Up 70% Down
Penarth, Central Cardiff and Caerphilly	CF1-4, CF64, CF83	108	6%	Westbound (Down)
St Fagans, Wenvoe	CF5	39	2%	Westbound (Down)
Cowbridge	CF71	26	2%	n/a – Too close
Llantwit Major	CF61	435	26%	n/a – Too close
St Athan, Rhoose, Barry	CF62	347	21%	50% Down
Barry Docks	CF63	50	3%	Westbound (Down)

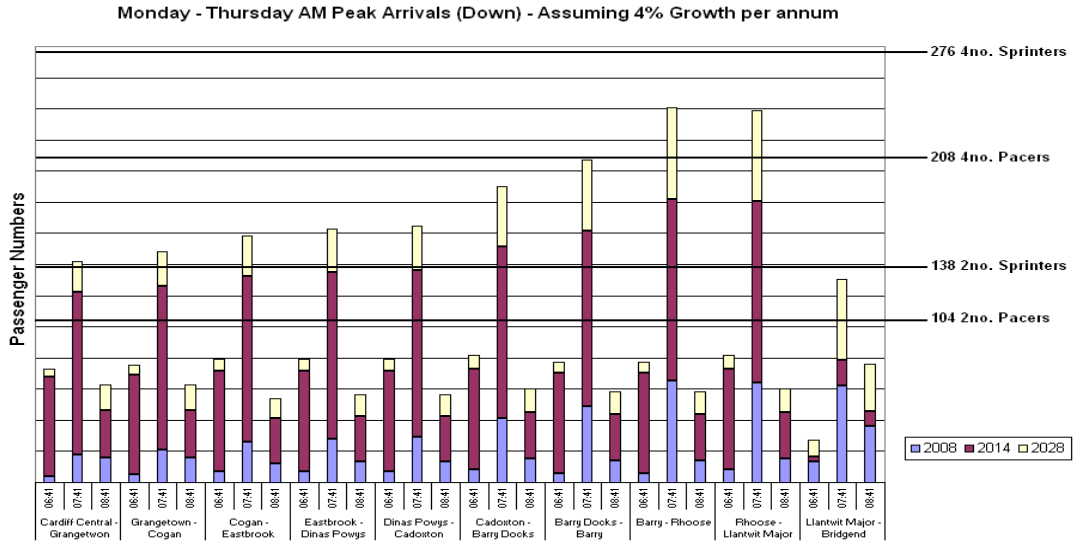
Effects on Network

Monday - Thursday



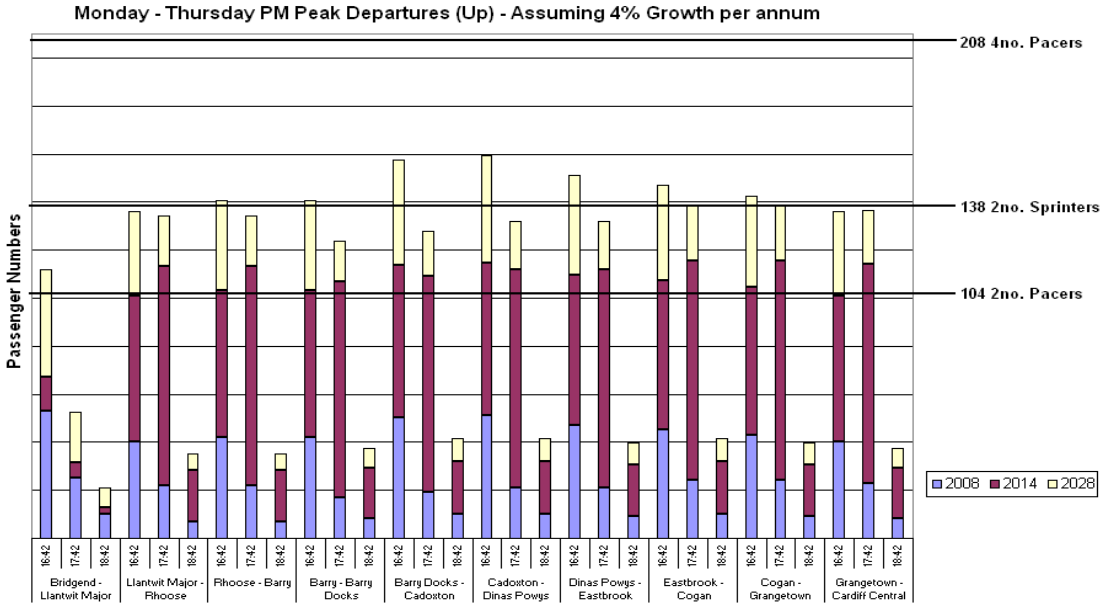
- During the AM Peak on the Up line the development only affects capacity between Bridgend and Llantwit Major. The predicted passenger figures for 2028 indicate a 2-car Sprinter will accommodate passenger demand without standing. The 07:42 service is operated by 4 x 150 sprinter units.

- Overall by 2028 the predicted patronage figures for the AM peak, due to general growth in Cardiff commuting, show that the 07:42 service, which is operated by 4 car x 150 sprinter units, will accommodate all passengers assuming a standing capacity of 0.3 patrons per seat, while the 06:42 service would result in standing of more than 0.3 patrons per seat between Barry Docks and Cardiff.



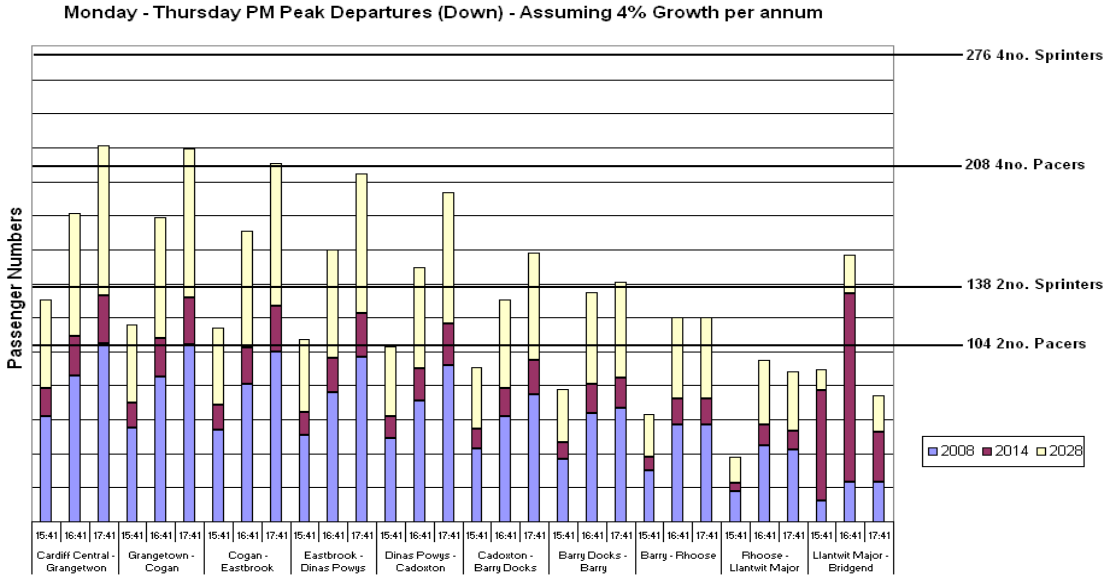
- The development is predicted to result in a significant increase in demand in the Down direction for the AM peak which is in the opposite direction of typical commuter traffic which travels towards Cardiff in the AM peak. This is forecast to result in standing of just over 0.3 passengers per seat by 2014 on the 07:41 service between Barry and Llantwit Major.

- Overall, by 2028, the additional growth is forecast to result in standing of more than 0.3 passengers per seat on the 07:41 service west of Cadoxton, reaching 0.6 passengers per seat between Barry and Llantwit Major. Train strengthening to a 4-car Pacer would accommodate all the passengers with standing of 0.2 patrons per seat or a 4-car Sprinter set (all seated).



- The development has results in significant increase in demand in the Up direction for the PM peak. However this is within the capacity of a 2-car Sprinter set. Again this additional flow is in the opposite direction of typical commuter traffic which travels away from Cardiff in the PM peak.

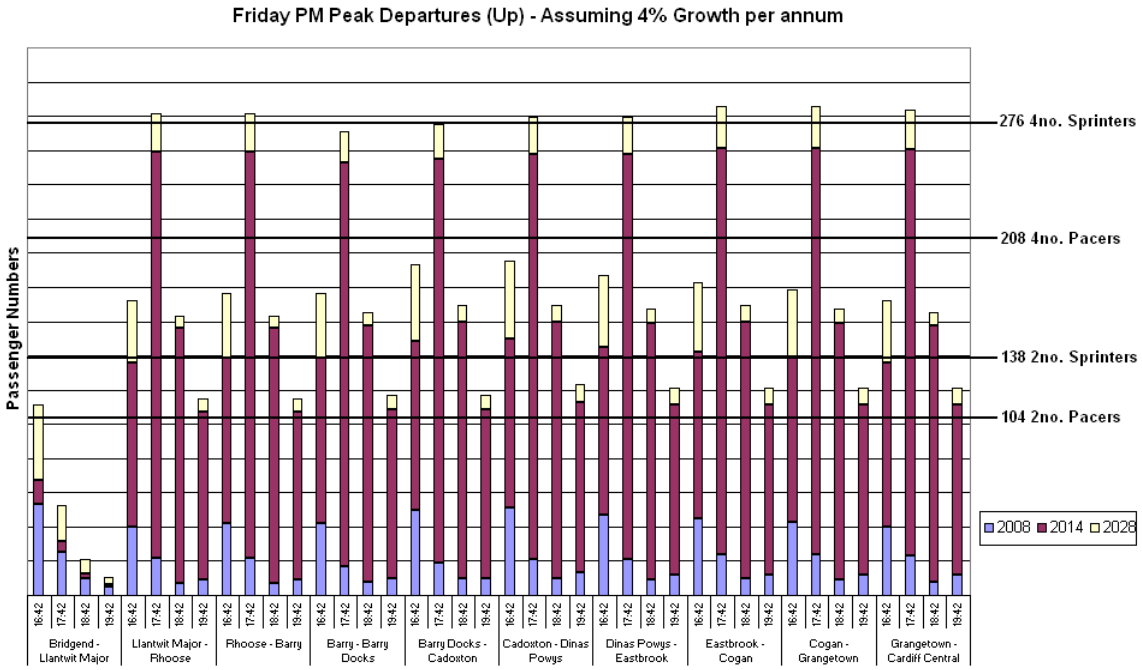
- Overall, by 2028, a 2-car Sprinter set would still accommodate all services on the Up line during the Monday to Thursday PM peaks from Llantwit Major to Cardiff Central with maximum standing of 0.16 passenger per seat between Barry Docks and Cadoxton on the 16:42 service.



- During the PM Peak on the Down line the development only affects capacity between Llantwit Major and Bridgend. The predicted passenger figures for 2014 indicate that demand on the busiest service (16:41 between Llantwit Major and Bridgend) is just within seated capacity for a 2 car sprinter. The 17:41 Service is operated by a 4 car Pacer unit.

- Overall, by 2028, demand on the busiest service between Llantwit Major and Bridgend (16:41) can be accommodated on a 2 car sprinter with standing of 0.16 passenger per seat. The highest demand on this service is departing Cardiff where standing is predicted to be at 0.3 passengers per seat. The 17:41 service is operated by a 4 car pacer unit, and therefore is forecast to have sufficient capacity to meet demand, with a small amount of standing between Cardiff and Cogan.

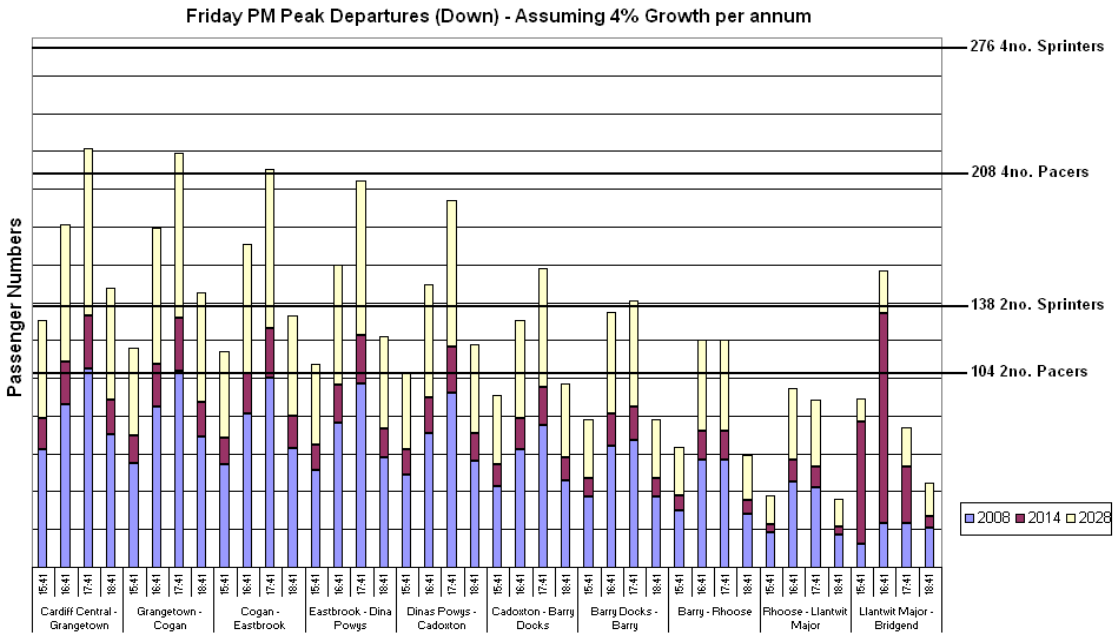
Friday



The Friday PM peak figures for passengers from the development have been calculated by assuming that 100% of the departing trainees will be travelling towards Cardiff. However the usual daily Monday to Thursday passengers will still be distributed as per the DARA distribution – 45% Eastbound (Up) and 55% Westbound (Down).

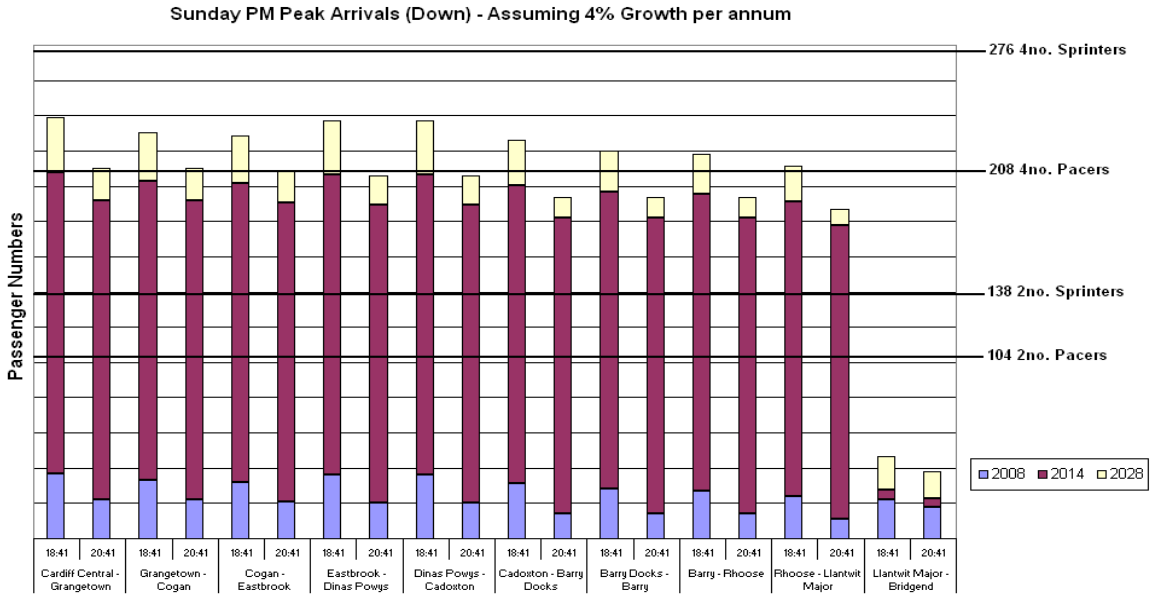
- Although the Friday PM peak tidal flow generated by the development will be counter existing peak flow (towards Cardiff whilst most existing demand is in the opposite direction), the additional passenger requirements could have a significant effect on these services. At present demand in the PM peak to Cardiff is an average of 22 people, providing spare capacity for 116. From 2014 the figures show that the 17:42 train between Llantwit Major and Cardiff would result in standing of around 0.95 passengers per seat unless strengthened to a 4-car (150) set. The 16:42 and 18:42 services would both have standing of approximately 0.15 persons per seat.

- The figures illustrate that overall by 2028 the PM peak demand toward Cardiff could be as high as 321 passengers for the 17:42 due to the combined effects of the development and general growth in patronage. Assuming a standing capacity of only 0.1 patrons per seat this demand can be accommodated by a 4-car Sprinter set. Demand for the 16:42 and 18:42 services would also increase with the 16:42 forecast to having a standing ratio of up to 0.55 and the 18:42 up to 0.3. Strengthening of the 16:42 to a 4 car Pacer or Sprinter would therefore also be required.



- As it has been assumed than 100% of trainees travel via Cardiff, in the Down direction, the impact of the development in the Friday PM peak is no different to that on Monday – Thursday.

Sunday



- On Sundays the main impact of the development is trainees arriving to commence their course or returning from weekend leave in the PM period. The 2 hourly Sunday services are operated by 2 car sprinter sets. Demand is predicted to result in up to 0.5 standing passengers per seat on the 18:41 and 20:41 departures from Cardiff by 2014. Train Strengthening would therefore be required to accommodate this demand by rail with a 4 car Pacer or Sprinter unit.

Solutions

Table 16.6: Monday – Thursday

Monday – Thursday AM Arrivals (Up) – Assuming 4% Growth per annum

From Bridgend (from Barry)		Services can be accommodated using:				Comments
		2 no. Pacer	2 no. Sprinter	4 no. Pacer	4 no. Sprinter	✓ Development demand ☑ Total commuter demand
06:42 (07:15)	2008	✓	☑			
	2014	✓	☑			
	2028	✓		☑		
07:42 (08:15)	2008	✓	☑			By 2028 demand for the 08:15 train from Barry may reach 350 passengers - a result of commuter growth and not attributable to the DTC and ABP developments. This is currently operated by a 4 car 150 sprinter unit.
	2014	✓			☑	
	2028		✓		☑	
08:42 (09:15)	2008	✓☑				
	2014	✓☑				
	2028	✓	☑			

Monday – Thursday AM Arrivals (Down) – Assuming 4% Growth per annum

From Cardiff (from Barry)		Services can be accommodated using:				Comments
		2 no. Pacer	2 no. Sprinter	4 no. Pacer	4 no. Sprinter	✓ Development demand ☑ Total commuter demand
06:41 (07:05)	2008	✓☑				
	2014	✓☑				
	2028	✓☑				
07:41 (08:05)	2008	✓☑				Standing will reach 0.3 persons per seat for a 2 car 150 sprinter unit by 2014 and 0.2 persons per seat if strengthened to a 4 car 143 pacer unit by 2028.
	2014		✓☑			
	2028			✓☑		
08:41 (09:05)	2008	✓☑				
	2014	✓☑				
	2028	✓☑				

Monday – Thursday PM Departures (Up) – Assuming 4% Growth per annum

From Bridgend (from Barry)		Services can be accommodated using:				Comments
		2 no. Pacer	2 no. Sprinter	4 no. Pacer	4 no. Sprinter	✓ Development demand ☑ Total commuter demand
16:42 (17:15)	2008	✓☑				Standing is forecast to reach 0.16 of seated capacity by 2028 between Barry Docks and Cadoxton.
	2014		✓☑			
	2028		✓☑			
17:42 (18:15)	2008	✓☑				
	2014		✓☑			
	2028		✓☑			
18:42 (19:15)	2008	✓☑				
	2014	✓☑				
	2028	✓☑				

Monday – Thursday PM Departures (Down) – Assuming 4% Growth per annum

From Cardiff (from Barry)		Services can be accommodated using:				Comments
		2 no. Pacer	2 no. Sprinter	4 no. Pacer	4 no. Sprinter	✓ Development demand ☑ Total commuter demand
15:41 (16:05)	2008	✓☑				
	2014	✓☑				
	2028	✓	☑			
16:41 (17:05)	2008	✓☑				By 2028 Standing is forecast to reach 0.16 passenger per seat between Llantwit Major and Bridgend and 0.3 passengers per seat departing Cardiff.
	2014		✓☑			
	2028		✓	☑		
17:41 (18:05)	2008	✓	☑			This service is currently operated by a 4 car 143 Pacer unit.
	2014	✓	☑			
	2028	✓	✓	☑		

Table 16.7: Friday

Friday PM Departures (Up) – Assuming 4% Growth per annum

From Bridgend (from Barry)		Services can be accommodated using:				Comments
		2 no. Pacer	2 no. Sprinter	4 no. Pacer	4 no. Sprinter	✓ Development demand ☑ Total commuter demand
16:42 (17:15)	2008	✓☑				By 2014 it is predicted there will be 0.15 standing passengers per seat for a 2 car 150 sprinter. By 2028 standing would reach 0.55 Passenger per seat unless train strengthening occurs or alternative measures put in place.
	2014		✓☑			
	2028			✓☑		
17:42 (18:15)	2008	✓☑				By 2028 the demand for the 17:42 train from Bridgend may reach 292 passengers. Most of this increase is as a direct result of the developments.
	2014				✓☑	
	2028				✓☑	
18:42 (19:15)	2008	✓☑				By 2014 it is predicted there will be 0.15 standing passengers per seat. By 2028 it is predicted there will be 0.3 standing passengers per seat for a 2 car 150 sprinter.
	2014		✓☑			
	2028			✓☑		
19:42 (20:15)	2008	✓☑				
	2014		✓☑			
	2028		✓☑			

Friday PM Departures (Down) – Assuming 4% Growth per annum

From Cardiff (from Barry)		Services can be accommodated using:				Comments
		2 no. Pacer	2 no. Sprinter	4 no. Pacer	4 no. Sprinter	✓ Development demand ☑ Total commuter demand
15:41 (16:05)	2008	✓☑				
	2014	✓☑				
	2028	✓	☑			
16:41 (17:05)	2008	✓☑				By 2028 Standing is forecast to reach 0.16 passenger per seat between Llantwit Major and Bridgend and 0.3 passengers per seat departing Cardiff.
	2014		✓☑			
	2028		✓	☑		
17:41 (18:05)	2008	✓	☑			This service is currently operated by a 4 car 143 Pacer unit.
	2014	✓	☑			
	2028	✓	✓	☑		
18:41 (19:05)	2008	✓☑				
	2014	✓☑				
	2028	✓	☑			

16.20 The following solutions could be implemented to accommodate the predicted demand for the 16:42 and 17:42 from Bridgend to Cardiff on a Friday evening:

- Use the DTC's 'White Fleet' (DTC coaches that have a primary use to transport trainees to/from field training exercises) to transfer trainees directly to Bridgend, Barry or Cardiff;
- Demand management - control departure time of trainees spreading the impact across services;
- Redirect passengers to travel via Bridgend to Cardiff
- Incentives - encourage passengers to choose earlier/later trains by offering significant fares savings for less congested train times;
- Strengthen the 16:42 and 17:42 services from Bridgend to 4 car sprinter sets;
- Increase service frequency to half hourly.

16.21 The DTC could use their 'White Fleet' to transfer trainees direct to either Barry, Bridgend or Cardiff Central Railway Stations where the demand for onward travel will be spread across multiple services and so create less of an impact. DTC will have a fleet of approximately 30 vehicles on site, being a mix of minibuses and 45 + 59 seater coaches.

16.22 Over a four hour period use of 2-car Sprinter sets and one 4 car sprinter set would provide capacity for 690 seated passengers (897 with standing) of which up to 95 seats are already taken. Therefore on a Friday there is capacity for an additional 807 passengers (595 seated passengers, plus 207 standing), on the services from Llantwit Major to Cardiff Central between 16:56 and 19:56. During this time the DTC

estimates that only 631 employees will require travel from the site towards Cardiff. This demand could therefore be met by the departure of trainees being staggered.

16.23 Passengers could be redirected to travel from Llantwit Major to Cardiff Central via Bridgend. This route will add only a few minutes to journey times. However this solution may be difficult to enforce and requires a train change which may deter some passengers. Whilst an assumption has been made, that Cardiff is the main interchange point, both Arriva Trains Wales and First Great Western have direct services, connecting at Bridgend to other parts of the UK (e.g. London, Manchester).

16.24 By offering fare reductions on the 18:42 and 19:42 services from Bridgend on Friday evenings the train operators may be able to spread the demand for passengers who can be encouraged to take later services for financial incentive. However this is unsuitable for more distant journeys.

16.25 It is usually cheaper and more effective to increase capacity by providing longer trains rather than increasing frequency. Strengthening the 16:42 and 17:42 service from Bridgend to 4 car sprinter operation would be sufficient to meet demand. However, as this would require more rolling stock it is unlikely to be cost effective to be used for one train per week.

16.26 Increasing frequency to a half hourly service will require an existing service from Barry Island to be re-directed or works at Cogan Junction and Cardiff to address capacity constraints.

Table 16.8: Sunday

Sunday PM Arrivals (Down) – Assuming 4% Growth per annum

From Cardiff (from Barry)		Services can be accommodated using:				Comments
		2 no. Pacer	2 no. Sprinter	4 no. Pacer	4 no. Sprinter	✓ Development demand ☑ Total commuter demand
18:41 (19:05)	2008	✓☑				
	2014			✓☑		
	2028			✓☑		
20:41 (21:05)	2008	✓☑				
	2014			✓☑		
	2028			✓☑		

16.27 Strengthening services to 4 car operation on Sunday to accommodate arrivals to the site would not be an issue due to the availability of spare rolling stock on the weekend. Alternatively the following solutions could be implemented to accommodate the predicted demand for the two services from Cardiff to Bridgend on a Sunday evening:

- Use the White Fleet to transfer trainees directly from Bridgend, Barry or Cardiff;
- Redirect passengers to travel via Bridgend to Cardiff – this route will add only a few minutes to journey times;
- Increase frequency to an hourly service.

Conclusion

16.28 The majority of the impact on services on the VoG line during the AM and PM peaks is due to general patronage growth and not attributable to this development. This is in part due to the tidal flow of the development creating counter commuting to the existing demand. There is minimal impact on typical commuting flows and demand generated by the development will help fill existing spare capacity. Outside of these peak hours existing 2-car sprinter sets will be sufficient to meet the predicted demand.

Monday to Thursday (including Friday commuting demand)

16.29 To meet the predicted rail passenger demands generated by the development by 2028, (with allowance of 0.3 standing passengers per seat), the existing 2-car Sprinter units (except where currently operated by 4 car trains) will be adequate to accommodate the Monday to Thursday arrivals from Bridgend on the Up line and Monday to Friday departures from Cardiff on the Down line with the exception of the 07:41 AM peak down service from Cardiff to Bridgend, which due to development flows is predicted to reach 0.3 persons per seat in 2014. To avoid unacceptable overcrowding the capacity of this particular train may need to be reviewed before 2028 unless frequency enhancements occur in the meantime.

16.30 To meet the predicted rail passenger demands due to overall growth by 2028 (with allowance of 0.3 standing passengers per seat) the existing 2-car Sprinter units, except where currently operated by 4 car trains, will be adequate to accommodate the Monday to Thursday arrivals from Bridgend on the Up line and Monday to Friday departures from Cardiff on the Down line with the exception of the 06:42 Bridgend – Cardiff service and the 16:41 Cardiff – Bridgend service, the capacities of which may need to be reviewed before 2028 due to general growth in commuting demand.

16.31 The Welsh Assembly Government is in principle committed to matching rail capacity to meet demand, subject to affordability and therefore the need to strengthen due peak services due to general growth in commuting will be kept under review in light of demand and the timing of other proposals in the Rail Forward Programme to increase capacity on the line.

Friday & Sunday (Weekend Travel by Trainees)

16.32 To meet the predicted rail passenger demands generated by the development;

- On Friday, PM departures on the Up line to Cardiff would require the additional capacity provided by 4-car Pacer and Sprinter sets for the 16:42 and 17:42 departures unless alternative provision is made.
- On Sunday, by 2014 PM trains from Cardiff on the down line would need to be strengthened to a minimum of 4 car Pacer units for the 18:41 and 20:41 departures unless alternative provision is made.

16.33 The associated rolling stock requirements to meet a single peak hour demand on a Friday are unlikely to be reasonably cost effective. It is therefore considered more practicable that the 'White Fleet' is used on a Friday to bus trainees directly to Cardiff, Barry or Bridgend Railway Stations and so spread the demand and reduce the impact on existing services.

16.34 Whilst the predicted Sunday PM peak demand on the Down line can be accommodated by train strengthening, the main source of this demand is trainees making their journeys to the base. It is therefore recommended that the trainees which will be dropped off on a Friday evening are also collected from Cardiff, Barry or

Bridgend Stations using the White Fleet on a Sunday evening which would simplify organisational and operational arrangements.

16.35 Therefore it is proposed to accommodate Friday and Sunday peak demand due to weekend travel by use of the DTC's White Fleet rather than strengthen train services on the Vale of Glamorgan Line. This will take the form of a Services of the available white fleet programmed to meet the Key train arrivals at Barry/Cardiff/Bridgend to collect students returning from weekend leave, or arriving for the first time. Also the white fleet will be available to transport students at the end of the working week to Barry/Cardiff/Bridgend on a timetabled basis.

17.0 Public Transport - Bus

17.1 The Vale of Glamorgan Local Bus Strategy (2004) outlines the Vale of Glamorgan Council's proposals to provide enhancements to the bus network to address the historic decline in patronage. Based on this strategy, the bus services in and around the St Athan site will be enhanced and the infrastructure improved.

17.2 Bus provision will play a key role in the movement of staff and students and It is important that sustainable travel options are available to employees and trainees – many of whom will not have access to a car (either due to lack of ownership or arrival at the facility by other modes). Military trainees will be transported to DTC by coach on their first day at St Athan.

Existing Position

17.3 The site is currently served by 5 bus routes. These are illustrated in Drawing CG/2419/TA02 and summarised in Table 17.1:

Table 17.1 – Existing Routes Serving the DTC Site

Svc No	Route	Days of Operation	Frequency	1st	Last	Operator
V2	Cowbridge - St Athan - Llantwit Major – via Boverton Castle, St Athan, Flemingstone, New Barn, St Mary Church & St Hillary	Mon to Sat	2 hourly	08:20	18:25	Cartel Travel (part of EST)
X5	Llantwit Major – Cardiff Via Cardiff Airport, Barry, Llandough Hospital	Sun & Bank Holiday Mon	2 hourly	07:45	22:50	Veolia Transport Cymru
X45	Cardiff City Centre to Llantwit Major via Barry. Connecting service 145 to Bridgend	Mon to Sat	Hourly	06:10	19:36	EST Bus Ltd
X91	LLANTWIT MAJOR - CARDIFF (Limited Stop Via St. Athan, Rhoose, Wenvoe, Ely Link Road, Wellington Street	Mon to Sat	Hourly	07:01	19:06	Cardiff Bus
X91	LLANTWIT MAJOR - CARDIFF (Limited Stop Via St. Athan, Rhoose, Wenvoe, Ely Link Road, Wellington Street	Sun	2 Hourly	08:30	19:15	Cardiff Bus
95	Llantwit Major to Cardiff	Mon to Sat	Hourly	18:58	22:53	Veolia Transport Cymru

Notes:
- Frequency refers to peak daytime service level; this is likely to be lower during evenings
- 1st and Last – refers to earliest outward call and last departure at St Athan/Eglwys Brewis.
- Number of journeys refers to those trips serving Eglwys Brewis, with each return trip = 1 journey

17.4 Current service patterns provide access from a range of destinations, with operation between approximately 06:00 and 19:00 hours. This provides access to the facility during the main hours of operation – particularly those staff originating from the main population centres of Barry, Bridgend and Cardiff.

17.5 Existing provision has a relatively low frequency, which results in a low hourly capacity and requires users to plan their journey in advance, often requiring early arrival at a bus stop to ensure they make their connection.

Existing Patronage

17.6 Boarding and alighting surveys were undertaken on the 2nd and 4th March 2009 to determine the current use patterns of the X91 and X45 services. The results are summarised in Table 17.2.

Table 17.2 – Boarding and Alighting Survey Results

Service number	Start location	End location	Depart time	Total Boarders			Max Occupancy
				Mon	Wed	Ave	
X45	Llantwit Major interchange	Cardiff Bus Station	06:10	12	19	16	12
X45	Llantwit Major interchange	Cardiff Bus Station	07:00	6	9	8	6
X45	Llantwit Major interchange	Cardiff Bus Station	07:55	38	38	38	29
X45	Llantwit Major interchange	Cardiff Bus Station	09:55	34	30	32	13
X45	Llantwit Major interchange	Cardiff Bus Station	10:55	47	48	48	31
X45	Llantwit Major interchange	Cardiff Bus Station	11:55	28	37	33	15

Service number	Start location	End location	Depart time	Total Boarders			Max Occupancy
				Mon	Wed	Ave	
X91	Llantwit Major interchange	Cardiff Bus Station	06:45	21	23	22	22
X91	Llantwit Major interchange	Cardiff Bus Station	07:20	32	25	29	28
X91	Llantwit Major interchange	Cardiff Bus Station	09:04	32	32	32	29
X91	Llantwit Major interchange	Cardiff Bus Station	09:59	16	24	20	23
X91	Llantwit Major interchange	Cardiff Bus Station	11:04	N/a*	28	28	22
X91	Llantwit Major interchange	Cardiff Bus Station	12:04	N/a*	30	30	19

Service number	Start location	End location	Depart time	Total Boarders			Max Occupancy
				Mon	Wed	Ave	
X45	Cardiff Bus Station	Llantwit Major interchange	07:25	38	44	41	21
X45	Cardiff Bus Station	Llantwit Major interchange	08:25	17	23	20	13
X45	Cardiff Bus Station	Llantwit Major interchange	09:25	25	38	32	13
X45	Cardiff Bus Station	Llantwit Major interchange	11:25	19	34	27	12
X45	Cardiff Bus Station	Llantwit Major interchange	12:25	46	36	41	26
X45	Cardiff Bus Station	Llantwit Major interchange	13:25	20	36	28	20

Service number	Start location	End location	Depart time	Total Boarders			Max Occupancy
				Mon	Wed	Ave	
X91	Cardiff Bus Station	Llantwit Major interchange	08:00	48	38	43	36
X91	Cardiff Bus Station	Llantwit Major interchange	08:57	11	8	10	11
X91	Cardiff Bus Station	Llantwit Major interchange	11:02	35	21	28	29
X91	Cardiff Bus Station	Llantwit Major interchange	12:02	14	7	11	10
X91	Cardiff Bus Station	Llantwit Major interchange	13:02	N/a*	15	15	13
X91	Cardiff Bus Station	Llantwit Major interchange	14:02	N/a*	27	27	23

*Survey not completed

17.7 All services were operated by single deck vehicles, which have a seating capacity of between 39 and 44 seats, with 12 to 18 standees. As such, existing services operate within current demand levels. It was evident there was a significant variation in the maximum occupancy, ranging from 6 to 36 passengers. The age profile of users was also surveyed and indicated a significant number of off peak users held a concessionary pass, which provided them with free travel.

17.8 The main shortcoming of the current provision is the inability to meet the peak demand on a Friday evening, when there is likely to be a high demand by personnel travelling home for the weekend.

Consultation with Incumbent Operators

17.9 An initial meeting was held with incumbent bus operators and the Vale of Glamorgan Council to consider the implications of the development on the local bus network and opportunities to enhance the public services. The possibility of utilising the 'White Fleet' to supplement existing public services was also discussed.

17.10 Whilst the operators appreciated there would be a significant increase in the potential demand for bus travel, their main concerns were:

- Extreme peak demand on a Friday evening which could not be accommodated within the capacity of the existing fleet
- Uncertainty regarding the origins and destinations of students and staff – in particular the changing patterns as students complete training.

17.11 In order to accommodate the additional demand, bus operators would be required to purchase additional vehicles; however they felt it would not be possible to recoup their investment on a commercial basis, given the limited operating window of the peak demand and relatively low existing levels of off peak demand which are currently met within their existing fleet capacity.

17.12 Operators would also require greater certainty regarding the origins of staff and students; however it is not possible to provide this information at this stage of the development. There is likely to be a high variability in origins.

17.13 At this stage it was agreed that consultation would continue with operators as the project develops; however their involvement is likely to be through the supply of contracted services, as they do not perceive a commercial opportunity from predicted travel patterns.

17.14 The links to the adjacent rail stations at Llantwit Major, Cardiff, Barry and Bridgend are of primary importance and based on the discussions with the incumbent operators, it is proposed that the 30 vehicle 'white fleet', (a mix of minibuses and 45 + 59seater coaches) is used to supplement the existing bus services during Peak in demand.

17.15 Predictions of increased demand are summarised in Appendix J.

Existing Rail Integration Opportunities

17.16 Many trainees are likely to originate a considerable distance from the facility; whilst many support staff are lively to originate from rail served areas; therefore rail links are likely to be extensively utilised. The nearest rail station is Llantwit Major Rail Station, which is located 3km from the proposed facility. It is therefore necessary to provide reliable bus links between the facility and the rail network.

17.17 Existing bus services provide good links to Llantwit Major Rail Station; however service timings are not fully integrated. This is illustrated in Table 17.3, which summarises the interchange time between connecting bus and rail services.

Table 17.3 – Interchange Time Penalty Between Arrival Modes at Llantwit Major Rail Station.

Journey	Minutes past the hour		
	Bus Arrives	Train Departs	Interchange wait
From St Athan to Cardiff	50	56	06
From St Athan to Bridgend	04	22	18
	Train Arrives	Bus Departs	
From Cardiff to St Athan	22	55	33
From Bridgend to St Athan	56	04*	08

*Daytime arrival time – varies during peak

17.18 Whilst the timings offer some integration opportunities, passengers travelling from Cardiff to St Athan would face a wait time of 33 minutes, which would not be attractive. In addition, existing bus services must comply with the reliability requirements of the Traffic Commissioner, which require services to arrive 'no more that one minute early or five minutes later' than the published time. As a result, buses would be unable to wait in order to meet a late running train.

17.19 Currently there are no opportunities to purchase integrated bus and rail tickets, with Llantwit Major Rail Station not included in the national 'Plus Bus Scheme'. Whilst this scheme provides a bus add on for passengers whose journey originates on the rail network, it does not provide this facility for these originating from St Athan.

17.20 It is proposed to enhance bus and rail integration. Whilst it would be possible to enhance existing services, there are a number of concerns. There are summarised in Table 17.4:

Table 17.4 – Comparison of Bus/Rail Integration Options

	Advantages	**Disadvantages**
Rail / Existing Bus	• Uses existing services - less risk of abstraction from local network • Possibility of Integrated tickets (subject to operator negotiation) • Most are commercial services; therefore low/ no subsidy requirement.	• Extended interchange time penalty • May be required to buy two tickets (subject to operator negotiation) • Limited control over service (if commercial service changes, may eliminate bus link) • Cannot guarantee connection with rail (particularly if delays to rail service) • Some existing bus services do not operate on a 'clockface' basis with variability in arrival time.
Dedicated Rail feeder	• Guaranteed connection with rail service/ability to compensate for let running of rail service. • Integrated tickets available • Can be integrated within the National Rail timetable. • Can only be used by rail passengers to minimise abstraction from local network • Contracted service – greater element of control over service availability. • Option to utilise special livery	• Possible abstraction from comparable bus services (X45, X91), which may reduce their commercial viability • High level of subsidy required (most are run on tendered basis) • All Wales pass not generally valid, as feeder bus is essentially an extension of rail service.

	on buses to advertise links with rail service. • Services call directly to Station • Provide a physical presence at the station. • Open to the public provided they are using the rail network	

17.21 The provision of a dedicated feeder bus offers a number of service advantages over use of existing services.

17.22 Current rail timetable patterns at Llantwit Major result in call patterns of:

From Cardiff ’22 past the hour
From Bridgend ’56 past the hour

17.23 As a result there is a maximum operating window of 26 minutes between train arrivals. In practice, however, there would also be a requirement to schedule addition interchange time for the bus service to allow for the following:

- Early/late arrival of the train service
- Sufficient time for users with limited mobility to interchange
- Boarding/alighting of bus passengers.

17.24 In view of these factors the feeder bus would be required to be at the station 5 minutes before and after the scheduled train arrival. These requirements effectively reduce the available running time between the station and facility to 16 minutes.

17.25 In order to determine the feasibility of a single vehicle providing the service, a trial run was undertaken on 5th March 2009. This was undertaken at 5pm to represent the possible peak traffic conditions. The following time requirements were identified.

Table 17.5: Journey Times

From	To	Time
Llantwit Station	North Gate	8 mins
Llantwit Station	East Gate	10 mins

17.26 A total time of 9 minutes is required to complete a full circuit of the perimeter. It should however be noted that the journey time for a dedicated service would be less than currently available due to the following factors:

- A feeder bus would be non-stop service
- The route would utilise the northern access road, which is quicker
- The possibility to incorporate bus priority into signals at the junction of the B4265/Llanmaes Road Junction and the B4265 / Northern Access Road Junction.

17.27 Accordingly it would be possible for a single bus to meet all rail arrivals and departures to provide a dedicated point-to-point service which acts as extension of the rail service. This would link the railway station to Gate 1, where it would turn.

Vehicle Requirements

17.28 The vehicle must provide sufficient capacity to serve commuter generated peaks. It is therefore suggested that a 25 seat capacity vehicle is provided. To ensure access for mobility-impaired persons, a low floor DDA compliant vehicle would be required. This

vehicle should also have a bespoke livery to identify the service as being integrated with the railway. The use of a Euro IV compliant vehicle would also reduce environmental impact.

Procurement

17.29 The type of service would be consistent with those provided for the opening of the Ebbw Valley Line. Whilst regularly utilised, the patronage levels do not facilitate commercial operation. Given the requirement for a bespoke vehicle, which is fully DDA compliant, the cost of existing tenders is in the range of £80,000 to £90,000 per annum. This provides service coverage Monday to Saturday, between 06:00 to 19:00 hours. Given the service may also be required to operate later and on Sundays, a budgetary allowance of £125,000 is estimated. The lead-time for procurement and implementation is approximately 6-12 months.

Infrastructure Considerations

17.30 Bus stops are often a potential users first point of contact with the bus network and as such, provide an indication of the level of service that can be expected. It is therefore imperative that suitable at-stop infrastructure is provided. Particular considerations being:

- Ease of access on and off vehicles – particularly for less mobile users
- Comfort whilst waiting
- Provision of service information

17.31 The importance of these attributes is highlighted in the Vale of Glamorgan UDP Supplementary Planning Guidance on Sustainable Development, which states:

'(iii) Public Transport
Adequate access for bus services and service vehicle should be provided.
Passenger facilities, such as bus shelters and timetable information should be provided, in consultation with the council.
Convenient access for pedestrians should be provided with bus stops located no more than 400m from residential properties'

17.32 It is proposed that the existing bus services continue on the section of Eglwys Brewis Road that remains open and will continue to serve all existing bus stops. Additional bus stops will also be provided near the main entrances the development (Drawing CG/003622/PA/133/rev A and 134).

17.33 An audit of existing bus stops has been undertaken; whilst the majority of the stops have a good level of provision, some stops do not have the full range of features which meet the aspirations of the Vale of Glamorgan Local Authority Bus Strategy. It is therefore proposed that all bus stops in the immediate vicinity of the facility brought up to a consistent standard, featuring:

- Raised boarding platform of 180mm height;
- Glazed shelter featuring internal illumination and perch seat;
- Bus Stop flag, displaying stop name, service numbers and travelling telephone and text enquiry numbers; and
- Timetable case containing service information and taxi contact details.

17.34 Footpath links between existing and proposed bus stops and the facility will be also be provided to facilitate bus use.

School Buses

17.35 Existing school bus routes for Primary and Secondary Schools are summarised in Drawings CG/2419/TA03 and 04 respectively. The provision of school buses is reviewed annually and is subject to demand and entitlement each year. The Vale of Glamorgan Council has stated that:

'If the development creates an additional demand this will need to be compensated for to ensure that no additional burden is placed on the public purse'.

17.36 Surveys of existing demand and spare capacity on school buses were undertaken on 2nd and 4th March 2009. The results show that there is currently spare capacity on most buses. The total child population of the SFA, their school ages and their preferences regarding individual schools cannot be estimated at this point. However, with base data having being collected, a future review of the impact of the development in terms of additional demand can be undertaken.

Summary of Proposals

17.37 The following proposals for bus provision are made:

- Discussions continue with incumbent operators as the development progresses to identify future options to enhance the network
- Provide a dedicated rail feeder bus service to link the facility and Llantwit Major Rail Station
- Enhance all bus stops in the immediate vicinity of the development to a common standard consistent with regional aspirations

18.0 Pedestrians/Cyclists

18.1 The College expects to accommodate 3,240 staff and trainees at any one time and there will be 483 Service Family Accommodation (SFA) properties by 2014 to provide family accommodation for personnel during their stay. These will be located outside the security perimeter but within easy walking distance. It is anticipated that the ABP will employ 2,303 civilians from the local area.

18.2 With the Travel Plan in place, an increase of 10% (ABP) and 30% (DTC) for walking and cycling modes is desired.

18.3 In year of opening the predicted pedestrian and cyclist numbers to and from the development are summarised in the following table:

Table 18.1: Increase in Pedestrians/Cyclists Patronage

2014-P & C	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
Arrive	855	855	855	855	855	-	24	4299
Depart	879	879	879	879	963	-	-	4479
AM Peak Arrive	170	170	170	170	170	-	24	874
PM Peak Depart	189	189	189	189	214	-	-	970

Pedestrians

18.4 Pedestrian linkage within and to the site has been based on the Vale of Glamorgan's UDP Supplementary Planning Guidance on Sustainable Development, which states:

> *"(i) Pedestrians*
> *Provide convenient routes, which are easy, safe and attractive to use;*
> *Provide clear sign posting and lighting where appropriate;*
> *Link routes to local facilities, public transport nodes, open spaces and longer distance footpaths such as public rights of way;*
> *Provide conveniently located pedestrian crossing* points *on busy sections of road"*

Measures

18.5 Pedestrian linkage has been provided between the SFA and DTC as well as the nearest existing or proposed bus stops. Links between Llantwit Major Railway Station and the site have also been created. The proposed linkages are shown on Drawings CG/003622/PA/131/rev A -134 and CG/003622/PA/1514. These plans also show existing footpaths and, where required, their rerouting.

18.6 A footpath/cycleway is proposed along the entire length of the Northern Access Road (NAR), which will be lit, providing connectivity between Boverton/Llantwit Major and the proposed developments. The existing steps on the B4265 cut slopes are retained providing pedestrian access to the proposed NAR/B4265 signalised junction. Pedestrians are accommodated at the junction with at grade pedestrian crossings. An alternative route to the cut slope steps is proposed on the B4265 northern verge, between the B4265 NAR junction to Llanmaes signals, where pedestrians and cyclists will cross at grade. Pedestrians complete their journey to Llantwit Major Railway Station using existing footpaths provided either side of Llanmaes Road. Cyclists will be required to use the main carriageway for this section of their journey.

18.7 Between the B4265 and Froglands Farm the pedestrian and cyclist facilities comprise of a 3.0m shared use footway cycleway on the northern side of the NAR. At Froglands Farm a 2.5 m central island crossing point is provided and the southern

verge widens to accommodate a 3.0m shared use footway cycleway. This facility continues for the remaining length of the scheme providing pedestrian/cycle access to the ABP, Gate 1 and Gate 2/3.

18.8 The 3.0m footway /cycleway is proposed to extend between Gate 1 and the junction of St Athan Road. This will provide access to the site from the proposed SFA on the Golf Course site and provide improved access for the existing community to the SPAR shop on Eglwys Brewis Road. Detailed drawings of this link are still being discussed between the developer and the Vale of Glamorgan Council.

18.9 The section of the route from Llantwit Major Railway Station to B4265 Llanmaes Signals is lit as a pedestrian route. Street lighting is mounted on wooden poles at a height of 8m or provided on 6m steel columns located at the back of the footway. Whilst not designed specifically for a footway/cycle way they provide sufficient light. The remainder of the proposed footway / cycleway route to the site is either new build or adjacent to the B4265. The intention is to light all the route, subject to agreement with the Vale of Glamorgan Council.

18.10 SFA sites bound the NAR. Pedestrian connections are proposed from each site to the combined footway/cycleway on the NAR. Both Tremains Farm and North of West Camp sites have pedestrian connections to Eglwys Brewis Road with either existing footways or proposed footways connecting these sites to existing bus stops. The Picketston South West site also has connectivity to the bus stop on Eglwys Brewis Road through the proposed provision of an uncontrolled crossing point, with dropped kerbs and buff coloured tactile paving.

18.11 At grade and grade separated crossing points are proposed on the NAR. The grade separated facility is to be located adjacent to Gate 2/3. The bridge will not be DDA compliant but an at grade facility at the adjacent traffic signals will meet DDA criteria and provide positive control for pedestrians.

18.12 The existing Safe Routes to School scheme at Boverton has also been connected to via the proposed bus stop footpath along Eglwys Brewis Road from the North of West Camp SFA site. Pedestrians from the SFA sites will be able to access this route by following the footpath through Eagle Way and crossing the B4265 at Boverton signals, which has an existing at-grade pedestrian crossing.

18.13 Improved cycling and pedestrian links between the development and Llantwit Major/St Athan are proposed to encourage the local community to walk or cycle to and from the site.

Cyclists

18.14 The proposals detailed within the Transport Assessment are based on the Vale of Glamorgan's UDP Supplementary Planning Guidance on Sustainable Development, which states:

> *"(ii) Cyclists*
> - *Provide direct, safe and attractive routes;*
> - *Link routes within developments to the wider cycle network*
> - *Provide prominent, secure cycle parking which should be close to building entrances or inside buildings and should avoid the need to carry cycles over steps"*

18.15 The 3.0m shared use footway / cycleway on the NAR, will extend from the B4265 Llanmaes Signals to St. Athan Road. At Llanmaes Signals the existing crossing

facilities will be improved by the installation of red tactile paving and extension of the existing central island from 1.8m to 4.0m

18.16 Crossing points are proposed on the NAR, including one adjacent to the Tremains Farm access within the 50 mph limit. Transport Note 2/08 'Cycle Infrastructure Design' (Table 10.1) indicates that use of a central refuge is acceptable.

18.17 The existing southern section of Eglwys Brewis Road will have a substantial decrease in traffic flow, which will encourage further cycle use.

18.18 Secure and sheltered cycle parking facilities with adequate lighting will be installed at both the Defence Technical College and the Aerospace Business Park, in appropriate locations.

18.19 Cycle parking provision within ABP is based on the Standing Conference on Regional Policy in South Wales 'Guidelines for the Provision of Facilities for Cyclists', which has been adopted by the Vale of Glamorgan Council and states:

Table 18.2: Guidelines on Cycle Parking

Type of Development	Requirement
Offices	1 space 400 sqm. gross floor area
Industrial development	1 space per 500 sqm. floor area

18.20 As part of the Travel Plan, cycle stands and cycle clubs will be created. Consultation with employees will identify the key cycle desire lines and cycle routes will be encouraged to serve the development. Cycle stands and shelters will be provided at key points within DTC and ABP. These will include lockable cycle stores.

19.0 Transport Implementation Strategy (TIS)

19.1 The objectives for the Transport Implementation Strategy are based on the St Athan Development Brief of July 2006:

- Identify a need for additional highway improvements to cater for the increased traffic flows
- Mitigate any adverse highways impacts that are identified
- Assess the routes and mitigation measures for construction traffic generated by the proposals
- Provision of a direct and separate access onto the main road, thus providing a bypass for the nearby settlements of Llantwit Major and St Athan
- An emergency access to be made available on the eastern side of the site

and the Vale of Glamorgan Adopted Unitary Development Plan - April 2005 (UDP):

- To ensure that a balance is maintained between the need to facilitate the development of the local economy, environmental concerns and social considerations, in order to create a safe, efficient and equitable transport network for the Vale of Glamorgan;
- To maintain and improve access to employment and services;
- To ensure that developments are accessible by means of travel other than the private car;
- To encourage greater use of public transport, cycling and walking;
- To safeguard road lines and routes/sites of approved transport schemes;
- To improve the safety and convenience of all means of transport; and,
- To ensure adequate parking facilities are provided in accordance with the Council's approved parking guidelines.

Measures to achieve objectives

19.2 Measures to achieve these objectives are a combination of physical highway improvement measures as summarised in Drawings CG/003622/PA/100/rev A, public transport improvements (Chapters 16/17) and Travel Plans for the site. The Travel Plans target is a reduction in car based trips of 20% and 15% for the DTC and ABP sites respectively. This target has been split into the following areas:

Public Transport

<u>DTC target</u>

19.3 It has been assumed that as a result of the DTC and ABP development there will be an extensive increase in use of rail transport, especially for junior trainees. Standard practice is for rail travel passes to be issued to their personnel so an increase in train use by 30% and bus travel by 10% is desired as the majority of personnel will remain on site during the week but travel significant distances across the UK on Friday and Sunday evenings.

<u>ABP target</u>

19.4 An increase in train use by 10% and bus travel by 10% is considered realistic as it is assumed a significant number of employees to the site will commute from nearby urban areas such as Cardiff and Bridgend.

Measures

19.5 Improved public transport links to the development have been developed and are summarised in Chapters 16/17.

Cycling and Walking

DTC target

19.6 The College expects to accommodate 3,240 staff and trainees at any one time and is constructing 483 Service Families' Accommodation (SFA) properties by 2014 to provide family accommodation for military personnel during their stay. These will be located outside the security perimeter but within easy walking distance. An increase of 30% for walking and cycling modes is desired.

ABP target

19.7 It is anticipated that the ABP will employ over 2,303 civilians from the local area. With the Travel Plan in place, an increase of 10% for walking and cycling modes is desired.

Measures

19.8 A shared footway/cycleway link is proposed to connect the sites to both Llantwit Major and St Athan. The linkages proposed are summarised in Chapter 18:

Car Sharing

DTC target

19.9 An increase of 30% of car sharing is desired.

ABP target

19.10 An increase of 70% of car sharing is desired.

Measures

19.11 To encourage the uptake of car sharing a range of initiatives including the provision of a car share database, a guaranteed lift home service and preferential car share parking spaces are being offered as part of the Travel Plans.

Monitoring of Scheme

19.12 Monitoring will be undertaken by tracking the progress and outcomes of the Travel Plans against the targets set within it.

20.0 **Conclusion**

20.1 The St Athan site has the potential to be developed as a world class Defence Technical College with an Aerospace Business Park as a Centre of Excellence.

20.2 The Defence Technical College will have 3,240 people living on site and working on site with a further 2,491 living off site, working on site. An additional 810 people are envisaged to visit the site / museum / church / hotel / leisure, generating a DTC population total of approximately 6,500 with assessments made of a population of just over 7,000. The Aerospace Business Park will provide employment for 2,303 staff. There is provision for 483 Service Family Accommodation units, a sports centre, 150 bed hotel, crèche, museum and faith centres.

20.3 The majority of the Defence Technical College's living accommodation will be within the site, therefore reducing the traffic impact on the surrounding highway network. SFA has been co-located with the DTC in order to minimise the necessity for travel to work by private cars.

20.4 The main accesses into the Defence Technical College will be via a new Northern Access Road connecting the B4265 to St Athan Road, to the west of the site. Traffic to and from the site will therefore be provided with direct and separate access onto the main road that bypasses both Llantwit Major and St Athan. Part of the aerospace development will be served by the same new access road but via a separate entrance. To minimise traffic flow increases in St Athan, access between the east and the developments on the Northern Access Road will not be permitted.

20.5 Based on discussion with the Vale of Glamorgan Council via the Transport Group, comprehensive junction surveys were undertaken in 2007 / 2008. Capacity analysis has been undertaken at these junctions for 2014 (opening year) and 2028 (design year), based on distribution from the SATURN Model. Existing traffic generation from the 335 personnel of No 4 School of Technical Training has not been discounted from the base traffic flows, providing a worse case analysis.

20.6 Travel Plans for DTC, ABP, construction traffic and schools have been created with the overall aim of reducing single occupant vehicles by 15-20%. The TA has been based on a worse case analysis of a 10% modal shift.

20.7 Junction capacity analysis has been undertaken on the basis of Monday AM/PM and Friday PM peaks to provide analysis of the worse case traffic scenarios. The following highway improvements are proposed on capacity/safety grounds:

- Construction of the Northern Access Road
- B4265 Gileston to Old Mill Link Improvement
- A4266 Waycock Cross Roundabout Improvement
- B4265 St Athan / Gileston Junction improvement

20.8 No improvements are currently proposed to existing minor roads (rat-runs) because improvements would just encourage their increased use, but it has been agreed with the Vale of Glamorgan Council that following the opening of the DTC, the actual rather than estimated effects of the development will be assessed on the adjacent minor roads. This review will be undertaken by the local highway authority and any appropriate traffic-management measures subsequently determined, would then be implemented by the HA via a limited fund provided by the developer.

20.9 In addition to a Construction Travel Plan, a Construction Method Statement has been developed and a route for construction traffic will be agreed with the Vale of

Glamorgan Council. Predicted HGV movements and associated workforce numbers have been summarised within the Transport Assessment.

20.10 Pedestrian linkage has been provided between the SFA and DTC as well as the nearest existing or proposed bus stops. Links between Llantwit Major Railway Station and the site have also been created. The proposed linkages are shown on Drawings CG/003622/PA/131/rev A -134 and CG/003622/PA/1514.

20.11 A 3.0m shared use footway/cycleway is proposed along the entire length of the Northern Access Road (NAR). This will extend along Eglwys Brewis Road to St Athan Road and on the B4265 to Llanmaes Signals, providing connectivity between Boverton/Llantwit Major and the proposed developments.

20.12 The linkage to Llantwit Major Railway Station will be further improved by the operation of a shuttle bus connecting the train services to the main access to the DTC site. New bus stops on the NAR are proposed and existing bus stops adjacent to the site will also be improved.

20.13 The majority of the impact on services on the Vale of Glamorgan Railway Line during the AM and PM peaks is due to general patronage growth and not attributable to this development. This is in part due to the tidal flow of the development creating counter commuting to the existing demand. There is minimal impact on typical commuting flows and demand generated by the development will help fill existing spare capacity. Outside of these peak hours existing 2-car sprinter sets will be sufficient to meet the predicted demand.

20.14 It is proposed to accommodate DTC's Friday and Sunday peak demand on the rail network via use of the DTC White Fleet with trainees who are be dropped off on a Friday evening being also collected from Cardiff, Barry or Bridgend stations, using the White Fleet on a Sunday evening.

20.15 Therefore, the development will link to the adjacent railway station by bus, cycle and walking routes. To assist in creating a sustainable site, the mixed use development profile of DTC, with shops, public houses, restaurants, sports facilities and places of worship will significantly reduce the traffic generation of the site. The capacity analysis has been based on a worse case scenario of only a 10% modal shift due to the Travel Plan, double counting of No 4 School of Technical Training and an overestimate of the traffic generated from ABP. Based on the analysis and existing accident issues, upgrades to the existing network, improving both capacity and safety, have been proposed.

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