CITY AND COUNTY OF SWANSEA

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Our Ref: DMP

Your Ref:

Date: 21 November 2007

Dear Mr George

PETITION: RE-OPENING OF SWANSEA TO MUMBLES RAILWAY

I refer to Mrs Val Lloyd's letter of 26 September 2007 and apologise for the delay in forwarding the information requested.

Please find enclosed a copy of the most recent feasibility study, which was carried out in 2000.

Yours sincerely

D. M. Penberthy

DIANNE PENBERTHY
PA TO THE CHIEF EXECUTIVE

Swansea Light Rail Feasibility Study
Astudiaeth Ymarferol Rheilffordd Ysgafn Abertawe

Final Report

Adroddiad Terfynol

Prepared for

City and County of Swansea

Wedi paratoi ar gyfer

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HALCROW FOX

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HALCROW FOX

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1 Introduction

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1.1 STUDY BACKGROUND

1.1.1 The City and County of Swansea appointed The Halcrow Group to undertake the Light Tram Feasibility Study in July 1998 to review previous proposals and re-examine the case for inclusion of rail based public transport schemes within the evolving Transport Strategy for the region.

1.1.2 Swansea is an important regional centre in South Wales, providing employment, retail, education and administrative services for a wide area. The City also provides access to the tourist areas of the Gower Peninsular and the Mumbles to the west. This corridor boasted the first passenger railway, which was subsequently converted to a tramway. The transport corridor is now the Swansea Bike Path and most of the formation and structures remain as an opportunity for development as a public transport corridor to serve future needs.

1.1.3 Significant progress has been made on the development of the Transport Plan for the City including; the specification of 4 key corridors for the provision of park and ride facilities; the development of local rail services and new stations, which opened in 1994 as the Swan Line, and; the development of improved public transport access around the City Centre, including a 'bus box' with bus priority lanes.

1.1.4 The future Transport Plan for the City involves the development of the Park and Ride facilities and the improvement of the quality of the bus services, possibly as segregated systems, including possible guided busways. However, previous studies have highlighted the poor accessibility of parts of the City Centre due to its size and the segregation of the Railway Station from other City Centre activities. This has been made worse in recent years through the development of the Quadrant Shopping Centre and bus station, moving the focus towards the South-west

1.1.5 Between 1994 and 1996 studies were undertaken of the potential to improve connections in the City Centre through the development of a 'minitram' system using local streets and a demonstration of a potential system attracted significant public interest.

1.1.6 The last study investigating the patronage potential for the system was undertaken by Halcrow Fox for the former County Council, but reported at the time of the creation of the new Unitary Authority for the City/ County. The new Authority has taken over responsibility for transport planning in Swansea and has produced a Draft Transportation Strategy and

commissioned research into the promotion and development of the City Centre. Both documents raise the issues of transport development, including recommendations that the issues surrounding people-movers or trams serving the City should be further investigated.

1.1.7 There have also been proposals for the re-instatement of the former Mumbles Railway, showing a continued desire, at least amongst part, of the community to improve transport access along this corridor. However, there are constraints to the re-introduction of rail or tramway services on the Mumbles line. In particular, the costs of construction, including the repair or replacement of some structures and the loss of the former alignment to reach a City Centre Terminus, including the development of County Hall on the formation. There are also perceived difficulties in securing land for associate park and ride facilities. The main public transport operator in Swansea, South Wales Transport has investigated the re-instatement of the railway and the local Mumbles Railway Society has recently submitted a funding application to the Millennium Commission, which was unsuccessful due to a lack of detail in the proposal.

1.2 STUDY OBJECTIVES

1.2.1 The Authority now requires an independent assessment of the previous proposals and potential alternatives for the City, to enable the Council to decide on an appropriate technology for public transport development and the most appropriate routes to serve the identified objectives and main traffic demands. The primary purpose of the study is to provide a clear and achievable direction for transport development and to provide a base for the further progression of the transport strategy.

1.3 STUDY REQUIREMENTS

1.3.1 The study brief issues at the study inception included the following requirements to enable a comprehensive review of the rail based transport potential to be achieved;

- Identification of potential and preferred route(s).
- Selection of appropriate mode/ technology (Fuels).
- Identification and assessment of operational difficulties.
- Potential partnerships with Local Transport Operators.
- Assessment of funding mechanisms and opportunities.
- Consideration of Sustainability issues.
- Requirements for scheme progression, including Transport and Works Act Approval.
- Pedestrian Safety and Access Issues.

- Practical construction difficulties.

1.3.2 In addition, in terms of the specified outputs of the study, the following factors have been identified as relevant to the overall decision-making assessment;

- Assessment of passenger flows;
- Identification of land requirements;
- Scheme capital and operating costs;
- Serving identified traffic objectives.

1.4 STUDY APPROACH

1.4.1 To meet the study objectives the Study team identified a study approach designed to utilise available information, best practise and knowledge and to undertake specific tasks in a logical order. This included the following key areas of work;

- Assessment of the previous information;
- Definition of the objectives and opportunities to be served;
- Assessment of alternative transport modes;
- Assessment of the practical constraints in the identified corridors;
- Estimation of the order of the capital and operating costs;
- Prediction of the likely patronage and revenue levels, and;
- Economic analysis and consideration of implementation issues.

1.5 STRUCTURE OF THE REPORT

1.5.1 Following this introduction to the study, Chapter 2 considers the policy context for light rail and Chapter 3 examine the overall scope for Light Rail in Swansea by examining the existing conditions, defining the transport objectives and study options. Chapter 4 assessed the practical issues related to Light rail development in the identified study corridors and Chapter 5 examines the patronage potential leading to the financial and economic assessment in Chapter 6. Scheme progression issues are considered in Chapter 7 and conclusions and recommendations are drawn in Chapter 8.

2 Policy Context

2 Policy Context

2.1 NATIONAL POLICY

2.1.1 In July 1998 the government released a new transport white paper promoting 'a new deal for transport; better for everyone'. This document, supported by the Welsh Transport Policy Statement 'Transport Wales into the Future', released at the same time, sets out a new approach to transport based on widening transport choice and moving away from the predict and provide approach which led to large scale road investment in the past.

2.1.2 UK Transport policy is defined as achieving five key policy objectives;

- Assisting Economic Growth;
- Protecting the Environment;
- Improving Accessibility;
- Promoting Integrated Transport; and
- Improving Safety.

2.1.3 The White Paper, supported by other Government directives and policies, such as the Air Quality Strategy and Road Traffic Reduction Act, aims to achieve these objectives though a package of measures delivered through Local Transport Plans. The change in transport policy represents a movement away from the 'predict and provide' approach to road investment, towards a management of roads and traffic. The new policy theme based on reducing the need to travel and encouraging a shift from car to walking, cycling and public transport, will be supported, eventually, by new funding mechanisms based on either road pricing or taxation of private non-residential car parking (workplace levies).

2.1.4 A key element of the delivery of the improved transport choice relates to the objectives to improve Integration in planning and transport at all levels, including;

- Integrated policies, such as health, education and wealth creation;
- Integration of transport with land-use planning;
- Integration with the environment; and

- Integration of different types of transport.

2.1.5 In terms of public transport the white paper encourages the development of bus and rail services and facilities, harnessing private and public sector investment through Quality Partnerships and Quality Contracts and introducing a Strategic Rail Authority. The Government is committed to introducing a national public transport information system, simpler more through ticketing, and a half fare, or better, Concessionary Fares scheme for the elderly.

2.1.6 This recent change in transport policy to be implemented over the coming years through further transport acts and guidance represents a climate of change for local authorities and transport operators. This represents an opportunity to implement sustainable transport plans for local authorities. However, although the white paper clearly sets out the new philosophy, the implementation of the policy will take some time to work through, including changes in regulation and the creation of new funding resources.

2.1.7 The new Government policy is less favourable about the development of new modes, such as Light Rail Transit, as experience has shown them to be 'expensive and less flexible' than other forms of public transport (buses). They encourage the development of less expensive measures and expect any proposals to be public/private partnerships.

2.2 REGIONAL POLICY

2.2.1 The Welsh transport policy statement embraces the UK white paper and emphasises some specific Welsh transport dimensions including; the peripherality of Wales, improving North-South connections and the differing needs of rural and urban areas. In advance of the creation of the Welsh Assembly, which will formulate regional transport policy, a Welsh Transport Advisory Group has been established, which will provide advice on the development of Integrated Transport Policy.

2.2.2 Although the roads programme has been significantly reduced, including the investments within Wales, the Welsh office literature (and the local authority plans) sees the need for further road improvements including local bypasses and strategic links. Examples within the region are the Mumbles Bypass, A4067 Neath Road Corridor, M4 junction 44, 45 and 46 measures and Gowerton bypass, contained within the 1997 Swansea Draft Transportation Strategy.

Swansea Local Plan

2.2.3 The Swansea Local Plan provides the regional policy for planning and transport. This was produced in 1996 and reveals trends in population and employment and resultant requirements for housing and development. The City's population declined between 1981 and 1985 but recovered by 1991 and is forecast to grow from 190,000 to 193,000 people by 2003. The population figures reveal a relatively high proportion of elderly residents, which reflects the attraction of the area as a residence during retirement. The proportion of elderly residents grew from 16% of the population in 1985 to 18% in 1991 and is expected to continue to rise.

2.2.4 The Housing needs assessment revealed a shortfall of suitable accommodation and a requirement for 4,681 units by 2003, this was modified to 3,913 units in the Swansea Local Plan review number 1, (August 1998) which allocates 3,360 to North, East and Central Swansea and 553 to West Swansea. Housing locations are considered by target corridor in chapter 4.

2.2.5 There is a downward trend in unemployment in the City, although unemployment remains relatively high at 10% of all workers in 1994 and 17% of male workers in certain wards. There has been relatively strong development and regeneration in the region, with £300m of development in the last 15 years in the Valley alone. The development plan envisages the consolidation of the City Centre and Eastern Fringe and the main employment areas are the City Centre, Enterprise Park, Docks and older industrial estates.

2.2.6 In transport terms there is slightly lower than average car ownership in the City, although there is a projected increase in car ownership of 27% between 1991 and 2003. Public transport use could decline by 19% over the same period. This growth in traffic ownership and use, if unchecked, could lead to current (1991) average peak traffic speeds of 16 mph falling to 11 mph by 2003 and 9 mph by 2011. Without provision for buses, this is forecast to lead to an increase in bus journey times of 60%.

2.2.7 The Strategy in the local plan is based on a Sustainable Development approach with full provision for the needs of employment, housing, public service and recreation. The strategy emphasises environmental protection and the quality aspiration of development and redevelopment. The plan emphasises the need to concentrate development to promote the economic health of the existing centres, well served by public transport, particularly the City Centre, and the consequent reduction of traffic impacts through integrated development.

Transport Strategy

2.2.8 The aims and objectives of the transport strategy are stated in the local plan as;

- To make the most efficient use of existing highway infrastructure;
- To secure improvements to the existing highway infrastructure where deficiencies exist, without increasing the overall capacity of the network;
- To increase the accessibility and attractiveness of public transport for all;
- To ensure that the provision and use of public car parking does not increase peak period road usage;
- To manage traffic and parking to minimise conflicts with other road users in sensitive residential and retail areas;
- To secure good accessibility to the City Centre and District Centres and between land use activities;
- To improve the environment and facilities for walking, cycling and other non motorised movement, and for other groups with special needs, and;
- To reduce the number and length of vehicular journeys.

Public Transport Strategy

2.2.9 For public transport the local plan emphasises its importance in contributing to the sustainable development plan and states principle policy objectives as;

- To provide the opportunity for public transport to be an attractive alternative to the car;
- To ensure that new development is located where it can be readily served by public transport;
- To give buses priority over other traffic on radial routes and on roads adjoining the city centre pedestrian 'core';
- To progressively improve the comfort, convenience and access for all users of public transport. The needs of disabled people should be given full consideration, with an emphasis on the avoidance of steps and barriers; provision of clear information signs and the introduction of appropriate public service vehicles, and;

- To provide on site customer services and high level security at park and ride sites and other identified locations.

2.2.10 The document goes on to promote specific bus priority measures within the City Centre and on the main arterial roads to the City Centre, specifically;

- The A4067, Oystermouth Corridor;
- The A483, Port Tenant Corridor;
- The A483, Fforestfach Corridor;
- The A4067, Morriston Hospital Corridor;
- The B4489, Llanyfelach Corridor, and;
- The A4118, Killay Corridor.

2.2.11 Mention is also made to the consideration of innovative public transport systems to link the railway station with the Quadrant. Further, Policy T6 mentions improvements to Bus/Rail interchange at the Station, including the development of a circular public transport routes linking key city centre destinations. The Plan also favours the opening of further railway stations and providing new services from Llanelli.

Parking Strategy

2.2.12 The parking strategy and plan is designed to be supportive of the sustainable transport plan including the development of a comprehensive parking demand management system, upgrading existing car parks, provision of park and ride schemes and to discourage city centre visitors from parking in adjoining residential streets. Although the plan encourages provision of parking to full standards which might encourage car use, it introduces the policy of commuted sum payments from developers towards the costs of provision of park and ride facilities.

2.2.13 The plan sets a limit (or target) of public parking in the city centre of 9,000 spaces (around 600 spaces more existed at the time of the Swansea Parking Study in 1994) and encourages their treatment to discourage peak period road use and increase their turnover. I.e. a reduction of long-stay commuter parking and increase in short-stay parking. In addition the plan proposes a computerised car parking signing system and a charging regime to deter peak period road use.

2.2.14 Park and ride sites are being sought in four corridors, these are as follows with a statement regarding the current position;

- The A483 Fabian Way – site identified, not yet secured;
- The A4067 at Landore – current site at Morfa Stadium;
- The A483 Carmarthen Road at Cwmdu – site not yet secured, and;
- The A4067 Oystermouth Road – existing site at St Helens.

2.2.15 The existing park and ride sites are poor quality in terms of the parking spaces, the bus stop facilities and highway and bus access. The improvement of the quality of the facilities is being sought through the Transport Grant bid process.

2.2.16 The Transportation Strategy is further amplified in the 1997 (Draft) document, which emphasises the importance of public transport amongst the encouragement of shorter journeys, promotion of network efficiency and promotion of strategic routes. The Parking section refers to the need to review parking needs in local centres and update the parking standards for new developments in partnership with other South Wales Authorities which seeks to apply maximum parking standards and to locate development appropriately in accordance with public transport accessibility levels.

2.2.17 The Transportation Strategy proposes encouraging Public Transport use through improvement to the security and quality of the systems, including investment in bus priorities, information and marketing, stops and stations, etc. The document reflects the deregulation and privatisation of public transport and the need to work in partnership with operators and developers to secure quality vehicles and infrastructure. The document also promotes walking and cycling through the development control process, the promotion of a cycle network, the protection of public rights of way and increasing public awareness of transport, environment and health issues to encourage use of sustainable modes.

City Centre Strategy

2.2.18 The Draft Transportation Strategy emphasises the issues relating to the City Centre. Particularly increasing traffic volumes and pedestrian severance, the impact of traffic on the environment, access difficulties and parking constraints. The document proposes a city centre management system based on securing investment to complete a transport 'box' and to promote a tram route/ bus priority route within a highway box enabling public transport priority and improvements to the pedestrian environment.

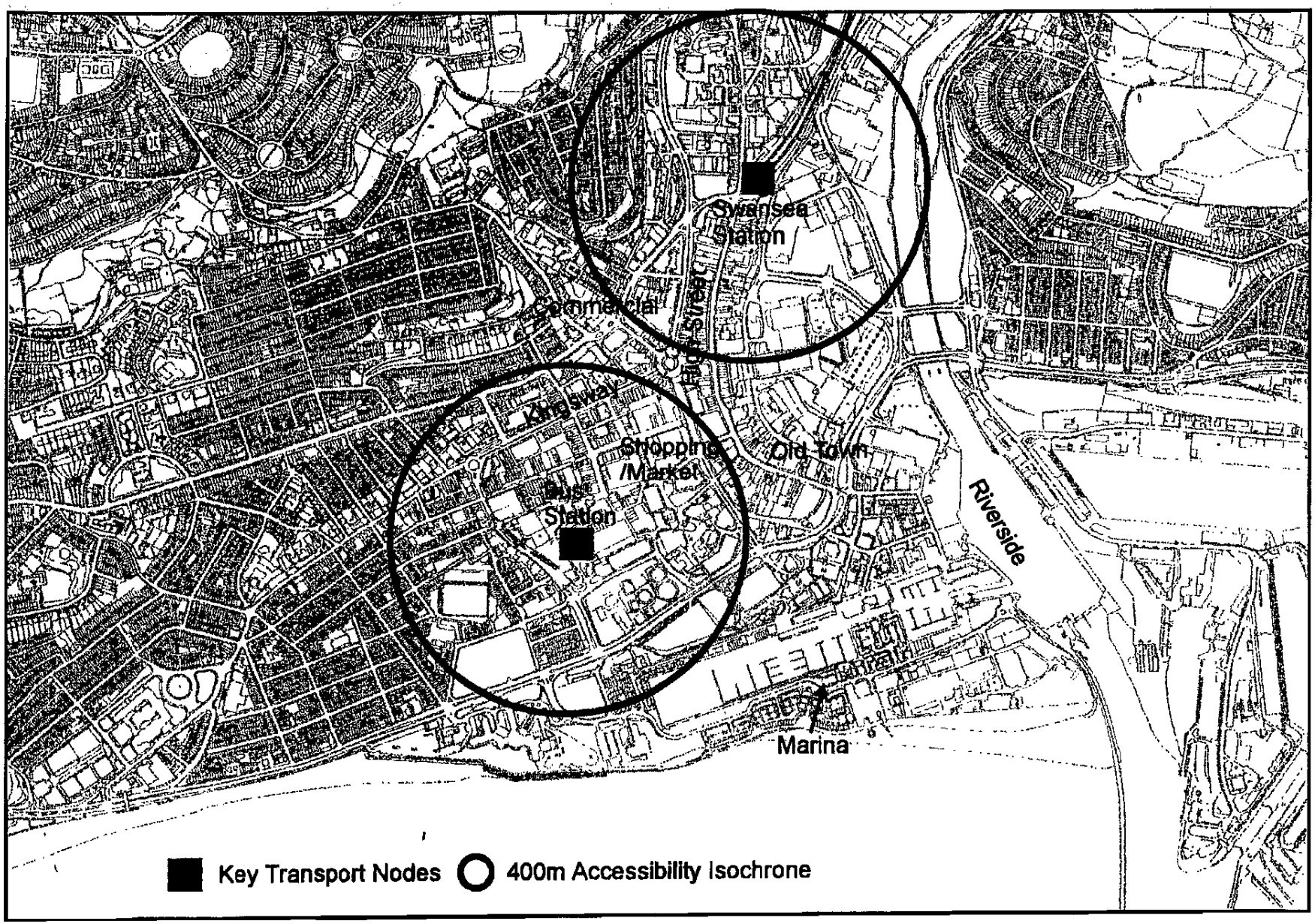
2.2.19 This strategy is in line with the conclusions and recommendations of a wider City Centre Study concerned with securing development and growth in the City Centre. The study, undertaken for the City and County of Swansea was led by URBED and involved the assessment of the economic background including a 'health' check, the development of a vision and development strategy and specific proposals for the environment and access. The Study noted that attractions are relatively sparse and that there was significant out-of-town development and jobs although the City Centre was still important, having 20,000 jobs accessible without a car.

2.2.20 The development plan emphasised the transformation of the old town and improvement of the environment of streets and 'gateways'. In this context the Castle Quays development is proposed to extend the retail area to the north east, towards the railway station. This 35,000 sqm development, will provide an increase in gross retail floor space of 7,300 sqm and is shown in the Swansea Local Plan Review (1998) to provide the additional parking spaces sought in the parking strategy.

2.2.21 The proposals recommended from the study included City Centre Management, the development of distinctive 'quarters' including the old town and High Street Gateway, providing a wider choice of shops, promoting visitors, conferences, wider leisure attractions and a 'living heart' to the City Centre. These are shown in Figure 2.1 which also shows the accessibility of the quarters from the existing transport nodes, using 400m isochrones to represent realistic walking distances.

2.2.22 Figure 2.1 shows that most of the main retail and commercial quarter is relatively inaccessible from the railway station and that the distance between the bus and rail stations is beyond the acceptable walking distance, at around 1km. Also, much of the developing area to the south and east of the city centre is not accessible by walking from either of the transport termini. In reality accessibility from some bus services is greater due to their City Centre looping and additional stops.

2.2.23 The conclusions of the transport assessment were in line with the transportation strategy, providing easier access, priority for pedestrians and better parking management. It also emphasised the need to develop the public transport gateways of the Railway and Bus Stations and to encourage car users to leave their vehicles at the periphery and park and ride. The report recommends the ' establishing properly the feasibility of a light tram to link up the different attractions in the centre, as in a resort'.



SWANSEA LRT STUDY

City Quarters and Accessibility from Key Transport Nodes

Figure 2.1

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3 Overview Of Scope For LRT In Swansea

3 Overview of Scope for LRT in Swansea

3.1 EXISTING TRANSPORT SYSTEMS

Bus Services

3.1.1 Bus services have been assessed for key movement corridors only.

3.1.2 In the Oystermouth and Mumbles corridor there are four different bus routes (2, 2A, 3 and 37), providing 10 services an hour between Swansea and Oystermouth. Three of these operating every 20 minutes, with the 37 operating hourly. Service 2 is the only direct service, using the Mumbles Road for its entire journey, whilst the others serve the University, Singleton Hospital and the different housing estates to the west of the corridor, before regaining the Mumbles Road at Norton. On arrival at Oystermouth, Service 2 continues on to serve Newton on a loop, with the other services terminating at the bus station.

3.1.3 In Swansea City Centre, on departure from the Quadrant bus station, these services run west along Oxford Street, then St Helens Road and Guildhall Road South, reaching the Mumbles Road by the Patti Pavillion. In-bound vehicles operate along Guildhall Road South, St Helens Road and Dillwyn Street West to the bus station. St Helens Road is a popular alighting point for in-bound passengers. At present, there are no direct services between the Quadrant, County Hall and Oystermouth.

3.1.4 Service 2A is a popular route for students, as it provides a direct route to the University from lodgings in Oystermouth and also from the city centre. Between the Hospital and the University, a bus gate is used both ways, which has a 'no-entry except buses' restriction eastbound.

3.1.5 In the Morriston Corridor Services 4, 4A, 5 and 122 operate, providing 7 buses an hour to Morriston Cross, the 4, 4A and 5 being on 30 minute frequencies. All services follow the same route along High Street, Neath Road, St Martins Street and Woodfield Street to Morriston Cross.

3.1.6 The main areas of congestion in the Morriston Corridor is around High Street and the station, along with the south end of Neath Road which has been traffic calmed using speed cushions and mini roundabouts. Further along Neath Road, the road widens, with the majority of the through traffic extracted onto the new Ffordd Cwm Tawe By-pass, giving relatively little traffic. Most of the houses along this road use on-street parking spaces on both sides of the road, whilst still maintaining one lane in each direction.

3.1.7 The Carmarthen Road is a dual carriageway situated part way up the north side of the valley. The majority of the housing is to the north of the road, with the stops close to pedestrian crossings. The main road is served by two buses per hour (routes 103 and 104), whilst Middle Road, just to the north through the housing is served by 4 buses an hour (routes 110, 111 and 112).

3.1.8 When considering this corridor for light rail, the possibility of a park and ride site at the Swansea West Service Area at junction 47 of the M4 should be considered. At present the 103/104 passes the site, but does not call. From observations, the possible LRT catchment from the 103/104 appears to be smaller than on the other two corridors, with the majority of these passengers continuing beyond the M4.

3.1.9 One of the problems with this corridor is the height difference between Carmarthen Road and the housing. Many of the passengers on the 111 surveyed were elderly, and would probably find it difficult to walk to and from the Carmarthen Road.

Rail Services

3.1.10 The main rail services in the area are provided by Great Western Trains on the main line, and by Wales and West on the Alphaline and Swanline services between Cardiff and Swansea. Some services continue on to Milford Haven and Haverfordwest. Generally there are around 3 services an hour from the east with one continuing to the west.

3.1.11 Swanline services call at all stations between Bridgend and Swansea, whilst Great Western services generally only call at Bridgend, Port Talbot Parkway and Neath. Local stations at Skewen and Llansamlet (between Neath and Swansea) have a significant commuter base, and it is expected that large proposed residential developments near Llansamlet will increase patronage at this station.

Parking

3.1.12 There are currently around 12,600 parking spaces in the city centre, with 2,737 in the central zone and 9,893 in the outer zone. Within the inner zone around 86% of parking is publicly available, the majority being off street and 15% are private non-residential (PNR) Spaces. In the Outer Zone around 61% of parking is publicly available split more evenly between off street and on-street (largely uncontrolled) spaces. 3% of parking is for resident permits and 36% of parking is PNR.

3.1.13 In total there are around 8,400 publicly available spaces, 5,800 off street, 2,150 unlimited on-street and 500 limited on-street. The City Local plan

seeks to increase this provision to a maximum of 9,000 spaces. However, the 1994 parking study recommended that the parking strategy should allow development to erode the parking supply and to provide park and ride spaces, which largely forms the Council's plan. The 1994 study also recommended taking control of the unlimited on-street parking and recommended a Voucher System of control. Whilst this would raise parking revenues, which would be useful to support park and ride costs, for example, it would be unpopular, especially with infrequent visitors. However, such a system might encourage more public transport use by visitors.

3.1.14 Parking prices vary by location and parking duration ranging from 70p per hour short stay, with 2 hour and 3 hour stays permitted, to between £2.10 to £3.00 for 4 hours. Long stay parking is available in multi-storey car parks at a cost of £4.20 and £4.50 for up to 9 hours. However, High Street Multistorey is charged at only £1.75 for up to 24 hours. Also, long stay car parks further out of the centre are available at £1.75 per day.

3.1.15 These relatively low all day charges encourage car use and limit the fares that could be charged for a potential LRT system.

3.1.16 The current transport plan aims to improve the quality and security of the existing public transport services and facilities. The Transport Grant Bid (1999/2000) includes proposals to develop the park and ride facilities starting with the Landore site with the development of a segregated express bus route from the site to Railway Station using available land alongside the rail lines. There are also proposals to improve the interchange between bus and rail at the Station by relocation and rearrangement of the Short Stay parking and taxi facilities.

3.1.17 The development of Light Rail systems in the City must be viewed in terms of their potential over and above what can be achieved from the existing transport plan based on bus services and traffic management. In particular the proposed integration of transport at the railway station could lead to an identifiable bus link between the Quadrant bus station, main shopping areas, rail station and the Landore park and ride site. This could provide much of the benefits being sought from the city centre light tram system at a significantly lower cost.

3.2 CURRENT DEMAND LOCATIONS

3.2.1 A successful light rail system must be designed to serve (many of) the key demand locations in the City and to meet the objectives of providing access between transport facilities. The study brief identified core demand

locations for consideration of the route of the light tram system, this list has been expanded through the review of previous studies, discussion with operators and the council and site visits. The key demand locations are shown in figure 3.1 and comprise;

- Swansea Railway Station
- Quadrant Bus Station
- Peripheral Car parks
- Core Shopping area
- Business Area
- Old Town
- The Guild Hall
- The University
- Singleton Hospital
- The existing and proposed park and ride sites.

3.2.2 However, as well as serving movement between these, largely town centre, locations, an intensive public transport system should seek regular demand locations to serve directly. Indeed, transport plans should seek to minimise interchange as this is a major deterrent to public transport use and other key corridors of movement should be examined for serving by the rail system as an alternative to providing only for interchange movements. In this context the following corridors were identified as offering the most potential public transport demand for Light Rail;

- Morriston
- Carmarthen Road
- Oystermouth/ Mumbles.

3.3 PROPOSED DEVELOPMENTS

3.3.1 In addition to considering the existing demand locations, as a light rail scheme will be developed over some years and will be designed to meet the long term development plan, key development proposals and aspirations should be examined. These have been identified as;

- The Castle Quays Shopping development, between Park Street, Kingsway, Castle Street and Oxford Street;

- The recently announced National Maritime Museum, which it is assumed will be developed by expansion of the existing Museum;

- The new Covered Stadium to be located at Morfa and;

- The further development of the eastern approach to the city centre and redevelopment of the docks.

3.4 PREVIOUS STUDIES

Swansea and Mumbles Tramway

3.4.1 The Swansea and Mumbles Tramway Feasibility Study was undertaken by South Wales Transport Ltd in 1989. It examined the options for a largely tourist related proposal, based on 'heritage' vehicles available on the continent. The study discounted other options such as road-trains, steam rail and diesel rail. The study contained a detailed engineering review of the former Mumbles railway line, but little detail on the estimation of demand and revenue.

3.4.2 The proposed scheme involved the reinstatement of a single track with passing loops and second-hand vehicle purchase to provide a 15 minute frequency service with an estimated journey time between Swansea and Oystermouth of around 20 minutes, based on operating speeds in Blackpool. Such a system, largely aimed at the seasonal tourist market, would have cost over £2m, not accounting for the potentially high costs of the diversion of Statutory Utilities equipment.

3.4.3 In 1996 the Mumbles Railway Society made a Millennium Fund bid for a modern Tramway proposal along the coastal formation, with a estimated cost of £19.5m, assuming the donation of land from the council. This outline bid contained little detail on the financing of the scheme and, receiving little support from the Council, was unsuccessful.

Transport Needs Study.

3.4.4 In 1992 consultants produced a transport strategy review for the period to the year 2000 and beyond for the former West Glamorgan County Council. This study involved the development and application of transport models and predicted acute traffic congestion on Swansea's main radial corridors.

The study recommended an integrated transport strategy based on;

- Public transport investment
- Some highway improvements
- Public transport priority.
- Park and Ride, integrated with;
- Parking policies to deter car journeys.

3.4.5 The study evaluated guided bus, Guided Light Transit (GLT), LRT and Traditional Rail options and recommended Kerb-Guided Bus as most appropriate for the City. The study concluded that the higher capacity systems such as light rail lines were not required in Swansea and were prohibitively expensive. Also, track sharing between light and heavy rail to Port Talbot and Llanelly were discounted.

3.4.6 The recommended strategy included the development of the City Centre bus priority 'box' - a one way route through the Centre on pedestrianised and Service only roads, separated from the strategic highway network, further away from the Centre. This along with the heavy rail service development and guided buses on the key radials leading to the park and ride sites, forms the basis of the current transport strategy which has been partly implemented.

Swansea Light Tramway System (Parry People Mover) Feasibility Study.

3.4.7 Swansea City Council commissioned JPM Parry and Associates to undertake a study of the feasibility of introducing a Parry People Mover light tramway, which was reported in 1995. The study objectives were; to link the Railway and Bus Stations, and; to link car parks (particularly the under-utilised multi-storey next to the railway station) with the City Centre shopping areas. The overall aims of the system were in line with environmental, safety, reliability and innovation objectives of the local authority.

3.4.8 A City Centre loop system was proposed from physical inspection and costs were estimated at around £1.5m. Pedestrian flows were measured and used to provide a revenue estimate of £460,000 per year assuming a 30p flat fare. The proposed scheme involved 2 loops, north and south of the City Centre and assumed a 6 vehicle fleet providing a 5 to 10 minute service headway. The assumed system had a maximum speed of 30mph and average speeds of 10 to 15 mph were assumed. A depot location was also sought and two

options were identified, the former bus garage in Plymouth Street (now proposed to be used to expand the Grand Theatre) and the old bus depot in Clarence Terrace.

3.4.9 A public demonstration of the Parry System using a narrow gauge track was organised and a survey of passenger reactions revealed that 83% of people were in favour of the system being implemented in the City Centre. Also, 63% stated that they would use their cars less. 91% wanted frequent public transport service linking the bus and rail stations and 81% of people interviewed stated that they would use the Parry People Mover service. However, the survey sample was less than 200 interviewees and consisted only those who attended the demonstration and could not therefore be used for financial planning or assessment of total reaction to the system.

3.4.10 The City Council commissioned a study from Halcrow Fox to evaluate the potential patronage from the Parry People Mover System. A different route was assessed involving a single long route around the City Centre. Market Research (using Stated Preference techniques, suitable for the assessment of new modes) was used to calibrate a diversion curve 'logit' model, applied to a City Centre trip matrix. This was formed from Pedestrian Counts and Origin Destination surveys revealing peoples final trip destinations, and using the Swansea Shopping Survey and car parks Statistical report (1993/94) and traffic counts.

3.4.11 The forecasting model estimated that 10% of trips to the City Centre would use the people-mover (around 4,000 trips per day) producing around £400,000 revenue per annum. The study also revealed a capacity problem and requirement to 'cap' for forecast, a high sensitivity to frequency, poor/good weather impacts on ridership and sensitivity to real time information about vehicle arrivals.

3.5 DEFINED LIGHT RAIL TRANSIT CORRIDOR OPTIONS

3.5.1 From consideration of the existing transport situation, key existing and future demand generators and the previous study results and conclusions five main options for further investigation as Light Rail alignments were defined. These are shown in Figures 3.2 and 3.3 and are;

- A City Centre distribution system based on the Parry People Mover studies and City Centre Strategy recommendations;
- The Mumbles and Oystermouth Corridor largely following the previous Mumbles Railway;

- The Carmarthen Road Corridor, making use of the available highway capacity;

- The Morriston Corridor, and;

- The extension/ conversion of existing rail lines and services, involving shared running of the rail infrastructure with other rail services.

3.6 LIGHT RAIL MODE OPTIONS

3.6.1 There are many different forms of segregated and improved public transport that can be considered for development. These range from a variety of bus based systems to rail based tramways and railways and to monorails and automated people movers. The different systems have differing levels of segregation from traffic and pedestrians and have differing capacities and costs.

3.6.2 This assessment excludes the traditional bus based options, bus priority lanes, segregated busways and kerb-guided buses, which are being promoted through the existing transport plans. Equally, we have discounted the further extension of the heavy rail network and the development of monorail and automated transport systems due to their high costs, impracticality of segregation within the City Centre and/or their impact on the urban environment and person movement.

3.6.3 Automated light railway systems can encompass a wide range of alternatives often designed for a specific people mover role, including the Maglev, magnetic levitation system developed for a people mover link at Birmingham International Airport in 1984. This is not now in use due to high maintenance costs. Also Unimobil rubber wheeled units guided by a steel track, which is in use at several US pleasure parks but, like the monorail is elevated and is not considered appropriate for a city centre. Also the Soule SK, cable hauled vehicles, developed as a prototype system at Charles de Gaulle Airport in 1986 which is also elevated.

3.6.4 By implication we have therefore also excluded a range of alternative fuel buses from the study, although these could meet environmental objectives but would offer little other benefit compared to the improvement of existing bus services. This list includes Trolley Buses, Duo-buses (hybrid trolley/ diesel/ LPG/ Battery buses for operational flexibility away from trolley bus operating areas), Battery buses and alternative fuels including ethanol, rape seed oil, compressed natural gas (CNG) and Liquid Petroleum Gas (LPG). Existing bus services can be converted to these cleaner fuels which result from gas burning more slowly and thoroughly than diesel.

3.6.5 The study therefore concentrates on the more traditional and rail based alternative systems, which are compatible with street running with other traffic. These are generally termed light rail and ultra-light rail.

Light Rail

3.6.6 Light Railways or tramways developed from the early electric tram systems common to most British cities until their replacement by diesel buses in the 1950's. These systems were retained in many locations on the continent and have developed significantly on a range of different rail gauges and vehicle designs. Light railways of tramways generally operate from overhead electric wires supplying, typically 750 Volts DC power. Fully enclosed single deck vehicles usually provide a significant area for standing and are increasingly being developed to a low floor standard.

3.6.7 Several British Cities have sought the re-introduction of light rail systems at considerable expense and have secured modern designs with low floor vehicles and/or level boarding and a high level of information and quality facilities integrated to provide a significant shift in passenger benefits compared to the bus or rail services they replaced.

3.6.8 Electric power provides a significantly improved performance compared to heavy rail, in terms of acceleration and deceleration, due to their lighter weight as they are not designed to withstand the same impact forces as traditional rail vehicles. The rail guidance provided a smooth ride for passenger comfort and the rails add to passenger perception and confidence in the certainty of the system. The lower forces exerted by the LRV on track and structures results in lower capital costs and the shorter, usually articulated, vehicles enable sharp bends and steep gradients (compared to conventional railways) to be incorporated into the route.

3.6.9 The ability to operate light rail on tracks fitted into most urban surroundings means that light rail can be made fully compatible with the following situations, with the associated rules applying;

- Pedestrianisation – Requires slow moving LRV and sufficient walkway space required, enables direct access to passenger destinations. Rails are flush with the ground presenting few problems of access across the alignment – most tramways and light rail systems have some sections within pedestrian areas.

- Un-segregated – with road traffic, congestion is a potential problem and should therefore be limited to small sections is possible.

- Segregated – alongside/ using existing road/ rail alignments. No new alignment required – the ideal, if possible, for routes from suburb to centre.

- Grade Separated – elevated or underground – expensive and restricted to essential places only.

- Combined Running – with conventional rail vehicles. Automatic train protection (ATP) or temporal segregation required.

3.6.10 Light rail systems usually have a mix of the differing operating conditions, depending on the requirements of the area served. Their specification and performance can also vary depending on the local requirements and should therefore not be seen as one mode, but rather a family of systems with similar characteristics. For example, the need to cope with steep gradients in Sheffield require a larger and heavier (and more expensive) vehicle with all bogies motored. Comparative information for different systems is given in Table 3.1.

Ultra-Light Rail

3.6.11 Even the relatively low costs of light rail systems are considered prohibitive for some towns, particularly where demands are lower and a number of ultra-light rail based transport systems are being developed. Examples include the Pullman Light Rail Car, based on bus and lorry vehicle technologies, coupled with a lighter street rail developed by Lewis Lesley at Liverpool University, also the Parry People Mover System developed on narrow gauge railway track with a charged flywheel automotive system. The Pullman/ Lewis Lesley rail system is a cheaper form of light rail, whereas the Parry People Mover (PPM) is a smaller capacity system which can be considered as a separate technology.

3.6.12 The PPM is a system involving manually driven small vehicles, powered by flywheel and run on ordinary lightweight tram tracks. The PPM has been in use as a visitor attraction at Himley Hall in the West Midlands and has recently entered regular service as a people-mover between a car park and the SS Great Britain in Bristol. Following a series of demonstrations on test tracks, the Parry Group are promoting the system as a low-cost alternative to conventional light rail and are investing in the development of a range of vehicles to cope with differing operating requirements. Several recognised public transport rolling stock and systems providers are now involved with the development of the system and several Cities have expressed interest in developing systems.

3.6.13 There are a number of advantages to the PPM system compared to heavier, more traditional, systems, particularly the absence of overhead power lines and its smaller scale, reducing costs. The flywheel is recharged at intermediate and terminus stations by drawing electric power while waiting for passengers to load and unload.

3.6.14 PPM vehicles can be designed to carry between 25 and 40 and run on either 600mm, 1000mm or 1435mm(Standard) gauge. A larger vehicle, capable of carrying 80 – 90 passengers, is being developed. The vehicles are powered by energy stored in a rotation flywheel driving through a continuously variable transmission (CVT). The vehicles are 1.95m wide, 2.1m high and 3.2m long (check latest spec) and weight between 3 and 4.4 tonnes (dependent on flywheel size). The low vehicle weight (and resultant axle weight) means that the tracks do not require as strong a sub-base, reducing construction and maintenance costs. The maximum speed is approximately 50 kph.

3.6.15 The size of the flywheel depends on the gradients to be tackled, the size and required range of the vehicles in service. It is estimated that a PPM system could cope with gradients of up to 8%, though this remains un-proven, and the minimum radius of curvature is 15m (narrow gauge) or 25m (standard gauge). The flywheel is also 'recharged' going downhill – a form of regenerative braking. Instead of the flywheel powering the vehicle, the vehicle turns the flywheel, accelerating the flywheel as the vehicle decelerates. Additional braking is provide by disc and track brakes.

3.6.16 The flywheel requires charging at termini and intermediate stops using a short section of electrified 'third' rail. This powers an electric motor to rotate the flywheel more quickly and restore energy within the flywheel. The electricity supply is 72 volts dc and therefore harmless. Latest vehicles are to be equipped with small diesel or LPG motors for emergency (return home) operation including moving vehicles around within the depot. Inter-urban operations require more assessment and trials of the PPM as the maximum station spacing so far provided is around 700m and charging times can be between 30 seconds and 2 minutes. However, Centro are considering the PPM for a replacement for a current rail link at Stourbridge Town/ Junction in the West Midlands. They require a larger vehicle to handle the anticipated demand and the station spacing is over 1km.

3.6.17 PPM capacity is estimated at 1500 passengers per hour per direction assuming 1 minute headways at an average speed of 12 kph. This could be doubled to 3000 pphpd with 2 vehicles in multiple. This can be compared with traditional Light Rail Capacities of 1000/2000 (single vehicle/coupled pair) pphpd at 15 minute headways to 5000/10000 pphpd at 3 minute

headways. Most urban systems provide around 2500/5000 pphpd capacity with headways between 5 and 10 minutes..

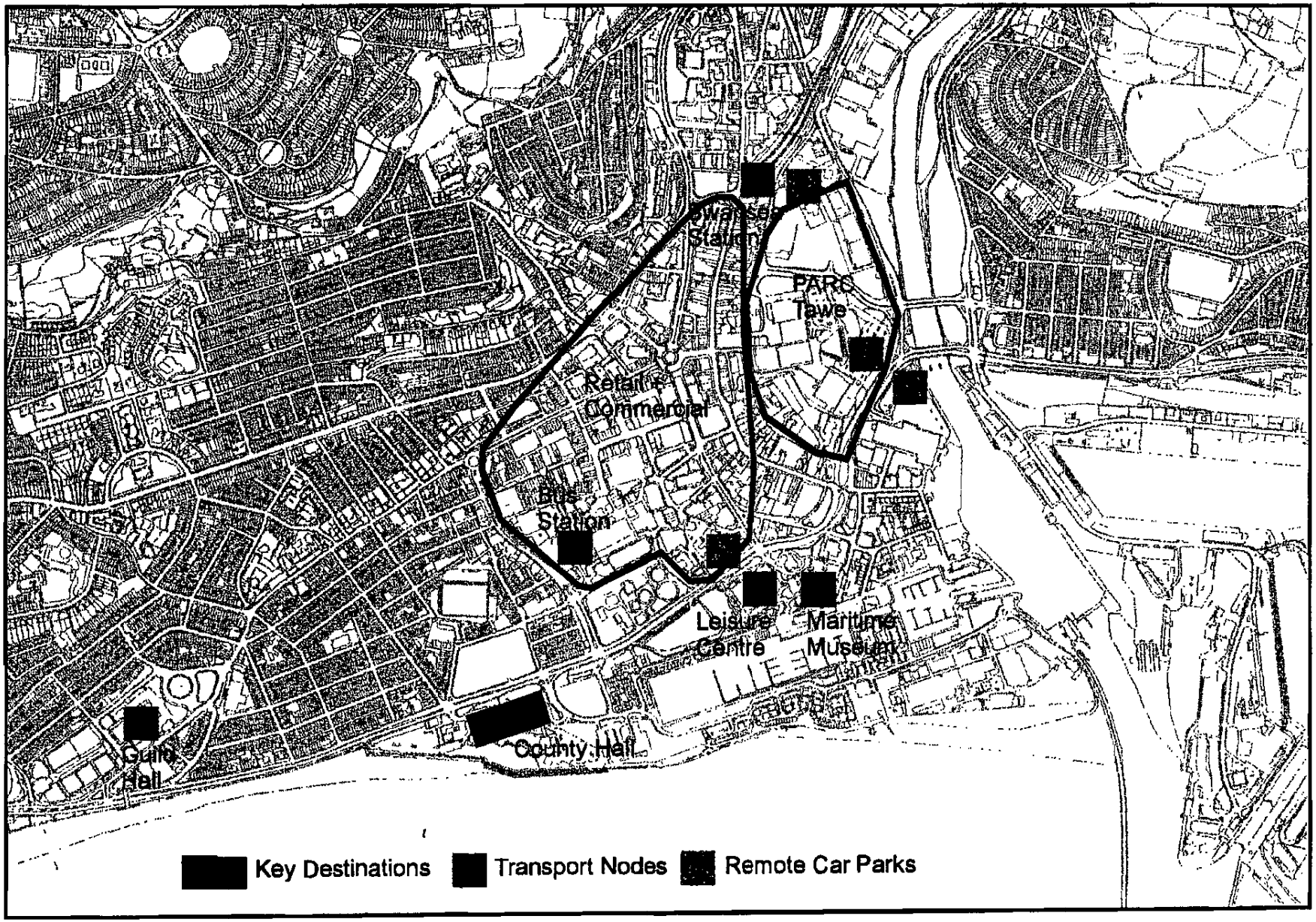
3.6.18 A further light rail option available is the Guided Light Transit (GLT) system developed and in operation in France. This system uses a rubber tyre based vehicle of similar size and design specification as a modern light rail car, with electric power akin to a trolley-bus system and a 'slot' guidance mechanism with a central slot cut into the road.

Table 3.1 Characteristics of Selected Light Rail Systems

	Manch'r Metrolink	Midland Metro	Croydon Tramlink	Grenoble Tramway	Nantes Tramway
Vehicle					
Max speed (kph)	80	75	80	75	70
Av. Speed (kph)	n/a	35	23.3	19.5	21
Max gradient	6.5%	6%	8%	6%	n/a
Max accel'n (m/s/s)	1.3	1.2	1.2	1.2	n/a
Min. turning circle	25	25	25	24	n/a
Vehicle length	29	24	30	29.4	39.2
Vehicle height	3.36	3.67	3.6	n/a	3.25
Vehicle width	2.65	2.65	2.65	2.3	2.3
Vehicle floor height	0.915	0.35	0.35	0.35	0.35/0.87
Capacity	206	160	208	184	236
Ratio (seat:stand)	86:120	58:102	70:138	58:126	74:162
System					
Station spacing	1.47 km	0.91 km	0.88 km	0.43 km	0.45 km
Route length	30.9 km	21 km	28 km	14.6 km	16.5 km
Track length	65 km	n/a	64 km	n/a	n/a
Capacity					
Service (Off Peak)	12 mins	10 mins	10 mins	6 – 10 mins	6 mins
Headway (peak)	6 mins	6 mins	n/a	2 mins	4 mins
Capacity (pphpd)	2100	1600	n/a	5200	3450
Capital Cost					
Total Cost (£m)	115 [a]	145 [b]	200 [b]	134 [c]	75 [c]
Vehicle Cost (£m)	21	21	n/a	31.5	28.3
Infrast're Cost (£m)	88	124	n/a	56	39.8
Cost/station (£m)	5.8	6.3	5.3	6.1	3.4
Cost/route km (£m)	3.7	6.9	7.1	9.2	4.5
Operating Cost					
Op.cost/vehkm (£)	3.1	2.0*	2.8*	n/a	22.7FF

* = forecast

[a] 1988 prices, [b] 1996 prices, [c] 1989 prices.



SWANSEA LRT STUDY

Key City Centre Destinations

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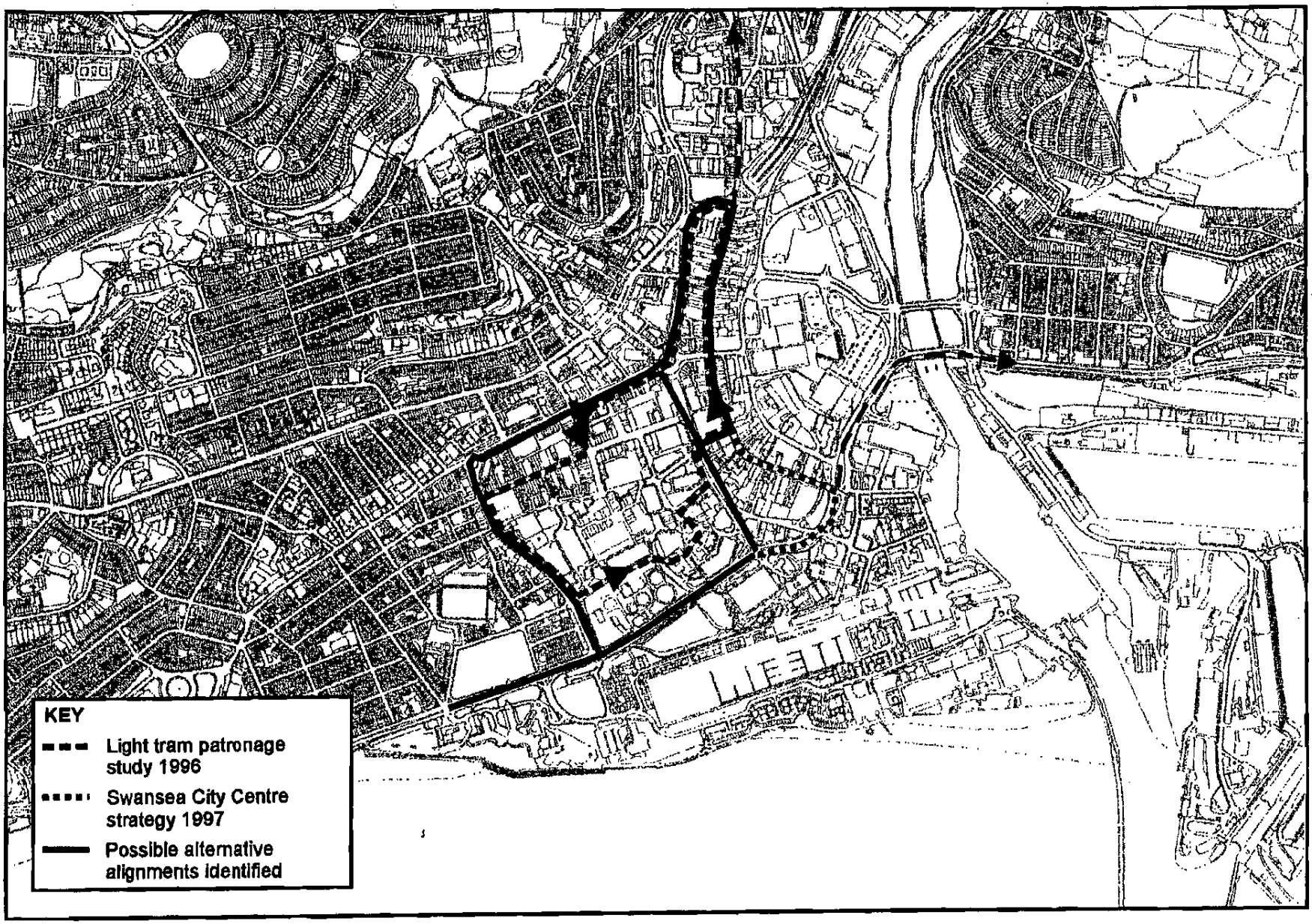
Figure 3.1



SWANSEA LRT STUDY

Light Rail City Centre Routing Options

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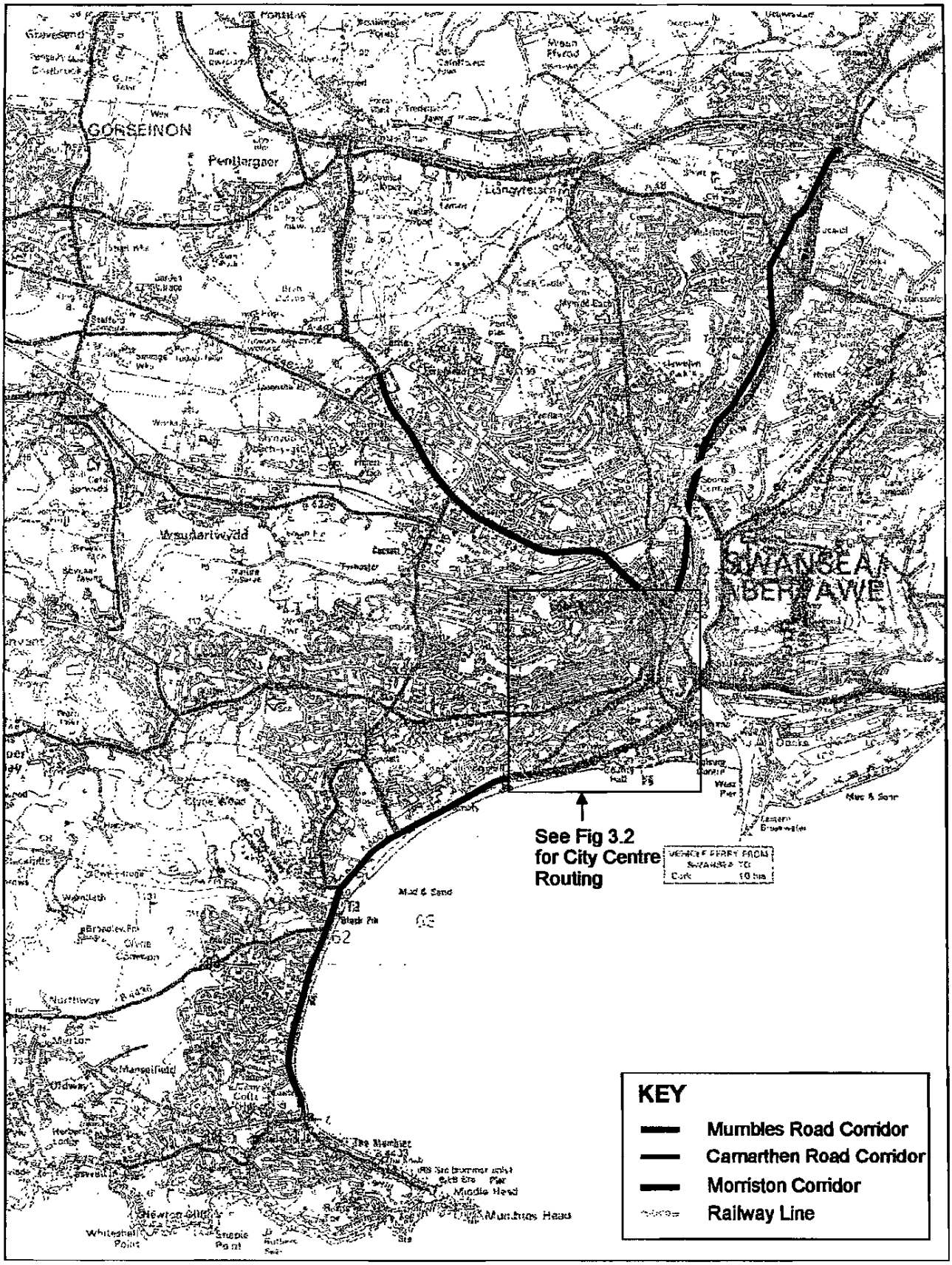
Figure 3.2



SWANSEA LRT STUDY

Study Corridors

4 Corridor Opportunities And Constraints

4 Corridor Opportunities and Constraints

4.1 APPROACH

4.1.1 For any new public transport corridor, it is imperative to determine where the major origins and destinations lie so that the most effective solution, both in terms of cost and markets served, may be promoted. This is particularly important when considering fixed modes of transport such as LRT to ensure that the most beneficial alignment is adopted.

4.1.2 There is, for example, no merit in a new LRT being proposed to follow the course of an old railway simply because it is there and would potentially make construction easier. It is essential to determine the markets to be served, their location and sphere of influence and then identify the best corridor to be used. If this should coincide with a rail alignment (whether in use or not), only then is it worth considering such alignment as worthy of use for LRT.

4.1.3 New LRT routes are, by their very nature, capital intensive to initiate. A variety of Government and European grants may be available to assist but if ongoing subsidy is to be avoided, it will be necessary to demonstrate that the day to day operational costs will, at the very least, be met through the farebox.

4.1.4 To ensure that LRT routes capture enough demand and revenues, particularly from existing car users, to cover the operating costs and provide economic justification for the capital expenditure they must be segregated from road traffic and operate at a sufficiently high speed and frequency.

4.1.5 Site visits have been made to each of the routes, the physical features and their suitability for use as an LRT route. The following route descriptions outline the broad physical features of the potential route corridors. Where appropriate, comments are made regarding the suitability of the existing road layouts and other features that may influence the location, design and operation of an LRT.

4.2 CITY CENTRE

4.2.1 The 1997 Swansea City Centre Strategy report recommended developing a city centre light tram route to;

- Start from the multi-storey High Street car park/ station;

- Run down High Street and Wind Street;
- Cross over Oystermouth Road to connect the Old Town and Swansea Museum;
- Run along the 'old tramway' alignment to the Leisure Centre and County Hall;
- Extend along the old route to the Guild Hall, the Hospital and University and the park and ride site (St Helens);

4.2.2 The study recommended that the system should provide good links with the bus station and railway station and the primary shopping centre and Castle Quays development. The study recommended using brightly coloured light-weight vehicles, possibly powered by battery to avoid intrusive (overhead) wires and to test the route with a 'fun bus'.

4.2.3 This route differs from the 1996 work, which used High Street only as far as Caer Street. It then used Princess Way to reach St Mary's Square and St David's Square. The 1996 route did not reach the Oystermouth Road, serving only the core shopping area.

4.2.4 Figure 3.2 shows the alternative alignments, which need to be considered in more detail in terms of the demand generation and policy objectives. The final routing needs checking for the impact on buses, servicing traffic and pedestrians and there are clearly alternative routes that can be assessed in detail. However, the potential to serve the City Centre by a through running LRT, and the route required, depends on the assessment of the individual corridors.

4.2.5 Detailed geometric assessment reveals that the route selected for the Parry People Mover has many very tight curves. The route would only be practical with small vehicles on narrow gauge track able to cope with 12m radii. This is considered inappropriate as the previous study showed capacity problems with the PPM and a larger vehicle (PPM or otherwise) is required.

4.2.6 Full size Light Rail systems require at least 25m radii and preferably 50m radii to negotiate turns at a reasonable speed and to minimise wheel noise. At 25m radii many of the PPM route corners would require use of the whole road. The following are junctions which present difficulties;

- Oxford St/ Dilwyn St; 25m radius requires part of the car park and very tight requiring whole carriageway at 12m;

- Union St/ Kingsway; requires carriageway width at 25m radius; also;
- Oxford St/ Unions St;
- Castle Bailey St/ Caer St/ Princess Way;
- St Mary's Square;
- St David's Sq to Thomas St.

4.2.7 In selecting a Light Rail route these tight radii should be avoided to allow a wider range of technologies to be considered.

4.2.8 Dilwyn Street is only 9m wide between kerbs and 17m between properties. Light Rail would need to run with general traffic in this section without stopping. This should not present any problems.

4.2.9 Kingsway is 16m wide (between kerbs) at the narrowest point and widens to up to 25m in places. This should enable a design for segregating the bus and Light Rail services at stops to minimise operational interference between systems.

4.2.10 Wind Street is only 9.5m wide requiring the Light Rail to share the highway with other traffic and probably preventing stops in this section. Princess way is wider at 15m in the narrowest points and 20m wide at the northern end. This provides more opportunity to provide a Light Rail alignment with operational segregation from buses to benefit both systems. LRT in Princess Street would require operation through the pedestrian section to reach Kingsway.

4.2.11 The presence of the former bus garage at Clarence Terrace offers the opportunity to site an LRT depot in the City Centre , with little dead-mileage required to initiate operations. Access to the depot from West Way would require 25m turns and removal of the subway. However, this site is considered small for a significant Light Rail network, which would need to be checked and compared with other options at a detailed feasibility stage.

4.2.12 Unless a small vehicles system is the aspiration for the future, the routes involving tight radii (1996 report)(figure 3.2) should be avoided, and the Dilwyn Street/Kingsway or Oystermouth Road/Princess Way routes should be adopted. These roads are sufficiently wide to provide for bus and LRT operation, but require detailed design.

4.3 MUMBLES CORRIDOR

Overview

4.3.1 This corridor largely mimics the route of the former Mumbles Railway which closed on 5th January 1960. The majority of the alignment west of the city has been converted to a well-used cycle and pedestrian way, the "Swansea Bike Path". The overall distance from the city centre to The Mumbles is around 10kms.

4.3.2 In order to achieve the re-instatement of a public transport facility along this former alignment, at minimum expense, would require significant alteration to this cycle way. Given the comparatively narrow width available, introduction of an LRT would render the alignment unusable for continued use as a cycle way. Pedestrians might be accommodated depending on the need for a single or double track LRT, albeit on a very much reduced width compared to today.

4.3.3 The loss of the cycleway would be contrary to the council's policy and therefore, if greater disruption (and consequently cost) were justifiable, it would be possible to relocate and/or realign some features in order to mitigate this effect.

4.3.4 There is little new development proposed in this corridor, with only infill housing identified in the local plan. However, there is a significant tourist market and a sizeable student market from Oystermouth to the University creating significant demand throughout the year.

Detailed Observations

4.3.5 At The Mumbles, an LRT could extend along the sea front as far as the café at the pier head. Space sufficient for one track terminating at a single platform face is readily available although Village Lane boat park and some car parking would need to be relocated. Further repositioning of boat parking facilities would be necessary if additional tracks were deemed appropriate.

4.3.6 If demand demonstrates that two tracks are desirable or if a shorter route with less impact were desirable, a larger, two-platform terminus could be constructed at Oystermouth Square, currently the site of a car park. This is conveniently sited for the principal shopping area and would form an interchange with local bus services.

4.3.7 There are proposals to improve the transport facilities at Oystermouth Square through a development plan, detailed in the Swansea Local Plan

Review number 1 (1998). The development of the area to the east of Newton Road as a retail expansion could lead to improvements to the public transport waiting area and associated facilities, car parking, toilets, tourist information facility, public open space, pedestrian links between Newton Road and the seafront and junction widening. It would be important to preserve the space for the introduction of the Light Railway along with the Walkway/Cycleway within such development plans and the Light Rail corridor if chosen, should be identified in any future review of the local plan.

4.3.8 Moving towards the city centre, a single track LRT could be accommodated within the Swansea Bike Path leaving sufficient space for either a cycle way or a pedestrian route. It would not be possible to have both unless additional land take was to be entertained. Alternatively, the LRT could run on-street through this critical section, requiring traffic control (signals) to allow for vehicle movement and traffic management to ensure the LRT a free path, minimising delays. See figure 4.1

4.3.9 When considering this section of the corridor, three areas have been identified that would require further detailed investigation as to the possible alignment of the route. The sections are:

- 250m south from Norton Road.
- 200m around the Fairwood Road junction, and
- the crossing of the Clyne River.

At the first two sections, the road, Promenade and sea wall all occupy a narrow area of land with little land in between the three, as opposed to the situation that exists elsewhere in the corridor. At the crossing of the Clyne River, a decision has to be made as to whether the route should run on-street and utilise the existing road bridge, or

4.3.10 To provide as attractive a public transport facility as possible, the ability to operate a frequent service is required. This in turn drives the need to allow LRVs to pass each other en route, either by means of double track or passing loops when only one track is used. The exact location of any loops would be determined during the route development phase of the project.

4.3.11 The route parallels the A4067, which is single carriageway in this vicinity. At Brynmill, the road widens out to four lanes giving rise to the possibility of utilising one carriageway as the alignment for the LRT. This would bring the LRT closer to the existing housing and enable the retention of the walkway/cycleway along the sea-front.

4.3.12 Two prime areas that the LRT could serve between Oystermouth and Swansea are Singleton Hospital and the University. These lie adjacent to one another to the north of the A4067. They represent a valuable source of potential patronage and it may well be that detailed demand forecasting will demonstrate that the LRT should access both sites directly.

4.3.13 The hospital and University complex is currently served by a number of frequent bus services using the various service roads. No obvious direct route that would be immediately suitable for an LRT currently exists through the Hospital and University complex. The road network servicing the buildings is sufficient for the frequent bus services. Detailed design will be required to plot the best path for an LRT through this intricate network bearing in mind the limiting factor of turning radii that Light Rail can negotiate.

4.3.14 Access to the University and hospital from the A4067 in the west would best be via the A4216. This is dual carriageway over the relevant part of its length lending itself to conversion to LRT. At the eastern end, access could be via the Park and Ride site at Brynmill, thence into the University grounds.

4.3.15 From Brynmill eastwards towards the city centre, the A4067 becomes dual carriageway. It is suggested that one carriageway could be given up in order to accommodate the LRT and thus avoid the need to impinge further on the Swansea Bike Path, although other possible alignments which involve re-assignment of the road space should be considered. (See figure 4.2)

4.3.16 This presents an opportunity to enact a radical solution that not only helps provide room for the LRT but also introduces a deterrent to the use of the private car. This in turn would assist the achievement of car journey reduction targets in accord with central government's approach to integrated transport and is in accordance with the aims of the local plan and draft transportation strategy.

4.3.17 From County Hall the route of the former tramway has been obliterated although there remains sufficient space south of the Oystermouth Road to accommodate a Light Rail as far eastwards as Wind Street. If it is considered that the marina, museum and leisure centre should be directly served the LRT could continue either alongside or along the dual carriageway Oystermouth Road, thence via Wind Street and High Street, or via Princess Way to Caer Street. However, adoption of this route would of course largely by-pass the commercial and shopping heart of Swansea.

4.3.18 Alternatively, in order to access the city centre, bus station, theatre, market, football ground, Quadrant shopping centre, railway station, together with

other attractions, the LRT line could turn left off the A4067 at West Way and follow the existing dual carriageway to The Kingsway. Sufficient space exists on this link for a two-track LRT; indeed, bus only lanes exist today over and above the traffic rights of way.

4.3.19 Access to The Kingsway could be achieved directly across the roundabout at the west end or via the relatively gentle curves of the roundabout itself. From there, the two-track system would either run along one carriageway or with one track adjacent to each of the existing pavements. At the east end, in order for the LRT to reach Swansea Station, significant work would be required to the roundabout before gaining access to either College Street and thence High Street, or Orchard Street.

4.4 CARMARTHEN ROAD CORRIDOR

4.4.1 An LRT route to Cwmdu would, building on the alignment described above, continue naturally from Swansea Station northwards before joining the A483. From here, the dual carriageway road could, as suggested for the A 4067, be converted to a single carriageway thereby creating room for the LRT.

4.4.2 This route involves some challenging gradients which, whilst not insuperable, imply the need for LRVs to have every axle powered (as the Sheffield Supertram). This would clearly impact on the cost of the vehicles.

4.4.3 The gradient of this corridor has been assessed from 1:1250 map information provided by the City and County of Swansea. The grade varies between 6% and 8% for large sections of the corridor, with one small section in the outer area having a grade of 11%. This particular problem could be realistically treated by infrastructure works, however, the gradient requires full motored bogies for traditional Light Rail, adding to the vehicle costs, and may also be beyond the PPM vehicle capability. (The PPM solution of a continuous power supply (effectively a third rail) for coping with steep gradients would be inappropriate in a street environment).

4.4.4 The route to Cwmdu and beyond chiefly serves low density housing together with some retail activity. However, the development is ribbon in nature and there is consequently no concentrated area of activity or single focus to justify an LRT on its own merit. Bus services penetrate the housing to the north of the corridor.

4.4.5 The LRT could extend as far as Junction 47 on the M4 so that, in conjunction with a Park and Ride at this location, it could act as a feeder to Swansea city centre and the Mumbles. However, due to the large expanse of open land

that currently exists along this corridor, it would be difficult to justify such an extension unless it was to be promoted in association with significant development.

4.4.6 The local plan identifies only infill housing within the corridor and the out of centre shopping at the end of the corridor. The city is surrounded by identified green space, limiting further development within the current plan. The corridor is flanked to the south by older industrial areas. This route would benefit from an integrated development/ redevelopment plan in the future.

4.5 MORRISTON CORRIDOR

4.5.1 Another extension northwards from Swansea Station would enable access to Morriston and potentially Junction 45 of the M4. This could be achieved by regaining the A 4067 by running through Hafod before passing twice under the main South Wales railway line.

4.5.2 The route from the station to the A4067 would present some traffic management and constructional difficulties. The existing roadway is fairly constrained and the junction with the A483 is on the brow of a hill. Detailed examination of potential routes should be undertaken so that, coupled with the traffic calming measures that have been taken in this area, an holistic solution may be prepared.

4.5.3 From Landore, the A4067 has recently been dualled providing excellent access to the M4. Indeed, a Park and Ride site has been established adjacent to the sports complex at the southern end of the dual carriageway at Landore to encourage motorists to leave their vehicles here and continue their journey to the city centre by bus.

4.5.4 The "new" A4067 is paralleled by the B4603 and it is this latter road that serves the communities between Swansea and the M4. Consequently, an LRT should follow this route in order that the maximum number of users can be attracted to the service.

4.5.5 However, the B4603 is mainly a relatively narrow, single carriageway road that, as it stands, does not lend itself readily to LRT usage and is seriously congested with local traffic. Local trips would appear to be well catered for by the present bus services along this corridor, which could be further improved with northern parts of the corridor provided with express services using the new road links (and possibly the proposed express busway from Landore to the City Centre).

4.5.6 Taken in conjunction with the dual carriageway A4067 and the existing Park and Ride arrangements, it is unlikely that an LRT would provide a viable public transport alternative for serving this entire corridor in the medium term.

4.5.7 The possibility of extending the Mumbles LRT (should that be constructed) through the city centre to Landore Park and Ride site may offer an attractive link to the north side of the city as an incremental development of the bus based park and ride system. The practical difficulties, referred to earlier, would need to be resolved but the potential to regenerate the area immediately north of the station as an adjunct to the scheme could provide added impetus.

4.6 EXTENSION/ CONVERSION OF RAIL SERVICES

4.6.1 Interest has been expressed in using the existing heavy rail route eastwards out of Swansea towards Neath for LRT, effectively extending the rail lines into the City Centre as was provided by Manchester Metrolink. This would provide longer distance journey opportunities which, by linking into the Mumbles proposal, could remove through east-west road based trips.

4.6.2 The use of this existing rail corridor does however, give rise to a number of issues. Firstly, due to the lack of space on the heavy rail alignment, it is implicit that LRVs would need to share tracks with conventional trains using this route. This would apply even if local trains were removed in favour of LRVs.

4.6.3 To date, shared running does not occur anywhere in the UK although there are plans for it to be introduced as part of the Tyne and Wear Metro extension to Sunderland. It was considered for Nottingham Express Transit but that scheme is now progressing without it.

4.6.4 Shared running introduces significant additional risks, not least due to the differing construction of LRVs and heavy rail trains together with the incompatible end and buffing loads that each are designed to withstand. This will require a risk assessment to be undertaken to demonstrate to Railtrack that there is no increase in the level of risk on their infrastructure.

4.6.5 Latest advice is that a Track Protection Warning System (TPWS) could be introduced, rather that Automatic Train Protection (ATP), which significantly reduces the likelihood of accidents. The equipment would need to be fitted to all trains likely to operate in the region and all signals along the shared track.

4.6.6 We have estimated that the costs of the TPWS as £2.21m, covering the Great Western HST fleet, Wales & West fleet and an estimated freight fleet of 100 locomotives. The LRVs would also need to be equipped, and with the installation costs etc we estimate the total cost to be in the order of £3m. However, there could be some savings on these costs if the Cardiff LRT system also involved TPWS costs through track sharing, which is subject to a parallel study.

4.6.7 Secondly, to the east of Swansea, the existing rail line is carried for a considerable distance on high embankment and viaduct which will act as a deterrent for potential users. Failure to provide an easily accessible system will dilute the attractiveness of it.

4.6.8 Thirdly, the density of rail traffic currently on this corridor may prevent a frequent enough service from being offered which again will tend to depress demand.

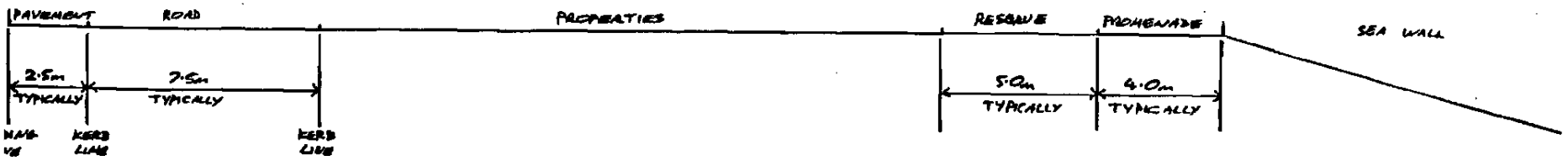
4.6.9 Finally, the existence of an LRT system adjacent to heavy rail can present problems regarding control of stray currents from the former. Shared running exacerbates this problem and requires that the heavy rail signalling system be immunised against it. This in turn implies re-signalling of the heavy rail corridor at a considerable additional capital outlay that must be carried by the LRT proposal.

4.6.10 With shared running, platforms would be common to both systems. This would require a high floor LRT vehicle to serve the existing heavy rail stations, resulting in high level platforms for the city centre stations and along any linking corridor. Such platforms would be environmentally intrusive and may have limited accessibility, so making a shared option undesirable.

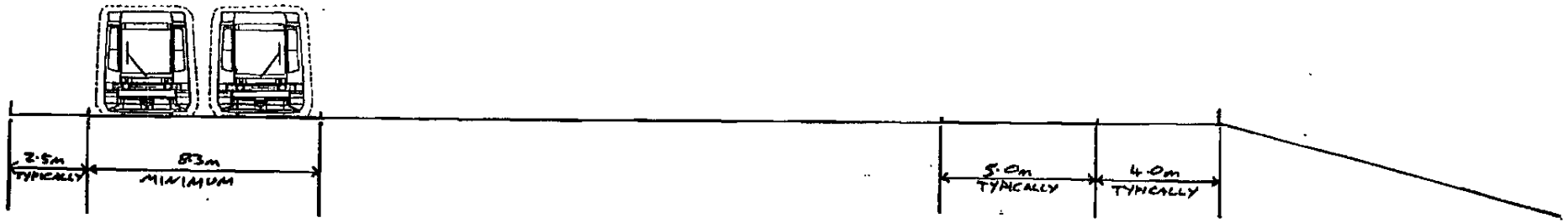
4.6.11 Given the above and coupled with the relative paucity of demand for trips east of Swansea that are not already catered for by heavy rail, it is unlikely that a financially viable scheme could be produced. However, should significant future development be promulgated along this corridor, it might be worth reconsidering.

4.6.12 However, as an alternative to the conversion of the existing rail services, the availability of the freight lines into the docks area, along with the possible long term expansion of the city eastwards makes an eastward extension of the LRT a long term possibility. This could be developed within an integrated plan with the regeneration of the docks and would provide a Light Rail route along a more southerly alignment to Briton Ferry. This

could remove long distance trips heading into the City Centre and through to Oystermouth and Mumbles from the M4 junction 42.



EXISTING SITUATION



SHARED STREET RUNNING

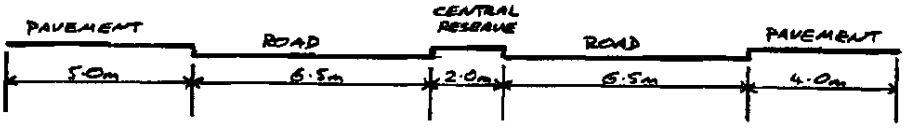
SEGREGATED RUNNING

SWANSEA LRT STUDY

Typical Cross Section near Oystermouth

HALCROW FOX

Figure 4.1



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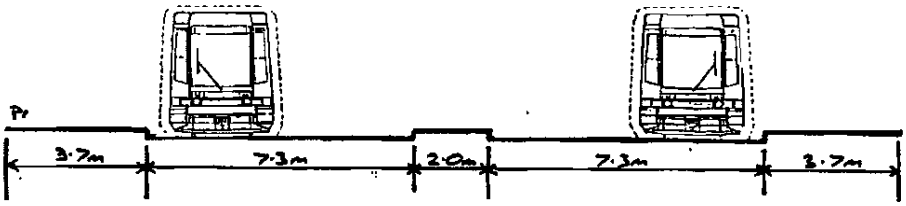
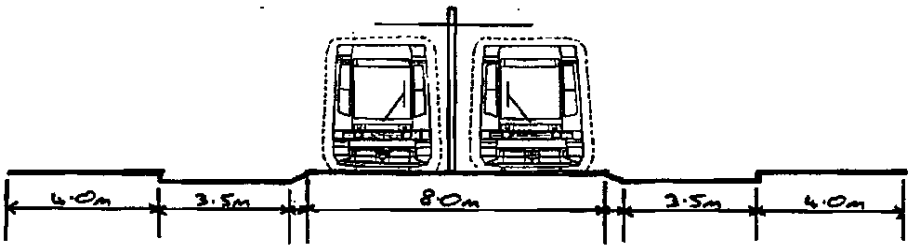
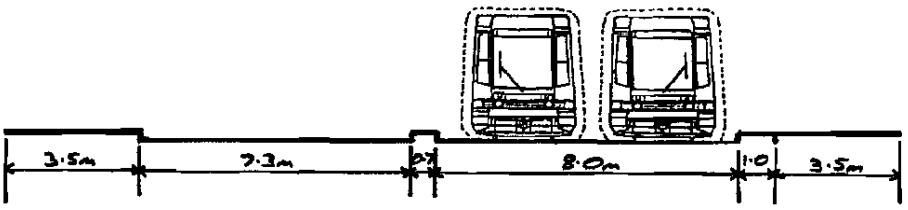


GUTTER RUNNING



"TRAM-BAHN" RUNNING



UTILISATION OF ONE CARRIAGEWAY

SWANSEA LRT STUDY

Typical Cross Sections on Dual Carriageway

Halcrow Fox

Figure 4.2

5 Demand Forecasts

5 Demand Forecasts

5.1 INTRODUCTION

5.1.1 The approach to patronage demand forecasts is to produce the best estimates based on using existing available data. The timescale and budget of the study have dictated this approach, with no significant allocation for the collection of new data through surveys.

5.1.2 The data provided to Halcrow Fox from City and Council of Swansea was carefully reviewed to define the most suitable approach and methodology for providing patronage and revenue estimates.

5.1.3 The forecasting model developed was based on a trip rate approach using census data for population and employment, mode of travel and trip distribution data. The use of the traffic model trip matrices was limited as after careful examination it was considered that the trip distribution was not sufficiently robust with poor correlation to the population and employment characteristics of the zone. Given the matrices were derived from Road Side interviews completed in the mid 70's and have been updated using estimation techniques based on traffic counts it result is not unexpected.

5.1.4 Included in this section of the report is a summary of the relevant existing data provided by the council, bus operators and from a small survey undertaken by Halcrow Fox. Also included is detail on how this data and information will be included in the patronage and revenue forecasting tasks to be completed once all data is available.

5.2 EXISTING DATA SOURCES

5.2.1 The following data sources are to be used in the demand forecasting assessment. The source of the data is indicated in each case.

- Census data at ward level including population, households, car ownership, employment (City and Council of Swansea);
- Journey to work data by district (City and Council of Swansea);
- Traffic count data for key sites in the city (City and Council of Swansea);
- Bus patronage flows in relevant corridors (FirstCymru) ;
- Journey time data and boarding/alighting surveys for bus (Halcrow Fox);
- City Centre Pedestrian surveys (Halcrow Fox).

5.2.2 This data will be used to form a simple, but robust, forecasting model that includes for the potential for travel demand in each study corridor, the distribution of trips within the corridor and with one end of the trip in the corridor.

5.3 CENSUS DATA

5.3.1 The 1991 census data for the City and County of Swansea area is summarised at ward level in Table 5.1. The data shows the following points for the full study area and for the main study corridors:

- The overall car ownership level is 65.2% of households own a car;
- The levels of ownership vary significantly between wards, with those to the north of the city centre showing a lower average of 57.8%. The Landore ward on the Morriston corridor has an ownership rate of 58.8%;
- The wards along the Oystermouth Road to Mumbles corridor have above average ownership levels at 75% average per household;
- Key population centres at in the north of the city over one third of the total population based on wards in this district; and
- The key centre for employment is central Swansea with 36% of all full and part time jobs. Northern wards in the city include 26% of jobs but the majority of these trips fall in wards not directly on the Morriston and Carmarthen Road corridors.

5.4 JOURNEY TO WORK DATA

5.4.1 The mode of travel to work for the study area is summarised in Table 5.2. This data is based on the 1991 census information and is presented at district level. The districts for which data is presented are as listed below:

- Northern Lliw;
- Southern Lliw;
- Gower and Gower Fringe;
- East Swansea;
- Central Swansea;
- Northern Swansea; and
- West Swansea.

5.4.2 The key points to be made from this data are listed below:

- The mode split of trips to work is 72.5% of residents living in one of the seven district use the car, with 10.7% walking;
- Only 12% of people use the bus to get to work overall, with higher proportions in Northern and Eastern Swansea;
- The highest proportion of walking trips occur in the northern Swansea, a key employment area;
- The highest mode split for bus passengers is in northern wards reflecting the lower levels of car ownership in the area.

5.5 TRAFFIC COUNTS

5.5.1 The data provides a good indicator the level of potential for travel in each study corridor, as the private car is the main mode of travel used in each case. Traffic data also provides good indicators of hourly travel demand, variations between the days of the week including weekends, and between different months of the year. The latter could be important given the impact the summer tourist trips may have, especially in the Oystermouth/ Mumbles corridor.

5.5.2 Counts have been examined for three key sites, one count on each of the three main corridors for the potential LRT system. The three

- A4067 Fforddcwm Bypass south of A48 Clase Road interchange;
- A483 Carmarthen Road; and
- A4067 Oystermouth Road.

5.5.3 The hourly flow profiles for each site are shown in Figure 5.1 to 5.3. Separate profiles are shown for the average weekday, Saturday and Sunday. A summary of the daily traffic flows, two-way vehicle flows, are provided in the table below.

Table 5.3 : Summary of Corridor Traffic Counts

Site	Daily Traffic Flow Two-Way		
	Weekday	Saturday	Sunday
A4067 Oystermouth Road	24,300	24,000	21,700
A483 Carmarthen Road	26,000	26,300	17,900
A4067 Fforddcwm Bypass	20,200	14,800	10,400

5.5.4 The following points can be made from the counts, namely:

- The flows on each corridor are similar on the weekdays, but differ greatly at the weekends;
- The busiest corridor in the weekday is A483 Carmarthen Road;
- At the weekends the A4067 Oystermouth Road is the busiest;
- The more attractive corridor for any LRT system is the A4067 Oystermouth Road to Mumbles as the demand, and hence benefit, appears more consistent over the week. For the other two corridors the benefits will vary and demand may be more unpredictable.

5.6 BUS PATRONAGE DATA

5.6.1 Bus patronage data has been obtained from the main bus operator First Cymru and from surveys undertaken by Halcrow Fox. The data from the operator related to the total number of trips completed in the corridor over a typical week and was derived from ticket machine data. As no breakdown of this data was available to include stops of boarding and alighting, nor loadings for different times of the day, Halcrow Fox completed a series of on-bus observations along each of the corridors. The data collected included bus passenger flows and travel time.

5.6.2 The results of the surveys for each corridor as summarised in Figures 5.4 to 5.6 for the Oystermouth Road to Mumbles, Neath Road to Morriston Cross and Carmarthen Road to Penllergaer respectively. In all three cases the observations were made to or from the city centre.

5.6.3 In each case the data is presented with average bus passenger boarding and alighting flows for sections of the bus routes. The sections are defined between key junctions. Also shown are the average passenger loadings along the route.

5.6.4 The key points to be made on the passenger loadings data are listed below:

- The typical number of passengers travelling by bus is 17,250 for the Oystermouth Road corridor and 17,700 for the Morriston corridor. No corresponding data is yet available for the Carmarthen Road corridor;
- The loadings are highest on the Oystermouth Road corridor, peaking between the University and Guildhall at just under 10 passengers per bus (one-way);

- The majority of the trips along Oystermouth Road occur between the city centre and Oystermouth Bus station or beyond to Mumbles;

- For all three corridors, the most popular boarding and alighting point is Swansea Quadrant area. This is to be expected as the area includes the bus station and the major attraction of the shopping centre;

- For trips observed along the Morriston corridor, a high proportion involve boarding and alighting at stops along the corridor and not at either end. This suggest trips are generally local journeys and short in length;

- For the Carmarthen Road the majority of trips appear to travel the full length of the corridor and have an origin/destination well outside of the likely route of an LRT line. Whilst such trips could be encouraged to use the possible LRT through feeder bus services, passengers would have the penalty of having to interchange between modes and hence potential patronage would be low.

5.7 JOURNEY TIME DATA

5.7.1 Journey time observations were recorded as part of the bus passenger survey. This data is further supported by bus timetable data for each corridor to assess congestion and delay times.

5.7.2 The journey times for the new mode will be defined from operating data. The assessments will include times for different modes to the stops/stations of the proposed new network. This includes walk times from realistic catchment areas, typically 400m, for each stop/station.

5.8 CORRIDOR PATRONAGE FORECASTS

5.8.1 Separate forecasts have been produced for each corridor. The forecasts for the city centre have been taken from the Halcrow Fox report of 1996. The corridor forecasts have been derived from the approach listed below:

- Trip rate model based on population and car ownership data for each ward in the corridor;

- Allowance for percentage of ward population living within 400m of the proposed alignment, hence the number of trips to and from areas on the proposed alignments within the wards;

- Assumed average household size of 2.5 as determined from census data, and average rate of 4 trips (two-way) per household per day;
- Census data for the proportion of trips completed within the same corridor, together with trips out of and into the corridor;
- Current mode of travel used for each ward with work trip patterns assumed as being representative for all trips made;
- Diversion rates based on relative travel times;
- Fares paid based on existing bus fare levels.

5.8.2 The outputs for the forecasts provided in Table 5.4 for the Mumbles, Carmarthen Road and Morriston Corridor respectively. The outputs show a range of demand, split between all trips in the corridor and just those trips that are completed solely within the corridor.

5.8.3 The latter trips are more likely to divert to the LRT as there is no need to interchange with another mode or divert from the existing travel pattern or routing. All trips include those with an origin or destination outside of the corridor.

5.8.4 The forecasts are summarised below split by patronage and revenue estimates. All values exclude for the extension of the LRT system around the city centre and the additional trips that may use the system:

Table 5.5: Summary of Patronage Forecasts

Corridor	Daily Demand Flow Two-Way Trips			
	All Trips		Intra Corridor Trips	
	Lower Forecast	Upper Forecast	Lower Forecast	Upper Forecast
Mumbles	1,240	2,150	449	805
Carmarthen Road	496	1,032	176	379
Morriston	1,551	2,898	512	1,010

Table 5.6: Summary of Revenue Forecasts

Corridor	Annual Revenue in £'s Millions			
	All Trips		Intra Corridor Trips	
	Lower Forecast	Upper Forecast	Lower Forecast	Upper Forecast
Mumbles	£0.72	£1.24	£0.26	£0.46
Carmarthen Road	£0.29	£0.60	£0.10	£0.22
Morriston	£0.90	£1.67	£0.30	£0.58

5.9 CITY CENTRE DEMAND

5.9.1 The 1996 light tram study investigated the demand for the Parry People Mover in detail, through data collection of passenger movements including walk trips and market research to develop a demand model for the City Centre loop system. This report identified a potential ridership of between 3,800 and 4,300 passengers per day and revenues of between £355,000 and £400,000 per year.

5.9.2 These figures are used to assess the economics of the City Centre loop and it is assumed that a proportion of the demand could also be attracted to the corridor options. The Mumbles Corridor would operate through the city centre in two directions, at least to the railway station, covering some key movements. The Carmarthen Road option could operate around a one way city centre loop, though probably at a lower frequency.

5.10 GENERATED/ INDUCED DEMAND

5.10.1 Many light rail evaluations include an estimate for generated demand, which relates to a range of non-modelled impacts including walk/cycle trips and redistributed demand as well as truly induced new trips. Within this evaluation we have included assessment of walk, cycle and city centre trips in the demand and revenue forecasts and it is not appropriate to include any further generation factors.

5.11 FUTURE PATRONAGE GROWTH

5.11.1 The Transport Needs 2000 and Beyond report used a transport model to assess future year traffic demands and impacts. This work, documented in 1992 forecast 23% growth in traffic to 2001 and 40% to 2011. This was expected to result in a doubling and tripling of overloaded highway links in these 2 future year scenarios and a reduction in average peak traffic speeds from 25kph to 18 kph in 2001 and to 14kph in 2011. This was forecast to lead to a 60% increase in bus journey times.

5.11.2 These forecasts were probably based on the national road traffic forecasts and reflect the 'predict and provide' approach of the time. Transport Policy has changed, with an emphasis on road traffic reduction and the use of land-use policies and parking supply and pricing to restrain traffic growth. Whilst this creates more of a market for public transport, it cannot be assumed that traffic congestion will growth to such high levels. Similarly, it cannot be assumed that bus journey times would actually reduce by this level as bus priority measures could be introduced in some locations.

5.11.3 However, traffic congestion and parking policy could encourage more use of the Light Rail options and as the demand forecasts also cannot take account of seasonal demand the Upper Range of the forecasts has been used in the financial and economic evaluations.

5.12 REVENUES

5.12.1 The annual revenues for the various options have been estimated through application of an average fare to the demand forecasts. It is assumed that the factor for grossing up daily forecasts to annual values is 330, and that the LRT system has fare levels that are similar in structure to the current bus fares.

5.13 RECOMMENDATIONS

5.13.1 If the patronage and revenue forecasts are to be improved then it will be necessary to understand the target markets in greater detail. The current forecasts have not used detailed origin and destination trip data, as no suitable and accurate data is available.

5.13.2 If more detailed surveys of current driver and bus passenger movements in each corridor where completed then a more robust diversion model could be developed and include for assessment of the tourist and Christmas travel demand.

Table 5.1 : Summary of the Census Data for the Study Area

Map Reference	WardCode1	WardCode2	Ward Name	District	Population	Households with No Car	% Households	Number of Households	Average Household Size	Total Employment
1	TQ	FB	Clydach	NL	2,822	334	28.9	1,156	2.4	328
2	TQ	FD	Dulais E.	SL	1,514	213	36.3	587	2.6	73
3	TQ	FF	Gorseinon C.	SL	1,531	192	32.6	589	2.6	730
4	TQ	FG	Gorseinon E.	SL	1,472	259	42.9	604	2.4	582
5	TQ	FH	Gowerton E	SL	2,014	142	19.9	714	2.8	185
6	TQ	FJ	Gowerton W	SL	1,906	233	31.1	749	2.5	338
7	TQ	FK	Graigfelin	NL	1,867	286	40.7	703	2.7	25
8	TQ	FM	Kingsbridge	SL	4,130	270	17.5	1,543	2.7	613
9	TQ	FN	Llangyfelach	SL	3,116	160	13.1	1,221	2.6	420
10	TQ	FQ	Lower Loughor	SL	2,226	320	36.5	877	2.5	40
11	TQ	FR	Mawr	NL	1,908	140	20.4	686	2.8	56
12	TQ	FS	Penllergaer	SL	2,303	226	27	837	2.8	964
13	TQ	FT	Penyrheol	SL	5,335	568	28.3	2,007	2.7	562
14	TQ	FW	Pontarddulais	SL	1,634	228	34.2	667	2.5	506
15	TQ	FY	Tal-y-bont	SL	2,037	232	29.1	797	2.6	82
16	TQ	GA	Upper Loughar	SL	2,914	264	24.1	1,095	2.7	80
17	TQ	GB	Vardre	NL	2,557	291	29.5	986	2.6	57
18	TT	FA	Bishopston	GF	4,806	286	15.6	1,833	2.6	276
19	TT	FB	Bonymaen	ES	7,372	1116	41.8	2,670	2.8	1,021
20	TT	FC	Castle	CS	11,354	3048	55.7	5,472	2.1	18,468
21	TT	FD	Cockett	NS	12,818	1712	34.3	4,991	2.6	5,717
22	TT	FE	Cwmbwrla	NS	8,211	1165	36.2	3,218	2.6	900
23	TT	FF	Dunvant	WS	4,993	232	13	1,785	2.8	80
24	TT	FG	Killay	WS	4,171	322	19	1,695	2.5	141
25	TT	FH	Lnadore	NS	6,661	1075	41.1	2,616	2.5	1,163
26	TT	FJ	Llansamlet	ES	10,656	1049	27.3	3,842	2.8	6,746
27	TT	FK	Mayals	WS	2,660	155	15.6	994	2.7	58
28	TT	FL	Morriston	NS	16,776	2036	31.9	6,382	2.6	3,389
29	TT	FM	Mynyddbach	NS	9,995	1392	34.9	3,989	2.5	2,988
30	TT	FN	Newton	WS	3,535	233	16.7	1,395	2.5	167
31	TT	FP	North Gower	GF	6,496	515	21.5	2,395	2.7	216
32	TT	FQ	Oystermouth	WS	4,192	455	25.5	1,784	2.3	435
33	TT	FR	Penderry	NS	12,476	2701	56	4,823	2.6	729
34	TT	FS	Pennard	GF	2,812	138	13.1	1,053	2.7	21
35	TT	FT	St Thomas	ES	7,084	1303	47.9	2,720	2.6	734
36	TT	FU	Sketty	WS	13,098	1649	30	5,497	2.4	6,230
37	TT	FW	South Gower	GF	2,295	99	11.6	853	2.7	-
38	TT	FX	Townhill	NS	10,343	2562	65.3	3,923	2.6	482
39	TT	FY	Uplands	CS	12,374	2096	38.9	5,388	2.3	2,981
40	TT	FZ	West Cross	WS	6,728	987	33.4	2,955	2.3	460
			TOTAL		**223,192**	**30,684**	**34.8**	**88,093**	**2.5**	**59,043**

District Totals

	Gower + Fringe GF	Northern Llw NL	Southern Llw SL	East Swansea ES	Central Swansea CS	Northern Swansea NS	West Swansea WS	TOTAL
Absolute District Totals								
POPULATION	16,409	9,154	32,132	25,112	23,728	77,280	39,377	223,192
HOUSEHOLDS NO CAR	1,038	1,051	3,307	3,468	5,144	12,643	4,033	30,684
NO HOUSEHOLDS	6,136	3,531	12,287	9,233	10,860	29,943	16,104	88,093
EMPLOYMENT	513	466	5,175	8,501	21,449	15,368	7,571	59,043
Precentage of Totals								
POPULATION	7.4%	4.1%	14.4%	11.3%	10.6%	34.6%	17.6%	100%
HOUSEHOLDS NO CAR	3.4%	3.4%	10.8%	11.3%	16.8%	41.2%	13.1%	100%
NO HOUSEHOLDS	7.0%	4.0%	13.9%	10.5%	12.3%	34.0%	18.3%	100%
EMPLOYMENT	0.9%	0.8%	8.8%	14.4%	36.3%	26.0%	12.8%	100%

Table 5.2 : Summary of Journey to Work Data

District		10% Sample	%Rail	%Bus	%Car/MC	%Cycle	%Foot	%Other	%Total
Northern Llw	Resident and Work in area	479	0	2.3	81	0.6	19.4	16.7	100
	Resident In, Work Out	855	0.2	7.5	87.8	0.6	1.7	2.3	100
	Resident Out, Work In	258	0	5	88.8	1.2	3.9	1.2	100
	Total resident	*1134*							
	Total working	*913*							
Southern Llw	Resident and Work in area	492	0.2	4.2	64.8	1.6	16.7	10.4	100
	Resident In, Work Out	655	0.5	9.1	87.1	1	1.4	0.8	100
	Resident Out, Work In	258	0	4.3	87.8	1.2	3.7	3.2	100
	Total resident	*1147*							
	Total working	*913*							
Gower and Fringe	Resident and Work in area	251	0	1.2	55	0.4	12.4	31.1	100
	Resident In, Work Out	444	0.7	4.3	92.8	0.2	1.1	0.9	100
	Resident Out, Work In	78	0	12.8	83.3	1.3	0	2.6	100
	Total resident	*695*							
	Total working	*522*							
East Swansea	Resident and Work in area	316	1	8.7	62.2	1	21.8	7.6	100
	Resident In, Work Out	564	0.5	13.5	77.8	0.9	8	1.2	100
	Resident Out, Work In	614	0.2	5	89.1	1	3.6	1.1	100
	Total resident	*879*							
	Total working	*1178*							
Central Swansea	Resident and Work in area	463	0.4	5	43.6	1.1	37.6	12.3	100
	Resident In, Work Out	366	2.2	9.6	74.9	1.9	9.8	1.6	100
	Resident Out, Work In	2193	1.2	18.4	73.6	0.8	5.3	0.9	100
	Total resident	*829*							
	Total working	*2559*							
Northern Swansea	Resident and Work in area	1264	0.1	6.2	62.7	0.4	18.4	10.2	100
	Resident In, Work Out	1439	0.4	18.3	73.6	0.6	5.6	1.5	100
	Resident Out, Work In	1211	0.1	6.9	90.1	0.9	1.5	0.6	100
	Total resident	*2703*							
	Total working	*2650*							
West Swansea	Resident and Work in area	511	0.4	3.9	62.8	1.8	15.5	15.7	100.1
	Resident In, Work Out	979	0.8	9.9	86.8	0.8	0.6	0.9	99.9
	Resident Out, Work In	429	0	11.4	79.7	1.6	5.6	1.4	99.9
	Total resident	*1490*							
	Total working	*1408*							
TOTAL	Resident and Work in area	3296	0.2	5.4	59.9	0.9	20.4	13.2	100.0
	Resident In, Work Out	4447	0.6	11.7	81.9	0.8	3.8	1.3	100.0
	Resident Out, Work In	4783	0.6	11.9	81.6	0.9	4.0	1.1	100.0
	Total resident	*7743*	*0.4*	*9.0*	*72.5*	*0.8*	*10.7*	*6.4*	*100.0*
	Total working	*9230*	*0.6*	*11.6*	*81.6*	*0.8*	*3.6*	*1.2*	*100.0*

: Corridor Patronage and Revenue Forecasts

Centre to Mumbles

ARY OF RESULTS t S Mode	Total Trips Lower	Upper	Intra Corridor Trips Lower	Upper
Car	8,600	14,500	1,700	2,900
Bus	1,000	1,700	600	1,000
Cycle/walk	2,500	5,200	2,300	4,700
Other	1,100	2,000	880	1,600
Total	13,200	23,400	5,480	10,200

e Observed Bus Speed 24 mph
re *40* min *135* max in pence

ed 18 mph
red to Bus Speed 75%
e Bus Fare 88 pence
on to LT 10% from car
20% from bus
5% from cycle
5% from walk

Car	860	1,450	170	290
Bus	200	340	120	200
Cycle/walk	125	260	115	235
Other	55	100	44	80
Total	1,240	2,150	449	805
Revenue per annum	£0.72	£1.24	£0.26	£0.46

City Centre to Carmarthen Road

SUMMARY OF RESULTS Percent INTRAS Mode	Total Trips Lower	Upper	Intra Corridor Trips Lower	Upper
20% Car	5,300	11,100	1,000	2,200
60% Bus	1,100	1,800	700	1,100
90% Cycle/walk	900	3,700	800	3,300
80% Other	500	1,400	400	1,120
Total	7,800	18,000	2,900	7,720

Average Observed Bus Speed 27 mph
Bus Fare *40* min *135* max in pence

LT Speed 18 mph
Compared to Bus Speed 67%
Average Bus Fare 88 pence
Diversion to LT 6% from car
12% from bus
3% from cycle
3% from walk

Car	329	688	62	136
Bus	132	216	84	132
Cycle/walk	23	93	20	83
Other	13	35	10	28
Total	496	1,032	176	379
Revenue per annum	£0.29	£0.60	£0.10	£0.22

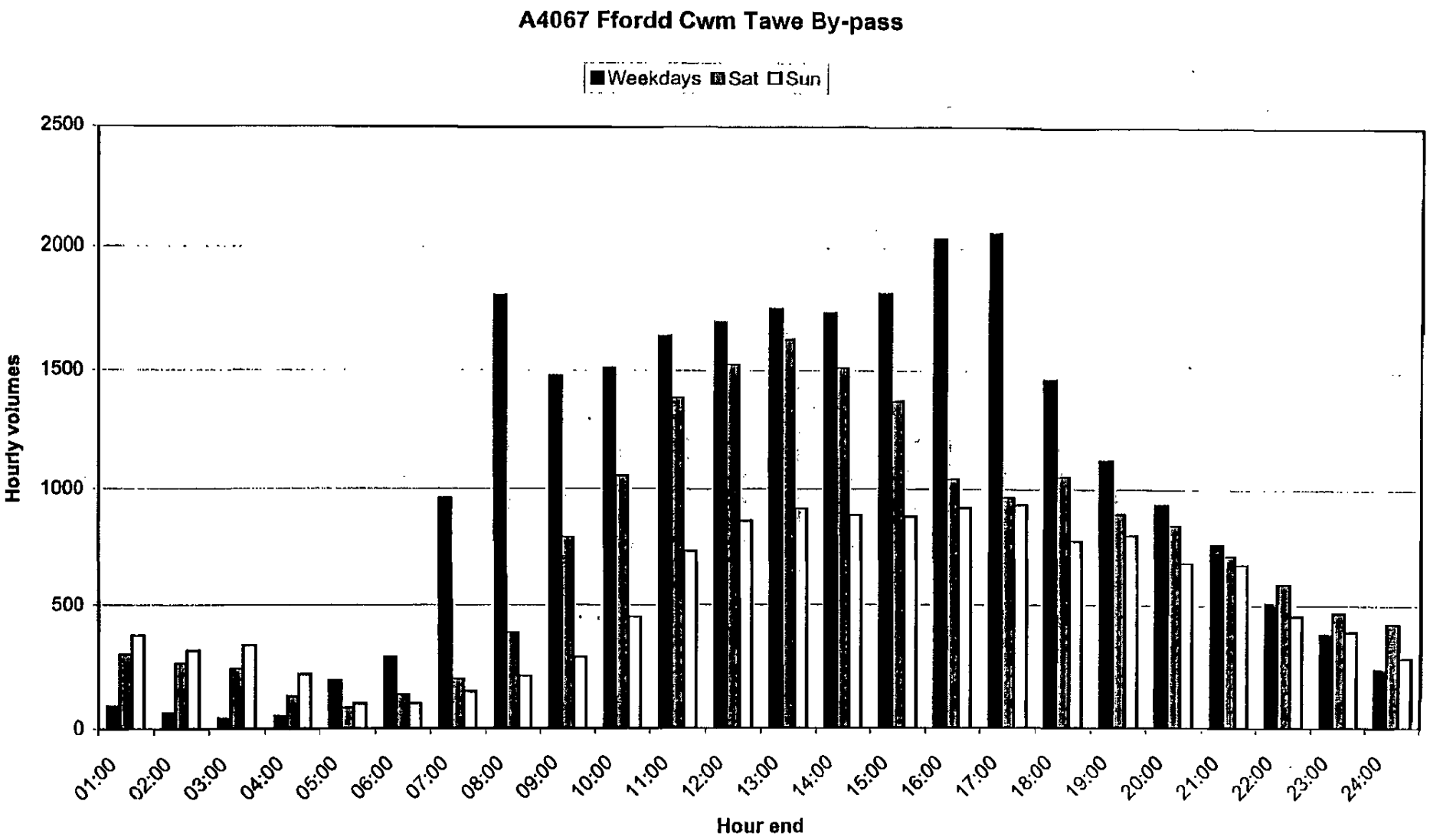
City Centre to Morriston

SUMMARY OF RESULTS Percent INTRAS Mode	Total Trips Lower	Upper	Intra Corridor Trips Lower	Upper
20% Car	6,700	12,600	1,300	2,500
60% Bus	1,400	2,100	800	1,300
90% Cycle/walk	1,200	3,900	1,100	3,500
80% Other	600	1,500	480	1,200
Total	9,900	20,100	3,680	8,500

Average Observed Bus Speed 20 mph
Bus Fare *40* min *135* max in pence

LT Speed 18 mph
Compared to Bus Speed 90%
Average Bus Fare 88 pence
Diversion to LT 15% from car
30% from bus
7% from cycle/walk
7% from other

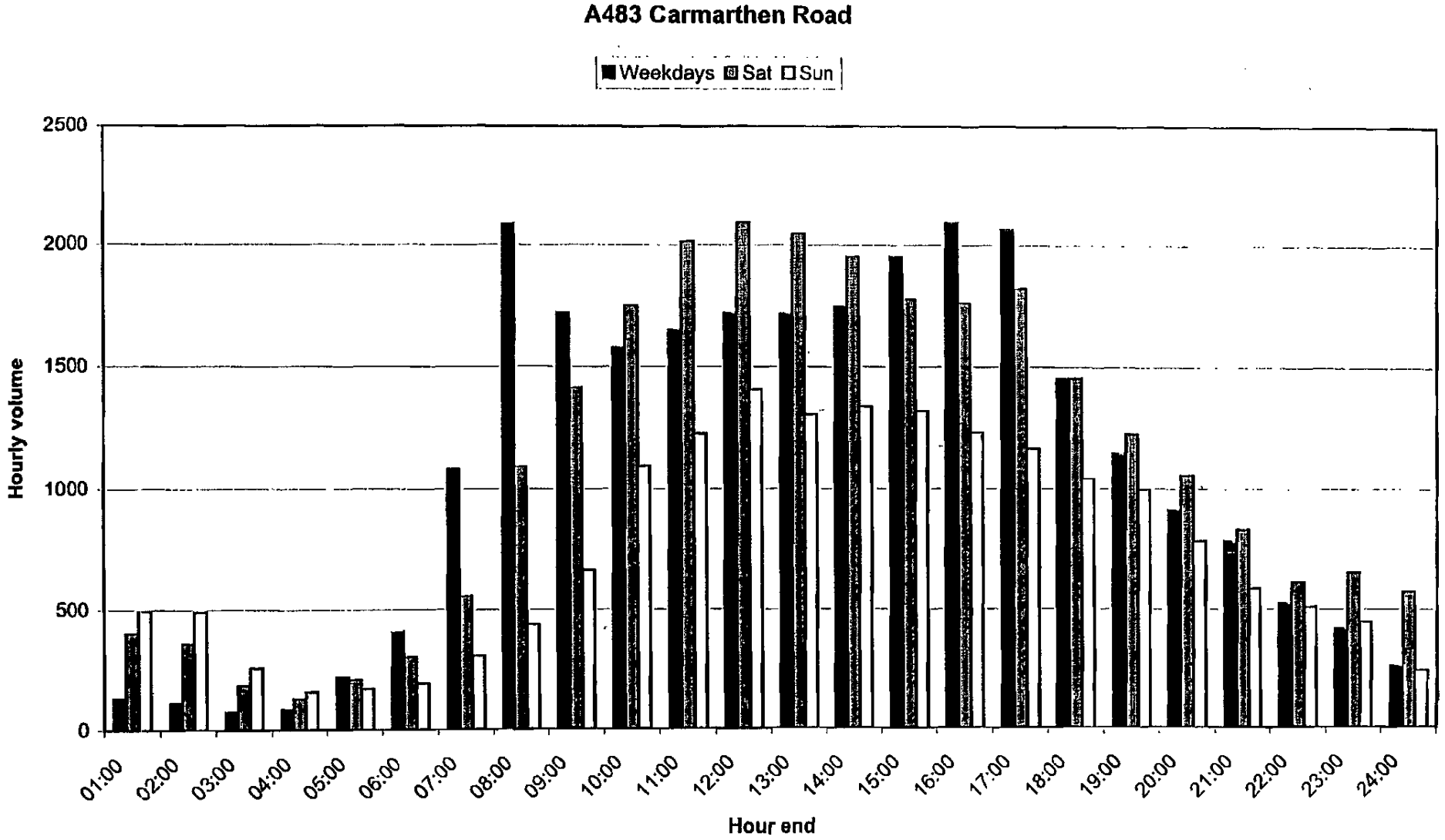
Car	1,005	1,890	195	375
Bus	420	630	240	390
Cycle/walk	84	273	77	245
Other	42	105	34	84
Total	1,551	2,898	546	1,094
Revenue per annum	£0.90	£1.67	£0.32	£0.63



Swansea Light Rail Feasibility Study

Traffic Flow Profile on A4067 Ffordd Cwn Tawe Bypass

Figure 5.1



Swansea Light Rail Feasibility Study

Traffic Flow Profile on A483 Carmarthen Road

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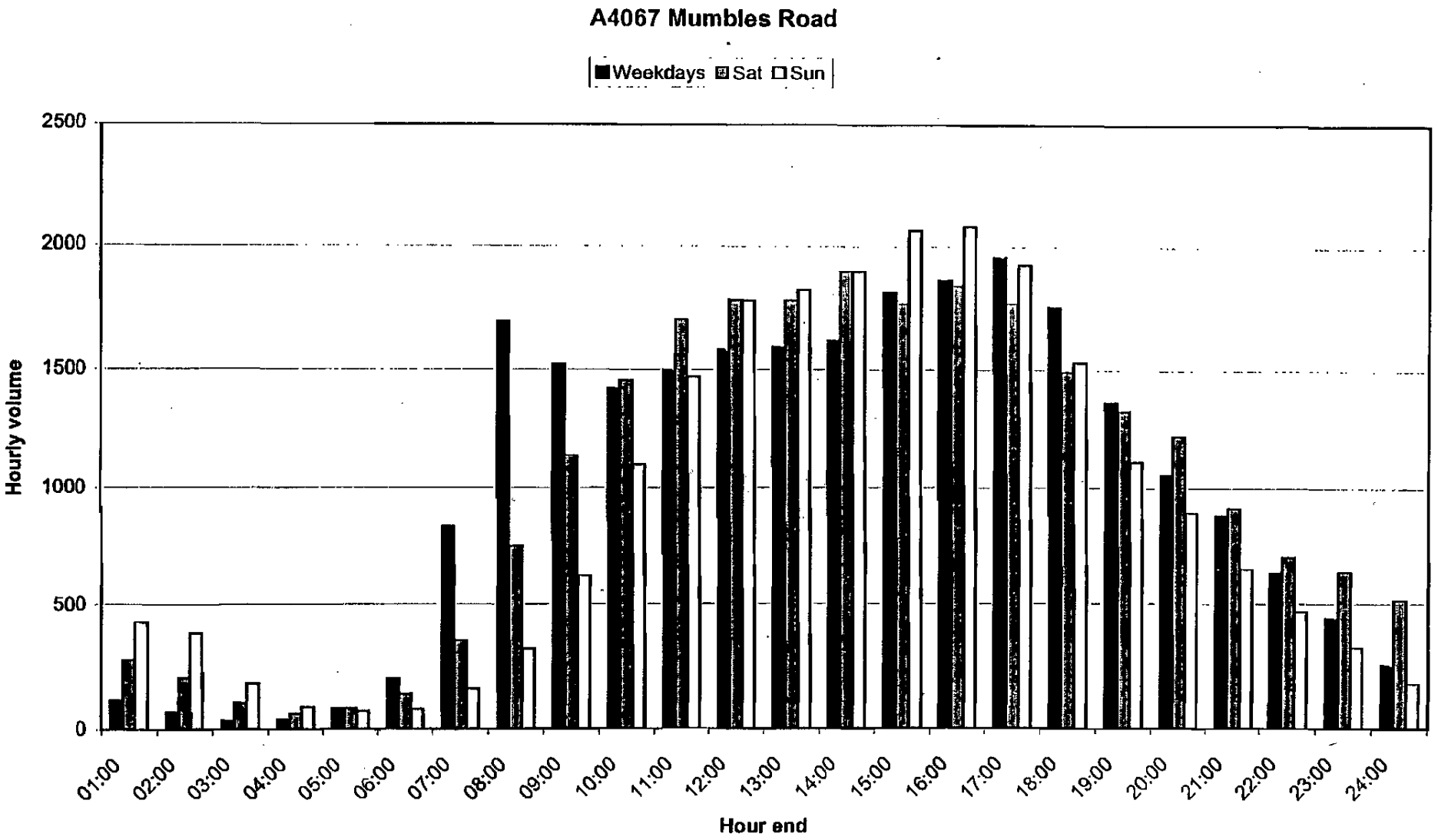
Figure 5.2



Swansea Light Rail Feasibility Study

Traffic Flow Profile on A4067 Mumbles Road

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Figure 5.3

6 Financial And Economic Evaluations

6 Financial and Economic Evaluations

6.1 APPROACH

6.1.1 In the assessment of the financial and economic case for Light Rail we have estimated the order of capital and operating costs for Light Rail and Ultra-light rail for the main options only. We have concluded from the previous assessment that the Morriston and heavy rail conversion options are impractical or long term possibilities and we therefore concentrate on the Mumbles, Carmarthen Road and City Centre loop options.

6.1.2 The patronage forecasts are converted into revenue forecasts by applying unit rates and the financial and operating viability are determined against the current government funding rules. It should be emphasised that with the lack of a locally calibrated multi-modal model and the collection of new data these assessments are undertaken to inform the overall decision making rather than as a reliable funding bid for any scheme.

6.2 OPERATING COSTS

6.2.1 Typical LRT operating costs lie in the range of £2.50 to £3 per vehicle km and Parry People Mover costs are estimated as around 30% lower as the system is less labour intensive. However, the lower capacity of the system could influence the relative balance between the main light rail options.

6.2.2 Through estimation of the frequency of service, length of the operating day, corridor length and days of operation per year we have estimated the range of operating costs shown in Table 6.1

6.3 CAPITAL COSTS

6.3.1 Similarly for estimating the relative capital costs of the light rail alternatives we have used unit rates of £7m per route km, encompassing vehicle and all other associated infrastructure, taken from the most recent LRT schemes. The Pullman/ Lewis Lesley LR55 rail and railcar are estimated to reduce costs by around 15%. We have therefore provided a broad range for Light Rail costs.

6.3.2 Parry People Mover costs are more difficult to determine as there are no examples of fully implemented street based systems on which to assess the complete costs and to assess the durability of the vehicle and therefore the mid life and total replacement costs. The manufacturer specifies a cost of £0.4m per route kilometre for single track, including allowance for vehicles.

Vehicles costs are quoted as between £50k and £75k, although these are expected to be higher for a larger vehicle which might be required to cope with demands in Swansea, and additional units would be required to cope with seasonal demand.

6.3.3 The PPM costs, however, are system costs, which don't include the costs of traffic management, third party costs including statutory utilities, park and ride sites, information, landscaping, and land, etc, which are part of the full LRT scheme costs. The decision to move services from under the tram tracks relates to the future disruption to service and re-instatement costs. Whilst not entirely necessary it is strongly recommended that such provisions are made at the outset of a scheme as they are incorporated within the Capital Costs, rather than the operating costs.

6.3.4 An alternative way to assess the order of the Ultra-light rail costs is to examine the areas of saving. The PPM would produce the highest savings in relation to power supply and vehicle costs and some savings in trackwork costs. These typically amount to only 40% of the LRT scheme costs in urban areas and therefore the figures quoted for Ultra-light schemes could be significantly under-estimated. A more precise estimate of the PPM costs can only be determined by detailed examination of the design and resultant works to accommodate it.

Table 6.1, Capital and Operating Cost Estimates.

	Mumbles Corridor	**Carmarthen Road Corridor**	**City Centre Loop**
LRT			
Capital Costs £m	£50 - £70	£35 - £45	-
Operating Costs £m pa	£1.1 - £1.3	£0.7 - £0.8	-
Ultra-light Rail			
Capital Costs £m	£5 - £30	£3 - £20	£1.5 - £12m
Operating Costs £m pa	£0.8 - £1.0	£0.5 - £0.6	£0.32m

6.4 KEY BENEFITS

6.4.1 Key benefits have been estimated for the Light Rail options, following accepted methodologies for public transport schemes and the 'rules' covering Light Rail funding through the Section 56 (of the 1968 Transport Act) Grant process, which focuses on non-user benefits such as, traffic decongestions, reductions in highway accidents and employment benefits through job creation. Without a detailed traffic model available to determine traffic decongestion benefits proxy values based on estimated reductions in vehicle kilometres have been used, taken from the OPRAF guidance 'Appraisal of support for passenger rail services'.

6.5 FINANCIAL AND ECONOMIC EVALUATIONS

6.5.1 To produce the financial and economic evaluations the annual costs, revenues and benefits have been discounted over a 30 year life to 2001/2 with a 2 year construction period and a ramping up of demand, revenue and benefits over two years at 67% in year 1 and 85% in year 2. Demand is assumed to grow at 1% per annum from this base and all figures are at 1997/8 prices. The resultant economic evaluations are shown in table 6.2.

Table 6.2, Financial and Economic Evaluations.

	Mumbles Corridor LRT	Carmarthen Road Corridor LRT	City Centre Loop (PPM)
Costs			
Capital Costs	55.0	36.7	9.2
Operating Costs	16.5	10.3	4.4
Total Costs	71.5	47.0	13.6
Financial Evaluation			
Revenues	23.7	14.1	5.3
Operating Profit	7.2	3.7	0.9
Net Cost	47.9	33.0	8.3
Benefits			
Decongestion benefits	3.9 - 9.5	1.3 – 3.1	0.2 – 0.6
Accident benefits	0.9	0.3	0
Employment Benefits	11.6	7.8	3.5
Sum NUB's	16.5 – 22.1	9.3 – 11.1	3.8 – 4.2
Economic Evaluation			
NPV	(25.8) – (31.3)	(21.8) – (23.6)	(4.1) – (4.4)

6.5.2 Table 6.2 shows that the high patronage assumption produces revenues which cover the annual operating costs for each option. This produces a contribution towards the capital costs, although no scheme is financially justified, i.e. all require third party or grant funding of the capital costs.

6.5.3 Table 6.2 also shows that the scale of non-user benefits for all options do not cover the capital costs leading to significant negative economic assessments for the Mumbles and Carmarthen Corridors. The evaluations apply a range of decongestion benefit rates based on 12p per vehicle km and 29p per vehicle km from the OPRAF guidance, representing 'outside London' and 'Outer London traffic conditions.

6.5.4 Mid range capital costs have been used. The lower range for the LRT options would not have a significant impact on the economic case. However, for the City Centre People mover a £10m capital cost was assumed, if these costs could be constrained to £5m a positive economic case can be made. However, this is highly dependent on the assumptions regarding traffic decongestion (assumed as 10% of the passenger kms) and the employment benefits, here related to the £10m construction costs and assumed 'additional' operations staff in the new company. Also, a large proportion of the benefits of this system may be able to be secured by the operation of a suitable branded bus loop, making use of the City Centre bus priorities. Through ticketing at the station and with other bus services could also erode the attraction of this system.

6.5.5 Sensitivity tests show that assuming the lowest range on the capital and operating costs, and a 10% increase in revenue, perhaps related to a significant increase in parking charges, the NPV's would be £-13m and £-17m for the Mumbles and Carmarthen Rd Corridors respectively. Even assuming a 25% increase in revenue, perhaps through the provision of park and ride on the corridors the NPV's are still negative at £-8m and £-15m.

6.5.6 In assessing the scope for the operation of the Corridors by ultra-light rail we have assessed the operating performance of the Parry People mover against the journey time of the bus services. The low maximum speed of the Parry People Mover (around 48kph) and the long dwell times at stops (minimum 30 seconds compared to minimum 15 seconds for LRT) lead to a low average speed. We have assumed a loss of 1.5 minutes per stop with a stop spacing of 700m along the Mumbles Corridor, leading to a journey time of 33 minutes. This compares with the 20 minutes existing journey time. Even with the application of the 60% increase in bus journey times forecast in the Transport Needs 2000 report, the buses would operate faster than the Parry People Mover.

6.5.7 Increasing the stop spacing on the PPM would increase the dwell times at remaining stops negating any running time increase. The slightly lower operating costs for the PPM would be unlikely to be covered by revenue on the basis of this assessment and the lower capital costs would not, therefore be covered by economic benefits. In addition, the small vehicle might not be able to cope with the peaks of demand observed at the university boarding point and a larger vehicle is required.

6.6 FUNDING IMPLICATIONS

6.6.1 The Section 56 Grant funding rules apply to Public Transport schemes over £5m and require the service to make an annual operating profit and for the residual capital costs to be covered by the wider benefits to the community (the non-user benefits). Whilst the Light Rail options pass the first criteria, they do not pass the second criteria and would therefore not qualify for full grant funding. Other third party funding could be sought for the scheme, although this is usually related to development benefiting from the accessibility benefits brought by the scheme and secured through planning agreements.

6.6.2 A further requirement for Section 56 funding is the comparison of the scheme with alternative (cheaper) options to demonstrate that the scheme provides best value for money. The potential for quality bus services along the Mumbles and Carmarthen Road corridors by the provision of a similar level of priority given to the Light Railway could provide a significantly attractive option at a significantly lower cost in each case. This would make justification of the light rail very difficult.

6.6.3 The government are concerned to maximise the private sector input to Light Rail schemes with the latest approved scheme, Nottingham Express Transit, awarded funding through a Private Finance Initiative (PFI) approach. This has the co-operation and full involvement of the main bus operator. This approach might be applicable in the Mumbles Corridor, if the bus operator was prepared to restrict competitive bus operations, including the integration of services, such as feeding the Oystermouth Terminus, and if the public were prepared to accept the consequences of this in reduced accessibility in places. This would need to be given further consideration, but would still probably require a significantly cheaper project.

6.6.4 There are few opportunities along the Mumbles corridor for development related funding, although their might be some opportunity from City Centre development associated perhaps with lower parking standards/requirements. On the Carmarthen Road corridor there are wider

opportunities for developer funding and park and ride expansion although there may be restraints to development through the Green Belt policies.

6.6.5 The City Centre people mover system might attract transport grant funding and development related funding sufficient to cover the capital costs if these can realistically be restrained to around £5m. This is doubtful if there is a need to relocate statutory undertakers equipment which could outweigh all other costs in the City Centre.

6.6.6 Whilst it is not possible to justify the creation of a full scale LRT line along the Mumbles corridor, the extension of the City Centre People Mover to the major traffic generator of the Hospital and University could provide an opportunity to incrementally develop the Light Rail system, whilst seeking performance improvements in the technology to provide a cheaper Light Rail system with improved attractiveness outside the City Centre.

6.6.7 The corridor towards the east of the City Centre, along Fabian Way offers significant long term scope for redevelopment, related to the change in use of the docks, and the integration of the scheme with new development. This might enable a City Centre People Mover to be extended along this corridor in the long term.

7 Scheme Development Issues

7 Scheme Development Issues

7.1 LEGISLATIVE AND PLANNING IMPLICATIONS

7.1.1 Light Rail systems in the UK, including the PPM system, involve an expensive and time consuming process. Scheme progression from the feasibility study to operation typically takes between 7 and 10 years and can be divided into 10 basic stages;

Pre-Feasibility study;

7.1.2 This involves the identification of corridors that could support enhanced public transport, initial alignments and broad estimates of financial viability.

Detailed Feasibility

7.1.3 Developing detailed proposals including the initial design of the centre line and swept path, station and infrastructure requirements, depot and operational requirements, environmental Impact Statement, and outline funding case.

Public Consultation

7.1.4 Involving the preparation of leaflets and exhibition material, public and private meetings and market research/ opinion polls.

Transport and Works Act.

7.1.5 The 1992 Transport and Works Act (England and Wales) eliminates the need for a Private Scheme Bill (Parliamentary Powers). Scheme promoters seek an 'order in council' from the Secretary of State for Transport and, following notifications and a period for objections to be registered a Public Inquiry is usually required. Any schemes of 'national significance' would be considered by parliament prior to any inquiry. Draft Orders require detailed preparation, involving land referencing consultants and significant legal costs to negotiate with objectors. The overall costs are similar to the Private Bill procedure and can be considerable if a public inquiry is required.

The Order in Council.

7.1.6 An 'Order in Council' gives the promoters of the light rail system the powers to construct the scheme, including the compulsory purchase powers (subject to a 'notice to treat') and operating powers. The Order protects the operator from claims and costs related to nuisance and provides outline

planning approval. Although, stations are usually submitted for detailed planning approval at a later stage.

Grant Application

7.1.7 Schemes over £5m and not fully financially viable (Commercial), require a grant application, currently under Section 56 of the 1968 Transport Act. This process can be expensive and protracted involving patronage and revenue forecasting for the scheme and alternatives. The rules for the grant evaluation are very specific with schemes having to show;

- Substantial benefits to the community, beyond the users of the system;
- Costs cannot be met by local funding including the maximisation of revenues from users;
- The scheme is the most cost effective method to achieve the desired objectives;
- Failure to achieve a commercial rate of return;
- Services not projected to require operational subsidy;
- Reasonable efforts to attract private sector capital;
- Non-user benefits exceed the total public sector grant.

7.1.8 Even passing these rules does not guarantee scheme funding, the Treasury (Welsh Office) still have to make the money available. In the West Midlands the first line of Midland Metro was delayed 3 years awaiting funding and two further lines were effectively abandoned even though full grant applications had been made.

Tendering

7.1.9 Private sector involvement is required by Government. This can take the form of developer contributions, PFI arrangements, franchise of design-build contracts. Manchester Metrolink was originally developed as a Design – Build – Operate – Maintain (DBOM) contract, as was Midland Metro and Croydon Tramlink, Sheffield Supertram was developed as a design – build contract with later sale of the operations. This was a less successful process. Nottingham Express Transit has recently been approved through the PFI process. Here the consortium are raising the capital privately, with government payments being spread out and related to performance criteria such as availability of service/ provision of capacity. The evaluation

requirements of any tendering approach are very similar and time consuming.

Finance Secured.

7.1.10 The Treasury and DoT complete the grant process after tendering is completed satisfactorily. Credit approvals may also be required for the local authority to obtain its share of the capital.

Construction.

7.1.11 This phase can involve any number of potential engineering problems, as with all construction, including the impact on businesses during street works and the reliance on third parties, particularly Railtrack and Statutory Utilities.

Opening.

7.1.12 Inspection by the appropriate authorities is required before a public service can commence. The Railway Inspectorate (Part of the Health and Safety Executive) has to inspect light rail systems and give their approval, which experience has shown has usually resulted in significant delays to opening.

7.2 RESOURCE IMPLICATIONS

7.2.1 The development of light rail systems, like other high risk construction projects including road building, requires the scheme development and promotion by the local authority to some greater or lesser extent. This typically involves the appointment and recruitment of a specific team for a considerable length of time, to procure and manage the various parts of the processes.

7.2.2 The council is likely to be required to cover the costs of the stages up to and including securing the Order through the Transport and Works Act and securing the funding through the Grant Applications and tendering. In Nottingham significant assistance from the private sector was secured in these stages.

7.2.3 The costs can be in the order of £3m for a substantial system and these high development costs work in favour of developing a large part of a network in a single phase, rather than the incremental development of a network.

8 Conclusions And Recommendations

8 Conclusions and Recommendations

8.1 SCOPE FOR MASS TRANSIT IN SWANSEA

8.1.1 This study suggests that there is scope for the development of a light rail system in Swansea dependent on the system costs and capacity, although even the most suitable corridors in engineering terms are difficult to justify economically.

8.1.2 The corridors with most potential for development are the Mumbles Line, Carmarthen Road and the Fabian Way Corridor as further development/ redevelopment of the docks takes place. Although the Morriston Corridor has significant demand it would be difficult to develop a segregated light rail alignment in the corridor, whilst also penetrating the urban area. This corridor should therefore be developed as a bus priority 'green route'.

8.1.3 Linking the Fabian Way and Mumbles Corridors could have significant traffic benefits in the tourist season, by encouraging people to park and ride not only into the City Centre, but to the other tourist attractions along the Bay. The system itself could receive income from the seasonal trade as an attraction, particularly if it was an innovative system such as the flywheel technology of the PPM. However, the low operating speed makes this currently unsuitable to attract sufficient revenues and benefits to make justify the investment.

8.1.4 These corridors could also effectively provide the City Centre people-mover link and would provide for some movements directly, removing the need to interchange including the link from the park and ride sites in those corridors.

8.1.5 Should further consideration of the potential for the development of the corridors be ruled out, it is recommended that the development of the City Centre people-mover should be taken forward. The specific route of such a system needs to be finally resolved and must take on board the City Centre Strategy recommendations in serving the University and Hospital, County Hall, Leisure Centre, Museum and Shopping Centre, as well as the Bus and Rail Stations. A larger vehicle, able to cope with the future peaks of demand and longer term aspirations should be designed for, which requires the adoption of different alignments in the city centre than previously suggested.

8.1.6 This scheme should be taken through the development phases indicated earlier, as it could have considerable benefit both in transport terms and in

promoting the image of Swansea and ease of access of the City Centre and facilities, particularly for the large number of visitors to the region.

8.2 JUSTIFICATION

8.2.1 However, in taking these schemes forward the incremental benefits of Light Rail or Ultra-light rail (such as the Parry People Mover) need to be considered in relation to the bus based strategy currently being implemented. There could be significant benefit for City Centre access improvements and use of public transport from the promotion of the express bus link from Landore through the Station and into/ around the City Centre. Other bus services also providing a link between the Railway and Bus Stations could also be suitable branded and marketed along with through ticketing and improved information.

8.2.2 The development of bus priority schemes on the main radials, although recommended in previous transport studies and the local plan, have not been introduced at a sufficient scale to encourage partnership investment by bus operators. However, significant benefits have been achieved through the provision of City centre bus priorities and it is possible that many people may now ride around the city centre by bus, reducing their need for light rail. It is recommended that at an appropriate time, a further market research exercise should be conducted to assess the impact of the existing strategy and residual need for light rail.

8.2.3 In developing the any proposed alignment we strongly recommend the initial testing of demand with a suitable low floor, easy access bus of modern design and branding or with a with modern design of road train. However, the latter might need to be provided free, due to the otherwise significant impact on journey times involved in taking revenue and providing tickets, due to the vehicle layout. However, if the Mumbles corridor, with significant off-road alignment is chosen for development a road train or quality bus could replicate the light railway to a significant extent.

8.3 RECOMMENDATIONS

8.3.1 It is therefore recommended that further investment in bus services and facilities is undertaken on the main corridors. Further investigation of the route, design and costs of a City Centre Loop Ultra-Light system be undertaken, taking into account the integration with buses, pedestrians and the streetscape and further demand forecasts be undertaken and an operating partner secured before any scheme is taken forward.

8.3.2 Light Rail costs are reducing through advances in technology and competition between manufacturers. The opportunity to introduce light rail on the Mumbles, Carmarthen Road and Fabian Way corridors needs to be secured for the long term through the planning process, both in protecting alignments from development and in integrating land-use and transport development where possible.