Rapid Transit
Ashton Gate to Temple Meads

Proposal

by the Sustraco Bristol Tram Consortium to Bristol City Council
November 2010

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Part 1

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Introduction and Background

The Ashton Gate to Temple Meads preserved light rail route is proposed as the first section of a rail based Rapid Transit Network for Bristol. A high quality frequent service will reduce traffic on Hotwells Road while serving the Ashton Gate, Hotwells, Southville/Ashton, South Harbourside and Redcliffe areas of the city.

An Ultra Light Rail Transport (ULRT) service is proposed which will provide all the benefits of light rail without the need for external electrification (since the vehicles are self-powered, using modern energy-efficient hybrid drive technology) at a far lower cost than conventional LRT. ULRT can operate safely and unobtrusively in pedestrian areas as well as on roads, sharing with other traffic, and on dedicated railway or tramway.

The benefits of biomethane powered ULRT include:

- Lower investment and operational cost than conventional Light Rail
- The capacity, safety, comfort and ride quality of LRT
- Minimal toxic emissions and no particulates
- Zero net carbon emissions
- Low noise, vibration and visual pollution
- No overhead wires
- Safe operation in pedestrian areas
- Energy efficiency due to hybrid drive, regenerative braking and steel wheels
- Low impact on immediate surroundings
- Low maintenance costs
- Ability to run on tram lines on road or railway.

The proposed route involves mixing with road traffic, operation in the pedestrian area of South Harbourside and operation on the existing harbour railway.

The Proposal

The core project

An Ultra Light Rail Transit (ULRT) system to run between a new Ashton Gate Park-and-Ride (on the Ashton Meadows site) and Bristol Temple Meads station is proposed. The trams will be powered initially by methane (Compressed Natural Gas) and later by bio-methane made from recycled local waste.

There will be 7 tram stops on the route at Ashton Gate, Create, New Cut (for SS Great Britain), Museum Street (by the new Industrial Museum), The Grove, Redcliffe and Temple Meads. All the stops will be equipped with ticket machines.

The vehicles will initially be 60-passenger single or double module vehicles. Within two years, this will be followed by larger 200-passenger vehicles, using Hybrid ULT technology with an external shell and interior designed and built to the Council and Operator's choice.

Construction and operation of this new route will be undertaken by the Bristol Tram Consortium.

Funding of the capital cost will be from the Department for Transport and other sources. The project contract will provide for the system to be operational within 18 months of start.

Allied proposals (to run alongside the core project)

Private Sector

- The construction of a 700 place Park-and-Ride site at Ashton Meadows (now publicly owned)
- The construction of a fully integrated (tram, bus, rail and bicycle) interchange at Ashton Meadows
- The construction of a fully integrated (tram, bus, ferry, rail and bicycle) interchange at Plot 6 at Temple Meads (now publicly owned).

This work will be carried out by a private development company with substantial funding to come from the private sector.

Community

A not-for-profit, Community owned company will be set up, bringing together representatives of the Council, private business sector and Bristol residents. This Company will take on the ownership and development of the rail project and of sites referred to later in this document – see page 22. This will be a Community owned project initially comprising light rail transit, property development and an Anaerobic Digestion plant.

Future development of further tram extensions

Further development will depend on approval from Network Rail to share local rail infrastructure.

- A new Ashton Gate station to serve a reopened Portishead line and a tram service as an alternative to heavy rail at a lower capital and running cost and greater frequency.
- A rail link between the Portishead line and the Ashton route to connect Portishead direct to the Centre and Temple Meads.
- Extension of the route from Temple Meads around the City Centre to Broadmead and Cabot Circus. Extensive public consultation will be required to agree the best route and ensure minimal disruption to traffic and businesses.
- A loop from Temple Meads using heavy rail lines to Parson St and Bedminster and back to Ashton Gate making use of tram-train technology.

The Growing Urgency

There is a growing need to curb greenhouse gas emissions in order to combat climate change, reduce air pollution, improve urban air quality and reduce fossil fuel dependence in order to increase energy security.

- Transport is the sector in which carbon emissions are still rising. Urgent action is badly needed if targets are to be met.
- Toxic emissions from transport, especially particulate matter and nitrogen oxides, are increasingly being recognised as a cause of mortality. Estimates for the UK are 6-8,000 annually in London and 24,000 in the country as a whole. Air quality in towns will be transformed by using biomethane as a substitute for fossil fuels
- Fossil fuels are a finite resource and their exploitation will eventually become uneconomic. It will take many years to wean transport off its dependence on fossil fuels. We need to start now.

Meeting the Challenge

Developing urban transport policy

There is an urgent need to move to more efficient, non-polluting public transport systems in order to encourage modal shift away from private cars, thereby also reducing congestion. Such a system needs to be rail-based to benefit from the low rolling resistance of steel wheels on steel rails which reduces energy consumption significantly. Autonomously powered light trams, with no external electrification, equipped with an on-board power source, a hybrid drive train and regenerative braking, provides the most energy efficient and popular form of public transport. The rail infrastructure for such systems can be laid quickly and inexpensively, with minimal urban disruption.

Alternative fuels

To meet the climate change and urban environmental objectives, alternative transport fuels must be considered. The most readily available renewable sources of transport fuel are sewage and other organic and food ‘wastes’ generated by urban populations. These materials need to be diverted from landfill and recycled in order to capture and use the methane they will otherwise emit into the atmosphere, where it causes 25 times more damage than carbon dioxide as a Greenhouse Gas.

A number of European cities such as Lille and Stockholm have already successfully pioneered the production and use of biomethane as a public transport fuel. Biomethane powered engines reduce noise and carbon emissions and minimise toxic emissions. A recent report has shown that in the UK it is possible to produce enough biomethane from waste to provide 16% of total transport fuel requirements. This is more than enough to enable all new urban public transport in the UK to be powered from this source. As anaerobic digestion plants for recycling organic waste come into production, Compressed Natural Gas (CNG) can be progressively replaced by biomethane.

Modal Shift

The UK Passenger Transport Executive Group concluded that the greater reliability, comfort, accessibility, faster journey times and capacity offered by light rail over the bus is reinforced by its perceived high status and permanence. All the above can help to explain why UK light rail schemes typically achieve a 20% modal shift from the car, a much higher level of modal shift than a typical bus priority scheme will achieve. Development work on the planned expansion of Manchester Metrolink shows that the extensions would take 5.6 million car journeys a year off the road compared with 2 million for the bus alternative.[1]

Cutting costs

A drawback to the reintroduction of conventional Light Rail Transport (LRT) is the prohibitive implementation cost. The cost can be reduced by introducing modern motive power technology already developed for hybrid buses, which removes the need for electrification and costly relocation of utility services. This is the basis of Ultra Light Rail Transport. The implementation cost per route km can be as low as £3M compared with £15M - £20M for conventional light rail systems, without any reduction in the quality of the service provided.

Reducing energy consumption

Three important factors result in minimal energy consumption:

1. Trams running on steel rails lose only one third of the energy wasted in wheel friction by buses running on rubber tyres
2. By using hybrid drive technology, brake energy recovery can result in 30% - 40% fuel savings
3. Hybrid drive technology allows the engine to be operated continuously at around maximum efficiency, saving up to 10% more energy.

This could result in up to 50% fuel savings compared with the equivalent standard bus.

Innovation

ULRT is an innovative system which is designed to make better use of existing transport technology and infrastructure in order to overcome the major challenges facing modern public transport i.e. climate change, toxic emissions and energy security. It combines the best elements of proven bus and tram technology. The vehicles are designed for minimum life-cycle costs, with long life, low maintenance costs and recycling of materials being given high priority. By using on-board energy generation and high efficiency energy storage in a hybrid electric drive train, the vehicles benefit from the latest advances in transport technology.

Reference

[1] Light Rail & Modern Trams Version three, May 2009. PTEG Wellington House, 40-50 Wellington Street, Leeds LS1 2DE. www.pteg.net

The ULRT Concept

At the outset trams with a capacity for 60 passengers will be used. When necessary two trams can be coupled together to bring vehicle capacity up to 120 passengers. As service patronage grows, trams with the capacity to carry up to 200 passengers will be introduced. An impression of a ULR tram is given in figure 1.

Tram operation in pedestrian zones is not new and it is common in most cities around the world. Figure 2 shows examples in the UK of conventional electric trams operating in pedestrian areas in Nottingham and Manchester.

The main feature of ULR trams is that they do not need overhead wires because they generate their own power. Therefore ULR tracks need no insulation, reducing the time and cost of installation. This characteristic of ULRT reduces the investment costs per kilometre, compared to conventional LRT, by up to 70%.

Trams have a visible, predictable path which is essential for safety in pedestrian areas. They are a popular feature throughout cities because of their image of permanence and reliability.

Figure 1. Impression of an ULR tram by Transport Design International Ltd

Figure 2. LRT operating in pedestrian areas

ULR Track Technologies

ULRT is able to use track systems which are lighter and less costly to install in streets than conventional tramway. ULR track form provides the minimum possible interference to access to services buried beneath the track, thus avoiding the need to relocate them. This is because the track does not have to be electrically insulated to carry electric traction currents. ULR trams are designed to have lower axle weights than conventional trams. This allows a shallow track to be constructed within the top layer of the roadway thus avoiding buried services. Some relocation of access points will still be required if these are within the swept path of the trams. However, the overall scale of utilities works is significantly reduced, leading to a lower infrastructure cost.

Two shallow track options are available for ULR. The first uses a rail of unconventional shape fixed into a pre-cast concrete beam as shown in Figure 3. A pair of these beams are fixed into grooves cut into the road surface to form the track.

The second option, shown in Figure 4, uses a more conventional grooved rail which is retained in a channel which forms part of a fabricated steel track structure set into a wider groove cut into the top layer of roadway and fixed by replacing the asphalt.

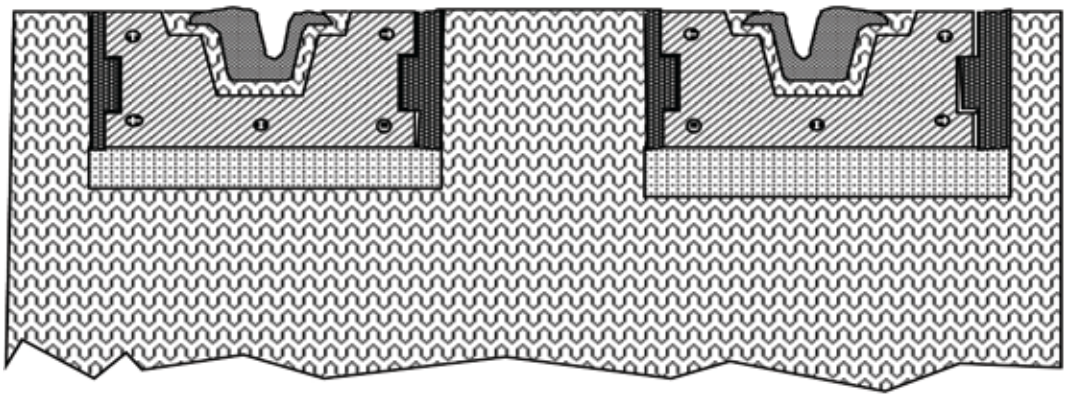


Figure 3. LR55 Track

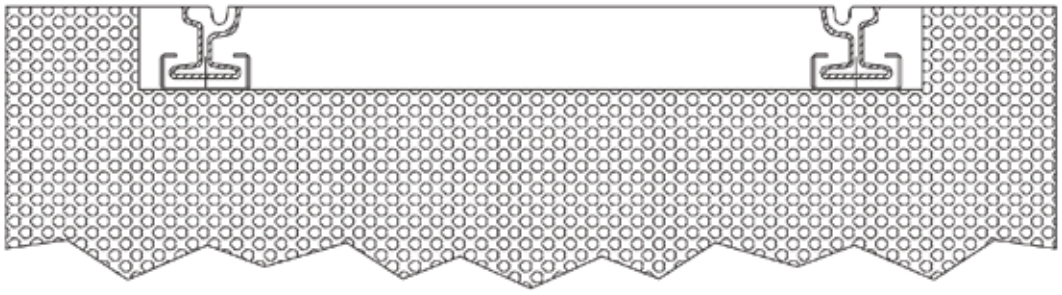


Figure 4. Alternative track form

The Route

The route uses the existing rail alignment between Wapping Road and Ashton Gate, via Spike Island and Ashton Meadows. It will serve visitors to the Museum of Bristol and SS Great Britain, residents near Vauxhall Foot Bridge, the CREATE Centre, BCC offices, and Ashton Gate area.

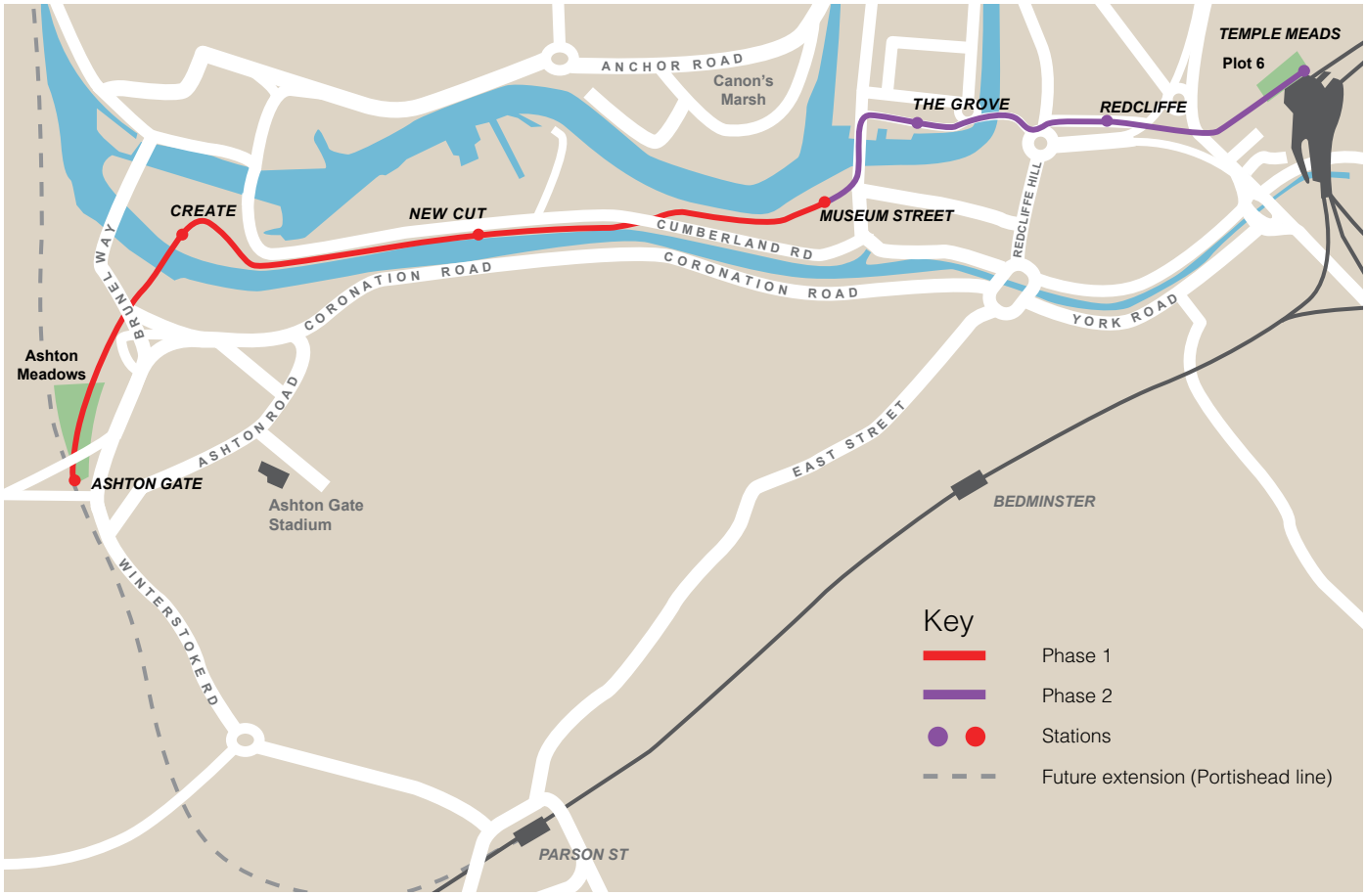
At Ashton Gate an interchange with the Portishead line, (once reopened) is proposed, allowing commuters and visitors from Portishead and Pill the option of travelling to central Bristol. By providing parking space, the service will operate as a visitor car park and controlled Park and Ride facility for A38 incoming traffic to supplement the existing Long Ashton P+R service and so relieve congestion on Hotwells Road and the Centre.

Though the Portishead line is scheduled to be reopened to heavy rail passenger operation, the possibility of a future alternative of through running of trams or tram-trains to Portishead remains open. This will save the cost of building a new bridge over the line at Portishead and provide a seamless service between Portishead and central Bristol, including Temple Meads.

In either case, the service will operate in parallel with the existing Long Ashton Park-and-Ride service which will be upgraded given the proposed remodelling of St Augustine's Parade to give buses priority. This service and the ULR service will be complimentary since the Long Ashton P+R service enables A370 traffic to park and continue to destinations on the Bristol inner circuit (present route) while the proposed tram service links Ashton Gate (and car park) with Spike Island, South Harbourside, Redcliffe and Temple Meads forecourt. This will increase overall P+R provision and the accessibility of central Bristol to commuters (via the A38) and visitors.

The route is currently preserved for light rail in the Joint Local Transport Plan. The route from Ashton Gate will cross Prince Street Bridge and proceed along the Grove and Portwall Lane to terminate alongside the north

Figure 5. Schematic of the proposed ULR route



western entrance to Temple Meads station, providing a convenient interchange for rail passengers.

The vehicle fleet will be stabled in a secure depot overnight, or when out of service, where repair, maintenance and routine cleaning can be carried out.

The route is in two sections, using the existing alignment between Ashton Gate and the Museum and secondly a newly laid section of track from the Museum to Temple Meads. These can be phased if there are administrative delays on the new section, to avoid holding up the project.

The proposed route is shown in figure 5.

Stops

The stops will have sheltered and illuminated platforms for level entry and wheelchair access and will provide full information and automatic ticketing. They will be sited at the following locations:

Ashton Gate
for School, College, Ashton Park and car park

CREATE
for CREATE Centre and BCC offices

New Cut
for SS Great Britain and UWE art complex and by footbridge to Southville

Museum St

The Grove
for Queens Square and Centre

Redcliffe

Temple Meads
main rail station and transport interchange

Termini

To the west, a terminus will be located in the vicinity of the junction at Ashton Gate with access to Winterstoke Road. This site can be developed commercially to include rail-related (kiosk etc) retail opportunities and will include a 700 space car park for visitors and commuters. Entry and exit can be via Brunel Way. This will serve to relieve traffic on Brunel Way and Hotwells Road. Further development can take place above the parking space.

To the east the line will terminate at Temple Meads in an area known as ‘Plot 6’, adjacent to the station entrance. Plot 6 presents a significant development opportunity both as a transport hub for main line rail, bus, ferry and the proposed light rail service and as an employment centre. It would thus be the most accessible site in the city.

Park & Ride

In phase 1, up to 700 visitor parking places will be provided on railway land north of Ashton Gate. Entry and exit can be via Brunel Way. This will serve to relieve traffic on Brunel Way and Hotwells Road. Further development can take place above the parking space.

The Proposed Service

The proposed service will be introduced in two phases:

Phase 1

The return service will operate daily between the Museum and Ashton Gate from 6am to midnight. The journey time will be 5 minutes. A 10-minute interval service will be provided by two operational vehicles to give an initial passenger capacity of up 360 passengers per hour per direction. Initially a patronage of 800 return trips per day is anticipated, catering mainly for visitors' P&R. The service will provide P&R access to South Harbourside attractions including the Museum of Bristol, Maritime Heritage Centre and SS Great Britain as well as access to central Bristol. Use by commuters will be controlled to avoid peak hour overcrowding. A business case for Phase 1 has been prepared.

Phase 2

In phase 2 the service will be extended to Temple Meads via Redcliffe giving a journey time of 11 minutes. A 10-minute interval service will require three operational vehicles, each with a capacity for 200 passengers allowing patronage to rise to 1200 passengers per hour per direction following further site development. It will link rail passengers with the above attractions and other local destinations (CREATE centre, Spike Island employment and housing) and, in addition, with attractions in the Ashton Gate area (Bristol City Stadium, Ashton Court, UWE).

Quality of service

Service quality, in terms in terms of reliability, comfort, safety, convenience and accessibility, will be maintained at a high level, with strict quality control measures in place. This is possible because of the precise vehicle guidance and control, inherent in light rail transport operation, allowing gapless level entry at stops, avoidance of accidents, particularly in pedestrian areas, and unimpeded progress along largely dedicated track. The route passes through South Harbourside, a pedestrian area with a number of visitor and local attractions. The service is designed to cause minimum intrusiveness, only possible with ultra light rail technology.

Infrastructure Requirements

Track

BCC and BER jointly commissioned Parsons Brinckerhoff Limited to produce an Engineering and Condition Study of the existing rail alignment between Ashton Gate and the Museum. This report (dated November 2000) is available for inspection. It established that this section of the track could be refurbished or renewed at modest cost.

In order to provide a sufficiently frequent service, provision must be made for either twin track or passing places. Passing places are available at each end of that part of the line adjacent to Cumberland Road so single line running will only be required along the Cut using the existing railway.

New light rail track will be laid across Prince Street Bridge and along the Grove and Portwall Lane to Temple Meads, i.e. along the reserved alignment for LRT1. Roadworks will be minimised by use of novel track designed to allow access to utility services beneath the road and so to avoid the need for costly relocation.

Bridges

The BRT2 costings for Prince street Bridge will be adopted in the ULR business case, as will be the repair element of Ashton Swing Bridge. See later reference to pedestrian/cyclist use, page 22. Ashton Swing Bridge is due for maintenance but has been inspected and declared fit to take light rail traffic. Some strengthening of Prince Street Bridge will be necessary.

Depot and Workshop Facilities

The preferred location is on Ashton Meadows. The Depot will need to accommodate four vehicles with a separate workshop and staff 'rest-room' area.

Costs

These are set out in a separate section and are still subject to detailed surveys.

Fuel

Bio-methane natural gas is cheaper than most fossil-based fuels, which means that running costs for natural gas vehicles can provide considerable savings in addition to those due to the low fuel consumption of the vehicle. Methane, (Compressed Natural Gas) will be used as alternative fuel while bio-methane natural gas is still in the early stages of distribution. There is already a comprehensive methane supply network in place across the UK.

Regeneration Benefits

The benefits of regeneration from this proposal will flow far beyond the immediate 'corridor' of development, boosting employment opportunities and local investment. A significant proportion of the available spend released from the new jobs will boost the local economy.

Park and Ride potential

700 spaces will be made available north of Ashton Gate, of which at least 200 will be available for commuter P&R. The car Park will be managed so as to even out the tram patronage during the day.

The Vehicles

The body will be of lightweight construction but built on a substantial chassis and superstructure. Access for passengers, including wheelchairs, will be by level entry from platforms of height less than 500mm above street level (accessed by ramp), by doors on either side of the vehicle. The vehicles will eventually have a capacity of 200 passengers with seating for 44. Light rail operation provides the ride quality required for the safety of standing passengers. The vehicle technical specification is given in Appendix 1.

Initially for phase 1 of the service, a smaller capacity (60-passenger) version of the vehicle is proposed to meet the expected lower patronage. Two of these can be coupled together if required.

Drive train

The elements of the hybrid drive train are as follows:

- Primary power – a compact, high efficiency, low emission gas engine running on natural gas or bio-methane derived from renewable waste sources.
- Energy store – the energy storage system provides the additional power to the drive motors for acceleration and stores the brake energy recovered during deceleration. This is proven but innovative hybrid technology giving up to 40% fuel savings.
- Fuel store – a tank for compressed natural gas is built into the roof of the vehicle. Its capacity will enable re-fuelling at the depot on a once-a-day basis. The depot will incorporate fuel storage and refuelling facilities.

Operation and Maintenance

Maintenance and refuelling will be undertaken when individual vehicles are out of service either daytime off peak or evenings. Vehicle maintenance costs and requirements are likely to be low compared with equivalent buses because of the low wear rate. Track maintenance costs will be lower than those of guided busway because of the durability of steel rail.

Environmental Impacts

The vehicle operation will have a very low impact on the environment. There will be zero net carbon emissions when the fuel used is biomethane made from recycled waste. Toxic emissions will be reduced significantly because of the low fuel consumption and the use of methane as fuel. Net carbon emissions will eventually be eliminated by the use of biomethane as fuel. Because of the small size of the engine running on gas and its relatively even light load due to hybrid operation, noise levels will be low in comparison to the equivalent diesel buses.

Trams have a useful life of 30-40 years compared with 8-13 years for conventional buses. This has the effect of reducing significantly the cost of operation over the life cycle of the vehicles.

Tracked vehicles are inherently safer than unguided vehicles, particularly in pedestrian areas where the route is clearly defined by the rails. Accessibility in pedestrian areas is enhanced without affecting the quality of the environment. There is no visual intrusion from overhead wires.

Achieving JLTP Objectives

The Joint Local Transport Plan (JLTP) is a joint initiative of Bristol, Bath and North East Somerset, North Somerset and South Gloucestershire Councils to plan and deliver transport improvements in the area.

The Plan aims to achieve the objectives listed below.

Extending choice of transport modes for all, and in particular for private car drivers to encourage a shift to public transport

ULRT is designed to provide a reasonably priced attractive alternative to the car, both for local residents and commuters and for visitors approaching from the South and South West.

Residents of Bower Ashton, Ashton Vale, Southville and Spike Island, as well as university and school staff and students based in the area, will have the option of accessing Bristol by way of quality light rail transport, while car drivers will have the option of parking at the proposed Ashton Gate Park-and-Ride and completing their journey into Bristol by light rail.

Promoting sustainable development by providing high quality public transport links

The route passes by and through many development areas, including Spike Island, Cumberland Basin, Ashton Meadows and beyond. The tram service will enhance the quality of the development by providing an attractive alternative to car use and allowing the viable development of a proportion of car free housing, a key feature of sustainable development.

Improving access to public transport areas which currently have poor provision

At present, Spike Island, Southville and Ashton Gate are poorly served by public transport. This proposal would result in a frequent service to these neighbourhoods giving access to the Centre and to the wider transport network.

Improving integration of the public transport network

The proposed service will connect with the 500 circular bus service on Cumberland Road, the ferry services at the Nova Scotia and Museum of Bristol, the Greater Bristol Bus Network in the Centre and with the national rail network at Temple Meads station and, when the heavy rail service is operative, with the Portishead line at an interchange at Ashton Gate.

Promoting social inclusion by improving access to employment, retail, community, leisure and educational facilities

The route will serve: the David Lloyd centre, the existing or proposed new Bristol City football stadium, Ashton

Park School, UWE Bower Ashton, Ashton Court, new housing on Ashton Meadows, the Riverside Garden Centre, Bristol Record Office and other B Bond offices, including the CREATE Centre, Spike Island Arts complex, the SS Great Britain and Maritime Heritage Centre, the Museum of Bristol the Centre, North Harbourside, Redcliffe and Temple Quay.

Improving safety along the corridor by providing a high quality public transport alternative to the private car

The service will meet the quality standards of conventional light rail transport by providing safety to pedestrians, improved safety and comfort to sitting and standing passengers due to high ride quality and level entry for wheelchair access. Boarding will be rapid, services regular and reliable and vehicles attractive.

Meeting the specific scheme objectives

Mode shift from car

The service is specifically designed to attract drivers, particularly those entering Bristol via the A38, to leave their cars and complete their journey by tram. Those living or working in the vicinity of the route will be encouraged to use the service rather than having to seek parking spaces at their destination.

Helping reduce traffic congestion

Proposed redesign of the centre is likely to reduce the capacity of the road network leading into the city from the south and consequent congestion. This can only be relieved by providing a viable alternative to access by car which this service will provide, particularly for A38 traffic assuming parking is provided in the Ashton Gate area.

Contributing towards economic growth

The proposed service will increase the accessibility of commercial areas such as Temple Quay, Redcliffe, Spike Island and Ashton Gate and the development potential of landlocked sites in the Cumberland Basin area for housing and employment.

Addressing the local context criteria

Low emission technology

The low emissions of the vehicle and the reduction in car traffic will improve air quality and reduce noise levels.

Retention of road network capacity

It is not intended to remove any road capacity. Where a reserved path is not available, e.g. in the centre, the vehicles will share road space with other traffic or with buses on bus lanes. Little impact on traffic flow is expected, except for an improvement due to a general reduction in traffic.

Integration with the network of Showcase bus corridors and GBBN proposals

Where the service shares road space with the bus services (e.g. in the Centre) full integration at stops is envisaged facilitating transfer and interchange between services. The operators of the tram service will participate in any joint ticketing system that emerges in order to reduce boarding delays and allow through, city-wide, ticketing for passenger convenience.

Maintaining, and where possible enhancing, existing cyclist and pedestrian provision.

Features will be incorporated to ensure the safety of pedestrians and cyclists in areas of shared use in accordance with HM Inspectorate requirements. By use of stretches of single track, the existing pedestrian and cycle path along the New Cut will be preserved.

Maintaining amenity value of the existing natural corridor

The light rail service will be designed to have minimal impact on the surroundings particularly regarding noise and pollutant emissions.

Physical opportunities and constraints of the technology

Ability to restrict access to authorised vehicles

Most of the route will be on dedicated tramway though access will be available if required, on occasions, to heavy rail traffic such as the Bristol Harbour Railway steam operation. Except between the Museum and Temple Meads, road traffic will be excluded from the route.

System resilience in terms of vehicle breakdown.

In the unlikely event of vehicle breakdown, the normal practice of propelling the vehicle from behind using a serviceable vehicle will be employed to move the faulty vehicle off the route.

Alignment width (land take) – horizontal alignment.

For a double track the width of land take is under 7.2m. Much of this is land already reserved for LRT. It is envisaged that sections of the route will be single track with passing points. This is to avoid interference with cycle and pedestrian routes along the New Cut.

Ability to deliver level boarding.

The tramway is guided throughout so that gapless level entry is provided at every stop.

Ability to negotiate or cross the infrastructure.

Light rail is inherently safe for pedestrians, who can cross the track without impediment with full awareness of the route of oncoming light rail vehicles. Other traffic can cross the track which, if on road, is flush with the road surface.

Impact on road network at junctions.

Where the route is along the road (e.g. between Prince Street Bridge and Temple Meads), the vehicles mix with other road traffic or run along bus lanes. At junctions the vehicles will obey normal traffic signals unless special priority arrangements are made.

Maintenance requirements

The light rail system will have its own purpose-built depot where routine maintenance will be carried out.

Deliverability and viability of the technology

The vehicles will be procured to an agreed specification from a reputable and experienced manufacturer. The track will be installed by a company already proficient in the latest track technology.

Capital cost of infrastructure and vehicles.

The rail track can be installed at a cost of below £1M per km which compares favourably with the cost of guided busway and has the advantage of being more durable.

The vehicle cost per passenger is similar to that of the equivalent hybrid low emission bus. The leasing cost should be lower because of the longer life of light rail vehicles compared with buses.

Operating costs of infrastructure and vehicles and reliability

Operating costs are below those of the equivalent bus services on account of the lower fuel costs and track maintenance cost, which are lower than the cost of the equivalent guided busway.

Risk associated with the technology.

The drive technology has already been proven on hybrid buses in Germany. The light rail technology is already well established. Safe operation of hybrid trams has been proved in the Bristol demonstration (1998-2000) and on the Stourbridge branch (2009 onwards).

UK Safety case

Street running will require permission under the Transport and Works Act. The proposers have been advised by HMRI that the costs of obtaining this will be proportional to the scheme cost and therefore will not be prohibitive and will be incorporated into the overall cost.

Part 2

Advantages of the Sustraco Bristol Tram Consortium Proposal compared to BRT2

Introduction

There are good reasons for believing that the Bristol Tram Consortium's proposal for an Ultra Light Rail Transit service to link a new car park at Ashton Gate with Temple Meads Station will provide greater advantages and a higher benefit to cost ratio than the proposed Bus Rapid Transit.

ULR is a light weight vehicle, standard gauge with on-board power unit. Without overhead power lines, there is no need for renewal of underground services – a major cost with conventional electric tram systems. Fuel for drive can be bio-methane from municipal waste. The ULR option will achieve wider ranging strategic aspirations than BRT2. There are fundamental differences between the two.

High on this list of differences is that the ULR alternative is proposed to run from Ashton Meadows to Plot 6, alongside Temple Meads. The ULR case relies much on these two key sites.

Figure 6 outlines the future strategy beyond this first phase link:

- to create a circuit by running from TM/Plot 6 through Bedminster and Parson Street (along-side the west-bound mainline), turning right onto the existing Portbury freight line and back to Ashton Meadows
- to this circuit, buses and/or future phases of the tram will connect for onward journey to Cabot Circus and other principal destinations. Thus Temple Meads for the first time will enjoy direct rail connectivity with the rest of the city.
- from this circuit, to use the freight line to Portbury and on to Portishead. Travelling from Portishead, there is a longer-term intention to create a diversion at Ashton Meadows which enables Portishead to connect to central Bristol from the West as well as through Temple Meads to more easterly destinations.

This paper outlines several assumptions on which the ULR case relies.

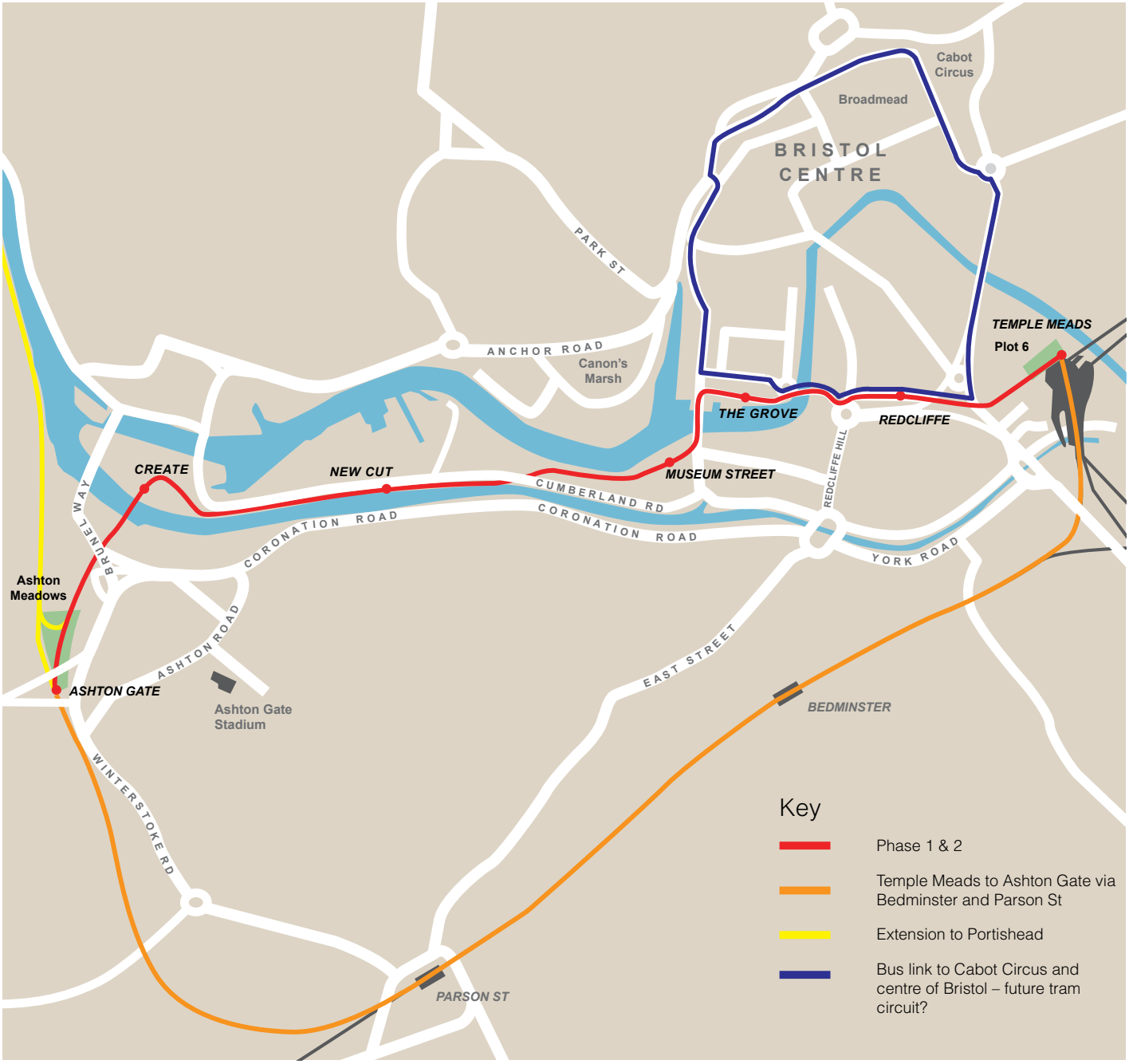


Figure 6. Future strategy

ULR Proposal & BRT2 differences

Public support and community 'ownership'

Overwhelming public support

It is believed – with good evidence – that there will be overwhelming public support for a tram-based system. This cannot be said for BRT2 – the objections to the TWA Orders are testament to this.

No link with Long Ashton Park and Ride (P&R) = no encroachment on Green Belt

The ULR tram system does not link with Long Ashton Park & Ride. It does not encroach on Ashton Vale green space, nor on Green Belt. This feature assures support where strong challenge to BRT2 exists.

South West Extension not envisaged

The tram proposal does not assume a South West Extension or a new BCFC Stadium, Arena or other uses which have been put forward as attendant to these functions. However, a tram service can help to provide a public transport service for the existing (or a new) stadium etc.

Harbour Railway remains intact

Bristol Harbour Railway and its historic civil engineering works alongside The New Cut are retained and used with no significant alteration either to the railway or to Cumberland Road. This has public support where little exists for BRT2.

More station stops – better access

The ULR system proposes to adopt a number of stops en route. These will serve the local communities who saw BRT2's 'rapid transit' as a corridor which assumed by its speed and scarce stopping points that it failed to provide access for them.

Slower speeds – more benign, greater sense of 'urbanism'

Slower speeds mean greater public safety and acceptability – even affection. Where the tram will run along Wapping Wharf, this well-trafficked perambulation will remain calm and enjoyable. Museum Street, behind Museum of Bristol, will become as originally promoted – a place for cafe culture to thrive, for pedestrians to feel happy and safe.

Community involvement and ownership via Social Enterprise

Community ownership via a Community Interest Company or similar social enterprise (established to use profits and assets for the public good) is intended to be the instrument to deliver the tram-based proposal, in partnership with the City Council or with BCC as a major shareholder – ie. the Council will be principal beneficiary.

Localism in the provision of public transport

Such community ownership is believed to sit well with the Coalition's ideals of 'Big Society', 'Localism' and 'collaborative democracy'. Community ownership combines with the support of the tram option from Bristol's communities. It is a persuasive partnership. It also enables procurement of key sites in public ownership – Ashton Meadows and Plot 6 – at the preferred rates enjoyed by other public interest bodies.

Route and Operation

Vital link with Portishead

A key feature of the ULR tram proposal is its expectation of future-phase connection with Portishead. Access to Bristol from Portishead will be through Temple Meads and easterly destinations, looping into Ashton Meadows, entering the west of the city.

Using existing redundant rail infrastructure

ULR will run on existing railway lines from Ashton Meadows[1] across Ashton Swing Bridge, then alongside the New Cut and under Cumberland Road bridge to Wapping Wharf, up to Prince's Wharf, behind the new Museum of Bristol.

Street-running along part of the route using LRT corridor

From the new Museum, it will turn into Wapping Road, across Prince Street Bridge swinging right along The Grove to the Bascule Bridge and down the Redcliffe Way corridor (Portwall Lane configuration) through the Island Site and across Victoria Street to Plot 6 – the proposed public transport interchange with Temple Meads. That is to say, ULR will use the LRT reserved (adopted) corridor.

[1] Ashton Meadows is the nine acres of land owned by British Rail Residuary - BRRB) at the point where the site abuts the Portbury heavy goods railway line and National Cycle Network (NCN) route 3

New Park-and-Ride at Ashton Meadows

ULR does not serve Long Ashton Park and Ride. A new Park and Ride will be provided on Ashton Meadows, to accommodate 700+[2] cars. BCC has shown concern not to challenge the viability of the Long Ashton P & R as a commuter/shopping facility – although this P&R only serves A370 traffic. To acknowledge BCC's concern, the new Ashton Meadows P&R can be reserved for visitors to south Harbourside attractions for their onward tram ride to various destinations.

W-S-Mare and Long Ashton P&R continue on existing routes

The ULR route alongside The New Cut will not accommodate Weston-super-mare, Clevedon and other buses which enter Bristol along the A370. These and the Long Ashton P&R buses will continue to use existing routes – retaining service to important destinations for their customers[3].

Museum of Bristol benefits

One of the several attractions served by the ULR and Ashton Meadows P&R is the new Museum of Bristol. The Museum's neighbour, the A3 Harbourside site, is currently occupied by a car park for 670 cars which will no longer be in use once the planning consent for the A3 site is implemented. Indeed, the A3 development will generate greater increase in car parking requirement than the permitted scheme provides on site.

Other destinations for those using Ashton Meadows P&R will be:

1. visitors to 'B' and 'A' Bond as well as future uses established by development of adjoining land around Cumberland Basin. The end of 'C' Bond's lease may bring a further 220,000 sq ft of potential new uses into the frame, where off-site car parking will increase viability.
2. visitors to SS Great Britain, Spike Island, Wapping Wharf, Museum of Bristol and future users of the A3 site development.
3. Bristol General Hospital – an assembly of important Listed buildings - soon to be put to Market – would benefit from off-site parking with direct tram link where it has minimal opportunity for on-site car parking.
4. Redcliffe Wharf, potentially a significant Bristol destination would benefit where off-site car parking linked by tram could enable more productive use of the available land.
5. St Mary Redcliffe, one of the city's most renowned and visited landmarks would benefit equally.
6. The BCC-owned land in the Redcliffe Way corridor is Bristol's highest value development site – the city's 'front-of-house' will be served by the tram service running through as well as in proximity to Temple Meads. Off-site car parking with direct tram link enables the optimum development footprint, car-free.

Without Ashton Meadows P&R and its door-to-door tram service, all the above new uses will generate congestion, pollution and the other disbenefits created by cars in the city centre.

Service to central & peripheral destinations – two way benefits

The ULR route into the city centre has a corollary which is scarcely mentioned in the BRT2 case; that the service also provides an important link for those who wish to travel from city centre destinations to UWE's Art Media and Design campus, also for city leisure-seekers and others wishing to visit Ashton Court and surrounding attractions.

Ashton Park School has a history of serving local communities. St Mary Redcliffe & Temple School has long enjoyed a wider catchment area because of its proximity to Temple Meads. The ULR tram service will enable Ashton Park to widen its catchment area.

Assumptions on which the ULR option is based

Copyright

The tram proposal described in this paper is copyrighted intellectual property. WEP and/or BCC are not entitled to abuse it by putting the proposal to the Market for tender to build or operate the service.

Bus Review

The ULR option is based on the assumption that the City Council's long-held aspiration for a Bus Review is carried out and implemented to achieve integration between buses and tram

[2] 7-800 cars can be accommodated in the open. This could be doubled or trebled by building multi-storey - dependent on commercial/ environmental viability based on levels of demand for out-of-town parking

[3] BRT2 and the intended re-routing of those buses turns its back on established destinations and their visitors/users served by these buses, at the same time requiring costly engineering works around Cumberland Road bridge to accommodate double-decker buses.

Cross-ticketing

Cross-ticketing has been assumed whether by sophisticated means (SMART) or more simple pre-purchase methods – to ensure efficient, seamless crossing between modes by users.

LRT reserved corridor

The adopted LRT reserved route is assumed to remain adopted – with the exception that the Portwall alignment takes the place of the reserved route where it passes along the Redcliffe Way corridor.

Plot 6 as vital interchange

Plot 6 is a one-off opportunity to create a public transport interchange of a stature deserved by Bristol's important regional and national status. Plot 6 is assumed to be acquired by West of England Partnership/Bristol City Council and dedicated to this purpose.

Ashton Meadows as interchange

Ashton Meadows (currently owned by BRRB) is deemed in the ULR case to be a key transport interchange between the private car, ULR/tram-train and mainline trains - also buses. Ashton Meadows is assumed to be acquired by West of England Partnership/ Bristol City Council and dedicated to this purpose.

Access to and from Portishead

Access to and from Portishead is assumed to be a key future goal of the ULR proposal, whether by ultra light tram or tram-train[4] – subject to National Government dictate in their negotiations with Network Rail (or successors) and the train operating companies.

New P&R releases Harbourside & central developments

The provision of Ashton Meadows as a new 'off-site' car park opens up opportunities to develop high-value waterside sites at Cumberland Basin, on south Harbourside as well as important city-centre sites, all in the City Council's ownership.

These include:

- Cumberland Basin
- 'A' Bond and surrounding land
- The remaining undeveloped floors of 'B' Bond
- City Docks Manager's car park
- Marina car park
- The possibility of relocating the Caravan Club
- SS Great Britain car park
- Redcliffe Wharf
- Redcliffe Way

Uplift in values is key to capital cost of ULR

The ULR case assumes that the uplift in site values provided by these opportunities, offset by the purchase and development cost of Ashton Meadows, is used to help the Community Interest Company in its provision of the tram system and its other social enterprise aspirations (and liabilities) in the field of public transport infrastructure. It opens up opportunities for the Council to capitalise future increases in rates that will be made possible by the uplift in property values, through the system known as Tax Increment Financing (TIF).

The ULR case assumes that Central Government finance is likely to be reduced drastically.

Patronage to support the ULR case

Patronage figures to support the ULR case are those which were provided with the business case invited by the City Council in 2006, for the 'Ashton Tram Link'.

These patronage figures were assessed by City Council officers in relation to Museum of Bristol and Ashton Court Estate. Also those assessments provided by UWE Art Media & Design, ss Great Britain and Arnolfini.

Owners of the 670-cars currently parked on the A3 Harbourside can reasonably be assumed to wish to relocate to the Ashton Meadows P&R.

Future visitors to and occupants of developments at Redcliffe Wharf, Redcliffe Way and Bristol General Hospital - as well as other car users who currently park at city centre destinations close to the ULR route – can reasonably be assumed to wish to relocate to the Ashton Meadows P&R.

BRT2 bridge costings assumed – where applicable

The BRT2 costings for Prince street Bridge will be adopted in the ULR business case, as will be the repair element of Ashton Swing Bridge. The ULR case assumes that pedestrians and cyclists will continue to use the lower deck of the Swing bridge, alongside the tram track.

References

[4] The current use of the Portbury Line is assumed to be taken out of exclusive use by freight and opened up to passenger trains also. The expectation is that the several hurdles to be overcome before this is made possible include that a new station stop between Portishead and Temple Meads is created at Ashton Meadows (once known as Ashton Gate station) where trains may also divert to enter Bristol by the western approach alongside the New Cut (ie. the proposed line) – or continue to TM for more easterly destinations and mainline connections. It should be noted that the radius of line curvature to enable such a diversion is possible to be achieved within the site constraints of Ashton Meadows but only by ULR vehicles with their relatively tight turning ability. It is believed that current, heavier tram-train models would not be capable of turning through this tight radius, limiting Portishead commuters to set down at Ashton Meadows, changing here to ULR for onward passage to central Bristol via the West.

Part 3

Sustraco Bristol Tram Consortium Proposed Financial Structure

Proposed Financial Structure

It is proposed that an autonomous, not-for-profit company (Community Interest Company or similar), should be set up by representatives of local residents, the Council and private business. This not-for-profit company (NFP) will be well situated to raise money from sources that might not be available if the different sectors were acting separately. By contracting with specialised professional companies the NFP will be able to mobilise the business sector and ensure that projects are implemented quickly and efficiently, acting on behalf of the community, as stewards for the environment and for the welfare of local residents.

The role of the NFP will be to act as a focal point for channelling funds into projects which residents, business and the Council all agree would be good for Bristol. The NFP can act as a catalyst by attracting funding for well planned commercially viable projects from all available sources, both private and charitable as well as official. Bringing the three sectors together will promote cooperation and coordination and thus help to enable all possible funding sources to be tapped in order to further the public interest.

By the creation of new productive assets and the improvement of transport and waste services the value of properties will be enhanced, thus increasing revenues to the Council. Under a new scheme, known as Tax Increment Financing (TIF), it is possible for the Council to borrow cash against anticipated future increases in revenue from rates, in order to make the investments that will generate those increases. The creation of this potential added value also makes it advantageous for the Council to transfer ownership of undeveloped properties to the NFP so that their full value can be realised through development for which funding might not otherwise be available.

The NFP could start off with three closely associated, synergistic projects:

- The proposed Ashton Gate/Temple Meads Ultra Light Rail service
- Development of Council properties along the transport route
- Anaerobic digestion plants to recycle organic waste to produce fuel and fertiliser

The immediate action required is for the NFP to be formed with the backing of leading residents, local business interests and the Council, who will decide on the name of the company and agree on the terms of its Memorandum and Articles of Association. The Sustraco consortium, which comprises companies with specialist skills in all three areas, would then offer to put forward proposals as to how these three projects may best be planned, finance raised and the projects implemented. Sustraco's role will be that of consultant and project manager for the NFP, which will pay pre-agreed fees to be funded as part of the contract.

The preliminary estimated figures in this section show that with a fare of £2 the operation of the rail service will generate an annual surplus of some £620,000, assuming that the capital expenditure on the project does not require servicing. This surplus income will be available to the NFP, either for reducing fares, for spending on improving or extending the rail service or on promoting and investing in other community projects. The aim will be to use the NFP as a channel through which new investment may flow into the community for the specific purpose of financing projects which the community wants to promote.

Financial Summary

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
OPERATING REVENUE	0	2571	2535	2526	2526	2526	2526	2526	2526	2526
OPERATING EXPENDITURE	896	2063	1911	1906	1906	1906	1906	1906	1906	1906
OPERATING SURPLUS	-896	508	624	620	620	620	620	620	620	620
CAPEX	-14670	0	0	0	0	0	0	0	0	0
DEVELOPMENT	0	0	0	0	0	0	0	0	0	0
VAT	To be completed									
Depreciation	To be completed									
Interest Charges	To be completed									
Cash Flow	-15566	508	624	620	620	620	620	620	620	620
Cumulate Cash Flow	-15566	-15058	-14434	-13814	-13194	-12574	-11955	-11335	-10715	-10095

FOOTNOTES

All numbers presented are based on internal management estimates of Sustraco only
All numbers will be confirmed in a full "investment grade" review which will be conducted as the next stage
Year 1 starts at project go-ahead
Passenger-carrying service starts at the beginning of Year 2
Vehicles are leased and are included in operating expenses, not capital
If an operator is appointed to run the line, operating costs and revenues would fall within its contract
No effects of tax are included in the numbers as presented
No financing costs are included. At this stage, capital cost is assumed to be met from a government grant

CONCLUSIONS

The capital cost for the Ashton Line is estimated to be £15m (subject to confirmation)
The operating revenue is projected to exceed the operating cost from year 2 (subject to confirmation)

Capital Expenditure £k
(2010 £)

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Project Costs										
Land Purchase	*0*									
Track Reinstatement	*3900*									
New Track	*5700*									
Stations	*1000*									
Depot	*1000*									
Vehicle Purchase	*0*									
Maintenance Equipment	*100*									
Spares	*50*									
Signalling Equipment	*50*									
Access Charges (road closures etc)	*20*									
Ticketing System	*50*									
Other Project Costs	*0*									
Project Sub-Total	11870	0	0	0	0	0	0	0	0	0
Professional Costs										
Consulting Engineers - Design	*100*									
Architects - Design	*25*									
Detailed Costings	*25*									
Lobbying & PR (initial)	*25*									
Permissions & Consents	*10*									
Bid Preparation	*25*									
Environmental Impact Statement	*10*									
Planning Permission Application	*10*									
Consultancy	*0*									
Legals	*50*									
Corporate Finance	*25*									
Tax Advice	*10*									
Business Plan Preparation	*0*									
Fund-Raising Costs	*0*									
Funding Transaction Costs	*10*									
Professional Sub-Total	325	0	0	0	0	0	0	0	0	0
Others										
Competitor Research	*10*									
Market Research	*0*									
IT System	*10*									
Consortium Development	*10*									
Others Sub-Total	30	0	0	0	0	0	0	0	0	0
Contingency										
Contruction Contingency	2374									
General Contingency	71									
Contingency Sub-Total	2445	0	0	0	0	0	0	0	0	0
TOTAL CAPEX	**14670**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

FOOTNOTES

All numbers are initial estimates only and remain subject to confirmation
Engineering costs are based on outline design concepts. A full engineering design is awaited for costing purposes
Contingency is set high to reflect uncertainty in the numbers at this stage of development
Contingency will be reduced following a full "investment grade" assessment at the next stage
All CAPEX is assumed to be completed in Year 1

Operating Expenditure £k
(2010 £)

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Employment Costs										
Wages & Salaries	*368*	*648*	*648*	*648*	*648*	*648*	*648*	*648*	*648*	*648*
Employment Oncosts	*74*	*130*	*130*	*130*	*130*	*130*	*130*	*130*	*130*	*130*
Recruitment	*37*	*37*	*13*	*13*	*13*	*13*	*13*	*13*	*13*	*13*
Training	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*
Expenses	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*
Health & Safety	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
Employment Sub-Total	523	859	835	835	835	835	835	835	835	835
Operational Costs										
Vehicle Lease Costs	*0*	*720*	*720*	*720*	*720*	*720*	*720*	*720*	*720*	*720*
Fuel	*0*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*
Maintenance	*0*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*
Vehicle Security	*0*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*
Special Events Provision	*0*	*20*	*5*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Cleaning	*0*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*	*30*
Vandalism Repair	*0*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*
Operational Sub-Total	0	850	835	830	830	830	830	830	830	830
Property Costs										
Rent - Fixed Sites	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
Track Rental & Lease Costs	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*
Rates	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*
Cleaning	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*
Site Security	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
Property Sub-Total	140	140	140	140	140	140	140	140	140	140
Administration Costs										
IT (inc software licences)	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
Insurance (company)	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Insurance (operations)	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*
Accountancy Services	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
Legal Services	*25*	*25*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
Telecoms	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*3*
Office Supplies	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Others	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
Administration Sub-Total	68	69	49	49	49	49	49	49	49	49
Sales & Marketing Costs										
Market Research	*10*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
Advertising	*100*	*100*	*20*	*20*	*20*	*20*	*20*	*20*	*20*	*20*
PR	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*
Literature	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Web Site	*5*	*5*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Brand & House Style	*25*	*10*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Events & Trade Shows	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sponsorship	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Consultancy	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sales & Marketing Sub-Total	165	145	52	52	52	52	52	52	52	52
TOTAL OPEX	**896**	**2063**	**1911**	**1906**	**1906**	**1906**	**1906**	**1906**	**1906**	**1906**

FOOTNOTES

All numbers are initial estimates only and remain subject to confirmation
Vehicle lease costs are estimated at the high end of expectations for the purposes of prudent forecasting
Vehicle lease costs will be confirmed following final vehicle selection and negotiation with lease companies
Marketing costs are principally to develop awareness of the service amongst the local population

Operating Revenue £k
(2010 £)

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Fare Income (gross)	0	2634	2594	2584	2584	2584	2584	2584	2584	2584
Less Fare Handling Costs (10%)	0	-263	-259	-258	-258	-258	-258	-258	-258	-258
Mobile Advertising (net)	0	100	100	100	100	100	100	100	100	100
Static Advertising (net)	0	100	100	100	100	100	100	100	100	100
Sponsorship	0	0	0	0	0	0	0	0	0	0
Freight	0	0	0	0	0	0	0	0	0	0
Subsidy Support (cf fuel)	0	0	0	0	0	0	0	0	0	0
TOTAL REVENUE	**0**	**2571**	**2535**	**2526**	**2526**	**2526**	**2526**	**2526**	**2526**	**2526**

FOOTNOTES

All numbers are initial estimates only and remain subject to confirmation
The main source of revenue is ticket sales
No allowance has been included for parking charges at a park and ride site
However, the CAPEX excluded the cost of establishing the park and ride site as well
There is an opportunity to use the vehicles to move freight during the night, but this is excluded in these numbers
Modest advertising revenue is projected from adverts on the vehicles and the stations

Passengers and Fares

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
NUMBERS										
Single Trips (fare paying)	0	1292100	1292100	1292100	1292100	1292100	1292100	1292100	1292100	1292100
Single Trips (concessionary)	0	0	0	0	0	0	0	0	0	0
Special Events Attendees	0	5000	1000	0	0	0	0	0	0	0
Total Passenger Users	0	1297100	1293100	1292100	1292100	1292100	1292100	1292100	1292100	1292100
FARES (£)										
Single Trip Standard Fare		2	2	2	2	2	2	2	2	2
Single Trip Concession Recovered		2	2	2	2	2	2	2	2	2
Special Event Single Ticket		10	10							
FARE INCOME (£k)										
Single Trips (fare paying)	0	2584	2584	2584	2584	2584	2584	2584	2584	2584
Single Trips (concessionary)	0	0	0	0	0	0	0	0	0	0
Special Events Attendees	0	50	10	0	0	0	0	0	0	0
TOTAL FARE INCOME (gross)	**0**	**2634**	**2594**	**2584**	**2584**	**2584**	**2584**	**2584**	**2584**	**2584**

FOOTNOTES

All numbers are initial estimates only and are subject to confirmation
A standard single fare of £2 is assumed, to be consistent with zone 1 charges on the London Underground (£1.80 with an Oyster card)
Annual passenger numbers are based solely on Sustraco internal estimates
A limited number of special promotional events is included (Christmas specials, etc)
All passengers are assumed to be fare paying
Any concessionary fares are assumed to be reimbursed to the operating company at the full single fare

Staffing

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Head Count										
Drivers	4.2	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Maintenance	1	2	2	2	2	2	2	2	2	2
Supervisors	1	2	2	2	2	2	2	2	2	2
Administration										
Ticketing		*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Financial		*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Regulatory, Health, Safety		*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Sales & Marketing										
General	*0.5*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Grants, Sponsorship, Ad Revenue		*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
Senior Management										
CEO	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Ops Director										
CFO	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
S&M Director	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Total (Full-Time Equiv)	9.7	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
Salaries (£k pa per FTE)										
Drivers	25	25	25	25	25	25	25	25	25	25
Maintenance	30	30	30	30	30	30	30	30	30	30
Supervisors	35	35	35	35	35	35	35	35	35	35
Administration										
Ticketing	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*
Financial	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*
Regulatory, Health, Safety	*35*	*35*	*35*	*35*	*35*	*35*	*35*	*35*	*35*	*35*
Sales & Marketing										
General	*35*	*35*	*35*	*35*	*35*	*35*	*35*	*35*	*35*	*35*
Grants, Sponsorship, Ad Revenue	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*	*25*
Senior Management										
CEO	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*	*80*
Ops Director	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
CFO	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
S&M Director	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*	*50*
Wages & Salaries (£k)										
Drivers	105	210	210	210	210	210	210	210	210	210
Maintenance	30	60	60	60	60	60	60	60	60	60
Supervisors	35	70	70	70	70	70	70	70	70	70
Administration										
Ticketing	0	50	50	50	50	50	50	50	50	50
Financial	0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Regulatory, Health, Safety	0	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5
Sales & Marketing										
General	17.5	35	35	35	35	35	35	35	35	35
Grants, Sponsorship, Ad Revenue	0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Senior Management										
CEO	80	80	80	80	80	80	80	80	80	80
Ops Director	0	0	0	0	0	0	0	0	0	0
CFO	50	50	50	50	50	50	50	50	50	50
S&M Director	50	50	50	50	50	50	50	50	50	50
Total Wages & Salaries	367.5	647.5	647.5	647.5	647.5	647.5	647.5	647.5	647.5	647.5
On-Cost (20%)	**73.5**	**129.5**	**129.5**	**129.5**	**129.5**	**129.5**	**129.5**	**129.5**	**129.5**	**129.5**
TOTAL EMPLOYMENT COST	441	777	777	777	777	777	777	777	777	777

FOOTNOTES

All numbers are estimates only and are subject to confirmation
An allowance is made for senior management and administration
If an operator is appointed to run the system, it may structure the staffing and costs differently

Part 4

Sustraco Bristol Tram Consortium

The Sustraco Consortium

Rotala PLC

Rotala PLC is an AIM-listed company which provides bus, coach and related services. As a major transport supplier in Bristol, Bath and the West Midlands, Rotala has annual revenues in excess of £40m and employs 952 staff. It has agreed in principle to be the operator of the Ashton Line, bringing its extensive local and national expertise to the venture.

Sersa Group AG

Headquartered in Switzerland and employing over 1000 staff, Sersa is a leading European specialist rail contractor offering a full range of services from innovative concept design through to finished build of full railway infrastructure. The Group is operational in Switzerland, Germany, Netherlands, UK and Canada and brings established capability and technical excellence.

Dow Hyperlast

The Dow Chemical Company is one of the world's largest chemical companies with a turnover of $45 billion in 2009 and employing around 52,000 people. Dow has developed innovative track technology that benefits from the application of tailor-made polyurethane systems. Dow Hyperlast, based in the UK, is the lead systems house for the rail industry

TTK Transport Technologie GMBH

TTK is a subsidiary of PTV, the largest private industry-independent German consulting and software company in the transport sector, and the regional transport company of Karlsruhe, AVG, the pioneer of the Tram Train, (track sharing between light and heavy rail). TTK will provide detailed engineering design and cost estimation of investment quality to underpin the Ashton Line concept.

Kilbride Group

Kilbride is a specialist transport and development company, focusing on the provision of new infrastructure, particularly in the rail sector. Serving existing manufacturing or logistics facilities and new or existing settlements, Kilbride takes a particular interest in community rail schemes. Current projects include the Bere Alston to Tavistock line reinstatement. Kilbride specialises in bringing private finance to rail transport projects.

WT Burden Limited

Bristol-based specialist distributor WT Burden has established Burden Rail to provide a sustainable supply chain to support the expanding rail network. It builds on over 80 years of Burdens' experience and its market-leading position in supporting civil engineering and utility industries. With a nationwide network of 47 depots and turnover in excess of £300m, Burdens provides efficient access to a broad range of essential materials.

Biomethane Burdens are also installers of Anaerobic Digestion (AD) plants for the recycling of organic waste to produce biogas, which can be used as fuel for the trams, to replace Compressed Natural Gas. The digestate can be used as fertiliser for local allotments.

Part 5

Appendices

APPENDIX 1

Vehicle Technical Data

(200 passenger vehicle)

Performance

Maximum speed	90km/h
Acceleration	up to 1.5m/s^2
Service braking	1.5m/s^2
Emergency brake	3.3m/s^2

Dimensions.

Overall length	29 m (16 to 38m options)
Overall width	2.65 m (2.5 or 2.4m options)
Overall height	2.9 m
Floor height	70% 300mm, 30% 750mm above track

Configuration

Body modular in 1.5m bays
Double ended (single ended option)
Double sided (single sided option)
Two section with single articulation in centre of car (options; rigid or two articulations)
Capacity: 200 passengers depending on seat/stand split
Space for 2 wheelchairs

Power and weight

Unladen weight	22tonnes

Two 90kW motors driving 80% of axles

Hybrid	100 kW Generator set with 90kW, 1kWh Energy storage unit
Fuel	renewable biogas (carbon neutral)

Operational performance.

Maximum gradient	10%
Minimum horizontal curve radius	15 m
Minimum vertical curve radius	200 m
Nominal axle loading	5t. (7t maximum fully laden)
Rail gauge	1435 mm. (standard)

Safety

Meeting EU STD (street running and crash protection)
RVAR compliant

Environmental

No external supply
Emissions below EURO 6 environmentally friendly vehicle specification

Noise	< 70db(A)
CO_2 emissions	< 800g/km (carbon neutral operation)

APPENDIX 2

The Service

The service will operate from 6 am to midnight.

Phase 1

	Tram	A	B	A	B	A	B
				Minutes past each hour			
Museum		0	10	20	30	40	50
New Cut		2	12	22	32	42	52
Create		3	13	23	33	43	53
Ashton Gt.		5	15	25	35	45	55
Ashton Gt.		8	18	28	38	48	58
Create		10	20	30	40	50	0
New Cut		11	21	31	41	51	1
Museum		13	23	33	43	53	3

Phase 2

	Tram	A	B	C	A	B	C
					Minutes past each hour		
Temple Meads		0	10	20	30	40	50
Redcliffe		2	12	22	32	42	52
The Grove		4	14	24	34	44	54
Museum		6	16	26	36	46	56
New Cut		8	18	28	38	48	58
Create		9	19	29	39	49	59
Ashton Gt.		11	21	31	41	51	1
Ashton Gt.		17	27	37	47	57	7
Create		19	29	39	49	59	9
New Cut		21	31	41	51	1	11
Museum		22	32	42	52	2	12
The Grove		24	34	44	54	4	14
Redcliffe		26	36	46	56	6	16
Temple Meads		28	38	48	58	8	18

APPENDIX 3

Patronage estimate

Phase 1

The estimated daily return trips (or pairs of single trips) between the 4 stops on the route is shown in table A4.1. It is expected that roughly half these will be during peak time over a two hour period. The figures for Ashton Gate assume that 700 car parking spaces are provided within a convenient distance of the terminus. This will be mainly for visitors with restricted space for commuters.

Table A3.1 Return trips per day

From (origin)	Museum	SS GB	CREATE	Ashton Gate	Total
To (destination)					
Museum		10	30	250	290
SS GB	30		20	250	270
CREATE	30	10		200	200
Ashton Gate	50	10	10		**760**
Total	110	20	10		**140**

Grand total of return trips: 900 per day.

Phase 2

The estimated daily return trips (or pairs of single trips) between the 7 stops on the route is shown in table A3.2. It is again expected that roughly half these will be during peak time over a two hour period. The figures for Ashton Gate assume that the same 700 car parking spaces are provided.

Table A3.2 Return trips per day

From (origin)	Temple Meads	Redcliffe	The Grove	Museum	SS GB	CREATE	Ashton Gate	Total
To (destination)								
Temple Meads		20	20	20	20	30	150	260
Redcliffe	20		10	10	10	10	150	190
The Grove	20	10		10	10	30	150	200
Museum	30	10	10		10	20	250	280
SS GB	40	10	20	10		10	250	260
CREATE	40	10	10	10	10		200	200
Ashton Gate	40	20	20	20	20	20		**1390**
Total	190	60	60	40	30	20		**400**

Grand total of return trips: 1790 per day.

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