West of England Rapid Transit North Fringe to Hengrove Package

Technology Review

Executive Summary

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EXECUTIVE SUMMARY

Introduction

1. The four Unitary Authorities of the West of England, Bath and North East Somerset, the City of Bristol, North Somerset and South Gloucestershire ("the West of England Authorities"), are currently undertaking a programme of work to develop a rapid transit system for the West of England area.

2. In 2006 the Greater Bristol Strategic Transport Study (GBSTS) identified the need to progress a rapid transit network for the sub-region, as part of a package to successfully and appropriately accommodate additional transport movements arising from predicted residential and employment development over the next 20 years. The study concluded that

   "*further work is required to identify the type of vehicle used to operate the service but modern, low-floor, articulated buses are likely to be the most appropriate, flexible and cost effective vehicles to satisfy the requirements of the service*".

3. The West of England Authorities wish to ensure that the most appropriate technology is identified for its rapid transit network. This will inform stakeholder discussions and public consultation and support the assessment of options as part of undertaking a major scheme business case appraisal which meets the Department for Transport's requirement for capital funding.

4. In 2008 a technology review of available technologies was undertaken to ascertain the most suitable rapid transit technology for the Ashton Vale to Temple Meads route. This study concluded that "*Bus Rapid Transit should be pursued for the Ashton Vale to Temple Meads rapid transit route as it: best meets the rapid transit scheme objectives; is the most cost effective, flexible; and can be delivered within the current programme and available funding*".[1]

5. In July 2009 the Secretary of State approved approximately £450 million of government funding for eleven major transport schemes across the West of England sub-region. Three of the approved projects form part of the proposed rapid transit system:

   - Ashton Vale to Temple Meads;
   - North Fringe to Hengrove Package; and
   - Rapid Transit – Temple Meads to Emerson's Green

[1] *West of England Rapid Transit, Technology Review*, August 2008, Steer Davies Gleave

6. The North Fringe to Hengrove Package (The Package) links existing housing with business and tackles current traffic and congestion issues, as well as helping to encourage investment into the area. It is aimed at improving the quality of life for people in the area - tackling congestion, improving road safety, making schools, shops, healthcare and jobs more accessible to people, and improving air quality.

7. The Temple Meads to Emerson's Green rapid transit comprises a continuation of the Ashton Vale to Temple Meads route to serve the communities on the outskirts of Bristol who currently have limited public transport and have to rely on the car. This route would be implemented towards the end of the current programme.

8. The three interrelated projects which make up the North Fringe to Hengrove Package are:

- Rapid transit route connecting Hengrove with the city centre;
- Rapid transit routes connecting the North and East Fringe with the city centre and the Stoke Gifford Transport Link; and
- M32 Park and Ride.

Note that the branch to the East Fringe (Emerson's Green) is distinct from the Temple Meads to Emerson's Green proposals.

9. Following the 2008 Technology Review, Steer Davies Gleave has been commissioned to undertake a further review of appropriate technologies that could be used to deliver the Package.

10. The rapid transit routes as part of the Package are still being developed and route options consulted on. For the purposes of this report and the comparison of different technologies, the following assumptions on the Package rapid transit routes were used:

- The North Fringe route is approximately 21.3 km long, including the branch to Emerson's Green.
- The route to South Bristol is approximately 5.7 km long.
- In the city centre the route has been assumed to follow the city centre route for the Ashton Vale to Temple Meads route, that is running on an anti-clockwise unidirectional loop around the city centre, approx 1.8 km long. For the bus-based options it is assumed no further work is required on this section. For light rail based options it assumed that these sections would have track laid and would operate as shared running.
- Peak service frequencies of 12 services per hour or a vehicle very 5 minutes.

Study Process

11. This technology review has followed professional guidance documents and accepted industry practice. In assessing the appropriateness of different technology options these advocate a process of:

- Assessment at increasing levels of detail in a step-wise or iterative manner to progressively eliminate those options that are not likely to provide an

appropriate or affordable solution to the identified need and objectives. To this end a staged process of firstly looking at a high level strategic assessment of the alternative technology options followed by a mode detailed review of the most appropriate technologies.

- Assessment against a set of criteria which includes:
  - Goals and objectives including policy objectives.
  - Current problems and future challenges, including issues of local context within which the transit system will be implemented and operated.
  - Physical opportunities and constraints that will influence the design or technology choice.
  - Deliverability.

12. Information for this study has been drawn from a number of sources including the following:

- West of England Rapid Transit, Technology Review, Steer Davies Gleave, August 2008;
- West of England Partnership: Greater Bristol Bus Rapid Transit (BRT) Technology Review of Systems, Halcrow Group Limited, September 2007;
- The Hybrid Ultra Light Transit System (HULTS): An Alternative Proposal to Bus Rapid Transit from Bristol City Centre to Long Ashton Park and Ride, Scott Wilson, June 2008;
- Railway Group Standards;
- ORR Technical Guidance;
- DfT and local authority press releases, magazine articles, vehicle and system manufacturers' websites and other online resource;
- Visits to the West of England Rapid Transit corridors, and other rapid transit schemes in UK and overseas; and
- Our knowledge and experience from other projects.

13. The following organisations involved in promoting the HULTS scheme were invited to contribute to this study:

- Parry People Movers / Parry Associates
- James Skinner
- Colin Jefferson

14. John Parry provided a general update on the PPM technology, reported increased interest in the system from North America, and advised us to view the Parry Associates website for further information.

Public Transport Technologies

15. The consideration of all the different public transport options for a transit network in the West of England has previously been undertaken firstly by GBSTS and further as part of the rapid transit scheme development. These range from high capacity, high cost mass transit systems such as London Underground to low capacity and low cost systems such as automated people movers and conventional bus systems.

16. A high level review of capacities and costs and previous assessment work undertaken, has concluded that the technology options of mass rapid transit, heavy rail, tramtrain and light rail are, in our opinion, not appropriate technologies for the proposed rapid transit network. This does not mean that these technologies are not appropriate in specific circumstances but they fit less well with the proposed objectives of the rapid transit scheme and they are less likely to provide a successful case for government funding for this particular scheme.

17. This technology review therefore concentrates on the rapid transit technologies of Light Weight Rail and Bus Rapid Transit.

Technical Review

Light Weight Rail

18. Light Weight Rail (LWR) (sometimes referred to as Ultra Light Rail) has been developed by Parry People Movers (PPM) as an intermediate mode between bus and tram and is also being promoted by Sustraco/Ultralight Rail. The aim is to provide a lower cost intermediate mode which could run in place of branch line services on the national rail network or a low cost alternative to tram technology.

19. The key benefits of this technology are its proposals to run on lower emission fuels and provision of a fixed rail system at a lower cost than light rail systems. The HULTS report states that fuel consumption could be up to 40% below that of a standard bus.

20. Deliverability is a significant concern with this technology as, with one exception, only development vehicles have been produced and trialled on a number of short rail routes, where the vehicles operation can be segregated from other uses. The one exception is the operation of 2 PPM vehicles on the Stourbridge branch since May 2009. This operation has been generally satisfactory so far, although the vehicles were briefly withdrawn due to rapid wheel wear problems, currently being investigated.

21. Some of the issues that would need significant investigation to determine the cost and risk include:

- Development of a LWR vehicle of the required size and capacity, sufficiently durable for long term public transport use;
- Development of the bogie technology and coupling arrangements required for such a vehicle;
- A robust assessment of the scope for adopting a lower cost trackform (in both segregated and street-running alignments) addressing initial cost, ongoing maintenance requirements and costs, interfaces with utility apparatus (including

utility safety and maintenance requirements), durability under traffic loading (for shared running), future track replacement issues etc.

22. Current LWR vehicles are small, and the ability to couple them to form a larger unit is unproven. For larger flows, it would be necessary to operate a higher frequency service of the smaller vehicles, which in turn will lead to a reduction in rapid transit priority and increased operating costs.

23. The current route options assume use of the M32 motorway between the Park and Ride site and the City Centre. For the purposes of a comparative assessment of LWR against other modes we have assumed that rail tracks could be provided along the motorway alignment. To our knowledge this had not been proposed elsewhere, and there must be considerable doubt that such a solution could be achieved in practice.

24. Conventional Light Rail systems are currently costing on average around £12 million per km (total cost). The HULTS promoter claims a cost of £3 million (for the track). Removing both the electrification and all the utilities cost from the average tram cost could account for a possible reduction of 33% in the cost of construction producing a track cost of approximately £8 million. The removal of all but the site preparation, highway and trackwork costs results in a cost of £5 million compared to the proposed £3 million rate. However, many of the non-track infrastructure elements of a Light Weight Rail system would be similar to those for a BRT system on the same route.

25. An estimate of costs has therefore been undertaken on two bases: firstly, the HULTS promoter cost of £3 million per km, together with an additional allowance of £0.6 million per km for structures, and secondly, the HULTS promoter cost of £3 million per km plus an allowance for structures, site preparation, highway works and park and ride site based on the Halcrow estimate for these elements of the comparator BRT scheme.

26. Using HULTS £3.6 million per km estimate the total scheme costs would be in the order of £130 million. Using the HULTS promoter cost but adding in an allowance for other elements from the BRT estimate provides a cost in the order of £232 million. Our estimation of costs per kilometre for this system, based on current tram costs but allowing for the proposed reductions proposed by HULTS for track work is in the order of £8.3 million per km. These all exclude costs such as land and environmental works but include vehicles and are in current prices.

Bus Rapid Transit

27. Bus Rapid Transit aims to deliver the characteristics of fixed rail systems but with bus-based technology. This consists of a variety of physical measures in conjunction with operational and system elements such as a segregated alignment, high quality dedicated vehicles, improved stop infrastructure, on-street priority, improved passenger information and high frequency services.

28. There are still relatively few BRT systems in operation, although this is increasing, and systems have applied the suite of different BRT measures, both physical and operational in varied ways. There have been significant issues with the quality and reliability of the bespoke bus technologies which have tried to use innovative technologies such as Phileas, Guided Light Transit etc. and there has been some

criticism of the ride quality of slip-form kerb guidance (which is dependant on the quality of construction).

29. Bus Rapid Transit does have a number of key benefits :

- Flexibility – routes are more easily adaptable to change through the life of the system and changing needs of urban conurbations. Bus services from a wider geographic area can benefit from the infrastructure investment improving the reach of the system.
- Value for money – BRT systems cost considerably less than comparable fixed rail systems.
- Mode shift – BRT systems are delivering good reliable services and as a result showing much higher levels of mode shift than conventional bus systems.
- BRT services can operate on the M32 motorway (although the provision of dedicated BRT lanes would need to be agreed with the Highways Agency).

30. BRT costs are estimated in the order of £160 million (2009 prices).

Trolley Buses

31. Trolley Buses have recently been selected as the preferred mode for Leeds New Generation Transit. Other than the need for an overhead power supply, the principal attributes of trolley buses are largely similar to diesel (or other fuel) buses. Trolley buses are considered in the power and fuel technologies section.

Power and Fuel Technologies

32. Alternative fuel technology is still in its infancy and is continuing to evolve. There are some encouraging developments including work being undertaken by Bath & North East Somerset Council and their partners First Group through the European Commission's CIVITAS Plus Initiative 'Testing Innovative Strategies for Clean Urban Transport for Historic European Cities'. This initiative will include a demonstration project in Bath and trial a 'green' fuel articulated bus, appropriate for a historic city environment. The outcomes of this will be important consideration to the rapid transit scheme development.

33. A key issue is the operational feasibility of alternative technologies for a large scale network, including the infrastructure investment required, maintenance and reliability. This, and the small fleet sales, manifests itself in high vehicle costs.

34. For the present and short to medium term, diesel power is likely to remain the most widely available fuel for local bus based vehicles. The ongoing development of hybrid drive systems is likely to reduce their cost and increase their capability and reliability. Hybrid vehicles could be a viable alternative in the next few years and developments in these markets should be followed to identify whether a feasible hybrid technology could be introduced at the time of rapid transit implementation.

Summary and Conclusions

35. LWR is also still in development. Both the vehicles and the track for LWR need to be developed, trials undertaken, required approvals obtained and large scale

procurement and construction undertaken. This is unlikely to happen before 2016 and therefore is outside the current regional funding allocation programme. In our opinion costs for LWR are also likely to significantly exceed the current funding available for rapid transit.

36. LWR may provide a future suitable application as part of a public transport network in the West of England area however there is significant development work of the technology that needs to be undertaken before a major scheme application based on LWR could be put forward. The delivery of rapid transit corridors using bus technology should not preclude the corridors from being changed to LWR in the future should this prove to be deliverable.

37. Without demonstration of costs in delivery of the technology on the scale of the North Fringe to Hengrove Package the proposal of LWR would require the West of England Authorities to take on considerable capital cost and development risk. The risks associated with delivering bus rapid transit are considerably lower than LWR.

38. Our best estimate of LWR costs is around £232 million, compared with £160 million for BRT.

39. Diesel power remains the most practical fuel technology for now. New technologies, offering low emissions, such as hybrid technology, are continuing to be developed, and are likely to be a viable and more cost effective alternative in the next few years. Progression of this technology should be monitored as the project develops, with further consideration of the most appropriate technology for the rapid transit network to be carried out as part of the scheme final specification before construction.

40. In our opinion, Bus Rapid Transit should be pursued for the North Fringe to Hengrove Package rapid transit routes as it: best meets the rapid transit scheme objectives; is the most cost effective, flexible; and can be delivered within the current programme and available funding.