

ArupTransport

Tyne and Wear Passenger Transport Authority

New Tyne Crossing

Summary of Proof of Evidence on Engineering

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SUMMARY OF PROOF OF EVIDENCE ON ENGINEERING

1. Following earlier studies, the Hambros consortium was appointed by the Tyne and Wear Passenger Transport Authority (TWPTA) in 1995 to report on the feasibility study for a new PFI crossing of the River Tyne at St Bedes. They considered a range of options, and concluded that there was a significant benefit in providing an immersed tube tunnel, funded by the PFI process.
2. The Arup consortium was appointed in 1999 to carry out the work necessary to obtain approval under the Transport and Works Act (TWA), to advise on the appointment of a Concessionaire to carry out the detail design and construction of an Immersed Tube Tunnel and to operate and maintain both it and the existing tunnels for a specified concession period.
3. As part of their initial work, the Arup consortium undertook a number of engineering, transport, environmental, planning legal and financial studies. These included a review of the original Feasibility Study Report by the Hambros consortium, which concluded that certain engineering parameters had changed. These were re-examined, and it was concluded that the changes did not invalidate the conclusions on which the TWPTA had chosen an immersed tube tunnel.
4. The Arup consortium also looked into various configurations for the immersed tube tunnel and concluded that a new two lane tunnel was appropriate. This would take southbound traffic, leaving the existing tunnel to become one way, northbound under normal operation.
5. In order to provide to the TWPTA a full, equivalent assessment of both a Bored and an immersed tube tunnel, the Arup consortium also undertook further detailed investigations into both options. These were presented in May 2001, comparing the main engineering features, economic parameters, costs, environmental effects other effects and likely tolls of the two options. This is summarised in paragraph 2.16 of my main Proof of Evidence. In May 2001 the TWPTA confirmed their choice of an immersed tube tunnel. The comparison was updated in January 2002, and the TWPTA reaffirmed their decision in February 2002.
6. Exhibitions and Consultations
 - 6.1 Exhibitions were held in July and August 2001 to make the scheme better known to the public, and to ask for their views on an alternative junction layouts to the south of the southern portal (known as the Jarrow Junction and Simonside junctions). The Simonside junction had hitherto always been shown on the development plan for the new crossing.
 - 6.2 Following the exhibitions the TWPTA resolved to accept the Jarrow junction as the selected option. This was also endorsed by South Tyneside Metropolitan Borough Council.
7. Reference Design and TWA Application
 - 7.1 Design work continued on the "Reference Design". The Reference Design is necessary to show that all engineering issues have been considered and are capable of being resolved, that all environmental and planning implications can be assessed that sufficient detail exists for the TWA application to be made, and that sufficient information exists for tenderers for the concession.
 - 7.2 This engineering analysis in the Reference Design considered such matters as: -
 - Spoil disposal
 - Tunnel alignments
 - Port of Tyne Authority requirement

- Northern junction options
- Southern junction options
- Right of way stoppages and diversions
- Public transport issues
- Safety
- Electrical and mechanical issues
- Probable construction and programme
- Accommodation works issues, particularly those of AMEC

7.3 It culminated in the plans and schedules submitted as part of the TWA application in May 2002.

8. The Concession

8.1 It is intended that that a Concessionaire will be responsible for the design, construction operation and maintenance of the existing tunnel and the operation and maintenance of the existing vehicular, pedestrian and cycle tunnels. He will also be responsible for upgrading the existing vehicular tunnel where this is practical, on safety and traffic operations considerations.

8.2 This concession is likely to be for a period of about 30 years. The Concessionaire will provide equity and take loans to accomplish this. These loans will be paid from tolls levied on vehicles using the vehicular tunnels.

8.3 The Concessionaire will be selected as providing the best value for money. The intended tolls will play a significant part in the selection, as will the intended construction programme.

9. Existing situation

9.1 My detailed proof contains information on the existing vehicular, cycle and pedestrian tunnels.

9.2 The existing layout of the three tunnels is shown on Figure 3.1 of the Environmental Statement, (CD5 ES), which is included in Appendix H.

9.3 The construction of the Pedestrian and Cycle tunnels was completed in 1951, (now both listed as Grade 2), and the existing road tunnel was completed in 1967. The carriageway through the latter is 7.3m wide overall, giving one lane traffic in each direction. All vehicles using the vehicular tunnel pay tolls which are collected at the toll booths on the northern end, on both the entrance and exit sides of the road. Junctions at either end of the tunnel provide connections to the A19 and the local highway network. The Pedestrian and Cycle tunnels are served at each end by lifts and escalators. There is no charge for using these tunnels, the TWPTA intend they remain so.

9.4. Other facilities include;-

- administration buildings
- maintenance facilities on the north side of the river
- smaller maintenance buildings on the south side
- ventilation buildings on both sides of the river.

These are shown on Figure 3.1 of the ES, (Appendix H).

10. Scope of Work

- 10.1 Next, I provide details on the intended scope of work. The proposal involves the retention and continued use of the existing tunnels and the provision of a new immersed tube tunnel on the east, (downstream side) of them. This is shown on Fig. 3.1 of the ES, attached in Appendix H.
- 10.2 Both tunnels will be wide enough to carry two lanes of traffic, the northbound flows being routed in the existing tunnel and the southbound flows in the new tunnel. These changes to traffic flows require the junctions at each end of the tunnels to be reconfigured, in order to maintain the connections to the existing A19 and the highway network.
- 10.3 Other changes and facilities, (shown on the drawings attached in Appendix H), include:-
- A reformed toll plaza at the northbound exit, and a new toll plaza on the A19 before the southbound portal. This toll plaza includes an inspection area and a dedicated access for public transport. Both toll plazas will increase the ability of vehicular public transport to access the tunnels. Increased capacity will be provided by the provision of another tunnel.
 - A new Administration building, (adjacent to the new toll plaza),
 - A new Ventilation building on the south side of the Howard Street bridge
 - Several retaining walls, mainly on the north side, new bridges at the Jarrow junction, and modifications to existing bridges.
- 10.4 The development of the design has taken into account all the issues noted in paragraph 7.2 above.
- 10.5 The design has progressed to “Preliminary Design” stage. This as stated above is known as the “Reference Design”. The design is based on the “Design Manual for Roads and Bridges”, and in particular on BD 78/99, “Design of Road Tunnels”. It is designed to a 40mph design speed. The parameters for the design of the tunnel have been approved by the Tunnel Design and Consultation Safety Group”, which has met several times to review the design. This will continue to meet as the design is progressed by the Concessionaire.

11. Construction

- 11.1 The construction of the tunnel will comprise a section in the river constructed as an immersed tube; two sections in tunnels constructed by the “cut and cover” method, on both sides of the river, and roads (in open ground and in retained cut) on each side of the “cut and cover sections”. Full details of the immersed tube construction, the cut and cover units, and a possible method of construction and installation are in my main Proof of Evidence and are shown on Figures 3.4 and 3.7 of the ES, attached in my Appendix H.
- 11.2 The assumed tunnel construction will consist of three main elements
- An immersed tube tunnel. This will be formed of four long, box units, cast initially in a dry dock in the Howdon basin on the north side of the river. Two will be cast first, then floated out, after making them watertight, and sunk on the south side of the river, whilst the next two units are built in the dry dock. Towards the end of the casting of these latter units, a trench will be excavated across the river, deep enough to accommodate the units, when sunk, with a covering of rock, one metre thick. This excavation will only be permitted between November and March in any one year to avoid creating conditions in the river which might affect salmon and trout migration. Some of the spoil arising will be taken to sea disposal; other more suitable spoil will be stored temporarily on the south side of the river on the RMC site for re-use. The effects of the dredging, are covered in the Environmental Matters proof of Dr Paul Johnson, and in the proof on Spoil and Waste Management of Mr Ian Lofthouse.

On completion of the trench, the units will be floated out and sunk across the river in the trench. They will be joined together and the rock armouring placed over them. The trench will then be backfilled from the spoil that has been temporarily stored.

- Cut and Cover sections. These occur adjacent to the immersed tube on both sides of the river, where the tunnel is significantly below ground level. They join the immersed tube section. The cut and cover on the south side is much longer and deeper than on the north. The method of construction is again shown on Figures 3.4 and 3.7 in the ES and attached in Appendix H.

In this method of construction, two deep trenches are cut into the ground, one on each side of the proposed tunnel, to below the invert level. These trenches are filled with concrete and the ground excavated inside the trenches. The tunnel is then constructed at the bottom of the excavation in the form of a large concrete box, and then the excavation is filled in.

The tunnel may not be constructed in one long open excavation; it will probably be built in sections, to minimise the amount of material that has to be stockpiled at any one time, for re-use in filling the excavation.

- Roads in retained cut and in the open. On each side of the “cut and cover” sections, the tunnel emerges into daylight at the Portals. From these, the roads on both sides are at ground level, or are in cuttings, open to the sky, with higher ground held back by retaining walls. These are again shown on the drawings in Appendix H.

11.3 Structures work will comprise of two new bridges (at Howard Street and Jarrow junction) in STMBC, and protection to existing bridges, north and south of the river.

11.4 Retaining walls north and south of the river will also be built.

12. Land and Property

12.1 As the TWPTA do not own all of the land required for construction of the works, it is necessary to acquire land. Land which is required for the final works will be retained permanently by the TWPTA. Other parcels of land are only required on a temporary basis, for example for working space or access for surveying purposes.

12.2 The schedule at Appendix B of my evidence explains why every piece of land is required. Details are also shown on Drawings 57621/OA—CSK-086 and 087, in Appendix H

12.3 In particular, there are three listed buildings affected by the proposals

- The Gaslight Public House (Grade II) which lies very close to major excavation works and is planned to be demolished.
- The Charles Palmer Statue which is proposed to be relocated and renovated.
- Part of the boundary wall at the approach to the southern entrance to the Pedestrian and Cycle tunnels, which is to be modified to provide a bus turning area.

These are covered in detail in Mr Harvey Emms Proof of Evidence on Planning.

13. Community Severance

13.1 As an inevitable consequence of the development, there will be effects on the local community. I have shown that although there will be interruption to public rights of way, during construction, these are mostly of a temporary nature, and that because of alternative provision little inconvenience should result. Some Rights of Way will be permanently stopped up, but alternative routes and new routes will be provided.

- 13.2 A description of the existing routes which are affected is given in Appendix A and they are shown in Appendix H.
- 13.3 Amongst other matters, the Code of Construction Practice, (CoCP), requires the Concessionaire to produce a Traffic Management plan which details the measure to be taken in respect of temporary and permanent road and footpath closures and diversions. This plan must have the approval of the Local Authorities and the Police.
- 13.4 I have summarise dthe changes to Public Open Space and this is dealt with in more detail by Mr Harvey Emms.
14. Environmental effects
- 14.1 The construction works will create some adverse environmental effects, but stringent measures will be taken to minimise these. These are discussed in detail in the Proof of Dr Paul Johnson on Environmental Matters.
15. Utilities
- Discussions have been held with the public utility companies to determine the effect of these proposals on their plant and equipment. This information has been used to assess the costs of their diversions or protection measures. Appendix D of my Proof of Evidence includes details of affected utilities.
- 15.1 Advance design and construction work may start on utility (public service) diversions ahead of the main tunnel contract, although it is expected that the Concessionaire will undertake the bulk of these.
16. Costs
- 16.1 The Capital Cost of the development has been derived from calculations of the relevant quantities of the constituent parts, with appropriate construction rates; and an estimation of the likely percentage costs where items are immeasurable at preliminary design stage.
- 16.2 These costs have been developed for a range of possible events leading to price changes, and probabilities of these events happening have been assigned and a cost profile produced for a range of probabilities. The cost of the tunnel at second quarter 2000 prices has been estimated at £138.9m using this method.
- 16.3 The Operational and Maintenance costs have been estimated over the life of the concession, and have been used, with the capital cost of construction and other financial data, to estimate the likely range of tolls.
17. Safety
- 17.1 The immersed tube will be provided with a continuous safety cell (passage) when underground, and the existing bored tunnel will be provided with two vertical escape shafts to enable egress should the occasion demand.
- 17.2 The single most effective increase in safety will arise because of the conversion of the existing tunnel to one-way operation. Both tunnels will be provided with lighting, communication, signing, and ventilation which meet current safety standards.
- 17.3 A Tunnel Design and Safety Group has met several times to consider the current design of the tunnel to ensure that at this stage it complies with all the requirements that are necessary for it to operate safely. This group will meet regularly during the detail design process.

- 17.4 A detailed Marine Hazards assessment has been undertaken which has shown that the risk to the immersed tube tunnel from vessels sinking on or anchors dropping on it, are very small and acceptable to the Port of Tyne Authority, as well as the TWPTA.
- 17.5 Extensive measures will be imposed on the Concessionaire to ensure the highest standards of Safety during construction and operation.
18. Programme for procurement of the Concession and for Design and Construction.
- 18.1 Tentative programmes for Concessionaire procurement and subsequent design and construction are given in Appendix G of my proof. These indicate that the concession may be awarded in early 2005, with construction being completed late 2008 and early 2009, should the scheme be approved.
19. Conclusion
- 19.1 In conclusion I have shown that the tunnel can be designed to safe and acceptable standards, that engineering solutions exist for all foreseen construction activities, that it has a likely construction cost of £138.9m at 2000 (2Q) prices and that the design features and facilities provided will enable an operator to operate it safely.