Enterprise and Learning Committee

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Purpose

1. The Committee intends to examine and seek to influence the priorities and mechanisms for future railway infrastructure planning in Wales over the next 20-30 years. Included in this is the issue of the state of the Severn Tunnel and the need for a second Severn rail tunnel/crossing.

2. This paper sets out the views of The Severn Tunnel Action Group (STAG) regarding this issue.

Background

3. The Severn Tunnel was the longest main line railway tunnel in the UK with a total bore length of 4miles 628 Yards, and with the approach descents a total length of 8 miles 572 yards. It was opened to regular Passenger use on 1st December 1886.

4. The significant characteristics of the Severn Tunnel are its length, its wetness, the ventilation fan, the underground river, the maintenance regime and the signalling arrangements.

5. As in all underground tunnels there is ingress of water. It has been the practice that where the water squirts between the brickwork to provide down pipes to catch the water and direct it to the base of the tunnel. A large barrel drain runs beneath the tunnel to collect drainage water that is then pumped out at Sudbrook. The hundreds of drain pipes down both walls give testament to the number of leaks into the tunnel, though none are believed to be of significant volume.

6. Unusually the wettest part of the tunnel is the Welsh end under dry land. Under the estuary the drainage water is slightly saline. At the English end the tunnel roof caved in during construction, the hole was filled with a clay plug. Forty years later this was replaced by a large concrete "Mushroom" plug. British Rail employed a helicopter to maximise the time available at low tide to take material to site to repair the scour the river had made into this concrete plug.

7. During construction approaching Sudbrook the tunnelling broke into what was effectively an underground river. Called "The Great Spring" all attempts to seal it off failed, with the pressure of water breaking in on each occasion. This is now tapped off to its' own sump and six submersible pumps drain the 20 million gallons of fresh water every day. A fan of 20 " water mains spread out from Sudbrook Pumping station once feeding the M.O.D. Site at Caerwent, The Steelworks at Llanwern, the Paper Mill at Sudbrook the Brewery at Magor, the village of Sudbrook itself and many outlying farms. Today only a dozen or so farms and the Brewery take the water which owing to its hardness is ideal for beer making.

8. Between the end of 1929 and early 1931 seepage of sea water resulted in two half mile sections of the tunnel walls being drilled through and waterproof cement injected through to provide an outside waterproof coating which has proved effective.

9. The length of the tunnel and the fact that most of it is under the estuary it was not possible to provide the usual natural ventilation shafts. The answer was to provide a large fan at Sudbrook with forces air into the tunnel to ventilate it.

10. One of the adverse effects of this is that when the air outside has a high moisture content, the coolness of the tunnel results in significant condensation. On humid days even if not raining outside, everything in the tunnel is dripping with condensation aggravating the normal wetness due to seepage through the walls.

11. The resultant wet corrosive conditions have required a more frequent renewal of rails (believed to be on a six year cycle) than would be necessary elsewhere. The resultant rigorous inspection regime and earlier renewal of the track to ensure safety has resulted in a greater number of engineering closures than on the rest of the line.

12. Based on this more frequent inspection and replacement regime it is not believed that there is any significant reason why the Severn Tunnel could not continue in operation for the foreseeable future. We are not aware of any other structural or other concerns that could drive its early replacement.

13. At the time of the building of the new Severn Bridge as it follows and actually crosses over the line of the tunnel, it is understood the inclusion of a replacement rail link was considered. Despite the maintenance costs both for drainage and renewals it appeared there was no business case for replacing the tunnel at that time. We are not aware that there has been any significant change in circumstances.

14. Capacity through the Severn Tunnel is often talked about as a constraint, but it appears to be more of a perception than a reality. With the advent of colour light signalling it was possible to break up the four and a half mile tunnel into shorter sections. In the event only one signal for regulation of trains was put inside the tunnel in each direction to effectively divide the tunnel in to two sections.

15. With the vast reduction of freight traffic following the closure of the Severn Tunnel Marshalling yards these signals were blanked out as they were no longer considered necessary for the lower volume of traffic passing through.

16. As part of the All Wales RUS the question was asked why these signals were not being replaced as the line was once again being talked about as one with capacity constraints. The answer was that Capacity is not an issue on the lines between Newport and the other side of the tunnel, but as the signals are still physically in place it would be a relatively easy matter to bring them back into use if capacity

considerations merited.

17. As part of the Newport Area Signalling Renewal (NASR) scheme these signals are being renewed within the tunnel including all the cabling out to the signalling interlocking but remain de-activated, retaining the ease of re-instatement should they be required in the future.

18 The Network Rail "Rules of The Plan" defines a four minute headway (minimum time between following trains for timetable planning0 for the line between Cardiff and Severn Tunnel Junction and seven minutes through the tunnel itself.

19. The Department for Transport uses the term Capacity Utilisation Index to categorise all railway lines in the UK into three broad bands. Low below 30%, Normal between 31% and 70% and high 71% or above. If a line is in the high category the DfT may veto any proposals for additional stations, services etc. unless satisfied that remedial measures are included to avoid a delay to one train causing cascade delays to several subsequent trains. There are many lines in the UK already in this high band.

20. The index is calculated by multiplying the headway by the number of trains timetabled in any one hour and dividing by an hour. In the case of the Severn Tunnel the Capacity Utilisation Index would only pass into the High band if there were seven or more trains timetabled in any one hour. The maximum number of passenger trains in any hour is only four so only if three or more freight trains were also timetabled in the same hour would the stretch of line be categorised as at high capacity.

21. Based on this it can be seen why Network Rail do not consider the need to introduce the additional signals at this time, as it is rare to have two freight trains in the same hour, there are usually only one or none at all. Capacity is therefore not an issue from a theoretical point of view.

22. From a practical point of view when severe failures occur causing trains to stack up, then the seven minute headway compared with the four minute headway on the approaches to the tunnel can add an actual two to three minutes into the recovery of following trains when they all start to move again. If this "bottleneck" did not exist it would in many instances move the congestion further down the line, for example waiting platform clearances at Newport and Cardiff.

23. The speed of the line on the English side is 90 mph up to the approach to Abbleton Lane Tunnel. From there and all the way through the Severn Tunnel the line speed is 75 mph. It drops to 70 mph through Severn Tunnel Junction station and the junction itself before returning to 75 mph all the way through to Cardiff. From Undy towards Newport there is a "Differential" speed limit that allows High Speed Trains only with their superior braking to run at 90 mph.

24. As can be seen the Tunnel itself is not a significant factor in limiting the speed of trains, as for normal trains it is no more restrictive than the whole of the main line between Severn Tunnel Junction and Newport and from Newport to through to Cardiff. For high Speed Trains once they have cleared the 70 mph restriction through the junction and station there is the potential of say three to three and a half miles of the higher 90 mph if the tunnel did not exist. This gives a potential savings of two minutes for the High Speed Trains though nil for the Portsmouth and Taunton services.

25. With regard to electrification the tunnel has a bowed side rising 7 foot high followed by a semicircular arch 26feet in diameter. This is no different than any other main line tunnel giving sufficient clearance for the provision of an overhead electrification catenary.

26. The item of concern is the inward seepage of water. Until it is identified and trapped by the provision of a drainage down pipe there must be the potential for causing a flashover from the 25,000 volt overhead wire.

27. The question is if it is the intention to undertake a similar exercise to that in the 1920's / 30's to inject a waterproof coating through the brickwork to effectively make the tunnel dry. If this is undertaken and if the majority of trains are electric there must be potential for reducing or eliminating the need for the fan to clear exhaust fumes from the tunnel.

28. If these two actions are taken it then poses the question of if the present maintenance cycle could then be extended owing to the dryer and less hostile conditions which would have the advantage of potentially reducing considerably the need for engineering closures and diversions.

29. If the Shoots option of a barrage was chosen to be constructed, it raises the possibility of building a new railway line across it and abandoning the existing tunnel. This could, depending on the alignment, allow the extension of the 90 mph running from the English side to where the differential 90 mph exists at Undy. As shown above this has the potential of speeding up the services by about two minutes. However as the alignment of the proposed new barrage does not follow the line of the existing railway, the "doglegs" on each approach may limit this potential for delivering the improvements.

30. Unlike the option of putting the railway high above the estuary on the new Severn Bridge, crossing on a barrage close to the water would require assurances that in winter storms and gales that the operation and the high voltage electrification would not be affected by salt water. One only has to see the effect of winter storms at Dawlish and even Penzance to realise that significant weather protection may have to be included.

Summary / Recommendations

31. There does not appear to be a real capacity constraint through the Severn Tunnel, and if as a result of growth it becomes so it is relatively easily and cheaply remedied by activating the dormant signals in the tunnel.

32. The potential for reducing journey time by building a replacement to the tunnel would appear to only be in the order of two

minutes, and if reducing journey times is an issue it would seem that examination of the 75 mph speed limit between Severn Tunnel Junction and Cardiff should deliver considerably greater savings.

33. With the present maintenance regimes there does not appear to be any necessity to finding an alternative to the existing tunnel.

34. The tunnel should allow electrification, though remedial work to limit water ingress will probably be required.

35. A dryer tunnel and potential for less forced ventilation raises the question of if the present maintenance regime could be extended, reducing the number of engineering possessions required.

36. As a financial case could not be made for including rail during the construction of the New Severn Bridge it raises doubts that a case could be made for utilising the Shoots barrage if this goes ahead.

37. Should a case be made for putting the line across a Shoots barrage, assurances need to be obtained that the design would enable an electrified railway not to be subject to closures / interruptions during severe weather.

38. If a case can be made for including a rail line across a new Shoots Barrage then subject to the assurances above it should be pursued as it would have the advantages of reducing the high level of engineering possessions and diversions required by the tunnel and also avoid the high costs of pumping and generally maintaining and operating the tunnel.