A proposal for improving the Murray Bridge to Adelaide railway

Executive summary

Various proposals have been put forward with a view to improving the standard gauge railway between Murray Bridge and Adelaide. The present route suffers from steep gradients, tight curves and low tunnels which result in slow speeds, high energy use and the inability to employ double stacking of containers. In addition, the steadily increasing freight traffic causes noise disturbance to suburban residents living close to the line and long delays to road traffic at level crossings. However, when the options put forward to overcome these problems were evaluated, they did not offer sufficient cost benefit to make them attractive.

This paper proposes a new approach which is likely to yield an improved cost benefit while providing a better solution to the problems mentioned above. This is to be achieved by the construction of a 19.5 km tunnel between Verdun and Goodwood which would have a number of advantages:

1. Steep gradients and tight curves would be eliminated and trains would not have to climb to the top of the Mount Lofty Ranges.
2. The route would be shortened by 18 km and built for high speed so that the transit time would be decreased by at least 50 minutes.
3. The above items would bring about a considerable saving in fuel and wear and tear and provide a useful reduction in CO_2 emissions.
4. Six low tunnels would be bypassed which would be a major step towards enabling the double stacking of containers.
5. Fifteen level crossings would be bypassed (including Cross Road where excessive traffic build up is experienced).
6. The noise disturbance to suburban residents would be eliminated.
7. The suburban railway to Belair could return to double track operation and hence deliver a better service to users.
8. The shorter route would be advantageous for the Overland passenger service to Melbourne and an express passenger service from Mount Barker and Balhannah to Adelaide would become feasible.
9. Minimal property acquisition would be necessary.
10. A significant step towards achieving a unified national rail network would have been taken.

1. Introduction

In June 2010, The Department of Infrastructure, Transport, Regional Development & Local Government issued the final report of its Adelaide Rail Freight Movements Study [1] in which five options were evaluated as follows:

Option 1: Upgrade Adelaide Existing Hills Alignment.
Option 2: Northern Bypass via north of Truro.
Option 3: Northern Bypass via south of Truro.
Option 4: Southern Alignment.
Option 5: Upgraded Existing Alignment and Northern Bypass via south of Truro.

As the cost benefit analyses for the various options were unfavourable, none of the possibilities has been put forward for implementation.

Notwithstanding this unfavourable response, there remains an earnest desire from the freight operators and the SA community for action to be taken. The responses from interested parties which are tabled in the Final Report show that a majority of respondents indicated a preference for Option 3 and examples of continuing interest in the matter since the issue of the Final Report can be seen in a paper from the City of Mitcham [2] and the minutes of a group of interested citizens known as the Rail and Transport Committee [3].

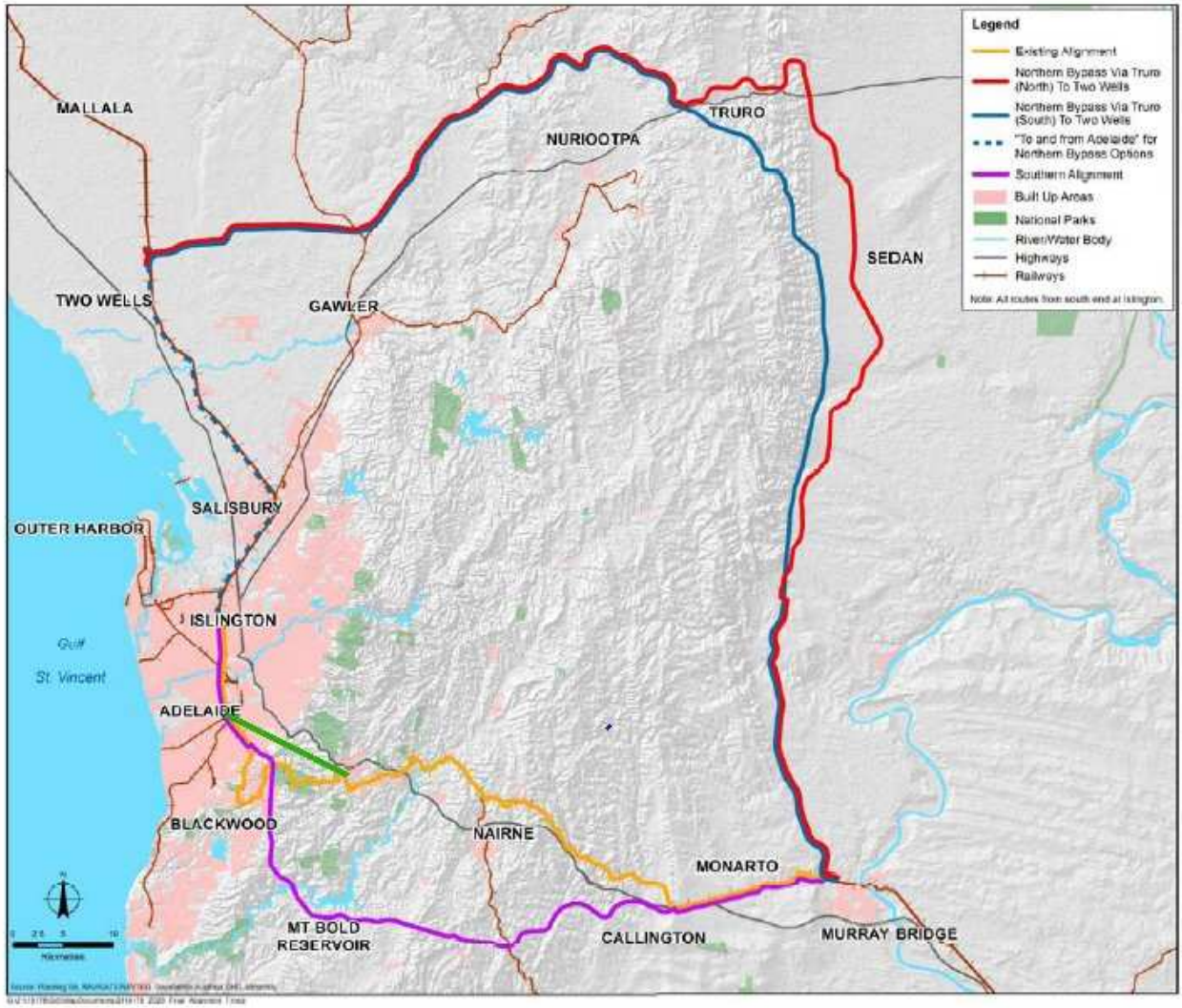
This paper proposes a new solution which does not seem to have been considered before. Essentially it suggests the construction of a 19.5 km tunnel under the highest part of the Mount Lofty Ranges between Verdun and Goodwood in combination with that part of the improvements included in Option 1 which are located east of Verdun (mainly near Murray Bridge). This combined solution would yield a result superior to that of Option 3 and at a lower cost. Moreover, a significant part of the increased savings enjoyed by the freight companies using the line could be recouped, leading to an improvement in the cost benefit.

2. Proposed Alignment

It is proposed that the eastern end of the tunnel would be sited at the Beaumonts Road bridge near Verdun. This location lies between the recently completed Ambleside loop and the Ambleside Tunnel. It is anticipated that a descending approach track, parallel with the existing embankment, would be required to the east of the portal plus road access for personnel and equipment from Beaumonts Road. Hence a small amount of land acquisition would be required at this location.

It is true that there are more sections with steep gradients from the east of Verdun to a few kilometres beyond Callington [4]. However, the cost of an additional 40 km of tunnel would be much harder to justify as there would be only a minor reduction in distance traveled and less spectacular savings of time and fuel.

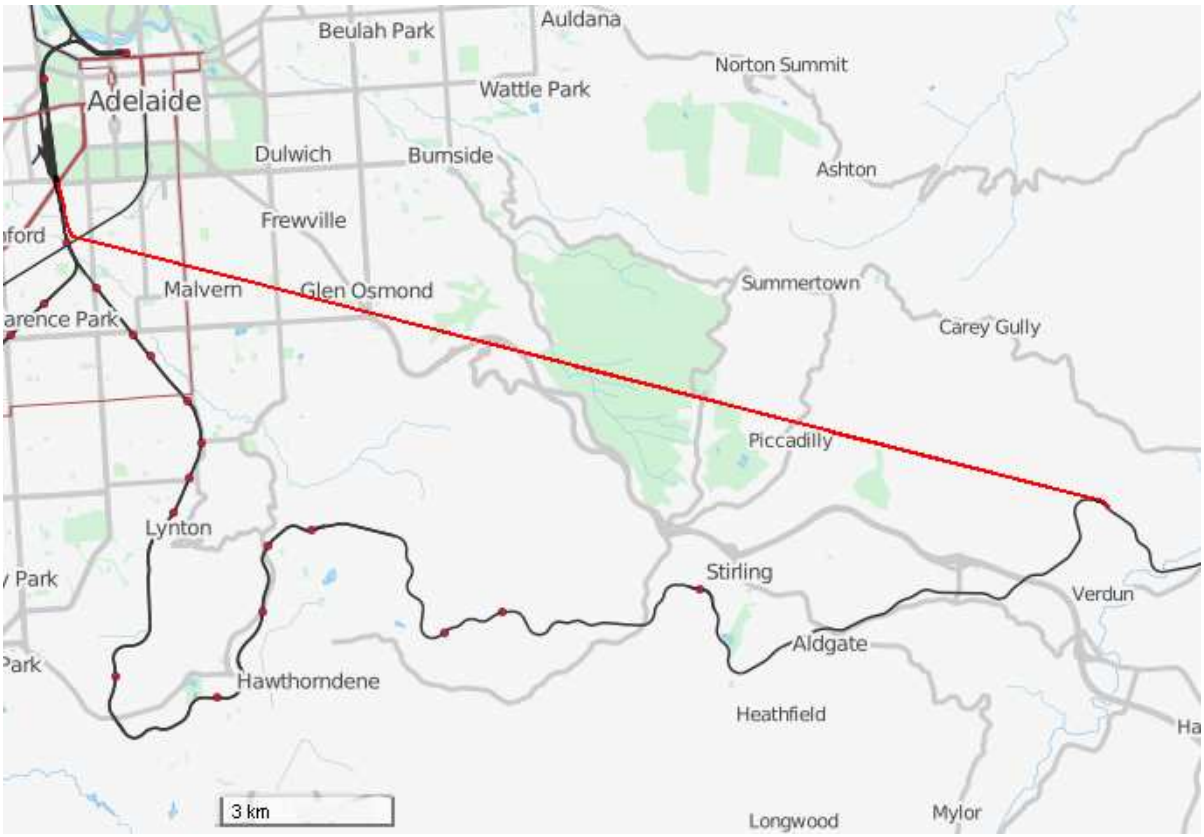
The Adelaide end of the tunnel would best be located between the Anzac Highway bridge and the Leader Street level crossing at Goodwood. The approach track would be required to descend from the bridge into a cutting leading to the portal close to Leader Street. This location satisfies the need to bypass suburban level crossings (as far as Mile End) and also provide access to the Keswick Passenger terminal required by the Overland passenger service. The tunnel location, relative to Options 1 to 5 can be seen shown in green on the map below. A larger scale map appears on the following page.



Source: GHD, 2010

Location of proposed tunnel – shown in green

It is suggested that the tunnel pass initially under Goodwood station in case there is a future need to provide a passenger interchange there. Thereafter it would follow a gentle curve until it was heading directly towards Verdun. Apart from this curve and one at the Verdun end, the bulk of the tunnel would be perfectly straight for the greater part of its length. Moreover, since it would be unnecessary to climb to the top of the Mount Lofty Range, the maximum gradient would be about 1.6% as opposed to the many sections with a gradient of 2.2% on the present track.



Location of proposed tunnel – shown in red (larger scale)

The total length of the resulting tunnel would be about 19.5 km, but it would replace 38 km of the existing alignment. It would be constructed to permit double stacking of containers and a high operating speed resulting in a much reduced transit time. This, along with the work at Murray Bridge proposed in Option 3 would result in a reduction of the transit time from Melbourne to Adelaide of almost 2 hours.

The estimated cost of the tunnel is about $1.3 bn which is quite a rough estimate and would require careful checking before any decision was taken. However, the writer has considered this matter carefully and tried to be realistic.

Of interest to the public of SA is the fact that the Overland passenger service would be improved and the possibility arises that an express passenger service from Mount Barker and Balhanna to Adelaide could be envisaged. Also the Adelaide Metro passenger service to Belair could return to double track operation providing a better service and possibly allowing the reopening of 3 stations which were closed when the standard gauge line commenced operation.

3. Engineering issues

3.1 Tunnelling

All of the Options 1-5 included some tunneling, especially Option 4 which proposed a greater total length of tunnels than this proposal. Although constructing a long tunnel is a major undertaking, there are many examples around the world of comparable size, either completed or currently under construction from which experience can be gained. Hence it should not be difficult to obtain information on the type of boring machinery best suited to our requirements, the method of supporting the tunnel roof and finishing the walls and, of course, the likely costs involved.

The major tunnel parameter to be determined would be its diameter. Double stacking of containers requires a clearance of 7.1 metres and hence the diameter to be bored is likely to be in the range of 8.5 – 9 metres. In this case, it is interesting to note that, if the main track were placed a little off-centre in the tunnel, it would be possible to include a second track beside it for trains requiring a clearance of 4.25 metres. This would be useful not only for single height freight but also for a possible express passenger service.

The technology required would be affected by the nature of the terrain to be tunnelled. The greater part of the tunnel would be through hard rock but much of the length across the Adelaide Plain could be in clay. This may require a different type of machinery and tunnel support technique. It would also be necessary to determine if pressurisation would be required to prevent roof falls at the working face.

Another interesting parameter is the rate at which tunnelling could be reasonably be completed. It is possible that a rate as high as 25 m per day could be achieved. Calculating on a more conservative average of 20 m per day and assuming tunnelling takes place from both ends, the work could be completed in 488 days, i.e. about 1 year and 4 months. This suggests that the whole project could be completed in about 4 years.

3.2 Water management

During tunnel construction, it is inevitable that some water would seep into the tunnel. Whether this would be a trickle or a flood is an important question. Expert advice should be sought, but in the end actual experience is what counts. At the Verdun end, water would run downhill to the working face. Any reasonable quantity would have to be pumped away and disposed of. Perhaps sink holes at regular intervals would suffice. At the Goodwood end, the water would run towards the lowest point near the tunnel portal.

Another matter which would require consultation with the appropriate experts would be the relationship between the tunnel and the aquifers on the Adelaide Plain.

3.3 Spoil handling

Provisions would have to be made for handling the spoil removed during tunnelling. Rock could be collected in wagons placed on the approach tracks and then transferred to a suitable site for crushing. The resulting material could then be sold for road metal, ballast or other construction purposes. To this end it may be useful to negotiate an agreement with a quarrying company to sell the product to ensure that the State is not inundated due to overproduction. The clay removed from the Goodwood end could also be used for the construction of bridge approaches etc. Whether there would be sufficient demand for the quantities involved is an interesting question, the solution of which may require some ingenuity.

3.4 Ventilation

Vertical ventilation shafts are the most effective but, as a large part of the tunnel would be quite deep underground, there would be limited opportunities for their application. Hence it would probably be necessary to supplement these with axial fans at suitable intervals. However, it would also be worth investigating whether some deviations from the straight track alignment proposed and a somewhat higher gradient over some sections would increase the number of possibilities for siting vertical shafts.

4. Benefits of this proposal

In order to compare the attributes of this proposal with those of the other options previously assessed, the following table has been constructed. For the most part it has been copied from the Adelaide Rail Freight Movements Study Final Report, but in addition it shows an Option 6 which consists of those upgrades from Option 1 which are east of Verdun plus the Verdun to Goodwood tunnel proposed herein.

The Options	Attributes						
	Distance (from Murray Bridge)		Capacity	Double-stack	Transit time (from Melbourne)		Total undiscounted preliminary estimate of capital cost
	(kms)		(Mtpa)	yes/no	(hrs)		($billion)
	Islington	Two Wells			ADE	PER	
Base Case: Existing Alignment	104	141	10.7	no	13	57	0
Option 1: Upgraded Existing Alignment	104	141	23.6	yes	13	57	0.7
Option 2: Northern Bypass via north Of Truro to Two Wells	209	172	40	yes	12.9	55.1	2.9
Option 3: Northern Bypass via south Of Truro to Two Wells	191	154	40	yes	12.6	54.8	2.4
Option 4: Southern Alignment	96	133	40	yes	11.2	55.2	3.0
Option 5: Upgraded existing and Northern Bypass via south Of Truro	104	154	63.6	yes	13	54.8	3.2
Option 6: Upgraded existing east of Verdun plus Verdun to Goodwood tunnel	86	123	40	yes	11.1	55.1	1.8

It is evident that Option 6 is superior in distance traveled and transit time while being the least expensive, except for Option 1 which fails to address the many disadvantages of the existing alignment. An additional advantage compared with the Base Case arises from the fact that traffic would not have to climb to the full height of the Mount Lofty Ranges. Hence it is clear that Option 6 would provide significant savings in fuel and wear and tear for the freight operators. Recouping some of their savings would make a major contribution to the cost benefit of the proposal.

Option 6 is also favourable in terms of social issues, including noise elimination in urban areas, bypassing level crossings and facilitating improvements to passenger services, including the Overland service to Melbourne. Finally, the environmental impact would be much less than for other options in terms of land use and CO_2 emissions..

5. Conclusions

A proposal has been put forward which would substantially alleviate the bottle-neck produced by the steep grades and tight curves on the railway through the Mount Lofty Ranges. The tunnel would reduce the distance traveled by 18 km and the transit time by more than 50 minutes. In addition, the bypassing of the 6 existing tunnels would be an enormous step towards the requirements of a unified national rail network, especially by enabling the double stacking of containers. The savings in time, fuel and wear and tear would be very appealing to freight companies and some of their savings could be recouped to improve the cost benefit.

As opposed to the favoured northern bypass (Option 3), this solution would provide a shorter route for freight between Melbourne and Adelaide, it would be suitable for the Overland passenger service and it would require only minor property acquisition. Moreover its environmental impact would be much less.

At the local level, the tunnel would eliminate the noise nuisance through the suburbs from Verdun to Mile End and the delays at 15 level crossings. The Adelaide Metro Belair passenger service could be returned to double track operation so that the delays due to trains having to pass twice per journey could be eliminated. It would also be possible to reopen 3 stations which were closed when single track operation commenced. In addition, the possibility of introducing an express passenger service between Mount Barker and Balhannah to Adelaide would be an added bonus, especially if a second track could be provided in the tunnel. Such a service would make a major contribution to reducing the peak hour traffic on the Hills Freeway and so realize an overall energy saving.

This is a project that would appeal to the freight operators, the SA Government and all of the citizens of SA who would benefit from it. Therefore, the writer commends the proposal to the Commonwealth Government via the Department of Infrastructure and Transport and to the Australian Rail Track Corporation (ARTC) in the sincere hope that it will be considered seriously, bearing in mind the many advantages outlined above. One trusts that at least an adequate and timely technical evaluation will be carried out before any further decisions are taken on the future of the railway. Naturally, the interested parties ardently hope for a speedy decision followed up by a commitment to begin the project.

6. References.

[1] The Department of Infrastructure, Transport, Regional Development & Local Government 2009 *Adelaide Rail Freight Movements Study, Final Report* Nation Building Program website, viewed 4 January 2013, <http://www.nationbuildingprogram.gov.au/publications/reports/pdf/Adelaide_Rail_Freight_Movements_Study_Final_Discussion_Paper_09_10_09.pdf>

[2] City of Mitcham 2010 *Freight for the Future = Northern Bypass* Mitcham Council website, viewed 14 February 2013, <http://www.mitchamcouncil.sa.gov.au/webdata/resources/files/Fact_Sheet_Rail_Freight_Public_Forum_30072010.pdf>

[3] Rail and Transport Committee 2012 *Minutes* website hosted by City of Mitcham, viewed 14 February 2013 <http://www.mitchamcouncil.sa.gov.au/webdata/resources/files/27%20September%202012%20Rail%20and%20Trasnport%20Committee%20Minutes.pdf>

[4] ARTC (Australian Rail Track Corporation) 2008 *Document No. TA02, Appendix XIII, ATRC Grades Adelaide to Serviceton* ARTC website, viewed 13 February 2013 <http://extranet.artc.com.au/docs/eng/network-config/cd/grades/05_grades_adelaide_to_serviceton.pdf>

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