Springvale Road Level Crossing Submission

A solution that benefits all:
Pedestrians, public transport and road users

PUBLIC TRANSPORT USERS ASSOCIATION

Public Transport Users Association
(PTUA)

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Public Transport Users Association

Ross House
247 Flinders Lane
Melbourne Victoria 3000

Phone (03) 9650 7898
Fax (03) 9650 3689
Web www.ptua.org.au
Org No. A-6256L
Affiliated with Transport 2000 International

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1.0 Abstract

This document explores the issues behind the level crossing at Springvale Road, Nunawading, comments on the current proposal for grade separation at this location, and suggests an alternative that better balances the needs of all transport users.

2.0 Executive Summary

The City of Whitehorse commissioned a feasibility study into relieving congestion at the intersection of Whitehorse Road and Springvale Road, Nunawading. A number of different methods were investigated.

While the official project brief was to relieve congestion at this road intersection, considerable press coverage has been given to the nearby railway crossing where the Ringwood line crosses over Springvale Road.

The feasibility study resulted in two separate yet interrelated reports:

- A Stage one report[1], where some options were studied in brief;
- Stage two report[2], where three of these options were studied in further detail.

The seven options are:

1. Tunnel for Springvale Road under the Ringwood line and Whitehorse Road ($83m, $100m[3]);
2. Tunnel for Springvale Road under Whitehorse Road only ($25m - $35m);
3. Overbridge for Springvale Road over Whitehorse Road only ($15m - $25m);
4. Overbridge for Springvale Road over the Ringwood line and Whitehorse Road ($75m);
5. An additional lane south-bound between Whitehorse Road and the level crossing, and reduced boom down-times ($518,000);
6. Raising or lowering the Ringwood line over or under Springvale Road;
7. Grade separation of the Whitehorse Road east-west through movement.

For brevity, the two variations of Option 6 (from within the Parsons Brinckerhoff report) are referred to as:

- Option 6a: lowering the Ringwood line under Springvale Road (tunnel/cutting, $55m[4]);
- Option 6b: raising the Ringwood line over Springvale Road (bridge, $150m).

Through this submission and the Public Transport Users Association suggests that Whitehorse Council's preferred option (Option 1 - Tunnels taking Springvale Road under the railway line and Whitehorse Road) should not be pursued. Instead we recommend either an alternative option (Option 6a - Lowering the railway line under Springvale Road, costing $55 m), or a variation of that

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[1] Springvale Road Traffic Improvements Feasibility Project Stage 1 - Initial Options Review, Parsons Brinckerhoff, June 2004. Costings are on p44-45.

[2] Springvale Road Traffic Improvements Feasibility Project Stage 2 - Final Options Review, Parsons Brinckerhoff, Aug 2004. Costings are on p31, except for Option 6a - p5.

[3] Whitehorse Council Media Release, Wednesday 25 August 2004.

[4] Liberal Party Policy Document, 2002 Victorian 2002 State Election, Cost of Option 6a at $55m.

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option, which includes expanding the project to also lower the railway line under Rooks Road and/or Mitcham Road as well.

The reasons for supporting Option 6a or one of its variations are as follows:

- Community expectations - they expect the level crossing to be eliminated, and it will be, under Option 6a, but not under Option 1;
- Avoids the visual impact of a road tunnel along with the safety issues inherent in a tunnel which would be used by 39,000 vehicles per day;
- Functionality - all three lanes of Springvale Road will continue to be available - unlike Option 1 where only two lanes (in each direction) will be tunnelled under;
- Option 6a presents the best opportunity for Travel Demand Management (reducing road traffic by increasing alternatives such as public transport modal share);
- The pedestrian movement across the railway line will also be grade-separated - unlike Option 1 which gives absolutely no benefit to pedestrians;
- The bus station at Nunawading can be designed to reduce overall length of bus travel times;
- Cost - Option 6a (approximately $55m) is significantly cheaper than Option 1 ($83m);
- There has been a lack of detailed geology work to examine the overall viability of option 1;
- Option 1 will fail to reduce surface traffic below saturation point, demonstrating the need for an option that provides the potential for further travel demand management.

While there are some disadvantages with option 6a there are on balance they are outweighed by the advantages.

- No separation of Whitehorse Road and Springvale Road;
- Aesthetics and parking in the neighbourhood - this option does not directly reduce the heavy traffic on Springvale Road.

It is noted that the Consultant's Report made no mention of any Travel Demand Management (TDM) options or accessibility issues.

There is considerable doubt surrounding the quoted cost of Option 6a (underground variant, $230m+) as listed in the consultant's report (p5)[5]. Both the Nunawading commissioned reports were lacking in the details of the costing of both Option 6a and 6b.

[5] Springvale Road Traffic Improvements Feasibility Project Stage 2 - Final Options Review, Parsons Brinckerhoff, Aug 2004. Costings are on p31, except for Option 6a - p5.

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3.0 Problem Definition

While the official problem is the traffic congestion at the Whitehorse Road and Springvale Road intersection considerable press coverage has been given to the nearby railway crossing, meaning that in the mind of the community, the latter is not only a source of traffic congestion but also the real problem.

Springvale Road is a busy North-South arterial route which has three lanes wide in each direction, and carries 39 000 vehicles a day. Additionally there are 21,000 vehicles that travel on Springvale Road but turn onto Whitehorse Road or other side streets[6]. The Ringwood/Belgrave/Lilydale railway line carries 250 trains a day[7]. There are 21 trains an hour during peak hours (14 in the peak direction, 7 in the counter-peak direction)[8], meaning that it is possible for the boom gates to be down for up to 10 minutes at a time. More commonly, the boom gates are down for 1 minute, 55 seconds at a time[9].

This causes the following problems:

- Traffic congestion along Springvale Road;
- Safety issues at the level crossing;
- Inability to increase train services without seriously affecting traffic flow along Springvale Road;
- Disruption to bus services due to both the boom gates and traffic congestion;
- Interruption to pedestrian access while the boom gates are down;
- Disruption to various traffic movements at the Whitehorse Road intersection with Springvale Road, particularly the right-hand turn to head south on Springvale Road.

The intersection at Whitehorse Road is congested during periods of time with queues of north-bound vehicles extending from the intersection back over the level crossing. Queues of south-bound vehicles also extend from the level crossing back over the intersection.

The proposal put forward in this submission is to grade separate the railway crossing and to provide pedestrian grade separation so that Springvale Road is not interrupted by the railway.

[6] Springvale Road Traffic Improvements Feasibility Project Stage 1 - Initial Options Review, Parsons Brinckerhoff, June 2004. Traffic trip matricis in Appendix C were used to get daily pro-rata traffic flows (proportions of the 125000 vehicles per day quoted in [1]).
[7] Whitehorse Council Media Release, Wednesday 25 August 2004.
[8] Train timetable, Belgrave/Lilydale line, effective Mar 23, 2003, Connex. 5-6pm weekdays: 14 trains in peak direction, 7 trains in other direction. Also 7-8am weekdays: 16 trains in peak direction, 5 trains in other direction. Times taken are those at Nunawading station.
[9] Personal observations, including timing with a stopwatch during Nov 2004. Ten minute observation comes from conversation with Grenda's bus driver.

4.0 The Solution

4.1 Description of Solution

Only one feasible solution is apparent - grade separation of the level crossing.

There are several methods of achieving this, and a variety of surrounding projects that can be catered to at the same time - such as the intersection of Springvale and Whitehorse Roads. This gives rise to most of the options considered in the consultant's report as commissioned by the City of Whitehorse.

Another solution, not in the original consultant's report, include:

- Reducing the amount of traffic within the area. This can be achieved by undertaking Travel Demand Management in line with the State Government goal of increasing public transport modal share to 20% by the year 2020.

The two options considered within this submission, as numbered in the Consultant's Report[10], are:

- **Option 1:**

  Build a road tunnel for Springvale Road that goes underneath the railway line and Whitehorse Road.

  This will be implemented as a pair of tunnels, two lanes each. The tunnels will run from West Street (about 350m south of the railway crossing) to Esdale Street (about 700m north of the Whitehorse Road intersection). This will mean that traffic from Canterbury Road to Donvale (and vice versa) will use the tunnels and avoid the level crossing and the Whitehorse Road intersection. Traffic (including buses) for the railway station, shops, and Whitehorse Road will use the surface level road. Additionally heavy freight will continue to use the level crossing and the Whitehorse Road intersection due to due safety issues.

- **Option 6:**

  Modify the railway line so it is over or under Springvale Road. The Public Transport Users Association submission favours putting the railway line under Springvale Road (Option 6a).

  This involves digging a cutting for the railway line from a point east of the Blackburn Road level crossing, going under Springvale Road, to the Rooks Road level crossing. A new station at Nunawading will be built, directly under where it is now. Examples of this type of approach can be seen at Elsternwick and at Boronia.

Possible variations for Option 6a are to eliminate the level crossings at Rooks Road and Mitcham Road at the same time. This would save money compared with completing these three level crossings at three separate times.

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[10] Springvale Road Traffic Improvements Feasibility Project Stage 1 - Initial Options Review, Parsons Brinckerhoff, June 2004.

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5.0 Similar Successful Projects

This section explores similar projects that have been successfully completed as a reference to the proposed lowering of the railway line at Springvale Road Nunawading.

5.1 Elsternwick – Glenhuntly Road

The grade separation at Elsternwick eliminated a road-tram-train level crossing, where the Sandringham line crossed over Glenhuntly Road and what is now the No. 67 tram route with the railway station immediately south of this crossing.

The method used was to dig a cutting for the railway line underneath Glenhuntly Road. The railway station was also rebuilt on the lower level. As such there are no tunnels - simply a bridge over the railway line for Glenhuntly Road and the tram route. The bridge also acts as the access point to Elsternwick Station. At present, there are two tracks, and there is enough space in the cutting for one more (or possibly two more) track(s). The grade separation was completed in 1960[11].

5.2 Boronia – Boronia and Dorset Roads

The grade separation at Boronia is more relevant as it cut through an entire intersection at Boronia and Dorset Roads.

The railway line cut through an entire intersection (Boronia and Dorset Roads) at an angle, with the station nearby the intersection. When the consultant's report was written, it listed a cost of $230m to put the line under the intersection, with the associated rebuilding of the station at the lower level.

In 1995, Peter Dann, an architect working along with the Public Transport Users Association, volunteered plans of the proposed work, and suggested it could be done for about $15m (a 15:1 difference). The Government produced a proposal that was similar, albeit more expensive, and approved funding for it in May 1996.

The tender was announced in April 1997 and construction commenced five months later, in September. The work was completed on 23 April 1999, but with the tunnel/cutting for the railway line longer than what was proposed as such it did cost slightly more to complete.

The final cost was $28m, still considerably far less than the initial consultant estimate.

[11] *Electric Railways of Victoria*, Dornan/Henderson, 1979.

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6.0 Issues Arising

This section examines issues that may arise in relation to our proposal to grade separate the rail crossing at Springvale Road, Nunawading.

6.1 Rail Gradients

Option 6a involves lowering the railway line at the Springvale Road crossing. It is also possible to choose several variations of this option, namely to lower the railway line at the Rooks Road crossing (865m east) as well, or to lower the railway line at both Rooks Road and Mitcham Road (another 759m east from Rooks Road). The purpose of this section is to validate each of these choices through ensuring that the track gradients do not exceed the maximum permissible 1:30[12] after completion of the work.

Appendix A gives details of the current geometry and the geometry for these scenarios:

- Lowering the track to go under just Springvale Road;
- Lowering the track to go under Springvale Road and Rooks Road;
- Lowering the track to go under Springvale Road, Rooks Road, and Mitcham Road.

The conclusions that can be drawn from this are:

1. Lowering the track under just Springvale Road is viable, with the maximum track gradient being 1:32.8 up-hill from Springvale to Rooks Road, except for the length of the platform which would be at grade.
2. Lowering the track under Springvale Road and Rooks Road is viable, with the maximum track gradient being 1:40 at several points.
3. Lowering the track under Springvale Road, Rooks Road, and Mitcham Road is viable. This can be done with no gradient being greater than 1:40, and with the platform at Nunawading and Mitcham stations being level.

It is noted that the Mitcham Road crossing is a high point, and the gradient falls away from there going further east. This makes the option of lowering the track at all three level crossings a very attractive one, because this gives an easier gradient between Blackburn Road and Cochrane Street[13].

6.2 Queuing across the intersection

A related issue is the queuing of south-bound vehicles across the intersection of Springvale Road and Whitehorse Road when the boom gates are down. This can be simplified by saying this is a reverse of the problem in the previous section, although the computer modelling[14] results indicate a

[12] Existing gradient between Upper Ferntree Gully and Belgrave is 1:30. There is an existing gradient between Wynyard and the Harbour Bridge (Sydney) of 1:27, but this is not considered feasible on the Ringwood line because of braking distances and the placement of station platforms.
[13] See Appendix A for measurement of gradients.
[14] See Appendix B for traffic modelling data.

longer queue length southbound (409m) on Springvale Road, than the queue length northbound (272m).

"The traffic analysis is also presented in Appendix B. It concludes that queuing in Springvale Road in both directions will still occur even if Option 1 is implemented, demonstrating that even this option is not a solution for traffic congestion.

6.3 Land Acquisition

On the Belgrave/Lilydale line between Blackburn Station and Heatherdale Station there is enough space within the railway alignment to lay four tracks[15], with the only exception being where car parking encroaches. Three tracks would fit very comfortably, even allowing space for retaining walls within the cutting. No land acquisition would be required required, and the work could very easily proceed if the train service was not required to be maintained during the work.

If service were to be maintained through utilising a temporary track, then several additional points must be considered.

This would require the laying a single track at grade, then building a retaining wall on each side, and laying three tracks into the cutting; as such this would be somewhat difficult in some locations.

If two temporary tracks were required, this would either require either land acquisition, or the project would have to be scaled down to only provide a cutting wide enough for two tracks, making installation of a third track much more expensive.

The Public Transport Users Association however, considers that temporary tracks would not be necessary, as explored under section 7.0 which considers issues during the construction phase.

[15] Personal observations.

7.0 Disruptions during Construction

Disruptions due to construction activity are an important consideration. For option 1, the disruptions would be limited to that arising from the cut-and-cover sections at each end of the tunnel, as described in the consultant's report[16].

The disruptions from Option 6 fall into two areas: disruptions to Springvale Road and disruptions to the railway line. Each will be considered separately.

Previous projects can be looked at to ascertain what the likely impacts are likely to be. The most recent project of this type as explored previously is the grade separation project at Boronia Station.

The following issues apply to the disruption to the railway line:

- If the line was completely closed, it would take about four weeks to dig the cutting and lay the tracks at the lower level to a stage where trains could resume operation. During the four-week closure, replacement buses around Nunawading would be run to maintain service for commuters;
  At Boronia, this was done during the Christmas-New Year period when there is lower commuter demand. This has the advantage that construction can proceed at full pace without the safety issues of trains regularly passing through. The disadvantage is that travel will be disrupted for commuters, requiring them to change for buses between Mitcham and Blackburn every day for approximately four weeks. This bus service will need to coincide with every train service as per the practice when track maintenance occurs;
- It is possible to place a higher priority on the track re-laying, and a lower priority on rebuilding the Nunawading Station at the lower level. Before the track is re-laid, the replacement bus service would cater for the total travel demand on the train line;
  Placing a higher priority on track re-laying will mean that the track would become available to run trains sooner, and after that, the replacement buses would no longer have to cater for the total travel demand: they would only required to carry passengers intending to alight or disembark the rail system at Nunawading;
- It is also possible to lay a temporary track (or two) so that trains can continue to run during the work. This has the disadvantage in that work is being completed immediately adjacent to a working rail service, meaning that construction time will be increase due to safety issues. The space to lay a temporary track is also an issue, especially if two tracks would be required.

While it is true that Connex has contractual obligations to maintain a particular level of service, the Government can choose to waive this requirement in favour of a replacement Service Level Agreement during the time of the replacement bus service. It is expected that the bus replacement services will be designed in such a way to minimise passenger inconvenience as much as possible.

The disruption to Springvale Road is somewhat more complex, but there are also several ways to handle manage this:

[16] Springvale Road Traffic Improvements Feasibility Project Stage 2 - Final Options Review, Parsons Brinckerhoff, Aug 2004.

- Close the crossing for one weekend, as was done at Boronia. It will be possible to direct limited amounts of traffic down Station St to the Rooks Road crossing. The pattern can be swapped when it comes time to close the Rooks Road crossing, if that crossing was also to be separated.
  While the Springvale Road crossing is closed, a bus only lane may need to be signposted, on Springvale Road from Canterbury Road to the crossing, to keep the route 888 & 889 buses running on time. A temporary arrangement will also be necessary for the route 273 bus, which will not be able to reach its usual terminus on the southbound side of Nunawading Station.
- Close only three lanes at a time. This would involve balancing the remaining three lanes to carry the traffic in each direction, then digging the cutting across the level crossing one half at a time. This has the disadvantage of possible stability problems affecting the working lanes while the non-working lanes are being dug out.

It should be must noted that the level crossing has been closed previously for an entire day (on a Sunday) without any severe traffic problems within the immediate area.

The most likely course of action would to close the railway line for duration of four weeks, close Nunawading Station for slightly longer, and close Springvale Road at the crossing for one weekend, to give the shortest possible construction time.

8.0 Pedestrian Access and Accessibility

At present, all pedestrians wanting to cross the tracks at Nunawading must do so over any of the three pedestrian level crossings. There has been one pedestrian fatality at the Springvale Road pedestrian crossing (eastern side) in October 2001, and two other fatalities as listed below:

- Fatal: Male wheelchair bound person at Nunawading
- Fatal: Female wheelchair bound person at Noble Park
- Fatal: Female able-bodied student at Bentleigh.

Implementation of Option 1, as recommended by the consultant[17], would do nothing to address pedestrian safety. By contrast, implementation of Option 6a with the undertaking of grade separation of the pedestrian crossing would ensure maximum pedestrian safety.

As noted during the *Wheelchair Pedestrian Railway Crossing Inquest* of 2004 the Coroner noted that design and engineering solutions must follow the seven *Universal Design Principal*s. These principals include pedestrian ‘grade separation in appropriate existing crossings’[18]. Given that the only form of pedestrian access along Springvale Road (as such between the two rail platforms at Nunawading Station and the bus/train interchange) is through a pedestrian grade level crossing consideration must be given to a solution that eliminates entirely this pedestrian safety issue.

An opportunity exists, if Option 6a is implemented, to build a subway pedestrian crossing to allow pedestrians to cross underneath Springvale Road (parallel to the railway line). This will be much more difficult to implement under Option 1.

[17] Springvale Road Traffic Improvements Feasibility Project Stage 2 - Final Options Review, Parsons Brinckerhoff, Aug 2004.
[18] Wheelchair Pedestrian Railway Crossing Inquest, State Coroner Victoria, 2nd April 2004

9.0 Supplementary Issues

This section explores additional issues relating to transport that must be considered within the overall scope of the project and the mentioned recommendations.

9.1 Bus routes

At present, two bus routes (273 and the 888/889 route) terminate at Nunawading station and are required to travel down lengthy side streets once they leave Nunawading station.

If the level crossing was eliminated, this would create an opportunity to combine these routes into a single route running between The Pines to Edithvale (and/or Chelsea). This would be possible, since the bus station could be designed so that buses can turn into Station Street, circulate around the station, and travel back onto Springvale Road.

It is even possible to move the station to a point almost under Springvale Road, and have direct pedestrian access from Springvale Road to the station, much like at Elsternwick. The buses can then maintain travel along Springvale Road, further reducing delays.

It must be noted that Springvale Road is also part of the Principle Public Transport Network[19]. If this level crossing were to remain, it would become a major source of delay for the proposed Red Orbital Route which envisages continuous bus travel along Springvale Road.

This adds to the case for supporting Option 6a over Option 1.

9.2 High Occupancy Vehicle (HOV) Lanes

To improve bus travel times, it is possible to set aside one lane of Springvale Road in each direction as a High Occupancy Vehicle (HOV) lane, alternatively referred to as a Transit Lane. While this does not require removal of the level crossing and can be implemented immediately, the maximum benefit is obtained once the level crossing has been eliminated as per Option 6a.

The type of HOV lane envisaged would be a T3 lane - allowing buses, taxis, and cars with three or more occupants with certain other traffic also being allowed. It would be necessary to have a hook turn for buses from the south to turn right from Springvale Road and into Station Street - a similar arrangement is now in place where buses turn right from Hoddle Street into Victoria Parade.

HOV lanes are a method of travel demand management of which further detail is available in Appendix C.

[19] Metropolitan Transport Plan, Department of Infrastructure, 2004

9.3 Traffic flow

It is noted that Option 1 from the Consultants' report will fail to reduce surface level traffic below saturation point (ie waiting more than one traffic cycle to progress through the intersection). As such due to the lack of scalability of Option 1, through the fact that travel demand management solutions cannot adequately complement this option, congestion from the perspective of car users and traders will still be a noticeable issue. This is particularly true since surface traffic including heavy vehicles, buses and local traffic would still need to queue for the level crossing, the major source of delays from the perspective of road users.

As demonstrated within Appendix D traffic congestion is a major economic burden costing the economy approximately $12 billion per annum[20]. Long-term research has demonstrated that the building of additional roads does not reduce traffic in the longer term. The Organisation for Economic Cooperation and Development (OECD) has stated that 'building more roads has not noticeably reduced congestion – new road space is quickly filled'.[21] This demonstrates the need for a scalable solution that provides complementary travel demand management measures.

The Public Transport Users Association contends that Option 6a with a complementary travel demand management solution (such as HOV lanes) will provide greater incentive to encourage public transport usage thereby providing a scalable solution that can reduce overall growth in traffic volume. This would therefore reduce the economic cost of traffic congestion thus benefiting local residents and traders.

[20] Appendix D – The Road Deficit
[21] Melbourne Metropolitan Strategy, Technical Report No.1, 2001

Public Transport Users Association

Ross House
247 Flinders Lane
Melbourne Victoria 3000

Phone (03) 9650 7898
Fax (03) 9650 3689
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10.0 Project Costs

Considerable doubt exists about the cost given for Option 6a - to dig a cutting for the railway line - the quoted cost of $230m is extremely high, given precedent established by the following:

1. Grade separation at Elsternwick in 1960[22];
2. Grade separation at Boronia eliminating the Dorset Road level crossing (a project more complex than the situation Nunawading), cost $28m in 1997[23].

It is estimated that the lowering of the railway line as per Option 6a would cost $30 million, a figure based upon precedent established at Boronia which entailed a more complex solution than that required for Nunawading. A redesign of Nunawading Station with pedestrian underpasses and the ability streamline the modal interchange between bus and trains is expected to cost an additional $5 million.

This means the total cost of the project for Option 6a is expected to cost $35 million, well under the cost estimates for the proposed tunnel option.

[22] *Electric Railways of Victoria*, Dornan/Henderson, 1979.
[23] Victorian Parliamentary Hansard - Legislative Assembly 14 May 1999, p 1116-7 (Phil Honeywood)

11.0 Adjacent and Future Projects

When considering any solution, it is important to consider the work that may be required in the future - and whether it is economical to complete this work at the same time, or whether to alter the current project so that any potential future work is easier or cheaper to execute. In this case other projects to consider are:

- Elimination of the adjacent level crossings at Rooks Road and Mitcham Road;
- The building of the Mitcham - Frankston Project (known as EastLink);
- The triplication of the line between Box Hill and Ringwood.

It is possible to expand the proposed project to complete a similar grade separation at the next level crossing to the east, which is Rooks Road, or possibly to separate the next two level crossings (Rooks Road and Mitcham Road) with the associated rebuilding of Mitcham Station.

If the Rooks Road crossing, or the Rooks and Mitcham Road crossings, are completed at the same time, then the following advantages are gained over doing them at three separate times:

- Gradients along the railway line are reduced.
- If completed as three separate projects the disruption to the railway service would be repeated for each level crossing separately. Undertaking the three grade separations within one project would require only one set of disruptions.
- The work in digging the cutting would be repeated in some locations, in that the cutting would be made deeper when the next level crossing was done.
- Project overhead costs (tendering, legal, and other contract management costs) would be reduced.

This means that an overall cost saving would be realised if all three projects were completed together.

Additionally the triplication of the railway line from Box Hill to Ringwood could also be completed. The three tracks can be laid while the grade separation project is under way, or the cutting can be made wide enough for a future installation of the third track at a later stage. If either of these options is undertaken, the following advantages arise:

- The cost of digging a cutting wide enough for three tracks is significantly less than digging a cutting, putting it into service (with trains running on two tracks), then widening the cutting later. This is because widening the cutting would mean disruption to train services, and additional work in rebuilding a retaining wall.
- Optimal placement of the tracks within the cutting will occur.

The building of the Mitcham - Frankston Project would require the closure of the railway line at Heatherdale Station to allow the freeway tunnel to be put underneath the railway line. The work for the grade separation should be timed with the Freeway Project. The obvious advantage is that commuter travel will only be disrupted once; this advantage is magnified if all three level crossings are done at once, as well.

12.0 Travel Demand Management

An alternative method of solving any road congestion problem, such as the congestion at the Whitehorse/Springvale Road intersection (with or without a level crossing) is Travel Demand Management. No mention of this was made in the Consultant's report.

Travel Demand Management is the name given to any strategy that reduces car usage (and may or may not reduce the need to travel by other motorised transport). Further details about the application of Traffic Demand Management are explored in Appendix C.

13.0 Conclusion

The Public Transport Users Association through this submission has highlighted a number of deficiencies within the current proposed solution (known as Option 1) for the Springvale and Whitehorse Roads intersections.

This includes the lack of consideration given in solving pedestrian safety issues and the failure of Option 1 to provide remedies that would allow for increased public transport capacity, consistent with the Melbourne 2030 policy.

The Public Transport Users Association suggests the adoption of Option 6a as the preferred and optimal solution for the Springvale and Whitehorse Road intersections. As noted, The Public Transport Users Association holds major reservations as to the consultant's projected costing of $230 million given precedent established by Boronia and believes that $35 million is a more appropriate figure for the level crossing elimination and corresponding pedestrian and interchange works.

Public Transport Users Association

Ross House
247 Flinders Lane
Melbourne Victoria 3000

Phone (03) 9650 7898
Fax (03) 9650 3689
Web www.ptua.org.au
Org No. A-6256L
Affiliated with Transport 2000 International

14.0 Appendix A - Calculations of Gradients

This appendix gives the known information about gradients between Blackburn and Heatherdale stations, and then applies three scenarios to this geometry:

- Lowering the track to go under Springvale Road only
- Lowering the track to go under Springvale Road and Rooks Road
- Lowering the track to go under Springvale Road, Rooks Road, and Mitcham Road.

For each of these, the maximum gradient is derived. Scenarios that present a gradient of more than 1:30 are ruled out, because of operational concerns - trains cannot reliably climb gradients greater than this, and increased braking distances when going down-hill have an impact on safety.

14.1 Current Geometry

Nunawading Station and the level crossing are half way up a stretch of track at 1:40 gradient. Table 1 gives information on the geometry that is directly available in Railway Gradients & Curves, Public Transport Corporation (Victoria) 7/92 and VicSig[24].

Location:	Distance from Melbourne:	Height above sea level:
Blackburn, distance from Melbourne	18.674 km	92 m
Blackburn Road, distance from Melbourne	18.926 km	-
Springvale Road, distance from Melbourne	20.946 km	-
Nunawading, distance from Melbourne	21.117 km	127 m
Rooks Road, distance from Melbourne	21.811 km	-
Mitcham, distance from Melbourne	22.408 km	147 m
Mitcham Road, distance from Melbourne	22.570 km	-
Cochrane Street, distance from Melbourne	23.301 km	-
Heatherdale, distance from Melbourne	24.211 km	127 m

Table 1: Distances and heights from *VicSig* and *Railway Curves and Gradients*

The Railway Gradients and Curves publication also provides gradients. To work out the height above sea level for various fixtures along the track, we use a combination of the height at a known point (from Table 1), the horizontal distance (also from Table 1) and the gradient[25].

Table 2 (next page) contains this data, working from Blackburn to Heatherdale, along with heights above sea level that can be calculated. Most horizontal measurements were scaled from the diagram. Figures directly calculated are in bold.

[24] Railway Gradients & Curves, Public Transport Corporation (Victoria) 7/92
[25] VicSig: http://vicsig.net/

Public Transport Users Association

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247 Flinders Lane
Melbourne Victoria 3000

Phone (03) 9650 7898
Fax (03) 9650 3689
Web www.ptua.org.au
Org No. A-6256L
Affiliated with Transport 2000 International

Location and length	**Gradient () = downhill**	**Height**
Blackburn Station, for next 70m	Level	92 m
Next 252m, to ...	1:40	
Blackburn Road		**96.6 m**
A point 20.816km from Melbourne (130m before Springvale Rd)		**123.8 m**
Next 130m, to ...	1:40	
Springvale Road	Level	127 m
Nunawading Station	Level	127 m
Nunawading Station, for next 70m	Level	127 m
Next 624m, to ...	1:40	
Rooks Road		**142.6 m**
Up-end of Mitcham Station		**146.9 m**
Next 70m, to ...	1:89.3	
Platform center, Mitcham Station		147 m
Next 162m, to ...	1:89.3	
Mitcham Road		**147.2 m**
Next 130m, to ...	(1:40)	
A point 22.700km from Melbourne (130m after Mitcham Rd)		**144.0 m**
Next 601m, to ...	(1:40)	
Cochrane St		**128.9 m**

Table 2: Calculation of heights using gradients from Railway Curves and Gradients

Notes:

1. Railway platforms are assumed to be 140m long, slightly longer than a six-carriage train (6 x 22.86m)
2. Distances and heights of railway platforms are those applying at the center of the platform.
3. Blackburn Station is shown as being on a 1:40 gradient[26], but a physical inspection quite clearly shows otherwise. It is more accurate to take the platform as being level at its center, and for 70m before and after that point.
4. Springvale Road, Rooks Road, and Mitcham Road are level crossings, while Cochrane St is a bridge with the road underneath the track.
5. The height of the Up-end of Mitcham Station (the end nearest the city) was calculated by working backwards from the platform center. The height 130m before Springvale Road was also calculated by working backwards - from Nunawading station.

To achieve a grade separation, the railway line needs to be lowered by a minimum of 6020mm, but it is more likely that it will be lowered by 6.5m (21 ft 4 in). The way that this changes the geometry is shown in the next three sections.

[26] VicSig: http://vicsig.net/

14.2 Springvale Road only

This scenario involves lowering the railway track under Springvale Road only, by 6.5m, rebuilding Nunawading at the lower level, and digging a cutting up to the existing Rooks Road level crossing.

It is assumed that Nunawading station will remain level (for 140m) and not be moved along the track in this scenario, but two variations of this scenario are presented in Table 3. Heights and gradients in bold are those that change because of the lowering of the railway track. The two variations are:

1. The tracks being laid with a 1:30 climb from under Springvale Road to the edge of the platform of Nunawading station;
2. The tracks being laid such that the gradient before and after the platform of Nunawading station is the same.

Location and length	Variation 1		Variation 2	
	Gradient	Height	Gradient	Height
A point 20.816km from Melbourne (130m before Springvale Rd)		123.8 m		123.8 m
Next 130m, to ...	**(1:40)**		**(1:40)**	
Springvale Road		**120.5 m**		**120.5 m**
Next 101m, to ...	**1:30**		**1:32.8**	
Up-end of Nunawading Station, for next 140m	Level	**123.9 m**	Level	**123.6 m**
Next 624m, to ...	**1:33**		**1:32.8**	
Rooks Road		142.6 m		142.6 m

Table 3: Calculation of heights and gradients after lowering the track under Springvale Road only

The conclusion from this calculation is that it is possible to lower the track under Springvale Road only, without exceeding a 1:30 gradient. The length of cutting required would be 995m.

A third variation is also possible, where the cutting would start 260m before Springvale Road (a point 20.686km from Melbourne, at a height of 120.5m) and proceed at a level gradient to a point under Springvale Road, then proceed at a 1:30 (or 1:32.8) gradient as for Variation 1 (or Variation 2) shown above. This would increase construction costs, but reduce electricity consumption by lowering the height that trains have to climb when travelling between Blackburn and Nunawading.

14.3 Springvale Road and Rooks Road

This scenario involves lowering the railway track under Springvale Road and Rooks Road, both by 6.5m, rebuilding Nunawading at the lower level, and digging a cutting up to the Up-end (western end) of the platform at Mitcham station. This is shown in Table 4. Heights and gradients in bold are those that change because of the lowering of the railway track.

It is assumed that Nunawading station will remain level (for 140m) and not be moved along the track in this scenario.

Location and length	**Gradient () = downhill**	**Height**
A point 20.816km from Melbourne (130m before Springvale Rd)		123.8 m
Next 130m, to ...	**(1:40)**	
Springvale Road	Level	**120.5 m**
Nunawading Station	Level	**120.5 m**
Nunawading Station, for next 70m	Level	**120.5 m**
Next 624m, to ...	1:40	
Rooks Road		**136.1 m**
Next 527m, to ...	**1:49**	
Up-end of Mitcham Station		146.9 m
Next 70m, to ...	1:89.3	
Platform center, Mitcham Station		147 m

Table 4: Calculation of heights and gradients after lowering the track under Springvale Road and Rooks Road

The conclusion from this calculation is that it is possible to do this scenario of lowering the track under Springvale Road and Rooks Road, without exceeding a 1:30 gradient. The length of cutting required would be 1522m.

Like the Springvale Road Only scenario, a second variation is also possible, where the cutting would start 260m before Springvale Road (a point 20.686km from Melbourne, at a height of 120.5m) and proceed at a level gradient to a point under Springvale Road, then proceed at a 1:30 (or 1:32.8) gradient as for Variation 1 (or Variation 2) shown above. This would increase construction costs, but reduce electricity consumption by lowering the height that trains have to climb when travelling between Blackburn and Nunawading.

Public Transport Users Association

Ross House
247 Flinders Lane
Melbourne Victoria 3000

PTUA
PUBLIC TRANSPORT USERS ASSOCIATION

Phone (03) 9650 7898
Fax (03) 9650 3689
Web www.ptua.org.au
Org No. A-6256L
Affiliated with Transport 2000 International

14.4 Springvale, Rooks, and Mitcham Roads

This scenario involves lowering the railway track under Springvale Road, Rooks Road, and Mitcham Road, all by 6.5m, rebuilding Nunawading and Mitcham stations at the lower level, and digging a cutting to a point 130m after Mitcham Road. This is shown in Table 5. Heights and gradients in bold are those that change because of the lowering of the railway track.

It is assumed that Nunawading station will remain level (for 140m), and Mitcham station will become level (for 140m), and neither will be moved along the track in this scenario.

Location and length	Gradient () = downhill	Height
A point 20.816km from Melbourne (130m before Springvale Rd)		123.8 m
Next 130m, to ...	**(1:40)**	
Springvale Road	Level	**120.5 m**
Nunawading Station	Level	**120.5 m**
Nunawading Station, for next 70m	Level	**120.5 m**
Next 624m, to ...	1:40	
Rooks Road		**136.1 m**
Next 527m, to ...	**1:114**	
Up-end of Mitcham Station		**140.7 m**
Next 232m, to Mitcham Road	**Level**	**140.7 m**
Next 130m, to ...	**1:40**	
A point 22.700km from Melbourne (130m after Mitcham Road)		144.0 m

Table 5: Calculation of heights and gradients after lowering the track under Springvale, Rooks, and Mitcham Roads

The conclusion from this calculation is that it is possible to do this scenario of lowering the track under Springvale, Rooks, and Mitcham Roads, without exceeding a 1:30 gradient. The length of cutting required would be 1884m.

A second variation is also possible, where the cutting would end 260m after Mitcham Road (a point 22.830km from Melbourne, at a height of 140.7m), and be level between Mitcham Road and this point. This would increase construction costs, but substantially reduce electricity consumption by lowering the height that trains have to climb when travelling between Mitcham and Heatherdale.

Like the Springvale Road Only scenario, a third variation is also possible, where the cutting would start 260m before Springvale Road (a point 20.686km from Melbourne, at a height of 120.5m) and proceed at a level gradient to a point under Springvale Road, then proceed at a 1:30 (or 1:32.8) gradient as for Variation 1 (or Variation 2) shown above. This would increase construction costs, but reduce electricity consumption by lowering the height that trains have to climb when travelling between Blackburn and Nunawading.

If both of these variations were chosen, the length of cutting would increase to 2144m.

15.0 Appendix B - Traffic Variability Modelling

15.1 Poisson Distribution - explained.

The Poisson distribution is used in any situation where the arrival of events is being modelled. It assumes that the events are not connected to each other, and that the events have no experience of the success, failure, or queuing experience of prior events.

Events can be telephone calls, people queuing at a bank, or vehicles arriving at an intersection. Given the average number of events in an interval (lambda), the Poisson Distribution tells the probability of exactly x random events occurring in an interval. It is more useful to use a Poisson Summation Chart, which gives the probability of x or more random events occurring in an interval, or one can reverse the process and derive x, the number of events occurring in an interval, that will be exceeded with a specified probability.

Charts, tables, and formulas for the Poisson distribution are available in Eton Statistical & Math Tables, Heinemann Publishers (NZ) Ltd 1980 - pp 44, 45, and 47[27].

An example: if I have an average of 10 events occurring in each minute, and want a 10% (0.1) probability, then I derive x=15 from the Summation Chart. That is to say, 10% of the time, there will be 15 or more events in a one minute interval. In page 47 of Eton Statistical & Math Tables orient the chart so the (lambda) axis runs along the bottom. Run your finger along to the point where (lambda) = 10, then guide your finger up the chart until it aligns with the 0.1 probability on the left axis. Look at the line running diagonally through this point and note that it says "x = 15".

It is assumed that the traffic indeed varies according to the Poisson distribution. It is noted that this is a little optimistic, because the prior signalised intersection (corner Canterbury Road and Springvale Road) will cause a greater statistical variation than the normal - that is to say that it lets traffic through in bunches. This will mean that the queues seen in real life will be slightly longer and occur more often than predicted here by this model.
Modelling assumptions

The following assumptions are used in this appendix:

- The space used by a queuing vehicle is nine metres[28].
- The useable queuing length between the intersection and the level crossing is 222m. The actual length is 240m, but there are a couple of gaps where queuing is not permitted[29].
- A probability of 5%. This means that we will model traffic conditions that will be exceeded 5% of the time. The choice is a little arbitrary, but with 21 trains per hour, the queuing will occur 21 times an hour. Choosing a 5% probability on 21 queues an hour gives 1 queue per hour where we can expect to see conditions like these.
- We note the figure of 62 vehicles per 2 hour peak period for north-bound vehicles prohibited from using the Option 1[30], this is for trucks that are prohibited from using the tunnel. Given the negligible impact of this on the overall traffic pattern, this will be ignored.

[27] Eton Statistical & Math Tables, Heinemann Publishers (NZ) Ltd 1980 - pp 44, 45, and 47.
[28] Personal observation: 24 vehicles per lane queued between level crossing and the Whitehorse Road intersection
[29] Estimate of gaps: 18m total

15.2 Introduction to the Traffic Variability Modelling

The table below models four different traffic scenarios:

- The current traffic conditions for north-bound traffic
- The traffic conditions in 2024 after Option 1 has been implemented, for north-bound traffic
- The current traffic conditions for south-bound traffic
- The traffic conditions in 2024 after Option 1 has been implemented, for south-bound traffic

Some of the data in the table below comes from Springvale Road Traffic Improvements Feasibility Project Stage 1 - Initial Options Review, Parsons Brinckerhoff (June 2004).

The items in the table are numbered, and explained in numbered order:

1. The dominant queue, from the Consultants' report, is the longest queue.
2. The number of lanes comes from the geometry modelled in the Consultants' report. It should be noted that the Option 1 south-bound has two right-turn lanes modelled, but has three lanes from the intersection to the level crossing.
3. The queue length, in metres, comes from the Consultants' report, and the number of vehicles is derived by a simple division by 9 (from an observation that each queued vehicle takes 9m of road space, on average).
4. The traffic for this queue, per hour, is taken from the Consultants' report, for the longest queue.
5. The vehicle arrivals are simply the number of vehicles in the queue, derived by multiplying the number of vehicles in (3) by the number of lanes (2). The actual interval is derived from the vehicle arrivals and the traffic for this queue in (4).
6. The figure obtained from the Poisson Summation Chart[31], when using (lambda) = [The vehicle arrivals in (5)], and a probability of 0.05. This figure represents the number of vehicles arriving in the interval that will be exceeded 5% of the time. For figures exceeding the chart ((lambda) > 30), a computer program executing the summation of the formula was used instead.
7. Queue length, from multiplying (6) by 9m per vehicle, and dividing by the number of lanes in (2). You can expect to see this queue about once per hour.
8. Proportion of queue immobilised by the boom gates: for north-bound traffic, the level crossing is modelled at 222m before the intersection. For queue lengths greater than 222m, the excess queue length will be immobilised behind the boom gates when they come down. This figure is not relevant for south-bound traffic.
9. A simple answer that indicates whether the north-bound queue from the intersection in (7) is greater than 222m. Not relevant for south-bound traffic. This indicates if safety at the level crossing is compromised.
10. A simple answer that indicates whether the south-bound queue from the level crossing in (14) is greater than 222m. Not relevant for north-bound traffic. This indicates if the intersection is being compromised by the level crossing.
11. Traffic for the boom gates, per hour, from a simple addition of the right numbers from the report.
12. Vehicle arrivals per 115 second interval. The boom gates can be down for 115 seconds, so this is a simple derivation from the figure in (11).

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[30] Springvale Road Traffic Improvements Feasibility Project Stage 1 - Initial Options Review, Parsons Brinckerhoff, June 2004 - Appendix D, SIDRA results (Springvale Road / Maroondah Highway - 2024 AM Option 1 no MFF)
[31] Eton Statistical & Math Tables, Heinemann Publishers (NZ) Ltd 1980 - pp 44, 45, and 47.

13. The figure obtained from the Poisson Summation Chart, when using (lambda) = [The vehicle arrivals in (12)], and a probability of 0.05. This figure represents the number of vehicles arriving in the interval that will be exceeded 5% of the time. For figures exceeding the chart ((lambda) > 30), a computer program executing the summation of the formula was used instead
14. Queue length, from multiplying (13) by 9m per vehicle, and dividing by the number of lanes in (2). This will be the queue that develops 5% of the time when the boom gates are down for 115 seconds. You can expect to see this level crossing queue once per hour.
15. Distance of level crossing queue from intersection. For north-bound traffic, a simple addition of the 222m distance of the level crossing from the intersection, the immobilised queue from (8), and the queue in (14). For south-bound traffic, this is not easily modelled on current traffic conditions, because the intersection does not "immobilise" traffic as such. Therefore, no figure is given for this particular scenario. For north-bound traffic, the gaps where queuing is not permitted (9m for the level crossing itself, and 18m for other gaps closer to the intersection) are included in the distance from the intersection, as appropriate for the length of queue calculated.

Description	**Option 1 north-bound**	**Option 1 south-bound**
1. Dominant queue	Left turn	Right turn
2. Number of lanes	2	2 (3 after turn)
3. Queue length, from consultants' report, and vehicles queued per lane	138m, 15.3 vehicles	79m, 6.6 vehicles
4. Traffic for this queue, 1hr peak	515	207
5. Vehicle arrivals per interval (lambda)1=	30.6 per 213 seconds	13.2 per 229 seconds
6. Poisson Summation chart, at 0.05. x1=	41	20
7. Queue length for x1	185m	60m
8. Portion of queue immobilised by boom gates	0	-
9. Intersection queue across level crossing?	No	-
10. Level crossing queue across intersection?	-	No
11. Traffic for the boom gates, 1hr peak	835	1006
12. Vehicle arrivals per 115s interval for boom down-time. (lambda)2=	26.6	32
13. Poisson Summation chart, at 0.05. x2=	36	43
14. Queue length for x2	162m	129m
15. Distance of level crossing queue from intersection	240+162= 402m prior	240-129=111m past

Table 6: Traffic Variability Modelling

15.3 Conclusions

This model proves that queues extend from the intersection over the level crossing, and vice versa, under current traffic conditions and that this would still occur if option 1 were implemented, demonstrating that surface traffic will reach saturation point.

16.0 Appendix C - Traffic Demand Management

16.1 General principles

Travel Demand Management is the name given to any strategy that reduces car usage (and may or may not reduce the need to travel by other motorised transport).

It is important to realise that each road-work that increases road capacity will increase the amount of traffic on the roads by a phenomenon known as 'traffic inducement'[32]. If this intersection is grade-separated, then traffic will increase, causing congestion at other points of the road network, like surrounding intersections. Conversely speaking, it can be argued that previous efforts to eliminate congestion at nearby locations have increased the congestion now experienced at the intersection of Whitehorse and Springvale Roads.

Travel Demand Management, on the other hand, does not increase road capacity, but seeks to reduce congestion by reducing the amount of traffic on the road system. Examples of traffic demand management are:

- locating shops close to residential areas (reduces the need to travel long distances to large shopping centres);
- encouraging walking and cycling (easier when shops and other facilities are located nearby); Examples: providing cycling lanes and sensible walking paths;
- providing information about public transport to people;
- making public transport more convenient;
- Reducing the parking available for private cars at major centres;
- Encouraging opportunities to work at home;
- Example: Given proper technology, call center workers can work at home;
- car-pooling;
- encouraging rail freight.

It will be noted that some examples of traffic demand management seek to eliminate travel altogether (for example: work at home), and other examples seek to reduce car travel in favour of walking, cycling, and public transport.

The benefits of Travel Demand Management are:

- Less congestion on the road system;
- Reduced air and noise pollution;
- Reduced reliance on oil supplies, much of which comes from politically unstable countries;
- Increased amenity;
- Reduced travelling times;
- Less household expenditure spent on private transport.

[32] http://www.aptnsw.org.au/2001rep.html - Action for Public Transport (APT) [http://www.aptnsw.org.au/]

16.2 Application to the project

When evaluating the various project options for the Whitehorse Road and Springvale Road intersection, some attention should be paid to Travel Demand Management principles.

There are two obvious ways to reduce car usage that are relevant to this project.

1. Reduce the road capacity - or at the very least, do nothing to fix congestion problems.
2. Increase public transport usage by making it more convenient, more frequent, and faster.

The Do Nothing option fits well with point 1 above, but it does not improve public transport.

Option 1 will certainly increase road capacity, and does nothing to improve public transport. It does not eliminate the level crossing, so increasing train services to make public transport more frequent will cause unacceptable delays to traffic still using the level crossing. This is a very poor option in terms of Travel Demand Management.

Option 6 will increase road capacity slightly, but it presents an excellent opportunity to increase train services to make public transport more frequent, without causing unacceptable delays to Springvale Road traffic. This is a very good option in terms of Travel Demand Management, especially if the project is expanded to include Rooks Road and Mitcham Road.

Public Transport Users Association

Ross House
247 Flinders Lane
Melbourne Victoria 3000

Phone (03) 9650 7898
Fax (03) 9650 3689
Web www.ptua.org.au
Org No. A-6256L
Affiliated with Transport 2000 International

17.0 Appendix D - The Road Deficit

The Road Deficit is a concept that describes the extent to which society subsidises private motor vehicle users. The ranges quoted below reflect various sources and estimates.[33]

Revenue/Cost Item	Amount ($ billion p.a.)
Revenue	
Fuel excise	8.5 to 12
Registration fees	2.2 to 3.8
Tolls	6
Insurance premiums	80
Total Revenue	**19.3 to 24.4**
Expenditure, subsidies & externalities	
Road construction & maintenance *Spending by all tiers of government fluctuates, however BTRE figures suggest average annual expenditure in the region of billions.*	4.6 to 7.58
Land use (land under roads) *The value of land under roads was estimated at around $100-120 billion in 1996, suggesting a current value of at least $120 billion adjusting for inflation or as much as $267 billion after indexing in line with house prices. Assuming a 5% return on assets, this equates to over $6 billion p.a.*	6 to 13
Congestion *Congestion on urban roads is a growing problem which is forecast to cost $30 billion p.a. by 2015. Much research shows that road building does little, if anything, to alleviate congestion in the long-term.*	11 to 12.8
Air pollution *Motor vehicles are a key source of urban air pollution, causing and aggravating respiratory diseases.*	3.3 to 4.3
Climate change *The transport sector is one of the main sources of carbon emissions.*	2.4
Noise *The primary source of urban noise pollution is motor vehicles.*	1.2
Accidents *The human cost of traffic accidents includes loss of life and productivity and significantly exceeds the insurance premiums paid by motorists.*	5 to 15
Tax deductions for car use *Deductibility of motor vehicle expenses reduces taxation revenues for government, and the current tax system includes perverse incentives to excessive vehicle travel such as the statutory method under the Fringe Benefits Tax regime.*	2.8
Queensland fuel subsidy *The fuel subsidy provided by the Queensland government represents funds that could have been allocated to schools, hospitals, police, etc or not taken from Victoria under horizontal fiscal equalisation.*	0.5
Total costs	**36.8 to 59.58**
Road deficit (in billions of dollars per annum)	**17.5 to 35.18**

Table 7: The Road Deficit

[33] PTUA Submission to the Productivity Commission Inquiry into the Economic and Environmental Potential offered by Energy Efficiency.