# Document Control Record

Document prepared by:
Aurecon Australia Pty Ltd
ABN 54 005 139 873
60 Albert Road
South Melbourne
Victoria 3205 Australia

T +61 3 8683 1333
F +61 3 8683 1444
E melbourne@aurecongroup.com
W aurecongroup.com

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Contents

1. Introduction  
   1.1 Background  1  
   1.2 Scope  1  
2. Site Conditions  2  
   2.1 Location  2  
   2.2 Existing Rail & Road Network  2  
   2.3 Utility Information  3  
3. Design  4  
   3.1 Design Criteria  4  
   3.2 Assumptions  4  
   3.3 Future Requirements  4  
4. Options Analysis  6  
   4.1 Option 1 – Rail to be lowered on or close to the existing rail alignment  6  
      4.1.1 Construction Methodology Example  6  
   4.2 Option 2 – Rail Lowered Offline  8  
   4.3 Option 3 – Rail lowered on existing alignment and road over rail bridge for 4 tracks  8  
   4.4 Options Comparison  9  
5. Cost Estimate  11  
6. Options Comparison  13  

Appendix A – Drawings  
Appendix B – Utilities
1. Introduction

1.1 Background

Aurecon Australia Pty Ltd has been engaged by VicRoads in September 2011 to undertake a review of the location of current Public Acquisition Overlay (PAO) at the existing level crossing of Toorak Road and the Glen Waverley Rail Line. The current PAO was developed with Toorak Road passing over the rail line prior to the construction of M1 in its current form.

As a result of the earlier M1 design, a number of properties were envisaged to be impacted due to the approach embankments for the bridge over the rail line. Following the construction of M1, the earlier conceptual layout is now not possible due to the geometry of the recently constructed Toorak Road and the Single Point Urban Interchange with the M1.

As part of the PAO review, a desktop assessment of options for a future grade separation of Toorak Road and the Glen Waverley Rail Line was undertaken to ascertain whether the PAO will need to be maintained, amended or removed.

1.2 Scope

The scope of this study is to identify options and the assumptions derived from them for the road/rail grade separation, to ascertain the likely impacts on the existing PAO’s. The key steps undertaken as part of this study include the following:

- Data collection which includes survey information and identification of key utility and services in the area
- High level concept design of options for future grade separation of road and rail
- High level constructability review of each option
- High level assessment of impacts to existing train stations relevant to options
- Traffic operations review of each option
- Preparation of indicative cost estimates and options.
2. Site Conditions

2.1 Location
The existing level crossing of Toorak Road and the Glen Waverley Rail Line is located to the west of the M1/Toorak Road interchange, situated at the midpoint between Kooyong Station and Tooronga Station. This is shown on the map below (Melway Map 59E4).

2.2 Existing Rail & Road Network
The existing level crossing of the Glen Waverley Rail Line and Toorak Road is midway between Kooyong Station to the northwest and Tooronga Station to the southeast. The rail corridor through this section is bound by the M1 Freeway to the east, residential properties to both the north-east and north-west, and office buildings sited in close proximity to the tracks along Milton Parade to the west (south of Toorak Road). Steep terrain exists adjacent to the tracks from Toorak Road in the direction of Kooyong Station.

Due to the high volume of traffic on Toorak Road and the M1, the existing level crossing contributes to traffic congestion and delays in Toorak Road and this site may be a candidate for a road / rail grade separated crossing in the future.

The existing Toorak Road grades down at a steep decline (approximately 10%) on the western approach to the level crossing, flattening out over the M1 with a low point at the level crossing. It is the intention of this assessment that all current access onto Toorak Road to be retained in the existing configuration. For the purposes of this study, the limit of works on Toorak Road have been determined as the edge of Milton Parade to the west and the edge of the M1 northbound exit ramp to the east.
2.3 Utility Information

The objective of the review of utility information was to identify key utility impacts due to the proposed works of each option. The focus was placed on major services that may affect the options and in turn influence the design, constructability or cost. A summary of major services within the rail reserve is shown in the table in Appendix B.

Similar impacts to services are present for each option, including the Melbourne Water (MW) Sewer Buffer which encroaches a small portion of the rail corridor. The MW Sewer buffer is a protection zone for the existing Gardiners Creek Sewer situated east of the Monash Freeway. Melbourne Water protocol requires that prior to final design or construction, Asset Services be contacted to enable a review and / or comment on any potential impact. However as the buffer exists to protect the sewer approximately 100 metres east of the Monash Freeway and all works exists on the west of the Monash Freeway, the sewer buffer is unlikely to impose significant implications for the Project and may have been implemented to protect the sewer during Monash Freeway construction or upgrade works.
3. Design

3.1 Design Criteria
The following design criteria have been adopted to carry out the preliminary concept design:

- Maximum track grade of 2.5%
- Vertical rail clearance of 5.75m
- Rail design speed of 80km/h
- Track minimum horizontal radius of 450m
- No direct impact to existing train stations although future requirements have been detailed within options assessment
- Maintain Toorak Road at or close to existing surface levels.

3.2 Assumptions
The high level concepts have been based on the following assumptions:

- The rail / road grade separation of Toorak Road would not preclude rail / road grade separation of the Glen Waverley Rail Line at both Glenferrie and Tooronga Roads in the future, however the design for these are not included as part of this options investigation.
- The current configuration of Toorak Road has been assumed to remain with respect to number of lanes and intersection layout.
- Toorak Road grade line to be kept as close to existing levels as possible, to minimise impact to the adjacent local road network and Monash Freeway (M1) ramps.
- A grade separation is required for two tracks only. However, provision for a possible future 3rd and 4th track has been considered as part of the options analysis. The Department of Transport have indicated that a third or fourth track is unlikely to be required in the short to medium term.
- Geology and ground conditions would allow for standard construction techniques for retaining walls, structures, etc., as no geotechnical assessment has been undertaken.
- The cadastre information from Vicmap and aerial photography is suitable and sufficient for option development phase to define likely property impacts and impacts on existing PAO.
- A complete shut down of the Glen Waverley line for 6-8 weeks would be possible.
- Off-peak closures and 2-3 weekend closures of Toorak Road would be possible.
- The accuracy of the available 1m contours, aerial photography, Vicmap cadastre information along with the digitised section of the Toorak Road construction drawings (as provided by VicRoads), is suitable for the concept designs.
- Utility and services information as obtained from MOCS data (Dial Before You Dig) are accurate and current.
- Drainage design has not been undertaken and it has been assumed that the rail drainage is able to discharge into the existing freeways drainage (i.e. no pumping system is required).

3.3 Future Requirements
The Department of Transport (DOT) has advised of future planning in this area as follows:

- Provision for possible future third and fourth tracks in the area. DOT advice is that the four rail track ultimate is a long term planning option and that grade separation may or may not precede the four track option.
- Plans to place trams along this section of Toorak Road. Bridge design would not preclude future issue of trams in any way. The current grade of Toorak Road down towards the level crossing is
approximately 10% which is greater than the current maximum vertical alignment grade of 6.67% (as stated in Yarra Trams – Tram Track Design Guidelines V1-4), although future tram design principals may accommodate higher grades to cope with this issue.

- Future provision for longer platforms at stations to accommodate possible 9 car trains (currently 6 car trains on the Glen Waverley Line).
- Design of Toorak Road grade separation does not preclude future grade separation of Glenferrie Road and Tooronga Road.
4. Options Analysis

As a result of the design and geometry of the M1 Toorak Road Interchange as a single point urban interchange, it was reconfirmed as part of this study that taking Toorak Road over the existing rail line is not feasible within operational constraints. Options of lowering the rail under the approximate level of Toorak Road are likely to be the only cost effective solutions given the constraints of maintaining rail and road services.

4.1 Option 1 – Rail to be lowered on or close to the existing rail alignment

Option 1 details the existing Glen Waverley Rail Line to be lowered under Toorak Road on or close to the current horizontal alignment, within the rail corridor. Toorak Road will remain in its current configuration with the exception that it would be raised by approximately 500mm at the existing level crossing location raising the low point as shown on drawing 22419-SK-R-0007.

For Option 1 the existing office buildings south of Toorak Road would be retained. Refer to Appendix A for alignment and typical cross section drawings.

It is proposed that the road over rail bridge would be constructed in a staged approach to provide the least impact to current high levels of traffic using Toorak Road. An example of a proposed construction methodology is outlined below and shown on Construction Staging drawings in Appendix A.

For Option 1, we envisage the construction period could be of the order of 6 months and would require a complete rail shut down for approximately 4 to 6 weeks midway through the construction period. The construction of the Toorak Road overbridge would require Toorak Road to be closed to traffic for short periods of time although every effort has been made to alleviate disruptions to traffic.

Rail shut downs have a major impact on the travelling public and the rail operators business and should be avoided if possible. To minimise impact, shutdowns must be very carefully planned and implemented. To reduce shutdown durations it is expected that works during the shutdown would likely be undertaken on a continuous 24 hours, 7 days a week basis during a time of the year when rail patronage is lower.

Although a significant proportion of the works would be carried out during the shutdown, track occupations will still be required before and after the scheduled shutdown, although most of this work could be carried out during night time occupations with some weekend occupations.

4.1.1 Construction Methodology Example

A) Prior to Rail Shutdown

Works to be undertaken adjacent to but clear of the rail lines behind barriers and with track protection. Works impacting rail operations would still be required to be completed outside peak periods during occupation an closure of the line.

- Mobilise on site, establish site compounds, site security, fencing etc.
- Clear site, remove trees (where required), provide construction access tracks
- Modify, redirect utility services (as required)
- Construct new rail services corridor, temporary connection to existing field equipment.
- Commence construction of bored piers for the retaining wall Talbot Crescent (if this type of wall was to be adopted)
- Preparation works for removal of level crossing
– Demolish VicRoads owned house in Toorak Road on the North West side of the level crossing. Earthworks, pavement works etc, to allow Toorak Road to be widened to the north for the temporary side track
– Localised modification to Talbot Road grade line at southern end
– Establish bus routes, enhanced bus stops at stations (if required) and traffic modifications along bus routes, as and where required so that an efficient train replacement service can be provided during rail shutdown.

B) Rail Shutdown

During the rail shut down, buses will replace trains on the Glen Waverley line for the duration of the works. It is anticipated that the shutdown would need to be scheduled for a period of low demand on the rail network and the duration kept to an absolute minimum. Works during the shutdown are likely to be on a 24 hour 7 day basis for reconstruction of the new tracks over existing.

Rail corridor works
– Remove existing level crossing
– Remove rail, overhead traction, signalling
– Continue and complete construction of retaining walls
– Bulk earthworks undertaken progressively through area. Opportunity may exist to store excavated material on site and approval is to be sought to alter levels of the existing parklands south of Toorak Road adjacent to the freeway therefore upgrading the park's urban amenity
– Construct rail formation, capping layer and drainage
– Install track work
– Install overhead traction masts and wiring
– Install signalling connected to services corridor installed in the earlier stages
– Connect to existing rail infrastructure, test and commission and reopen railway.

Toorak Road Bridgeworks
– Install bored piers in stages by realigning eastbound traffic (2 No. lanes) and removing median (median to be demolished and used as traffic lane during construction)
– Cover bored piers with steel plates or similar to enable road to be re-opened in stages
– Partial excavation beneath bridge deck to be carried out in stages
– Install precast crosshead, 2 lanes at a time by diverting traffic in stages
– Install bridge deck two lanes at a time
– Complete road over bridge by raising road to design level (up to 500mm max.)
– Install utility services in bridge (as required)
– Progressively work across Toorak Road as detailed on Construction Staging Drawing 224109-SK-R0024 in Appendix A
– Complete bridge works
– Excavate beneath bridge to rail formation level.

C) After Rail Shutdown
– Complete Roadwork’s in Toorak Road and Talbot Crescent
– Landscaping, fencing
– Remove temporary side tracks
– Reinstall footpaths etc.
– Demobilisation.
The grade separation work is confined between Kooyong and Tooronga Stations and therefore no station works are required. The vertical grade line does not preclude the construction of a future grade separation of Glenferrie Road.

4.2 Option 2 – Rail Lowered Offline

Option 2 details the existing Glen Waverley Rail Line to be lowered offline to minimise disruption to the rail network. It is proposed that two new rail tracks be built offline to the east of the existing tracks. This will be carried out by constructing a retaining wall to the east, adjacent to the existing rail tracks. This will enable the Glen Waverley Rail Line to operate throughout most of the construction period of the proposed lowered rail tracks.

As in Option 1, Toorak Road will remain in its current configuration and raised by approximately 500mm. The road over rail bridge at Toorak Road is designed to accommodate the two proposed tracks encompassing the new alignment to the east of the existing alignment only (the existing tracks are no longer required).

The overbridge consists of a single span cross sectional structure similar to that detailed for Option 1. Refer to Appendix A for alignment and typical cross section drawings.

The new track alignment extends over an approximate distance of 450m adjacent to the existing tracks. This then ties in to the existing tracks prior to both Tooronga and Kooyong Stations at either end of the works through a transition measuring approximately 150m.

For Option 2, the rail realignment and subsequent works may be undertaken adjacent to but clear of the rail lines behind barriers and with track protection. Works impacting rail operations would still be required to be completed outside peak periods during occupation an closure of the line.

Regular weekend and night-time occupations would be required throughout the construction period and a short shutdown (4 to 5 days) may be required to complete the bridge construction, and to connect and commission the new rail infrastructure. Similar to Option 1, the construction of the bridge would require Toorak Road to be closed to traffic for short periods of time.

As a significant amount of works would be required to be undertaken during weekend rail occupations the construction period will be longer than Option 1, possibly of the order of 12 months. A short but complete rail shut down for approximately 4 to 5 days towards the end of the construction period may also be required.

No works will be required at Kooyong and Tooronga Stations. This option however requires the rail reserve to be widened into Talbot Crescent. Although Talbot Crescent could be retained, the existing landscaped zone between the road and rail cannot be reinstated which could reduce amenity for the local Talbot Crescent residents.

4.3 Option 3 – Rail lowered on existing alignment and road over rail bridge for 4 tracks

Option 3 provides a combination of both Options 1 and 2 to accommodate for the existing Glen Waverley Rail Line, lowered under Toorak Road on or close to the current horizontal alignment, and future proofed for the additional 3rd and 4th tracks to the east.

This option has been separated into sub-options (A) and (B) as described below:

Option 3A
Option 3A provides four tracks under Toorak Road. The proposed twin track bridge for Options 1 or 2 would be extended and an additional span constructed. The eastern abutment (Option 1) or the western abutment (Option 2) would be converted to a central pier. Refer to Appendix A for construction staging (224109-SK-R0026) and typical cross section (224109-SK-R0022) drawings.

Additionally, the cost of option 3A is considered to be comparable to option 3B as the wider excavation width of 2.67m for 3A is offset by the deeper excavation of 0.8m due to the increase in single span structural depth from 1.2m to 2.0m.

**Option 3B**

Option 3B, a single span bridge over the ultimate four track alignment would be constructed. The future tracks would be constructed adjacent to the existing alignment at minimum track centres of 4m. Refer to Appendix A for construction staging (224109-SK-R0027) and typical cross section (224109-SK-R0023) drawings.

Constructing the 4 track ultimate options as outlined above alleviates the requirement for separate bridging disruptions to Toorak Road. Toorak Road is to remain in its current configuration and as Options 1 and 2, raised by approximately 500mm.

If the four tracks were constructed in the future both Tooronga and Kooyong Stations will need to be modified.

### 4.4 Options Comparison

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<th>Option 2 – offline to the east</th>
<th>Option 3B – Four Track Ultimate</th>
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<tr>
<td>Glen Waverley Rail Line</td>
<td>Glen Waverley Rail Line closed during many weekend and night occupations, however a 4 to 5 day shutdown may be required.</td>
<td>Glen Waverley Rail Line closed for approximately 4 to 6 weeks</td>
</tr>
<tr>
<td>Toorak Road closed during off-peak hours (nights) and possibly during weekends</td>
<td>Toorak Road closed during off-peak hours (nights) and possibly during weekends</td>
<td>Toorak Road closed during off-peak hours (nights) and possibly during weekends</td>
</tr>
<tr>
<td>Construction period approx. 6 months</td>
<td>Construction period approx. 12 months</td>
<td>Construction period approx. 12 months</td>
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<td>Future 3rd and 4th track to be built to the east of existing tracks if required</td>
<td>Future 3rd and 4th track to be built on the same horizontal alignment as existing tracks if required</td>
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<td>No impact on existing Kooyong Station and Tooronga Station</td>
<td>No impact on existing Kooyong Station and Tooronga Station</td>
<td>Kooyong and Tooronga Stations would need to be reconstructed to accommodate 4 tracks</td>
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<td>Existing PAO to be amended as per Drawing 224109-SK-R0024 in Appendix A</td>
<td>Existing PAO to be amended as per Drawing 224109-SK-R0025 in Appendix A</td>
<td>Existing PAO to be amended as per Drawing 224109-SK-R0027 in Appendix A</td>
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<tr>
<td>All works carried out within</td>
<td>Additional land required to the</td>
<td>Additional land required to the</td>
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<tr>
<td>Option 1 – online</td>
<td>Option 2 – offline to the east</td>
<td>Option 3B – Four Track Ultimate</td>
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<td>-------------------</td>
<td>--------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>existing rail reserve</td>
<td>east of the existing rail reserve. However no private land acquisition is thought to be necessary</td>
<td>east of the existing rail reserve. However no private land acquisition is thought to be necessary</td>
</tr>
<tr>
<td>Gas, sewer, water, power, communication services will be impacted by the works</td>
<td>Gas, sewer, water, power, communication services will be impacted by the works</td>
<td>Gas, sewer, water, power, communication services will be impacted by the works</td>
</tr>
<tr>
<td>Construction of rail tracks carried out under rail occupation</td>
<td>Construction of rail tracks carried out mostly with live rail line adjacent to work zone</td>
<td>Construction of rail tracks carried out under rail occupation</td>
</tr>
<tr>
<td>Minor regrading of Toorak Road and Talbot Crescent required</td>
<td>Minor regrading of Toorak Road and Talbot Crescent required</td>
<td>Minor regrading of Toorak Road and Talbot Crescent required</td>
</tr>
<tr>
<td>Major regrading of Toorak Road may be required to accommodate future plans for Toorak Road tram line extension.</td>
<td>Major regrading of Toorak Road may be required to accommodate future plans for Toorak Road tram line extension.</td>
<td>Major regrading of Toorak Road may be required to accommodate future plans for Toorak Road tram line extension.</td>
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<td>Total Cut = 34,200m³</td>
<td>Total Cut = 26,200m³</td>
<td>Total Cut = 60,000m³</td>
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<td>Retaining Wall Area = 4400m²</td>
<td>Retaining Wall Area = 5000m²</td>
<td>Retaining Wall Area = 5400m²</td>
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5. Cost Estimate

An indicative high level cost estimate has been prepared for the alignment options as follows.

It is likely during later stages of the project, when community and stakeholder requirements are identified, site investigations undertaken and construction options developed, the scope of the project will change. These changes along with any findings from any risk assessments may have a significant impact on the project costs.

This estimate must be used as a general guide only and for comparison purposes.

We anticipate that the current day project cost would be:

Option 1  $124M
Option 2  $135M
Option 3B  $148M (excluding 4 track and station works beyond Toorak Road site).

We have made no provision for escalation, as the timing for the project is unknown. GST is excluded from the costs.

A broad breakdown of the estimates is as follows:

<table>
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<th>Option 1</th>
<th>Option 2</th>
<th>Option 3B</th>
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<td>Project development, inclusive of concept design, VicRoads and stakeholder costs in the initial development phase</td>
<td>$0.32M</td>
<td>$0.32M</td>
<td>$0.32M</td>
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<tr>
<td>Design and investigations, inclusive of preliminary and detailed designs, surveys, geotechnical and contamination investigations, safety audits, heritage, urban planning, architecture etc.</td>
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<td>$1.59M</td>
<td>$2.10M</td>
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<td>Relocate Utility Services</td>
<td>$0.60M</td>
<td>$0.63M</td>
<td>$0.63M</td>
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<td>Bulk Earthworks</td>
<td>$3.60M</td>
<td>$3.08M</td>
<td>6.65M</td>
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<tr>
<td>Retaining Walls</td>
<td>$8.19M</td>
<td>$9.22M</td>
<td>$9.65M</td>
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<tr>
<td>Stormwater Drainage</td>
<td>$0.55M</td>
<td>$0.73M</td>
<td>$0.80M</td>
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<tr>
<td>Rail Track / Overhead / Signalling / Railway services</td>
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<td>$13.92M</td>
<td>$15.00M</td>
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<td>Road bridge, Roadwork’s, Pedestrian crossing, Signage, Traffic Management etc.</td>
<td>$3.78M</td>
<td>$3.78M</td>
<td>$6.50M</td>
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<tr>
<td>Fencing, landscaping, barriers, noise attenuation etc.</td>
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<td>$1.74M</td>
<td>$2.00M</td>
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<tr>
<td>Rail occupations, safe working, MTM Rail operational costs</td>
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<td>$17.26M</td>
<td>$17.26M</td>
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<td>Indicative Bussing costs, including any minor infrastructure upgrades</td>
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<td>$4.50M</td>
<td>$5.50M</td>
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<td>Project on costs, contractors overheads, margins,</td>
<td>$42.55M</td>
<td>$47.19M</td>
<td>$49.00M</td>
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<tr>
<td>Item description</td>
<td>Option 1</td>
<td>Option 2</td>
<td>Option 3B</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------</td>
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<tr>
<td>profit, legal, MTM costs, Project management costs, public consultation costs etc.</td>
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<tr>
<td>Risk provision</td>
<td>$26.97M</td>
<td>$30.54M</td>
<td>$32.00M</td>
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<tr>
<td>Total</td>
<td>$123.8M</td>
<td>$134.5M</td>
<td>$147.4M</td>
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6. Options Comparison

The options identified for the road over rail grade separation at Toorak Road provide differing benefits for this section of rail corridor. The question remains as to future patronage requirements and if the third and fourth tracks will, at some point, be required.

Options 1 and 2 provide a two track scenario as is currently the case, with two separate construction options identified to alleviate disruption to both road and rail users, whilst providing a road over rail structure at Toorak Road.

Option 3 provides the excavated space to allow for four tracks to be constructed in the future. This option forms two separate scenarios, one being a road over rail bridge with central pier (or retaining wall) abutting an unexcavated adjacent section for the future two tracks and, secondly, a single span structure encompassing the four track ultimate alignment.

As four tracks on the Glen Waverley Rail Line are not required in the short to medium term, and the long term requirement for four tracks is yet to be established, we suggest that for planning purposes the grade separated crossing should be designed for two tracks only (Option 1 or Option 2) but, the designs should be future proof (as far as reasonably practical) to allow for a four track to be constructed if it was to be required in the long term.

The Public Acquisition Overlay (PAO) as highlighted within this report has been assessed against the options and future DOT requirements and it is likely that only property at 737 Toorak Road will be required to accommodate the construction of the future grade separated crossing. On the basis that the existing Toorak Road footprint is adequate for the grade separation, no further widening is required either side of Toorak Road between Elizabeth Street and the rail tracks. The existing PAO not currently required for road purposes can be removed. No property is required on the freeway side of Talbot Crescent so the Public Acquisition Overlay here can be removed.
Appendix A

Drawings