SOUTH MORANG RAIL EXTENSION PROJECT

An Alliance between the Department of Transport, VicRoads, John Holland, MTM and AECOM

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Introduction

The population in Melbourne's north, including the areas surrounding Plenty Valley and South Morang, continues to expand. To serve this growing area, the single rail track between Keon Park and Epping was duplicated and extended to South Morang as part of the South Morang Rail Extension Project (SMREP) (refer to Figure 2 below for details of the project alignment).

The Epping corridor currently has the largest rail maintenance facility in Victoria at the end of the corridor. This adds another level of complexity due to additional train running requirements to the facility outside of normal train running times.

The SMREP was set up as an Alliance based contract between the Department of Transport, VicRoads, John Holland, MTM and AECOM.

From the start of the project the alliance set out to achieve a gain breaking result (project completed in accordance with all Key Performance Indicators). Part of achieving this result included commissioning the project 9 months ahead of schedule and under budget.

In order to achieve such results, the Alliance relied heavily on the organisation structure to fast track approvals through the design and construction phases. The team structure consisted of key personnel from all alliance partners positioned throughout the organisation structure as shown in Figure 1 below.

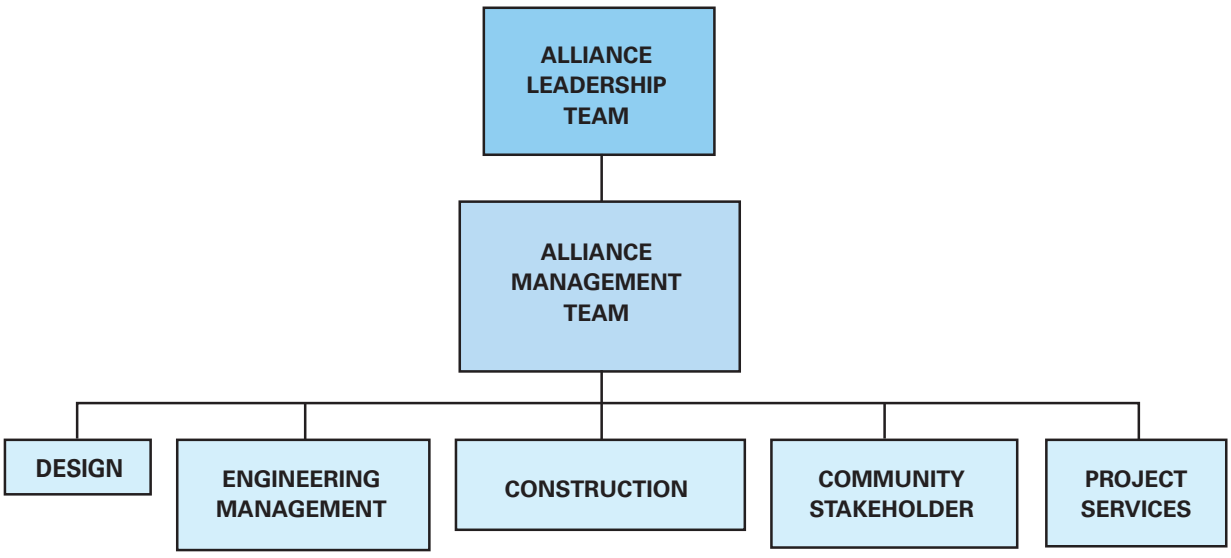


Figure 1 – Alliance Organisation Structure

Project Scope

As part of the project the following works were undertaken:

- Duplication of the 5km of single electrified rail track between Keon Park and Epping
- New Construction of 3.5km double electrified rail track extension from Epping to South Morang
- New Signalling Smart Lock CBI installed – First of its type in Australia
- 3 new Premium Rail Stations at
  - o Thomastown Station
  - o Epping Station and
  - o South Morang
- 3 major VicRoads roads over rail grade separations
  - o Cooper Street
  - o Pindari Avenue
  - o Civic Drive
- 3 new rail bridges over
  - o Darebin Creek
  - o Henderson's Creek and
  - o McDonalds Drain
- Upgrade of 5 road/rail at grade level crossings
- Construction of a new 4 road, 24 car siding at the Epping Yard Precinct
- New Drivers Facility and parking at Epping
- Two new Substations at Thomastown and South Morang and an Upgrade of the existing Epping Substation
- New car park Installed at Lalor Station
- Upgrade of existing car park at Keon Park Station
- Net increase of car parking of 1100 spaces over the project
- Major Services relocations including Sewer, Water, communications and HV electrical

The project, which commenced in June 2010, was scheduled for completion in December 2012. However, with strategic planning and project staging the project was successfully completed 9 months ahead of schedule. At the height of the construction phase there were around 480 project personnel on site.

As part of the project there were many challenges faced. Of these, the report below covers the following in detail:

- Developing the design to suit construction within a live operating rail environment
- Working within a sensitive environment
- Stage signalling commissioning of the Smart Lock CBI System
- Building Epping Yard in 10 days to meet Metro demand for stabling in the network

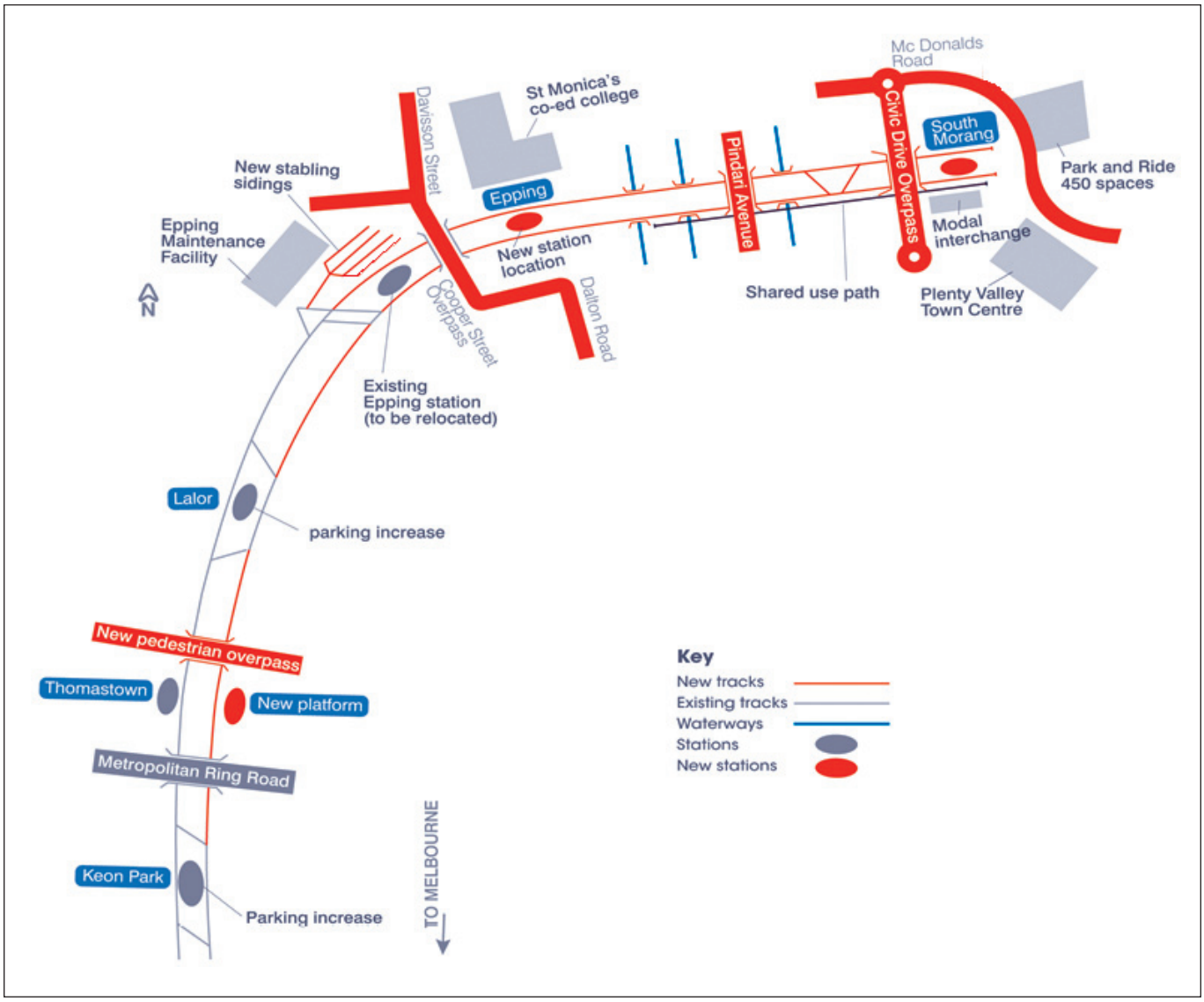


Figure 2 - Project Alignment

Developing the design to suit construction within a live operating rail environment

The 5 km duplication of the existing line between Keon Park and Epping was at Tender stage designed at 5.5m centres. Under this arrangement formation design required a subsurface drain to be installed between the new and existing formation for the full length of the alignment; as per Figure 3 below. The subsurface drain was designed to ensure that the interface between the old and new alignment would drain due to the new formation not tying into the existing.

Due to the position of the subsurface drain and the location of the construction fence, which was specified to be 3.8m from track centre line (3m from outer running rail), the works to undertake the subsurface drains were required to be constructed under After Last Before First Train (ALBFT) occupations over a six month period. With this constraint in mind, the construction team went about developing proposals to remove the ALBFT construction constraint from the project, as it was proving to have a large impact on program and budget.

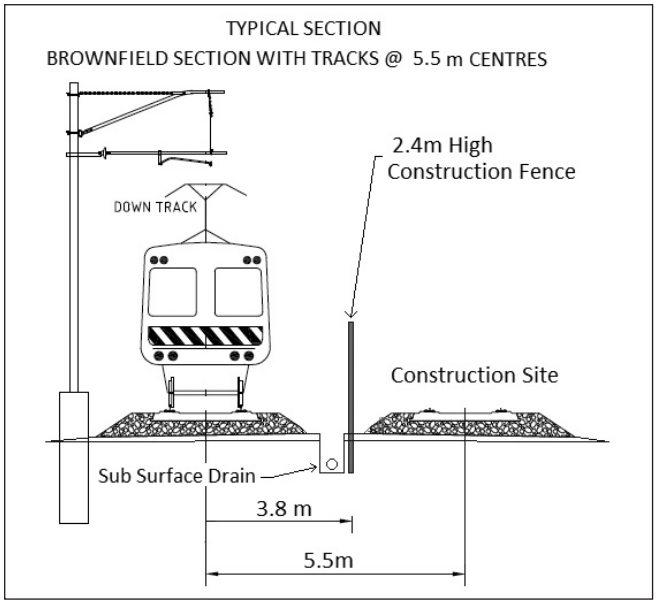
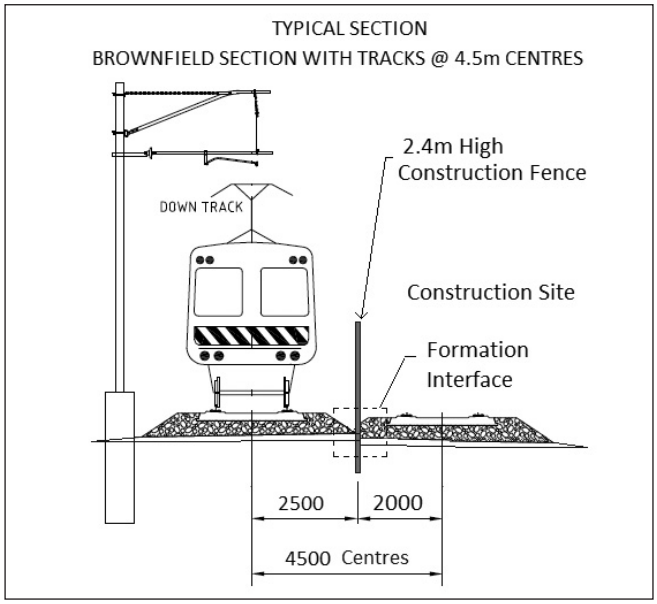


Figure 3 – Tender Design at 5.5m Centres with Construction Fence at 3.8m from Existing Track Centreline



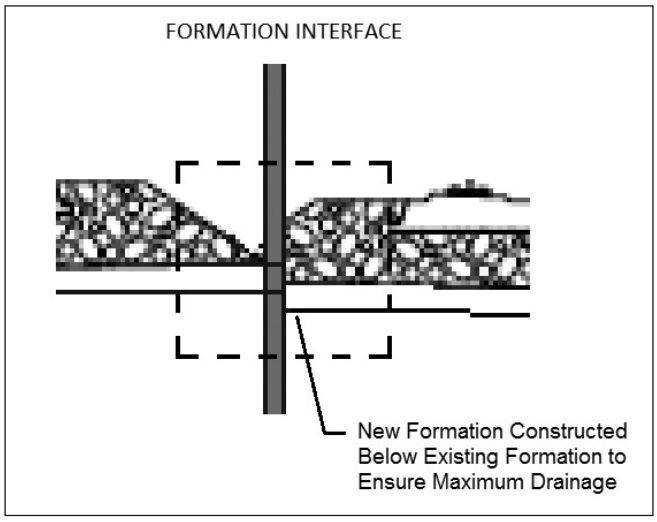


Figure 4 – Revised Design at 4.5 Centres with Construction Fence at 2.5m from Existing Track Centreline

In order to remove the requirement of the subsurface drain, the design needed to tie the new formation into the existing at a level lower than the existing capping. To undertake this work outside of ALBFT occupations, the construction team went through a consultation process with MTM infrastructure and the rail safety team to have the position of the construction fence brought closer to the existing track. After a series of risk assessments, the construction fence was redesigned and permission was given to place the construction fence at 1.7m from outer rail of the existing track (2.5m from track centreline).

By reducing the fence offset, it allowed the design to be redeveloped to enable the formation to be tied into the existing under train running. The new position also enabled the design team to reduce the track centres to 4.5m as per Figure 4 below. These reduced track centres had a flow on affect along Station Street, which runs parallel with the alignment. With the tracks redesigned at 4.5m centres it reduced the required width of the rail boundary, which in turn provided the road space with sufficient width to install additional parking along the alignment.

Construction within a Sensitive Environment

Prior to the South Morang Rail Extension Project, the Greenfields portion of the alignment between Epping and South Morang was maintained as a community park consisting of walking and riding paths winding through the Red Gum park land, as shown in Figure 5 below.

The process of managing the 286 residences that back onto the rail corridor took a dedicated team. This team ran a series of campaigns leading up to the works. This involved information days where concepts such as those shown in Figure 5 were presented, and continuous consultation throughout the construction phase, which consisted of a 7 day notification period for all works. This process ensured that residents were made aware of any disruptive activities in advance.

The rail easement was previously utilised by the local community as a park and thoroughfare for pedestrians and cyclists. The urban design incorporated a new shared user path within the constructed railway easement along the extended 3.5km section to South Morang. This maintained connectivity within the area without geographically disconnecting the community. To further enhance this, a grade separated pedestrian crossing was installed.

The Greenfields corridor, as shown in Figure 6 (on the following page), is approximately 32m wide resulting in the formation backing onto the residents' boundaries. As shown in Figure 5, there was a requirement to lower the formation through most of the Greenfields alignment to reduce the impact of the new railway tracks through the densely populated area. In order to meet the design alignment, 180,000 cubic metres of rock with MPA values up to 50MPA were removed.

Due to the proximity constraints of the residences, the conventional drill and blast techniques were not an option and all of the rock had to be removed using 65 tonne excavators, mounted with rock breakers and large diameter rock saws.

Greenfields Alignment Pre Construction

Alignment Cross Section Developed For Community Consultation

Figure 5 - Rail Corridor Prior to Construction

Pindary Avenue Road Bridge

Congested Site at Construction Peak

Figure 6 - Rail Corridor Backing onto 286 homes

Staged Signalling Commissioning

The next generation SmartLock SML400 CBI was selected as the signalling control system for the project. The SmartLock features Solid State Interlocking (SSI) with backward compatibility, as well as a modern architecture to support an incremental technology upgrade (both field and control side) into the future. These features made the CBI suitable as it enabled the project to be staged around the existing signalling systems.

The SmartLock SML400 CBI was designed to control the lines from the down side of Ruthven Station (4km South of project boundary) through to South Morang - including the Epping Yard and the Epping sidings. By separating the CBI Zones into 14 areas it enabled the delivery of the works to be broken into the required stages for construction purposes. The significant changes required to integrate the new control system into the existing system, could be implemented through the 14 stages by making incremental changes.

The commissioning of the new CBI involved a number of stages to introduce the new system and to enable full control of all tracks between Ruthven and South Morang. These stages were as follows:

1. Heart transplant of existing Epping Yard SSI to the SmartLock CBI, transferring all control and peripheral systems accordingly

2. Commission Keon Park to Epping to the new SmartLock CBI, update data and hardware ("more of same" basis of peripheral systems)

3. Commission Epping to South Morang to the new SmartLock CBI, update data and hardware ("more of same" basis of peripheral systems). (Stages 1, 2 & 3 were delivered during a four day commissioning occupation)

4. Commission new stabling sidings at Epping Yard (Stage 4 was delivered during a ALBFT commissioning occupation)

To meet programme objectives, stages 1, 2 and 3 were all commissioned as a single four day commissioning that incorporated final construction tie in works and driver training. Stage 4 was brought on line 15 days later upon completion of the Epping Yard stabling sidings over an ALFBT occupation.

Leaving aside the technological benefits, SmartLock SML400 represented a low technical risk solution for implementation. It enabled maximum compatibility and re-use of the various legacy systems on the ground and in the Epping Control Centre. The existing field equipment (including Trackside Function Modules and copper datalink) could be retained essentially unchanged with the SmartLock CBI.

The SmartLock SML400 CBI is built on a SIL-4 platform widely used in safety critical applications throughout Europe. For European railways, the platform is able to integrate with vital signal telemetry networks and next generation object controllers. UGL Limited faced the challenge of developing and testing data for 4 interlocking areas essentially simultaneously to meet the target delivery schedule.

Building Epping Yard in 15 days

The Epping Rail Yard, consisting of a four road siding design to stable 4 number of 6 car sets, was designed to be constructed in the area occupied by the existing Epping Train Station, as shown in Figure 7. As part of the project delivery, the Epping Yard could not be delivered until the first stage of the project was completed following the relocation of the existing Epping Station to the north side of Coopers Street. As part of the staging of the project, a goal was set to construct the yard in 15 days. In order to achieve the 15 day program, the design of the yard was modified to enable a large portion of the works to be undertaken prior to the removal of the station. These works included:

- Pre-installing all OHW foundations and installation
- Installing the outer conduit route containing DC Feeders and signalling cables
- Preparing existing Tracks around Island Platform to be slewed to new alignment
- Installing outer drainage along existing platform roads

Figure 7 – Epping Station Prior to Construction and Epping Yard half way through the Construction

Figure 8 – Epping Yard on completion

Once the stage one commissioning was completed, the construction team went into 24 hr operation and over the next 30 shifts (15 Days) the following works were undertaken:

- Demolition of the existing station and platform
- Preparation of the formation
- Installation of the capping
- Slew existing platform tracks into final alignment
- Installation of remaining drainage works and local cable route
- Installation of OHW structures and running of the new wires
- Installation of the bottom ballast and track
- Installation of signalling cables and signals
- Installation of asphalt pathways
- Final commissioning of Signalling, Track and OHW works

As shown in Figure 7, the station was in full operation on the 27th of October 2011. 7 days later the track had been laid and the OHW teams had 6 machines on track starting to run wires on each road. As shown in Figure 8, the yard was completed 15 working days later on the 11th of November.

The South Morang Rail Extension was handed over to MTM on April 2012, nine months ahead of program and including driver training requirements on the new extension ready for train running services. Success of the project was measured by its gain breaking achievements in all Key Result Areas:

- Stakeholder & Community Engagement
- Safety
- Disruptions
- Quality of Workmanship
- Schedule
- Design & Sustainability
- Value
- Environmental Compliance

Conclusion

This paper provides an overview of many aspects of the South Morang Rail Extension Project. Upon reflection, it is clear that the performance of the team was pivotal in ensuring that the requirements for successful delivery were met. The project introduced next generation technology coupled with an implementation approach and method that resulted in achievement ahead of schedule, and on budget. This gave rise to the opportunity to achieve a game breaking result on a difficult Brownfields project. The Alliance style contract complimented the delivery approach, as having the operator of the line embedded within the Alliance team gave the opportunity to realise significant innovation to be delivered throughout the project with ease.