Sheet Pile Retaining Walls
Design and Construction in Brown Fields Environment

Level Crossing Removal Project 1

Burke Road, North Road, McKinnon Road and Centre Road

27 November 2017
LEVEL CROSSING REMOVAL PROJECT 1

4 LEVEL CROSSINGS

- Burke Road / Gardiner Station
- North Road / Ormond Station
- McKinnon Road / McKinnon Station
- Centre Road / Bentleigh Station

ALLIANCE PARTNERS

- VicRoads / Level Crossing Removal Authority
- John Holland
- MTM
- PTV
- KBR

TIME FRAME

- Design commenced – May 2015
- Burke Road bridge & main occupation complete in Jan 2016
- North, McKinnon, Centre Road bridges complete
- Main occupation occurred in June/July 2016
- Ormond, McKinnon & Bentleigh stations opened in August 2016
## INTRODUCTION

| 1. Level Crossing Removal Project 1 – Project Background |
| 2. Working in the Rail Environment – Online vs Offline Construction |
| 3. Retention Solutions |
| 4. Sheet Piled Walls |
| 5. Versatile design |
| 6. Coordination of Design and Construction Teams |
| 7. Conclusion – Connecting Communities |
ONLINE CONSTRUCTION – NORTH, MCKINNON AND CENTRE ROAD

Use Where

• The new horizontal rail alignment closely follows the existing
• Concerns over visual, noise and disruptions

Characteristics

• The main occupation is longer and has critical construction activities
• De-risk the main occupation by minimising the occupation works
Construction features

• Retention walls built ‘on’ existing alignment consisting of predominately Continuous Flight Auger (CFA) and Sheet piles.
  • CFA piles used except where geometric/environmental constraints dictate
  • Sheet piling - utilising the GIKEN ‘silent-piler’
  • Props used to minimise pile size
  • Piling facilitates main occupation excavation

• Bridges constructed on existing level crossings

• Challenge of a high ground water table
OFFLINE CONSTRUCTION – BURKE ROAD

Use Where

• The rail line can be diverted onto the new alignment i.e. Requires a larger rail corridor to work

• Major construction occurs adjacent the existing rail line

Characteristics

• Avoids long occupations

• Critical construction activities can occur without the time pressure of an occupation
NORTH, MCKINNON, CENTRE ALIGNMENT PLAN
Efficient Selection Considerations:

- Cost
- Methodology
- Geometry
- Environmental (Vibration/Noise)

Types

Retention system comprised of:

- Post and panel
- Shotcrete/Soil Nail
- Sheet pile
- Continuous flight auger piles
RETENTION SOLUTIONS – POST & PANEL

Features

- Low excavation depths
- Small diameter piles w steel and pre-cast panels
- Lower cost

Used predominantly between batter slopes and heavier systems and, at interfaces.
RETENTION SOLUTIONS – SHOTCRETE / SOIL NAIL

Features

• Suitable geotechnical present (up to 7m)
• Good speed of construction
• Anchored and non-anchored
• Lower cost
RETENTION SOLUTIONS – CFA/Bored Piles

Features

• Deep excavation
• Poor Soils
• Axial capacity
• Optimisation of pile spacing/reinforcement
• High Cost

Used in conjunction with soil anchors and permanent props for increasing depth.
Features

- Moderate to deep excavation
- Small structural thickness
- Variety of profiles available
- Moderate cost

- Live rail environment
- Existing services
- Operational roads

Corrosion and stray current
Types:

- Z Section
- U Section
RETENTION SOLUTIONS – SHEET PILE

Wall Heights:

- Free standing up to 4.5m height
- Propped up to 6.0m height
  - Temporary Prop
- Propped up to 7.0m height
  - Permanent Anchors
- Propped and composite 7.5m height (special case)
  - Temporary Prop
  - Composite Concrete Infill

Propping System:
- Base slab
- Temporary props
- Permanent anchors
LEVEL CROSSING REMOVAL
PROJECT 1
RETENTION SOLUTIONS – SHEET PILE
GIKEN & HIGH RESONATOR

Piling Methods:

• GIKEN ‘silent-piler’ using a push method (less noise and vibration)
• High frequency sheet pile driver
  avoiding damage from hammering
  vibrations
EXISTING CONDITIONS
MAJOR SERVICES REALIGNMENTS

- 1750 diameter drain at Bentleigh designed as a ‘Siphon’
Bentleigh Bathtub Wall
Bentleigh Bathtub Wall
VERSATILE DESIGN

Sheet pile infills

- Collision requirement
- Base slab uplift
- Increase strength of sheets for deflection
VERSATILE DESIGN

Overhead structures

• Structures kept within the rail corridor
• Avoid site welding where possible
• Non-uniform sheet piles required a flexible attachment detail
• Two details: top mount and face mount.
COORDINATION OF DESIGN AND CONSTRUCTION TEAMS

• Achieving practical design through close interaction between design and construction teams

• Civil, structural and geotechnical design support on site from early stages.

• 7 day per week support during major occupations

• 24 hour design support in 12 hour shifts during critical construction phase
CONCLUSION

• Travel times reduced
• Safety increased
• Completed on schedule
• Connected the communities either side of the rail at Glen Iris, Ormond, McKinnon and Bentleigh
• Successful project