CityLink Tulla Widening
– Bulla Road Bridge Modification

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Introduction | Presentation outline

• Project Background
• Existing Bridge Details
• Proposed Upgrade Works
• Major Constraints
• Construction Sequence
• Movement Monitoring
• Conclusions
Introduction | Project Background

- 2 packages of work
  - Melbourne Airport to Bulla Road
    - Funded by Federal and State Government
    - Delivered by VicRoads
    - Approx. length of 8 KM
  - Bulla Road to Power Street (CTW - this project)
    - Funded and delivered by Transurban
    - Approx. length of 16 KM
- One extra lane in each direction
- Contract Awarded May 2015
- Expected Completion by end 2017
- Total capital cost ~$1.28 billion for both packages
**Introduction | Project Background**

- **Client**: Transurban
- **Contractor**: CPB – Design & Construct Partner
- **Main Consultants**: Aurecon-GHD Joint Venture (AGJV)
- **Other Consultants**: Doulgas Partners (geotechnical)
  SLR (Noise Modelling)
  KBR (Proof Engineering)
  PowerPlant (Lighting Design)
  Hassel (Urban and Architectural)
  Visionstream (ITS)
  Davis Langdon & AECOM (IR)
Introduction | Existing Bulla Road Bridge
Introduction | Existing Bulla Road Bridge

REFERENCE DESIGN

ALTERNATE DESIGN
Introduction | Existing Bulla Road Bridge

- Constructed in 1968
- Four span (11.3m+25.9m+25.9m+9.15m) continuous I girder Bridge composite with deck
**Introduction | Existing Bulla Road Bridge**

- Discrete Abutment support on Counterfort Wall
- Counterfort Wall supported on Decomposed Basalt
Major Constraints

• The fill at the back of the existing abutment requires careful assessment before the construction of soil nail wall due to no approach slab on bridge approach above.

• Space constraint under the north abutment due to low headroom from existing I girder and the existing batter slope.

• Part of the existing reinforced concrete buttress walls and footings must be cut off, removed and grouted.
Introduction | Proposed Modification
Introduction | Construction Sequence

**STEP 1**
- Excavate existing batter to 1:1 line
- Existing surface level

**STEP 2**
- Excavate to min 0.3m below first row of soil wall
- Existing bridge abutment buttress wall & footing

**STEP 3**
- Apply sacrificial steel fibre reinforced shotcrete (SPS)
- Install soil wall
- Install red
- Apply shotcrete

**STEP 4**
- Excavate to min 0.3m below first row of soil wall
- Row 1

**STEP 5**
- Apply sacrificial steel fibre reinforced shotcrete (SPS)
- Install soil wall
- Install red
- Apply shotcrete

**STEP 6**
- Excavate to bottom of the existing footing
- Row 1
- Row 2
Introduction | Construction Sequence

1. Apply sacrificial steel fibre reinforced shotcrete (SFRC)
2. Install SRN NA.1
3. Install red
4. Apply shotcrete

**Step 7**

1. Build new abutment wall
2. After abutment wall concrete strength has reached 35 MPa, saw cut portion of existing buttress wall & footing refer to DIN 3105 for extent of saw cut and DIN 18802 for surface treatment
3. Excavate to min 6 m below the first row of rock bolts

**Step 8**

1. Install first row of rock bolts
2. Shotcrete after grouting of bolts

**Step 9**

1. Excavate to min 6 m below the second row of rock bolts
2. Install second row of rock bolts
3. Shotcrete after grouting of bolts

**Step 10**

1. Excavate to min 6 m below the third row of rock bolts

**Step 11**

1. Note: During Stage 2 construction full geotechnical supervision must be in place. If poor quality material is present or rock is damaged, work will be halted until acceptable remedial measures are in place. If significant defects are found to compromise the integrity of bridge works, will immediately be contacted regarding operation of the bridge.
Introduction | Construction Sequence

STEP 13

INSTALL THIRD ROW OF ROCK BOLTS SHOTCRETE AFTER GRouting OF BOLTS

STEP 14

EXCAVATE TO MIN 15m BELOW THE LAST ROW OF ROCK BOLTS

STEP 15

1. INSTALL LAST ROW OF ROCK BOLTS SHOTCRETE AFTER GRouting OF BOLTS CONTINUE EXCAVATION TO FORMATION LEVEL.

2. CAST 100mm THICK HORIZONTAL SLAB AT TOP OF ROCK BOLT SHOTCRETE WALL
**Introduction**

**Construction Sequence**

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**Stage 1: Construction Sequence Above Base of Footing for Soil Nails**

- Excavate in hit one, miss two sequence slots, in numerical sequence 1 to 10 to form horizontal benches for nail installation.
- Bench levels 1 to 9 below head of nail.
- Apply one layer of steel fibre reinforced shotcrete; Minimal show thickness.
- Loose material is excavated in exposed excavated face refer to note 7 on DRI 0021.
- Drill holes for soil nails; install & grout within each sequential area.
- Install all stakes and load test nails along row prior to excavation for subsequent bench lowering.
- Fix reinforcing mesh on bar chairs to maintain correct cover under nail and bolt head play; Spire shotcrete after soil nails; repeat sequence to row 2.
- Note: rock is expected at row 2 and below; low vibration drilling methods to be adopted; Diamond core or use of diamond hammer with approval of geological chemist; this may require vibration monitoring trials.
- Excavation of basalt will require vibration-free methods to minimise fracturing and lowering of rock mass under existing footings.
- Excavation methods to be approved by geological engineers/AGI/USCL.

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**Stage 2: Construction Sequence Below Top of Footing for Rock Bolts**

- Saw cut existing footing and provide corrosion treatment.
- Excavate in hit one, miss two sequence slots to base of footing in numerical sequence.
- Excavate next bench below footing and install rock bolts as per above sequence.
- Excavate lower benches over max. 18m horizontal length and install rock bolts.
- Excavation at abutment to be undertaken under continuous geological inspector.

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**Notes:**

1. For soil nail, general notes refer to drawings CWI-TMLDS-AGS-500-SER-2675 & 6014.
2. For rock nail, general notes refer to drawings CWI-TMLDS-AGS-500-SBR-867 & 9017.
3. Temporary baffles to be formed no steeper than 1:1.
4. Refer to drawings CTW-TMLDS-AGS-500-SER-5404A to obtain for construction sequence.
5. Coordinate staging of excavation with structural package STR-AB.5 sequence.
Introduction | Construction Sequence

STR52 - SILL BEAM MONITORING POINTS
Offset Movement - Standardised

- PHASE 1 BASELINE 13/05/2016
- COMMENCEMENT EXCAVATION 7/10/2016
- CUT EXISTING SPREAD FOOTINGS 17/02/2017
- COMPLETION EXCAVATION & ROCK BOLT 29/05/2017
- PHASE 1 LAST READING 13/07/2017
- PHASE 2 BASELINE 25/07/2017

PERPENDICULAR DISPLACEMENT (m)

- MONO01 DIFF STD
- MONO02 DIFF STD
- MONO03 DIFF STD
- MONO04 DIFF STD
- MONO05 DIFF STD
- MONO06 DIFF STD
- MONO07 DIFF STD
- ALARM (-)
- ALARM (+)
Introduction | Construction Sequence
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Introduction | Pier Protection
Introduction | Pier Protection
Introduction | Pier Protection
Conclusions

• Two additional traffic lanes accommodated under existing bridge by
  • Removing spill through and
  • Partial demolition of counterfort wall
• Remaining part of the footing was found insufficient in providing axial and lateral support to the abutment
• New infill blade walls constructed in between existing support to carry axial load out of existing footing
• Combination of blade wall with soil nail provided required lateral support
• Monitoring result shows little or no movement of the wall
• All construction now completed and Road open for traffic
Acknowledgments and Questions

• Acknowledgments
  – CPB Contractors
  – Transurban
  – VicRoads
  – Douglas Partners
  – Hassell

• Thank you for listening