



• ENGINEERING • PROCUREMENT • MANAGEMENT

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33532.00-L-106

26 July 2021

GA ENVIRONMENT (PTY) LTD  
Glad Africa House Block G, 2nd & 3rd Floor  
90 Bekker Road  
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JOHANNESBURG, 1686

Attention : Ms. Nkhensani Khandlhela

Email : [nkhensanik@gaenvironment.com](mailto:nkhensanik@gaenvironment.com)

Dear Madam,

**CONTRACT NRA R.101-080-2019/1F: CONSULTING ENGINEERING SERVICES FOR THE IMPROVEMENT OF NATIONAL ROAD R101 SECTION 8 FROM BELA BELA (KM 0.0) TO MODIMOLLE (KM 26.8)**

**CONSTRUCTION METHODOLOGY FOR THE REPLACEMENT OF MAJOR STRUCTURES ON THE R101 SECTION 8**

BVi Consulting Engineers Western Cape (Pty) Ltd was requested by GA Environment to compile a basic construction methodology for the replacement of 5 major structures on the R101 Section 8 between Bela Bela and Modimolle. This includes the preliminary traffic accommodation solutions, sequence of demolition, as well as sequence of construction of new bridge components. Please note that this methodology may change during construction after inputs from the contractor and discussions with the client. However, primary environmental recommendations and government requirements will be met at all times.

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**BVi Consulting Engineers Western Cape (Pty) Ltd. Trading as BVi, Reg No. 1998/000157/07**

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**BVi Consulting Engineers (Pty) Ltd.**

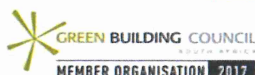
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Seeing as all major structures are drainage structures, it would be advisable that major construction activities take place in the dry season. Two of the structures are situated in major watercourses which may have limited flow in the dry season. Special consideration is given to these two structures, to mitigate possible pollution of the watercourse. During construction, monitoring of the river water quality will be a priority in sensitive areas and strict control measures will be put in place to ensure hazardous materials do not contaminate the natural surroundings. The construction methodology for each bridge, and a general methodology for the major culverts (with Major Culvert IDC3321 used as example), are discussed as follows:

### **Construction of Major Culverts:**

3 Major Culverts are situated along the R101 Section 8. These are IDC3321, IDC3322 and Major Culvert at km 22.5. BVi has recommended the replacement of the existing structures due to insufficient drainage capacity. This proposal was accepted by SANRAL.

All 3 major culverts will be constructed in half-widths, with the construction following the sequence below:

- Before excavations or demolition works commence, all endangered plants to be removed and relocated by a specialist, where required, for later relocation.
- Reduce the roadway width and introduce a stop-and-go if necessary. Strict Health and Safety measures will be put in place to ensure safety of the road users and pedestrians.
- The roadway fill on the side of the first half-width construction will be removed and part of the existing structure demolished. Demolition will be done using excavators, jack hammers, water-jetting, and/or manual demolition methods, with material being taken to a temporary stockpiling area. The use of explosives will not be permitted during demolition works.
- Excavations of between 1m and 2m deep will be required for soil improvements, over the full footprint of the culvert. Slopes will be maintained to within a safe limit to ensure collapse of soil into the excavations do not take place. Where space is limited, shoring will be provided.
- A temporary pipe culvert will be installed for minor flow in the dry season. This pipe is provided to mitigate any contamination of the water through contact with the construction site and materials. As an alternative, a river or stream could also be diverted, with a temporary culvert being constructed away from the construction site. Due to the high traffic volumes along this road, and substantial delays possible for construction of a temporary bypass, this option is not preferred, but can be considered again once construction commences and with inputs from the contractor.
- Graded material or rock-fill will be imported, placed and compacted where excavations took place. This whole infill will be lined by Geofabric.
- A concrete blinding layer will be cast above the new infill material, for setting out of the new structures' foundations.
- The first half-width portion of the structure will be constructed, with formwork and reinforcement being placed, concrete cast, and curing of concrete taking place, in successive portions (as planned by contractor).

- Once the first half has been completed, backfilling with graded material around the structure, as well as new road layer works and surfacing construction will commence.
- Once completed, the traffic will be diverted over the newly constructed half of the structure.
- A similar sequence will commence for the excavation, fill, and construction of the second half-width of the major culverts.
- Once the structure has been constructed, rehabilitation of the site can take place, with any endangered plants initially removed and relocated, being reintroduced. Embankments can be seeded and planted, to prevent short- to medium-term erosion around the new structure.

An example layout of Major Culvert IDC3321 is included in Annexure A, which illustrates the construction sequence as well as the area that will be excavated. Note that all works will be carried out in accordance with the relevant Health & Safety and Environmental guidelines and regulations.

### **Construction of Bridge B375:**

The existing Bridge B375 is a 5 span structure with a total length of 62m. BVi recommended that the bridge be replaced due to insufficient drainage capacity, an increased roadway width at the structure, as well as a vertical realignment of the road.

Due to the limited space around the structure (the river flows almost parallel to the road approaches, and the structure is situated between two steep hills), a bypass was not recommended. A construction sequence consisting of half-width type construction, while retaining the existing structure's abutments, were considered most viable, considering the severe spatial constraints. SANRAL approved the structural replacement, as well as the construction sequence. The construction sequence is detailed as follows:

- Excavations will take place underneath the existing structure, while the structure remains in use. Areas between the existing foundations will be excavated for the new foundations, down to natural rock level (up to 3m deep). Slopes will be maintained to within a safe limit to ensure collapse of soil into the excavations do not take place. Where space is limited, shoring will be provided.
- A temporary pipe culvert will be installed for minor flow in the dry season. This pipe is provided to mitigate any contamination of the water through contact with the construction site and materials. A temporary diversion of the river is not possible in this location, due to the constrained space between the two steep hills on either sides of the watercourse. Given that this watercourse is not a perennial river, limited to no flow is expected in the dry season.
- Cordon off the structure construction area, which should include the full excavation footprint and areas where plant is to be positioned. Stormwater management and isolation of this area is to be prioritized, to prevent any hazardous materials from leaving the perimeter of the site or infiltrate the groundwater. All endangered plants to be removed and relocated by a specialist, where required, for later relocation.
- The new foundations will be constructed onto the exposed natural rock, in between the existing foundations. Piers will be partially constructed to the underside of the existing deck soffit.

- Traffic will be closed on the western side of the existing bridge, and a stop-and-go facility will be implemented on the eastern side. Strict Health and Safety measures will be put in place to ensure safety of the road users and pedestrians.
- Holes are to be demolished through the western side of the existing bridge deck, for new piers to pass through.
- Formwork and reinforcement for the new piers and abutment alterations are to be placed, and concrete cast, for the first half-width of the new bridge.
- Formwork and reinforcement placement, and casting and curing of concrete for the first half-width of the new bridge deck will take place. The existing deck as well as staging to be utilized to support the new deck formwork.
- Once construction of the first half-width is completed, backfilling with graded material around the structure, as well as new road layer works and surfacing construction will be initiated.
- Two-way traffic to be diverted over the newly constructed half-width of the bridge.
- Demolition will be done using excavators, jack hammers, water-jetting, and/or manual demolition methods. The use of explosives will not be permitted during demolition works. Shielding (such as sheeting or similar protective layers) can be placed underneath the existing structure, if required. Rubble to be spoilt at temporary stockpiles.
- A similar sequence will commence for the excavation, fill, and construction of the second half-width of the new bridge.
- Once complete, the bridge will be fully opened for traffic. Rehabilitation of the site can then take place, with any endangered plants initially removed and relocated being reintroduced. Embankments can be seeded and planted, to prevent short- to medium-term erosion around the new structure.

Scheduling will be prioritized for this structure, in collaboration with the contractor once appointed, in order to mitigate against any possible delays that might put pressure on environmental considerations (such as relocation of endangered plants that might require a minimum timeframe). An example layout of Bridge B375 is included in Annexure C, which illustrates the construction sequence. Note that all works will be carried out in accordance with the relevant Health & Safety and Environmental guidelines and regulations.

#### **Construction of Bridge B447:**

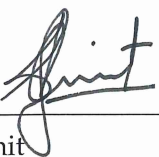
The existing Bridge B447 is a 4 span structure with a total length of 30m. BVi recommended that the bridge be replaced due to insufficient drainage capacity as well as a vertical realignment of the road. This bridge is situated in a large perennial river, and a diversion of the watercourse will be necessary, even during the dry season. The construction sequence for this structure is as follows:


- Clearing vegetation, placement of fill and construction of temporary drainage structure for the temporary bypass. All endangered plants to be removed and relocated by a specialist, where required, for later relocation.

- Divert the river through the temporary structure, as well as through the existing structure, and also divert traffic over the bypass.
- Demolish part of the existing fill next to the existing structure, and divert the river through this area, away from the bridge construction area.
- Cordon off the bridge construction area, which should include the full excavation footprint and areas where plant is to be positioned. Stormwater management and isolation of this area is to be prioritized, to prevent any hazardous materials to leave the perimeter of the site or infiltrate the groundwater. All endangered plants to be removed and relocated by a specialist, where required, for later relocation.
- Demolition will be done using excavators, jack hammers, water-jetting, and/or manual demolition methods. The use of explosives will not be permitted during demolition works. Shielding (such as sheeting or similar protective layers) can be placed underneath the existing structure, if required. Rubble to be spoilt at temporary stockpiles.
- Excavations to take place for new structure foundations, to a maximum depth of 2m. Slopes will be maintained to within a safe limit to ensure collapse of soil into the excavations do not take place. Where space is limited, shoring will be provided.
- Pilling operations to take place, with auger piles being installed to a maximum depth of 11m and socketed into the bedrock.
- The rest of the bridge will be constructed, with formwork being placed, reinforcement placed, concrete cast, and curing of concrete taking place, in successive portions (as planned by contractor).
- Once construction of the bridge is completed, backfilling with graded material around the structure, as well as new road layer works and surfacing construction will be initiated.
- Once completed, the traffic will be diverted over the new bridge.
- Demolition of the temporary bypass as well as the temporary drainage structure will take place. This will happen in sequence, ensuring that no debris and materials enter the river.
- Once complete, the site will be rehabilitated and any endangered plants can be relocated.

An example layout of Bridge B447 is included in Annexure C, which illustrates the construction sequence as well as the area that will be excavated. Note that all works will be carried out in accordance with the relevant Health & Safety and Environmental guidelines and regulations.

Yours faithfully,

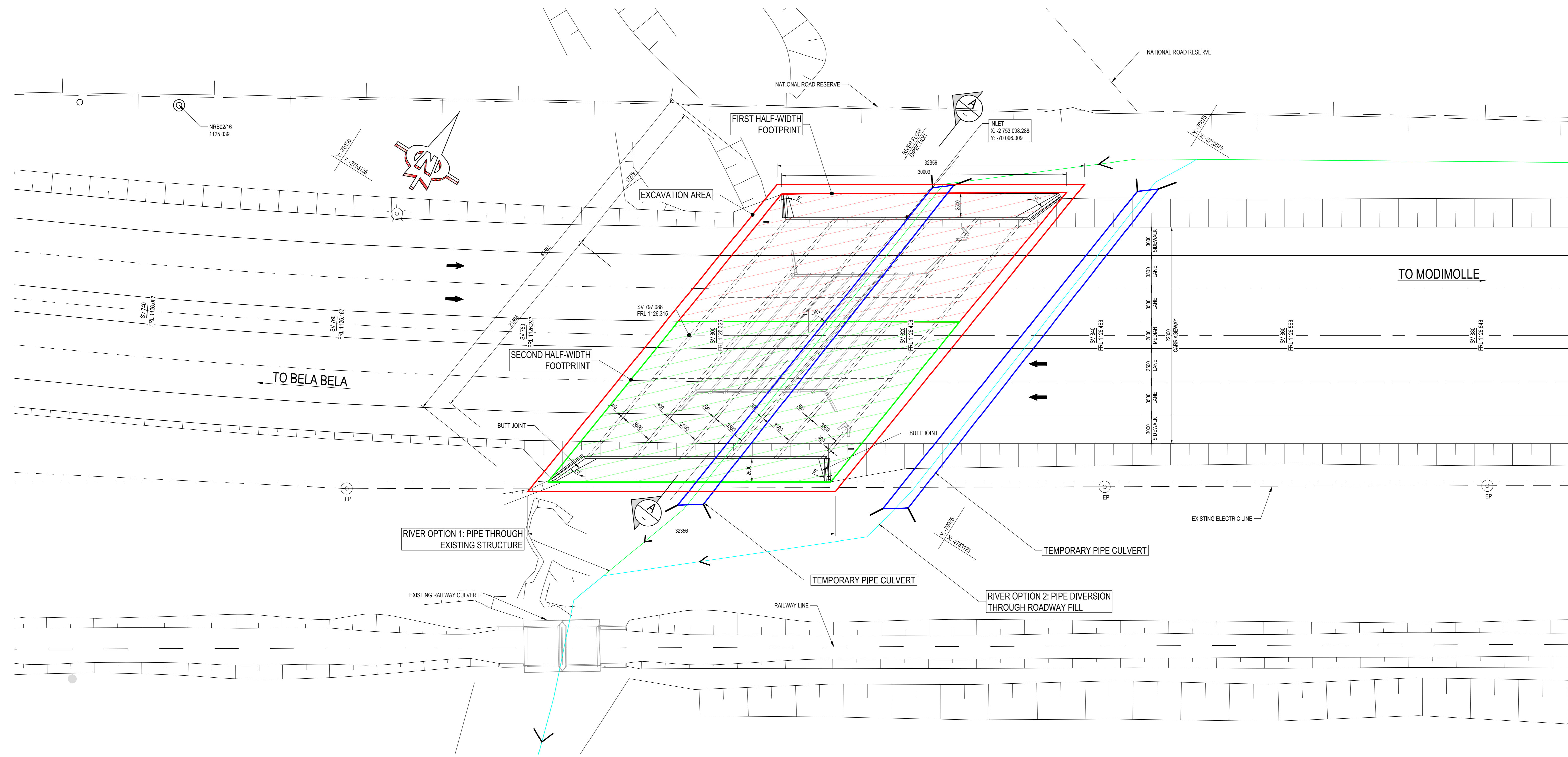
  
 \_\_\_\_\_  
 CA Smit Pr Eng  
**BVi CONSULTING ENGINEERS**

  
 \_\_\_\_\_  
 AH Greyling Pr Eng  
**DIRECTOR**

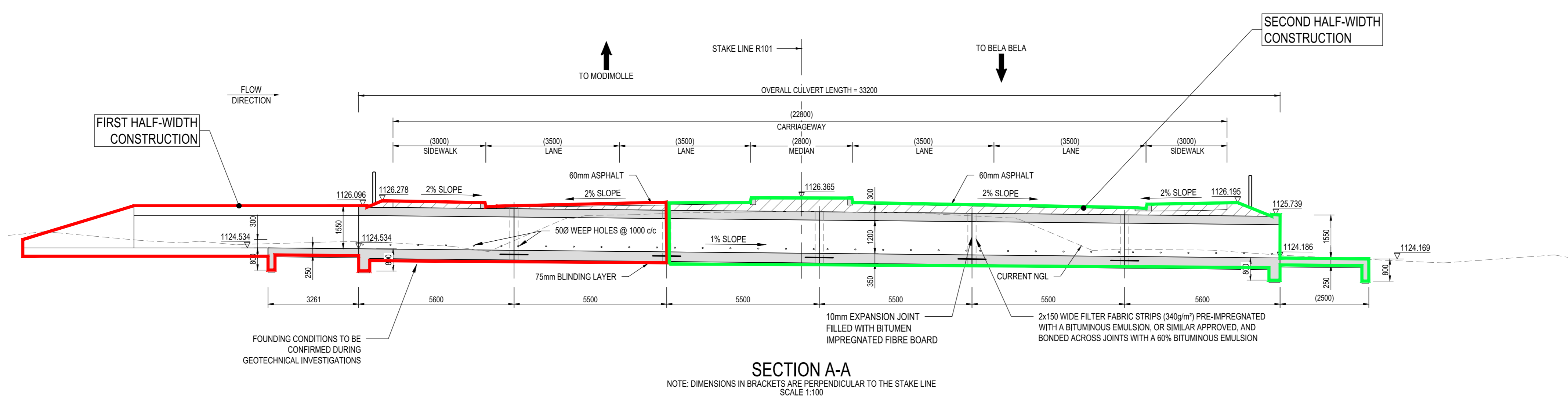
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**ANNEXURE A:**

**Major Culvert IDC3321 Half-width Construction Sequence Drawing**



PLAN  
SCALE 1:200



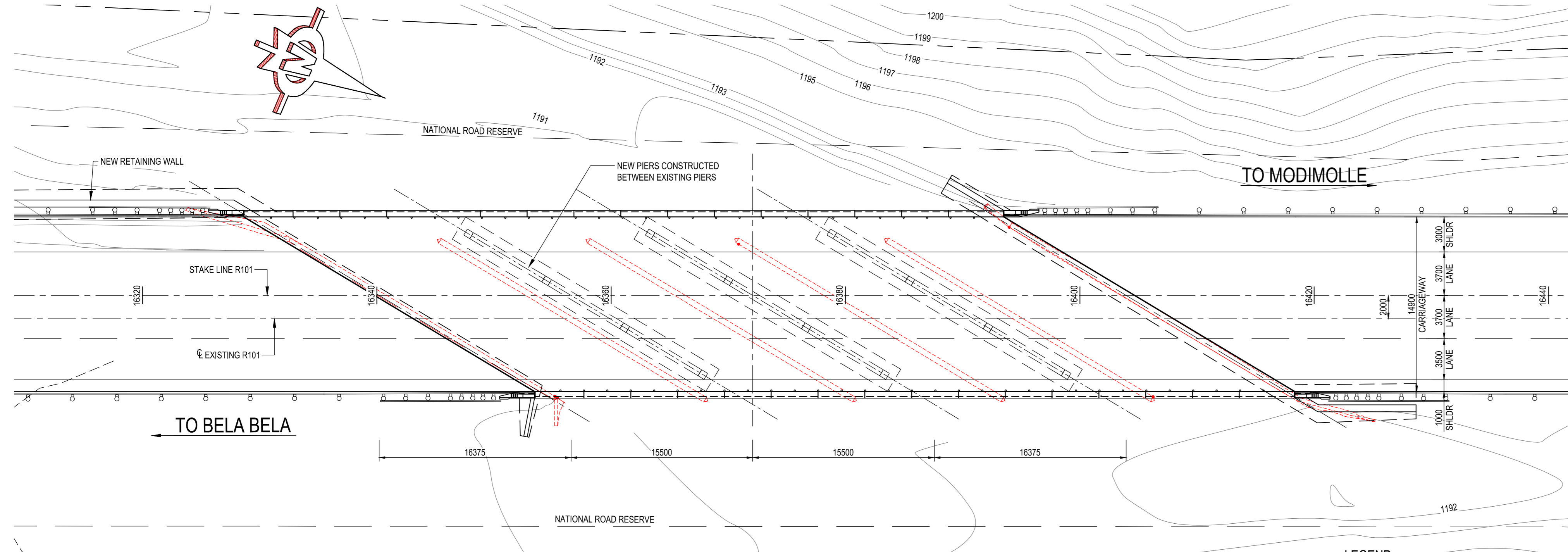
SECTION A-A  
NOTE: DIMENSIONS IN BRACKETS ARE PERPENDICULAR TO THE STAKE LINE  
SCALE 1:100

<b>CONSTRUCTION RECORD (AS-BUILT)</b> WORKS CONTRACT ENGINEER Name: _____ Prof. Reg. No.: _____ Date: _____			<b>DESIGNED BY</b> NAME: A. SMT Prof. Reg. No.: 20170222 CHECKED BY: C. LOURENS Prof. Reg. No.: 750425 DRAWN BY: M. LUKS		<b>CONSULTANT APPROVAL</b> Name: A. GREYLING Prof. Reg. No.: 20080025 Date: _____		<b>HEAD OFFICE</b> 43 Tambolis Avenue Val de Grace Pretoria 0184 PO Box 415 Pretoria 0001 South Africa Tel: (012) 844 8000		<b>NORTHERN REGION</b> 38 1st Street Menlo Park Pretoria 0081 Private Bag X17 Lynnwood Ridge 0040 Tel: (012) 426 6200		ACCEPTANCE THIS ACCEPTANCE IS FOR PROCEDURAL AND ADMINISTRATIVE REVIEW PURPOSES ONLY AND DOES NOT ATTRACT LEGAL LIABILITY OR LIABILITY OF ANY KIND FROM WHATSOEVER CAUSE OR HOWEVER ARISING for the SA NATIONAL ROADS AGENCY SOC LTD. Date: _____		<b>PROJECT DESCRIPTION</b> CONSULTING ENGINEERING SERVICES FOR THE IMPROVEMENT OF NATIONAL ROAD R101 SECTION 8 FROM BELA BELA (Km0.0) TO MODIMOLLE (Km26.8) <b>MAJOR CULVERT IDC3321 HALF-WIDTH CONSTRUCTION SEQUENCE</b>		<b>PROJECT NUMBER</b> R. 101-080-2019/1F	
<b>SANRAL PROJECT MANAGER</b> Name: _____ Date: _____			<b>WESTERN CAPE</b> Cape Town Block 62, Edison Square c/o Edison Way & Century Avenue Century City, 7441 P O Box 86 Century City, 7446 E-mail: cpt@bviwc.co.za Website: www.bviwc.co.za Tel: +27 (21) 527 7000 Fax: +27 (21) 527 7001		<b>SCALE:</b> AS SHOWN		<b>SHEET</b> 1 OF 1		<b>DRAWING LOCATION DATA</b> ROUTE: R101 SECTION: 8 DRAWING km DISTANCE: Km0.80 STRUCTURES - CULVERTS: Km0.82 BRIDGE/STRUCTURE No.: IDC3321 CONSULTANT DRAWING No.: _____ SANRAL DOCUMENT #: _____		<b>VER</b>					

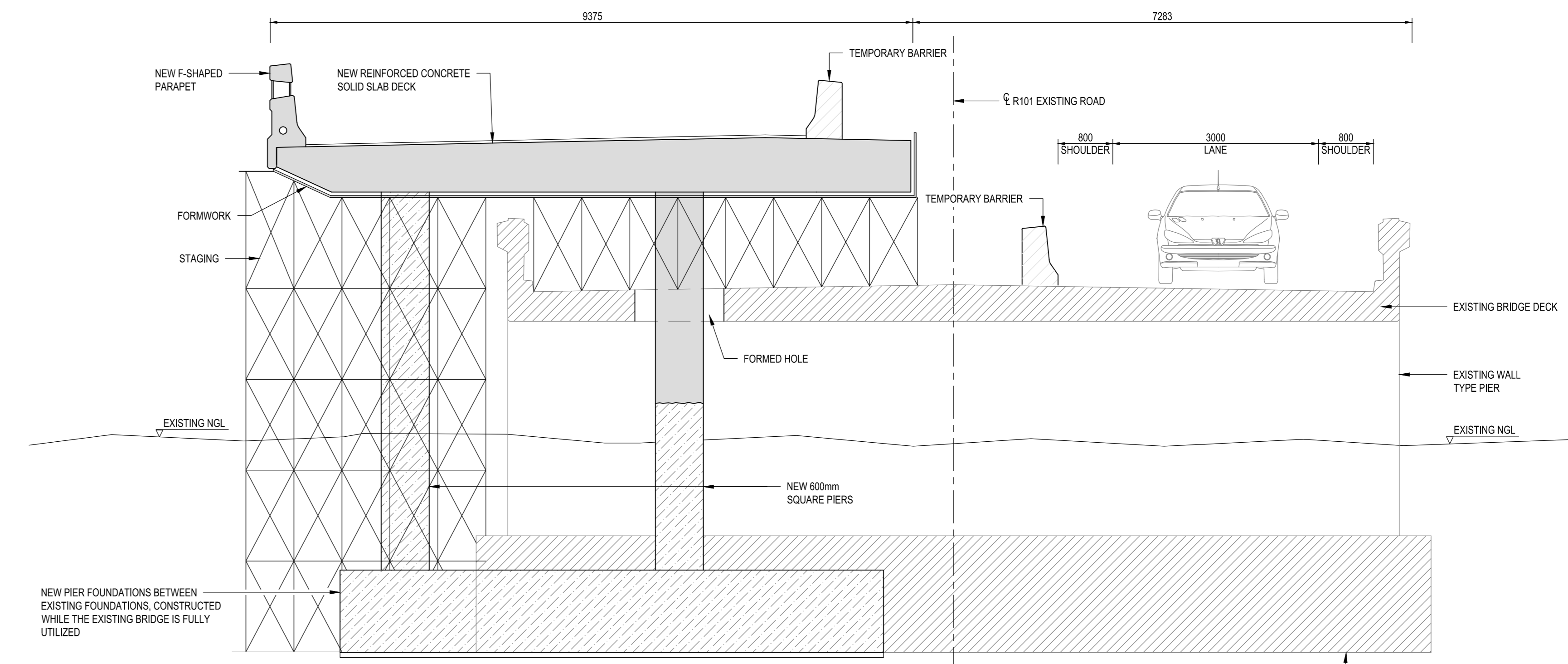
**ANNEXURE B:**

**Bridge B375 Construction Sequence Drawing**



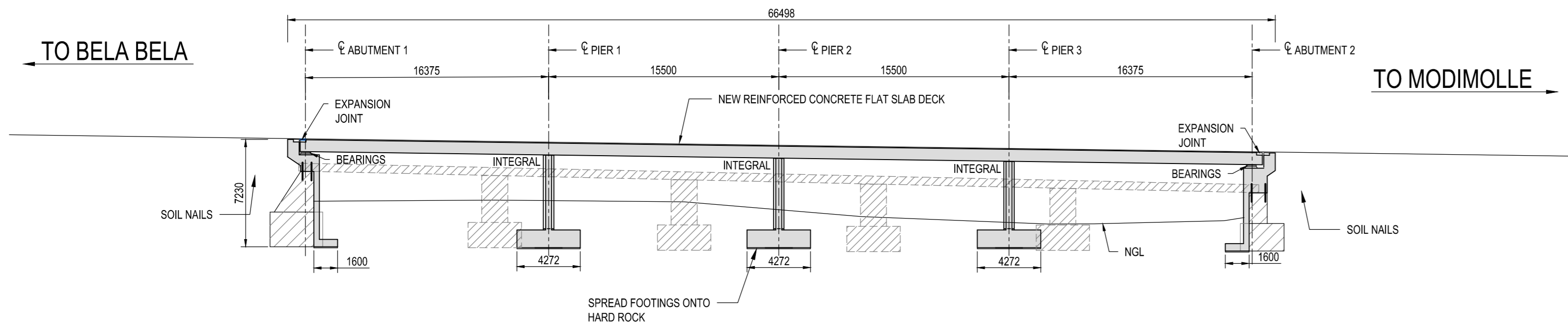


PLAN  
SCALE 1:500



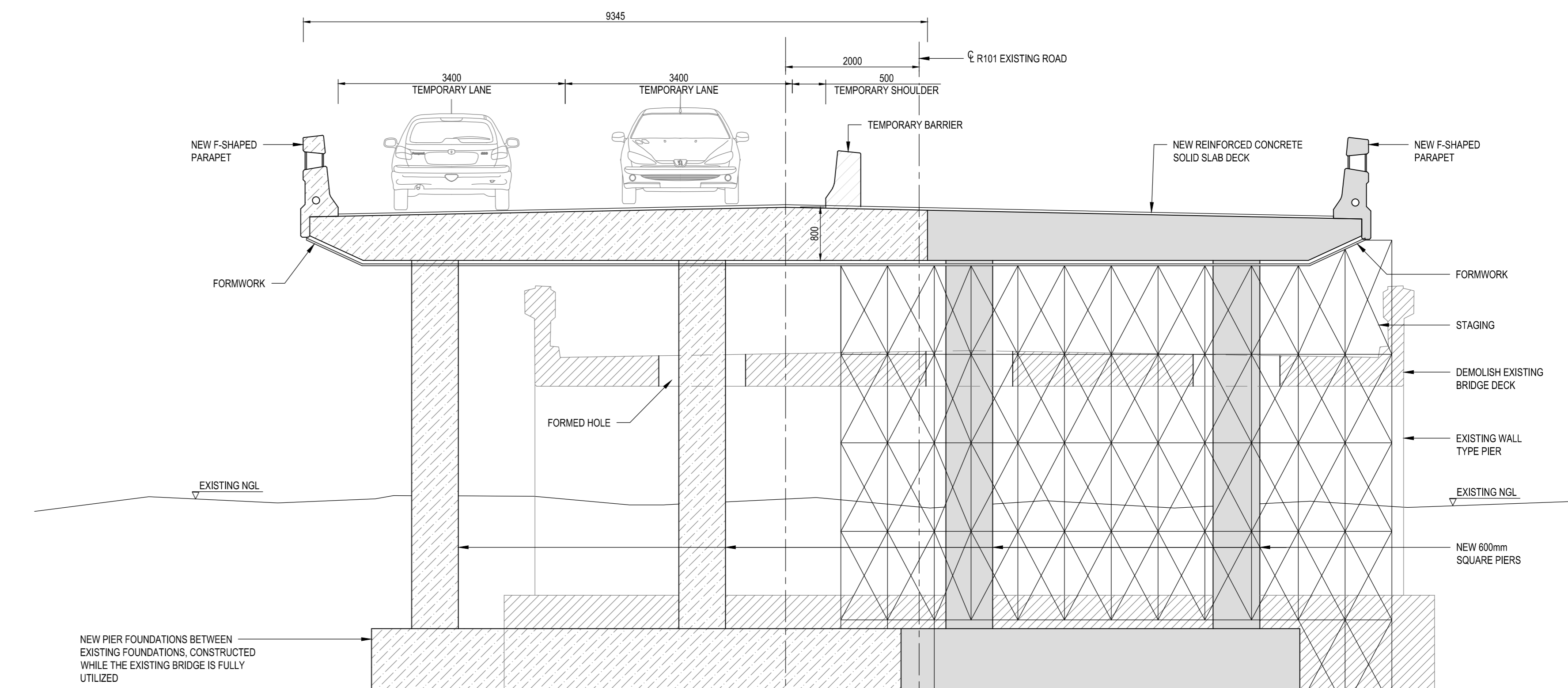
STAGE 2: HALF-WIDTH CONSTRUCTION  
1. CLOSE TRAFFIC ON HALF OF EXISTING DECK  
2. FORM HOLES THROUGH EXISTING DECK  
3. PLACE STAGING FOR NEW DECK  
4. CONSTRUCT HALF OF NEW DECK  
5. CLOSE TEMPORARY TRAFFIC ACCOMMODATION ON EXISTING DECK

LEGEND:  
EXISTING BRIDGE  
NEW CONCRETE  
CONSTRUCTED IN STAGE 1



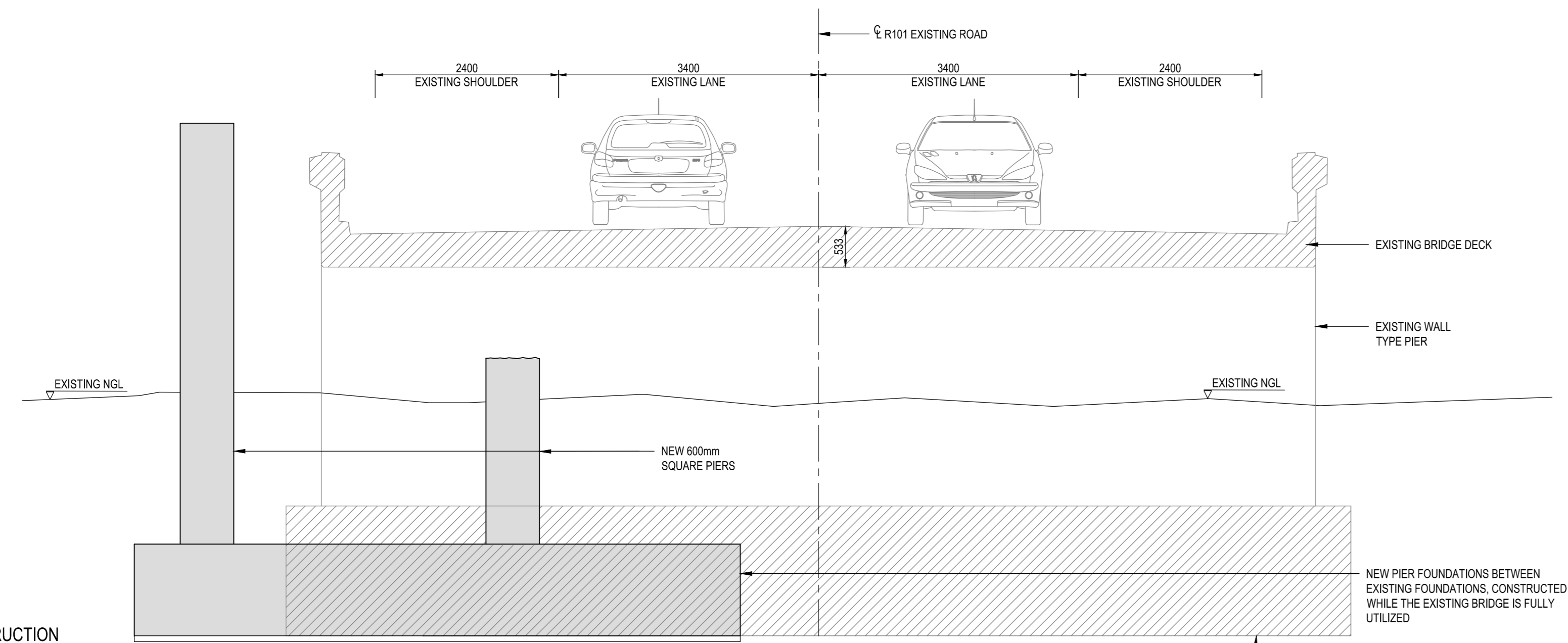
LONGITUDINAL SECTION  
SCALE 1:250

LEGEND:  
EXISTING BRIDGE  
NEW CONCRETE



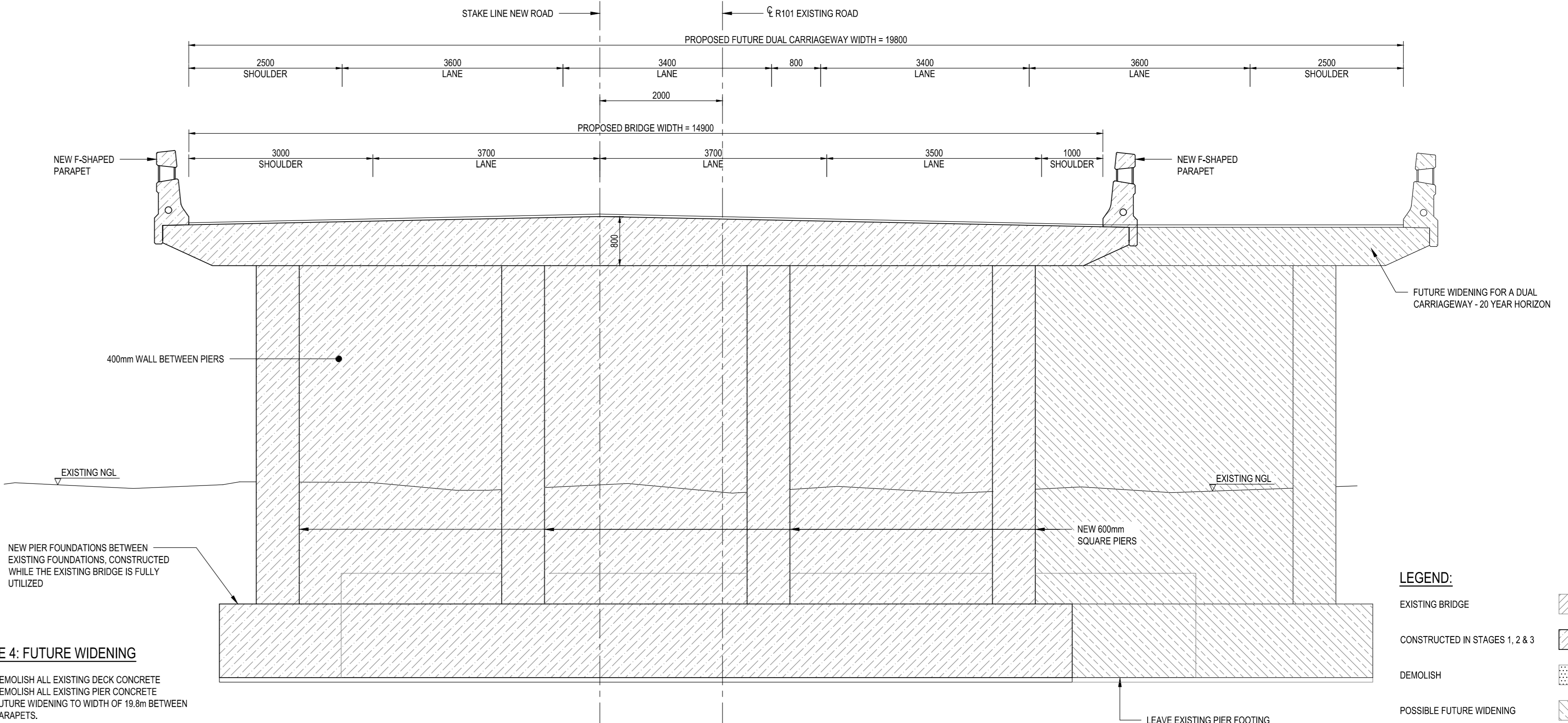
STAGE 3: FULL-WIDTH CONSTRUCTION  
1. OPEN TRAFFIC ON COMPLETED HALF OF NEW DECK  
2. DEMOLISH EXISTING BRIDGE  
3. PLACE STAGING FOR NEW DECK  
4. CONSTRUCT HALF OF NEW DECK  
5. REMOVE TEMPORARY BARRIERS AND OPEN TRAFFIC ON NEW DECK

LEGEND:  
EXISTING BRIDGE  
NEW CONCRETE  
CONSTRUCTED IN STAGES 1 & 2



STAGE 1: FOUNDATION CONSTRUCTION  
1. EXCAVATE FOR NEW PIER FOUNDATIONS  
2. CONSTRUCT NEW PIER FOUNDATIONS  
3. CONSTRUCT FIRST LIFT FOR ALL PIERS

LEGEND:  
EXISTING BRIDGE  
NEW CONCRETE



STAGE 4: FUTURE WIDENING  
1. DEMOLISH ALL EXISTING DECK CONCRETE  
2. DEMOLISH ALL EXISTING PIER CONCRETE  
3. FUTURE WIDENING TO WIDTH OF 19.8m BETWEEN PARAPETS.

LEGEND:  
EXISTING BRIDGE  
NEW CONCRETE  
DEMOLISH  
POSSIBLE FUTURE WIDENING

CONSTRUCTION RECORD (AS-BUILT) WORKS CONTRACT ENGINEER
Name: _____
Prof. Reg. No.: _____
Date: _____
SANRAL PROJECT MANAGER
Name: _____
Date: _____

DESIGNED BY
NAME: M. KHATHRADA
Prof. Reg. No.: 20140483
CHECKED BY
NAME: C. LOURENS
Prof. Reg. No.: 750425
DRAWN BY
NAME: G. vd SCHYFF

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**CONSULTANT APPROVAL**  
Name: A. GREYLING  
Prof. Reg. No.: 20080025  
Date: 27/11/2020

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for the SA NATIONAL ROADS AGENCY SOC LTD.  
Date: \_\_\_\_\_

**PROJECT DESCRIPTION**  
CONSULTING ENGINEERING SERVICES FOR THE IMPROVEMENT OF NATIONAL ROAD R101 SECTION 8 FROM BELA BELA (Km0.0) TO MODIMOLLE (Km26.8)  
BRIDGE B375 CONSTRUCTION SEQUENCE

**PROJECT NUMBER**  
R.101-080-2019/1F

DRAWING LOCATION DATA	START	END
ROUTE	R101	R101
SECTION	8	8
DRAWING km DISTANCE	16.41km	16.41km
DRAWING TYPE	STRUCTURES - BRIDGES	
BRIDGE/STRUCTURE No.	B375	
CONSULTANT DRAWING #	SANRAL DOCUMENT #	
		VER

SCALE: AS SHOWN SHEET 1 OF 1

REGISTRATION NO. 1998/001157/07

REGISTERED ENGINEERING CONSULTANT

**bvi** ENGINEERING PROCUREMENT MANAGEMENT

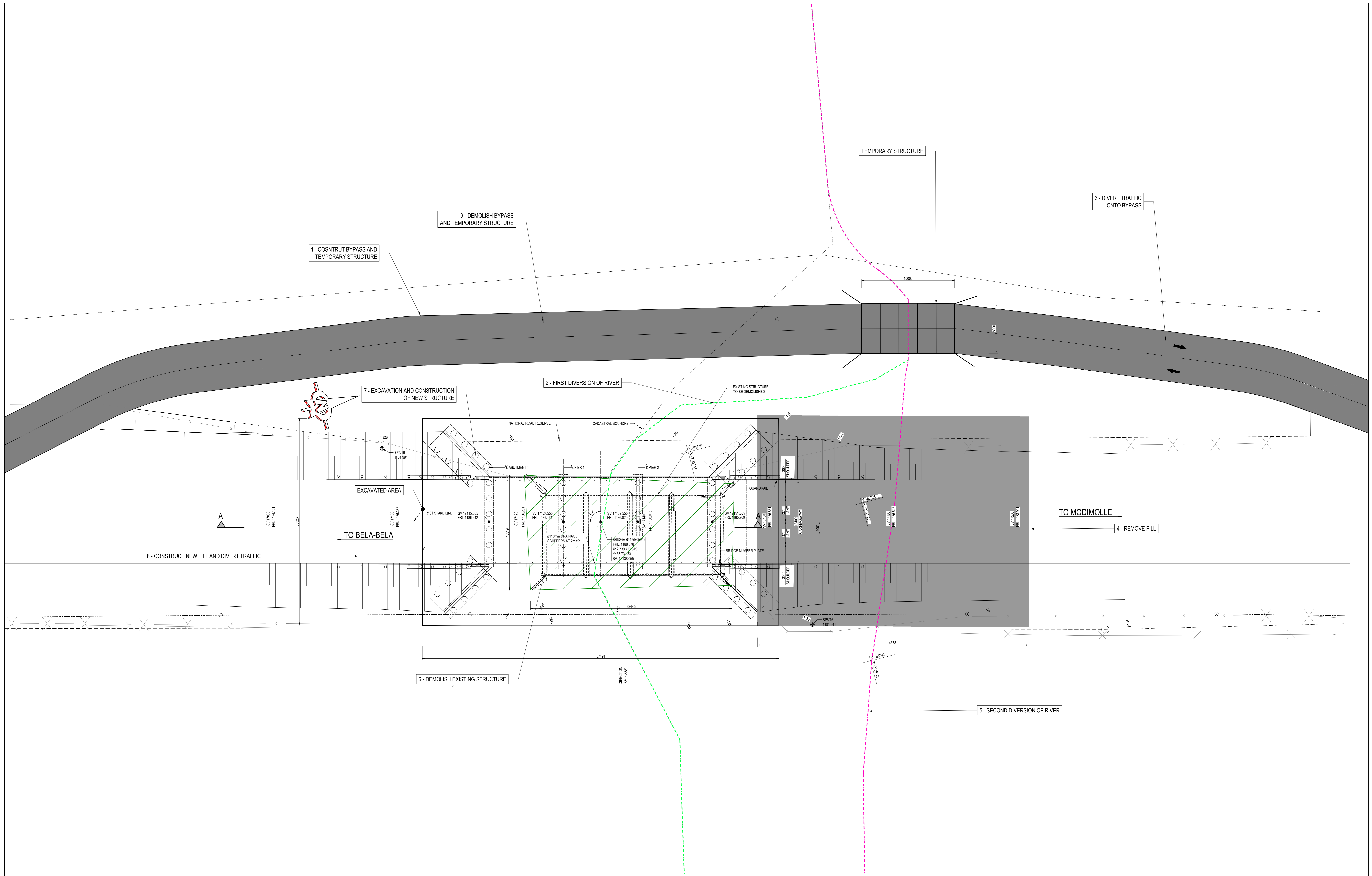
**CESA**

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ANNEXURE C:

Bridge B447 Construction Sequence Drawing



PLAN  
SCALE 1:200

CONSTRUCTION RECORD (AS-BUILT) WORKS CONTRACT ENGINEER
Name : Prof. Reg. No. : Date :
SANRAL PROJECT MANAGER
Name : Date :

DESIGNED BY
NAME : A. SMT Prof. Reg. No. : 20170222 CHECKED BY
NAME : C. LOURENS Prof. Reg. No. : 750428 DRAWN BY
NAME : M. LINDS

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CONSULTANT APPROVAL
Name : A. GREYLING Prof. Reg. No. : 20080025 Date : 27/11/2020

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 Date:

<b>PROJECT DESCRIPTION</b> THE IMPROVEMENT OF NATIONAL ROAD R101 SECTION 8 FROM BELA BELA(Km0.0) TO MODIMOLLE(Km26.8) <b>BRIDGE B447 CONSTRUCTION SEQUENCE</b>	
SCALE :	AS SHOWN
SHEET	1 OF 1

PROJECT NUMBER	R.101-080-2019/1	
DRAWING LOCATION DATA	START	END
ROUTE	R101	R101
SECTION	8	8
DRAWING km DISTANCE	KM 17.11	KM17.15
DRAWING TYPE	STRUCTURES - BRIDGES	
BRIDGE/STRUCTURE No.	B447	
CONSULTANT DRAWING No.		
SANRAL DOCUMENT #		
	VER	

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