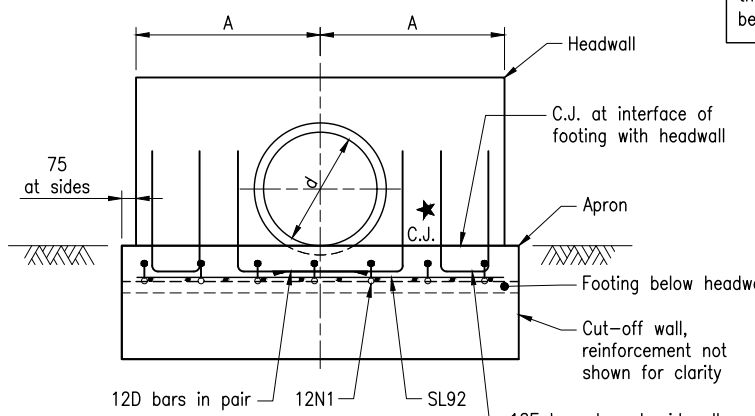
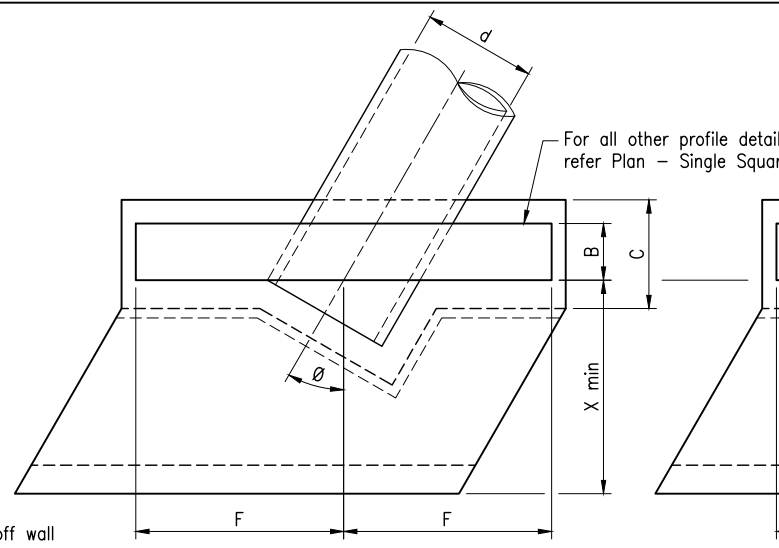


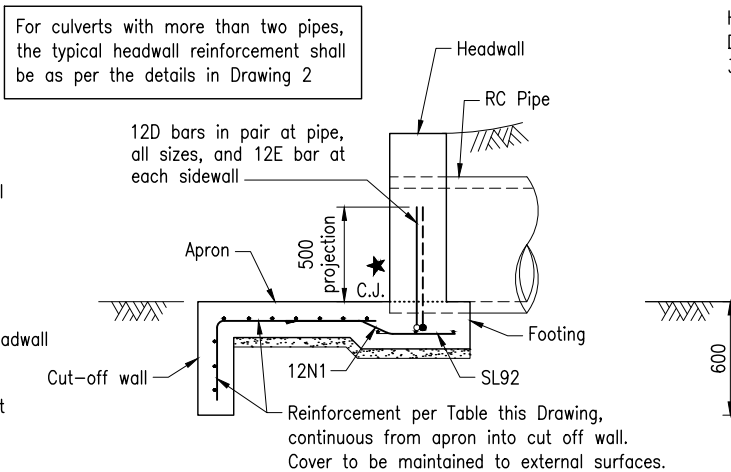
TYPICAL PLAN - SQUARE SINGLE CULVERT



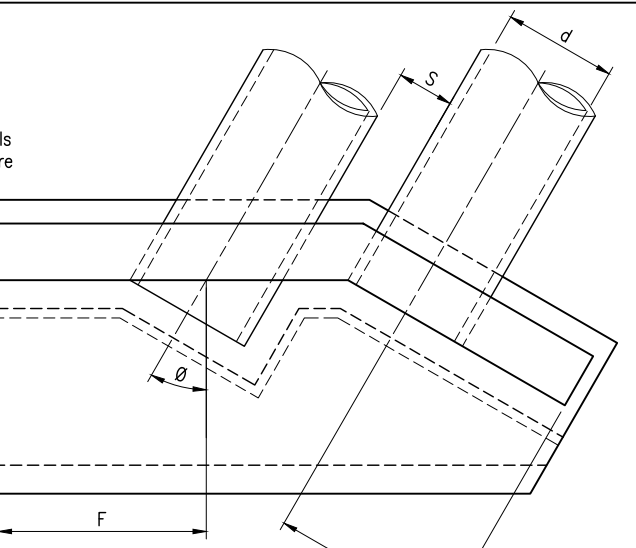
TYPICAL ELEVATION - SQUARE SINGLE CULVERT SHOWN SKEWED AND OR MAXIMUM TWO PIPE ARRANGEMENTS SIMILAR



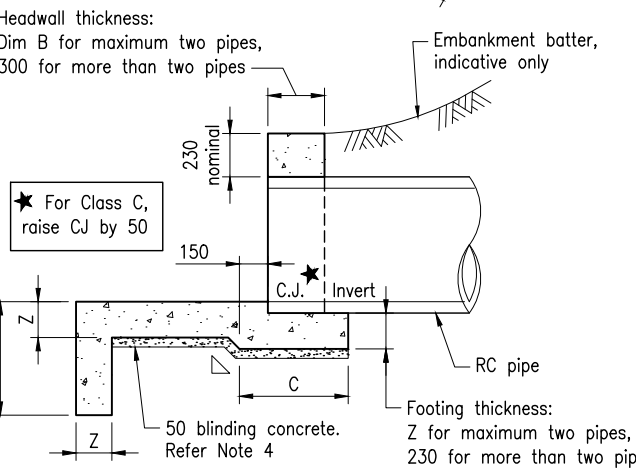
PLAN - SKEWED SINGLE CULVERT



SECTION B REINFORCEMENT DETAILS FOR MAXIMUM TWO PIPES

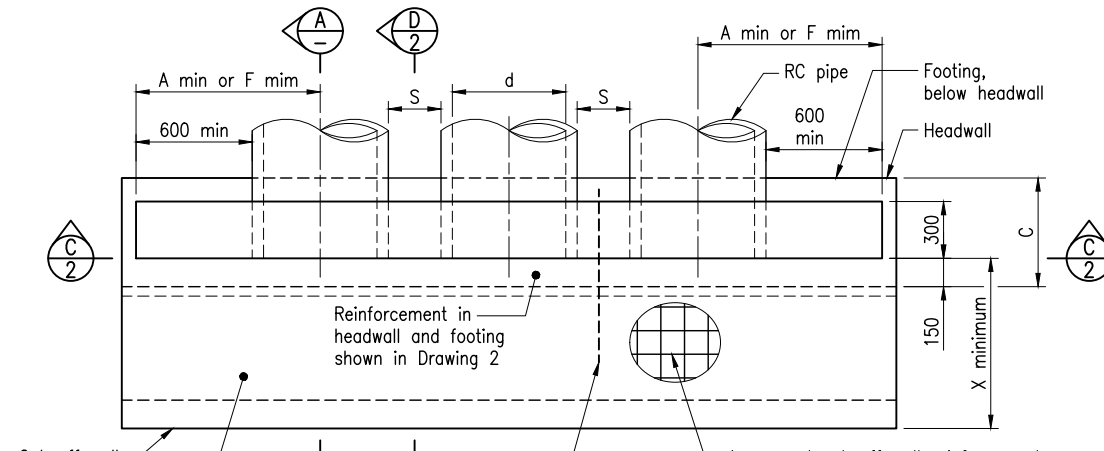


PLAN - MAXIMUM TWO PIPES SKEWED CULVERT

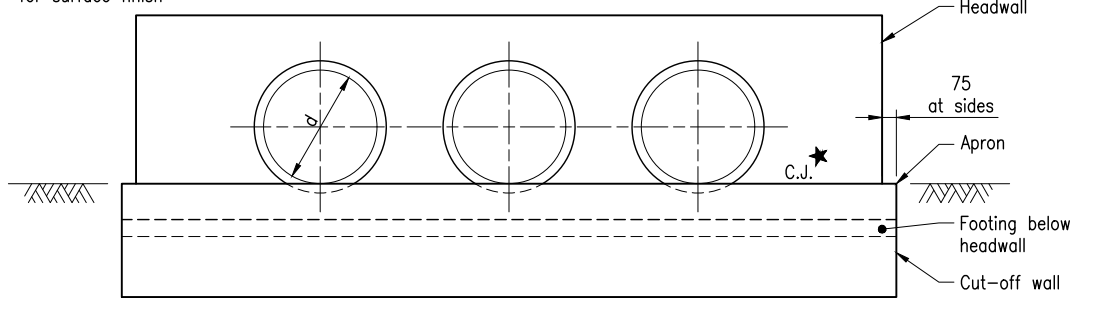


SECTION A TYPICAL DETAILS ALL ARRANGEMENTS

FOR MAXIMUM TWO PIPES



TYPICAL PLAN - MORE THAN TWO PIPES



TYPICAL ELEVATION - SQUARE CULVERT FOR MORE THAN TWO PIPES SKEWED ARRANGEMENTS SIMILAR

MORE THAN TWO PIPES

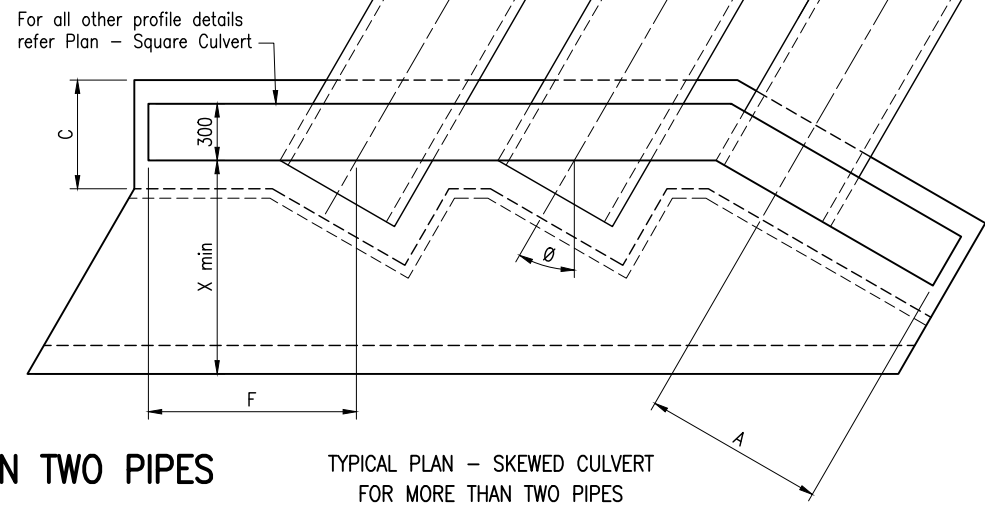
APRON AND CUT OFF WALL DETAILS

Exposure classification	Apron and Cut off wall #	
	Thickness Z	Reinforcement
B2	150	N12 at 150 both ways
C1	175	N12 at 150 both ways
C2	190	N12 at 125 both ways

# Apron minimum reinforcement for shrinkage and temperature effects is designed considering the full restraint condition to AS 5100. For the slab on ground condition, only the top half of the apron thickness is considered for calculation of this reinforcement.

TABLE OF DIMENSIONS

Dim	Nominal internal diameter, d				
	375	450	525	600	675
A	600	725	850	975	1100
B	250	250	300	300	300
C	525	525	575	575	575
F	700	825	950	1100	1250
X	565	675	790	900	1015
S	Spacing for multiple pipes "S" is as specified on Standard Drawing 1359				



TYPICAL PLAN - SKEWED CULVERT FOR MORE THAN TWO PIPES

The purpose of this Standard Drawing is to provide typical standard details that shall be used within the limitations specified in the drawing and in accordance with the following:

- The adaptability of the standard details shall be assessed by the project designer in respect of specific project geometric, appropriate foundation and scour conditions.
- If the insitu bearing capacity is inadequate, insitu ground improvement may be explored subject to review and acceptance by E&T Structures and Geotechnical sections.
- When there is uncertainty regarding the application of the standard details on this drawing for a specific project, advice shall be sought from E&T Structures.
- The details specific to the project shall be shown on the project specific drawings.

NOTES:

- PIPE CULVERT END STRUCTURES shall be constructed in accordance with MRTS03. The purpose of this drawing is to provide typical details of headwalls and aprons for culverts with pipe diameter 375 to 675. This drawing contains headwall details for maximum 2 pipe and more than 2 pipe situations. Refer Standard Drawing 1304 for typical details of end structures for pipe culverts with diameter 750 to 2400. Refer Standard Drawing 1359 and MRTS03 for details of culvert installation and earthworks. This standard drawing does not provide details of fish passage requirements. Where project specific environmental assessment determines that waterway barrier works are required, additional details shall be developed and included in the project drawings.
- Maximum design pressure ( $E_d$ ) under the culvert apron is 75 kPa.
- Where CULVERT APRONS are longer than 20m, the project specific design shall be developed with transverse contraction joints, with direction of flow, at every 20m length, located between pipes. The typical detail is provided in this standard drawing.
- CONCRETE shall be in accordance with MRTS70. Unreinforced concrete headwall shall be N20/20. Reinforced concrete headwall, apron and footing shall be in accordance to AS 5100, and as shown in table below for exposure classification and cover to reinforcement.

Exposure classification	minimum B2	C1	C2
Minimum concrete strength	S40/20	S50/20	S55/20
Minimum cover UNO	60	70	80

- If it is preferred to construct the footing and cut off wall against the ground, the cover to ground shall be increased by 30mm, and the thickness to be increased accordingly. Blinding concrete N20/20.
- Surface roughening of the aprons shall be broom finish using a broom not less than 400 wide to achieve an average texture depth of 0.8. The direction of brushing shall be perpendicular to the direction of flow.
- REINFORCING STEEL shall be read in conjunction with Standard Drawings 1043 and 1044, and shall be in accordance with MRTS71 and AS/NZS 4671. Deformed bars Grade D500N. Mesh Grade D500L.
- TACK WELDING to reinforcement for location purposes to AS/NZS 1554.3. Welding consumables shall be controlled hydrogen type: G49X to AS/NZS ISO 14341-B or T49X to AS/NZS ISO 17632-B.
- PROJECT-SPECIFIC INFORMATION TO BE SHOWN ON THE DRAWINGS: Exposure classification; Culvert chainage; Skew angle  $\theta$ ; Apron setout and extents; Headwall extents; Steel schedule; Requirements for fish passage.
- DIMENSIONS are in millimetres.

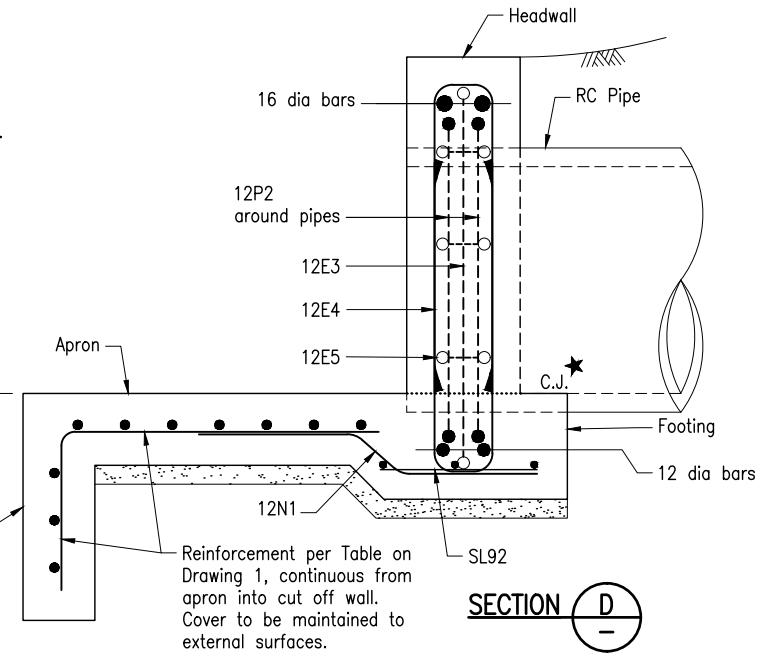
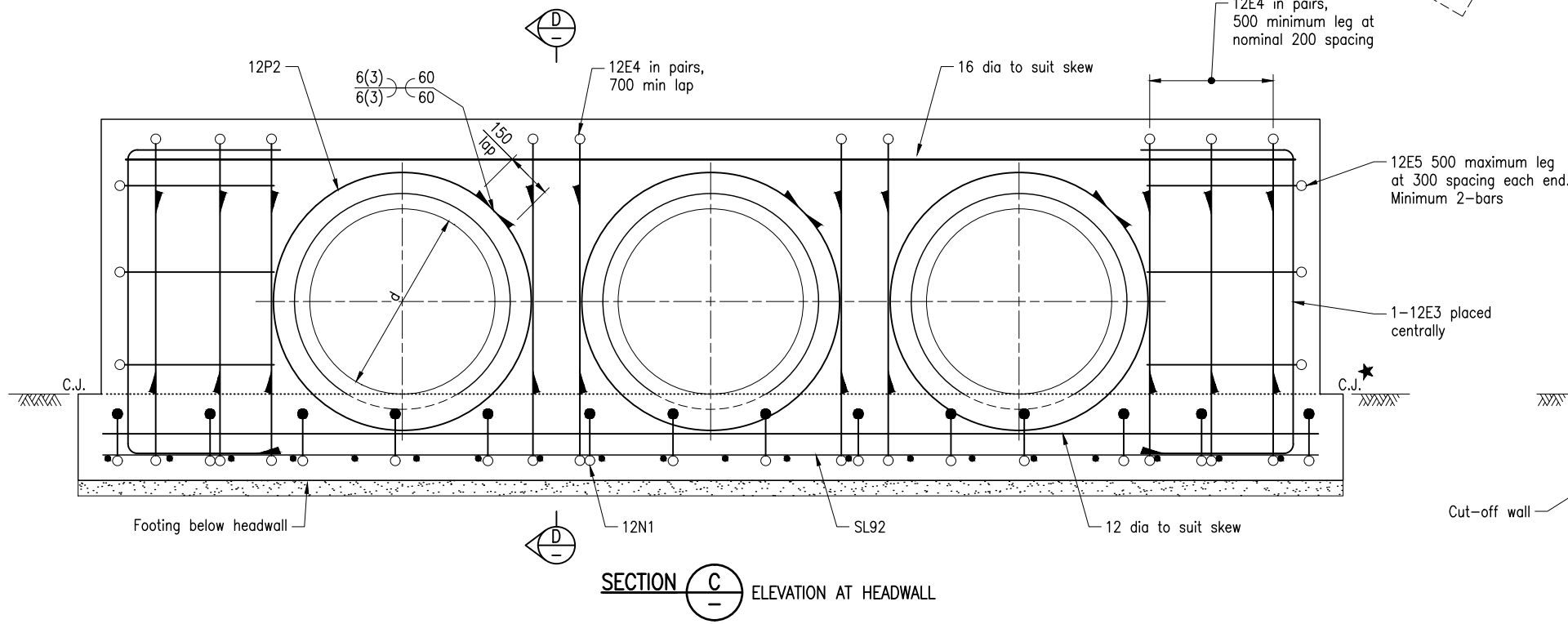
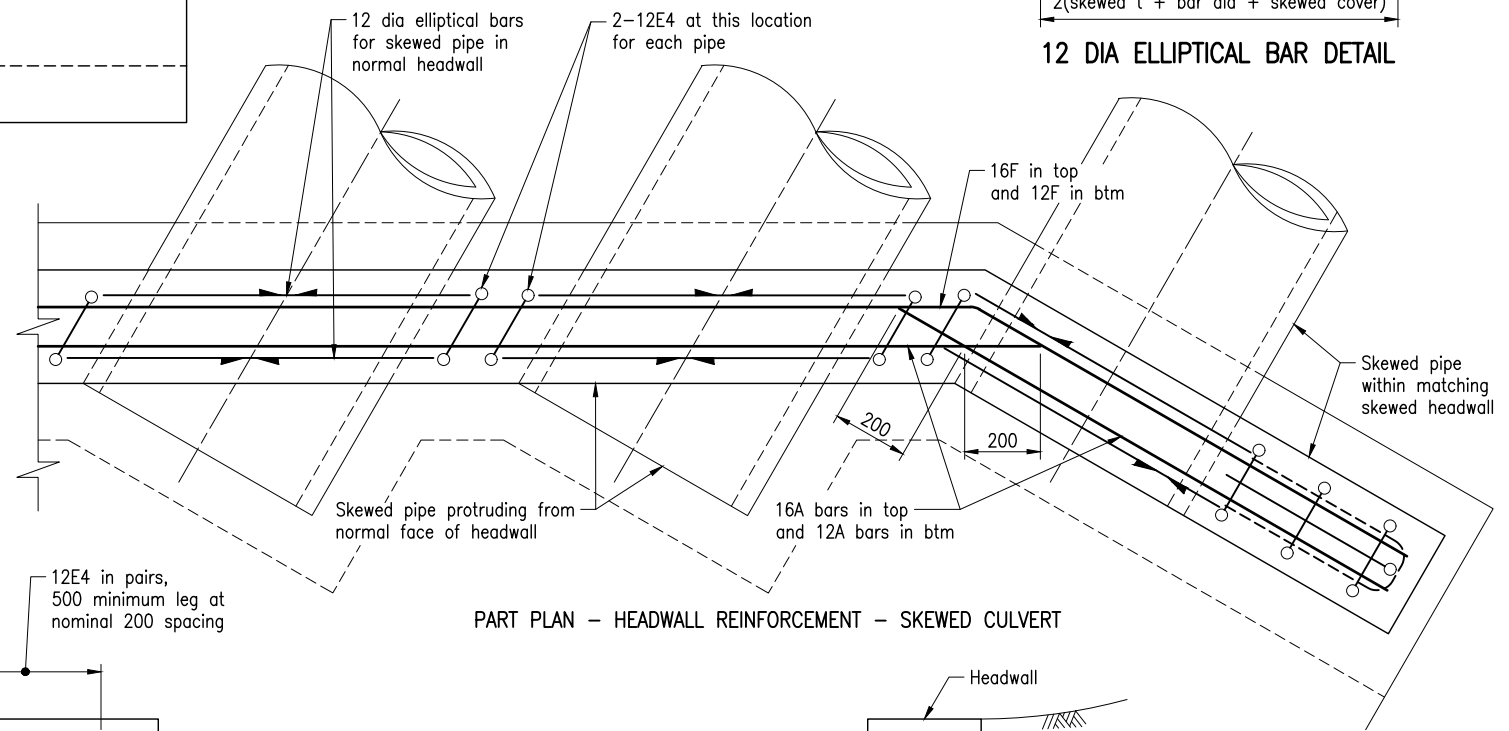
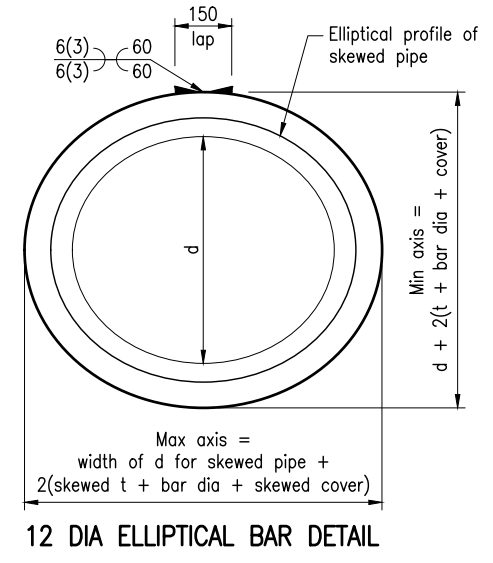
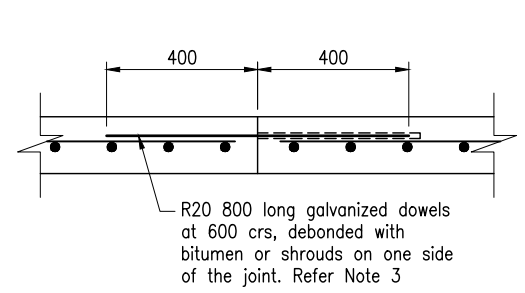
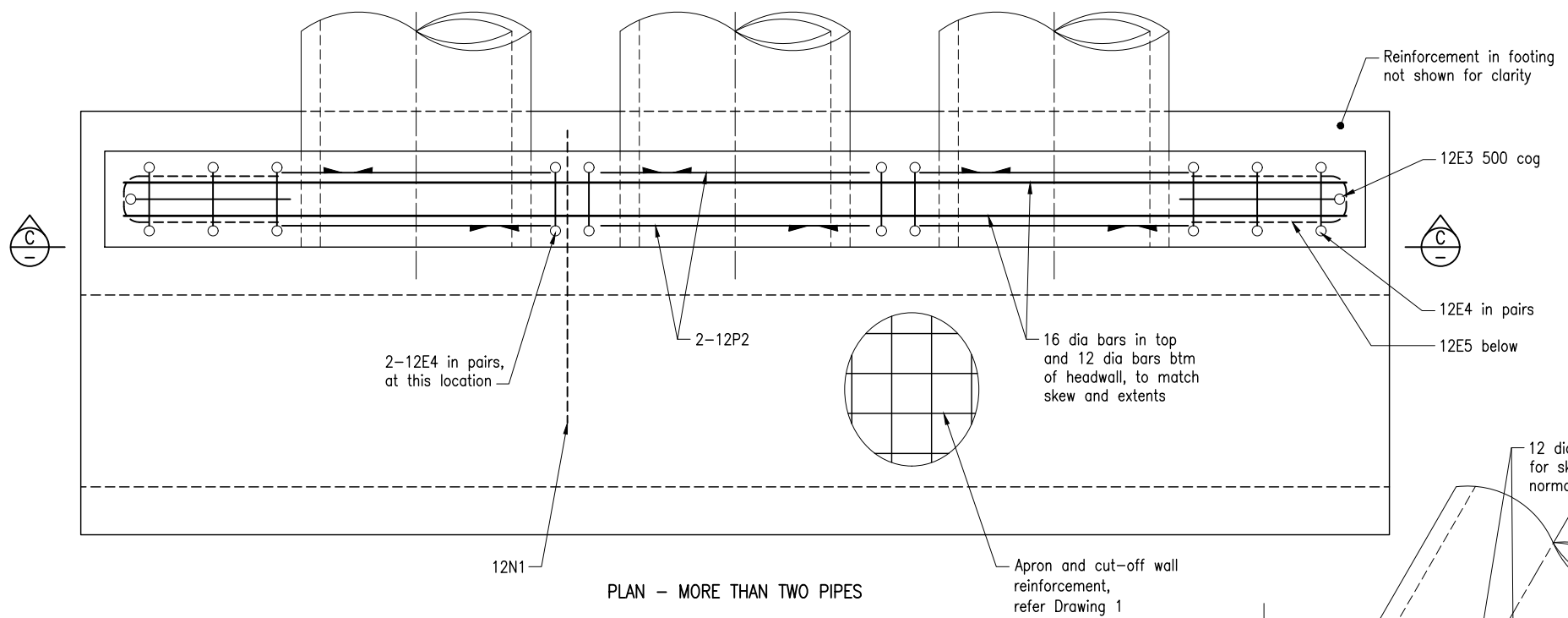
ASSOCIATED DEPARTMENTAL DOCUMENTS:

- Design Criteria for Bridges and Other Structures
- Road Drainage Manual (RDM); NDRRA Design Guidelines

REFERENCED DOCUMENTS:

- Departmental Standard Drawings:
  - 1044 Reinforcing Steel - Lap Lengths
  - 1304 Pipe Culverts - Wingwalls, Headwall and Apron for Pipe Diameter 750 to 2400
  - 1359 Culverts - Installation, Bedding and Filling/backfilling against/over Culverts
- Departmental Specifications:
  - MRTS03 Drainage, Retaining Structures and Protective Treatments
  - MRTS70 Concrete
  - MRTS71 Reinforcing Steel

Department of Transport and Main Roads			
PIPE CULVERTS			
HEADWALL AND APRON FOR PIPE DIAMETER 375 to 675 DRAWING 1 OF 2		A3	Standard Drawing No 1305
		Not to Scale	Date 3/2024



HEADWALL AND FOOTING REINFORCEMENT FOR MORE THAN TWO PIPES

Department of Transport and Main Roads			
PIPE CULVERTS			
HEADWALL AND APRON FOR PIPE DIAMETER 375 to 675		A3	Standard Drawing No
DRAWING 2 OF 2		Not to Scale	1305
			Date 3/2024