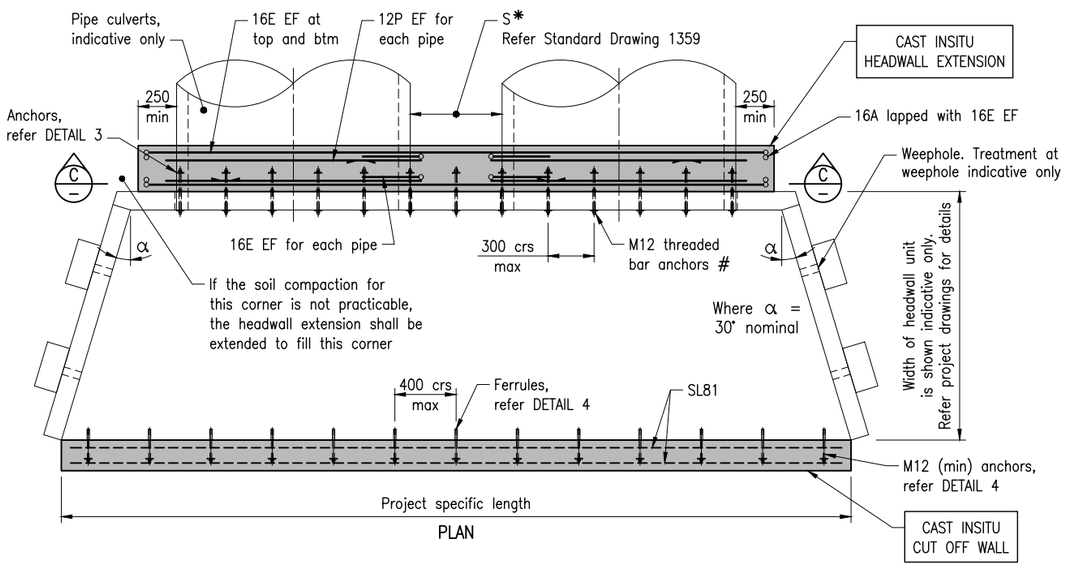

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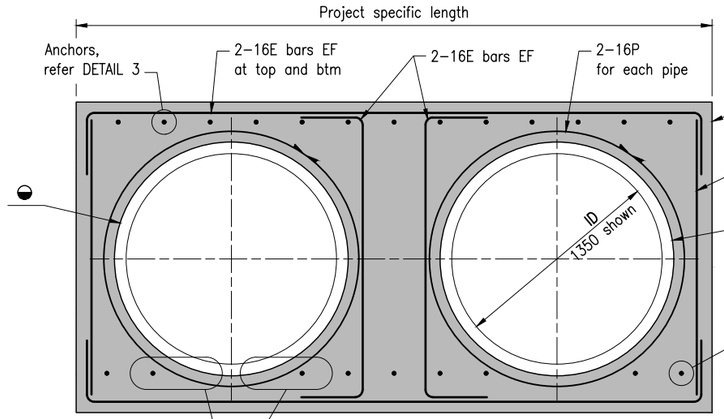
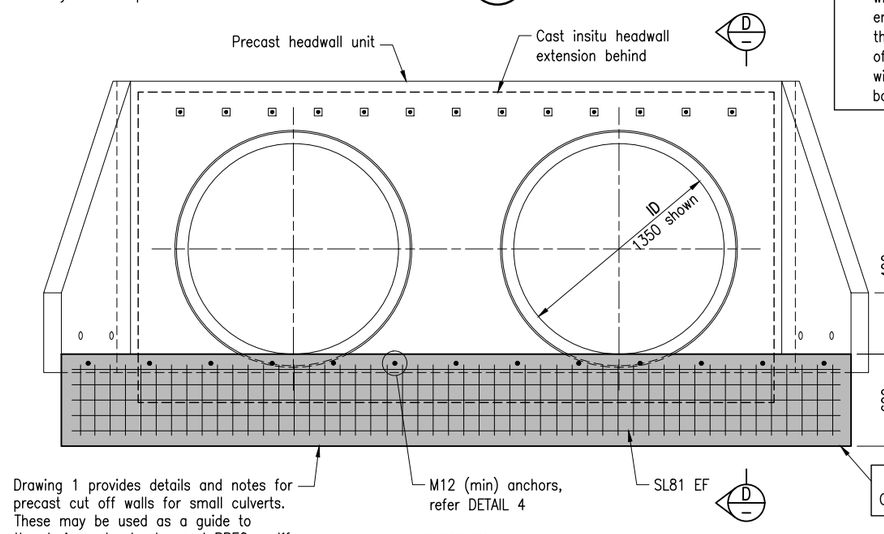


SECTION C



Drawing 1 provides details and notes for precast cut off walls for small culverts. These may be used as a guide to the designer to develop and RPEQ certify a precast cut off wall for a large size culvert, specific to the project

ELEVATION

GENERAL ARRANGEMENT

Detail is similar in upstream and downstream sides

SCOPE OF PRECAST HEADWALL STANDARD DRAWING 1243

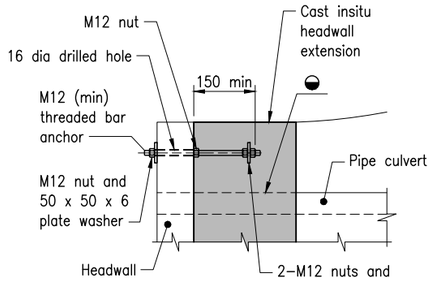
The scope of this standard drawing is to provide standard details for culvert headwall connections for pipe culverts.
It is the responsibility of the precast headwall supplier and the project design engineer to provide project specific drawings, based on these standard details, to suit the project situation and to RPEQ certify the project specific drawings.
This standard drawing is applicable for single cell and multi–cell headwalls

HEADWALL ANCHORS

Internal pipe diameter ID	Minimum No OFF # anchors
375	4
450	4
525	4
600	4
675	4
750	8
825	8
900	8
1050	8
1200	8
1350	8
1500	8
1650	12
1800	12
1950	12
2100	12
2250	12
2400	12
2550	12

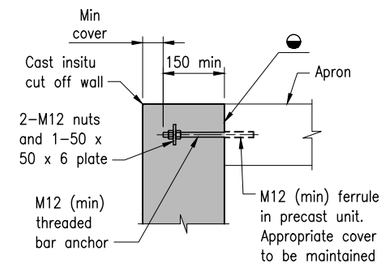
This minimum No OFF anchors shall be provided at the top and bottom of the headwall, for each pipe.
Before drilling precast units, the position of the reinforcements shall be identified and any drilling shall avoid cutting the reinforcement.

Additional erosion protection may be required to protect the toe of the embankment where the precast wingwall end dimension is higher than the preferred dimension of 400, or the top of the wingwall is lower than the batter



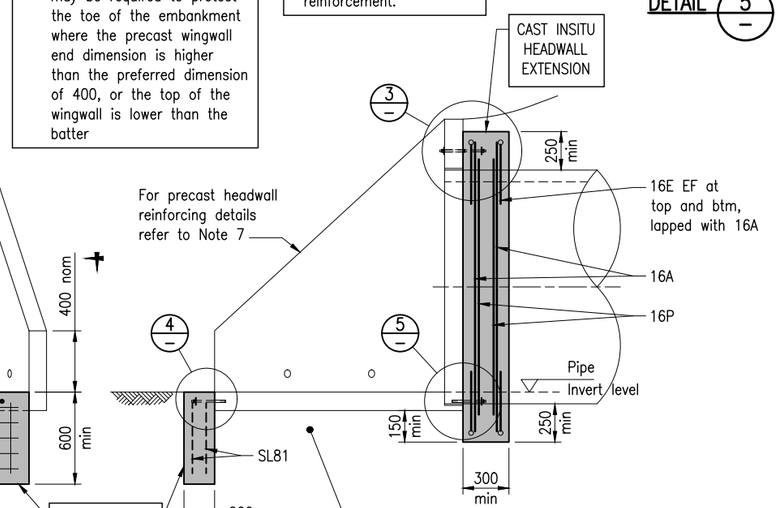
DETAIL 3 ANCHOR BOLT ASSEMBLY

Reinforcement omitted from these details for clarity



DETAIL 4 ANCHOR BOLT ASSEMBLY

DETAIL 5 SIMILAR



Prior to placing the precast headwall, surface shall be levelled and base prepared in accordance with MRTS04. Apron shall be installed on a slope to match the slope of the culvert

SECTION D

NOTES for PIPE CULVERTS:

1. PIPE CULVERTS shall be in accordance with MRTS03.
   Precast headwall unit and cast insitu headwall extension shall be designed in accordance with Technical Note 27 (TN27).
   The standard details shown in this drawing are for exposure class B2 to AS 5100.
   Refer Note 8 for additional requirements for projects in exposure class C1 and C2.
2. FOR SMALLER CULVERTS diameter up to 450, including sloping headwalls, the use of the cast insitu headwall extension details shown in this drawing can be omitted dependent upon site conditions and risk of separation of headwall, as assessed by the Project Engineer. Factors such as low flow in small culverts, ease of maintenance in the event of headwall separation, can be considered in the assessment.
   Refer Drawing 3 for alternative bolted connection details for culverts diameter ≤ 1200.
3. PRECAST HEADWALLS shall be manufactured in accordance with MRTS72.
4. CONCRETE shall be in accordance with MRTS70.
   Requirements for cast insitu concrete for headwall extensions and cut off walls are shown in the table below.

Item	Design requirements
Design life	100 years
Minimum exposure classification	B2 to AS 5100
Minimum concrete class	S40/20
Cover to reinforcement	60 cover to AS 5100

5. STEELWORK shall be fabricated to MRTS78, for exposure class B2.
   Ferrules shall be TMR approved.
   Threaded bar, bolts and screws to Class 4.6 to AS 1111.1.
   Nuts class 5 to AS 1112.1. Washers class 5 to AS 1237.1.
   Steel plate Grade 250 minimum to AS/NZS 3678.
   All ferrules, anchors, bolts and nuts shall be hot dip galvanised to AS 1214.
   All other steelwork hot dip galvanised to AS/NZS 4680 unless shown otherwise.
6. REINFORCING STEEL shall be in accordance with Standard Drawings 1043 and 1044, and compliant with MRTS71 and AS/NZS 4671.
   All reinforcing steel shall be ACRS certified.
   Reinforcing Steel welding shall be in accordance with Standard Drawing 1044.
   Deformed bars Grade D500N. Reinforcing mesh Grade D500L.
7. PRECAST HEADWALL UNIT shall be designed and RPEQ certified by the precaster's designer according to the project specific requirements. Minimum details to be shown in the precast supplier provided project specific drawings are:
   – All dimensions of precast headwall unit including wingwall and apron lengths and reinforcement details.
   – Design loads and design standards including Technical Note 27.
   – Details of formed holes/ferrules for the threaded bar anchors for connection between precast headwall unit and cast insitu headwall extension/cut off wall.
   – Design minimum exposure classification.
   – Concrete notes including concrete class, aggregate size, cover to reinforcement.
8. Additional requirements for exposure class C1 and C2:
   Minimum concrete strength and cover to reinforcement shall be to AS 5100. Anchor bolt assemblies shall be of stainless steel bolts, threaded bar, plate, and washers to Grade 316, and nuts to Grade 304, in accordance with MRTS78A, and its referred standards.
9. PROJECT–SPECIFIC INFORMATION TO BE SHOWN ON THE PROJECT DRAWINGS:
   – Cast insitu headwall extension dimensions.
   – Cast insitu cut off wall dimensions.
   – Details of threaded bar anchors for cast insitu headwall extension and for cut off wall.
10. DIMENSIONS are in millimetres unless shown otherwise.

ASSOCIATED DEPARTMENTAL DOCUMENTS:
NDRRA Design Guidelines; Road Drainage Manual

REFERENCED DEPARTMENTAL DOCUMENTS:
Standard Drawing 1043 Reinforcing Steel – Standard Bar Shapes
Standard Drawing 1044 Reinforcing Steel – Lap Lengths
MRTS03 Drainage, Retaining Structures and Protective Treatments
MRTS70 Concrete
MRTS71 Reinforcing Steel
MRTS72 Manufacture of Concrete Elements
MRTS78 Fabrication of Structural Steelwork
MRTS78A Fabrication of Structural Stainless Steelwork
TN27 Guidelines for Design of Precast Culvert and Pipe Headwalls

Department of Transport and Main Roads

PRECAST CULVERT HEADWALLS

HEADWALL CONNECTIONS DRAWING 1 OF 3

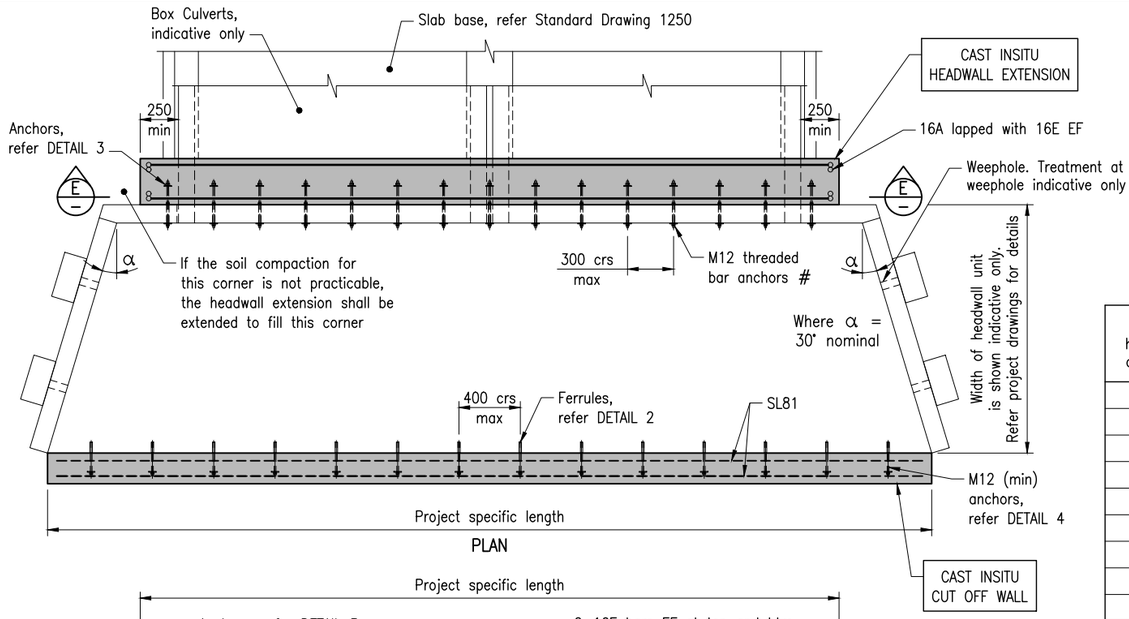
FOR PIPE CULVERTS – ALL SIZES

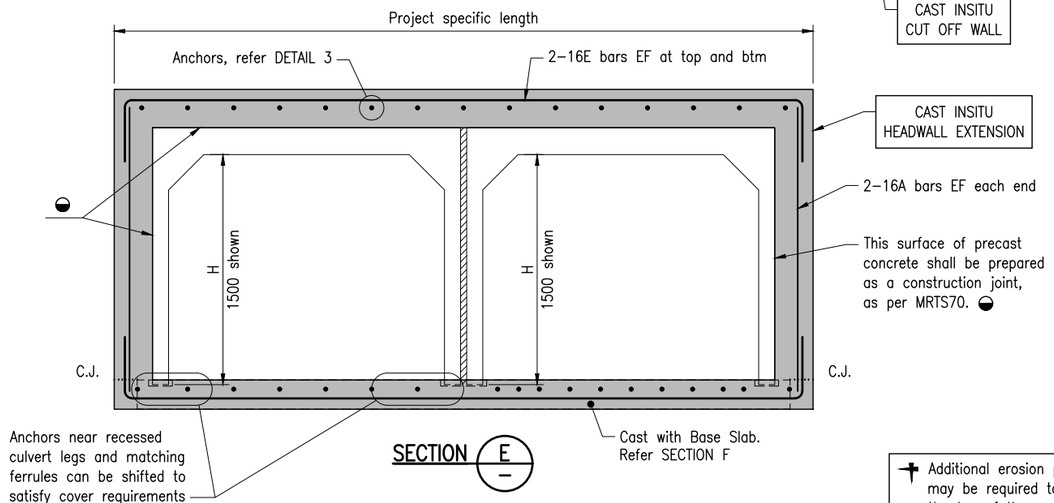
Queensland Government

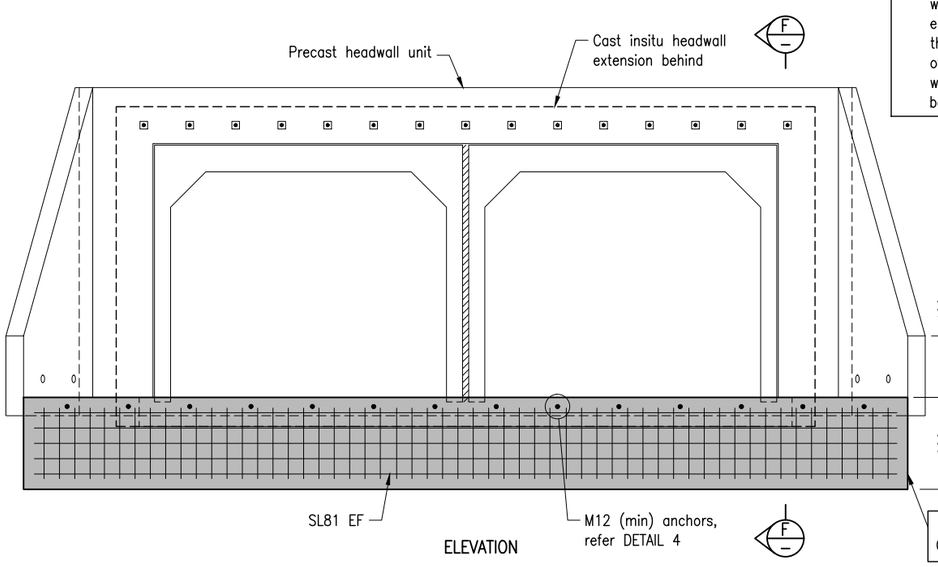
A3
Not to Scale

Standard Drawing No 1243
Date 7/2022

A | B | C | D







GENERAL ARRANGEMENT

Detail is similar in upstream and downstream sides

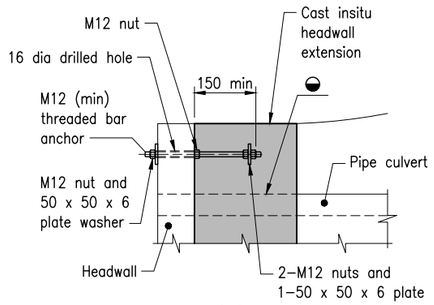
SCOPE OF PRECAST HEADWALL STANDARD DRAWING 1243

The scope of this standard drawing is to provide standard details for culvert headwall extensions for box culverts.
It is the responsibility of the precast headwall supplier and the project design engineer to provide project specific drawings, based on these standard details, to suit the project situation and to RPEQ certify the project specific drawings.
This standard drawing is applicable for single cell and multi–cell headwalls

HEADWALL ANCHORS

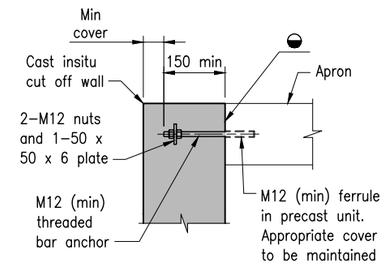
Internal height of culvert H	Minimum No OFF # anchors
375	4
450	4
600	4
750	4
900	4
1200	6
1500	6
1800	8
2100	8
2400	12

This minimum No OFF anchors shall be provided at the top and bottom of the headwall, for each box.
Before drilling precast units, the position of the reinforcements shall be identified and any drilling shall avoid cutting the reinforcement.



DETAIL 3 – ANCHOR BOLT ASSEMBLY

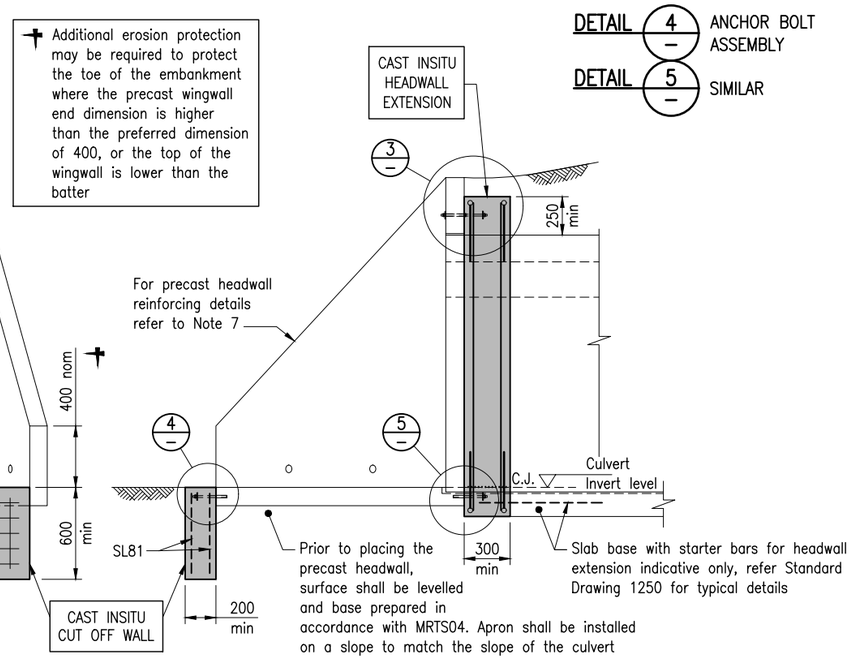
Reinforcement omitted from these details for clarity



DETAIL 4 – ANCHOR BOLT ASSEMBLY

DETAIL 5 – SIMILAR

Additional erosion protection may be required to protect the toe of the embankment where the precast wingwall end dimension is higher than the preferred dimension of 400, or the top of the wingwall is lower than the batter



SECTION F

NOTES for BOX CULVERTS:

1. BOX CULVERTS shall be in accordance with MRTS03.
   Precast headwall unit and cast insitu headwall extension shall be designed in accordance with Technical Note 27 (TN27).
   The standard details shown in this drawing are for exposure class B2 to AS 5100.
   Refer Note 8 for additional requirements for projects in exposure class C1 and C2.
2. FOR SMALLER CULVERTS diameter up to 450, including sloping headwalls, the use of the cast insitu headwall extension details shown in this drawing can be omitted dependent upon site conditions and risk of separation of headwall, as assessed by the Project Engineer. Factors such as low flow in small culverts, ease of maintenance in the event of headwall separation, can be considered in the assessment.
   Refer Drawing 3 for alternative bolted connection details for culverts height ≤ 1200.
3. PRECAST HEADWALLS shall be manufactured in accordance with MRTS72.
4. CONCRETE shall be in accordance with MRTS70.
   Requirements for cast insitu concrete for headwall extensions and cut off walls are shown in the table below.

Item	Design requirements
Design life	100 years
Minimum exposure classification	B2 to AS 5100
Minimum concrete class	S40/20
Cover to reinforcement	60 cover to AS 5100

5. STEELWORK shall be fabricated to MRTS78, for exposure class B2.
   Ferrules shall be TMR approved.
   Threaded bar, bolts and screws to Class 4.6 to AS 1111.1.
   Nuts class 5 to AS 1112.1. Washers class 5 to AS 1237.1.
   Steel plate Grade 250 minimum to AS/NZS 3678.
   All ferrules, anchors, bolts and nuts shall be hot dip galvanised to AS 1214.
   All other steelwork hot dip galvanised to AS/NZS 4680 unless shown otherwise.
6. REINFORCING STEEL shall be in accordance with Standard Drawings 1043 and 1044, and compliant with MRTS71 and AS/NZS 4671.
   All reinforcing steel shall be ACRS certified.
   Reinforcing Steel welding shall be in accordance with Standard Drawing 1044.
   Deformed bars Grade D500N. Reinforcing mesh Grade D500L.
7. PRECAST HEADWALL UNIT shall be designed and RPEQ certified by the precaster's designer according to the project specific requirements. Minimum details to be shown in the precast supplier provided project specific drawings are:
   – All dimensions of precast headwall unit including wingwall and apron lengths and reinforcement details.
   – Design loads and design standards including Technical Note 27.
   – Details of formed holes/ferrules for the threaded bar anchors for connection between precast headwall unit and cast insitu headwall extension/cut off wall.
   – Design minimum exposure classification.
   – Concrete notes including concrete class, aggregate size, cover to reinforcement.
8. Additional requirements for exposure class C1 and C2:
   Minimum concrete strength and cover to reinforcement shall be to AS 5100. Anchor bolt assemblies shall be of stainless steel bolts, threaded bar, plate, and washers to Grade 316, and nuts to Grade 304, in accordance with MRTS78A, and its referred standards.
9. PROJECT–SPECIFIC INFORMATION TO BE SHOWN ON THE PROJECT DRAWINGS:
   – Cast insitu headwall extension dimensions.
   – Cast insitu cut off wall dimensions.
   – Details of threaded bar anchors for cast insitu headwall extension and for cut off wall.
10. DIMENSIONS are in millimetres unless shown otherwise.

ASSOCIATED DEPARTMENTAL DOCUMENTS:
NDRRA Design Guidelines; Road Drainage Manual

REFERENCED DEPARTMENTAL DOCUMENTS:
Standard Drawing 1043 Reinforcing Steel – Standard Bar Shapes
Standard Drawing 1044 Reinforcing Steel – Lap Lengths
MRTS03 Drainage, Retaining Structures and Protective Treatments
MRTS70 Concrete
MRTS71 Reinforcing Steel
MRTS72 Manufacture of Concrete Elements
MRTS78 Fabrication of Structural Steelwork
MRTS78A Fabrication of Structural Stainless Steelwork
TN27 Guidelines for Design of Precast Culvert and Pipe Headwalls

Department of Transport and Main Roads

PRECAST CULVERT HEADWALLS

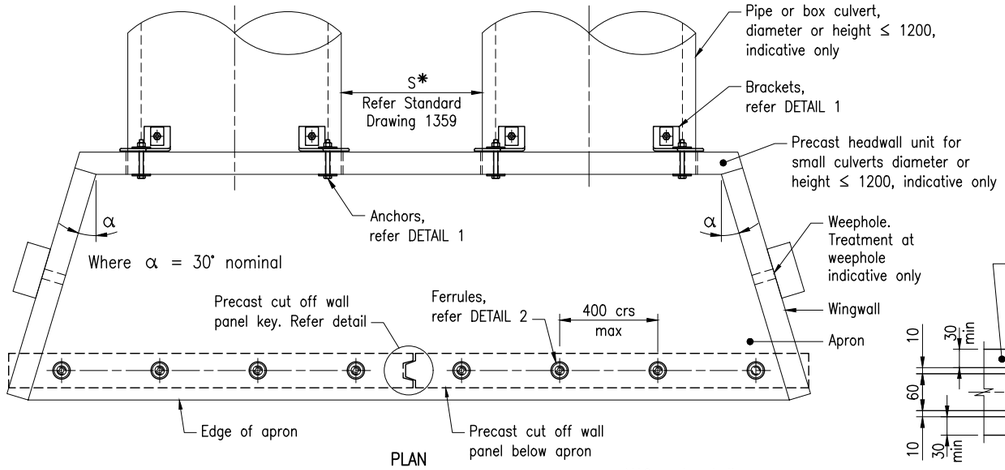
HEADWALL CONNECTIONS
DRAWING 2 OF 3

FOR BOX CULVERTS – ALL SIZES

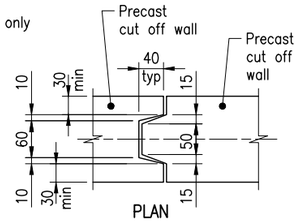
A3
Not to Scale

Standard Drawing No
1243
Date 7/2022

A | B | C | D



PLAN



PLAN

KEY DETAIL FOR PRECAST CUT OFF WALL PANEL

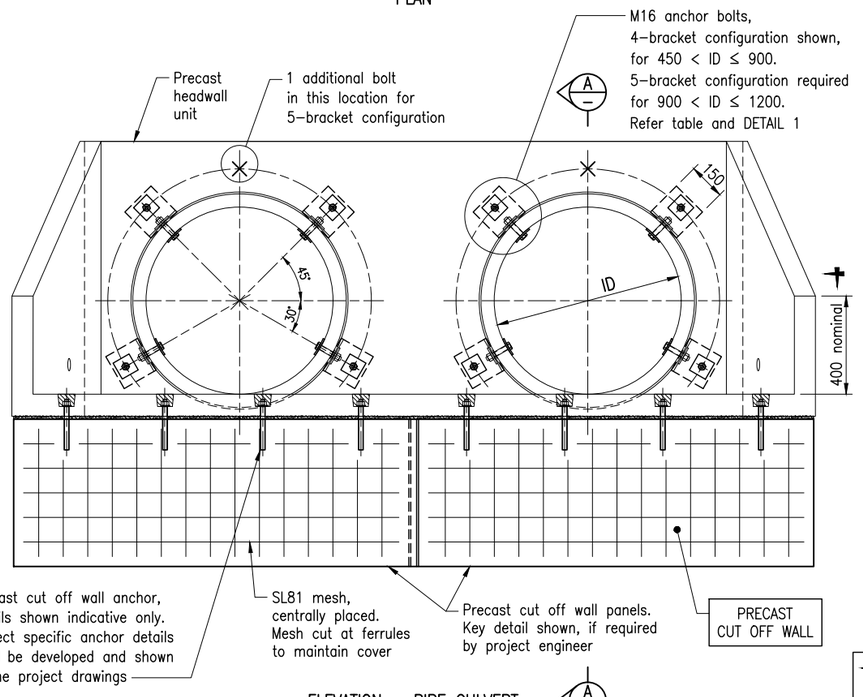
SCOPE OF PRECAST HEADWALL STANDARD DRAWING 1243

The scope of this standard drawing is to provide standard details for precast headwall connection for pipe or box culverts.
It is the responsibility of the project design engineer to provide project specific drawings for the use of precast headwall units supplied by registered precast supplier, to suit the project situation and to RPEQ certify the project specific drawings. The precast headwall unit dimensions shall be checked to ensure fit for purpose.
This standard drawing is applicable for single cell and multi-cell headwalls.

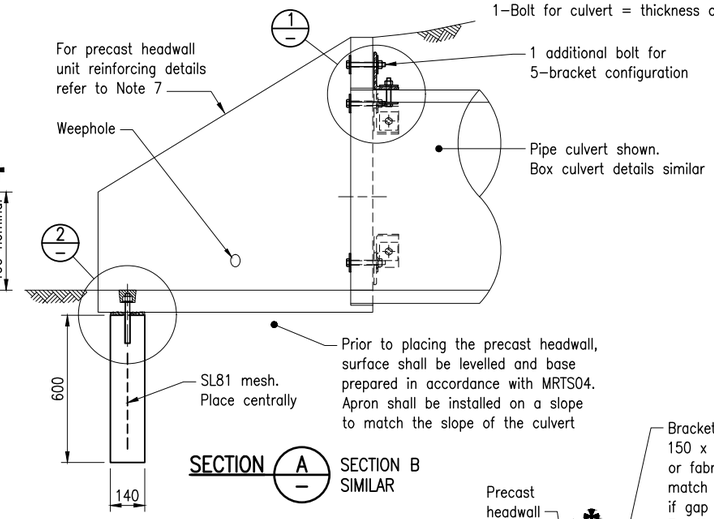
ANCHOR BOLT DETAILS

	Culvert Size Pipe ID or H of Box	No OFF Brackets per culvert ✤	
Pipe	375 < ID ≤ 900	4 per pipe	
	900 < ID ≤ 1200	5 per pipe	
Box culvert	375 < H ≤ 600	Multicell culvert : Outer units = 3 Inner units = 2	Single cell = 4
	600 < H ≤ 900	Multicell culvert : Outer units = 5 Inner units = 3	Single cell = 7
	900 < H ≤ 1200		

✤ Each bracket requires 2 bolts, length as follows :
1–Bolt for headwall = thickness of headwall t_h + 60
1–Bolt for culvert = thickness of culvert t_c + 60

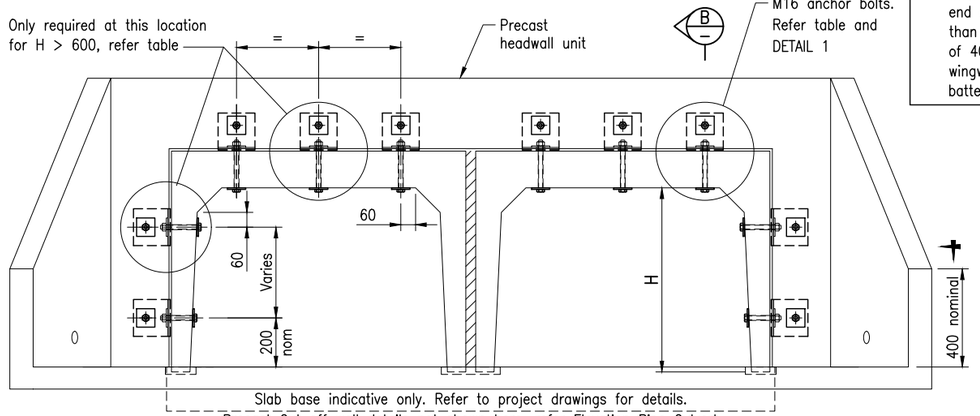


ELEVATION – PIPE CULVERT



SECTION A SECTION B SIMILAR

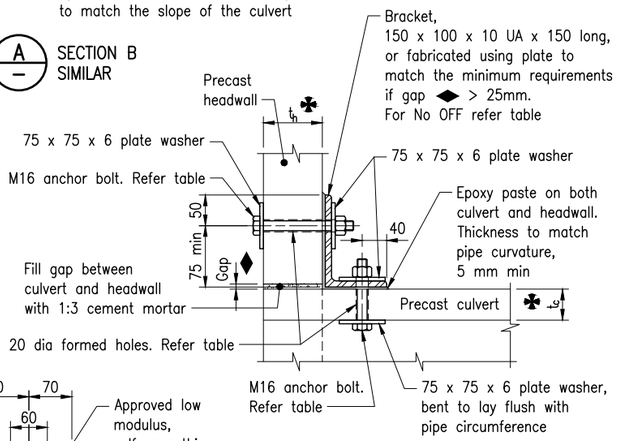
✚ Additional erosion protection may be required to protect the toe of the embankment where the precast wingwall end dimension is higher than the preferred dimension of 400, or the top of the wingwall is lower than the batter



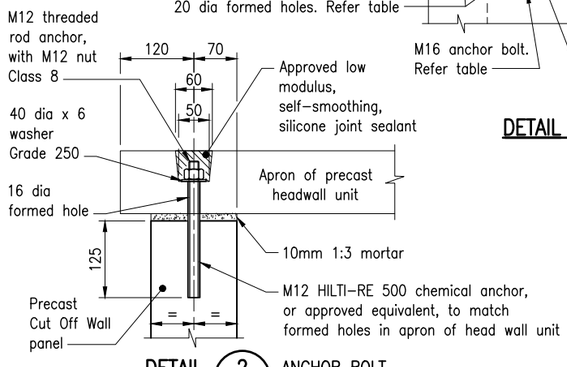
ELEVATION – BOX CULVERT

GENERAL ARRANGEMENT

Detail is similar in upstream and downstream sides



DETAIL 1 ANCHOR BOLT ASSEMBLY



DETAIL 2 ANCHOR BOLT ASSEMBLY

NOTES for PIPE and BOX CULVERTS diameter ≤ 1200:

1. PIPE and BOX CULVERTS shall be in accordance with MRTS03.
   Precast headwalls shall be manufactured in accordance with MRTS03 and MRTS72.
   Precast cut off wall panels shall be manufactured in accordance with MRTS72.
   Precast headwall unit and headwall connection to this standard drawing shall be designed in accordance with Technical Note 27 (TN27).
   The standard details shown in this drawing are for exposure class B2 to AS 5100.
   Refer Note 8 for additional requirements for projects in exposure class C1 and C2.
2. PRECAST HEADWALL CONNECTIONS detailed on this standard drawing are applicable for pipe and box culvert of diameter or height ≤ 1200.
3. FOR SMALLER CULVERTS diameter or height up to 450, including sloping headwalls, the use of the bolted connection details shown in this drawing can be omitted dependent upon site conditions and risk of separation of headwall, as assessed by the Project Engineer. Factors such as low flow in small culverts, ease of maintenance in the event of headwall separation, can be considered in the assessment.
4. CONCRETE shall be in accordance with MRTS70.
   Design life 100 years. Minimum concrete strength shall be S50/20.
   Minimum exposure classification B2 to AS 5100.
   Minimum cover to reinforcement shall be 40 with rigid formwork and subjected to intense compaction. An approved super–workable concrete mix may be used in lieu of intense vibration. All exposed edges shall have 20 x 20 chamfers.
   Refer Note 8 for additional requirements for higher exposure classifications.
5. STEELWORK shall be fabricated to MRTS78, for exposure class B2.
   Steel angle Grade 300 to AS/NZS 3679.1.
   Threaded bar, bolts and screws Class 4.6 to AS 1111.1.
   Nuts Class 5 to AS 1112.1. Washers Class 5 to AS 1237.1.
   Steel plate Grade 250 minimum to AS/NZS 3678.
   All anchors, bolts and nuts shall be hot dip galvanised to AS 1214.
   All other steelwork shall be hot dip galvanised to AS/NZS 4680.
6. REINFORCING STEEL shall be in accordance with Standard Drawing 1044, and compliant with MRTS71 and AS/NZS 4671.
   Reinforcing mesh Grade D500L. All reinforcing steel to be ACRS certified.
   Reinforcing Steel welding shall be in accordance with Standard Drawing 1044.
7. PRECAST HEADWALL UNIT AND CUT OFF WALL PANELS shall be designed and RPEQ certified by the precaster's designer according to the project specific requirements.
   Minimum details to be shown in the precast supplier provided project specific drawings are:
   - All dimensions of precast headwall unit including wingwall and apron lengths and reinforcement details;
   - Design loads and design standards including Technical Note 27;
   - Details of formed holes/ferrules for the threaded bar anchors for connection between precast headwall unit and precast cut off wall;
   - Design minimum exposure classification;
   - Concrete notes including concrete class, aggregate size, cover to reinforcement.

   These precast supplier provided project specific drawings shall be included in the project scheme drawings prepared by the project designer.
8. Additional requirements for exposure class C1 and C2:
   Minimum concrete strength and cover to reinforcement shall be to AS 5100.
   Anchor bolt assemblies shall be of stainless steel bolts, threaded bar, angle, plate, and washers to Grade 316, and nuts to Grade 304, in accordance with MRTS78A, and its referred standards.
9. PROJECT–SPECIFIC INFORMATION TO BE SHOWN ON THE PROJECT DRAWINGS:
   - Precast headwall connection details;
   - Precast cut off wall details;
   - Details of all anchors at culvert apron and cut off wall.
10. Before drilling precast units, the position of the reinforcements shall be identified and any drilling shall avoid cutting the reinforcement.
11. DIMENSIONS are in millimetres unless shown otherwise.

ASSOCIATED DEPARTMENTAL DOCUMENTS:
NDRRA Design Guidelines; Road Drainage Manual

REFERENCED DEPARTMENTAL DOCUMENTS:
Standard Drawing 1044 Reinforcing Steel – Lap Lengths
MRTS03 Drainage, Retaining Structures and Protective Treatments
MRTS70 Concrete
MRTS72 Manufacture of Concrete Elements
MRTS78 Fabrication of Structural Steelwork;
MRTS78A Fabrication of Structural Stainless Steelwork
TN27 Guidelines for Design of Precast Culvert and Pipe Headwalls

Department of Transport and Main Roads

PRECAST CULVERT HEADWALLS

HEADWALL CONNECTIONS DRAWING 3 OF 3

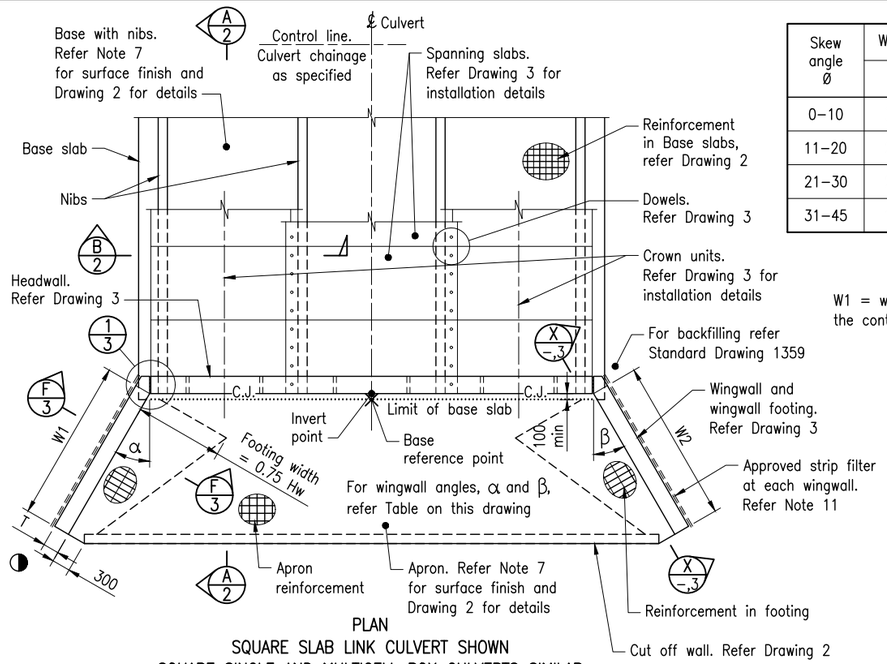
ALTERNATIVE FOR SMALL CULVERTS DIAMETER OR HEIGHT ≤ 1200

A3 Not to Scale

Standard Drawing No 1243

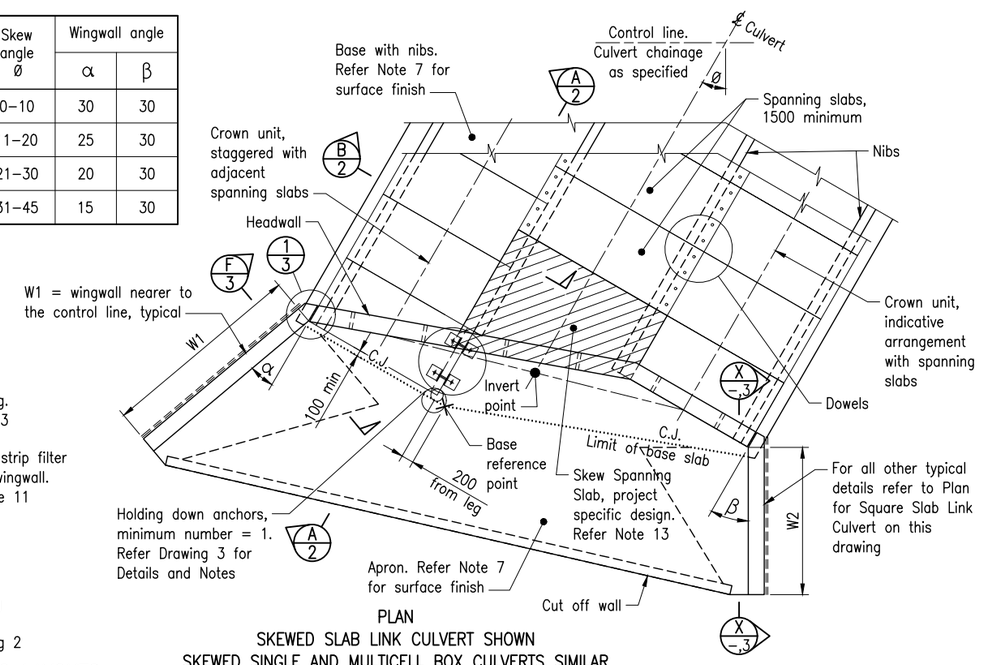
Date 7/2022

A | B | C | D



PLAN
SQUARE SLAB LINK CULVERT SHOWN
SQUARE SINGLE AND MULTICELL BOX CULVERTS SIMILAR

Skew angle Ø	Wingwall angle	
	α	β
0–10	30	30
11–20	25	30
21–30	20	30
31–45	15	30

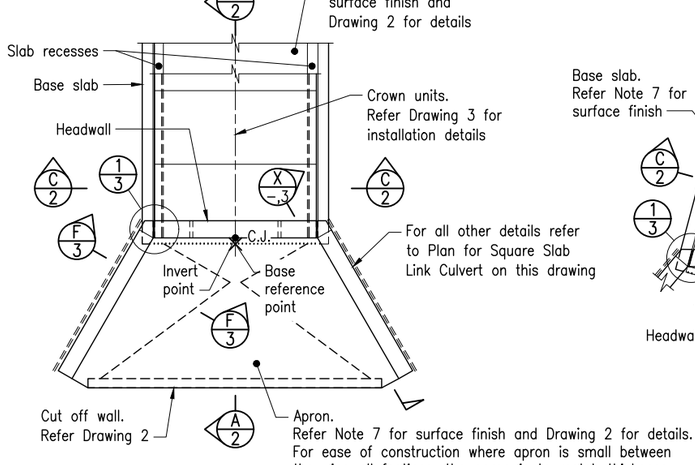


PLAN
SKEWED SLAB LINK CULVERT SHOWN
SKEWED SINGLE AND MULTICELL BOX CULVERTS SIMILAR

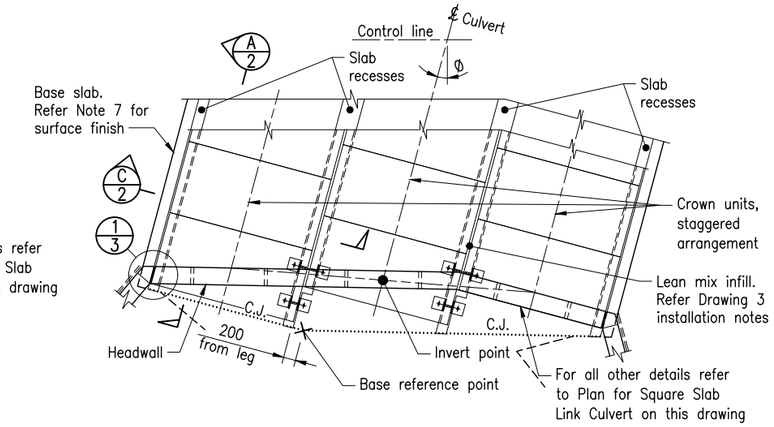
TYPICAL FRAMING LAYOUTS FOR BASE SLAB WITH NIBS

† where Hw = H + tc + 10 + ts + 275
height of opening H;
thickness of culvert tc;
thickness of slab ts.
Refer table on Drawing 3

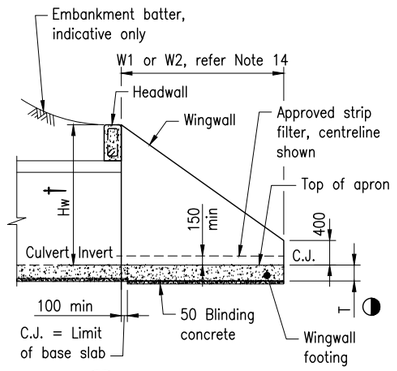
◑ T is a constant thickness for wingwalls and footings. Refer table on Drawing 3



PLAN
SQUARE SINGLE BOX CULVERT SHOWN
SQUARE MULTIPLE CELL BOX AND SLAB LINK CULVERTS SIMILAR

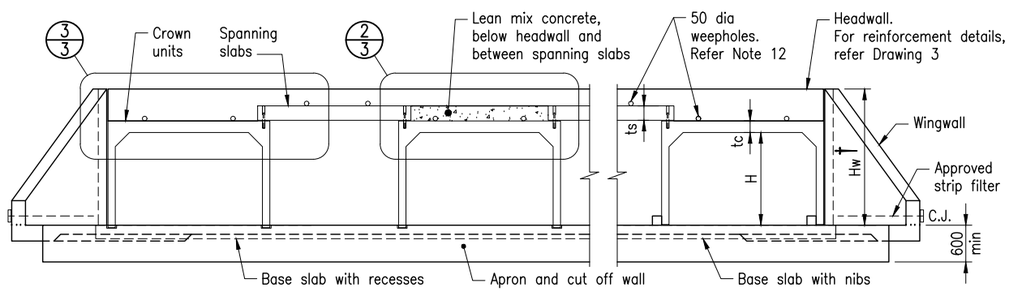


PLAN
SKEWED MULTIPLE CELL BOX CULVERT SHOWN
SKEWED SINGLE BOX AND SLAB LINK CULVERTS SIMILAR



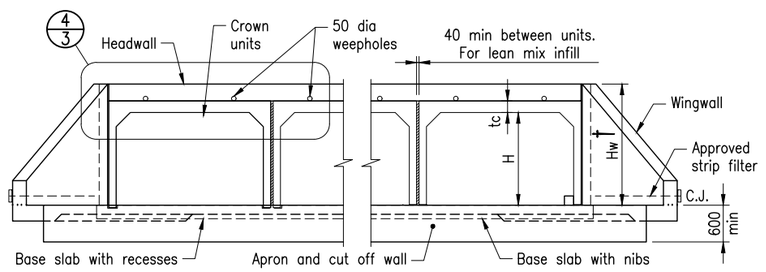
SECTION X – TYPICAL ELEVATION AT WINGWALL – CONCRETE DETAILS

TYPICAL FRAMING LAYOUTS FOR BASE SLAB WITH RECESSES



TYPICAL ELEVATION – BASE WITH RECESSES
TYPICAL ELEVATION – SPANNING SLAB DETAILS
TYPICAL ELEVATION – BASE WITH NIBS

GENERAL ARRANGEMENT – SLAB LINK BOX CULVERT



TYPICAL ELEVATION

GENERAL ARRANGEMENT – MULTIPLE CELL R C BOX CULVERT

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:

1. The adaptability of the standard details shall be assessed by the project designer in respect of specific project geometric, appropriate foundation and scour conditions.
2. In reactive soils: this standard drawing is only applicable for reactive soils with linear shrinkage up to 8%. Specialist geotechnical design advice shall be sought otherwise.
3. If the insitu bearing capacity is inadequate, the following options may be explored subject to review and acceptance by E&T Structures and Geotechnical sections:
   a. Insitu ground improvement, and/or
   b. Redesign of the base slab.

   Any redesign works shall be RPEQ certified by appropriate engineering disciplines for compliance.
4. 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.

GENERAL NOTES:

1. SCOPE: This drawing is to detail cast insitu base slab, aprons, headwalls and wingwalls for precast RC Box Culverts and Slab Link Box Culverts where H (height of opening) > 600.
   This drawing supersedes Standard Drawings 1303, 1316, 1317, 1318 and 1320.
   This 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.
2. BOX CULVERTS shall be constructed in accordance with MRTS03.
3. DESIGN TRAFFIC LOADING: HLP400, M1600, A160 and W80 are in accordance with AS 5100.2.
   Maximum height of fill over the culvert shall be 2000.
   Maximum design pressure (E_d) under the culvert slab bases is provided in the Base slab Details table on drawing 2.
   Maximum design pressure (E_d) under the culvert apron is 75 kPa.
4. DOWELLED CONTRACTION JOINTS shall be provided where (a) the length and/or (b) the width of the base slab exceed 20m. When contraction joints are required across the width, they shall be located at 1/4 span points of crown units and are to be continued across the aprons and cut off walls. 24 hours minimum shall be allowed between pours.
5. APRON AND BASE SLAB MINIMUM REINFORCEMENT for shrinkage and temperature effects are designed considering the full restraint condition to AS 5100. For the slab on ground condition, only the top half of the slab thickness is considered for calculation of this reinforcement.
6. WINGWALLS for skewed culverts with angle greater than 45 require a special design.
7. CONCRETE shall be in accordance with MRTS70.
   Design life 100 years.
   Exposure classification and cover to reinforcement shall be in accordance with AS 5100. Minimum concrete strength and cover to reinforcement shall be as shown in table below.

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

   Triple–blend concrete in accordance with MRTS70 is required for Exposure classifications C1 and C2.
   Blinding concrete N20/20.
   Surface roughening of the aprons, and traversable areas of slabs between nibs or recesses if required, 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.
   All exposed edges shall have 19 x 19 chamfers, unless nominated otherwise.
8. PRECAST CONCRETE CULVERTS shall be designed and manufactured in accordance with MRTS24.
9. STEELWORK shall be fabricated to the requirements of MRTS78.
   Flat bar and angle shall be Grade 300 to AS/NZS 3679.1. Bolts and screws Class 4.6 to AS 1111.1. Nuts Class 5 to AS 1112.1. Washers Class 5 to AS 1237.1.
   After fabrication all bolts and nuts shall be hot dip galvanised to AS 1214, and all other steelwork to AS/NZS 4680.

General Notes are continued on Drawing 2.

Department of Transport and Main Roads

R C BOX CULVERTS AND SLAB LINK BOX CULVERTS

CULVERTS HEIGHT > 600
DRAWING 1 OF 3

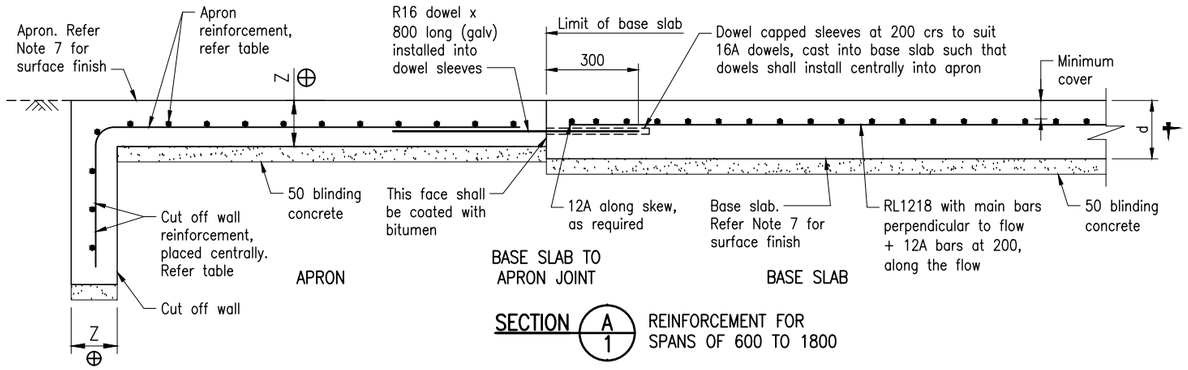
GENERAL ARRANGEMENT AND NOTES

Queensland Government

A3
Not to Scale

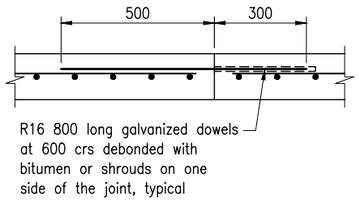
Standard Drawing No
1250
Date 3/2023

A | B | C | D | E | F

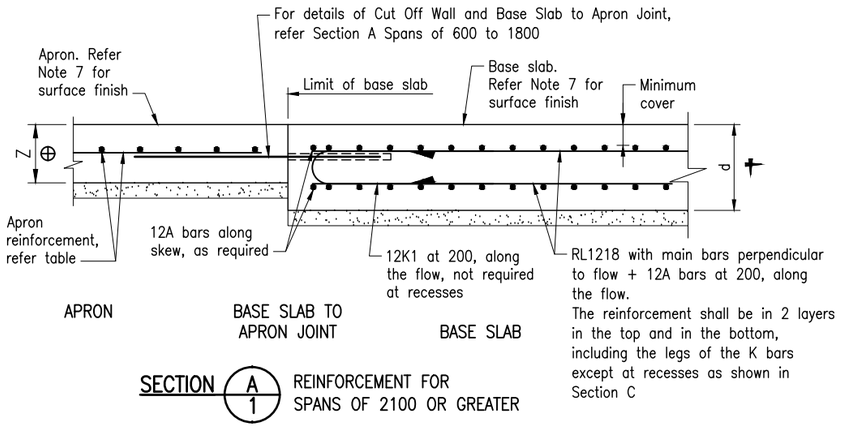


SECTION A 1 REINFORCEMENT FOR SPANS OF 600 TO 1800

CUT OFF WALL
TYPICAL FOR ALL SPANS



DOWELLED CONTRACTION JOINT DETAIL
FOR ALL APRONS, IF REQUIRED
For use longitudinally. Refer Note 4 on Drawing 1



SECTION A 1 REINFORCEMENT FOR SPANS OF 2100 OR GREATER

APRON AND CUT OFF WALL DIMENSIONS AND MINIMUM REINFORCEMENT REQUIREMENTS

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

⊕ where Z is a constant thickness for aprons and cut off walls.

Refer Note 5 of Drawing 1

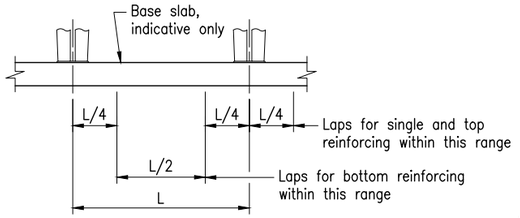
BASE SLAB DETAILS

Up to Span	Maximum design pressure (E_d) kPa		Base slab thickness d ✚ for Exposure classification			Depth of embedment of 12E nib bar
	H < 1500	H ≥ 1500	B2	C1	C2	
750	190	180	180	190	200	120
900			180	190	200	
1200			180	190	200	
1500			190	200	210	
1800			190	200	210	
2100	180	170	220	240	260	150
2400			245	255	265	
2700			255	265	275	
3000			260	270	280	200
3300			265	275	285	
3600			275	285	295	

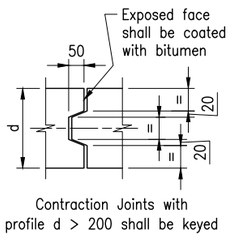
✚ where d is a constant thickness for base slab

GENERAL NOTES, continued from Drawing 1:

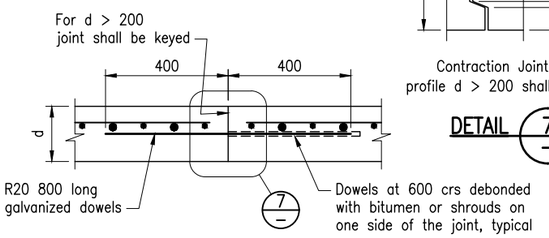
10. REINFORCING STEEL shall be read in conjunction with Standard Drawings 1043 and 1044, shall be in accordance with MRTS71 and AS/NZS 4671, and ACRS certified. Deformed bars Grade D500N. Round bars Grade R250N. Mesh Grade D500L. Reinforcement shall be hot dip galvanised to AS/NZS 4680 where shown. Reinforcing Steel welding shall be in accordance with Standard Drawing 1044.
11. WINGWALL DRAINAGE shall be provided behind wingwalls to prevent hydrostatic pressure being applied to the wingwall. A strip filter shall be used at each wingwall to drain out at the low end of the wingwall as shown.
12. WEEPHOLES shall be provided horizontally at headwalls, a minimum of 2 weepholes for each culvert crown or link slab, located such that reinforcement cover requirements are met, and a 300 x 300 x 150 no fines concrete block or approved equivalent shall be provided at each weephole as a drainage filter.
13. Refer Standard Drawing 1359 for details of earthworks to culverts.
14. PROJECT–SPECIFIC INFORMATION to be shown on the drawings:
    Exposure classification; Culvert chainage; Skew angle; Base and apron setout, surface roughening, extents and details; Skew spanning slab details (if required); Headwall and wingwall extents (W1, W2, α, β) and details; Requirements for fish passage.
15. DIMENSIONS are in millimetres.
    ASSOCIATED and REFERENCED DEPARTMENTAL DOCUMENTS:
    Design Criteria for Bridges and Other Structures; Road Drainage Manual (RDM)
    Standard Drawing 1359 Culverts – Installation, Bedding and Filling/Backfilling
    MRTS03 Drainage, Retaining Structures and Protective Treatments
    MRTS24 Manufacture of Precast Concrete Culverts
    MRTS70 Concrete; MRTS71 Reinforcing Steel; MRTS78 Structural Steelwork



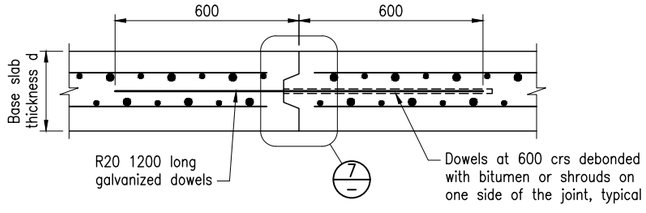
REINFORCING BAR LAP LOCATIONS – ALL BASE SLABS



DETAIL 7



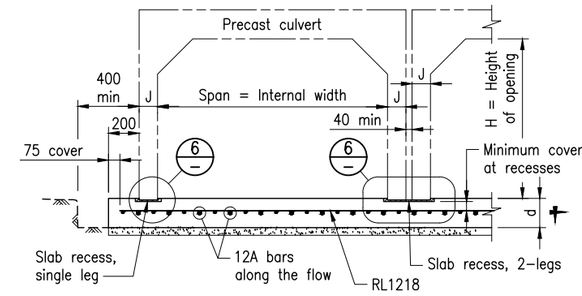
IN BASE SLAB FOR SPANS OF 600 TO 1800



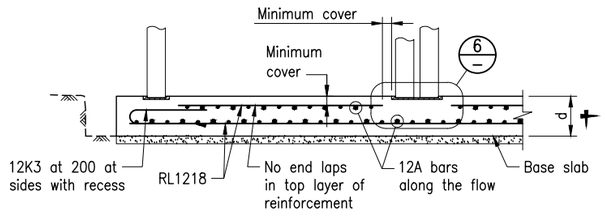
IN BASE SLAB FOR SPANS OF 2100 OR GREATER

BASE SLAB DOWELLED CONTRACTION JOINTS, IF REQUIRED

For use traversely and/or longitudinally. Refer Note 4 on Drawing 1

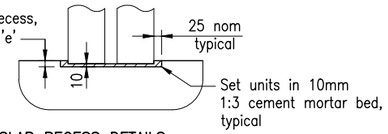


SECTION C 1 WITH RECESSES FOR SPANS OF 600 TO 1800



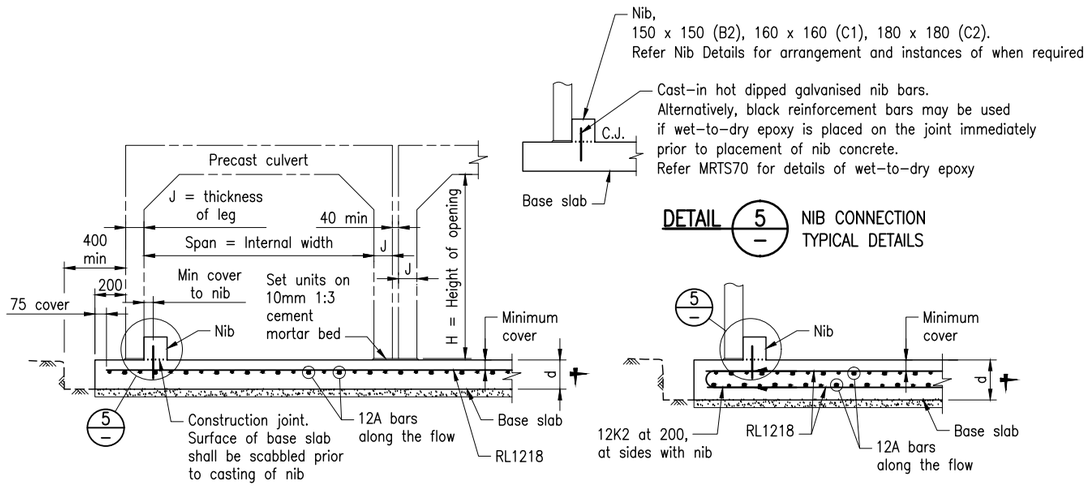
SECTION C 1 WITH RECESSES FOR SPANS OF 2100 OR GREATER

Recess depths 'e' for H are as follows :
where H > 600 to 750, 'e' = 20
H > 750 to 1200, 'e' = 30
H > 1200, 'e' = 40



DETAIL 6 SLAB RECESS DETAILS

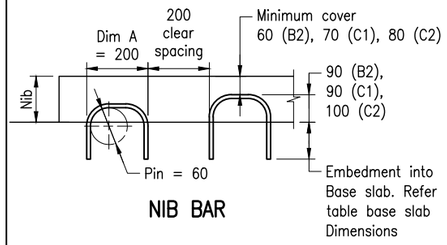
TYPICAL BASE SLAB WITH RECESSES



DETAIL 5 NIB CONNECTION TYPICAL DETAILS

SECTION B 1 WITH NIB FOR SPANS OF 600 TO 1800

SECTION B 1 WITH NIB FOR SPANS OF 2100 OR GREATER



NIB BAR

Arrangements:	for RCBC H > 600	–	nibs supporting external legs of external cells
	for SLBC H > 600 to 900	–	nibs supporting external legs of external cells
	for SLBC H > 900	–	nibs supporting both legs of external cells
Installation:	for H < 1500	–	nibs cast before placement of units
	for H ≥ 1500	–	nibs cast after placement of units

NIB DETAILS

TYPICAL BASE SLAB WITH NIBS

Department of Transport and Main Roads

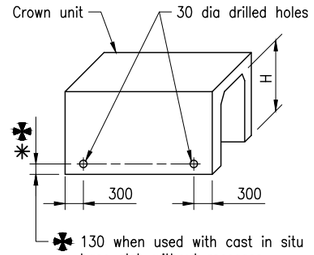
R C BOX CULVERTS AND SLAB LINK BOX CULVERTS

CULVERTS HEIGHT > 600
DRAWING 2 OF 3
CONSTRUCTION OF
BASE SLABS AND APRONS

A3
Not to Scale

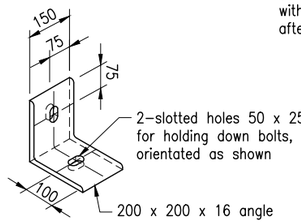
Standard Drawing No
1250
Date 3/2023

A B C D E F



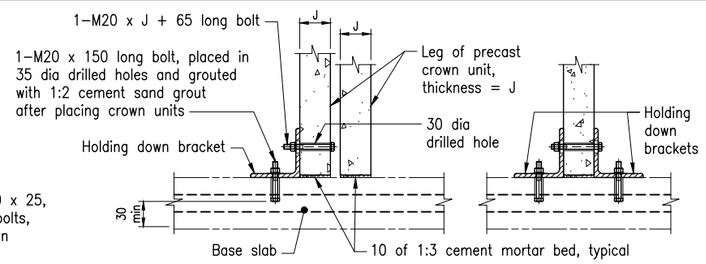
SKEWED CULVERTS ONLY

DRILLED HOLES IN CROWN UNITS FOR HOLDING DOWN ANCHORS

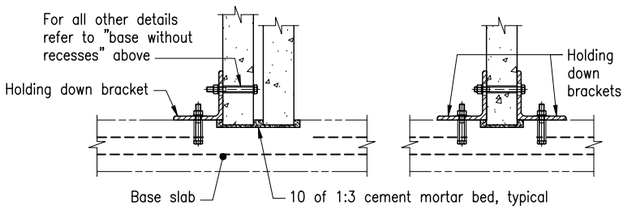


HOLDING DOWN BRACKET

Isometric view

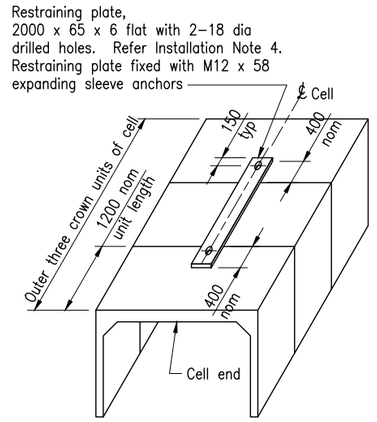


TYPICAL DETAILS FOR BASE WITHOUT RECESSES



TYPICAL DETAILS FOR BASE WITH RECESSES

HOLDING DOWN ANCHORS

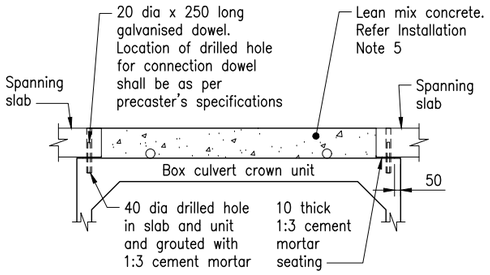


RESTRAINING PLATE

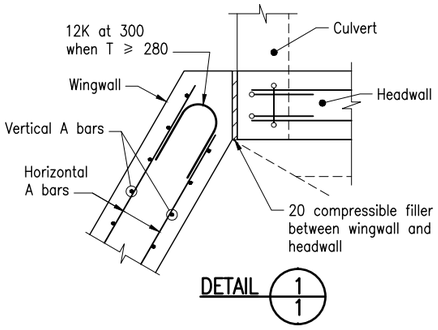
FOR USE WITH SLAB LINK BOX CULVERT
1200 LONG CROWN UNITS ONLY

NOTES FOR INSTALLATION OF PRECAST UNITS:

1. PRECAST CONCRETE CULVERTS shall be supplied and installed in accordance with MRTS03 and MRTS24.
   Doweled connections shall be in accordance with this drawing.
2. INFILL between legs of multiple cell culverts shall be achieved by placing concrete plugs of 250 minimum length at both ends of the structure and infill the remaining gap with 1:10 lean mix having maximum aggregate size of 10mm packed dry.
   Do not use fluid grout as hydrostatic head will damage culvert legs.
3. HOLDING DOWN ANCHORS shall be installed where the leg(s) of the crown unit extend more than 300 beyond the outside face of the headwall.
   Nibs are not required for these crown units. Where nibs are required, they are to extend for the full length of all other units.
   Refer details on this drawing for holding down anchor placement and installation.
4. CROWN UNIT RESTRAINING PLATES are required on the outer 3 of all internal cells when Slab Link Box Culvert > 5 cells when crown units ≥ 1800 high, and 1200 long, are used.
   Expanding Sleeve Anchors shall be selected and installed in accordance with manufacturer's specifications.
5. LEAN MIX CONCRETE shall be placed between spanning slabs on crown unit cells.
   Lean mix concrete infill is not required on the outermost crown units.



DETAIL 5 — SPANNING SLAB SUPPORT AND LEAN MIX CONCRETE FILL DETAILS



DETAIL 1/1

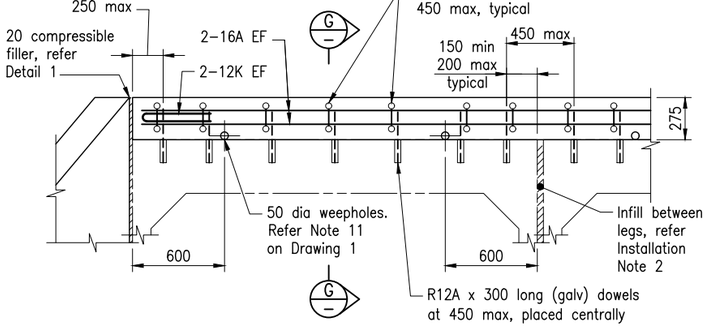
WINGWALL DIMENSIONS AND MINIMUM REINFORCEMENT REQUIREMENTS

up to Hw †	T ◑ for Exposure classification			Vertical A bars BF		Vertical A bars FF		Horizontal A bars FF and BF						D1 bars	
	B2	C1	C2	Dia	Spacing	Dia	Spacing	B2		C1		C2		Dia	Dim A
								Dia	Spacing	Dia	Spacing	Dia	Spacing		
1000	220	240	260	12	150	12	300	12	150	12	125	12	100	12	500
1500	220	240	260						150		125				
2000	260	270	280						125		100				
2500	330	340	350						100	16	150	16	125		
3000	380	390	400	16				16	150		125			16	700
3700	410	420	430			16		16	150	20	175	20	175		
4350	440	450	460	20				20	175				150	20	800

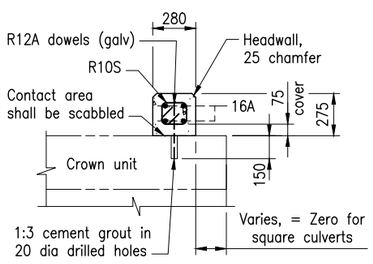
† where Hw = H + tc + 10 + ts + 275
height of opening H; thickness of culvert tc; thickness of slab ts.

◆ where type D1 and D2 bars exceed the wall height at the wingwall ends, curtail the bars to match the wall height, ensuring cover requirements are met

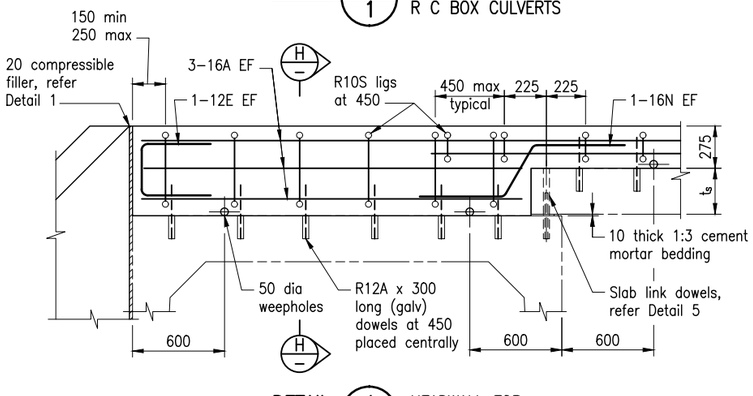
◑ T is a constant thickness for wingwalls and footings



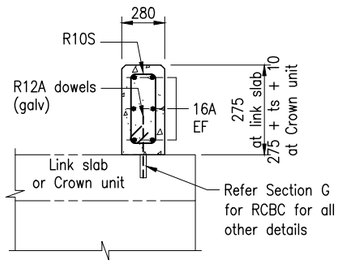
DETAIL 3/1 — HEADWALL FOR R C BOX CULVERTS



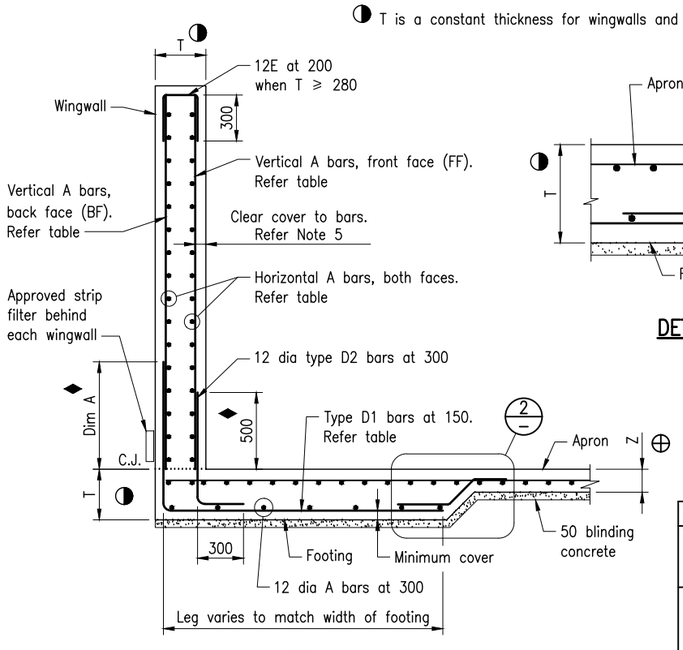
SECTION G/– HEADWALL DETAILS



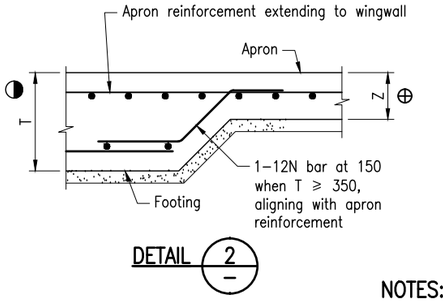
DETAIL 4/1 — HEADWALL FOR SLAB LINK CULVERTS



SECTION H/– HEADWALL DETAILS



SECTION F/1 — WINGWALL AND FOOTING REINFORCEMENT DETAILS



DETAIL 2/–

NOTES:

1. Refer Drawings 1 and 2 for all General Notes.
2. Refer Drawing 1 for typical General Arrangements for large RCBC and SLBC culverts.
3. Refer Drawing 2 for typical details of base slabs for large box culverts.

Department of Transport and Main Roads

R C BOX CULVERTS AND SLAB LINK BOX CULVERTS

CULVERTS HEIGHT > 600
DRAWING 3 OF 3
INSTALLATION OF PRECAST UNITS AND CONSTRUCTION OF HEADWALLS & WINGWALLS

Queensland Government

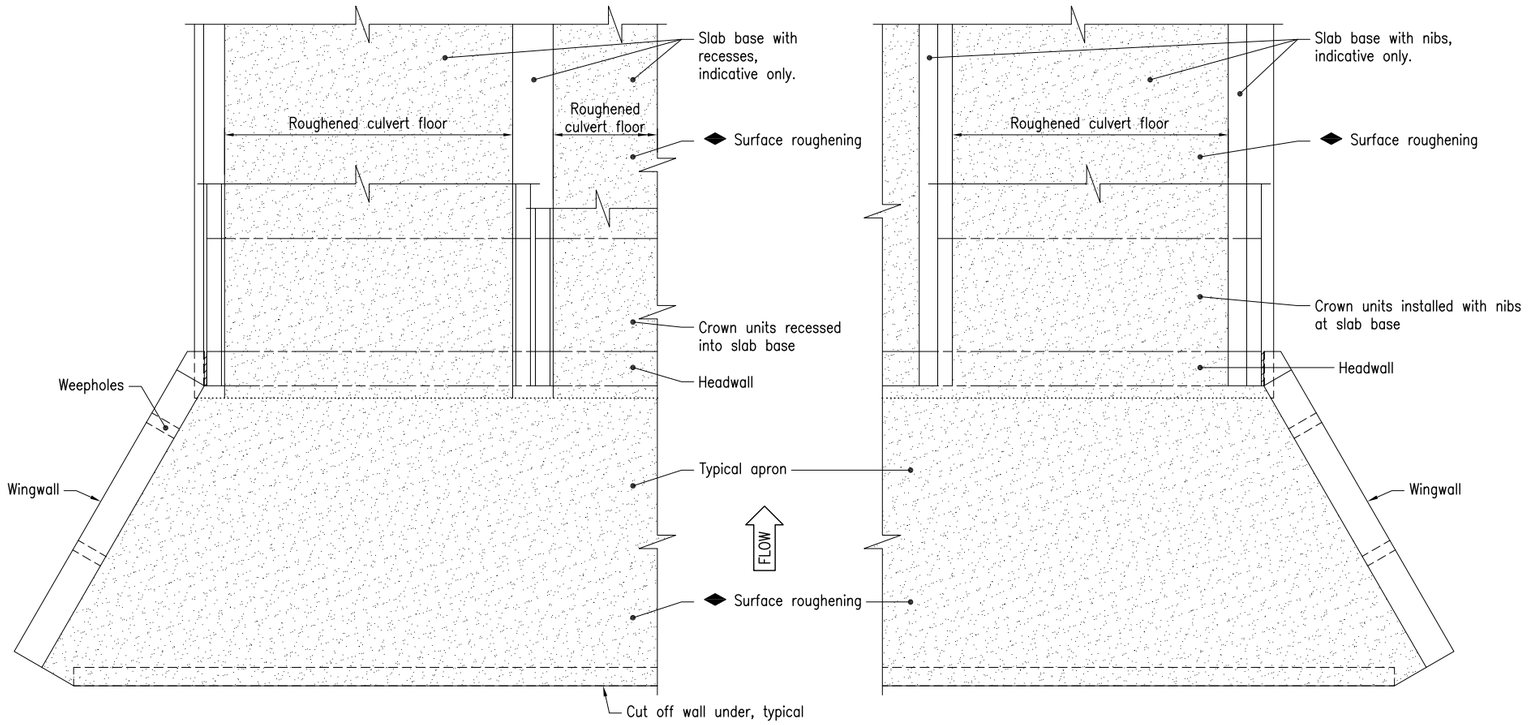
A3
Not to Scale

Standard Drawing No
1250
Date 3/2023

A B C D E F

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

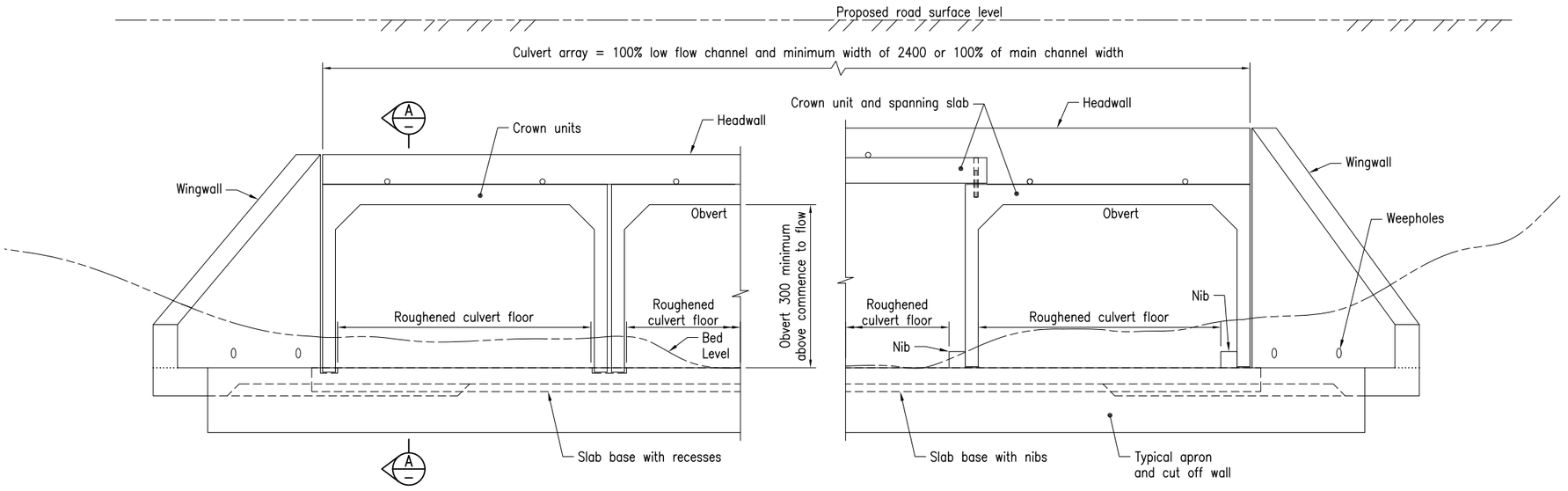
1. The use of the standard details shall be assessed by the project designer in respect of project situation.
2. When there is uncertainty around the application of the standard details on this drawing for a specific project, advice shall be sought from E&T Structures.
3. The details specific to the project shall be shown on the project specific drawings.



TYPICAL PART PLAN – SLAB WITH RECESSES

TYPICAL PART PLAN – BASE SLAB WITH NIBS

◆ Surface roughening of the culvert floor.
The surface area of culvert floor comprising the top of the base slab between nibs shall be broom finished. The direction of brushing shall be perpendicular to the direction of flow using a broom not less than 400 wide to achieve an average texture depth of 0.8.
Refer MRTS77.



TYPICAL ELEVATION – SLAB WITH RECESSES

TYPICAL ELEVATION – – BASE SLAB WITH NIBS

GENERAL ARRANGEMENT – BOX CULVERTS ON AMBER MAPPED WATERWAYS

NOTES:

1. SCOPE: This standard drawing shall be read in conjunction with the document "Accepted development requirements for operational work that is constructing or raising waterway barrier works" (ADR).
   This standard drawing provides detailed modifications to standard TMR culvert designs for box culverts where Amber mapped waterway barrier treatment is determined by project specific assessment.
   Culvert base slabs and aprons shall be no steeper than the waterway bed gradient.
   Culverts shall align, within 10°, to the direction of water flow to minimise turbulence.
2. This Standard Drawing is applicable for culverts constructed in accordance with Standard Drawing 1240, 1250 and 1260, as appropriate.
3. BOX CULVERTS shall be constructed in accordance with MRTS03 and MRTS24.
4. ROUGHENING of concrete shall be to the requirements of MRTS77.
5. DIMENSIONS are in millimetres.

ASSOCIATED AND REFERENCED DOCUMENTS:

Accepted Development Requirements for Operational Work that is Constructing or Raising Waterway Barrier Works

Departmental Standard Drawings:

1240 RC Slab Deck Culvert
1250 RC Box Culverts and Slab Link Box Culverts – Culverts Height > 600
1260 RC Box Culverts and Slab Link Box Culverts – Culverts Height 375 to 600

Departmental Specifications:

MRTS03 Drainage, Retaining Structures and Protective Treatments
MRTS24 Manufacture of Precast Concrete Culverts
MRTS77 Bridge Deck

Department of Transport and Main Roads

FISH PASSAGE

RC BOX CULVERTS IN ADR AMBER MAPPED WATERWAYS

Queensland Government

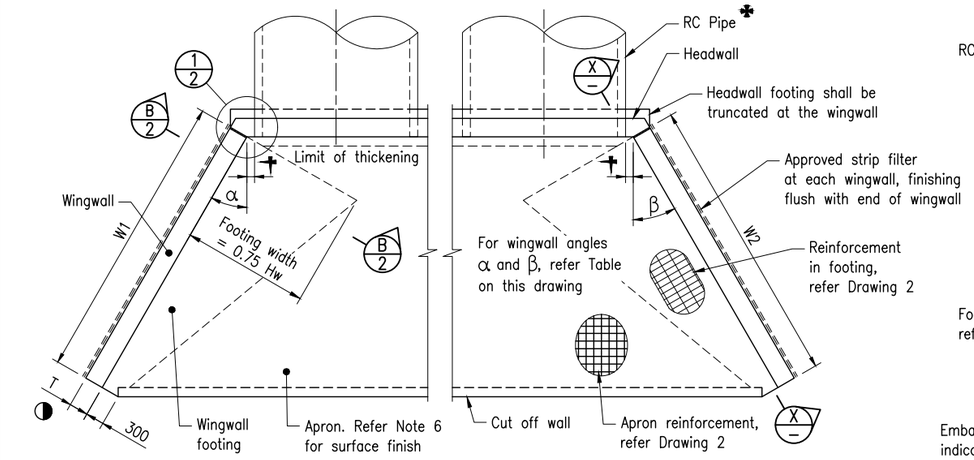
A3

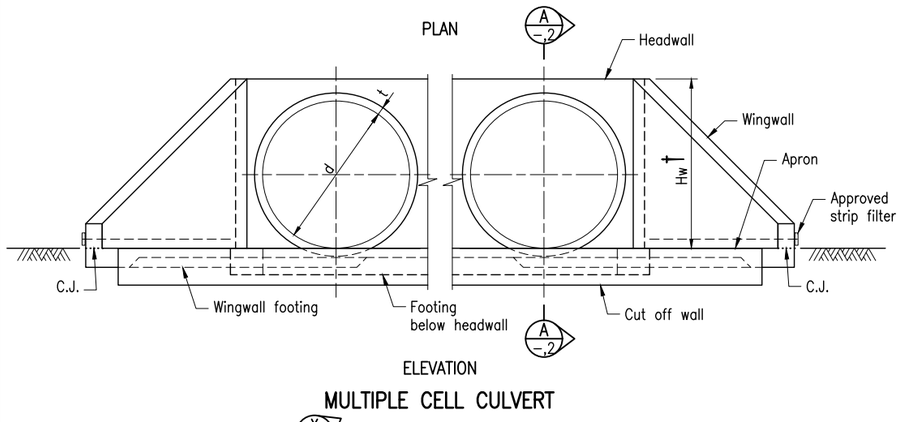
Not to Scale

Standard Drawing No 1271

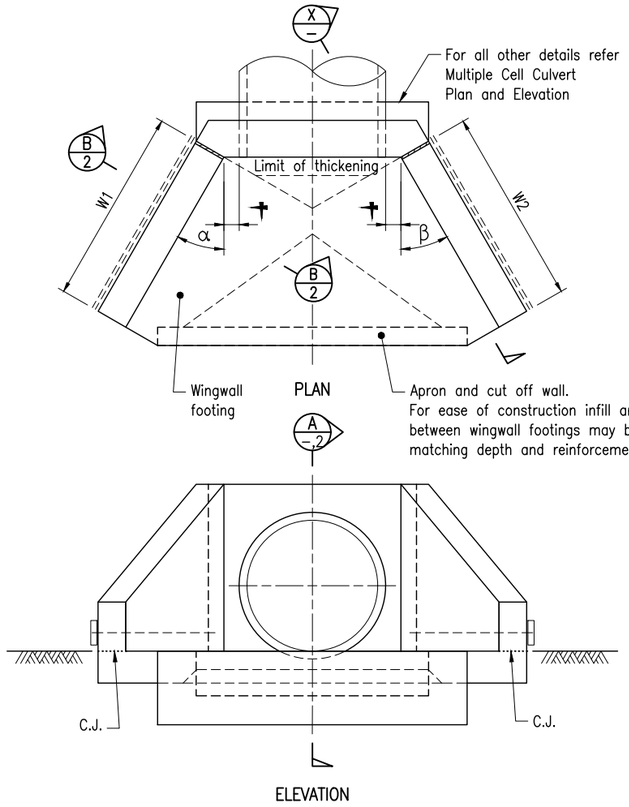
Date 3/2021

A | B

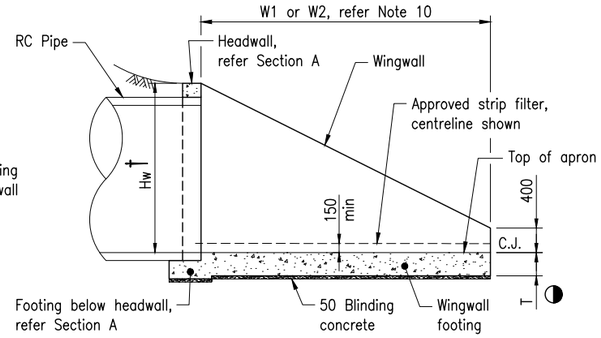




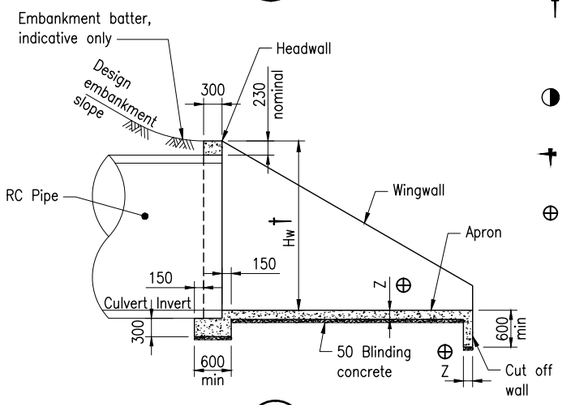
MULTIPLE CELL CULVERT



SINGLE CELL CULVERT



SECTION X – ELEVATION AT WINGWALL – CONCRETE DETAILS



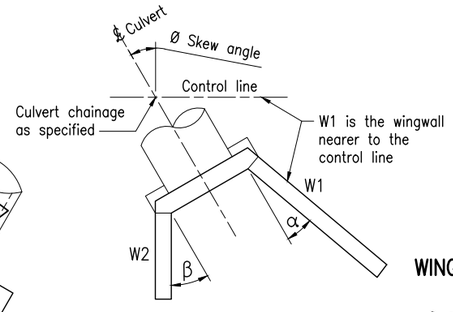
SECTION A – HEADWALL AND APRON – CONCRETE DETAILS

† Hw = Internal pipe diameter (d) + pipe thickness (t) + 230 min. Refer table on Drawing 2

◑ T is a constant thickness for wingwalls and footings. Refer table on Drawing 2

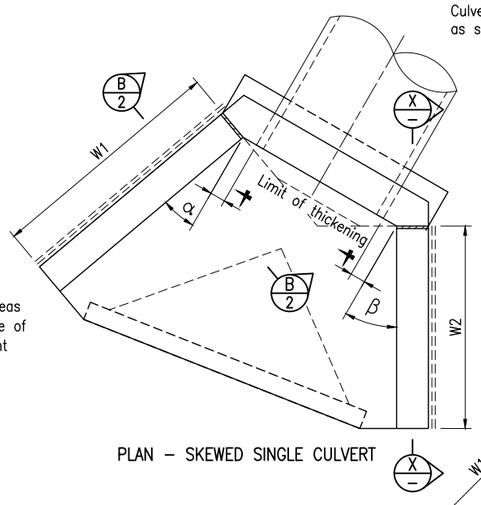
✝ Exposure classification B2 = 100
Exposure classification C1 and C2 = 125

⊕ Z is a constant thickness for aprons and cut off walls. Refer table on Drawing 2

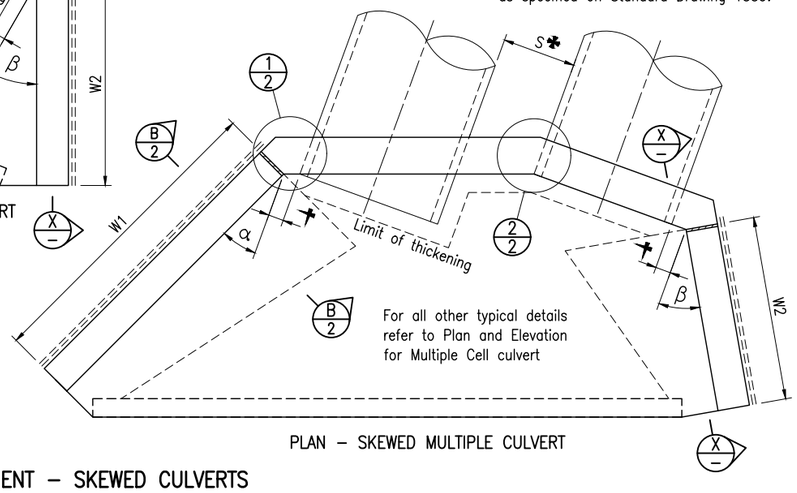


Skew angle Ø	Wingwall angle	
	α	β
0 – 10	30	30
11 – 20	25	30
21 – 30	20	30
31 – 45	15	30

WINGWALL ANGLES



✤ Spacing for multiple pipes "S" is as specified on Standard Drawing 1359.



GENERAL ARRANGEMENT – SKEWED CULVERTS

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:

1. The adaptability of the standard details shall be assessed by the project designer in respect of specific project geometric, appropriate foundation and scour conditions.
2. 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.
3. 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.
4. The details specific to the project shall be shown on the project specific drawings.

NOTES:

1. PIPE CULVERT END STRUCTURES shall be in accordance with MRTS03.
   The purpose of this drawing is to provide typical details for wingwalls, headwall and apron for culverts with pipe diameter 750 to 2400.
   Refer Standard Drawing 1305 for typical details of headwall and apron for culverts with pipe diameter 375 to 675.
   Refer Standard Drawing 1359 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.
2. Maximum design pressure (E_d) under the culvert apron is 75 kPa.
3. PIPE DIAMETERS greater than 2400 require a special design.
4. Where CULVERT APRONS are longer than 20m, the project specific design shall be developed with a transverse contraction joint, with direction of flow, at every 20m length. Typical contraction joint details provided in this standard drawing are to be used.
5. WINGWALLS for skewed culverts with angle greater than 45 require a special design.
6. CONCRETE shall be in accordance with MRTS70.
   Design life 100 years.
   Exposure classification and cover to reinforcement shall be in accordance with AS 5100. Minimum concrete strength and cover to reinforcement shall be as shown in table below.

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

   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.
7. 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. Round bars Grade R250N. Mesh Grade D500L.
   Reinforcement shall be hot dip galvanised to AS/NZS 4680 where shown.
8. TACK WELDING to reinforcement for location purposes to AS/NZS 1554.3.
   Welding consumables to be controlled hydrogen type: G49X to AS/NZS ISO 14341–B or T49X to AS/NZS ISO 17632–B.
9. WINGWALL DRAINAGE shall be provided behind wingwalls to prevent hydrostatic pressure being applied to the wingwall. A strip filter shall be used at each wingwall to drain out at the low end of the wingwall as shown.
10. PROJECT–SPECIFIC INFORMATION to be shown on the drawings:
    Exposure classification; Culvert chainage; Skew angle; Apron setout and extents; Headwall and wingwall extents (W1, W2, α, β); Requirements for fish passage.
11. DIMENSIONS are in millimetres.

ASSOCIATED DEPARTMENTAL DOCUMENTS:

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

REFERENCED DOCUMENTS:

Departmental Standard Drawings:

1043 Reinforcing Steel – Standard Bar Shapes
1044 Reinforcing Steel – Lap Lengths
1305 Pipe Culverts – Headwall and Apron for Pipe Diameter 375 to 675
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

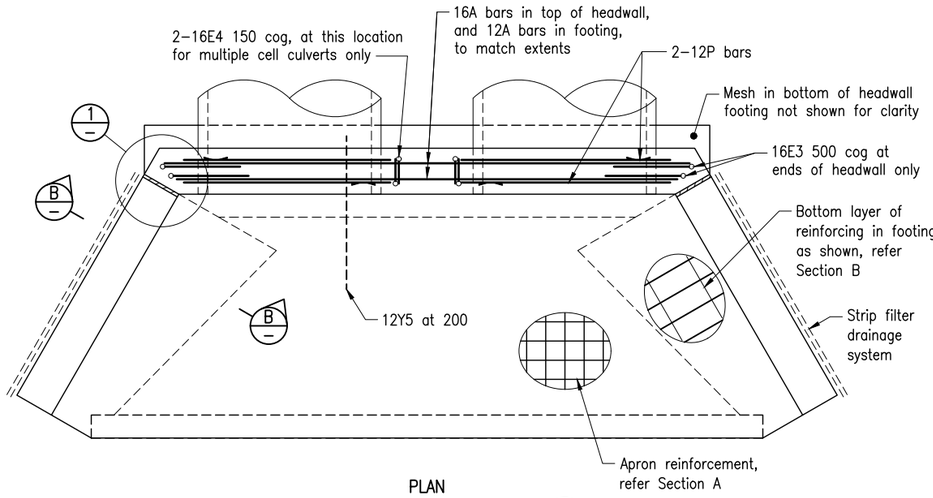
PIPE CULVERTS

WINGWALLS, HEADWALL AND APRON FOR PIPE DIAMETER 750 TO 2400 DRAWING 1 OF 2

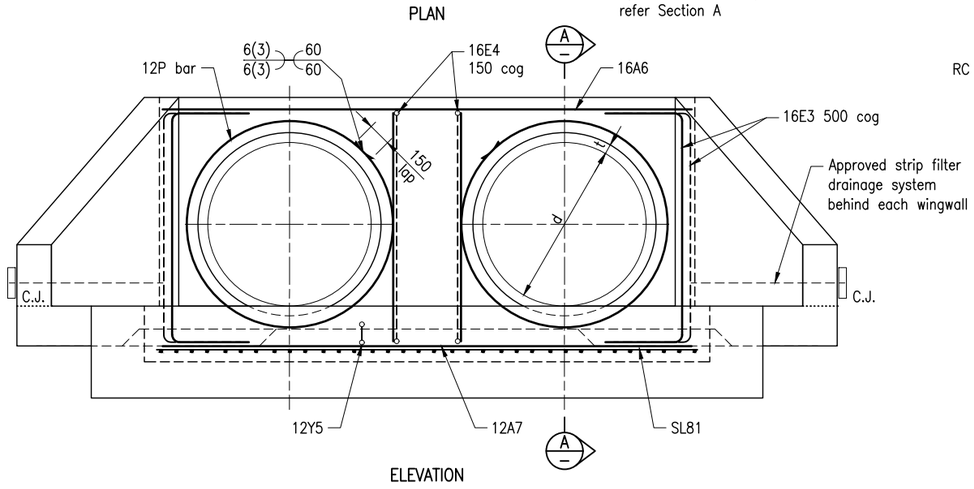
A3
Not to Scale

Standard Drawing No
1304
Date 7/2021

J K L M N 0

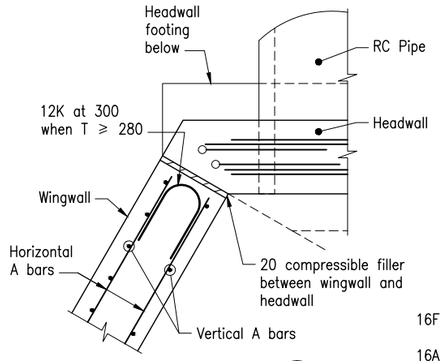


PLAN

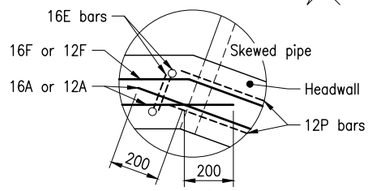


ELEVATION

HEADWALL REINFORCEMENT – SQUARE CULVERT



DETAIL 1 –,1



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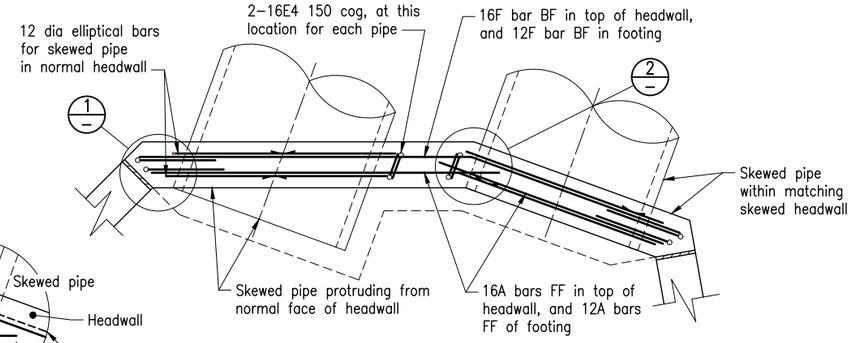
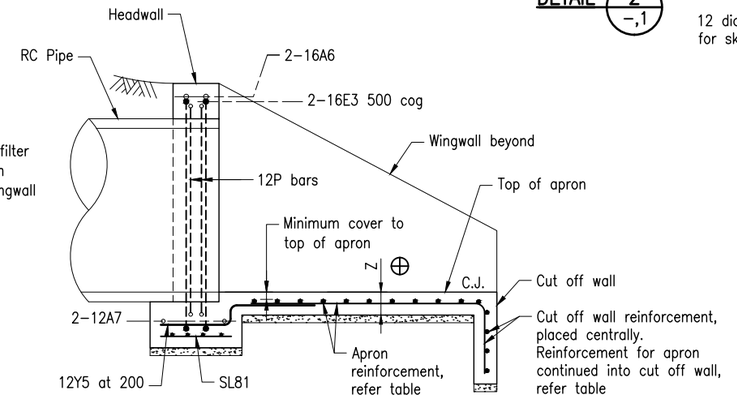


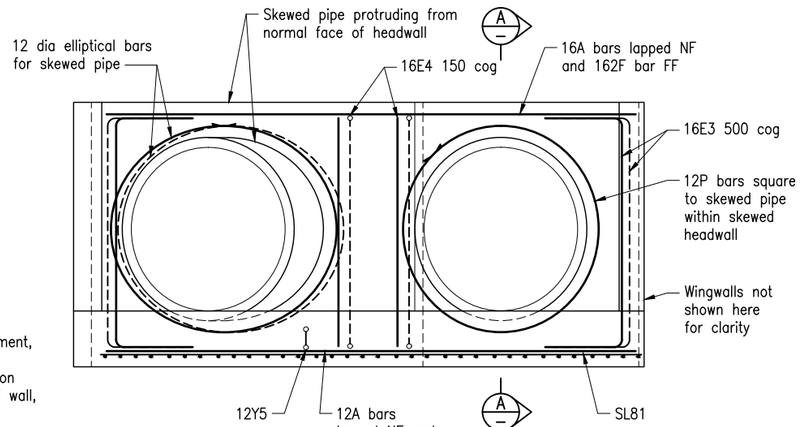
PART PLAN



HEADWALL REINFORCEMENT

APRON AND CUT OFF WALL REINFORCEMENT

SECTION A –,1



PART ELEVATION

HEADWALL REINFORCEMENT – SKEWED MULTIPLE CULVERT

WINGWALL DIMENSIONS AND MINIMUM REINFORCEMENT REQUIREMENTS

up to Hw †	T for Exposure classification			Vertical A bars BF		Vertical A bars FF		Horizontal A bars FF and BF						D1 bars	
	B2	C1	C2	Dia	Spacing	Dia	Spacing	B2		C1		C2		Dia	Dim A ◆
								Dia	Spacing	Dia	Spacing	Dia	Spacing		
1000	220	240	260	12	150	12	300	12	150	12	125	12	100	12	500
1500	220	240	260						150		125				
2000	260	270	280						125		100				
2500	330	340	350						100	16	150	16	125		
3000	380	390	400	16				16	150		125			16	700

† where Hw = Internal pipe diameter d + pipe thickness t + headwall thickness nominal 230 above pipes

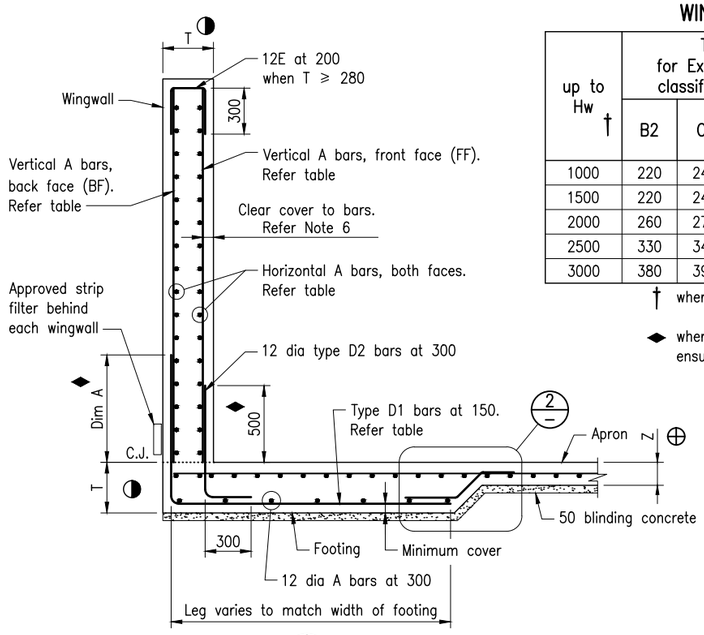
◆ where type D1 and D2 bars exceed the wall height, curtail the bars to match the wall height, ensuring cover requirements are met

APRON AND CUT OFF WALL THICKNESSES AND MINIMUM REINFORCEMENT REQUIREMENTS

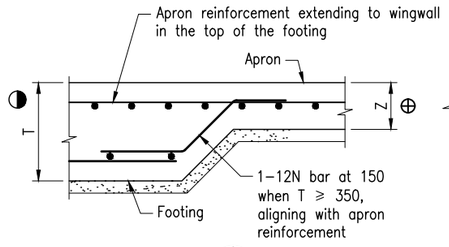
Exposure classification	Apron and Cut off wall #	
	Thickness Z ⊕	Reinforcement
B2	150	N12 at 150 both ways
C1	175	N12 at 150 both ways
C2	190	N12 at 125 both ways

⊕ where Z is a constant thickness for aprons and cut off walls.

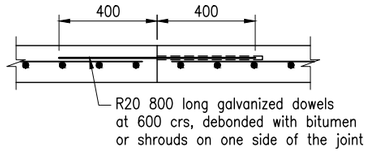
\# Apron minimum reinforcement for shrinkage and temperature effects is designed considering the full restraint condition to AS 5100. For the slab on ground condition, only the top half of the apron thickness is considered for calculation of this reinforcement.



SECTION B –,1 WINGWALL AND FOOTING REINFORCEMENT DETAILS

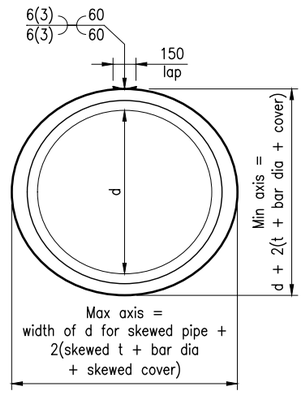


DETAIL 2 –



TYPICAL DOWELLED CONTRACTION JOINT

Installed with direction of flow, for aprons larger than 20m. Refer Note 4 on Drawing 1



12 DIA ELLIPTICAL BAR DETAIL

Department of Transport and Main Roads

PIPE CULVERTS

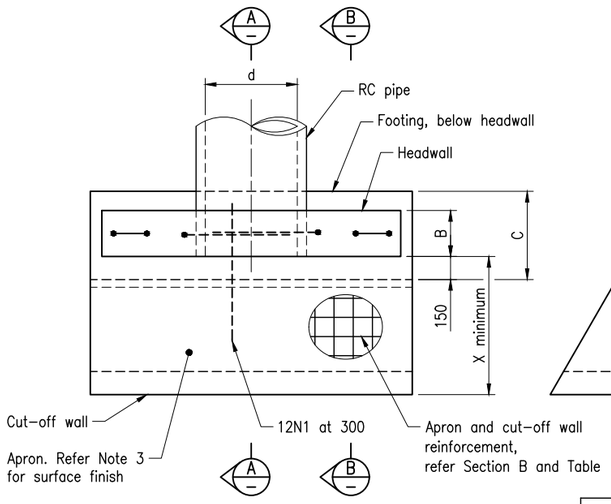
WINGWALLS, HEADWALL AND APRON FOR PIPE DIAMETER 750 TO 2400 DRAWING 2 OF 2

A3 | Not to Scale

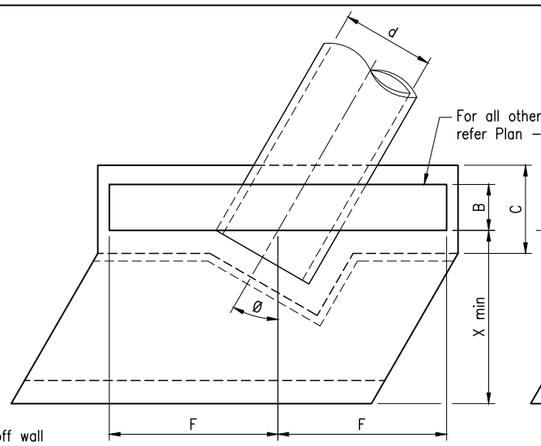
Standard Drawing No 1304

Date 7/2021

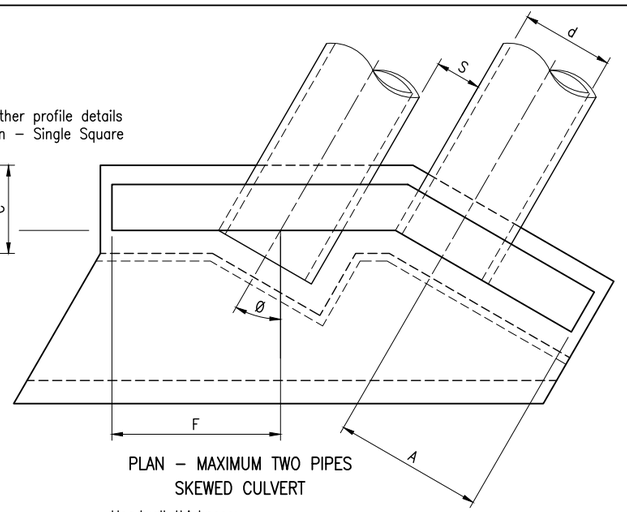
J | K | L | M | N | 0



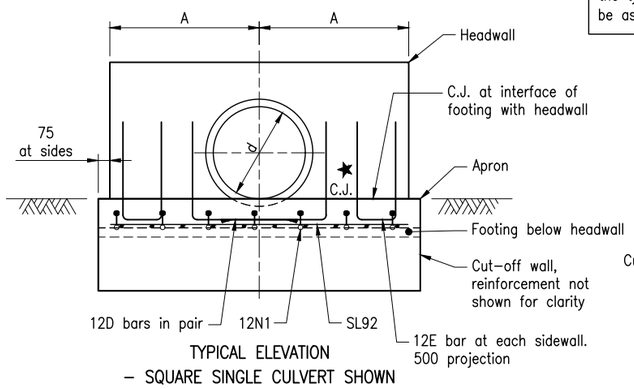
TYPICAL PLAN – SQUARE SINGLE CULVERT



PLAN – SKEWED SINGLE CULVERT

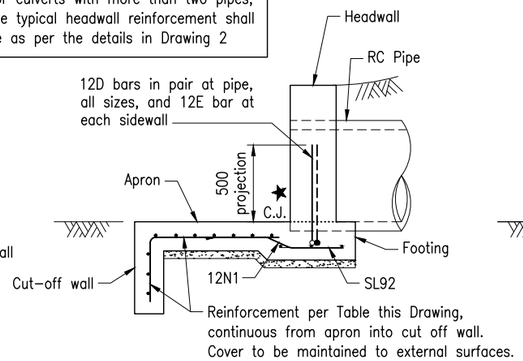


PLAN – MAXIMUM TWO PIPES SKEWED CULVERT

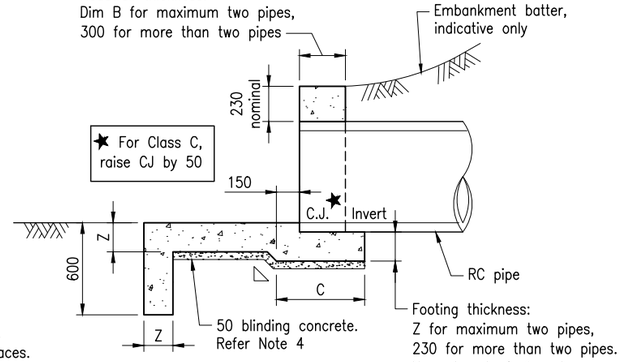


TYPICAL ELEVATION – SQUARE SINGLE CULVERT SHOWN
SKEWED AND OR MAXIMUM TWO PIPE ARRANGEMENTS SIMILAR

For culverts with more than two pipes, the typical headwall reinforcement shall be as per the details in Drawing 2

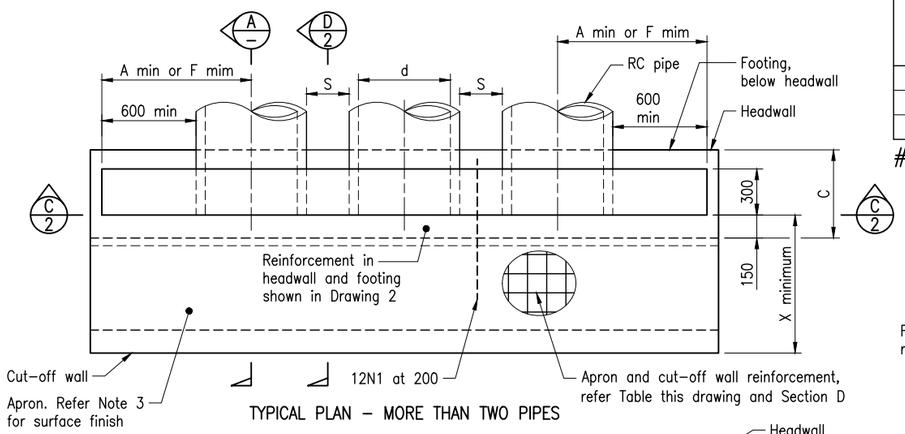


SECTION B – REINFORCEMENT DETAILS FOR MAXIMUM TWO PIPES

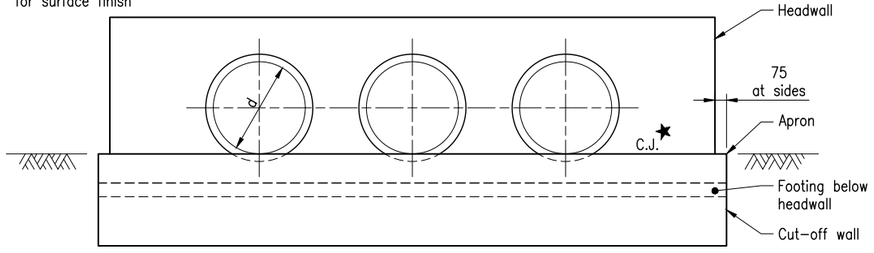


SECTION A – TYPICAL DETAILS ALL ARRANGEMENTS

FOR MAXIMUM TWO PIPES



TYPICAL PLAN – MORE THAN TWO PIPES



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

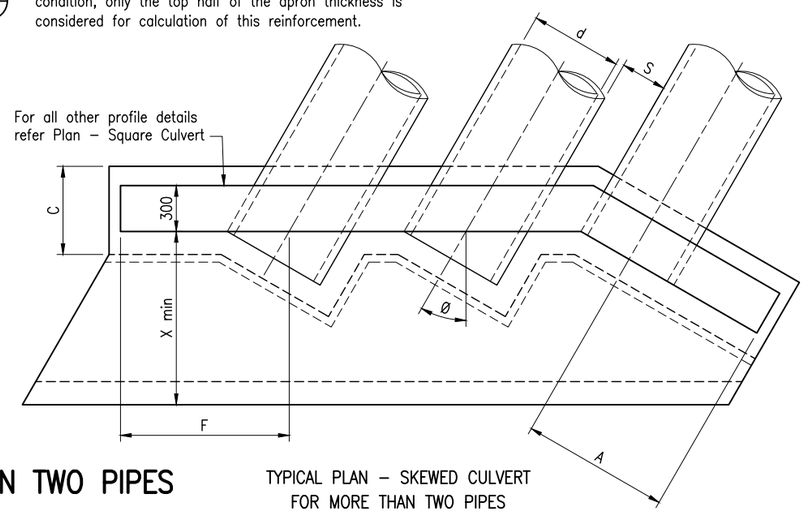
APRON AND CUT OFF WALL DETAILS

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

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:

1. The adaptability of the standard details shall be assessed by the project designer in respect of specific project geometric, appropriate foundation and scour conditions.
2. 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.
3. 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.
4. The details specific to the project shall be shown on the project specific drawings.

NOTES:

1. 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.
2. Maximum design pressure (E_d) under the culvert apron is 75 kPa.
3. 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.
4. 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.
5. 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.
6. 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.
7. PROJECT–SPECIFIC INFORMATION TO BE SHOWN ON THE DRAWINGS:
   Exposure classification; Culvert chainage; Skew angle Ø; Apron setout and extents; Headwall extents; Steel schedule; Requirements for fish passage.
8. 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

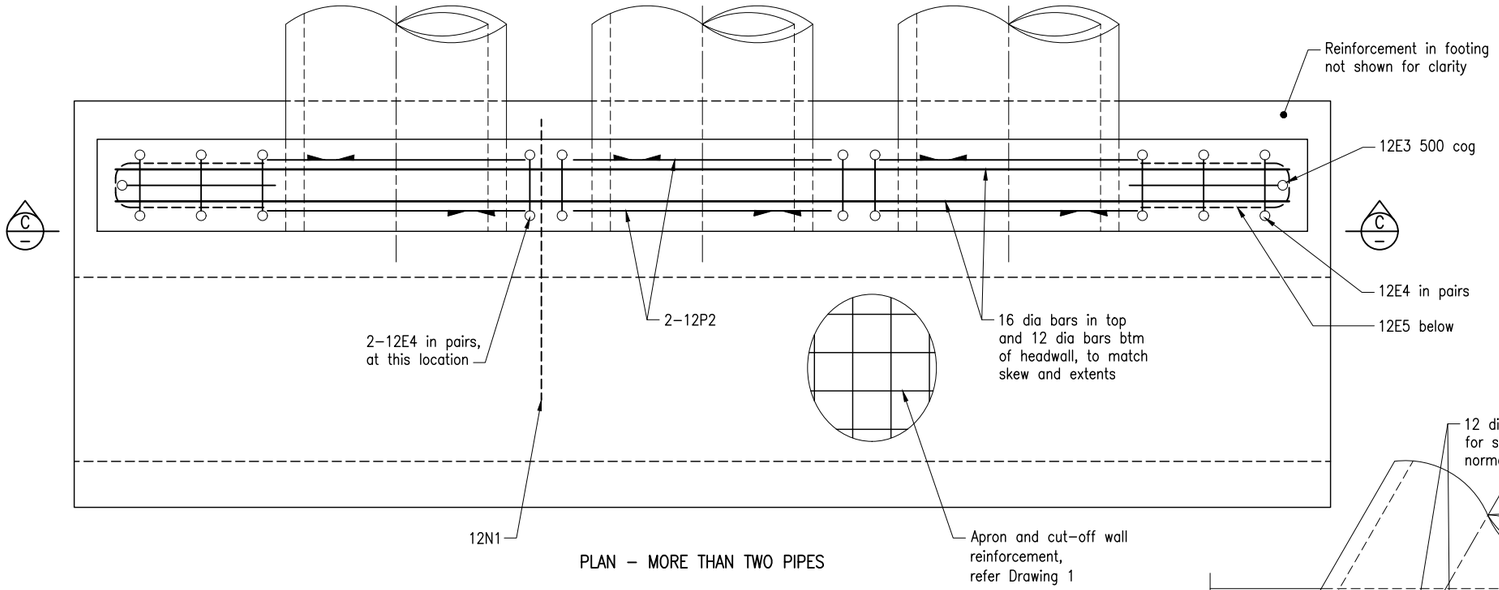
Queensland Government

A3 | Not to Scale

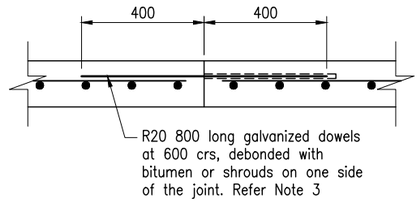
Standard Drawing No 1305

Date 3/2024

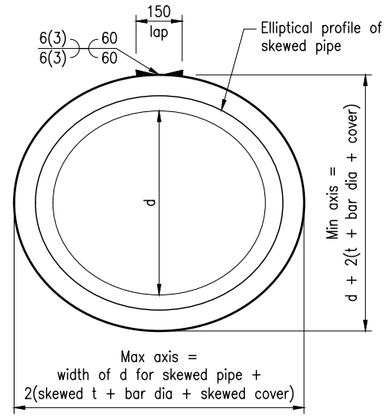
D | E | F | G | H



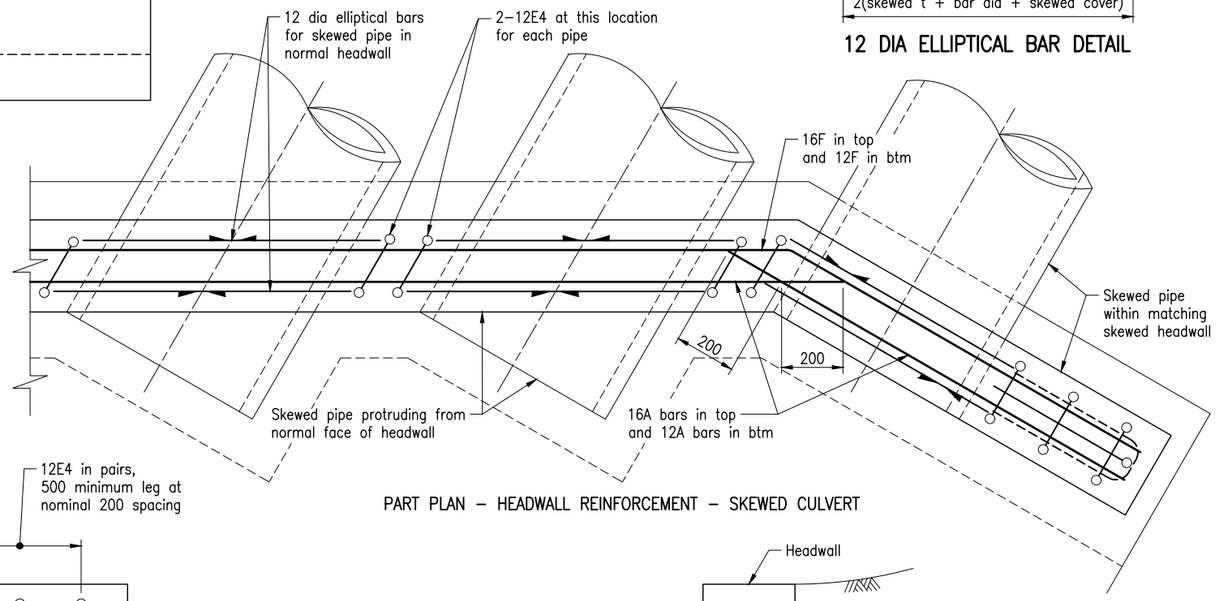
PLAN – MORE THAN TWO PIPES



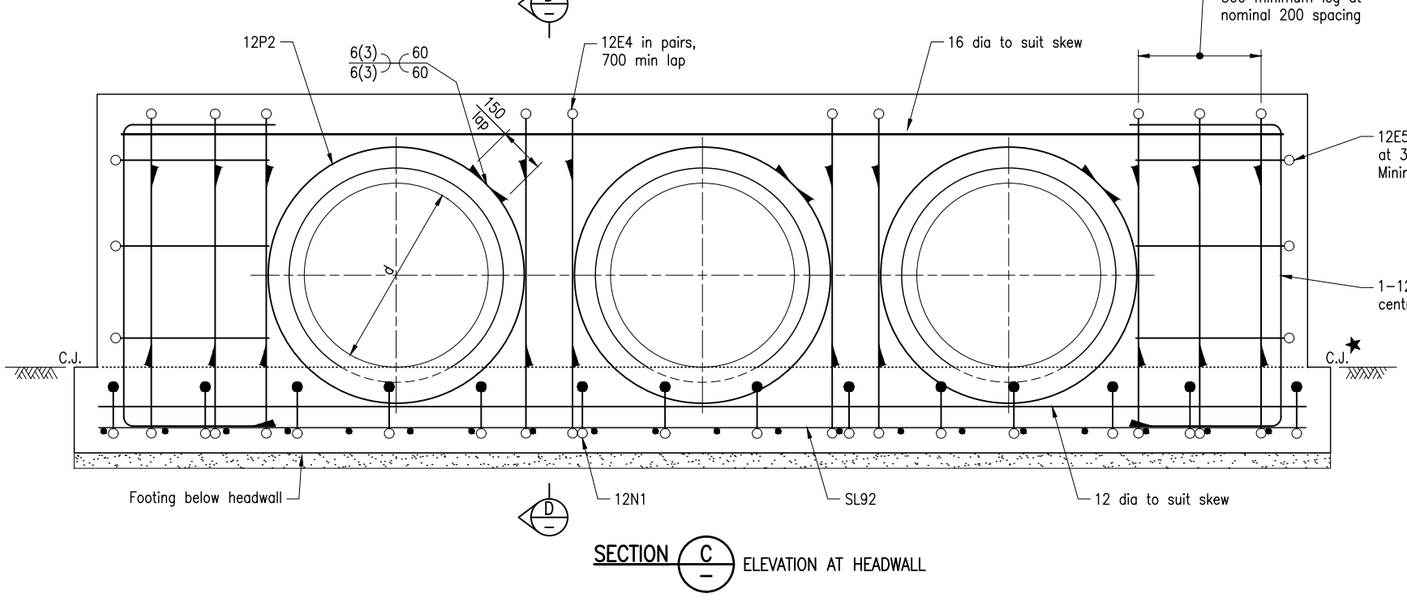
TYPICAL DOWELLED CONTRACTION JOINT



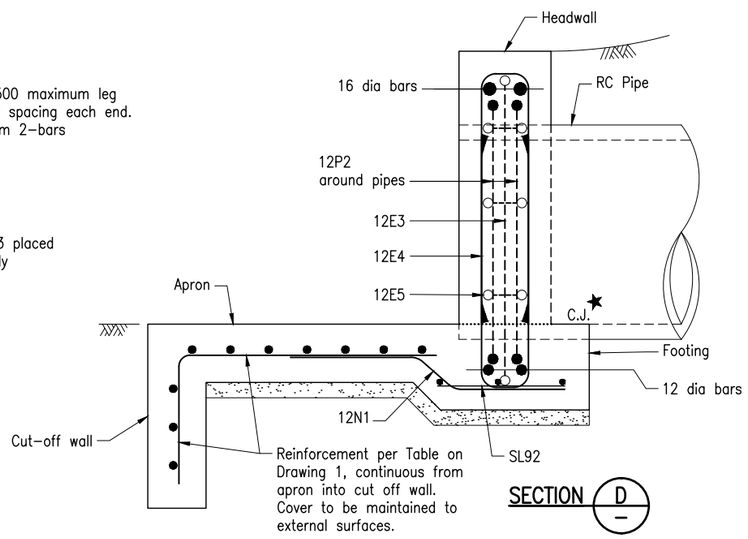
12 DIA ELLIPTICAL BAR DETAIL



PART PLAN – HEADWALL REINFORCEMENT – SKEWED CULVERT



SECTION C – ELEVATION AT HEADWALL



SECTION D

HEADWALL AND FOOTING REINFORCEMENT FOR MORE THAN TWO PIPES

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