

PART 1

CONCRETE DRAINAGE PRODUCTS (CP)

NOTE:

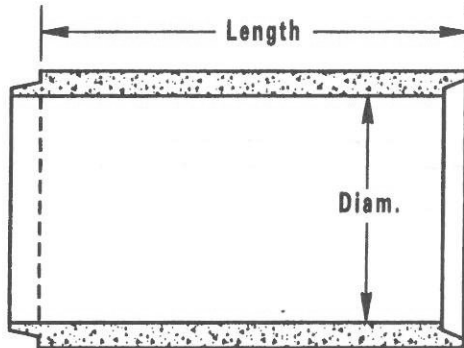
Design information for concrete pipe and box sections may be obtained from Division 1, Section 17 of the American Association of State Highway and Transportation Officials (AASHTO) bridge specifications (*Standard Specifications for Highway Bridges*). Additional information on concrete pipe and box sections may be obtained from the American Concrete Pipe Association (*Concrete Pipe Handbook* and *Concrete Pipe Design Manual*).

SECTION CPS—SHAPES

Circular Concrete Pipe	CPS-1-96	11
Arch Concrete Pipe	CPS-2-96	12
Elliptical Concrete Pipe	CPS-3-96	13
Precast Concrete Box Sections	CPS-4-96	14



BELL & SPIGOT



TONGUE & GROOVE

SPECIFICATIONS

Non-Reinforced Concrete Pipe:
 Plain - AASHTO M 86M (ASTM C 14M) (ASTM C 985)
 Porous - AASHTO M 176M (ASTM C 654M)
 Perforated - AASHTO M 175M (ASTM C 444M)
 Drain Tile - AASHTO M 178M (ASTM C 412M)
Reinforced Concrete Pipe:
 AASHTO M 170M (ASTM C 76)*
 AASHTO M 242M (ASTM C 655M) for D-Load Pipe
 ASTM C 361 for Low-Head Pressure Pipe

Joints: See CPJ-2-96

*except that the use of elliptical reinforcement will not be permitted.

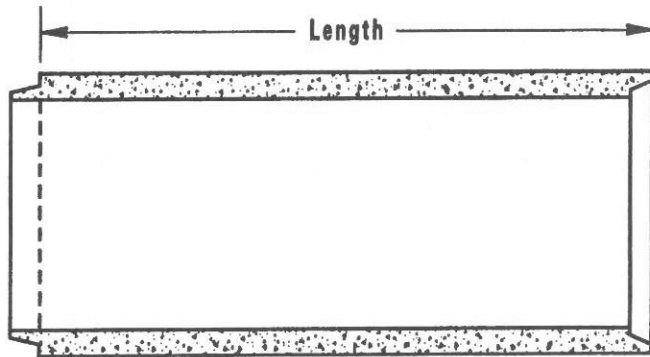
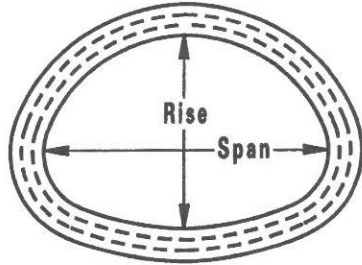
USE

Non-Reinforced and Reinforced Concrete Pipe for Culverts, Storm Drains, Sewers and Underdrains.

CIRCULAR CONCRETE PIPE

AASHTO-AGC-ARTBA
 TF-13 DRAWING

CPS-1-96



SPECIFICATIONS

AASHTO M 206M (ASTM C 506M)

USES

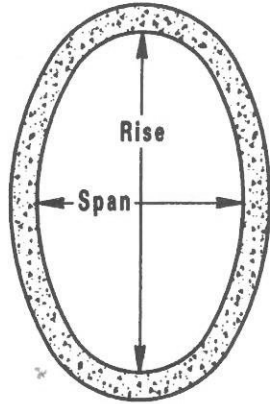
Reinforced Concrete Arch Pipe for Culverts, Storm Drains and Sewers, where clearance above the pipe is critical.

12

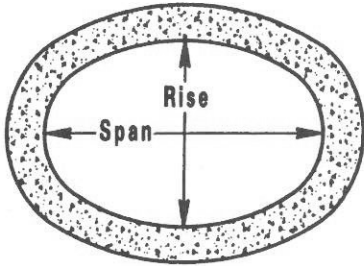
ARCH CONCRETE PIPE

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

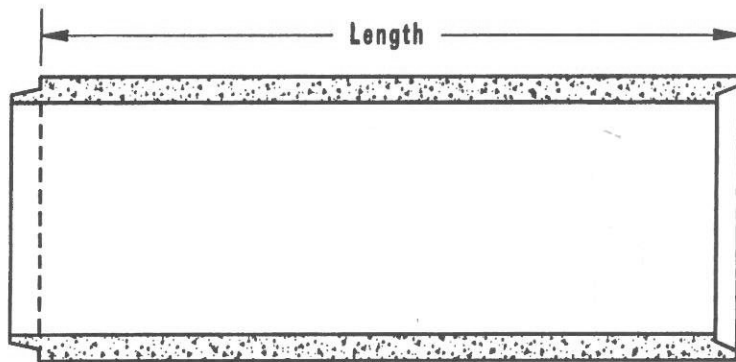
CPS-2-96



VERTICAL
ELLIPTICAL



HORIZONTAL
ELLIPTICAL



SPECIFICATIONS

AASHTO M 207M (ASTM C 507M)

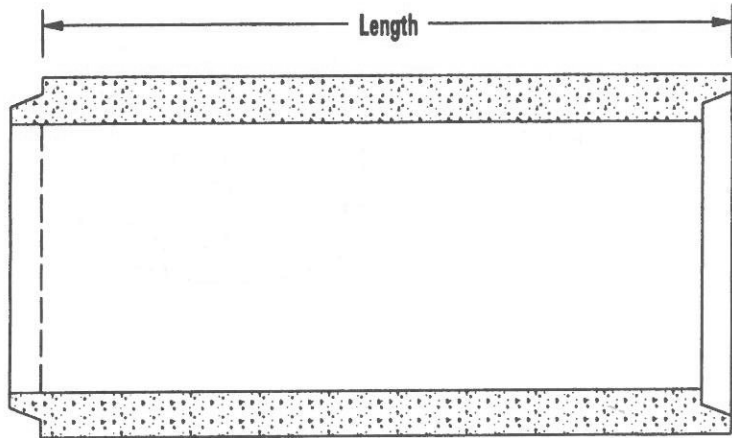
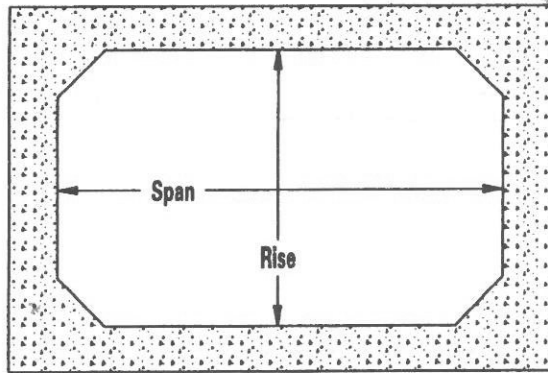
USES

Reinforced Concrete Elliptical Pipe for Culverts, Storm Drains and Sewers.

ELLIPTICAL CONCRETE PIPE

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

CPS-3-96



SPECIFICATIONS

AASHTO M 259M (ASTM C 789M)

For fill heights less than 610 mm use AASHTO M 273M (ASTM C 850M)

USES

Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers.

14

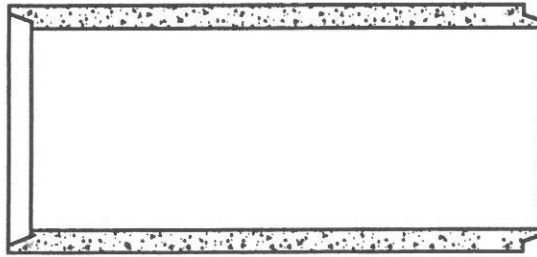
PRECAST CONCRETE BOX SECTIONS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPS-4-96

SECTION CPJ—JOINTING MATERIALS

Types of Joints for Concrete Pipe	CPJ-1-96	16
Jointing Materials for Concrete Pipe	CPJ-2-96	17



TONGUE & GROOVE



BELL & SPIGOT



BUTT-END (Drain Tile)

SPECIFICATIONS

Specifications are not available on dimensions of the various types of joints. Manufacturers develop their own dimensions and can supply this data, if necessary.

USES

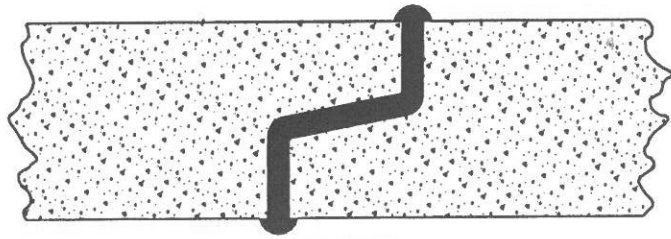
Tongue & Groove Joints provide smooth straight line pipe which creates fewer problems in excavation, laying or jacking.

Bell & Spigot joints require slightly more excavation and can be jacked. Butt-end joints (Tile) are used for underdrains where infiltration is desired.

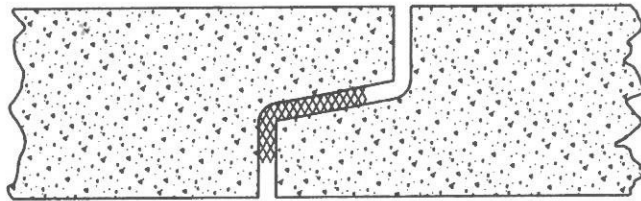
TYPES OF JOINTS FOR CONCRETE PIPE

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

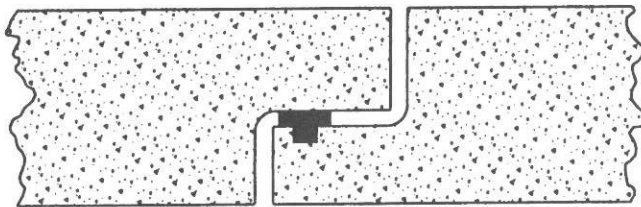
CPJ-1-96



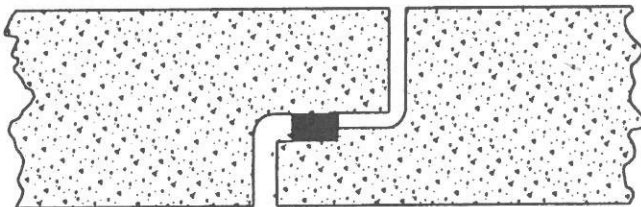
MASTIC



RUBBER GASKET*



O-RING GASKET



SINGLE OFFSET GASKET

SPECIFICATIONS

Mastic: AASHTO M 198 ASTM C 990
 Rubber Gasket: AASHTO M 315

ASTM C 443
 ASTM C 361

USE

For sealing of joints in Concrete Pipe Sewers and Culverts to prevent infiltration, exfiltration or provide low-head pressure sealing.

JOINTING MATERIALS FOR CONCRETE PIPE

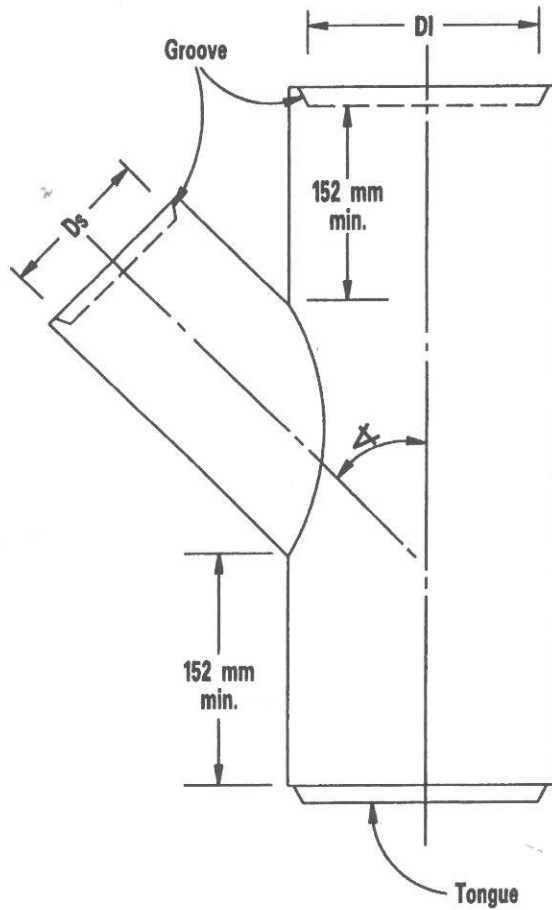
AASHTO-AGC-ARTBA
 TF-13 DRAWING

CPJ-2-96

* O-RING AND SINGLE OFFSET JOINTS USE RUBBER GASKETS

SECTION CPF—STANDARD FITTINGS

Concrete Pipe "Y" Fitting	CPF-1-96	19
Concrete Pipe Tee Fitting	CPF-2-96	20
Concrete Radius Pipe	CPF-3-96	21
Concrete Pipe Bends	CPF-4-96	22



SPECIFICATIONS

"Y" Fittings to be produced from concrete pipe meeting the specifications for the type & class of pipe required. Consult a Producer for details.

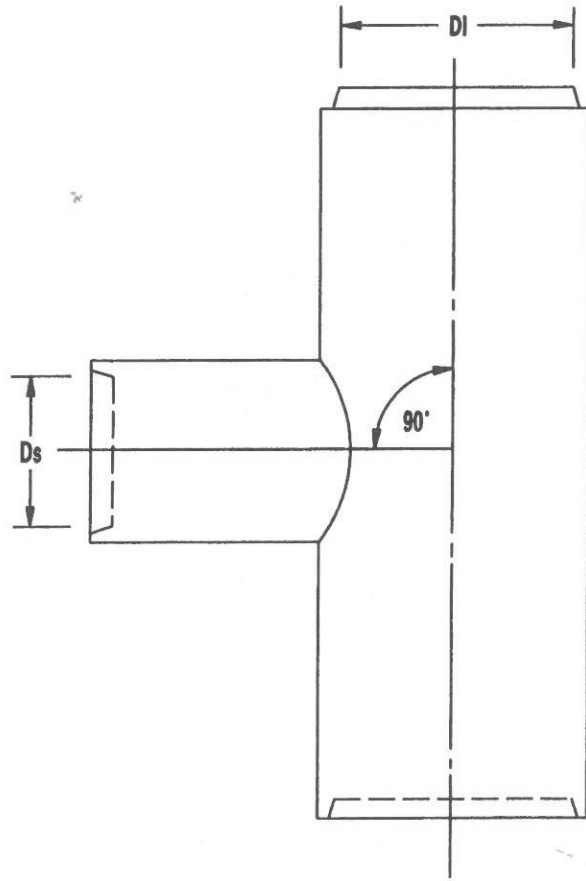
USES

To provide a prefabricated intersection of two lines of pipe.

CONCRETE PIPE "Y" FITTING

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPF-1-96



SPECIFICATIONS

Tee fittings are to be produced from concrete pipe meeting the specifications for the type & class of pipe required. Consult a Producer for details.

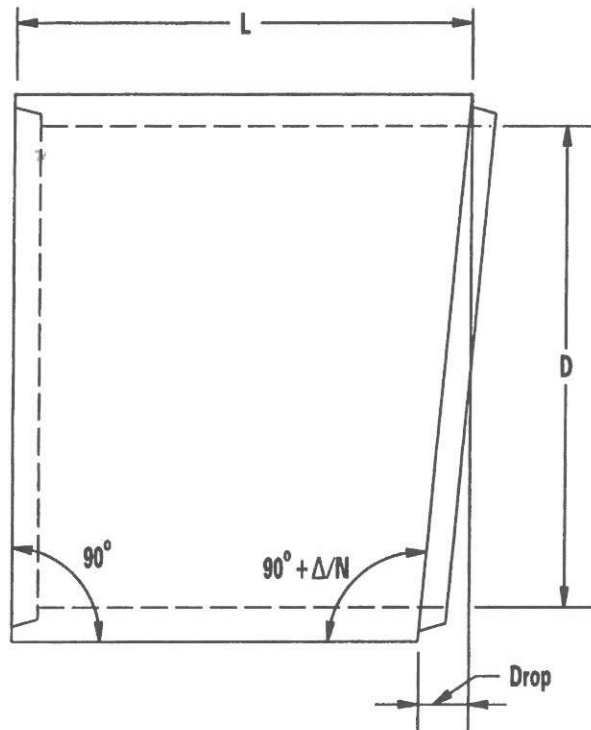
USES

To provide a prefabricated right angle intersection of two lines of pipe.

CONCRETE PIPE TEE FITTING

**AASHTO-AGC-ARTBA
TF-13 DRAWING**

CPF-2-96

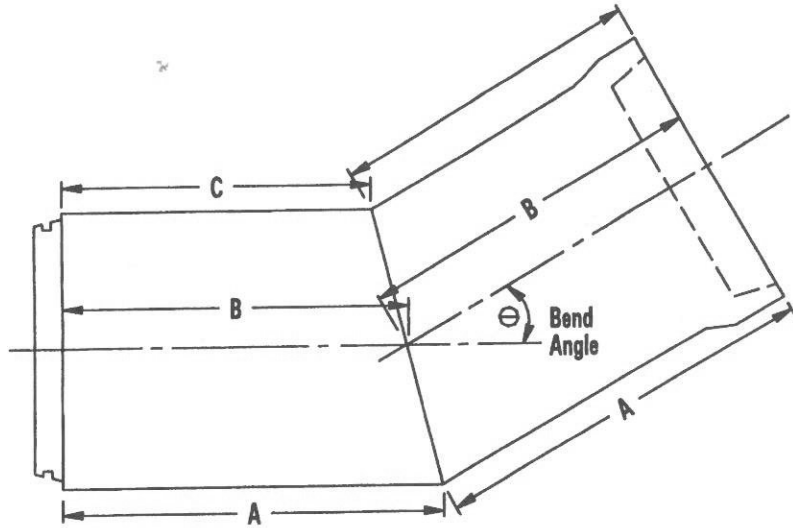
**SPECIFICATIONS**

Radius pipe shall be produced in accordance with the applicable specifications for circular pipe. Consult a producer for details.

USES

For sharply curving lines of pipe which cannot be accommodated by the deflected straight pipe method or by other special precast fittings.

CONCRETE RADIUS PIPE**AASHTO-AGC-ARTBA
TF-13 DRAWING****CPF-3-96**



SPECIFICATIONS

Bends to be produced from concrete pipe meeting the Specifications for the type & Class of pipe required.

ASTM C-76M ("O"-Ring Gasket, Bell and Spigot shown)

USE

For sharply curving lines of pipe or for redirection of line pipe.

Bends normally produced with bend angles of 15°, 30°, 45°, & 90°.

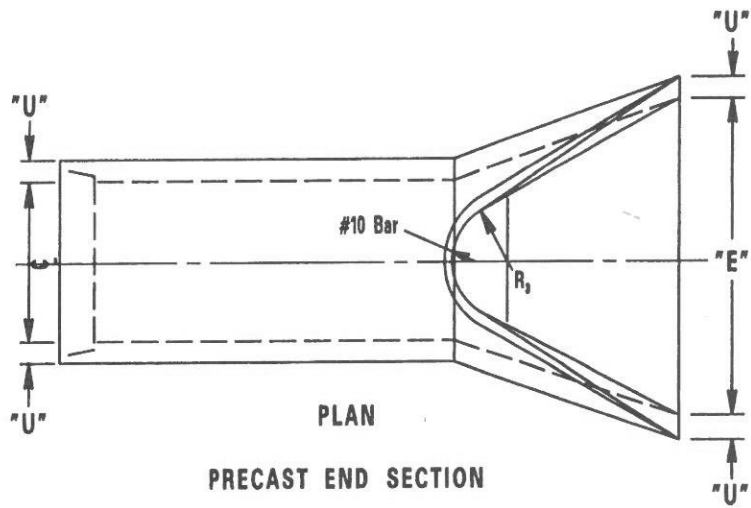
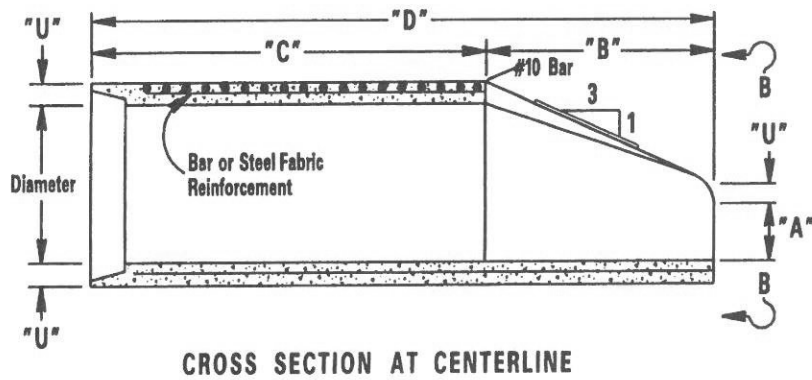
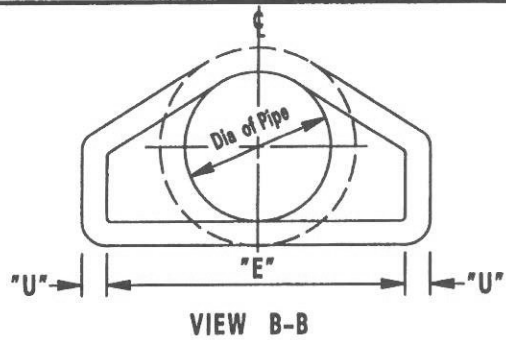
CONCRETE PIPE BENDS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPF-4-96

SECTION CPE—END TREATMENTS

Precast Concrete End Section	CPE-1-96	24
Precast Concrete End Section	CPE-2-96	25
Precast Concrete End Section	CPE-3-96	26
Precast Concrete Flared Inlet	CPE-4-96	27
Concrete Pipe Skew Joints	CPE-5-96	28
Concrete Pipe 1:6 Sloped End Section	CPE-6-96	29
Precast Concrete Pipe Sloped End Section Grate	CPE-7-96	30
Concrete Pipe Sloped End Sections	CPE-8-96	31



APPLICABLE SPECIFICATIONS

Precast End Sections shall be of the same quality as the pipe with which they are to be used.

Precast reinforced concrete flared end sections shall be constructed in accordance with the applicable portions of AASHTO M 170M Class III, wall B reinforced concrete pipe.

USES

Precast End Sections serve as a Prefabricated Headwall for Culverts and Storm Sewers

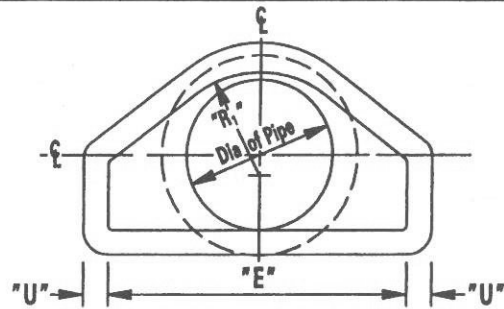
TABLE OF DIMENSIONS (millimeters)

PIPE DIA.	"U"	"A"	"B"	"C"	"D"	"E"	"R ₃ "
300	50	100	600	1250	1850	600	100
375	57	150	675	1180	1855	750	150
450	63	225	675	1180	1855	900	188
525	69	225	900	955	1855	1050	125
600	75	241	1077	790	1867	1200	200
675	82	267	1224	643	1867	1350	225
750	88	300	1350	523	1873	1500	200
825	94	343	1446	954	2400	1650	225
900	100	381	1557	843	2400	1800	275
1050	113	533	1551	849	2400	1950	275
1200	125	600	1800	600	2400	2100	300

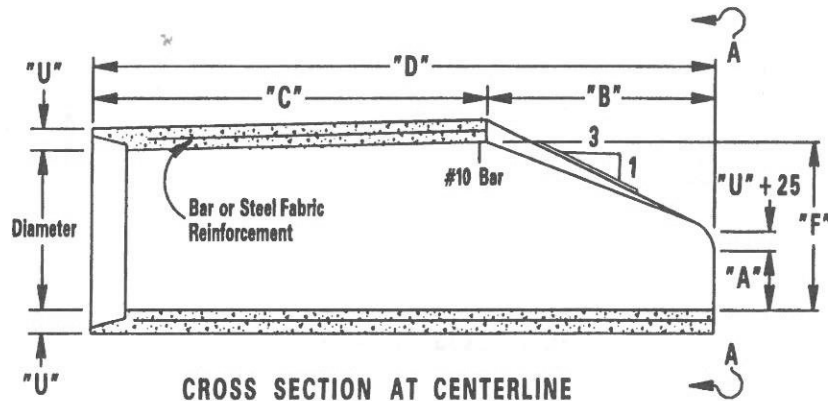
PRECAST CONCRETE END SECTION

AASHTO-AGC-ARTBA
TF-13 DRAWING

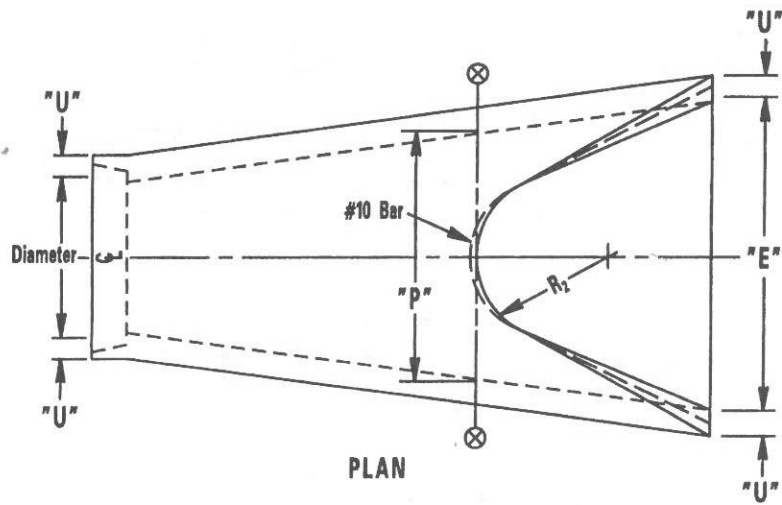
CPE-1-96



VIEW A-A



CROSS SECTION AT CENTERLINE



PLAN
PRECAST END SECTION

APPLICABLE SPECIFICATIONS

Precast End Sections shall be of the same quality as the pipe with which they are to be used.

Precast reinforced concrete flared end sections shall be constructed in accordance with the applicable portions of AASHTO M 170M Class III, wall B reinforced concrete pipe.

USES

Precast End Sections serve as a Prefabricated Headwall for Culverts and Storm Sewers

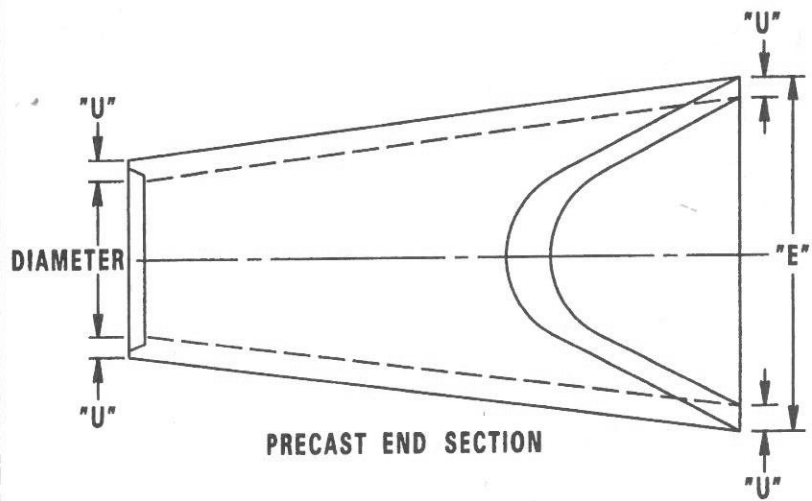
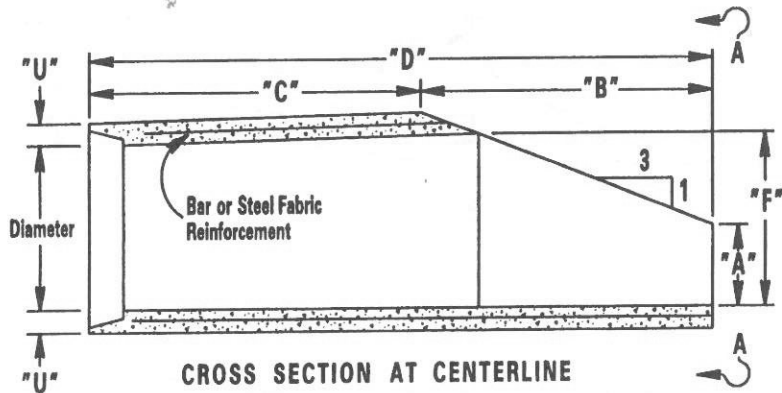
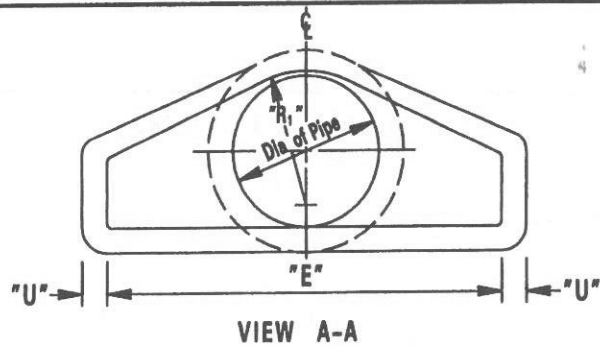
TABLE OF DIMENSIONS (millimeters)

PIPE DIA.	"U"	"A"	"B"	"C"	"D"	"E"	"F"	AT X-X ONLY		
								"P"	"R ₁ "	"R ₂ "
300	50	100	600	1250	1850	600	325	256	257	225
375	57	150	675	1180	1855	750	400	589	318	275
450	63	225	675	1180	1855	900	475	737	394	300
525	69	225	900	955	1855	1050	550	797	419	325
600	75	241	1077	790	1867	1200	625	843	427	350
675	82	267	1224	643	1867	1350	700	965	471	383
750	88	300	1350	523	1873	1500	775	940	470	375
825	94	343	1446	954	2400	1650	850	1148	603	438
900	100	381	1557	843	2400	1800	925	1156	589	500
1050	113	533	1551	849	2400	1950	1075	1359	699	550
1200	125	600	1800	600	2400	2100	1225	1441	724	550

PRECAST CONCRETE END SECTION

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPE-2-96



APPLICABLE SPECIFICATIONS

Precast End Sections shall be of the same quality as the pipe with which they are to be used.

Precast reinforced concrete flared end sections shall be constructed in accordance with the applicable portions of AASHTO M 170M Class III, wall B reinforced concrete pipe.

BASIS OF PURCHASE

Pipe Diameter
Class or Quality
Material Requirements

USES

Precast End Sections serve as a Prefabricated Headwall for Culverts and Storm Sewers.
Optional to CPE-1 and CPE-2.

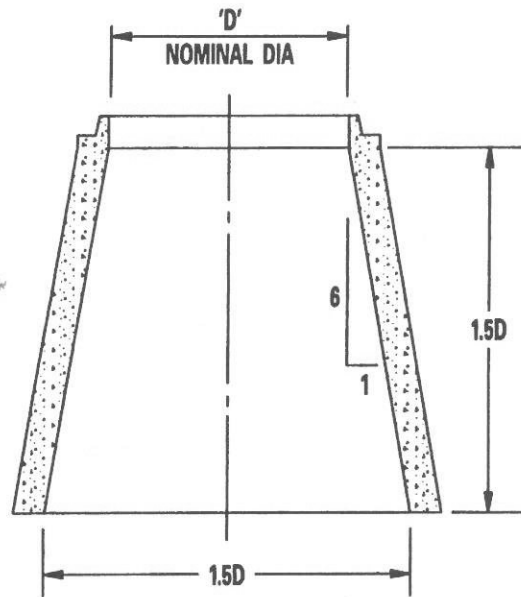
TABLE OF DIMENSIONS (millimeters)

PIPE DIA.	"U"	"A"	"B"	"C"	"D"	"E"	"F"	"R ₁ "
300	50	175	600	1250	1850	600	325	257
375	57	231	678	1177	1855	750	400	318
450	63	312	681	1174	1855	900	475	394
525	69	319	903	952	1855	1050	550	419
600	75	338	1086	781	1867	1200	625	427
675	82	369	1242	625	1867	1350	700	471
750	88	412	1356	517	1873	1500	775	470
825	94	456	1467	933	2400	1650	850	603
900	100	500	1575	825	2400	1800	925	589
1050	113	662	1581	819	2400	1950	1075	699
1200	125	750	1800	600	2400	2100	1225	724

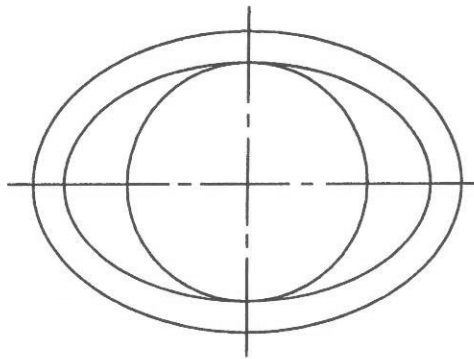
PRECAST CONCRETE END SECTION

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPE-3-96



PLAN VIEW



END VIEW

APPLICABLE SPECIFICATIONS

Flared Inlet shall meet the applicable Sections of AASHTO M-207M (ASTM C 507M) for materials, reinforcement and concrete strength.

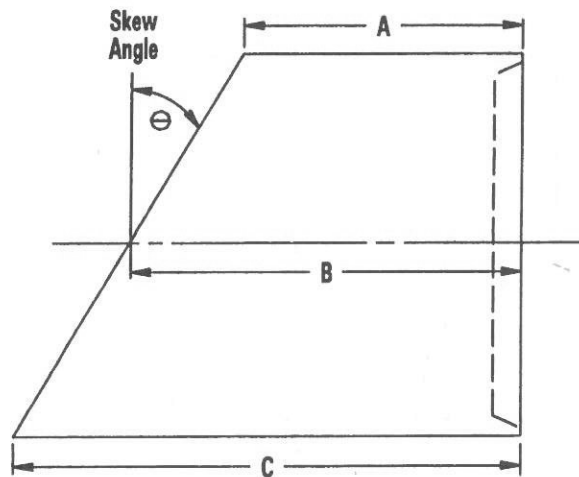
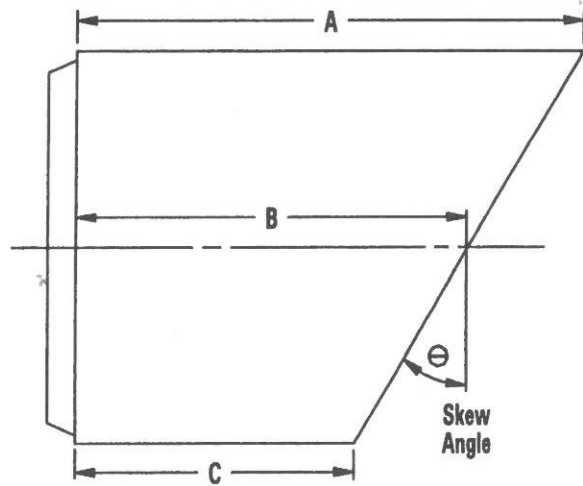
USES

Flared inlets are used on the upstream end of culverts or sewers to improve the hydraulic operation of the facility entrance.

PRECAST CONCRETE FLARED INLET

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPE-4-96



APPLICABLE SPECIFICATIONS

Skews to be produced from concrete pipe meeting the specifications for the type & Class of pipe required. ASTM C 76M (Tongue & Groove shown)

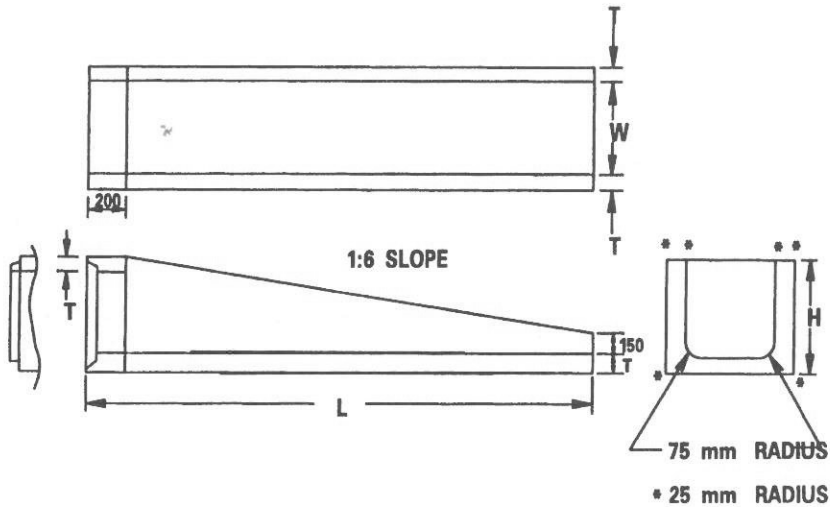
USE

To provide end finish to a line of pipe conforming to embankment contour.

CONCRETE PIPE SKEW JOINTS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPE-5-96



Pipe Dia.	T	W	H	L
375	75	375	525	1950
450	75	450	600	2400
600	75	600	750	3300
750	100	750	950	4350
900	100	900	1100	5250
1050	100	1050	1250	6150
1200	125	1200	1450	7200

Not to Scale

NOTE: ALL DIMENSIONS SHOWN ARE IN MILLIMETERS

APPLICABLE SPECIFICATIONS

Precast reinforced concrete sloped end sections shall be in accordance with the applicable portions of AASHTO M 170M, with concrete strength and reinforcement equivalent to class II pipe except that an additional #13 bar shall be added in the top and bottom of each side.

USES

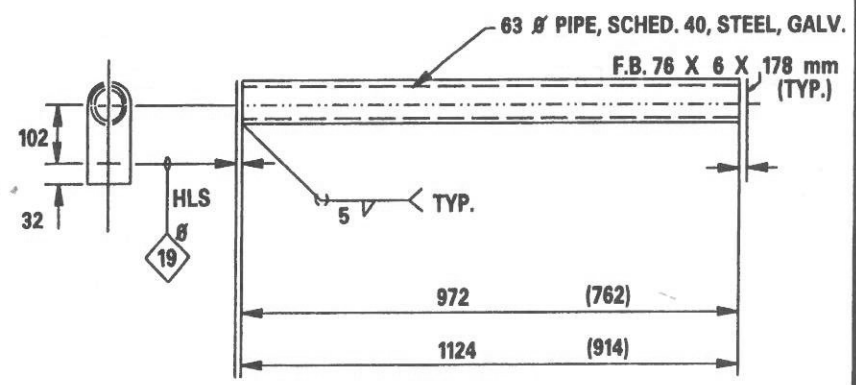
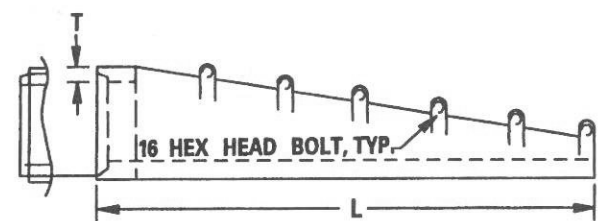
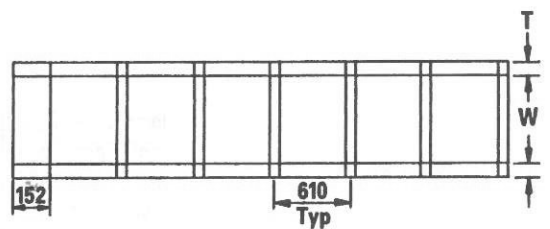
To provide inlets and outlets where a 1V:6H slope safety end treatment is required on culverts and storm sewers.

PRECAST CONCRETE 1:6 SLOPED END SECTION

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPE-6-96

30



Note: All dimensions are in millimeters.

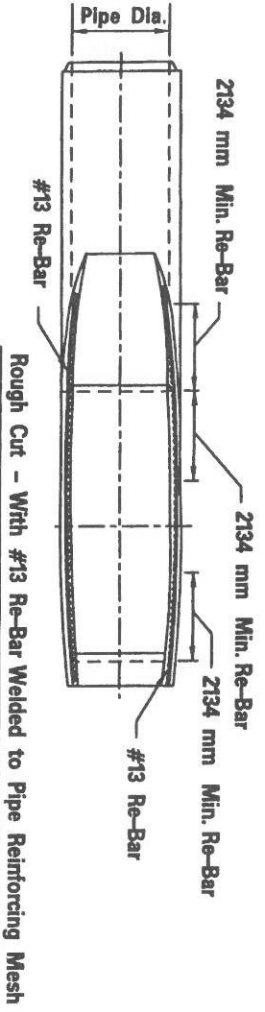
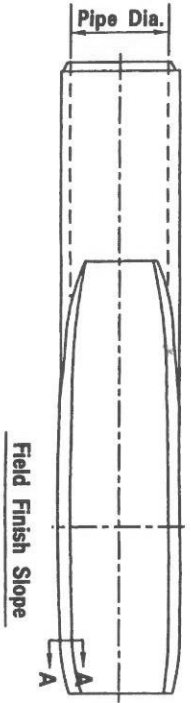
APPLICABLE SPECIFICATIONS

Note:
 Sloped ends are typically used to reduce hazard of culvert end to errant vehicles. Grates or other devices may be required, especially on ≤ 750 mm diameter size of parallel drains and ≤ 1050 mm diameter size of cross drains. On parallel drains the grates are transverse, and on cross drains they are longitudinal.

PRECAST CONCRETE SLOPED END SECTION GRATE

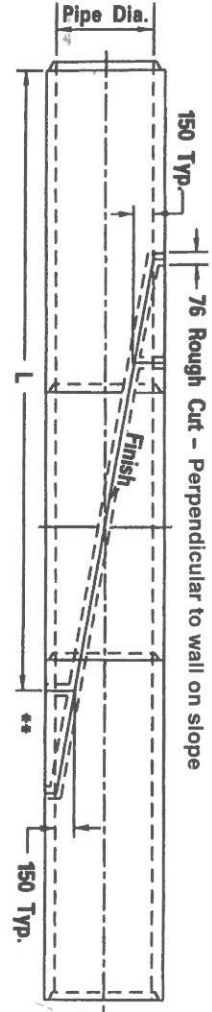
AASHTO-AGC-ARTBA
 TF-13 DRAWING

CPE-7-96

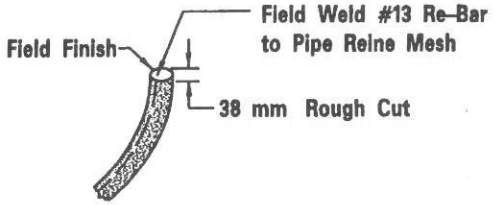


Rough Cut As Shown - Cut Reinforcing in field Lay Pipe - Weld on #13 Bar - Finish As Required.

Typical Rough Cut Layout - 1:6 Slope Pipe to be Shipped As Individual Joints.



Section A-A



- ** Other slopes and some pipe diameters may require different number of pipe segments.
- * As an alternate to finish shown, cast cut edge into slope apron.

APPLICABLE SPECIFICATIONS

Sloped End Sections to be produced from Concrete Pipe meeting the specifications for the type and class of pipe required.

ASTM C 76M (Tongue & Groove shown)

NOTE: Sloped ends are typically used to reduce hazard of culvert end to errant vehicles. Grates or other devices may also be required to effect this end.

USES

To provide end finish to a line of pipe conforming to embankment contour. Various slopes may be specified.

Note: All dimensions are in millimeters.

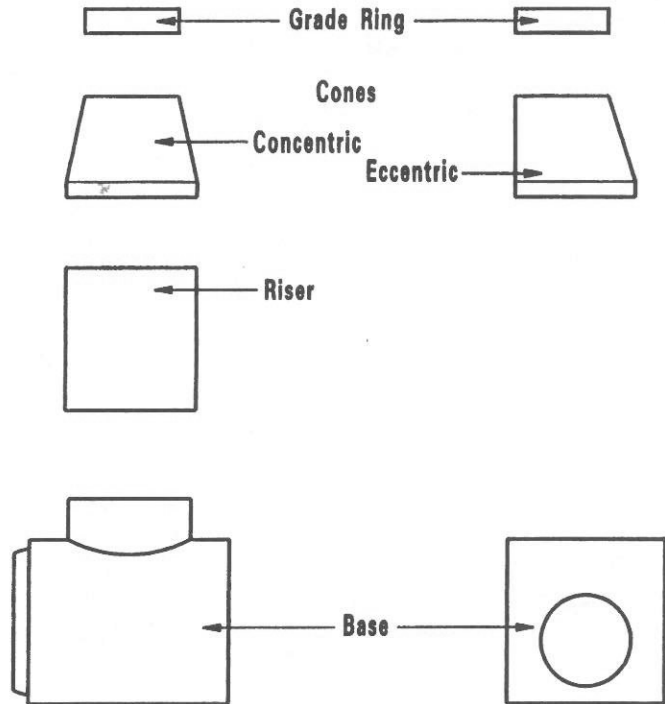
CONCRETE PIPE SLOPED END SECTIONS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPE-8-96

SECTION CPA—APPURTENANCES

Precast Concrete Manhole Sections	CPA-1-96	33
3-m 2-Piece Precast Curb Inlet	CPA-2-96	34
1.5-m 2-Piece Precast Curb Inlet	CPA-3-96	35



TYPICAL CONFIGURATION
OF
PRECAST MANHOLE SECTIONS

APPLICABLE SPECIFICATIONS

AASHTO M 199M (ASTM C 478M) except that the minimum wall thickness shall be 76 mm.

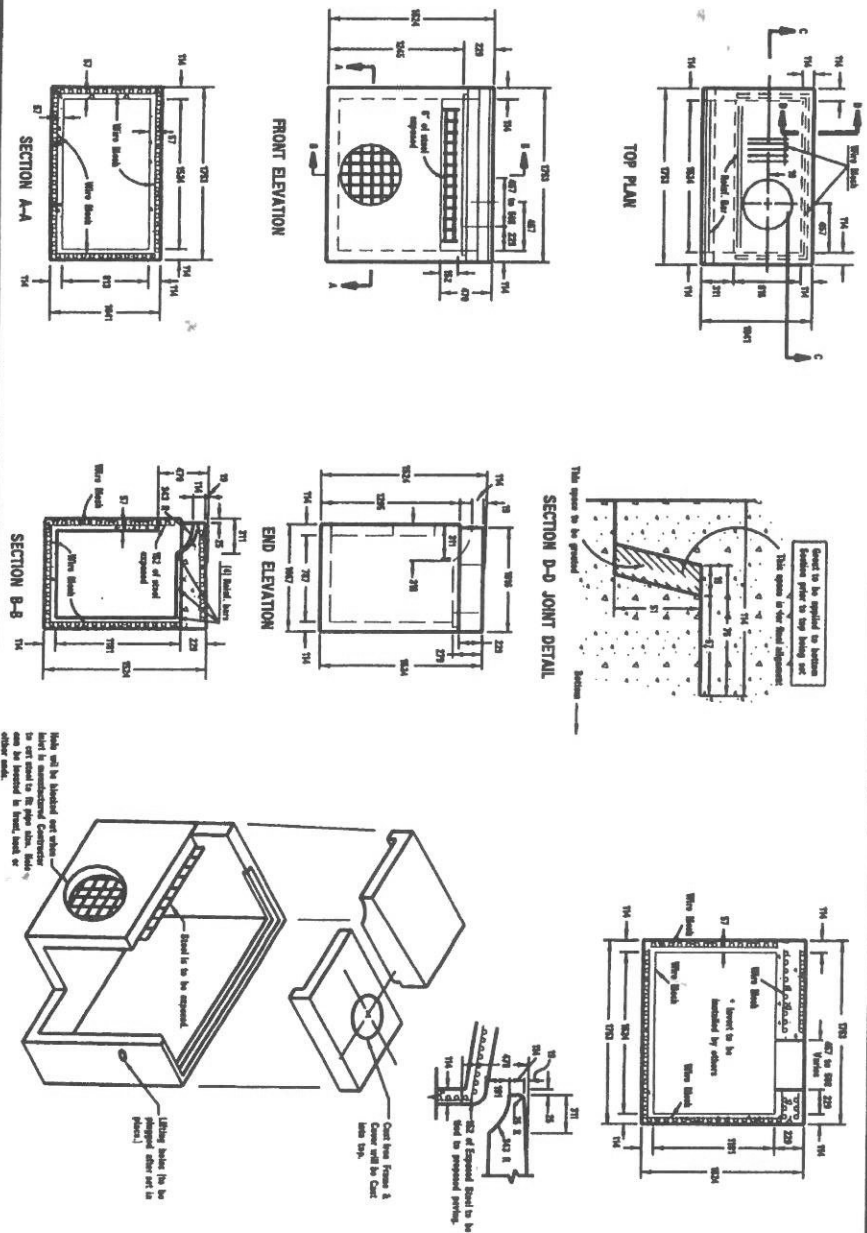
USE

Precast Manholes provide a vertical access to drainage structures and allow for intersection and junction.

PRECAST CONCRETE MANHOLE SECTIONS

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPA-1-96



Note: All dimensions shown are in millimeters.

APPLICABLE SPECIFICATIONS

AASHTO Standard Specifications for Highway Bridges. Section 8

USE

Provide an entry for drainage water from a curbed gutter to a storm drain or culvert.

1.5-m 2-PIECE PRECAST CURB INLET

AASHTO-AGC-ARTBA
TF-13 DRAWING

CPA-3-96