

APPENDICES

American Society for Testing and Materials (ASTM)	
A 139	Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
A 463	Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
A 742	Specification for Steel Sheet, Metallic-Coated and Polymer Precoated for Corrugated Steel Pipe
A 760	Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
A 761	Specification for Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches and Arches
A 762	Specification for Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
A 798	Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
A 849	Specification for Post Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
A 924	Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
B 744	Specification for Aluminum Alloy Sheet for Corrugated Aluminum Pipe
B 745	Specification for Corrugated Aluminum Pipe for Sewers and Drains
B 746	Specification for Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe Arches, and Arches
C 14	Specification for Concrete Sewer, Storm Drain, and Culvert Pipe
C 76	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C 443	Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
C 655	Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
C 700	Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
C 822	Terminology Relating to Concrete Pipe and Related Products
C 990	Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
D 92	Test Method for Flash and Fire Points by Cleveland Open Cup
D 618	Practice for Conditioning Plastics and Electrical Insulating Materials for Testing
D 883	Terminology Relating to Plastics
D 1693	Test Method for Environmental Stress-Cracking of Ethylene Plastics
D 2122	Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
D 2412	Test Method for Determination of External Loading Characteristics of Plastic Pipe By Parallel-Plate Loading
D 2444	Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
D 3350	Specification for Polyethylene Plastic Pipe and Fitting Materials
F 477	Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F 949	Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

The Reference Materials listed below should be consulted if more details are needed on items found within this Manual.

N. C. Department of Transportation (NCDOT)	
	Basic Pipe Culverts
	Construction Manual
	Guidelines For Drainage Studies and Hydraulic Design
	Policy On Street and Driveway Access to North Carolina Highways
	Roadway Design Manual
	Roadway Standard Drawings
	Safety Policy and Procedure Manual
	Standard Specifications for Roads and Structures
	Subdivision Roads - Minimum Construction Standards
American Association of State Highway and Transportation Officials (AASHTO)	
M 36	Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains
M 86	Concrete Sewer, Storm Drain, and Culvert Pipe
M 167	Corrugated Steel Structural Plate, Zinc-Coated, for Field-Bolted Pipe, Pipe-Arches, and Arches
M 170	Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
M 190	Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches
M 196	Corrugated Aluminum Pipe for Sewers and Drains
M 197	Aluminum Alloy Sheet for Corrugated Aluminum Pipe
M 198	Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
M 218	Steel Sheet, Zinc-Coated (Galvanized), for Corrugated Steel Pipe
M 219	Corrugated Aluminum Alloy Structural Plate for Field-Bolted Pipe, Pipe-Arches, and Arches
M 242	Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
M 243	Field-Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
M 245	Corrugated Steel Pipe, Polymer-Precoated, for Sewers and Drains
M 246	Steel Sheet, Metallic-Coated and Polymer-Precoated for Corrugated Steel Pipe
M 252	Corrugated Polyethylene Drainage Pipe
M 262	Concrete Pipe and Related Products
M 274	Steel Sheet, Aluminum-Coated (Type 2), for Corrugated Steel Pipe
M 294	Corrugated Polyethylene Pipe, 12 in. to 48 in. Diameter
M 315	Joints for Circular Concrete Sewer and Culvert

developers occasionally construct roadway or structures which eventually will be incorporated into the Department's maintained system. Right-of-Way encroachment agreements are reviewed by Department engineers to ensure that, among other things, Department approved products are used by the encroaching parties.

5. Committee approved products for which the Department's Standard Specifications do not apply, and which have not been included as a bid alternate in a project design, may be considered in Value Engineering Proposals which can be submitted by contractors after a contract has been awarded. Product vendors or manufacturers may wish to work with contractors to develop cost saving Value Engineering Proposals which utilize their products. Contractors are awarded a 50% share of the savings obtained through approved value engineering proposals. For more information on the Value Engineering Proposal clause and procedures contact the Value Engineer's Office at (919) 250-4128.

Questions regarding the New Products Evaluation Program in general or about specific products should be directed to:

New Products Evaluation Committee Chairman
N. C. Department of Transportation
Design Services Unit
P.O. Box 25201,
Raleigh, NC 27611

Telephone: (919) 250-4128

Fax No.: (919) 250-4119

Website: www.doh.dot.state.nc.us/preconstruct/highway/dsn_srvc/value/newprod/

with programs including the Approved Products Listing. However, these engineers are under no obligation to specify or use specific products once the product has been approved by this Committee. Vendors or manufacturers wanting to promote the use of their product(s) after receiving committee approval should consider the following:

1. Vendors or manufacturers of products which meet the requirements of the "NCDOT Standard Specifications for Roads and Structures" may wish to contact contractors who have been awarded construction projects which will need the particular product. The types and quantities of materials to be used in new construction projects can be identified in the Department's monthly publication "Invitation to Bid". Persons wishing to subscribe to this listing may contact the State Contract Office - Proposals Squad of the Design Services Unit at (919) 250-4128. The identity of contractors who have been awarded specific projects can be obtained through the Public Affairs Office @ (919) 733-2520 or the State Contract Office @ (919) 250-4128.
2. Committee approved products for which a Standard Specification is not applicable may be designed into a specific project by a Department Project Design Engineer. A special provision will be prepared by the design engineer and included in the contract documents to define the requirements for, and quantities of, products to be used. As stated earlier, Project Design Engineers are made aware of new products through the Approved Products Listing. However, vendors or manufacturers may wish to periodically mail product information flyers to Department Design & Maintenance Branch Units indicating that the product is available and has been approved by the New Products Evaluation Committee.
3. In addition to constructing new projects, the NCDOT is responsible for maintaining over 78,000 miles of roadway and more than 16,500 bridges. Maintenance of these facilities is directed through both the Raleigh Central Office and Division of Highways offices located throughout the state. Vendors or manufacturers of roadway or bridge maintenance products approved by the Committee may wish to promote these types of products to Division Maintenance Engineers and Area Bridge Maintenance Superintendents. A list of addresses for these individuals can be provided upon a request made to the New Products Evaluation Program Coordinator at (919) 250-4128. Department Maintenance Engineers are under no obligation to use the products approved by the committee.
4. Upon receiving product approval from the Committee vendors or manufacturers may wish to promote their products to users within the state having similar needs as the Department. Municipalities or private

10. Acceptance of a product for evaluation by NCDOT or Committee's approval of the product after evaluation is in no way a commitment to purchase, or specify the product investigated regardless of its performance.
11. The following status codes have been adopted as a means of identifying the Committee's action on products submitted for evaluation. Some codes are self-explanatory.

Status	Code Explanation
AU	Approved for Use
CA	Conceptual Approved on a project by project basis
TU	Approved for Trial Use
NFC/NAT	No Further Consideration/No Action Taken
H	Holding (awaiting on-going evaluation)
UNR	Usage Not Recommended

A better explanation of these codes can be found at the New Products website:

www.doh.dot.state.nc.us/preconstruct/highway/dsn_srvc/value/newprod/

NOTE: There may be occasions when a new product has merit potential. However, insufficient information is available concerning it's performance to enable a Committee decision. Experimental use of these products may be coordinated through the Design, Construction or Maintenance Units interested in specifying or using the product. The information obtained through experimental usage will be used by the Committee to complete an evaluation and make a ruling.

12. Data resulting from an evaluation of the submitted product is public information and will not be considered privileged. All information developed during this product evaluation may be released by the North Carolina Department of Transportation at its discretion.

APPROVED PRODUCTS LISTING

The Approved Products Listing is intended to tabulate information about certain proprietary products for highway use. Products covered by the Standard Specifications for Road and Structures are not usually included. Approval of a product is not to be construed as an endorsement or indication that the product(s) will be used. Project Design Engineers and Division Construction and Maintenance Engineers are made aware of approved products through a database

appropriate Committee members. The Committee members will examine product information and history of use, if applicable, relevant to their field of operations. Testing of material properties may be requested at this time. After reviewing this information, the Committee member will provide a recommendation concerning approval or rejection of the product to the Committee for a ruling.

2. When additional information is desired by the Committee, it may request:
(a) additional information from the sales representative, (b) that sales representatives work with various members of the Committee to develop an in-depth study or additional test data, or (c) various members perform a more in-depth study and make a recommendation to the full Committee. The Chairman or his designate will serve as study coordinator in the development of these reports to the Committee.
3. The Evaluation Committee will meet bimonthly to assure timely consideration of submitted products for evaluation.
4. The Committee may approve, disapprove, recommend trial use, or recommend limited use, of new products in construction and maintenance of North Carolina highways.
5. The Committee will coordinate the monitoring of trial installations and ensure that long term documentation on the durability and performance of the products and methods is obtained.
6. The Committee will not normally consider new equipment products such as those handled by the Equipment Unit.
7. Vendors failing to satisfactorily respond to inquiries or correspondence or maintain contact with the Chairman or his Coordinator for a period of one year will be subject to having their product dropped from the Evaluation Program.
8. The Chairman has the authority to drop from the Evaluation Program products with no apparent or significant application for usage in the Highway Program or products which are deemed not to be far enough along in the development process to evaluate.
9. This program is intended for the evaluation of new and/or proprietary products for highway use. Products meeting the "NCDOT Standard Specification for Roads and Structures" are not usually evaluated.

North Carolina Department Of Transportation Multi-Branch Evaluation Committee Policy For New Products And Technology

BACKGROUND

In the past, sales representatives often visited various sections of the Department of Transportation in an effort to sell their product(s). If a Branch or Unit felt the product had merit, that section may have elected to evaluate the product(s). The results of those evaluations were normally used within that section and were not distributed to other Units. At times, this has resulted in the same item or method being evaluated by more than one Unit. To provide a more thorough and orderly evaluation of products and methods, a Multi-Disciplinary Committee was formed and operates through the cooperative efforts of the Design, Construction, Maintenance, Traffic Engineering, and Planning and Research Branches. The Federal Highway Administration (FHWA) also has representation on this committee.

PURPOSE

The Multi-Disciplinary Committee provides a comprehensive evaluation of new products and methods. The Committee may approve or disapprove the use of these products or methods in the design, construction, and maintenance of our highways. Sales representatives submit their information to one central committee rather than visiting the many different units. The Committee also monitors installations and provides long-term documentation on the durability and performance of new products and methods.

EVALUATION COMMITTEE

The Chairman of the Committee or his designated Coordinator is responsible for arranging meetings, receiving information from the various sales representatives, and disseminating it to the other Committee members conducting or coordinating product studies when needed and other miscellaneous duties as required.

PROCEDURES AND OPERATIONS

1. Sales representatives seeking approval of new products are instructed to submit their information to the Coordinator for distribution to the

Example 1: Assume 250 ft (76.2 m) pipe culvert on 1.5 % grade under 25 ft (7.6 m) of fill with soft foundation material:

Table Camber: factor = 0.0025 (no units), $L = 250$ ft (76.2 m)
 250 ft \times $0.0025 = 0.625$ ft (0.190 m)

Limit Checks: $L = 250$ ft (76.2 m), % grade = 0.015
 $(250 \div 2) \times 0.015 = 1.875$ ft
 or $(76.2 \div 2) \times 0.015 = 0.571$ m

Compare 0.625 ft to 1.875 ft; therefore, $C_m = 0.625$ ft (0.190 m)

Example 2: Assume 250 ft (76.2 m) pipe culvert on 0.4 % grade under 25 ft (7.6 m) of fill with soft foundation material:

Table Camber: factor = 0.0025 (no units), $L = 250$ ft (76.2 m)
 250 ft \times $0.0025 = 0.625$ ft (0.190 m)

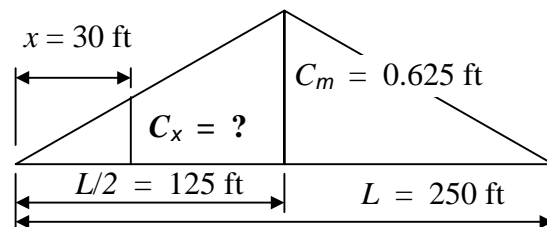
Limit Checks: $L = 250$ ft (76.2 m), % grade = 0.004
 $(250 \div 2) \times 0.004 = 0.500$ ft
 or $(76.2 \div 2) \times 0.004 = 0.152$ m

Compare 0.625 ft to 0.500 ft; therefore, $C_m = 0.500$ ft (0.152 m)

Example 3: For Example 1 above, determine the camber 30 ft from the end of the culvert.

From Example 1: $L = 250$ ft, $C_m = 0.625$ ft

$$\begin{aligned} C_x &= (C_m) (x \div (L/2)) \\ &= (0.625 \text{ ft}) (30 \text{ ft} \div (250 \text{ ft} \div 2)) \\ &= 0.15 \text{ ft} \end{aligned}$$



CAMBER FOR PIPE AND BOX CULVERTS

When pipes or box culverts are founded on compressible material, camber should be placed in the grade to compensate for the settlement. The amount of camber to be used depends on the load imposed on the foundation material and the compressibility of the material. Since these factors vary, judgement is required in selecting the amount of camber to be used. Unless provided in the plans, the camber is determined as follows for pipe culverts.

The table below includes camber factors based on the load imposed (fill height) and the compressibility (soil type) of the material. Using the fill height and soil type, a corresponding factor is selected from the table. For continuous culverts beneath the entire width of the embankment, multiply the selected factor by the length of the culvert (L) to determine the midpoint camber.

CAMBER TABLE

Fill Height		Soil Type Factors		
(feet)	(meters)	medium	soft	very soft
0 to 10	0 to 3	0.0008	0.0013	0.0017
10 to 30	3 to 9	0.0017	0.0025	0.0033
30 to 50	9 to 15	0.0025	0.0038	0.0050

The mid point camber for pipe culverts shall be limited to one-half of the available fall in the pipe culvert or, $(L/2) \times (\% \text{ grade})$, where L is the length of the culvert in feet (meters) and shall be limited to 2 ft (0.6 m). The proposed grade for the culvert at the midpoint ($L/2$ from the end of the culvert) should be adjusted upward by C_m where C_m is the smaller of the calculated camber and the limits stated above. The amount of camber C_x at any distance x along the length of the culvert that can be determined by:

$$(C_m) (x \div (L/2)), \quad \text{where } x \text{ is any distance along the length of the culvert } L.$$

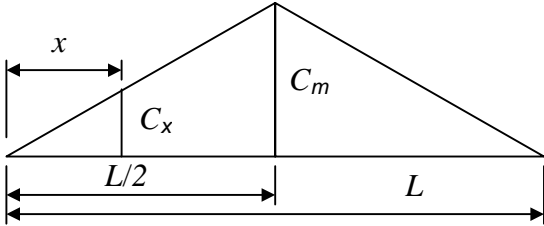
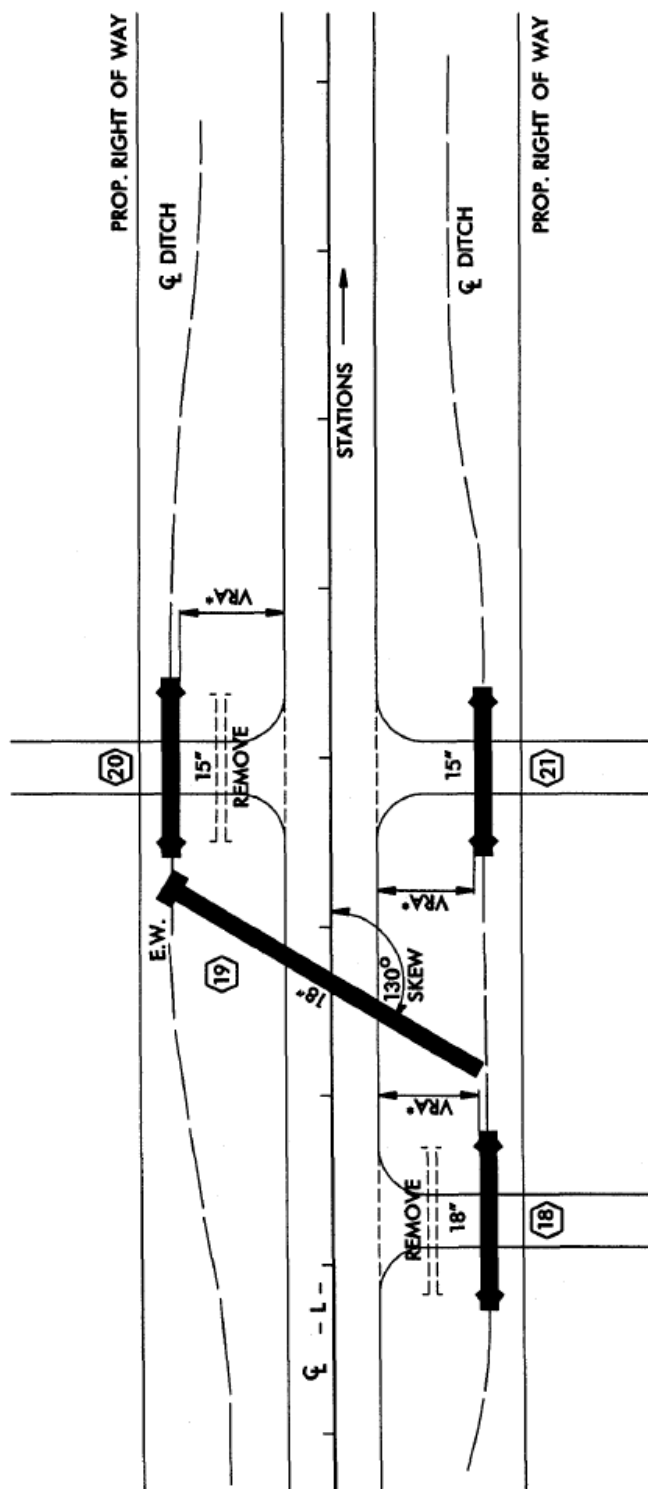


FIGURE 2

5 - 20
F - 2



*VRA = VEHICLE RECOVERY AREA

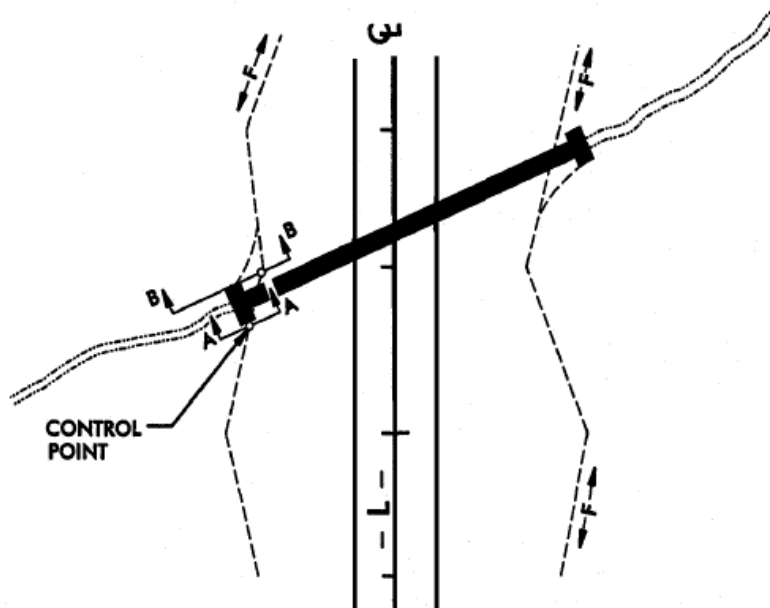
NOTE: SEE 1-4M PART I OF THIS MANUAL, FIGURES A, B, C & D FOR VEHICLE RECOVERY AREA.

CLEAR ROADSIDE RECOVERY AREA FOR ACCESS ROADS

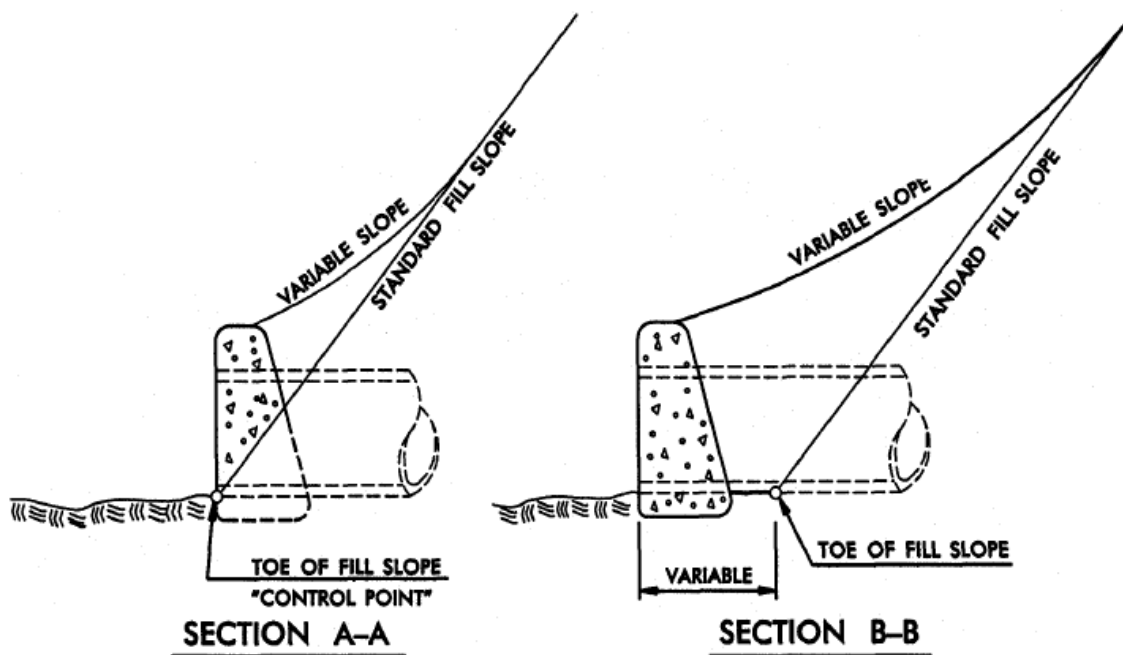
REV. DATE : 01/02/02

FIGURE 1

5 - 20
F - 1



EXAMPLE OF ENDWALL TREATMENT



REV. DATE 01/02/02

CLEAR ZONE DISTANCES
(IN FEET FROM EDGE OF TRAVEL LANE)

DESIGN SPEED	DESIGN ADT		FILL SLOPES	
40 MPH OR LESS		6:1 OR FLATTER	5:1 TO 4:1	3:1
	UNDER 750	7 - 10	7 - 10	**
	750 - 1500	10 - 12	12 - 14	**
	1500 - 6000	12 - 14	14 - 16	**
	OVER 6000	14 - 16	16 - 18	**
45 - 50 MPH				
	UNDER 750	10 - 12	12 - 14	**
	750 - 1500	12 - 14	16 - 20	**
	1500 - 6000	16 - 18	20 - 26	**
	OVER 6000	18 - 20	24 - 28	**
55 MPH				**
	UNDER 750	12 - 14	14 - 18	**
	750 - 1500	16 - 18	20 - 24	**
	1500 - 6000	20 - 22	24 - 30	**
	OVER 6000	22 - 24	26 - 32*	**
60 MPH				**
	UNDER 750	16 - 18	20 - 24	**
	750 - 1500	20 - 24	26 - 32*	**
	1500 - 6000	26 - 30	32 - 40*	**
	OVER 6000	30 - 32*	36 - 44*	**
65 - 70 MPH				**
	UNDER 750	18 - 20	20 - 26	**
	750 - 1500	24 - 26	28 - 36*	**
	1500 - 6000	28 - 32*	34 - 42*	**
	OVER 6000	30 - 34*	38 - 46*	**

* CLEAR ZONE DISTANCES CAN BE LIMITED TO 30 FEET UNLESS IN A HIGH ACCIDENT RATE AREA.

** SINCE 3:1 SLOPES ARE NOT RECOVERABLE, ADDITIONAL RUNOUT AREA MUST BE PROVIDED AT THE TOE OF THE SLOPE. PLEASE REFER TO FIGURE 1 ON SHEET 1-4M.

REV. DATE : 01/02/02

ROADWAY DESIGN MANUAL

PART I

MASONRY DRAINAGE STRUCTURES QUANTITY – VOLUME BASIS

5-2D

Any masonry drainage structure which incorporates an opening for circular pipe exceeding 48 inches in diameter, or for pipe arch of any size, will be measured and paid for on a volume basis. The quantity of masonry to be paid for will be the number of cubic yards of cast-in-place concrete, brick, or precast masonry which has been incorporated into the structure.

These quantities are provided in the Roadway Standard Drawings Manual.

MINIMUM PIPE CLEARANCE

REQUIREMENT FROM INVERT TO SUBGRADE

5-3

<u>Pipe Size</u> (inches)	<u>CLEARANCE DISTANCE</u>	
	<u>R. C. Pipe</u> (feet)	<u>C. S. Pipe</u> (feet)
15	2.4	2.3
18	2.7	2.6
24	3.3	3.1
30	3.8	3.6
36	4.3	4.1
42	4.9	4.6
48	5.4	5.1
54	6.0	5.6
60	6.5	6.1
66	7.0	6.6
72	7.6	7.1

NOTE: This is a minimum desirable clearance and can be reduced with Special Structural and/or Installation Provisions.

**MAXIMUM ALLOWABLE FILL HEIGHTS
OVER REINFORCED CONCRETE PIPE**

5-4

Class III		All sizes 23 feet
Class IV		All sizes 32 feet
Class IV	with Method B installation	All sizes 60 feet
Class V	with Method B installation	All sizes 90 feet

NOTES: Use material thickness on all pipe except structural plate pipe.
Use gage for structural plate pipe and on all pipe arches.
Use Method "B" for R. C. Pipes under fills greater than 32 feet.

PVC
CORRUGATED DOUBLE WALL PLASTIC PIPE

MAXIMUM HEIGHT OF COVER LIMITS IN FEET

PIPE SIZE (inches)	MINIMUM COVER (inches)	MAXIMUM COVER (feet)
8	12	20
12	12	20
15	12	20
18	12	20
24	12	20
30	12	20
36	12	20

HDPE
CORRUGATED DOUBLE WALL PLASTIC PIPE

MAXIMUM HEIGHT OF COVER LIMITS IN FEET

PIPE SIZE (inches)	MINIMUM COVER (inches)	MAXIMUM COVER (feet)
12	12	20
15	12	20
18	12	20
24	12	20
30	12	20
36	12	20
42	12	20
48	12	20

**ALUMINUM
SPIRAL RIB PIPE**

MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SIZE (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)			
		0.060	0.075	0.105	0.135
		MAXIMUM COVER - FEET			
18	12	40			
24	12		40		
30	12		30	50	
36	12			45	60
42	15			35	55
48	18			30	45
54	21			[30]	40
60	18				35
66	21				35
72	24				[30]
78	30				<25>
84	30				<25>

[] Condition 2 - Installation per ASTM A798 with trench conditions are required.

< > Condition 3 – Same as condition 2 except select granular backfill required.

**ALUMINUM
SPIRAL RIB PIPE ARCH**

MAXIMUM HEIGHT OF COVER LIMITS IN FEET

PIPE ARCH DIMENSIONS (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)	MAXIMUM COVER - FEET (for Corner Bearing Pressure) (2 tons/ft ²)
20 x 16	12	0.060	15
27 x 21	12	0.075	15
33 x 26	12	0.105	15
40 x 31	12	0.105	15
46 x 36	12	0.105	15
53 x 41	12	0.105	15
60 x 46	12	0.135	15
66 x 51	12	0.135	15

**STEEL
SPIRAL RIB PIPE**

MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SIZE (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t)		
		gage (inches)		
		16 (0.064)	14 (0.079)	12 (0.109)
MAXIMUM COVER - FEET				
18	12	50		
24	12	35	50	90
30	12		40	70
36	12		30	60
42	12			50
48	12			45
54	12			35
60	12			35
66	15			30
72	15			30
78	18			[25]
84	21			[25]
90	24			<20>
96	24			<20>
102	24			<20>

[] Condition 2 - Installation per ASTM A798 with trench conditions are required.

< > Condition 3 – Same as condition 2 except select granular backfill required.

**STEEL
SPIRAL RIB PIPE ARCH**

MAXIMUM HEIGHT OF COVER LIMITS IN FEET

PIPE ARCH DIMENSIONS (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)	MAXIMUM COVER - FEET (for Corner Bearing Pressure) (2 tons/ft ²)
20 X 16	12	0.064"	15
27 x 21	12	0.064"	15
33 x 26	12	0.079"	15
40 x 31	12	0.079"	15
46 x 36	12	0.109"	15
53 x 41	12	0.109"	15
60 x 46	12	0.109"	15
66 x 51	12	0.109"	15

STRUCTURAL PLATE ALUMINUM PIPE

9" X 2-1/2" CORRUGATIONS
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SIZE (inches)	AREA	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)													
			0.100		0.125		0.150		0.175		0.200		0.225		0.250	
			Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.
MAXIMUM COVER - FEET																
72	28	12	24		26	32	28	41	30	48	32	55	34	61	36	66
84	38	18	20		23	27	24	35	25	41	26	47	28	52	29	57
96	50	18	18		21	24	22	30	22	36	23	41	24	45	25	50
108	64	24			19	21	20	27	21	32	21	37	22	40	22	44
120	78	24			19	19	19	24	20	29	20	33	20	36	21	40
132	95	24					18	22	19	26	19	30	19	33	20	36
144	113	30					18	20	18	24	19	27	19	30	19	33
156	133	30					18	18	18	22	18	25	18	28	19	30
168	154	30					17		18	20	18	23	18	26	18	28
180	177	30					16		17	19	18	22	18	24	18	26

CORRUGATED ALUMINUM PIPE

3" X 1" CORRUGATIONS
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SIZE (inches)	AREA	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)							
			0.075		0.105		0.135		0.164	
			Circular	Elongated	Circular	Elongated	Circular	Elongated	Circular	Elongated
MAXIMUM COVER - FEET										
36	7.1	12	24	37	27	51	30	61	34	68
42	9.6	12			23	44	25	51	27	55
48	12.6	12			21	38	22	45	24	48
54	15.9	12			20	34	21	42	22	44
60	19.6	12			19	31	20	40	20	41
66	23.8	12			18	28	19	38	19	39
72	28.3	12			18	25	18	37	19	38
78	33	12			18	23	18	31	18	37
84	38	18			17	19	18	25	18	31
90	44	18			15		17	20	18	25
96	50	18			12		16		17	21
102	57	24					14		17	
108	64	24					11		14	
114	71	24							12	
120	78	24							10	

STRUCTURAL PLATE STEEL PIPE ARCHES

6" X 2" CORRUGATIONS - 31" CORNER RADIUS
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SPAN	RISE	AREA	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (gage)	MAXIMUM COVER - FEET (for Corner Bearing Pressure)	
					(2 tons/ft ²)	(3 tons/ft ²)
13'-3"	9'-4"	97	48	8	12	19
13'-6"	9'-6"	102	48	8	12	19
14'-0"	9'-8"	105	48	8	12	18
14'-2"	9'-10"	109	48	8	12	18
14'-5"	10'-0"	114	48	8	11	17
14'-11"	10'-2"	118	48	8	11	17
15'-4"	10'-4"	123	48	8	11	16
15'-7"	10'-6"	127	48	8	10	16
15'-10"	10'-8"	132	48	8	10	16
16'-3"	10'-10"	137	48	8	10	15
16'-6"	11'-0"	142	48	8	10	15
17'-0"	11'-2"	146	48	8	10	15
17'-2"	11'-4"	151	48	8	9	14
17'-5"	11'-6"	157	48	8	9	14
17'-11"	11'-8"	161	48	8	9	14
18'-1"	11'-10"	167	48	8	9	14
18'-7"	12'-0"	172	48	8	9	13
18'-9"	12'-2"	177	48	8	9	13
19'-3"	12'-4"	182	48	8	8	13
19'-6"	12'-6"	188	48	8	8	13
19'-8"	12'-8"	194	48	8	8	12
19'-11"	12'-10"	200	48	8	8	12
20'-5"	13'-0"	205	48	8	8	11
20'-7"	13'-2"	211	48	8	8	11

STRUCTURAL PLATE ALUMINUM PIPE ARCH

9" X 2-1/2" CORRUGATIONS - 28.8" CORNER RADIUS
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SPAN	RISE	AREA	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)	MAXIMUM COVER - FEET (for Corner Bearing Pressure)	
					(2 tons/ft ²)	(3 tons/ft ²)
5'-11"	5'-4"	25	24	0.100	24	32*
6'-8"	5'-7"	29	24	0.100	22	29*
7'-4"	5'-11"	34	24	0.100	20	26*
8'-0"	6'-2"	39	24	0.100	18	24*
8'-7"	6'-6"	45	24	0.100	17	22*
9'-0"	6'-8"	48	24	0.100	16	21*
9'-4"	6'-10"	50	24	0.125	17	20
10'-0"	7'-1"	56	36	0.125	16	19
10'-5"	7'-3"	60	36	0.125	15	18
11'-2"	7'-6"	66	36	0.125	14	17
11'-8"	7'-10"	73	36	0.125	13	16
12'-2"	8'-0"	76	36	0.150	13	19
12'-10"	8'-3"	83	36	0.150	12	18
13'-7"	8'-7"	91	36	0.150	11	17
14'-3"	8'-10"	98	48	0.150	11	16
14'-9"	9'-2"	107	48	0.150	10	16
15'-3"	9'-4"	111	48	0.150	10	15
16'-0"	9'-7"	119	48	0.150	10	14
16'-8"	9'-11"	128	48	0.150	9	12
16'-11"	10'-1"	132	48	0.150	9	12

* 0.125" Minimum Thickness Required

STRUCTURAL PLATE STEEL PIPE ARCHES

6" X 2" CORRUGATIONS - 18" CORNER RADIUS
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SPAN	RISE	AREA	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (gage)	MAXIMUM COVER - FEET (for Corner Bearing Pressure)	
					(2 tons/ft ²)	(3 tons/ft ²)
6'-1"	4'-7"	22	24	12	16	24
6'-4"	4'-7"	24	24	12	15	23
6'-9"	4'-11"	26	24	12	14	21
7'-0"	5'-1"	28	24	12	14	21
7'-3"	5'-3"	31	24	12	13	20
7'-8"	5'-5"	33	24	12	12	19
7'-11"	5'-7"	35	24	12	12	18
8'-2"	5'-9"	38	24	12	12	18
8'-7"	5'-11"	40	24	12	11	17
8'-10"	6'-1"	43	24	12	11	16
9'-4"	6'-3"	46	24	12	10	16
9'-6"	6'-5"	49	24	12	10	15
9'-9"	6'-7"	52	24	10	10	15
10'-3"	6'-9"	55	36	10	9	14
10'-8"	6'-11"	58	36	10	9	13
10'-11"	7'-1'	61	36	10	9	13
11'-5"	7'-3"	64	36	10	8	13
11'-7"	7'-5"	67	36	10	8	12
11'-10"	7'-7"	71	36	10	8	12
12'-4"	7'-9"	74	36	8	8	12
12'-6"	7'-11"	78	36	8	8	12
12'-8"	8'-1"	81	36	8	7	11
12'-10"	8'-4"	85	36	8	7	11
13'-5"	8'-5"	89	36	8	7	11
13'-11"	8'-7"	93	36	8	7	10
14'-1"	8'-9"	97	48	8	7	10
14'-3"	8'-11"	101	48	8	6	10
14'-10"	9'-1"	105	48	8	6	10
15'-4"	9'-3"	109	48	8	6	9
15'-6"	9'-5"	113	48	8	6	9
15'-8"	9'-7"	118	48	8	6	9
15'-10"	9'-10"	122	48	8	6	9
16'-5"	9'-11"	126	48	8	6	9
16'-7"	10'-1"	131	48	8	6	9

CORRUGATED ALUMINUM PIPE ARCHES

**2" X *" OR 2-1/2" X *" CORRUGATIONS – RIVETED OR HELICAL FABRICATION
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET**

PIPE ARCH DIMENSIONS (inches)	CORNER RADIUS (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)	MAXIMUM COVER - FEET (for Corner Bearing Pressure)	
				(2 tons/ft ²)	(3 tons/ft ²)
18 X 11	4-3/4	18	0.060	16	23
22 X 13	4-3/4	18	0.060	15	22
25 X 16	4-1/2	18	0.075	13	19
29 X 18	4-1/2	18	0.075	12	18
36 X 22	5	18	0.075	11	17
43 X 27	5-1/2	18	0.105	10	15
50 X 31	6	18	0.105	10	14
58 X 36	7	18	0.135	10	14
65 X 40	8	18	0.135	10	15
72 X 44	9	18	0.164	10	15

Heavier gages may be used where required for abrasion, corrosion or other factors, but not for additional fill on arches as corner pressures govern amount of fill.

STRUCTURAL PLATE STEEL PIPE

**6" X 2" CORRUGATIONS – BOLTED FABRICATIONS
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET**

SIZE	MINIMUM COVER	MINIMUM THICKNESS (t) (inches)															
		0.109 12 gage		0.138 10 gage		0.168 8 gage		0.188 7 gage		0.218 5 gage		0.249 3 gage		0.280 1 gage		0.280 * 1 gage	
																6 Bolts	8 Bolts
		Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.
MAXIMUM COVER - FEET																	
60"	12"	42	42	61	62	70	81	76	93	86	112	96	132	106	144	184	220
66"	12"	38	38	49	58	60	74	64	85	72	102	80	120	83	130	168	198
72"	12"	35	35	38	51	50	67	53	77	59	93	65	108	71	118	157	181
78"	12"	32	32	36	47	44	62	46	71	51	83	55	100	60	109	143	159
84"	12"	30	30	35	44	39	57	41	66	45	75	49	95	52	102	131	145
90"	12"	28	28	33	40	35	53	37	61	40	72	43	84	45	91	122	133
96"	12"	26	26	31	38	33	50	34	58	36	70	39	78	41	82	115	124
102"	24"			29	36	31	47	32	54	34	65	36	72	38	75	107	117
108"	24"			27	34	29	45	30	51	32	62	34	68	35	70	102	112
114"	24"			26	33	28	42	29	48	31	58	32	63	34	65	96	107
120"	24"			25	31	27	40	28	46	29	56	30	60	33	62	92	104
126"	24"					26	37	26	44	27	52	29	58	30	59	86	100
132"	24"					25	36	25	42	26	50	28	56	29	58	83	98
138"	24"					24	34	25	39	25	48	27	54	28	55	79	94
144"	24"					24	33	25	38	25	46	26	52	27	54	76	92
156"	24"					23	31	23	35	24	43	25	50	26	52	70	85
168"	24"					23	28	23	33	23	40	24	47	25	50	65	78
180"	24"					22	27	22	31	23	37	23	44	24	48	61	73
192"	24"					22	25	22	29	23	35	23	41	23	45	57	69
204"	36"					22	23	22	27	22	33	22	39	23	42	54	65

*EXCELLENT BACKFILL 95% DENSITY

REV. DATE 5/28/93

CORRUGATED STEEL PIPE ARCHES

**3" X 1" CORRUGATIONS - RIVETED, WELDED, OR HELICAL FABRICATION
MAXIMUM HEIGHT OF COVER LIMITS IN FEET**

EQUIVALENT PIPE DIAMETER (inches)	PIPE ARCH DIMENSIONS (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) gage (inches)	MAXIMUM COVER - FEET (for Corner Bearing Pressure)	
				(2 tons/ft ²)	(3 tons/ft ²)
36	40 X 31	12	14 (0.079)	14	21
42	46 X 36	12	12 (0.109)	14	21
48	53 X 41	12	12 (0.109)	14	21
54	60 X 46	12	12 (0.109)	14	21
60	66 X 51	12	12 (0.109)	14	21
66	73 X 55	12	12 (0.109)	19	28
72	81 X 59	12	12 (0.109)	17	26
78	87 X 63	12	12 (0.109)	16	24
84	95 X 67	12	12 (0.109)	15	22
90	103 X 71	18	12 (0.109)	13	20
96	112 X 75	18	12 (0.109)	13	18
102	117 X 79	18	10 (0.138)	12	18
108	128 X 83	24	10 (0.138)	11	16
114	137 X 87	24	10 (0.138)	10	15
120	142 X 91	24	10 (0.138)	10	15

Heavier gages may be used where required for durability or other factors, but not for additional fill, as corner pressures govern amount of fill.

CORRUGATED ALUMINUM PIPE

**2" X 1/2" OR 2-2/3" X 1/2" CORRUGATIONS – RIVETED, WELDED, OR HELICAL FABRICATION
MAXIMUM HEIGHT OF COVER LIMITS IN FEET**

SIZE (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)									
		0.060 (16 gage)		0.079 (14 gage)		0.109 (12 gage)		0.138 (10 gage)		0.168 (8 gage)	
		Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.
MAXIMUM COVER - FEET											
12	12	45		45		77					
18	12	30		30		43		50		57	
24	12			22		30		34		37	
30	12			18		25		27		29	
36	12					23		24		25	
42	12				25	23	42	23	46	23	46
48	12					21	29	22	37	22	44
54	12						20	21	26	22	31
60	12						15	19	19	22	24
66	12							14	14	17	17
72	12									13	13

With Method "B" installation increase fill heights allowable by 33%

REV. DATE 5/28/93

CORRUGATED ALUMINUM PIPE
3" x 1" CORRUGATIONS
MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SIZE (inches)	AREA	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)							
			0.075		0.105		0.135		0.164	
			Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.
			MAXIMUM COVER - FEET							
36	7.1	12	24	37	27	51	30	61	34	68
42	9.6	12			23	44	25	51	27	55
48	12.6	12			21	38	22	45	24	48
54	15.9	12			20	34	21	42	22	44
60	19.6	12			19	31	20	40	20	41
66	23.8	12			18	28	19	38	19	39
72	28.3	12			18	25	18	37	19	38
78	33.0	12			18	23	18	31	18	37
84	38.0	18			17	19	18	25	18	31
90	44.0	18			15		17	20	18	25
96	50.0	18			12		16		17	21
102	57.0	24					14		17	
108	64.0	24					11		14	
114	71.0	24							12	
120	78.0	24							10	

See Roadway Standards, Std. No. 300.02

CORRUGATED STEEL PIPE

3" X 1" CORRUGATIONS - RIVETED, WELDED, OR HELICAL FABRICATION
MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SIZE (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)							
		0.079 (14 gage)		0.109 (12 gage)		0.138 (10 gage)		0.168 (8 gage)	
		Cir.	El.	Cir.	El.	Cir.	El.	Cir.	El.
		MAXIMUM COVER - FEET							
36	12	47	60	58	88	70	106	82	118
42	12			44	76	51	91	59	101
48	12			36	66	41	80	46	88
54	12			31	59	35	71	38	76
60	12			28	58	31	62	33	66
66	12			26	48	30	58	32	64
72	12			25	44	28	56	30	60
78	12			24	41	26	52	28	56
84	18			22	36	24	46	28	56
90	18			20	33	22	43	26	53
96	18			17	31	20	40	25	49
102	24					19	38	23	46
108	24					18	35	21	42
114	24					16	32	19	38
120	24					15	29	18	36

Note: With Method "B" installation, fill heights may be increased by 50%.
 See Roadway Standards, Std. No. 300.02

REV. DATE 5/28/93

CORRUGATED STEEL PIPE

2" X *" OR 2-2/3" X *" CORRUGATIONS – RIVETED, WELDED, OR HELICAL FABRICATION
 MAXIMUM HEIGHT OF COVER LIMITS IN FEET

SIZE (inches)	MINIMUM COVER (inches)	0.064" (16 gage)	0.079" (14 gage)	0.109" (12 gage)		0.138" (10 gage)		0.168" (8 gage)	
		Circular	Circular	Circular	Elongated	Circular	Elongated	Circular	Elongated
MAXIMUM COVER - FEET									
12	12	83	90						
15	12	67	73	93					
18	12	55	67	70					
24	12	36	40	47		57			
30	12		31	35		40		50	
36	12		20	30		35		40	
42	12			26	59	29	54	35	58
48	12			24	48	25	50	26	52
54	12			23	45	24	48	25	50
60	12	NOTE: WITH METHOD "B" INSTALLATION FILL HEIGHTS MAY BE INCREASED BY 50% OF TABLE VALUES				23	46	23	48
66	12					20	40	23	46
72	12					18	30	22	40
78	12							22	30
84	12							22	25

See Roadway Standards, Std. No. 300.02

CORRUGATED STEEL PIPE ARCHES

MAXIMUM HEIGHT OF COVER LIMITS IN FEET

PIPE ARCH DIMENSIONS (inches)	MINIMUM COVER (inches)	MINIMUM THICKNESS (t) (inches)	MAXIMUM COVER - FEET (for Corner Bearing Pressure)	
			(2 tons/ft ²)	(3 tons/ft ²)
17 X 13	18	0.064	16	23
21 X 15	18	0.064	15	22
24 X 18	18	0.064	13	19
28 X 20	18	0.064	12	18
35 X 24	18	0.079	11	17
42 X 29	18	0.079	10	15
49 X 33	18	0.109	10	14
57 X 38	18	0.109	10	14
64 X 43	18	0.109	10	14
71 X 47	18	0.138	10	15
77 X 52	18	0.168	10	15
83 X 57	18	0.168	9	14

Heavier gages may be used where required for abrasion, corrosion or other factors, but not for additional fill on arches as corner pressures govern amount of fill.

REV. DATE 5/28/93

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH DETAIL DRAWING FOR
DRIVEWAY PIPE CONSTRUCTION
USING NO SPECIAL END SECTIONS

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH DETAIL DRAWING FOR
DRIVEWAY PIPE CONSTRUCTION
USING NO SPECIAL END SECTIONS

SHEET 1 OF 1
310D10

SHEET 1 OF 1
310D10

ISOMETRIC OF END PIPE TREATMENT
USE AT LOCATIONS AS DIRECTED BY THE ENGINEER

GENERAL NOTES:
ALL DIMENSIONS GIVEN ARE FOR MINIMUM CONDITIONS. PROPER ENGINEERING JUDGEMENT MUST BE USED IN DETERMINING DRIVEWAY LOCATIONS, WIDTHS, AND PIPE LENGTHS.
FACTORS SUCH AS VEHICLE TURNING RADIUS, TRAFFIC VOLUMES, DRIVEWAY SKEW, OFFSET DISTANCE OF PIPE FROM EDGE OF PAVEMENT, PIPE DEPTH, AND DESIGN SPEED SHOULD BE CONSIDERED IN DETERMINING DRIVEWAY WIDTHS.

NOTE:
1. THESE AREAS ARE TO BE USED TO BLEND THE INTERSECTING SLOPES TO THE PROPOSED DITCH.

ROADWAY CROSS PIPE TYPICAL SECTION

ROADWAY CROSS PIPE TYPICAL SECTION

END TREATMENT DIMENSIONS

D	L	W	THICK. GAGE
18"	2'-8"	2'-0"	16 MIN.
24"	4'-8"	2'-6"	16 MIN.
30"	6'-8"	3'-0"	16 MIN.

REINFORCED EDGE FULL LENGTH OF END SECTION AND TOE PLATE

SIDE VIEW

ISOMETRIC VIEW

ISOMETRIC VIEW

PLAN VIEW

PLAN VIEW

END VIEW

END VIEW

NOTE:
 PREFABRICATED STEEL END SECTION AND ALL PARTS
 WILL MEET THE REQUIREMENTS OF AASHTO M-218.

STATE OF NORTH CAROLINA
 DEPT. OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
CROSS PIPE END SECTION
 PREFABRICATED STEEL SECTION FOR 18" TO 30" PIPE

STATE OF NORTH CAROLINA
 DEPT. OF TRANSPORTATION
 DIVISION OF HIGHWAYS
 RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
CROSS PIPE END SECTION
 PREFABRICATED STEEL SECTION FOR 18" TO 30" PIPE

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

1-02

ENGLISH STANDARD DRAWING FOR
PARALLEL PIPE END SECTION
PREFABRICATED STEEL SECTION FOR 15" TO 24" PIPE

SHEET 1 OF 1
310.04

DRIVEWAY PIPE TYPICAL SECTION

END TREATMENT DIMENSIONS			
D	L	W	THICK. GAGE
15"	2'-6"	1'-9"	16 MIN.
18"	4'-0"	2'-0"	16 MIN.
24"	7'-0"	2'-6"	16 MIN.

ISOMETRIC VIEW

NOTE:
PREFABRICATED STEEL END SECTION AND ALL PARTS
WILL MEET THE REQUIREMENTS OF AASHTO M-218.

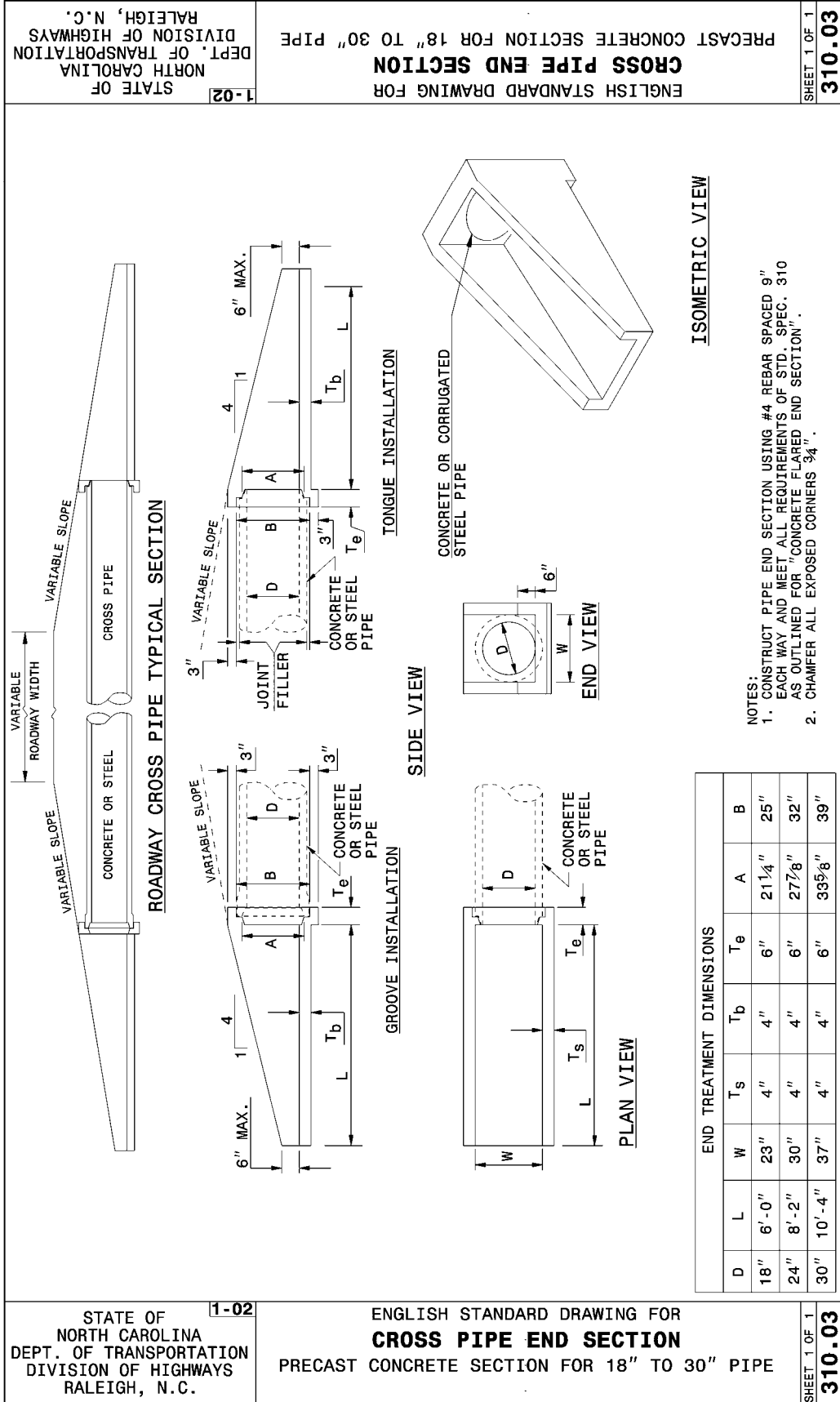
SIDE VIEW

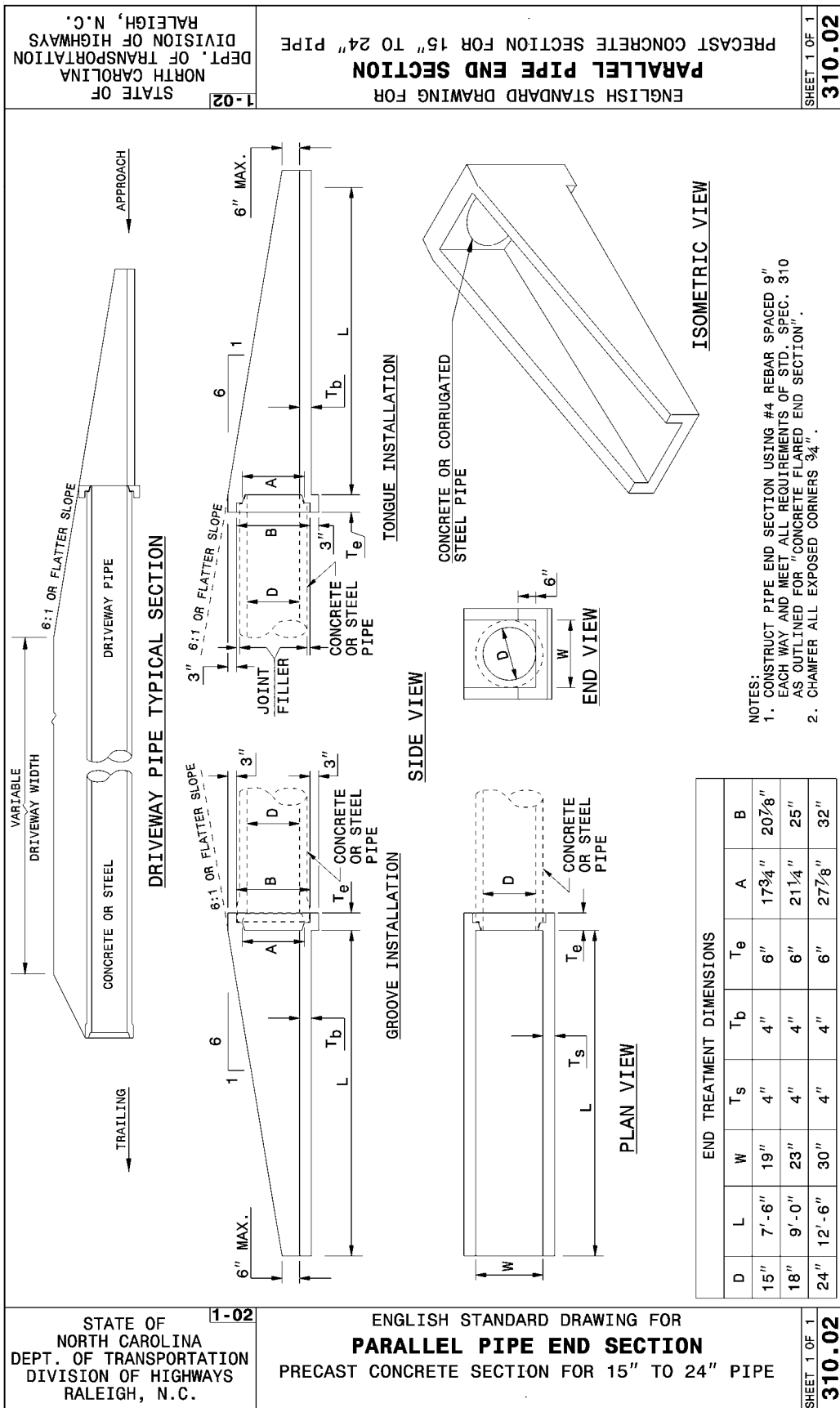
PLAN VIEW

END VIEW

STEEL END SECTION

SHEET 1 OF 1
310.04





STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
**METHOD OF STRUCTURAL PLATE
PIPE & PIPE ARCH INSTALLATION**
METHOD 'B'

SHEET 1 OF 1
300.04

PIPE IN TRENCH

PIPE ABOVE GROUND

GENERAL NOTES:

- USE METHOD 'B' PIPE INSTALLATION ONLY WHERE CALLED FOR ON THE PLANS.
- O.D. = THE MAXIMUM HORIZONTAL OUTSIDE DIMENSION.
- H = THE FILL HEIGHT MEASURED VERTICALLY AT ANY POINT ALONG THE PIPE FROM THE TOP OF THE PIPE TO THE TOP OF THE EMBANKMENT AT THAT POINT.
- W = WIDTH OF SHAPED BEDDING
- LOOSELY PLACED APPROVED SUITABLE LOCAL MATERIAL OR SELECT MATERIAL FOR FOUNDATION CONDITIONING AS DIRECTED BY THE ENGINEER. (STONE WILL NOT BE ALLOWED)
- SELECT MATERIAL OF THE APPROPRIATE CLASS AS FOLLOWS:

SELECT BACKFILL					
CLASS IV		OVER 50 FEET	H		
CLASS III		OVER 40 FEET THROUGH 50 FEET			
CLASS II		OVER 30 FEET THROUGH 40 FEET			

NOTE: A HIGHER CLASS SELECT MATERIAL, NOT TO EXCEED CLASS IV, MAY BE USED IN LIEU OF CLASS II OR III.

LOOSE COMPRESSIBLE MATERIAL - THE BOTTOM THIRD OF THIS MATERIAL WILL BE UNBALED HAY OR STRAW. PLACE THE REMAINING APPROVED BACKFILL IN A LOOSE UNCOMPACTED CONDITION. WHEN 'H' IS LESS THAN 30" THE LOOSE MATERIAL AND HAY IS NOT REQUIRED.

PREPARE THE PIPE FOUNDATION IN ACCORDANCE WITH METHOD 'B' INSTALLATION. PLACE BACKFILL MATERIAL TO THE WIDTH REQUIRED BY THE DRAWING AND TO A DEPTH OVER THE PIPE EQUAL TO 'H'. EXCAVATE THE BACKFILL MATERIAL DIRECTLY OVER THE PIPE AND BACKFILL THE TRENCH WITH MATERIAL DEPOSITED IN THE LOOSEST POSSIBLE CONDITION. COMPLETE THE EMBANKMENT IN ACCORDANCE WITH SECTION 235 OF THE SPECIFICATIONS.

DO NOT OPERATE HEAVY EQUIPMENT OVER THE PIPE CULVERT UNTIL THE BACKFILL, INCLUDING THE TRENCH OF LOOSE COMPRESSIBLE MATERIAL, HAS BEEN COMPLETED.

* O.D./12 NOT LESS THAN 6" MIN.

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
**METHOD OF STRUCTURAL PLATE
PIPE & PIPE ARCH INSTALLATION**
METHOD 'B'

SHEET 1 OF 1
300.04

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
**METHOD OF STRUCTURAL PLATE
PIPE & PIPE ARCH INSTALLATION**
METHOD 'A'

1-02
STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

NORMAL EARTH FOUNDATION

AS DIRECTED BY ENGR.

**ROCK FOUNDATION
PIPE IN TRENCH**

AS DIRECTED BY ENGR.

UNSUITABLE MATERIAL FOUNDATION

AS DIRECTED BY ENGR.

NORMAL EARTH FOUNDATION

AS DIRECTED BY ENGR.

**ROCK FOUNDATION
PIPE ABOVE GROUND**

AS DIRECTED BY ENGR.

UNSUITABLE MATERIAL FOUNDATION

AS DIRECTED BY ENGR.

1 1/2" PER FOOT OF 'H'
BUT NOT LESS THAN 12"
NOR MORE THAN 24"

1 1/2" PER FOOT OF 'H'
BUT NOT LESS THAN 12"
NOR MORE THAN 24"

APPROVED SUITABLE LOCAL MATERIAL OR SELECT MATERIAL FOR FOUNDATION CONDITIONING AS DIRECTED BY THE ENGINEER.

APPROVED BACKFILL OR SELECT MATERIAL. WHEN 'H' IS GREATER THAN 30', SELECT MATERIAL OF THE APPROPRIATE CLASS WILL BE USED AS FOLLOWS:

UNDISTURBED EARTH MATERIAL

SELECT MATERIAL

CLASS IV
CLASS III
CLASS II

APPROVED SUITABLE LOCAL MATERIAL OR SELECT MATERIAL FOR FOUNDATION CONDITIONING AS DIRECTED BY THE ENGINEER.

APPROVED BACKFILL OR SELECT MATERIAL. WHEN 'H' IS GREATER THAN 30', SELECT MATERIAL OF THE APPROPRIATE CLASS WILL BE USED AS FOLLOWS:

UNDISTURBED EARTH MATERIAL

SELECT MATERIAL

CLASS IV
CLASS III
CLASS II

DO NOT OPERATE HEAVY EQUIPMENT OVER ANY STRUCTURAL PLATE PIPE UNTIL THE STRUCTURAL PLATE PIPE HAS BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 3 FEET OF APPROVED MATERIAL.

* O.D./12 NOT LESS THAN 6" MIN.

DO NOT OPERATE HEAVY EQUIPMENT OVER ANY STRUCTURAL PLATE PIPE UNTIL THE STRUCTURAL PLATE PIPE HAS BEEN PROPERLY BACKFILLED AND COVERED WITH AT LEAST 3 FEET OF APPROVED MATERIAL.

* O.D./12 NOT LESS THAN 6" MIN.

THE CLASS OF SELECT BACKFILL MATERIAL TO BE USED FOR AN INDIVIDUAL PIPE INSTALLATION WILL BE BASED ON THE MAXIMUM H WHICH OCCURS ALONG THE PIPE INSTALLATION. A HIGHER CLASS SELECT MATERIAL, NOT TO EXCEED CLASS IV, MAY BE USED IN LIEU OF CLASS II OR III. PIPE INSTALLATION LOCATED UNDER THAT PART OF THE FILL WHERE 'H' IS 30 FEET OR LESS

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STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
**METHOD OF STRUCTURAL PLATE
PIPE & PIPE ARCH INSTALLATION**
METHOD 'A'

1-02
STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

SHEET 1 OF 1
300.03

SHEET 1 OF 1
300.03

SHEET 1 OF 1
300.03

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
METHOD OF PIPE INSTALLATION
METHOD 'B'

1-02

GENERAL NOTES:

USE METHOD B PIPE INSTALLATION ONLY WHERE CALLED FOR ON THE PLANS.

I. D. = THE MAXIMUM HORIZONTAL INSIDE DIMENSION.

O. D. = THE MAXIMUM HORIZONTAL OUTSIDE DIMENSION.

H = THE FILL HEIGHT MEASURED VERTICALLY AT ANY POINT ALONG THE PIPE FROM THE TOP OF THE EMBANKMENT AT THAT POINT.

LOOSELY PLACED APPROVED SUITABLE LOCAL MATERIAL OR SELECT MATERIAL FOR FOUNDATION CONDITIONING AS DIRECTED BY THE ENGINEER. (STONE WILL NOT BE ALLOWED)

SELECT MATERIAL OF THE APPROPRIATE CLASS AS FOLLOWS:

CLASS IV	OVER 50 FEET
CLASS III	OVER 40 FEET THROUGH 50 FEET
CLASS II	OVER 30 FEET THROUGH 40 FEET

NOTE: A HIGHER CLASS SELECT MATERIAL, NOT TO EXCEED CLASS IV, MAY BE USED IN LIEU OF CLASS II OR III.

LOOSE COMPRESSIBLE MATERIAL. THE BOTTOM THIRD OF THIS MATERIAL WILL BE UNBALED HAY OR STRAW. PLACE THE REMAINING APPROVED BACKFILL IN A LOOSE UNCOMPACTED CONDITION. WHEN 'H' IS LESS THAN 30' THE LOOSE MATERIAL AND HAY IS NOT REQUIRED.

PREPARE THE PIPE FOUNDATION AND BEDDING OF THE PIPE IN ACCORDANCE WITH METHOD 'A' INSTALLATION. PLACE BACKFILL MATERIAL DIRECTLY OVER THE PIPE AND BACKFILL THE TRENCH WITH MATERIAL DEPOSITED IN THE LOOSEST POSSIBLE CONDITION. COMPLETE THE EMBANKMENT IN ACCORDANCE WITH SECTION 235 OF THE SPECIFICATIONS.

DO NOT OPERATE HEAVY EQUIPMENT OVER THE PIPE CULVERT UNTIL THE BACKFILL, INCLUDING THE TRENCH OF LOOSE COMPRESSIBLE MATERIAL, HAS BEEN COMPLETED.

STATE OF NORTH CAROLINA
DEPT. OF TRANSPORTATION
DIVISION OF HIGHWAYS
RALEIGH, N.C.

ENGLISH STANDARD DRAWING FOR
METHOD OF PIPE INSTALLATION
METHOD 'B'

1-02

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SHEET 1 OF 1
300.02

SHEET 1 OF 1
300.02

Appendices

Appendix	Page	
A	NCDOT Roadway Standard Drawings	A-3
	300.01 Method of Pipe Installation (Method 'A')	A-3
	300.02 Method of Pipe Installation (Method 'B')	A-4
	300.03 Method of Structural Plate Pipe & Pipe Arch Installation (Method 'A')	A-5
	300.04 Method of Structural Plate Pipe & Pipe Arch Installation (Method 'B')	A-6
	310.02 Parallel Pipe End Section (Precast Concrete Section for 15" to 24" Pipe)	A-7
	310.03 Cross Pipe End Section (Precast Concrete Section for 18" to 30" Pipe)	A-8
	310.04 Parallel Pipe End Section (Prefabricated Steel Section for 15" to 24" Pipe)	A-9
	310.05 Cross Pipe End Section (Prefabricated Steel Section for 18" to 30" Pipe)	A-10
	310D10 Driveway Pipe Construction (Using No Special End Sections)	A-11
B	Fill Height Tables - Finished Grade	A-12
	Corrugated Steel Pipe (2" x *" or 2-2/3" x *" Corrugations)	A-12
	Corrugated Steel Pipe Arches	A-12
	Corrugated Aluminum Pipe (3" x 1" Corrugations)	A-13
	Corrugated Steel Pipe (3" x 1" Corrugations)	A-13
	Corrugated Steel Pipe Arches (3" x 1" Corrugations)	A-14
	Corrugated Aluminum Pipe (2" x 1/2" or 2-2/3" x 1/2" Corrugations)	A-14
	Corrugated Aluminum Pipe Arches (2" x *" or 2-1/2" x *" Corrugations)	A-15
	Structural Plate Steel Pipe (6" x 2" Corrugations)	A-16
	Structural Plate Steel Pipe Arches (6" x 2" Corrugations, 18" Corner Radius)	A-17
	Structural Plate Steel Pipe Arches (6" x 2" Corrugations, 31" Corner Radius)	A-18
	Structural Plate Aluminum Pipe Arch (9" x 2 1/2" Corrugations, 28.8" Corner Radius)	A-19
	Structural Plate Aluminum Pipe (9" x 2 1/2" Corrugations)	A-20
	Corrugated Aluminum Pipe (3" x 1" Corrugations)	A-21
	Reinforced Concrete Pipe	A-22
	Steel Spiral Rib Pipe	A-23
	Steel Spiral Rib Pipe Arch	A-23
	Aluminum Spiral Rib Pipe	A-24
	Aluminum Spiral Rib Pipe Arch	A-24
	PVC Corrugated Double Wall Plastic Pipe	A-25
	HDPE Corrugated Double Wall Plastic Pipe	A-25
C	End Treatment Tables and Figures	A-26
D	Camber Determination	A-29
E	New Products Committee Procedures	A-31
F	References	A-36