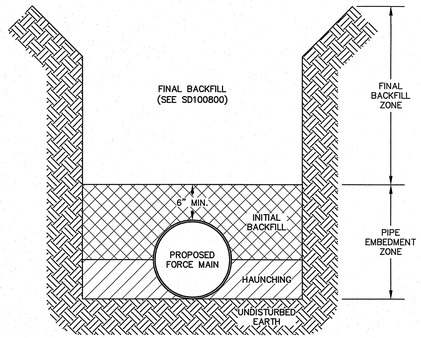
8/17/99

REVISIONS



PIPE EMBEDMENT ZONE MATERIAL REQUIREMENTS

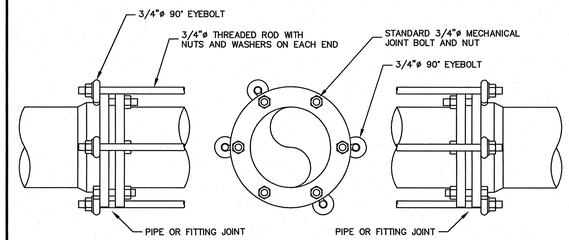
- INITIAL BACKFILL MATERIAL SHALL BE NATIVE SOIL (PROVIDED COMPACTION CAN BE OBTAINED), BORROW, OR SELECT BACKFILL
- HAUNCHING MATERIAL SHALL BE NATIVE SOIL (PROVIDED COMPACTION CAN BE OBTAINED), BORROW, OR SELECT BACKFILL

PIPE EMBEDMENT ZONE COMPACTON REQUIREMENTS

- INITIAL BACKFILL – FROM CENTERLINE OF PIPE TO 6" ABOVE TOP OF PIPE COMPACTION = 90% STANDARD PROCTOR
- HAUNCHING – FROM UNDISTURBED TRENCH BOTTOM TO CENTERLINE OF PIPE COMPACTION = 90% STANDARD PROCTOR

BEDDING AND COMPACTION REQUIREMENTS FOR SEWER FORCE MAINS

A



NOMINAL PIPE SIZE (inches)	NUMBER OF THRUST RODS REQUIRED
4	2
6	2
8	2
10	4
12	4

1. PROVIDE THRUST RODDING IN ACCORDANCE WITH SECTION 02668 OF THE SPECIFICATIONS.
2. PROVIDE THRUST RODDING WITH 90° EYEBOLTS, RODDING LUGS, AND THREADED RODS IN ACCORDANCE WITH THE TABLE TO THE LEFT.
3. EVENLY SPACE THE REQUIRED NUMBER OF THRUST RODS AROUND THE PIPE JOINT
4. INSTALL EYEBOLTS IN LIEU OF STANDARD MECHANICAL JOINT BOLTS IN ROUND HOLES. INSTALL RODDING LUGS USING STANDARD MECHANICAL JOINT BOLTS IN SLOTTED HOLES. DO NOT USE EYEBOLTS IN SLOTTED HOLES.
5. COMPLETELY TIGHTEN ALL MECHANICAL JOINT BOLTS BEFORE INSTALLING THREADED RODS.
6. WHERE THRUST RODDING IS REQUIRED AT THE ENDS OF STEEL CASING, WELD EYEBOLTS TO THE OUTSIDE OF THE CASING WITH 1/4" BY 3" LONG WELDS ON EACH SIDE OF EYEBOLTS. SPACE EYEBOLTS AROUND CASING AT ANGULAR LOCATIONS CORRESPONDING TO THE ANGULAR LOCATIONS OF EYEBOLTS AND/OR RODDING LUGS ON THE FITTING OR VALVE.
7. INSTALL THREADED RODS THROUGH EYEBOLTS AND RODDING LUGS. INSTALL NUT AND WASHER ON EACH END OF THREADED ROD AND TIGHTEN SNUG. DO NOT OVERTIGHTEN.

MECHANICAL JOINT THRUST RODDING

B

PROJECT REFERENCE NO.	SHEET NO.
B-4926	UC-3C
DESIGNED BY: JWM	NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DRAWN BY: MW	
CHECKED BY: DEG	UTILITIES ENGINEERING SEC. PHONE: (919)707-6690 FAX: (919)250-4151
APPROVED BY: JWM	
REVISED:	

UTILITY CONSTRUCTION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

McDAVID ASSOCIATES, INC. CORPORATE OFFICE FARMVILLE, N.C. SEAL 1972

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 28431 9/13/12 JOSEPH W. MCKEMEY

UTILITY CONSTRUCTION PLANS ONLY

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REVISIONS

NO.	DATE	DESCRIPTION

MAI REVIEW OFFICER APPROVAL

DATE — MAI REVIEW OFFICER

1-19-0309-3401

TABLE 1 – MINIMUM THRUST BLOCK AREAS AND DIMENSIONS

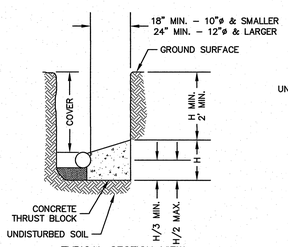
NOMINAL PIPE SIZE	90° BEND			45° BEND			22½° BEND			11¼° BEND			TEES, PLUGS AND VALVES		
	AREA (sf)	B (in)	H (in)	AREA (sf)	B (in)	H (in)	AREA (sf)	B (in)	H (in)	AREA (sf)	B (in)	H (in)	AREA (sf)	B (in)	H (in)
2"	0.4	10	6	0.2	8	4	0.1	6	3	0.1	6	3	0.3	8	6
3"	0.8	13	9	0.4	10	6	0.2	6	5	0.1	6	4	0.6	11	8
4"	1.5	18	12	0.8	13	9	0.4	10	6	0.2	6	6	1.0	15	10
6"	3.0	24	18	1.6	20	12	0.8	13	9	0.4	8	8	2.1	21	15
8"	5.2	32	24	2.8	24	17	1.4	17	12	0.7	11	11	3.6	26	20
10"	7.7	40	28	4.2	30	20	2.1	22	14	1.1	13	13	5.5	33	24
12"	10.9	50	32	5.9	36	24	3.0	24	18	1.5	15	15	7.7	40	28

BEARING AREAS IN TABLE 1 ABOVE ARE BASED ON BEARING AGAINST SAND. FOR OTHER SOIL CONDITIONS, THE AREAS AND DIMENSIONS IN TABLE 1 ABOVE SHALL BE MULTIPLIED BY THE APPROPRIATE MULTIPLIER FROM TABLE 2 BELOW.

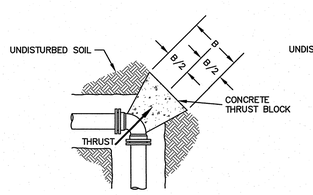
TABLE 2 – SOIL MULTIPLIERS

SOIL TYPE	SOIL BEARING STRENGTH (psf)	AREA MULTIPLIER	DIMENSION MULTIPLIER
SOFT CLAY	1,000	4.00	2.00
SILT	1,500	2.67	1.64
SANDY SILT	3,000	1.33	1.16
SAND	4,000	1.00	1.00
SANDY CLAY	5,000	0.80	0.90
HARD CLAY	9,000	0.45	0.67

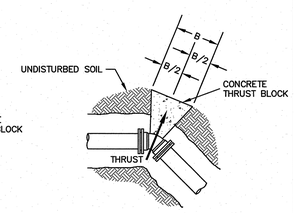
1. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 2500 PSI AT 28 DAYS.
2. MINIMUM THRUST BLOCK BEARING AREAS SHALL BE AS SHOWN IN TABLE 1. THRUST BLOCK DIMENSIONS SHALL BE CHOSEN SUCH THAT THE WIDTH (B) IS BETWEEN ONE AND TWO TIMES THE BLOCK HEIGHT (H). DIMENSIONS SHOWN IN TABLE 1 ARE PREFERRED BUT MAY BE VARIED TO MEET SITE CONDITIONS.
3. THRUST BLOCKS SHALL BEAR AGAINST THE ITEM BEING BLOCKED FOR A MINIMUM OF 60° ABOVE AND BELOW THE HORIZONTAL CENTERLINE OF THE ITEM.
4. SURFACES OF ITEM BEING BLOCKED SHALL BE COVERED WITH POLYETHYLENE ENCASEMENT PRIOR TO PLACING CONCRETE TO PREVENT DIRECT CONTACT AND BONDING WITH CONCRETE.
5. ALL JOINTS SHALL BE ACCESSIBLE FOR REPAIR AND/OR FUTURE CONNECTIONS. CONCRETE SHALL NOT COVER BOLTS, NUTS, OR GLANDS.
6. FOR 12" AND SMALLER DIAMETER FITTINGS (BOTH RESTRAINED JOINT AND NON RESTRAINED JOINT) CONCRETE THRUST BLOCKING IS REQUIRED.



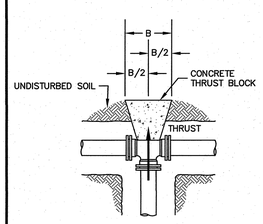
TYPICAL SECTION VIEW



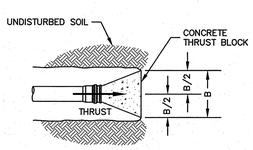
PLAN VIEW – 90° BEND



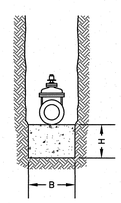
PLAN VIEW – 45°, 22½°, AND 11¼° BENDS



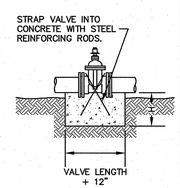
PLAN VIEW – TEE



PLAN VIEW – PLUG



SECTION VIEW – VALVE

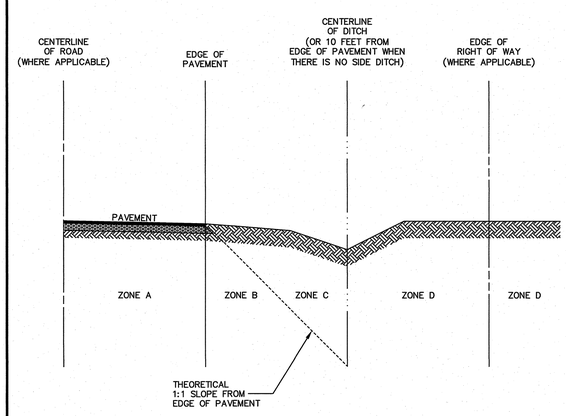


PROFILE VIEW – VALVE

VALVE SIZE	STRAP SIZE
2"	#3
3"	#3
4"	#3
6"	#4
8"	#4
10"	#4
12"	#5

CONCRETE THRUST BLOCKING FOR FORCE MAINS

C



I. FINAL BACKFILL ZONE MATERIAL REQUIREMENTS

A. ZONE A – UNDER ROADWAY, DRIVEWAY, AND PARKING AREAS

1. NATIVE SOIL, BORROW, OR SELECT BACKFILL MATERIAL CONSISTING OF SOIL CLASSIFIED AS TYPE GW, GP, SW, SP, GM, GC, SM, OR SC IN ACCORDANCE WITH ASTM D2487. BORROW AND/OR SELECT BACKFILL SHALL BE USED IF NATIVE SOIL CANNOT BE COMPACTED TO THE REQUIRED DENSITY.
2. NO. 67 OR NO. 78M STONE IN COMPLIANCE WITH THE NCDOT STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES.

B. ZONE B – BETWEEN THE EDGE OF PAVEMENT AND BOTTOM OF SIDE DITCH (OR 10 FEET FROM EDGE OF PAVEMENT WHEN THERE IS NO SIDE DITCH) BELOW THE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT TO THE BOTTOM OF THE NEAREST EXCAVATION WALL

1. NATIVE SOIL, BORROW, OR SELECT BACKFILL MATERIAL CONSISTING OF SOIL CLASSIFIED AS TYPE GW, GP, SW, SP, GM, GC, SM, OR SC IN ACCORDANCE WITH ASTM D2487.
2. NO. 67 OR NO. 78M STONE IN COMPLIANCE WITH THE NCDOT STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES.

C. ZONE C – BETWEEN THE EDGE OF PAVEMENT AND BOTTOM OF SIDE DITCH (OR 10 FEET FROM EDGE OF PAVEMENT WHEN THERE IS NO SIDE DITCH) ABOVE THE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT TO THE BOTTOM OF THE NEAREST EXCAVATION WALL

1. NATIVE SOIL FREE OF LUMPS, CLODS, STONES, ROCKS, BOULDERS, HIGHLY PLASTIC CLAY, FROZEN LUMPS, OR OTHER OBJECTIONABLE MATERIAL. PROVIDE AND ADD SUITABLE SOIL MATERIALS AS REQUIRED TO MEET COMPACTION REQUIREMENTS. SUITABLE SOIL MATERIALS SHALL BE SOIL CLASSIFIED AS TYPE GW, GP, SW, SP, GM, GC, SM, OR SC IN ACCORDANCE WITH ASTM D2487.
2. BORROW OR SELECT BACKFILL MATERIAL CONSISTING OF SOIL CLASSIFIED AS TYPE GW, GP, SW, SP, GM, GC, SM, OR SC IN ACCORDANCE WITH ASTM D2487.

D. ZONE D – BEYOND THE CENTERLINE OF SIDE DITCH (OR 10 FEET FROM EDGE OF PAVEMENT WHEN THERE IS NO SIDE DITCH)

1. NATIVE SOIL FREE OF LUMPS, CLODS, STONES, ROCKS, BOULDERS, HIGHLY PLASTIC CLAY, FROZEN LUMPS, OR OTHER OBJECTIONABLE MATERIAL. PROVIDE AND ADD SUITABLE SOIL MATERIALS AS REQUIRED TO MEET COMPACTION REQUIREMENTS. SUITABLE SOIL MATERIALS SHALL BE SOIL CLASSIFIED AS TYPE GW, GP, SW, SP, GM, GC, SM, OR SC IN ACCORDANCE WITH ASTM D2487.

II. FINAL BACKFILL ZONE COMPACTION REQUIREMENTS NOT WITHIN PUBLIC RIGHTS-OF-WAY

A. ALL TRAFFIC WAYS – 98% STANDARD PROCTOR DENSITY (ASTM D698)

B. ALL NON-TRAFFIC WAYS – 95% STANDARD PROCTOR DENSITY (ASTM D698)

III. FINAL BACKFILL ZONE COMPACTION REQUIREMENTS WITHIN PUBLIC RIGHTS-OF-WAY

A. ZONE A – UNDER ROADWAY PAVEMENTS

1. FROM THE TOP OF INITIAL BACKFILL TO 8" BELOW FINISHED SUBGRADE – 98% STANDARD PROCTOR DENSITY (ASTM D698)
2. FROM 8" BELOW FINISHED SUBGRADE TO THE FINISHED SUBGRADE – 100% STANDARD PROCTOR DENSITY (ASTM D698)

B. ZONE A – UNDER DRIVEWAY AND PARKING AREAS (PAVED AND UNPAVED)

1. FROM THE TOP OF INITIAL BACKFILL TO THE FINISHED SUBGRADE – 98% STANDARD PROCTOR DENSITY (ASTM D698)

C. ZONE B – BETWEEN THE EDGE OF PAVEMENT AND BOTTOM OF SIDE DITCH (OR 10 FEET FROM EDGE OF PAVEMENT WHEN THERE IS NO SIDE DITCH) BELOW THE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT TO THE BOTTOM OF THE NEAREST EXCAVATION WALL

1. FROM THE TOP OF INITIAL BACKFILL TO THE FINISHED SUBGRADE – 98% STANDARD PROCTOR DENSITY (ASTM D698)

D. ZONE C – BETWEEN THE EDGE OF PAVEMENT AND BOTTOM OF SIDE DITCH (OR 10 FEET FROM EDGE OF PAVEMENT WHEN THERE IS NO SIDE DITCH) ABOVE THE THEORETICAL 1:1 SLOPE FROM THE EDGE OF PAVEMENT TO THE BOTTOM OF THE NEAREST EXCAVATION WALL

1. ALL TRAFFIC WAYS – 98% STANDARD PROCTOR DENSITY (ASTM D698)
2. ALL NON-TRAFFIC WAYS – 95% STANDARD PROCTOR DENSITY (ASTM D698)

E. ZONE D – BEYOND THE CENTERLINE OF SIDE DITCH (OR 10 FEET FROM EDGE OF PAVEMENT WHEN THERE IS NO SIDE DITCH)

1. ALL TRAFFIC WAYS – 98% STANDARD PROCTOR DENSITY (ASTM D698)
2. ALL NON-TRAFFIC WAYS – 95% STANDARD PROCTOR DENSITY (ASTM D698)

IV. COMPACTION REQUIREMENTS ADJACENT TO BUILDINGS, STRUCTURES, AND UTILITIES

1. 98% STANDARD PROCTOR DENSITY (ASTM D698)

V. MOISTEN AND/OR DRY BACKFILL MATERIALS AS NECESSARY TO ADJUST MOISTURE CONTENT TO WITHIN 2% OF OPTIMUM MOISTURE CONTENT AND ACHIEVE THE REQUIRED DENSITY AND STRUCTURAL STABILITY.

VI. DISPOSE OF EXCESS AND/OR UNSUITABLE EXCAVATED MATERIALS NOT REQUIRED FOR FILL OR BACKFILL AT AN APPROVED OFF-SITE DISPOSAL SITE PROVIDED BY THE CONTRACTOR.

FINAL BACKFILL AND COMPACTION REQUIREMENTS FOR FORCE MAIN

D