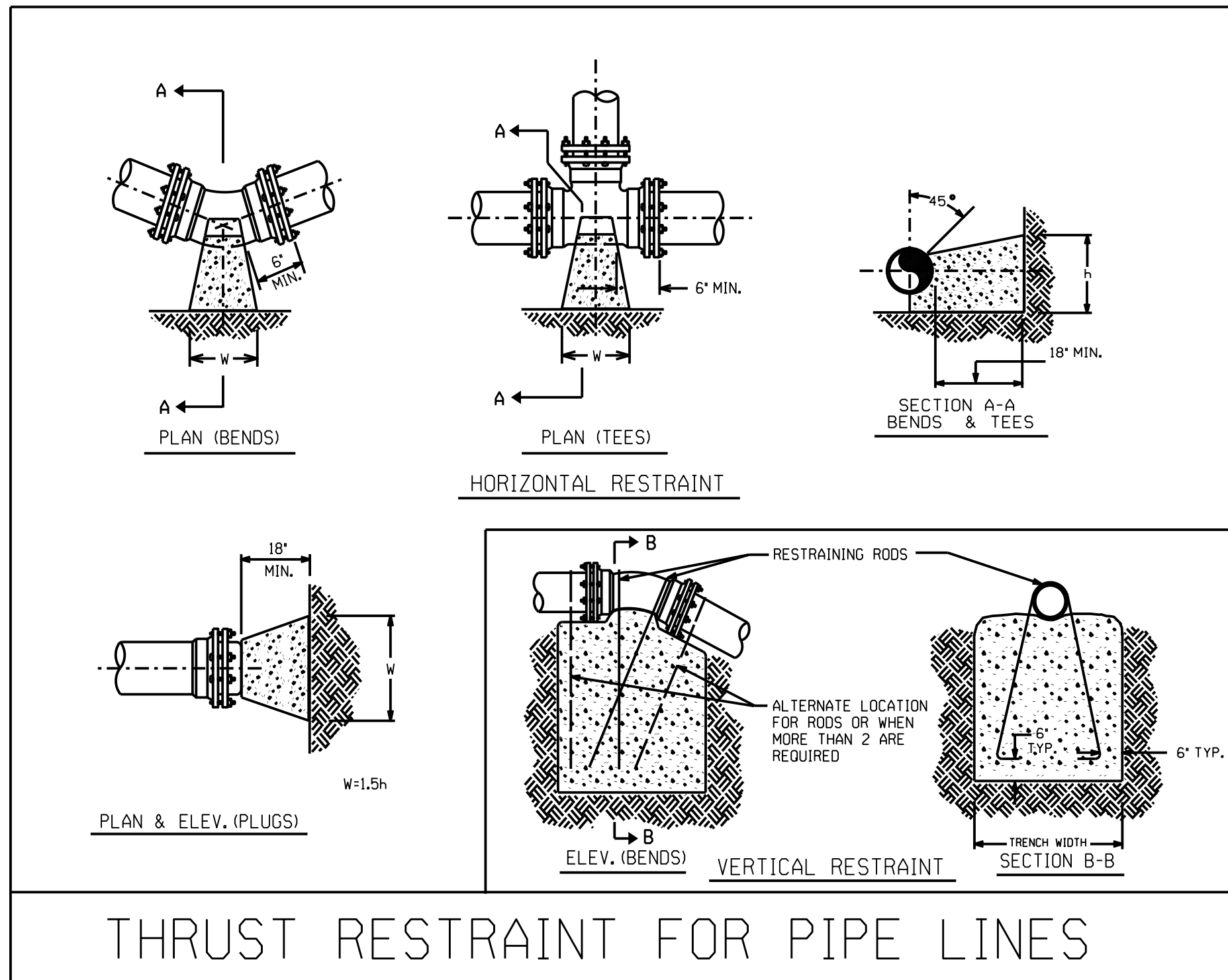


5/14/99



THRUST RESTRAINT FOR PIPE LINES

PVC PIPE RESTRAINED JOINT DESIGN TABLE

FITTING	REQUIRED RESTRAINED LENGTH (FT) OF PVC PIPE BY DEPTH OF COVER							
	3 FT	4 FT	5 FT	6 FT	7 FT	8 FT	9 FT	10 FT
HORIZONTAL BENDS								
8 INCH DIA - 11.25 DEG	3	3	3	2	2	2	2	2
8 INCH DIA - 22.5 DEG	6	5	5	4	4	4	3	3
8 INCH DIA - 45 DEG	12	11	9	8	7	7	6	6
8 INCH DIA - 90 DEG	29	25	22	19	17	16	14	13
VERTICAL DOWN BENDS								
8 INCH DIA - 11.25 DEG	11	9	8	7	6	5	5	5
8 INCH DIA - 22.5 DEG	22	18	15	13	12	11	10	9
8 INCH DIA - 45 DEG	45	37	31	27	24	21	19	18
VERTICAL UP BENDS								
8 INCH DIA - 11.25 DEG	3	3	3	2	2	2	2	2
8 INCH DIA - 22.5 DEG	6	5	5	4	4	4	3	3
8 INCH DIA - 45 DEG	12	11	9	8	7	7	6	6
DEAD ENDS / VALVES								
8 INCH DIA	83	71	62	55	49	45	41	38

ASSUMPTIONS
 LAYING CONDITION = TYPE 4
 SOIL DESIGNATION = GC = COHESIVE-GRANULAR
 DESIGN PRESSURE = 200 PSI (TEST PRESSURE)
 SAFETY FACTOR = 1.5

- NOTES**
1. RL = RUN LENGTH BETWEEN FIRST JOINTS OF PIPE ALONG THE RUN LINE OF TEE.
 2. RESTRAINED LENGTH IS MEASURED AS FOLLOWS:
 A. HORIZONTAL/VERTICAL BENDS: ALONG EACH SIDE OF BEND.
 B. HORIZONTAL/VERTICAL BENDS - OFFSET: ALONG THE OUTER SIDE OF EACH BEND.
 ALL PIPE BETWEEN THE TWO BENDS SHALL BE RESTRAINED JOINT.
 C. DEAD ENDS: ALONG PIPE FROM THE PLUG.
 D. VALVES: ALONG THE PIPE IN EACH DIRECTION FROM THE VALVE.
 E. REDUCERS: ALONG THE LARGER PIPE.
 F. TEES: ALONG THE BRANCH PIPE FROM THE TEE.
 3. WHEN IT IS NOT POSSIBLE TO INSTALL THE RESTRAINED LENGTHS AS NOTED BY THIS TABLE, CONTRACTOR SHALL INSTALL THE APPROPRIATE CONCRETE THRUST RESTRAINTS AS PER THE DETAILS HEREIN.

PROJECT REFERENCE NO. B-4761	SHEET NO. UC-3B
DESIGNED BY: JKC	
DRAWN BY: JKC	
CHECKED BY: KCZ	
APPROVED BY: KCZ	
REVISED:	
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION UTILITIES ENGINEERING SEC. PHONE: (919) 707-6690 FAX: (919) 250-4151	

UTILITY CONSTRUCTION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

BASED ON TEST PRESSURE OF 200 P.S.I.

PIPE SIZE	DEGREE OF BEND	LBS. STATIC THRUST *	HORIZONTAL RESTRAINT (ALL AREAS GIVEN ARE IN SQUARE FEET)								VERTICAL RESTRAINT (ALL VOLUMES GIVEN ARE IN CUBIC YARDS)**						
			ALLOWABLE SOIL BEARING (PSF)								PIPE SIZE	RESTRAINING RODS NO./REQ'D	DIA.	DEGREE OF BEND			
1000	2000	3000	4000	5000	6000	7000	8000	11/4°	22 1/2°	45°							
4"	11/4°	616	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	45°	2,465	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	TEE/PLUG	4,244	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	22 1/2°	3,063	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
6"	11/4°	1,485	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	45°	6,109	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	TEE/PLUG	9,939	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
	22 1/2°	7,068	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
8"	11/4°	2,523	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	45°	9,619	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
	TEE/PLUG	17,773	18	18	18	18	18	18	18	18	18	18	18	18	18	18	
	22 1/2°	12,459	13	13	13	13	13	13	13	13	13	13	13	13	13	13	
10"	11/4°	3,846	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	45°	15,028	15	15	15	15	15	15	15	15	15	15	15	15	15	15	
	TEE/PLUG	27,768	28	28	28	28	28	28	28	28	28	28	28	28	28	28	
	22 1/2°	19,432	20	20	20	20	20	20	20	20	20	20	20	20	20	20	
12"	11/4°	5,533	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	45°	21,641	22	22	22	22	22	22	22	22	22	22	22	22	22	22	
	TEE/PLUG	39,394	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
	22 1/2°	28,026	28	28	28	28	28	28	28	28	28	28	28	28	28	28	
14"	11/4°	7,543	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	45°	29,255	29	29	29	29	29	29	29	29	29	29	29	29	29	29	
	TEE/PLUG	54,246	55	55	55	55	55	55	55	55	55	55	55	55	55	55	
	22 1/2°	38,432	39	39	39	39	39	39	39	39	39	39	39	39	39	39	
16"	11/4°	9,853	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	45°	38,271	38	38	38	38	38	38	38	38	38	38	38	38	38	38	
	TEE/PLUG	60,282	60	60	60	60	60	60	60	60	60	60	60	60	60	60	
	22 1/2°	43,026	43	43	43	43	43	43	43	43	43	43	43	43	43	43	

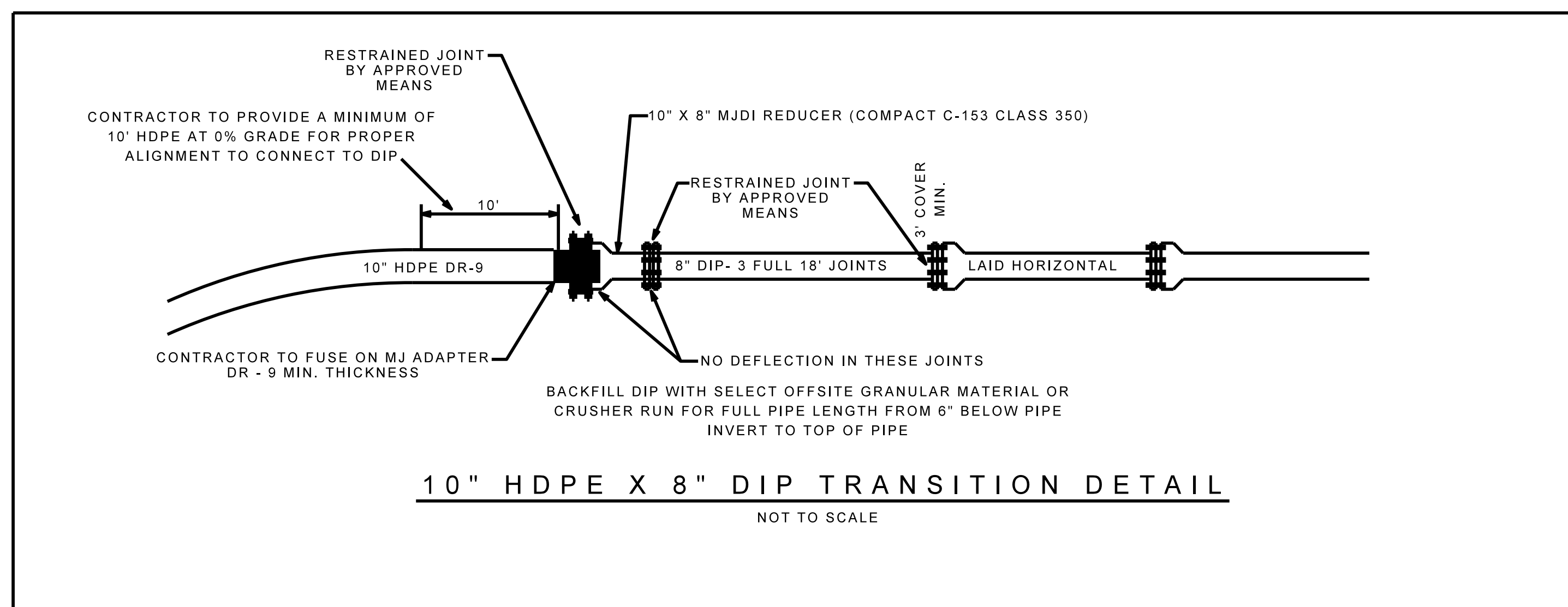
* INCLUDES 1.25 SAFETY FACTOR
 ** INCLUDES 1.50 SAFETY FACTOR

GENERAL NOTES:
 1. CONCRETE SHALL BE CLASS "B".
 2. CONCRETE SHALL NOT CONTACT BOLTS ENDS OF MECHANICAL JOINT FITTINGS.
 3. CONSULT WITH ENGINEER FOR CONCRETE REQUIREMENTS ON MAINS LARGER THAN 16 INCHES.
 4. ALLOWABLE SOIL BEARING SHALL BE DETERMINED BY THE ENGINEER.

REVISIONS	
NO.	DESCRIPTION

SHEET 2 OF 2

THRUST RESTRAINT FOR WATER MAINS



10" HDPE X 8" DIP TRANSITION DETAIL

NOT TO SCALE

N:\103000\B-4761\11\res\Engineering\UC\Proj\B-4761\ut-UC-03B.dgn
 5/14/2016 10:30:00 AM