

- NOTES:
- CASINGS SHALL HAVE A MINIMUM OF 3 FEET (36") COVER TO THE TOP OF THE PIPE BELOW THE PARALLEL DITCH LINES OR 3 1/2 FEET (42") BELOW THE TOP OF THE HIGHWAY SUBGRADE, WHICHEVER GIVES THE GREATER COVER. CASING SHOULD EXTEND THE FULL WIDTH OF THE RIGHT-OF-WAY BUT AS A MINIMUM MUST EXTEND SIX FEET BEYOND THE FLOWLINE OF THE PARALLEL DITCHES, TOE OF THE FORESLOPE, OR BACK OF CURBS AS APPLICABLE FOR THE ROADWAY SECTION.
  - BORES SHALL BE PAID FOR PER UNIT FOOT OF BORE WITH LINE INSIDE ENCASMENT BEING PAID FOR SEPARATELY.
  - INSTALL STAINLESS STEEL BAND CASING INSULATORS (MODEL NO. 59 BY 4-FOUR PIPELINE PRODUCTS) OR APPROVED EQUAL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
  - SEAL EACH END WITH ZIPPER END SEALS.
  - WATERLINE SHALL BE PLACED ON PVC SKIDS WITHIN ENCASMENT PIPE.

STANDARD ROADWAY CROSSING DETAIL  
N.T.S.  
WA.1.1

CONCRETE BLOCKING DATA  
THRUST PER LB. OF WATER PRESSURE  
(COEFFICIENT)

PIPE SIZE OR TEE	90° BEND	45° BEND	22 1/2° BEND	11 1/4° BEND
2	5	3	2	1
3	7	4	3	2
4	10	6	4	3
6	18	10	7	5
8	21	12	8	6
10	24	14	9	7
12	27	16	10	8
14	30	18	11	9
16	33	20	12	10
18	36	22	13	11
20	39	24	14	12
22	42	26	15	13
24	45	28	16	14

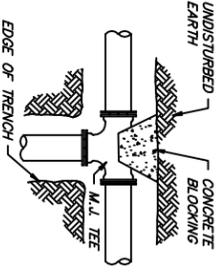
BEARING STRENGTH OF SOILS

SOIL TYPE	SAFE BEARING LOAD, LBS./SQ. FT.
MUCK	0
SOFT CLAY	1,000
MEDIUM CLAY OR SAND	2,500
COMPACTED SAND	3,000
HARD CLAY	6,000
SHALE	10,000

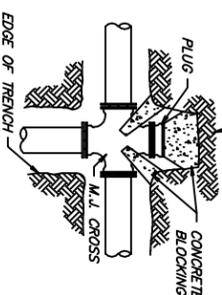
- NOTES:
- A PROPERLY DESIGNED RESTRAINT SYSTEM USING MEGA-LUG BY EBIA IRON OR APPROVED EQUAL MAY BE USED IN LIEU OF CONCRETE BLOCKING ON THE PLANS.
  - NO CONCRETE BLOCKING SHALL BE USED IF A RESTRAINT SYSTEM IS SHOWN ON THE PLANS.
  - AN ALLOWANCE FOR WATER HAMMER OF 50% OF THE PRESSURE CONDITION SHALL BE MADE IN SIZING ALL THRUST BLOCKS UNLESS OTHERWISE DIRECTED. FOR BENDS IN WHICH THE RESULTANT THRUST IS HORIZONTAL OR DOWNWARD, THE AREA OF UNDISTURBED TRENCH BACKING FOR THRUST BLOCKS SHALL BE IN ACCORDANCE WITH THE FOLLOWING FORMULA:  

$$A = \frac{P \times C}{S}$$
 WHERE:  
 A = UNDISTURBED PRESSURE CONDITION X 1.5 COEFFICIENT  
 P = THRUST FORCE  
 C = SAFE BEARING LOAD OF SOIL  
 S = MINIMUM AREA OF TRENCH BACKING FOR THRUST BLOCKS SHALL BE 10 SQ. FT. REGARDLESS OF SIZE GIVEN BY FORMULA.  
 EXAMPLE: 90 BEND, 8" LINE, 100 PSI LINE PRESSURE, MEDIUM SOIL. FT. OF TRENCH BACKING =  $\frac{100 \times 1.5 \times 84}{5.0} = 5.0$  SQ. FT.
  - THE MINIMUM AREA OF TRENCH BACKING FOR THRUST BLOCKS SHALL BE 10 SQ. FT. REGARDLESS OF SIZE GIVEN BY FORMULA.  
 EXAMPLE: 90 BEND, 8" LINE, 100 PSI LINE PRESSURE, MEDIUM SOIL. FT. OF TRENCH BACKING =  $\frac{100 \times 1.5 \times 84}{5.0} = 5.0$  SQ. FT.
  - FOR VERTICAL BENDS IN WHICH THE RESULTANT THRUST IS UPWARD, THE THRUST BLOCK SHALL BE SIZED IN ACCORDANCE WITH THE FOLLOWING FORMULA:  

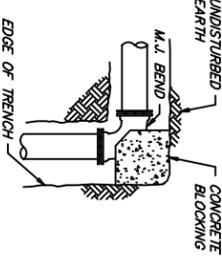
$$A = \frac{P}{S}$$
 WHERE:  
 A = THRUST BLOCK AREA  
 P = THRUST FORCE  
 S = PRESSURE CONDITION X 1.5 COEFFICIENT  
 EXAMPLE: 11-1/4" VERTICAL BEND WITH UPWARD THRUST, 16" PIPE, 100 PSI, TYPE SOIL IS NOT CONSIDERED.  
 SIZE OF BLOCK =  $\frac{100 \times 1.5 \times 40}{40} = 40$  SQ. FT.
  - THE STRAPS FOR VERTICAL BENDS SHALL BE OF GALVANIZED STEEL WITH MIN. DIMENSIONS OF 3/16" X 2-1/2". THE LENGTH OF THE STRAPS SHALL BE SUFFICIENT TO PROVIDE FOR 12" OF EMBEDMENT OF EACH END INTO THE CONCRETE BLOCK. THE END 2" OF THE STRAP SHALL BE BENT AT 90 DEGREES TO THE AXIS OF THE STRAP TO PROVIDE FOR ANCHORAGE. COSTS OF STRAPS IS TO BE INCLUDED IN THE UNIT PRICE FOR CONCRETE BLOCKING.



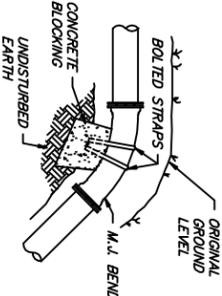
BLOCKING FOR TEES  
N.T.S.  
WA.1.4



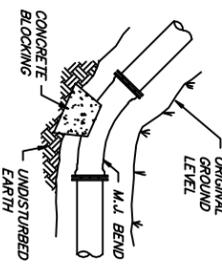
BLOCKING FOR CROSSES  
N.T.S.  
WA.1.5



BLOCKING FOR BENDS  
N.T.S.  
WA.1.6

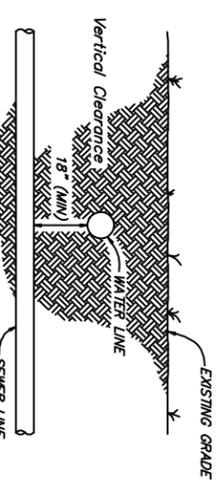


BLOCKING FOR BENDS  
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WA.1.7

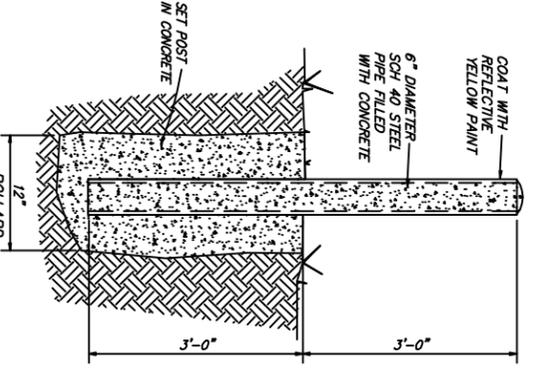


BLOCKING FOR BENDS  
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WA.1.8

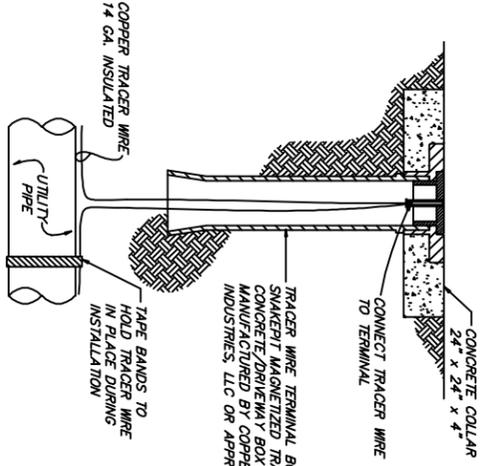
- NOTES:
- ALL WATER & SANITARY SEWER TRENCHES WHICH ARE UNDER THE PROPOSED STREETS MUST BE BACKFILLED AS SHOWN ON THE TRENCHING, BEDDING, AND BACKFILL STANDARD DETAIL DRAWINGS.
  - WATER AND SEWER LINES SHALL MAINTAIN A MINIMUM OF HORIZONTAL SEPARATION DISTANCE OF 10 FEET AT ALL TIMES. ANY DEVIATION SHALL BE CONSIDERED ON A CASE-BY-CASE BASIS. ANY WATER LINE CONSTRUCTED WITHIN 10 FEET HORIZONTALLY FROM SEWER LINES SHALL BE DUCTILE IRON.
  - WATER AND SEWER LINES SHALL MAINTAIN A MINIMUM VERTICAL SEPARATION OF 18 INCHES WITH THE WATER LINE CROSSING ABOVE THE SEWER LINE. ANY DEVIATION FROM THIS REQUIREMENT WILL BE CONSIDERED BY THE STATE HEALTH DEPARTMENT ON A CASE-BY-CASE BASIS, AND IF APPROVED, BOTH WATER AND SEWER LINES SHALL BE DUCTILE IRON FOR A 20 FOOT SECTION, TO BE CENTERED AT THE VERTICAL CROSSING.
  - WHERE A WATERLINE MUST UNAVOIDABLY PASS BENEATH A SEWER LINE, AT LEAST 18 INCHES OF SEPARATION MUST BE MAINTAINED AND BOTH WATER AND SEWER LINES SHALL BE DUCTILE IRON FOR A 20 FOOT SECTION, TO BE CENTERED AT THE VERTICAL CROSSING POINT.



DETAIL - WATER/SEWER LINE SEPARATION  
N.T.S.  
WA.1.2

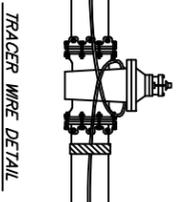
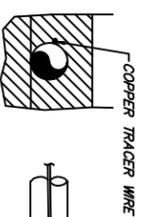


BOLLARD  
N.T.S.  
WA.1.3



TRACER WIRE TERMINAL  
N.T.S.  
WA.1.9

- NOTES:
- WIRE SHALL BE SPLICED USING 3M DIRECT BURY SPLICE KIT DRY-V-6 OR APPROVED EQUAL.
  - TERMINAL BOXES SHALL BE LOCATED AT APPROX. INTERVALS OF 500' AT LOCATIONS DETERMINED BY THE ENGINEER AND AT EACH END OF THE PIPING ON EACH TERMINAL BOX LOCATED OUTSIDE OF PAVEMENT SURFACES OR SIDEWALKS.
  - TAPE BANDS SHALL BE PLACED EVERY FOUR FEET TO HOLD TRACER WIRE IN PLACE DURING INSTALLATION.
  - THE CONTRACTOR SHALL PROVIDE AN INSTRUMENT AND DEMONSTRATE THE ELECTRICAL CONTINUITY OF ALL TRACER WIRES PRIOR TO THE FINAL ACCEPTANCE BY THE OWNER.
  - TRACER WIRE SHALL BE INSTALLED ON ALL WATERLINES AND INSTALLED IN THE LOCATION DIRECTED BY THE ENGINEER BUT SHALL GENERALLY BE LOCATED IMMEDIATELY ADJACENT TO THE PIPE AND AT THE SAME SERVICE. TRACER WIRE SHALL ALSO BE INSTALLED ON SERVICE LINES BETWEEN THE MAIN TRUNK AND THE WATER METER. THE TRACER WIRE SHALL EXTEND AT LEAST ONE FOOT INTO WATER BOX.



TRACER WIRE DETAIL  
N.T.S.  
WA.1.10



TAPE BANDS TO HOLD TRACER WIRE IN PLACE DURING INSTALLATION