STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

2009 Edition

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BY WAY OF EXPLANATION

This edition of *Standard Plans for Public Works Construction* is the fruition of over twenty eight years of intensive work by a multi-governmental agency subcommittee of the Public Works Standards, Inc., American Public Works Association, and the Southern California Districts, Associated General Contractors of California.

These plans, representing the professional thinking of the leading public works officials and private members of the construction industry, were prepared to answer a need for uniform design governing public works construction performed for the many cities, counties, and public agencies. This need dates back to the very founding of these governmental jurisdictions.

Uniform plans, embracing the most modern design and construction techniques, will greatly benefit both the general public and the private contracting industry. Such plans will eliminate conflicts and confusion, lower construction costs, and encourage more competitive bidding by private contractors.

The prime sponsors of this effort have been the City and County of Los Angeles, County of Ventura, City and County of San Diego, City of Long Beach, City of Burbank, and County of Orange. In the case of Los Angeles County, this includes the Road Department, Flood Control District, County Engineer/Facilities Department, and the Sanitation Districts. In addition to these major organizations, numerous municipal agencies, large and small, served a key role on the various task forces.

The Standard Plans are to be used in conjunction with the *Standard Specifications for Public Works Construction* as a companion document. This latter document has been in existence since 1967 and is commonly referred to as the *"Greenbook."* The Standard Plans, being engineering plans, are subject to the provisions of Chapter 7, Division 3, Business and Professions Code, State of California when used in that state. As such, they must be approved by a registered professional engineer to indicate his or her responsibility for them. In addition, they do not have the legal effect of a contract document or construction plan until officially adopted by the particular user agency.

The plans are numbered with a three digit prefix and a single digit suffix. The first number denotes the section in which the plan is located. The suffix is used to denote changes. All plans when originally approved will bear the suffix "0." As they are amended, the suffix will be numbered to denote the change number.

The *Standard Plans for Public Works Construction* will be revised periodically and reprinted to reflect advanced thinking and the changing technology of the construction industry. Subsequent editions will be published as additional material is prepared. To this end, the Public Works Standards, Inc. will continue to study and recommend changes to both the *Standard Plans* and *Standard Specifications*. Interested parties who wish to suggest additions or amendments may communicate with the Public Works Standards, Inc., c/o Associated General Contractors of California, 1906 W. Garvey Avenue South, Suite 100, West Covina, CA 91790.

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Sewers and Sanitation

NOTES:

1. EXCEPT AS NOTED HEREON, THE PRECAST UNITS SHALL BE MANUFACTURED AND TESTED IN ACCORDANCE WITH ASTM C 478. AS AN ALTERNATE CURING METHOD, THE UNITS MAY BE CURED USING SATURATED STEAM FOR A MINIMUM OF 12 HOURS FOLLOWED BY 6 DAYS OF WATER CURING OR MEMBRANE CURING. IF THE UNITS ARE CURED BY THE ALTERNATE METHOD, THEY SHALL NOT BE SHIPPED PRIOR TO 8 DAYS AFTER CASTING NOR UNTIL THE CONCRETE HAS ATTAINED A STRENGTH OF 3500 PSI (25 MPa).

2. MANHOLE STEPS SHALL CONFORM TO SPPWC 635 TYPE 1 OR 3 OR SPPWC 636. THE MANHOLE STEPS SHALL BE UNIFORMLY SPACED AT A MAXIMUM OF 16" (400 mm). THE LOWEST STEP SHALL BE PLACED NOT LESS THAN 8" (200 mm) NOR MORE THAN 18" (450 mm) ABOVE THE SHELF. THE STEPS SHALL PROJECT 5" (125 mm) INSIDE THE MANHOLE.

3. RISER SECTIONS MAY BE REINFORCED OR UNREINFORCED. REINFORCED SECTIONS SHALL BE REINFORCED IN ACCORDANCE WITH ASTM C 478 AND SHALL HAVE A MINIMUM WALL THICKNESS OF 5" (125 mm). UNREINFORCED RISER SECTIONS SHALL HAVE A MINIMUM WALL THICKNESS OF 6" (150 mm).

4. THE 24"x48" (600 mm x 1200 mm) ECCENTRIC CONES MAY BE REINFORCED OR UNREINFORCED. IF REINFORCED, THE WALL THICKNESS SHALL BE NOT LESS THAN 5" (125 mm). IF UNREINFORCED, THE WALL THICKNESS SHALL NOT BE LESS THAN 6" (150 mm).

5. JOINTS SHALL BE TONGUE AND GROOVE. JOINTS FOR REINFORCED STRUCTURES SHALL CONFORM WITH ASTM C 478 SECTION 14.

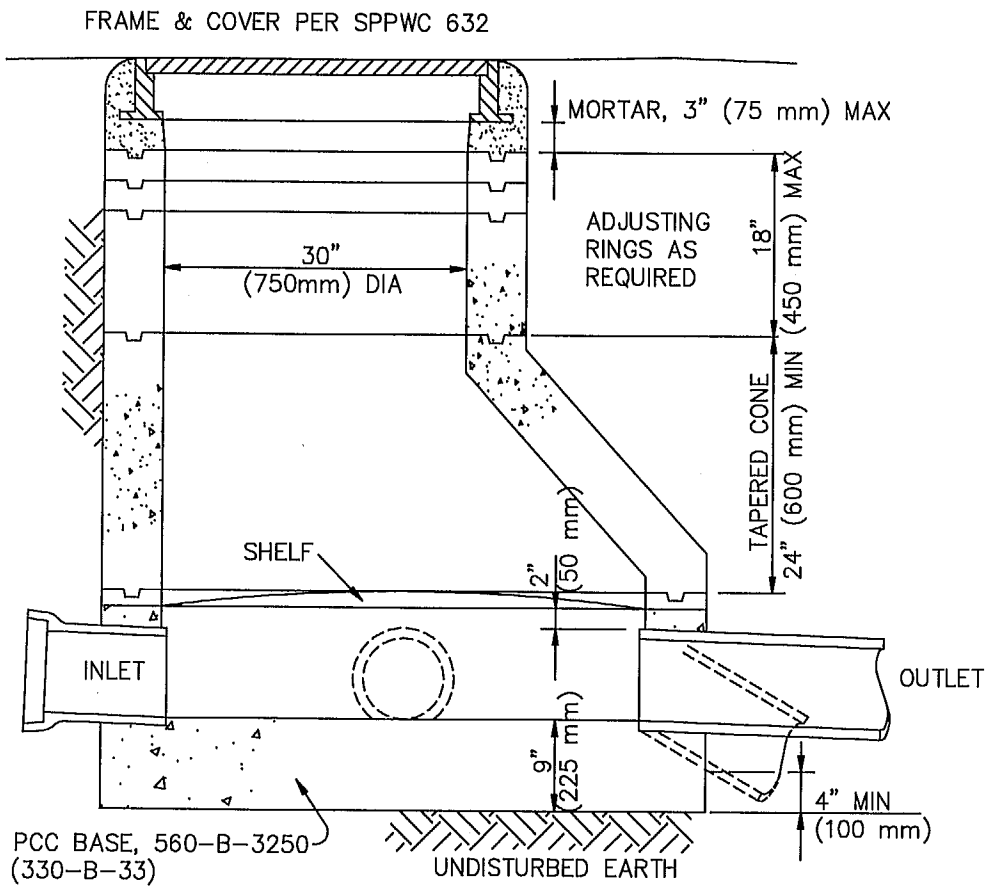
6. PRECAST UNITS SHALL BE ASSEMBLED USING CLASS "B" MORTAR.

7. IF 30" (762 mm) DIAMETER MANHOLE FRAME AND COVER IS REQUIRED, IT SHALL BE INSTALLED WHERE THE REDUCER RING IS SHOWN IN THE SECTION.

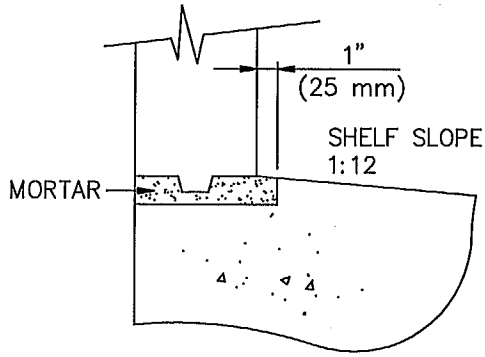
8. FOR REINFORCED PRECAST STRUCTURES, ALL REINFORCEMENT SHALL HAVE A MINIMUM OF 2" (50 mm) OF COVER OVER THE STEEL ON THE INSIDE FACE.

9. THE TOP OPENING OF THE MANHOLE AND THE STEPS SHALL BE PLACED DIRECTLY OVER THE OUTLET OF THE STRUCTURE EXCEPT AS OTHERWISE NOTED ON PLANS.

10. CONCRETE BASE AND STUB WALLS SHALL BE POURED IN ONE OPERATION TO A POINT 2" (50 mm) ABOVE THE INLET AND OUTLET PIPES. ALL PIPES SHALL BE RIGIDLY SUPPORTED BY TEMPORARY PIERS OR OTHER METHODS DURING THE OPERATION. CONCRETE SHALL SET FOR 24 HOURS BEFORE PLACING PRECAST UNITS.



SECTION A-A



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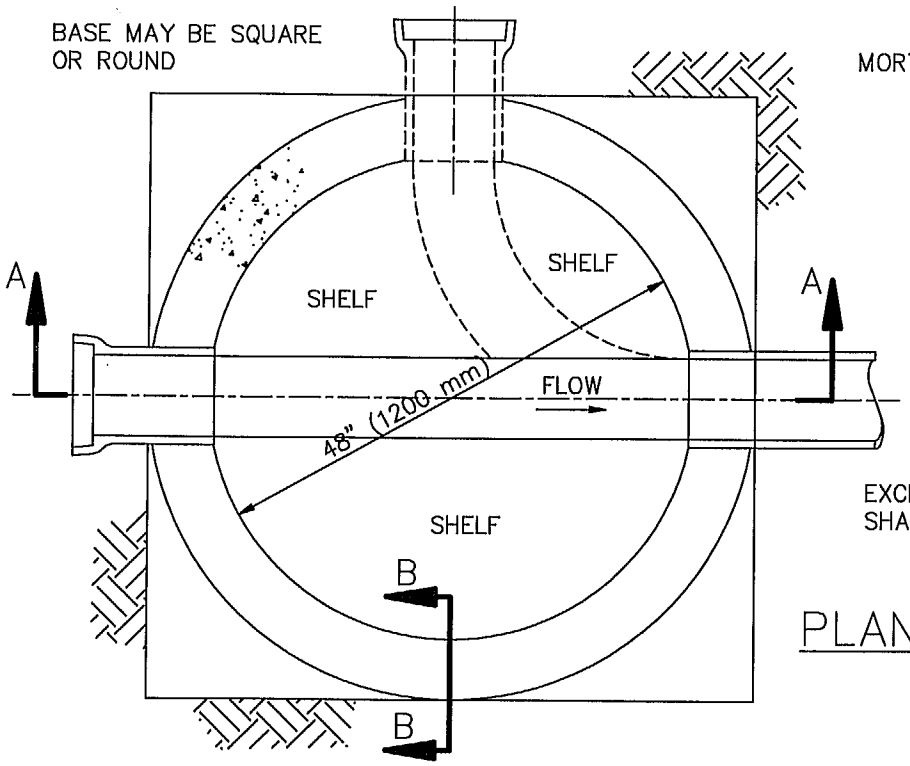


PLAN

EXCEPT AS SHOWN HEREON, MANHOLES SHALL CONFORM TO SPPWC 200.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

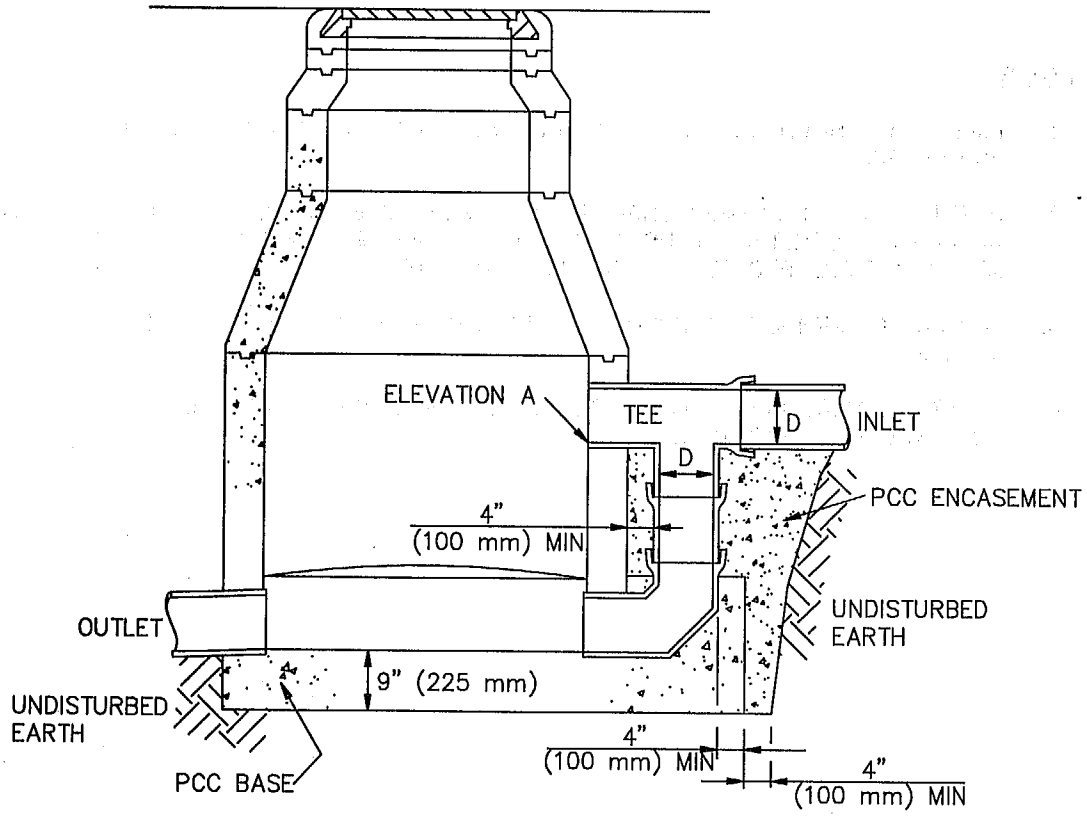
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1994 REV. 2005, 2009

PRECAST CONCRETE SHALLOW MANHOLE

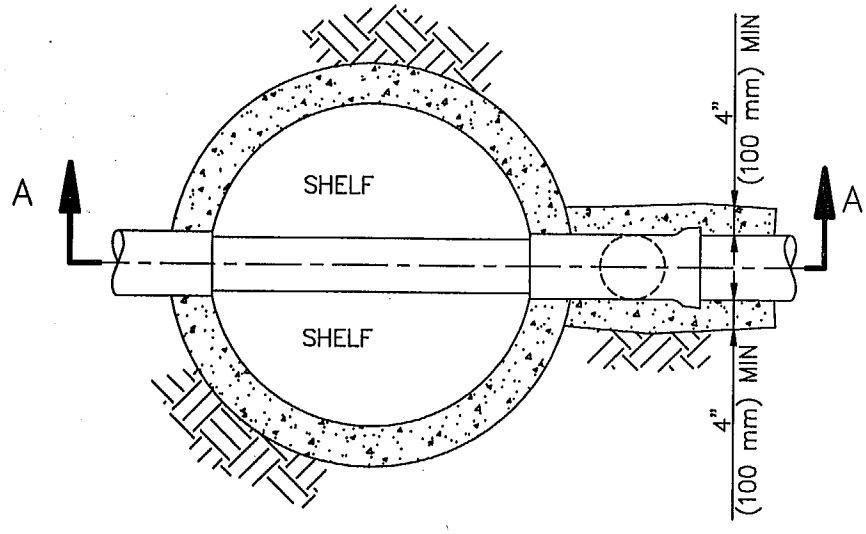
USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 201-2

SHEET 1 OF 1



SECTION A–A



PLAN

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE
PUBLIC WORKS STANDARDS INC.
GREENBOOK COMMITTEE
1993
REV. 2005, 2009

DROP SEWER MANHOLE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN
202–2
SHEET 1 OF 2

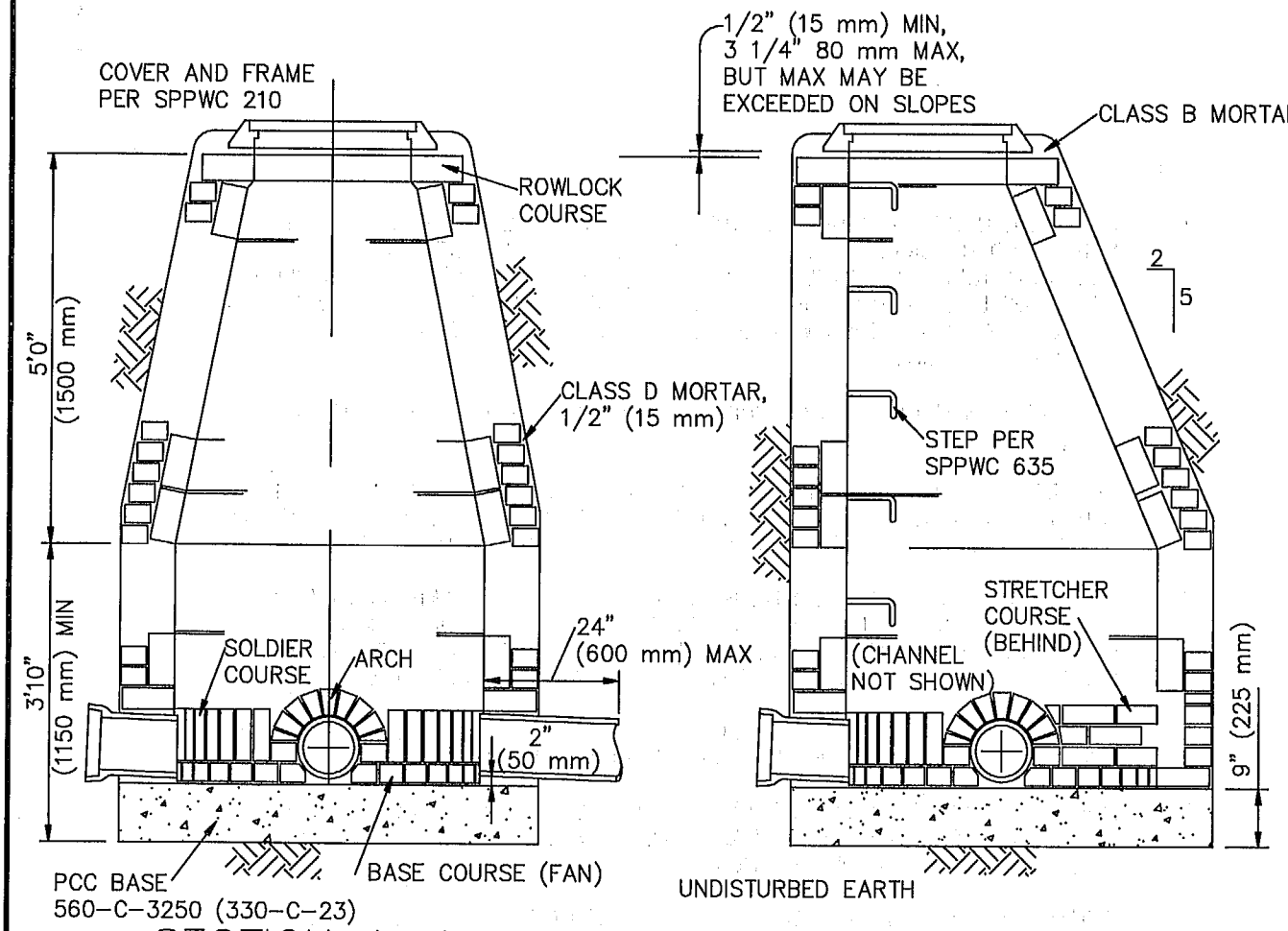
NOTES:

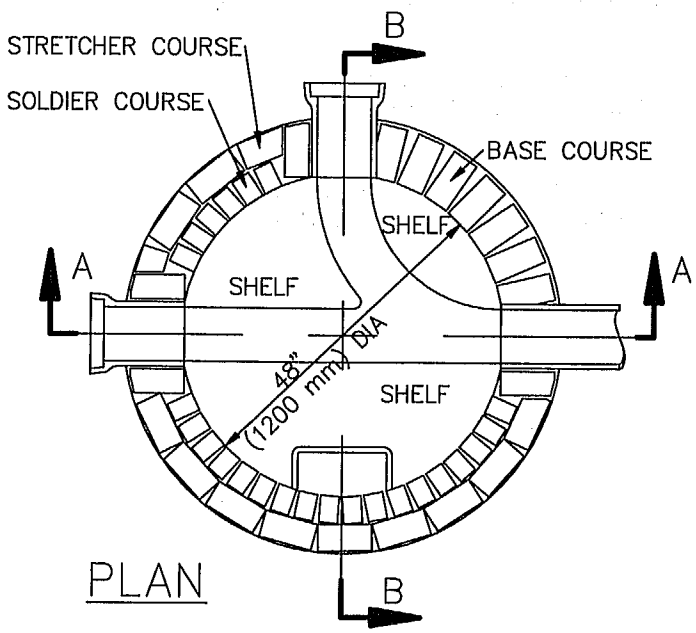
1. EXCEPT AS SHOWN ON THIS PLAN, MANHOLES SHALL CONFORM TO SPPWC 200 OR 203.

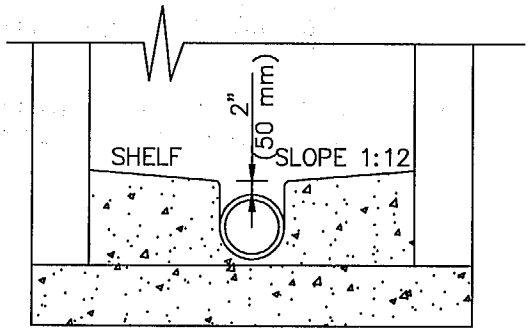
2. PIPE FOR THE DROP INLET SHALL BE THE SAME MATERIAL AS THE SEWER UNLESS APPROVED ADAPTERS ARE USED. IF SO, THE PIPE MAY BE VCP, ABS SOLID WALL, ABS COMPOSITE, PVC PLASTIC, OR POLYETHELYNE.

3. FOR BRICK MANHOLES, A BRICK ARCH IS ALSO REQUIRED OVER THE UPPER INLET PIPE.

4. IF TWO OR MORE DROP INLETS ARE REQUIRED IN A SINGLE MANHOLE, EACH SHALL BE CONSTRUCTED SEPARATELY.







CHANNEL
TYPICAL SECTION

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION		
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1993 REV. 2005, 2009	**BRICK SEWER MANHOLE**	STANDARD PLAN **203-2**
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 2

NOTES:

1. CONCRETE BASE: DURING CONSTRUCTION, ALL PIPES SHALL BE RIGIDLY SUPPORTED BY BRICK PIERS 12" (300 mm) DEEP, LOCATED JUST OUTSIDE THE STRUCTURE. CONSTRUCT TOP OF CONCRETE BASE 2" (50 mm) BELOW INVERT OF LOWEST PIPE. FILL SPACE BENEATH PIPE WITH MORTAR AND SHOVE FROM BOTH SIDES WITH BASE COURSE BRICK TO FORM A WATER–TIGHT JOINT.

2. BASE OF FAN COURSE: LAY BRICK FLAT ON RADIAL LINES WITH TOPS TO SAME LEVEL.

3. ARCHES: LAY SPALLED BRICK ON EDGE TO FORM A TRUE RADIAL ARCH WITH FULL MORTAR JOINT AROUND ALL PIPE OPENINGS. TURN ARCH OF TWO SUCH COURSES OVER PIPES 15" (375 mm) OR MORE IN DIAMETER.

4. SOLDIER COURSES: LAY INSIDE BRICK ON RADIAL LINES WITH FIRST FOUR COURSES VERTICAL. LAY SUCCEEDING COURSES WITH A UNIFORM BATTER TO OBTAIN AN INSIDE DIAMETER OF 24" (600 mm) AT TOP OF LAST OR FRACTIONAL SOLDIER COURSE. USE SPLIT BRICK TO CLOSE SOLDIER COURSE.

5. STRETCHER COURSES: LAY OUTSIDE BRICK FLAT IN A DEEP BED OF MORTAR. SHOVE BRICK TOGETHER AGAINST ADJACENT SOLDIER COURSE.

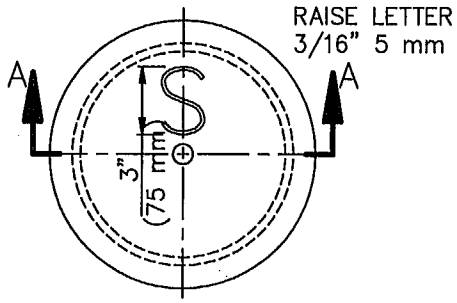
6. ROWLOCK COURSE: LAY LAST COURSE OF BRICK ON EDGE ACROSS SOLDIER AND STRETCHER COURSES ON RADIAL LINES, WITH TOPS PARALLEL AND 4 1/2" (120 mm) BELOW FINISHED GRADE.

7. JOINTS: INSIDE JOINTS SHALL BE NEATLY STRUCK AND SHALL NOT EXCEED 3/8" (10 mm) IN THICKNESS.

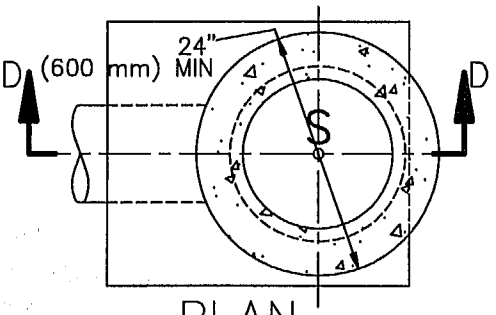
8. STEPS: MANHOLE STEPS SHALL CONFORM WITH SPPWC 635 TYPE 3. THE TOP STEP SHALL BE PLACED JUST UNDER THE MANHOLE FRAME. THE LOWEST STEP SHALL BE PLACED BETWEEN 8" (200 mm) AND 24" (600 mm) ABOVE THE SHELF.

9. WALL THICKNESS: BRICKWORK SHALL BE 8" (200 mm) THICK TO A DEPTH OF 22' (6.5 m). BRICKWORK BELOW 22' (6.5 m) DEEP SHALL BE 12" (300 mm) THICK.

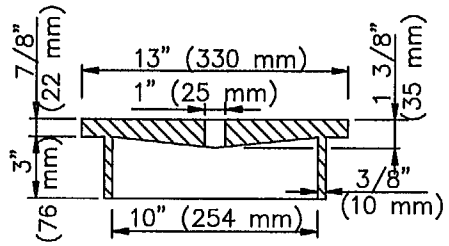
10. A FLEXIBLE JOINT SHALL BE INSTALLED AT THE FIRST JOINT FROM MANHOLE FOR ALL CONNECTIONS EXCEPT THOSE WITH REINFORCED CONCRETE PIPE.



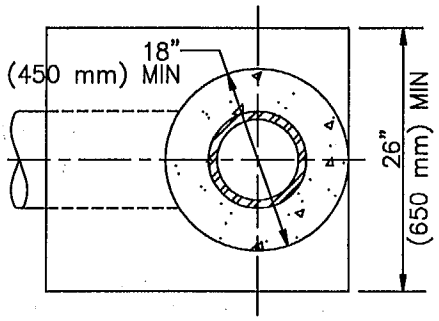
ACCESS COVER



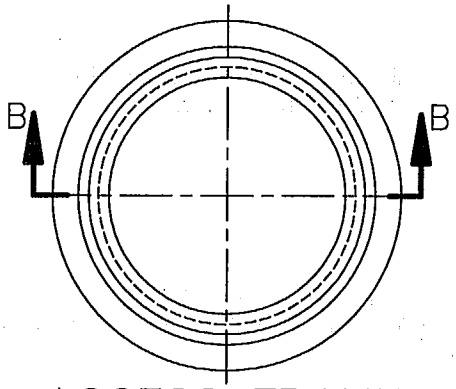
PLAN



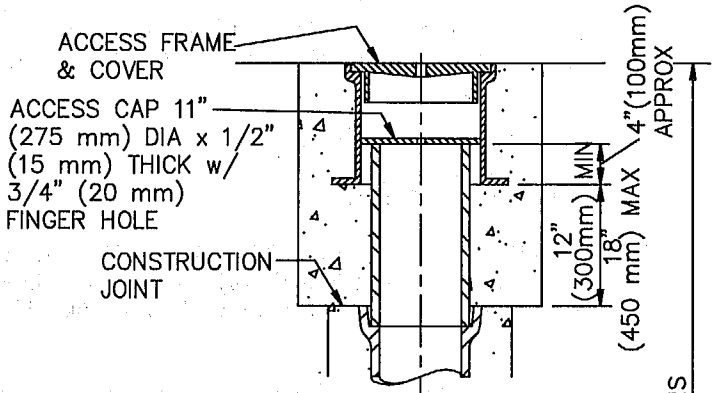
SECTION A–A

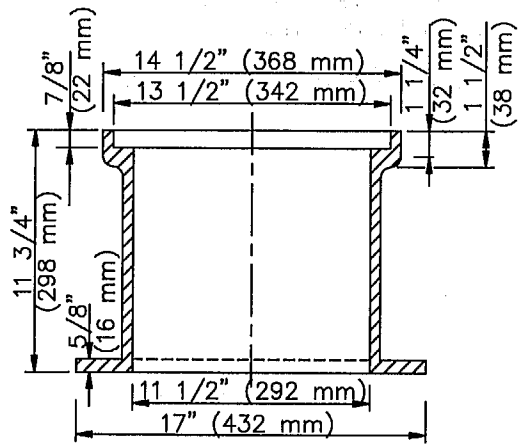


SECTION C–C

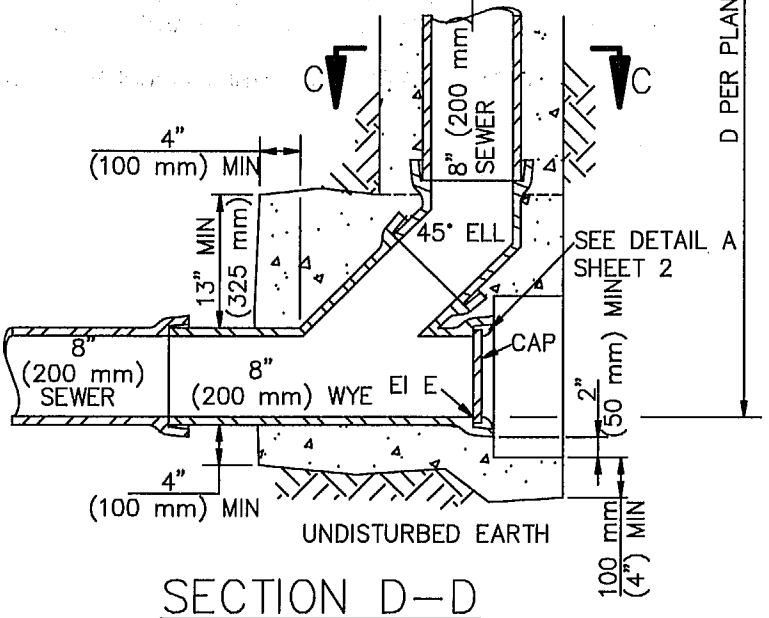


ACCESS FRAME





SECTION B–B



SECTION D–D

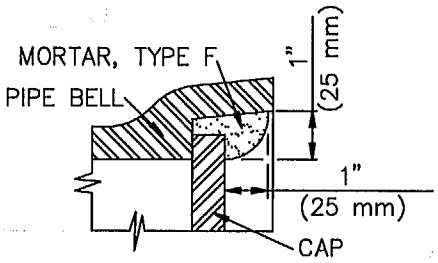
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE
PUBLIC WORKS STANDARDS INC.
GREENBOOK COMMITTEE
1993
REV. 2005, 2009

TERMINAL CLEANOUT STRUCTURE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN
204–2
SHEET 1 OF 2



DETAIL A

NOTES:

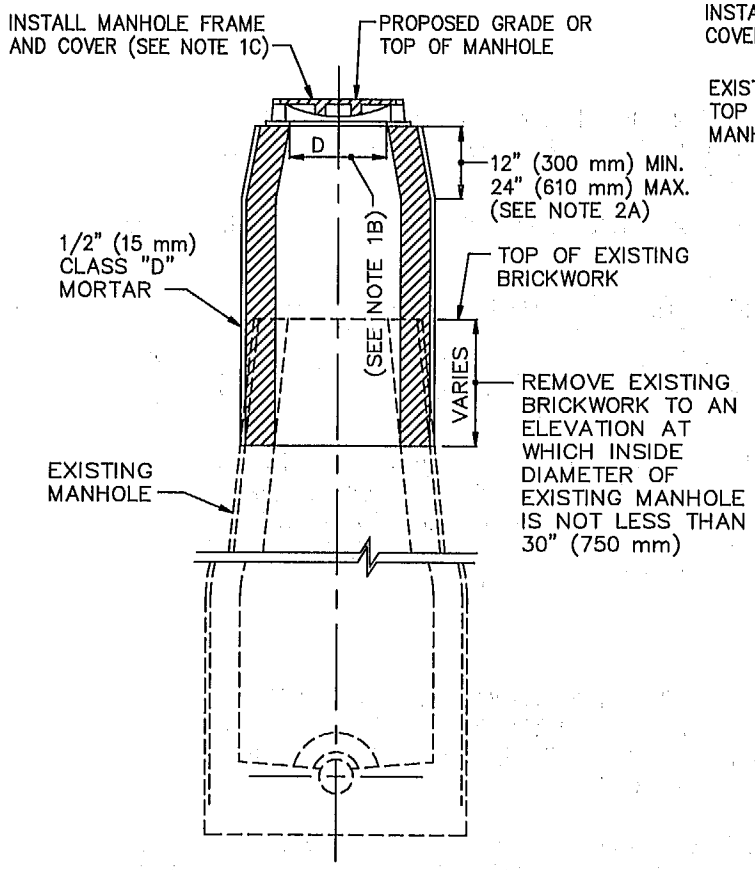
1. SEE PLANS FOR VALUES OF DIMENSION D AND ELEVATION E.

2. PIPE AND FITTINGS, UNLESS OTHERWISE NOTED, SHALL BE OF THE SAME MATERIALS AS THE SEWER, UNLESS APPROVED ADAPTORS ARE USED, AND MAY BE ANY OF THE FOLLOWING:
   A. VC PIPE
   B. PE PIPE
   C. ABS SOLID WALL PIPE
   D. ABS COMPOSITE PIPE
   E. PVC PLASTIC PIPE

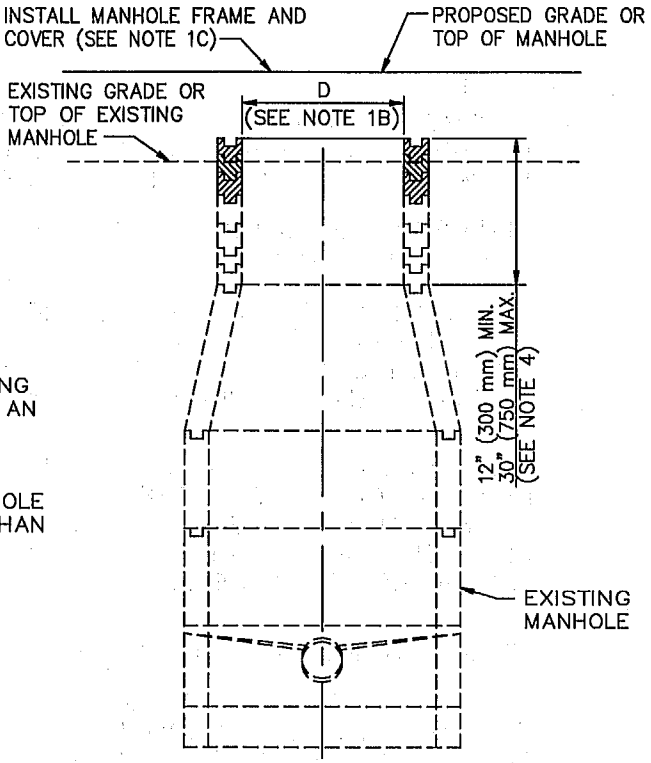
3. PIPE AND FITTINGS SHALL BE BEDDED AND ENCASED IN PCC AS SHOWN. PCC SHALL BE CLASS 450-C-2000(265-C-14). JOIN AND ALIGN PIPE AND FITTINGS BEFORE PLACING CONCRETE. MAINTAIN ALIGNMENT WHILE PLACING AND ALLOWING PCC TO SET.

4. THE ACCESS FRAME, COVER AND CAP SHALL BE CAST IRON. THE FINGER HOLES MAY BE DRILLED OR BLOCKED OUT PRIOR TO CASTING. THEY SHALL NOT BE PUNCHED OUT.

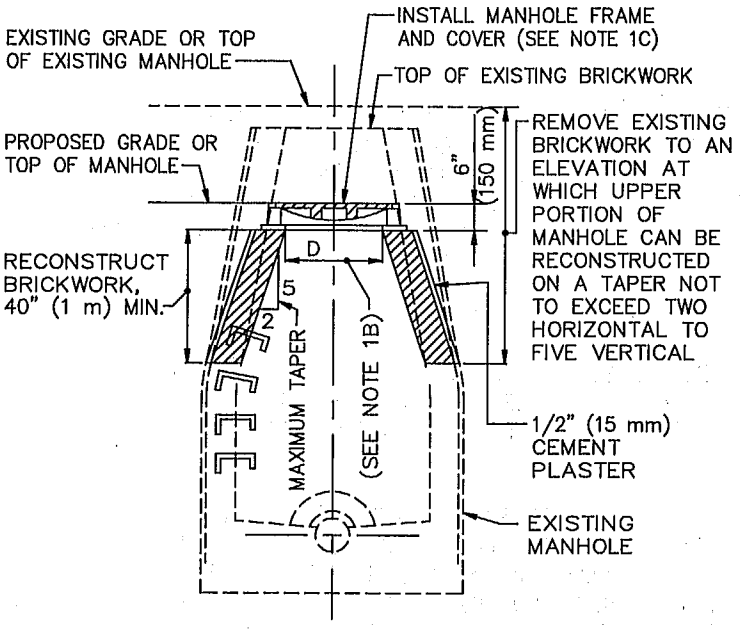
5. THE CONTRACTOR MAY PLACE EITHER CIRCULAR OR SQUARE CONCRETE PIPE WALL SUPPORTS.



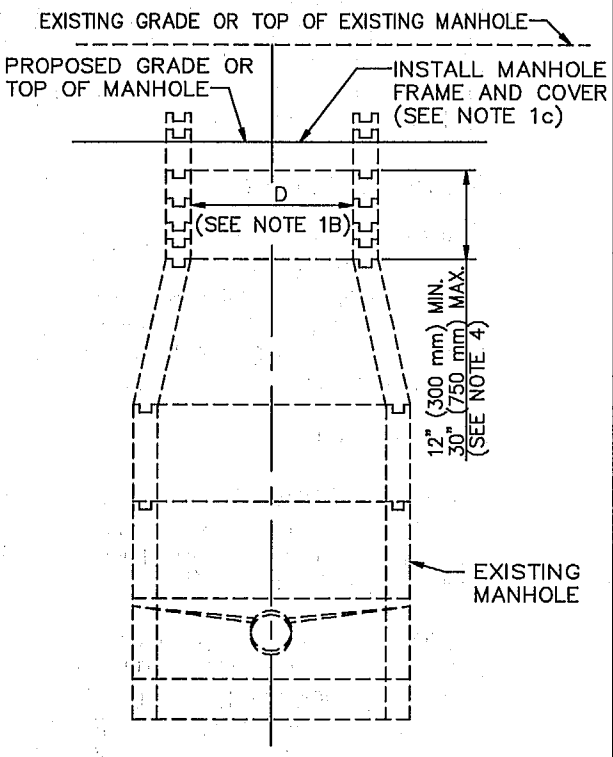
RAISING EXISTING BRICK MANHOLES



RAISING EXISTING PRECAST CONCRETE SEWER MANHOLES



LOWERING EXISTING BRICK MANHOLES



LOWERING EXISTING PRECAST CONCRETE SEWER MANHOLES

BRICK MANHOLES

PRECAST CONCRETE SEWER MANHOLES

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARD, INC. GREENBOOK COMMITTEE 1984 REV. 1998, 2009

SEWER MANHOLE ADJUSTMENT

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 205-2

NOTES:

1. GENERAL
   A. EXCEPT AS INDICATED HEREON OR ON THE PLANS, MANHOLES SHALL CONFORM TO: SPPWC 200, PRECAST CONCRETE SEWER MANHOLE AND SPPWC 203, BRICK SEWER MANHOLE.

   B. DIMENSION "D" SHALL BE THE SAME AS THE SIZE OF MANHOLE FRAME AND COVER TO BE USED.

   C. THE CONTRACTOR MAY REUSE THE EXISTING MANHOLE FRAME AND COVER, UNLESS DAMAGED DURING THE WORK OR WHEN OTHERWISE SHOWN IN THE CONTRACT DOCUMENTS. ITEMS DAMAGED BY THE CONTRACTOR SHALL BE REPLACED WITH IDENTICAL NEW ITEMS AT NO EXPENSE TO THE AGENCY.

   D. EXISTING STEPS LOCATED WITHIN REMOVAL LIMITS SHALL BE REPLACED. WHEN REMOVAL OF EXISTING STEPS BEYOND THE MANHOLE REMOVAL LIMITS IS SHOWN ON THE PLANS, THE STEPS SHALL BE REMOVED TO A DEPTH OF 2" (50 mm) BEYOND THE INSIDE FACE OF THE BRICK MANHOLE AND THE HOLES SHALL BE FILLED WITH CLASS "D" MORTAR.

2. RAISING EXISTING BRICK MANHOLES

   A. BRICK MANHOLES TO BE RAISED LESS THAN 1' (300 mm) MAY BE EXTEND VERTICALLY, PROVIDED THAT AT A DEPTH OF 2 1/2' (750 mm) BELOW THE TOP OF THE MANHOLE AT ITS NEW ELEVATION, THE INSIDE DIAMETER OF THE MANHOLE IS 30" (750 mm) OR GREATER.

   B. BRICK MANHOLES TO BE RAISED LESS THAN 3 1/2" (90 mm) MAY BE RAISED BY APPLYING CLASS "D" MORTAR TO THE TOP OF THE EXISTING BRICKWORK. IF THE BRICK MANHOLE IS TO BE RAISED 3 1/2" (90 mm) OR MORE, A NEW COURSE OR COURSES OF BRICKWORK SHALL BE PLACED ON TOP OF THE EXISTING BRICKWORK.

3. LOWERING EXISTING BRICK MANHOLES

   A. WHERE A BRICK MANHOLE IS TO BE LOWERED LESS THAN 1' (300 mm), THE FRAME MAY BE RESET ON THE EXISTING BRICKWORK AND THE 40" (1 m) MINIMUM BRICKWORK RECONSTRUCTION OMITTED, PROVIDED THAT THE BASE OF THE FRAME DOES NOT OVERHANG THE BRICKWORK ON THE INSIDE SURFACE OF THE MANHOLE MORE THAN AN AVERAGE OF 1 1/2" (35 mm) IN ANY QUADRANT NOR MORE THAN 2" (50 mm) AT ANY POINT.

4. RAISING EXISTING PRECAST CONCRETE SEWER MANHOLES

   A. PRECAST CONCRETE MANHOLES TO BE RAISED LESS THAN 3" (75 mm) MAY BE RAISED BY APPLYING CLASS "D" MORTAR TO THE TOP OF THE EXISTING MANHOLE, PROVIDED THE TOTAL HEIGHT OF MORTAR, EXISTING AND NEWLY APPLIED, DOES NOT EXCEED 3" (75 mm).

   B. WHERE THE PRECAST CONCRETE MANHOLE IS TO BE RAISED 3" (75 mm) OR MORE, OR WHERE THE TOTAL HEIGHT OF MORTAR, EXISTING AND NEWLY APPLIED, WOULD EXCEED 3" (75 mm), GRADE RINGS SHALL BE UTILIZED. CLASS "D" MORTAR MAY BE USED FOR FINAL ADJUSTMENT, BUT NOT MORE THAN 3" (75 mm) IN HEIGHT. WHERE RAISING THE MANHOLE WOULD RESULT IN THE UPPER SEGMENT OF THE SHAFT BEING MORE THAN 30" (750 mm) IN HEIGHT, REMOVE THE REDUCER AND THE UPPER SEGMENT OF THE SHAFT, INSTALL ADDITIONAL RINGS OR PIPE TO THE LOWER SEGMENT OF THE SHAFT, AND REINSTALL THE REDUCER AND GRADE RINGS AS REQUIRED.

5. LOWERING EXISTING PRECAST CONCRETE SEWER MANHOLES

   A. REMOVE SUFFICIENT GRADE RINGS TO LOWER THE MANHOLES AS REQUIRED, APPLY CLASS "D" MORTAR TO A HEIGHT NOT EXCEEDING 3" (75 mm) FOR ADJUSTMENT TO FINAL GRADE.

   B. WHERE REMOVAL OF GRADE RINGS WOULD RESULT IN THE UPPER SEGMENT OF THE SHAFT BEING LESS THAN 12" (300 mm) IN HEIGHT, REMOVE THE REDUCER AND SUFFICIENT SECTIONS OF THE LOWER SEGMENT OF THE SHAFT AND REINSTALL ANY NECESSARY SEGMENT OF THE LOWER SHAFT, THE REDUCER, AND THE GRADE RINGS TO CONFORM TO THE REQUIREMENTS OF THIS PLAN.

   C. EXISTING GRADE RINGS NEED NOT BE REMOVED IF EXISTNG MORTAR IS REMOVED, AND AT LEAST 1 1/2" (35 mm) OF MORTAR MAY BE PLACED ON TOP OF THE EXISTING GRADE RINGS TO RESEAT THE FRAME.

6. REPLACEMENT OF BRICK REDUCER WITH PRECAST CONCRETE REDUCER AND SHAFT

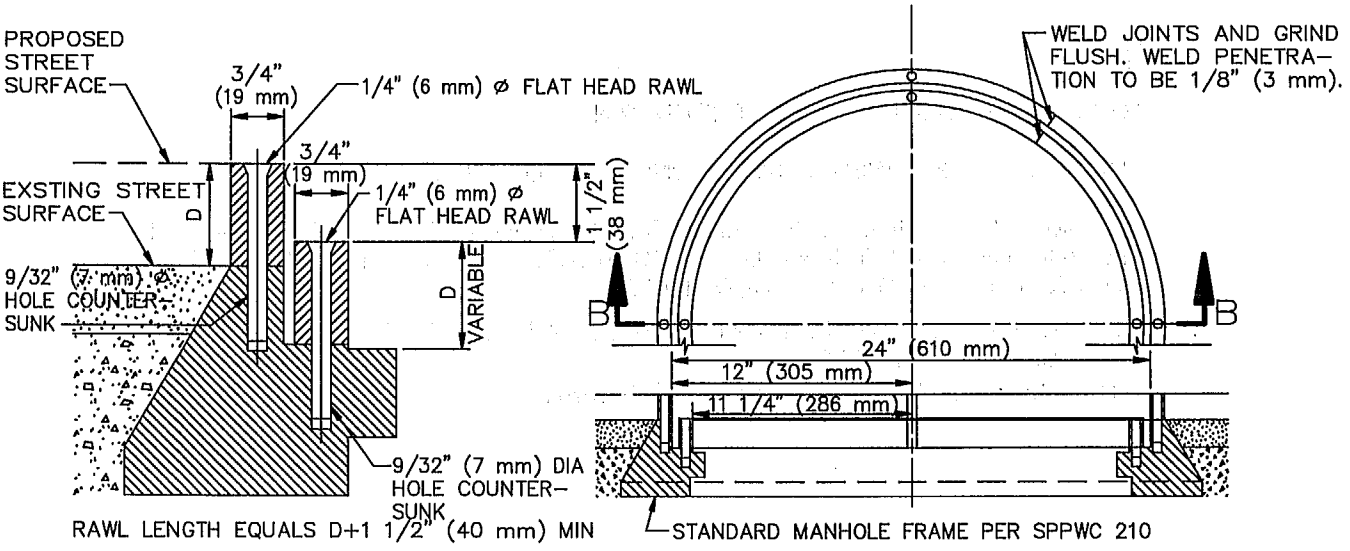
   UNLESS OTHERWISE INDICATED ON THE PLANS, THE CONTRACTOR MAY INSTALL A PRECAST CONCENTRIC CONCRETE REDUCER, CONCRETE GRADE RINGS, AND CONCRETE PIPE IN LIEU OF RECONSTRUCTING A BRICK REDUCER, PROVIDED:

   A. THE MAXIMUM ID OF SEWER PIPE CONNNECTED TO THE MANHOLE DOES NOT EXCEED 8" (200 mm).

   B. THE CONTRACTOR SECURES PRIOR APPROVAL FROM THE ENGINEER TO INSTALL THE CONCENTRIC REDUCER ONTO THE MANHOLE SHAFT. THE ENGINEER MAY, AS PART OF THE INSTALLATION REQUIREMENTS, REQUIRE THE CONTRACTOR TO COAT THE INSIDE OF THE REDUCER, RINGS, AND PIPE WITH AN APPROVED COATING.

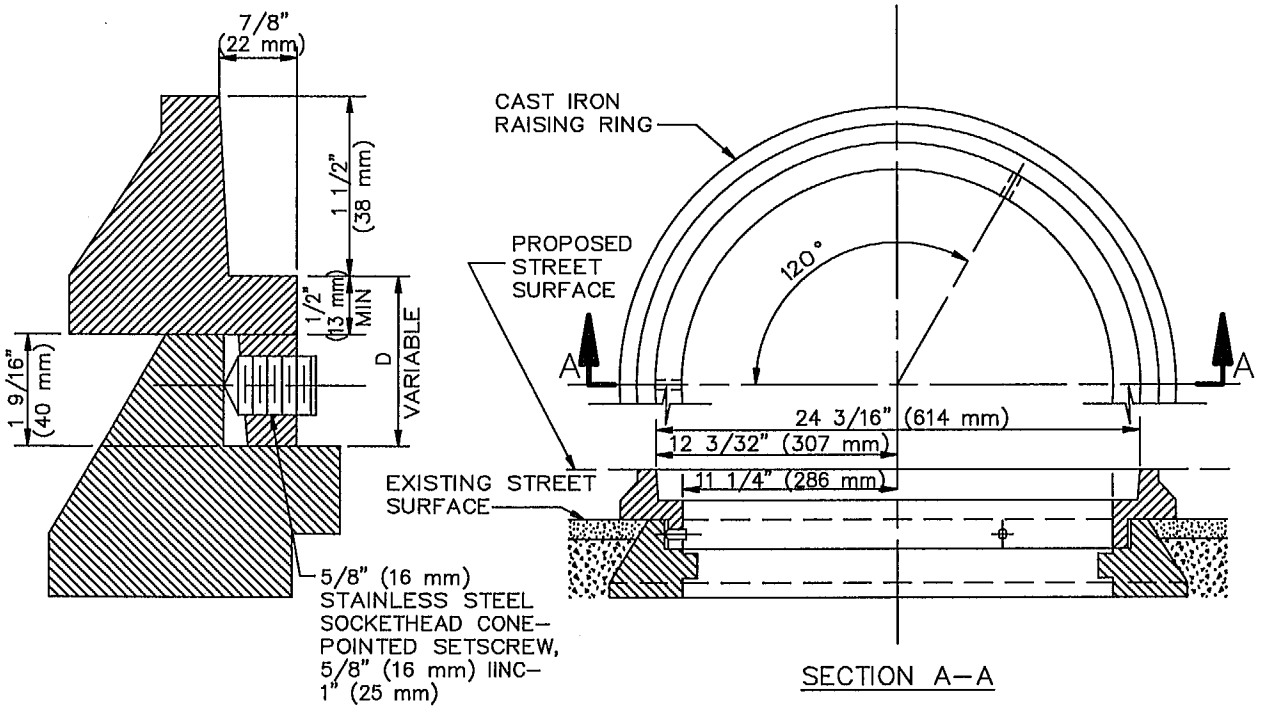
   C. THE CONCRETE GRADE RINGS, THE CONCRETE REDUCER, AND ANY CONCRETE PIPE SHALL BE JOINED TOGETHER AND BEDDED ONTO THE EXISTING BRICK MANHOLE WITH CLASS "D" MORTAR. THE DEPTH, WIDTH, AND THICKNESS OF THE MORTAR SHALL BE OF SUFFICIENT DIMENSIONS TO PROPERLY AND ADEQUATELY JOIN AND BED THE COMPONENT PARTS.

RAISING RINGS TO BE MADE OF STEEL, ASTM DESIGNATION AT MERCHANT QUALITY



SECTION B–B

STEEL RAISING RINGS



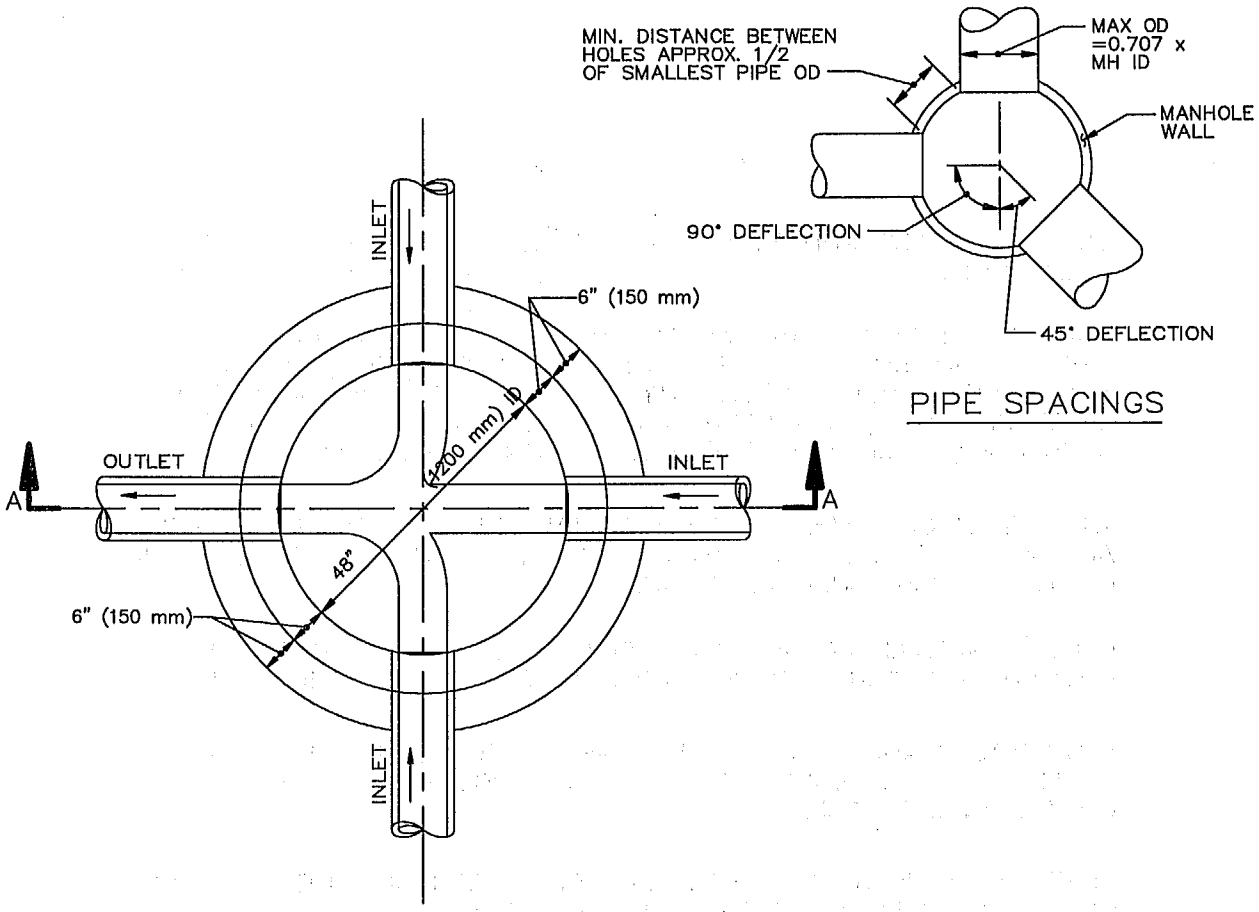
SECTION A–A

CAST IRON RAISING RINGS

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION		
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1984 REV. 1996, 2009	**MANHOLE RAISING RINGS**	STANDARD PLAN **206–2**
	USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION	SHEET 1 OF 2

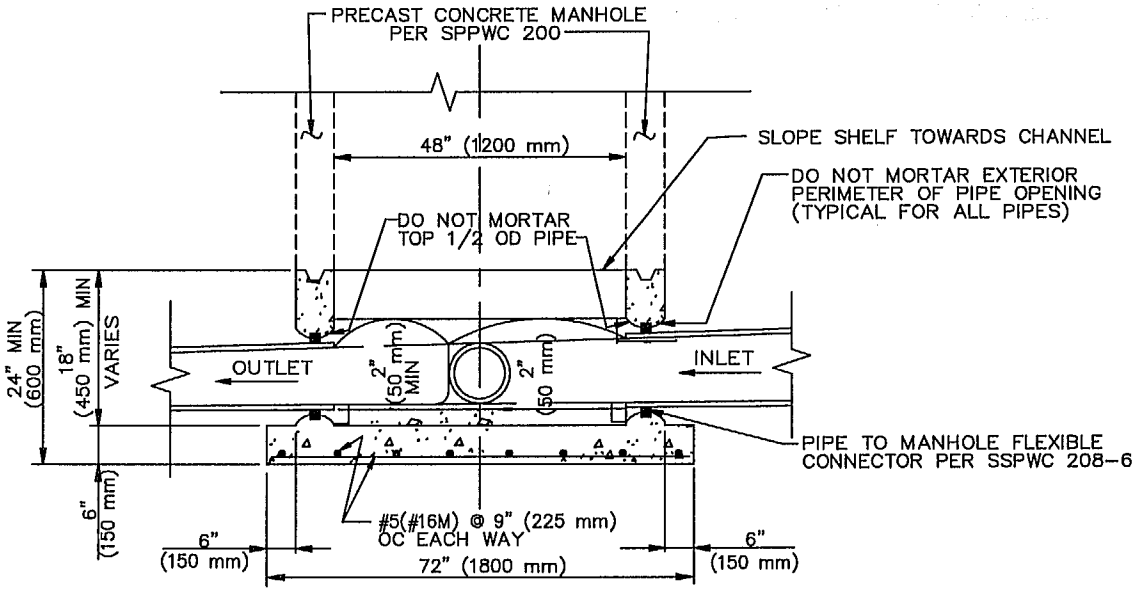
NOTES:

1. MACHINE SEATS FROM CAST IRON RINGS.
2. THE CAST IRON USED SHALL CONFORM TO SSPWC 206–3.
3. THE METAL RAISING RINGS MAY BE USED IN LIEU OF THE REGULAR METHOD OF ADJUSTMENT UTILIZING MORTAR OR BRICK AND MORTAR UNDER THE FOLLOWING CONDITIONS.
   A. ONLY ONE ADJUSTMENT WITH RAISING RINGS WILL BE ALLOWED ON ANY MANHOLE.
   B. MAXIMUM "D" SHALL BE 3" (75 mm).



PIPE SPACINGS

PLAN VIEW



SECTION A–A

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1984 REV. 1996, 2009

PRECAST REINFORCED CONCRETE MANHOLE BASE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 207–2

NOTES

1. CONCRETE BASE AND STUB WALLS SHALL BE POURED IN ONE OPERATION.

2. CONCRETE FOR ALL PRECAST UNITS SHALL BE COMPACTLY VIBRATED IN THE FORMS. IT SHALL BE CURED ACCORDING TO APPROVED PRACTICE EITHER BY STEAM, SPRINKLING, MEMBRANE SOLUTION, OR A COMBINATION OF THESE. IT SHALL DEVELOP 3500 PSI (25 MPa) OR GREATER STRENGTH IN 28 DAYS.

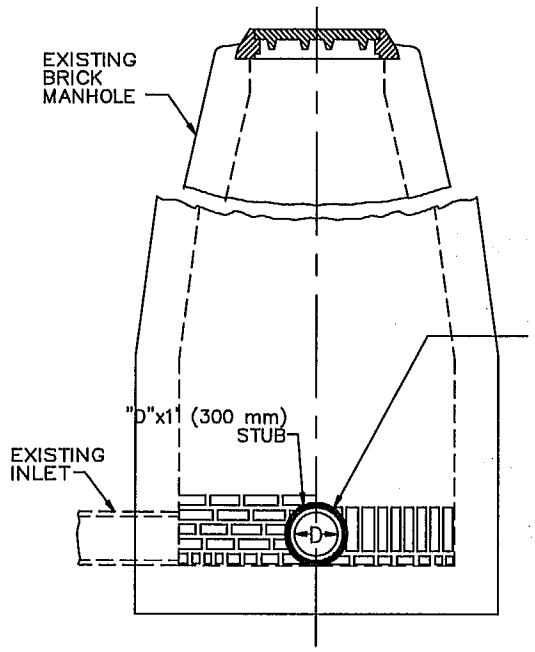
3. THE DEPTH OF CHANNEL SHALL EQUAL THE PIPE DIAMETER FOR ALL SIZES OF PIPE. FOR SPECIAL CHANNELS IN TRAP OR GAUGING MANHOLES, SEE SPECIAL PLANS.

4. CEMENT MORTAR INSIDE JOINTS SHALL BE NEATLY STRUCK AND POINTED AND SHALL NOT EXCEED 3/8" (10 mm) IN THICKNESS.

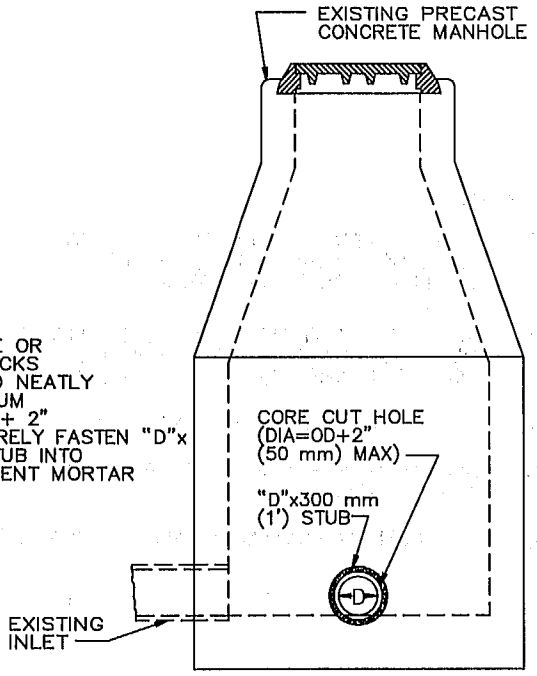
5. STUB WALLS AND BASE SHALL CONFORM TO ASTM C 478 AND SHALL HAVE A MINIMUM OF 2" (50 mm) COVER THE STEEL ON THE INSIDE FACE.

6. INVERT CHANNELS AND SHELF MAY BE POURED AT THE FACTORY OR IN THE FIELD AT THE OPTION OF THE CONTRACTOR.

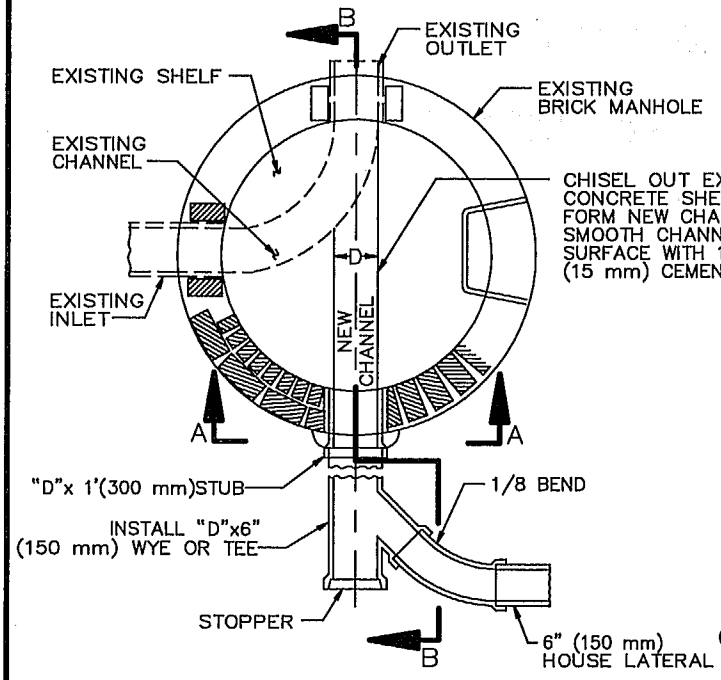
7. BEDDING FOR PRECAST BASE SHALL BE EQUAL TO BEDDING FOR PIPE. IF PIPE IS PLACED ON NATIVE MATERIAL USE 6" (150 mm) MINIMUM CRUSHED ROCK UNDER BASE.



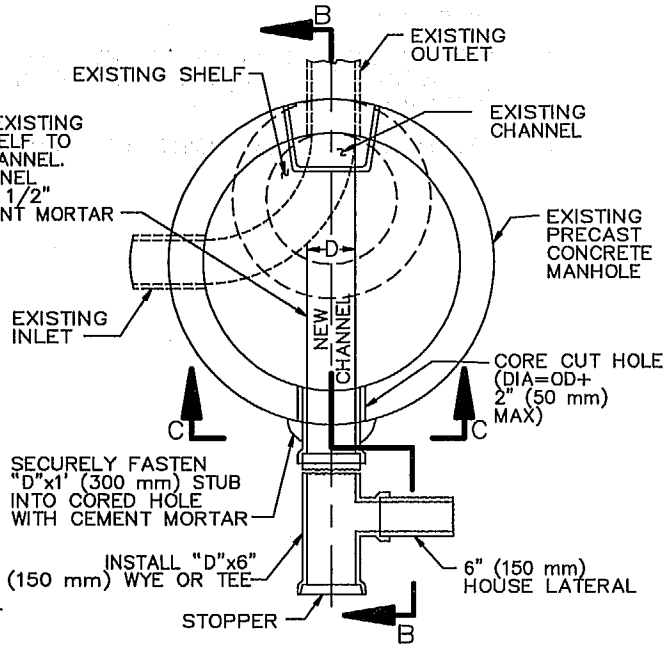
SECTIONAL ELEVATION A–A



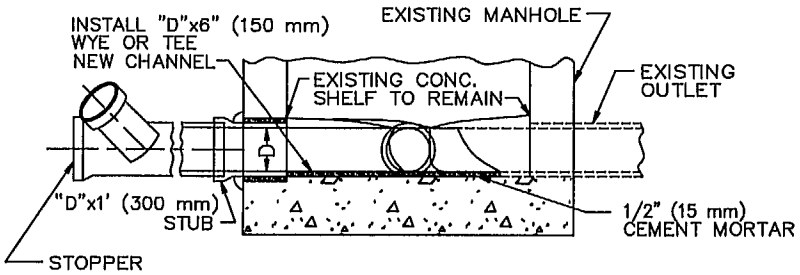
SECTIONAL ELEVATION C–C



SECTIONAL PLAN OF BASE



SECTIONAL PLAN OF BASE



SECTIONAL ELEVATION B–B
CHANNEL BASE

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS, INC., GREENBOOK COMMITTEE 1984 REV. 1996, 2009

BREAKING INTO EXISTING MANHOLES

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 208–2

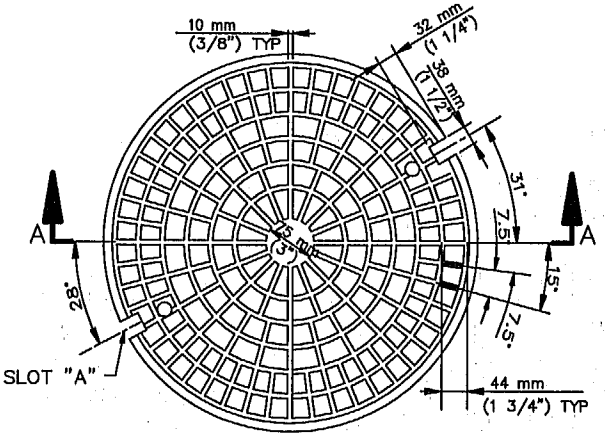
SHEET 1 OF 2

NOTES:

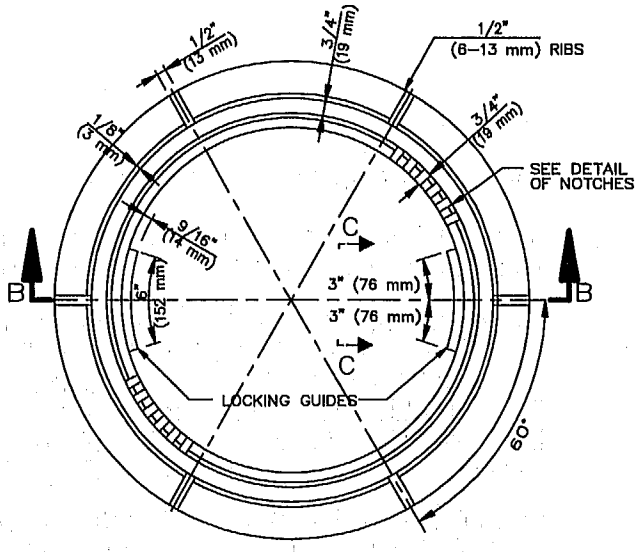
1. INVERT ELEVATION OF "D" x 1' (300 mm) STUB AT THE INSIDE FACE OF MANHOLE TO BE 0.10' (30 mm) HIGHER THAN EXISTING OUTLET INVERT ELEVATION.
2. THE CORE CUT HOLE SHALL BE MADE WITH EQUIPMENT SPECIALLY DESIGNED TO CUT A SMOOTH HOLE WITHOUT SPALLING OR DAMAGE TO THE REINFORCING STEEL OR STRUCTURE.
3. "D" TO BE 8" (200 mm) MINIMUM.
4. ALL WORK SHALL BE UNCOVERED AND CONVENIENT FOR THE INSPECTION.
5. ALL CEMENT MORTAR SHALL BE CLASS "D" PER SSPWC 201–5.1.

HOUSE LATERAL NOTES:

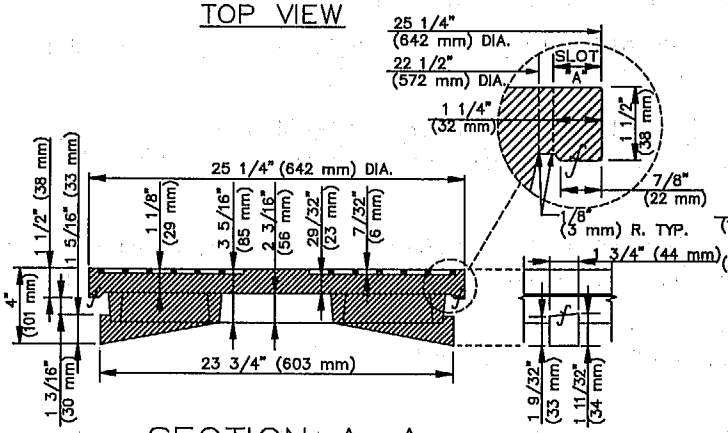
1. WYE SHALL BE LAID WITH 1/8' (3 mm) RISE PER 1" (300 mm) AND 6" (150 mm) SPUR AT 45° FROM HORIZONTAL UNLESS OTHERWISE NOTED ON PLANS.
2. "D" X 4" (100 mm) WYE OR TEE AND 4" (100 mm) HOUSE LATERAL MAY BE SUBSTITUTED FOR "D" x 6" (150 mm) WYE OR TEE AND 6" (150 mm) HOUSE LATERAL.
3. USE TYPE "D" OR "G" JOINTS PER SSPWC 208–2.



PLAN OF COVER
TOP VIEW

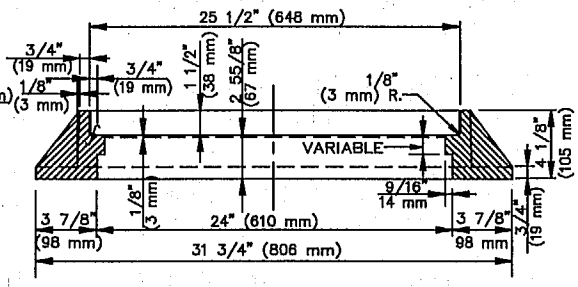


PLAN OF FRAME

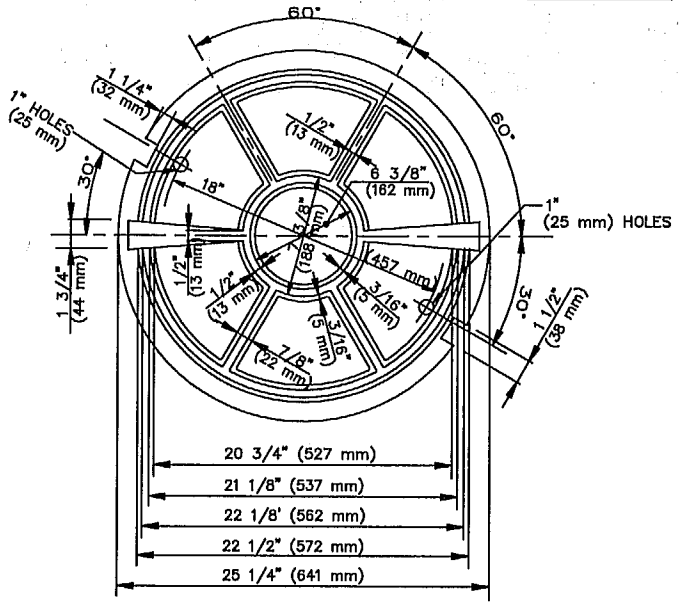


SECTION A–A

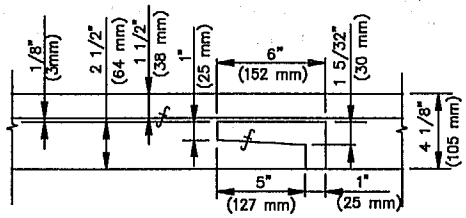
COVER LUG
END VIEW



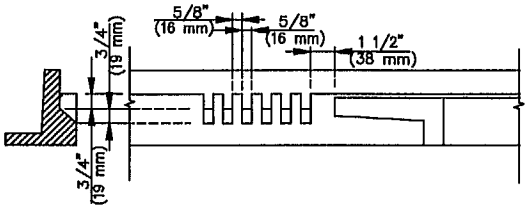
SECTION B–B



PLAN OF COVER
BOTTOM VIEW



LOCKING GUIDE
SIDE VIEW C–C



DETAIL OF NOTCHES

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS, INC., GREENBOOK COMMITTEE 1984 REV. 1993, 1998, 2009

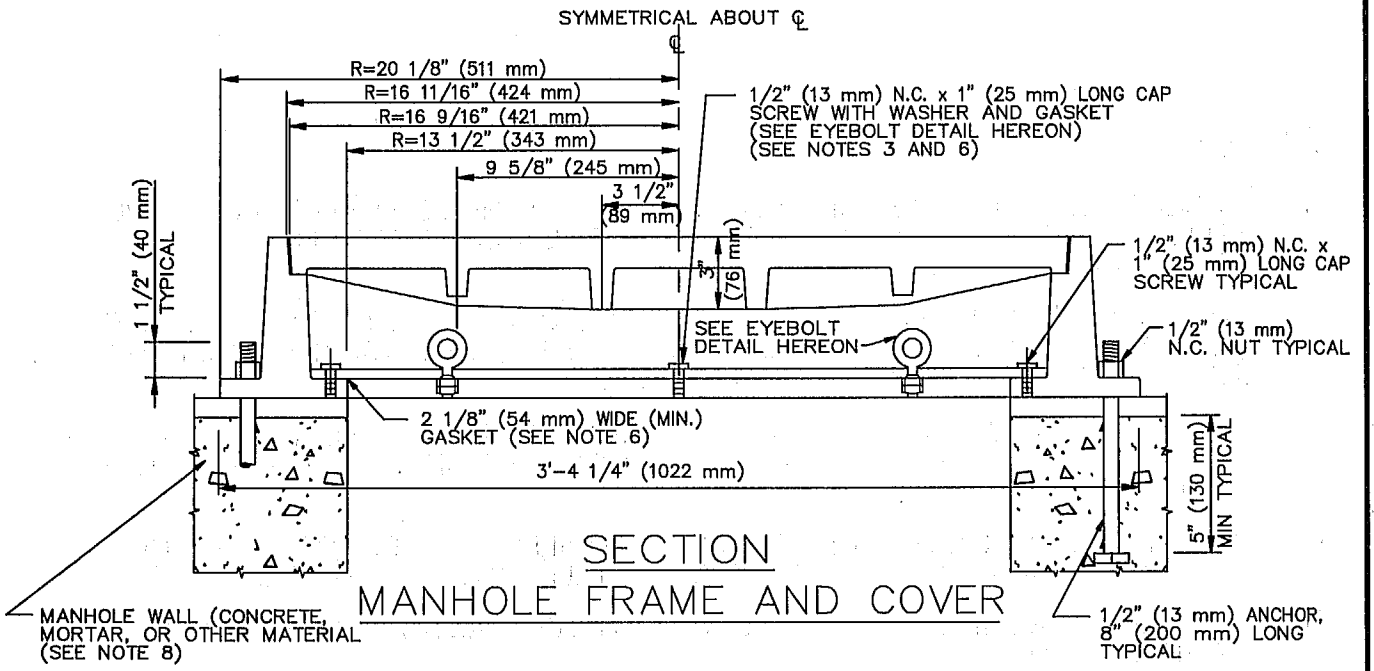
24" (610 mm) MANHOLE FRAME AND COVER–OCKING TYPE

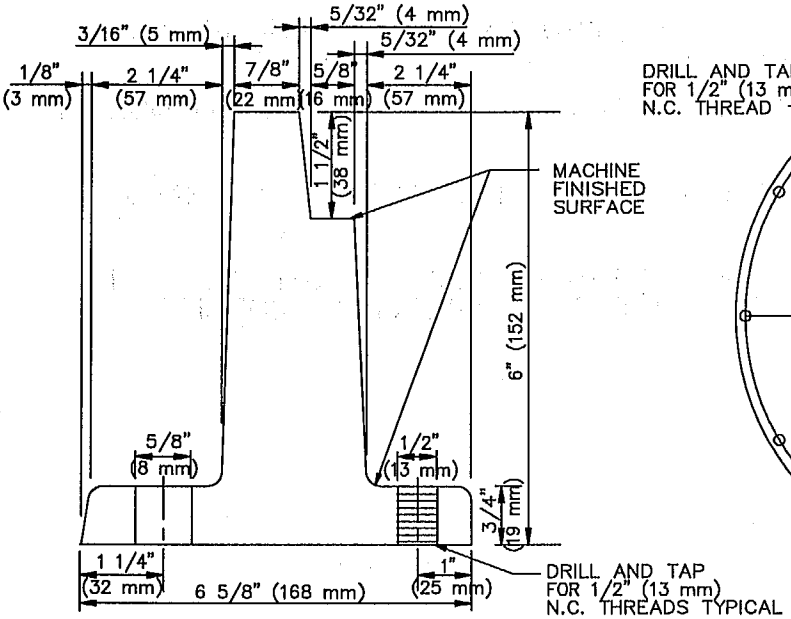
USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

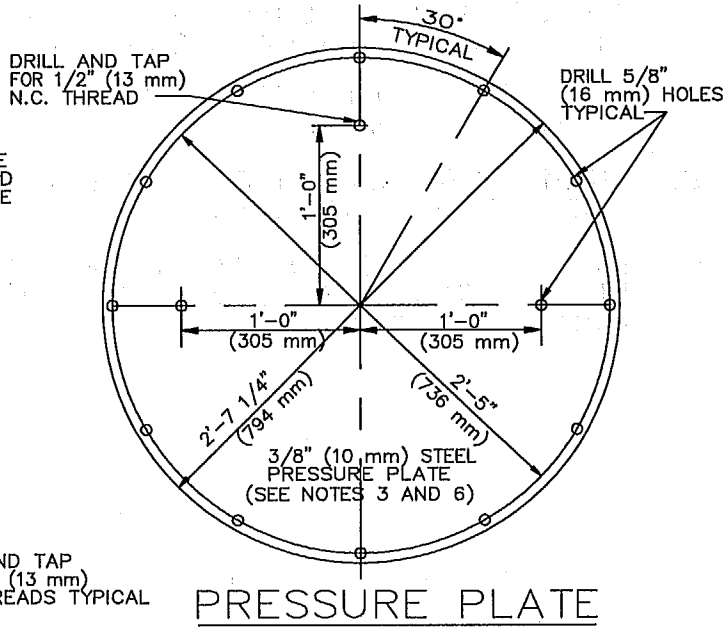
STANDARD PLAN 210–3

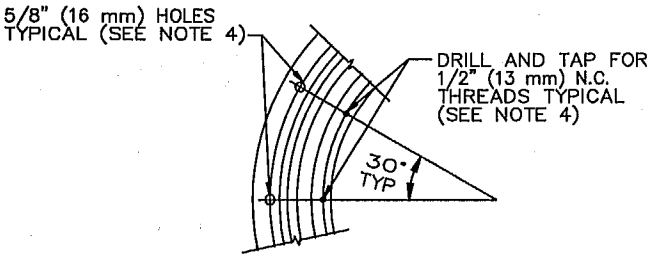
NOTES:

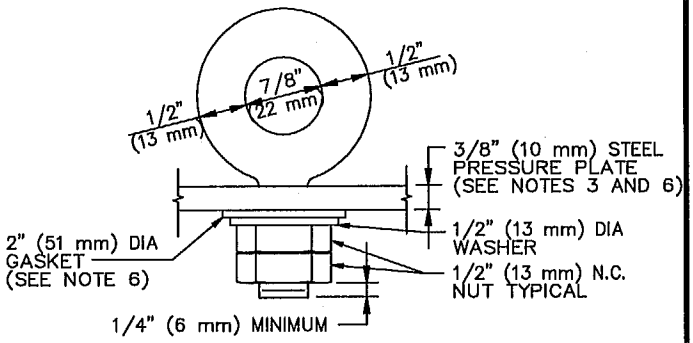
1. THE CAST IRON USED SHALL CONFORM TO ASTM A–48 CLASS 35B.
2. THE FRAME AND COVER SHALL BE COATED WITH ASPHALTUM OR BITUMINOUS PAINT AFTER TESTING AND INSPECTION.
3. COVERS SHALL BE CAST WITH THE LETTER "D" FOR STORM DRAINS AND "S" FOR SEWERS AND THE AGENCY IDENTIFICATION IN ACCORDANCE WITH INSTRUCTIONS FURNISHED BY THE AGENCY. THE LETTER "D" OR "S" SHALL BE APPROXIMATELY 2 1/2" (65 mm) HIGH WITH 1/2" (13 mm) LINE WIDTH AND PLACED IN THE CENTER OF THE COVER. ALL LETTERS SHALL BE FLUSH WITH THE FINISHED SURFACE OF THE COVER.
4. FOUNDRY IDENTIFYING MARK, HEAT AND DATE SHALL BE CAST ON THE BOTTOM OF THE COVER AND ON THE INSIDE OF THE FRAME.
5. IMPORTED COVERS AND FRAMES SHALL HAVE THE COUNTRY OF ORIGIN MARKING IN COMPLIANCE WITH FEDERAL REGULATIONS.
6. WEIGHT OF FRAME SHALL BE 160 POUNDS (73 kg). WEIGHT OF COVER SHALL BE 200 POUNDS (91 kg). ACTUAL WEIGHTS SHALL BE WITHIN A RANGE OF 95% TO 110%.
7. THE MANHOLE FRAME AND COVER SHALL BE INSPECTED BY THE ENGINEER PRIOR TO SHIPMENT TO THE JOBSITE. ACCEPTANCE WILL BE INDICATED BY THE AGENCY'S MARK.
8. THE PROOF–LOAD FOR TEST METHOD B OF SSPWC 206–3.2 IS 55,300 POUNDS (228 kN).
9. COVERS FOR MANHOLES LOCATED IN EASEMENTS, ALLEYS, PARKWAYS AND ALL OTHER PLACES EXCEPT PAVED STREETS SHALL BE PROVIDED WITH SOCKET SET SCREW LOCKING DEVICES. DRILL AND TAP TWO HOLES TO A DEPTH OF 1" (25 mm) AT 90° TO PICK HOLE AND INSTALL 3/4" x 3/4" (19 mm x 19 mm) STAINLESS STEEL SOCKET SET SCREWS WITH 3/8" (10 mm) RECESSED HEX HEAD. ALL THREADS SHALL BE N.C.











STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS, INC., GREENBOOK COMMITTEE 1984 REV. 1996, 2009

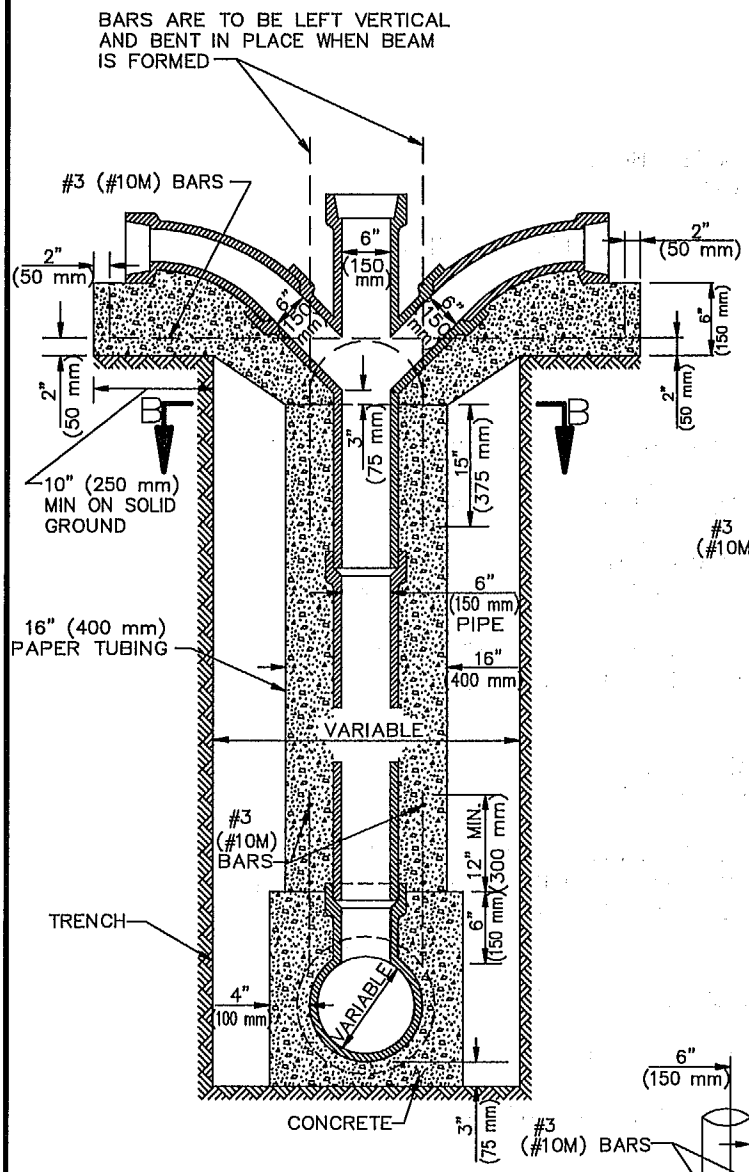
MANHOLE FRAME AND COVER PRESSURE TYPE

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

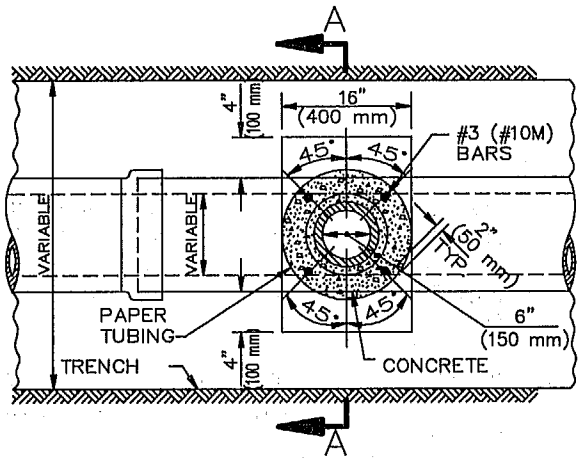
STANDARD PLAN 211-2

NOTES:

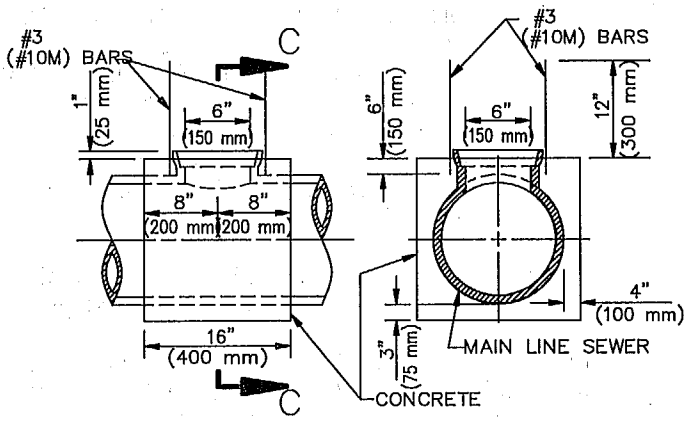
1. ANCHOR SYSTEM DESIGNED FOR LESS THAN 10' (3 m) OF HEAD.
2. MINIMUM EMBEDMENT OF 1/2" (13 mm) ø ANCHOR BOLT WITH HEAD SHALL BE 5" (130 mm).
3. SET CONCRETE ANCHOR ON WET, CLASS "B" MORTAR ON TOP OF BRICK MANHOLE SHAFT OR PRECAST CONCRETE CONE.
4. UNLESS OTHERWISE NOTED, 1/2" (13 mm) ø ANCHOR BOLTS AND NUTS ARE REQUIRED AND SHALL BE FABRICATED FROM ANY SERIES 300 STAINLESS STEEL.
5. NUTS ON ANCHOR BOLTS SHALL BE TIGHTENED TO A MINIMUM TORQUE OF 25 FOOT–POUNDS (34 Nm).



SECTION A–A

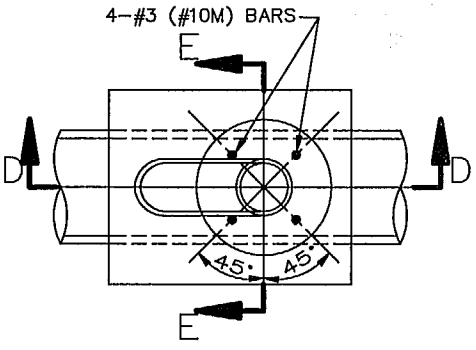


SECTION B–B

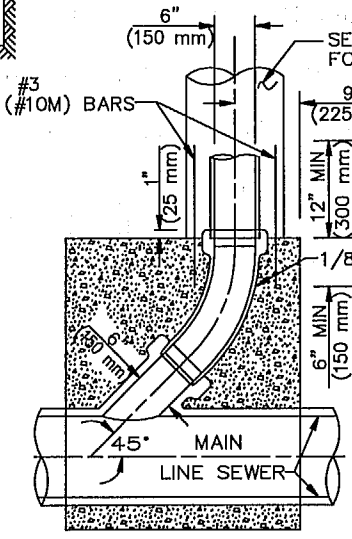


ELEVATION SECTION C–C

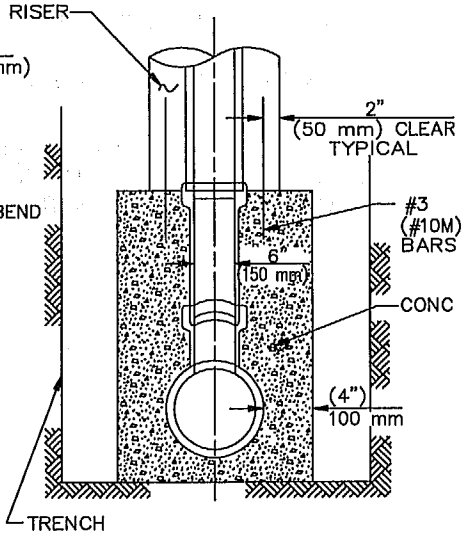
CHIMNEY BASE
CASE I



SECTION B–B



SECTION D–D



SECTION E–E

CHIMNEY BASE
CASE II

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1984 REV. 1993, 1996, 2009

CHIMNEYS

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 220–3

NOTES

1. THE UPPER END OF THE CHIMNEY PIPE SHALL BE AT LEAST 8' (2.5 m) BELOW THE GRADE OF THE LOWER CURB.

2. NO CONNECTION SHALL BE MADE DIRECTLY TO TOP OF CHIMNEY PIPE.

3. WHERE ONE HOUSE LATERAL IS TO BE JOINED TO THE CHIMNEY PIPE, USE A SINGLE WYE AND FACE WYE TOWARDS PROPERTY TO BE SERVED.

4. WHERE TWO OR MORE HOUSE LATERALS ARE TO BE JOINED TO THE CHIMNEY PIPE, INSTALL WYE BRANCHES AS FOLLOWS:
   A. FOR TWO HOUSE LATERALS, ONE SERVING EACH SIDE OF STREET, USE A DOUBLE WYE BRANCH.
   B. FOR TWO HOUSE LATERALS SERVING THE SAME SIDE OF THE STREET, USE TWO SINGLE WYES STACKED WITH BRANCHES FACING THE PROPERTIES SERVED.
   C. FOR THREE OR FOUR HOUSE LATERALS, USE TWO DOUBLE WYE BRANCHES OR ONE DOUBLE AND ONE SINGLE WYE BRANCH STACKED.

5. EACH DOUBLE OR SINGLE WYE BRANCH AND EIGHTH BEND SHALL BE SUPPORTED BY A CONCRETE BEAM AS SHOWN.

6. FOR CHIMNEY BASE, 6" (150 mm) TEE BRANCH OR WYE SHALL BE INSTALLED VERTICALLY ON TOP OF THE MAIN LINE SEWER AS SHOWN. THE CHIMNEY BASE MUST BE POURED AND SET WITH DOWELS AS SHOWN 24 HOURS BEFORE THE CHIMNEY CONCRETE IS POURED.

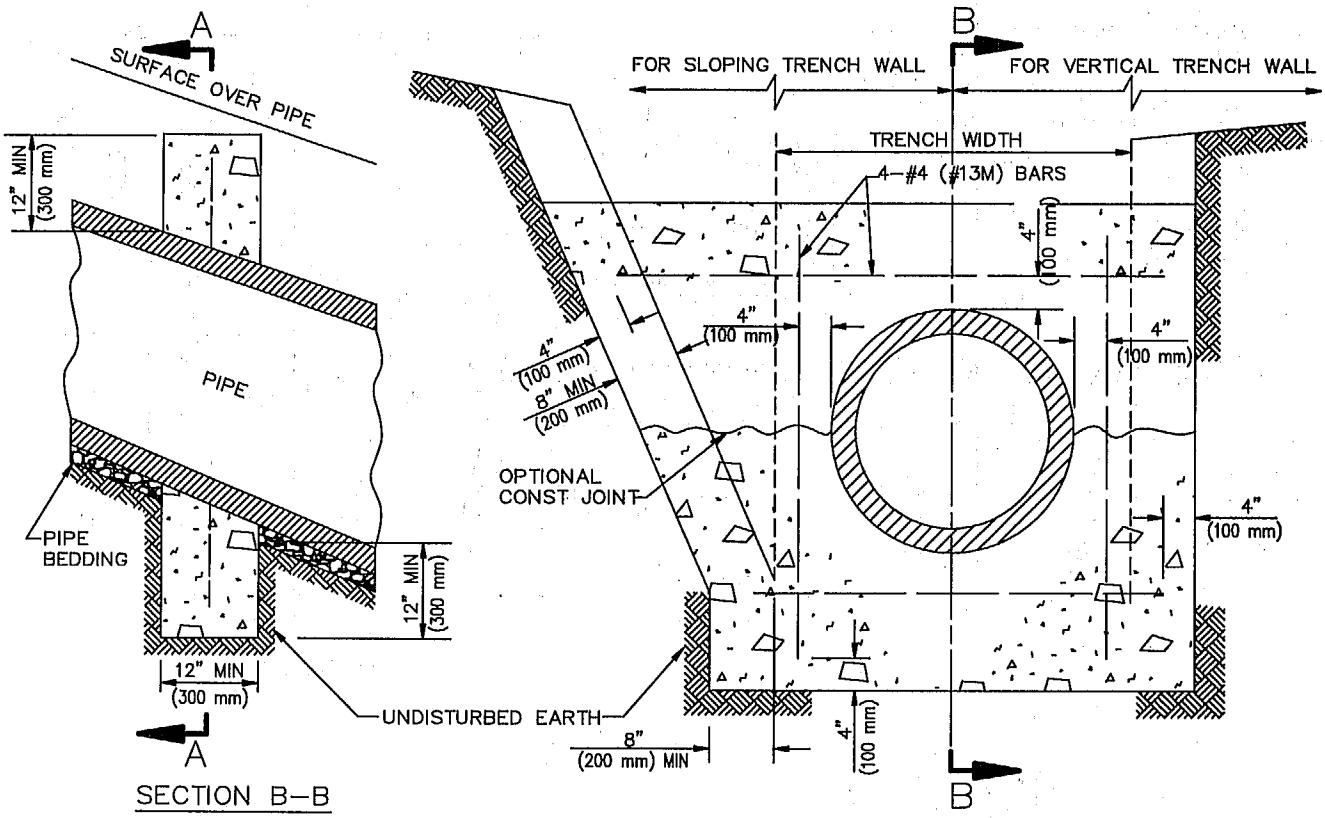
7. ALL CONCRETE SHOWN SHALL BE CLASS 520-C-2500 (310-C-17).

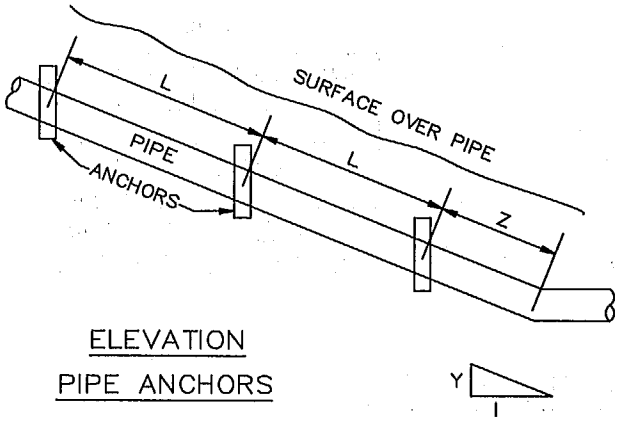
8. CASE I SHALL BE FOR VITRIFIED CLAY PIPE ONLY.

9. CASE II SHALL BE FOR ALL ALLOWABLE PIPE MATERIALS.

10. FOR ABS PIPE USE SOLVENT WELDED JOINTS ONLY.

11. A CAP SHALL BE INSTALLED AT THE OPENING OF THE PIPE RISER AND AT EACH UNCONNECTED BRANCH, SEALED AROUND ITS CIRCUMFERENCE WITH 1" (25 mm) THICK TYPE "F" MORTAR.





ELEVATION
PIPE ANCHORS

TABLE A

PIPE SLOPE(%) Y:1(100)	L DISTANCE (MAX)	Z DISTANCE (MAX)
100	12' (3.65 m)	4' (1.20 m)
67	14' (4.25 m)	8' (2.40 m)
50	16' (4.90 m)	12' (3.65 m)
40	18' (5.50 m)	18' (5.50 m)
33	20' (6.00 m)	20' (6.00 m)

ANCHORS

NOTES:

1. ANCHORS SHALL BE CLASS 450–C–2000 (265–C–14) CONCRETE.
2. FOR CLAY PIPE, ANCHORS SHALL NOT BE PLACED WITHIN 6" (150 mm) OF THE PIPE JOINT.
3. TRENCH SHALL BE BACKFILL PER NOTE 4 ON SHEET 2.
4. SPACING OF ANCHORS FOR PIPE SLOPES BETWEEN VALUES SHOWN IN TABLE "A" MAY BE PROPORTIONED.

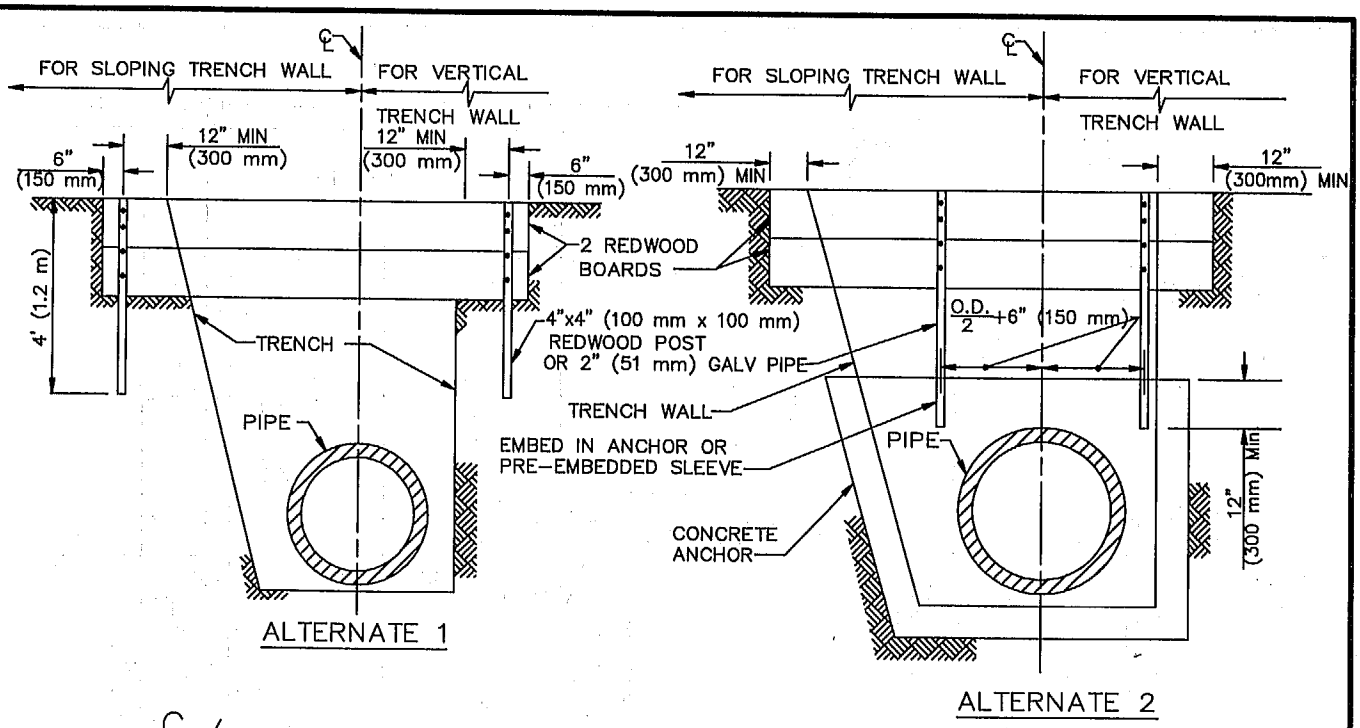
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

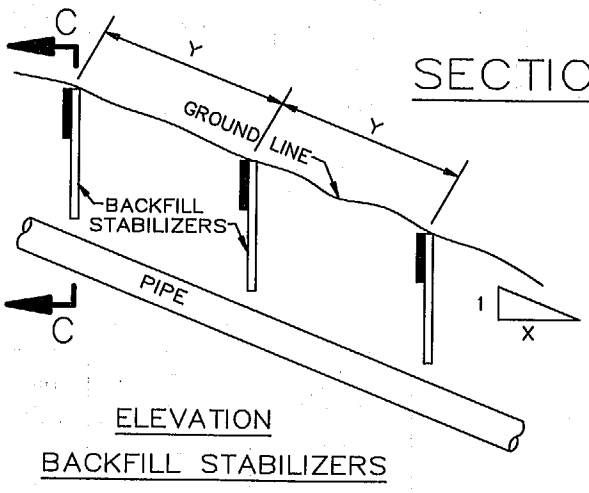
PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1984 REV. 1996, 2009

PIPE ANCHORS AND BACKFILL STABILIZERS

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 221–2





SECTION C–C

ELEVATION
BACKFILL STABILIZERS

TABLE B

GROUND SLOPE X:1	TABLE B Y (MAX)
1:1	5' (1.5 m)
1 1/2:1	9' (2.75 m)
2:1	12' (3.65 m)
2 1/2:1	16' (4.9 m)
3:1	20' (6.0 m)

STABILIZERS

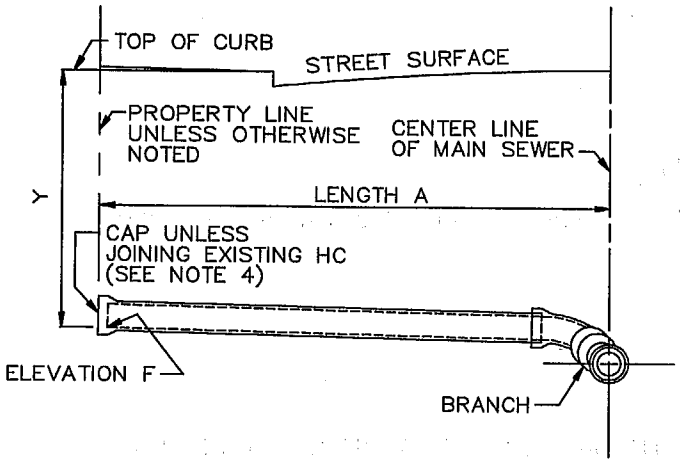
NOTES:

1. REDWOOD BOARDS SHALL BE 2" x 12" (50 x 300 mm) WHERE DEPTH OF COVER OVER PIPE PERMITS, OTHERWISE USE 2" x 10" (50 x 250 mm).
2. REDWOOD BOARDS SHALL BE PLACED ON THE HIGH GROUND SIDE OF THE POSTS.
3. EACH REDWOOD BOARD SHALL BE FASTENED BY USING 2–16d NAILS TO EACH REDWOOD POST OR A 3/8" (10 mm) BOLT AND NUT WITH WASHERS TO EACH GALVANIZED PIPE. ALL HARDWARE SHALL BE GALVANIZED.
4. TRENCH BACKFILL SHALL BE CONSOLIDATED BY MECHANICAL COMPACTION. IN LIEU OF MECHANICALLY COMPACTION, SOIL CEMENT MAY BE USED; HOWEVER, THE TOP 12" (300 mm) OF BACKFILL SHALL BE NATIVE SOIL, MECHANICALLY COMPACTED.
5. SPACING OF STABILIZERS FOR GROUND SLOPES BETWEEN VALUES SHOWN IN TABLE "B" MAY BE PROPORTIONED.
6. THE CONTRACTOR MAY, AT ITS OPTION, SUBSTITUTE DOUGLAS FIR FOR THE REDWOOD PROVIDED IT HAS BEEN TREATED WITH PRESERVATIVES.

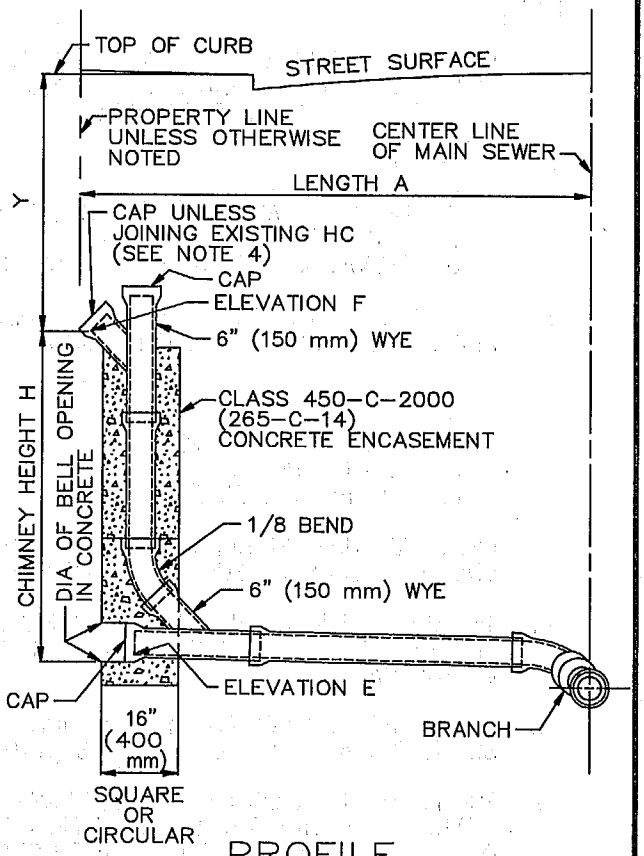
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PIPE ANCHORS AND BACKFILL STABILIZERS

STANDARD PLAN
221–2
SHEET 2 OF 2



PROFILE
TYPE A



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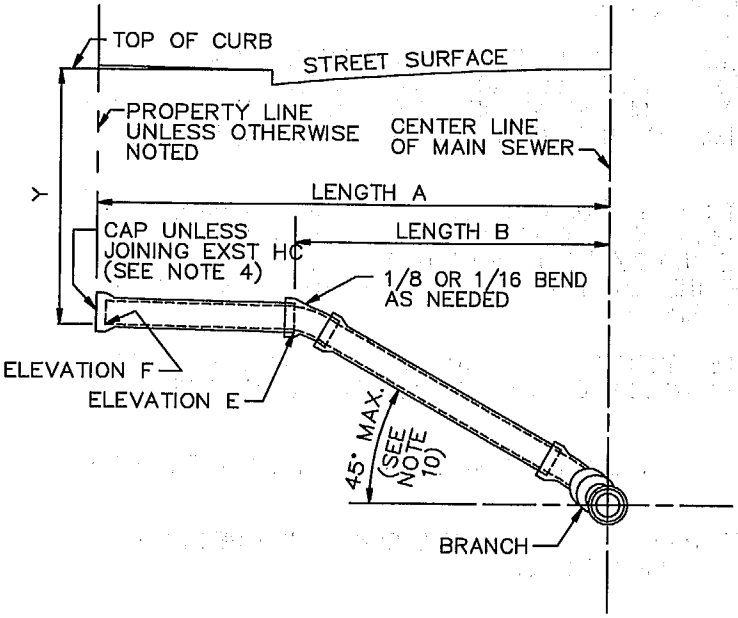
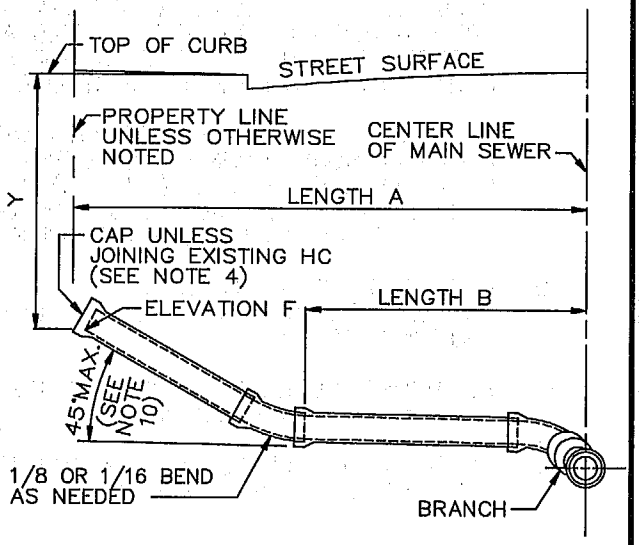
TYPE B



PROFILE
TYPE C



PROFILE
TYPE D

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE
PUBLIC WORKS STANDARDS INC.
GREENBOOK COMMITTEE
1984
REV. 1996, 2009

HOUSE CONNECTION SEWER

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN
222-2
SHEET 1 OF 2

NOTES

1. EXCEPT AS OTHERWISE INDICATED ON THE PLANS, ALL HOUSE CONNECTION SEWERS SHALL BE TYPE "A" AND SHALL BE CONSTRUCTED ON STRAIGHT LINES AND GRADES BETWEEN CONTROL POINTS AND ELEVATIONS.

2. DIMENSIONS:
   A. Y = ~~6' (1.85 m)~~ 3.0' (0.92m) MINIMUM
   B. LENGTHS "A" AND "B" – SEE PLANS
   C. HEIGHT "H" – SEE PLANS
   D. ELEVATIONS "E" AND "F" – SEE PLANS

3. ALL HOUSE CONNECTION SEWER PIPE SHALL BE ~~150 mm (6")~~ 100 mm (4") UNLESS OTHERWISE INDICATED AND MAY BE ANY OF THE FOLLOWING:

   A. VC PIPE
   B. PE PIPE
   C. ABS SOLID WALL PIPE
   D. ABS COMPOSITE PIPE
   E. PVC PLASTIC PIPE

   PROVIDED THAT CHANGES FROM ONE TYPE OF MATERIAL OR SIZE TO ANOTHER SHALL BE MADE ONLY BY MEANS OF SUITABLE ADAPTERS APPROVED BY THE ENGINEER.

4. THE UPPER END OF THE HOUSE CONNECTION SHALL BE SEALED BY INSTALLING A CAP AND SEALING THE CAP WITH 1" (25 mm) THICK TYPE "F" MORTAR AROUND THE CIRCUMFERENCE OF THE CAP.

5. EXCEPT AS CONTROLLED BY ELEVATIONS INDICATED ON THE PROJECT PLANS, THE MINIMUM SLOPE FOR ALL PIPE SHALL BE 2% (S=0.02 MINIMUM).

6. THE FIGURE IN A CIRCLE ON THE PLANS ADJACENT TO A HOUSE CONNECTION SEWER STATION INDICATES THE DEPTH IN FEET (METERS) BELOW THE EXISTING TOP OF CURB TO WHICH THE INVERT OF THE UPPER END OF THE HOUSE CONNECTION SEWER SHALL BE CONSTRUCTED. IF NO DEPTH IS INDICATED, THE INVERT OF THE UPPER END SHALL BE THE ELEVATION SHOWN ON THE PROFILE. WHERE NEITHER DEPTH NOR ELEVATION IS INDICATED, THE INVERT SHALL BE 6' (1.85 m) BELOW THE TOP OF THE EXISTING CURB.

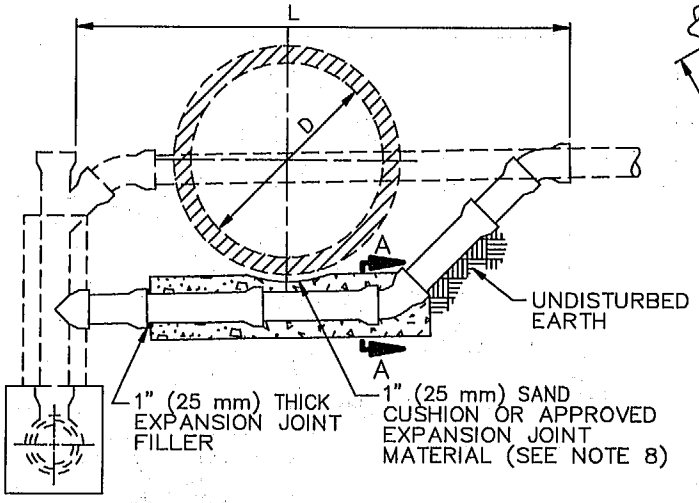
7. BRANCHES SHALL BE EITHER TEES OR WYES AND SHALL BE ROTATED UPWARD FROM THE HORIZONTAL TO AN ANGLE OF 22-1/2° TO 45° WHEN TEES ARE USED. BENDS ARE NOT REQUIRED BUT MAY BE USED AT THE OPTION OF THE CONTRACTOR. WHEN THE BRANCH ROTATION DOES NOT CONFORM TO THE SLOPE OF THE HOUSE CONNECTION SEWER, PULLED JOINTS MAY BE USED FOR ADJUSTMENT.

8. THE MAXIMUM DEFLECTION AT EACH JOINT FOR 4" (100 mm) AND 6' (150 mm) VITRIFIED CLAY PIPE HOUSE CONNECTION SEWERS SHALL BE 4°, WHICH IS EQUAL TO A PULL OF 9/16" (14 mm) FOR A 6" (150 mm) PIPE AND 3/8" (10 mm) FOR A 4" (100 mm) PIPE. (PULL IS DEFINED AS THE SEPARATION OF THE ABUTTING PIPE ENDS ON THE CONVEX SIDE OF THE CURVE MEASURED AT THE OUTSIDE PIPE BARREL.)

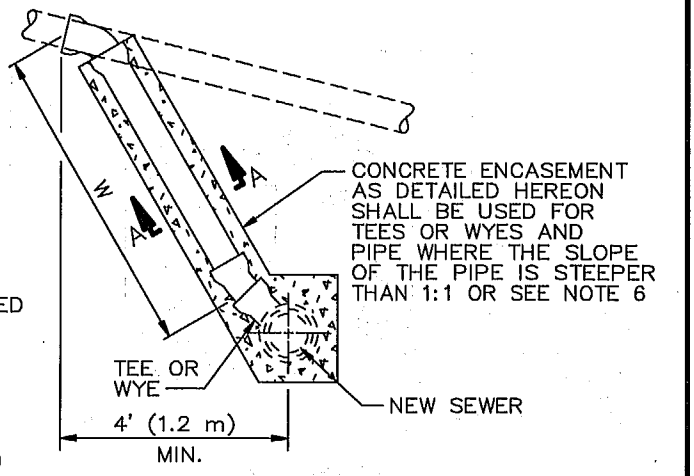
9. CONNECTION OF A BUILDING SEWER SMALLER THAN 6" (150 mm) TO A 6" (150 mm) HOUSE CONNECTION SEWER SHALL BE MADE USING AN APPROVED INCREASER TEE OR AN INCREASER FOLLOWED BY A TEE.

10. ALL HOUSE CONNECTION SEWERS OR PORTIONS THEREOF CONSTRUCTED ON A SLOPE EXCEEDING 45° SHALL BE ANCHORED PER SPPWC 221.

11. HOUSE CONNECTION SEWERS CONSTRUCTED PURSUANT TO A HOUSE CONNECTION PERMIT SHALL CONFORM TO ALL APPLICABLE STATUTES AND ORDINANCES.



CASE G



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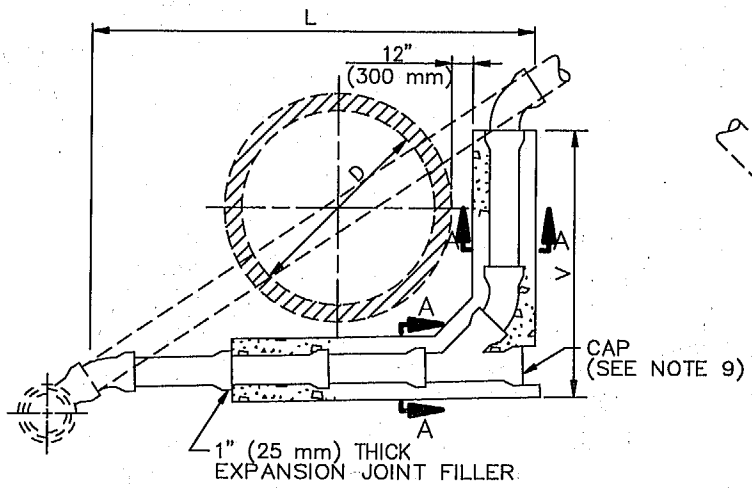

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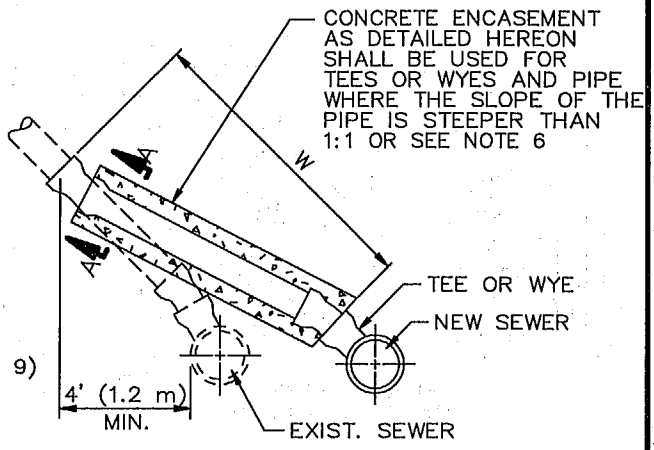

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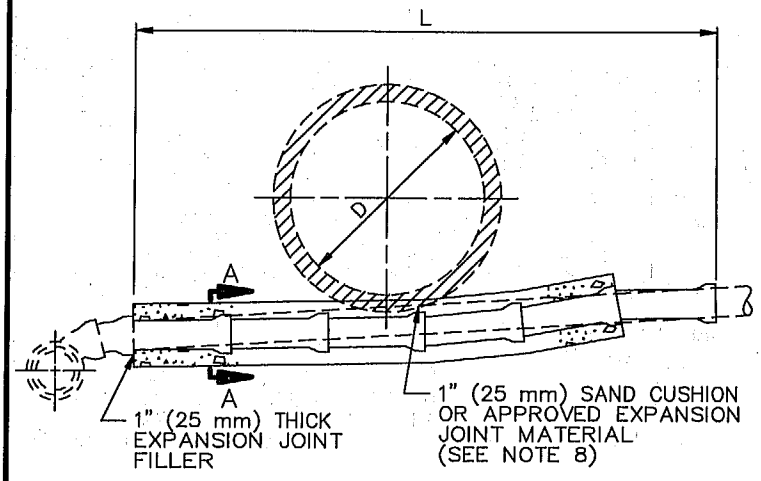
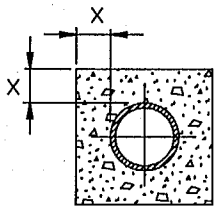


CASE K



NOMINAL DIAMETER OF PIPE INCHES (mm)	MINIMUM DIMENSIONS X INCHES (mm)
6 (150)	3 (75)
8 (200)	4 (100)
10 (250)	5 (125)
12 (300)	6 (150)

SECTION A–A
CONCRETE ENCASEMENT DETAIL
(SEE NOTE 5)

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

HOUSE CONNECTION REMODELING

STANDARD PLAN
223–2
SHEET 2 OF 3

NOTES

1. EXCEPT AS OTHERWISE INDICATED HEREON OR ON THE PLANS, ALL HOUSE CONNECTION REMODELING SHALL CONFORM TO THE APPLICABLE PORTIONS OF SPPWC 222, HOUSE CONNECTION SEWER.

2. SEE PROJECT PLANS FOR VALUES OF D, L, V, AND W. (DIMENSION L IS THE HORIZONTAL LENGTH OF THE HOUSE CONNECTION REMODELING).

3. EXISTING SEWERS ARE INDICATED BY DASHED LINES. HOUSE CONNECTION SEWERS TO BE CONSTRUCTED ARE INDICATED BY SOLID LINES AND SHALL BE OF THE SAME MATERIAL AS THE EXISTING SEWER. THE CONTRACTOR MAY CONSTRUCT THE SEWER WITH OTHER MATERIALS ALLOWED BY SPPWC 222 PROVIDED APPROVED ADAPTORS ARE UTILIZED.

4. 1/16 (22.5°) OR 1/8 (45°) BENDS SHALL BE USED TO REMODEL OR CONSTRUCT ANY SEWER ON A CURVE OR AT ANY CHANGE IN ALIGNMENT. WHERE PHYSICAL OR GEOMETRIC LIMITATIONS PRECLUDE THE USE OF 1/16 (22.5°) OR 1/8 (45°) BENDS, THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL THE PROPOSED METHOD OF REMODELING OR CONSTRUCTION.

5. ALL HOUSE CONNECTION SEWERS TO BE CONSTRUCTED UNDER A PROPOSED CONDUIT SHALL BE ENCASED IN CONCRETE AS SHOWN HEREON. WHEN THE HOUSE CONNECTION SEWER SLOPE EXCEEDS 1:1 THE CONTRACTOR MAY, AT ITS OPTION, PLACE A CIRCULAR CROSS SECTION WITH MINIMUM COVER EQUAL TO DIMENSION "X" AS SHOWN ON SECTION A–A HEREON IN LIEU OF A SQUARE CROSS SECTION OF CONCRETE. CONCRETE BEDDING AND ENCASEMENT SHALL BE CLASS 450–C–2000 (250–C–14) AND SHALL EXTEND TO THE FIRST PIPE JOINT AT LEAST 1' (300 mm) BEYOND THE OD OF EACH SIDE OF THE PROPOSED CONDUIT.

6. FOR CASE R AND S, WHEN THE SLOPE OF THE PIPE EXCEEDS 1:1, THE CONTRACTOR MAY, AT ITS OPTION, CONSTRUCT A CHIMNEY CONFORMING TO SPPWC 220 ON THE NEW SEWER IN LIEU OF CONSTRUCTING THE ENCASEMENT SHOWN HEREON.

7. FOR CASES E AND F, SADDLES SHALL BE CONNECTED EITHER TO THE LENGTH OF PIPE CONTAINING THE EXISTING TEE OR WYE OR TO THE ADJACENT DOWNSTREAM PIPE LENGTH.

8. CONDUITS TO BE INSTALLED OVER OR WITHIN 1" (25 mm) OF ANY CONCRETE ENCASEMENT OR STRUCTURE, WHETHER EXISTING OR TO BE PLACED IN CONFORMITY WITH THE REQUIREMENTS HEREIN, SHALL BE INSTALLED ON A 1" (25 mm) SAND CUSHION OR APPROVED EXPANSION JOINT MATERIAL. CONCRETE ENCASEMENT INSTALLED PURSUANT TO THIS STANDARD PLAN SHALL BE SEPARATED FROM EXISTING CONDUIT WITH 1" (25 mm) THICK EXPANSION JOINT MATERIAL.

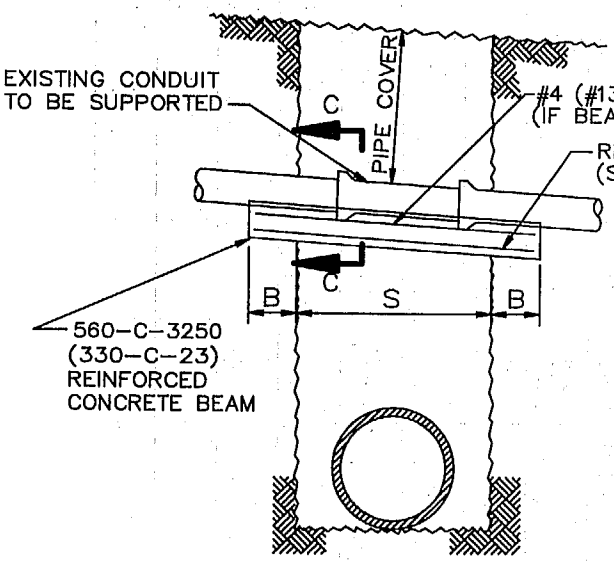
9. THOSE PORTIONS OF AN ABANDONED PIPE LOCATED BENEATH OR WITHIN 6" (150 mm) OF A RELOCATED HOUSE CONNECTION SEWER SHALL BE REMOVED. THE EXCAVATION SHALL BE REFILLED TO THE GRADE OF THE NEW PIPE INVERT WITH CLASS 100–E–100 (60–E–0.7) CONCRETE. THE CONTRACTOR MAY, AT ITS OPTION, SUBSTITUTE MECHANICALLY COMPACTED BACKFILL IN LIEU OF THE CLASS 100–E–100 (60–E0.7) CONCRETE. THOSE PORTIONS OF ABANDONED PIPE NOT REMOVED SHALL BE SEALED. WHERE CAPS ARE USED, THEY SHALL BE SEALED BY FILLING THE SPACE ABOVE THE CAP WITH SAND AND A 1" (25 mm) THICK COATING OF TYPE "F" MORTAR.

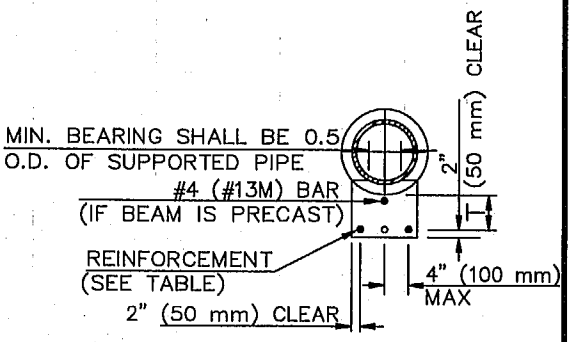
10. SUPPORT WALLS SHALL CONFORM TO SPPWC 224.

11. WHEN INDICATED ON THE PLANS OR THE SPECIAL PROVISIONS, A CLEANOUT SHALL BE CONSTRUCTED IN CONJUNCTION WITH CASE E AS FOLLOWS:

    A. SUBSTITUTE A "Y" FOR THE 45° BEND.
    B. PLACE A 45° BEND ON THE UPPER END OF THE "Y".
    C. CAP TOP OF 45° BEND WITH A CAP AND SEAL WITH 1" (25 mm) THICK TYPE "F" MORTAR AROUND THE CIRCUMFERENCE OF THE CAP.

CASE I
REINFORCED CONCRETE BEAM
FOR 4" (100 mm) TO 24" (610 mm) ID PIPE





SECTION C-C

NOTES:

1. WIDTH OF BEAM SHALL EQUAL OD OF SUPPORTED PIPE. MINIMUM WIDTH SHALL BE 6" (150 mm).
2. IF SUPPORTED PIPE IS BEDDED IN CONCRETE, BEAM WIDTH SHALL EQUAL BEDDING WIDTH.
3. IF BEAM IS PRECAST, ENDS OF BEAM SHALL BE FULLY BEDDED IN 450-C-2000 (265-C-14) CONCRETE FOR LENGTH "B". THE BEDDING SHALL HAVE A MINIMUM THICKNESS OF 4" (100 mm). CLASS "C" MORTAR SHALL BE PLACED BETWEEN TOP OF BEAM AND SUPPORTED PIPE TO PROVIDE MINIMUM BEARING SHOWN.
4. THIS CASE IS PERMITTED ONLY IF THE TRENCH WALLS ARE FIRM AND UNYIELDING.
5. MAXIMUM SPACING OF BARS SHALL BE 4" (100 mm) OC.

SEE REINFORCED CONCRETE BEAM TABLE (DIMENSIONS AND REINFORCEMENT) ON PAGE 2, THIS SECTION.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

SUPPORTS FOR CONDUITS ACROSS TRENCHES

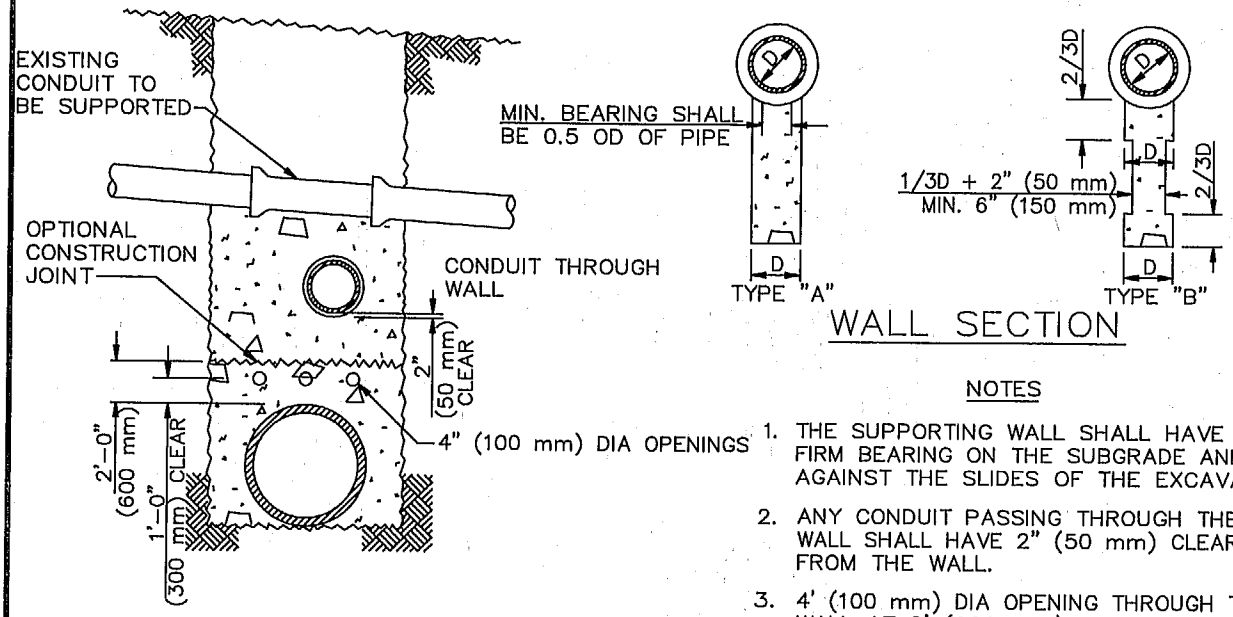
STANDARD PLAN 224-2

SHEET 2 OF 3

REINFORCED CONCRETE BEAM (DIMENSIONS AND REINFORCEMENT)

S	PIPE COVER														
	0' TO 8'-0" (0 m TO 2.4 m)			8'-0" TO 12'-0" (2.4 m TO 3.7 m)			12-0" TO 16'-0" (3.7 m TO 4.9 m)			16'-0" TO 20'-0" (4.9 m TO 6.0 m)			20'-0" TO 25'-0" (6.0 m TO 7.6 m)		
	T	BARS	B	T	BARS	B	T	BARS	B	T	BARS	B	T	BARS	B
0" TO 4'-0" (8m TO 1.2m)	8" (200mm)	#4 (#13M)	1'-6" (0.50m)	8" (200mm)	#4 (#13M)	1'-6" (0.50m)	9" (230mm)	#4 (#13M)	1'-6" (0.50m)	10" (255mm)	#4 (#13M)	1'-6" (0.50m)	10 1/2" (270mm)	#4 (#13M)	0.50m (1'-6")
4'-0" TO 5'-0" (1.2m TO 1.50m)	8" (200mm)	#4 (#13M)	1'-6" (0.50m)	9 1/2" (250mm)	#4 (#13M)	1'-6" (0.50m)	11" (280mm)	#4 (#13M)	1'-6" (0.50m)	12" (305mm)	#4 (#13M)	1'-6" (0.50m)	12 1/2" (320mm)	#5 (#16M)	0.50m (1'-6")
5'-0" TO 6'-0" (1.5m TO 1.85m)	9" (230mm)	#4 (#13M)	1'-6" (0.50m)	11" (280mm)	#5 (#16M)	1'-6" (0.50m)	12 1/2" (320mm)	#5 (#16M)	1'-6" (0.50m)	13 1/2" (340mm)	#5 (#16M)	2'-0" (0.6m)	14 1/2" (370mm)	#5 (#16M)	0.6m (3'-0")
6'-0" TO 7'-0" (1.85m TO 2.15m)	10" (255mm)	#5 (#16M)	1'-6" (0.50m)	12 1/2" (320mm)	#5 (#16M)	2'-0" (0.6m)	14 1/2" (370mm)	#5 (#16M)	2'-0" (0.6m)	15 1/2" (395mm)	#5 (#16M)	2'-0" (0.6m)	16 1/2" (420mm)	#6 (#19M)	2'-0" (0.6m)
7'-0" TO 8'-0" (2.15m TO 2.45m)	11" (280mm)	#5 (#16M)	1'-6" (0.50m)	14" (355mm)	#5 (#16M)	2'-0" (0.6m)	16" (410mm)	#5 (#16M)	2'-0" (0.6m)	17 1/2" (445mm)	#5 (#16M)	2'-6" (0.75m)	19" (485mm)	#6 (#19M)	2'-6" (0.75m)
8'-0" TO 9'-0" (2.45m TO 2.75m)	12 1/2" (320mm)	#5 (#16M)	2'-0" (0.6m)	15 1/2" (395mm)	#6 (#19M)	2'-6" (0.75m)	17 1/2" (445mm)	#6 (#19M)	3'-0" (0.90m)	19 1/2" (495mm)	#6 (#19M)	2'-6" (0.75m)	21" (535mm)	#6 (#19M)	2'-6" (0.75m)
9'-0" TO 10'-0" (2.75m TO 3.0m)	13 1/2" (340mm)	#6 (#19M)	2'-0" (0.6m)	17" (430mm)	#6 (#19M)	2'-6" (0.75m)	19 1/2" (495mm)	#6 (#19M)	3'-0" (0.90m)	21 1/2" (545mm)	#6 (#19M)	3'-0" (0.9m)	23" (585mm)	#6 (#19M)	3'-0" (0.90m)
10'-0" TO 10'-0" (3.0m TO 3.35m)	14 1/2" (370mm)	#6 (#19M)	2'-6" (0.75m)	18 1/2" (470mm)	#6 (#19M)	3'-0" (0.90m)	21" (535mm)	#6 (#19M)	3'-0" (0.90m)	23 1/2" (595mm)	#7 (#22M)	3'-0" (0.9m)	25" (635mm)	#7 (#22M)	3'-0" (0.90m)
11'0" TO 12'-0" (3.35m TO 3.65m)	15 1/2" (395mm)	#6 (#19M)	2'-6" (0.75m)	20" (510mm)	#6 (#19M)	3'-0" (0.90m)	23" (585mm)	#7 (#22M)	3'-6" (1.10m)	25 1/2" (650mm)	#7 (#22M)	3'-6" (1.10m)	27" (685mm)	#7 (#22M)	3'-6" (1.10m)
12'-0" TO 13'-0" (3.65m TO 4.00m)	17" (430mm)	#6 (#19M)	3'-0" (0.90m)	21 1/2" (545mm)	#7 (#22M)	3'-6" (1.10m)	24 1/2" (625mm)	#7 (#22M)	3'-6" (1.10m)	27 1/2" (700mm)	#7 (#22M)	4'-0" (1.20m)	29" (740mm)	#7 (#22M)	4'-0" (1.20m)
13'-1" TO 14'-0" (4.00m TO 4.25m)	18" (455mm)	#7 (#22M)	3'-0" (0.90m)	23" (585mm)	#7 (#22M)	3'-6" (1.10m)	26 1/2" (675mm)	#7 (#22M)	4'-0" (1.20m)	29 1/2" (750mm)	#7 (#22M)	4'-0" (1.20m)	31 1/2" (800mm)	#7 (#22M)	4'-0" (1.20m)
14'-0" TO 15'-0" (4.25m TO 4.60m)	19" (485mm)	#7 (#22M)	3'-0" (0.90m)	25" (635mm)	#7 (#22M)	4'-0" (1.20m)	28" (710mm)	#7 (#22M)	4'-0" (1.20m)	31 1/2" (800mm)	#7 (#22M)	4'-6" (1.40m)			
15'-0" TO 16'-0" (4.6m TO 4.90m)	20 1/2" (520mm)	#7 (#22M)	3'-6" (1.10m)	26 1/2" (675mm)	#7 (#22M)	4'-0" (1.20m)	30" (760mm)	#8 (#25M)	4'-6" (1.40m)						
16'-0" TO 17'-0" (4.90 TO 5.20m)	21 1/2" (545mm)	#7 (#22M)	3'-6" (1.10m)	28" (710mm)	#8 (#25M)	4'-6" (1.40m)									
17'-0" TO 18'-0" (5.20m TO 5.50m)	22 1/2" (570mm)	#8 (#25M)	4'-6" (1.40m)	29 1/2" (750mm)	#8 (#25M)	4'-6" (1.40m)									

CASE 2
CONCRETE WALL

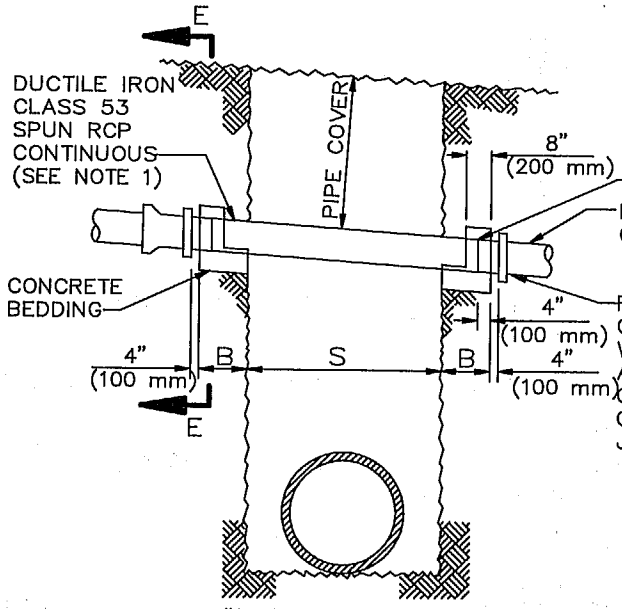


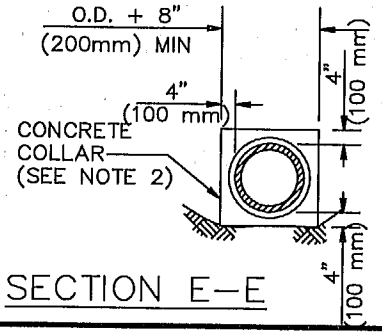
WALL SECTION

NOTES

1. THE SUPPORTING WALL SHALL HAVE A FIRM BEARING ON THE SUBGRADE AND AGAINST THE SLIDES OF THE EXCAVATION.
2. ANY CONDUIT PASSING THROUGH THE WALL SHALL HAVE 2" (50 mm) CLEARANCE FROM THE WALL.
3. 4' (100 mm) DIA OPENING THROUGH THE WALL AT 2' (600 mm) OC HORIZONTALLY AND AT 5' (1.5 m) OC VERTICALLY SHALL BE PROVIDED TO PREVENT UNEQUAL PRESSURE RESULTING FROM JETTED BACKFILL.
4. IF SUPPORTED PIPE IS BEDDED IN CONCRETE, MINIMUM THICKNESS OF WALL SHALL EQUAL BEDDING WIDTH.
5. BRICK WITH MORTAR JOINTS MAY BE USED IN LIEU OF CONCRETE FOR WALLS UP TO 5' (1.5 m) IN HEIGHT OR LENGTH.

CASE 3
DUCTILE IRON PIPE





SECTION E-E

NOTES

1. 2000-D (100-D) SPUN RCP OF SAME DIAMETER AS THE EXISTING PIPE MAY BE USED ONLY WHEN THE EXISTING PIPE IS ACP, NRCP OR RCP AND THE TRENCH WIDTH IS 5' (1.5 m) OR LESS.
2. THE CONCRETE COLLAR JOINT SHALL BE USED FOR JOINTS IN STORM DRAIN PIPE.

ALLOWABLE SPANS AND MIN. REQUIRED BEARING FOR DUCTILE IRON PIPE

DEPTH OF COVER	6" (150 mm) PIPE		8" (200 mm) PIPE		10" (250 mm) PIPE	
	S (Max)	B (Min)	S (Max)	B (Min)	S (Max)	B (Min)
0" TO 8'-0" (0 m TO 2.45 m)	11'-0" (3.35 m)	1'-6" (0.5 m)	13'-6" (4.10 m)	1'-6" (0.5 m)	16'-6" (5.03 m)	2'-0" (0.6 m)
8'-0" TO 16'-0" (2.45m TO 4.90m)	8'-0" (2.45 m)	1'-6" (0.5 m)	10'-0" (3.00 m)	2'-0" (0.6 m)	12'-0" (3.66 m)	2'-0" (0.6 m)
16'-0" TO 25'-0" (4.90m TO 7.60m)	7'-0" (2.15 m)	1'-6" (0.5 m)	9'-0" (2.75 m)	2'-0" (0.6 m)	10'-6" (3.20 m)	2'-6" (0.75 m)

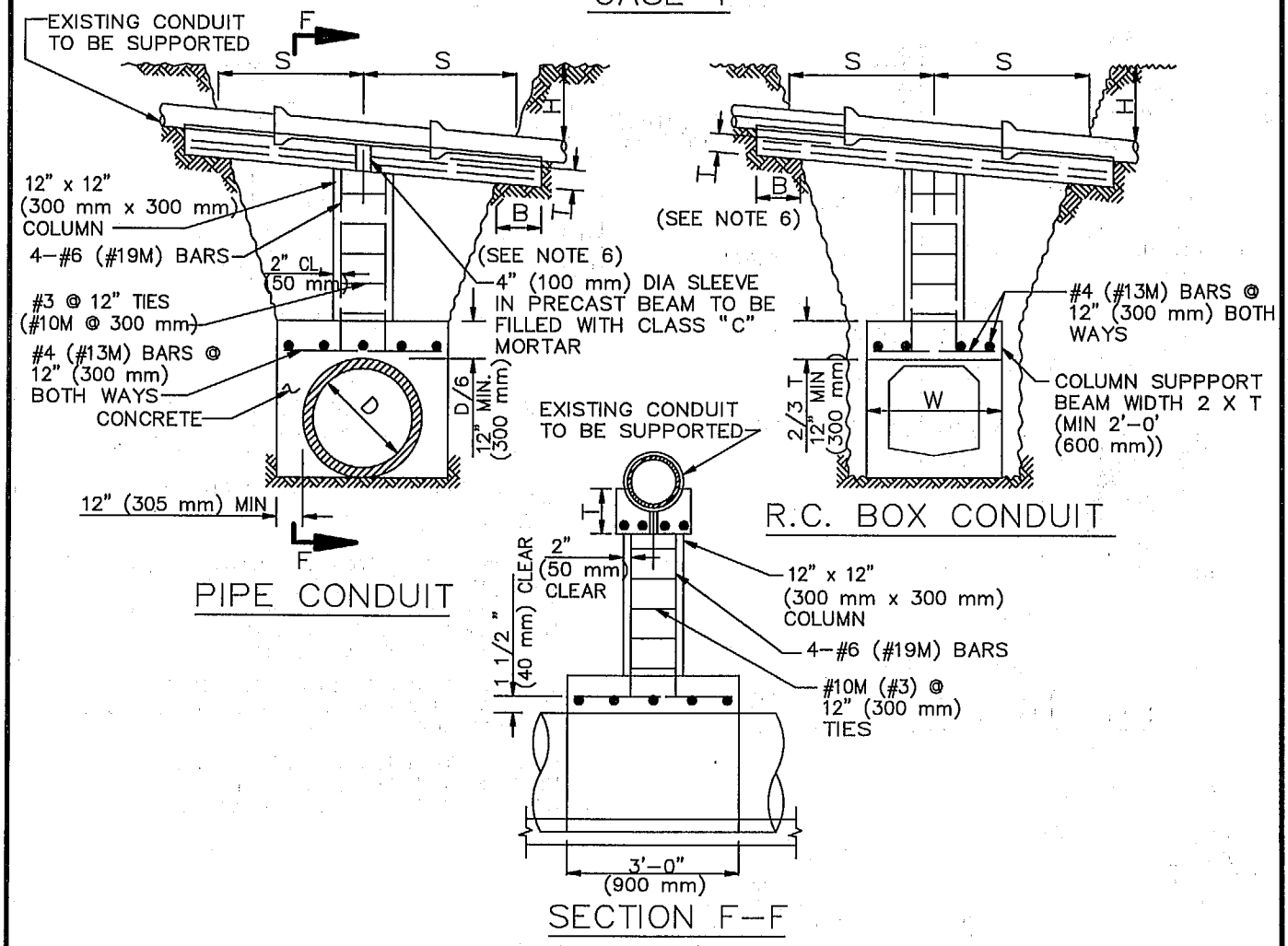
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

SUPPORTS FOR CONDUITS ACROSS TRENCHES

STANDARD PLAN 224-2

COLUMN SUPPORT WITH REINFORCED CONCRETE BEAM

CASE 4



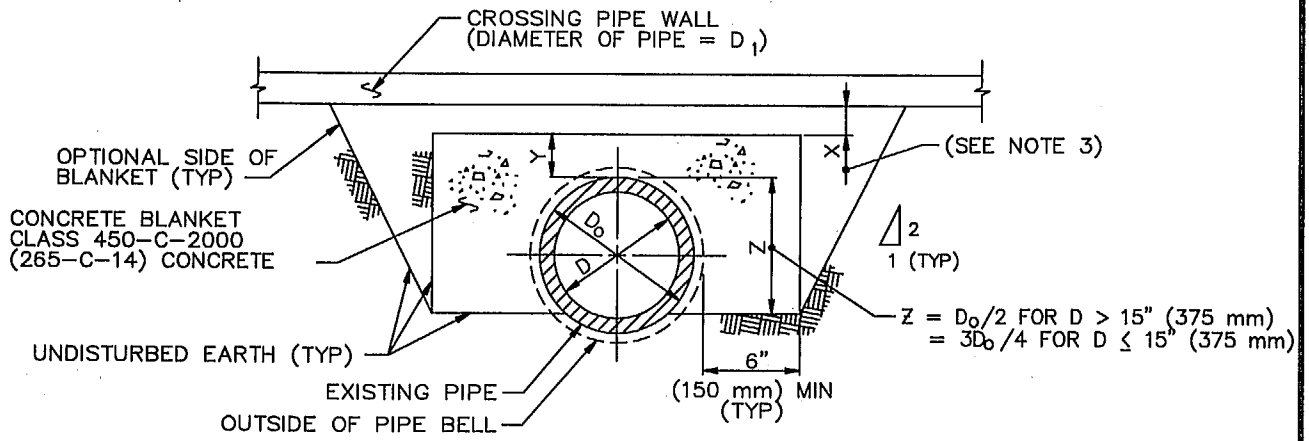
NOTES

1. SPAN "S" SHALL BE MAXIMUM 18' (5.5 m) FOR EARTH COVER 8' (2.45 m) OR LESS, 12' (3.65 m) FOR EARTH COVER 16' (4.9 m) OR LESS, AND 10' (3.0 m) FOR OVER 16' (4.9 m) EARTH COVER.
2. CONCRETE SHALL BE CLASS 560–C–3250 (330–C–23).
3. WHEN THE PIPE TO BE SUPPORTED CROSSES THE TRENCH ON A SKEW ANGLE, THE WALL OR BEAM WHICH SUPPORTS THE COLUMN SHALL BE CONSTRUCTED AT RIGHT ANGLE TO THE TRENCH.
4. SUPPORT SYSTEM MAY BE USED OVER CAST–IN–PLACE STRUCTURES.
5. BACKFILL ABOVE THE SUPPORT BEAM SHALL NOT BE PLACED UNTIL 72 HOURS AFTER THE SUPPORT IS POURED.
6. REINFORCED CONCRETE BEAM DIMENSIONED AND REINFORCED PER TABLE UNDER CASE 1.

GENERAL NOTES

1. "S" IS THE SPAN OF THE PIPE SUPPORT MEASURED ALONG ITS CENTERLINE.
2. "B" IS THE LENGTH OF BEARING OF THE SUPPORT AGAINST UNDISTURBED EARTH MEASURED ALONG THE PIPE CENTERLINE.
3. CASE 2 SHALL BE USED FOR PARTIAL CROSSINGS, EXCEPT THAT WHERE THE DISTANCE FROM A SEWER CHIMNEY TO UN–DISTURBED EARTH IS 18" (450 mm) OR LESS, THE TRENCH BACKFILL MAY BE DENSIFIED TO 18" (450 mm) ABOVE A HOUSE CONNECTION SEWER AND THEN RE–EXCAVATED FOR THE PIPE INSTALLATION.
4. ANY SEWER OR STORM DRAIN EXPOSED OR PARTIALLY EXPOSED IN A TUNNEL EXCAVATION SHALL BE SUPPORTED WITH A WALL, CASE 2.
5. IF BEDDING IS REMOVED FROM THE EXISTING PIPE THAT WILL REMAIN IN PLACE, THE PIPE SHALL BE EMBEDDED WITH CONCRETE AT NO EXTRA COST TO THE AGENCY.
6. UNLESS OTHERWISE INDICATED, CONCRETE SHALL BE CLASS 450–C2000 (265–C–14).

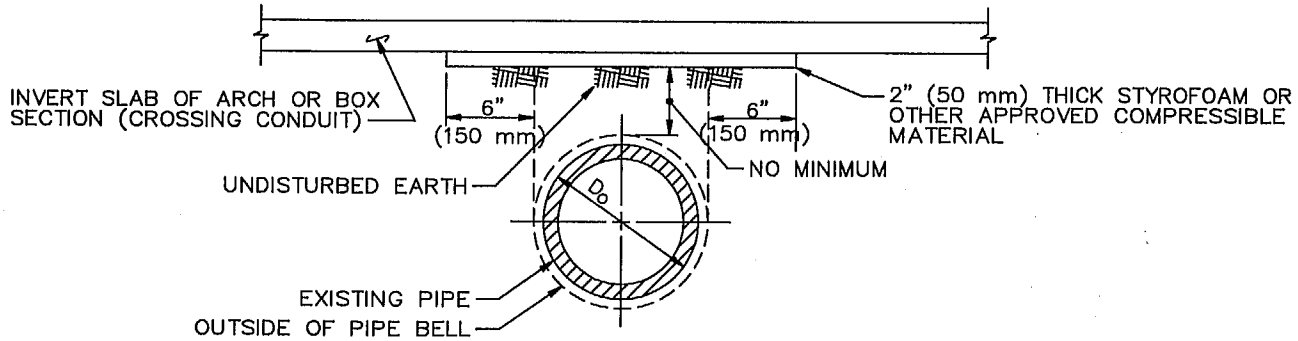
STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION	STANDARD PLAN
SUPPORTS FOR CONDUITS ACROSS TRENCHES	**224–2**
	SHEET 4 OF 3



CONCRETE BLANKET
(FOR EXISTING PIPES CROSSED OVER BY A NEW PIPE)

NOTES:

1. CONCRETE BLANKET IS REQUIRED WHEN THE CLEARANCE BETWEEN THE TOP OF THE EXISTING PIPE AND THE BOTTOM OF THE CROSSING PIPE IS LESS THAN 18" (450 mm).
2. Y = D/6 (6" (150 mm) MIN). WHERE THE CLEARANCE BETWEEN THE TOP OF THE EXISTING PIPE AND THE BOTTOM OF THE CROSSING PIPE IS LESS THAN Y, THE CONCRETE SHALL BE PLACED BETWEEN THE PIPES AND AROUND THE SIDES OF THE CROSSING PIPE UP TO A LEVEL EQUAL TO Y ABOVE THE EXISTING PIPE, OR AS REQUIRED BY NOTE 3 BELOW, WHICHEVER IS HIGHER.
3. X = D/12, MINIMUM, TO PROVIDE BEDDING MATERIAL FOR THE CROSSING CONDUIT. WHEN X IS LESS THAN THIS MINIMUM, THE ENTIRE TOP SURFACE OF THE BLANKET SHALL BE RAISED TO MAKE CONTACT WITH THE LOWER 90° OF THE CROSSING PIPE.
4. THE BLANKET SHALL EXTEND LONGITUDINALLY TO THE FIRST JOINT BEYOND THE TRENCH EXCAVATION AT EACH END OF THE BLANKET, EXCEPT THAT THE BLANKET NEED NOT BE EXTENDED MORE THAN 4' (1.2m) BEYOND THE TRENCH.
5. WHENEVER A PIPE BELL IS ENCOUNTERED WITHIN THE LIMITS OF THE BLANKET, ALL DIMENSIONS SHALL REFER TO THE BELL.



COMPRESSIBLE BLANKET
(FOR EXISTING PIPES CROSSED OVER BY A NEW BOX OR ARCH)

NOTES:

1. COMPRESSIBLE BLANKET IS REQUIRED WHEN THE CLEARANCE BETWEEN THE TOP OF THE EXISTING PIPE AND THE BOTTOM OF THE CROSSING CONDUIT (BOX OR ARCH) IS LESS THAN 18" (450 mm).
2. THE BLANKET SHALL EXTEND LONGITUDINALLY FOR THE FULL CROSSING CONDUIT TRENCH WIDTH.

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION

PROMULGATED BY THE PUBLIC WORKS STANDARDS INC. GREENBOOK COMMITTEE 1984 REV. 1996, 2009

BLANKET PROTECTION FOR PIPES

USE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

STANDARD PLAN 225-2

SHEET 1 OF 1