

MANHEIM TOWNSHIP
IMPROVEMENTS SPECIFICATIONS MANUAL

PROCEDURES, MATERIALS AND SPECIFICATIONS



MANHEIM TOWNSHIP COMMISSIONERS
1840 Municipal Drive
Lancaster, Pennsylvania 17601

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MANHEIM TOWNSHIP
IMPROVEMENTS SPECIFICATIONS MANUAL

PROCEDURES, MATERIALS AND SPECIFICATIONS

THE FOLLOWING SPECIFICATIONS SHALL SUPPLEMENT THE MANHEIM TOWNSHIP SUBDIVISION AND LAND DEVELOPMENT ORDINANCE, STORM WATER MANAGEMENT ORDINANCE, SANITARY SEWER ORDINANCES, AND ALL OTHER REGULATIONS OF MANHEIM TOWNSHIP WHICH PERTAIN TO THE CONSTRUCTION OF THE TYPES OF IMPROVEMENTS REGULATED BY THESE SPECIFICATIONS.

NOTIFICATIONS

The Director of Public Works of Manheim Township shall be notified prior to the start of any excavation, including removal of topsoil, grubbing of shrubs, bushes, trees and vegetation of any kind, or removal of anything in an existing street, existing right-of-way, existing utility easement, existing storm drainage easement, and waterways in Manheim Township.

Notification shall provide proof of all required permits, certifications and all other similar required approvals prior to the start of construction or reconstruction and submittal to the Commissioners or their assigned agent for review at said time.

PERMITS AND CERTIFICATES

<u>Permits</u>	<u>Agency</u>
Water Quality	(D.E.R.)
Stream Encroachment	(D.E.R.) and (C.O.E.)
Flood Plain Encroachment.	(C.O.E.)
State Highway Occupancy	(P.D.O.T.)
Structure and Bond	
Blasting and Bond	
Closure and Plan	
Township Street Opening Permit.	(M.T.)
Insurance Certificate	
Sewer Connection.	(M.T.)
Grading Permit.	(M.T.)
Water Connection.	(G.M.A.T.M.) and (L.C.B.W.)
Lancaster County Bridge Encroachment. . . .	(L.C.)
Sediment & Erosion Control.	(Soil Conservation Service)
All Others as Required	

LOCATION OF UTILITIES

Provide proof of compliance with the Utility Notification Requirements of Act No. 172/287, Acts of November 20, 1986 and December 10, 1974.

OPERATIONAL SAFETY

Work being performed on any and all existing public highways, streets, rights-of-way and easements, shall require Street Occupancy Permit from the proper authority, and all required safety protection, including flag persons, signing, barricades, flashing warning devices and other required devices, shall conform to Pennsylvania Department of Transportation Publication 203, Work Zone Traffic Control, and will be furnished and maintained solely by the applicant.

All work being performed shall be in compliance with Federal, State and local safety regulations and shall provide for public safety and the safety of all personnel involved directly or indirectly in the construction of all improvements, including, but not limited to trench shoring, protective clothing, safety shields and switches on power equipment, equipment and vehicle alarms.

INSPECTIONS

Inspections shall be performed by the Township to guarantee the proper procedures and methods of installation of all approved structures and approved materials required to be installed.

Inspections shall be required prior to starting construction, during the installation of materials and structures, and upon the completion of all improvements. All improvements shall be installed in accordance with all required approved regulations and specifications.

Any and all unsatisfactory work, faulty procedures and methods, and defective materials that have been installed, shall be rejected and noted for the record on the inspection standards punch list, and shall be corrected before final acceptance.

The placement of all required improvements shall be in accordance with the controls set by a surveyor registered by the State of Pennsylvania, to ensure installation of improvements to proper location, elevation, alignment and profile.

The following is intended to describe the format of inspections and notification procedures. Scheduling of required inspections shall be the responsibility of the owner. Types:

Sanitary Sewer System

Inspection of all improvements having been installed complete by section, requiring section by section air testing to required standards.

Water Distribution System

Inspection of all improvements having been installed complete by section, requiring section by section pressure test and bacteria test to required standards.

Storm Drainage System

Shall require visual inspection, section by section, upon completion of that section, prior to backfilling any section including pipes, inlets, manholes, endwalls, detention and retention basins, culverts and bridges, and all items being installed as part of the storm drainage system. Concrete culvert and bridge structures shall require material samples, in compliance with ASTM C39 standards. Samples must be taken in the presence of the inspector.

Subsoil System

Inspection to determine subsoil structure compaction to required density, and inspection of subsoil elevation to insure grade and profile compatibility to selected street construction materials type alternate.

Subgrade Structure and Underdrain Pipe

Inspection and testing of subgrade type and required density and visual inspection of under drain pipe installation including all connections to the storm drainage system and service laterals as required.

Concrete Curb Structure

Inspection prior to installation to verify type of curb, straight or rolled, and/or a combination of both. String line shall be set prior to any concrete pour to show line and grade, profile and alignment. Material inspection, including the submittal of all certified material delivery slips.

Subbase Course

Inspection of materials placed as subbase prior to installation of base course, including the submittal of all certified material delivery slips.

Base Course

Inspection of materials placed as base, including the submittal of all certified material weight slips.

Wearing Course Structure

Inspection of materials placed as wearing surface, including the submittal of all certified material weight slips.

Sidewalk Structures

Inspection of subbase grade and form grade and alignment prior to any pour.

Right-of-Way Profile

Inspection of required finish grade elevations to limits of street right-of-way.

Drainage Easement Structures

Inspection of required finish grade elevations, alignments and profiles to limits of easement.

Seeding, Sodding and Erosion Controls

Inspection as required to assure compliance with storm drainage regulations.

The intent of the inspection specifications and procedures is to ensure the proper placement and workmanship of constructed improvements.

STREET SPECIFICATIONS

All material depths as listed, shall mean material depths compacted in place to the density required for each type of material. Placement of materials shall be by using compaction equipment and methods conforming to Pennsylvania Department of Transportation Publication 408, as amended with the exception that the ID-2 wearing course shall be installed in two passes of the paver.

Street subsoil shall be excavated, compacted and profiled to a point one foot (1') beyond back of concrete curb structure. Subsoil shall have slope of 2% from center line of street to point one foot (1') beyond back of curb.

The use of geotextile Type 1 between the subgrade and aggregate base course shall be required for streets subgrades which cannot be compacted or which are moist and flow under the weight of a 10-ton roller or vibratory roller.

Paving rings for the purpose of bringing manhole covers and valve boxes to finished grade are prohibited. Manhole covers and valve boxes shall not be placed within curb structures.

Concrete curb types and dimensions of placement:

Standard straight curb (type machine slip form) shall be minimum (18") structure height, installed on a minimum 4-inch layer of (#2) CA stone bed. Expansion joints shall be every 60 feet, at structures, 10 foot away from each side of a structure, and at the end of a day's work. Contraction joints shall be saw cut every 10 feet a minimum of 2-inches in depth. Minimum 4,000 psi compressive strength.

Standard straight curb (type hand form) shall be minimum (24") structure height and as a minimum installed on compacted subgrade. Expansion joints shall be every 10 feet, at structures, 10 foot away from each side of a structure, and at the end of a day's work. Minimum 4,000 psi compressive strength.

Roll type curb shall be (12") structure height installed on a minimum 4-inch layer of (#2) CA stone bed. Expansion and contraction joints for machine slip form type installed as described under straight curb. Hand form curbing shall have control joints every 10 feet, expansion joints at structures and 10 foot away from each side of a structure, and at the end of a day's work. Minimum 4,000 psi compressive strength.

Sidewalk shall be 4 foot wide, 4-inch thick placed on a minimum 4-inch layer of (#2) CA stone bedding. Expansion joints shall be every 20 feet with contraction joints cut every 5 feet a minimum of 1-inch in

depth. Additional expansion materials shall be placed between any curb and driveway aprons and in the sidewalk at the driveway limits. A contraction joint shall be cut between the sidewalk and apron.

As a minimum, welded wire fabric, 6" x 6" by 10 gauge, shall be installed in all driveway apron/sidewalk areas. Minimum 4,000 psi compressive strength.

All areas adjacent to straight curbs, inlets, utility covers, and trench repair areas shall be sealed with AC-20.

The coarse aggregate used in bituminous wearing course shall meet the skid resistance level (SRL) letter designation as determined by the designer based upon guidelines from PennDOT's Specification 408 and approved by the Township.

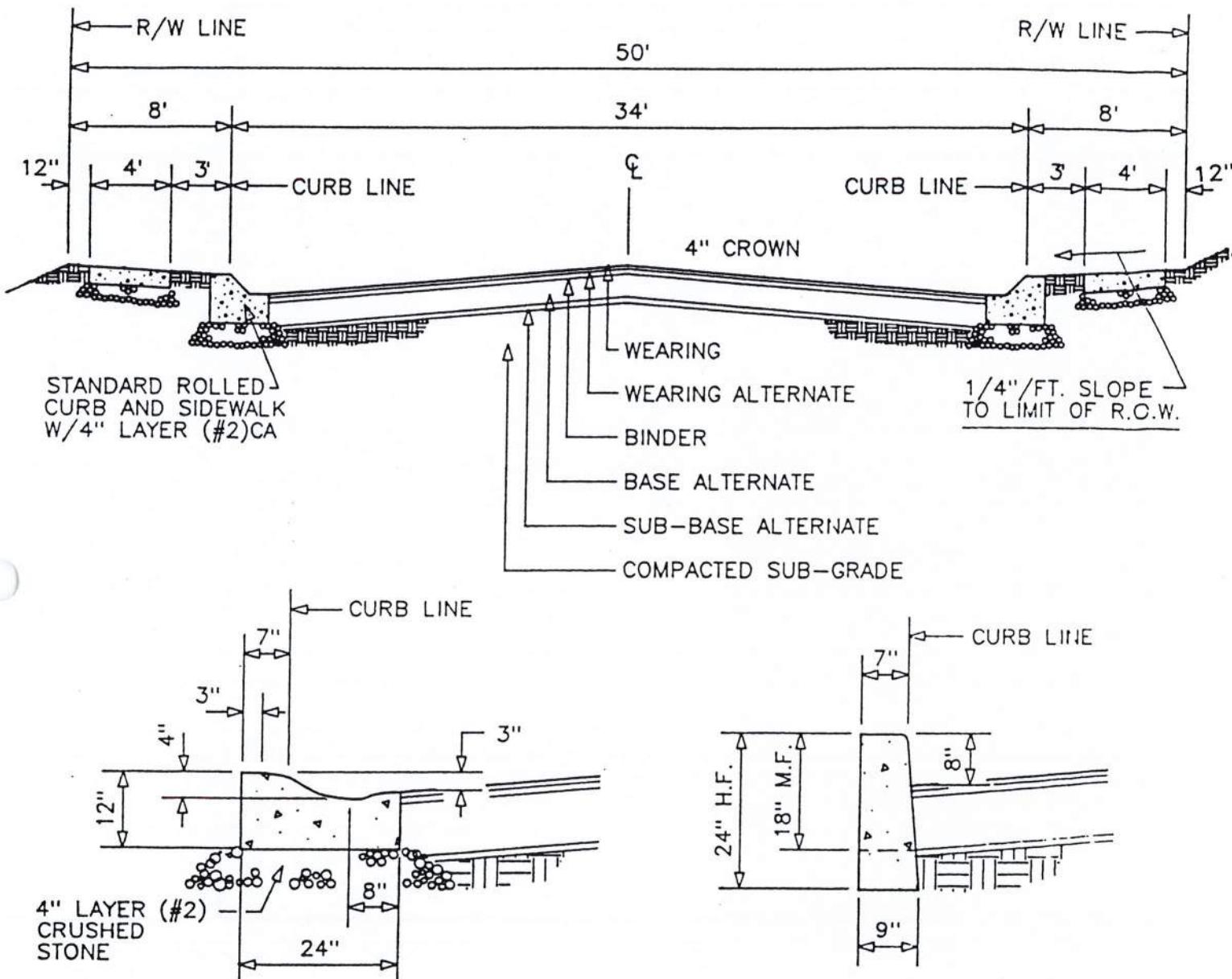
Restoration of trench openings in existing streets:

Initial restoration shall be made with the installation of 2-inches of temporary paving, maintained until the final restoration is completed. Final restoration shall be made between 60 and 180 days after the street opening.

Prior to making final restoration, one foot from each edge of the trench shall be saw cut, in a neat straight line, to the bottom elevation of the existing base course, and the detached material shall be removed. The pavement depths shall be a minimum of 4-1/2 inches of bituminous concrete base course (BCBC), and 1-1/2 inches of bituminous wearing course. Additional BCBC material shall be used to match the total existing pavement thickness if the total thickness exceeds 6-inches.

MANHEIM TOWNSHIP SPECIFICATIONS FOR
STREET CONSTRUCTION

TYPICAL LOCAL TYPE STREET CROSS SECTION



STANDARD ROLLED CURB

NOTES:

1. PLACE ON 4" (#2)CA STONE BED.
2. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

SIDEWALK

CONCRETE SIDEWALK AS REQUIRED,
MINIMUM, 4000 P.S.I. COMPR. STRENGTH.

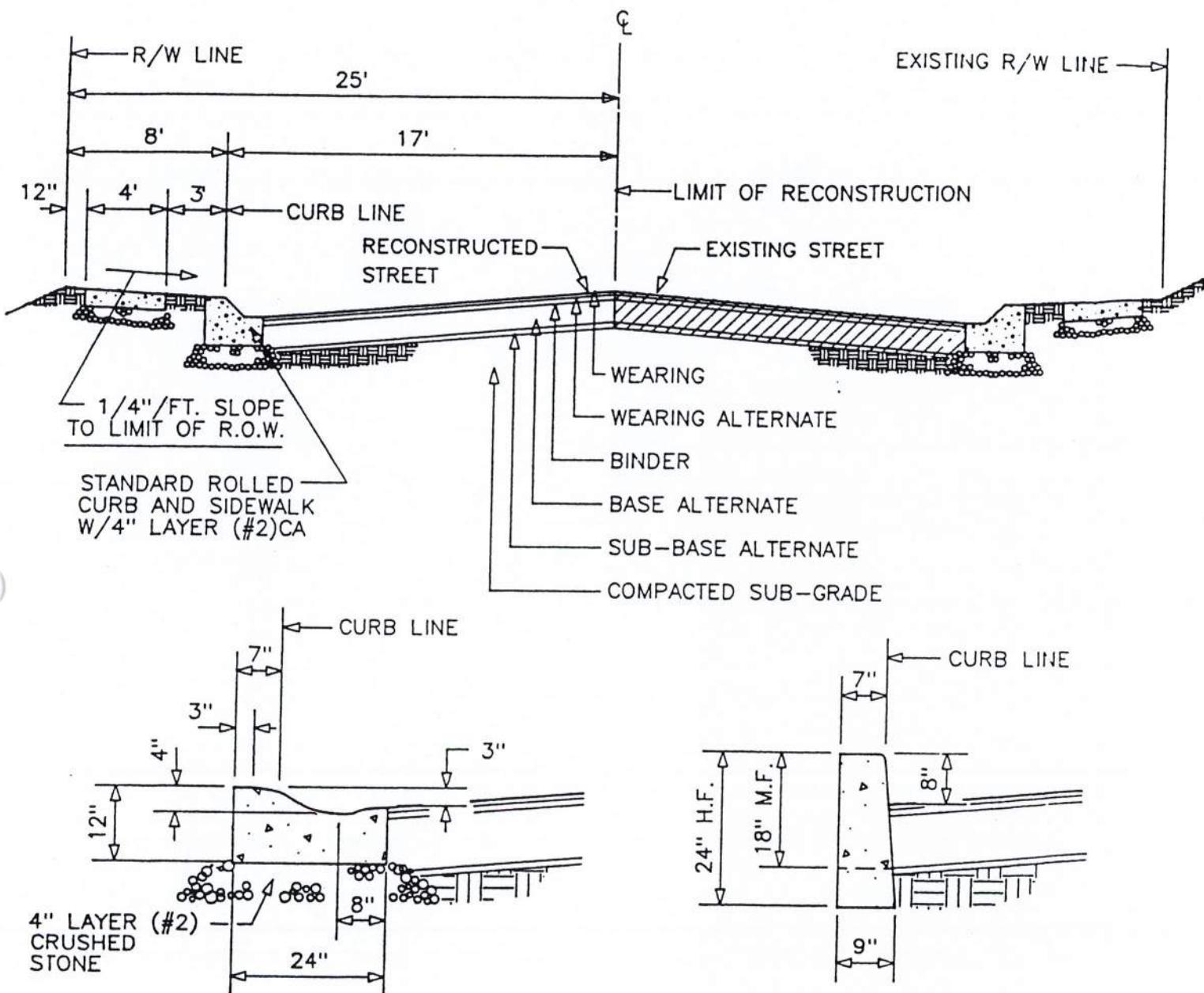
STANDARD STRAIGHT CURB

NOTES:

1. HAND FORMED STRAIGHT CURB SHALL BE 24" MINIMUM HEIGHT.
2. MACHINE FORMED STRAIGHT CURB SHALL BE 18" MINIMUM HEIGHT.
PLACE ON 4" (#2)CA STONE BED.
3. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

MANHEIM TOWNSHIP SPECIFICATIONS FOR
STREET RECONSTRUCTION

TYPICAL LOCAL TYPE STREET CROSS SECTION



STANDARD ROLLED CURB

NOTES:

1. PLACE ON 4" (#2)CA STONE BED.
2. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

SIDEWALK

CONCRETE SIDEWALK AS REQUIRED,
MINIMUM, 4000 P.S.I. COMPR. STRENGTH.

STANDARD STRAIGHT CURB

NOTES:

1. HAND FORMED STRAIGHT CURB SHALL BE 24" MINIMUM HEIGHT.
2. MACHINE FORMED STRAIGHT CURB SHALL BE 18" MINIMUM HEIGHT.
PLACE ON 4" (#2)CA STONE BED.
3. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

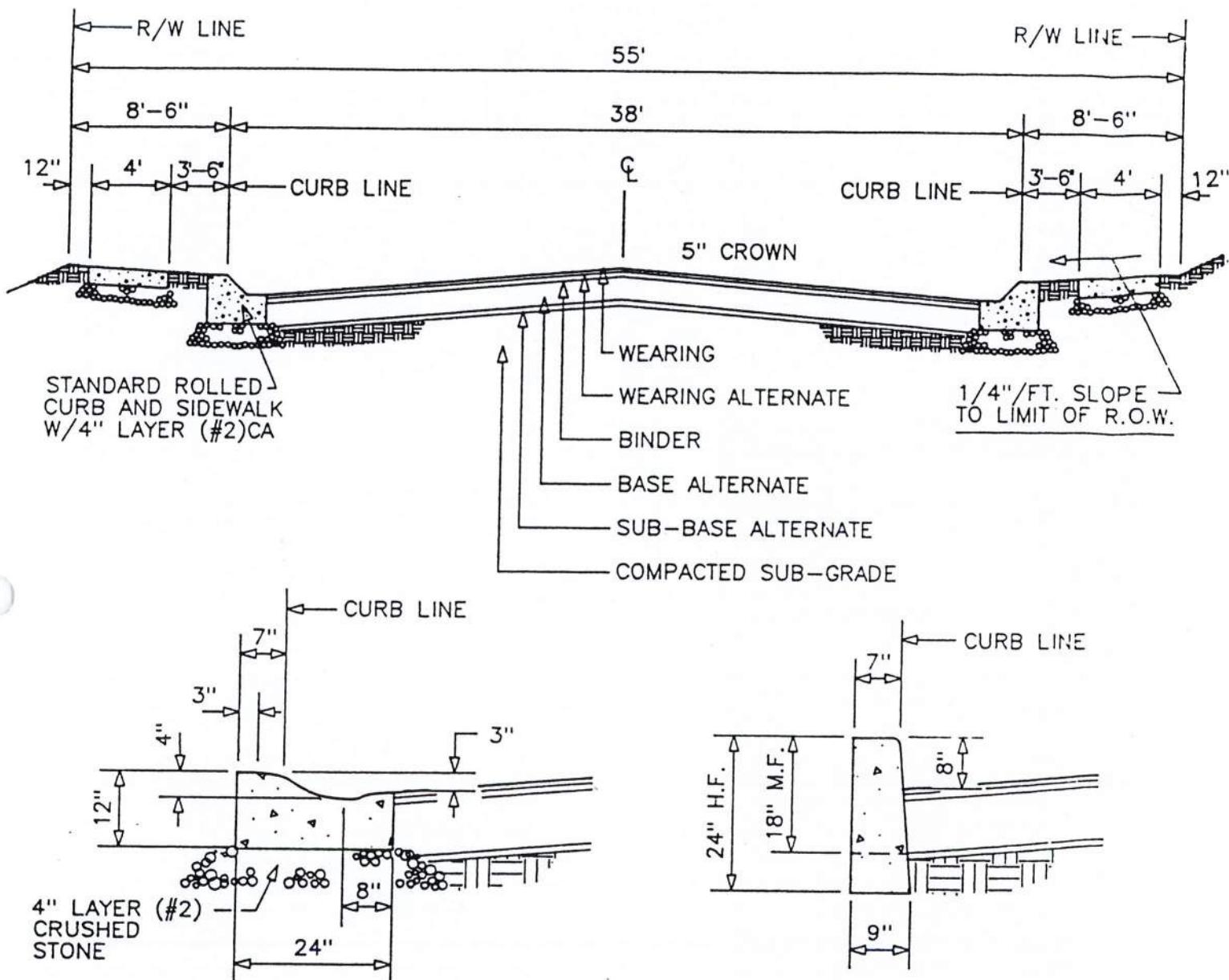
LOCAL STREET MATERIAL ALTERNATES

Alternate Type	Base Specifications	Geotextile #2 Spec.
BCBC	3"(2A)CA 4"(BCBC) 1-1/2"(ID2)WH	3"(2A)CA 4"(BCBC) Geo.#2 1"(ID2)WH
D.G./ Calcium & Tack	7"(D.G.) 2"(ID2)BH 1-1/2"(ID2)WH	7"(D.G.) 1-1/2"(ID2)BH Geo.#2 1-1/2"(ID2)WH
C.A.B.C. Type #1/ Screen	8"(#1) 2"(ID2)BH 1-1/2"(ID2)WH	8"(#1) 1-1/2"(ID2)BH Geo.#2 1-1/2"(ID2)WH
C.A.B.C. Type 3AM	10"(3AM) 2"(ID2)BH 1-1/2"(ID2)WH	10"(3AM) 1-1/2"(ID2)BH Geo.#2 1-1/2"(ID2)WH

(BCBC) Bituminous Concrete Base Course
(D.G./Cal.) Dense Graded Base Course with Calcium, Prime MC-30
.15 Gal./Sq.Yrd.
(C.A.B.C.) Crushed Aggregate Base Course
(3AM) 3A Modified

MANHEIM TOWNSHIP SPECIFICATIONS FOR
STREET CONSTRUCTION

TYPICAL COLLECTOR TYPE STREET
CROSS SECTION



STANDARD ROLLED CURB

NOTES:

1. PLACE ON 4" (#2)CA STONE BED.
2. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

SIDEWALK

CONCRETE SIDEWALK AS REQUIRED,
MINIMUM, 4000 P.S.I. COMPR. STRENGTH.

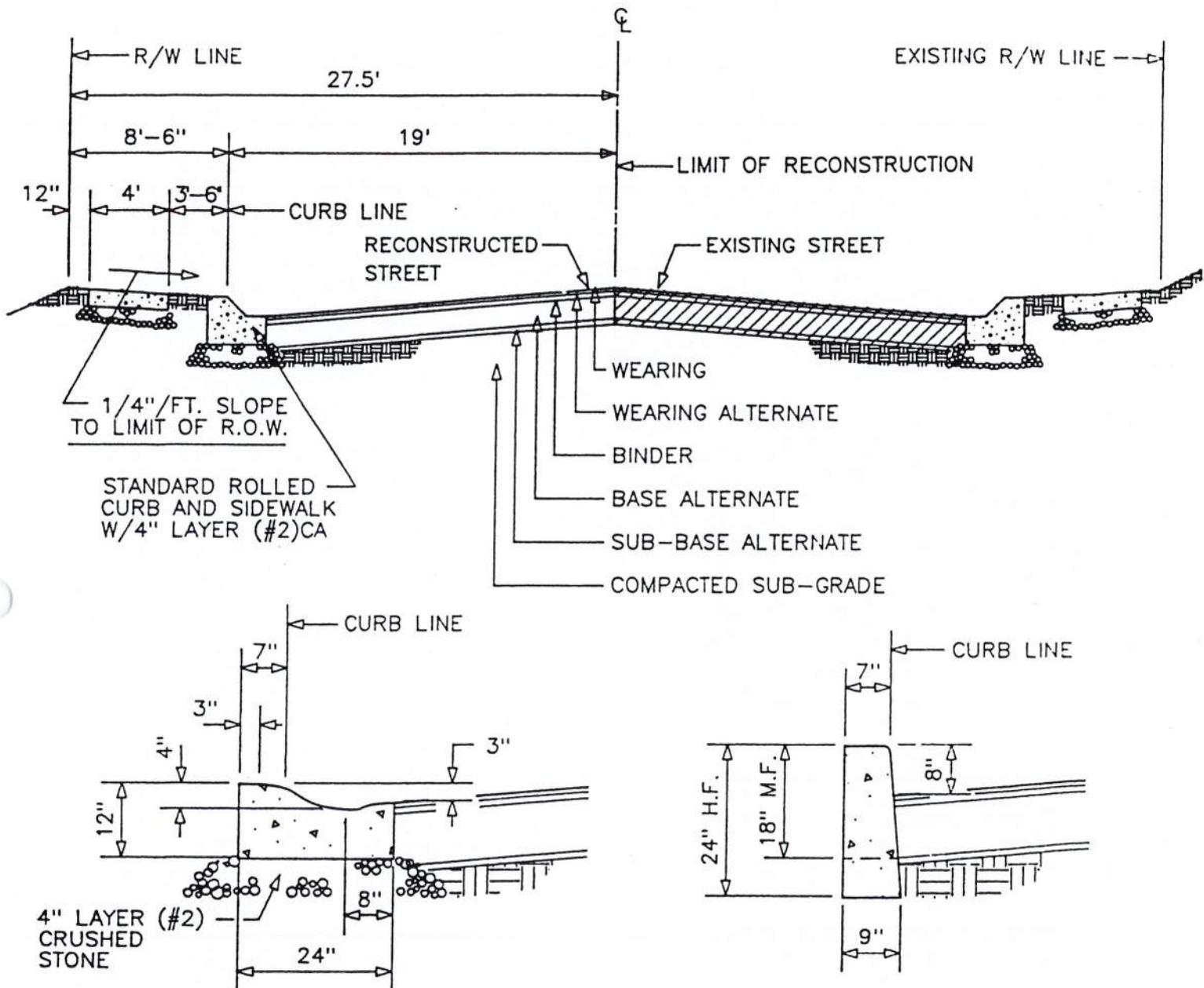
STANDARD STRAIGHT CURB

NOTES:

1. HAND FORMED STRAIGHT CURB SHALL BE 24" MINIMUM HEIGHT.
2. MACHINE FORMED STRAIGHT CURB SHALL BE 18" MINIMUM HEIGHT.
PLACE ON 4" (#2)CA STONE BED.
3. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

MANHEIM TOWNSHIP SPECIFICATIONS FOR
STREET RECONSTRUCTION

TYPICAL COLLECTOR TYPE STREET
CROSS SECTION



STANDARD ROLLED CURB

NOTES:

1. PLACE ON 4" (#2)CA STONE BED.
2. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

SIDEWALK

CONCRETE SIDEWALK AS REQUIRED,
MINIMUM, 4000 P.S.I. COMPR. STRENGTH.

STANDARD STRAIGHT CURB

NOTES:

1. HAND FORMED STRAIGHT CURB SHALL BE 24" MINIMUM HEIGHT.
2. MACHINE FORMED STRAIGHT CURB SHALL BE 18" MINIMUM HEIGHT.
PLACE ON 4" (#2)CA STONE BED.
3. CURB STRUCTURE, MINIMUM 4000 P.S.I. COMPR. STRENGTH.

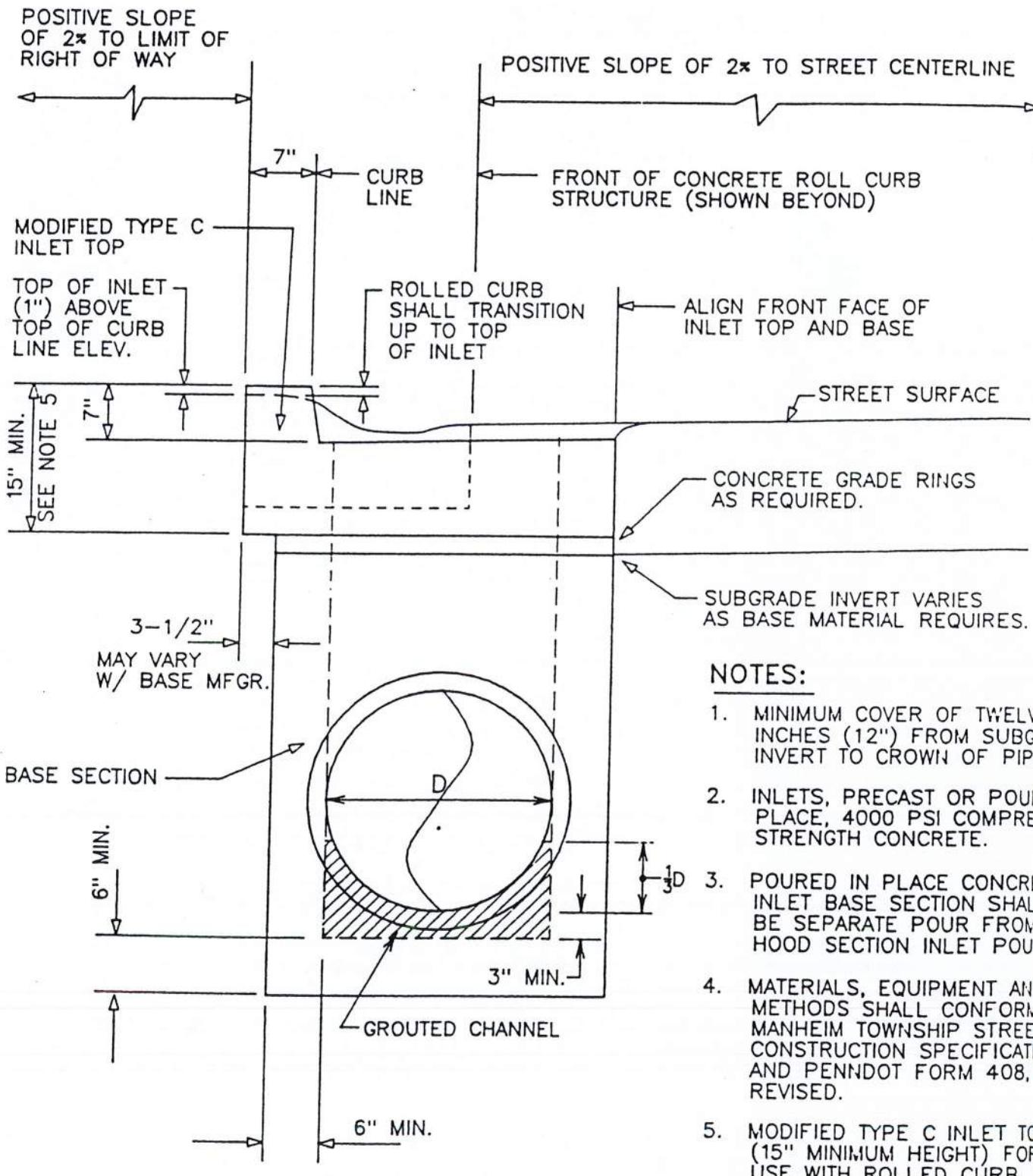
COLLECTOR STREET MATERIAL ALTERNATES

Alternate Type	Base Specifications	Geotextile #2 Spec.
BCBC	3"(2A)CA 5"(BCBC) 25 mm 1-1/2"(ID2)WH	3"(2A)CA 4-1/2"(BCBC) Geo.#2 1-1/2"(ID2)WH
D.G./ Calcium & Tack	9"(D.G.) 2"(ID2)BH 1-1/2"(ID2)WH	9"(D.G.) 1-1/2"(ID2)WH Geo.#2 1-1/2"(ID2)WH
C.A.B.C. Type #1/ Screen	10" (#1) 2"(ID2)BH 1-1/2"(ID2)WH	10" (#1) 1-1/2"(ID2)BH Geo.#2 1-1/2"(ID2)WH
C.A.B.C. Type 3AM	10"(3AM) 2"(ID2)BH 2"(ID2)WH	10"(3AM) 2"(ID2)BH Geo.#2 1-1/2"(ID2)WH

(BCBC) Bituminous Concrete Base Course
 (D.G./Cal.) Dense Graded Base Course with Calcium, Prime MC-30
 .15 Gal./Sq.Yrd.
 (C.A.B.C.) Crushed Aggregate Base Course
 (3AM) 3A Modified

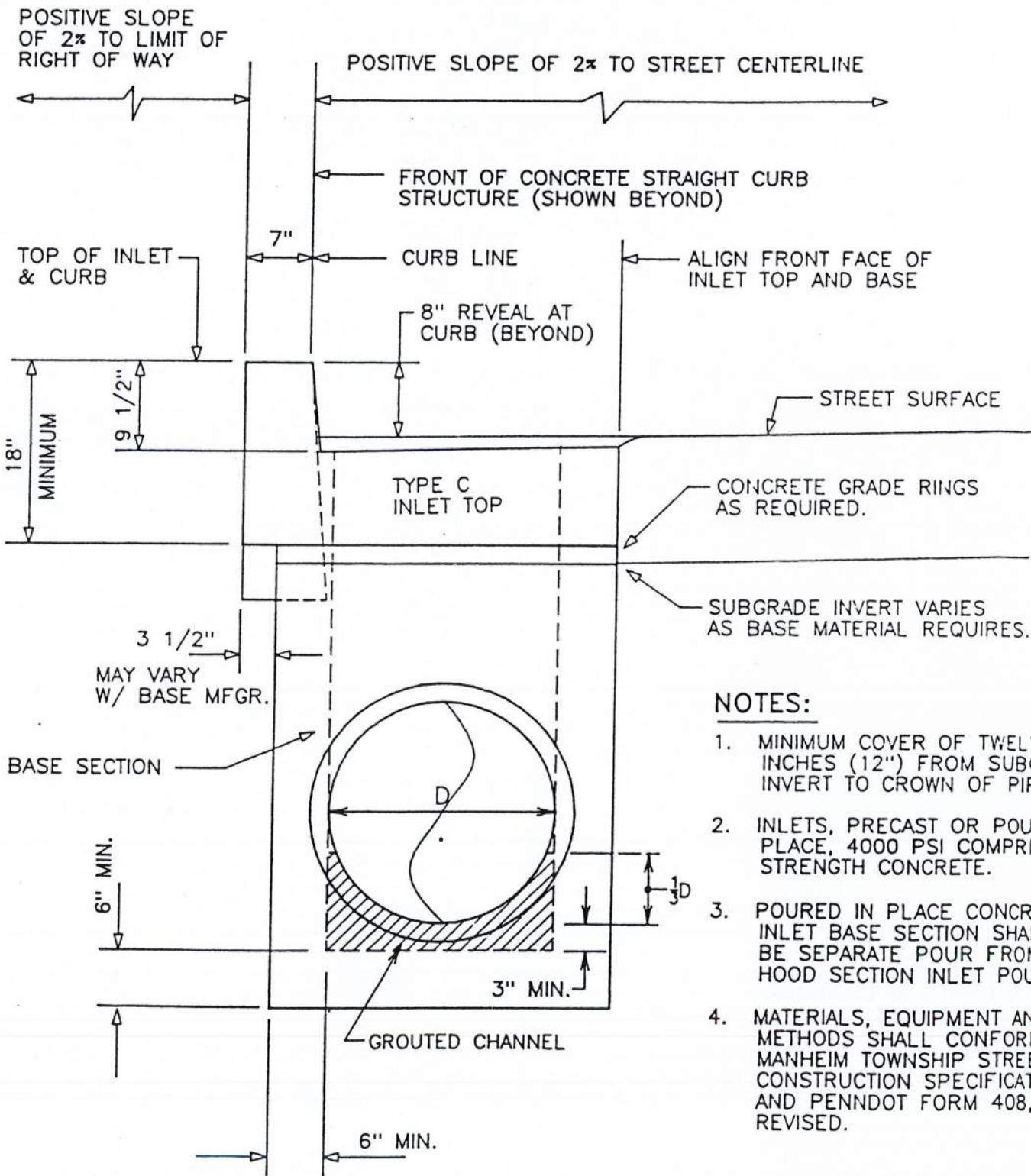
MANHEIM TOWNSHIP SPECIFICATIONS FOR
STREET CONSTRUCTION AND RECONSTRUCTION

TYPICAL INLET CONSTRUCTION
ALONG STREETS WITH
ROLLED CURB



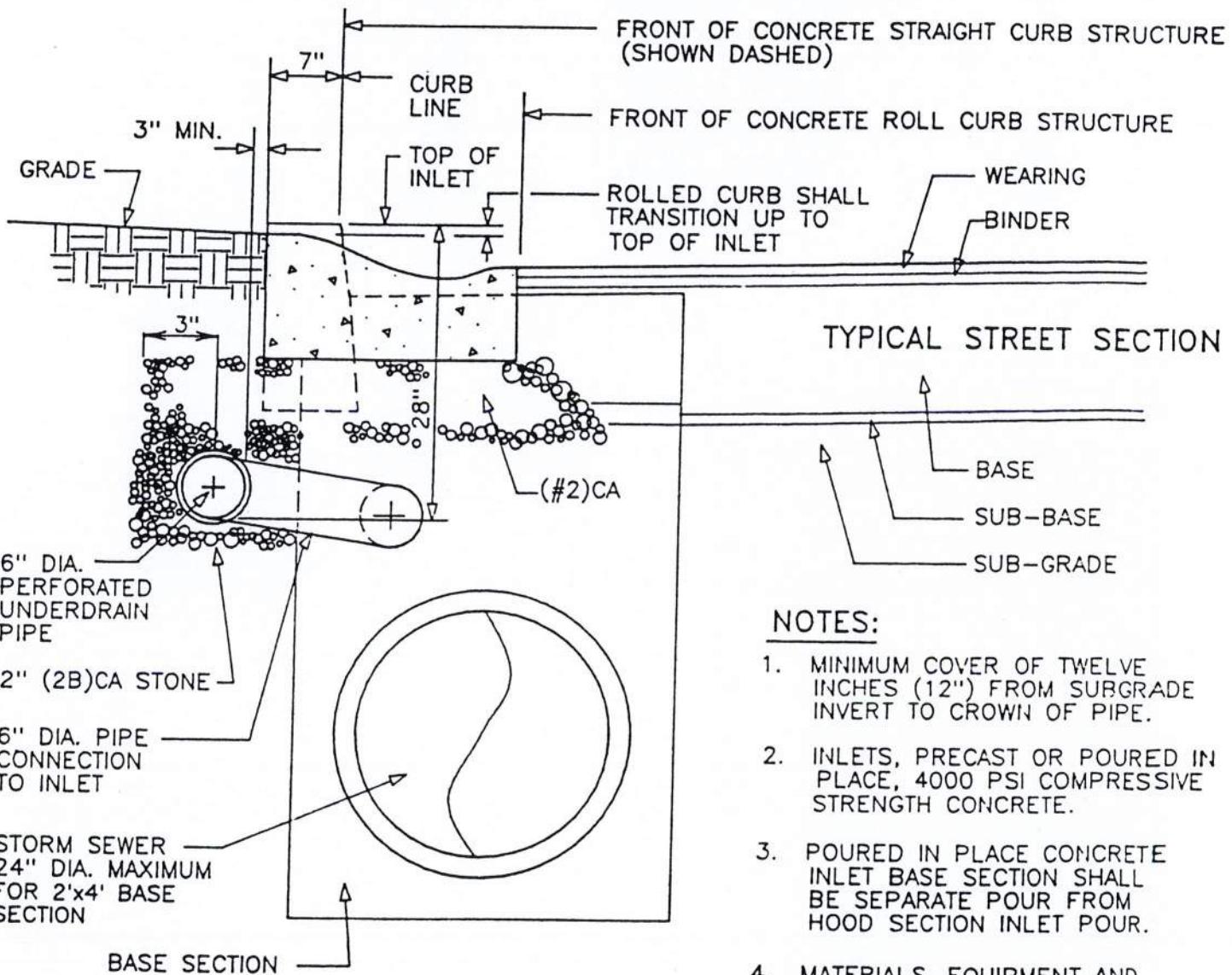
MANHEIM TOWNSHIP SPECIFICATIONS FOR
STREET CONSTRUCTION AND RECONSTRUCTION

TYPICAL INLET CONSTRUCTION
ALONG STREETS WITH
STRAIGHT CURB



MANHEIM TOWNSHIP SPECIFICATIONS FOR
STREET CONSTRUCTION AND RECONSTRUCTION

UNDERDRAIN INSTALLATION DETAIL
FOR STREETS WITH LESS THAN
1% SLOPE WITH ROLLED CURB
AND/OR STRAIGHT CURB



NOTES:

1. MINIMUM COVER OF TWELVE INCHES (12") FROM SURGRADE INVERT TO CROWN OF PIPE.
2. INLETS, PRECAST OR POURED IN PLACE, 4000 PSI COMPRESSIVE STRENGTH CONCRETE.
3. POURED IN PLACE CONCRETE INLET BASE SECTION SHALL BE SEPARATE POUR FROM HOOD SECTION INLET POUR.
4. MATERIALS, EQUIPMENT AND METHODS SHALL CONFORM TO MANHEIM TOWNSHIP STREET CONSTRUCTION SPECIFICATIONS AND PENNDOT FORM 408, AS REVISED.

NOTE:

INSTALL SIX-INCH (6") DIAMETER PERFORATED UNDERDRAIN PIPE PARALLEL TO CURB.

SEE MANHEIM TOWNSHIP CONSTRUCTION STANDARDS AND SPECIFICATION MANUAL FOR REQUIREMENTS OF PERFORATED UNDERDRAINS.

STORM DRAINAGE

PIPE

An enclosed water carrying structure of one or more barrels having a total flow area equivalent to 48-inch diameter or less.

Material Alternates:

Pipes with continuous or intermittent water flow other than rainfall events:

Reinforced concrete, rubber gasketed, shall conform to AASHTO M170, M198 and M207.

Pipes excluding continuous or intermittent water flow other than rainfall events:

Corrugated aluminized steel Type II, helical design shall conform to AASHTO M36.

Corrugated polymeric coated galvanized steel (10 mil.) full inside and outside coating, helical design, shall conform to AASHTO M245, Type 1.

Corrugated aluminum alloy, helical design, shall conform to AASHTO M196.

Corrugated aluminum-zinc alloy, helical design, shall conform to AASHTO M36.

The following shall be minimum gauge requirements for corrugated aluminized steel Type II, corrugated polymeric coated galvanized steel, corrugated aluminum alloy, and corrugated aluminum-zinc alloy pipe sizes. Heavier gauge may be required depending upon application.

Normal Size Diameter	Minimum Gauge Requirement
6"	
to	
24"	16 Gauge
27"	
to	
42"	14 Gauge
48"	10 Gauge

Reinforced concrete, tongue and groove, shall conform to AASHTO M170 and M207.

Corrugated polyethylene (PE) smooth interior only, shall conform to ASTM D1248 and D2412. Stone backfill (#7) shall be placed to the crown of the pipe.

Corrugated polyethylene (PE) perforated underdrain shall conform to AASHTO M252.

Corrugated polyvinyl (PVC) minimum stiffness 46 P.S.I. shall conform to ASTM F794.

NOTE - Reinforced concrete pipe shall be used in all easement areas.

CULVERT

An enclosed water carrying structure of one or more barrels having a combined span less than 8 feet and having a total flow area greater than 48-inch diameter.

Material Alternates:

Cement concrete cast in place, mix design strength 4,000 p.s.i.

Precast reinforced concrete box sections in accordance with AASHTO M259.

Reinforced concrete piping, rubber gasketed, shall conform to AASHTO M170, M198 and M207.

Corrugated aluminum alloy.

All culverts shall have reinforced concrete precast or cast in place full flow invert to limits of required endwall sections, with invert base end cut-off walls extending (3') three feet below channel flow line, or to rock whichever occurs first.

All culverts with continuous or intermittent water flow other than rainfall events shall have Type "DW" headwalls/endwalls installed.

Installations having a maximum (5') five feet vertical rise from flow channel invert to crown of street, with the required maximum 3 to 1 embankment slope from limit of right-of-way to elevation of flow channel invert, shall not require protective parapets. All other installations shall require protective concrete parapets and approach guide rail in accordance with PennDOT.

All culvert structures shall require submission of complete design drawings and shop drawings, for review by Manheim Township, to assure compliance to H-25 loading, flow design capacity and calculated life cycle of proposed structures.

Minimum (1') one foot cover from crown of culvert to subgrade.

BRIDGE

An enclosed water carrying structure of one or more barrels having a combined span of 8 foot or greater.

All bridge designs shall be in accordance with PennDOT Design Manual, Part IV (Latest Revisions) and shall be submitted to Manheim Township for approval of materials, structural design, compliance to H-25 loading, flow design capacity and calculated life cycle of proposed structures. All bridges shall have approach guide rail in accordance with PennDOT.

DETENTION/RETENTION BASINS

Primary Outlet Structures:

Pipe - Reinforced concrete, rubber gasketed, shall conform to AASHTO M170, M198 and M207.

Poured-in-Place Outlet Structure - Reinforced concrete, minimum 4,000 psi compressive strength in accordance with PennDOT Publication 408, Latest Edition.

Precast Outlet Structure - Reinforced concrete, minimum 4,000 psi compressive strength in accordance with PennDOT Publication 408, Latest Edition. Submit design for Township review and approval.

Precast Reinforced Concrete Box Sections in accordance with AASHTO M259.

Orifice Plates - Stainless steel, type 304, with stainless steel mounting hardware. Use 1/4-inch thick up to 24-inch span and 3/8-inch thick over 24-inch spans.

Headwalls/Endwalls - Reinforced concrete, minimum 3,750 psi. Compressive strength in accordance with PennDOT Publication 408, Latest Edition.

Cutoff Collars - Reinforced concrete, minimum 3,750 psi compressive strength.

Concrete Pipe End Sections - Reinforced concrete in accordance with PennDOT Publication 408.

Steel Grates - In accordance with PennDOT Publication 408, Latest Edition.

Emergency Spillway Structure:

Surface/Slopes - Gabion mattresses minimum 9-inches thick with grouted weir area all placed on geotextile type 3. Gabion materials including aggregate and grout shall be in accordance with PennDOT Publication 408. Installation shall be in accordance with manufacturer's recommendation.

Embankment:

Embankment Structure - Materials suitable, including an impervious core and cutoff trench if required, to limit the seepage through the embankment so that no internal erosion takes place.

Underground Detention:

Structure - Materials as approved under pipes. Submit design for Township review and approval.

STORM DRAINAGE APPURTENANCES

Headwalls, endwalls, inlets, manholes and energy flow dissipators shall be in accordance with PennDOT Publication 408, Latest Edition. All manhole covers shall have the words "Storm Sewer" cast in them. Channels shall be poured in inlets and manholes using 3,300 psi compressive strength concrete.

WATER DISTRIBUTION SYSTEM

Water distribution system shall be in compliance with the rules and regulations and materials and procedures, as required by the City of Lancaster, Bureau of Water, as amended from time to time, EXCEPT at all times:

Water line service laterals, installed from main to corporation curb stop, and from corporation curb stop to meter, must be minimum one-inch (1") inside diameter pipe.

Fire hydrants shall be placed 1 foot clear distance from the R/W line where no sidewalk is installed and installed 4-inches clear distance from the street side of the sidewalk when sidewalk is installed.

Fire hydrant gate valves shall be installed within 4 feet from the main line. Fire hydrant tees are permissible.

Main line gate valves at intersections shall be positioned on each branch at the end of curb radius. Where storm sewer pipe crosses between inlets at curb radii the valve shall be kept 3 feet away from the pipe towards the intersection.

Service boxes shall be positioned 12-inches behind back face of curb.

Copper service line from the curb box to the meter shall be a continuous piece with no joints.

PVC conduit may be placed from the curb box to a point behind the R/W to avoid future excavation around electric, telephone, cable TV and gas, for water service installations.

Fire hydrants shall be painted in accordance with City of Lancaster standards. Paint is as follows:

DeRusto D-6, Gloss Yellow
DeRusto D-2, Gloss Red

Water mains, excluding copper services, shall have 6-inches of crushed stone bedding below and 6-inches of crushed stone backfill above the pipe.

Copper services tapped from lines owned by the General Municipal Authority of the Township of Manheim shall be bedded with 6-inches of silica sand and covered with 18-inches of silica sand from the main line to the curb box.

Pressure testing of water mains shall follow the procedures outlined under hydrostatic tests for force mains in this Specification.

Record drawings for water distribution installations shall be submitted to the City of Lancaster, Bureau of Water.

SPECIFICATIONS FOR GEOTEXTILES

Geotextile Type 1 - Street Applications

When installed on compacted subgrade to front of concrete curb structure installation in compliance with manufacturer's recommendations. All edges of fabric shall be overlapped minimum of (2') two feet. Fabric shall be installed from edge line of street to center line of street. Geotextile Type 1 shall be equal to manufacturer Phillips Fibers Corporation Supac Non Woven Geotextile 5NP.

Geotextile Type 2

When installed as part of wearing surface structure to be machine placed. Apply (.25) gallon rate of AC-20 or (.35) gallon rate of E-3 or E-8 per square yard of area. Geotextile Type 2 shall be equal to manufacturer Phillips Fibers Corporation Petromat 4-1/2 oz. weight per square yard.

Geotextile Type 3 - Storm Drainage Applications

Storm Drainage Applications installed in conjunction with rip rap and gabion mattresses on compacted subgrade. All edges of fabric shall be key way channel set and fabric overlapped in key cut and backfilled to flow line with rip rap or gabion mattresses. Geotextile Type 3 shall be equal to manufacturer Phillips Fibers Corporation Supac Non Woven Geotextile 4NP.

Geotextile Type 4

Shall be installed as required for sediment control and construction site storm water drainage control. The fabric shall be installed as to create a fence. The bottom of the fabric shall be adequately buried in a trench cut into the ground so as to prevent sediment from escaping under the fence. Geotextile Type 4 shall be equal to manufacturer Phillips Fibers Corporation 3WS-UV.

Geotextile Type 5

Erosion control and revegetation mat for use in storm drainage easements, embankments (excluding emergency spillways) and flow channels. Geotextile shall be a flexible mat of vinyl monofilaments bonded together into a three-dimensional web. The mat shall have an optimum balance of web density, porosity, flexibility and weight. Placement, site preparation, mat anchor trenches, seeding, mat placement, ground fastening, and

ditches/channels, in accordance with manufacturer's guidelines., Geotextile Type 5 shall be equal to manufacturer Mirafi Inc., Miramat 3M.

STREET SIGNS AND MARKINGS

Street sign posts, hot dipped galvanized steel tubing, twelve feet (12') one piece section, 2-3/8" O.D., minimum 2 lbs. per foot.

All fittings shall be aluminum and/or stainless steel.

Signs shall be aluminum minimum .080 gauge thickness.

Sign facing shall be 3M Engineer Grade, color white.

Letters shall be 3M Series 605-B, H.A., color black.

STREET END BARRIERS

Barriers shall be pressure treated lumber, full depth to .60 p.s.i., type equal to wolmanized process.

Barrier structure shall be post and beam type construction, 4"x4" posts installed 36" below finish grade, posts maximum 10' centers, 4"x4" cross members fit into framing structure as self supporting unit, with (1) 4"x4" cross member mounted horizontal top of upright posts, (1) 4"x4" cross member mounted horizontal 24" above finish grade surface.

Barrier length shall be 30'. Barrier height shall be 54", as measured from adjacent street surface.

Barrier shall have minimum of 60 square inches of reflectorized marking high intensity grade material, placed on barrier facing direction of traffic approach.

SANITARY SEWER SYSTEM

MATERIALS

GRAVITY SEWER PIPE

Polyvinyl Chloride Sewer Pipe (PVC)

Materials

PVC pipe and fittings shall be made from virgin, Type 1, grade 1 PVC compounds as defined and described in ASTM D3034 for Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds. Wall thickness shall conform to SDR 35, extra strength.

Joints

Pipe joints shall be of the locked-in rubber gasket type with a grooved premoulded coupling bell or sleeve. Joints shall be made in strict accordance with the manufacturer's recommendations. Joints shall be equal to Johns-Manville Ring-Tite Joint.

Polyvinyl Chloride Sewer Pipe (PVC) Large Diameter Ribbed Gravity Sewer Pipe

Materials

Pipe and fittings controlled inside diameter in accordance with ASTM F794, ASTM D1784, ASTM D3212, and performance requirements of D3034 and ASTM F679 (Latest Revision), with 46 P.S.I. uniform pipe stiffness.

Reinforced Concrete Pipe

Material

Reinforced concrete gravity sewer pipe shall conform to ASTM C76 (Latest Revision) for the class or strength designated. Pipe shall be manufactured without lift holes. Pipe shall have a straight outside wall with a minimum length of eight feet.

Joints

Joints shall be Steel End Ring and Rubber Joints conforming to AWWA C302. The interior surfaces of the steel joints shall be protected with concrete mortar or plastic material. The exterior of the joint shall be protected with concrete mortar or preformed plastic joint sealing material such as Rubber-Nek as manufactured by K. T. Snyder Co., MAS-STIK as manufactured by Concrete Product Supply Co., or approved equal. The interior surfaces of the steel end rings shall be galvanized.

Vitrified Clay Sewer Pipe and Fittings

Material

Vitrified clay sewer pipe and fittings shall conform to the latest revision of the following specifications:

Material	Specification Designation
Extra Strength Clay Pipe (all sizes)	ASTM C700
Testing Clay Pipe	ASTM C301

Joints

Vitrified clay pipe joints shall be Type III joint conforming to ASTM Specification C425 (Latest Revision) for compression joints for Vitrified Clay Bell and Spigot Pipe, using rubber gasket.

Cement Lined Ductile Iron Pipe and Fittings

Ductile Iron Pipe shall be in full accord with the Standard Specification as set forth in the ANSI Specification A21.51 or AWWA Specification C151, Latest Edition, with wall thickness in full accord with the standard specification as set forth in the ANSI Specification A21.50 or AWWA Specification C150, Latest Edition.

Joints shall be of the push-on type or mechanical joint type in full accordance with ANSI A21.11 or AWWA C111 Specifications, Latest Edition.

Cement Mortar Linings shall be in full accord with ANSI Specification A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than the following:

Pipe Diameter	Lining Thickness
3" through 12"	1/8"
14" through 24"	3/16"

Minimum Pipe Thickness

The minimum pipe thickness shall be Class 50.

NOTE - Pipe material alternate selection shall require approval by the Township.

FORCE MAIN SEWERS

Cement Lined Ductile Iron Pipe and Fittings

Ductile Iron Pipe shall be in full accord with the Standard Specification as set forth in the ANSI Specification A21.51 or AWWA Specification C151, Latest Edition, with wall thickness in full accord with

the standard specification as set forth in the ANSI Specification A21.50 or AWWA Specification C150, Latest Edition.

Joints shall be of the push-on type or mechanical joint type in full accordance with ANSI A21.11 or AWWA C111 Specifications, Latest Edition.

Cement Mortar Linings shall be in full accord with ANSI specification A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than the following:

Pipe Diameter	Lining Thickness
3" through 12"	1/8"
14" through 24"	3/16"

Minimum Pipe Thickness

The minimum pipe thickness shall be Class 52.

Polyvinyl Chloride Pressure Pipe (Maximum 2-1/2" Diameter Nominal Pipe Size)

Materials

Pipe and fittings shall conform to ASTM D2241 having integral bell and gaskets, 200 P.S.I., and rubber rings to ASTM F477 fittings ASTM D3139 conformance, approved equal to Johns-Manville Ring-Tite.

Air Release and/or Vacuum Valves

The valves shall be designed for sewage service and shall be non-clogging with cast iron body, buna-n trim and stainless steel floats. Valves shall be provided with shutoff valve, blow-off valve, and quick disconnect hose connection and backflushing hose and valve.

Valves shall be similar to those manufactured by APCO.

Manhole shall be standard precast concrete construction in accordance with the standard specifications. Manhole base shall be provided with drain. Manhole cover shall be adequately vented to insure discharge or intake of free air as specified above.

MANHOLES AND CASTINGS

RISERS AND TOPS

All manholes shall be precast Reinforced Concrete Manhole Units of the Wet Cast Type, and manufactured in compliance with ASTM Designation C478. Manholes must be mechanically vibrated to render a high density concrete to insure against groundwater infiltration through the walls of the manhole. Dry Cast Manholes will not be accepted. Joints between manhole sections shall be provided with preformed plastic joint sealing material equal to

Rubber-Nek Material or neoprene gasket. The preformed joint sealer shall be protected by a removable two-piece wrapper and shall be applied in strict accordance with the manufacturer's recommendations. It shall meet Federal Specification SS-S-210A, Latest Revision. The neoprene gasket shall meet ASTM D1056, Latest Revision.

Lift holes in manholes shall not extend through the entire width of the wall. Prior to backfill, all lift holes, blemishes, scrapes, or the like on the manhole exterior, shall be filled and/or brushed with an approved non-shrink grout.

Manholes shall require typical shop drawings from supplier, submitted for approval.

All manholes shall be adjusted to finished grade. If the proposed construction includes an existing street or right-of-way in which the existing grade will be changed, the owner shall be responsible for adjusting all existing manholes to finished grade. All adjustments required shall be in accordance with methods approved by the Township.

CONCRETE BASES

Manhole bases shall be precast reinforced concrete unless tying into an existing sewer between existing manholes, in which case cast-in-place bases shall be used. The compressive strength of the cast-in-place concrete base shall be 4,000 psi after 28 days.

Cast-in-place and precast manhole bases shall have flexible watertight joints at the point of entry of any sewer pipe into the manhole. The rubber materials shall conform to ASTM C923. The gaskets shall be cast into the manhole base to become an integral part of the concrete. The gaskets shall be Press Wedge II as manufactured by Pres-Seal Gasket Corporation, Dura-Seal III, or Dura-Seal PSX, as manufactured by Dura Tech Inc., Dual Seal II, "FLEX-LOK", or equal.

The first piece of pipe at a cast-in-place base shall have a maximum external length of 3 feet.

FRAME AND COVER

Manhole frame and cover shall be of soft grey iron equal in design to Number R-1656 manufactured by the Neenah Foundry Company, Neenah, Wisconsin, machined and having the word "SEWER" cast approximately in the center of the cover. The joint between the frame and the precast manhole section shall be provided with preformed plastic joint sealing material equal to Rubber-Nek, and all grade adjustment shimming shall be concrete full donut type. It is required that this joint be watertight. All frames on manholes extending above finished grade shall be securely attached to the manhole by use of anchor bolts.

WATERTIGHT MANHOLE FRAME AND COVER

Watertight manhole frames shall be of soft grey iron similar in design to Number R-1755C as manufactured by Neenah Foundry Co., Neenah, Wisconsin, and having the word "SEWER" cast approximately in the center of the cover. Watertight frames shall be securely attached to the manhole by use of anchor bolts. The joint between the frame and the precast manhole section shall be provided with preformed plastic joint sealing material equal to Rubber-Nek. It is required that this joint be watertight.

MANHOLE STEPS

Manhole steps shall be 3/4-inch diameter aluminum alloy 6061-T6 similar in design to R-1982-W as manufactured by the Neenah Foundry Co., Neenah, Wisconsin or Copolymer Polypropylene Plastic Coated 1/2" diameter grade 60 steel reinforcement as manufactured by M. A. Industries, Inc. The steps shall be installed during manufacture and the utilization of polypropylene inserts to secure the manhole steps shall be permitted.

Steps shall have a drop front design with minimum 10" clear rung width and the distance between rungs shall be 12".

Manhole steps shall be aligned in the manhole in such a manner to permit easy access in the manhole and not conflict with either influent or effluent lines. The first step shall be no farther than 24-inches below the manhole cover rim.

CHANNELS

Channels shall be poured to a height of 3/4 the diameter of the pipe using 3,300 psi. compressive strength concrete.

PIPE BEDDING AND TRENCH BACKFILL

Classification of Materials

Class 1 - This material shall consist of sand, gravel or crushed stone meeting a PennDOT designation as required. Note: 2RC is not permissible for use in wet conditions.

Class 2 - This material shall consist of excavated material approved by the Township and containing no stones larger than one (1) inch in maximum dimension.

Class 3 - This material shall consist of excavated material approved by the Township and containing no stones larger than eight (8) inches in maximum dimension. A maximum of 20% of the backfill volume may be stones if they are evenly distributed within the material.

INSTALLATION OF PIPELINES

LAYING PIPE

General

All pipe shall be laid to a uniform line and grade between structures, socket ends upgrade, where applicable, with a firm and even bearing along the barrel of the pipe, close joints and smooth invert. The spigot end of the pipe is to be centered in, shoved tight and secured against the bell or socket of the previously laid pipe. The interior of each pipe shall be cleaned of all excess joint and foreign material before the next pipe is laid. The pipe shall be laid in the backfill materials as specified. Pipe laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at all other times when pipe is not being laid, the open end of the pipe shall be protected with a close fitting stopper.

During the installation of a force main, the pipe shall be laid at a constantly increasing grade to each high point, air release manhole, or point of discharge. The Contractor shall provide sufficient construction control to assure that there are no sags or loss in grade in the force main which could tend to accumulate air other than at the high points. During the installation of corrugated pipe, the pipe joints shall be free of dirt to insure that the bands fit tightly against the pipe.

BEDDING AND CRADLE

The trench shall be excavated to a depth to place bedding as required. The resultant subgrade shall be undisturbed, or compacted as approved by the Inspector if disturbed. The bedding shall then be prepared by placing a thoroughly compacted material in 3-inch (uncompacted thickness). Bedding shall provide uniform and continuous bearing and support for the pipe at every point between bell holes.

Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable or other organic material, or large pieces of fragments of inorganic material which, in the judgement of the Inspector, should be removed, the owner shall excavate and remove such unsuitable material to the width and depth ordered by the Inspector. Before the pipe is laid, the subgrade shall be made by backfilling with #4 stone material in 6-inch (uncompacted thickness) layers. The layers shall be thoroughly tamped and the subgrade prepared as herein before specified.

CONCRETE CRADLE AND CONCRETE ENCASEMENT

The trench shall be excavated to a depth of six (6) inches below the final invert elevation of pipes 24 inches in diameter or less and nine (9) inches below the final invert elevation of pipes larger than 24 inches in diameter.

All of this excavation may be done by machine. Concrete shall have a compressive strength of not less than 3,000 psi after 28 days.

SPECIAL FOUNDATIONS

Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Inspector, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the contractor shall construct a foundation for the pipe, consisting of piling, timbers or other materials approved by the Inspector.

SUBGRADE IN ROCK

Where excavation is made in rock or boulders and the clearance specified is provided, the subgrade shall be made by backfilling with bedding material in 3-inch (uncompacted thickness) layers. The layers shall be thoroughly tamped and the subgrade prepared as hereinbefore specified.

EXCAVATION IN FILL

When the pipe is laid in fill, the compacted embankment shall be brought to the proposed grade and compaction to a 95% density prior to excavation. Pipe installed prior to the compaction will not be accepted.

REACTION BLOCKING

All pressure mains shall be provided with suitable concrete reaction blocking at each bend and fitting. The concrete shall be sufficient to transfer the forces to the surrounding earth. The concrete shall be placed against undisturbed earth of satisfactory capacity. Backfilling to provide the required bearing will not be permitted. Concrete shall be minimum 3,000 psi compressive strength.

PIPE BEDDING AND TRENCH BACKFILLING METHODS

General

All bedding and backfill material shall be free from cinders, ashes, refuse, vegetable, or organic material, boulders, rocks, or stone, or other material which, in the opinion of the Inspector, is unsuitable. Bedding and backfill material shall conform to the requirements established under "Classification of Material". Where backfill material is unsuitable, the owner shall be required to provide satisfactory material.

Bedding and Backfilling Conditions

Bedding Beneath Pipe to Centerline of Pipe

All trenches shall be bedded by hand, from the bottom of the trench to the centerline of the pipe in layers of 3 inches (uncompacted thickness) and compacted by tamping.

Sanitary Sewer: From 6-inches beneath with #8 or #57 stone

Storm Sewer: From the bottom of the trench with Class 2 backfill excluding corrugated polyethylene which requires #8 stone to the top of pipe, and #8 stone for protection in rock conditions for all pipes.

Water Mains: From 6-inches beneath with #8, #57, 2A or 2RC stone.

Bedding shall be deposited in the trench for its full width on each side of the pipe and fittings simultaneously.

All bedding material shall be compacted to a minimum density of 90% Proctor (ASTM D1557).

Backfill over Pipe

From the centerline of the pipe and fittings to the depth indicated above the top of the pipe, the trench shall be backfilled by hand or by approved mechanical methods. The contractor shall use special care in placing this portion of the backfill so as to avoid injuring or moving the pipe. The backfill shall be placed in layers 6 inches (uncompacted thickness) thick and compacted by tamping. Backfill in this section of the trench shall be as follows:

Sanitary Sewer: to a depth 12-inches above the top of pipe with #8, #57, 2A or 2RC stone.

Storm Sewer: To the top of the pipe with Class 2 backfill excluding corrugated polyethylene which requires #8 stone to the top of the pipe, and #8 stone for protection in rock conditions for all pipes.

Water Mains: To a depth of 6-inches above the top of pipe with #8, #57, 2A or 2RC stone.

Backfill to Grade (New street construction and in easements)

From the depth described in "Backfill Over Pipe" to grade, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench may be Class 3 material subject to limitations specified and consolidated by tamping in eight (8) inch layers.

In lieu of tamping in eight (8) inch layers, the contractor may place the backfill material in layers not exceeding three (3) feet and machine tamp the trench. Tamping shall proceed from the center of the trench to the sides to prevent arching. If the trench depth exceeds the working depth of the machine, the backfill shall be mechanically tamped in eight (8) inch layers to a depth at which the machine can be utilized.

Backfill to Grade (Existing Street Right-of-Way)

#8, #57, 2A or 2RC material will be required to grade when trench excavation is located in an existing street right-of-way.

PIPE CLEARANCE IN ROCKS

Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings for pipes 24 inches in diameter or less, and 9 inches for pipes larger than 24 inches in diameter.

The specified minimum clearances are the minimum clear distances which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone.

CONCRETE CRADLE AND ENCASEMENT

Preparation

Prior to the formation of the cradle or encasement, temporary supports consisting of timber wedges and solid concrete bricks or cap blocks shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.

Placing

After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. Placement shall be done by the use of suitable equipment. The concrete shall be wet enough during placement to permit its flow, without excessive prodding, to all required points around the pipe surface. The width of cradle shall be such as to fill completely the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width, but in no case shall it be less than the width of trench required for the size of pipe being used. Care shall be exercised to prevent pipe flotation during concrete placement.

Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to or flow over concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Township, for a period of seven days or until backfilling is begun. In no case shall backfilling begin within 24 hours of the time of placing and the Township shall have strict control of the rate of backfilling.

MANHOLE FLOW CHANNELS

The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly with concrete in the manhole base. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than one inch per foot and not more than two inches per foot. Prior to testing, all blemishes, scrapes, or the like on the manhole interior, shall be filled and/or brushed with an approved non-shrink grout.

LATERAL SEWERS

Fittings, (Wye branches, risers and bends) and lateral sewer pipe shall be furnished and installed in strict accordance with these specifications and any and all practices and precautions required for the main sewers are equally applicable to the lateral sewers. Lateral sewers shall be a minimum 6-inch diameter, and shall be installed to serve all lots. Installation shall be at a minimum 2% slope, shall be to a point five (5) feet behind right-of-way, and shall include a watertight plug at the end, blocked to withstand 10 psi air test. The wye shall be turned up such that the invert of the lateral is set at the same elevation as the top of the main line pipe. Prior to backfilling, a minimum 2" x 4" wooden marker shall be placed against the end of each lateral, and shall extend a minimum of four feet (4') above the ground.

GRADE AND ALIGNMENT CONTROL

Prior to construction, the owner shall furnish to the Township three copies of a grade sheet for each manhole run. Grade and alignment control shall be established by one of the following methods:

1. Laser - Direct reading
2. Twin string line offset
3. Single center string line with two (2) station lead

The use of a single offset line will not be permitted.

TESTS

Alignment

After the mains have been laid and backfill placed, a light will be flashed between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. Each section (manhole to manhole) of sewer shall show a good light circle throughout its length and any and all defects shall be corrected, to the satisfaction of the Township. Sewers

shall be tested for leakage only after all sewers and lateral sewers, including stoppers, are installed as a complete manhole to manhole section.

Leakage Tests

Air Testing

Each section of sewer between manholes and all laterals, using low pressure air. Testing shall not be performed until all backfilling has been completed. The contractor may, at his option, test the section of sewer for his own purposes, prior to completion of backfilling; however, the requirements of this subsection shall not be deemed to be completed until the lines have been tested after the backfilling has been completed and trench settlement has been minimized. The owner shall furnish all labor, materials, water, tools, equipment and accessories necessary to perform the required tests. All tests shall be made in the presence of and to the complete satisfaction of the Township representative.

A minimum period of two (2) minutes shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. The rate of air loss shall be determined by measuring the time interval required for the average internal pressure to decrease by 0.5 psig.

The initial test pressure to be developed in the sewer and laterals shall be determined as follows:

For depths six (6) feet or less, the internal pressure shall not be less than 6.0 psig.

For depths greater than six (6) feet, the internal pressure in psig shall be calculated as the sum of 3.5 plus the maximum height in feet divided by 2.3 between the invert of the sewer and the existing ground surface in the section of sewer to be tested. For example, if the maximum height is determined to be 9.2 feet, the added pressure would be 4.0 psig. The initial test pressure in the sewer would then be 7.5 psig. The allowable drop would be to 7.0 psig within the time indicated elsewhere in this subsection.

In no case shall the test pressure in the sewers or laterals be greater than the maximum internal differential joint pressure recommended by the manufacturer of the pipe.

The time for the air pressure to decrease 0.5 psig shall not be less than the time indicated in the following table:

Pipe Diameter	Specification Time for Length (L) Shown (min:sec)					
	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.
4"	1:53	1:53	1:53	1:53	1:53	1:53
6"	2:50	2:50	2:50	2:50	2:50	2:51
8"	3:47	3:47	3:47	3:48	4:26	5:04
10"	4:43	4:43	4:57	5:56	6:55	7:54
12"	5:40	5:42	7:08	8:33	9:58	11:24
15"	7:05	8:54	11:08	13:21	15:35	17:48
18"	9:37	12:49	16:01	19:14	22:26	25:38
21"	13:05	17:27	21:49	26:11	30:32	34:54
24"	17:57	22:48	28:30	34:11	39:53	45:35
27"	21:38	28:51	36:04	43:16	50:30	57:42
30"	26:43	35:37	44:31	53:25	62:19	71:13
33"	32:19	43:56	53:52	64:38	75:24	86:10
36"	38:28	51:17	64:06	76:55	89:44	102:34

If the above rates of leakage are exceeded, the owner shall cause to determine source of leakage and make all necessary corrections and retest.

Manhole Testing (When requested by the Township)

The owner shall conduct exfiltration tests on all manholes. The owner shall furnish all labor, materials, water, tools, equipment and accessories necessary to perform the required tests. All tests shall be made in the presence of and to the complete satisfaction of the Township representative.

The manhole shall be thoroughly cleaned and all openings sealed to the satisfaction of the Township. All pipe openings in the base and the walls shall be plugged with plugs properly designed to provide a watertight seal.

After the manhole has been properly cleaned and sealed, it shall be completely filled with water. In order to make allowance for the amount of water which will be absorbed by the manhole, the manhole to be tested shall be completely filled with water for a period of 12 hours prior to commencement of the test.

At the time of commencement of the test, the manhole shall be filled with water to a point level with the top of the top manhole section. The amount of exfiltration shall be determined from the loss in water level converted into gallons per day. The manhole being tested shall be considered "acceptable" when there is no perceptible loss in water level.

If any manhole fails to meet the exfiltration requirements specified hereinafter, the owner shall determine at his own expense the source or sources of leakage. The owner shall repair or replace all defective material and/or workmanship and shall conduct such additional retests as required to demonstrate that the manhole meets the requirements. All materials and methods used to repair the manholes shall meet with the approval of the Township.

Hydrostatic Tests for Force Mains

Pressure Test

After the pipe has been laid and backfilled as specified, all newly laid pipe, or any valved section thereof, shall be subjected to a hydrostatic pressure of 150 pounds per square inch, or 50% in excess of the normal working pressure, whichever is greater.

Duration of Pressure Tests

The duration of each pressure test shall be at least two hours.

Procedure

Each section of pipe shall be slowly filled with water and the specified test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Township. The pump, pipe connections, and all necessary apparatus, including gauges, shall be furnished by the owner. The owner will make all taps into the pipe, and furnish all necessary assistance for conducting the tests.

Expelling Air before Test

Before applying the specified test pressure, all air shall be expelled from the pipe.

Examination Under Pressure

Any cracks or defective pipes, fittings, or valves discovered in consequence of this pressure test, shall be removed and replaced with sound material, and the test shall be repeated until satisfactory to the Township.

Leakage Test

A leakage test shall be conducted concurrently with the pressure test. The owner will furnish the gauge and all necessary assistance to conduct the test. The duration of each leakage test shall be two hours, and during the test the main shall be subjected to the pressure stated herein.

Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD \sqrt{P}}{133,200}$$

in which "L" equals the allowable leakage in gallons per hour; "S" is the length of pipeline tested in feet; "D" is the nominal diameter of the pipe, in inches, and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. (The allowable leakage according to the formula is equivalent to 11.65 U.S. Gal. per 24 hours per mile of pipe per inch nominal diameter, for pipe in 18' lengths evaluated on a pressure basis of 150 psi). When testing against closed metal seated valves, an additional leakage per closed valve of 0.0078 gallon per hour per inch of nominal valve size shall be allowed.

The Inspector will record both the makeup water and pressure at one-half hour intervals during the test period.

Variation from Permissible Leakage

Should any test of pipe laid disclose leakage greater than that specified herein, the owner shall cause to locate and repair the defective joints until the leakage is within the specified allowance.

Time for Making Test

Where any section of a main is provided with concrete reaction backing, the hydrostatic pressure test shall not be made until at least five days have elapsed after the concrete reaction backing was installed. If high early strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least two days have elapsed.

SPECIFICATIONS - PUMP STATIONS

Available at Manheim Township Commissioners Office.

SPECIFICATIONS - PRE-TREATMENT FACILITIES

Pre-treatment structures shall require material and type certifications, design drawings and specifications for approval.

SPECIFICATIONS - SANITARY SEWER SYSTEM APPURTEANCES

Grease traps, holding tanks, separator tanks, valves, meters, sampling pits, test manholes, and all other similar appurtenances, shall require material and type certifications, design drawings and specifications, for approval.

CHANGES IN PROCEDURES, MATERIALS AND SPECIFICATIONS

The procedures, materials and specifications set forth in this specifications manual may, from time to time, be revised, amended or supplemented by amendment adopted by the Board of Commissioners of Manheim Township.

TABLE OF ABBREVIATIONS

(D.E.R.)	Pennsylvania Department of Environmental Resources
(C.O.E.)	Corps of Engineers
(P.D.O.T.)	Pennsylvania Department of Transportation
(M.T.)	Manheim Township
(L.C.B.W.)	Lancaster City Bureau of Water
(G.M.A.T.M.)	General Municipal Authority of the Township of Manheim
(L.C.)	Lancaster County
(L.C.S.C.S.)	Lancaster County Soil Conservation Service
ASTM	American Society for Testing Materials
AASHTO	American Association of State Highway and Transportation Officials
AWWA	American Water Works Association
ANSI	American National Standards Institute

MANHEIM TOWNSHIP COMMISSIONERS

Date: _____

By: James M. Martin
Manager-Secretary

Appendix A -- Manning "n"

TABLE OF MANNING "n" VALUES FOR PIPES

PIPES

<u>Pipe Material</u>	<u>Manning "n"</u>
Helical corrugated steel/aluminum diameter (inches) 2-2/3 x 1/2 corrugations	
15	0.014
18	0.015
21	0.016
24	0.017
27	0.018
30	0.019
36	0.020
42	0.021
48	0.021
3 x 1 corrugations	
36	0.022
42	0.023
48	0.024

NOTE: Arch pipe shall have the Manning "n" of an equal periphery of circular pipe.

Reinforced Concrete

All diameters	0.013
Corrugated Polyethylene	
Smooth lining All diameters	0.012
Ribbed PVC, PS46	
All diameters	0.011

CULVERTS AND BRIDGES

<u>Material</u>	<u>Manning "n"</u>
All concrete	0.013
Corrugated Aluminum (Culverts only)	Figure B-3 (Composite roughness)
Stone lined channel (Bridges only)	0.030

Composite Roughness

Culverts and bridges fabricated using different materials for the inverts, sidewalls and roofs shall use a composite roughness coefficient for capacity determination. In order to derive a composite Manning "n" value the assumption that the conveyance section can be broken into G parts with associated wetted perimeters (P) and Manning "n" values is made. Each part of the conveyance section is then assumed to have a mean velocity equal to the mean velocity of the entire flow section. These assumptions lead to the following equation.

$$\bar{n} = \left[\frac{\sum_{i=1}^G (p_i n_i^{1.5})}{P} \right]^{0.67}$$

\bar{n} is the weighted Manning n value.

G is the number of different roughnesses in the perimeter,

p_1 is the wetted perimeter in ft. influenced by the material 1,
 p_2 is the perimeter influenced by material 2, etc.

n_1 is the Manning n value for material 1, n_2 is for material 2, etc.

P is the total wetted perimeter, ft

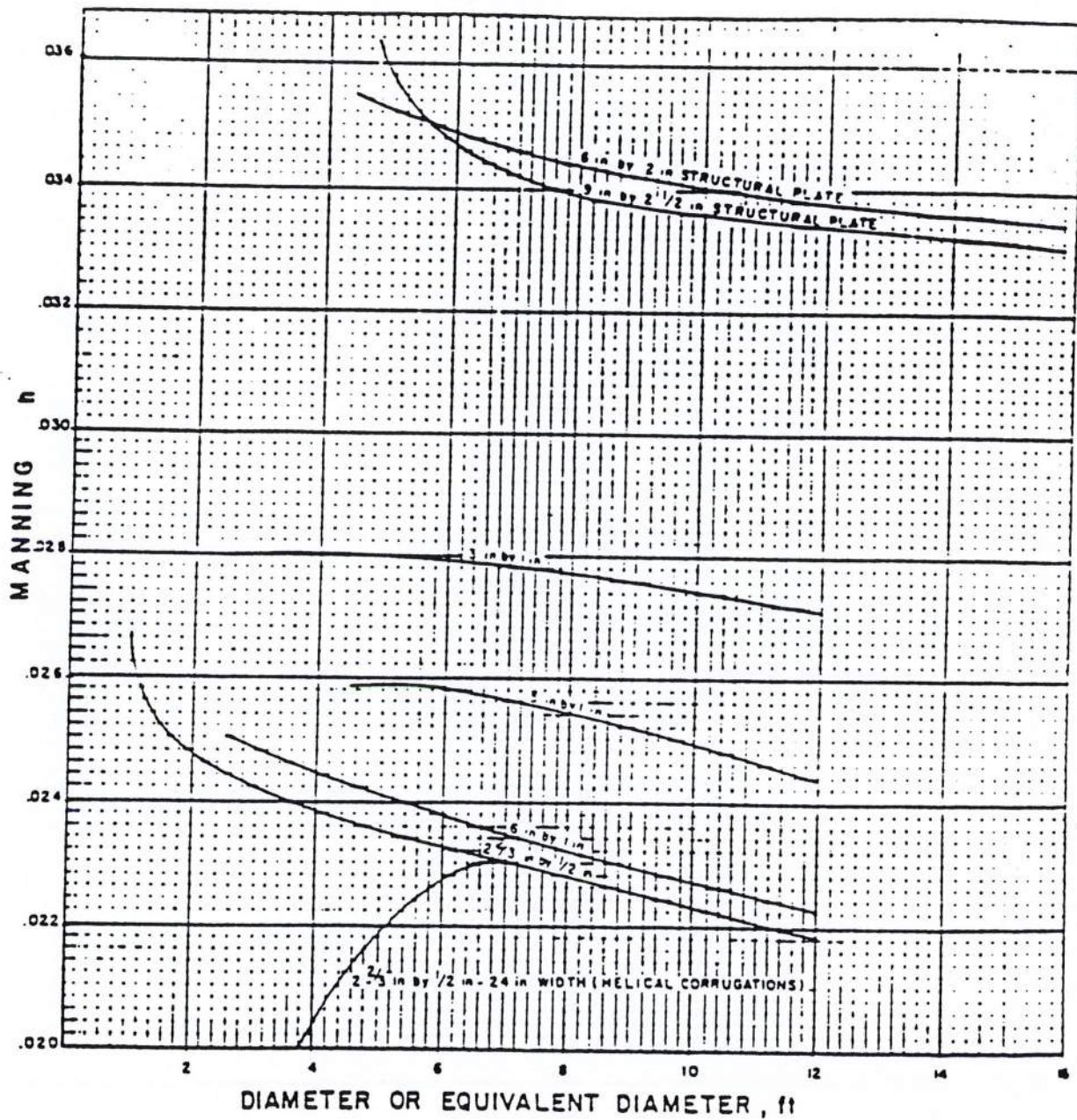


Figure B-3—Manning n versus diameter for corrugated metal conduits.

Example: Compute the Manning n value for a 6 ft. diameter corrugated metal pipe with 5 by 1 inch annular corrugations, and a smooth lining over 40 percent of the perimeter.

1. Determine the Manning n for the 6 ft corrugated metal pipe with 5 by 1 inch corrugations.

$$n = 0.026 \text{ (figure B-3)}$$

2. Determine the Manning n for smooth lining.

$$n = 0.013 \text{ (assume concrete lining)}$$

3. Determine the relative perimeters composed of each material.

$$p = D = (3.14)(6) = 18.84 \text{ ft. (total wetter perimeter)}$$

$$p_1 \text{ (corrugated)} = (0.60)(18.84) = 11.30 \text{ ft.}$$

$$p_2 \text{ (smooth)} = (0.40)(18.84) = 7.54 \text{ ft.}$$

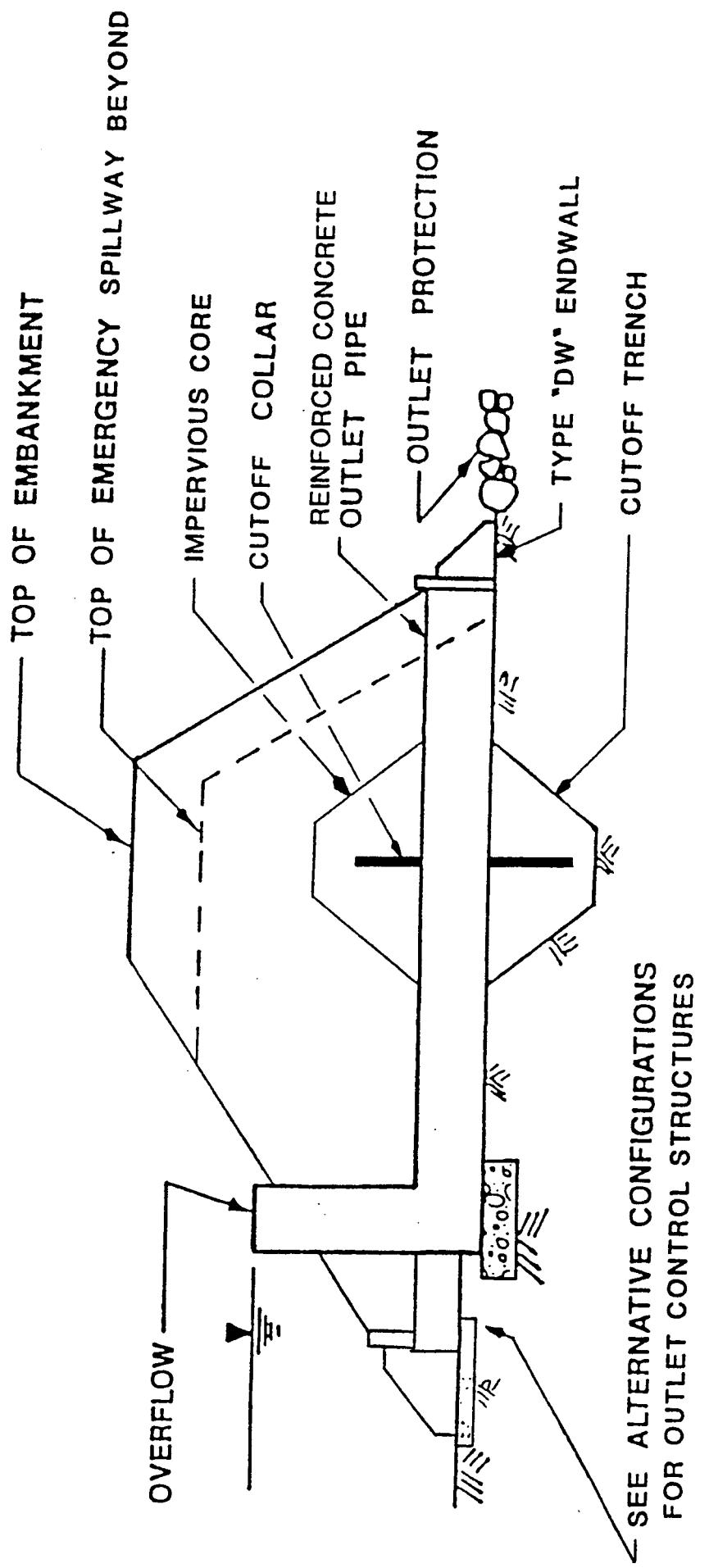
4. Use the previous equation to calculate the Manning n value

0.67

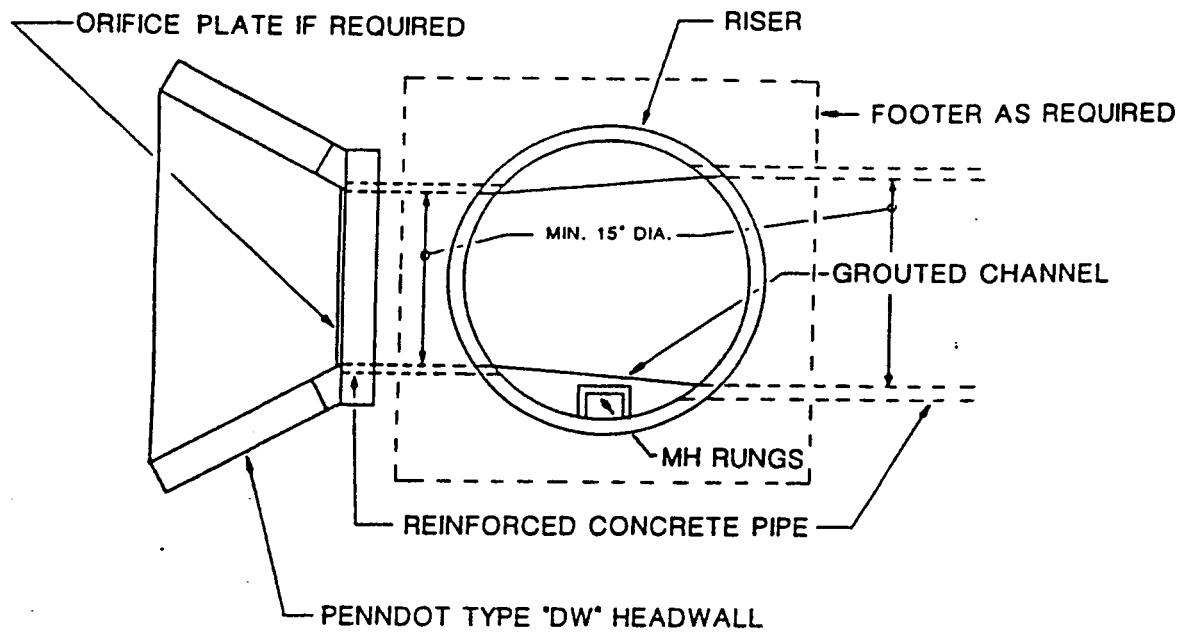
$$\bar{n} = \left[\frac{(11.30)(0.026)^{1.5} + (7.54)(0.013)^{1.5}}{18.84} \right]$$

$$= 0.021$$

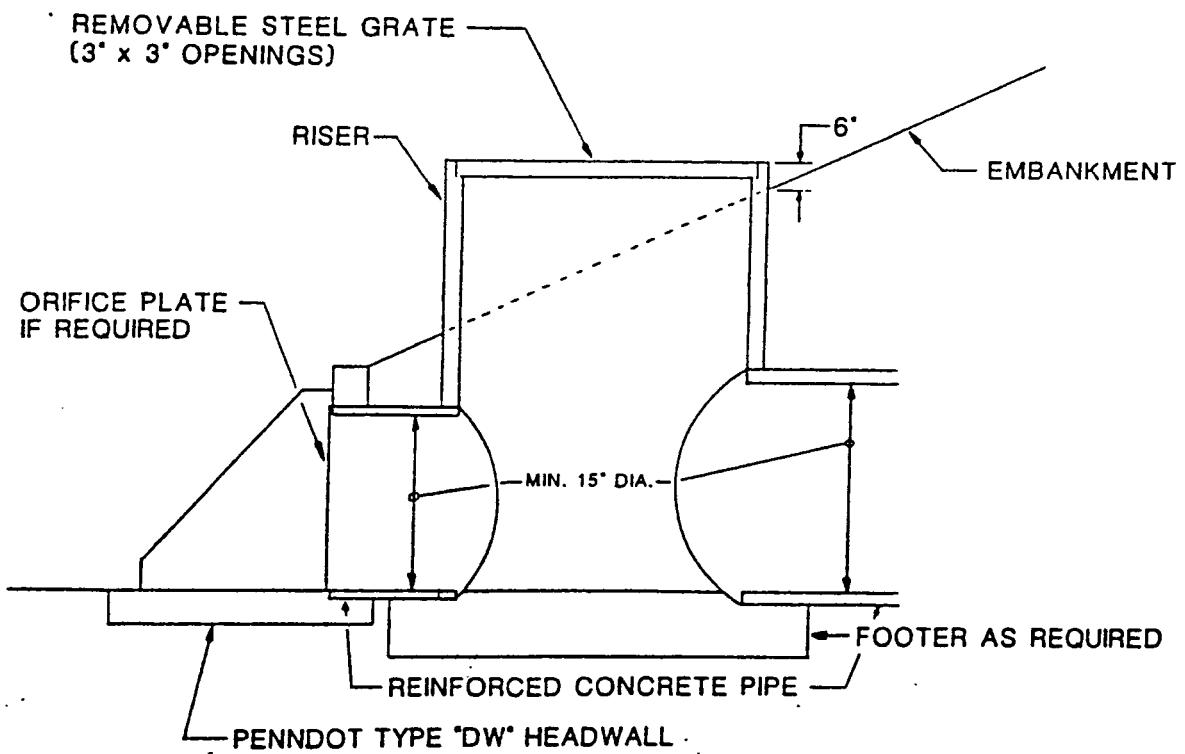
Appendix B -- Details



BASIC OUTLET THROUGH DETENTION POND EMBANKMENT

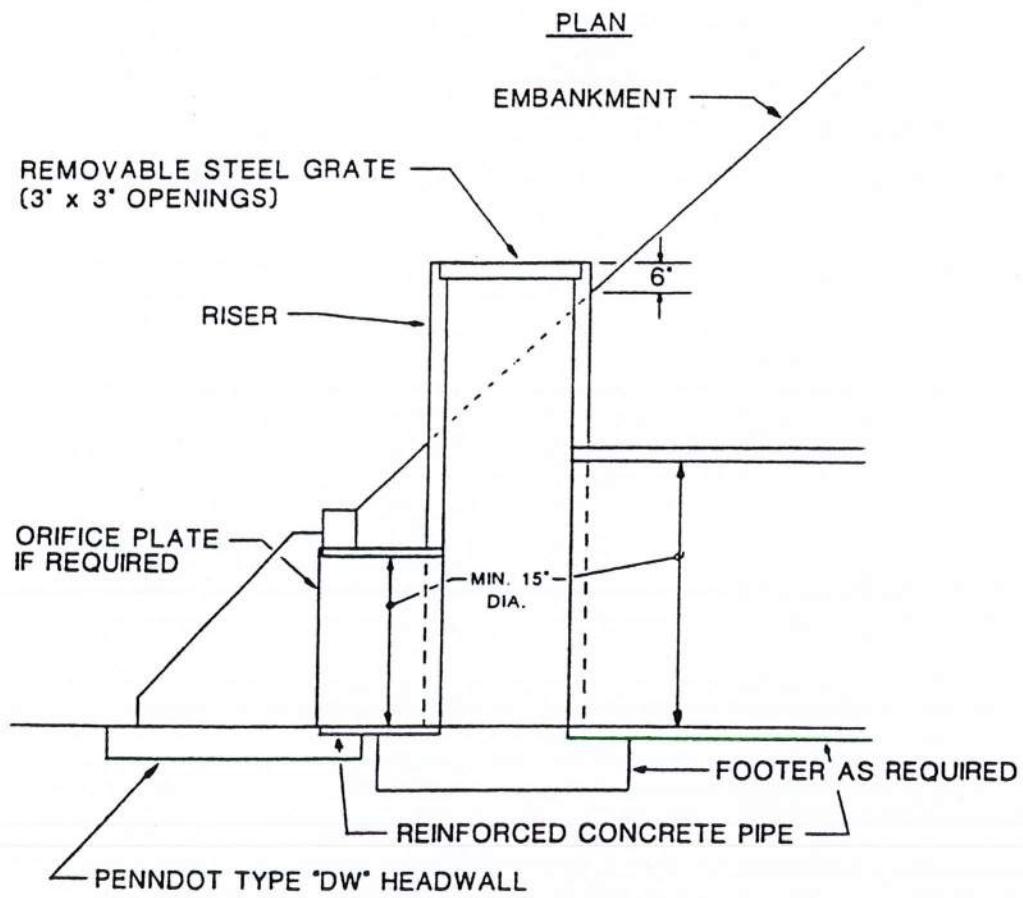
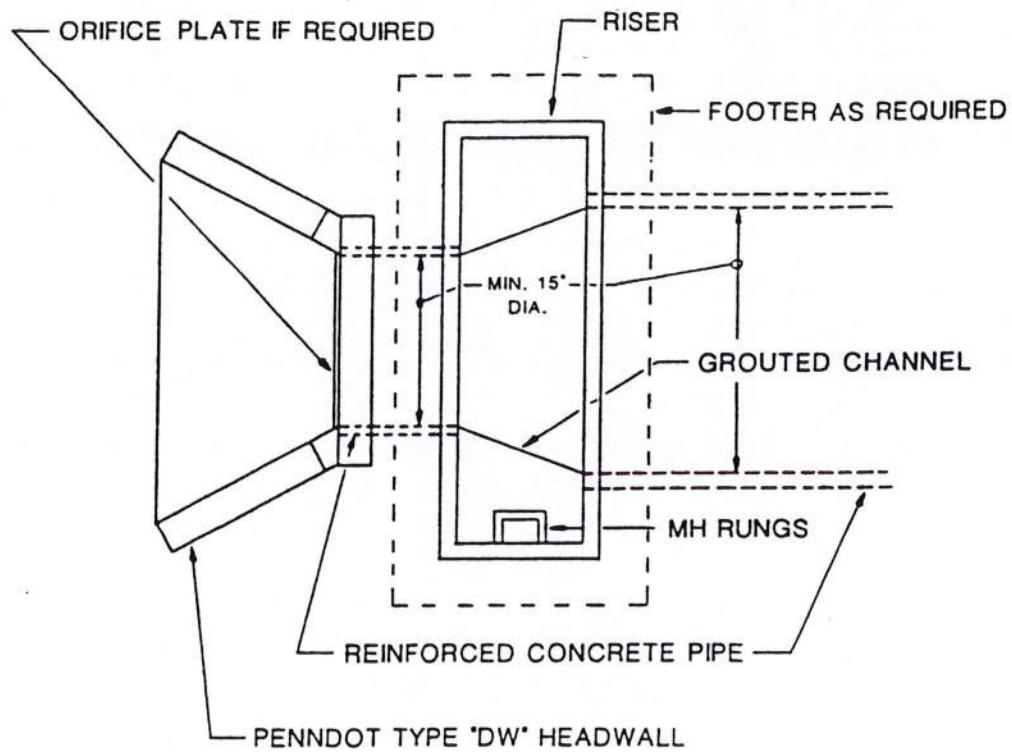


PLAN



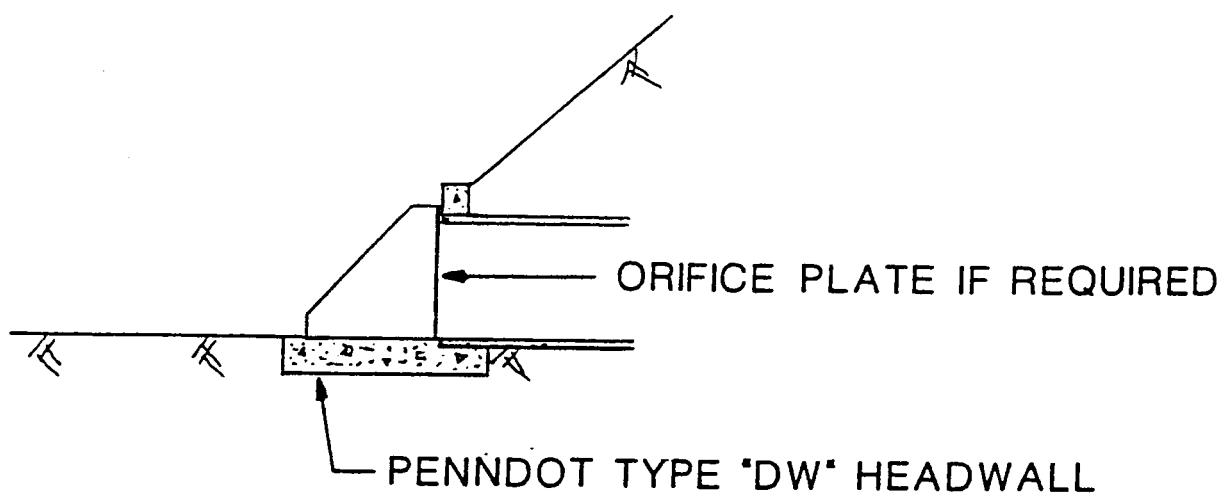
SECTION

ALTERNATIVE CONFIGURATIONS FOR OUTLET CONTROL STRUCTURES

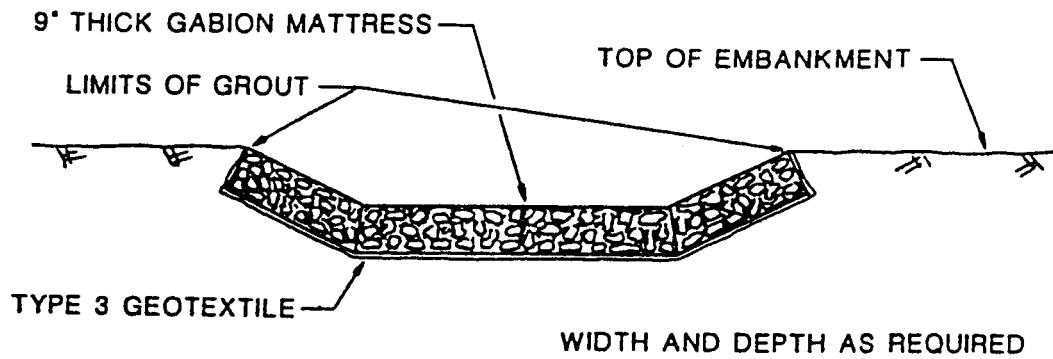


SECTION

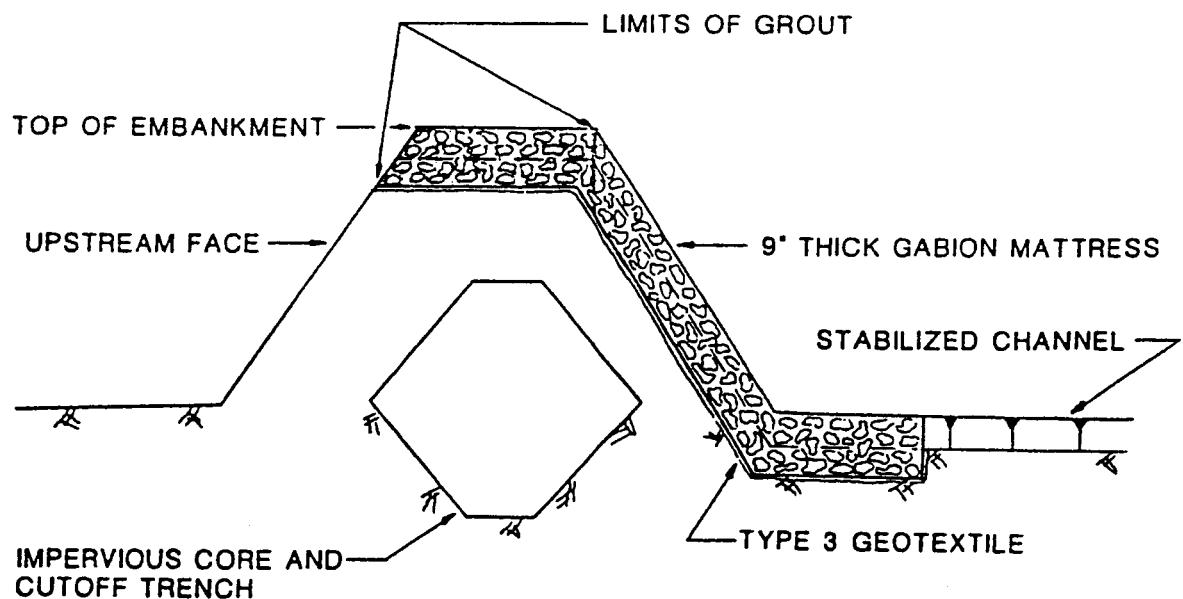
ALTERNATIVE CONFIGURATIONS FOR OUTLET CONTROL STRUCTURES



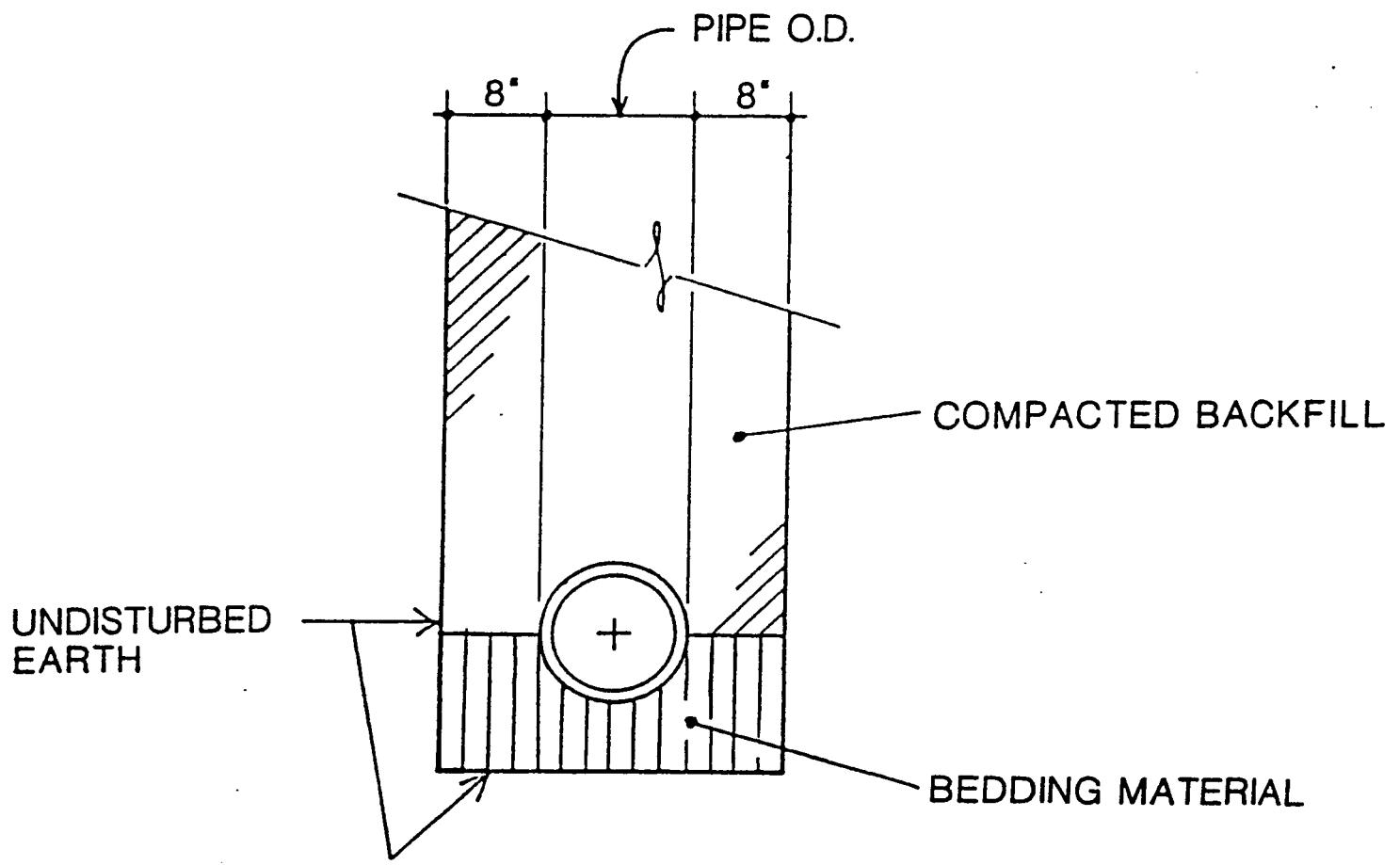
ALTERNATIVE CONFIGURATIONS FOR OUTLET CONTROL STRUCTURES



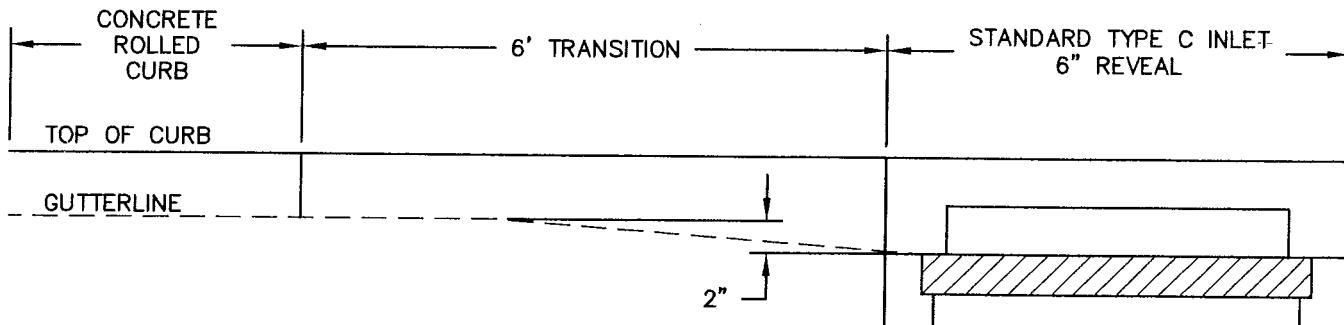
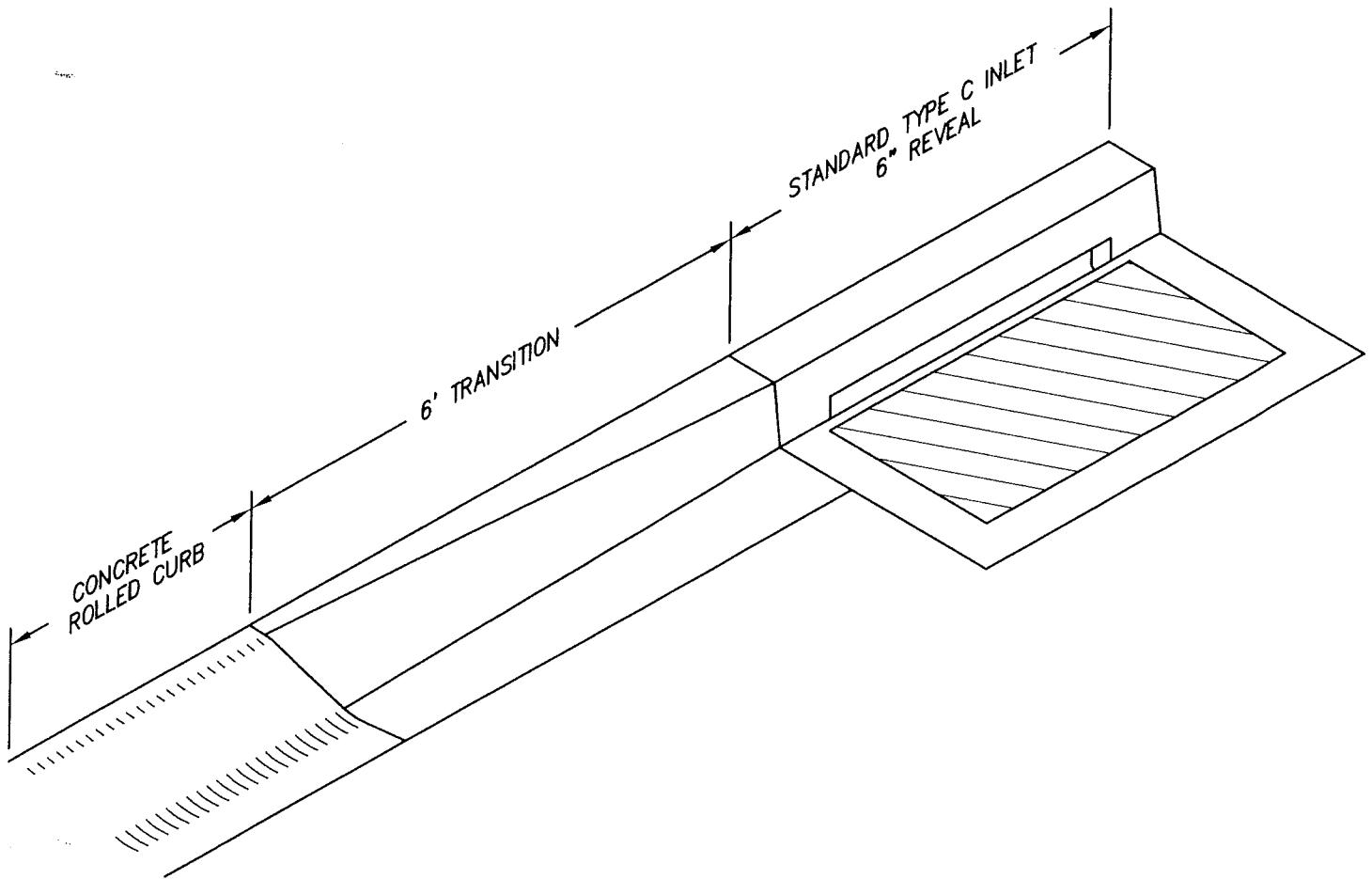
SECTION THROUGH EMERGENCY SPILLWAY CREST



SECTION THROUGH EMBANKMENT AT EMERGENCY SPILLWAY



TYPICAL TRENCH DETAIL



NOTE: NOT TO SCALE

MANHEIM TOWNSHIP COMMISSIONERS

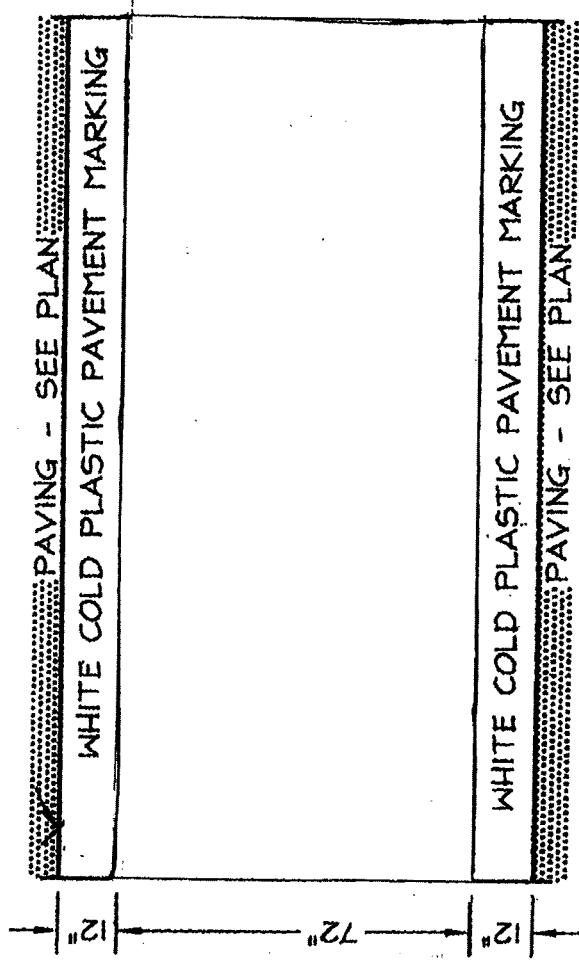


ROLLED CURB TRANSITION DETAIL

DATE:	6/2/2011
DRAWN BY:	CRP
CHK. BY:	ASB
NO. Rolled Curb Transition Detail	

NOTES:

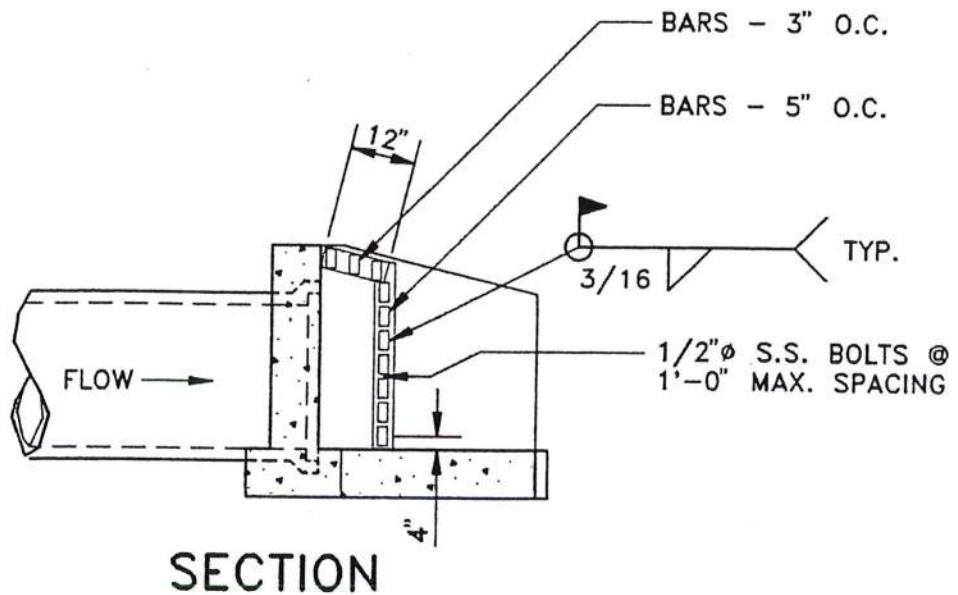
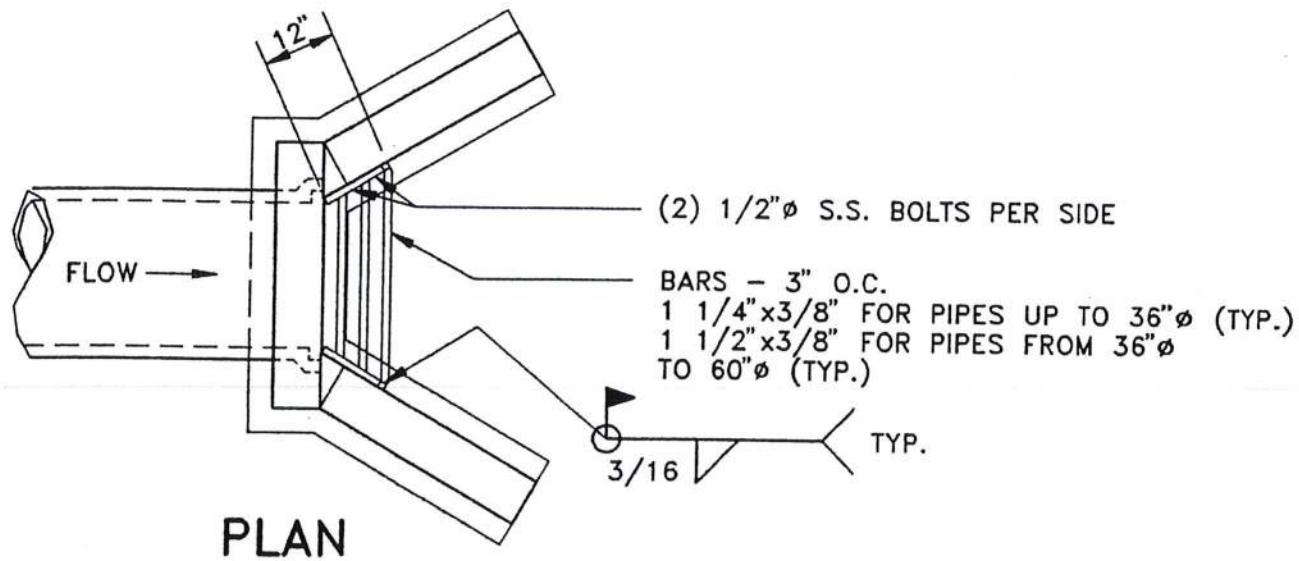
- REFER TO SITE PLANS FOR LOCATIONS.
- PROVIDE PEDESTRIAN CROSSWALK SIGNS AS PER PADOT SPECIFICATIONS



PLAN

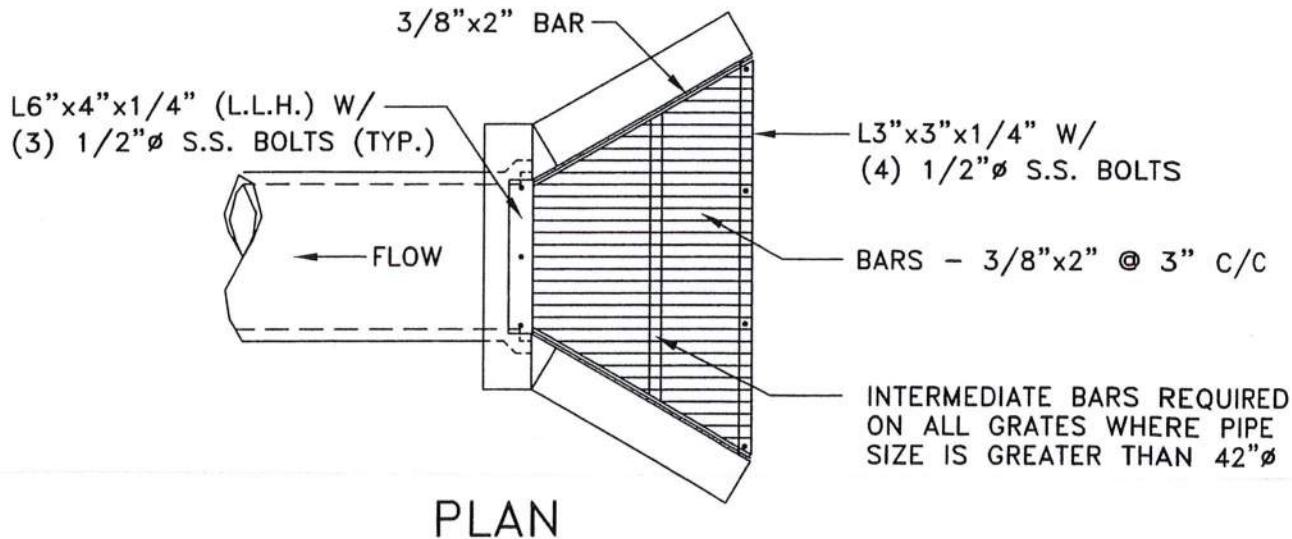
CROSSWALK

NOT TO SCALE

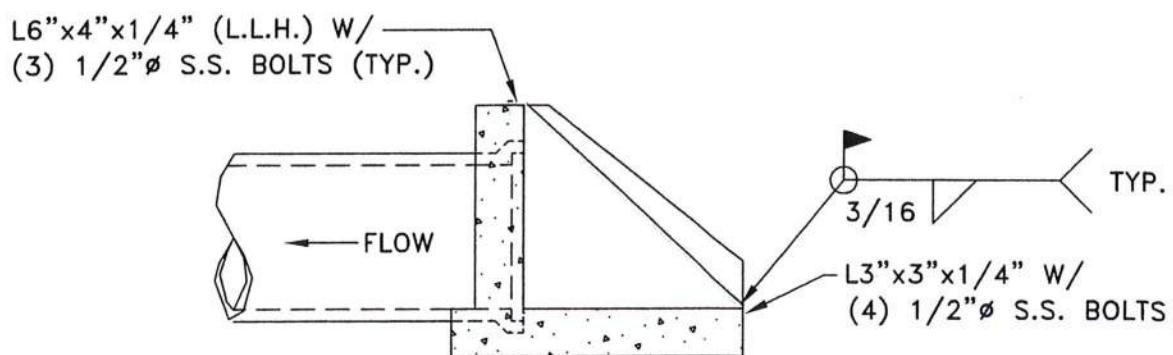


TRASH RACK DETAIL - ENDWALL CONDITION

NO SCALE



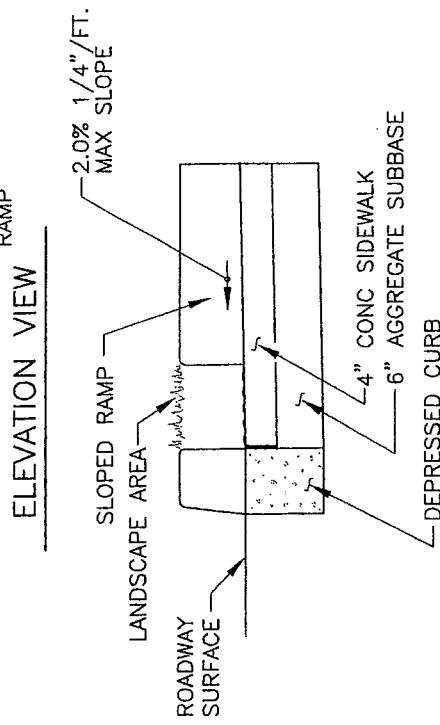
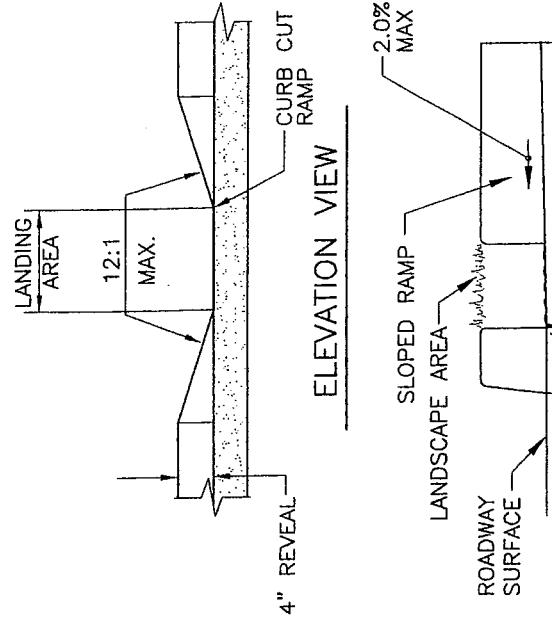
PLAN



SECTION

TRASH RACK DETAIL - HEADWALL CONDITION

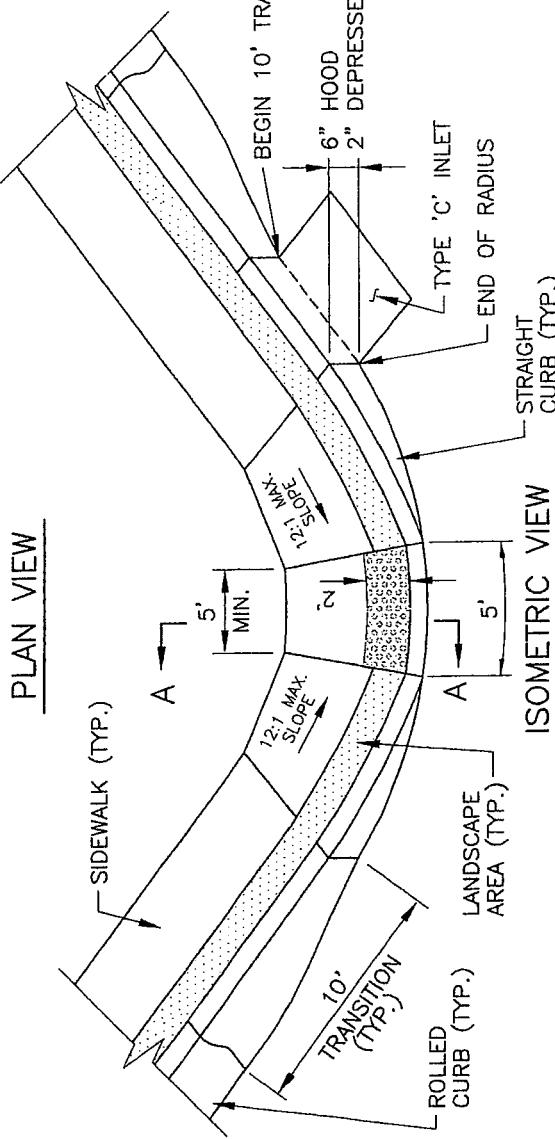
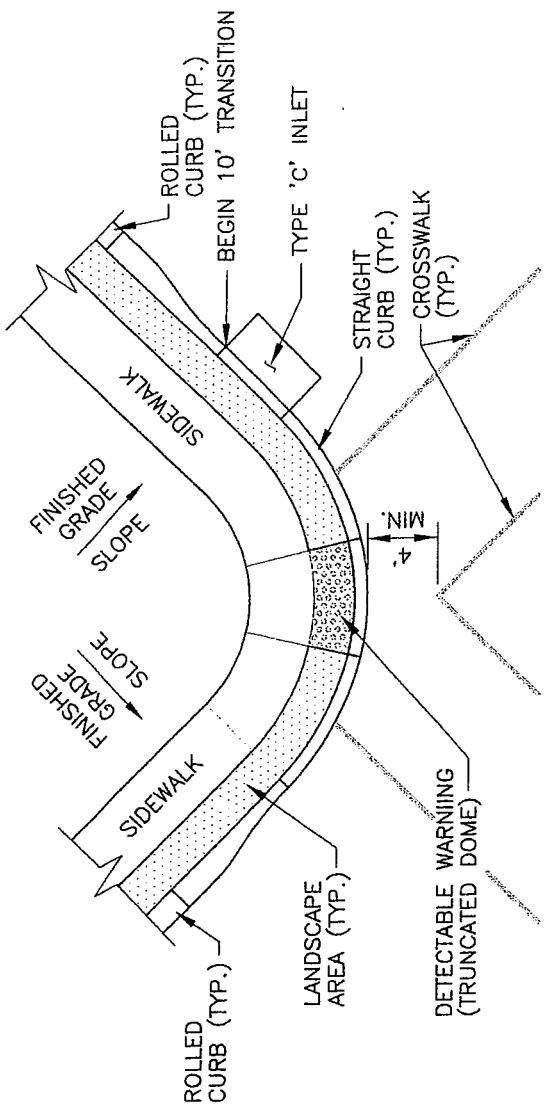
NO SCALE



SECTION A-A

NOTES:

1. PROVIDE 1/2" EXPANSION JOINT MATERIAL WHERE CURB CUT RAMP ADJOINS ANY RIGID PAVEMENT, SIDEWALK OR STRUCTURE WITH THE TOP OF JOINT FILLER FLUSH WITH ADJACENT CONCRETE SURFACE.
2. DIMENSION AND SLOPES SHOULD BE ADHERED TO UNLESS EXISTING CONDITIONS REQUIRE SPECIAL DESIGN BASED ON ROADWAY GRADES.
3. PROVIDE SLIP RESISTANT TEXTURE ON CURB CUT RAMP BY COURSE BROOMING TRANSVERSE TO THE SLOPE OF THE RAMP. EXTEND TEXTURE THE FULL WIDTH AND LENGTH OF THE CURB CUT RAMP INCLUDING FLARED SIDE RAMPS.



CURB CUT RAMP DETAILS

NO SCALE



SCALE:	AS NOTED	DATE	8/31/07	DWG. NO.	06680632.DWG
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