

City of Tiffin Public Works Improvements Design Manual



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REVISED: JANUARY 2025

TABLE OF CONTENTS

Section 1 – General Notes & Planning		Page(s)
1.1	Preliminary Matters	1.1
1.2	Definitions & Acronyms	1.2 – 1.4
1.3	General Plan Standards	1.5
1.4	Plan Revisions	1.5
1.5	Shop Drawings	1.5
1.6	Record (As-Built) Drawings	1.5
1.7	Permitting	1.6
1.8	Utility Locates	1.6
1.9	Safety	1.6
1.10	Traffic Control	1.6
1.11	Monuments & Property Pins	1.6
1.12	Environmental Controls	1.7
1.13	Haul Routes	1.7
1.14	Inspections & Stop Work Notices	1.7
1.15	Excavation/Embankment – General Notes	1.7
1.16	Post-Construction	1.7
Section 2 – Sanitary Sewers		Page(s)
2.1	Materials	2.1 – 2.32
A.	Gravity Sewers	2.1 – 2.2
B.	Force Mains	2.3 – 2.4
C.	Polyethylene Encasement	2.5
D.	Pipe Insulation	2.5
E.	Steel Encasement Pipe	2.5 – 2.6
F.	Manholes	2.6 – 2.9
G.	Frames & Covers	2.9 – 2.10
H.	Drop Connections	2.10 – 2.11
I.	Air Release Valves & Manholes	2.11
J.	Wastewater Pumping Stations	2.11 – 2.31
K.	Bedding & Backfill	2.31 – 2.32

<u>Section 2 – Sanitary Sewers (cont.)</u>		<u>Page(s)</u>
2.2	Installation	2.32 – 2.43
	A. Trenches	2.32 – 2.34
	B. Protection of Existing Utilities	2.34 – 2.36
	C. Trench Protection	2.36
	D. Pipe Embedment	2.36 – 2.37
	E. Pipe Laying	2.37 – 2.39
	F. Backfilling	2.39 – 2.41
	G. Connections to Structures and Pipes	2.41 – 2.43
2.3	Testing	2.43 – 2.47
	A. Testing for Deflection & Obstructions in Gravity Sewers	2.43
	B. Testing for Leakage of Gravity Sewers	2.43 – 2.45
	C. Testing of Manholes	2.45
	D. Pressure and Leakage Tests for Force Mains	2.46 – 2.47
	E. Testing for Pumping Stations	2.47
2.4	Design	2.47 – 2.49
	A. Design Flow	2.47
	B. Size and Slope	2.48
	C. Velocity	2.48
	D. Hydraulic Design	2.48 – 2.49
	E. Cover and Depth	2.49
	F. Manhole Placement & Alignment	2.49
	G. Materials	2.49

<u>Section 3 – Storm Sewers & Stormwater Control Guidance</u>		<u>Page(s)</u>
3.1	Materials	3.1 – 3.9
	A. Pipe and Fittings	3.1 – 3.2
	B. PVC Plastic Pipe and Fittings	3.2
	C. Concrete Pipe and Fittings	3.2 – 3.3
	D. Steel Encasement Pipe	3.3 – 3.4
	E. Bridges & Box Culverts	3.4
	F. Catch Basins	3.4 – 3.5
	G. Manholes	3.5 – 3.7
	H. Frames and Covers	3.7 – 3.8

Section 3 – Storm Sewers & Stormwater Control Guidance (cont.) Page(s)

	I.	Bedding and Backfill	3.8 – 3.9
	J.	Downspouts	3.9
3.2		Installation	3.9 – 3.16
	A.	Trenches	3.9 – 3.10
	B.	Protection of Existing Utilities	3.10 – 3.11
	C.	Replacement of Existing Sewers and Drains	3.11
	D.	Trench Protection	3.11 – 3.12
	E.	Pipe Embedment	3.12 – 3.13
	F.	Pipe Laying	3.13
	G.	Backfilling	3.13 – 3.15
	H.	Connections to Structures and Pipes	3.15 – 3.16
3.3		Inspection and Testing	3.16 – 3.17
3.4		Design	3.17 – 3.23
3.5		Stormwater Quantity Controls	3.23 - 3.33

Section 4 – Roadways & Alleys Page(s)

4.1		General Requirements	4.1
4.2		Typical Sections	4.1 – 4.6
	A.	Pavement Width	4.1 – 4.2
	B.	Cross Slope	4.2
	C.	Horizontal Slope	4.2
	D.	Approaches	4.2
	E.	Curbs & Underdrains	4.2 – 4.3
	F.	Pavement Buildup	4.3
	G.	Utility Trench	4.3 – 4.4
	H.	Roadway Widening	4.4
	I.	Pavement Markings	4.5
	J.	Monuments	4.5
	K.	Signage	4.5
	L.	Guardrail	4.6
	M.	Casting Adjustments	4.6

Section 5 – Sidewalks & Multi-Use Trails		Page(s)
5.1	Sidewalks	5.1 – 5.5
5.2	Curb Ramps	5.6
5.3	Detectable Warning Mats	5.6
5.4	Decorative Furniture Areas	5.6
5.5	Multi-Use Trails	5.7

Section 6 – Driveways		Page(s)
6.1	General Requirements	6.1 – 6.2

Section 7 – Decorative Street Lights		Page(s)
7.1	Pole Specifications	7.1
7.2	Luminaire Specifications	7.1 – 7.2
7.3	Pole Foundation Requirements	7.2
7.4	Wiring/Conduit Specification	7.2
7.5	Pull Box Specification	7.2

Section 8 – Traffic & Pedestrian Signals		Page(s)
8.1	General Notes	8.1
8.2	Traffic Signal Pole & Mast Arm Specifications	8.1 – 8.4
8.3	Traffic Signal Specifications	8.4 – 8.5
8.4	Pedestrian Signal Heads	8.5 – 8.6
8.5	Flashing Beacons	8.6
8.6	Pedestrian Pushbuttons	8.6
8.7	Pedestrian Signal Pedestal	8.6 – 8.7
8.8	Electrical, Wiring & Conduit Specifications	8.7 – 8.13
8.9	Video Detection Systems	8.13 – 8.14
8.10	Pole Foundation Requirements	8.14 – 8.15

Section 9 – Planning		Page(s)
9.1	Zoning	9.1
9.2	Architectural Board of Review District	9.1
9.3	Subdivision & Planning Regulations	9.1
9.4	Flood Plain Regulations	9.1

Section 10 – Small Cell Facilities**Page(s)**

10.1 Wireless Support Structures 10.1-10.2

Section 11 – Exhibits

- A. Sanitary Sewer Manhole Casting & Cover Assembly
- B. Sanitary Sewer Manhole Standard Frame and Cover
- C. Sanitary Sewer Manhole Gasketed Frame and Cover
- D. Sewer Lateral Specification Drawing
- E. Air Test Holding Table and Timing Formula
- F. Sewer Line Air Test Inspection Form
- G. Concrete Manhole Vacuum Test Info Card
- H. Storm Sewer Standard Frame and Cover
- I. Allowable Downspout Connection Standard Drawings
- J. Intersection Standard Drawing
- K. Chapters 1121, 1123, 1125, 1127, & 1129 of the City of Tiffin Codified Ordinances
- L. Cul-De-Sac Standard Drawing
- M. Alley & Drive Approach Profile Standard Drawing
- N. Asphalt Roadway – Typical Section
- O. Reinforced Concrete Roadway – Typical Section
- P. Utility Trench Repair – Typical Section
- Q. Standard & Ladder Crosswalk – Standard Drawing
- R. Decorative Crosswalk – Standard Drawing
- S. Standard Sidewalk Drawings
- T. Standard Curb Ramp Drawings
- U. Stamped Concrete - Furniture Area – Standard Drawing
- V. Brick Paver – Furniture Area – Standard Drawing
- W. Multi – Use Trail – Typical Section
- X. Bollard – Standard Drawing
- Y. Residential Driveway – Standard Drawing
- Z. Commercial Driveway – Standard Drawing
- AA. Vehicular Pull Off – Standard Drawing
- AB. Mast Arm – Standard Drawings
- AC. Signal Pole Foundation – Standard Drawing
- AD. Sewer CCTV – Photo Naming Convention

SECTION 1
GENERAL NOTES & PLANNING

Section 1 – General Notes & Planning

1.1 Preliminary Matters

- A. Per Ordinance 20-109, This manual shall replace the previously adopted City of Tiffin Public Works Design Manual dated July 1, 1967.
- B. Purpose . The standards, as set forth herein, are intended for quality and uniformity of public and private infrastructure improvements. These standards are intended to compliment all City, County, State and Federal Standards.
 - 1. It shall be the duty of the City Engineer to review these provisions in this manual not less than each 2 year period from the date of their adoption and publication in order to keep them current with standard practices of construction, to take advantage of new methods and materials, and to ensure accordance with Ordinances of the City of Tiffin and regulations of the City of Tiffin Planning Commission and City Engineer's Office.
- C. Objectives
 - 1. To standardize design practices and construction procedures on Public Works Improvements within the corporate limits of the City of Tiffin and adjacent areas where connections will be made to City owned utilities, or areas under jurisdiction of the City Planning Commission.
 - 2. To provide a single source of information for the design and planning of Public Works Improvements.
- D. Conflicts with Other Regulations . When the provisions of this standard are inconsistent with one another or when the provisions of this standard conflict with provisions found in other adopted ordinances or regulations, the more restrictive provision shall govern.
- E. Severability . If a court of competent jurisdiction declares that any Section, Division, Item or Paragraph of this Standard is invalid, that ruling shall not affect the validity of any other part of this standard or of the standard as a whole, which shall remain in full force and effect.

1.2 Definitions & Acronyms

- A. AASHTO: Refers to all the publications of the American Association of State Highway Transportation Officials, and specifically, A Policy on Geometric Design of Highways and Streets, current edition.
- B. ANSI: American National Standards Institute
- C. ASTM: American Society for Testing and Materials
- D. AWWA: American Water Works Association
- E. CDF: Control Density Fill, a lean concrete mixture that may be broken and removed easier than regular concrete mixes and frequently cures rapidly. Used commonly for trench backfill applications.
- F. City: Refers to the City of Tiffin
- G. City Engineer: A professional Engineer, registered in the State of Ohio, who has been appointed as the City Engineer by the City of Tiffin, or the City Engineer's authorized agent.
- H. Contractor: An individual, company, firm, or other party or organization who contracts with an Owner to construct all or a portion of a project.
- I. Day: Shall constitute a calendar day of 24 hours measured from midnight to the next midnight.
- J. Developer: Any person, firm, corporation, agent, partnership, or entity who seeks to improve and/or modify land in accordance with the City's regulations.
- K. Development: A man-made change to improved or unimproved real estate.
- L. Drawings or Plans: The approved plans, profiles, typical cross sections, working drawings, supplemental drawings, text, notes, or exact reproductions that show the location, character, dimensions, and details of the proposed work to be done.
- M. Edge of Pavement: The location of the white or yellow line on an uncurbed road, the edge of the asphalt driving surface on an unstriped roadway, the edge of the gutter plate on a curb and gutter road or the face of the curb on a curbed road.
- N. Improvements: Any changes, additions, modifications, revisions, etc. to infrastructure, structures, land, etc.
- O. ITE: Institute of Transportation Engineers

- P. LED: Light-emitting diode, a semiconductor light source that emits light when current flows through it.
- Q. NEC: National Electrical Code
- R. NEMA: National Electrical Manufacturers Association
- S. OMUTCD: Ohio Manual of Uniform Traffic Control Devices. Ohio Department of Transportation Manual that establishes uniform standards for traffic control devices, such as signs, signals, markings, and construction signage.
- T. OSHA: Occupational Safety and Health Administration
- U. OUPS: Ohio Utility Protection Services
- V. Owner: The individual, entity, public body, or authority with whom the Contractor has entered into an agreement and for whom the work is to be performed.
- W. PCBs: Polychlorinated biphenyls
- X. Petroleum: Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
- Y. Project: The total construction of which the work to be performed under the Contract Documents may be the whole, or a part as may be indicated elsewhere in the Contract Documents.
- Z. Public Improvement: Public sewers, water mains, storm water relief provisions, highways, parkways, sidewalks, street lighting, and all other public improvements to be required by the City.
- AA. PVC: Polyvinyl Chloride
- AB. Record Drawings (As-Builts): Design plans reviewed in the field and revised to show the actual construction dimensions, quantities, and locations.
- AC. Right-of-Way: A strip of land dedicated, condemned, or reserved for public use.
- AD. Road or Roadway: Limits of the paved area including paved shoulders, traveled lanes, gutters and curbs within the public right-of-way.

- AE. Samples: Physical examples of materials, equipment, or workmanship that are representative of some portion of the work and which establish the Standards by which such portion of the work will be judged.
- AF. Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for the Contractor and submitted by the Contractor to illustrate some portion of the work.
- AG. Site: Lands or areas indicated in the Contract Documents as being furnished by the Owner upon which the work is to be performed, including lands or areas being developed by a private developer, and also including rights-of-way and easements for access thereto, and such other lands furnished by the Owner which are designated for the use of the Contractor.
- AH. Specifications: The part of the Contract Documents or Drawings consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the work and certain administrative details applicable thereto.
- AI. Subgrade: The surface of the roadbed on which the pavement structure, curb and gutter, and/or shoulders are constructed.
- AJ. Supplier: A manufacturer, fabricator, supplier, distributor, material man, or vendor having a direct contract with the Contractor or with any Subcontractor to furnish materials or equipment as specified on, or in, the approved Contract Documents, drawings, specifications, etc., to be incorporated in the work by the Contractor or any Subcontractor.
- AK. Surveyor: A licensed Professional Surveyor Registered in the State of Ohio responsible for the preparation and supervision of plats, easements, boundary surveys, construction staking, record drawings, etc.
- AD. Thru Lane: The portion of roadway for the thru movement of vehicles, exclusive of shoulders, turn lanes, curbs and gutters.
- AL. Turn Lanes: The portion of the roadway for the turning movement of vehicles, exclusive of shoulders, thru lanes, curbs and gutters.
- AM. Work: The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

1.3 General Plan Standards

- A. Preliminary plans, profiles, and supporting design data shall be submitted to the City Engineer of the City of Tiffin for consideration and approval before final construction plans are prepared for any Public Works Improvement project.
 - 1. Approval constitutes neither expressed nor implied warranties as to the fitness, accuracy, or sufficiency of plans, designs or specifications.
- B. Submittals can be made by either paper or electronic format or as determined by the City Engineer.
- C. All drawings are to be prepared on standard size sheets;
 - 1. 8 ½"x 11+
 - 2. 11"x 17+
 - 3. 18"x 24+
 - 4. 24"x 36+
 - 5. 36"x 48+

1.4 Plan Revisions

Upon obtaining approval from the City Engineer, no changes or revisions shall be made to the approved plans; nor shall any field changes be made until permission has been granted by the City Engineer.

1.5 Shop Drawings

In order for the City to determine conformance with information given in the Drawings and Specifications and compatibility with the design concept of the project as a functioning whole as indicated by the Drawing and Specifications, the Contractor shall cause to be prepared and shall submit to the City Engineer, at their discretion, detail drawings for each product, material, etc., to be used within a project.

1.6 Record (As-Built) Drawings

In order for the City to maintain accurate records of city maintained infrastructure, the City Engineer may require Record ~~%~~As-Built Drawings for any public or private Public Works Improvement project. If As-Built Drawings are required for a particular project, the contractor shall be responsible for maintaining Record ~~%~~As-Built Drawings throughout the duration of the project and shall submit record drawings to the City Engineer within 30 days of the completion of the project. The City Engineer will have the discretion of determining the format of the submitted record drawings.

1.7 Permitting

The Contractor shall be responsible for obtaining and paying for all permits required for the project.

1.8 Utility Locates

The Contractor must alert the Ohio Utility Protection Services (OUPS) at least 48 hours before any excavation at 8-1-1 or 1-800-362-2764.

1.9 Safety

- A. It is the responsibility of the contractor to be familiar with all applicable Federal, State and Local safety regulations.
- B. Any excavation shall comply with regulations specified in Section 902.04 ~~%~~Barriers and Warning Lights+of the City of Tiffin Codified Ordinances.

1.10 Traffic Control

- A. Approval must be obtained from the City prior to the closure of a vehicular lane of travel of any street or alley, any on-street parking space or public access pedestrian route such as a sidewalk or multi-use trail.
- B. All traffic control must comply with provisions contained in the OMUTCD. Signs must be in good condition and all wording must be clearly legible. Signs must be placed in such a way that they can be easily seen by affected traffic. Directions provided on signs must be complete and accurate. Detours created by road closures must be clearly marked. Whenever a road is reduced to one lane, traffic control must be maintained with a flag person at each end of the lane reduction and the flag person shall conform will all minimum OSHA provisions.

1.11 Monuments & Property Pins

The Contractor shall, prior to actual construction, erect protective barricades around all visible survey monuments that are in or adjacent to the construction area. Whenever a monument or property corner stake, pin or marker discovered or uncovered during progress of work, the contractor shall immediately notify the City Engineer and said monument shall be protected from damage or loss. Any survey monument, property corner, property pin, right-of-way pin, or other marker damaged or destroyed shall be replaced by a Licensed Professional Surveyor in the State of Ohio at the cost of the damaging party unless circumstances surrounding the damage suggest further negotiation.

1.12 Environmental Controls

- A. The Contractor shall provide and maintain methods, equipment, and temporary construction as necessary to provide controls over environmental conditions. All environmental controls shall be in accordance with applicable Federal, State, County and local laws, rules and regulations governing noise, dust, water quality, pollution and erosion and sediment control, and the requirements of these standards. In the event of a conflict between the requirements of these Standards and Federal, State, County and local laws, rules and regulations, the more restrictive shall apply.
- B. The Contractor shall immediately notify the City if suspected hazardous material or any other material that may create a health risk is discovered on site.

1.13 Haul Routes

All haul routes shall be approved by the City prior to commencement of the project.

1.14 Inspections & Stop Work Notices

- A. The City has the right to inspect any public or private Public Works Infrastructure project at any time.
- B. The City has the authority to stop work on the project, or any part thereof, if necessary to secure compliance with the plans, or City regulations or Ordinances. This shall not give the owner, subdivider, developer, or contractor any claim for damages against the City.

1.15 Excavation/Embankment . General Notes

- A. Nuclear compaction testing shall be required for all fill areas over 2 feet in depth, at 6+lifts per ASTM A-1557, 95% modified proctor unless otherwise approved by the City Engineer.
- B. All proposed slopes of 3:1 or steeper and all earthen drainage ways shall receive Jute or Excelsior matting as per ODOT 667 or 668.

1.16 Post-Construction

- A. At the conclusion of all work, the Contractor shall cleanup all rubbish and foreign materials and leave all areas of work in a condition at least as good as existed prior to construction activities, or as approved by the City.
- B. All disturbed areas shall receive 4+of topsoil and be seeded and mulched as directed by the City.

SECTION 2
SANITARY SEWERS

Section 2 – Sanitary Sewers

2.1 Materials

A. Gravity Sewers

1. Requirements

- a. Acceptable pipe materials shall have a minimum hydrostatic design basis (HDB) of 4000.
 1. High density polyethylene (HDPE) pipe, corrugated pipe and/or open profile pipe materials shall not be acceptable.
- b. The manufacturer shall furnish an affidavit indicating that the pipe, fittings and appurtenances have been manufactured and tested in accordance with the requirements of the applicable referenced standards.

2. PVC Plastic Pipe & Fittings

- a. PVC plastic pipe and fittings shall have a minimum pipe stiffness of 46 psi at 5% deflection when tested in accordance with ASTM D2412, and, as applicable for the sizes involved, shall be the requirements of ASTM D3034, ASTM F679 (T-1 wall), or ASTM F1803. The pipe shall be of the elastomeric gasket joint (integral bell) type. Joints shall provide a watertight seal and shall be made in accordance with the pipe manufacturer's instructions. Joints shall be of the push-on type meeting the requirements of ASTM D3212, and, in addition, the bell shall be designed to retain the gasket to prevent pull-out during the making of the joint.
- b. PVC plastic fittings for use with ASTM D3034 pipe 8+in size and smaller shall meet the requirements of ASTM D3034 with a minimum wall thickness of SDR 35 and shall be molded in one piece with elastomeric joints and minimum socket depths. PVC material shall have a cell classification of 12454-B or C as defined in ASTM D1784. Gaskets shall have minimum cross sectional area of 0.20 sq. in. and shall meet the requirements of ASTM F477.
- c. PVC plastic fittings for use with ASTM D3034 pipe 10+in size or larger, and for use with all sizes of PVC plastic pipes other than ASTM D3034 shall be molded or

fabricated in accordance with, and have joints meeting the requirements of the ASTM Standard as specified for the pipe.

- d. At the end of all fittings, premanufactured tees, the final fitting at the plug shall be SDR 35 compatible. Non-compatible joints shall be made to existing pipe using banded neoprene couplings as manufactured by Fernco, Inc. or equivalent as determined by the City Engineer.
- e. The pipe shall be installed in accordance with ASTM D2321, and with the requirements of these specifications. Any requirements in these specifications which may be in conflict or inconsistent with the requirements of ASTM D2321 shall be void to the extent of such conflict or inconsistency.

3. Concrete Pipe & Fittings

- a. Concrete pipe and fittings shall be of the spigot and socket pattern meeting the requirements of ASTM C76 and shall be Class IV or V. Pipes shall be of the greatest lengths commercially available. Circular pipes having elliptical reinforcing shall have the word "Top" or "Bottom" clearly stenciled on the inside of the pipe at the correct place to indicate the proper position when laid. Joints shall be of the rubber gasket type meeting the requirements of ASTM C443. The gasket shall be confined in a groove and shall be installed in accordance with the manufacturer's instructions.
- b. Interior of concrete pipes shall be lined with an epoxy coating to protect the pipe from attack by hydrogen sulfide gas and other corrosive elements common in sanitary sewers.
- c. Branches on fittings in the main line for connections shall be of the same material as the pipe which will be connected. The branches shall be cast with the concrete pipe by the pipe manufacturer and shall not be done in the field. The joint in the branch shall be as specified for the respective type of pipe.

B. Force Mains

1. Requirements

- a. All force mains shall be constructed of ductile iron pipe, PVC pipe, or material approved by City Engineer.
- b. The manufacturer shall furnish an affidavit indicating that all pipe, fittings and appurtenances have been manufactured and tested in accordance with the requirements of the applicable referenced standards.

2. Ductile Iron Pipe & Fittings

- a. Ductile iron pipe shall be designed in accordance with AWWA C150 and manufactured in accordance with AWWA C151 and shall be Thickness Class 52. The pipe shall be of the push-on joint or mechanical joint type, with joints within the lengths noted on the drawings to be restrained type joints. Restrained joint lengths shall meet Ductile Iron Pipe Research Association (DIPRA) minimum lengths recommended. All pipe shall be coated with a bituminous material on the outside and shall be cement mortar lined by the factory in accordance with AWWA C104. Pipe shall be furnished in minimum 18 foot lengths unless otherwise specified.
- b. Fittings shall be of ductile iron, shall conform to AWWA C153, and shall be factory coated and lined and have joints as specified for the pipe
- c. Mechanical joints and push-ons shall be in accordance with AWWA C111, incorporating rubber gaskets. With push-on joints, the surfaces to be in contact with the rubber gasket shall be wiped clean and dry just prior to making the joint and, when making the joint, a lubricant shall be used in accordance with the manufacturer's recommendations. With mechanical joints, the surfaces to be in contact with rubber gasket shall be brushed with soapy water to remove all sand and grit just prior to making the joint.
- d. Restrained push-on joints shall be completely boltless and shall be Clow Super-Lock, American Flex-Ring, or U.S. Pipe TR Flex, or equivalent as determined by the City Engineer. Field-loc gaskets may be used, as approved by the City Engineer. Restrained mechanical joints shall be of

the pipe manufacturer's standard design, or shall be MEGALUG as manufactured by EBAA Iron, Inc., or equal, of ductile iron and with a working pressure of at least 250 psi and a minimum safety factor of 2:1.

- e. Whenever it is necessary to cut the pipe at fittings, valves, specials, or elsewhere, the remaining portions may be used where possible to minimize the number of scrap pieces when the project is complete; however, scrap pieces less than 5 feet shall not be used. Cut pieces of pipe shall be beveled to the manufacturer's specifications.

3. PVC Pipe and Ductile Iron Fittings

- a. Molecularly oriented polyvinyl chloride (PVC) shall be designed in accordance with AWWA C909, pressure class 200 for 4+through 12+diameter. The pipe shall be push-on joint type with integral wall-thickened bell ends incorporating an elastomeric gasket. It shall have a cast iron equivalent outside diameter (CIOD) and be furnished in nominal 20 foot laying lengths.
- b. Joints within the lengths noted on drawings to be restrained type joints shall be MEGALUG or retainers as manufactured by EBAA Iron, Inc., or as approved, of ductile iron and with a working pressure at least equal to that of the PVC pipe on which it is to be installed, and a minimum safety factor of 2:1.
- c. Fittings shall be of ductile iron, shall conform to AWWA C153, and shall be coated and lined and have joints as specified for the ductile iron pipe and fittings.
- d. Tracer tape shall be installed over non-metallic force mains including service lines per ODOT Item 638.
 - 1. Tracer wire shall be installed along the top of all non-metallic force mains and shall be #6 AWG copper wire with RHW-2 insulation and shall be strung continuously along the force main. Splices in tracer wire shall be made with shrink type, butt-end electrical connectors. The tracer wire shall be connected to each valve box. At each valve box, the tracer wire shall be placed outside of the valve box and then enter the valve box through a hole

drilled by the contractor approximately 8" below the top of the valve box.

C. Polyethylene Encasement

Ductile iron pipe, fittings and appurtenances shall be field wrapped with a minimum 8-mil thick polyethylene tube meeting the requirements of AWWA C105 as directed by the City. Installation shall be in accordance with Method A and the instructions of the manufacturer. All overlaps and seams shall be completely taped. All rips, punctures and other damage to the polyethylene shall be acceptably repaired. Tape shall be 2" wide plastic backed adhesive tape which will bond securely to both metal surfaces and the polyethylene film.

D. Pipe Insulation

1. Provide minimum 1" cellular glass insulation with an aluminum jacket; adequate to prevent freezing at 0 degrees Fahrenheit, suitable for burial. Insulation shall be FOMGLAS by Pittsburgh Corning Corporation or approved equivalent by the City Engineer.
2. Provide insulation in any area where the depth of cover, horizontal on slopes or vertical, is less than or equal to 36" for force mains and/or pumping station piping. Install pipe insulation and jacketing per manufacturer's recommendations, and to prevent entry of water between pipe and insulation.

E. Steel Encasement Pipe

1. When the pipe is to be installed within welded steel encasement pipe, the encasement pipe shall meet the requirements of ASTM A139, Grade B, and shall be bituminous coated on the outside. Any coating applied in the field shall be applied a minimum 48 hours prior to installation. The encasement pipe diameter shall be 4" larger than the diameter of the pipe bell, rounded up to the next nominal pipe size. The minimum wall thickness of the encasement pipe shall be 0.375" and is based on the steel pipe having a minimum tensile strength of 60,000 psi and minimum yield strength of 35,000 psi. The wall thickness shall be adjusted as necessary for other grades of pipe. All joints shall be fully welded on the circumference.
2. The encasement pipe shall be installed by boring and jacking and in such a manner so as to allow the pipe to be laid at the grade shown. This shall include both horizontal and vertical control methods as approved by the City. Control methods shall permit location of and realignment of the cutting heads at all times during

installation. Boring and jacking operations shall be continuous. The pipe shall be blocked in place within the encasement pipe to prevent shifting or flotation. The ends of the encasement pipe shall be blocked up in such a way as to prevent the entrance of foreign material, but allowing leakage to pass in the event of same within the encasement pipe.

3. Blocking shall be accomplished using wood blocks or approved casing chocks. Wood blocking shall be of hardwood lumber. Banding straps for holding the wood blocks in place shall be stainless steel. Casing chocks shall be of polyethylene or stainless steel with a liner and UHMW polymer plastic runners, shall be as manufactured by Power Seal Pipeline Products Corporation, Cascade Waterworks Manufacturing Company, Advance Products & Systems, Inc., or approved equal by the City Engineer, and shall be installed in accordance with the manufacturer's instructions. Blocking shall be notched to secure banding to blocking without slipping off. Two sets of blocks or chocks shall be used per pipe segment.
4. Steel encased pipe crossing the right-of-ways of others shall comply to the most restrictive jurisdictional regulations.

F. Manholes

1. Manholes shall be constructed of precast reinforced concrete sections and appurtenances meeting the requirements of ASTM C478, except when a modification is approved, and shall be complete with required sewer stubs. Manholes shall have minimum 48+ inside diameter or larger as recommended by the manufacturer. An affidavit from the manufacturer shall be provided stating that the manhole is appropriately sized for the sizes and angles of incoming pipes.
2. The City may require anti-flotation pads for manholes upon review of the required soil borings
3. The City may require a sampling manhole for industrial and commercial facilities to be located prior to connection to City sewers.
4. Bases shall be constructed in two pours or monolithically with bottom reinforcement tied to side reinforcement to form an integral structure. Bases shall have a minimum thickness of 8+
5. Bases shall incorporate provisions for making a flexible joint between the pipe and the manhole for all pipe connections.

Flexible joints shall be Press Wedge II as manufactured by Press Seal Gasket Corporation; Kor-N-Seal as manufactured by National Pollution Control Systems, Inc.; A-LOK as manufactured by A-LOK Products Corporation, or equivalent as approved by the City Engineer. Flexible joints shall be shock absorbent and shear resistant; shall be designed to prevent any direct contact between the pipe and manhole; and shall provide a tight, infiltration proof sewer connection with the pipe deflected up to 10 degrees in any direction. Should incorporation of the flexible joints require a base I.D. greater than required for the wall sections, the Contractor shall furnish and install the larger base and an approved precast reinforced concrete transition section to go from the larger base to the wall sections.

6. Joints between bases and wall sections shall be as subsequently specified for the walls.
7. If not integrally cast with the base, after installation of the pipes provide an ODOT Class F concrete invert through the manhole. The invert shall have a depth through the manhole equal to one half of the diameter of the sewer pipe and shall slope upward toward the manhole walls approximately 3+. Concrete shall be trowelled smooth, and shall be placed so as not to interfere with the flexibility of the joint.
8. Drop pipes shall be included in the invert and shall not discharge on the slope portion.
9. Bases shall be set plumb and at the proper elevation on a cushion of compacted ODOT #57 crushed limestone.
10. Walls shall be vertical precast concrete riser sections meeting the requirements of ASTM C478. The top section shall be an eccentric cone narrowing down to an I.D. of not less than 24+clear and an O.D. of not less than that of the subsequently specified grade rings. No pipes shall enter the cone section. Manholes too shallow to accommodate a cone section shall have a reinforced flat slab top. Flat slab tops shall be designed to withstand H-20 traffic loading.
11. Adjoining riser sections shall be firmly keyed together by means of tongue and groove joints with rubber gaskets meeting the requirements of ASTM C443. In addition, preformed plastic gasket material shall be provided on the outside shoulder of all joints. Installation of the gasket material shall not interfere with the proper sealing of the gasket. The preformed gasket material

shall meet the requirements of Federal Specifications SS-S-210A and shall be as manufactured by Hamilton-Kent Manufacturing Company; K.T. Snyder Company, Inc.; or equivalent as approved by the City Engineer.

12. Each manhole frame shall be set at the proper elevation by use of precast concrete grade rings. The rings shall be provided for a minimum height of 4+ and shall not exceed 12+ in height. Rings, unless otherwise subsequently specified, shall have an I.D. equal to the access opening in the manhole top section, and an O.D. not less than the O.D. of the manhole frame. The rings shall each be set in a full bed of mortar composed of 1 part, by volume, Portland cement and 2 parts clean, hard sand. The interior of the grade rings shall be mortared to provide a smooth common surface from frame to top.
13. When the manhole frame is to be anchored to the manhole top, the top section and grade rings shall have four 1+ diameter holes located to match the holes in the casting and shall be of such dimensions as to provide a minimum 2+ concrete cover for the 1+ diameter holes. Holes in the top section shall extend at least 6+ into the concrete. Holes shall not be made in the field.
14. Any manhole requiring adjusting grade rings shall also have external manhole chimney seals installed per the manufacturer's recommendations. Chimney seals shall be manufactured by Crotex Specialty Products or equivalent as approved by the City Engineer.
15. Steps shall be provided in manholes, if shown on the standard detail. Steps shall meet the requirements of ASTM C478 and shall be of reinforced polypropylene. Installation of manholes, when in pavement, shall be such that the steps are in the center of a traffic lane or between lanes where possible, and, when outside pavement, shall be such that steps are located away from the pavement edge unless the manhole is within a ditch line, in which case they should be located at the high side of the ditch slope. Reinforced polypropylene steps shall consist of a ½+ steel reinforcing rod encapsulated in a copolymer polypropylene plastic and shall incorporate a notched tread ridge and retainer lugs on each side of the tread ridge. The steel rod shall be continuous through the entire length of legs and tread. Steps of the press fit type driven into the concrete wall shall have a pullout resistance of not less than 1,500 pounds per leg.

16. Where noted, pipe sewer stubs shall be provided at manholes for future sewer connections. The stubs shall be of the same type and material as being provided on the project for the respective sizes of pipe, shall be a minimum 24-in length outside the manhole wall, and shall terminate with a full pipe bell. The end of each stub shall be provided with a pipe stopper (plug) specifically designed for use with the pipe. Plugs shall be for permanent or temporary use, shall be watertight, and shall be removable without damaging the pipe.

G. Frames and Covers

1. All frames and covers shall be heavy duty gray iron castings conforming to ASTM A48. Both the underside of the cover and the upper surface of the ledge upon which it rests shall be factory-machined so as to prevent rocking on its supporting surface. All castings shall be cleaned and factory coated with asphalt paint prior to installation and, after installation, the tops of frames and covers shall be given an additional coat of asphalt paint. Asphalt paint shall be water based, non-toxic, non-flammable, and odorless asphalt emulsion that dries to a hard, black gloss finish.
2. The frames shall have a clear opening of not less than 24-in diameter and a height of not less than 7-in. Covers shall have the words "Sanitary Sewer" cast into the top. No frame cover shall weigh less than 375 pounds.
 - a. See Exhibit A
3. Standard frames and covers shall be East Jordan Iron Works 1040A with Type A solid cover or equivalent as approved by the City Engineer.
 - b. See Exhibit B
4. Gasketed frames and covers shall be East Jordan Iron Works 1040AGS with Type A solid cover, or equivalent as approved by the City Engineer, with the cover having a factory installed gasket seal with no open pickholes.
 - c. See Exhibit C
5. Frames shall have four equally spaced anchor bolt holes in the base flange and shall be anchored to the manhole top. Anchors shall be 3/4-in diameter all-thread rods, and each shall be complete with washer and nut for holding down the frame. Anchors shall be of a length to extend through the grade rings and to the bottom of

the hole in the manhole top, and allow for at least the length of one nut to protrude through the nut when tightened. The anchors shall be set with the entire annular space around the rods filled with epoxy from the top of the rings to the bottom of the hole in the manhole top. The epoxy shall be 100%, 2-part, with a minimum compressive strength of 5,000 psi, and shall be Rawl/Sika Foil-Fast Injection Gel System by the Rawl/Plug Company, Inc., or equivalent as approved by the City Engineer. After the epoxy has cured, the frame shall be bolted in place.

6. The manhole frames shall be firmly set on top of the adjusting rings with a full level bed of 1:1 cement mortar. Where manholes are located in paved areas, the surface of the cover shall be made flush with the pavement surface. In unpaved streets and alley areas, the cover shall be set to not exceed 1" above the ground surface. On right-of-way and in ditches the cover elevation shall be approved by the City Engineer.
7. After a manhole frame is installed in its final position, it shall be encased in Class C concrete. The concrete encasement shall extend from a horizontal plane 4" below the lowest adjusting ring up to a horizontal plane through the mid-point of the frame in grass areas, and up to the top of the frame in all other areas. The concrete encasement shall be made circular, using a minimum 48" diameter steel casing ring as a form, and shall be centered on the frame.

H. Drop Connections

1. Drop connections shall be constructed at all points where one gravity sewer intersects another and the difference in invert elevations exceeds 24" or where it is required to keep the velocity of flow in the sewer less than 10 feet per second. The drop connections shall consist of a tee at the upper end connected into the manhole, a vertical section of pipe, and 90 degree bend at the lower end connected into the manhole at the lowest pipe invert, the whole encased in concrete. The pipe and fittings shall be of the same as used for the main sewer. The diameter of the drop connection shall be two sizes smaller than the main sewer, but in no case shall it be less than 8". Provide an approved removable watertight plug in the upstream end of the tee, when not immediately connected to a sewer. Drop connections may be integral precast manhole sections constructed in accordance with ASTM C478 with joints in accordance with ASTM C443. The drop shall incorporate a PVC liner with cast in place monolithic rubber

joints. Precast sections shall be as manufactured by Dura-Crete, Inc., or approved equivalent by the City Engineer.

2. Drop connections to connect a new sewer to an existing manhole may be an inside drop, constructed of the same material as the sewers. All other drop connections shall be outside of the structures.

I. Air Release Valves and Manholes

1. An air release valve shall be installed in a manhole, and shall be screw connected into a tapped blind flange on an appropriate fitting in the main line with required lengths of stainless steel pipe and fittings.
2. Air release valves shall be installed at high points in the main to permit the release of air when the main is being filled and during service by manually opening the valve. The valve shall be a 2" ball valve and shall be installed so as to permit use without entering the manhole. Provisions shall be made for adding an automatic air release valve as may be needed in the future.
3. Manholes shall be provided with a removable top slab constructed of Class C reinforced concrete. The top slab shall have 2" diameter lifting holes, filled with mastic to prevent the entry of dirt, or approved lifting rings, and a cast iron manhole frame and cover. Covers shall have the same visual appearance as shown in Exhibits A-C.

J. Wastewater Pumping Stations

Unless an alternative measure is approved by the City of Tiffin, all wastewater pumping stations shall be duplex, submersible type stations with a separate wet well and valve vault, panel board, alarms and appurtenances as specified herein.

4. Supports

- a. Provide Class C concrete piers and beams to support piping entering and piping leaving the wet well and valve vault and within the valve vault.
- b. Supports shall include grout where required.
- c. This shall also include the furnishing and installation of supports for beams, pipes, etc. All supports shall be aluminum. All hardware shall be stainless steel.

2. Wet Well

- a. The bottom slab and the top slab shall be of ODOT Class C air-entrained concrete. Walls shall be constructed of precast reinforced concrete sections meeting the requirements of ASTM C478. Adjoining rings shall be firmly keyed together by means of approved tongue and groove joints with $\frac{1}{2}$ "-ring gaskets meeting the requirements of ASTM C443. Provide ODOT Class F concrete fill in the bottom of the wet well.
- b. Wall shall incorporate flexible joints for influent sewers. Flexible joints shall be as manufactured by Press Seal Gasket Corporation, A-LOK Products Corporation, or approved equivalent by the City Engineer. Flexible joints shall be shock absorbent and shear resistant; shall be designed to prevent any direct contact between the pipe and manhole; and shall provide a tight, infiltration proof sewer connection with the pipe deflected up to 10 degrees in any direction.
- c. Provide a 4"-diameter Class 50 ductile iron vent pipe and required wall casting in the top slab. The outlet of the vent shall be provided with a No. 2 mesh, 0.063"-diameter bronze wire screen mechanically held in place between two flanges. Vent shall be painted with two coats of epoxy paint.

3. Valve Vault

- a. The valve vault shall be of precast reinforced concrete construction and shall be designed for an AASHTO H-20 traffic load and a minimum lateral earth pressure of 60 psf per foot of depth. Concrete shall be air-entrained and have a 5,000 psi minimum 28 day compressive strength. Design calculations for the vault shall be submitted to the City upon request. The calculations must bear the seal of a professional engineer registered in the State of Ohio.
- b. The top slab shall have a floor door. The floor door shall be as subsequently specified as described in the ~~5"~~ Floor Doors and Pump Guides Section+, except it shall be insulated with 1"-thick glass fiber, fully covered with 18 gage aluminum sheet and the upper guide holder, cable holders, and hook are not required.

- c. Provide a vent pipe in the top slab. Vent shall be 6+ diameter and the bronze wire screen shall be No. 8 mesh, 0.032+diameter.
- d. Provide manhole steps where shown, including those designated as grab bars. Manhole steps shall be of the drop-front design, with non-skid grooves and a minimum 2+ vertical hook on the embedded ends, and shall be made of reinforced polypropylene meeting the requirements of ASTM C-478.
- e. The underside of the top slab and for a minimum of two feet below grade on each of the side walls inside the valve chamber shall be insulated with a dense semi-rigid insulation board. The insulation board shall have a minimum aged R value of 6.3, and shall consist of a glass fiber reinforced polyisocyanurate foam core with a reflective foil facing on the back side and a white coated embossed aluminum sheet laminated over foil on the interior face.
- f. Insulation shall comply with the requirements of Federal Specification HH-1-1972/1, Class 2, shall be Factory Mutual approved for exposed interior insulation and shall be Thermax Plus Liner Panel 665 as manufactured by the Celotex Corporation, or approved equivalent.
- g. The insulation boards shall be installed by the use of male and female PVC $\frac{1}{2}$ +strips and, in addition, shall be secured by the use of an adhesive compatible with the insulation and the surface being adhered to, all in strict accordance with the manufacturer's instructions. This shall include the furnishing and installation of a collar a minimum 14 gauge aluminum for protection of the insulation at the floor door opening.
- h. Provide a 20A-Duplex, GFCI explosion proof receptacle in the valve vault for use for blowers, heaters, etc. Connect to a 20A circuit breaker in the control panel.

4. Pumps

a. Wastewater Pumps

- 1. Shall be non-clog, completely submersible, integral pump/motor units designed for handling raw, unscreened sewage, and shall be complete with

access frames (floor doors) and pultruded pump guide rail.

b. Grinder Pumps

1. Where approved by the City shall be explosion-proof and one spare pump shall be furnished and delivered to the City.
2. Shall have metal data plates containing the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity and head rating, frame and bearing numbers, and other pertinent data as applicable to the type of pump shall be mechanically attached to each pump.

c. Operating Conditions

1. The pumps shall be designed for both intermittent and continuous 24 hours per day operation. Pump efficiencies must be acceptable to the City. The motors shall be capable of sustaining a minimum of 10 starts per hour.

d. The design shall be such that the pumps will be automatically connected to the discharge piping when they are lowered into place on a discharge connection, and shall be easily removable for inspection or service, requiring no bolts or nuts to remove, or the need for any personnel to enter into the wet well. Each pump shall be provided with a stainless steel lifting cable or stainless steel lifting chain of adequate strength and sufficient length to permit raising the pump for inspection and removal.

e. The pump and motor casings and impellers shall be of cast iron. Shafts and all external bolts and nuts shall be of stainless steel. Replaceable wear rings designed for abrasion resistance shall be installed at the inlet of the pump to provide protection against wear to the impeller. Impellers shall be of non-clog design, capable of passing solids, fibrous material, and heavy sludge. Solids handling capacity must be acceptable to the City. Bearings shall be prelubricated.

f. Motor internals shall be separated from pump end by an oil filled chamber with upper and lower mechanical seals.

Seals shall require neither routine maintenance nor adjustment, and shall be replaceable.

- g. Units shall have an approved sewage resistant coating.
- h. A sliding guide bracket shall be an integral part of each pumping unit and the pump casing shall have a mating connecting flange to connect with the discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump connecting flange without the need of any bolts or nuts.
- i. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided to and pressing tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the sump. No rotary motion of the pump shall be required for sealing.
- j. **Motors**
 - 1. Motors shall be housed in a dielectric oil-filled watertight casing, shall have moisture resistant Class F insulated windings, and shall be NEMA Design B. The motors shall be Class I, Division I, Group D rated for explosion proof service. Motors shall have a 1.15 service factor, and shall be capable of operating on 240 volt, three phase, 3-wire, 60 hertz electrical service, or as approved by the City. Motors shall have voltage tolerances of +10% and -14% of nameplate value and shall have cooling characteristics suitable to permit continuous operation in a totally submerged condition. Each unit shall be complete with sufficient UL approved Type SO four conductor electrical cable to run unspliced from the motor to the control panel.
 - 2. Each motor shall be supplied with two heat sensing units attached to the motor winding which shall trip the starter and provide indication in the event of motor overheat. Pumps shall be provided with seal chambers fitted with an electrode probe and signal box to indicate when water is present in the seal chamber. This shall also trip the starter. Heat sensing units and seal chamber probes shall be

provided with sufficient cable to run unspliced from the pumping unit to the appropriate point of connection provided herewith.

3. Motor power cable, motor heat sensing unit cable, and seal chamber cable for each pump shall be bundled together with plastic (nylon) tie wraps at 2q intervals over the entire length of the control panel. Signal conductors shall be in separate cable from power conductors. All cables shall be provided with strain relief at point of entry.

k. Pump Tests

1. The pump manufacturer shall perform the following tests on each pump before shipment from the factory:
 - A motor and cable insulation test for moisture content and insulation defects.
 - Prior to submergence, the pump shall be run dry and checked for correct rotation and mechanical integrity.
 - Pump shall be run for 30 minutes in a submerged condition, minimum 6 feet under water.
 - After operational test, insulation test shall be ran again.
 - A written certified test report giving the above information shall be supplied with each pump at the time of shipment.
2. Each pump shall be subjected to a non-witnessed certified Hydraulic Institute performance test as follows:
 - The pump shall be tested at the design point as well as at least 7 other points to develop a curve. Data shall be collected to plot the

head-capacity curve as well as a KW input and amperage curve.

- In making the tests, no minus tolerance or margin shall be allowed with respect to capacity, total head, or efficiency at the specified design condition. Pump shall be held within a tolerance of +10% of rated capacity or at a rated capacity with a tolerance of +5% of rated head. The pump shall be tested at the shut-off but shall not be plotted and only used as a reference point when plotting the performance curve.
- Complete records shall be kept of all information relevant to the test as well as the manufacturer's seal number, type and size of pump, and any impeller modifications made to meet the design conditions.
- A written test report shall be prepared, signed and dated by the test engineer incorporating three curves (head-capacity, KW input, and amperage) along with the pump serial number, test number, date, speed, volts, phase, and impeller diameter, and the report submitted to the Engineer.

3. After testing, all ends of pump cables shall be sealed with a high quality protective covering to make them impervious to moisture or water seepage prior to electrical installation.

I. Floor Doors and Pump Guides

1. Floor doors shall be of aluminum construction and shall be complete with upper guide holder, required cable holders, and lifting cable/chain hook. The frame shall be securely anchored in the slab.

2. Floor door shall be of the slush type and built to withstand a live load of 150 psf. The frame shall be of 1/4" extruded aluminum, with built-in neoprene cushion, and shall be provided with anchors. Door leafs shall be 1/4" aluminum diamond plate reinforced with aluminum stiffeners as required. Each leaf shall open to 90 degrees and automatically lock with a stainless steel hold open arm with an aluminum or stainless steel release handle. A stainless steel hasp and staple shall be provided for padlocking. Unit shall have a mill finish, with a bituminous coating applied to the exterior of the frame by the manufacturer. Lifting handle, hinges, and all fastening hardware shall be stainless steel. The floor door shall be as manufactured by Bilco Company, Halliday Products, or approved equivalent by the City Engineer.
3. Each pumping unit shall be complete with required pump guides and mounting hardware for raising and lowering the units. Pump guides shall be a pultruded I-beam rail, and shall extend from the lower guide holders integral with the pump discharge connection to upper guide holders mounted at the access opening. Pump guides shall not support any portion of the weight of the pumps, and shall provide for proper seating alignment. Follow manufacturer's installation instructions.

m. Piping

1. Piping includes the following, each with required pipe, fittings, valves, and appurtenances:
 - Wastewater pump ductile iron discharge piping to and including the connection to the force main.
 - Valve vault PVC plastic drain piping to the wet well.
2. Installation of buried piping shall be in accordance with all applicable requirements.

3. Unless otherwise specified or shown, all valves 2+ diameter and smaller, except check valves, shall be ball valves. All valves 3+and larger, except check valves, shall be plug valves.
 4. Connections to equipment shall have unions to facilitate removal.
 5. Dielectric unions shall be provided when joining dissimilar metals.
 6. All pipe, fittings, valves and appurtenances shall be appropriately marked for purposes of identification. The materials and methods of manufacture, and the completed pipes, fittings, valves and appurtenances shall be subject to inspection and rejection at all times. The Owner and the City shall have the right to make inspections.
 7. The manufacturer shall furnish an affidavit indicating that the pipe, fittings, valves and appurtenances have been manufactured and tested in accordance with all requirements of the applicable referenced standards. A copy of the affidavit, indicating the Project on which the material is to be used, shall be forwarded to the City prior to construction.
- n. Wall Castings, Sleeves, Etc.
1. Furnish all wall castings, sleeves, inserts, cored openings, etc. necessary for installation of piping in this item and as otherwise required. Installation of items embedded in concrete shall be in accordance with the requirements of ODOT Item 604. For new construction, all items shall be in their proper location and elevation before the concrete and piping are placed. Boxing out of forms for later placement will not be permitted. All wall castings and sleeves shall have an intermediate wall collar (waterstop).
 2. For sleeves and cored openings in concrete, the opening between the pipe and sleeve or cored opening shall be sealed using ~~Link-Seal~~ modular mechanical type seals as manufactured by

Thunderline Corporation or equivalent. Installation shall be in strict accordance with the manufacturer's instructions and shall be such that bolt heads are accessible after installation.

3. Where piping is to pass through the walls of structures without a wall casting or sleeve, and the opening cannot be sealed using Link-Seal as determined by the City, the openings shall be carefully made at the proper locations, the pipes inserted, and the openings around the pipes neatly and permanently closed with a non-shrink and non-corrosive grout, and an approved caulk.

o. Ductile Iron Pipe and Fittings

1. Ductile iron pipe and fittings shall be used for wastewater pump discharge pressure pipe in the wet well and valve vault and shall be in accordance with the following requirements:

- All buried pipe shall have restrained joints.
- All exposed pipe shall be of the flanged joint type and shall be Thickness Class 52. Flanged joints shall be in accordance with AWWA C115, with flanges to be of ductile iron. Bolts, nuts and gaskets shall be in accordance with Appendix A of AWWA C115. Bolts and nuts shall be zinc plated. Bolts shall be of such length that, when nuts are completely tightened, not more than 1+ of the bolt, but at least the length of one full nut, shall be left protruded through the nuts. Flanged joints shall be completely tightened with all bolts taking equal stress.

p. PVC Plastic Pipe and Fittings

1. The 2+drain piping shall be of Schedule 40 PVC pipe meeting the requirements of ASTM D1785 and shall be complete with a 2+bronze check valve, 2+ trap and a 2+buried plug valve between the wet well and vault.
2. Check valve shall be a plastic ball check.

3. Plug valve shall be specified as follows;
 - Shall be complete with an extension stem and operating nut terminating 2 feet below ground surface and shall be provided with a valve box. Extension stem shall be centered in the valve box by approved stem guides. Provide a tee wrench 5 feet long.
4. Valve box shall be constructed of a good grade cast iron, shall be coated, shall be adjustable, shall have a 5-1/4" shaft, shall be of the three piece Buffalo pattern with close fittings parts and shall be provided with a heavy neat fitting cover having the word "SEWER" cast on the top of the cover. Valve box shall be of sufficient length for the depth as shown. Shaft shall be of the screw type with the bottom section covering the entire valve.

q. Plug Valves

1. Plug valves in wastewater pump discharge piping shall be of the non-lubricated eccentric type with resilient faced plugs and flanged ends. Flanges shall be faced and drilled to ANSI B16.1, Class 125 standard, except four bolt holes may be drilled and tapped.
2. Valve bodies shall be of ASTM A126 Class B cast iron. Bodies shall be furnished with 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contact only nickel. Screwed-in seats shall not be acceptable.
3. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with wastewater.

4. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF-8M for valves through 36+in size. Non-metallic bearings shall not be acceptable.
5. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.
6. Valve pressure ratings shall be 175 psi for valves through 12+in size. Each valve shall be given a hydrostatic and seat test.
7. Valves less than 6+in size shall have lever actuators.
8. Valves 6+and larger shall be equipped with gear actuators and handwheels. All gearing shall be enclosed in a semi-steel housing and suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.
9. Plug valves shall be manufactured by DeZurik.

r. Check Valves

1. Check valves in wastewater pump discharge piping shall be full flow, cast iron body, flanged ends, bronze mounted, full opening swing type, and shall comply with AWWA C508; and, in addition, shall be complete with outside lever and weight, and shall be suitable for installation in either horizontal or vertical position. Valve clapper shall swing completely clear of the waterway when valve is fully open, permitting a flow through the valve equal to

the nominal pipe diameter. Valves through 12+ shall be rated at 175 psi water working pressure. End connections shall be flanged conforming to ANSI B16.1, Class 125. Cast iron shall conform to ASTM A126, Class B. Clappers shall be all bronze for sizes through 4+, and cast iron bronze faced for sizes 6+and larger. Hinge pins shall be 18-8 stainless steel with bronze bushing and O-ring seals. Check valves shall be constructed to permit top entry for complete removal of internal components without removing the valve from the line, and shall be American-Flow Control, Kennedy Valve, or equivalent as approved by the City Engineer.

2. Ball check valves in valve vault drain piping shall be plastic ball check, and shall be rated for at least 150 psi. Valve shall be constructed of materials for use with PVC plastic pipe, shall be of the double union design which permits removal of the valve without disrupting the existing pipe and shall have socket, threaded or flanged ends. Valves shall be a true union ball check valve as manufactured by Chemtrol or equivalent as approved by the City Engineer.

s. Ball Valves

1. Ball valves shall be bronze, two piece body, chrome plated, brass ball, Teflon seats and stuffing box ring, with lever handle and balancing stops, solder or threaded ends with union; and shall be model S-216 as manufactured by Stockholm; or Model #S-587-70 or T-587070 as manufactured by Nibco or equivalent as approved by the City Engineer.

t. Pipe Couplings

1. Pipe couplings for ductile iron pipe shall be of the gasketed sleeve type and shall be of the proper diameter to fit the pipe. Each coupling shall consist of one steel middle ring, two steel followers, two rubber-compound wedge section gaskets and sufficient track-head steel bolts to properly compress the gaskets. Provide tie rods or other

positive means of restraint to prevent pipe separation at the coupling. Couplings shall be similar and equal to Dresser Style 38, and shall be as manufactured by Dresser Industries, Inc.; Smith-Blair, Inc.; or equal and shall be completely factory furnished.

2. Pipe couplings for PVC piping shall be threaded unions with Viton or EPDM O-rings.

u. Pump Controls

1. Pump controls shall include the furnishing of a pump control panel and float switches, as provided by Quality Controls, Inc., or equivalent as approved by the City Engineer.

2. Pumping Control Panel

- The pump control panel shall include all of the features as described herein. All equipment provided herein shall be heavy duty type. All components shall be factory mounted, wired, inspected, and tested.
- Control panel shall be designed for operation on 240 volt, three phase, 3-wire, 60 hertz service as required. Phase Sentry shall be provided.
- Control panel shall be a NEMA 4x reinforced fiberglass enclosure and shall be dead front, with hinged inside panel to protect electrical equipment. A lock hasp shall be provided on the outside of the door.
- Two 100 ampere circuit breakers rated for service entrance use shall be mounted inside the panel for serving as main disconnects of both the normal power and the emergency power. Both disconnects shall be mechanically interlocked so that closing of one circuit breaker will prevent the closing of the other.

- Instantaneous adjustable magnetic trip type circuit breakers shall be provided for protection of each motor.
- Lightning protection shall be provided on the main power conductors within the panel. Protection shall be Model TE/6XF as manufactured by Advanced Protection Technologies, or approved equivalent.
- NEMA size 2 magnetic starters with three ambient compensating overload relays for each pump motor. IEC rated starters are not acceptable. Provide one N.O. auxiliary contact from each overload relay, which shall close upon an overload condition. The alarm controls shall be wired to the master terminal strip. Auxiliary contacts shall be provided on the motor coil as necessary to meet the control requirements of this paragraph.
- Provide 120 VAC, single phase, 10 ampere circuit breakers for individual protection and disconnect means for 120 VAC non-control related loads. One circuit breaker shall be provided for each of the following loads:
 - * Thermostat strip heaters
 - * Internal panel light and control switch
 - * Radio Telemetry Panel
 - * 120 VAC receptacle, mounted internal to panel
- Provide a thermo-magnetic circuit breaker for protection and disconnect of the control circuit.
- Provide intrinsically safe control relays, as manufactured by Warwick Controls, for the connection of the float switches.

- Provide control circuitry designed to start and stop the pumps based on the wet well liquid level, utilizing float control. A lag pump shall start if the lead pump cannot keep up with inflow. If a pump is called to start, and the motor coil does not energize within 10 seconds of the start signal, the circuitry shall try the second pump. Control shall automatically alternate the pumps on each successful pump-down cycle.
- Three-position selector switch to select automatic alternation, Pump No. 1 or Pump No. 2. Select switch shall be mounted on the front of the inside panel door.
- Hand-Off-Auto selector switches for each motor starter.
- Low-level lockout float, to lockout both motors, regardless of whether operating in manual or automatic mode. Low level lockout shall be latching, and shall reset via a pushbutton or upon the well level reaching the pump start+float elevation (whichever occurs first). Low level alarm shall include a red pilot light on the front of the inside panel door for alarm indication, and a normally-open dry contact wired to the master terminal strip.
- Provide a moisture detection relay for seal failure alarm circuitry on each pump. Each moisture detection relay shall energize a 0-30 second adjustable time delay upon detection of moisture in the seal chamber. If the seal failure alarm is continuously present throughout the adjustable time period, an alarm shall latch and shall also energize a red pilot light. Each alarm shall be resettable via a pushbutton mounted on the front of the inside panel door. A N.O. dry contact from each lockout relay shall be wired to the master terminal strip.

- The circuitry shall accept a normally-closed dry contact from each motor winding for winding overheat monitoring. Each winding overheat contact shall energize a 2 second time delay relay via a normally-closed contact. This shall prevent false alarms due to race conditions between relays. If the winding overheat contact opens continuously for a two second time period, the alarm shall latch and lockout the overheated motor. Each alarm shall also energize a red pilot light. Each alarm shall be resettable via a pushbutton mounted on the front of the inside panel door. A.N.O. dry contact from each lockout circuit shall be wired to the master terminal strip. The dry contact shall not close until the two second time period has expired.
- Provide a green pilot light for each motor, to indicate when a motor coil is energized. Each pilot light shall be energized via an auxiliary motor contact.
- Wire one N.O. auxiliary motor contact from each motor coil to the master terminal strip.
- Provide an elapsed time meter for each motor, measuring in hours and tenths of hours running time. Each elapsed time meter shall be energized via an auxiliary motor contact.
- Provide a high-level float with a latching relay and red pilot light. High level alarm shall be resettable via a pushbutton. Alarm circuitry shall include a N.O. dry contact wired to the master terminal strip for remote monitoring. High level alarm shall also energize a lag pump.
- All pilot lights, pushbuttons, and selector switches shall be heavy duty, oil-tight type, and shall be mounted on the front of the inside panel door. Pilot lamps shall be rated for a minimum 10,000 hour life. All pilot

lights shall be push-to-test. Each device shall be identified with an engraved plastic nameplate fastened with stainless steel screws. Nameplates fastened only with adhesive backing are not acceptable.

- Two 250 W heating stripes wired in series, controlled via a thermostat to maintain an inside temperature of 50-70 degrees Fahrenheit. Thermostat shall include visible temperature settings and shall be Dayton Model 2E206, or equivalent. Strip heaters shall be Model 1212 as manufactured by Vulcan or equivalent. Silicone rubber/fiberglass stock heaters or cartridge type heaters are not acceptable.
- Fluorescent or incandescent light for interior panel illumination. Light shall energize via a limit switch whenever the inside door is opened.
- A common alarm contact for an outdoor alarm light. The common alarm contact shall consist of dry contacts from all alarms mentioned in this item wired in parallel. A test switch or pushbutton shall be provided for testing the light. Alarm light shall be Model 105 HISTR-N5 as manufactured by Edwards, or equivalent, and shall be mounted on the side of the panel. The light shall be provided complete with electronic strobe subassembly, flash tube, and red lexan lens.
- A 100 A, three-phase, four wire receptacle with angle adapter and back box shall be installed on the right side of the control panel. Crouse-Hinds Catalog Number AR1042-S22 with spring door, or equivalent.
- Provide a 1 KVA, 240 to 120 VAC transformer, fused on all ungrounded legs.
- Incoming and outgoing wire and cable shall be connected to a master numbered

terminal strip. Every wire leaving or entering a terminal shall have a permanent sleeve type wire maker. Include ten spare terminals for future termination. Include properly sized ground lug for termination of the ground wire.

- All equipment and components within panel shall have a permanently affixed tape on the device or on an adjacent surface which identifies the device.
- A placard shall be affixed to the inside surface of the access door of the panel. The placard shall display the connection legend and the circuit schematic. The schematic shall identify each wire, junction and termination with respect to corresponding terminals and connections in the panel. Devices and connections associated with, but exterior to, the panel shall be shown in phantom and appropriately identified. The schematic may be a miniature plasticized copy of the connection schematic furnished, if suitable for display.
- Shop drawings shall include complete catalog data for each item equipment used, including all circuit breakers, starters, overload, pilot lights, selector switches, pushbuttons, floats, light fixtures, receptacles, strip heater, thermostat, and enclosure. Control schematics shall be submitted in ladder logic form for the City's review. A front panel view shall also be submitted, showing all equipment mounted on the panel.
- Furnish and install galvanized steel posts, aluminum backplates and other miscellaneous mounting hardware as required to complete mounting and installations of the pump control panel. The aluminum backplate for mounting of the

radio telemetry panel shall be supplied and mounted by others. RTU shall be compatible with existing City equipment.

3. Float Switches

- Furnish and install five mechanical, micro-switch type float switches as herein specified. Float switches shall be ITT/Flygt Corporation Model ENM-10, Warrick Controls Series M, or equal. Each float switch shall be furnished with 30 feet of unspliced cable to run from the float switch elevation to a junction box.
- Provide two spare floats with 30 feet of cable. Spare floats shall be delivered to the Owner.
- Floats shall be mounted on a 3/8 inch diameter nylon rope. The wire rope shall be attached at the top of the wet well and shall extend down to within 6+of the bottom of the well (without touching), and shall be terminated with an eight pound PVC coated anchor, provided wherewith. Anchor shall be attached with stainless steel hardware. Floats shall be easily accessible from the access hatch for cleaning and replacement.
- The float switches and float switch wiring shall be attached to the cable by means of plastic tie wraps, in such a way as to be field adjustable.

v. Standby Power

1. Based upon the pump data to be submitted to the City, the City will determine if portable standby power or permanent standby power is required. If portable standby power is required, an existing City-owned generator will supply power to the pump station in the event of a power failure. The pump station electrical power configuration including the generator receptacle shall be compatible for connecting the City's portable

generator. The pump station's electrical configuration, receptacle, transfer switch, and all appurtenances shall be sized to operate all aspects of the pumping station. The receptacle shall be located to provide easy access for the portable generator. If permanent standby power is required, Contractor or developer shall supply the permanent standby generator in accordance with the current Ten States Standards requirements. Permanent standby generators shall be sized to operate all aspects of the pumping station; shall be housed in pump station buildings and shall be submitted to the City for review and approval.

w. Building and Appurtenances

1. For all pumping stations which require permanent standby power and for other pumping stations deemed applicable by the City, a building adequately sized ventilated and powered, as submitted by the contractor or developer, and as approved by the City, shall be provided to house the permanent standby generator (if required), pump control panel, and appurtenances. In general, the building shall be constructed of insulated brick-on-block walls, gabled wood truss insulated roof, fiberglass shingles, vented soffits, aluminum gutters, and steel doors and it shall be compatible with the surrounding architecture, as approved by the City.
2. Guard posts shall be 6+ diameter x 7q6+long, black steel pipe meeting the requirements of ASTM A36. Each post shall be set in a 1q6+ diameter x 3q6+ deep concrete footing crowned to shed water, with the shaft to be completely filled with concrete and shall be located as approved by the City.

K. Bedding and Backfill

1. Bedding

- a. Pipe embedment shall be #8q or #57q gravel or limestone for gravity sewers and sand meeting the requirements of ODOT Item 703.06 force mains, from 4+ below the pipe

barrel to 12+above the pipe barrel for flexible pipes and to the springline for rigid pipes.

2. Granular Backfill
 - a. Granular backfill shall meet the requirements of ODOT Item 304 crushed limestone.
3. Control Density Fill (CDF)
 - a. CDF shall be ODOT Item 613, Type 1 low strength mortar, except no fly ash or slag permitted. The design mix used shall be approved by the City, and shall have a compressive strength of 50 psi.

2.2 Installation

A. Trenches

1. Gravity Sewers
 - a. Except where otherwise specifically required or permitted by the City, sewers shall be laid in an open trench, shall be started at the lowest point, and shall have spigot ends pointing in the flow direction.
 - b. The use of equipment with metal tracks or treads will not be permitted on paved surfaces which will not be removed during trenching operations without some type of pavement protection, such as matting or rubber tracks.
 - c. The width of trench, from a point 12 inches above the top of the outside wall surface of the pipe to the bottom of the trench shall not be wider than the largest width provided by the two formulas below. The width of trenches shall not be less than 12+greater in width than the outside diameter of the pipe barrel. Where the trench width at the bottom of the trench, provides a space greater than 18+on both sides of the pipe, and the pipe is 10 feet or more below the surface ground immediately adjacent to the trench, it may be required that the pipe is encased with 6 inches of concrete or other special protection is taken to insure adequate protection of the pipe to both line and grade. Whenever the maximum allowable trench width (below the level of the top of the pipe) is exceeded for any reason, the City reserves the right to direct the contractor to utilize pipe of greater strength, to modify the type of backfill, to embed

the pipe in concrete, or to utilize a combination of these procedures, all at the expense of the Contractor.

- d. Trenches in earth shall be excavated to a depth of not less than $\frac{1}{8}$ the outside diameter of the pipe being installed or 4", whichever is greater, below the outside bottom of the pipe barrel and bell when the pipe is laid on its final grade.
- e. Trenches in rock shall be excavated to a depth of $\frac{1}{3}$ the inside diameter of the pipe, but within the limits of 4" to 12", below the outside bottom of the pipe barrel and bell when the pipe is laid on its final grade and the pipe shall be laid on a cushioned layer of bedding material as specified or as approved by the City and provided by and at the expense of the Contractor.
- f. Prior to open trenches entering the paved limits of a street, alley, driveway, sidewalk, or parking area, the pavement shall be neatly cut for its full depth, removed, and disposed of off the Project site.
- g. Trenches shall be kept sufficiently free of water during pipe laying and jointing. When water exists in the trenches at the time of pipe laying, the Contractor shall dewater the trench at their expense.
 - Draining a sewer trench, in which sanitary sewer is being constructed, into an existing sanitary sewer of the City will not be permitted. The trench water shall be intercepted by a sump, or a manhole, before it reaches the existing sanitary sewer and shall not be pumped into a surface ditch or onto the ground surface, unless permission is obtained from the City Engineer to discharge into a storm sewer.
 - The same rule, as above, shall be followed with reference to existing combination sewers.

2. Force Mains

- a. Trenches shall be as specified for Gravity Sewers except as modified herein. Except where otherwise specifically required or permitted by the City, the mains shall be laid in an open trench excavated to a depth sufficient to provide not less than 4 feet of vertical cover over the top of the pipe barrel and to provide not less than 4" of bedding below the outside bottom of the pipe barrel. However,

pipes shall be installed at a greater depth when shown on the drawings; when necessary to pass under other utilities or obstructions; or where necessary to prevent high points in the main. In addition to the minimum vertical cover, where any pipes are parallel to roadside ditches or streams, a lateral cover shall be provided at least equal to the specified vertical cover.

- b. The width of the trench shall not be more than 24+greater than the outside diameter of the pipe, except at joints, where sufficient space shall be provided for properly making the joints without raising the length of the pipe above the solid bottom of the trench. Care shall be taken to detect and remove stones and debris in the bottom of the trench which would damage the pipe or be detrimental to the proper bedding of the pipe, with removal to be for a depth of at least 6+below the bottom of the pipe and replaced with bedding material.

B. Protection of Existing Utilities

1. Utility Conflicts

- a. Existing underground utilities along the route of construction, as shown on the drawings or marked at the time of construction by the utility owner, shall be uncovered by the Contractor and their elevations determined at least 400 feet in advance of pipe installation for gravity sewers and 200 feet in advance for force main piping. Contractor shall contact OUPS 48 hours prior to any excavation work.
- b. All underground utilities, when encountered, shall be adequately supported, shored up or otherwise protected whenever exposed in the excavation. Timber supports shall be a minimum of 6+square. Supports shall extend into the undisturbed earth a minimum of 12+ each side of the trench and the pipe, conduit, etc., banded or tied to the bridging for its full length using stainless steel banding. Where bridging cannot be supported by a firm foundation, the Contractor shall provide vertical support for the bridging, including any lateral bracing necessary to provide a firm and substantial support. Supports and bracing shall be of native hardwood and shall be furnished and installed by the Contractor.

- c. The excavation work shall be planned as to avoid damage to and minimize the interference with existing underground utilities in the area. Adequate clearance between the cutting edge of the excavation equipment and underground utility shall be maintained to avoid damage to the utility.
- d. Above ground (aerial) utilities, including but not limited to, power, telephone and cable television, shall remain in service at all times. Any anticipated disruption of service shall be with the full knowledge of the utility company and required advance notice to the affected users by the Contractor. Removal of guy wires and holding of poles shall be done as required to complete the work, shall be agreed upon by the utility company and the Contractor, and shall be at the expense of the Contractor.
- e. Arbitrary disruption of underground and aerial utility services will not be permitted.

2. Replacement of Existing Sewers and Drains

- a. The Contractor is cautioned to use the greatest care in reporting to the City all existing sewers and drains exposed during trenching or other operations. Replacements shall be made in accordance with all applicable requirements of these specifications for new construction and in accordance with all applicable requirements of ODOT Item 603 using pipe with premium joints unless otherwise specified, as approved by the City. In the event of conflict, the requirements of these specifications shall take precedence.
- b. Pipe for sanitary sewers shall be approved for such use. Replacements 12 feet or less in length of perforated pipe or open joint tile (underdrains) shall be made by using PVC plastic pipe meeting the requirements of ASTM D3034, SDR 35, or F679. Joints between existing and replacement pipes, when differing materials or with otherwise non-compatible joints, shall be made using banded neoprene couplings as manufactured by Fernco, Inc. or equivalent as approved by the City Engineer.
- c. Existing sewers and drains shall be replaced as to withstand future settlement by bridging with timber supports a minimum of 6+square. Bridging shall extend into undisturbed earth a minimum of 12+each side of the

trench, and the pipe, tile, etc., banded or tied to the bridging its full length. Where timber bridging cannot be supported by a firm foundation, the Contractor shall provide vertical support for the timber bridging, including any lateral bracing necessary to provide a firm and substantial support. Supports and bracing shall be of native hardwood.

C. Trench Protection

1. Where necessary to prevent caving of the trench and other excavation, and for protection of workmen and nearby structures, trench protection shall be provided per OSHA standards by and at the expense of the Contractor. Trench protection shall be by trench box, wood sheeting and bracing or such other methods as determined by the Contractor. Contractor shall have a competent person on-site determine the appropriate methods for the conditions.
2. Wood sheeting and bracing shall be of sound lumber approved per ANSI specifications and shall be so arranged as to support the trench walls and existing structures and utilities. Sheeting left in place shall be cut off not less than 18 inches below ground surface.
3. Sheeting and bracing not noted to be left in place may be removed at the discretion and responsibility of the Contractor after backfill has been placed and compacted to a level at least 2 feet above the top of the pipe. In no case shall sheeting be pulled in increments exceeding 3 . 4 feet in order to avoid the danger of breaking pipe due to the weight of the backfill. Upon removal of sheeting and bracing, voids left due to such removal shall immediately be filled and the back recompacted.
4. Where it is necessary to drive sheeting below the centerline of the pipe, it shall be driven below the bottom of the pipe as determined by the City, and that sheeting below a point 2 feet above the top of the pipe shall be left in place.

D. Pipe Embedment

1. The bedding material shall be shaped to conform to the bottom quadrant of the pipe barrel. The City reserves the privilege of altering the type of bedding material and regulating the exact grading of the bedding material depending upon the water

characteristics of the trench. At the very least the minimum of bedding shall be provided under pipe bells.

2. After the pipe is laid, the bedding material shall be shovel placed and tamped to fill all voids. The bedding material shall be placed in 6+layers, loose measurement, and compacted by hand or mechanical tamping to secure a good compaction. All embedment material shall be carefully placed and tamped so as not to damage or displace the joints or pipe, and no material shall be dropped directly on the pipe. The material shall be compacted to not less than 98% of maximum density as determined in accordance with ASTM D1557 (Modified Proctor).
3. An exception shall be made where concrete encasement is noted on the drawings. Concrete encasement shall be square in cross section, shall have a minimum thickness of 6+at pipe bells, and shall be of length noted.
4. This shall include the materials and construction of concrete pipe cradles to support the new pipes where they cross over existing pipes in the locations noted on the drawings. Damage to existing pipes resulting from the Contractor's operations shall be repaired or replacements made to the satisfaction of the City by and at the expense of the Contractor.
5. If material found at the specified depths of excavation below the elevation of the outside bottom of the pipe barrel is not suitable to provide an adequate foundation for the pipe, a further depth shall be excavated and filled with granular bedding material approved by the City.

E. Pipe Laying

1. Gravity Sewers
 - a. Pipes shall be laid with their full lengths true to line and grade with the aid of lasers, or other method approved by the City, and shall rest on the bedding material provided.
 - b. When laser beam equipment is used, it shall be checked a minimum of twice daily, once in the a.m. and once in the p.m. In addition, when temperature and other atmospheric conditions prevent the laser beam from maintaining grade, the Contractor shall provide additional ventilation through the pipeline by the use of blowers as recommended by the equipment manufacturer or as directed by the City.

- c. Regardless of the method used, the City shall be immediately notified of any misalignment of the pipe when laid in accordance with established cuts or elevations.
- d. Pipes and manholes shall be installed at a minimum 10 foot horizontal distance from water mains, and pipes laid at a minimum 18+vertical distance from water mains at their crossing, both as measured between the outside of the pipe walls. At crossings, one full length of pipe shall be installed so both joints will be as far from the main as possible.
- e. Seal Joints on both bell and spigot ends of pipe sections shall be wiped clean and painted with the proper type of solvent specified by the manufacturer. It is preferred that the cleaning and painting of joints with the solvent is done within the trench just prior to laying and not on the ground surface at the top of the trench. The pipe shall be rammed home using a bar and a wood block on the end of the pipe, or by use of a mechanical pipe pulling device.

2. Force Mains

- a. Pipe sections shall be strung along the route of the mains within the right-of-way or easement so as to interfere least with pedestrian and vehicular traffic and to protect the pipe as fully as possible. Care shall be taken at all times in handling the pipe and at no time shall other pipes or material be placed in the pipes.
- b. The mains shall be laid in the locations and at the grades shown on the drawings, except as specifically permitted or ordered otherwise by the City in order to avoid existing or proposed utility lines or any other obstructions encountered in the progress of the work; to secure a more readily accessible position for trenching; or to facilitate the location of various appurtenances of the main. Maximum deflection of pipe joints shall be $\frac{1}{2}$ of the manufacturer's recommendation and in strict accordance with the pipe manufacturer's instructions.
- c. Force main pipe installed shall be provided with a tracer tape and detectable tracer wire. The tracer tape shall be buried in the trench approximately 1-1/2 feet below the ground surface directly above the centerline of the pipe.

Detectable tracer wire shall be affixed to the non-metal pipes.

- d. When abrupt changes in the grade of the main are necessary to avoid existing utilities or other obstructions, suitable fittings, usually 1/8 bends, shall be used so as to secure an easy flow of liquid and to provide sufficient cover below same unless otherwise specified or noted on the drawings. Care shall be taken to avoid high and low points in the mains.
- e. Pipe shall be laid at a minimum 10 foot horizontal distance from water mains and at a minimum 18+vertical distance from water mains at their crossing, both as measured between the outside of the pipe walls. At crossings, one full length of force main pipe shall be installed so both joints will be as far from the water main as possible.

F. Backfilling

- 1. Backfill shall include the material placed above the pipe embedment material previously specified. No heavy or large quantities of backfill material shall be placed over the pipe until backfilling has progressed to a depth of at least 3 feet over the top of the pipe barrel. All backfill material shall be carefully placed so as not to damage the joints or displace the pipe. Backfilling shall immediately follow trenching and pipe laying operations to reduce the possibility of damage to pavements and utilities.
- 2. Trenches within existing and proposed stoned streets, alleys, driveways, stone parking areas and concrete or brick sidewalks shall be backfilled with granular material. The material shall be placed and compacted to not less than 100% of maximum density in accordance with ASTM D1557 (Modified Proctor). Contractor shall provide the Certified Proctor from the limestone supplier with the shop drawings, prior to stone being delivered to the Project site.
- 3. Where sewers are installed along and across existing and proposed paved or stoned streets, alleys, driveways and parking areas, the specified compacted granular material shall also be provided for backfilling any portion of the trenches falling within that area below a line drawn at 45 degrees to the horizontal from the surface at the edge of the pavement or back of curb and above the horizontal plane of the pipe embedment material.

4. For trenches within existing or proposed paved streets, alleys, driveways and paved parking areas CDF may be provided as backfill as approved by the City in lieu of the specified granular backfill. CDF may also be required to permit pavement restoration during adverse weather conditions, as determined by the City, and shall be provided at no additional cost to the City. The mix shall be placed in usable fluid form and in uniform vertical lifts. Design, finishing and protection of the material shall be recommended by the manufacturer for the application. Quality control test procedures of the manufacturer shall include ASTM C138 . Test for Unit Weight, and ASTM C39 . Test for Compressive Strength. No compaction is required for CDF. The City at its discretion can require CDF to be used as backfill within any trench.
5. The City may require the Contractor to check compaction of the backfill at anytime at no cost to the City.
6. Where trenches are backfilled with granular material, the Contractor shall remove excess excavated material. Any excess excavated spoil shall be removed to an approved dump site.
7. In all paved streets and highways, immediately upon completion of other backfilling operations and prior to the end of work for that day, a temporary pavement shall be provided and shall remain in place and be properly maintained until such time as the permanent pavement is placed. Permanent pavements shall be placed within two weeks after completion of tests and acceptance of each section of the sanitary sewer or force main.
8. For backfilling the remainder of the trenches, as much of the excavated material as possible shall be replaced until backfilling has progressed to a depth of at least 3 feet over the top of the pipe barrel. The material shall be finely divided free of stones 3+ or greater in any dimension, boulders organic materials or other harmful debris, and shall be placed in 6+layers, loose measurement, and compacted by mechanical tamping.
9. After backfilling, along weed or unsodded areas the material shall be graded to conform to the original ground profile. In lawn areas in fields used for farming, all topsoil removed and stockpiled prior to trenching shall be replaced and graded to conform to the original ground profile. In lawns and other areas where grass exists, as determined by the Owner or the City, the area shall be graded and made ready for seeding. In lawn areas, if the existing replaced topsoil does not provide the required 4+minimum depth, the Contractor shall provide additional topsoil at their expense.

10. The Contractor shall be required to regrade and reshape all road shoulders and all ditches or swales from existing high points to existing drainage structures or other outlets along the proposed improvement. The Contractor and the City shall mutually agree and establish all ditch grades to be restored prior to construction. Ditches, which are reshaped, shall have reasonable side slopes. Vertical or steep slopes will not be permitted.

G. Connections to Structures and Pipes

1. General Requirements

- a. When required, new and existing sewers shall be connected to structures through stubs, wall castings, wall sleeves, etc. provided for same or an opening shall be made at the proper elevation in the wall of the structure, the pipe inserted and the opening around the pipe neatly and permanently closed with a non-shrinking and non-corrosive grout. Grout shall be Five Star Grout as manufactured by Five Star Products, Inc; Sealtight 588 Grout as manufactured by W.R. Meadows, Inc.; Set Grout as manufactured by Master Builders; or approved equivalent. All connections shall be watertight. Where necessary, the bottoms of existing structures shall be reshaped to give a smooth flow in all directions.
- b. Connections to unlike types and sizes of pipe shall be accomplished using the proper adapter and/or connector as manufactured by Fernco, Inc. or equivalent as approved by the City Engineer.

2. Service Connections

- a. Service connections for sanitary sewers shall be 6+ in diameter, unless otherwise shown, and shall be furnished and installed for existing and future houses and businesses.
- b. New service connections shall be connected into existing sanitary sewers where approved by means of positively sealing connections. Connectors shall be of materials such as rubber gaskets, sleeves, etc. with or without stainless steel clamps, bolts, etc. that will not erode over time. Connectors shall

be designed specifically for the application intended. Service connections shall be by sewer saddles, style %GB+all stainless steel, as manufactured by Romac Industries or approved equivalent; or by use of Inserta Tees as manufactured by Inserta Fittings Company.

- c. Where service connections are to be installed to the right of way line, the pipe shall be installed true to line, at a 90 degree angle from the mainline, if possible, and on at least a 1% grade, but no more than a 3% grade.
- d. In general, riser sections will be required between the main line sewer connection and that portion of the service connection installed on at least a 1% grade where depths to the main sewer invert exceed 12 feet. Riser pipe shall be defined as the vertical pipe, plus all pipe and fittings required between the vertical pipe and the connection at the main sewer. The riser shall be fixed in place for its full height by providing thoroughly tamped pipe embedment material.
- e. Where required, service connections shall be installed within steel encasement pipe. Steel encasement pipe shall extend 5 feet each side of the pavement. The encasement pipe shall be sized for at least 2+clearance around the pipe bell, but not to exceed 14+in size, and the minimum wall thickness shall be 0.188+.
- f. House connections shall not empty directly into manholes, and shall be connected to the mainline sewer unless prior approval is obtained from the City Engineer. This is required to prevent the build-up of sludge deposits in the bottom of the manhole causing odors, due to the small quantities of water flows at anytime from single residence structures.
- g. Service connections not immediately connected to an existing sewer shall be closed with a stopper. Stoppers shall be specifically designed for use with the pipe, shall be for use as a permanent or temporary plug, shall be watertight, and shall be removable without damaging the pipe. Pipe

damaged when installing or removing stoppers shall be replaced at the expense of the Contractor.

- h. The ends of service connections shall not be backfilled until the location is identified by the City. A 2+square oak pole shall be accurately placed over the termini of all such service connections and shall extend vertically to flush with the surface of the ground so that it can be located.
- i. Draining of basement excavations through the house service to the main sanitary sewer will not be permitted.
- j. Each individual lot shall have its own house connection.
- k. Reference Sewer Lateral Specification Drawing
- See Exhibit D

2.3 Testing

A. Testing for Deflection & Obstructions within Gravity Sewers

- 1. All sanitary sewers of PVC plastic pipe shall be tested for a maximum deflection of 5% of the pipe average inside diameter not less than 90 days after final full backfill, has been placed, as determined by the City. The 90 day requirement may be reduced to a shorter duration upon approval from the City Engineer. The requirement will never be permitted to be less than 30 days.
- 2. Such tests shall be conducted with a representative of the City present. All pipes exceeding a deflection of 5% of the average inside diameter shall be repaired or replaced and then retested until satisfactory test results are obtained. The City shall not be responsible for any costs associated to testing.
- 3. Each section of pipe shall be tested for obstructions by use of mandrels, solid cylinders or balls with diameters of 95% of the pipe diameter.

B. Testing for Leakage of Gravity Sewers

- 1. After backfilling, air tests shall be conducted between two consecutive manholes. Prior to conducting air tests on air permeable pipe, the walls of the pipe shall be dampened.

2. Each end of the section to be tested and all pipe outlets in the section shall be plugged with suitable test plugs. One plug used at a manhole shall have an inlet tap or other provision for connecting an air hose from the air supply equipment. The equipment shall include valves to control the rate at which air flows into the test section and pressure gauges with minimum gradations of 0.1 psi and an accuracy of +/- 0.04 psi to monitor the air pressure within the test section.
3. All plugs shall be seal tested prior to being used. One length of pipe shall be laid on the ground and sealed at both ends with pneumatic plugs. Air shall be introduced into the plugs to 25 psi. The sealed pipe shall be pressurized to 5 psi. The plugs shall hold against this pressure without bracing and without movement of the plugs out of the pipe.
4. Air pressure shall be applied slowly to the test section until the pressure reaches 4.0 psi, plus an adjustment of 0.433 psi for each foot of ground water above the crown of the pipe being tested. Internal air pressure, including adjustment for ground water, should never exceed 5.0 psi.
5. In areas where groundwater is known to exist, the Contractor shall install a 1/2+inch diameter capped pipe nipple, approximately 10+feet long, through the manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately before air testing, the ground water shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.
6. When the pressure reaches 4.0 psi, plus adjustment for ground water, the air supply shall be throttled so that the internal pressure is maintained between 4.0 and 3.5 psi for at least 2 minutes to permit temperature stabilization. When the pressure has stabilized at or above 3.5 psi, the air supply shall be disconnected and a stop watch shall be used to determine the time it takes for the pressure to drop 1.0 psi.
7. The permissible time allocated for the 1.0 pressure drop shall be calculated on the basis of the diameter and length of the main sewer tested and no adjustment shall be made for service

connections included in the test section. The air test for a section shall be considered acceptable if the time elapsed for the 1.0 psi pressure drop is equal or greater than the time indicated, and shall be considered unacceptable if the elapsed time is less than that indicated.

- a. See ~~%~~Air Test Holding Time Table+and ~~%~~Timing Formula+ (Exhibit E)
 - b. See ~~%~~Sewer Line Air Test+Inspection Form (Exhibit F)
8. Sewers 30+in diameter and larger shall have individual air tests conducted at joints, and lift holes, along with visual inspection. Perform air tests in accordance with all applicable requirements above except that a test shall be acceptable if the pressure holds or drops less than 1 psi in 5 seconds.
 9. The Contractor may air test sections before backfilling the trench as a check for defects and workmanship. Such tests are the option of the Contractor and are not suitable for tests required after backfilling has been completed.

C. Testing of Manholes

1. Each manhole shall be tested after assembly and after all lift holes have been plugged with an approved non-shrink grout, and, at the option of the Contractor, before or after backfilling is complete.
2. Testing shall be by drawing a vacuum on the manhole using equipment specifically designed for such testing. All pipes entering the manhole shall be plugged and braced to prevent being drawn into the manhole. A test head with necessary gauges and connections shall be placed at the opening of the casting and sealed in accordance with the manufacturer's instructions. A vacuum of 10+of mercury shall then be drawn and the vacuum pump shut off. With valves closed, the time shall be measured for the vacuum to drop to 9+of mercury. The test shall be successful if the time measured meets or exceeds that as shown in the table below described below.
 - a. See ~~%~~Concrete Manhole Vacuum Test Info Card+ (Exhibit G)
3. If the test is unsuccessful, necessary repairs shall be made and retesting shall proceed until a satisfactory test is obtained.

D. Pressure and Leakage Tests for Force Mains

1. The main shall be subjected to a pressure and leakage test in accordance with AWWA C600-93 for ductile iron pipe and AWWA C605 for PVC piping as follows:
 - a. The main shall be isolated and pressure shall be applied by pumping water into the main. The test pressure shall be 150 psi, unless valves in the existing mains are involved within section of the new main being tested; in which case the test pressure shall be 100 psi; and shall not vary by more than +/- 5 psi.
 - b. The pressure test shall be started in an afternoon and the pressure shall be on for 18 hours, and then, the test pressure shall be maintained for an additional two hours by pumping water into the main. At the end of the two hour period, the water used shall be measured and the loss by leakage shall not exceed that as determined by the following formulas:
 - For ductile iron pipe:
$$L = (SDP^{1/2})/133,200$$

L = allowable leakage (gallons per hour)
S = Length of pipe tested (feet)
D = Nominal Diameter of pipe (inches)
P = Average test pressure during test (psi)
 - For PVC pipe:
$$L = (NDP^{1/2})/7,400$$

L = allowable leakage (gallons per hour)
N = Number of Joints in the length of pipe tested
D = Nominal Diameter of pipe (inches)
P = Average test pressure during test (psi)
 - c. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed.
 - d. If the main does not pass the leakage test, the leak or leaks shall be located and repaired and the testing procedure repeated by and at the expense of the Contractor. All visible leaks shall be repaired regardless of the amount of leakage.

- e. Pressure and leakage testing is the responsibility of the Contractor, who shall provide all materials, labor and equipment, and in addition pay for the total volume of water used.

E. Testing for Pumping Stations

1. Pump Draw-Down Test

- a. The Contractor shall perform an on-site draw-down test to test the pumps in the specified operating range using portable vaults. This test shall be performed in the presence of the City. After installation of the pumps and prior to start-up.

2. Pressure and Leakage Tests

- a. Upon completion of pipe installation, pressure and leakage tests shall be applied to all piping. Valve vault drain piping shall be demonstrated free to drain.
- b. The Contractor shall provide all labor and equipment required for pressure and leakage testing, and, in addition pay for the total volume of water used.
- c. Upon the successful completion of testing, all piping shall be flushed and cleaned. Flushing shall be done in such a manner that no obstructions shall be lodged under valve seats, and all valve seats shall be left in perfect condition.

2.4 Design

A. Design Flow

- 1. Use the table below in evaluating flows used in existing sanitary sewers and in sizing new sanitary sewers.

a.	<u>Type of Waste</u>	<u>Avg. Flow</u>	<u>Peak to Avg. Flow Ratio</u>
	Domestic Waste	70 GPCD *	3.25 . 4
	Industrial Waste	4000 GPAD **	2
	Infiltration	50 GPCD *	1.5

* Use population density of 10 persons per acre for sizing new sewers.

** Average 30 GPCD throughout the city

GPCD = Gallons per capita per day

GPAD = Gallons per acre per day

B. Size and Slope

1. The minimum size, or diameter, of a sewer lateral is 6 inches with a minimum slope of 1%.
2. The minimum size, or diameter, of any sanitary sewer other than a sewer lateral is 8 inches. All sanitary sewers shall be laid on slopes that will provide a minimum velocity of flow, when flowing full of 2 feet per second per the following chart:

a.

<u>Pipe Diameter</u>	<u>Minimum Slope</u>
8+	0.40%
10+	0.30%
12+	0.22%
15+	0.15%
18+	0.12%
21+	0.095%
24+	0.08%
27+	0.07%
30+	0.06%
36+	0.045%
42+	0.037%

C. Velocity

1. The maximum velocity of flow in sanitary sewers shall not exceed 10 feet per second. The sewer shall be designed to maintain a uniform velocity of flow as far as practical and the grades should be uniform; not steep in one section and then leveling off in grade of lesser slope.
2. Where a sanitary sewer has more than 1 upper run, or branch, it shall never have a drop in capacity. Particular attention shall be paid by the designer to the capacity of sewers, including all lateral connections.

D. Hydraulic Design

1. Sewer capacities shall be computed using Kutter's or Manning's formulas, with a value for n equal to 0.015 for sewers less than 30 inches in diameter and with a value for n equal to 0.013 for sewers greater 30 inches or greater in diameter. The hydraulic design shall compensate for head losses of various kinds.
2. Sanitary sewers shall be designed to have sufficient capacity for the drainage area they must serve at anytime. The designer shall

study the entire drainage area in which the sewer is proposed, to ensure that ample future capacity is provided.

E. Cover and Depth

1. The minimum cover above a sanitary sewer shall not be less than 4 feet.
2. If possible, the main sewer shall have sufficient depth to provide that the house connection at the property line would have a depth of cover of 7 feet; and that invert of the main sewer would be not less than 3 feet below the basement floor elevation of any residence building or structure that would be drained by said main sewer.

F. Manhole Placement & Alignment

1. Manholes shall be located at:
 - a. At all changes in grade
 - b. At all changes in alignment
 - c. At all points of intersection of sewers
 - d. At the end of all sewers
 - e. At the point of all changes in pipe size and rate of flow
2. Manholes shall be spaced 250 feet apart but not exceed 300 feet apart on straight run sewers, unless special permission of the City Engineer is obtained. On large sewers, 5 feet in diameter or above, spacing of manholes on straight runs will be determined by the City Engineer.
3. Where main sewers enter trunk sewers at right angles, special transition structures shall be used to prevent blocking of flow in either sewer.

G. Materials

1. See Section 2.1 of the City of Tiffin Public Works Improvements Design Manual

SECTION 3
STORM SEWERS

Section 3 – Storm Sewers & Stormwater Control Guidance

3.1 Materials

A. Pipe and Fittings

1. Requirements

- a. Sewers, pipes, culverts, etc. shall be a minimum size of 12" diameter.
- b. Acceptable pipe materials shall have a minimum hydrostatic design basis (HDB) of 4000. High density polyethylene (HDPE) pipe materials shall not be acceptable.
 - 15" Diameter or Smaller
ASTM D-3034
ASTM C-76
 - 18" Through 27" Diameter
ASTM F679
ASTM F1803
ASTM C-76
 - 30" Diameter and Larger
ASTM F1803
ASTM C-76
- c. All drive culverts with 2' or less cover above the top of the culvert shall be concrete meeting ASTM C76 Class IV. All drive culverts with greater than 2' of cover shall be of pipe material as specified above.
- d. All drive culverts greater than 15" in diameter shall at a minimum be installed with half height headwalls. Full headwalls may be required upon review by the City. All drive culverts 15" or smaller are not required to have headwalls. All headwalls shall be constructed per the most current ODOT specifications.
- e. The manufacturer shall furnish an affidavit indicating that the pipe, fittings, and appurtenances have been manufactured and tested in accordance with the requirements of the applicable standards.
- f. All pipes, fittings, and appurtenances shall be appropriately marked for purposes of identification. The materials and methods of manufacture, and the completed pipes, fittings

and appurtenances shall be subject to inspection and rejection at all times. The City has the right to make inspections.

B. PVC Plastic Pipe and Fittings

1. PVC plastic pipe and fittings shall have a minimum pipe stiffness of 46 psi at 5% deflection when tested in accordance with ASTM D2412, and, as applicable for the sizes involved, shall meet the requirements of ASTM D3034, ASTM F679, or ASTM F1803. The pipe shall be of the elastomeric gasket joint (integral bell) type. Joints shall provide a watertight seal and shall be made in accordance with the pipe manufacturer's instructions. Joints shall be of the push-on type meeting the requirements of ASTM D3212, and, in addition, the bell shall be designed to retain the gasket to prevent pull-out during the making of the joint.
2. PVC plastic fittings for use with ASTM D3034 pipe 10" in size and larger, and for use with all sizes of PVC plastic pipes other than ASTM D3034 shall be molded or fabricated in accordance with, and have joints meeting the requirements of the ASTM standard as specified for the pipe.
3. At the end of all fittings, pre-manufactured tee's, etc., of all pipe installations, the final fitting at the "plug" shall be SDR 35 compatible. Non-compatible joints to existing sewers shall be made using banded neoprene couplings as manufactured by Fernco, Inc. or equivalent as approved by the City Engineer.
4. The pipe shall be installed in accordance with ASTM D2321 and with the requirements of these specifications. Any requirements in these specifications which may be in conflict or inconsistent with the requirements of ASTM D2321 shall be void to the extent of such conflict or inconsistency.

C. Concrete Pipe and Fittings

1. Concrete pipe and fittings shall be of the spigot and socket or tongue and groove pattern meeting the requirements of ASTM C76 and shall be of Class IV or V. Pipes shall be of the greatest lengths commercially available. Circular pipes having elliptical reinforcing shall have the word "Top" or "Bottom" clearly stenciled on the inside of the pipe at the correct place to indicate the proper position when laid. Joints shall be of the rubber gasket type meeting the requirements of ASTM C443. The gasket shall be confined in a groove and shall be installed in accordance with the manufacturer's instructions.

2. For pipes installed in open trench, the maximum allowable trench width at the top of the pipe for the various sizes and classes of pipe shall be as follows:

<u>Pipe Diameter</u>	<u>IV</u>	<u>V</u>
12"	2'-9"	3'-0"
15"	3'-0"	3'-3"
18"	3'-3"	3'-6"
21"	3'-6"	3'-9"
24"	4'-0"	4'-3"
27"	4'-6"	4'-9"
30"	4'-9"	5'-0"
33"	5'-3"	5'-6"
36"	5'-9"	6'-0"
42"	6'-3"	6'-6"
48"	6'-9"	7'-0"
54"	7'-6"	8'-0"
60"	8'-0"	8'-6"
66"	9'-0"	9'-6"
72"	9'-6"	10'-0"

D. Steel Encasement Pipe

1. When the pipe is to be installed within a welded steel encasement pipe, the encasement pipe shall meet the requirements of ASTM A139, Grade B, and shall be bituminous coated on the outside. Any coating applied in the field shall be applied a minimum of 48 hours prior to installation. The encasement pipe diameter shall be 4" larger than the diameter of the pipe bell, rounded up to the next nominal pipe size. The minimum wall thickness of the encasement pipe shall be 0.375" and is based on steel pipe having a minimum tensile strength of 60,000 psi and minimum yield strength of 35,000 psi. The wall thickness shall be adjusted as necessary for other grades of pipe. All joints shall be fully welded on the circumference.
2. The encasement pipe shall be installed by boring and jacking and in such a manner so as to allow the pipe to be laid at the grade shown. This shall include both horizontal and vertical control methods as approved by the City. Control methods shall permit location of and realignment of the cutting heads at all times during installation. Boring and jacking operations shall be continuous. The pipe shall be blocked in place with the encasement pipe to prevent shifting or flotation. The ends of the encasement pipe shall be blocked in such a way as to prevent the entrance of foreign material, but allowing leakage to pass in the event of same within the encasement pipe.

3. Blocking shall be accomplished using wood blocks or approved casing chocks. Wood blocking shall be as shown on the drawings. Wood blocks shall be of hardwood lumber. Branding straps for holding the wood blocks in place shall be stainless steel. Casing chocks shall be of polyethylene or stainless steel with a liner and UHMW polymer plastic runners, shall be as manufactured by Power Seal Pipeline Products Corporation, Cascade Waterworks Manufacturing Company, Advance Products & Systems, Inc., or approved equivalent and shall be installed in accordance with the manufacturer's instructions. Blocking shall be notched to secure banding to blocking without slippage. Two sets of blocks or chocks shall be used per pipe segment.

E. Bridges & Box Culverts

1. A bridge is any structure greater than or equal to 10' in length, including supports, erected over a depression or an obstruction, as water, highway or railway, and having a passageway for moving traffic, pedestrians, or other moving loads. Bridge and box culverts shall be sized according to the latest edition of the ODOT Bridge Design Manual. Box culvert material and construction shall be in compliance with the most current ODOT specifications. Bridges shall meet AASHTO Standard Specifications for Highway Bridges, latest edition.

F. Catch Basins

1. Bases and Walls

- a. Bases and walls for Catch Basins shall be precast and shall either be 2'-0" x 2'-0" (2-2A or B) or 3'-0" x 3'-0" in size, or as required to properly accommodate the pipe sizes required for the installation. The structures shall meet H-20 loadings if located within any pavement. Spacing shall be no greater than 300 feet apart. Inverts shall be poured to the crown of the pipe. Catch Basins greater than 4' deep should be a minimum of 3' x 3' with polypropylene steps.

2. Frames and Grates

- a. Frames and grates for Catch Basins shall be East Jordan Iron Work 5250 with Type MI grate or approved equal. Frames and grates with curb shall be East Jordan Iron 7035 (single); 7036 (double) with Type MI grate and Type T1 backs, or approved equal. Grate openings shall allow passage of 25 year storm events. If a catch basin is

located within a pedestrian walkway an ADA compliant grate shall be installed per the approval of the City.

G. Manholes

1. Manholes shall be constructed of precast reinforced concrete sections and appurtenances meeting the requirements of ASTM C478, except as modified by these specifications. Manholes shall have a minimum 48" inside diameter or larger as recommended by the manufacturer. An affidavit from the manufacturer shall be provided stating that the manhole is appropriately sized for the sizes and angles of the incoming pipes.
2. Bases shall be constructed in two pours or monolithically with bottom reinforcement tied to side reinforcement to form integral structure. Base shall have a minimum thickness of 8".
3. Bases shall incorporate provisions for making a flexible joint between the pipe and the manhole for all pipe connections. Flexible joints shall be Press Wedge II as manufactured by Press Seal Gasket Corporation; Kor-N-Seal as manufactured by National Pollution Control Systems, Inc.; A-LOK as manufactured by A-LOK Products Corporation, or equivalent. Flexible joints shall be shock absorbent and shear resistant; shall be designed to prevent any direct contact between the pipe and manhole; and shall provide a tight, infiltration proof sewer connection with the pipe deflected up to 10 degrees in any direction. Should incorporation of the flexible joints require a base inside diameter greater than required for the wall sections, the contractor shall furnish and install the larger base and an approved precast reinforced concrete transition section to go from the larger base to the wall sections.
4. Joints between bases and wall sections shall be as subsequently specified for the walls.
5. If not integrally cast with the base, after installation of the pipes provide an ODOT Class F concrete invert through the manhole. The invert shall have a depth through the manhole equal to one half of the diameter of the sewer pipe and shall slope upward toward the manhole walls approximately 3". Concrete shall be trowelled smooth, and shall be placed so as not to interfere with the flexibility of the joint.
6. Bases shall be set plumb and at the proper elevation on a cushion compacted ODOT #57 crushed limestone as approved by the City.

7. Walls shall be vertical precast concrete riser sections meeting the requirements of ASTM C478. The top section shall be an eccentric cone narrowing down to an inside diameter of not less than 24" and an outside diameter of not less than that of the subsequently specified grade rings. No pipes shall enter the cone section. Manholes too shallow to accommodate a cone section shall have a reinforced flat slab top. Flat slab tops shall be designed to withstand H-20 traffic loading.
8. Adjoining riser sections shall be firmly keyed together by means of tongue and groove joints with rubber gaskets meeting the requirements of ASTM C443. In addition, preformed plastic gasket material shall be provided on the outside shoulder of all joints. Installation of the gasket material shall not interfere with the proper sealing of the rubber gasket. The preformed gasket material shall meet the requirements of Federal Specification SS-S-210A and shall be as manufactured by Hamilton-Kent Manufacturing Company; K.T. Snyder Company, Inc., or equivalent as approved by the City Engineer.
9. Each manhole frame shall be set at the proper elevation by use of precast concrete grade rings. The rings shall be provided for a minimum height of 4" and shall not exceed 12" in height. Rings, unless otherwise subsequently specified, shall have an inside diameter equal to the access opening in the manhole top section, and an outside diameter not less than the outside diameter of the manhole frame. The rings shall each be set in a full bed of mortar composed of 1 part, by volume, Portland cement and 2 parts clean, hard sand. The interior of the grade rings shall be mortared to provide a smooth common surface from frame to top.
10. When the manhole frame is to be anchored to the manhole top, top section and grade rings shall have four 1" diameter holes located to match the holes in the casting and shall be of such dimensions as to provide a minimum 2" concrete cover for the 1" diameter holes. Holes in the top section shall extend at least 6" into the concrete. Holes shall not be made in the field.
11. Steps shall be provided in all manholes. Steps shall meet the requirements of ASTM C478 and shall be of reinforced polypropylene. Installation of manholes, when in pavement, shall be such that steps are in the center of the traffic lane or between lanes where possible, and, when outside pavement, shall be such that steps are located away from the edge of pavement unless the manhole is within a ditch line, in which case they shall be located at the high side of the ditch slope.

12. Reinforced polypropylene steps shall consist of ½” steel reinforcing rod encapsulated in a copolymer polypropylene plastic and shall incorporate a notched tread ridge and retainer lugs on each side of the tread ridge. The steel rod shall be continuous through the entire length of legs and tread. Steps of the press fit type driven into the concrete wall shall have a pullout resistance of not less than 1,500 pounds per leg, as evidenced by test data. Steps must be provided for any structure greater than 4’ deep.
13. Where noted, pipe sewer stubs shall be provided at manholes for future sewer connections. The stubs shall be of the same type of pipe as being provided on the project for the respective sizes of pipe, shall be a minimum of 2’-0” in length outside the manhole wall, and shall terminate with a full pipe bell. The end of each stub shall be provided with a pipe stopper (plug) specifically designed for use with the pipe. Plugs shall be for permanent or temporary use, shall be watertight, and shall be removable without damaging the pipe.

H. Frames and Covers

1. All frames and covers shall be heavy duty gray iron castings conforming to ASTM A48. Both the underside of the cover and the upper surface of the ledge upon which it rests shall be factory machined so as to prevent rocking on its supporting surface. All castings shall be cleaned and factory coated with asphalt paint prior to installation. Asphalt paint shall be water based, non-toxic, non-flammable, and odorless asphalt emulsion that dries to a hard, black gloss finish.
2. The frames shall have a clear opening of not less than 24” in diameter and a height of not less than 7”. Covers shall have the words “Storm Sewer” and “Dump No Waste! Drains to Waterways” cast into the top. No frame and cover unit shall weigh less than 360 pounds. Standard frames and covers shall be East Jordan Iron Works 1040 with Type M2 heavy duty, grated cover or equivalent.
 - a. See Exhibit X for manhole cover specification.
3. Frames shall have four equally spaced anchor bolt holes in the base flange and shall be anchored to the manhole top. Anchors shall be four ¾” diameter all-thread rods, and each shall be complete with washers and nuts for holding the frame down. Anchors shall be of a length to extend through the grade rings and to the bottom of the hole in the manhole top, and allow for at least

the length of one nut to protrude through the nut when tightened. The anchors shall be set with the entire annular space around the rods filled with epoxy from the top of the rings to the bottom of the hole in the manhole top. The epoxy shall be 100%, 2-part, with a minimum compressive strength of 5,000 psi, and shall be Rawl/Sika Foil-Fast Injection Gel System by The Rawl/Plug Company, Inc. or equivalent. After the epoxy has cured, the frame shall be bolted in place.

4. The manhole frames shall be firmly set on top of the adjusting rings with a full leveling bed of 1:1 cement mortar. Where manholes are located in paved areas, the surface of the cover shall be made flush with the pavement surface. In unpaved streets and alley areas, the cover shall be set not to exceed 1" above the ground surface. On rights-of-way and ditches cover elevation shall be approved by the City.
5. After a manhole frame is installed in its final position, it shall be encased in Class C concrete. The concrete encasement shall extend from a horizontal plane 4" below the lowest adjusting ring up to a horizontal plane through the mid-point of the frame in lawn and grass areas, and up to the top of the frame in all other areas. The concrete encasement shall be made circular in plan, using a minimum 48" diameter steel casing ring as a form, and shall be centered on the frame.

I. Bedding and Backfill

1. Pipe embedment shall be No. 8 or No. 57 gravel or limestone, from 4" below the pipe barrel to 12" above the pipe barrel for flexible pipes and to the springline for rigid pipes.
2. Concrete encasement and concrete pipe cradles shall be ODOT Class C concrete.
3. Granular backfill shall meet the requirements of ODOT Item 304 crushed limestone.
4. Control Density Fill (CDF) shall be ODOT Item 613, Type 1 low strength mortar, except no slag or fly ash permitted. The design mix shall be approved by the City, and shall have a design strength of 50 psf.

J. Downspouts

1. Downspouts shall not be permitted to be connected to a sanitary or combined sewer.

2. See Exhibit I for various types of allowable Downspout Connections.

3.2 Installation

A. Trenches

1. Except where otherwise specifically required or permitted by the City, sewers shall be laid in open trench, shall be started at the lowest point, and shall have spigot ends pointing in the direction of flow.
2. Prior to trenching, in lawn areas and in fields used for farming, both as determined by the City, all topsoil shall be removed and stockpiled for replacement during backfilling.
3. The use of equipment with metal tracks or treads will not be permitted on paved surfaces which will not be removed during trenching operations with some type of pavement protection, such as matting or rubber tracks.
4. The width of trenches below the level of the top of the pipe shall not exceed the dimensions previously specified for the various types and sizes of pipe, and shall not be less than 12" greater in width than the outside diameter of the pipe barrel. Whenever the maximum allowable trench width (below the level of the top of the pipe) is exceeded for any reason, the City reserves the right to direct the Contractor to utilize a pipe of greater strength, to modify the type of backfill, to embed the pipe in concrete, or to utilize a combination of these procedures, at all the expense of the Contractor.
5. Trenches in earth shall be excavated to a depth of not less than $1/8^{\text{th}}$ the outside diameter of the pipe being installed or 4", whichever is greater, below the outside bottom of the pipe barrel and bell when the pipe is laid on its final grade.
6. Trenches in rock shall be excavated to a depth of $1/3$ the inside diameter of the pipe, but within the limits of 4" to 12", below the outside bottom of the pipe barrel and bell when the pipe is laid on its final grade and the pipe shall be laid on a cushioning layer of bedding material as specified or as approved by the City and provided by and at the expense of the Contractor.
7. Prior to open trenches entering the paved limits of a street, alley, driveway, sidewalk or parking area, the pavement shall be neatly cut for its full depth, removed, and disposed of off the Project site.

8. Trenches shall be kept sufficiently free of water during pipe laying and jointing. When water exists in the trenches at the time of pipe laying, the Contractor shall dewater the trench at their expense.

B. Protection of Existing Utilities

1. Existing underground utilities along the route of construction, as shown on the drawings or marked at the time of construction by the utility owner, shall be uncovered by the Contractor and their elevations determined at least 400 feet in advance of pipe installation for sewers. The Contractor shall contact OUPS at least 48 hours in advance of any excavation work.
2. All underground utilities, when encountered, shall be adequately supported, shored up or otherwise protected whenever exposed in the excavation. Timber supports shall be a minimum 6" square. Supports shall extend into the undisturbed earth a minimum of 12" each side of the trench and the pipe, conduit, etc., banded or tied to the bridging for its full length using stainless steel banding. Where bridging cannot be supported by a firm foundation, the contractor shall provide vertical support for the bridging, including any lateral bracing necessary to provide a firm and substantial support. Supports and bracing shall be a native hardwood and shall be furnished and installed by the Contractor.
3. The excavation work shall be so planned as to avoid damage to minimize the interference with existing underground utilities in the area. Adequate clearance between the cutting edge of the excavation equipment and underground utility shall be maintained to avoid damage to the utility.
4. Above ground (aerial) utilities including power, telephone, and cable television shall remain in service at all times. Any anticipated disruption of service shall be with the full knowledge of the utility company and required advance notice to the affected users by the Contractor. Removal of guy wires and holding of poles shall be done as required to complete the work and shall be agreed upon by the utility company and the Contractor.
5. Arbitrary disruption of underground and aerial utility services will not be permitted.

C. Replacement of Existing Sewers and Drains

1. The Contractor shall report to the City all existing sewers and drains exposed during trenching or other operations. Replacements shall be made in accordance with all applicable

requirements of these specifications for new construction and in accordance with all applicable requirements of ODOT Item 603 using pipe with premium joints unless otherwise specified, as approved by the City. In the event of conflict, the requirements of these specifications shall take precedence.

2. Pipe for storm sewers shall be approved for such use. Replacements 12 feet or less in length of perforated pipe or open joint tile (such as underdrains) shall be made by using PVC plastic pipe meeting the requirements of ASTM D3034, SDR 35, or F679 based on diameter. In any event, all such replacements in cultivated fields shall be with the specified perforated pipe. Drain discharges removed at ditches or other watercourses shall be replaced with one standard length of reinforced concrete pipe or otherwise approved by the City. Joints between existing and replacement pipes, when of differing materials, or with otherwise non-compatible joints, shall be made using banded neoprene couplings as manufactured by Fernco, Inc., or equivalent.
3. Existing sewers and drains shall be replaced so as to withstand future settlement by bridging with timber supports a minimum of 6" square. Bridging shall extend into undisturbed earth a minimum of 12" each side of the trench, and the pipe, tile, etc. banded or tied using stainless steel banding to the bridging for its full length. Where timber bridging cannot be supported by a firm foundation, the Contractor shall provide vertical support for the timber bridging, including any lateral bracing necessary to provide a firm and substantial support. Supports and bracing shall be of native hardwood.

D. Trench Protection

1. Where necessary to prevent caving of the trench and other excavation, and for protection of workmen and nearby structures, trench protection shall be provided per OSHA standards by and at the expense of the Contractor. Trench protection shall be by trench box, wood sheeting and bracing or such other methods as determined by the Contractor. Contractor shall have a competent person on-site to determine the appropriate method for the conditions.
2. Wood sheeting and bracing shall be of sound lumber, approved lumber per ANSI specifications, suitable for the purpose intended, and shall be so arranged as to support the trench walls and existing structures and utilities. Sheeting left in place shall be cut off not less than 18" below ground surface.

3. Sheeting and bracing not noted to be left in place may be removed at the discretion and responsibility of the Contractor after backfill has been placed and compacted to a level at least two feet above the top of the pipe. In no case shall sheeting be pulled in increments exceeding three to four feet in order to avoid the danger of breaking the pipe due to weight of the backfill. Upon removal of sheeting and bracing, voids left due to such removal shall immediately be filled and the backfill recompact.
4. Where it is necessary to drive sheeting below the centerline of the pipe, it shall be driven below the bottom of the pipe as determined by the City, and that sheeting below a point two feet above the top of the pipe shall be left in place.

E. Pipe Embedment

1. The bedding material shall be shaped to conform to the bottom quadrant of the pipe barrel. The City reserves the privilege of altering the type of bedding material and regulating the exact grading of the bedding material depending upon the water characteristics of the trench. At least the minimum of bedding shall be provided under pipe bells.
2. After the pipe is laid, the bedding material shall be shovel placed and tamped to fill all voids. The bedding material shall be placed in 6" layers, loose measurement, and compacted by hand or mechanical tamping to secure good compaction. All embedment material shall be carefully placed and tamped so as not to damage or displace the joints or pipe, and no material shall be dropped directly on the pipe. The material shall be compacted to not less than 98% of maximum density as determined in accordance with ASTM D1557 (Modified Proctor).
3. If the material found at the specified depths of excavation below the elevation of the outside bottom of the pipe barrel is not suitable to provide adequate foundation for the pipe, a further depth shall be excavated and filled with granular bedding material as approved by the City.

F. Pipe Laying

1. When laser beam equipment is used, it shall be checked twice daily, once in the a.m. and once in the p.m., in the presence of the City to verify that the equipment is maintaining the established line and grade. In addition, when temperature and other atmospheric conditions prevent the laser beam from maintaining grade, the Contractor shall provide additional ventilation through the pipeline

by the use of blowers as recommended by the equipment manufacturer or as directed by the City.

2. The City shall be immediately notified of any misalignment of the pipe when laid in accordance with established cuts or elevations.

G. Backfilling

1. Backfill shall include the material placed above the pipe embedment previously specified. No heavy or large quantities of backfill material shall be placed over the pipe until backfilling has progressed to a depth of at least 3 feet over the top of the pipe barrel. All backfill material shall be carefully placed so as not to damage the joints or displace the pipe. Backfilling shall immediately follow trenching and pipe laying operations to reduce the possibility of damage to pavements and utilities.
2. Trenches within existing and proposed stoned streets, alleys, driveways, stone parking areas and concrete or brick sidewalks shall be backfilled with granular material. The material shall be placed and compacted to not less than 100% of maximum density as determined in accordance with ASTM D1557 (Modified Proctor).
3. Where sewers are installed along and across existing and proposed paved or stoned streets, alleys, driveways and parking areas, the specified compacted granular material shall also be provided for backfilling any portion of the trenches falling within that area below a line drawn at 45 degrees to the horizontal from the surface at the edge of the pavement or back of curb and above the horizontal plane of the pipe embedment material.
4. For trenches within existing or proposed paved streets, alleys, driveways and paved parking areas CDF may be provided as backfill as approved by the City in lieu of the specified granular backfill. CDF may also be required to permit pavement restoration during adverse weather conditions, as determined by the City. The mix shall be placed in a usable fluid form and in uniform vertical lifts. Design, finishing and protection of the material shall be recommended by the manufacturer for the application. Quality control test procedures of the manufacturer shall include ASTM C138 – Test for Unit Weight, and ASTM C39 – Test for Compressive Strength. No compaction is required for CDF. The City at its discretion can require CDF to be used as backfill within any trench.

5. The City may require the Contractor to check compaction of the backfill at any time at no cost to the City.
6. Where trenches are backfilled with granular material, the Contractor shall remove excess excavated material. Any excess excavated spoil shall be removed to an approved dump site.
7. In all paved streets and highways, immediately upon completion of other backfilling operations, and prior to the end of the work for that day, a temporary pavement shall be provided and shall remain in place and be properly maintained until such time as the permanent pavements are placed. For a project with more than one road crossing permanent pavements shall be placed within two weeks after completion and acceptance of each section of the storm sewer.
8. For backfilling the remainder of the trenches, as much of the excavated material as possible shall be replaced until backfilling has progressed to a depth of at least 3 feet over the top of the pipe barrel. The material shall be finely divided free of stones 3" or greater in any dimension, no boulders, organic materials or other harmful debris shall be used. The material shall be placed in 6" layers, loose measurement, and compacted by mechanical tamping.
9. After backfilling, along weed or unsodded areas the material shall be graded to conform to the original ground profile. In lawn areas and in fields used for farming, all topsoil removed and stockpiled prior to trenching shall be replaced and graded to conform to the original ground profile. In lawns and other areas where grass exists, as determined by the Owner or City, the area shall be graded and made ready for seeding. In lawn areas, if the existing replaced topsoil does not provide the required 4" minimum depth, the Contractor shall provide additional topsoil.
10. The Contractor shall be required to regrade and reshape all road shoulders and ditches or swales from existing high points to existing drainage structures or other outlets along the proposed improvement. The Contractor and City shall mutually agree and establish all ditch grades to be restored prior to construction. Ditches, which are reshaped, shall have reasonable side slopes. Vertical or steep slopes will not be permitted.

H. Connections to Structures and Pipes

1. When required, new and existing sewers shall be connected to structures through stubs, wall castings, wall sleeves, etc. provided

for same or cored opening shall be made at the proper elevation in the wall of the structure, the pipe inserted and the opening around the pipe neatly and permanently closed with a non-shrinking and non-corrosive grout. No hammering of openings will be allowed. Grout shall be Five Star Grout as manufactured by Five Star Products, Inc.; Sealtight 588 Grout as manufactured by W.R. Meadows, Inc.; Set Grout as manufactured by Master Builders; or equivalent. All connections shall be watertight. Where necessary, the bottoms of existing structures shall be reshaped to give a smooth flow in all directions.

2. Connections to unlike types and sizes of pipe shall be accomplished using the proper adapter and/or connection as manufactured by Fernco, Inc., or equivalent as approved by the City Engineer.
3. All connections from private property shall be coordinated with the City in regard to pipe size, depth, and connection type.
4. Connections to the main sewer shall include the furnishing and installation of an appropriate wye in the new sewer.
5. New stormwater connections shall be connected into existing sewers where approved by means of positively sealing connections. Connections shall be of materials such as rubber gaskets, sleeves, etc. with or without stainless steel clamps, bolts, etc. that will not erode over time. Connectors shall be designed specifically for the application intended. Service connections shall be by sewer saddles, style "CB" all stainless steel, as manufactured by Romac Industries or equivalent or by use of Inserta Tees as manufactured by Inserta Fittings Company.
6. Where stormwater connections are to be installed to the property line, the pipe shall be installed true to line, at a 90 degree angle from the mainline, if possible, and on at least a 1% grade, but no more than a 3% grade. Except where otherwise specifically required or permitted by the City, stormwater connections shall be installed by open cut excavation, shall have a minimum depth of 6 feet at the property line and shall be deep enough to serve all basement foundation drains. The requirements for construction shall, in all respects, comply with those specified in this section for main sewers.
7. In general, riser sections will be required between the main line sewer connection and that portion of the service connection installed at least 1% grade where depths to the main sewer invert

exceed 12 feet. Riser pipe shall be defined as the vertical pipe, plus all pipe fittings required between the vertical pipe and the connection at the main sewer. The riser shall be fixed in place for its full height by providing thoroughly tamped pipe embedment material. Clean-outs shall be allowed as required and/or approved by City.

8. Where required, stormwater connections shall be installed within steel encasement pipe. Steel encasement pipe shall extend 5 feet each side of the pavement. Steel encasement pipe shall be sized for at least 2" clearance around the pipe bell, but not to exceed 14" in size, and the minimum wall thickness shall be 0.188".
9. Stormwater connections not immediately connected to an existing sewer shall be closed with a stopper. Stoppers shall be specifically designed for use with the pipe, shall be for use as a permanent or temporary plug, shall be watertight, and shall be removable without damaging the pipe. Pipe damaged when installing or removing stoppers shall be replaced at the expense of the Contractor.
10. The ends of stormwater connections shall not be backfilled until the location is referenced. A 2" square oak pole shall be accurately placed over the termini of all such stormwater connections and shall extend vertically flush with the surface of the ground so that it can be located.

3.3 Inspection and Testing

- A. The installation of any storm sewer both within private property or the public right-of-way shall be coordinated with the City Engineer's Office. The City Engineer's Office will determine whether or not permitting and/or inspections and testing are required for the proposed project.
- B. Each section of pipe shall be tested for obstructions by use of either mandrels, solid cylinders, or balls with diameters of 95% of the pipe diameter not less than 30 days after final full backfill has been placed.
- C. All City maintained culverts shall be inspected using the requirements established in the most recent version of ODOT's Culvert Management Manual.
- D. All Storm Water facilities shall be inspected annually per the City of Tiffin's Storm Water Management Plan & Codified Ordinance Chapter 909.

3.4 Design

- A. Storm sewer systems shall be constructed for storm water run-off only. Construction of Combined Sewers will not be permitted.
- B. The quantity of storm water run-off to be used in the design of storm sewers shall be computed using the "Rational Method". This method is designated by the equation:

$$Q = C \times I \times A$$

Q = Ratio of run-off (Cu. Ft./Sec)

C = Ratio of run-off rainfall

I = Rainfall Intensity (In/Hr)

A = Area of the watershed (Acres)

- 1. The Flood Co-efficient. The "C" factor in the Rational Method equation is an uncertain factor since it is influenced by many circumstances, including but not limited to:
 - a. Infiltration: The character of the soil, antecedent moisture, frozen ground, etc.
 - b. Geographical Characteristics: Shape and Slope of the watershed.
 - c. Natural Storage: valley storage, tributaries, ponds, swamps, etc.
 - d. Artificial Storage: reservoirs, channel improvements, etc.
 - e. Land Coverage: forested, cultivated, pasture, barren, lawn, paved, etc.
 - f. Sudden Releases of Flow: Snow Melts
- 2. The constantly changing forces of nature bring these factors into focus from time to time. Furthermore, new housing developments, highways and drainage facilities influence the percent of run-off. At best, it must be admitted that run-off factors are estimates. For the purpose of this manual, it is assumed that various parts of the watersheds will have different run-off coefficients, as follows:
 - a. Commercial Areas 0.70 – 0.80
 - b. Residential Areas 0.35 – 0.40
 - c. Industrial Areas 0.40 – 0.80
 - d. Parks, Cemeteries, Golf Courses, etc. 0.15
 - e. All Areas within the exterior limits of dedicated streets, alleys, public ways 1.00

Other suggested minimum co-efficients of “C” are as follows:

- | | | |
|----|----------------------|------|
| a. | Flat, Gravel Ground | 0.30 |
| b. | Flat, Clay Ground | 0.40 |
| c. | Steep, Gravel Ground | 0.40 |
| d. | Steep, Clay Ground | 0.50 |

3. Rainfall Intensity is one of the most sensitive factors in the Rational Method equation. The depth of flooding, and hence the inconvenience it causes depends largely upon the rainfall intensity curve, or frequency, that is used to design storm sewers and drains. The Rational Method of calculating storm water run-off assumes that the rainfall intensity “I” used in the equation shall be the maximum rainfall that may be expected to fall on the up-stream drainage areas during the “concentration” time at the location being studied. The up-stream areas, where concentration time is short, the critical rainfall intensity is high. Where the time of concentration is greater, the rainfall intensity will be lower.

a. The time of concentration factor is a necessary part of the preliminary data required to make a calculation using the Rational Method equation. It is composed of two components referred to as the “Inlet time” and “Time of Flow”.

- The “Inlet Time” is the time expended for the water to flow from the most distant point in the drainage area to the inlet of a drainage structure or to a point of concentration, where the water flow is picked up into a storm sewer or water course. Determination of inlet time is dependent upon the slope, type of surface and distance of travel.
- Some indication of estimates of inlet time in areas with relatively flat topography, such as in the Tiffin area, are shown below:

Distance of Travel to Inlet (ft)	Inlet Time (Min)
100	13
200	17
300	21
400	25
500	28
600	30
700	32
800	34

- In most drainage plans for street projects, highway projects, parking lot projects, drainage areas of the catch basins is easily defined and the “inlet time” or “time of concentration” will vary from 3 to 15 minutes, though it may be higher in some instances for areas within the street right-of-way or usual parking lots in municipal practice. When it also includes certain time of flow over immediate adjacent land to the street right-of-way from areas that must be included in the time of concentration, the “inlet time” above will be more than 3 to 15 minutes.
 - Time of concentration for large open areas, hillsides, etc. shall be based on a standard engineering practice and the best judgment of the Engineer designing the storm sewer.
- b. “Time of Flow” is the time consumed in flowing through the drainage system, open channels and storm sewers, from the inlet to the point being evaluated. This time is readily determined if the slope and physical properties of the storm sewer or open drainage channel are known.
- Design Storm Frequency. Storm sewer or drainage systems are usually designed to provide for run-off from rainfall having a certain average frequency to occurrence. The design storm frequency serves as an index to when the average systems will be taxed to capacity. The selection of a design storm frequency for a particular project must be based primarily on judgment, with consideration of the purpose and importance of the given area, and such economic and engineering limitations as may exist. It is necessary for this manual to establish minimum design storm frequencies to be used in designing storm sewers and drainage systems in the area controlled by the City of Tiffin and which will be used in reviewing plans submitted to the City Engineer for approval. Minimum frequencies shall be based upon the Critical Storm Method as identified in the Ohio Rainwater and Land Development Manual

- C. The plans for a proposed storm sewer project or storm drainage system shall include sheets that show the entire drainage area required to review the design. Design sheets, including run-off computations, and topographical maps showing contours on 5 foot or 2 foot intervals of the water-sheds or drainage areas involved shall be submitted with the plans.
- D. Any existing storm sewers, natural drainage ditches, creeks, etc. or man-made drainage systems in the above mentioned areas shall be shown on the plans submitted. Where it is proposed to connect new storm sewers into existing sewers, the existing sewers shall be un-covered and accurate location surveys shall be made including accurate invert elevations.
- E. The proposed drainage plans shall show the location of all streets, alleys, public right of ways, easements, catch basins, manholes, drainage structures that may be required to drain all easements, streets and other areas where storm water run-off would collect to the possible damage of property owners.
- F. The plans shall show the extent of all drainage areas that the proposed storm sewers, or drainage system, would have to care for now and in the future.
- G. The plans and profiles shall show the proposed storm sewers or proposed drainage system in such detail and to such scale that it will be possible to make a review of the project without undue delay.
- H. The minimum depth of cover over a main storm water sewer shall be four feet to the finished surface grade. This shall be measured over the point of the largest diameter of the pipe or sewer.
- I. The minimum size of a public storm sewer shall be 12 inches in diameter.
- J. The pipe leading from catch basins to main sewers may be sized to adequately care for the flow of water but not less than 12 inches in diameter without written approval of the City Engineer. These pipes, leading from catch basins to main storm sewers shall have a minimum cover of 12 inches at the gutter line and shall have a minimum grade of 2%.
- K. Catch basin or inlet spacing along the curb lines of a street shall not be greater than 250 feet unless approval is obtained from the City Engineer.

- L. The maximum spacing between manholes is 250 feet unless approval is obtained from the City Engineer.
- M. Pipes from catch basins or inlets to main sewers shall connect with the main sewers at manholes only.
- N. Velocities when flowing full or half full shall not be less than 3 feet per second nor more than 12 feet per second. Minimum grades can be determined from these velocities for any shape of pipe or conduit.
- O. Drop structures shall be used where velocities would otherwise exceed the maximum limit of 12 feet per second.
- P. Sewer capacities shall be computed using Kutter's or Manning's Formula, with a value of $n = 0.015$ for pipe sewers under 30 inches in diameter and $n = 0.013$ for pipe sewers over 30 inches in diameter.
- Q. Sewer invert grades and elevations shall be established wherever possible, to prevent surcharge and in no case shall the hydraulic grade line be above the surface of the ground or street for flows equal to or less than computed for the design storm.
- R. At points where the sewer diameters or pipe sizes or shapes change, a manhole shall be constructed. The inside top surfaces of the sewers shall be held at the same elevation but the inverts of the sewers will be stepped thereby.
- S. Where main sewers, enter trunk sewers, special attention shall be given to preventing any "blocking" of water flow in either sewer. In some instances, special transition types of structures may have to be provided. Smooth flow of water at all manholes and junction structures on storm sewers is vital.
- T. Manholes shall be located at all junction points of main, sub-main or lateral storm sewers particularly in sewers up to and including 60 inch diameter or equal to this in case the shape of the sewer is other than a circle.
- U. Manholes are required to be constructed at all changes in grade or changes in alignment particularly in sewers up to and including 60 inch diameter or equal to this in case the shape of the sewer is other than a circle.

- V. For approved castings for manholes and inlets, see the “Materials” Section of the Storm Sewer Specifications.

- W. All outfall ends of storm sewers shall be properly protected by headwalls of concrete, rip-rapping of banks of open drainage channels, paved inverts of open drainage channels, etc. as required by standard engineering practice and approved by the City Engineer. In case of small pipe outfall ends, sufficient length of paved and coated metal culvert pipe may be required instead of the concrete headwalls, or may be required in conjunction with such headwalls.

- X. Storm sewers shall be laid in the dedicated street right-of-way.

- Y. Open drainage channels may be used to collect and convey storm water run-off where approved by the City Engineer and/or City Planning Commission, if closed conduits would have to be equal in size and capacity to pipe larger than 4 feet in diameter.

- Z. Reference Section 909.11 of the City of Tiffin Codified Ordinances for easement requirements for storm water facilities including but not limited to flood plains, flood control facilities, run-off drainage ditches and channels, run-off storage facilities, storm sewers and other drainage ways and structures, permanent vegetative and/or mechanical post-construction water quality conservation practices (BMPs) and other areas, as required by the City Engineer.

- AA. An open drainage channel shall be so located on an individual lot so that there is a minimum distance of not less than 15 feet from the top of bank of the drainage channel and the property line, or to any physical encroachment, obstacle or structure. It is intended by this requirement to provide an area along the top of each bank of the drainage channel at least 15 feet wide in width in which to move equipment for maintenance of the open drainage channel.
 - 1. The above does not preclude an open drainage channel, where permitted, to be so located so that it’s centerline follows a property line dividing individual lots of a subdivision, or along a boundary line of a tract of property, provided the minimum width of 15 feet along top of each bank is provided, as mentioned.

- AB. Open drainage channels, shall be designed to adequately care of the storm water run-off, which shall be determined as if closed conduits or storm sewers were to be constructed as provided in this manual. The slopes shall be protected from erosion; the grade of the invert of the

bottom of the channel. Cross-sections shall show the type of channel every fifty feet along the channel centerline. Check dams shall be constructed as required to preserve the channel from excessive velocities.

- AC. Existing drainage channels shall be enlarged, repaired, re-aligned, graded and sloped as required for new channels and shall be adequately sized to care for the run-off.
- AD. Pipe culverts or other types of culvert structures under streets or public ways shall extend completely across the streets or public right-of-way and extend a minimum 20 feet beyond the right-of-way line on each side. If retaining wall type of headwalls are not provided to retain the fill, if any, the culvert or structure shall be extended beyond this minimum 20 feet point a sufficient distance required by the slope of the banks.
- AE. Open drainage channels shall be protected from scouring on curves, storm sewer outfalls, and similar proper rip-rapping of the banks using heavy stone or concrete. Pave stone channels shall lead from storm sewer outfalls where deemed necessary to prevent scouring and erosion.
- AF. Open drainage channel banks shall be properly sloped in accordance with standard engineering practice and properly seeded or sodded or paved as may be required.
- AG. In subdivisions with lots with areas of 2 acres or more and frontages of 150 feet or more, the City Engineer and/or Planning Commission may approve open roadside ditches where right-of-way widths for the street and public ways are not less than 66 feet.
- AH. Reference the City of Tiffin "Storm Water Management Plan" for all storm water permitting and inspection regulations.

3.5 Stormwater Quantity Controls

A. Hydrology Requirements

1. This section indicates which methods can be used to design various components of the stormwater system. Generally, the Rational Method, as presented in Section 3.4.3 shall be used for designing storm sewer systems.
2. The Rational Method is not appropriate for designing stormwater detention basins, designing major conveyance systems (systems draining more than 200 acres) or evaluating downstream impacts on streams. Several methodologies are available for calculating runoff hydrographs and routing them through the stormwater system. Additional information can be found in section 3.5.C.

3. There are constraints to using various Hydrologic Methods. These constraints are summarized in Table 3-1 below.

Table 3-1: Limitations to Hydrologic Methods

Method	Size Limitation	Applicability
Peak Flow Methods <ul style="list-style-type: none"> • Rational Method 	Up to 200 Acres	Can be used to estimate peak flows for the design of small storm sewer systems
Approved Hydrograph Methods	All sizes	Can be used for estimating peak flows and hydrographs for all stormwater design applications

B. Hydrologic Components

1. Rainfall intensity-duration-frequency (IDF) curves for Northwestern Ohio/Rainfall Intensity Zone B, based upon precipitation data obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, or most recent version, shall be used in conjunction with the appropriate hydrologic method and/or model to determine design runoff volumes and intensities. In general, these curves shall be used directly where the rational formula is appropriate to calculate runoff. Design rainfall hyetographs distributed over a 24-hour period with the SCS Type II distribution are presented. The 24-hour Type II rainfall distribution represents design rainfall intensities over a time of concentration range typical of a small urban watershed, coupled with wet antecedent conditions at the time of peak rainfall intensity. A copy of the Type II hyetograph for Tiffin, Ohio can be found in **Appendix A**. Note that the hyetograph data is sourced from NOAA Atlas 14 and will need updated with the release of Atlas 15.
2. Additional information on rainfall intensity is located in Section 3.4.B.3.

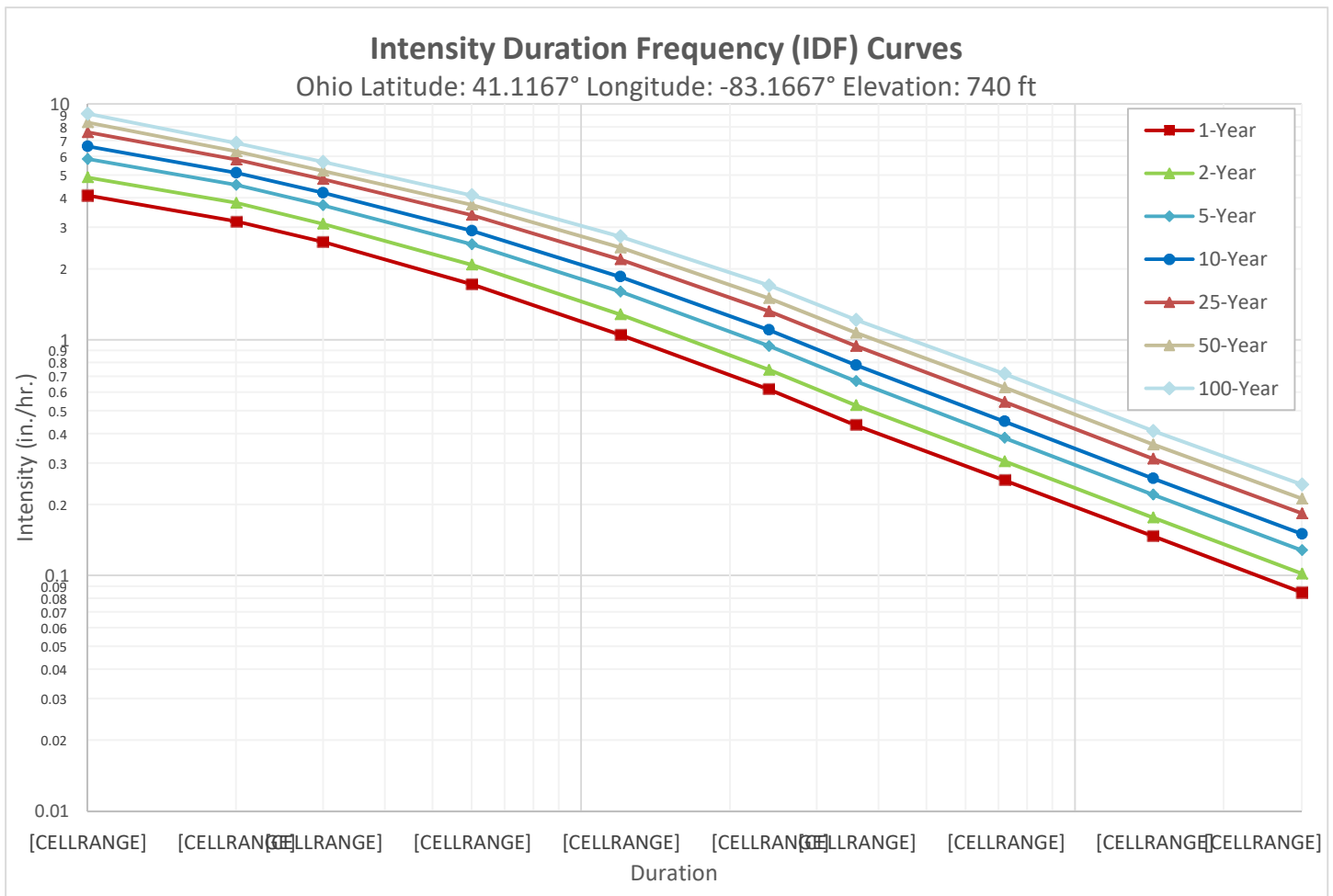


Figure 3-1: Intensity-Duration-Frequency Curves – Tiffin, Ohio

C. Acceptable Runoff Hydrograph Development Methods

1. Peak flow methods are not appropriate for designing stormwater detention basins, evaluating downstream impacts on streams, or designing major conveyances with drainage areas larger than 200 acres. In these cases, the City requires that a hydrograph be developed and routed through the system to support design. Hydrograph methods may also be used to design other elements of the stormwater system as part of a comprehensive hydrologic and hydraulic evaluation supported by computer models or other appropriate means.
2. This section outlines the methodologies for defining runoff hydrographs and routing them through the stormwater system. The following methodologies are accepted by the City:
 - a. Rainfall Hyetographs - all runoff hydrographs must be based on a design storm hyetograph defined using the 24-hour design storm rainfall volumes for the City of Tiffin, and the 24-hour SCS Type II rainfall distribution.
 - b. Abstractions from Rainfall - abstractions from rainfall must be determined for each 15-minute rainfall volume within the hyetograph. Abstractions include depression storage and infiltration into the soil, based on the soil and land cover characteristics of the catchment. The NRCS curve number methodology is

accepted for defining rainfall abstractions, and other methods like the Green-Ampt and Horton's methods may be used with appropriate documentation, and approval by the City.

- c. Unit Hydrographs - The SCS dimensionless unit hydrograph can serve as the basis for developing runoff hydrographs. Develop a unit runoff hydrograph from each catchment in the project site for each 15-minute rainfall increment within the SCS Type II distribution. The total hydrograph is then determined by adding the individual unit hydrographs. The City will accept calculations based on computer models that use the SCS unit hydrograph method and may consider alternative methods like the Snyder and Clark unit hydrograph methods or the kinematic wave method.

- i. A runoff unit hydrograph can be developed for each 15-minute rainfall increment within the SCS Type II distribution, using the following equations and variables outlined in **Table 3-2**.
 - ii. $t_p = 0.666 * t_c$ and $Q_p = P_e * 484 * A/t_p$

where: t_p = time to peak, hours

t_c = time of concentration, hours

Q_p = peak flow rate from one inch of excess rainfall, cfs

P_e = excess rainfall during the 15-minute increment, in.

= total rainfall minus the abstraction to rainfall

A = watershed area, sq. miles

The total hydrograph from the catchment is determined by adding the individual unit hydrographs determined using the above equation. The City will accept calculations based on computer models that use the SCS unit hydrograph method to develop runoff hydrographs.

Table 3-2: SCS Dimensionless Unit Hydrograph

t/t_p	Q/Q_p
0.0	0.000
0.2	0.100
0.4	0.310
0.6	0.660
0.8	0.930
1.0	1.000
1.2	0.930
1.4	0.780
1.6	0.560
1.8	0.390
2.0	0.280
2.2	0.207
2.4	0.147
2.6	0.107
2.8	0.077
3.0	0.055
3.2	0.040
3.4	0.029
3.6	0.021
3.8	0.015
4.0	0.011
4.2	0.008
4.4	0.006
4.6	0.004
4.8	0.002
5.0	0.000

D. Hydrologic Requirements

1. Stormwater control facilities/BMPs shall be designed to control runoff from various storm events before being discharged from the site. The criteria outlined in this section are intended to minimize flooding downstream of proposed development and reduce streambank erosion of nearby watercourses.
2. The volume and distribution of rainfall for the storm events to be used for quantity control calculations shall be developed using the 24-hour rainfall intensity from the IDF curves noted in **Figure 3-1**. This intensity shall be converted into a rainfall volume by multiplying it times 24 hours. Stormwater quantity control facilities/BMPs shall be designed using one of the hydrograph methods defined in Section 3.5.C. Onsite facilities to control post-development stormwater runoff from residential, commercial, and industrial development sites shall be designed according to the methodology presented below, which is derived from the critical storm method. Under this methodology, the percent increase in post-development runoff volume from a site during a 1-year storm event shall be calculated in the following manner to determine the critical storm event:

- a. Determine the total volume of runoff from a 1-year, 24-hour storm, occurring over each of the site's drainage areas before and after development, using the methodology outlined in 3.5.C.
- b. Determine the percent of increase in runoff volume due to development. Using this percentage, select the critical storm from **Table 3-3**.

Table 3-3: Critical Storm Determination

If the percent of increase in runoff volume is		The critical storm for peak rate control will be
Equal to or greater than	And less than	
-	10	1-year
10	20	2-year
20	50	5-year
50	100	10-year
100	250	25-year
250	500	50-year
500	-	100-year

3. Runoff from storm events that are less than or equal to the critical storm event shall be released at a rate no greater than the peak runoff during a 1-year storm event under pre-developed conditions. Moreover, the peak runoff rate during the 25-year storm event shall be released at a rate less than or equal to the peak runoff rate during the 2-year storm event under pre-developed conditions, for networks that will tie into a combined sewer. All other developments should follow critical storm methodology.
4. These conservative quantity control requirements are essential strategies for meeting the goals of the City of Tiffin long-term control plan and Stormwater Management Program.

3.6 Stormwater Quality Controls

1. Stormwater control facilities/BMPs shall be designed to control runoff from various storm events before being discharged from the site. The criteria outlined in this section shall be used to supplement the criteria detailed in the Ohio Rainwater and Land Development Manual and the Ohio Construction General Permit.
2. All stormwater runoff from proposed development sites shall be conveyed to one (or more) stormwater best management practices (BMPs) designed according to:
 - a. Effective Ohio EPA (OEPA) Authorization for Stormwater Discharges Associated with Construction Activity under the National Pollutant Discharge Elimination System (Construction General Permit (CGP), OHC000006), or most recent version.
 - b. Any supplemental documentation provided by OEPA pertaining to the effective CGP
 - c. Effective Rainwater and Land Development Manual

3. Refer to the City of Tiffin Stormwater Management Program, MCM #5, for post-construction stormwater management standard operating procedures, BMP inventory, and associated inspection checklists for all approved BMPs.
4. Refer to Chapter 909 of the City of Tiffin Codified Ordinances for more information on long-term inspection and maintenance agreements required for best management practices.

3.7 Stormwater Report Requirements

The following items must be included in all stormwater calculations and reports submitted for review to the City of Tiffin:

1. Construction Plans
2. Calculation Package/Stormwater Report
3. Model Outputs from HydroCAD or PondPack
4. Compliance Table (refer to Appendix B)
5. Critical Storm Models (1-year storm, including both existing and proposed conditions)
6. If tying into a combined sewer system, a Model showing compliance with the peak reduction requirements outlined in D.3.

Appendix A:
Type II 24-Hour Rainfall Distribution
Tiffin, Ohio

Hour	Type II Mass Curve Delta Rain		Type II 24-Hour Distribution							
			Rainfall (in)							
			Frequency: Duration: Depth (in.):	1-Year 24-Hour 2.03	2-Year 24-Hour 2.44	5-Year 24-Hour 3.07	10-Year 24-Hour 3.60	25-Year 24-Hour 4.40	50-Year 24-Hour 5.08	100-Year 24-Hour 5.83
0:00	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0:15	0.003	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
0:30	0.005	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
0:45	0.008	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
1:00	0.011	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
1:15	0.014	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
1:30	0.016	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
1:45	0.019	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
2:00	0.022	0.003	0.006	0.007	0.008	0.010	0.012	0.014	0.016	0.016
2:15	0.025	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
2:30	0.028	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
2:45	0.032	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
3:00	0.035	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
3:15	0.038	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
3:30	0.041	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
3:45	0.045	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
4:00	0.048	0.003	0.007	0.008	0.010	0.012	0.014	0.017	0.019	0.019
4:15	0.052	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
4:30	0.056	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
4:45	0.060	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
5:00	0.064	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
5:15	0.068	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
5:30	0.072	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
5:45	0.076	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
6:00	0.080	0.004	0.008	0.010	0.012	0.014	0.018	0.020	0.023	0.023
6:15	0.084	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
6:30	0.089	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
6:45	0.093	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
7:00	0.098	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
7:15	0.103	0.006	0.011	0.013	0.017	0.020	0.024	0.028	0.032	0.032
7:30	0.109	0.006	0.011	0.013	0.017	0.020	0.024	0.028	0.032	0.032
7:45	0.114	0.006	0.011	0.013	0.017	0.020	0.024	0.028	0.032	0.032
8:00	0.120	0.006	0.011	0.013	0.017	0.020	0.024	0.028	0.032	0.032
8:15	0.127	0.007	0.013	0.016	0.020	0.023	0.029	0.033	0.038	0.038
8:30	0.133	0.007	0.013	0.016	0.020	0.023	0.029	0.033	0.038	0.038
8:45	0.140	0.007	0.014	0.017	0.022	0.025	0.031	0.036	0.041	0.041
9:00	0.147	0.007	0.014	0.017	0.022	0.025	0.031	0.036	0.041	0.041
9:15	0.155	0.008	0.016	0.020	0.025	0.029	0.035	0.041	0.047	0.047
9:30	0.163	0.008	0.016	0.020	0.025	0.029	0.035	0.041	0.047	0.047
9:45	0.172	0.009	0.018	0.022	0.028	0.033	0.040	0.046	0.053	0.053
10:00	0.181	0.009	0.018	0.022	0.028	0.033	0.040	0.046	0.053	0.053
10:15	0.193	0.012	0.023	0.028	0.035	0.042	0.051	0.059	0.067	0.067
10:30	0.204	0.012	0.023	0.028	0.035	0.042	0.051	0.059	0.067	0.067
10:45	0.220	0.016	0.032	0.038	0.048	0.056	0.068	0.079	0.090	0.090
11:00	0.235	0.016	0.032	0.038	0.048	0.056	0.068	0.079	0.090	0.090
11:15	0.259	0.024	0.049	0.059	0.074	0.087	0.106	0.122	0.140	0.140
11:30	0.283	0.024	0.049	0.059	0.074	0.087	0.106	0.122	0.140	0.140
11:45	0.357	0.074	0.150	0.181	0.227	0.267	0.326	0.376	0.432	0.432
12:00	0.663	0.306	0.621	0.747	0.940	1.102	1.347	1.555	1.784	1.784
12:15	0.699	0.036	0.073	0.088	0.111	0.130	0.159	0.183	0.210	0.210
12:30	0.735	0.036	0.073	0.088	0.111	0.130	0.159	0.183	0.210	0.210
12:45	0.754	0.018	0.038	0.045	0.057	0.067	0.082	0.094	0.108	0.108
13:00	0.772	0.018	0.038	0.045	0.057	0.067	0.082	0.094	0.108	0.108
13:15	0.786	0.014	0.028	0.033	0.042	0.049	0.060	0.069	0.079	0.079
13:30	0.799	0.014	0.028	0.033	0.042	0.049	0.060	0.069	0.079	0.079
13:45	0.810	0.011	0.021	0.026	0.032	0.038	0.046	0.053	0.061	0.061
14:00	0.820	0.011	0.021	0.026	0.032	0.038	0.046	0.053	0.061	0.061
14:15	0.828	0.008	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
14:30	0.835	0.007	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
14:45	0.843	0.008	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
15:00	0.850	0.008	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
15:15	0.858	0.007	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
15:30	0.865	0.008	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
15:45	0.873	0.007	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
16:00	0.880	0.008	0.015	0.018	0.023	0.027	0.033	0.038	0.044	0.044
16:15	0.885	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
16:30	0.889	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
16:45	0.894	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
17:00	0.898	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
17:15	0.903	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
17:30	0.907	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
17:45	0.912	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
18:00	0.916	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
18:15	0.921	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
18:30	0.925	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
18:45	0.930	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
19:00	0.934	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
19:15	0.939	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
19:30	0.943	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
19:45	0.948	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
20:00	0.952	0.004	0.009	0.011	0.014	0.016	0.020	0.023	0.026	0.026
20:15	0.955	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
20:30	0.958	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
20:45	0.961	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
21:00	0.964	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
21:15	0.967	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
21:30	0.970	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
21:45	0.973	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
22:00	0.976	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
22:15	0.979	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
22:30	0.982	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
22:45	0.985	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
23:00	0.988	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
23:15	0.991	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
23:30	0.994	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
23:45	0.997	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018
0:00	1.000	0.003	0.006	0.007	0.009	0.011	0.013	0.015	0.018	0.018

Appendix B:
Example Compliance Table

Compliance Table						
PLEASE FILL IN THE CELLS SHOWN IN GRAY.						
Recurrence	Existing (cfs)	Disturbed Allowable* (cfs)	Undisturbed Flow** (cfs)	Total Allowable (cfs)	Proposed (cfs)	Credit Available (cfs)
1						
2						
5						
10						
25						
50						
100						

Critical Storm Determination			
Pre 1-Yr Volume =		cfs	1-Year Existing
Post 1-Yr Volume =		cfs	1-Year Proposed
% Increase =		X-year critical storm	

If the percent of increase in runoff volume is		The critical storm for peak rate control will be
Equal to or greater than	And less than	
-	10	1-year
10	20	2-year
20	50	5-year
50	100	10-year
100	250	25-year
250	500	50-year
500	-	100-year

SECTION 4
ROADWAYS & ALLEYS

Section 4 – Roadways & Alleys

4.1 General Requirements

- A. Roadway plans shall be designed based upon the latest edition of the Ohio Department of Transportation (ODOT) Location and Design Manual, American Association of State Highway and Transportation Officials (AASHTO) Policy on Geometric Design of Highways and Streets, ODOT Standard Construction Drawings, the ODOT Construction and Material Specifications, and Chapters 9 and 11 of the City of Tiffin Codified Ordinances.
 - 1. Horizontal and vertical design, geometric design of intersections, barrier design, pavement design and driveway design for new and reconstructed roadways shall follow ODOT L&D Manual Volume 1 and AASHTO Policy on Geometric Design of Highways and Streets or as required by the City.
 - a. At street intersections, the minimum radius, measured to the face of curb shall not be less than 25 feet.
 - b. At alley intersections, the minimum radius, measured to the face of curb shall not be less than 20 feet.
 - See Exhibit J for Intersection Standard Drawing
 - 2. Where new public roadways are to be built, or existing roads are to be widened, soil borings shall be required at 200 foot intervals along the centerline of the proposed improvements. The California Bearing Ratio (CBR) value of the existing soil shall be determined and made available to the City Engineer in a report which shall include any subgrade stabilization measures required.

4.2 Typical Sections

A. Pavement Width

- 1. Refer to Section 1127.04 of the City of Tiffin Codified Ordinances Attached as Exhibit K.
- 2. The minimum width for a 2 traffic lane road with on-street parking permitted on one side of the street is 34 feet.
- 3. The minimum width for a 2 traffic lane road with on-street parking permitted on both sides of the street is 44 feet.

4. The minimum width for a 4 traffic lane road with no on-street parking permitted anytime on either side is 48 feet.
5. The width of pavement is defined as the width of street measured from one curb face to the opposite curb face or one edge of gutter plate to the opposite end of gutter plate.
6. Cul-de-Sacs
 - a. See Exhibit L for Typical Cul-de-Sac Layouts

B. Cross Slope

1. Unless unusual circumstances apply the cross slope for a typical section of pavement shall be designed at 1/4+per 1 foot or 2%.
2. The street cross section shall be level. The top of curb on each side of the street shall be at the same elevation, unless topography requires one curb to be higher than the other.

C. Horizontal Slope

1. The minimum centerline grade shall be not less than 0.30%; the maximum grade shall not exceed 8% unless unusual topography is present.

D. Approaches

1. Refer to Exhibit M for Typical Profile of Alleys & Drive Approaches

E. Curbs & Underdrains

1. Refer to Section 1127.09 of the City of Tiffin Codified Ordinances Attached as Exhibit K.
2. All types of curbs shall be constructed per the current ODOT specifications.
3. The curb type shall be at the discretion of the City Engineer and/or Planning Commission.
4. Curbs shall have a sawed joint every 10 feet.
5. The joint created between the curb face and the pavement shall be sealed with asphalt cement as per the latest addition of the ODOT Construction and Material Specifications.
6. Underdrains shall be 6+in diameter and underdrain inverts shall be typically 18+below the subgrade surface.

7. Underdrains shall be PVC plastic, smooth walled and perforated, meeting ODOT 707.41.

F. Pavement Buildup

1. The minimum pavement buildup section for all City streets shall consist of the following courses and comply with the latest edition of the ODOT Construction and Material Specifications.
 - a. Local Residential Public Street & Alley
 - See Exhibits N&O for Asphalt and Concrete Roadway Sections.
 - b. Local Collector or Arterial
 - See Exhibit N&O for Asphalt and Concrete Roadway Sections.
2. In all cases, the minimum pavement buildup shall be calculated based on soil conditions and truck traffic and modified as required to meet the expected loadings. The City shall review a copy of the asphalt pavement design, including the calculations, for review and approval. The method for pavement design shall follow the latest edition of the ODOT Pavement Design and Rehabilitation Manual.

G. Utility Trench

1. Asphalt Streets & Alleys
 - a. Pavement replacement shall consist of a minimum of 8+of ODOT Item 304 Aggregate Base compacted in (2) 4+lifts or ODOT Item 613 Control Density Fill (CDF) as determined by the City Engineer, 2-1/2+of ODOT Item 448 Asphalt Concrete Intermediate Course and 1-1/2+of ODOT Item 448 Asphalt Concrete Surface Course.
 - See Exhibit P
 - b. The existing pavement shall be saw cut two feet wider than the width of the utility trench at the surface of the trench (one foot on each side of the trench).
 - c. The thickness and depth of the concrete base and asphalt surface shall be adjusted to match the existing pavement buildup if greater than the minimum requirements.

2. Concrete Streets & Alleys
 - a. Pavement replacement shall match the existing typical section of the pavement that was disturbed.
 - b. The existing pavement shall be saw cut two feet wider than the width of the utility trench at the surface of the trench (one foot on each side of the trench) or to the nearest joint per the discretion of the City Engineer.
3. General Requirements
 - a. Utility trench repair shall be completed within 48 hours of Control Density Fill (CDF) placement or granular backfill unless otherwise approved by the City. If the Engineer determines that the trench shall not be restored within the 48 hour time frame in order to allow further time for potential settlement to take place, the Engineer can determine at his/her discretion the means and methods for temporary fill of the trench to the pavement surface such as cold patch, CDF, plating, granular backfill, etc.
 - b. All plates shall be pinned to ensure no movement and the area on either side of the plate shall be ramped with cold patch.
 - c. If weather conditions do not allow permanent pavement placement, the City Engineer can require the trench to be filled with cold patch or other construction methods such as a 4+concrete cap with a visqueen separation layer. Selection will be at the discretion of the City Engineer.

H. Roadway Widening

1. The length and width of the existing pavement surface course, within the limits of the proposed widening, shall be planed to a depth of 1-1/2". The planed area shall be resurfaced with 1-1/2" of ODOT Item 448 Asphalt Concrete Surface Course after the widening has been completed.
2. Existing underdrains shall be protected, left in place and connected to any modified storm drainage system.
3. Pavement buildup shall comply with the requirements of Section 4.2.F of the City of Tiffin Public Works Improvements Design Manual.

I. Pavement Markings

1. Pavement markings for existing roadways shall be quick drying traffic paint following ODOT 642, the OMUTCD, and as approved by the City.
2. Pavement markings for new and resurfaced roadways will need to comply with ODOT 642 or ODOT 644 per the discretion of the City and follow all OMUTCD requirements.
3. Any temporary tape placed on the finished course shall be removed without damaging or scarring the roadway surface prior to the final pavement markings being placed on the finished course.
4. Crosswalks
 - a. See Exhibits Q & R for crosswalk striping details.
 - b. All crosswalks immediately adjacent to a school, that are part of the City of Tiffin's Mult-Use Trail System or crossing a roadway classified as a Principal Arterial, Minor Arterial, or Major Collector per ODOT's Functional Highway Classification System shall be striped with a ladder style crosswalk as depicted in Exhibit R.

J. Monuments

1. The centerline of the right-of-way shall be monumented at a minimum at the P.C. and P.T. of horizontal curves, angle points and at centerline intersections of side roads.
2. The monuments shall be constructed per ODOT Standard Drawing RM-1.1.
3. All monuments shall be set under the supervision of a Professional Surveyor, registered in the State of Ohio.
4. Monument boxes shall be East Jordan 8365 Heavy Duty monument or equivalent as approved by the City Engineer.
5. No risers shall be used on any Monument Box.

K. Signage

1. All signs shall comply with the most recent version of the Ohio Manual of Uniform Traffic Control Devices (OMUTCD).

L. Guardrail

1. Guardrail conforming to the most current standards of the Ohio Department of Transportation and OMUTCD and shall be constructed where necessary to protect pedestrian and vehicular traffic.
2. The location of the guardrail, with reference to the centerline of the street, if possible, shall be 8 feet minimum from the face of the curb line or edge of pavement to allow for space for a pedestrian walkway.

M. Casting Adjustments

1. Unless other-wise directed, when streets are surfaced with asphalt concrete the roadway valve boxes, manhole castings, catch basins, and similar structures in the pavement area shall be adjusted level with the finished pavement surface after the final finish surface layer of pavement is applied.
2. The finished pavement shall be ~~sawed~~ a minimum distance of 8 inches from the extreme edge of the casting being adjusted
3. After the structure has been raised the pavement area removed shall be neatly patched with concrete and the edge of concrete collar where it matches the new asphalt surface shall be appropriately sealed.
4. In the case of rigid pavements, such as concrete, the area around the roadway valve box, manhole casting, catch basin, and similar structure shall be ~~blocked~~ or ~~boxed~~ out with forms so the pavement around the structures mentioned can be poured at a later time, permitting easy removal of the pavement area around the structure without requiring any concrete sawing.

SECTION 5
SIDEWALKS & MULTI-USE TRAILS

Section 5 – Sidewalks & Multi-Use Trails

5.1 Sidewalks

A. General Requirements

1. All sidewalks shall comply with ODOT Specification 608, except as noted within these specifications.
2. All sidewalks shall be a minimum of 4qin width, have contraction joints, and shall be constructed through all driveways.
 - a. See Exhibit S for Standard Sidewalk Drawings
 - b. See Exhibit M for Drive Approach Profiles
3. Concrete shall placed on a minimum of 2 inches of well compacted aggregate base, unless otherwise approved by the City Engineer.
4. The City may approve sidewalks from materials other than concrete as follows:
 - a. Sidewalks may be made from paving bricks set in a cement mortar setting bed upon a Portland cement foundation.
 - b. Sidewalks may be made from paving bricks set in a sand bed upon a compacted soil base.
 - c. Asphalt sidewalks upon a sufficient base are only permitted within 20 feet of a railroad crossing.
5. The aggregate base shall be brought to an even surface uniformly below the proposed surface of the finished walk and shall be as wide as or wider than the sidewalk. Soft or spongy base or organic matter shall be removed and replaced with compacted stone. Wherever a fill is necessary, the material shall be stone and it shall be spread in lifts not to exceed 4 inches maximum with each layer being compacted.
6. Substantial side forms with sufficient strength to prevent springing shall be accurately placed to line and grade and shall not be removed until sufficient time has been allowed for the concrete to properly cure. Forms may be either wood or metal and must extend the full depth of the slab.

7. Concrete shall be placed in one course to at least the full minimum thickness required and screeded to bring the top to a smooth even surface.
8. The surface shall have a light broom or burlap finish.
9. Finished concrete shall be kept moist for 48 hours or sealed by spraying a manufactured curing membrane uniformly over all exposed surfaces. Sealing shall be performed immediately after the finishing work is completed and all free standing water has disappeared.
10. Sprinkling of dry cement on the floated surface to hasten drying is prohibited.
11. Cold weather installation shall meet the requirements of ODOT Item 511.12 or 499.02.
12. Hot weather placement will require special precaution to prevent rapid slump loss, shrinkage, or crazing. Addition of water to the mix may not be permitted, and it may be necessary to cover the concrete to protect from extreme heating from direct sunlight.
13. 1/2 inch thick expansion joint filler, extending the full depth of the walk, shall be placed between the walk and any fixed surface including existing concrete driveways and existing walks and curbs.
14. Contraction joints shall be placed at no more than 5qintervals and as nearly as possible to ascertain property lines. They shall be a minimum of 1/8 inch wide and 1/4 the thickness of the slab. Joints shall be sawed as soon as no raveling occurs or sawing does not damage the concrete, preferably within 12 hours after concrete has been placed, and not longer than 24 hours.
15. The contractor is responsible for supplying grade and line stakes for sidewalks within the public right-of-way, if needed.
16. When sidewalks are placed against the back of curb, the minimum width shall be increased to account for the width of the curb. At the city's discretion the width of the sidewalk can be further increased for areas determined to have a high volume of pedestrian traffic.
17. All curbs and sidewalks shall be constructed in a manner so as to have the least impact on surrounding city owned trees. When

roots must be cut, the City Forester will examine the affected tree(s) and determine if removal is appropriate.

18. All surplus material shall be removed from the excavated sidewalk area. Materials are not to be placed onto adjacent property without written permission from the property owner. Refuse material from the sidewalk work shall be removed lot by lot, upon completion of the work.
19. The contractor is responsible for arranging all necessary utility locates by contacting OUPS at 811 or 1-800-362-2764. Utility locates shall be scheduled well in advance of but not less than 2 working days prior to construction.
20. A Street Cut Permit and Bond is required to be obtained through the City of Tiffin Public Works Department, prior to any work being performed on any sidewalk/curb within the City right-of-way. The City will determine the alignment of all newly constructed sidewalks.
21. Contractors may request, at their option, inspections of the forms by the City, prior to pouring. 48 hours advance notice must be provided to be guaranteed an inspection. Final inspections will be performed even if the forms had a prior inspection. If it is found that the sidewalks do not meet the City's requirements, the City may require removal and/or correction at the installer's expense. The City, also, reserves the right, at its expense, to randomly test core any sidewalk installation. The installer will repair the core test hole at his or her expense.

B. Sidewalk Specifications

1. Concrete
 - a. Shall be ODOT Class C, 4000 PSI at 28 days with 7% (plus or minus 1.5%) air entrapment, minimum 6 sacks of cement per cubic yard, and a maximum water/cement ratio of 0.50. Maximum slump shall be 4+and in conformance with ASTM C94 and related designs. 4+slump may be exceeded only by the use of high range water reducer.
2. Course Aggregate
 - a. Shall be #57 limestone or natural stone

3. Fine Aggregate
 - a. Shall be sand manufactured from limestone and conform to ODOT 703.02 and ASTM C33.
4. Portland Cement
 - a. Shall be Type 1 and conform to ASTM C150
5. Admixtures
 - a. Air Entrapment, ASTM C260 and high range water reducer ASTM C294 are permitted. No other admixtures, including fly ash and raw or calcined natural pozzolans, are permitted without written authorization from the City Engineer.
6. Slump Testing
 - a. Shall be performed by the contractor in the presence of, and at intervals requested by the City or their inspector.
7. Excavation
 - a. Shall be an average of one inch deeper than the slab to permit leveling of the sub grade with #411 crushed aggregate, which shall be compacted and thoroughly wetted prior to placement of the concrete.
8. Steel Reinforcement
 - a. If required and with authorization from the City, #4 bars shall be used at 10+c/c maximum, in both directions. Steel shall be 2+from the bottom of the slab.

C Sidewalk Repair Requirements

1. The following sidewalk conditions shall be considered outside the required sidewalk specifications and must be repaired:
 - a. Sidewalks with excessive or reverse cross slope.
 - b. Sidewalks with excessive longitudinal slope.
 - c. Sidewalks having joint differentials at any point between slabs greater than 1/2 inch.
 - Joint Differentials between 1/2 . 1 inch may be repaired by grinding, replacement, or mud jacking.

- Joint Differentials greater than 1 inch must be repaired by either replacement or mud jacking.
- d. Sidewalk slabs with multiple cracks, with cracks open 1/2 inch or greater, or with cracks with 1/4 inch vertical displacement must be replaced.
- e. Sidewalk slabs with holes greater than 1 square foot must be replaced.
- f. Sidewalk slabs with displacement due to tree roots shall be removed and the base shall be excavated to a depth 1 foot below the sidewalk base. All tree roots within this 1 foot area shall be removed.
 - Upon removal of slabs damaged as a result of a city owned tree, please notify the City for an inspection.
 - The City Forester shall consider the tree for removal.
- g. Sidewalks may be rerouted around trees only if there is prior approval from the City.
- h. Any utility valves or manholes within a sidewalk shall either be relocated or made flush with the surface and it is the contractor's responsibility to make these arrangements with the appropriate utility company.
- i. If the sidewalk is replaced across the entire frontage of a property, excluding driveways, sidewalks with widths greater than 4 feet may be replaced with a 4 feet wide walk.
 - Transitions from a 4 feet wide walk to walks wider than 4 feet must be done per Exhibit S.
- j. Sandstone sidewalk slabs may be repaired upon a sufficient base when approved by the City or shown to have historical significance.

5.2 Curb Ramps

- A. All curb ramps shall be constructed in accordance to the Specifications of Section 5.1 unless otherwise specified in Exhibit T.
- B. All curb ramps shall be 6 inches thick within 6 feet of a vehicular traveled path.

5.3 Detectable Warning Mats

- A. Truncated Dome Detectable Warning mats shall be installed at all street, alley, and signalized commercial drive intersections.
- B. Truncated Dome Detectable Warning mats shall be cast in place mats from an approved ODOT supplier unless the existing ramp is approved by the City as being compliant to slope then a Retro-Fit Detectable Warning Mat may be installed on the surface of the existing slab at a location determined by the City.
- C. Detectable Warning Mats shall be provided 24+in direction of travel and extend the full width of the curb ramp or flush surface. The Detectable Warning shall be located adjacent to the curb line.
- D. Detectable Warning Mats, where applicable, shall be placed 6+ 8+ behind the face of curb & behind the curb joint.
- E. Cast In Place Detectable Warning Mats shall have a minimum of 3+of concrete on each side of the mat. When conditions do not allow this buffer, the edges of the Cast in Place Mat shall run flush with the dges of the concrete to prevent spalling or cracking.
- F. All Detectable Warning Mats shall be of the color %brick red+unless otherwise specified by the City Engineer.

5.4 Decorative Furniture Areas

- A. Stamped Concrete
 - 1. See Exhibit U for detailed specifications
- B. Decorative Brick Pavers
 - 1. See Exhibit V for detailed specifications

5.5 Multi-Use Trails

A. Typical Section

1. See Exhibit W for Typical Pavement Section.

B. Bollards

1. Bollards shall be used where applicable to prohibit vehicular access onto a Multi-Use Trail.

A See 7 - Exhibit X for Typical Bollard Detail.

C. Curb Ramps

1. Curb Ramps shall comply with Section 5.2 & 5.3.

D. Shared Lane Markings

1. Where Shared Lane Markings are used as a part of a Multi-Use Trail, markings shall comply with the requirements of the OMUTCD and ODOT Multimodal Design Guide.

E. Signage

1. Multi-Use Trails shall be appropriately and properly signed per the requirements of the OMUTCD and ODOT Multimodal Design Guide.

F. Crosswalks

1. Multi-Use Trail crossings shall be appropriately marked with ladder style crosswalks per Section 4.2 . (I)(4)(b).

SECTION 6
DRIVEWAYS

Section 6 – Driveways

5.1 General Requirements

- A. Driveways can be constructed of concrete, asphalt, or aggregate materials.
 - 1. See Exhibits Y & Z for residential and commercial driveway specifications within the City right-of-way.
 - 2. The City Engineer at his/her discretion may not permit a gravel drive approach within the public right-of-way if he/she determines the gravel approach will continuously washout into the public roadway.
- B. All proposed Driveway locations shall be approved by the City Engineer and shall be located on the property based upon engineering judgment related to access management. Visibility and traffic flow impacts shall be considered when determining the approved location.
 - 1. If possible, all driveways shall be designed to create the maximum amount of spacing to the nearest adjacent driveway.
 - 2. Driveways for corner lots shall be designed to create the maximum amount of spacing between the driveway and intersection.
 - 3. Multiple driveway approaches to a single property are discouraged. Prior to approving a second drive approach on any property, the City Engineer shall analyze the proposal in regard to the proposed spacing between each proposed driveway and the characteristics of the existing neighborhood.
- C. The driveway approaches serving one property shall not extend into the front of an adjacent property without written permission of the owner of the adjacent property which shall be filed in the office of the City Engineer.
- D. Off-Street parking between the edge of pavement and sidewalk will not be permitted unless approved by the City of Tiffin Traffic Safety Committee.
 - 1. See Exhibit AA for Vehicular Pull Off Standard Drawing.
- E. ADA compliance needs to extend through the limits of the driveway.
 - 1. See Exhibits M&S for specifications for sidewalks within a driveways.

- F. Prior to the installation of a driveway, the installer must contact the City to determine whether or not a street cut permit or inspections will be required for their project. The basis of determining whether or not a street cut permit will be required will include whether or not an existing curb is being cut, whether an existing sidewalk is present within the block and an ADA complaint sidewalk needs to be maintained through the driveway, and the construction material being proposed within the new driveway.
- G. Trench Repair
 - 1. All trench repairs within a driveway shall comply with standards for Roadway & Alley Trench Repairs per Section 4.2 (G)(1).

SECTION 7
DECORATIVE STREET LIGHTS

Section 7 – Decorative Street Lights

7.1 Pole Specifications

A. General Notes

1. Pole specification will be dependent upon location within the City. Any project which is an extension of a previous project shall specify the same pole that was previously used or equivalent unless otherwise determined by the City.
2. All poles shall be glossy black powder coated.
3. All poles shall be installed per the supplier and manufacturer specifications.
4. Pole spacing will be based upon an engineered analysis of the site.

B. Banner Arms

1. Where applicable, banner arms shall be threaded and removable. The pole shall have integrally welded threaded couplings to support banner arms. The banner arms shall be sized appropriately to display the proposed banner size (Downtown 2qx 3qbanners with an arm diameter of 1.5+). All banner arms shall have a glossy black powder coat finish to match the color of the street light poles. Matching colored threaded caps to plug the banner arms shall also be included and inserted when banner arms are removed from a light pole. Banner arms shall have a removable decorative cap to prevent the banner from sliding off the bracket arm. The bottom bracket arm shall be inserted a minimum of 8 feet vertically from the base of the pole. Orientation of the banners (towards the curb or towards the sidewalk) shall be determined by the City.

C. Receptacles

1. Where applicable, receptacles shall be 15 amp, tamper and weather resistant GFCI with a weather proof lockable aluminum cover.

7.2 Luminaire Specification

- A. Luminaire specification will be dependent upon location within the City. Any project which is an extension of a previous project shall specify the same luminaire that was previously used or equivalent unless otherwise determined by the City.

- B. All luminaires shall be installed per the supplier and manufacturer specifications.
- C. All new luminaires shall be equipped with LED lamping capabilities.

7.3 Pole Foundation Requirements

- A. Light Pole Foundations shall be constructed 24"x 24"x 6" deep and per ODOT 625.10 and Standard Construction Drawing HL-20.11.
- B. Pole Manufacturer specifications shall be used for anchor bolt size and layout.

7.4 Wiring/Conduit Specification

- A. Unless special conditions or circumstances are encountered all conduit shall be Schedule 40 PVC.
- B. Conduit shall either be installed by open trench or jack or drilled. Installation method will be determined by the City based upon considerations of existing conditions such as existing utilities and existing surface.
- C. If possible, all conduits shall be installed directly behind the back of curb.
- D. Wire gage shall be determined by the City Engineer/City Electrician.

7.5 Pull Box Specification

- A. Pull Boxes shall conform to ODOT Item 625 and Standard Construction Drawing HL-30.11.
- B. All Pull Boxes shall be labeled "Electrical".
- C. Pull Box size will be determined by City Engineer/City Electrician.

SECTION 8
TRAFFIC & PEDESTRIAN SIGNALS

Section 8 – Traffic & Pedestrian Signals

8.1 General Notes

- A. The Contractor shall furnish and install traffic control and related materials in compliance with these specifications, as well as the most recent version of the Ohio Department of Transportation's Construction and Material Specifications, the Ohio Manual of Uniform Traffic Control Devices for Streets and Highways, NEMA Standard Publications, and the Standard Construction Drawings issued by the Ohio Department of Transportation.
- B. All traffic signals shall be inspected by the City Electrician and the City Engineer prior to being put into operation.

8.2 Traffic Signal Pole & Mast Arm Specifications

- A. All poles and arms, including base and flange plates, bolt covers, handholes, and wire entrances, shall be hot dipped galvanized after fabrication in accordance with ODOT 711.02. All visible elements of the signal support, and any other parts required to be coated, shall be galvanized and then powder-coated. All painting shall be performed under controlled environmental conditions, and in accordance with the paint manufacturer's recommendations pertaining to surface preparation, material handling, and application. The top finish coat of paint shall be similar to Federal Specification 595-B Color #27040, BLACK. Paint samples shall be submitted to the City for review.
- B. The inside of each signal support pole assembly, each mast arm assembly, and other signal support accessories shall be coated with galvanizing material. The inside area formed by the gussets, pole, and pole flange plate shall be coated to protect the area from corrosion. It is to be noted that some type of opening shall be required to coat the gusset area. This opening shall not hamper the structural integrity of the flange assembly.
- C. All exterior surfaces of the signal support pole shaft assembly, mast arm assembly, all bolt covers, clamps, clevis-to-clevis universal, wire entrance, all handhole covers, luminaire and video brackets, pole and arm caps, signal head hangers and weatherheads shall have a coating properly applied to them. Exterior surfaces of all fastener bolts/screws, washers, nuts, and other attachment hardware shall have a coating applied to them. Fastener threads shall not be clogged with coating material.
- D. All coating items shall be shipped in a manner to minimize damage in transit. Surfaces should be protected by foam padding, by wrapping in

cardboard, by spiral wrapping with wax paper, by crating, by a combination of methods, or by any other method selected by the manufacturer which will insure delivery of undamaged materials. Materials damaged in transit caused by improper packaging or improper transit handling shall be rejected.

- E. Each coating layer shall be properly cured before the application of the next coat. The application procedure shall be such to guarantee a finish that will not scale, flake or peel, and will retain its color brightness and fresh appearance for 10 years without dulling or fading.
- F. Traffic Signal Supports shall be as per ODOT Item 632 except that the support poles and arms shall have a circular cross section (constant cross sectional radius) and shall be tapered tubes having a true and continuous taper. Multi-sided or fluted poles and poles having a tapered effect accomplished with the use of reducers will not be accepted.
- G. The Contractor shall provide all necessary attachments or connections to the poles. Additional wiring holes in the pole shall be drilled, reamed, or hole sawed. Lamé cutting will not be accepted. All cut edges or other defects in the zinc coating shall be cleaned and covered with two coats of zinc rich repair paint matching the factory finish. Brackets and appurtenances shall be securely attached with stainless steel screws of sufficient size for the intended loading. Stainless steel banding shall not be used unless approved by the City. All banding, where used, shall be factory painted to match the signal supports.
- H. In addition to the requirements of ODOT Item 632, signal support structures shall be designed and constructed by the supplier to support the loads caused by the signs, signals, and other equipment attached hereto.
- I. The signal support manufacturer shall provide drawings of a signal support with structural aspects of the design and materials in compliance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals. The signal support shall be ASTM A595 Grade A or approved equal with a minimum yield strength of 50 ksi.
 - 1. The following design parameters shall be used;
 - a. Basic Wind Speed: 90 mph
 - b. Design Life: 25 years
 - c. Fatigue Category: III
 - d. Galloping: No
 - e. Truck Induced Gust: No

- J. Signal support drawings, which identify and describe the manufactured signal support and signal support items that are being incorporated into the construction shall be submitted to the City, prior to construction. The drawings shall each be reviewed, sealed, stamped, and dated by a Registered Professional Engineer in the State of Ohio.
- K. Pole and Mast Arm Manufacturer shall be the same.
- L. All pre-drilled holes for all items shall be deburred and free of all sharp edges. All outside welds shall be rolled or ground smooth. All inside welds shall be void of sharp edges. Any structural fastener (3/4+or greater) shall be galvanized per ASTM 153 and shall be made of high strength carbon steel. Any other fastener (less than 3/4+) shall be stainless steel. All visible fasteners shall match the coating of the structure.
- M. Arms more than 40 feet long may be constructed in no more than 2 pieces.
- N. Mast Arms should be inspected for excessive wind induced deflection in the vertical direction. If found, a damping device should be placed on the arm.
- O. An approved damping device shall be installed as close as possible to the end of the arm. Mechanical damping devices shall installed on all arms 59qor longer. Flat plate dampers shall only be used for new construction if directed by the engineer.
- P. Mast Arm connection bolts shall be ASTM A325 for diameters 1.5+and smaller. Bolts larger than a 1.5+diameter shall be ASTM A449.
- Q. Supports shall have 1,2, or 3 hand holes, each complete with a cover, a rectangular, or elliptical reinforced frame, and a stainless steel fastener for the cover. The fastener shall be flush with the hand hole surface. The hand holes shall be located 180 degrees from the mast arm unless otherwise specified.
 - 1. The hand hole near the bracket arm shall have a minimum inside opening of 3+x 5+and be similar in design to the bottom hand hole except that no grounding provision is required.
 - 2. The hand hole near the arm attachment shall have a minimum inside opening of 4+x 6+and be similar in design to the bottom hand hole except that no grounding provision is required.
 - 3. The bottom hand hole shall have a minimum inside opening of 5+ x 8+. A grounding provision capable of accepting 4 - #4 AWG

copper grounding wires shall be provided and shall be attached to the frame.

- R. Supports shall have a removable pole cap attached either by a minimum 3 stainless steel set screws or by a stainless steel through bolt.
- S. Supports shall have a steel pole based plate/anchor bolt-nut cover (1/4+ thick square plate, two piece construction, galvanized to ASTM A123 then coated) that skirts the bolts, nuts and base plate. All screw holes shall be pre-drilled and stainless steel fasteners shall be used.
- T. Supports shall have 1, 2, or 3 welded cable hooks (±qor ±C+Hooks) located on the inside of the pole and 90 degrees from the mast arm.
- U. The arm shall have a removable end of arm cap attached by a minimum 3 stainless steel set screws. This will be the only attachment method acceptable. The inside diameter of the end of arm cap shall be equal to the end of arm outside diameter plus two times the arm taper.
- V. The arm shall not have pre-drilled holes for the signal head cable entry. The contractor shall field drill these holes.
- W. See Exhibit AB for Standard Mast Arm Drawings.

8.3 Traffic Signal Specifications

- A. Signals shall meet the requirements of ODOT C&MS 632 and 732.
- B. The signal heads and visors for all new and replacement signals shall be constructed of black polycarbonate plastic with visors that meet ITE specifications.
- C. Proper exterior colors shall be obtained by use of colored plastic material rather than painting.
- D. The entrance fitting shall be of the tri-stud design with serrated rings in order to achieve positive locking.
- E. All signal heads shall be rigidly mounted to any mast arm with the yellow module located in front of the mast arm.
- F. Aluminum backplates shall be in accordance with the C&MS and include a fluorescent yellow reflective border.
- G. When applicable, the light emitting diode (LED) modules shall meet the requirements of C&MS 732.04-C. The Contractor shall provide the Engineer, in writing, the LED manufacturer name, serial number, part number, description of lamp, and date of manufacture for all LED units

that are to be used in the signal head prior to installation, for acceptance and warranty purposes.

- H. Signal heads shall have a minimum wall thickness of 0.117 inches.
- I. LED signal heads shall include cutaway type visors unless otherwise specified in the plans.
- J. Apply a bead of silicone to the signal head, washer, and entrance adapter serrations to prevent water intrusion. Also, fill the space between concentric serration rings on the top of the signal head to completely exclude water from the space between concentric rings.
- K. Arm Plate hole diameter shall be bolt diameter plus 1/8". Pole plate tapped hole shall have threads with 75% minimum, full profile height. Threads may be retapped after galvanizing.
- L. The arm attachment plate shall be welded using a full penetration weld. The pole attachment to the base plate shall be welded using a full penetration weld.
- M. A minimum of 1 bolt thread shall remain above the anchor nut.
- N. All unused couplings shall be provided with a removable galvanized cast iron plug.
- O. When free swinging vehicular signal heads are permitted, the wire entrance part of the signal head may be oriented in any direction to keep the cable drip loop from rubbing on the signal head. The signal head shall hang level and plumb.

8.4 Pedestrian Signal Heads

- A. Signals shall meet the requirements of ODOT C&MS 632 and 732.
- B. The signal heads and visors for all new and replacement signals shall be constructed of black polycarbonate plastic.
- C. Proper exterior colors shall be obtained by use of colored plastic material rather than painting.
- D. The pedestrian signal head shall be of the LED countdown type.
- E. Pedestrian signal heads shall be mounted on the top of the pedestrian pedestal. All mounting hardware shall be coated black to match the pedestal support.
- F. The light emitting diode (LED) modules shall meet the requirements of C&MS 732.04-C. The Contractor shall provide the Engineer, in writing,

the LED manufacturer name, serial number, part number, description of lamp, and date of manufacturer for all led units that are to be used in the signal head prior to installation, for acceptance and warranty purposes.

8.5 Flashing Beacons

- A. All flashing beacons shall be installed in accordance with the most current regulations of the OMUTCD, Federal Highway Administration, and Ohio Department of Transportation.

8.6 Pedestrian Pushbuttons

- A. Pedestrian Pushbuttons shall meet the Accessible Pedestrian Signals and Director requirements set forth by the Ohio Manual of Uniform Traffic Control Devices. Pushbuttons shall be the 2-wire Polara iNavigator. The pushbutton shall be furnished with a yellow housing.
- B. All new pedestrian pushbutton system shall provide audible cues for, pushbutton locator tones, %Walk+and %Don't Walk+indications. The system shall also include custom voice messages for location and walk messages, provide for a vibrating arrow capable of being placed on mute and self-adjusting to ambient street noise.
- C. The system shall be furnished with all equipment and cables needed to operate and program the system, including but not limited to any configuration devices, software and hand-held remotes. The configuration equipment shall be left in the cabinet.
- D. One aluminum sign shall be supplied with each pushbutton. The bottom of the sign shall be mounted just above the top of the pushbutton, using necessary mounting bracket with the Polara Navigator Pedestrian System. Mount the center of the pushbutton 42+above the pedestrian pathway surface.
- E. The back of all signs, mounting hardware, and support assemblies mounted on either signal supports or pedestal supports mounted on either signal supports or pedestal supports shall be coated to match its respective support. All coatings shall match the color of the signal supports.

8.7 Pedestrian Signal Pedestal

- A. All exterior surfaces shall be coated in accordance with the finish section requirements of Item 632 Combination Signal Support, Type COC 4120.
- B. All pedestals shall be a powder coated black color.
- C. Minimum Height of a pedestal shall be 8 feet.

- D. All signal cables shall be run inside the pole, use of external conduit risers for signal cabling, or any other use is prohibited.

8.8 Electrical, Wiring & Conduit Specifications

- A. All signal cables shall be run inside the pole, the use of external conduit risers for signal cabling, or any other use is prohibited.
- B. All metallic parts containing electrical conductors shall be permanently joined to form an Effective Ground Fault Current Path back to the grounded conductor in the power service disconnect switch.
 - 1. When an equipment grounding conductor shall be provided in a metallic conduit, the conduit shall be bonded to the grounding conductor.
 - 2. When an equipment grounding conductor is required in a plastic conduit, the installation shall include a separate equipment grounding conductor.
 - 3. If multiple conduit runs begin and end at the same points, only one equipment grounding conductor is required.
 - 4. Messenger Wire will be used at intersections as the conductive path from corner to corner if conduit is not provided under the roadway. When conduit connects the corners of an intersection, an equipment grounding conductor shall be used in the conduit.
- C. Conduits
 - 1. All metallic conduits shall have grounding bushings installed at all termination points. The bushing material shall be compatible with galvanized steel conduit and the grounding lug material shall be compatible for use with copper wire. Threaded or compression type bushings may be used.
 - 2. All plastic conduits shall have the inside and outside diameters of the conduit debarred at all termination points.
 - 3. Both ends of metallic conduit shall be bonded to the equipment grounding conductor.
 - 4. Metallic conduit may be bonded to metallic boxes through the use of conduit fittings UL approved for this type of connection, with the box bonded to the equipment grounding conductor.

5. Conduits placed under roadway shall have a minimum overall depth of 24 inches and/or a minimum depth of 12 inches under the final pavement subgrade whichever is deeper.
6. Conduit shall be either installed by open trench or jack or drilled. Installation method will be determined by the City based upon considerations of existing conditions such as existing utilities and existing surface.

D. Wire for Grounding and Bonding

1. Use insulated, copper wire for the equipment grounding conductor. Bonding jumpers in boxes and enclosures may be bare or insulated copper wire. Wire sizes shall be as follows:
 - a. Use 4 AWG between the power service and supports, poles, pedestals, controller or flasher cabinets.
 - b. Use a minimum 8 AWG between loop detector pull boxes and the first conduit that requires a larger size as specified above.
 - c. The insulation shall be green or green with yellow stripe(s). For 4 AWG or larger, insulation may also be black with green tape/labels installed at all access points.
2. In a highway lighting system, the equipment grounding conductor shall be the same wire size as the duct cable or distribution cable circuit conductors, with the minimum conductor size of 4 AWG. Bonding jumpers will be minimum size 4 AWG.

E. Ground Rod

1. A 3/4 inch Schedule 40 PVC conduit will be used in foundations and concrete walls for the grounding conductor (ground wire) raceway to the ground rod. Should metallic conduit be used, both ends of the conduit shall be bonded to the grounding conductor.
2. The typical grounding conductor (ground wire) shall be 4 AWG insulated, copper.

- F. The green conductor in signal cables (conductor #4) shall not be used to supply power to a signal indication. It will be connected to the signal body as an equipment ground in aluminum heads and it will be unused in plastic heads. Unused conductors shall be grounded in the cabinet. Typical use of conductors is as follows:

<u>Cond. No.</u>	<u>Color</u>	<u>Vehicle Signal</u>	<u>Ped. Signal</u>
1	Black	Green Ball	#1 Walk
2	White	AC Neutral	AC Neutral
3	Red	Red Ball	#1 DW/FDW
4	Green	Equip. Ground	Equip. Ground
5	Orange	Yellow Ball	#2 DW/FDW
6	Blue	Green Arrow	#2 Walk
7	White/Black Stripe	Yellow Arrow	Not Used

G. Power Service and Disconnect Switch

1. At the power service location, the grounding conductor (ground wire) from the disconnect switch neutral (AC-) bar to the ground rod shall be a continuous, unspliced conductor. If spliced, it shall be an exothermic weld butt splice.
2. The service neutral (AC-) shall only be connected to ground at the primary power service disconnect switch.
 - a. NEMA Controller Cabinets: If a power service disconnect switch is located before the controller cabinet, the neutral (AC-) and the grounding bars in the controller cabinet shall not be connected together as shown in NEMA TS-2
 - b. If secondary disconnect switches are connected after the primary disconnect switch, the neutral (AC-) shall only be grounded at the primary switch. Equipment grounding conductors shall be brought to the primary switch, but shall be grounded at both secondary and primary switches.
3. Power cable shall be provided as per ODOT 632.23 between the control cabinet and the tap-in location.

H. UPS & Controller Cabinet & Unit

1. Provide an Arc Flash Hazard Warning sign on the outside front door of the enclosure in accordance with the current National Electrical Code paragraph 110.16.
2. Provide an available fault current sign on the outside of the front door of the power service disconnect switch at the controller cabinet in accordance with the National Electrical Code paragraph 110.24.
3. The controller unit shall be an EPAC M 60 or newer as manufactured by Siemens Corporation with ground mounted 8 phase cabinet or approved equivalent.

4. The controller unit shall provide telemetry features for inclusion in the City's existing interconnect system (Tactics).
5. The cabinet shall be size 18-UPS+ with an integral battery back-up compartment with a separate door. The controller and battery back-up cabinet shall appear as one cabinet from the outside with two internal compartments accessed by separate doors (P-UPS). The ground mounted control cabinet shall be configured for eight phase operation. Cabinets shall be properly insulated to prevent solid state equipment from overheating. Operating temperatures shall conform to that specified in ODOT 733.03. In addition to the requirements of ODOT Item 633, the controller and cabinet shall provide the following features:
 - a. Extended monitoring
 - b. Manual control and pushbutton
 - c. Automatic/Manual transfer switch
 - d. Coordinated/Free Switch
 - e. Detector Test Switches
 - f. Interconnect Isolation Panel and De-Connector
 - g. Slide out laptop Shelf/Drawer
 - h. 8 port SDLC panel
 - i. Power harness for Type 1 and Type 2 controllers
 - j. Surge Suppressor in modular package utilizing a 12 pin BEAU connector with LED failure indicators.
 - k. Cabinet shall include wiring from uninterruptible power supply to signal cabinet to provide alarms for on battery, two hour timer, low battery and off battery in signal cabinet.
 - l. Auxiliary power shall charge batteries
 - m. The police panel on the outside of the cabinet door shall have a flash switch, a switch for automatic/manual operations, signal on/off switch and a manual pushbutton with a minimum cord length of 10 feet.
 - n. Interior under shelf LED cabinet lighting, including a minimum of 2 panels of 6 high (intensity LEDs) each and a

- door activated switch. The LED panels shall be mounted in locations to maximize the light on the cabinet equipment.
- o. A gooseneck/adjustable light fixture with an LED lamp.
 - p. A minimum of 2 GFCI protected duplex receptacles.
 - q. A minimum of 4 non-GFCI protected duplex receptacles.
 - r. Controller Cabinet labeling to identify the wiring and function, detector lead-in cable, phase number service, direction, movement type, and loop plan number. Signal head field wiring phase number, direction, movement type, and color (red, yellow, green, yellow arrow, green arrow) or pedestrian movement.
 - s. The applicable Datakey shall be provided for future connectivity with the City's radio interconnect system.
6. In addition to the requirements of CMS 633 and 733, the UPS cabinet shall include a generator power panel with a heavy duty power relay versus the line voltage generator switch. The generator inlet shall be a recessed panel with a door that is flush with the external side of the UPS cabinet. It shall include a recessed plug, manual transfer switch and a door that securely closes over the power cord.
7. The Uninterruptable Power Supply (UPS) shall be manufactured by The Alpha Group. Additionally, an Alphaguard, network compatible, battery charging management system shall be furnished and installed.
8. The UPS output notifications for on battery, battery 2 hour timer, off battery and low battery shall be wired into the traffic signal cabinet back panel to provide special status alarms for each output into the signal controller. This item shall include a red LED status indicator lamp to allow maintenance personnel and law enforcement to quickly assess whether a traffic signal cabinet, is being powered by a UPS. The LED housing shall be NEMA 4X, IP65 or IP66, rated for outdoor use and be tamper/shatter resistant. It shall be a domed enclosure containing a red lens with LED that is visible from 100 foot minimum. The enclosure and LED module should be placed and centered on the top surface of the UPS cabinet and sealed from water intrusion. It should be wired using minimum 20GA stranded, insulated hookup wire to the status relay outputs of the UPS. The wires shall be terminated by lugs at the display end and permanently labeled %BACKUP

POWER STATUS DISPLAY+with wire polarity indicated. The red LED shall only illuminate to indicate the cabinet is operating under UPS backup power (the %backup+operating condition). This item includes programming the UPS status relay outputs to produce the lamp status displays. These status displays will be solid 100% duty cycle (not flashing) displays. The operating voltage of the LED lamp shall be 120V AC unless otherwise indicated.

9. The Generator Inlet shall be 30 amp, 125/250V, locking, 4 wire grounding and meet the NEMA configuration number L14-30-P 30A 125/250 V specification. The inlet shall be a Hubbell catalog #2715 or equivalent as approved by the City Engineer.
10. The Line Voltage Generator Switch shall be 30 amp, 125/250V AC, 2 pole, 3 position (On, Off, On). The switch shall be a Hubbell catalog #1388 or equivalent as approved by the City Engineer.
11. The Line Voltage Indicator Light shall be 125V AC light emitting diode with a red lens.
12. The Line Voltage Circuit Breaker shall be a single pole single throw and a minimum of 30 amps. The amperage shall be increased to accommodate greater loads, if necessary. The gauge of the power cable shall be of the proper size per N.E.C.
13. External Line Voltage Indicator Light shall be a 1+waterproof NEMA 4X or IP66 LED lamp with a green lens.
14. Generator Power Panel Enclosure shall be constructed of 1/8+ thick aluminum. The lock shall be the standard police door type, keyed with the standard flasher door skeleton key. The door shall be sealed with a foam rubber gasket to prevent moisture from entering the enclosure. The enclosure shall be mounted onto the outside of the controller cabinet with non-accessible bolts and sealed with a high quality silicon caulk at all surfaces touching the cabinet. The hinge shall be of stainless steel or equivalent corrosive-resistant material. Keyhole shall be covered with a movable circular aluminum or brass cover with top pivot pin.

I. Traffic Control Loops

1. When metallic conduits are used to carry loop wires from in the pavement to the pull box, the splice location will only be bonded at the pull box end, and will not contain an equipment grounding conduit.

J. Interconnect Cable

1. If an equipment grounding conductor is needed in the conduit between signalized intersections for underground interconnect cable, the grounding system for each signalized intersection will be separated about midway between intersections.

K. Pull Boxes

1. Pull Boxes shall conform to ODOT Item 625 and Standard Construction Drawing HL-30.11.
2. All Pull Boxes shall be labeled %Traffic+.
3. Pull Box size will be determined by the City Engineer/City Electrician.

8.9 Video Detection Systems

- A. Video Detection systems shall be manufactured by Iteris, Inc.
- B. Video Detection system shall monitor vehicles on a roadway via processing of video images detection and provide standard detector outputs to the traffic signal controller. Each system shall outfit one entire intersection and shall include one RZ-4 Advanced WDR image sensor (camera) for each intersection approach, communications hubs (as needed), and all necessary mating cables.
- C. Wiring, couplers, modification of the cabinet facilities, and all other devices, whether or not specifically itemized on the plan sheets, shall be provided and installed as required to render the video system completely operational in compliance with the Ohio Department of Transportation Standards, Supplemental Specifications 816 and 907 and the Manufacturer's recommendations. All major components of the video vehicle detection system shall be supplied by the same manufacturer as a complete system, ready to operate.
- D. All video devices except the image sensors shall be housed in the controller cabinet. All devices shall be mounted so all cable connections are accessible and all device doors can be fully opened for servicing. The video vehicle detection system shall be capable of being controlled via a remote supervisor computer, either on-line or off-line. The user shall be able to create, edit, store and delete detection zones from either the supervisor computer or at the remote intersection location.
- E. The detection sensor shall be housed in an environmental enclosure that is waterproof and dust tight to NEMA-4 specifications.

- F. The enclosure shall be heated to prevent the accumulation of ice and condensation on the lens. All exposed exterior surfaces of the video sensors, mounting hardware, and related items shall be painted to match the signal supports.

8.10 Pole Foundation Requirements

A. Traffic Signal Pole Foundation

1. Use preformed joint filler as per ODOT 705.03 between foundations and adjacent paved areas.
2. A special foundation design will be required when cohesive soil with undrained shear strength of less than 2000 lb/sq. ft. or granular soil with an angle of internal friction less than 30 degrees and a wet density less than 120 lb/cu. ft. is encountered.
3. Provide all anchor bolts with standard steel hex nuts, leveling nuts, and plain washers. The nuts shall be capable of developing the full strength of the anchor bolts.
4. At locations where existing slope is 6:1 or greater, the buried depth of the foundation shall apply to the low side of the slope. Set the top of the foundation 2+above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the formed top.
5. The size, number (minimum 2), type, and orientation of the conduit ells shall be as shown in the detailed drawing, except that 3/4+Schedule 40 PVC conduit shall be installed in each foundation. Any unused conduit ells shall be capped.
6. Tie spacing, starting from the top of the drilled shaft, shall be 3+ between the first two ties and 12+spacing thereafter.
7. The anchor base pole foundation sides shall be oriented parallel to the sidewalk or back of curb or edge of pavement.
8. The top of the foundation shall be set as follows:
 - a. Foundation Located Entirely in Walk or Concrete Area
 - Top of Foundation shall be flush with Walk or Concrete.
 - b. Foundation Located Behind Curb Associated with Curb Ramp

- Top of Foundation shall be flush with top of curb at back of ramp for a parallel ramp.
- c. Foundation Located Adjacent to Walk or Concrete Area
- Top of Foundation shall be flush with Walk or Concrete Area.
- d. Foundation Located Adjacent to Walk or Concrete with Steep Grade Change (Rises Steeply Behind Walk)
- The back side of the foundation shall match the ground slope and the street side of the foundation shall be above the sidewalk or concrete area and completely out of the sidewalk or concrete area.
9. The pole foundation shall be edged using a $\frac{1}{2}$ " sidewalk edger and not chamfered.
10. Anchor Bolt length shall be increased when foundation is installed in a brick sidewalk.
11. All reinforcing steel shall be epoxy coated and comply with and be placed in accordance with ODOT CM&S 509. Rebar cage shall extend to within $3\frac{1}{2}$ " +/- $\frac{1}{2}$ " of top and bottom of foundation.
12. If shallow bedrock is encountered, the foundation length may be decreased by embedding the shaft a minimum of 5 feet into the bedrock. Field cut the vertical rebar to fit the shortened foundation.
13. If excavating within 8 feet of, but greater than 5 feet from the edge of an existing signal support or strain pole foundation, provide temporary support of the pole (down guy, head guy, base guy, mechanical/crane support, etc.) during excavation and construction activities.
14. If a utility is within 5 feet of the foundation increase the foundation length per Exhibit AC.
15. See Exhibit AC for Signal Pole Foundation - Standard Drawing.

SECTION 9
PLANNING

Section 9 – Planning

9.1 Zoning

A. Zoning District Map

1. Refer to the City of Tiffin website (TiffinOhio.gov) for the most current version of the Tiffin - Zoning District Map.

B. Zoning Code Regulations

1. Refer to Part 11 of the City of Tiffin Codified Ordinances.

9.2 Architectural Board of Review District

A. Architectural Board of Review District Boundaries

1. Refer to the City of Tiffin website (TiffinOhio.gov) for the most current version of the City of Tiffin - Architectural Board of Review District Map.

B. Architectural Board of Review District Guidelines

1. Refer to the most current version of the City of Tiffin's Downtown Design Review District Guidelines.+

9.3 Subdivision & Planning Regulations

- #### A.
1. Refer to Part 11 of the City of Tiffin Codified Ordinances.

9.4 Flood Plain Regulations

- #### A.
1. Refer to Chapter 1191 of the City of Tiffin Codified Ordinances.

SECTION 10
SMALL CELL FACILITIES

Section 10 – Small Cell Facilities

10.1 Wireless Support Structures

A. Refer to Chapter 936 of the City of Tiffin Codified Ordinances

B. Design Guidelines

1. Wireless Support Structures and/or Small Cell Facilities located within City Right of Ways

a. No Wireless Support Structure and/or Small Cell Facility shall be installed in a location that creates a safety issue and/or impedes pedestrian or vehicular traffic flow.

b. No Wireless Support Structure and/or Small Cell Facility shall be installed in a location in which the Wireless Support Structure and/or Small Cell Facility impact the overall aesthetics and character of a neighborhood.

1. No standalone Wireless Support Structure shall be installed within a street right of way on the followings streets. Alternative locations to said streets would be an adjacent alley right of way.

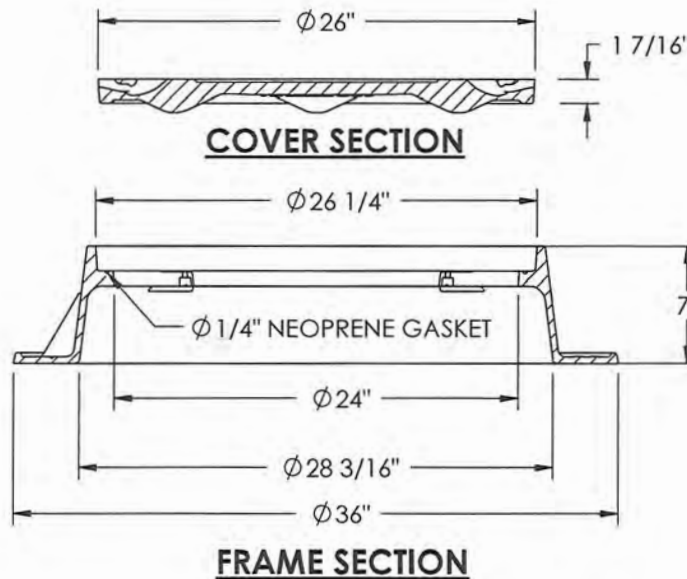
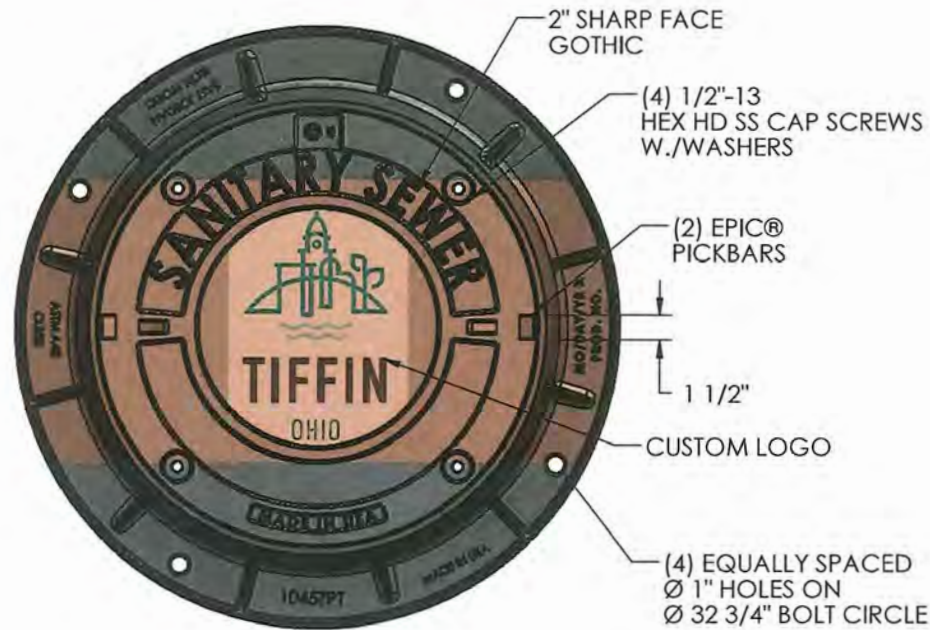
- South Washington Street between Sycamore Street and Frost Parkway
- Jefferson Street between Madison Street and Riverside Drive
- South Monroe Street between Riverside Drive and Madison Street
- Riverside Drive between Jefferson Street and South Monroe Street
- East Perry Street between Circular Street and the Sandusky River
- East Market Street between Circular Street and the Sandusky River
- Court Street
- Madison Street
- Main Street between South Washington Street and Jefferson Street

- Charlotte Street between South Washington Street and South Monroe Street
 - Frost Parkway
2. Any Wireless Support Structure and/or Small Cell Facility that is installed in an area of the city in which streetscape features are already previously installed within the city right of way, including but not limited to decorative light poles and decorative sidewalks, the applicant of said Wireless Support and/or Small Cell Facility shall propose the installation of a decorative Wireless Support Structure that reasonably matches the aesthetics and character of the neighborhood. The proposed Wireless Support Structure will be reviewed for approval by the City Engineer.

SECTION 11
EXHIBITS



1045ZPT 1040APT Assembly



PRELIMINARY

Submission Number

NPR18-1584D

Design Features

-Materials

- Frame
Gray Iron (CL35B)
- Cover
Gray Iron (CL35B)

-Design Load

Heavy Duty

-Open Area

n/a

-Coating

Dipped

-√ Designates Machined Surface

Certification

-ASTM A48

-Country of Origin: USA

Major Components

00104512

001040XXX

Drawing Revision

4/20/2018 Designer: MAH

04/24/2018 Revised By: MAH

Disclaimer

Weights (lbs/kg), dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

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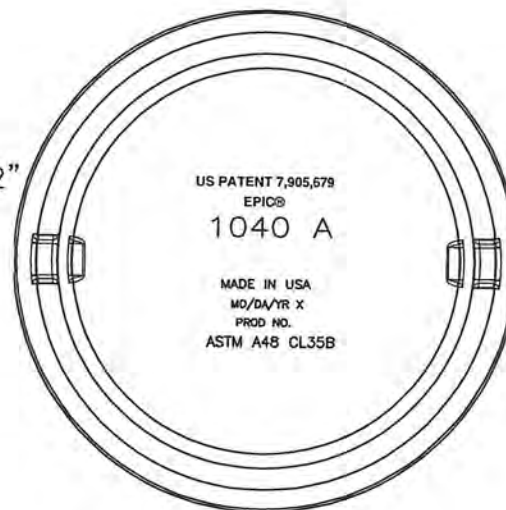
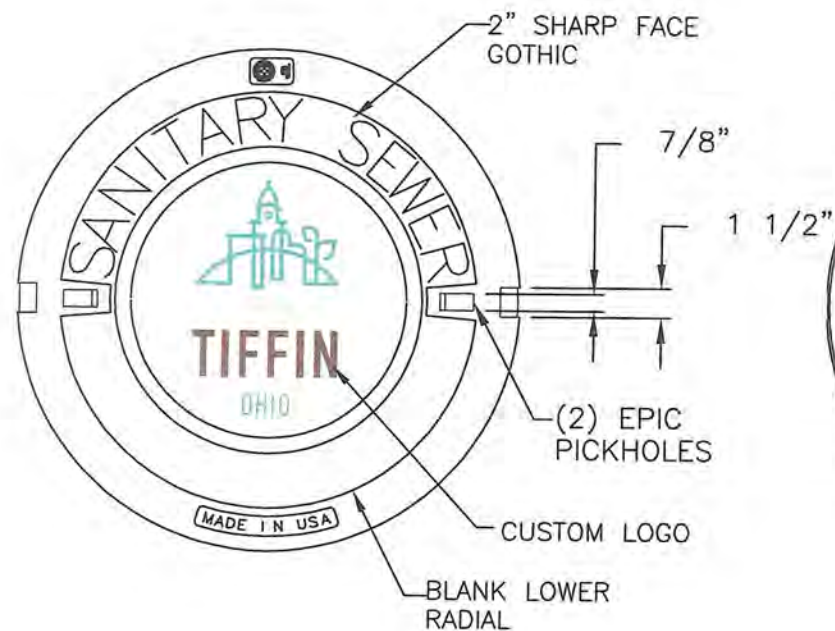
Contact

800 626 4653

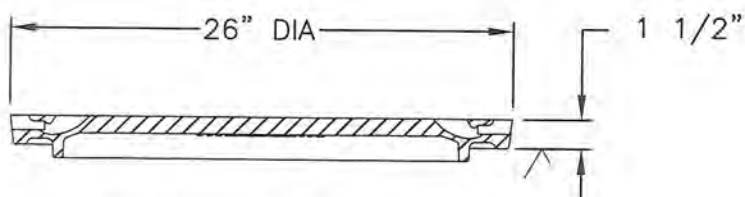
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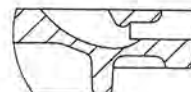
1040A Cover



BOTTOM VIEW OF COVER



COVER SECTION



EPIC® DETAIL

PRELIMINARY

Submission Number

NPR18-1584C

Design Features

- Materials
Gray Iron (CL35B)
- Design Load
Heavy Duty
- Open Area
n/a
- Coating
Dipped
- √ Designates Machined Surface

Certification

- ASTM A48
-
- Country of Origin: USA

Drawing Revision

04/20/2018 Designer: MAH
4/24/2018 Revised By: MAH

Disclaimer

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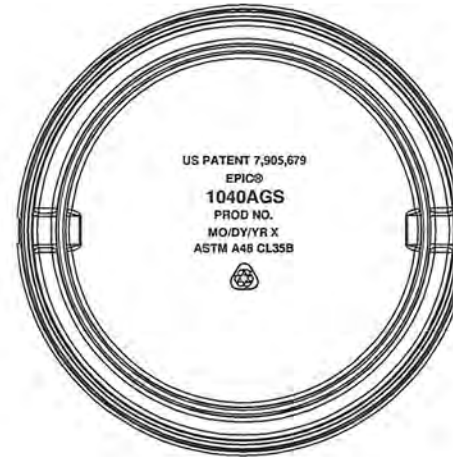
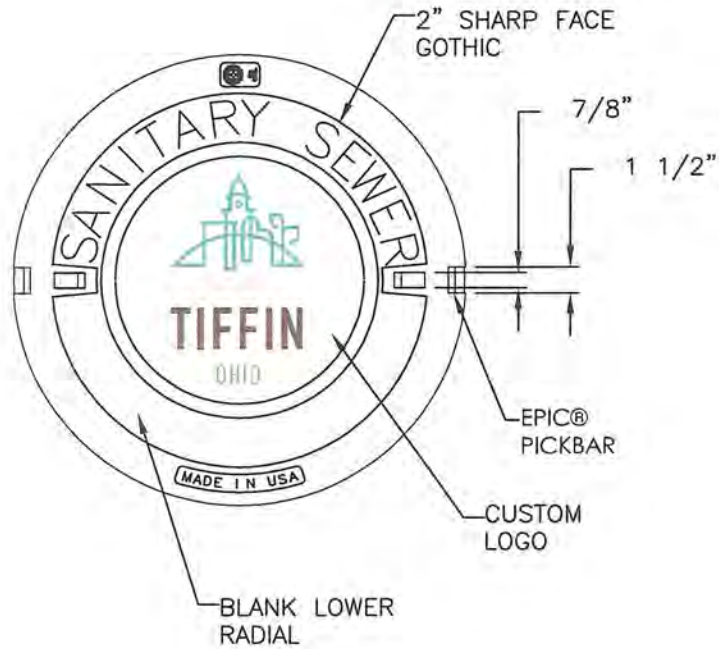
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Contact

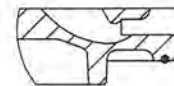
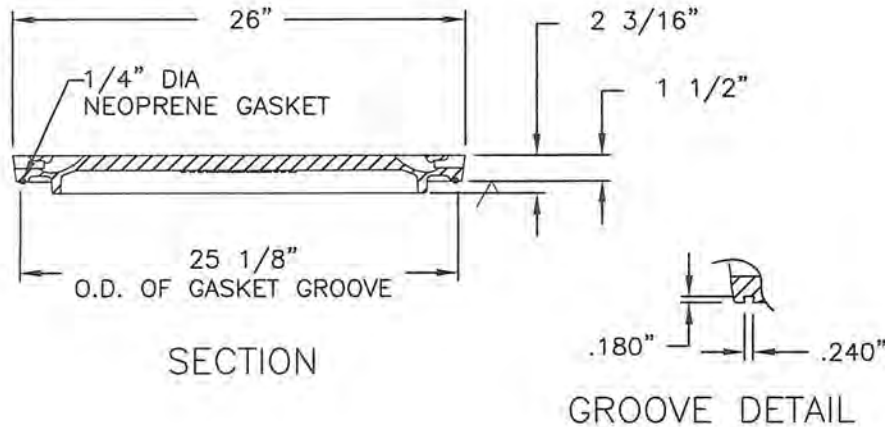
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1040 AGS Cover



BOTTOM VIEW



EPIC® DETAIL

PRELIMINARY

Submittal Number

NPR18-1584A

Design Features

- Materials
Gray Iron (CL35B)
- Design Load
Heavy Duty
- Open Area
n/a
- Coating
Dipped
- √ Designates Machined Surface

Certification

- ASTM A48
-
- Country of Origin: USA

Drawing Revision

04/20/2018 Designer: MAH
4/24/2018 Revised By: MAH

Disclaimer

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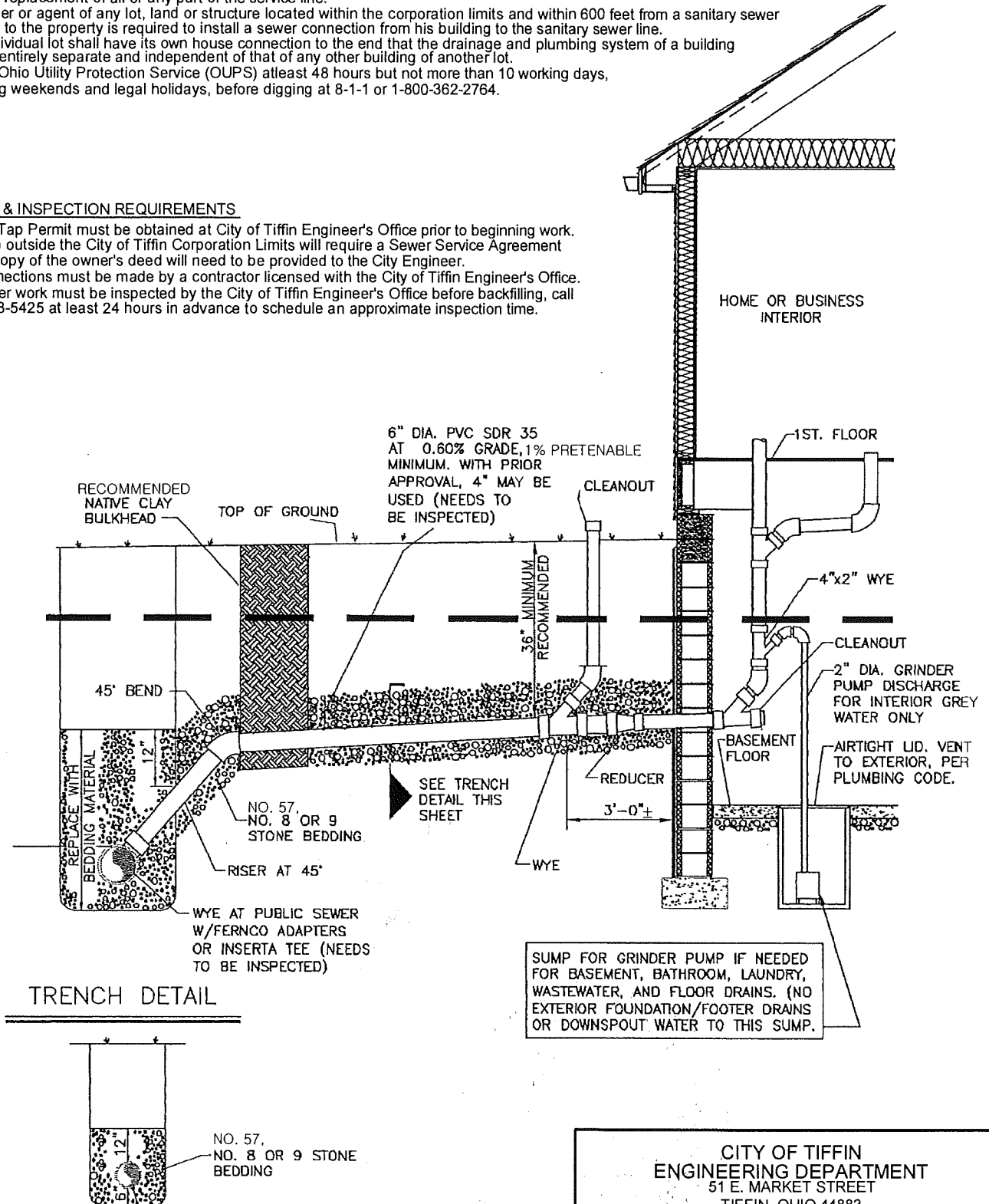
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GENERAL NOTES:

- Sanitary Sewer lateral shall not be directly connected inside a Sanitary Sewer Manhole, unless prior approval is obtained from the City Engineer.
- All service lines should incorporate a cleanout with a removable stopper at all bends of an angle greater than 45 degrees and for every 300' of installed pipe.
- No 90° bends permitted.
- All exterior water from foundations, footer drains, yard drains, driveway drains, downspouts, etc. are prohibited from connecting to the Sanitary Sewer System.
- During construction, repair, replacement, relocation, or addition to a service connection, the licensed contractor shall be responsible to prevent storm water, mud, stone, etc. from entering the sanitary sewer system.
- If the installation of a service connection will require excavation within any public right-of-way, it is the responsibility of the owner/contractor to obtain all necessary permits from the appropriate agency having jurisdiction of said right-of-way.
- Any lane or temporary road closures as a result of sewer work within the City of Tiffin must be coordinated with the City Public Works Dept.
- The owner of the property served by a connection to the public sewer shall be responsible for the maintenance, repair or replacement of all or any part of the service line.
- The owner or agent of any lot, land or structure located within the corporation limits and within 600 feet from a sanitary sewer adjacent to the property is required to install a sewer connection from his building to the sanitary sewer line.
- Each individual lot shall have its own house connection to the end that the drainage and plumbing system of a building shall be entirely separate and independent of that of any other building of another lot.
- Call the Ohio Utility Protection Service (OUPS) atleast 48 hours but not more than 10 working days, excluding weekends and legal holidays, before digging at 8-1-1 or 1-800-362-2764.

PERMIT & INSPECTION REQUIREMENTS

- Sewer Tap Permit must be obtained at City of Tiffin Engineer's Office prior to beginning work.
- Any tap outside the City of Tiffin Corporation Limits will require a Sewer Service Agreement and a copy of the owner's deed will need to be provided to the City Engineer.
- All connections must be made by a contractor licensed with the City of Tiffin Engineer's Office.
- All sewer work must be inspected by the City of Tiffin Engineer's Office before backfilling, call 419-448-5425 at least 24 hours in advance to schedule an approximate inspection time.

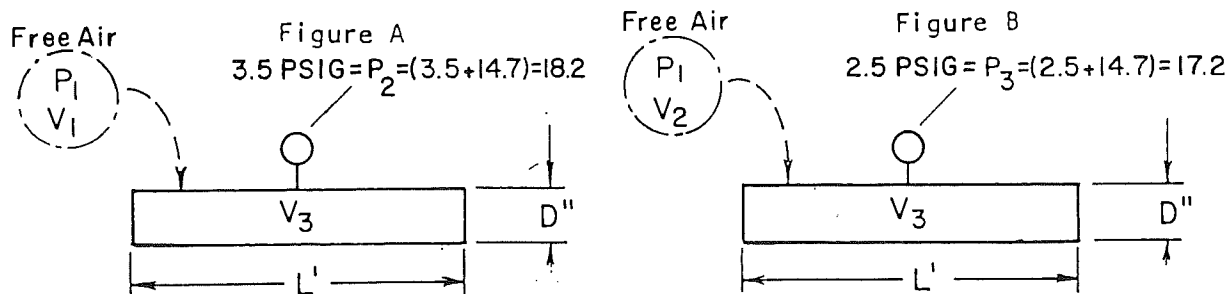


Air Test Holding Time Table

Pipe Diameter (in)	Minutes
4	2
6	3
8	4
10	5
12	5.5
15	7.5
18	8.5
21	10
24	11.5

TIMING FORMULA FOR 1 PSIG DROP

FORMULA FOR CALCULATING THE MINUTES NEEDED FOR THE GAUGE READING TO DROP FROM 3.5 TO 2.5 PSIG WITH PIPE OF D" DIAMETER AND L' LENGTH.



P_1 = Free Air at 14.7 psi atmospheric pressure
 P_2 = 3.5 psig pressure in the pipe = 18.2 psia (3.5+14.7)
 P_3 = 2.5 psig pressure in the pipe = 17.2 psia (2.5+14.7)

V_1 = Volume of free air needed to compress to 3.5 psig -- See Figure A
 $P_1 V_1 = P_2 V_3$ (basic equation)
 $= P_2 V_3 / P_1$

V_2 = Volume of free air needed to compress to 2.5 psig -- See Figure B
 $P_1 V_2 = P_3 V_3$
 $= P_3 V_3 / P_1$

V_3 = Volume of Pipe consisting of L' length and D'' diameter.
 $= 3.14 \times \left(\frac{D}{2 \times 12}\right)^2 \times L$
 $= .00545 D^2 L$

Q = Rate of loss permitted
 $= .003$ cubic feet per minute per sq. ft. of pipe surface

Q_s = Total cubic feet of air per minute permitted to leak through the surface of a pipe that is L' in length and D'' in diameter
 $= Q \times \text{Surface Area of Pipe}$
 $= .003 \times 3.14 \times L \times D/12$
 $= .000785 LD$

Minutes = The portion of free air originally pumped into the pipe of L' length and D'' diameter at 3.5 psig which leaked out so that now the gauge reads 2.5 psig. This cubic feet of air is divided by Q_s .

$$= \frac{V_1 - V_2}{Q_s} = \frac{\left(\frac{P_2 V_3}{P_1}\right) - \left(\frac{P_3 V_3}{P_1}\right)}{Q_s} = \frac{V_3 (P_2 - P_3)}{P_1 Q_s}$$

$$= \frac{(.00545 D^2 L) \times (18.2 - 17.2)}{(14.7) \times (.000785 LD)}$$

Minutes = .472 D

(EXAMPLE: If a pipe is 8" in diameter the timing is .472 x 8" = 3.8 minutes)

SEWERLINE AIR TEST

PROJECT: _____

BY: _____ DATE: _____

OFFICIAL PRESENT: _____

MH # _____ TO MH # _____

LENGTH OF LINE: _____ TIME STARTED: _____

TIME FINISHED: _____

TYPE OF PIPE: _____ SIZE OF PIPE: _____

MH # _____ TO MH # _____

LENGTH OF LINE: _____ TIME STARTED: _____

TIME FINISHED: _____

TYPE OF PIPE: _____ SIZE OF PIPE: _____

MH # _____ TO MH # _____

LENGTH OF LINE: _____ TIME STARTED: _____

TIME FINISHED: _____

TYPE OF PIPE: _____ SIZE OF PIPE: _____

MH # _____ TO MH # _____

LENGTH OF LINE: _____ TIME STARTED: _____

TIME FINISHED: _____

TYPE OF PIPE: _____ SIZE OF PIPE: _____

Concrete Manhole Vacuum Test Info Card*

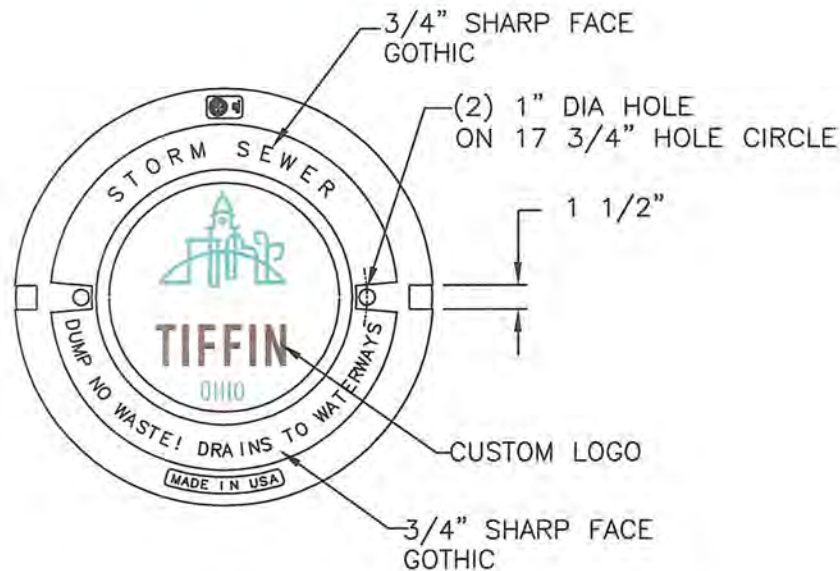
*Based on ASTM C 1244-93; but newest version is C 1244-11

Depth (ft)	Diameter (in)								
	30	33	36	42	48	54	60	66	72
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	65	74	87	98	108	121

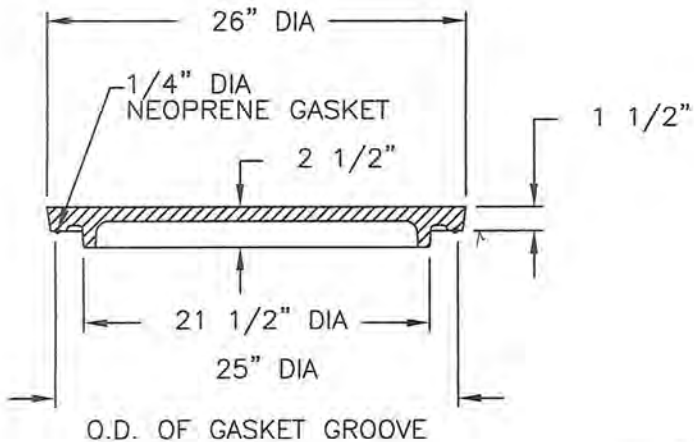
- 1) Plug all pipe entrances to the manhole
- 2) Place vacuum cover on top of casting
 NOTE: Vacuum test must include the casting ring for the manhole lid. Concrete manhole manufacturers sometimes offer free testing, but they typically only test their concrete manhole which will not meet the standard for testing
- 3) Draw a vacuum of 10 in Hg and start timing
 NOTE: Do not attempt to create an unreasonably high vacuum (e.g. >15 in Hg) as doing so may cause damage to the structure, pipes, fittings, etc.
- 4) Vacuum must remain higher than 9 in Hg for the time listed in the above chart for the given conditions
- 5) Vacuum loss of more than 1 in Hg constitutes a failure



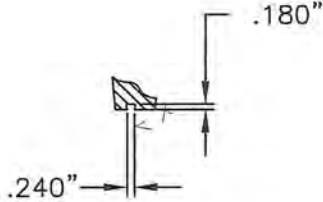
1040 CGS Cover



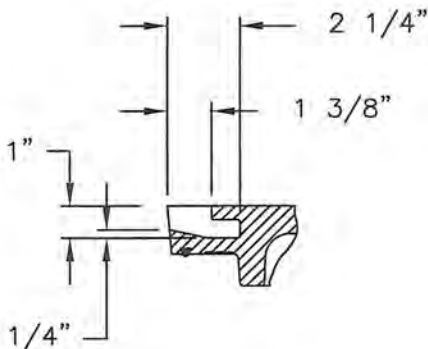
**BOTTOM VIEW
OF COVER**



COVER SECTION



GROOVE DETAIL



PICKHOLE DETAIL

PRELIMINARY

Submission Number

NPR18-1584B

Design Features

- Materials
Gray Iron (CL35B)
- Design Load
Heavy Duty
- Open Area
n/a
- Coating
Dipped
- ✓ Designates Machined Surface

Certification

- ASTM A48
-
- Country of Origin: USA

Drawing Revision

04/20/2018 Designer: MAH
4/24/2018 Revised By: MAH

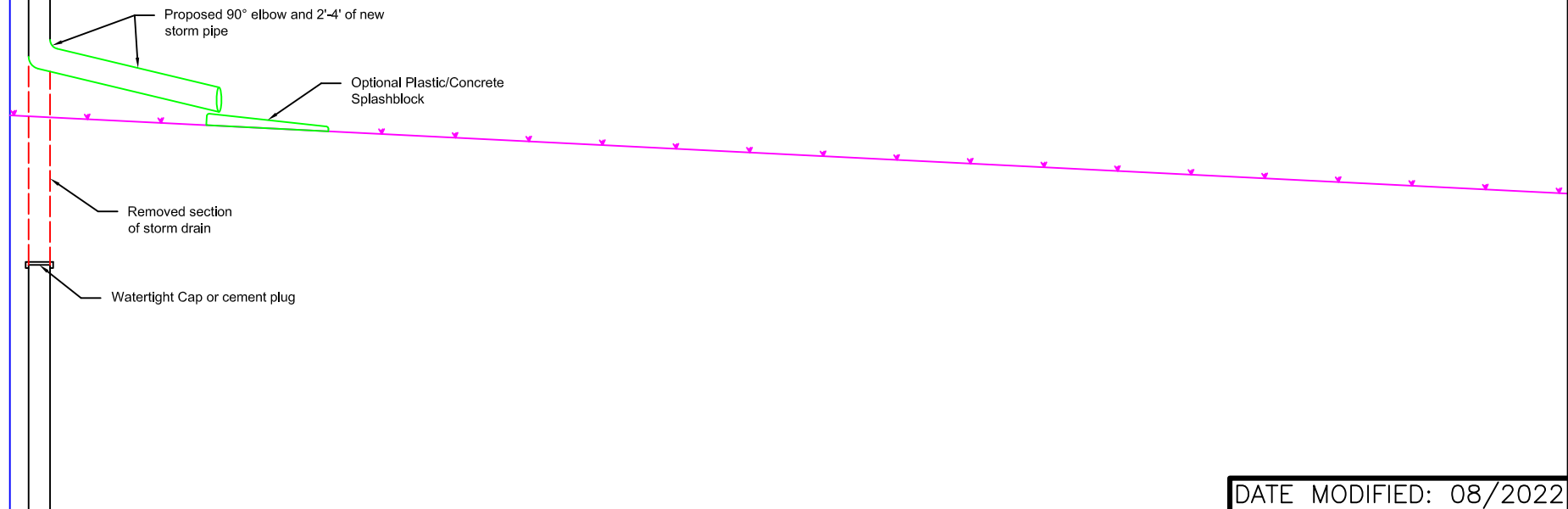
Disclaimer

Weights (lbs./kg) dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

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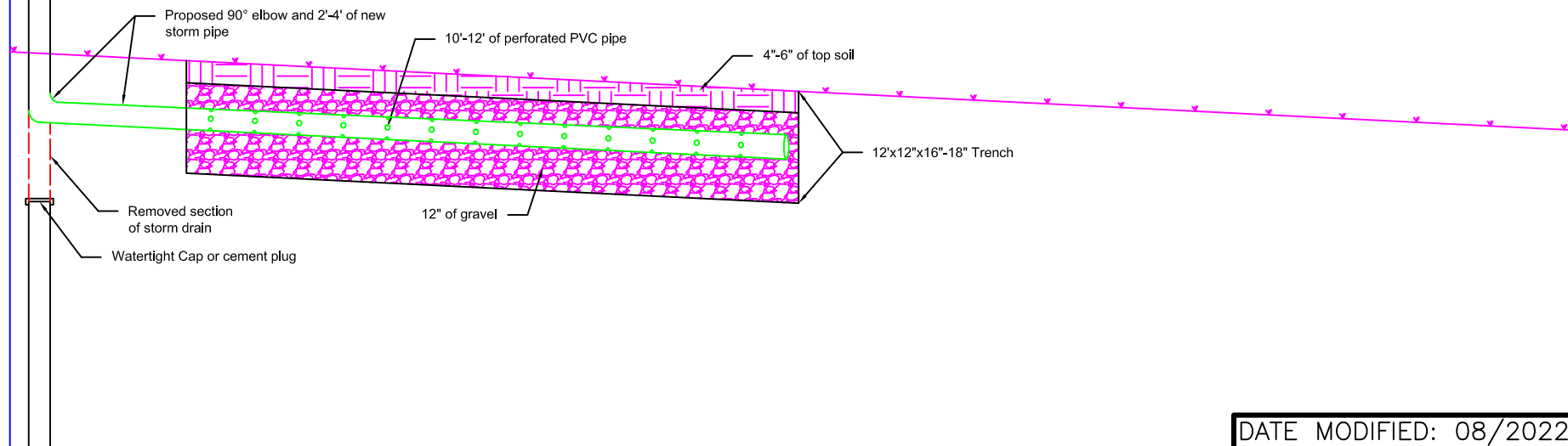
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DATE MODIFIED: 08/2022

DOWNSPOUT DISCONNECTION OPTION #1

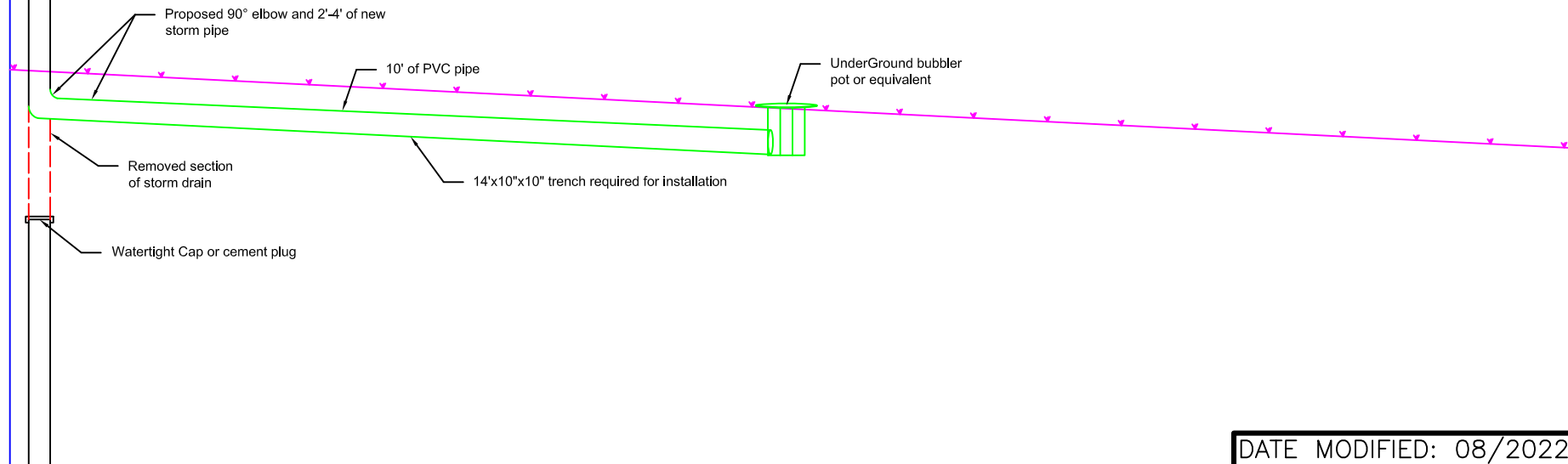




DATE MODIFIED: 08/2022

DOWNSPOUT DISCONNECTION OPTION #2

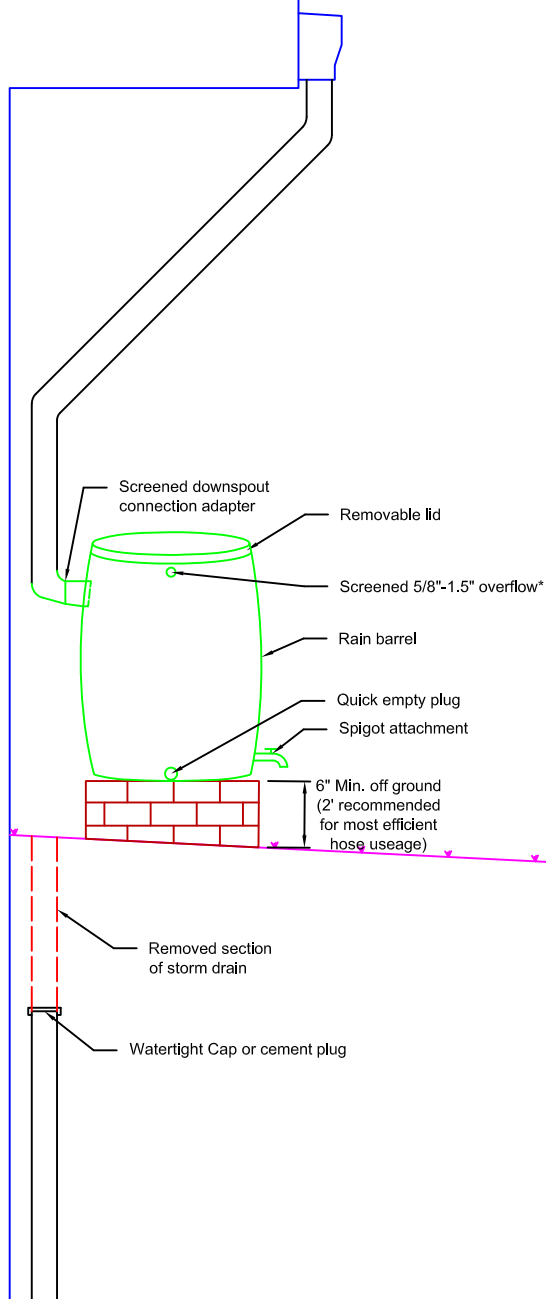




DATE MODIFIED: 08/2022

DOWNSPOUT DISCONNECTION OPTION #3





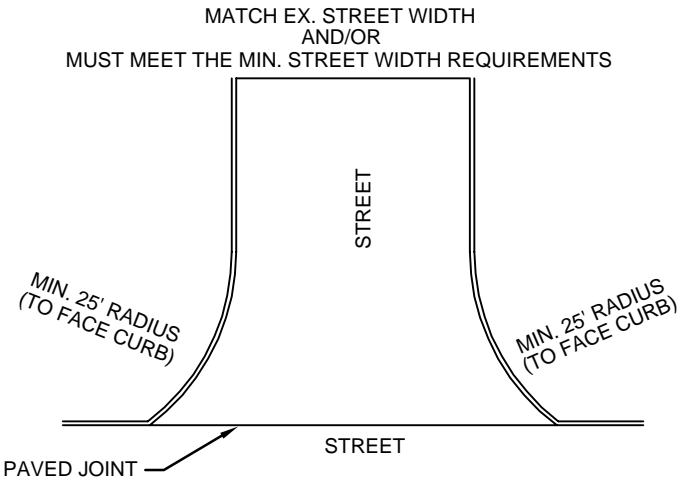
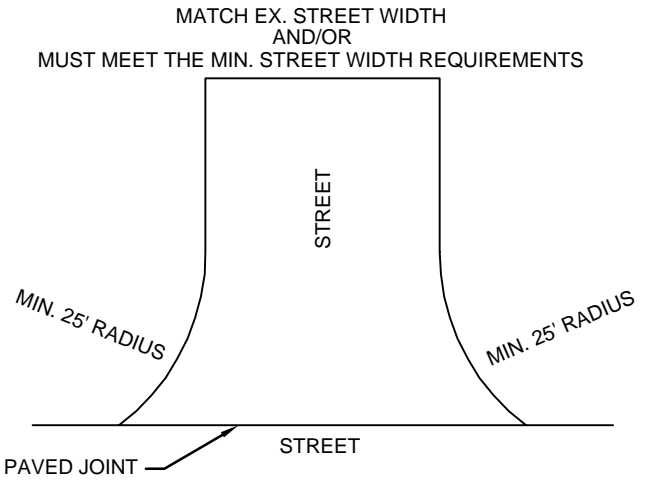
NOTES:

- Barrels should be emptied weekly to avoid any possible standing water issues
- Optional hose attachment to be provided by Owner
- Residents may request reimbursement for one rain barrel per dwelling through the City's Clean Water Connection Removal Grant, Residents may install additional barrels and piping at their own cost in order to increase collection capacity.
- *Overflow can be connected to outlet pipe and/or splash block to divert overflow away from house
- Winterizing you rain barrel involves a few steps including:
 1. Drain all water and leave spigot open
 2. Remove hoses and detach barrel from downspout, a flexible extension can be placed on gutter to divert any water away from house
 3. Remove any debris from filter screens
 4. Storing barrel upside down in garage, shed, or outside covered area

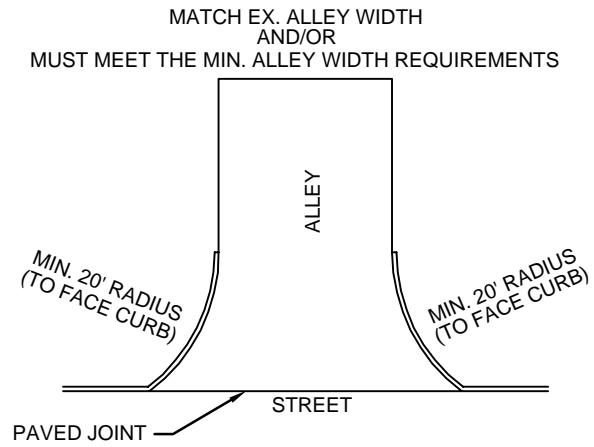
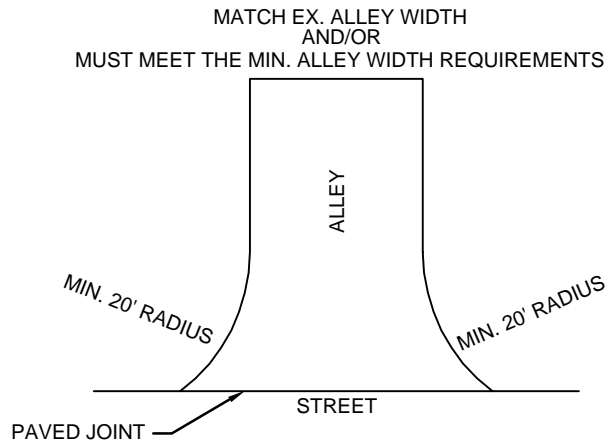
DATE MODIFIED: 08/2022

DOWNSPOUT DISCONNECTION OPTION #4





NOTE:
IF CURBED STREET IS MATCHING INTO A NON CURBED STREET
COORDINATE THE TRANSITION WITH CITY ENGINEER.



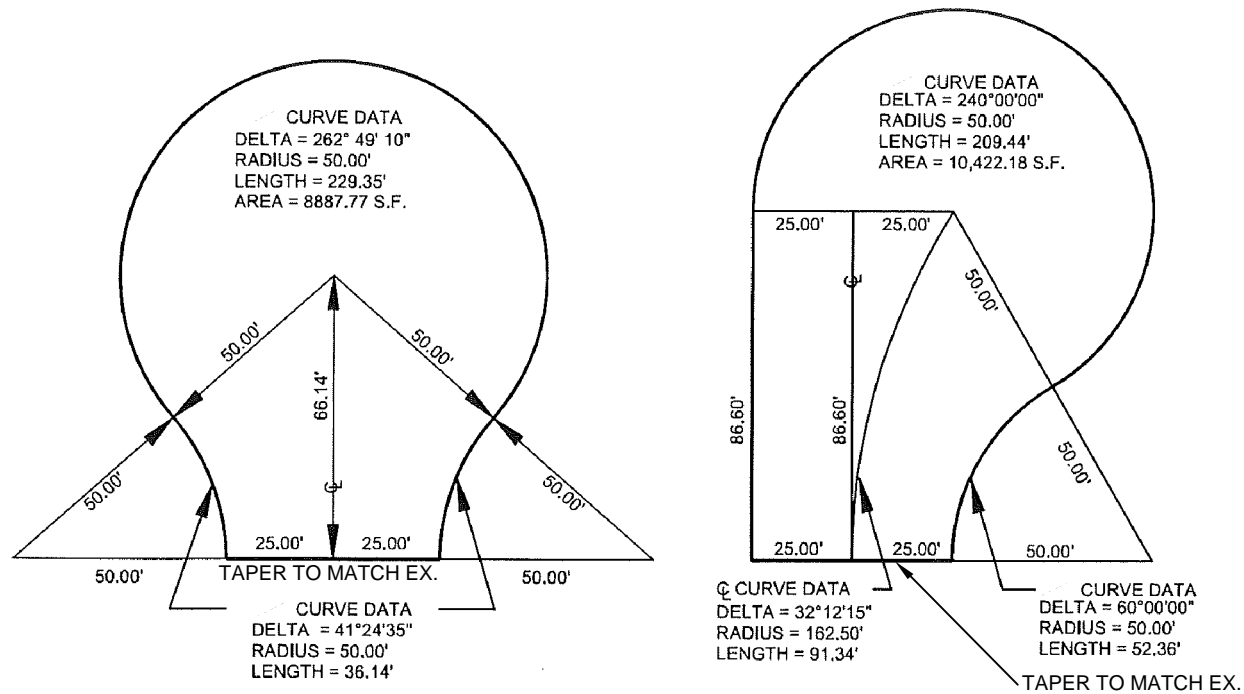
NOTE:
CURBED APPROACH SHOULD EXTEND TO THE (PT) OF THE RADIUS

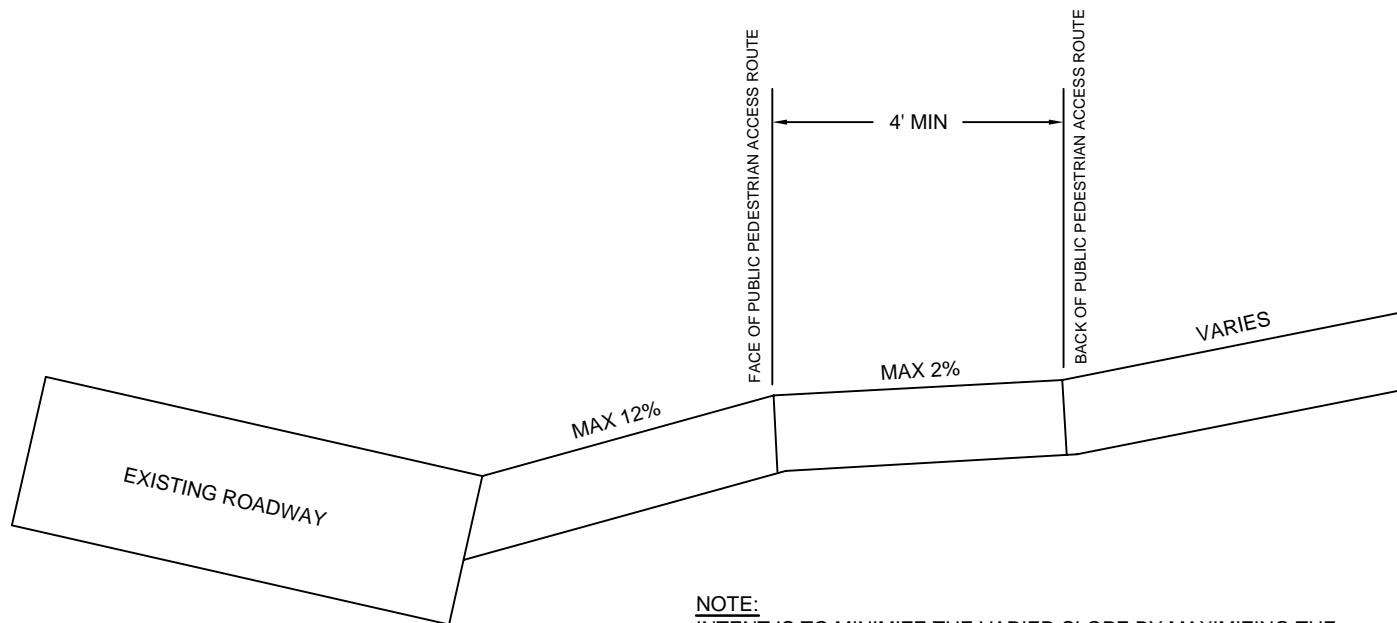


TITLE ONE - Subdivision Regulations

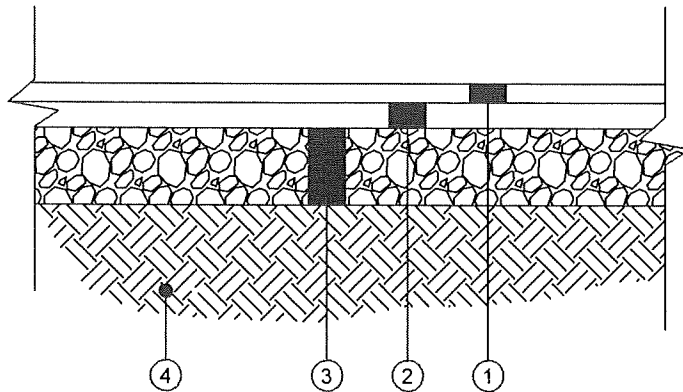
Refer to the following Chapters for the City of Tiffin Subdivision Regulations:

- Chapter 1121 - Title, Scope and Jurisdiction.
- Chapter 1123- Definitions.
- Chapter 1125 - Procedure for Subdivision Approval.
- Chapter 1127 - Subdivision Design Standards.
- Chapter 1129 - Revisions, Enforcement and Fees.





NOTE:
INTENT IS TO MINIMIZE THE VARIED SLOPE BY MAXIMIZING THE SLOPE BETWEEN THE EDGE OF ROADWAY AND THE FACE OF THE PUBLIC PEDESTRIAN ACCESS ROUTE. IF POSSIBLE, TO PREVENT VEHICLES FROM BOTTOMING OUT, NO SLOPE SHALL EXCEED 16%. IF A MAXIMUM SLOPE OF 16% CAN NOT BE ACHIEVED, ALTERATIONS MAY NEED TO BE MADE FROM THE STANDARD DRAWING.

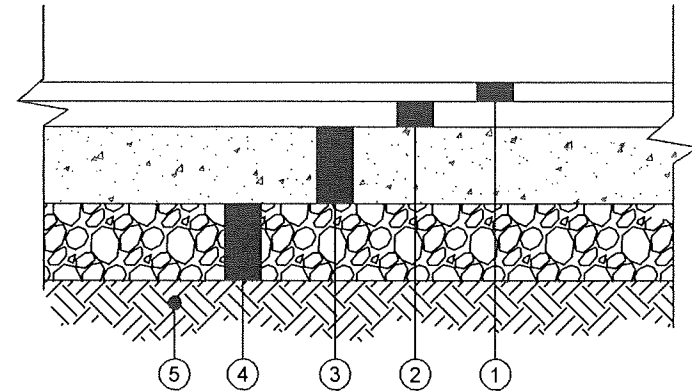


LEGEND

- ① 1 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 SURFACE COURSE, TYPE I
- ② 2 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 INTERMEDIATE COURSE, TYPE 1
- ③ 8" AGGREGATE BASE, ODOT ITEM 304, COMPACTED IN (2) 4" LIFTS
- ④ COMPACTED AND PROOF ROLLED SUBGRADE, ODOT ITEM 204

LOCAL RESIDENTIAL PUBLIC STREET

NOT TO SCALE



LEGEND

- ① 1 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 SURFACE COURSE, TYPE I
- ② 1 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 INTERMEDIATE COURSE, TYPE 1
- ③ 7" ASPHALT CONCRETE BASE, ODOT ITEM 301, PAVED IN 2 LIFTS
- ④ 6" AGGREGATE BASE, ODOT ITEM 304, COMPACTED IN (2) 3" LIFTS
- ⑤ COMPACTED AND PROOF ROLLED SUBGRADE, ODOT ITEM 204

LOCAL COLLECTOR OR ARTERIAL

NOT TO SCALE

*NOTE: IN ALL CASES, THE MINIMUM PAVEMENT BUILDUP SHALL BE CALCULATED BASED ON SOIL CONDITIONS AND TRUCK TRAFFIC AND MODIFIED AS REQUIRED TO MEET THE EXPECTED LOADINGS.

DATE MODIFIED: 06/2020

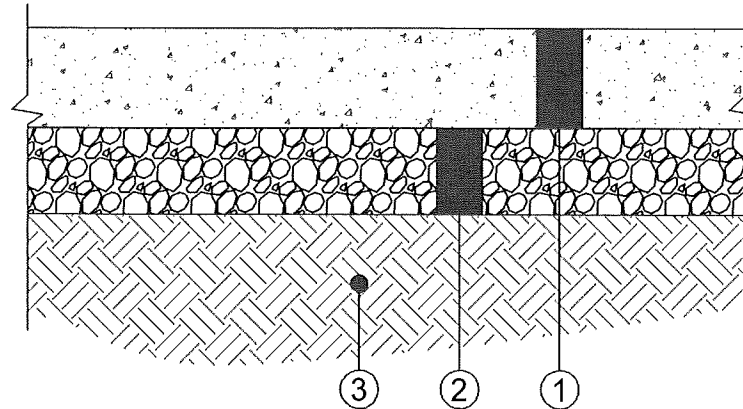
TYPICAL SECTION - ASPHALT STREET

CITY OF TIFFIN
 ENGINEERING DEPARTMENT
 51 E. MARKET STREET
 TIFFIN, OHIO 44883



CONTRACTION JOINT SPACING	
TYPES OF PAVEMENT OR BASE	MAXIMUM SPACING BETWEEN JOINTS
ITEM 451 - REINFORCED CONCRETE PAVEMENT	21'
ITEM 452 - NON-REINFORCED CONCRETE PAVEMENT	15'
ITEM 305 - CONCRETE BASE	15'

CONTRACTION JOINTS: CONTRACTION JOINTS OF THE TYPE SPECIFIED SHALL BE SPACED IN ACCORDANCE WITH THE CONTRACTION JOINT SPACING TABLE. -CONTRACTION JOINTS SHALL BE CUT TO A DEPTH OF $\frac{1}{4}$ THE SLAB THICKNESS FOR ALL SLABS 9" OR LESS. FOR ALL SLABS WITH A THICKNESS GREATER THAN 9", CONTRACTION JOINT SHALL BE CUT TO A DEPTH OF $\frac{1}{3}$ THE SLAB THICKNESS. CONSTRUCTION JOINTS: IN ITEM 305 - CONCRETE BASE, A CONSTRUCTION JOINT SHALL NOT BE LOCATED CLOSER THAN 6' TO ANOTHER PARALLEL JOINT.

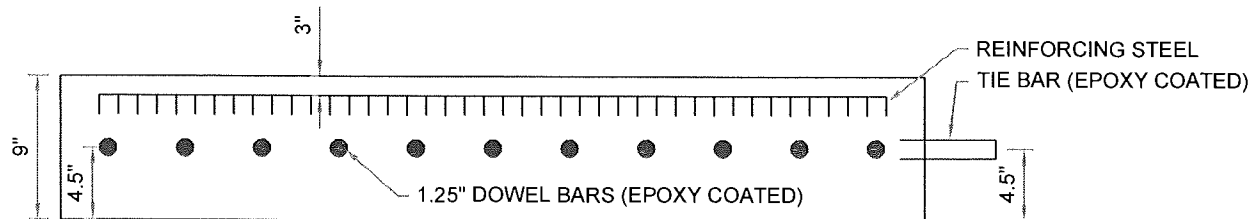


LEGEND

- ① 9" OF REINFORCED CONCRETE PAVEMENT, CLASS QC1 (SEE DETAIL BELOW), ODOT ITEM 451
- ② 6" OF AGGREGATE BASE, ODOT ITEM 304, COMPACTED IN (2) 3" LIFTS
- ③ COMPACTED SUBGRADE, ODOT ITEM 204

REINFORCED CONCRETE STREET SECTION

NOT TO SCALE



9" REINFORCED CONCRETE PAVEMENT DETAIL

NOT TO SCALE

*NOTE:

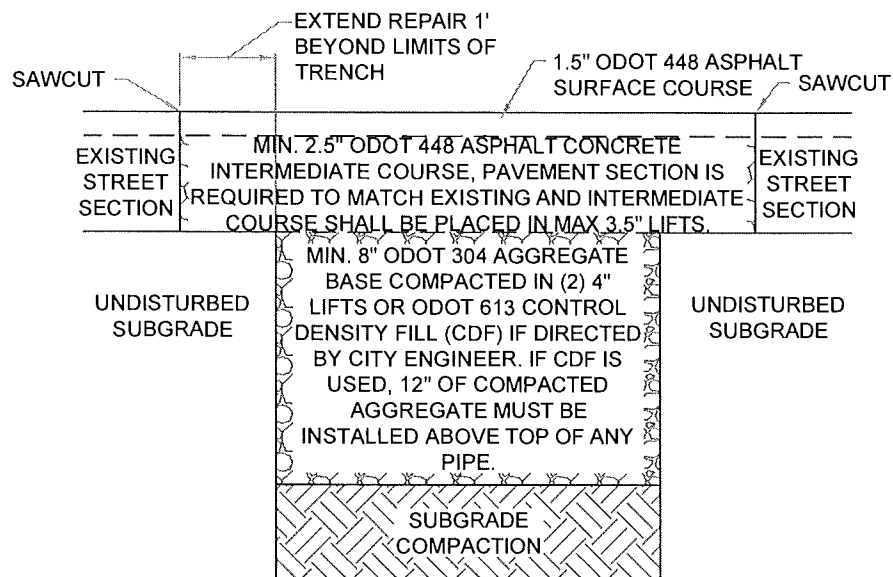
- *LONGITUDINAL JOINTS SHALL BE PLACED AT ALL LANE LINES
- *CONTRACTION JOINTS SHALL BE PLACED AT 21'

DATE MODIFIED: 06/2020

TYPICAL SECTION - REINFORCED CONCRETE STREET

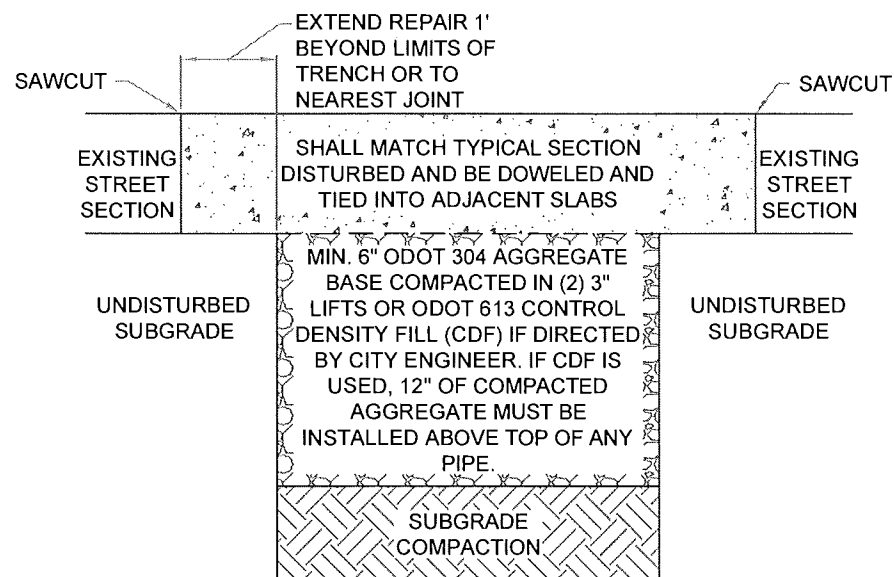
CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883





CONTRACTOR SHALL EXCAVATE, REMOVE AND DISPOSE OF EXISTING PAVEMENT, SOIL OR OTHER MATERIAL AS NECESSARY TO COMPLETE THE WORK DETAILED ABOVE.

FULL DEPTH ASPHALT ROADWAY REPAIR



CONTRACTOR SHALL EXCAVATE, REMOVE AND DISPOSE OF EXISTING PAVEMENT, SOIL OR OTHER MATERIAL AS NECESSARY TO COMPLETE THE WORK DETAILED ABOVE.

FULL DEPTH CONCRETE ROADWAY REPAIR

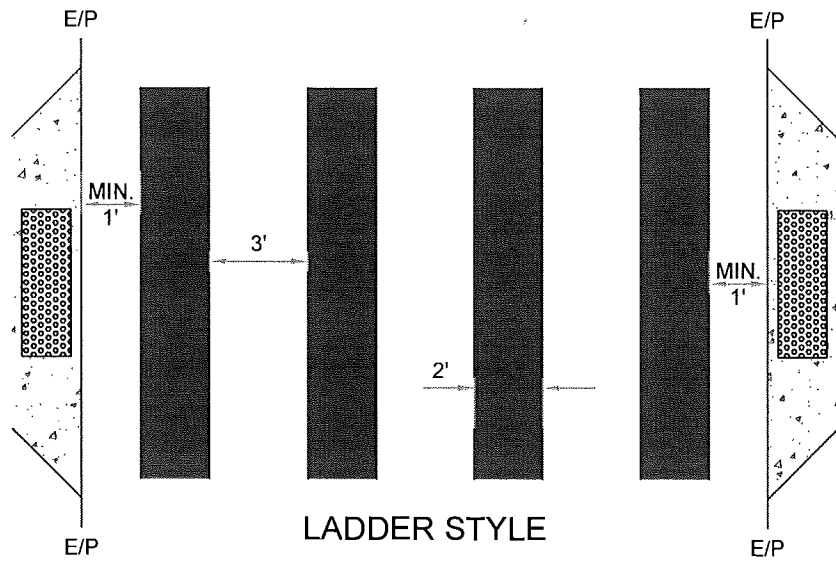
Date Modified: 06/2020

TYPICAL SECTION - TRENCH REPAIR

CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883

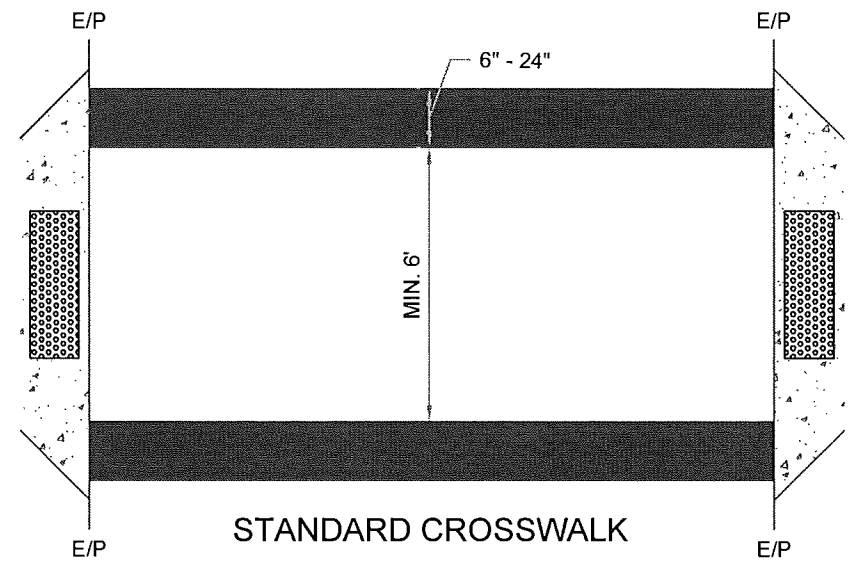


*GENERAL NOTE: WIDTH OF CROSSWALK SHALL BE A MIN. OF 6' BUT SHALL BE LAYED OUT TO SPAN THE ENTIRE WIDTH OF THE CURB RAMP.



LADDER STYLE

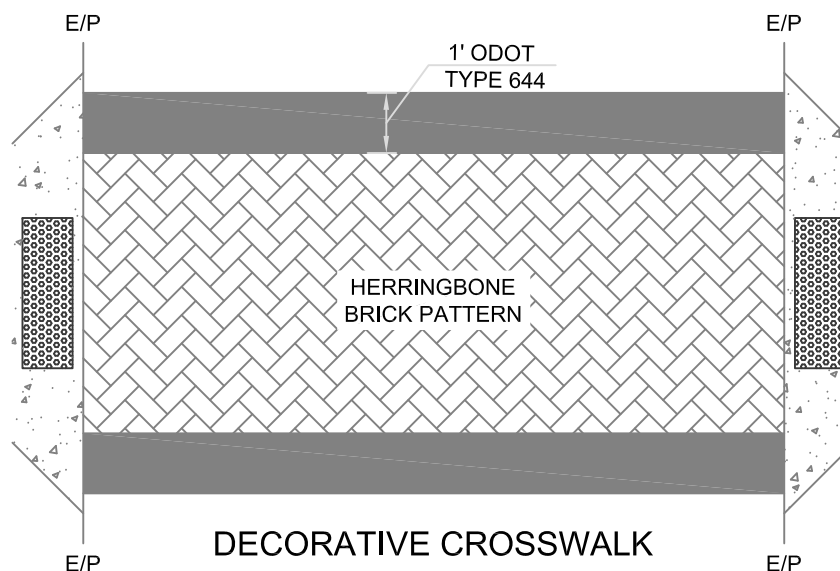
*NOTE: 3' TYPICAL SPACING MAY BE ADJUSTED SLIGHTLY FOR CLEARANCE OF WHEEL TRACKS.



STANDARD CROSSWALK

Date Modified: 06/2020

***GENERAL NOTE:** WIDTH OF CROSSWALK SHALL BE A MIN. OF 6' BUT SHALL BE LAYED OUT TO SPAN THE ENTIRE WIDTH OF THE CURB RAMP.



***NOTE:** ASPHALT BRICK HERRINGBONE PATTERN AT A 45° ANGLE TO THE CROSSWALK LINES UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER. BRICK COLOR AND PATTERN TO MATCH AS CLOSELY AS POSSIBLE TO THE EXISTING CROSSWALK WITHIN THE DOWNTOWN. SHALL BE "TRAFFIC PATTERN XD" AS MANUFACTURED BY ENNIS-FLINT OR EQUIVALENT AND SHALL BE APPLIED BY A CERTIFIED APPLICATOR.

CONCRETE: SHALL BE BRICK HERRINGBONE PATTERN AT 45° ANGLE TO THE CROSSWALK LINES UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER. SHALL BE A MIN. 8" THICK INTEGRAL COLORED CONCRETE SLAB AND COLOR SHALL MATCH AS CLOSE AS POSSIBLE TO DOWNTOWN STREETSCAPE. COLOR HARDENERS SHALL BE DARK POPPY #CH - 4235 OR APPROVED EQUAL. CONTRACTOR SHALL SUPPLY 2'x2' SAMPLE PRIOR TO INSTALLATION.

Date Modified: 12/2021

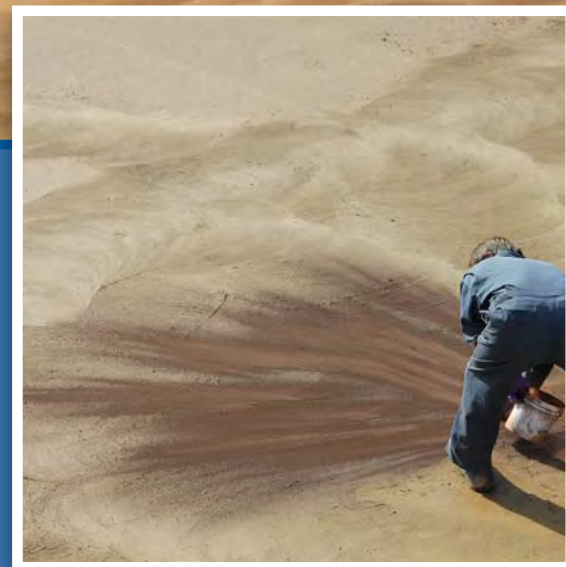
Color Hardener

Color Hardener

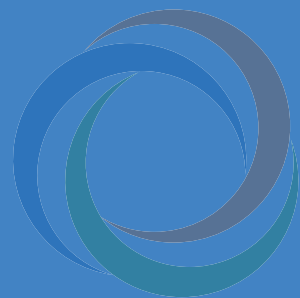


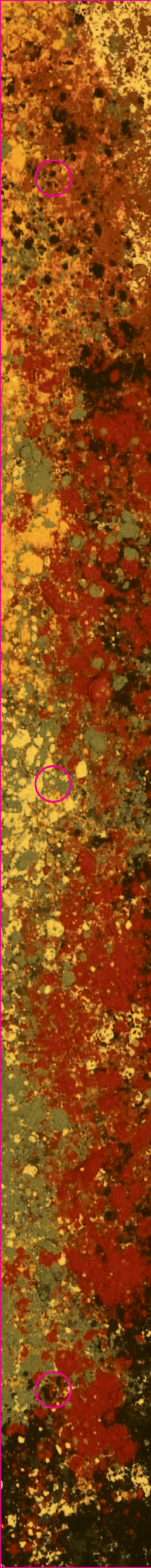
Color Hardener

Pre-blended and ready to use, Interstar Color Hardener adds surface color to freshly placed concrete.



Color Hardener may be applied as a solid surface coat or as a randomly dispersed highlight color to create a marbled effect.





CH-8000
Corn

CH-3000
Honey

CH-3110
Dark Honey

CH-3211
Caramel

CH-3216
Apricot



CH-8211
Dove

CH-8216
Cantaloupe

CH-3218
Straw

CH-3761
Honied Apricot

CH-3431
Burnt Orange



CH-3760
Pumpkin

CH-3636
Carrot

CH-3459
Mango

CH-4221
Paprika

CH-4227
Umber



CH-8760
Tangerine

CH-8232
Mandarin Orange

CH-8251
Pink

CH-4251
Rust

CH-4377
Chocolate Orange



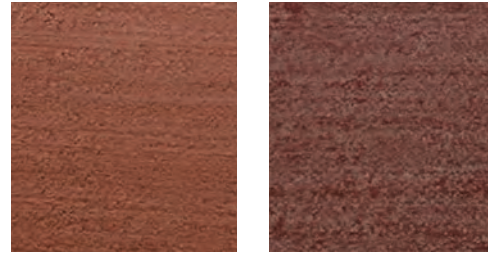
CH-4232
Sunset

CH-4235
Dark Poppy

CH-3434
Orange Copper

CH-5231
Carob

CH-5230
Maple Syrup



CH-5114
Groundhog

CH-4372
Mink



CH-8440
Sand

CH-8171
Slate Green

CH-8353
Tarragon Gray

CH-8200
Baby Blue

CH-9200
Sea Blue



CH-9112
Cloud

CH-8344
Pistachio

CH-9310
Shamrock Green

CH-9344
Pine Green

CH-9353
Midnight Green



CH-5101
Brownie

CH-5111
Bison Brown

CH-5103
Root Beer

CH-5105
Ferret

CH-5440
Bark



CH-5381
Dark Chocolate

CH-5380
Tobacco Brown

CH-5220
Espresso

CH-5210
Deep Taupe

CH-5016
Midnight Brown



CH-6171
Wrought Iron

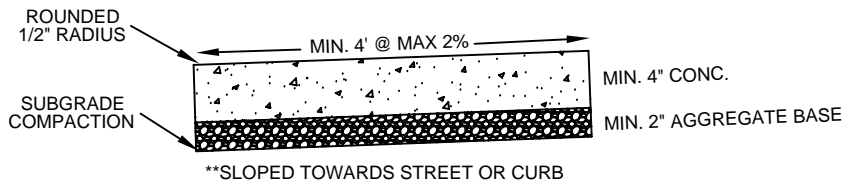
CH-6011
Gray Shadow

CH-6105
Black Bean

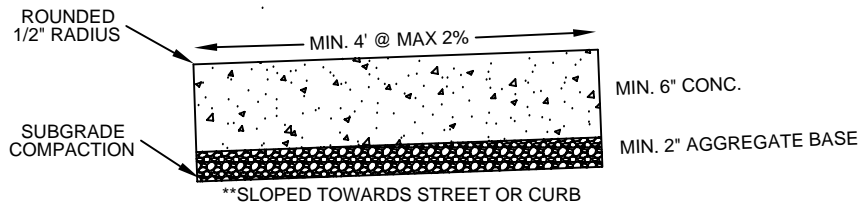
CH-6177
Universal Black

CH-6157
Jet Black

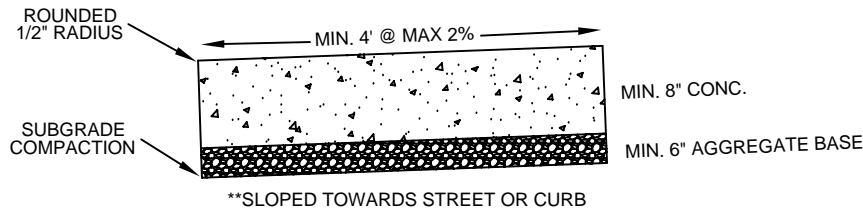
Note: This color chart only provides an estimate of the final colors that can be obtained. It is intended to serve as a guideline for color selection and does not represent the exact colors that will be produced.



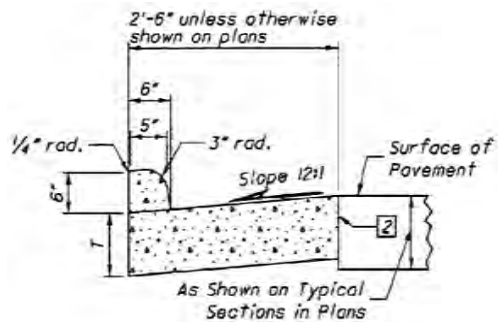
Typical Section Concrete Sidewalk



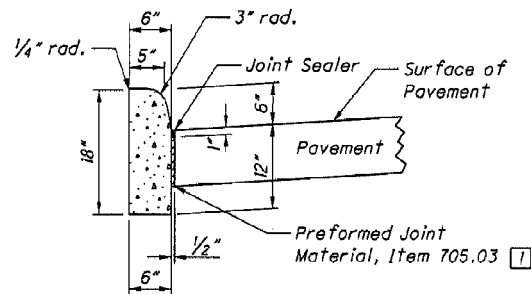
Typical Section Concrete Sidewalk Through A Residential Driveway



Typical Section Concrete Sidewalk Through A Commercial Driveway

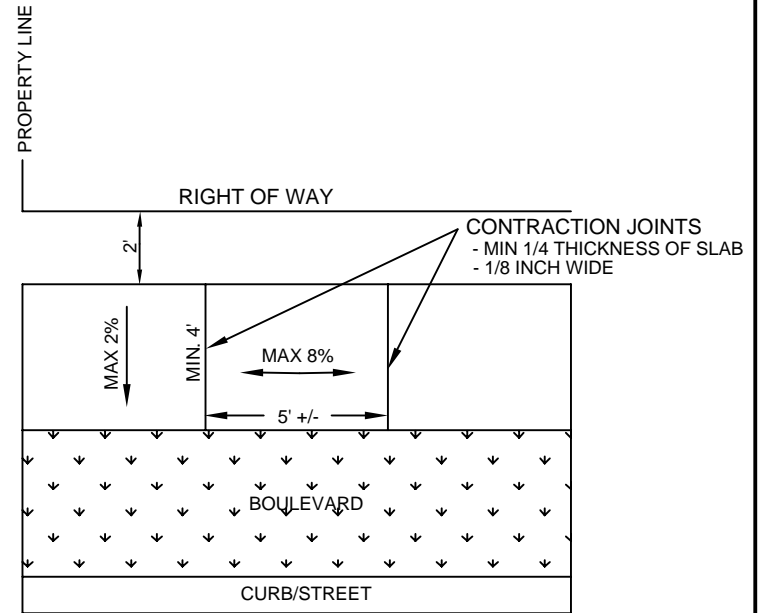


TYPE 2

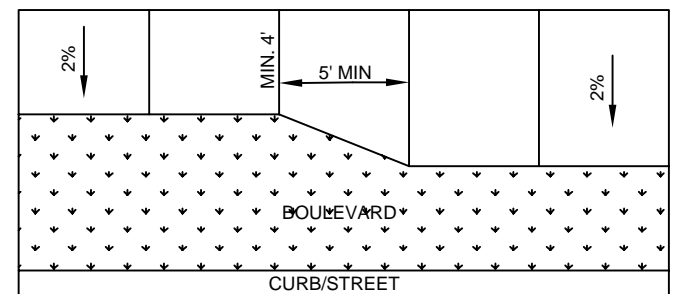


TYPE 6

Typical Curb Sections



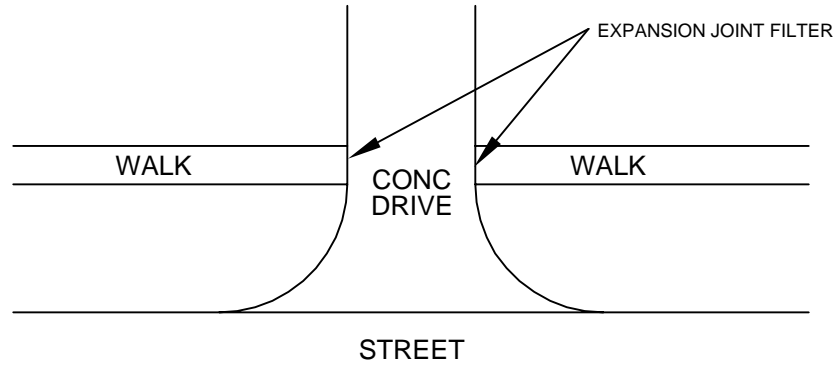
Typical Concrete Sidewalk Plan



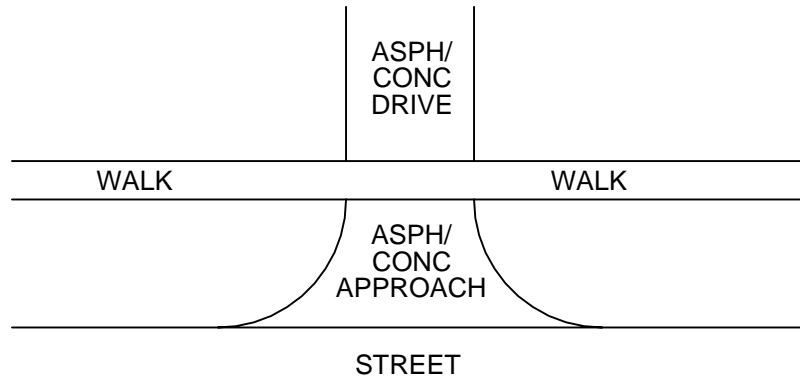
**HOLD ALIGNMENT OF BACK OF SIDEWALK

Typical Concrete Sidewalk Transition Plan

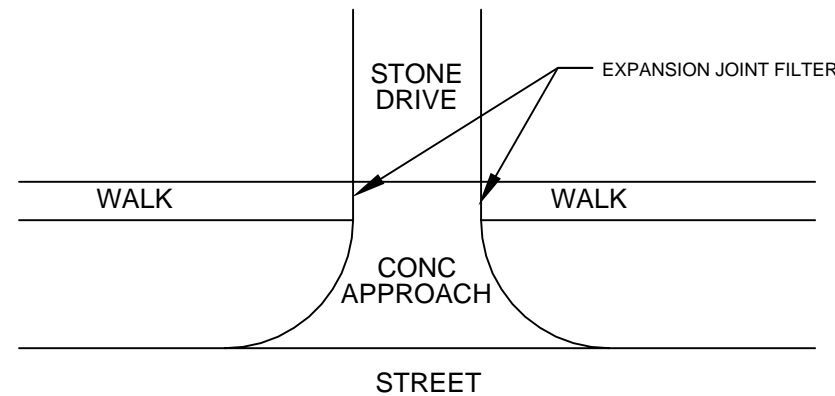
OPTION A



OPTION B



OPTION C

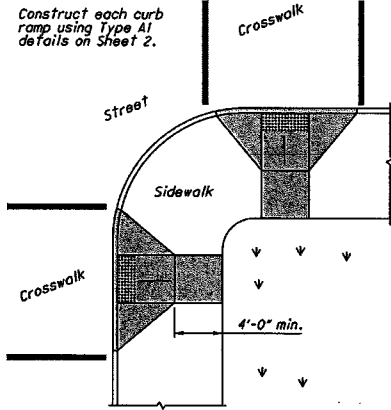


SIDEWALKS THROUGH DRIVES

**NOTE: ALL SIDEWALKS THROUGH DRIVES AND ALL DRIVE APPROACHES BEING USED FOR SIDEWALKS MUST MEET ALL APPLICABLE SIDEWALK REQUIREMENTS.

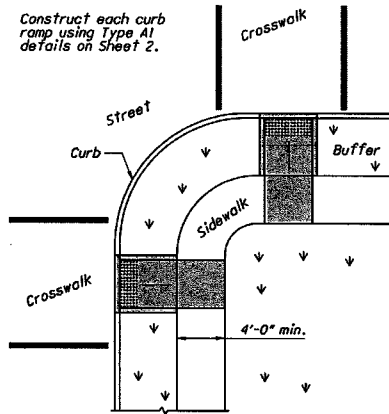
CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883





Construct each curb ramp using Type A1 details on Sheet 2.

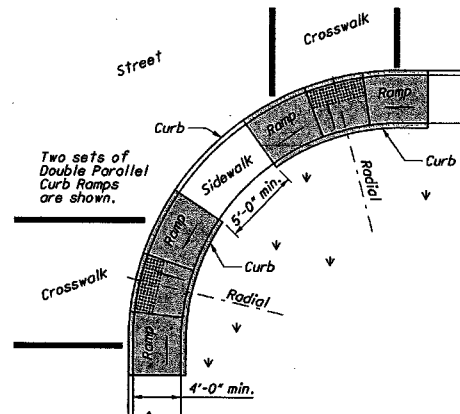
Use curb ramps with flared sides at locations with wide sidewalks.



Construct each curb ramp using Type A1 details on Sheet 2.

Use curb ramps with returned curbs where buffer is wide enough to accommodate ramp slope.

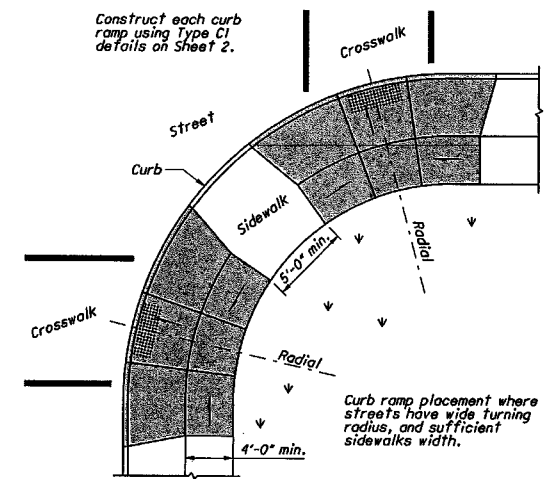
PERPENDICULAR CURB RAMPS



Two sets of Double Parallel Curb Ramps are shown.

Place on streets having wide turning radius and where sidewalks are narrow.

PARALLEL CURB RAMPS

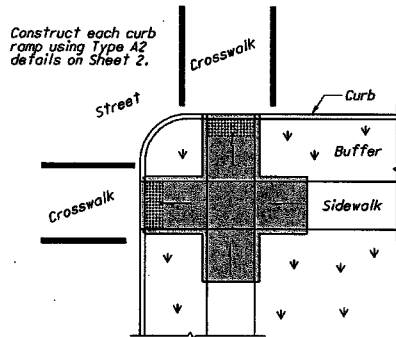


Construct each curb ramp using Type C1 details on Sheet 2.

Curb ramp placement where streets have wide turning radius, and sufficient sidewalks width.

COMBINATION CURB RAMPS

PREFERRED CONSTRUCTION PLACEMENT



Construct each curb ramp using Type A2 details on Sheet 2.

NOTES

GENERAL: This drawing shows curb ramp types details and placement examples for curb ramp construction, including the installation of detectable warnings.

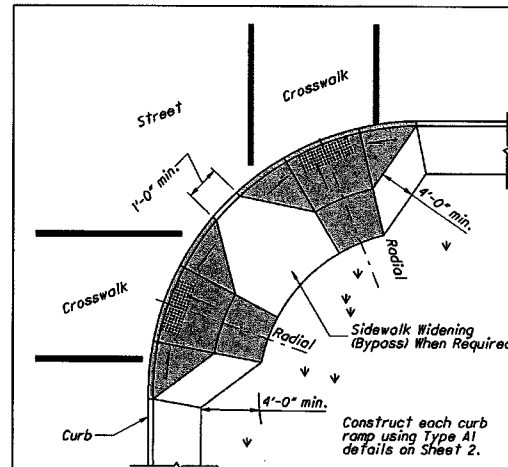
Curb ramp types are shown on Sheet 2 and include Perpendicular, Parallel, and Combined types as specified to be constructed in the locations shown on the project plans.

Curb ramps added to an existing intersection or walk should be individually detailed on the project plans to assure that the design is appropriate for site constraints and all items can be constructed to ADA standards. The contractor may adjust the placement of curb ramps if existing field conditions warrant with the approval of the Engineer.

PAYMENT: Measure and pay for the ramp area within the shaded limits of this drawing as Item 608 Curb Ramp, Square Foot. This includes the cost of any curb or curb and gutter, detectable warnings, landing areas and any additional materials, installation, grading, forming, and finishing required within the shaded area.

Work beyond the shaded ramp/landing area is paid for as curb (609) and walk (608). Removal of existing curb, walk (or existing curb ramps) are paid under Item 202.

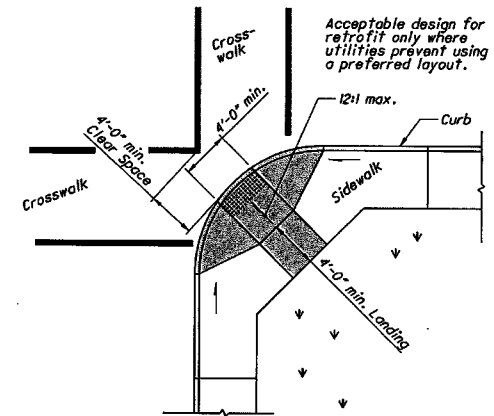
For at-grade crossing locations where only detectable warnings are required in order to achieve ADA compliance, measure and pay for the strip of detectable warnings as Item 608 Detectable Warning, Square Foot. The work to cast the tiles in place will also require removal of existing pavement (Item 202) to the nearest joint, or if no joint exists, a minimum of 4 feet.



Construct each curb ramp using Type A1 details on Sheet 2.

Acceptable design on corners with wide turning radius where user is able to maneuver within crosswalk limits so as not to encroach into adjacent traveled lanes.

PERPENDICULAR RAMPS

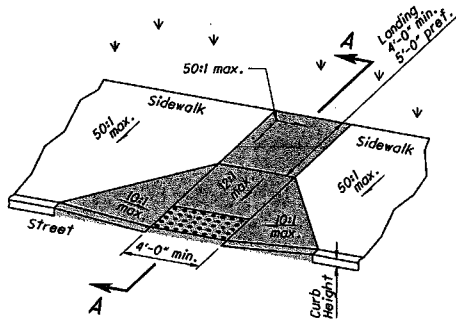


Acceptable design for retrofit only where utilities prevent using a preferred layout.

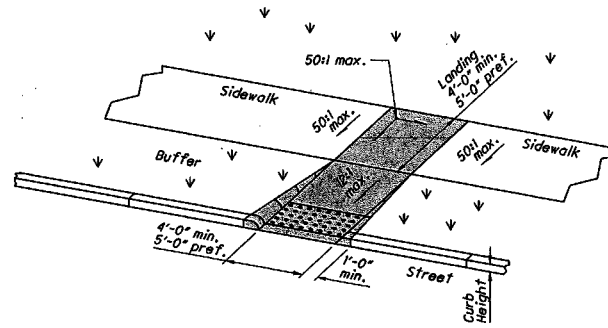
Use this design only for existing walks, and when site constraints prohibit other designs. The diagonal Type D ramp may be constructed as either a Perpendicular, Parallel or Combination curb ramp type. Avoid using where curb radii are less than 20'-0".

DIAGONAL RAMP (Type D)

ACCEPTABLE CONSTRUCTION PLACEMENT

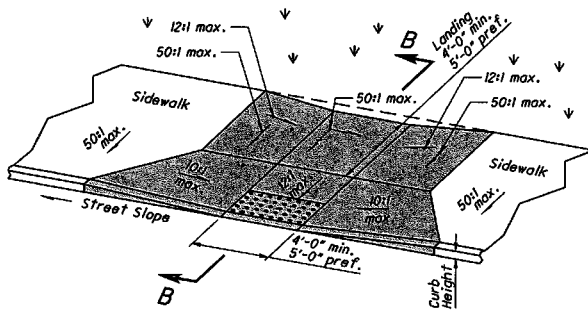


Type A1 (Perpendicular with flared sides)

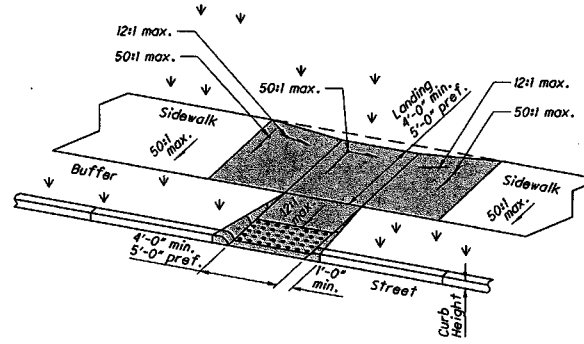


Type A2 (Perpendicular with returned curb)

PERPENDICULAR CURB RAMP DETAILS

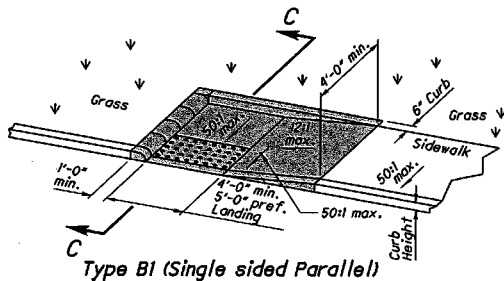


Type C1 (Combined with flared sides)

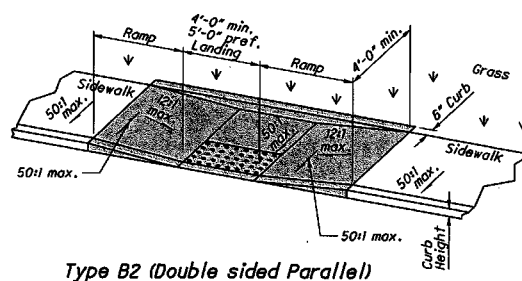


Type C2 (Combined with returned curb)

COMBINED CURB RAMP DETAILS

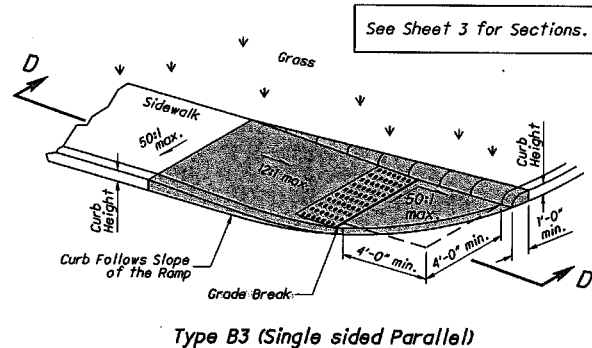


Type B1 (Single sided Parallel)



Type B2 (Double sided Parallel)

PARALLEL CURB RAMP DETAILS



Type B3 (Single sided Parallel)

NOTES CONTINUED

The running slope of the ramp is preferred to be 12:1 or flatter. In existing sidewalks, where the maximum ramp slope is not feasible due to site constraints (e.g. utility poles or vaults, right-of-way limits) it may be reduced as follows:

- A) 10:1 for a max. rise of 6",
- B) 8:1 for a max. rise of 3",
- C) 6:1 over a max. run of 2'-0" for historic areas where a flatter slope is not feasible.

To prevent chasing the grade indefinitely, the transition from existing sidewalk to the shaded curb ramp area is not required to exceed 15 feet in length.

While ramps may be skewed to the crosswalk, the entire lower landing area must fall within the cross walk that the ramp serves and cannot be located in the traveled lane of opposing traffic.

The counter slope of the gutter or street at the foot of a curb ramp, landing, or blended transitions shall be 20:1 or flatter.

The bottom edge of the ramp shall change planes perpendicular to the landing.

The edge of the curb shall be flush with the edge of the adjacent pavement and gutter and surface slopes that meet grade breaks shall also be flush.

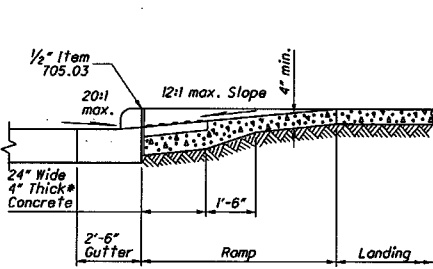
Ramp landings shall be 4' min. x 4' min. with a 50:1 or flatter cross slope and running slope.

DETECTABLE WARNINGS: Install Detectable Warnings on each curb ramp with approved materials, as shown on Sheet 3. Install these proprietary products as per manufacturer's written instructions.

DRAINAGE: Contractor is to ensure the base of each constructed curb ramp allows for proper drainage, without exceeding allowable cross slope or ramp slopes. Vertical change in level exceeding 1/4" between the sidewalk and gutter, and 2" gutter and ramp, are not allowed.

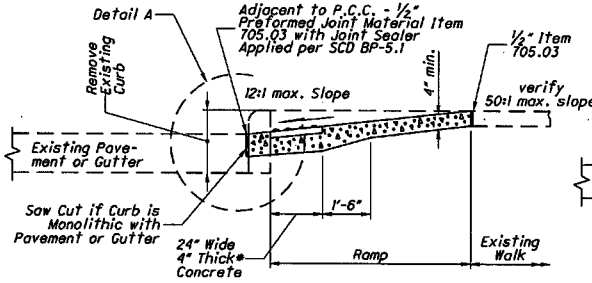
SURFACE TEXTURE: Texture concrete surfaces by coarse brooming transverse to the ramp slopes to be rougher than the adjacent walk.

JOINTS: Provide expansion joints in the curb ramp as extensions of walk joints and consistent with Item 608.03 requirements for a new concrete walk. Provide a 1/2" Item 705.03 expansion joint filler around the edge of ramps built in existing concrete walks. Lines shown on this drawing indicate the ramp edges and slope changes, and do not necessarily indicate joint lines.

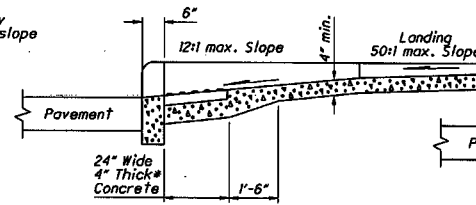


New gutter shown.

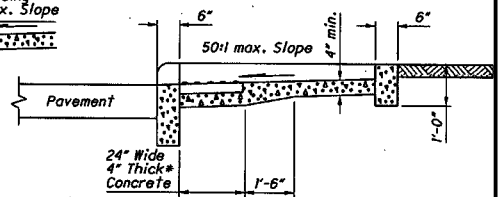
**SECTION A-A
NORMAL DETAIL**
See Sheet 2.



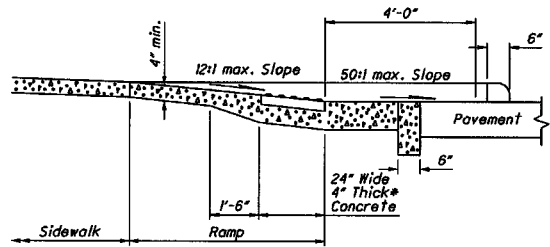
**SECTION A-A
EXISTING WALK DETAIL**
See Sheet 2.



SECTION B-B
See Sheet 2.



SECTION C-C
See Sheet 2.



SECTION D-D
See Sheet 2.

*Where possible, pour ramp area integral with the curb, otherwise use 6" thick walk.

DETECTABLE WARNINGS NOTES

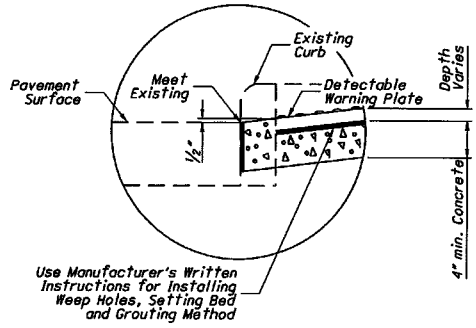
GENERAL: Detectable Warnings are a distinctive surface pattern of truncated domes which are detectable by cane or underfoot to alert people with vision impairments of their approach to streets and hazardous drop-offs.

PLACEMENT: Detectable warnings are to be installed at any location where pedestrians might cross paths with vehicular traffic lanes, such as the base of curb ramps or at blended curbs. A 24" strip of domes is to be installed for the full width of the ramp or walk. Typical street corner placement locations are shown on Sheet 1.

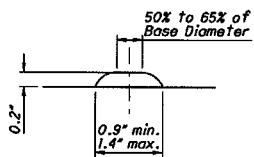
The depth of concrete underneath detectable warning products shall be a minimum of 4". See DETAIL A.

ALIGNMENT: Truncated domes should be aligned with the primary direction of the ramp as shown on the DETECTABLE WARNING ALIGNMENT Detail. Normally the detectable warnings should be flush with the back of the curb, but for skewed conditions see DETECTABLE WARNING ALIGNMENT Detail. For non-standard layouts, detectable warning materials may have to be mitered and placed segmentally.

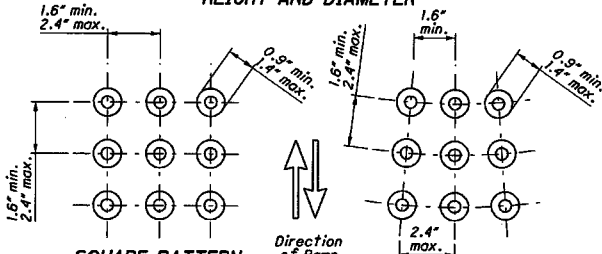
PRODUCTS & COLORS: Color of the detectable warnings should contrast with surrounding concrete walk and ramp. Black is not an acceptable color. Approved products and guidance on color may be found on the Office of Roadway Engineering Service's Detectable Warnings Approved List. Install products as per manufacturer's printed instructions.



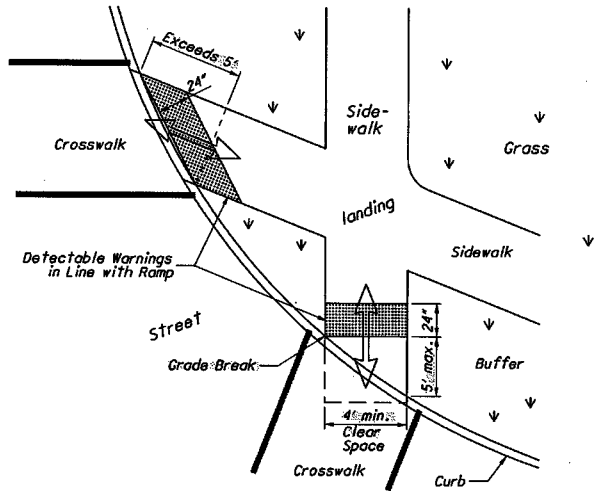
DETAIL A



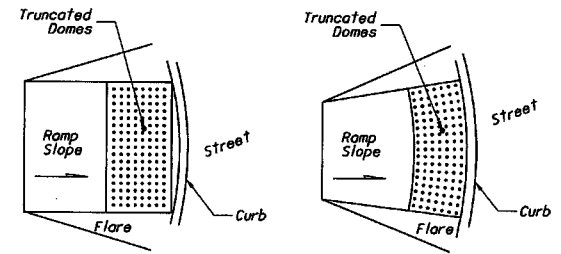
HEIGHT AND DIAMETER



**SQUARE PATTERN,
PARALLEL ALIGNMENT** **RADIAL ALIGNMENT**
TRUNCATED DOMES DETAILS

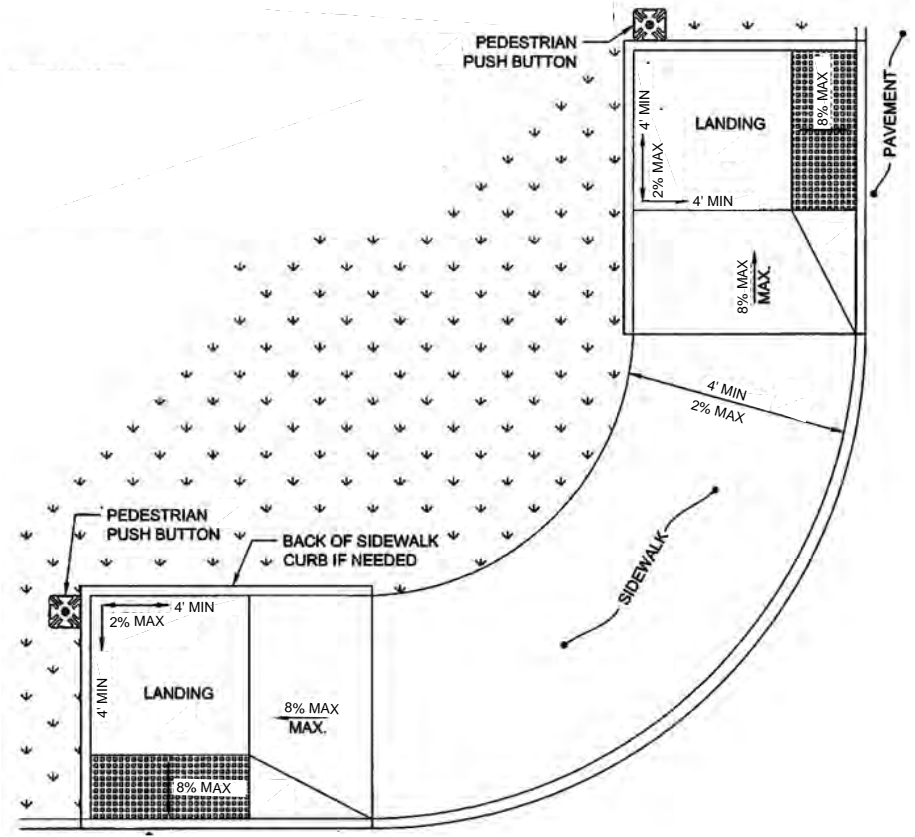
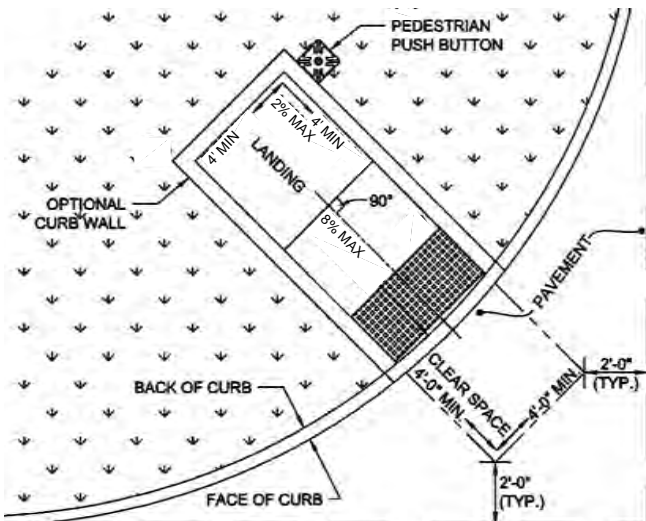
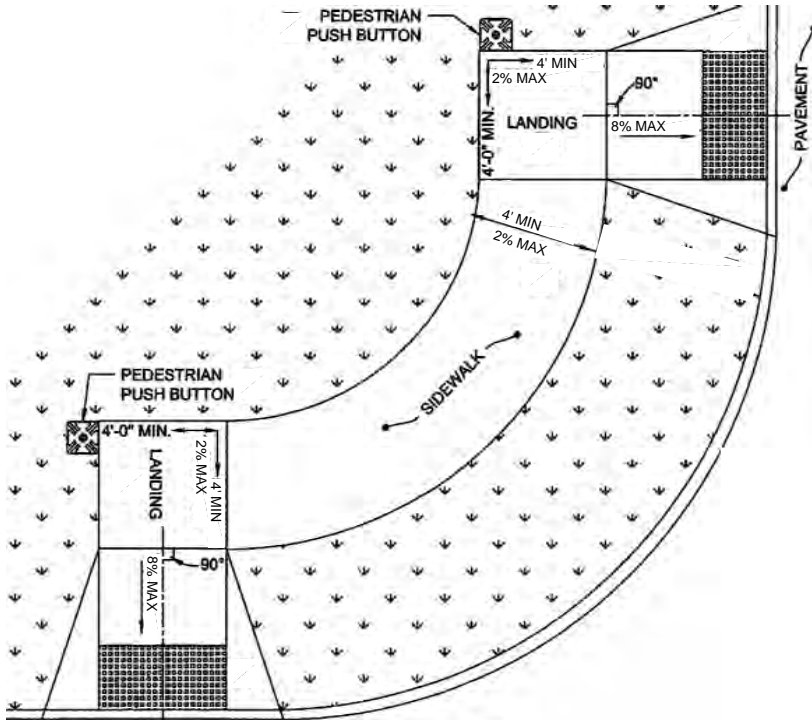


DETECTABLE WARNING ALIGNMENT



DOME ALIGNMENT ON RADIUS CURB

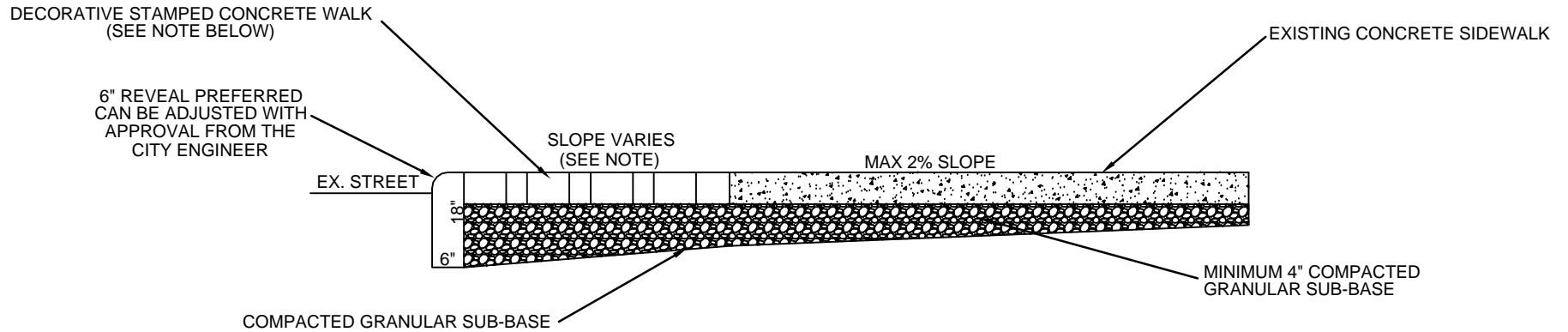




CURB RAMPS WITH PEDESTRIAN PUSH BUTTONS - STANDARD DRAWING

CITY OF TIFFIN
 ENGINEERING DEPARTMENT
 51 E. MARKET STREET
 TIFFIN, OHIO 44883





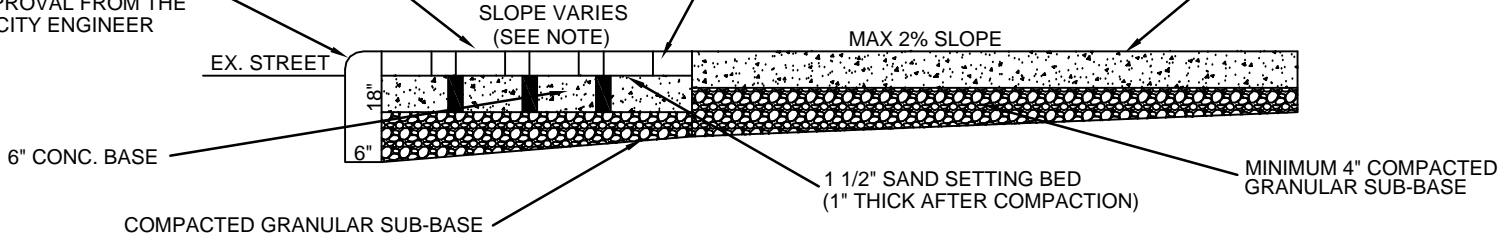
NOTE: DECORATIVE STAMPED CONCRETE SECTION SHALL BE INTEGRAL COLORED, IMPRINTED AND TEXTURED CONCRETE WITH AN ACCENT RELEASE AGENT. STAMPED CONCRETE WALK SHALL HAVE A MINIMUM THICKNESS OF 4 INCHES. CONCRETE SHALL BE SEALED WITH CONCRETE EARTH STAMPSHEEN 350 OR EQUIVALENT. H&C BEAUTIFUL CONCRETE PROTECTION SHARK GRIP SLIP RESISTANT ADDITIVE OR EQUIVALENT SHALL BE ADDED TO THE SEALER AT THE TIME OF APPLICATION. THE CONTRACTOR SHALL SUPPLY THE WITH 4' X 4' TEST SAMPLES FOR REVIEW PRIOR TO CONSTRUCTION.

BRICK PAVERS (RE-USE EXISTING IF POSSIBLE)
TO MATCH EX. STREETScape
(FILL JOINTS WITH POLYMERIC JOINTING SAND
AND VIBRATE WITH A PLATE COMPACTOR)

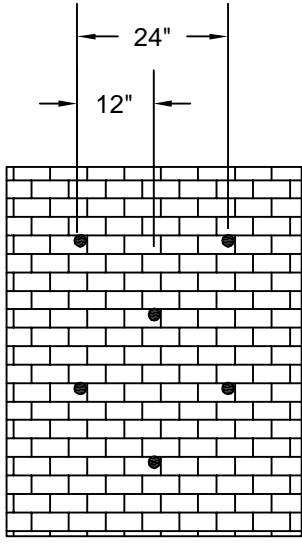
6" REVEAL PREFERRED
CAN BE ADJUSTED WITH
APPROVAL FROM THE
CITY ENGINEER

2" DIAM. PVC WEEP HOLES SPACED @
12" ON CENTER AND STAGGERED (SEE DETAIL)
(FILL WEEP HOLES W/ SAND)

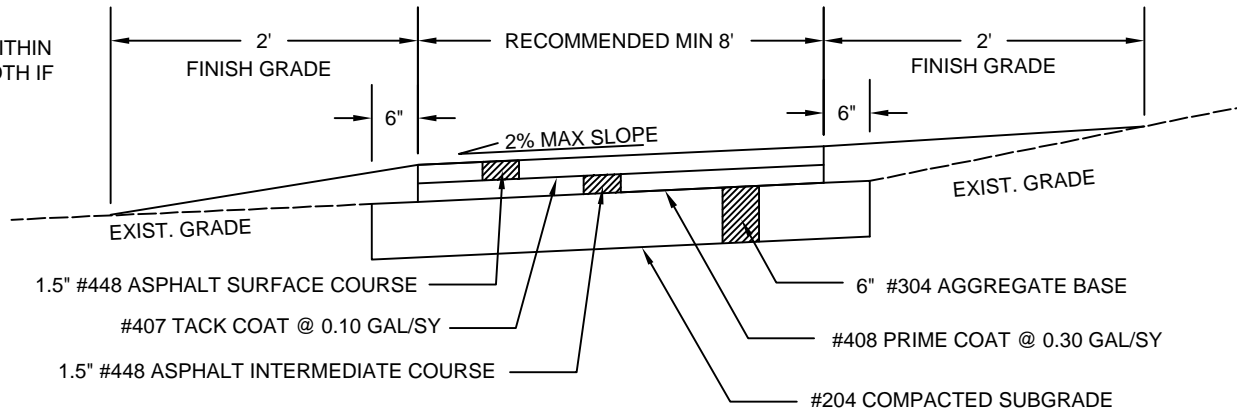
EXISTING CONCRETE SIDEWALK



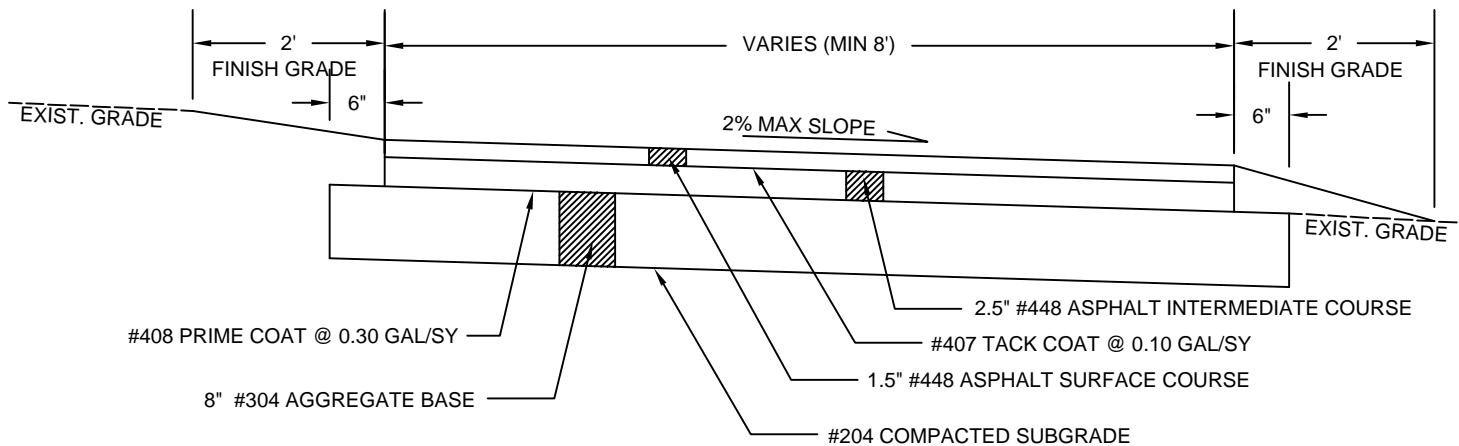
NOTE: SLOPE WILL VARY DEPENDENT UPON MAINTAINING A MAXIMUM 2% CROSS SLOPE ACROSS THE PEDESTRIAN WALKWAY AND PROPOSED CURB REVEAL. IDEALLY THE CROSS SLOPE OF THE BRICK PAVER FURNITURE AREA WILL NOT EXCEED 2%, HOWEVER, THIS AREA MAY EXCEED THE 2% REQUIREMENT BASED UPON EXISTING TOPOGRAPHY OF THE AREA.



NOTE: TRAILS OR WALKWAYS WITHIN PARKS CAN BE REDUCED IN WIDTH IF NECESSARY.

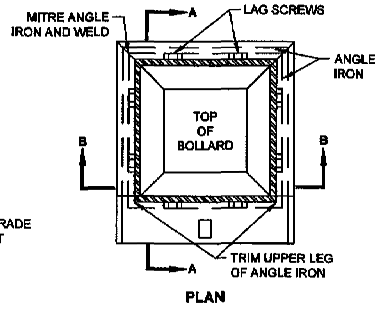
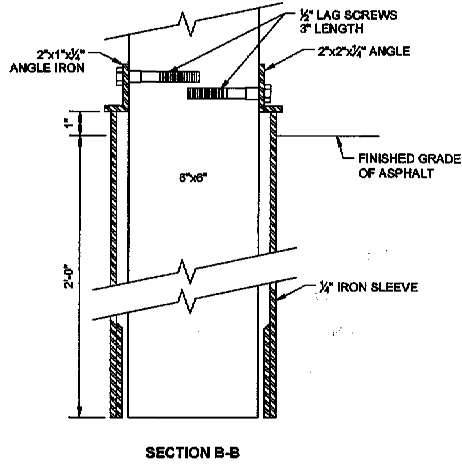
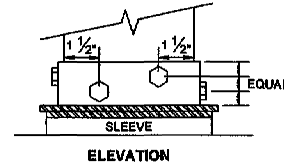
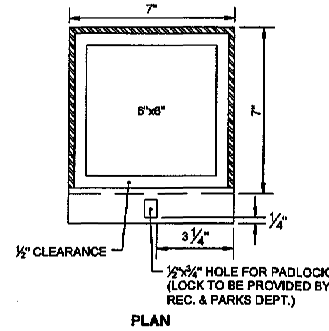
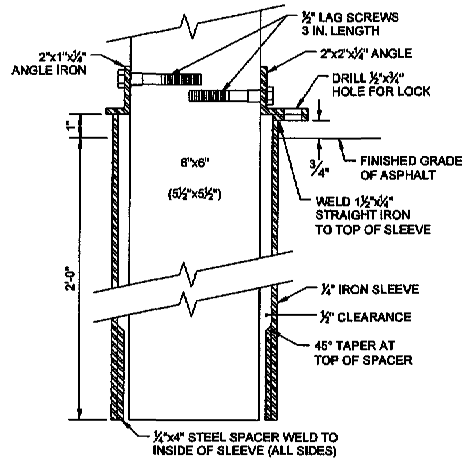


PEDESTRIAN TRAIL SECTION



VEHICULAR TRAIL SECTION





TYPICAL REMOVABLE BOLLARD DETAIL

CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883



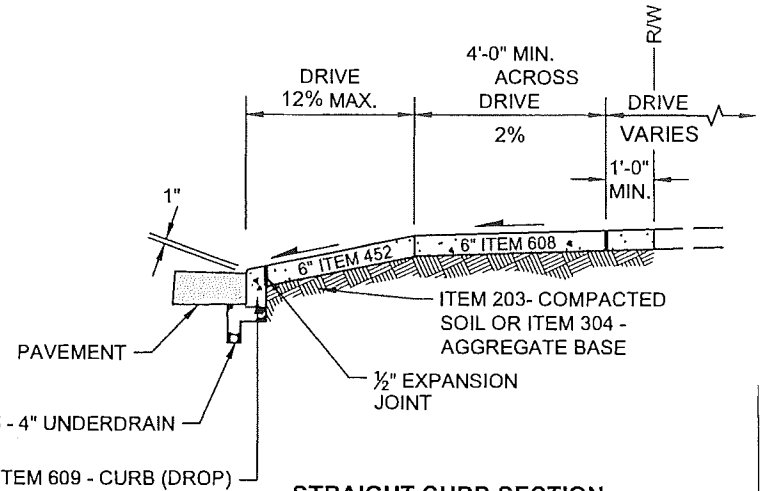
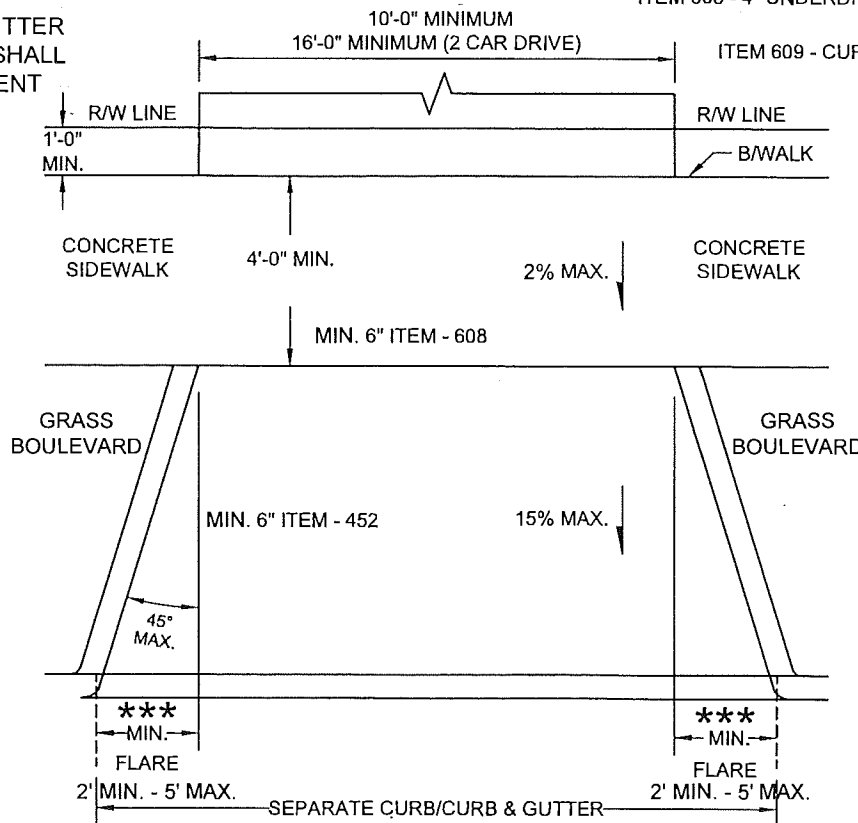
FOR USE ON A PARCEL WITH A SINGLE DWELLING

EXHIBIT Y

* CURB OR COMBINED CURB AND GUTTER SHALL BE TAKEN OUT AND REPLACED WITH CONCRETE, SEPARATED FROM THE DRIVE BY 1/2" PREMOLDED EXPANSION JOINT. WHEN LESS THAN 5 FT. OF A CURB SECTION REMAINS AFTER THE CURB CUT IS LOCATED, IT SHALL ALSO BE REMOVED AND REPLACED. CURB SHALL BE CONSTRUCTED IN MINIMUM 5 FT. SECTIONS AND MAXIMUM 10 FT. SECTIONS.

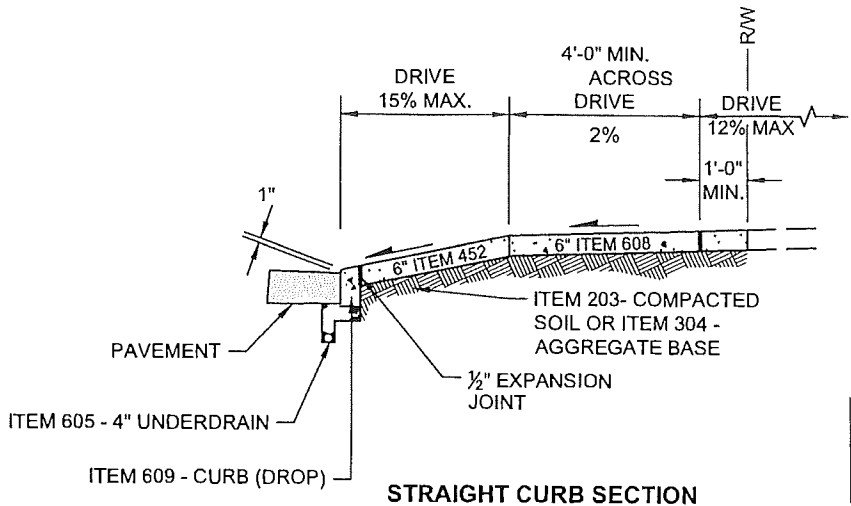
*** 5 FT. ON ROADWAYS WITH 35 MPH SPEED LIMIT, 2 FT. FOR SPEED LIMITS LESS THAN 35 MPH.

WHEN A CURB OR CURB AND GUTTER ARE PRESENT ALL DRIVEWAYS SHALL BE ITEM 452 CONCRETE PAVEMENT

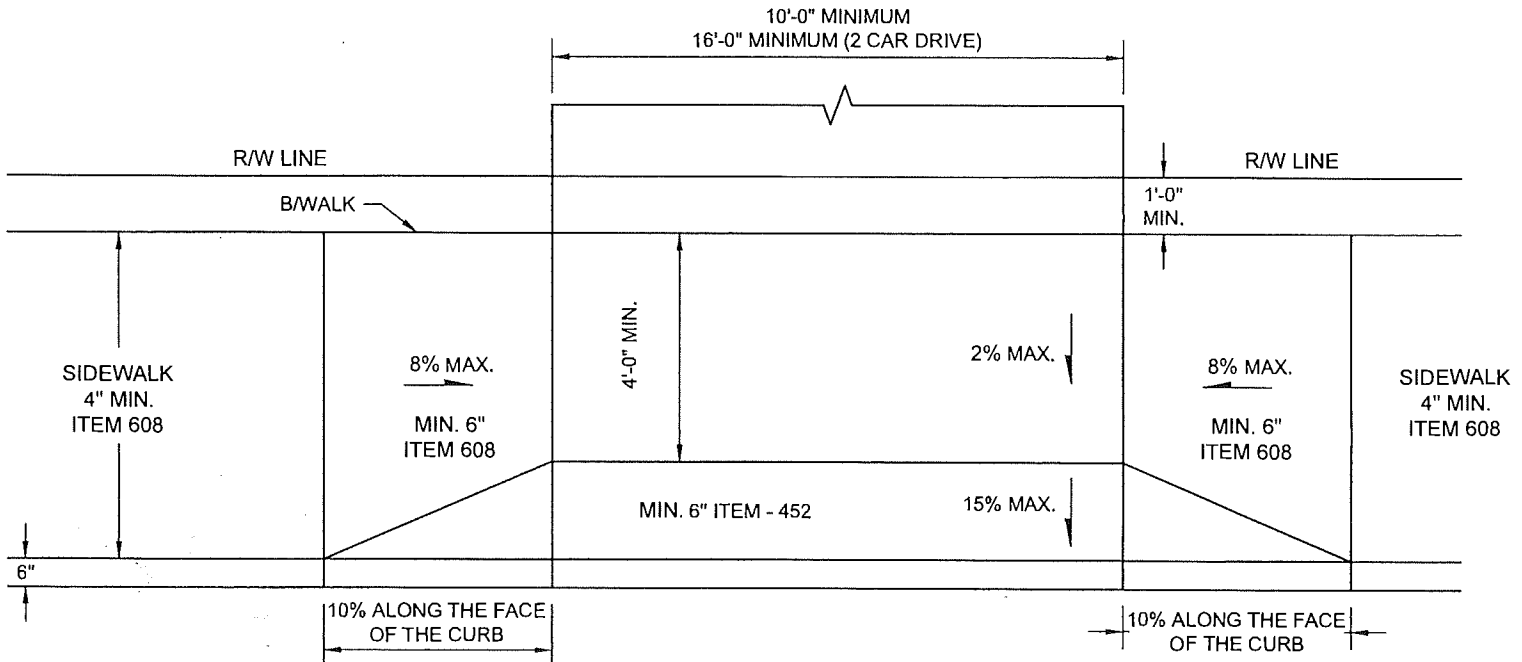


STRAIGHT CURB SECTION

NOTE: INTENT IS TO MINIMIZE THE VARIED SLOPE BY MAXIMIZING THE SLOPE BETWEEN THE EDGE OF ROADWAY AND THE FACE OF THE PUBLIC PEDESTRIAN ACCESS ROUTE. IF POSSIBLE, TO PREVENT VEHICLES FROM BOTTOMING OUT, NO SLOPE SHALL EXCEED 16%. IF A MAXIMUM SLOPE OF 16% CAN NOT BE ACHIEVED, ALTERATIONS MAY NEED TO BE MADE FROM THE STANDARD DRAWING.

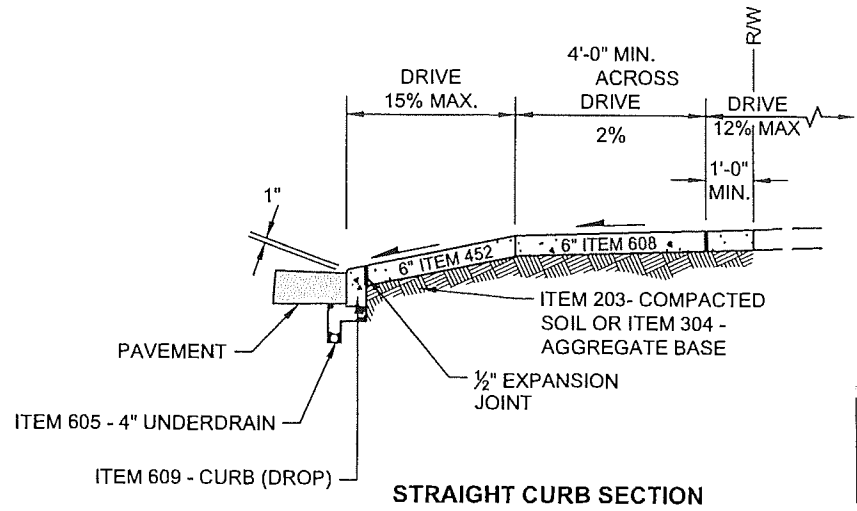


NOTE: INTENT IS TO MINIMIZE THE VARIED SLOPE BY MAXIMIZING THE SLOPE BETWEEN THE EDGE OF ROADWAY AND THE FACE OF THE PUBLIC PEDESTRIAN ACCESS ROUTE. IF POSSIBLE, TO PREVENT VEHICLES FROM BOTTOMING OUT, NO SLOPE SHALL EXCEED 16%. IF A MAXIMUM SLOPE OF 16% CAN NOT BE ACHIEVED, ALTERATIONS MAY NEED TO BE MADE FROM THE STANDARD DRAWING.

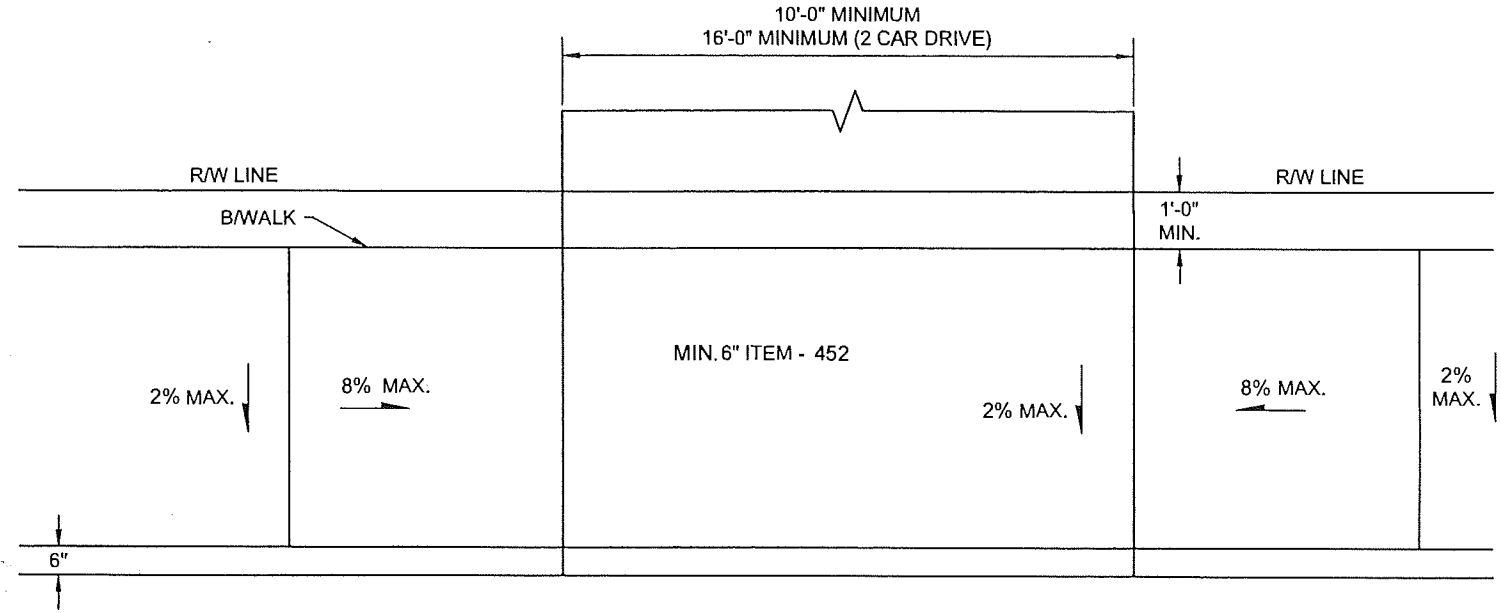


DATE MODIFIED: 07/2020

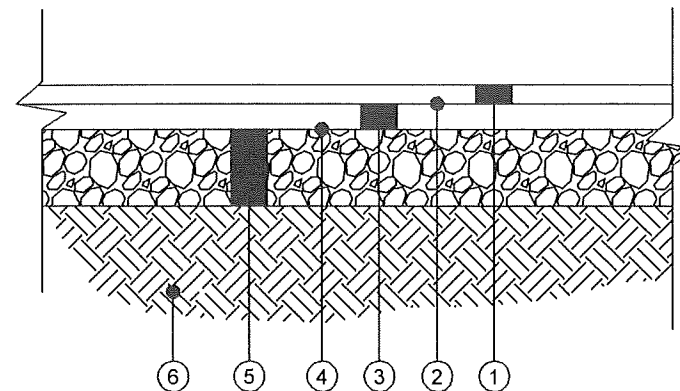
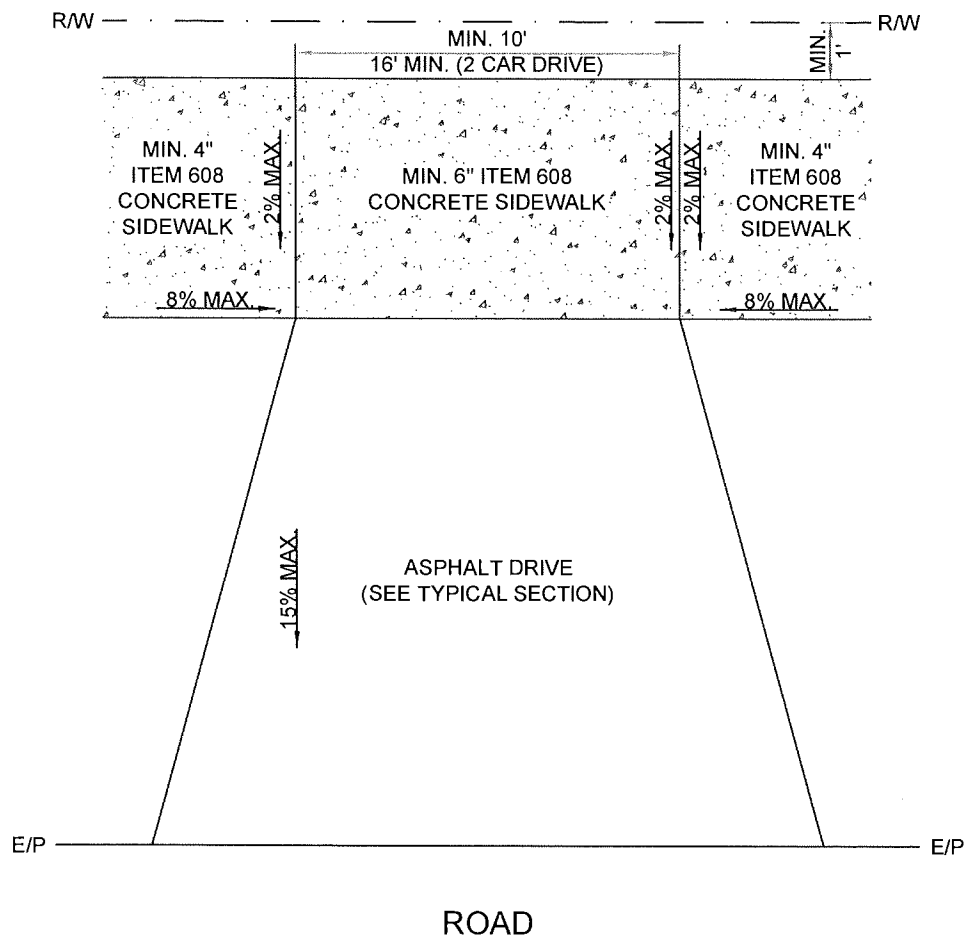




NOTE: INTENT IS TO MINIMIZE THE VARIED SLOPE BY MAXIMIZING THE SLOPE BETWEEN THE EDGE OF ROADWAY AND THE FACE OF THE PUBLIC PEDESTRIAN ACCESS ROUTE. IF POSSIBLE, TO PREVENT VEHICLES FROM BOTTOMING OUT, NO SLOPE SHALL EXCEED 16%. IF A MAXIMUM SLOPE OF 16% CAN NOT BE ACHIEVED, ALTERATIONS MAY NEED TO BE MADE FROM THE STANDARD DRAWING.



DATE MODIFIED: 07/2020



LEGEND

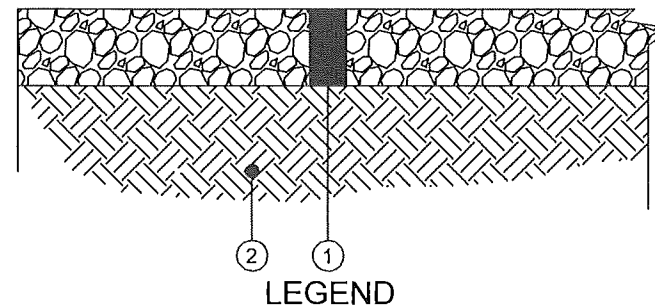
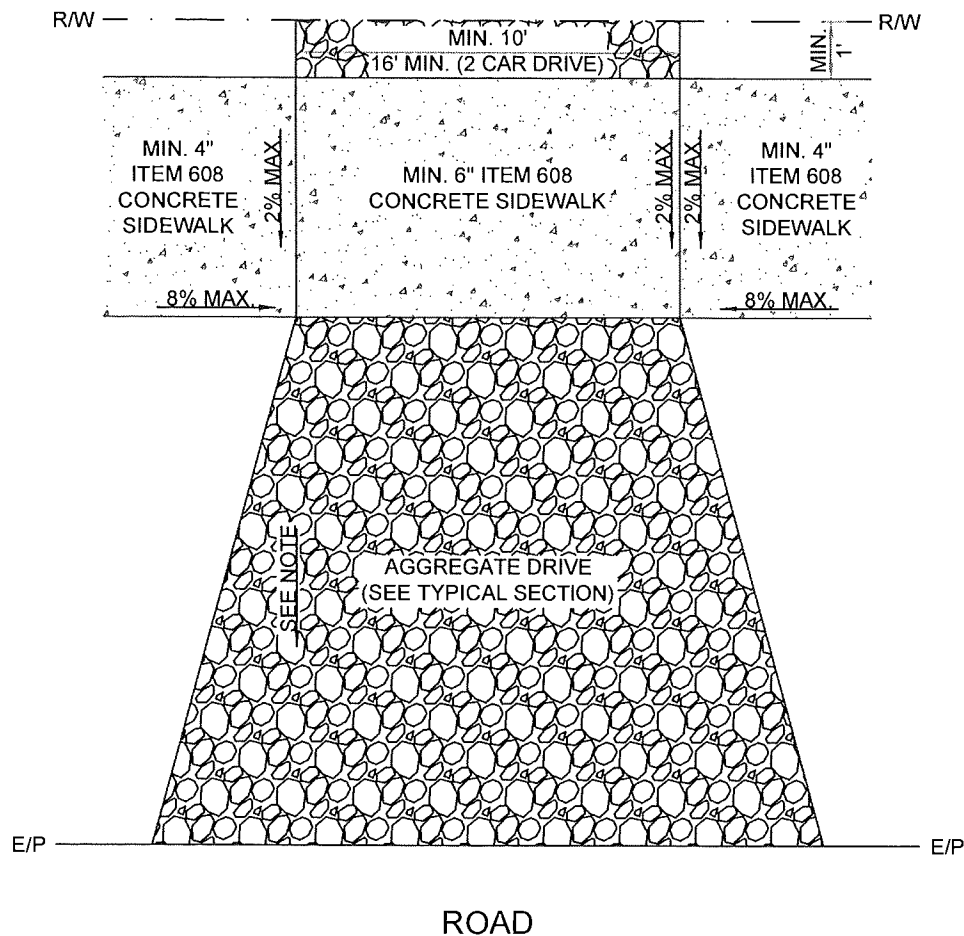
- ① 1 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 SURFACE COURSE, TYPE I
- ② TACK COAT, ODOT ITEM 407
- ③ 1 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 INTERMEDIATE COURSE, TYPE 1
- ④ PRIME COAT, ODOT ITEM 408
- ⑤ 8" AGGREGATE BASE, ODOT ITEM 304, COMPACTED IN (2) 4" LIFTS
- ⑥ COMPACTED AND PROOF ROLLED SUBGRADE, ODOT ITEM 204

**ASPHALT DRIVE TYPICAL SECTION
NOT TO SCALE**

NOTES:

- 1) DRIVEWAY MUST BE FLARED BY TAPER OR RADIUS A MINIMUM OF 2' AND MAXIMUM OF 5' WITHIN AREA BETWEEN EDGE OF PAVEMENT AND FACE OF SIDEWALK.
- 2) IF AN EXISTING CURB CUT OR REMOVAL IS REQUIRED, LIMITS AND MEANS AND METHODS OF WORK WILL BE DETERMINED BY THE CITY ENGINEER.
- 3) IF NO EXISTING SIDEWALK IS PRESENT, ASPHALT DRIVE CAN EXTEND THROUGH THE REQUIRED 6" ITEM 608 CONCRETE SIDEWALK SECTION.

Date Modified: 07/2020

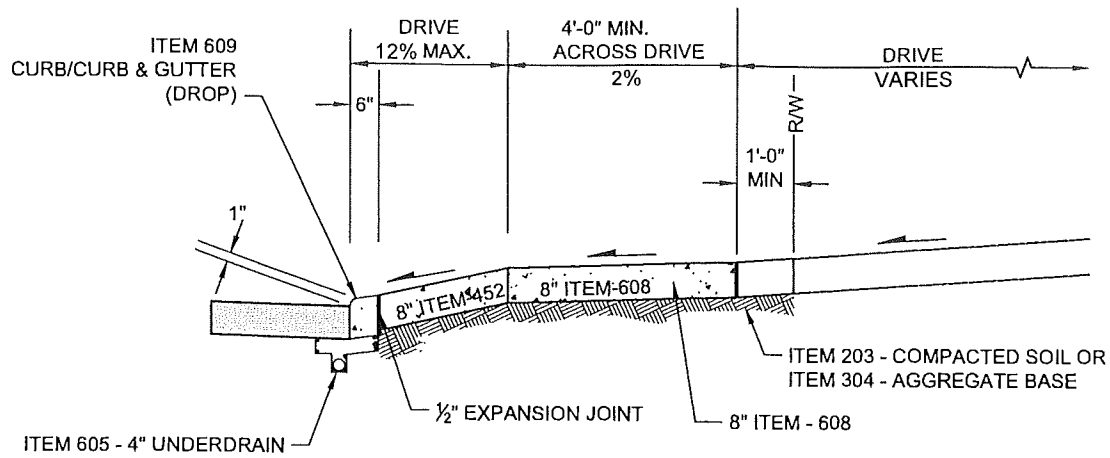


- LEGEND**
- ① MIN. 8" AGGREGATE BASE, ODOT ITEM 304, COMPACTED IN (2) 4" LIFTS
 - ② COMPACTED AND PROOF ROLLED SUBGRADE, ODOT ITEM 204
- AGGREGATE DRIVE TYPICAL SECTION**
NOT TO SCALE

NOTES:

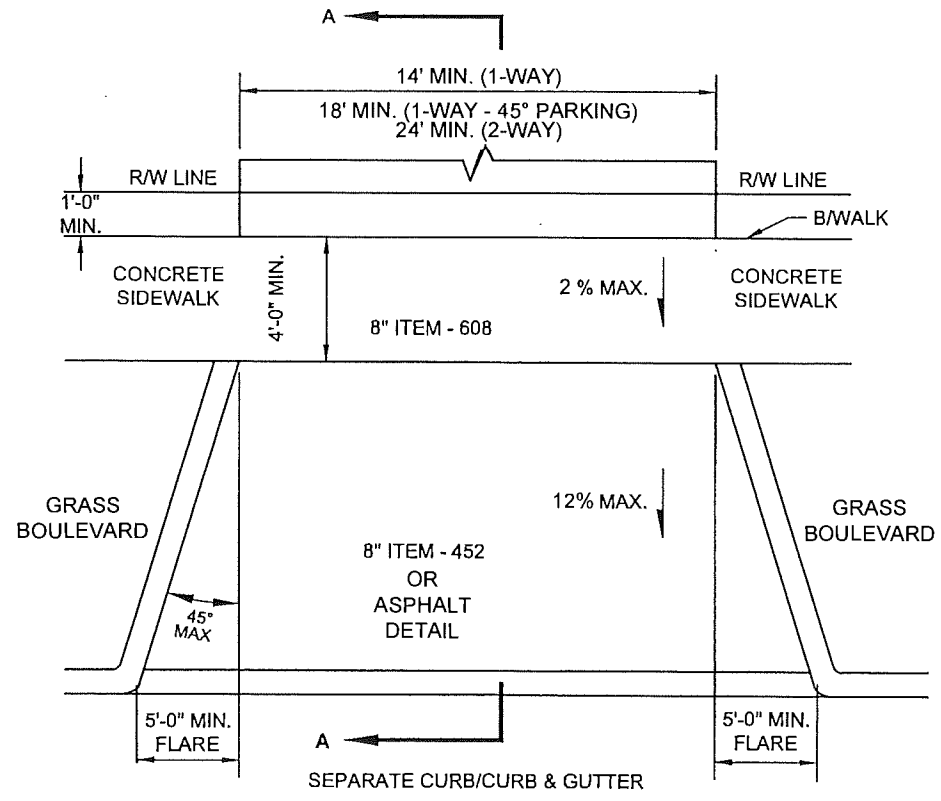
- 1) DRIVEWAY MUST BE FLARED BY TAPER OR RADIUS A MINIMUM OF 2' AND MAXIMUM OF 5' WITHIN AREA BETWEEN EDGE OF PAVEMENT AND FACE OF SIDEWALK.
- 2) IF AN EXISTING CURB CUT OR REMOVAL IS REQUIRED, LIMITS AND MEANS AND METHODS OF WORK WILL BE DETERMINED BY THE CITY ENGINEER.
- 3) IF NO EXISTING SIDEWALK IS PRESENT, AGGREGATE DRIVE CAN EXTEND THROUGH THE REQUIRED 6" ITEM 608 CONCRETE SIDEWALK SECTION.
- 4) AGGREGATE BASE SHALL BE ADEQUATELY COMPACTED TO PREVENT WASHOUT ONTO ROADWAY. PREFERRED SECTION WILL CONSIST OF 8" OF 304 OR 411 CRUSHED GRAVEL TOPPED WITH #8 CRUSHED GRAVEL.
- 5) IF CITY ENGINEER DETERMINES THE SLOPE OF THE APPROACH IS EXCESSIVE AND MAY CONTINUOUSLY CAUSE A WASHOUT OF THE AGGREGATE APPROACH INTO THE PUBLIC STREET, THE CITY ENGINEER MAY REQUIRE THE DRIVE APPROACH TO BE SURFACED WITH EITHER AN ASPHALT OR CONCRETE SURFACE. MAX SLOPE OF THE APPROACH, REGARDLESS OF SURFACE SHALL NOT EXCEED 15%.

Date Modified: 07/2020

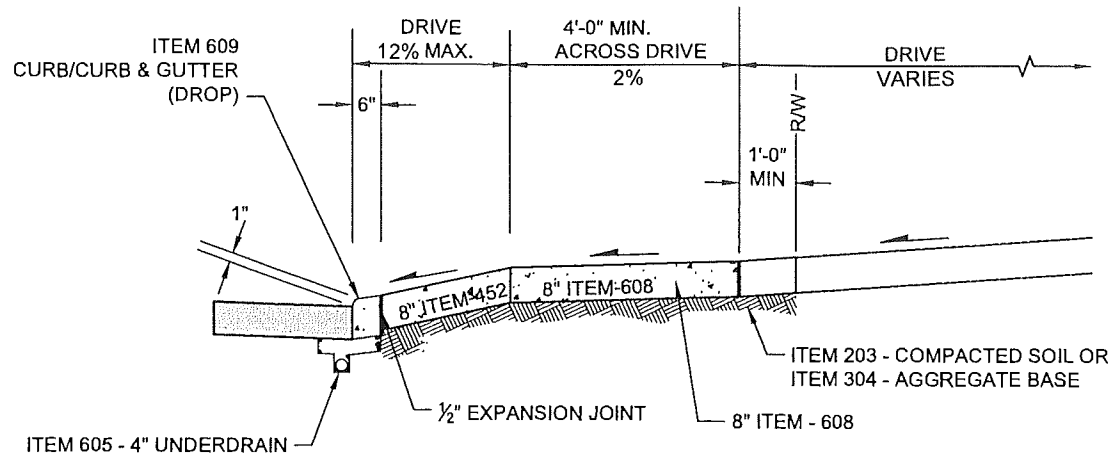


***NOTE:** INTENT IS TO MINIMIZE THE VARIED SLOPE BY MAXIMIZING THE SLOPE BETWEEN THE EDGE OF ROADWAY AND THE FACE OF THE PUBLIC PEDESTRIAN ACCESS ROUTE. IF POSSIBLE, TO PREVENT VEHICLES FROM BOTTOMING OUT, NO SLOPE SHALL EXCEED 16%. IF A MAXIMUM SLOPE OF 16% CAN NOT BE ACHIEVED, ALTERATIONS MAY NEED TO BE MADE FROM THE STANDARD DRAWING.

SECTION A-A



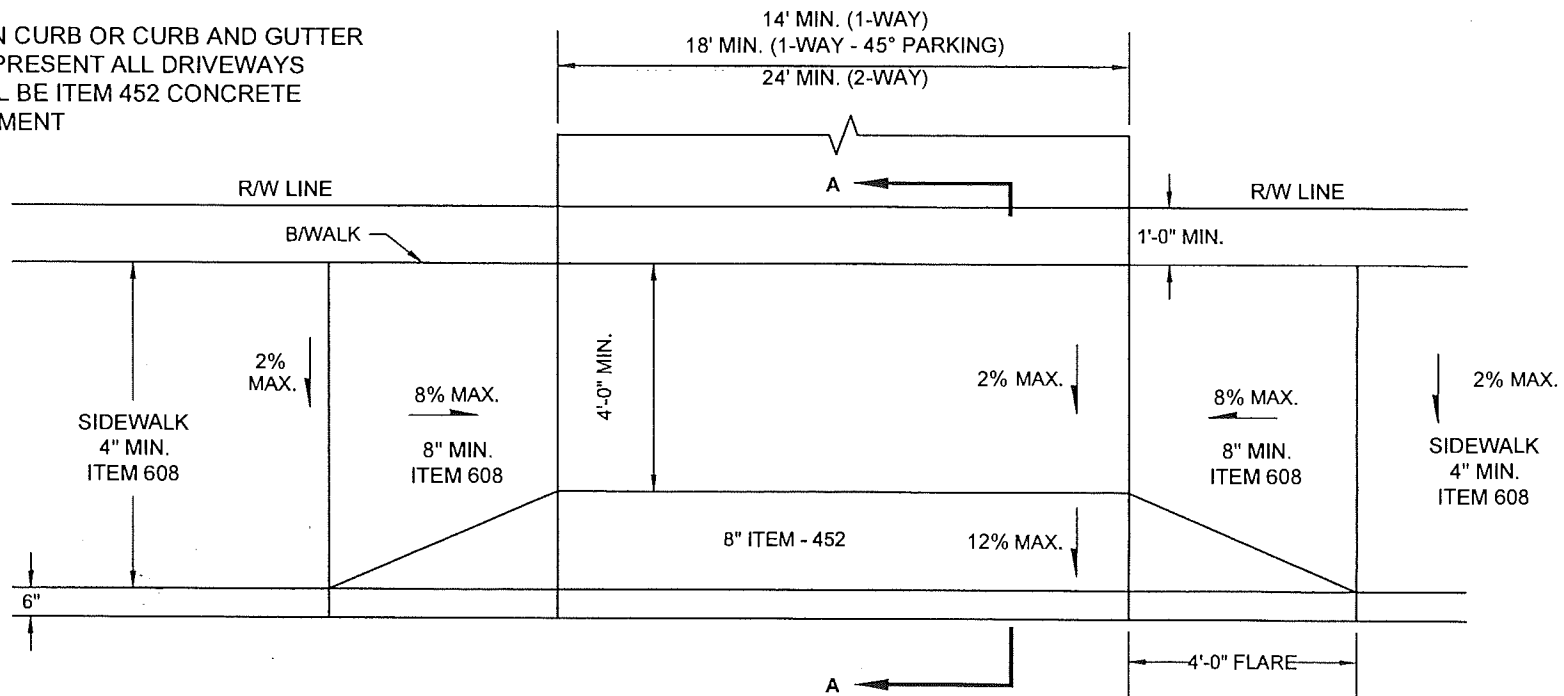
DATE MODIFIED: 07/2020



*NOTE: INTENT IS TO MINIMIZE THE VARIED SLOPE BY MAXIMIZING THE SLOPE BETWEEN THE EDGE OF ROADWAY AND THE FACE OF THE PUBLIC PEDESTRIAN ACCESS ROUTE. IF POSSIBLE, TO PREVENT VEHICLES FROM BOTTOMING OUT, NO SLOPE SHALL EXCEED 16%. IF A MAXIMUM SLOPE OF 16% CAN NOT BE ACHIEVED, ALTERATIONS MAY NEED TO BE MADE FROM THE STANDARD DRAWING.

SECTION A-A

WHEN CURB OR CURB AND GUTTER ARE PRESENT ALL DRIVEWAYS SHALL BE ITEM 452 CONCRETE PAVEMENT

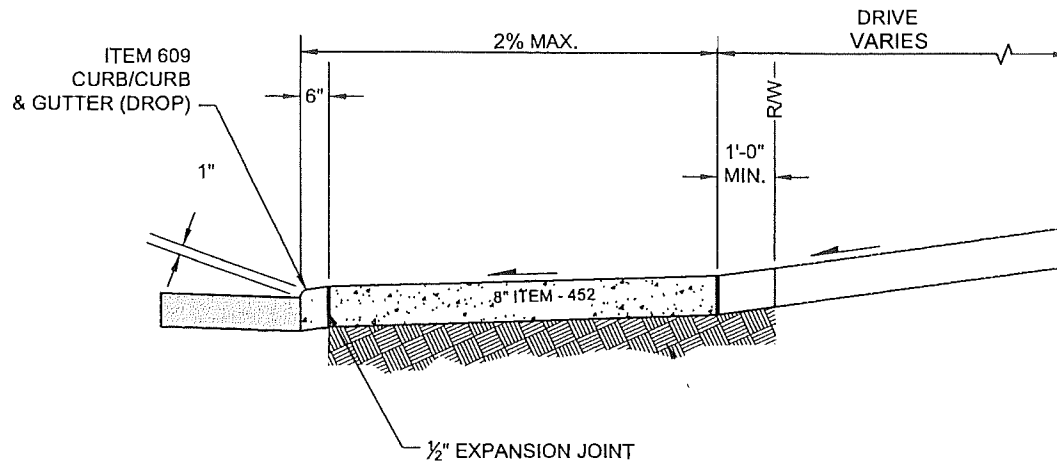


DATE MODIFIED: 07/2020

COMMERCIAL DRIVEWAY, FLARED APPROACH, TYPE B

CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883

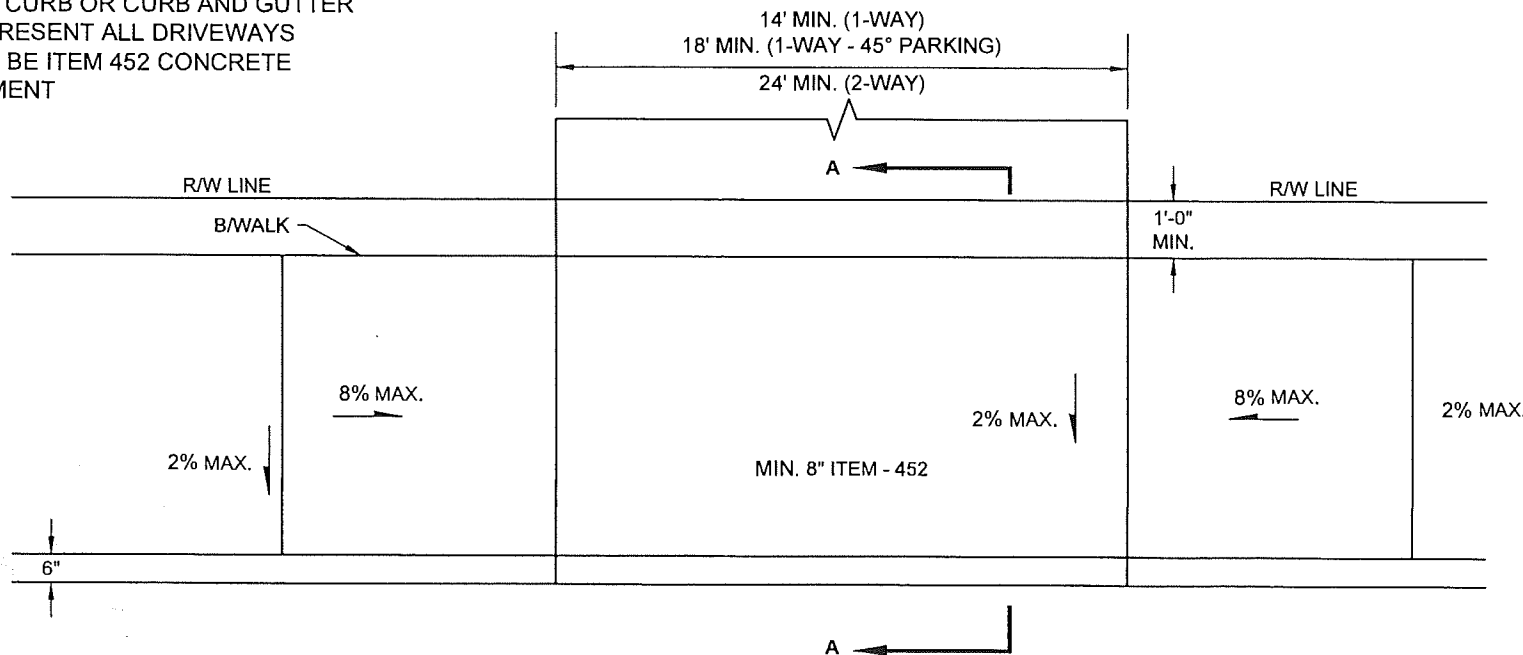




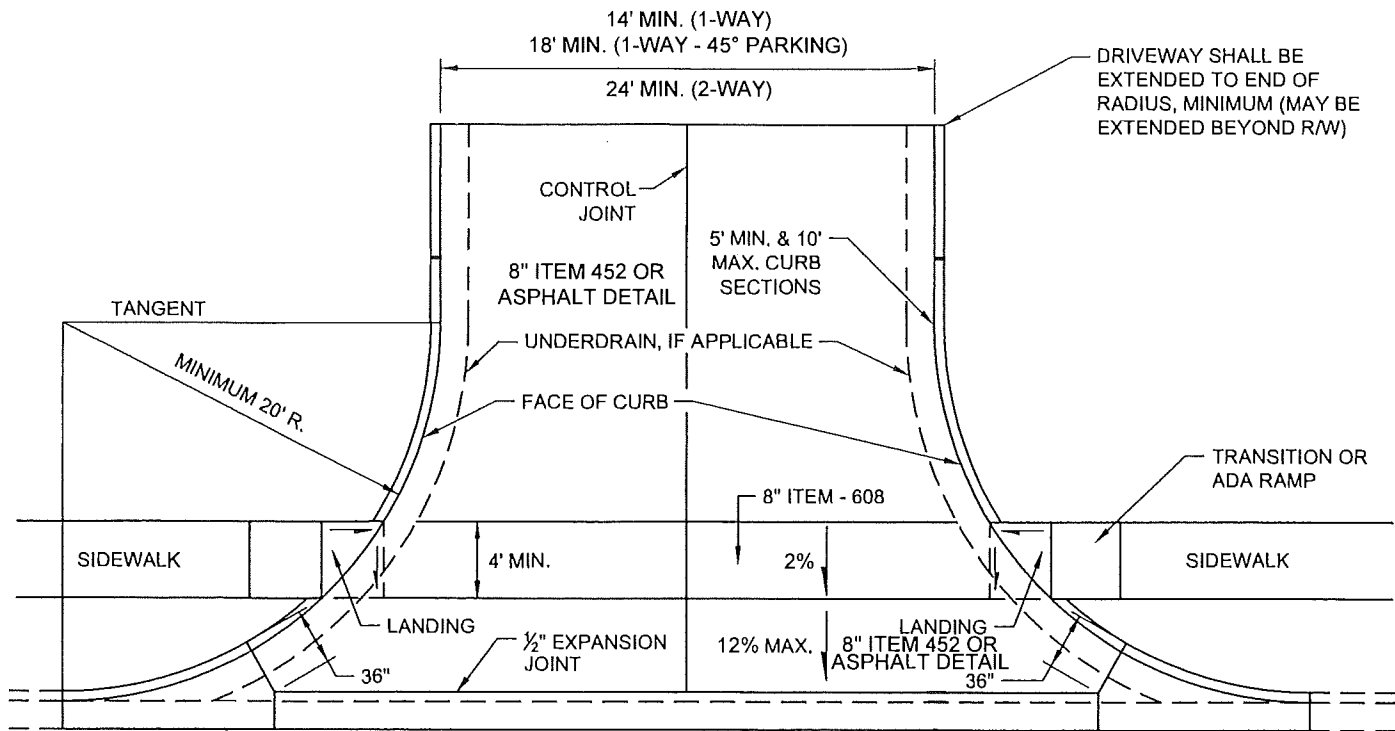
*NOTE: INTENT IS TO MINIMIZE THE VARIED SLOPE BY MAXIMIZING THE SLOPE BETWEEN THE EDGE OF ROADWAY AND THE FACE OF THE PUBLIC PEDESTRIAN ACCESS ROUTE. IF POSSIBLE, TO PREVENT VEHICLES FROM BOTTOMING OUT, NO SLOPE SHALL EXCEED 16%. IF A MAXIMUM SLOPE OF 16% CAN NOT BE ACHIEVED, ALTERATIONS MAY NEED TO BE MADE FROM THE STANDARD DRAWING.

SECTION A-A

WHEN CURB OR CURB AND GUTTER ARE PRESENT ALL DRIVEWAYS SHALL BE ITEM 452 CONCRETE PAVEMENT



Date Modified: 07/2020

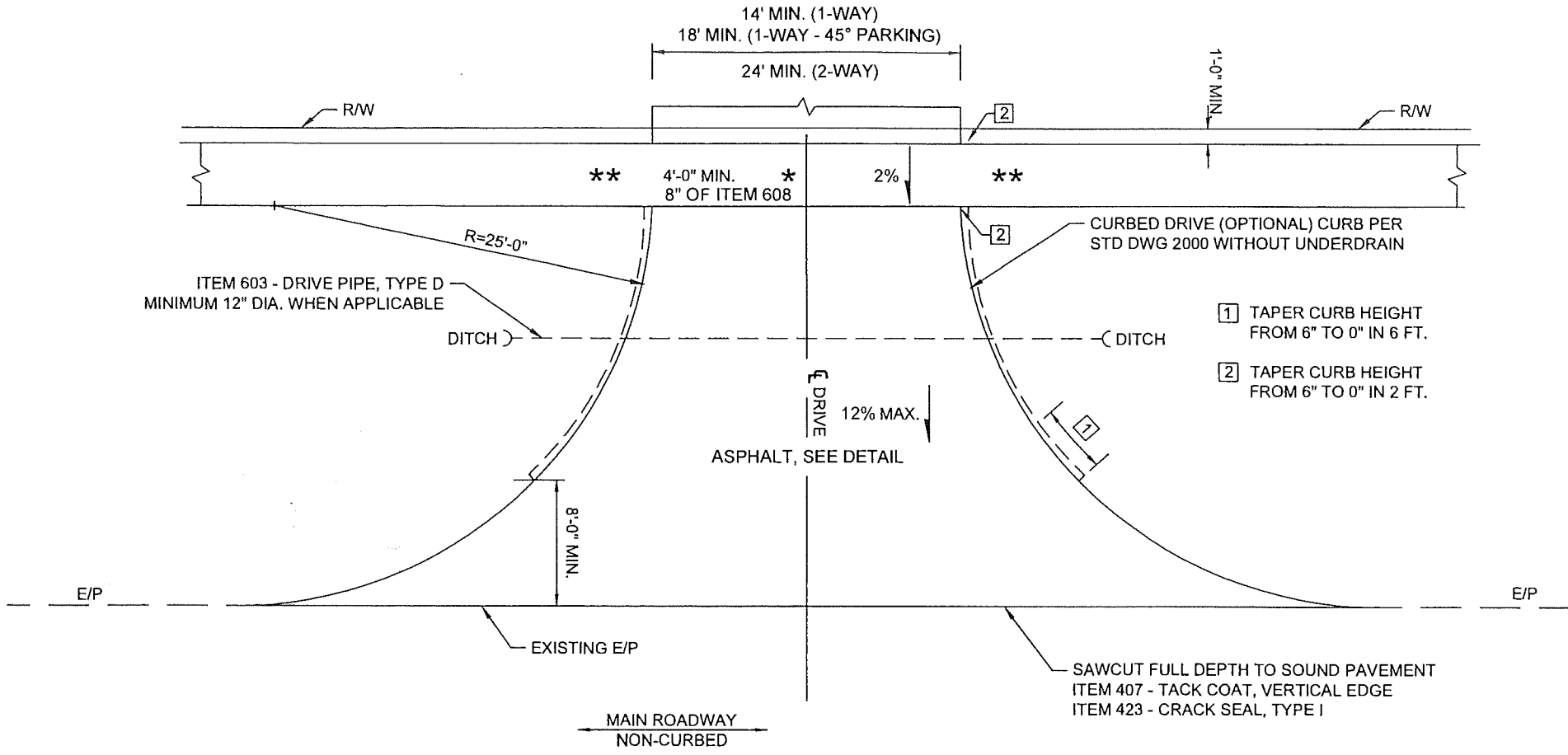


Date Modified: 07/2020

COMMERCIAL DRIVEWAY, CURBED APPROACH WITH RADIUS

CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883





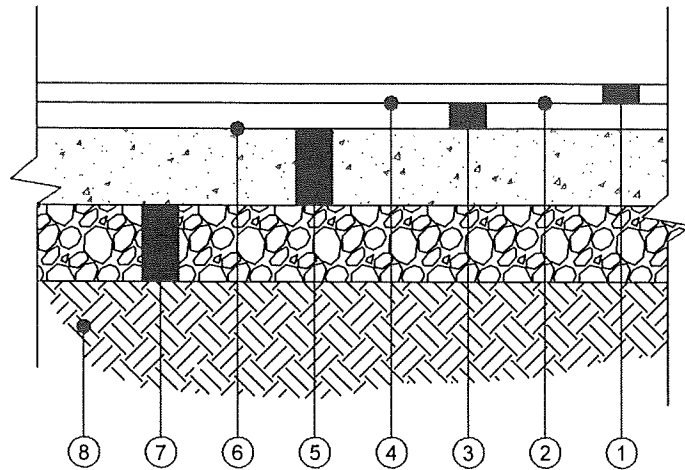
- * SET SIDEWALK THROUGH APPROACH AT SIDEWALK GRADE TO AVOID RAMP OR TRANSITION. IF NOT POSSIBLE, THEN MINIMIZE TRANSITION FROM SIDEWALK TO APPROACH.
- ** 8" THICK CONCRETE SIDEWALK FOR 1 FULL PANEL (MIN. 5 FT.) BEYOND THE EDGE OF THE FULL WIDTH SECTION OF THE DRIVE.

Date Modified: 07/2020

COMMERCIAL DRIVEWAY, NON-CURBED ASPHALT APPROACH, WITH RADIUS

CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883

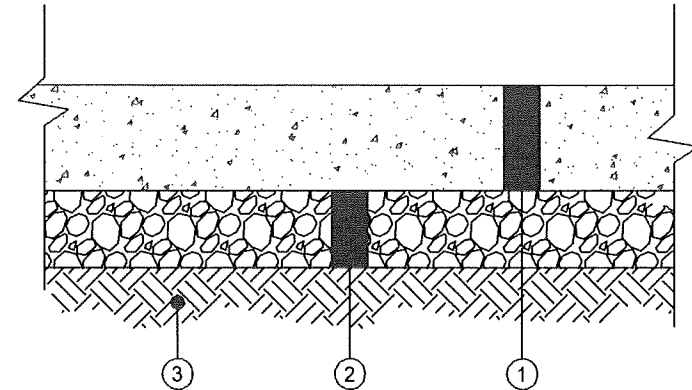




LEGEND

- ① 1 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 SURFACE COURSE, TYPE I
- ② TACK COAT, ODOT ITEM 407
- ③ 1 1/2" OF ASPHALT CONCRETE, ODOT ITEM 448 INTERMEDIATE COURSE, TYPE 1
- ④ TACK COAT, ODOT ITEM 407
- ⑤ 7" ASPHALT CONCRETE BASE, ODOT ITEM 301
- ⑥ PRIME COAT, ODOT ITEM 408
- ⑦ 6" AGGREGATE BASE, ODOT ITEM 304, COMPACTED IN (2) 3" LIFTS
- ⑧ COMPACTED AND PROOF ROLLED SUBGRADE, ODOT ITEM 204

COMMERCIAL ASPHALT DRIVE DETAIL
NOT TO SCALE

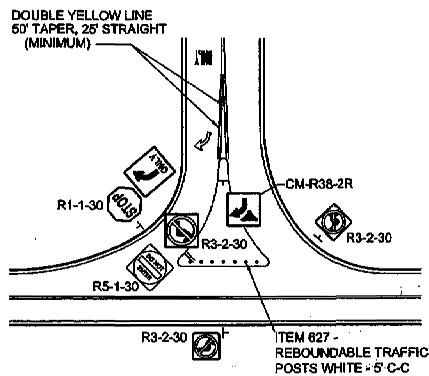
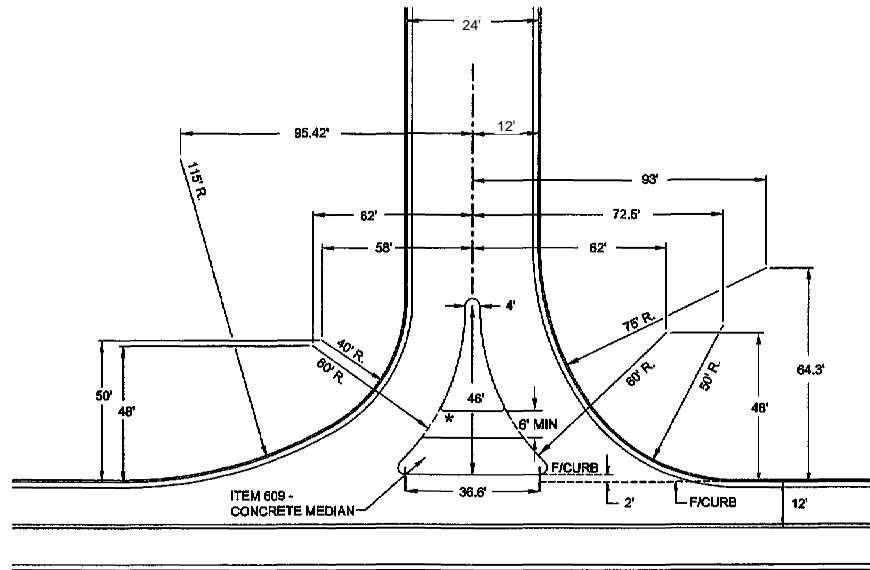


LEGEND

- ① 8" NON-REINFORCED CONCRETE PAVEMENT, ODOT ITEM 452
- ② 6" AGGREGATE BASE, ODOT ITEM 304, COMPACTED IN (2) 3" LIFTS
- ③ COMPACTED AND PROOF ROLLED SUBGRADE, ODOT ITEM 204

COMMERCIAL CONCRETE DRIVE DETAIL
NOT TO SCALE

DATE MODIFIED: 07/2020



ANY DEVIATIONS FROM THE ABOVE DIMENSIONS SHALL REQUIRE A DESIGN SPECIFICALLY FOR THOSE DEVIATIONS.

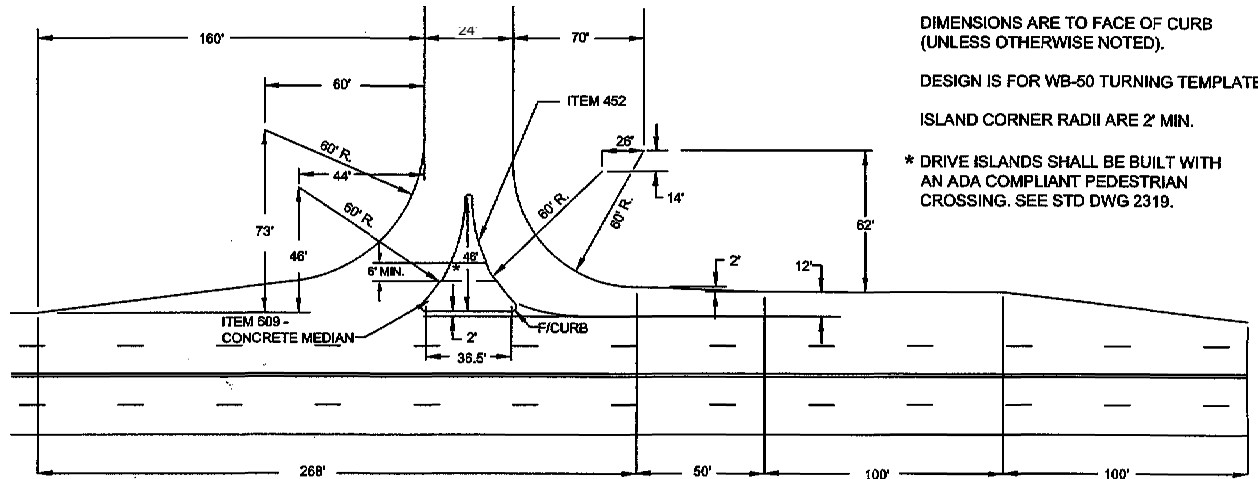
DIMENSIONS ARE TO FACE OF CURB (UNLESS OTHERWISE NOTED).

DESIGN IS FOR WB-50 TURNING TEMPLATE.

CHANGES FROM THESE DRAWINGS REQUIRE APPROVAL FROM THE CITY ENGINEER.

* DRIVE ISLANDS SHALL BE BUILT WITH AN ADA COMPLIANT PEDESTRIAN CROSSING. SEE STD DWG 2319.

ISLAND CORNER RADII ARE 2' MIN.

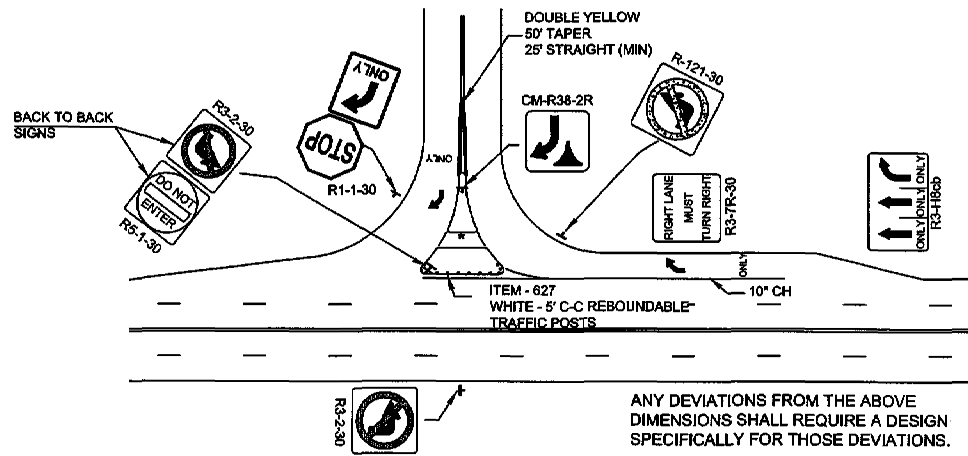


DIMENSIONS ARE TO FACE OF CURB
(UNLESS OTHERWISE NOTED).

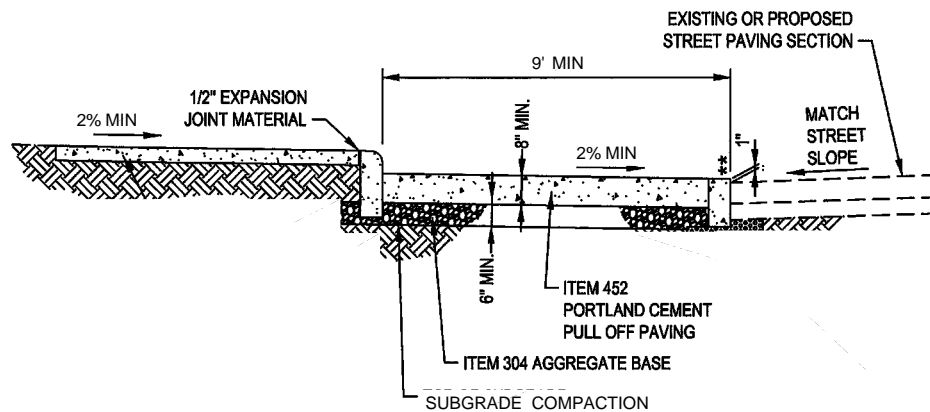
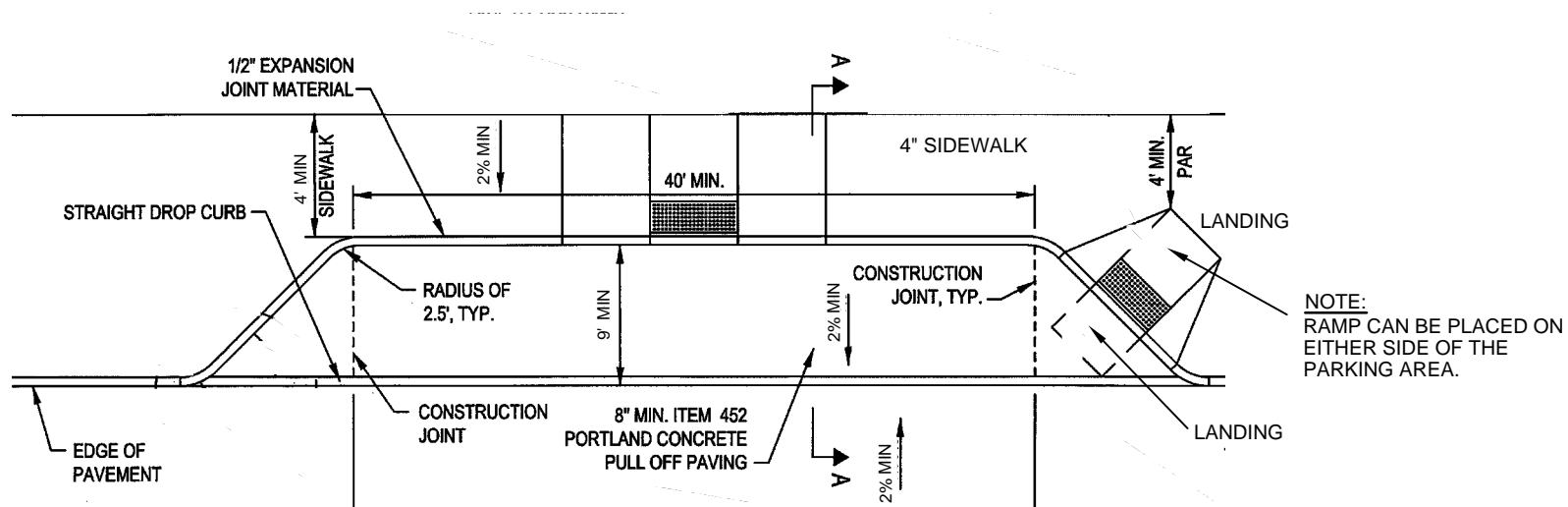
DESIGN IS FOR WB-50 TURNING TEMPLATE.

ISLAND CORNER RADII ARE 2' MIN.

* DRIVE ISLANDS SHALL BE BUILT WITH
AN ADA COMPLIANT PEDESTRIAN
CROSSING. SEE STD DWG 2319.



ANY DEVIATIONS FROM THE ABOVE
DIMENSIONS SHALL REQUIRE A DESIGN
SPECIFICALLY FOR THOSE DEVIATIONS.



VEHICULAR PULL OFF - STANDARD DRAWING

CITY OF TIFFIN
ENGINEERING DEPARTMENT
51 E. MARKET STREET
TIFFIN, OHIO 44883



EXHIBIT AB

TABLE 1 - PART A - POLE DIMENSIONS

DESIGN NO.	MAXIMUM DESIGN SOFT POINT (NOTE A)	DESIGN DISTANCE FROM C (FT)	POLE		ARM				
			TYPE	WALL THICK	BASE DIAMETER	MAX LENGTH	TYPE	WALL THICK	SIZE
4	42	37.5	ROUND	.239	13	38'	ROUND	.239	10.32x5.00"
12	42	47.5	ROUND	.289	14	48'	ROUND	.289	11x8.82x17.5"
13	40	58.5	ROUND	.289	16	60'	ROUND	.289	13x8.80x30.0"
14	38	69.5	ROUND	.289	17	70'	ROUND	.3125	14x9.11x39.0"
14	38	69.5	ROUND	.289	17	70'	ROUND	0.373	14x8.68x38.0"
C15	60	78.5	ROUND	.313	18	79'	ROUND	0.250	9.50x4.74x34.0"
C16 DOUBLE ARM	48/48	49.5	ROUND	.313	16	50/50'	ROUND	.313	14.40x8.70x40.75"
		49.5	ROUND	.313	16	50/50'	ROUND	.179	9.34x3.71x40.25"
								.250	12.00x8.55x17.5"
								.179	10.19x5.40x34.25"
								.178	10.19x5.40x34.25"

ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE NOTED. *SINGLE PIECE ARM

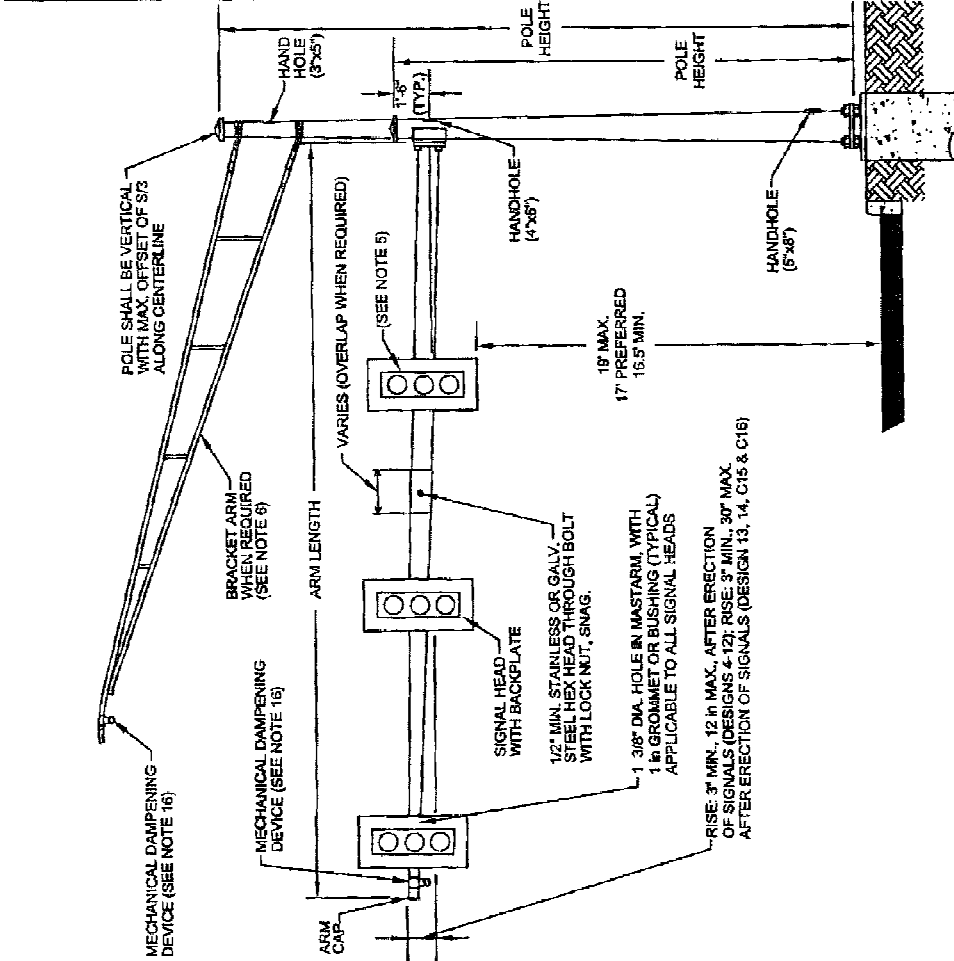
TABLE 1 - PART B - POLE DIMENSIONS

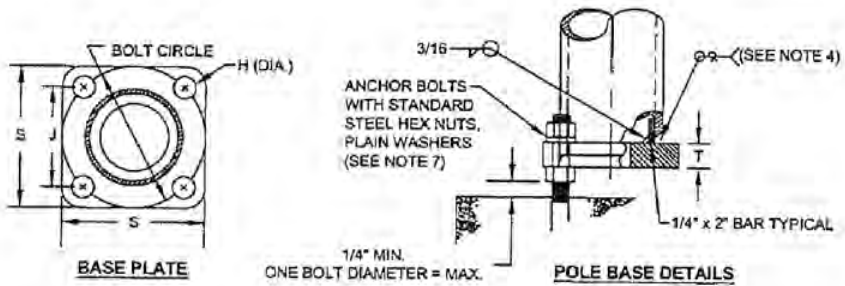
DESIGN NO.	ARM ATTACHMENT										ANCHOR BASE			PLATE SKIRT		
	A	B	C	D	E	F	G	P	S	J	T	H	M	K		
4	16.50	14.50	12.50	9.50	1.50	2	1.25	0.25	18	18.50	12.75	2	2.13	16.75	7.75	
12	16.50	14.50	12.50	9.50	1.75	2	1.50	0.31	20	20.50	14.13	2	2.38	7.5	6.5	
13	19.50	16.50	15	12	1.50	2	1.50	0.31	22	23	15.56	2	2.38	7.5	8.5	
14	19.50	16.50	15	12	2.00	2	2.00	0.38	22	23	15.56	2	2.38	7.5	8.5	
C15	24	19	18	13	2.00	2	2.00	0.38	24	17	2	2.38	7.5	8.5		
C16 DOUBLE ARM	19	15	14	10	1.75	2	1.50	0.31	22	23	15.56	2	2.38	7.5	8.5	
	19	15	14	10	1.75	2	1.50	0.31	22	23	15.56	2	2.38	7.5	8.5	

ALL DIMENSIONS ARE IN INCHES, UNLESS OTHERWISE NOTED. THESE DESIGNS USE FULL PENETRATION WELDS AT THE ARM AND BASE PLATE CONNECTIONS.

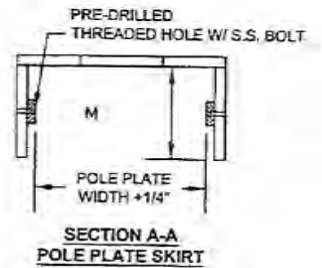
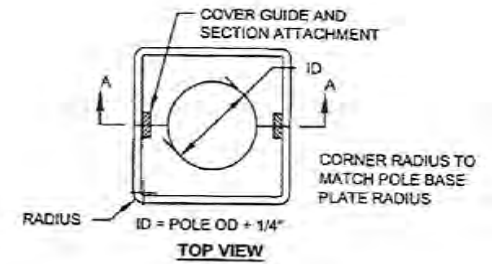
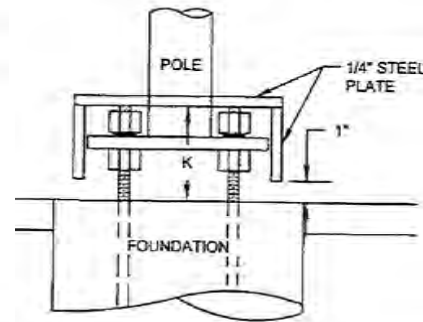
NOTES:

- A. MAXIMUM DESIGN AREA IS BASED ON 93 MPH DESIGN WIND SPEED WITH A PRESSURE OF 25 PSF.
- B. DIMENSION LOCATIONS ARE ILLUSTRATED ON SHEETS 3 & 6.

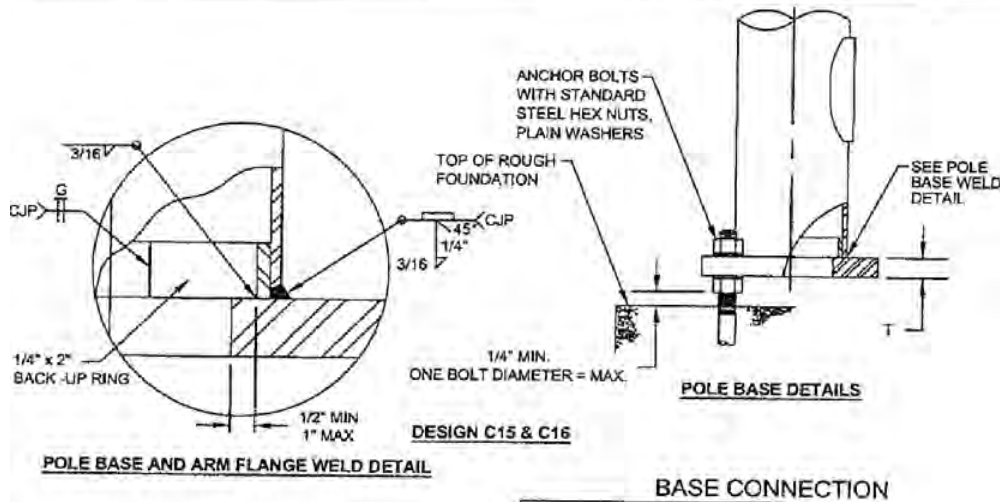


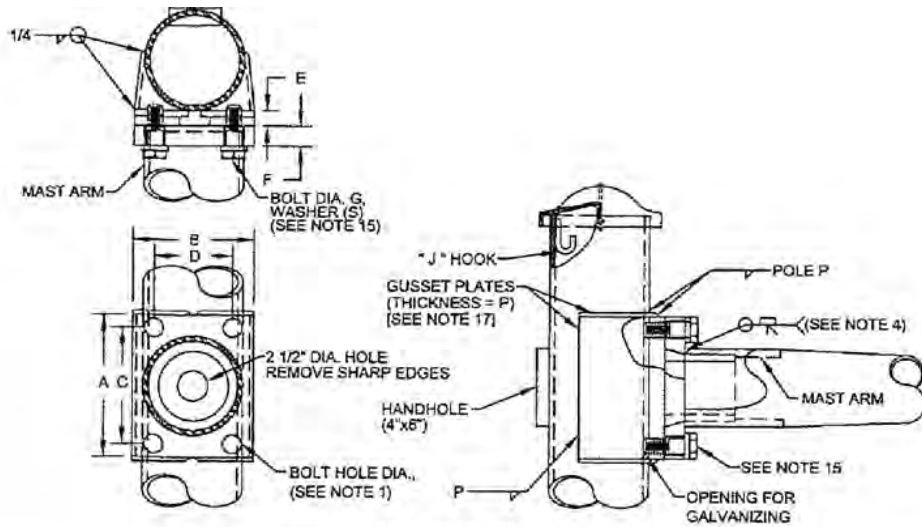


DESIGN 4, 12, 13, & 14

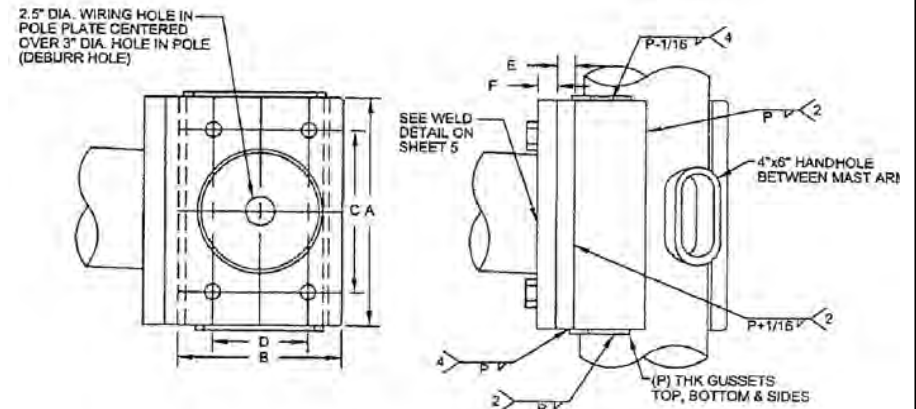


STEEL BASE COVER

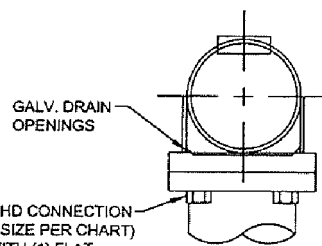
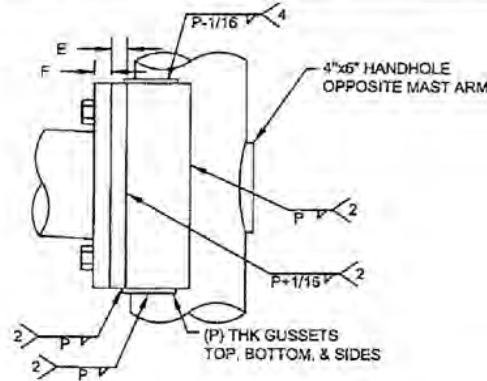
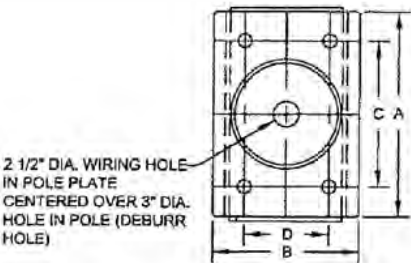
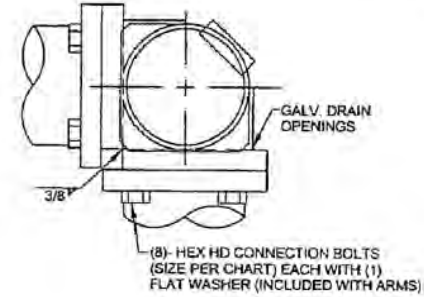




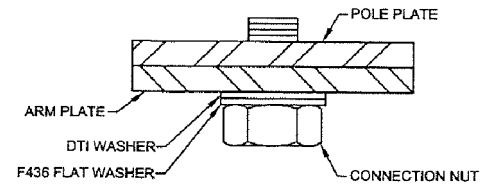
**ARM ATTACHMENT (TYP.)
DESIGN 4, 12, 13 & 14**



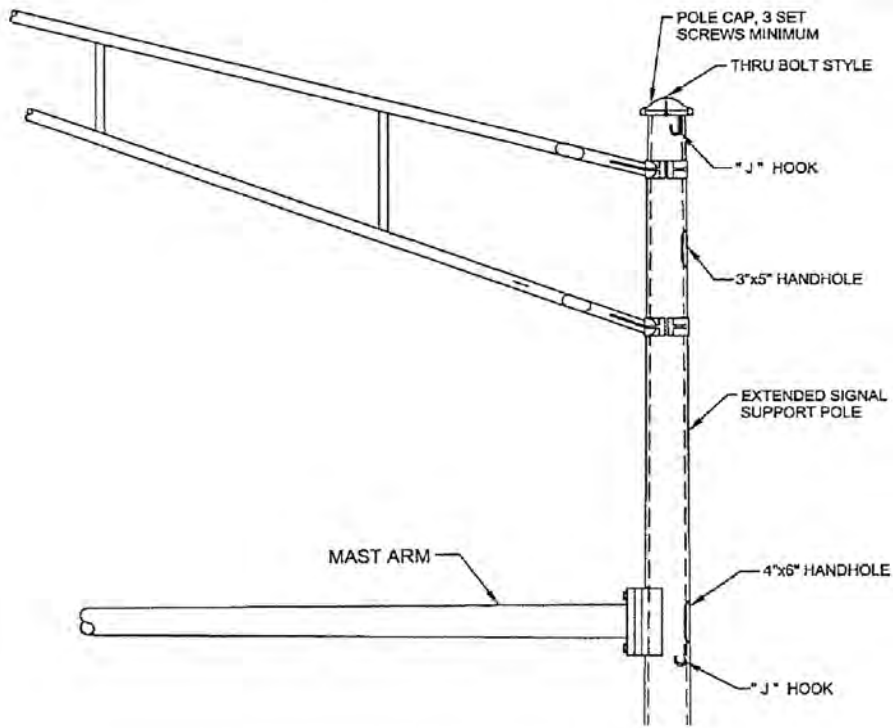
**ARM ATTACHMENT (TYP.)
DESIGN C16**



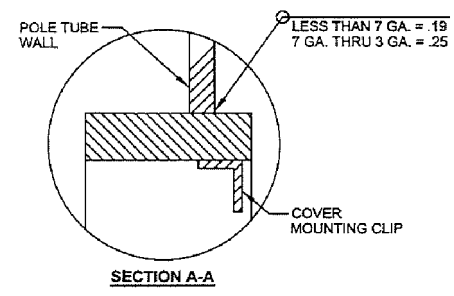
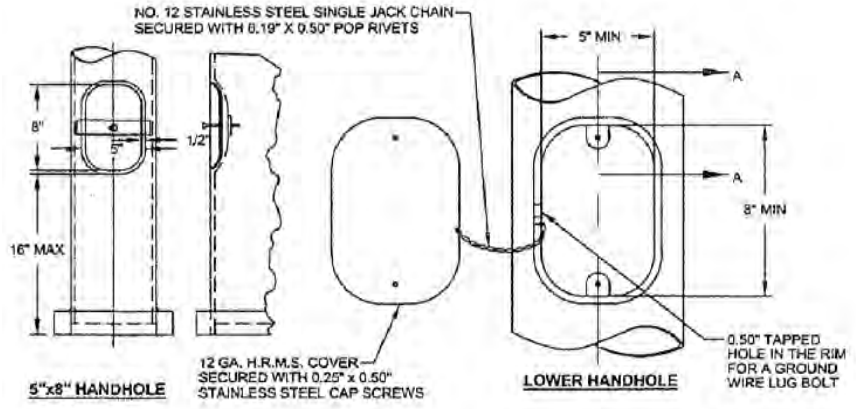
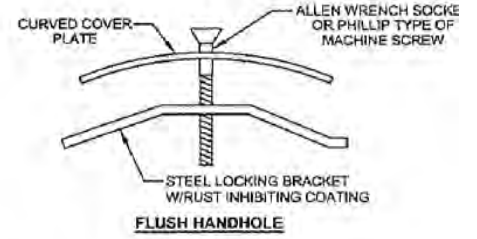
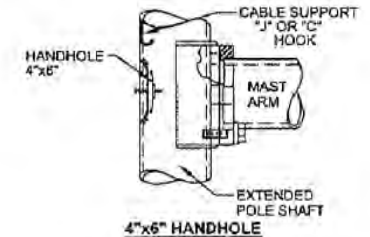
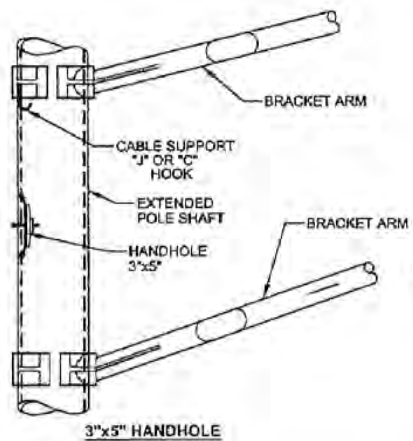
**ARM ATTACHMENT (TYP.)
DESIGN C15**

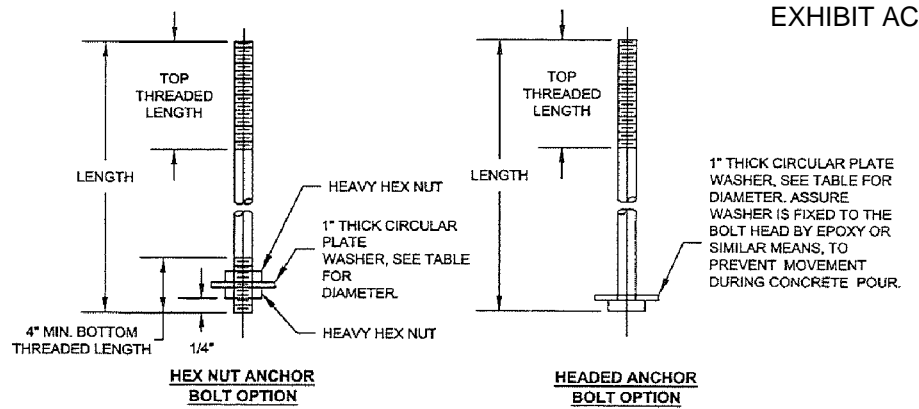
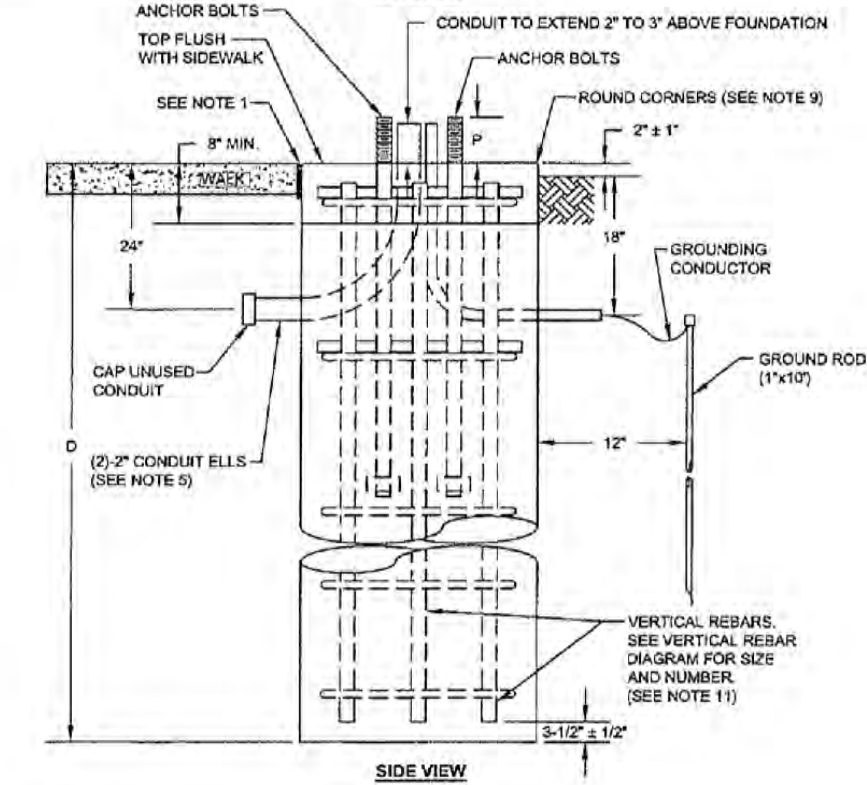
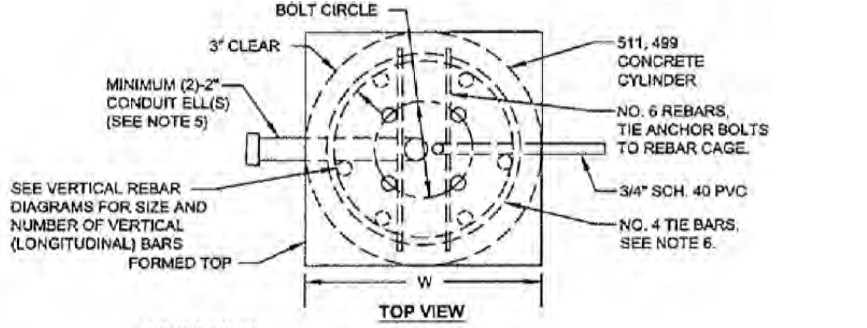


**DTI WASHER PLACEMENT
(FOR DESIGNS 13, 14, C15 & C16)
(SEE NOTE 15)**



POLE EXTENSION FOR BRACKET ARM

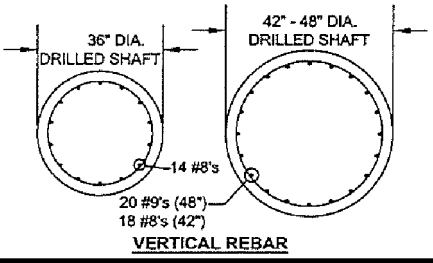




TYPE 4120 & 4121 SUPPORTS						ANCHOR BOLTS			
DESIGN NO.	D (FT)	W	SIZE	CIRCLE	P	DIA.	TOP THREAD LENGTH	THR ENDS PER INCH	PLATE WASHER DIAMETER
4	10	36	1.75 X 62	18	7.75	1.5	9	7	2
11	11	36	2 X 62	20	8.5	1.75	9	5	4
12	13	36	2 X 62	22	8.5	2	9	4.5	4
14	15	36	2 X 62	22	8.5	2.25	10	4.5	5
C15	15	36	2 X 62	24	8.5	2.5	10	4	5
C16	15	36	2 X 62	22	8.5	2	12	4	5

TYPE 4170 SUPPORTS			Type 4120 & 4121 SUPPORTS			Type 4120 & 4121 SUPPORTS					
DESIGN NO.	D (FT)	W	ANCHOR BOLTS			DESIGN NO.	DEPTH OF ADJACENT UTILITY EXCAVATION		DESIGN NO.	DEPTH OF ADJACENT UTILITY EXCAVATION	
			SIZE	CIRCLE	P		3 FT	6 FT		3 FT	6 FT
5	9	36	1.75 X 62	16	7.75	4	D=18	D=22	5	D=15	D=19
6	9	36	1.75 X 62	16	7.75	12	D=18	D=22	6	D=15	D=19
7	10	36	2 X 62	18	8.5	13	D=18	D=22	7	D=15	D=19
8	10	36	2 X 62	20	8.5	14	D=18	D=22	8	D=15	D=19
9	10	36	2 X 62	22	8.5	C15	D=18	D=22	9	D=15	D=19
10	11	36	2.25 X 63	22	9	C16	D=18	D=22	9	D=15	D=19
11	11	36	2.25 X 63	22	9	SEE BELOW		10	D=15	D=19	
12	12	36	2.5 X 64	23.5	9.75	SPECIAL FOUNDATION REQUIRED FOR UTILITY EXCAVATIONS ADJACENT TO C16.		11	D=20	D=24	
13	16	42 OR 48	3 X 66	26	11.75			12	D=20	D=24	
14	17	48	3 X 72	34	11.75			13	D=20	D=24	
								14	D=20	D=24	

*ALL DIMENSIONS IN INCHES UNLESS OTHERWISE NOTED



Sewer CCTV/Photo File Naming Convention

(Don't use Spaces)

Sewer CCTV

Interceptor Sewer **int-29_int-27_u_20240125_1435**
Sanitary Sewer **27-2837_27-2834_d_20231118_0945**
Storm Sewer **10450-010_10450-015_d_20250504_0800**

Upstream MH

Downstream MH

Travel Direction

u = Upstream

d = Downstream

Date
YYYYMMDD

Time

MH Photo

Sanitary MH **27-2837_n_20231118_0945**
Storm MH **10450-010_se_20250504_0800**

MH Number

Top of Photo
Cardinal Direction

Date
YYYYMMDD

Time

Pole Cam Photo

27-2837_n_12vcp_20231118_0945

Photo Facing
Cardinal Direction

Description of Subject of
Photo (DiaMatl for pipes)