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# Specifications and Standards for Utility and Street Construction

City of Jefferson, Wisconsin

July 2022

#### **CITY OF JEFFERSON**

#### SPECIFICATIONS AND STANDARDS FOR UTILITY AND STREET CONSTRUCTION

#### July 2022

Construc	tion Standards Summary	1
Utility Layout Standards		
Stormwater Guidelines		1
As-Built	As-Built Requirements	
Electrical	al Utility Line Extension Standards	
<u>Specifica</u>	tions	
03 30 01	Cast-In-Place Concrete	5
31 22 13	Roadway Excavation & Grading	6
31 22 17	Trench Excavation, Backfill & Compaction	11
31 25 00	Erosion and Sediment Control	8
32 05 00	Soils and Aggregates and Exterior Improvements	7
32 12 16	Asphalt Paving	8
32 16 23	Sidewalks	8
32 16 25	Concrete Curb & Gutter	7
32 90 00	Landscape Restoration	6
33 05 13	Manholes and Structures	8
33 11 00	Water Distribution Systems	10
33 31 13	Sanitary Sewerage Piping	9
33 41 13	Public Storm Utility Drainage Piping	10
C( 1 1		

#### Standard Detail Drawings

Erosion Control	6
Sanitary Sewer	4
Storm Šewer	8
Street Reconstruction	6
Water Main	8

## City of Jefferson Construction Standards Summary

July 2019

Sidewalk Ramp Treatment	Truncated domes, cast iron painted yellow
Sidewalk Thickness	4-inch, except in driveways which are 6-inch
Material Between Two Curb Ramps at Same Corner	Concrete
Manhole Casting Treatment for Defined Surface Asphalt	Place to asphalt surface grade, but require lower course to be constructed to surface course level around the casting by lifting the paver screed with the asphalt being ground down around the manhole when the surface course is constructed
Manhole Casting Adjustment	Cretex rings with manufacturer-recommended adhesive
Post-Construction Sewer Televising	Required, done by City staff
Standard Residential Sewer Size	4-inch
Lateral Marking Method	Tracer Wire or City-Approved Alternative
Standard Storm Sewer Inlet Sump	None
Storm Sewer Inlet Casting Treatment in Driveways	Neenah R-3067 with curb plate



#### SANITARY SEWER LATERAL NOTES: SANITARY SEWER LATERALS SHALL BE 4" DIAMETER OR LARGER.

INDIVIDUAL SANITARY SEWER LATERALS ARE REQUIRED FOR EVERY SINGLE FAMILY RESIDENCE AND EACH UNIT OF A DUPLEX.

WHERE SEWER AND WATER LATERALS ARE IN A COMMON TRENCH, THE SEWER LATERAL SHALL BE ON THE DOWNSTREAM SIDE OF THE WATER LATERAL (BASED UPON SANITARY SEWER MAIN FLOW DIRECTION).

MULTI-FAMILY DEVELOPMENTS (LARGER THAN DUPLEXES) MAY HAVE ONE SANITARY SEWER SERVICE LATERAL PER BUILDING WITH A MINIMUM SIZE OF 6" DIAMETER.

MULTI-FAMILY DEVELOPMENTS LARGER THAN 64 UNITS PER BUILDING MUST HAVE A MINIMUM 8" DIAMETER SANITARY SEWER SERVICE LATERAL.

ANY SANITARY SEWER LINE CONNECTING MORE THAN ONE BUILDING MUST HAVE A MINIMUM SIZE OF 8" DIAMETER. THIS LINE WILL ALSO REQUIRE MANHOLES AT ANY BEND IN PIPE AND AT ENDS OF PIPES.

#### WATER LATERAL NOTES:

INDIVIDUAL WATER SERVICE LATERALS ARE REQUIRED FOR EVERY SINGLE FAMILY RESIDENCE AND EACH UNIT OF A DUPLEX.

CURB BOXES SHALL BE AT THE PROPERTY LINE.

WATER LATERALS TO MULTI-FAMILY UNITS (LARGER THAN A DUPLEX) MAY HAVE ONE WATER SERVICE FOR THE BUILDING IF IT IS PROPERLY SIZED. HOWEVER, SEPARATE METERS FOR EACH UNIT IN THE BUILDING ARE REQUIRED.

#### GENERAL UTILITY NOTES:

BOTH WATER AND SANITARY SEWER SERVICES IN ALL DEVELOPMENTS SHALL BE PUBLIC. WHERE 30' PUBLIC EASEMENT OR ACCESS CANNOT BE PROVIDED FOR A SINGLE PIPE OR 40' FOR DOUBLE PIPES (WATER & SEWER), THE CITY PUBLIC UTILITIES COMMITTEE MAY DECIDE WHETHER THE UTILITY SHALL BE PUBLIC OR PRIVATE. WHERE UTILITIES ARE DETERMINED TO BE PRIVATE, A MAINTENANCE AGREEMENT BETWEEN THE OWNER AND THE CITY SHALL BE REQUIRED.

#### AFTER CONSTRUCTION:

CITY RESPONSIBILITY FOR WATER LATERALS EXTENDS FROM THE MAIN THROUGH THE SHUT-OFF DEVICE (VALVE OR CURB BOX)

OWNER RESPONSIBILITY FOR WATER LATERALS EXTENDS FROM THE CONNECTION TO, NOT INCLUDING, THE SHUT-OFF (VALVE OR CURB BOX) INTO THE BUILDING

CITY RESPONSIBILITY FOR SANITARY SEWER INCLUDES ONLY THE SEWER MAIN

OWNER RESPONSIBILITY FOR SANITARY SEWER LATERALS INCLUDES THE ENTIRE LATERAL INCLUDING THE 'WYE'

#### Storm Water Management Practices and Guidelines for Storm Sewer Inlet Design Not Specifically Set Forth in City Ordinances

#### City of Jefferson

- Confine 100 year storm runoff to public right-of-way or easement until runoff reaches a permanent water course.
  - $\Rightarrow$  This prevents any private property from being damaged by the 100 year flood.
- Keep the 5 year storm runoff out of traffic lanes.
  - $\Rightarrow$  This allows unimpeded traffic flow during majority of storms.
- Do not allow 25 year storm runoff to cross crown of the street.
  - ⇒ This recognizes there will be flooding of the street and that traffic will be impeded, but tries to maintain passable streets.

• Inlet placement at intersections should be upstream of primary sidewalk crossings.

⇒ Because intersections are often low points, inlets must be placed at low points but try to capture as much runoff as possible before it crosses walking lanes.

It is desirable to limit storm runoff to 400 feet before reaching an inlet or storm drainage channel. However, 800 feet is acceptable, providing the above criteria are met. (With the above criteria inlet spacing will almost always be less than 800 feet.) Where inlets are on steep grades, multiple inlets may be required to prevent part of the runoff from "jumping" the inlet. At intersections where steep streets intersect with flatter streets, extra inlets on the steep street side may be necessary to prevent runoff from flooding the intersection because the momentum of the runoff makes it difficult for the water to turn the corner.

The City of Jefferson standard street inlet casting is the Neenah R-3067 inlet. Where water reaches the inlet from only one direction, the inlet is either R-3067-LL or R-3067-LR. The manhole castings are Neenah R-1550 with concealed pick-holes, gasketed, and non-rocking lids.

#### City of Jefferson As-Built Plan Requirements

As-built plans shall be provided in both an electronic format and hard copy.

As-built plans in electronic format and readable by AutoCAD must be provided showing all horizontal and vertical locations of public sanitary, water, and storm water utilities i.e. manholes, hydrants, water main bends and tee's, valves, sanitary and water lateral curb boxes, inlets, endwalls, etc. All vertical information shall be on NAVD88 datum. The profile drawings must also show the diameter, length and slope of all pipes.

The horizontal location of all water and sewer services shall be located as follows: Sewer laterals shall be located by the distance to the sewer 'wye' from the downstream manhole.

The ends of stubbed sewer laterals for future connection shall be located and the elevations determined and shown.

Water laterals shall be located by the distance from the nearest hydrant or valve on the main (whichever is closest) to the corporation stop.

The distance to the curb stop from the main shall also be provided.

Any bends in water main shall be indicated by the length from the nearest main-line valve.

For mapping purposes, a single electronic point file of the entire development describing the as-built surface features of the new sanitary sewer, water system and storm sewer system, i.e. manholes, hydrants, water main bends, lateral curb boxes, valves, inlets, endwalls, etc., on the Jefferson County Coordinate system must be provided. This point file must include; northing, easting, elevation (NAVD88), and a point description.

The City can obtain the electronic file for the surface features, at the Developer's cost, when requested by either the City or the Developer, provided that the Developer locates these features in the field.

The City Engineer will update all applicable City maps and computer water and stormwater models. The cost of updating of City maps and computer water and stormwater models to incorporate this development shall be borne by the Developer.

## JEFFERSON UTILITY REQUIREMENTS FOR LINE EXTENSIONS WITHIN NEW LAND DEVELOPMENTS

The Developer of a land division or subdivision shall be responsible for all costs related to the installation of new street lighting within public right-of-way. Below are the current City of Jefferson minimum street lighting requirements that apply to all local, collector and arterial streets. When new distribution line extension or relocation of existing distribution is requested, Jefferson Utilities shall design, install and perform the work in accordance with current PSC Rate Tariffs and Electric Rules. Contact Jefferson Utilities for additional questions regarding design parameters at 920- 674-7711.

- 1. Street lights shall be installed at each intersection, as well as each cul-desac. Additional street lights between intersections and cul-de-sacs shall be evenly spaced.
- 2. Jefferson Utilities' standard 18' fiberglass black pole or current utility standard stock decorative pole with a LED fixture. Poles shall be evenly spaced 250'-350'and must have approval from City Engineer prior to installation. Developer may be asked to provide lighting calculations for proper spacing. The pole shall be Direct Bury Round Tapered Composite Tuff-Pole. The fixture shall be 46 watt "Acorn" style LED lighting approved by the City of Jefferson.
- 3. Jefferson Utilities' standard 35' fiberglass black or current utility standard stock decorative pole with a LED fixture shall be installed. Poles shall be evenly spaced 250'-350' and must have approval from City Engineer prior to installation. Developer may be asked to provide lighting calculations for proper spacing. The pole shall be Direct Bury Round Tapered Pole. The fixture shall be 74 watt "Cobra" style lighting approved by the City of Jefferson.
- 4. Poles will be spaced with public safety in mind
- 5. Easements shall be provided as necessary for underground cables to street light locations approved by the appropriate governmental authority.

## SPECIFICATIONS

#### SECTION 03 30 01 - CAST-IN-PLACE CONCRETE - MUNICIPAL

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Description of Work Covered by This Section
  - 1. This section establishes the specifications by which the Contractor shall abide in supplying and placing concrete. Such concrete shall be Portland cement concrete composed of a mixture of an air entraining type Portland cement, fine, and course aggregates, and water. Admixtures may be added to achieve a desired result provided they are first approved by the Engineer and provided such admixture does not adversely affect the strength and durability of the concrete.
  - 2. The materials for each class of concrete shall be apportioned according to Part 2 and Section 3.2, Table 1. The Contractor shall use Class BB concrete if the exact use is not indicated in the Table or if the class is not specified elsewhere on the Plans or in these specifications.
- B. Cost of Testing
  - 1. The cost of the tests, including materials, transportation, and reports, shall be paid for by the Contractor, except for initial base compaction tests.

#### 1.2 REFERENCE STANDARDS

- A. American Concrete Institute
- B. ASTM International
- C. American Association of State Highway and Transportation Officials

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Cement
  - 1. The cement used shall be air entraining Portland cement, ASTM C150, Type IA. When high early strength is specified, Type IIIA shall be used.
- B. Aggregates
  - 1. All aggregates used shall comply with ASTM C33. Aggregate shall consist of clean, hard, durable sand and crushed stone, fine gravel or crushed gravel. Fine aggregate shall conform to the following grading requirements:

Sieve Size	Percent Passing, by weight
<sup>3</sup> / <sub>8</sub> -inch	100
No. 4	90-100
No. 16	45-80
No. 50	10-30
No. 100	2-10

2. Course aggregate shall meet the following grading requirements:

	Percent Pass	ing, by weight
Sieve Size	No. 1	No. 2
2-inch	-	100
1 <sup>1</sup> / <sub>2</sub> -inch	-	90-100
1-inch	100	20-55
<sup>3</sup> / <sub>4</sub> -inch	90-100	0-15
<sup>3</sup> / <sub>8</sub> -inch	20-55	0-5
No. 4	0-10	-
No. 8	0-5	-

- 3. Of the total coarse aggregate, all shall be No. 1, or there shall be a mixture of No. 1 and No. 2, such that 35 to 65 percent is No. 1, and the remainder No. 2.
- 4. The ratio of coarse aggregates to fine aggregates shall not be less than 1:1, or more that 2:1, by weight.

#### C. Water

1. Mixing water shall be free of oil, acid, excessive alkalinity, organic matter, and salts.

#### D. Admixtures

1. Admixtures shall be used only when specified or with the written permission of the Engineer, and they shall be used in strict accordance with the manufacturer's instructions. Care shall be exercised to assure that the admixture does not increase or decrease the air content outside of allowable limits.

#### E. Reinforcing Steel

- 1. Reinforcing steel shall be ASTM A615, Grade 60, new billet steel bars. The Contractor shall provide metal spacers to support the reinforcing steel and to insure that displacement of the steel during the placement of concrete will not occur.
- F. Concrete Mixture
  - 1. The concrete mixture shall be proportioned in accordance with the requirements of Section 3.2, Table 1.

#### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION

#### A. Preparation

- 1. Surfaces that will be in contact with the new concrete shall be prepared as follows:
  - Forms shall be wetted with light oil and the subgrade shall be sprinkled with water.
  - Old concrete and adjacent structures shall be separated from new pours with <sup>1</sup>/<sub>2</sub>-inch asphalt impregnated felt, as specified under Subsection B.
  - All reinforcing steel shall be positioned to provide a minimum of 1<sup>1</sup>/<sub>2</sub>-inch concrete cover.
- 2. Concrete shall not be placed around castings, frames, joints, and other embedded fixtures until they have been accurately adjusted and set to the required alignment and grades. Before placing of concrete, castings, frames, and embedded metal, fixtures shall be painted on their contact surfaces with a heavy coat of asphaltic mastic or separated from the concrete with expansion joint material.

#### B. Joints

- 1. Expansion joints shall consist of <sup>3</sup>/<sub>4</sub>-inch asphalt impregnated felt or other approved expansion joint fillers placed the full depth of the concrete.
- 2. Contraction joints shall consist of a slot or groove, at least 1-inch in depth and <sup>1</sup>/<sub>4</sub>-inch wide, constructed in a manner approved by the Engineer.
- C. Mixing Concrete
  - 1. If "ready mix" concrete is used, it shall be produced, delivered, and handled in accordance with the requirements of the most recent edition of the State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction. The concrete shall be deposited at the job site within one (1) hour after introduction of water into the mix. Care shall be taken in transferring concrete from the truck or mixer to avoid segregation of aggregates in the mixture. The concrete shall not be diluted with water to make it more fluid after slump tests have been taken.

#### D. Inspection

- 1. Before placing concrete, the Contractor shall notify the Engineer for inspection and approval of reinforcing steel, if any.
- E. Placing Concrete
  - 1. The concrete shall be deposited on the subgrade in a manner requiring as little re-handling as possible. Necessary hand spreading shall be done with shovels, not with rakes. Workers shall not walk in the concrete with boots coated with earth.
  - 2. Sufficient spading, rodding, and mechanical vibrating shall be provided to ensure concrete flow into the smallest corners, under pipes, and all places where concrete will not readily flow. The finished concrete shall be watertight and shall be devoid of honeycomb.
  - 3. Placing of concrete shall be continuous between transverse joints without the use of intermediate bulkheads. In case a temporary shutdown is required, the concrete at the unfinished end of slabs shall be covered with wet burlap. When delays are necessary and they are of such length that the concrete deposited will attain its initial set, or if any interruption in the concrete placing operations of more than thirty (30) minutes occurs, a joint shall be installed in accordance with the provisions of subsection B.

- 4. Batches shall be dumped so that the concrete will not displace or disarrange the joint installations. The concrete shall be shoveled into place against the expansion joints or other joint installations that might otherwise be displaced or disarranged by concrete flowing against them. The concrete shall be placed simultaneously against both sides of intermediate joint installations.
- 5. Any rock pockets or voids found after the forms are removed shall be filled immediately with a well-mixed grout composed of one (1) part Portland cement and three (3) parts of fine aggregate and the grout shall then be finished to the true surface of the concrete.
- 6. Except when authorized in writing by the Engineer, concrete shall not be poured or cast when the air temperature in the shade away from artificial heat falls below 40° Fahrenheit. During the season of the year when freezing temperatures can be expected or when the atmospheric temperature are forecast to drop below 40° Fahrenheit within the 24 hours following the pour, curing of concrete may be omitted and the newly laid concrete shall be protected by covering with a layer of impermeable paper or plastic. When the temperature is forecast to drop below 22° Fahrenheit, the plastic shall be covered with not less than 12 inches of loose dry hay or straw. The covering shall be retained in place for a period of 10 days.
- 7. Neither salt nor chemical admixtures shall be added to the concrete to prevent freezing.
- F. Testing Requirements
  - 1. The Contractor shall conduct tests, at the Contractor's cost, on the proposed concrete mixture to determine the slump, entrained air content, compressive strength, or other appropriate criterion, to determine compliance with these specifications.
  - 2. Tests for slump and air entrainment shall be made before placement of the concrete. Testing shall be done under the supervision of the Engineer or other Owner's representative. Failure to meet the slump or air entrainment requirements of Subsection 3.2, Table 1 may result in rejection of the load.
  - 3. The concrete shall be subjected to compressive strength tests. The Contractor shall supply the standard cylinders and the Engineer or other Owner's representative may fill the cylinders or may require the Contractor to do so. Three (3) cylinders, one for a compressive strength test at seven (7) days and two (2) for compressive strength tests at twenty-eight (28) days shall be cast for each test. One test is required for each twenty five (25) cubic yards poured in each day, and one for each multiple of twenty five (25) cubic yards.
  - 4. Test procedures shall be according to ASTM C31, C39, C143, and C172. The choice of the testing laboratory shall be subject to the Engineer's approval.
  - 5. Initial Proctor or field density tests to determine the adequacy of compaction of the subgrade or base materials, if deemed necessary by the Owner, shall be conducted at the Owner's expense. If the tests show that satisfactory compaction has not been obtained the Contractor shall, at its own expense, re-compact the areas designated by the Engineer and obtain compaction tests from an independent laboratory at his own cost demonstrating that satisfactory compaction has been obtained.
- G. Finishing
  - 1. The surface of the concrete shall be thoroughly floated after the concrete has been struck off. After the concrete has begun to set up, the Contractor shall lightly broom the surface of walks, pavements, curb and gutter and driveways to create a grain perpendicular to the direction of vehicle or pedestrian travel. Edges shall be neatly trimmed with a <sup>1</sup>/<sub>4</sub>-inch radius-edging tool. Any honeycombed areas shall be pointed with mortar.

#### H. Curing

1. All exposed concrete slabs and formed structures above grade shall have provisions to prevent loss of moisture for at least 24 hours after placement. Methods to prevent loss of moisture may include covering with plastic sheets, constant wetting of the surface with water, covering with curing paper, or application of an approved commercial curing compound conforming to AASHO Designation M148, Type 2. The rate of application of such a compound shall be not more than two hundred (200) square feet per gallon of compound. The compound shall be applied in accordance with manufacturer's recommendations.

Maximum Water	Air Content	Slump Inches	Minimum Compressive	Uses
Gallons	Percent By		Strength	
Cubic Yd.	Volume		<b>P.S.I</b> .	
32	5-8	1-3	2,000	High Early Strength,
			(3 Days)	Special Construction,
				Pavement
33	5-8	1-3	3,500	Curbs, Walks, Open
			(28 Days)	Channels, Walls
30	2-4	1-4	3,000	Manhole, Bases,
			(28 Days)	Envelopes, Cradles
24	2-4	1-4	2,000	Pavement Base
			(28 Days)	

Table 1 – Concrete	Classifications
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Maximum water contents include aggregate moisture.

END OF SECTION 03 30 01

### SECTION 31 22 13 - ROADWAY EXCAVATION & GRADING

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Contractor Responsibilities
  - 1. The Contractor shall complete excavation, backfill, embankment, compaction and grading as necessary to prepare the roadway or street for application of base course and pavement as shown on the cross-sections and details of the Plans. The Contractor shall legally dispose of all excess or unsuitable materials. The Contractor shall blend private lawns, driveways, alleys and intersecting streets.
- B. Section Includes:
  - 1. Excavating topsoil.
  - 2. Excavating subsoil.
  - 3. Excavating for roads, street and parking areas.
  - 4. Excavating for landscaping.
  - 5. Fill under slabs-on-grade.
  - 6. Fill under paving.
  - 7. Compaction of Fill
  - 8. Grading and compacting site for slabs-on-grade, paving and landscaping.

#### 1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials
- B. ASTM International
- C. Local utility standards when working in the vicinity of utility lines.

#### 1.3 SUBMITTALS

- A. Section 01 33 00 Submittals: Requirements for submittals.
- B. Product data: Submit data for any geotextile fabric used.
- C. Materials source: Submit name of imported materials suppliers.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Topsoil: As specified in Section 32 05 00.
- B. Embankment materials: Materials used for embankment shall not contain logs, stumps, brush, perishable materials, frozen lumps of soil, or rocks or pieces of pavement of such size or conformation that they would interfere with proper compaction. Materials to be incorporated in the top 18 inches of earth embankments shall be free of stones, or pieces of pavement, which are greater than six (6) inches in any dimension.
- C. Crushed aggregate: As specified in Section 32 05 00.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

#### 3.2 PREPARATION

- A. Call Local Utility Line Information service not less than three working days before performing Work.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility companies to remove or relocate conflicting utilities.
- D. Protect utilities to remain from damage.
- E. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- F. Protect bench marks, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

#### 3.3 CLEARING & GRUBBING

A. Contractor shall remove and legally dispose of existing trees, shrubs, fences pavements and other obstacles within the construction area where removal of such obstacles is necessary to complete the work and as shown on the plans. Remove only those trees and shrubs marked for removal on the plans.

B. The Contractor shall protect remaining trees and shrubs from scarring or from injury of any type. The excavation operations shall not disturb the original ground surface within one foot of trees or shrubs or within twice the diameter of trees, whichever is greater. Roots which may be exposed as a result of excavation shall be cut cleanly and covered with soil with high humus content. When necessary, or when required by the Plans or the Special Conditions, tree wells shall be constructed to protect trees and shrubs from embankments. In such cases, tree well design shall be as shown on the Plans or as approved by the Engineer.

#### 3.4 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile on site to depth not exceeding 8 feet and protect from erosion.
- D. Excess topsoil not needed for reuse shall be stockpiled as directed by the Owner.

### 3.5 SUBSOIL EXCAVATION

### A. Definitions

- 1. Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one (1) cubic yard equipped with attachments (such as shovel, bucket, backhoe, dragline, or clam shell) appropriate to the character of the materials and the site conditions. For the purposes of this classification heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower, at the flywheel, such equipment being in well-maintained condition. Pusher tractor shall be defined as a track-type tractor having a power rating of 200-300 net horsepower, at the flywheel, equipped with appropriate attachments and being in well-maintained operating condition.
- 2. Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials, the excavation of which requires blasting or use of excavators larger than defined for common excavation. Such rock excavation shall include all hard, solid rock ledges, bedded deposits or any other material as firmly-cemented as to present all the characteristics of solid rock. The excavation and removal of isolated boulders or rock fragments larger than one (1) cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. Rock excavation will merit extra payment unless a separate bid item has been provided or unless elsewhere in the specifications such rock excavation is declared incidental to the work. Existing asphaltic or concrete pavements, curb & gutter, sidewalk and utility structures shall be classified as common excavation. The presence of isolated boulders or rock fragments larger than one (1) cubic yard in size will not, in itself, be sufficient cause to change the classification of surrounding material.

- B. The Contractor shall excavate as shown on the Plans and legally dispose of all excess materials to allow construction of the roadway. Earthwork shall include, but not be limited to, excavation within the roadway; embankments with the roadway; excavation and embankments to create intersections, ditches, channels, waterways and dikes; grading of the roadway subgrade, entrances and approaches; and other such activities outside the right-of-way as may be specifically designated on the Plans. Earthwork shall include the removal and reuse or satisfactory disposal of existing pavements and base courses, masonry or concrete structures, and other structures that may be within the right-of-way.
- C. Monuments from land surveys which are shown on the plans or which are clearly visible in the field and which are in the path of the work shall be carefully protected from movement. If the Contractor feels that removal is necessary he shall notify the Engineer at least 48 hours in advance of such removal. If the Engineer concurs that removal is necessary, the municipality will assume the cost of resetting those monuments, unless a bid price is provided in the Bid Proposal or unless elsewhere in the specifications it is stated that removal and replacement of monuments is incidental to the bid price(s). Monuments that the Contractor moves due to failure to exercise reasonable precautions or proper construction techniques, or for which he has failed to notify the Engineer sufficiently in advance, shall be replaced at the Contractor's cost.
- D. The Contractor shall notify utility companies of any interfering structures or cables and shall arrange for those structures or cables to be moved, if necessary. The project plans show the approximate location and size of sewers, drains, culverts, gas mains, water mains, electric, and telephone conduits and other underground structures or utilities, as such locations and sizes are available to the municipality, or as surface markings indicate their existence. The Contractor shall arrange with the utility companies for exact location of utilities and for necessary relocations or modifications of interfering utilities. The cost of arranging such relocations or modifications, and the cost of any "downtime" resulting from delays or changes to the Contractor's work schedule as a result of waiting for a private utility (gas, electric, telephone, cable TV) to make the relocation or modifications shall be incidental to the Contractor's bid. The Contractor shall use caution in excavating and trenching so that the exact location of underground structures, both known and unknown, may be determined; the Contractor shall be held responsible for the repair of such structures when broken or otherwise damaged during construction. When the Owner permits the Contractor to make a change in the project to avoid utility relocation, the Engineer shall determine whether the change constitutes extra work as defined in the General Conditions. Such relocations shall not be cause for extension of contract time of completion.
- E. The Contractor shall also, at least one week in advance of his operations, notify private property owners who have structures or who have planted trees, shrubbery, or flowers in the right-of-way so that the private property owners may remove and reinstall such features if they so wish. The Contractor shall be responsible for removal, temporary relocation, and replacement of all mail and newspaper delivery boxes. The Contractor shall contact the local postmaster to determine acceptable locations and heights of such boxes. Replacement of such boxes shall be in locations acceptable to the property owner.
- F. Deposits of frost heave material, unstable soils such as clay or muck, soil containing considerable amounts of organic matter, or other undesirable foundation material shall be excavated as directed by the Engineer. The Contractor shall notify the Engineer of such questionable materials and obtain the Engineer's approval prior to excavating them. Failure to notify the Engineer of such questionable materials shall be cause for the forfeiture of right to extra payment.

31 22 13 Roadway Excavation & Grading
November 15, 2017 - Master
Page 4 of 6

- G. The Contractor shall scarify the subgrade to such depth as necessary to accomplish grading and shaping operations as specified in Subsection 3.5 of this section.
- H. The Contractor shall conduct earthwork operations in such a manner as to avoid removing or disturbing any material or structure outside of the designated construction limits, as shown on the Plans or as defined in the Special Conditions. Should any such material or structure be removed or disturbed the Contractor shall assume the expense of restoring it to its original condition.

#### 3.6 FILLING

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place.
- C. Fill areas to contours and elevations with unfrozen materials.
- D. The Contractor shall, if possible and feasible, utilize all suitable excavated material for backfill and embankment within the roadway in conformity with the lines, grades, cross-sections and dimensions shown on the Plans or in these Specifications or at other places shown on the Plans. When excavated materials are insufficient or unsuitable the Contractor shall furnish materials from borrow pits approved by the Engineer. Before use of borrow materials, the Contractor shall notify the Engineer so that the materials may be inspected.
- E. Backfill or embankments shall be made in successive uniform layers not exceeding 12 inches in depth. Each layer shall cover the entire area and shall be compacted before additional layers are placed. Prior to compaction each layer shall be worked to break up clods over six (6) inches in any dimension and to obtain uniform moisture content. In the case of filling on steep slopes construct the fill in such layers as can be achieved by the equipment until the fill can be constructed in 12 inch layers. Each layer shall be compacted to 95 percent of maximum density as measured by AASHTO Designation: T99, Method C, with replacement of the fraction of material retained on the <sup>3</sup>/<sub>4</sub>-inch sieve with No. 4 to <sup>3</sup>/<sub>4</sub>-inch material.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.

#### 3.7 GRADING AND SHAPING

A. The Contractor shall shape the subgrade for the full width of the roadbed in advance of base or surface laying operations. The grade of the completed course shall at all points be within + or - 0.04 foot of the grade shown on the Plans, as measured at the curb line or the edge of the pavement, but without more than 5 percent net over-excavation or under-excavation of the subgrade materials for the project. Subgrade need not be crowned between measurement points at opposite edges of the roadway. He shall maintain the subgrade in a firm smooth condition, removing any ruts or surface irregularities produced by hauling equipment or other traffic until final acceptance or until laying of the subbase or base course. The subgrade shall have a compaction of 95 percent of maximum density as measured by AASHTO Designation: T99, Method C, with replacement of the fraction of material retained on the <sup>3</sup>/<sub>4</sub> inch sieve with No. 4 to <sup>3</sup>/<sub>4</sub> inch material. Any soft or yielding places, holes or other defects which may develop in the subgrade by reason of traffic, hauling, poor drainage, unstable materials, or from any other cause shall be corrected before acceptance or before the base or surface course is placed thereon.

- B. Unless otherwise approved by the Engineer, the subbase shall be compacted before any crushed aggregate is added in other to minimize crushed aggregate being forced down into the subbase.
- C. All intersecting road, approaches, entrances and driveways shall be graded as shown on the Plans or as designated in the field by the Owner's Authorized Representative.
- D. Make grade changes gradual. Blend slope into level areas.
- E. During construction, the Contractor shall assure that all ditches and channels are drained at all times by keeping the excavation areas and embankments sloped to the approximate section of the final earth grade. If existing surface drainage must be interrupted alternate drainage shall be provided.
- F. Construction in and adjacent to flowing streams shall be performed to avoid washing, sloughing or deposition of materials into the channel which may obstruct or impair stream flow or which may result in contamination and/or silting of the waterway. The Contractor shall comply with any requirements or permits from the Owner or obtained by the Owner from the Department of Natural Resources and shall use erosion control measures in the locations shown on the Plans or as specified elsewhere in the specifications.
- G. The Contractor shall take precautions to preserve, protect, and continue service of all existing tile drains, sewers and other subsurface utilities and shall repair any damage to drains, sewers, other utilities or surface features.

#### 3.8 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1 inch from required elevation.

#### 3.9 FIELD QUALITY CONTROL

- A. Perform laboratory material tests in accordance with AASHTO T 99.
- B. Perform in place compaction tests in accordance with the following:
  - 1. Density Tests: ASTM D2922.
  - 2. Moisture Tests: ASTM D3017.
- C. A test-roll of the graded and compacted subbase will be required. This test-roll shall be performed with a fully loaded tri-axle dump truck (60,000 pound minimum total weight) with the tag-wheels lifted, provided by the Contractor. The test-roll shall be performed on the entire length and width of the subbase in the presence of an Engineer. Any deflection of the sub-base, wheel rutting, or cracking of the subbase will signify a failure of the subbase. The Engineer shall make the determination of subbase course acceptance or failure. In the case of subbase failure, the Engineer shall determine the area and depth of undercut or other corrective action.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION 31 22 13

#### SECTION 31 22 17 - TRENCH EXCAVATION, BACKFILL AND COMPACTION

#### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Description of Work Covered by This Section - This section describes the conditions under which the Contractor shall perform trenching and excavation necessary to construct all parts of underground pipe system and appurtenances. This section also covers the refilling and compaction by the Contractor of all trenches and excavations, and the disposal of all surplus material and excavated material unsuitable for use in backfill operations.

#### 1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials
- B. ASTM International
- C. Wisconsin Department of Transportation (WisDOT) Standard Specifications for Highway and Structure Construction available on the WisDOT website.

#### 1.3 SUBMITTALS

- A. Section 01 33 00 Submittals: Requirements for submittals.
- B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

#### 1.4 QUALITY ASSURANCE

A. Perform Work in accordance with these Specifications and all applicable Local, State and Federal regulations.

#### 1.5 FIELD MEASUREMENTS

A. The contractor shall verify field measurements.

#### 1.6 COORDINATION

A. The Contractor shall notify all affected utility companies of his construction operations to coordinate his work regarding poles, wires, valve boxes, and other surface obstructions and to determine the location of gas, water main, power, light, telephone or telegraph conduit or service connections thereto or any other sub-surface structure that crosses or

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 1 of 11	

passes through the space occupied by any of the proposed improvements. The Contractor shall make arrangements with the utility companies for any relocation of interfering utilities.

#### PART 2 - PRODUCTS

#### 2.1 FILL MATERIALS

- A. Gravel Bedding: Gravel used for bedding shall be <sup>3</sup>/<sub>4</sub>-inch crushed aggregate imported from off the project site, meeting the requirements for <sup>3</sup>/<sub>4</sub>-inch dense graded base course set forth in Section 305 of the latest version of Wisconsin Department of Transportation (WisDOT) Standard Specifications for Highway and Structure Construction available of the WisDOT website.
- B. Granular Backfill; Material used for granular backfill shall be pit run coarse sand (free of organic debris, rubble or cinders) or gravel imported from off the project site.

#### PART 3 - EXECUTION

#### 3.1 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
  - 1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use laser-beam instrument with qualified operator to establish lines and grades.

#### 3.2 PREPARATION

- A. Call Digger's Hotline (800) 242-8511 not less than three working days before performing Work. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, control points and datum locations.
- C. Protect plant life, lawns, landscaping and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control and detours when trenching is performed in public right-of-way.

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 2 of 11	

#### 3.3 TRENCHING

- A. Excavation shall be made in such a manner that the pipe can be laid safely and accurately to the line and grade shown on the Plans. Topsoil shall be salvaged and used in restoring the surface of the trench, where applicable
- B. Contractor shall segregate materials that are suitable for replacement in the trench from those which are not suitable. Contractor shall spread and attempt to dry materials that are unsuitable for replacement in the trench due solely to moisture content. All such segregation and drying efforts shall be at no additional cost.
- C. Excavation shall extend from the surface to the bottom of the pipe bedding, as defined below for different types of soils. Unnecessary excavation below the specified level shall be backfilled at the Contractor's expense with gravel as approved by the Engineer.
- D. In no case shall the Contractor open any trench more than 100 feet in advance of the pipe laying unless otherwise permitted by the Engineer. The backfilling shall be kept within 300 feet of the completed pipe laying. Not more than one (1) street crossing may be obstructed by the same trench at any one time.
- E. Trench widths for different soil conditions are illustrated on the plan detail sheet. Trench widths at the top of the pipe shall provide at least a six (6) inch clearance on either side of the barrel to allow for the free flow of bedding material between the pipe and the trench wall. Maximum trench width at the top of the pipe shall be the outside pipe diameter plus 24 inches. However, the trench width need not be less than 36 inches for any size of pipe. The trench width above a point 12 inches above the top of the pipe may be sloped, stepped, or vertical in order to comply with State and Federal regulations regarding trenching, bracing, and shoring. In unconsolidated materials (not rock), trench shields narrower than four feet inside dimension will not be required.
- F. Where rock occurs at the bottom of the trench, the depth of excavation shall be a minimum of six (6) inches below the pipe barrel to provide space for the imported bedding material. Bedding material shall be evenly spread, compacted and shaped to conform to the pipe.
- G. In rock the maximum trench width (and maximum payment width, whether or not a Contractor chooses to use a trench shield) shall be the outside of the pipe diameter plus 18 inches, as measured at the top of the pipe. However, even in rock the trench width need not be less than 36 inches for any size of pipe. In rock, the maximum trench width shall be assumed to have vertical sides. Where a new pipeline is installed in the same location where a pipeline already exists, rock excavation will not be paid for the existing pipeline and any open space above, below or around the existing pipeline. Rather, rock excavation will be paid only for actual rock material to the extent that the existing open area must be widened or deepened to meet the minimum clearances set forth herein or on the plan details.
- H. Rock excavation shall be defined to include all hard, solid rock in ledges, bedded deposits, boulders greater than one (1) cubic yard in volume, and all naturally conglomerated deposits, such as silt stone, sandstone, shale, or conglomerate so firmly deposited or cemented as to possess all the characteristics of solid rock. Buried concrete structures shown on the Plans which must be removed in the course of the work shall be considered

31 22 17 Trench Excavation, Backfill and Compaction
November 6, 2017 – Master
Page 3 of 11

as rock. Material shall be classified as rock if it is deemed by the Engineer to be so hard that it cannot be excavated with a 50,000 pound or larger track backhoe with a 30-inch bucket with rock teeth used by an experienced operator. Shale, hard pan, masonry and concrete rubble, and boulders less than one (1) cubic yard in volume that are not a part of or attached to substrata of rock shall not be considered rock excavation. The Engineer's judgment of what is classified as rock shall be binding upon the municipality and the Contractor.

- I. Blasting will be permitted only after the Contractor secures the Engineer's approval. To secure such approval the Contractor must show evidence of insurance specifically for such work and must demonstrate that the blasting will be conducted in such a manner that adjacent existing structures or completed work, persons and property will be protected. The hours of blasting may be fixed by the Engineer. Any blasting shall be done in accordance with the provisions of the Wisconsin Administrative Code and any applicable local ordinances. The Contractor shall conduct and document pre-blast and post-blast surveys of any nearby buildings or structures as required by the scaled-distance equation specified in Chapter COMM 7 of the Wisconsin Administrative Code. These surveys shall consist of visually inspecting and recording all existing defects in the structures, both before and after the blasting operations, including use of photographs and video recording. All blasting shall be done under the direct supervision of a certified blaster. Any damage caused by the blasting shall be repaired or replaced at the Contractor's expense. Contractor shall hold Owner and Engineer harmless from legal costs of any lawsuits resulting from blasting.
- J. Excavate trenches to depth indicated on Drawings.
- K. In firm clay soils the bottom of the trench must be dug to a depth of four (4) inches below the pipe barrel and three (3) inches below the bell to make room for the imported bedding material. Bell holes must be hand excavated to allow for proper jointing and to insure that the pipe rests evenly along the barrel and is not resting on the bell.
- L. When subsurface materials at bottom of trench are loose or soft notify Engineer and request instructions, cut out soft areas of subgrade not capable of compaction in place. Backfill with Granular Backfill and compact to density equal to or greater than requirements for subsequent backfill material.
- M. All excavated material to be used for trench backfilling must be stored so that it will cause a minimum of inconvenience to public travel, adjacent owners, or tenants and other Contractors or Subcontractors. The excavated material that is not to be used for trench backfilling shall be removed immediately from the site of the work. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- N. A temporary water-tight stopper or plug shall be installed on the upper end of each pipe being laid at the end of each day and at the end of each pipe being laid during the day if there is danger of soil or debris being washed into the pipe, or if runoff or rainfall could enter the pipe and cause back-up.
- O. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer

31 22 17 Trench Excavation, Backfill and Compaction
November 6, 2017 – Master
Page 4 of 11

P. Remove excess subsoil not intended for reuse, from site.

#### 3.4 OBSTRUCTIONS

- A. Clearing and grubbing, removal of pavements, sidewalks, curbs, signs, poles, fences, trees, shrubs and other surface obstructions shall be done only as necessary for the completion of the work. Mailboxes, street signs, and traffic signs shall be stored and protected or temporarily relocated by the Contractor as specified elsewhere in these specifications and shall be replaced as directed by the Owners.
- B. The Contractor shall dispose of brush, trees, shrubs, rubble, and other items not intended to be reinstalled, such disposal being in a legal manner off the site of the work. Burning of any material is not permitted.
- C. Monuments from land surveys which are shown on the plans or which are clearly visible in the field and which are in the path of the work shall be carefully protected from movement. If the Contractor feels that removal is necessary he shall notify the Engineer at least 48 hours in advance of such removal. If the Engineer concurs that removal is necessary, the municipality will assume the cost of resetting those monuments, unless a bid price is provided in the Bid Proposal or unless elsewhere in the specifications it is stated that removal and replacement of monuments is incidental to the bid price(s). Monuments that the Contractor moves due to failure to exercise reasonable precautions or proper construction techniques, or for which he has failed to notify the Engineer sufficiently in advance, shall be replaced at the Contractor's cost.
- D. The project plans show the approximate location and size of sewers, drains, culverts, gas mains, water mains, electric, and telephone conduits and other underground structures or utilities, as such locations and sizes are available to the municipality, or as surface markings indicate their existence. The Contractor shall arrange with the utility companies for exact location of utilities and for necessary relocations or modifications of interfering utilities. The cost of arranging such relocations or modifications, and the cost of any "downtime" resulting from delays or changes to the Contractor's work schedule as a result of waiting for a private utility (gas, electric, telephone, cable TV) to make the relocation or modifications shall be incidental to the Contractor's bid. The Contractor shall use caution in excavating and trenching so that the exact location of underground structures, both known and unknown, may be determined; the Contractor shall be held responsible for the repair of such structures when broken or otherwise damaged during construction. When the Owner permits the Contractor to make a change in the project to avoid utility relocation, the Engineer shall determine whether the change constitutes extra work as defined in the General Conditions. Such relocations shall not be cause for extension of contract time of completion.
- E. During the construction of pipelines, it may be necessary to cross under other pipelines or pass around underground structures. Where necessary, the flow in such existing pipelines shall be diverted so that the excavation may be kept dry during the progress of construction work. The Contractor shall make every effort to prevent damage to such pipelines, conduits, or structures. Wherever such pipelines, conduits, or structures are disturbed or damaged, the Contractor shall restore them to their original conditions at no additional cost

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 5 of 11	

to the municipality. The Contractor shall use <sup>3</sup>/<sub>4</sub>-inch crushed aggregate, thoroughly compacted, six (6) inches under and around to six (6) inches above such pipelines and structures when it is necessary to excavate around or under them or to repair them. Such crushed aggregate bedding and backfill shall not merit extra payment as supplemental backfill. Unless otherwise authorized by the Engineer, when water services must be cut and that cut is within 10 feet of the water main, new copper shall be installed from the cut all the way to the main. The cost of the necessary copper tubing and fittings shall be incidental to the bid items. If a water service lateral is broken by a pulling action, that service shall be replaced all the way to the main and all the way to the curb stop.

F. All structures, sidewalks, driveways, curb and gutter, trees, shrubs, lawns, signs, fences, utilities, survey monuments, pavements, culverts, underground pipelines, or conduits, and other features which are adjacent to the work area or easement, shall be carefully protected by the Contractor against damage from construction activities. In the event that there is any question whether any features are located in the construction zone where it is necessary to disturb them in order to complete the project the Engineer's decision shall be binding upon the municipality and the Contractor. In the event of damage or inadvertent injury or removal of surface or subsurface features, the Contractor shall bear the full cost and responsibility for repair for his own failure to exercise reasonable precautions or to use proper construction techniques. The Contractor shall replace the item or repair such damage as early as possible. In determining contract completion time there will be no allowance for such repairs or replacements.

#### 3.5 SHEATHING AND SHORING

- A. Sheathe, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Tight sheathing will be required where it is necessary to protect nearby structures and pavements or when the trench must be confined to allow for traffic flow. Sheathing must be driven unless soil conditions allow the sets to be placed after excavation. If the sheathing is placed after excavation the voids between the trench wall and the sheathing must be immediately filled with sand.
- C. Removal of sheathing must not take place until the trench is backfilled. If flooding or jetting is used to achieve compaction it shall be done after the sheathing is removed. However, this removal of sheathing from the uncompacted trench shall be done in such a manner as to prevent disturbance to the completed pipelines and adjacent ground. The Engineer may order, in writing, leaving some or all of the sheathing in place. Sheathing ordered left in place shall have the upper portion within three (3) feet of the surface cut off and removed.
- D. The right of the Engineer to order sheathing and bracing left in place shall not be construed as creating any obligation on his part to issue such orders. His failure to exercise his right to do so shall not relieve the Contractor of any liability for damages to persons or property occurring from or upon the work of constructing the pipeline or appurtenances occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place in the trench sufficient sheathing and bracing to prevent the caving or moving of

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 6 of 11	

the ground, or disturbance of the completed work or any of the surface or subsurface structures.

- E. Spot braces, individual shorings spaced at various intervals along the trench and portable trench boxes or sliding shields will be considered incidental to the cost of pipe construction. When portable trench boxes or sliding shields are used the Contractor shall provide an acceptable method of rechecking line, grade and horizontal location of the pipe after the shield has been moved ahead. If the pipe has moved, it shall be reset to the proper line and grade. The width of the trench shield or box shall be such that a minimum six (6) inch horizontal clearance is maintained between the pipe and shield at all times. Any voids occurring between the trench box or shield and the undisturbed trench wall within the pipe zone (bottom of the trench to the top of the initial backfill zone) shall be filled with gravel immediately after the box or shield is positioned.
- F. Design sheathing and shoring to be removed at completion of excavation work.
- G. Repair damage caused by failure of the sheathing, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- H. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheathing, shoring, or bracing.

#### 3.6 PIPE BASE AND BEDDING

- A. Any time the Contractor encounters material such as muck, sawdust, bark, or other materials which would not form suitable and permanent base below the limits of normal excavation required to place the pipeline, the Contractor shall notify the Engineer to obtain approval to remove that material and replace it with an approved foundation material. Such replacements will merit extra payment unless specified elsewhere as being incidental. This foundation material shall be compacted as directed by the Engineer.
- B. Trenches shall have as bedding 1-inch maximum size gravel from the bottom of the trench to a point one foot above the top of the pipe. Where wet trench conditions are encountered and sumping is used for dewatering, clear stone (maximum 1½-inch) may be used for pipe base and bedding up to the springline of the pipe. Then, however, bentonite or clay cut-offs two feet wide shall be used in lieu of the clear stone every 400 feet, maximum, and on each service lateral to prevent groundwater flow from following the pipe. All base, bedding and cut-offs shall be incidental to the per foot lineal pipeline price and shall not merit extra payment. Required trench bedding is illustrated on the plan detail sheet.

#### 3.7 WET TRENCH CONDITIONS

A. The Contractor shall keep all excavations free of water or sewage during preparation of the trench for pipe laying and during pipe laying. The Contractor shall attempt to dispose of all ground water and surface drainage seeping into the trench by employing ordinary dewatering techniques, such as the use of sump pumps, dikes, etc. When the trench bottom is unstable because of ground water the Engineer may require extra excavation to remove the unstable material and replacement with fabric-wrapped Breaker Run as shown on the

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 7 of 11	

plan detail sheet. Bedding as required in Paragraph 3.7 of this section shall then be placed on the stone foundation before the pipe is laid.

- B. Where operating or abandoned landfills, leaking underground storage tanks, or hazardous substance spills are known to be adjacent to the project site the Contractor shall contact the Department of Natural Resources district solid waste coordinator for assistance prior to installing the dewatering wells.
- C. The Contractor shall be responsible for obtaining the necessary discharge permit from the Department of Natural Resources for all dewatering systems and for maintaining the discharge quality in accordance with that permit.
- D. Allowing the water to flow into the pipe system being constructed will not be permitted except in the case of a storm sewer.
- E. Where, in the opinion of the Engineer, the trench cannot be kept dry by ordinary dewatering techniques a well point system shall be employed to effectively dewater the trench. If wells are approved for dewatering, the wells shall be constructed, maintained and abandoned in accordance with the requirements of the Department of Natural Resources. The Contractor shall be responsible for contacting the Department of Natural Resources Private Water Supply Section for a permit for all wells installed or operated for which the single or aggregate capacity may be in excess of 70 gallons per minute. The Private Water Supply Section's address is:

Wisconsin Department of Natural Resources Private Water Supply Section 101 South Webster Street Madison, WI 53707

#### 3.8 BACKFILLING AND RESTORATION

- A. Backfill trenches to contours and elevations shown on the plans with unfrozen fill materials.
- B. The Contractor shall backfill the trench, with allowance for pavement and base course, if applicable, as soon as possible after the installation of the pipe, unless otherwise approved or directed by the Engineer. Unless otherwise approved by the Engineer, partial payments for pipeline construction will be made only for the cost of materials, based upon submitted invoice, until restoration is complete and approved by the Engineer.
- C. The initial backfill material to a minimum depth of one (1) foot above the top of the pipe shall be placed by hand and shall be well compacted with hand tampers or by mechanical means to achieve a density equal to that of the undisturbed earth. Special care shall be taken in placing and tamping the initial backfill material so that the alignment and grade of the pipe will not be disturbed nor the pipe damaged. In all areas where settlement is not greatly important, the backfilling above the initial one-foot backfill zone may be done from the top of the trench by mechanical means. In no case shall the backfill material be dropped from such a height or in such volume that its impact upon the pipe will cause damage or

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 8 of 11	

misalignment. Large rocks, rubbish, wood and other undesirable material shall not be used for backfill material.

- D. Trench Compaction: Compaction shall be of the class indicated on the Plans or in the Special Conditions to these specifications. The classes of compaction are as follows:
- E. Class I Class I trench compaction shall consist of mechanically compacting the backfill in 12 inch or thinner layers from a distance of one (1) foot above the top of the pipe to the surface. The degree of compaction shall be 90% of Modified Proctor Density at depths greater than three (3) feet below the finished surface. Within three (3) feet of the finished surface, compaction shall be a minimum of 95% of Modified Proctor Density. The Contractor shall use smaller lifts if the required compaction cannot be obtained with 12 inch lifts
- F. Class II Class II trench compaction shall consist of jetting and flooding the trench using at least a 1½ inch diameter hose to carry the water from available hydrants. A 1½ inch diameter steel pipe with a minimum length of four (4) feet shall be attached to the end of the hose. This pipe shall be inserted into the fully-backfilled trench. The pipe shall be inserted at intervals of no more than three (3) feet along the trench, the hose being left in place until that section of the trench is saturated. The hose shall be equipped with a throttling valve to allow the hydrant valve to remain fully open. Depression caused by settlement shall be backfilled. Water for jetting will be provided by the Owner at the Contractor's cost, and the methods and times of removal shall be subject to the Owner's approval. Percent compaction requirements shall be as specified for Class I. This method may be approved only where the soil is sandy in nature.
- G. Class III Class III trench compaction shall consist of refilling the trench in lifts of no greater than three (3) feet, mechanical compaction, and mounding of soil over the trench to allow for settlement due to natural forces. This class of compaction shall be used only where compaction is not of great importance, and where water is not available for jetting and flooding or the backfill material is not conducive to compaction by jetting and flooding.
- H. Where no class is otherwise specified on the plans or in other specification sections, Class I compaction shall be used.
- I. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- J. Place fill material in continuous layers and compact in accordance with Section 310516 (Aggregates for Earthwork).
- K. The material placed in the initial backfill zone from the pipe bedding to a depth of one (1) foot above the top of the pipe shall be imported <sup>3</sup>/<sub>4</sub>-inch crushed aggregate. Under low temperature conditions the Contractor shall use only loose, thawed material in the initial backfill zone. No frozen material shall be placed in the trench within two (2) feet of the top of the pipe. No frozen material shall be placed around manholes or structures. No lumps of frozen material larger than six (6) inches in any dimension shall be placed anywhere in the trench.

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 9 of 11	
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- L. Where the trench is in an existing street or in a location in which a street will be constructed, as shown on the Plans, the top 12 inches of backfill (that portion just beneath the final street pavement) shall be new <sup>3</sup>/<sub>4</sub>-inch crushed aggregate, provided incidentally to the contract cost, unless otherwise shown on the Plans or specified in the Special Conditions, the Measurement and Payment section of the specifications or the Bid Proposal.
- M. Contractor shall move excess excavated materials that are suitable for replacement in the trench as backfill from one point of the project to other parts of the project where insufficient suitable backfill materials exist at no extra cost.
- N. Supplemental backfill provided by the Contractor when the excavated material is unsuitable for use shall be placed only after the Engineer has approved its use in advance so the volume may be measured for payment, if extra payment is to be provided. If extra payment is to be provided, where a trench shield is used the maximum payment width shall be the inside shield width plus 24 inches, with a minimum payment width of 6 feet. (Shields wider than 4 feet inside dimension shall be used only where a combination of pipe diameter and minimum clearances around the pipe so necessitate, in the judgment of the Engineer.) Trench walls shall be assumed to be vertical. If a trench shield is not used, the maximum payment width 12 inches above the top of the pipe shall be no wider than the outside diameter of the pipe plus 24 inches, with the trench widths above that point being no wider than required to meet OSHA safety standards. In no case shall a quantity of supplemental backfill be paid for a trench where a shield is not used greater than if a shield was used.
- O. Employ placement method that does not disturb or damage utilities in trench.
- P. Maintain optimum moisture content of fill materials to attain required compaction density.
- Q. Do not leave more than 20 feet of trench open at end of working day.
- R. Protect open trenches to prevent danger to construction site personnel and the public.
- S. Disposal of Excess or Undesirable Material: Surplus material shall include all that material which is more than the amount needed for backfilling or which is undesirable for backfilling. Surplus material shall be disposed of by the Contractor incidentally to the completion of the project. The Owner reserves the right to designate a disposal site within two (2) miles of the point of loading.

#### 3.9 FIELD QUALITY CONTROL

- A. Section 01 40 00 Quality Requirements
- B. Section 01 70 00 Execution Requirements and Project Closeout: Field inspecting, testing, adjusting, and balancing.
- C. If the Owner desires to check the compaction he shall hire an independent testing laboratory at his own expense. If the tests show that the required compaction was not

31 22 17 Trench Excavation, Backfill and Compaction	
November 6, 2017 – Master	
Page 10 of 11	

achieved, the Contractor shall re-compact the areas designated by the Engineer and shall bear the cost of retesting to prove that the required compaction was achieved.

D. When tests indicate Work does not meet specified requirements and, in the judgement of the Engineer, the failure to meet the specified requirements is the Contractor's fault, the Engineer may require that the material be removed, replaced, compacted and re-tested at the Contractor's expense.

#### 3.10 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 Execution Requirements and Project Closeout: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 31 22 17

#### SECTION 31 25 00 - EROSION AND SEDIMENT CONTROL

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Description of work covered by this Section
- B. This section describes the requirements for control of erosion on construction sites. The Contractor shall provide the necessary materials, equipment, and labor to control erosion by the methods specified herein. If no specific quantities are shown on the Plans, the Contractor shall use whatever quantities are necessary to prevent sediment transport into adjacent storm water conveyances or streams. Other similar products may be used only with the prior approval of the Engineer. All work under this section shall be done in conformance with the requirements of NR 151 of the Wisconsin Administrative Code and Wisconsin Department of Natural Resources best management practices (BMPs).
- C. Section Includes:
  - 1. Temporary Grass Seed
  - 2. Straw Mulch
  - 3. Filter Fabric
  - 4. Sediment Control (Silt) Fence
  - 5. Double Sediment Control Barrier
  - 6. Construction Entrance Material
  - 7. Straw or Straw/Coconut Fiber Erosion Control Mat
  - 8. Coconut Fiber Erosion Control Mat
  - 9. Erosion Control Polymer (Soil Stabilizer)
  - 10. Temporary Ditch Checks (Wattles)
  - 11. Diversion Channels
  - 12. Rock Energy Dissipator
  - 13. Sediment Traps
  - 14. Dust Control

#### 1.2 **REFERENCES**

- A. American Association of State Highway and Transportation Officials
- B. ASTM International
- C. Wisconsin Department of Natural Resources –(WDNR) Wisconsin Administrative Code NR-151
- D. Wisconsin Department of Transportation (WisDOT Standards) Standard Specifications for Highway and Structure Construction available on the WisDOT website.

#### 1.3 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals

31 25 00 Erosion and Sediment Control
February 11, 2019 – Master
Page 1 of 8

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### 1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution Requirements and Project Closeout: Requirements for submittals.

#### 1.5 QUALITY ASSURANCE

A. Perform Work according to these Specifications and all applicable Local, State and Federal regulations

#### 1.6 ENVIRONMENTAL REQUIREMENTS

A. Perform work in accordance the requirements of WDNR NR 151.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS, EQUIPMENT AND PRACTICES

- A. Erosion Control Materials
  - 1. Temporary Grass Seed: Temporary grass seed shall be annual ryegrass, annual oats or winter wheat, depending upon the time of year as set forth in Part 3. Grass seed shall be delivered to the site in bags, tagged, or labeled to show the percentage of purity and germination. The seed shall have been tested by a recognized seed-testing laboratory within one (1) year before the date of seeding and shall conform to the latest laws of the U.S. and the State of Wisconsin. Upon request, the Contractor shall furnish to the Engineer copies of the test results.
  - 2. Straw Mulch: Unless otherwise specified, mulch shall be straw, reasonably free of grain, weed, seed, and mold. Mulch materials shall not contain excessive moisture that might prevent feeding through a mulch blower machine. Other fibers may be used only upon approval by the Engineer.
  - 3. Filter Fabric: Filter fabric for inlet bags shall meet the requirements of the Wisconsin Department of Transportation Product Acceptability List for Inlet Protection, Type D, or equal, and shall be ultraviolet stabilized.
  - 4. Sediment Control (Silt) Fence: Sediment control fabric shall be woven or non-woven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride. For non-woven fabric the contractor may use needle punched, heat bonded, resin bonded, or combinations of all 3. Sediment control fence shall be made of Mirafi 100 sediment control fabric, backed by industrial polypropylene netting, manufactured by Dominion Textile Company, or equal. For other fabrics contractor shall submit a certificate of compliance certifying that the geotextile conforms to the latest version available on the website of the Wisconsin Department of Transportation Standard Specification for Highway and Structure Construction, Section 628. Posts used to support the fabric shall be at least two (2) inch by two (2) inch in cross-section.
  - 5. Double Sediment Control Barrier: Double sediment control barrier shall consist of a combination of sediment control fence and straw or hay bale erosion control barrier, with

31 25 00 Erosion and Sediment Control	
February 11, 2019 – Master	
Page 2 of 8	

the fence being installed on the upstream side of the bales. The bales used in the double sediment control barrier shall be either hay or straw, have rectangular surfaces, and be tightly bound with twine, not wire. The material in the bales shall be reasonably free of grain, weed, seed, and mold, and shall be dry and suitable for the purpose intended.

- 6. Construction Entrance Material: Material used in construction entrances shall be three (3) inch to six (6) clear crushed stone. All material shall be retained on a 3-inch sieve.
- 7. Straw or Straw/Coconut Fiber Erosion Control Mat: The straw or straw/coconut fiber erosion control mat shall be a biodegradable machine-produced mat from the latest edition of the Wisconsin Department of Transportation Product Acceptability List for Erosion Mat, Class I, Type B
- 8. Coconut Fiber Erosion Control Mat: The coconut fiber erosion control mat shall be a machine-produced 100% biodegradable mat with a 100% coconut fiber matrix listed under the latest edition of the Wisconsin Department of Transportation Product Acceptability List for Erosion Mat, Class II, Type B. The erosion mat shall be of consistent thickness with the coconut fiber evenly distributed over the entire area of the mat. The mat shall be covered on the top and bottom with photodegradable woven netting. The netting shall consist of photodegradable polypropylene square mesh openings of 5% inch to 3/4 inch dimension on each side. The blanket shall be sewn together with photodegradable polypropylene thread.
- 9. Erosion Control Polymer (Soil Stabilizer): Erosion control polymer shall be from the latest edition of the Wisconsin Department of Transportation Product Acceptability List for Soil Stabilizers, Type B. The polymer shall have no odor. The polymer shall be protected from ignition sources and contact with strong oxidizing agents and hear shall be avoided.
- 10. Temporary Ditch Checks (Wattles): Temporary ditch checks, also called wattles, shall be from the latest edition of the Wisconsin Department of Transportation Product Acceptability List for temporary ditch checks.

#### 2.2 ROCK AND GEOTEXTILE MATERIALS

- A. Materials provided under this section shall be in conformance with the requirements of NR 151 of the Wisconsin Administrative Code and Wisconsin Department of Natural Resources best management practices (BMPs).
- B. Rock : Sound, hard and angular shape; well graded; without shale seams, structural defects and foreign substances; with width and thickness greater than one third its length; minimum specific gravity of 2.5, as determined in accordance with AASHTO T-180 and ASTM C-127

#### 2.3 CONCRETE MATERIALS

- A. Furnish according to WisDOT Standards.
- B. Furnish according to WDNR NR-151 and WisDOT Standards: As specified in Paragraph 3.2 Seeding
- C. Mulch: As specified in Paragraph 3.3 Application of Straw Mulch

31 25 00 Erosion and Sediment Control
February 11, 2019 – Master
Page 3 of 8

#### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION

- A. Install Work according to WDNR NR-151 Standards for Site Stabilization
  - 1. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
  - 2. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
  - 3. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 14 days.
  - 4. Stabilize diversion channels, sediment traps, and stockpiles immediately.
- B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
- C. All activities on the site shall be conducted in a logical sequence to minimize the area of bare soil exposed at any one time.
- D. All disturbed ground left inactive for seven (7) or more days shall be stabilized by temporary seeding and mulching or by covering, or by other equivalent control measure.
- E. Water pumped from the site shall be treated by appropriate controls designed and used to remove particles of 100 microns or greater for the highest dewatering pumping rate. If the water is demonstrated to have no particles greater than 100 microns during dewatering operations, then no control is needed before discharge. Water may not be discharged in a manner that causes erosion of the site or receiving channels.
- F. The Contractor shall construct clear stone entrance pads to the construction site and shall take all other possible precautions to prevent sediment from being tracked onto public or private roadways. Any sediment reaching a public or private road shall be removed by street cleaning (not flushing) before the end of each workday and before any rainfall occurs.
- G. All storm drain or culvert inlets shall be protected with sediment control fences or equivalent barriers approved by the Engineer.
- H. Channelized runoff from adjacent areas passing through the site shall be diverted around disturbed areas when necessary. Sheet flow runoff from adjacent areas greater than 10,000 square feet in area shall also be diverted around disturbed areas. Diverted runoff shall be conveyed in a manner that will not erode the conveyance and receiving channels. (Note: Soil and Conservation Service guidelines for allowable velocities in different types of channels should be followed.)
- I. Sediment control fences or equivalent control measures shall be placed along all sideslope and downslope sides of the site where runoff can reach a surface water course, wetland, or as shown on the Plans or specified in the Special Conditions. If a channel or area of concentrated runoff passes through the site and is not diverted, sediment control fences shall be placed along the channel edges to reduce sediment reaching the channel.
- J. Any soil or dirt storage piles containing more than ten cubic yards of material should not be located with a downslope drainage length of less than 25 feet to a roadway or drainage channel.

31 25 00 Erosion and Sediment Control
February 11, 2019 – Master
Page 4 of 8

If remaining for more than seven (7) days, they shall be stabilized by mulching, vegetative cover, tarps, or other means. Erosion from piles, which will be in existence for less than seven (7) days, shall be controlled by placing hay bales or sediment control fence barriers around the pile. Instreet utility repair or construction soil, or dirt storage piles located closer than 25 feet to a roadway or drainage channel must be covered with tarps or a suitable alternative control must be used if exposed for more than seven (7) days, and storm drain or culvert inlets must be protected with straw bales or other appropriate filtering barriers.

#### 3.2 SEEDING

 A. Seeding, where used for erosion control, shall be temporary grass seed as follows: Before June 15 Annual Oats June 15 to September 15 Annual Ryegrass After September 15 Winter Wheat

- B. The Contractor shall apply the seed using a hydroseeder, a power-drawn drill, or spreader, or approved blower equipment with an adjustable disseminating device capable of maintaining a constant measurement rate of material discharge that will insure an even distribution of seed and fertilizer. Seed mixture shall be applied at the rates of 3 lbs/1,000 ft<sup>2</sup>.
- C. Seedbeds shall be maintained in a moist growing condition. When necessary, the Contractor shall soak the seedbed by sprinkling with water.

#### 3.3 APPLICATION OF STRAW MULCH

- A. The Contractor shall furnish, haul and evenly apply straw mulch at a rate not less than 1½ tons per acre to a loose depth of one (1) or two (2) inches. Mulch shall be placed loose and open enough to allow some sunlight to penetrate and air to circulate but still cover a minimum of 70% of the soil surface. The mulch spreading equipment shall utilize forced air to blow mulch material onto the seeded area, unless otherwise approved by the Engineer. Where mulch is used, alone, as a temporary cover, the rate of application shall be not less than three (3) tons per acre and shall cover a minimum of 80% of the soil surface.
- B. Unless otherwise designated the Contractor shall anchor the straw mulch by crimping so that the mulch is partially embedded in the soil.

## 3.4 PLACING STRAW OR HAY BALE BARRIERS AS PART OF DOUBLE SEDIMENT CONTROL BARRIER

- A. Sufficient bales shall be on the site to create the necessary barriers before the start of groundbreaking operations. The bales shall be stacked and covered with plastic sheeting until required for use.
- B. The bales shall be placed with the cut side of the bale downward, in a shallow trench excavated for that purpose. The bales shall be fixed in place using reinforcing rod or steel fence posts extending completely through the bale and driven at least 18 inches into the ground. Two (2) rods or posts shall be placed in each bale, one at each <sup>1</sup>/<sub>3</sub> point.

31 25 00 Erosion and Sediment Control	
February 11, 2019 – Master	
Page 5 of 8	
C. If a bale in a barrier is wholly or partially destroyed during the course of the project the Contractor shall, at its own expense, replace the bale with a fresh, unused bale.

# 3.5 CONSTRUCTION OF SEDIMENT CONTROL FENCE

- A. Sediment control fence shall be constructed according to the manufacturer's recommendations, the provisions of the Wisconsin Department of Natural Resources Conservation Practice Standard 1056, and generally as follows:
- B. Excavate a six inch by six inch (6"x 6") trench along the upslope perimeter of the fence location
- C. Unroll the fencing fabric a section at a time and position the posts against the downslope side of the trench, with the fabric on the upslope side of the posts. Drive the posts into the ground until the support netting is approximately two (2) inches from the trench bottom (the fabric should extend several inches below the netting.)
- D. Lay the toe-in flap of fabric onto the undisturbed trench bottom, backfill the trench and tamp the soil down firmly.

## 3.6 INSTALLING STRAW/COCONUT AND COCONUT FIBER EROSION CONTROL MAT

- A. Erosion control mat shall be installed according to the manufacturer's recommendations and generally as follows:
- B. Prepare soil before installing blankets, including any application of fertilizer and seed.
- C. Begin at the top of the channel by anchoring the blanket in a six (6) inch deep by six (6) inch wide trench with approximately 12 inches of blanket extended beyond the up-slope portion of the trench. Anchor the blanket with a row of staples/stakes approximately 12 inches apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12-inch portion of blanket back over seed and compacted soil. Secure blanket over compacted soil with a row of staples/stakes spaced approximately 12 inches apart across the width of the blanket.
- D. Roll center blanket in direction of water flow in bottom of channel. Blankets will unroll with appropriate side against the soil surface. All blankets must be securely fastened to the soil surface by placing staples/stakes in appropriate locations as recommended by the manufacturer.
- E. Place consecutive blankets end over end (shingle style) with a four (4) to six (6) inch overlap. Use a double row of staples staggered four (4) inches apart and four (4) inches on center to secure blankets.
- F. Full-length edge of blankets at top of side slope must be anchored with a row of staples/stakes approximately 12 inches apart in a six (6) inch deep by six (6) inch wide trench. Backfill and compact the trench after stapling.
- G. Adjacent blankets must be overlapped four (4) inches (depending on blanket type) and stapled.
- H. A staple check slot is required at 30 to 40 foot intervals. Use a double row of staples staggered four (4) inches apart and four (4) inches on center over entire width of the channel.

31 25 00 Erosion and Sediment Control
February 11, 2019 – Master
Page 6 of 8

- I. The terminal end of the blankets must be anchored with a row of staples/stakes approximately 12 inches apart in a six (6) inch deep by six (6) inch wide trench. Backfill and compact the trench after stapling. In loose soil conditions, the use of staples or stake lengths greater than six (6) inches may be necessary to property anchor the blankets.
- J. Rock Energy Dissipator: Rock shall be fully fractured to the sizes as noted on the details.
- K. Sediment Traps: Sediment traps shall be constructed by the Contractor as necessary to control sediment runoff from the worksite. Locations for all sedimentation basins shall be approved by the Owner or Engineer prior to construction.
- L. Sediment Traps: The Contractor shall construct sediment traps similar to the sediment pond requirements.
- M. Dust Control: The Contractor shall employ measures to reduce or prevent the surface and air transport of dust during construction. Dust control measures for construction activities include minimization of soil disturbance, applying mulch and establishing vegetation, water spraying, surface roughening, applying polymers, spray-on tackifiers, chlorides and barriers.

# 3.7 APPLICATION OF POLYMER (SOIL STABILIZER)

A. Polymer shall be evenly applied. Minimum application rates shall be as recommended by the manufacturer. Maximum application rates shall be less than the maximum rates allowed by the Department of Natural Resources, if applicable

# 3.8 DIVERSION CHANNELS

- A. Windrow excavated material on low side of channel.
- B. Compact to 95% maximum density.
- C. Install Work according to WDNR NR-151 Standards

## 3.9 ROCK ENERGY DISSIPATOR

- A. Excavate to indicated depth of rock lining or nominal placement thickness. Remove loose, unsuitable material below bottom of rock lining, then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface.
- B. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Overlap edges upstream over downstream and upslope over downslope. Provide a minimum overlap of 18 inches. Carefully place rock on geotextile fabric to produce an even distribution of pieces, with minimum of voids and without tearing geotextile.
- C. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and to avoid displacement of underlying material. Arrange individual rocks for uniform distribution.

31 25 00 Erosion and Sediment Control	
February 11, 2019 – Master	
Page 7 of 8	

## 3.10 FIELD QUALITY CONTROL

#### A. INSPECTIONS:

B. Contractor shall be responsible for all inspections of erosion control provisions from the beginning of the project to stabilization of all disturbed surfaces. Inspections of implemented erosion control best management practices must be performed weekly and within 24 hours after a precipitation event of 0.5 inches or greater which results in runoff. Department of Natural Resources form 3400-187 (Construction Site Inspection Report) shall be used. Inspect erosion control devices on a weekly basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

## 3.11 CLEANING

- A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.
- B. Do not damage structure or device during cleaning operations.
- C. Do not permit sediment to erode into construction or site areas or natural waterways.

## 3.12 MAINTENANCE AND REMOVAL

A. Contractor shall be responsible for maintaining all erosion control items in a functioning manner, replacement (as necessary), and removal of all items once the site has been fully stabilized.

END OF SECTION 31 25 00

31 25 00 Erosion and Sediment Control	
February 11, 2019 – Master	
Page 8 of 8	

# SECTION 32 05 00 – SOILS AND AGGREGATES AND EXTERIOR IMPROVEMENTS

# PART 1 - GENERAL

## 1.1 SUMMARY

- A. Description of Work Covered by This Section
- B. The Contractor shall provide the necessary soils, aggregates, geotextiles and other materials to construct earthwork, utilities, roadways and structures in the locations and depths shown on the Plans and Specifications.
- C. Section Includes:
  - 1. Coarse aggregate materials
  - 2. Fine aggregate materials
  - 3. Nonwoven geotextile material

#### 1.2 GENERAL REQUIREMENTS

- A. The Contractor shall provide the necessary materials, equipment and labor to construct, on the prepared road subgrade, a crushed aggregate base course, and shall construct such a base course in the locations and depths shown on the Plans and in these Specifications. Fine grading of the base course to the required tolerances is included in the scope of work under this section.
- B. On contracts under which the prepared roadbed or subbase has been substantially completed under a previous contract, any requirements of the specifications shall not be considered presumptive as to the character of the materials which may be encountered on the work to be performed under this section.
- C. When a bid proposal form refers to "crushed aggregate" or "crushed aggregate base course" it shall be taken to mean dense graded crushed aggregate base course.

#### 1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials
- B. ASTM International
- C. Wisconsin Department of Transportation (WisDOT) Standard Specifications for Highway and Structure Construction available at the time of bidding on the WisDOT website.

## 1.4 SUBMITTALS

A. Refer to Section 01 33 00 - Submittals

# 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with these Specifications and all applicable local, State and Federal regulations.
- B. Perform Work in accordance with WisDOT Standards.

# PART 2 - PRODUCTS

# 2.1 TOPSOIL MATERIALS

- A. Excavated and Reused Topsoil
  - 1. Graded.
  - 2. Free of roots, rocks larger than <sup>1</sup>/<sub>2</sub>-inch, subsoil, debris, large weeds and foreign matter.
- B. Imported Topsoil
  - 1. Friable loam.
  - 2. Completely free of roots, rocks larger than <sup>1</sup>/<sub>2</sub>-inch, subsoil, debris, large weeds, foreign matter, atrazine and any other similar chemicals harmful to plant growth.
  - 3. Reasonably free of weed seeds.
  - 4. Single screened.
  - 5. Acidity range (pH) of 5.5 to 7.5.
  - 6. Containing minimum of 4% and maximum of 25% inorganic matter.

# 2.2 CRUSHED AGGREGATE CHARACTERISTICS

- A. The material used for constructing crushed aggregate base coarse shall be hard, durable particles of virgin crushed stone or virgin crushed gravel and a filler of natural sand, stone sand, or other finely divided mineral matter. Unless specifically allowed in the Bid Proposal recycled materials shall not be used. Oversize material encountered in deposits from which the material is taken shall be removed by screening or shall be crushed to the required sizes. The composite material shall be free from organic matter, shale and lumps or balls of clay and shall meet the gradation requirements specified in Paragraph 2.2 of this section.
- B. The right is reserved to prohibit the use of crushed stone from limestone deposits having thinly bedded strata or strata of shale or to reject material from any source where the character of the material will not meet the applicable requirements.
- C. The aggregate, including any blended filler, shall have a liquid limit of not more than 25 and a plasticity index of no more than 6, except in the case of aggregates for base course placed between old and new pavements, where the plasticity index shall not exceed 3.

- D. At least 45% of the particles of aggregate retained on the No. 4 sieve shall have at least one (1) surface or face produced by the fracture of a larger particle.
- E. Aggregate shall have a percentage of wear of not more than 50, as determined by AASHTO Designation: T 96, unless otherwise noted.
- F. When the fraction of aggregate retained on the No. 4 sieve is subjected to five cycles of the sodium sulfate soundness test (AASHTO designation T104), the weighed loss shall not exceed 18% by weight.

#### 2.3 DENSE GRADED CRUSHED AGGREGATE MATERIALS

- A. Gradation Requirements <sup>3</sup>/<sub>4</sub>-Inch Crushed Aggregate
  - 1. The aggregates shall be well graded between the limits specified and unless otherwise specified, shall conform to the gradation requirements for <sup>3</sup>/<sub>4</sub>-inch dense graded base of the State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, most current edition Specification No. 305.2.2.1, as follows:
  - 2.

Sieve Size	Percent Passing, by weight
1-inch (25 mm)	100
<sup>3</sup> / <sub>4</sub> -inch (19 mm)	95 - 100
<sup>3</sup> / <sub>8</sub> -inch (9.5 mm)	50 - 90
No. 4 (4.75 mm)	35 - 70
No. 10 (2.00 mm)	15 - 55
No. 40 (425 μm)	10 - 35
No. 200(75 μm)	5 - 15

- 3. If filler is necessary in addition to that naturally present in the base coarse material for meeting the gradation requirement, or for satisfactory binding of the material, it shall be uniformly blended with the base course at the screening plant or on the road. The material obtained for such purpose shall be obtained from sources approved by the Engineer, shall be free from agglomerations or lumps, and shall contain not more than 15% of material retained on a No. 4 sieve.
- B. Gradation Requirements 1<sup>1</sup>/<sub>4</sub>-Inch Crushed Aggregate
  - 1. Where 1<sup>1</sup>/<sub>4</sub>-inch base course is specified the aggregate shall be well graded between the limits specified shall conform to the gradation requirements for 1<sup>1</sup>/<sub>4</sub>-inch dense graded base of the State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, most current edition, as follows:

	Percent Passing, by weight
$1\frac{1}{4}$ -inch (37.5 mm)	95 - 100
1-inch (25.0 mm)	-
<sup>3</sup> / <sub>4</sub> -inch (19.0 mm)	70 - 93
<sup>3</sup> / <sub>8</sub> -inch (9.5 mm)	42 - 80
No. 4 (4.75 mm)	25 - 63
No. 10 (2.00 mm)	16 - 48
No. 40 (425 μm)	8 - 28
No. 200(75 μm)	2 - 12

- C. Gradation Requirements Breaker Run with Fines
  - 1. The aggregate shall be Breaker Run, <u>with fines</u>, well graded between the limits specified, as follows:

Sieve Size		Percent Passing, by weight
3-inch		90 - 100
1 <sup>1</sup> / <sub>2</sub> -inch	(37.5 mm)	60 - 85
1-inch	(25.0 mm)	-
<sup>3</sup> / <sub>4</sub> -inch	(19.0 mm)	40 - 65
<sup>3</sup> / <sub>8</sub> -inch	(9.5 mm)	-
No. 4	(4.75 mm)	15 - 40
No. 10	(2.0 mm)	10 - 30
No. 40	(425 µm)	5 - 20
No. 200	(75 µm)	2 - 12

- D. Reclaimed, reprocessed or blended asphalt or concrete materials shall not be used as dense graded crushed aggregate materials.
- E. By-product materials, such as glass, slag, ash or pottery cull shall not be mixed into the crushed aggregate.
- 2.4 Open Graded Crushed Aggregate Materials Under Porous Asphalt
  - A. Gravel Filter Layers Furnish crushed stone or crushed gravel conforming to Specification Section 02232, except the gradation shall conform to ASTM No. 57, as follows:

Sieve Size	Percent Passing, by weight
1 <sup>1</sup> / <sub>2</sub> -inch	95 - 100
<sup>1</sup> /2-inch	25 - 60
No. 4	0 - 10
No. 8	0 - 5

B. Aggregate Storage Reservoir - Furnish crushed stone or crushed gravel conforming to Specification Section 02232, except the gradation shall conform to ASTM No. 3, as follows:

Sieve Size	Percent Passing, by weight
2 <sup>1</sup> / <sub>2</sub> -inch	100
2-inch	90 - 100
1 <sup>1</sup> / <sub>2</sub> -inch	35 - 70
1-inch	0 - 15
<sup>1</sup> /2-inch	0 - 5

- 2.5 Open Graded Crushed Aggregate Materials Under Permeable Concrete
  - A. Bedding or Choker Course Furnish crushed stone or crushed gravel conforming to Specification Section 02232, except the gradation shall conform to ASTM No. 8, as follows:

Sieve Size	Percent Passing, by weight
<sup>1</sup> / <sub>2</sub> -inch	100
<sup>3</sup> / <sub>8</sub> -inch	5 - 100
No. 4	10 - 30
No. 8	0 - 10
No. 16	0 - 5

B. Aggregate Storage Layer - Furnish crushed stone or crushed gravel conforming to Specification Section 02232, except the gradation shall conform to ASTM No. 57, as follows:

Sieve Size	Percent Passing, by weight
1 <sup>1</sup> / <sub>2</sub> -inch	95 - 100
<sup>1</sup> /2-inch	25 - 60
No. 4	0-10
No. 8	0 - 5

## 2.6 GEOTEXTILE MATERIALS

- A. Geotextile for areas below dense graded crushed aggregate base courses except Breaker Run shall be Mirafi 500X, or equal.
- B. Geotextile below Breaker Run shall be Mirafi 180N, or equal.
- C. Geotextile below open graded base courses where required shall be Mirafi 160N, or equal.

# 2.7 SOURCE QUALITY CONTROL

A. Source quality control shall comply with WisDOT Standard Specifications for Highway and Structure Construction, available at the time of bidding, on the WisDOT website.

# PART 3 - EXECUTION

# 3.1 AGGREGATE BASE COURSE PLACEMENT

- A. The Contractor shall place the crushed aggregate base material to the depth, line, and grade shown on the Plans. Contractor shall do his own "blue-top" staking to establish crown elevation. Engineer will <u>not</u> perform such staking.
- B. Base course placement shall be in conformance with the State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, most current edition available on the Department of Transportation website, except as modified below. The grade of the completed course shall at all points be within + or 0.04 feet of the grade shown on

the Plans, providing that the thickness of the course is at least that specified and there will not be more than a 5% total increase or decrease in the planned overlay asphalt or concrete thickness over the points measured. This includes fine grading in preparation for pavement construction. The Contractor shall maintain the prepared roadbed or subbase course ahead of the crushed aggregate base course laying operations in a smooth condition and at not less than the densities specified in paragraph 3.2, below. Any ruts or surface irregularities produced on the prepared road bed or subbase course by reason of traffic, hauling, poor drainage, unstable materials, or from any other cause, shall be corrected before crushed aggregate base course is placed. Snow or ice, if any, shall be removed from the prepared roadbed before the base course is placed. The base course Contractor shall coordinate with the paving Contractor and give written notice to the Engineer and paving Contractor at least seven (7) calendar days prior to acceptance of the base course. Once the base course is accepted by the Owner/Engineer, any damage to the base by traffic, poor drainage, or any other cause shall not be the responsibility of this Contractor. The repair of that damage shall be the responsibility of the paving Contractor.

- C. For open graded crushed aggregate materials compacted into layers not exceeding 8 inches. If using a pneumatic roller, do not exceed a compacted thickness of 6 inches per layer.
- D. If the required compacted depth of the dense graded crushed aggregate base course exceeds 12 inches, the base shall be constructed in two or more layers of approximately equal thickness. The <sup>3</sup>/<sub>4</sub>-inch and 1<sup>1</sup>/<sub>4</sub>-inch material shall be compacted in lifts not greater than 6 inches. The 3-inch material shall be compacted in lifts not greater than 9 inches. The base course material shall be deposited in such a manner as to minimize segregation and to facilitate spreading in a uniform layer of the required thickness. Excessive manipulation or mixing that causes segregation between the course and fine materials shall be avoided.
- E. The work shall generally proceed so that the hauling equipment will travel over previously placed material, and the hauling equipment shall be routed as uniformly as possible over all portions of the previously constructed courses or layers of the base course.
- F. The Contractor shall refer to Specification Section 33 05 13 Manholes and Structures and the Plan Detail sheet for manhole adjustment requirements. Manhole rims shall be tipped, if necessary, to match the slope of the finished pavement surface. Water valve boxes and curb boxes shall be adjusted by the Contractor after coordinating with the Owner.

# 3.2 COMPACTION

A. Base Course: The Contractor shall compact the base course to 95% of maximum density as determined by AASHTO Designation: T 99, Method C, with replacement of the fraction of material retained on the <sup>3</sup>/<sub>4</sub>-inch sieve with No. 4 to <sup>3</sup>/<sub>4</sub>-inch material.

# 3.3 ACCEPTANCE TESTING

A. The Engineer, if he questions the compliance with the material specification for the crushed aggregate base, may order the Contractor to demonstrate compliance by obtaining, at the Contractor's own expense, tests by an independent laboratory. Such tests shall be performed in accordance with the following AASHTO standard testing methods:

Sampling Aggregate	T 02
Material Finer Than No. 200	T 11
Sieve Analysis of Aggregates	T 27
Sieve Analysis of Mineral Filler	T 37
Liquid Limit of Soils	T 89
Plastic Limit of Soils, Plasticity Index of Soils	T 90
Los Angeles Abrasion of Coarse Aggregate	T 96
Specific Gravity and Absorption of Fine Aggregate	T 84
Specific Gravity and Absorption of Coarse Aggregate	T 85*
Soundness of Aggregates	T 104

\*As revised by the Department of Transportation Method T 85-1

- B. A test-roll of the fine graded and compacted base course will be required. This test-roll shall be performed with a fully loaded tri-axle dump truck (60,000 pound minimum gross weight) with the tag-wheels lifted, provided by the Contractor. The test-roll shall be performed on the entire length and width of the base course in the presence of the Engineer. Any deflection of the base course, wheel rutting, or cracking of the base will signify a failure of the base. The Engineer shall make the determination of base course acceptance or failure. In the case of failure, the Engineer shall determine the area and depth of undercut or other corrective action.
- C. If the Owner so desires, compaction tests may be taken. The Owner shall pay for the first set of such tests at locations to be designated by the Engineer. If these tests show that compaction in accordance with these specifications has not been achieved, the Contractor shall re-compact the areas designated by the Engineer at its own expense. The Contractor shall then pay for tests to be performed by an independent testing laboratory to verify compliance with the specifications.

# 3.4 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 Quality Requirements
- B. Refer to Section 01 70 00 Execution Requirements and Project Close-Out

# 3.5 **PROTECTION**

A. Refer to Section 01 70 00 – Execution Requirements and Project Close-Out

# END OF SECTION 32 05 00

# SECTION 32 12 16 - ASPHALT PAVING

# PART 1 - GENERAL

## 1.1 SUMMARY

- A. Description of Work Covered by This Section
  - 1. For construction of asphalt over an aggregate base course, the Contractor shall apply an asphaltic pavement consisting of a lower course and an upper course, placed on the prepared base course, to the thickness and cross-sections shown on the Plan Detail Sheets, and to the lines and grades shown on the Plans. Fine grading in preparation for paving will have been completed under Specification Section 32 05 00. Any repair of this fine grading due to damage by poor or excessive drainage, traffic, or other causes shall be part of this paving work.
  - 2. For asphalt overlay or wedging, the Contractor shall apply upper course over the prepared surface to the thickness specified in the Special Conditions or Bid Schedule.
  - 3. Manhole casting adjustment methods are described in Specification Section 33 05 13. The paving contractor shall turn valve boxes to finished grade as part of the paving work without extra payment.
  - 4. The Contractor shall conform to the requirements of the State of Wisconsin Department of Transportation (WisDOT) Standard Specifications for Highway and Structure Construction, most current edition, and all incorporated errata, annotated revisions, and subsequently issued supplemental specifications, except where this specification is stricter, except that verification testing is omitted, Owner density testing in the field and the related incentives and disincentives shall be omitted, binder and tack coat sampling and testing shall be omitted, ride quality testing shall be omitted.
  - 5. The Contractor shall provide and apply an asphaltic tack coat on all existing asphaltic surfaces. The Contractor shall conform to the requirements of the State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, most current edition, and all incorporated errata, annotated revisions, and subsequently issued supplemental specifications, unless the requirements set forth elsewhere in this section are more stringent.
  - 6. The Engineer may elect to enforce the most stringent testing requirements in these specifications regardless of the tonnage placed under the project.
- B. Section Includes:
  - 1. Asphalt materials.
  - 2. Aggregate materials.
  - 3. Asphalt paving base course, binder course, and wearing course.
  - 4. Tack Coat

## 1.2 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials
- B. Asphalt Institute
- C. ASTM International
- D. Wisconsin Department of Transportation (WisDOT Standards) Standard Specifications for Highway and Structure Construction available on the WisDOT website.

#### 1.3 SUBMITTALS

- A. Refer to Section 01 33 00 Submittals
- B. Product Data:
  - 1. Submit product information for asphalt, aggregate and tack coat materials.
  - 2. Submit mix design with laboratory test results supporting design.
  - 3. The formula shall have been derived from tests performed and approved by Wisconsin Department of Transportation within the previous 12 months. A previous mix design using the same aggregates from the same source and using the same brand and type of asphaltic material may be used with the approval of the Engineer. The tests shall have been performed by a qualified, certified testing laboratory.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 Execution Requirements and Project Closeout.
- B. Project Record Documents: Refer to Article 7.11 in Section 00 70 00 General Conditions

## 1.5 QUALITY ASSURANCE

- A. Mixing Plant: Conform to WisDOT Standards
- B. Obtain materials from same source throughout.
- C. Perform Work in accordance with WisDOT Standards.

# PART 2 - PRODUCTS

# 2.1 MATERIALS AND EQUIPMENT

- A. Asphaltic Concrete
  - 1. Unless otherwise specified in the Special Conditions or the Measurement and Payment specification section, the asphaltic materials used in or north of the following counties shall

32 12 16 Asphalt Paving
November 13, 2017 – Master
Page 2 of 8

be LT 58-34S: Trempealeau, Jackson, Clark, Taylor, Lincoln, Langlade, Menominee and Oconto, and shall be LT 58-28S south of the counties listed above.

- B. Lower Course Aggregate
  - 1. Unless otherwise specified in the Special Conditions or Measurement and Payment section of the specifications the Contractor shall use hard, durable angular crushed stone conforming to the gradation requirements for nominal 12.5 millimeter aggregate size as specified under the appropriate section of the Wisconsin Standard Specifications for Highway and Structure Construction, latest edition.
- C. Upper Course or Surface Course Aggregates
  - 1. Unless otherwise specified in the Special Conditions or Measurement and Payment section of the specifications the Contractor shall use hard, durable angular crushed stone, which, including mineral filler, shall conform to the gradation requirements for nominal 9.5 millimeter aggregate size as specified under the appropriate section of the Wisconsin Specifications for Highway and Structure Construction, latest edition.
- D. Tack Coat
  - 1. The tack coat shall be emulsified asphalt, conforming to AASHTO Designation, M140 or M208, as appropriate. The tack coat shall be SS-1, SS-1h, or CSS-1h with the asphalt emulsion diluted with equal parts water.
- E. Recycled Asphaltic Materials
  - 1. The mix shall contain no more of such materials than allowed by the appropriate section of the Wisconsin Specifications for Highway and Structure Construction, latest edition.
- F. Tack Coat Equipment
  - 1. The Contractor shall furnish and use a pressure distributor capable of applying tack material uniformly, without atomization. He shall provide all tools as necessary to complete the work.
- G. Paving Equipment
  - 1. The Contractor shall use hauling, paving and compacting equipment, as specified in the appropriate section of the WisDOT Standards as referenced above.

# PART 3 - EXECUTION

# 3.1 CONSTRUCTION

- A. Fine Grading
  - 1. The Contractor shall repair, as necessary, fine-graded unpaved surfaces to the grade shown on the Plans before paving operations begin. Fine grading will have been completed previously in accordance with Section 32 05 00 of these Specifications. Any repair due to traffic, poor or excessive drainage, or other causes shall be the responsibility of the Asphalt Paving Contractor. Soft spots shall be excavated and such cavities and other holes or depressions filled with crushed aggregate base course in accordance with Section 32 05 00 of these Specifications.

# B. Tack Coat

- 1. Construction Methods: The Contractor shall place tack coat in a single operation, but only during daylight hours when the air temperature is 40° Fahrenheit or more and only upon a prepared, existing pavement which is dry and free of loosen dirt, dust or other foreign matter. The tack coat shall not be applied when it appears probable that the surface may be exposed to moisture during the penetration period. Immediately prior to the application of tack coat the prepared base shall be thoroughly swept with a power broom to remove dust and loose dirt. Care shall be taken to avoid overlapping of joints.
- 2. Heating and Applying Tack Coat Materials: Application Rate: The asphaltic materials shall be heated and applied by equipment suitable for that purpose. The rate of application shall be 0.05 to 0.15 gallons per square yard, with a target application rate of 0.10 gallons per square yard. The amount shall be sufficient to wet, but not flood the surface.
- 3. Protection of Surfaces: The Contractor shall protect all adjacent surfaces, including curb and gutter, by some method satisfactory to the Engineer, to prevent their being spattered or disfigured by tacking operations. Traffic shall not be permitted on the tack coat until paving has occurred or for a period of time sufficient to allow the tack coat to penetrate and/or evaporate so that vehicles and pedestrians are not spattered. One line of the street shall remain open and untacked at all times. The work shall be properly protected by barricades and flagmen to prevent damage to freshly placed tack coat.
- 4. Drying Time: Daily application of the tack coat shall be limited to approximately that area of surface which can reasonably be expected to be paved during the same day. The area tacked shall not be paved until a period sufficient to allow for proper penetration and curing has elapsed.
- 5. Correction of Deficient Work: Any areas containing an excess or deficiency of asphaltic material and any breaks, reveled spots or other unsatisfactory areas in the tack coat shall be corrected prior to paving by the Contractor at his own expense.
- C. Paving Prerequisites
  - 1. The Contractor shall place asphaltic paving mixture only on a prepared, firm, and compacted base or foundation course, substantially surface -dry and free and clear of loose and foreign material. The Contractor shall incorporate loose aggregate existing on the roadbed into shoulder construction, if any, or dispose of such aggregates as directed by the Engineer.
  - 2. Holes and depressions in existing paved surfaces which are to be overlaid shall be prepared by removing all loose and defective material from the hole or depression and replacing with a hot-mix asphalt patching material, compacted to produce a tight surface conforming to the adjacent area.
  - 3. If any repair work in the fine graded surface is necessary, the Contractor shall proof-roll prepared surfaces to check for unstable areas requiring additional compaction. If the Contractor finds such areas, notification of these unsatisfactory conditions to the Engineer shall be made and paving work shall not begin until such conditions have been corrected.
  - 4. The Contractor shall not place asphaltic paving mixtures during the calendar period from October 15 to May 1, of the next succeeding year, regardless of temperature, except with the written authorization of the Owner or the Engineer.
  - 5. Immediately prior to paving, the Contractor shall saw cut all intersecting streets and adjacent pavements to form a straight, vertical joint line.
  - 6. Asphaltic paving mixtures shall not be placed over frozen subgrade or base or where the roadbed underlying the foundation or base is temporarily unstable from the effects of frost heaving.

- 7. The Contractor shall not place asphaltic paving mixtures when it is raining or snowing; any mixture exposed to rain or snow before final rolling which has, in the judgment of the Engineer, been adversely affected thereby, shall be removed and replaced at the Contractor's expense.
- 8. The Contractor shall not place asphaltic paving mixtures when the air temperature at the site of work, approximately three (3) feet above the ground in the shade and away from the effects of artificial heat is less than 36° F. The Contractor may place lower layer mixtures at a lower temperature with the Engineer's written approval.
- D. Preparation and Transport of the Mixture
  - 1. The paving mixture shall be composed of a homogeneous mixture of coarse and fine aggregate, mineral filler (when required), and asphalt cement heated to the proper viscosity for uniform distribution throughout the mixture.
  - 2. Aggregates shall be fed uniformly to the plant so that surpluses and shortages will not occur, thereby causing breaks in the continuous operation. The aggregate shall be heated to provide a paving mixture temperature immediately after mixing of 300oF, plus or minus 150. Mixing time shall be sufficient to provide uniformly coated aggregate.
  - 3. Contractor shall deliver the mixture to the paver receiving hopper at a temperature no lower than 275°F (135°C). Contractor shall cover all loads during transport in periods of inclement weather or when the ambient temperature falls below 65°F (18°C).
  - 4. The Engineer may reject asphaltic paving mixture not sufficiently mixed or defective in any manner.
- E. Spreading and Finishing
  - 1. The Contractor shall place the asphaltic mixtures by use of self-propelled spreading and finishing machines conforming to the specified requirements to the thicknesses shown on the Plans. The compacted thickness of individual lower courses shall not be greater than three (3) inches nor less than 1<sup>3</sup>/<sub>4</sub> inches. The compacted thickness of individual surface courses shall not be greater than 2 inches nor less than 1<sup>1</sup>/<sub>2</sub> inches.
  - 2. The operating speed of the paving machine when it is placing the asphaltic mixtures shall be consistent and shall not exceed that speed which is appropriate for the type of paver and type of mixture to produce a uniformly spread and struck-off layer having a dense, smooth texture without any tearing or segregation of the material, and without rolls or bumps in the surface. The speed shall coincide as closely as possible with the rate of delivery of the asphaltic mixture to provide, as nearly as possible, a continuous paving operation. The speed of the paver shall be subject to the approval of the Engineer.
  - 3. Spreading and finishing shall be in accordance with the requirements of the appropriate section of the WisDOT Standards, latest edition.
- F. Compaction
  - 1. The Contractor shall compact the course thoroughly and uniformly by rolling after spreading and strike-off. The initial rolling shall begin as soon as practical after the mixture is spread but not until the mixture will bear the roller weight without displacement, hair-cracking, or checking. The roller speed shall be slow enough to avoid undue displacement of the mixture. Keep roller wheels moistened to keep the mixture from sticking to them, without using excessive water. Rolling shall begin at the sides and proceed longitudinally parallel to the road centerline, each trip overlapping the previous trip and progressing to the crown of the road, except that when paving abuts a previously placed strip, the longitudinal joint shall be rolled first.

- 2. The Contractor shall compact with hot hand tampers or vibratory compactors in areas inaccessible to rollers. The Contractor shall not use pneumatic tire rollers for rolling of driveways and other areas where roller tire marks will not roll out smooth.
- 3. The Contractor shall check the surface after the initial rolling and shall repair displaced areas by loosening and filling, if required, with hot material. Following initial rolling and while the mixture has been compacted to the degree that no further appreciable consolidation is evidenced under the action of the compaction equipment.
- 4. The Contractor shall perform finish rolling while the mixture is still warm enough for removal of roller marks, and shall continue rolling until all roller marks are eliminated.
- 5. The lower course shall be compacted to 91½% Laboratory Density as determined by the nuclear density tests performed by a nuclear density technician certified at Level 1 and provided by the Contractor. Where a lower course is constructed directly over base course the compaction shall be 89½% density determined by the same test. The surface course shall be compacted to 91½% density determined by the same test. There will be no incentive pay adjustment for densities above the minimum specified.
- G. Joints
  - 1. The placing of any course or layer thereof shall be as nearly continuous as possible without joints. The Contractor shall not roll the unprotected end of the freshly laid mixture unless placement is discontinued long enough to permit the mixture to cool. The Contractor shall make joints between old and new pavement and between fresh and previously cooled work so as to ensure bonding for the full depth of the course or layer. When laying is resumed, the Contractor shall clean the contact surfaces and apply emulsified asphalt tack coat. Joints for continuing work shall be formed by cutting back on the previous run so as to expose the full depth of the course or layer with a ½- to 1-inch vertical notch being created at the top of tapers on all layers. When a new mat is adjoining an old mat, the joint shall be formed by sawcutting the old mat on a straight line to provide a butt joint for the full depth of the new mat. The surface of the two courses or layers shall be co-planer across the joint.
- H. Surface Requirements
  - 1. The finished surfaces shall be smooth and true. The Contractor shall test surfaces by means of a 10 foot straightedge laid parallel to the centerline of the road. Irregularities in the binder course surface which vary in excess of <sup>1</sup>/<sub>4</sub>-inch from the lower edge of the straightedge between any two contact points shall be corrected.
  - 2. Irregularities in the surface course that vary in excess of <sup>1</sup>/<sub>8</sub>-inch from the lower edge of the straightedge between any two contact points shall be corrected.
- I. Asphalt Paving Overlay and Asphalt Wedging
  - 1. Holes and depressions in existing paved surfaces which are to be overlaid shall be prepared by removing all loose and defective material from the hole or depression and replacing with an asphalt-aggregate patching material, compacted to produce a tight surface conforming to the adjacent area.
  - 2. The entire surface to be overlaid shall be thoroughly cleaned with a power broom.
  - 3. The Contractor shall proof-roll prepared surfaces to check for unstable areas requiring additional compaction. If the Contractor finds such areas he shall notify the Engineer of these unsatisfactory conditions and shall not begin paving work until such conditions have been corrected.
  - 4. Place wearing course to compacted thickness identified in the Special Conditions or Bid Schedule.



- 5. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
- 6. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- 7. The finished cross-section of the pavement shall have a slope as near as possible to 2%, from center of pavement to the edge, unless otherwise specifically approved by the Engineer or shown on the plans.
- 8. The edges of wedged areas shall be feathered to blend with the existing pavement. These two surfaces shall be co-planer across the joint so that water will drain from the center of the roadway to the edge rather than standing at the joint or running longitudinally down the roadway.

# J. Curbs

- 1. Install extruded asphalt curbs as indicated on the Plans
- K. Maintenance
  - 1. Maintain and protect the work during the various stages of construction until the final acceptance. Any rich or bleeding areas, any breaks, raveled spots, or other unsatisfactory areas in the wearing surfaces shall be corrected during such maintenance period.
- L. Traffic; Protection of Work
  - 1. One lane of traffic shall be maintained on the street at all times. Access to private driveways shall not be prevented for more than one 24 hour period. Property owners shall be notified one day in advance of periods of restricted access.
  - 2. The work shall be properly protected by barricades, flares, and flagmen to prevent damage to freshly placed asphalt until the pavement has cooled and hardened, and to prevent damage to vehicles.
- M. Alley and Driveway
  - 1. All requirements for grading, compaction and supplementing the base course that are set forth herein for the roadway, also apply to alleys and driveways, and for pavement construction shown on the Plans or specified to be paved.
- N. Acceptance Testing
  - 1. For all projects, the Contractor shall provide to the Engineer a sample of the job mix to be kept for future testing if required. The sample shall be of sufficient size to measure asphalt content, aggregate gradation, and volumetrics. The sample shall be taken from the actual mix delivered to the job site.
  - 2. When so determined by the Engineer or the Owner's Authorized Representative the Contractor shall cut samples from the finished pavement at locations selected by the Engineer and restore the surface with new compacted material. The samples shall be tested by a recognized testing laboratory approved by the Engineer for pavement thickness, pavement density, asphalt content, and aggregate gradation. Samples shall extend the full depth of the pavement and shall be not less than 65 square inches.
  - 3. One sample may be required from each day's run. The cutting of the sample, restoration of the surface and testing of the sample shall be incidental to the contract unit price for asphaltic concrete paving.
  - 4. For all projects, the Contractor shall submit test results for the mixtures used from the manufacturer's Quality Management Program. Such tests shall be performed under the

32 12 16 Asphalt Paving	
November 13, 2017 – Master	
Page 7 of 8	

supervision of a Certified Asphaltic Technician. Such tests shall include aggregate gradation, percent asphalt content, and air voids.

- O. Guarantee
  - 1. The Contractor shall guarantee all materials and workmanship for one year from the date of approval of the final payment request by the Owner. This guarantee shall cover, but not be limited to, edge cracking, block cracking and raveling. Defects appearing within that period shall be corrected by the Contractor at his own expense.

## 3.2 PREPARATION

A. Prepare subbase in accordance with WisDOT Standards

## 3.3 DEMOLITION

- A. Saw cut and notch existing paving as shown on the Plans or as required by the Engineer.
- B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.
- C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

## 3.4 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 Quality Requirements
- B. Refer to Section 01 70 00 Execution Requirements and Project Close-Out

#### 3.5 **PROTECTION**

A. Refer to Section 01 70 00 – Execution Requirements and Project Close-Out

#### END OF SECTION 32 12 16

# SECTION 32 16 23 - SIDEWALKS

# PART 1 - GENERAL

## 1.1 SUMMARY

- A. Description of Work Covered by This Section
- B. This section describes the methods by which and the materials from which the Contractor shall construct concrete sidewalks. Included in this work is the construction of sidewalk ramps with surface corrugations and thickened sidewalk sections at alleys and driveways.
- C. The Contractor shall construct sidewalk ramps in accordance with Section 66.616 of Wisconsin Statutes and any applicable standards of the municipality.
- D. This section covers framework for cast-in-place concrete, including shoring for concrete work and installation into the formwork of items furnished under other Sections of these specifications such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, and other accessory items embedded in the concrete.
- E. This section describes concrete accessories, such as curing compounds, to be used and the methods to be followed in such use.
- F. Section Includes:
- G. Formwork for concrete sidewalks.
- H. Concrete paving for sidewalks.
- I. Curing and finishing concrete sidewalks.

#### 1.2 FORMWORK - CODES AND STANDARDS

A. Unless otherwise indicated in the Special Conditions the Contractor shall comply with the American Concrete Institute (ACI) Standard 347, "Recommended Practice for Concrete Formwork".

#### 1.3 FORMWORK - DESIGN

A. Design of formwork, shoring and accessories shall be the responsibility of the Contractor. He shall design, erect, support and maintain formwork to safely support all vertical and lateral loads until such loads can be supported by the concrete structure, as determined in accordance with ACI 347.

32 16 23 Sidewalks
November 27, 2017 – Municipal Master
Page 1 of 8

#### 1.4 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials
- B. American Concrete Institute
- C. ASTM International
- D. Wisconsin Department of Transportation (WisDOT Standards) Standard Specifications for Highway and Structure Construction available on the WisDOT website

#### 1.5 PREINSTALLATION MEETINGS

A. A.Refer to Article 2.04 in Section 00 70 00 – General Conditions.

#### 1.6 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals

## 1.7 QUALITY ASSURANCE

- A. Perform Work according to Section 03 30 01 Cast-in-place Concrete Municipal
- B. Perform work in accordance with these Specifications and all applicable local, State and Federal regulations.

# PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Forms The forms used in constructing sidewalk shall be made of steel, plastic or wood and shall be of sufficient size and strength to resist movement during placement of concrete and to retain alignment and grade. Straight section wood forms shall be at least two (2) inches in nominal thickness. Curved sections of sidewalk shall be constructed using flexible spring steel forms or laminated boards.
- B. Gravel Base Gravel used for base under sidewalks shall be <sup>3</sup>/<sub>4</sub> inch dense graded base as specified in Section 301 of the WisDOT Standards, as set forth on the Department of Transportation website.
- C. Concrete Concrete shall be Class BB, as specified in Section 03 30 01 of these specifications.
- D. Expansion Joint Filler Expansion joints shall be created using pre-molded joint filler, bituminous fiber type or asphalt impregnated type, ASTM D1751. The filler material shall be three-quarters (<sup>3</sup>/<sub>4</sub>) of an inch in thickness and of sufficient size to provide a continuous joint

<b>32 16 23 Sidewalks</b>
November 27, 2017 – Municipal Master
Page 2 of 8

from the top surface to the bottom surface of the sidewalk and from one side of the walk to the other.

- E. Curing Compound
  - 1. The compound shall be such that the coating formed by its application on concrete surfaces will provide an effective seal for at least 10 days. It shall adhere firmly to concrete, either partially set or hardened, and shall be ready-mixed for immediate use without alteration other than stirring.
  - 2. Liquid membrane-forming compounds used for curing concrete under normal conditions shall conform to ASTM C309 or AASHTO M148, and shall be one of the following, or approved equal:
    - a. Horn Clear Seal W. R. Grace Construction Products
    - b. Sealtite Cure and Seal CS309 W. R. Meadows, Inc.
    - c. Eucocure Euclid Chemical Company
    - d. Kure-N-Seal Sonneborn Building Products
    - e. L & M Cure L & M Construction Chemicals, Inc.
- F. Forms for Exposed Finish Concrete Unless otherwise designated, the Contractor shall construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood, or other panel type acceptable to the Engineer. The forms shall provide continuous, straight, smooth surfaces. The Contractor shall furnish panels in the largest practicable sizes to minimize the number of joints. He shall provide form material of sufficient stiffness to withstand pressure of newly placed concrete without bow or deflection. When using board formwork for architectural pattern finish, the Contractor shall replace all boards with tie holes before each reuse.
- G. Plywood Forms Form plywood shall be Douglas Fir, 5 ply "Plyform", mill treated, edge sealed, water resistant plywood made for this purpose, free of loose knots, splits, checks, or excessive raised grain.
- H. Form Coating Compounds Form coating compounds shall be commercial formulations that will not bond with, stain, nor adversely affect in other ways the concrete surfaces. Form coating compounds shall not impede the wetting of surfaces to be cured with water or curing compounds. Forms for concrete surfaces requiring subsequent treatment shall receive a type of coating that will not impair bond or adhesion. Form oil used on steel forms shall be nonstaining, rust preventative type.
- I. Moisture-Retaining Cover When curing and sealing compounds are not used the Contractor shall provide one of the following moisture-retaining covers which comply with ASTM C171:
  - 1. Waterproof paper
  - 2. Polyethylene film
  - 3. Polyethylene-coated burlap
- J. Truncated Dome Warning Plates Truncated Dome Warning Plates shall be unpainted 24" x 36" gray cast iron detectable warning plates for embedment in sidewalk ramps in accordance with Section 4.29 of the ADA Accessibility Guidelines. The cast iron shall conform to ASTM A-48, Class 30A minimum. The plates shall have 0.2-inch high truncated domes with a base diameter of 0.9 inches to 1.4 inches, and a top diameter of 50% to 65% of the base diameter. These domes shall be located at a center-to-center spacing of 1.6 inches to 2.4 inches, and a

32 16 23 Sidewalks	
November 27, 2017 – Municipal Master	
Page 3 of 8	

minimum base-to-base spacing of 0.65 inches in a square grid pattern. The plates shall be as provided by Neenah Foundry Company.

## 2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Testing: Comply with ASTM C94.

# PART 3 - EXECUTION

# 3.1 CONSTRUCTION

- A. Removal of Obstructions Clearing and Grubbing
  - 1. The Contractor shall remove all old sidewalk, curb and gutter, driveways, pavements, drains, trees, shrubs and any other items necessary to allow construction of the new sidewalks.
  - 2. Tree roots shall be removed to a depth of 12 inches below the bottom of the sidewalk sand or gravel base materials and shall be cut at a point at least 12 inches horizontally from the finished edge of the sidewalk. Holes left from the removal of trees or obstructions shall be backfilled with sand and shall be thoroughly compacted and moistened before concrete is placed. All removed trees and obstructions shall be disposed of at a location outside the project area, such location and manner of disposal being acceptable to the Owner and in conformance with applicable solid waste disposal regulations.
- B. Excavation, Backfilling, and Grading
  - 1. The Contractor shall excavate or backfill as necessary to meet the line and grades established in the field by the Owner, shown on the Plans, defined in the Special Conditions, or defined in these specifications. All existing sod, pavements, and other surface materials obviously unsuitable for subgrade materials shall properly be removed and disposed. The Contractor shall notify the Engineer at least three working days in advance of his need for lines and grades. Where lines and grades are staked in the field stakes will be provided at an offset convenient for the Contractor at 50-foot intervals. Where curb & gutter exists, the top of curb shall be used for grade.
  - 2. The costs of excavation and backfill shall be incidental to the unit bid price for concrete sidewalk being constructed in that location, unless the materials being excavated are being removed after the surface sod, pavements, etc., have been removed, are below the subgrade, are unsuitable for subgrade materials and are ordered removed by the Engineer. In such cases, an extra payment shall be negotiated as provided in the General Conditions.
  - 3. Obstructions shown on the Plans or visible from the ground surface prior to clearing and grubbing and which can reasonably be expected to be removed in order for construction of new sidewalk will not be basis for extra payment. Nor will extra payment be allowed for excavations below grade or for backfill materials required to fill such excavations when such excavation is caused by negligence of the Contractor.

November 27, 2017 – Municipal Master	32 16 23 Sidewalks	
November 27, 2017 – Wumeipar Waster	November 27, 2017 – Municipal Master	
Page 4 of 8	Page 4 of 8	

- 4. Backfilling shall be accomplished by placing approved backfill materials in lifts not to exceed 12 inches. Each lift shall be mechanically compacted to a density greater than or equal to 95% of maximum density as determined by the Modified Proctor test or by AASHTO Designation: T99, Method C, with replacement of the fraction of material on the <sup>3</sup>/<sub>4</sub>-inch sieve with No. 4 to <sup>3</sup>/<sub>4</sub>-inch material. The Owner shall pay for the first series of compaction tests, if such tests are ordered by the Engineer. If the compaction tests fail the Contractor shall recompact those areas and shall pay for the compaction tests on the recompacted areas.
- 5. After completion of necessary excavation and/or backfilling the Contractor shall grade the subgrade to within one inch of established grade and the area between the sidewalk and the adjacent property line shall be shaped to line, grade and section shown on the Plans, in the details at the end of this section, or defined in the Special Conditions. He shall remove all loose material from the subgrade, proof roll the subbase to check for unstable areas needing additional compaction and shall furnish the compacted subgrade to a true, uniform and smooth surface. Unless a payment item is provided for restoration all work in the boulevard area or in the area between the sidewalk and the adjacent property line shall be incidental to the payment for sidewalk.
- C. Base Preparation
  - 1. The Contractorshall provide a crushed aggregate base to a minimum six (6) inch thickness for all sidewalks, unless otherwise shown on the Plans or specified in the Special Conditions. These materials shall be compacted as required for backfill in the previous subsection and shall be fine graded to the established grade. Any valve or curb stop boxes, catch basins, manholes or other utility appurtenances which exist within the limits of the sidewalk construction shall be adjusted to the finished grade at no extra cost so that the new construction will not interfere with the proper operation of the facility.
  - 2. The base shall be thoroughly dampened before the time the concrete is placed. It is the sole responsibility of the Contractor to arrange for the water necessary for such dampening. No extra payment will be made for water or for the dampening process.
- D. Form Construction
  - 1. The Contractor shall set the forms to the required grades and lines, rigidly brace the forms, and secure them. Where the Owner selects to provide no line and grade, such as in cases where individual sections of existing walks are being replaced, it is the Contractor's sole responsibility to establish his own line and grade to construct the sidewalk in such a manner as to blend, both horizontally and vertically, with the existing walks or pavements.
  - 2. Unless otherwise shown on the Plans or specified or ordered by the Engineer ,where the new sidewalk is being constructed adjacent to a street with existing curb and gutter the sidewalk shall be constructed at a grade at the front of the walk 0.3 foot higher than the grade of the top of the curb.
  - 3. Tolerances for formwork grade and alignment, and for the resulting finished sidewalk, from the established line and grade, from 0.3 foot above the adjacent top of curb, or from the existing walks or pavements with which the new sidewalk is being blended shall be as follows:

a.	Alignment and Grade Tolerance	-	Less than or equal to <sup>1</sup> / <sub>4</sub> -inch
b.	Surface Variation	-	Less than or equal to <sup>1</sup> / <sub>4</sub> -inch in 10 feet
c.	Vertical and /or Horizontal	-	Less than or equal to <sup>1</sup> / <sub>4</sub> -inch

32 16 23 Sidewalks November 27, 2017 – Municipal Master Page 5 of 8

- 4. Joint Displacement With Reference to Existing Walks or Pavements- Variations greater than those specified above shall be grounds for rejection of the work. Rejected work shall be removed and replaced by the Contractor at no cost to the Owner.
- 5. Unless otherwise shown on the Plans, where new sidewalks are being constructed adjacent to a street, the forms shall be set and the sidewalk constructed with a transverse slope of <sup>1</sup>/<sub>4</sub>-inch per foot, toward the street side of the walk.
- 6. Formwork shall be properly braced or tied together so as to maintain position and shape and insure safety to workman and passersby.
- 7. The Contractor shall coat steel forms with form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.
- 8. The Contractor shall coat the surfaces of forms which will contact the concrete to be poured with form coating compound before concrete is placed. He shall not allow excess form coating material to accumulate in the forms or to come into contact with existing concrete against which fresh concrete will be placed. He shall apply form coatings in compliance with the instructions of the manufacturer of the coating compound.
- 9. The Contractor shall clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing materials are not acceptable for re-use. The Contractor shall apply new form coating compound to concrete surfaces of forms to be re-used, just as is specified herein for new framework.
- 10. The Contractor shall assemble forms so their removal will not damage the concrete.

# E. Joints

- 1. The Contractor shall construct weakened plane (contraction), expansion and construction joints with faces perpendicular to the sidewalk surface and transverse (at right angles) to the centerline of the walk, unless otherwise shown on the Plans or specified in the Special Conditions.
- 2. The Contractor shall provide expansion joints at not more than 96-foot centers and as shown on the plan detail sheets. Joint fillers shall extend the full width and depth of the joint, terminating not less than two (2) inches nor more than one (1) inch below the top surface of the finished sidewalk. On the sides of the walk, the joint filler shall be trimmed even with the concrete.
- 3. Joint fillers shall be provided in one-piece lengths, except as approved by the Engineer. Where more than one piece of joint filler is allowed the Contractor shall lace or clip together the sections of the filler.
- 4. Weakened plane (contraction) joints shall be formed by grooving the fresh concrete to a depth of at least <sup>1</sup>/<sub>4</sub> of the walk thickness with a cutting tool. Transverse joints, either weakened place or expansion, shall be spaced at five foot centers.
- 5. Joints shall be matched to joints in adjacent driveways and curbs.
- F. Concrete Thickness and Placement
  - 1. Sidewalk thickness is shown on the Plan Detail Sheets, in the Special Conditions, Measurement and Payment Section, or in the Bid Proposal.
  - 2. Concrete shall be placed and cured in accordance with the requirements of Section 03 30 01 Cast In Place Concrete Municipal of these specifications. The Contractor shall also comply with the provisions of that section and with Subsection 2.1C of this section with regard to proportioning, mixing, and testing. The Contractorshall not place the concrete until the subgrade and forms have been checked for line and grade. He shall moisten the subgrade as required to provide a uniform dampened condition at the time the concrete is placed.

32 16 23 Sidewalks
November 27, 2017 – Municipal Master
Page 6 of 8

- 3. The Contractor shall spread the concrete uniformly between the forms and shall strike it off and thoroughly compact it with a steel shod strikeboard.
- G. Finishing Concrete
  - 1. After the concrete has been thoroughly compacted and leveled, it shall be floated with wood or metal floats to smooth the surface and to eliminate irregularities and honeycombed areas. The surface shall be tested for trueness with a 10 foot straightedge.
  - 2. Joints shall be edged with a <sup>1</sup>/<sub>8</sub> to <sup>1</sup>/<sub>4</sub>-inch radius edger. Sidewalk edges shall be tooled with a <sup>1</sup>/<sub>4</sub> to 2-inch radius edger.
  - 3. The Contractor shall then create a brushed finish using a fiber-haired brush drawn transversely to the centerline of the sidewalk, except at driveway and alley crossings where the brush finish shall be longitudinal to the centerline of the walk.
  - 4. The Contractor shall wet cure or cure finish the concrete with a white pigmented curing compound meeting the requirements or Subsection 2.1E.
- H. Curb Ramps
  - 1. The Contractor shall construct curb ramps at all intersections. Such ramps shall be Type 1, as shown on the ramp detail on the plans in all areas where the distance from the back of the curb to the back of the sidewalk is less than 12 feet. Type 2 curb ramps as shown on the plans shall be constructed in all areas where the distance from the back of the curb to the back of the sidewalk is 12 feet or greater, unless otherwise shown on the Plans or specified in the Special Conditions.
  - 2. All ramps shall have a surface texture. Unless a truncated dome detectable panel is specified in the Bid Proposal, the Special Conditions or the Measurement & Payment Section, surface texturing shall consist of linear impressions approximately <sup>1</sup>/<sub>4</sub>-inch to <sup>3</sup>/<sub>8</sub>-inch in depth and width, oriented to provide a uniform pattern of diamond shapes measuring approximately 1<sup>1</sup>/<sub>4</sub> inches in width by 2<sup>1</sup>/<sub>4</sub> inches in length, with the length being parallel to the direction of pedestrian movement. This surface texture may be achieved by impressing and removing a piece of expanded metal regular industrial mesh into the surface of the ramp while the concrete is in a plastic state. If state or federal codes require a surface texture at variance with this requirement, those codes shall govern.
- I. Alleys and Driveways
  - 1. Sidewalks at alleys and driveways shall be constructed to the minimum thickness shown on the plan detail sheet. Transverse slopes of sidewalks at driveways and alley entrances shall match the slope of the driveway or alley ramp, but shall not exceed 5%.
  - 2. Where a new concrete driveway pavement joins an existing concrete driveway pavement with at least a 7-inch average thickness, the two pavements shall be joined by drilling ties made of No. 4 reinforcing rod at least six inches into the existing pavement at the midpoint of the thickness and extending those ties at least six inches into the new pavement. Ties shall be placed at 24 inches on center or closer. These ties shall be paid on a per tie basis separately from the concrete sidewalk or driveway.
- J. Restoration of Boulevard Areas and Embankment and Excavation Slopes]
  - The Contractor shall finish all boulevard areas and embankment and excavation slopes to the blend lines or points shown on the plans or plan cross-sections. If only blend points are shown on plan cross-sections the Contractor shall, for bid purposes, interpolate between adjacent sections. For blend areas, where topsoil cover will be greater than two (2) inches, the existing sod shall be removed before new topsoil is placed. The

32 16 23 Sidewalks
November 27, 2017 – Municipal Master
Page 7 of 8

Contractor shall also repair all other areas he has disturbed. Restoration shall be in accordance with the provisions of Section 32 90 00.

- K. Protection
  - 1. The Contractor shall protect sidewalk from damage until acceptance of the work. The Contractor shall exclude traffic from sidewalk for at least 7 days after placement and shall repair or replace broken or defective sidewalk as directed. He shall make provisions for pedestrians and vehicular traffic both during construction and during the 7 day traffic exclusion period using whatever barricades, warning signs, lanterns, and lights may be necessary.
- L. Guarantee Period
  - 1. The Contractor shall guarantee the sidewalk to remain free from cracks, chips, and spalling due to weather related or settlement causes for a period of one year from acceptance. The Owner may inspect the sidewalk after it has passed through the first winter for such defects and may call the Contractor back to the project area to repair or replace broken, cracked, chipped or defective sidewalks at no cost to the Owner.
- M. Section 01 70 00 Execution Requirements and Project Closeout: Requirements for installation examination.

## 3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

# PART 4 - MUNICIPAL REQUIREMENTS

#### 4.1 TRUNCATED DOME PANELS

A. Truncated domes are not required unless listed in the bid proposal.

#### 4.2 SYNTHETIC FIBER REINFORCEMENT

A. Synthetic fiber reinforcement is not required unless listed in the bid proposal.

END OF SECTION 32 16 23

# SECTION 32 16 25 - CONCRETE CURB & GUTTER

# PART 1 - GENERAL

# 1.1 SUMMARY

- A. Description of Work Covered by This Section:
  - 1. The Contractor shall construct curb & gutter, curb transitions, gutter sections for ramps for the handicapped, drive-over gutter sections, and incidental appurtenances. The Contractor shall construct these structures in the locations and to the lines and grades shown on the Plans. The work includes protecting the curb and gutter against damage until restoration is complete.
  - 2. The Contractor shall construct the curb and gutter in accordance with the provisions of the current edition of the State of Wisconsin Department of Transportation, Standard Specifications for Highway and Structure Construction, latest version, as set forth on the Department of Transportation website, and in conformance with Wisconsin Statues, 66.0909, Curb Ramping.
- B. Section Includes:
  - 1. Concrete paving for curb and gutter
  - 2. Parking Bumpers

# 1.2 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials
- B. American Concrete Institute
- C. ASTM International
- D. Wisconsin Department of Transportation (WisDOT Standards) Standard Specifications for Highway and Structure Construction available on the WisDOT website

# 1.3 PRE-INSTALLATION MEETINGS

A. Refer to Article 2.04 in Section 00 70 00 – General Conditions

#### 1.4 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals

## 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with these Specifications and all applicable local, State and Federal regulations.
- B. Perform Work according to WisDOT Standards

# PART 2 - PRODUCTS

# 2.1 MATERIALS & EQUIPMENT

- A. Concrete: The Contractor shall use concrete that complies with the specifications for Type BB concrete as set forth in Section 03 30 01 of these specifications. Special care shall be taken to use aggregates that yield concrete of the proper workability for this application.
- B. Forms
  - 1. Forms may be either stationary or slip-type forms. If machine pavers and slip forms are used for placing, forming, and consolidating the concrete, the finished curb and gutter shall be of quality equal to that produced by stationary forms and the methods described below.
  - 2. Forms for straight sections shall be steel and shall be straight and free from defects. They shall be of such size and strength that when properly supported they can resist movement in any direction during concrete placement and can retain horizontal and vertical alignment. Bent, warped, split, or defective form materials are not permitted. Forms shall be full depth of curb and gutter sections.
  - 3. The Contractor shall use flexible spring steel forms or laminated boards to form radius sections.
- C. Joint Fillers: Joint fillers shall be used in expansion joints and for joints between the curb and existing sidewalk or other structures. Such fillers shall be pre-molded joint fillers, bituminous fiber type, or asphalt-impregnated felt type, complying with ASTM D1751 or AASHTO Designation M213. Such fillers shall be ½-inch in thickness and shall extend the full depth of the concrete. Pre-molded joint fillers shall be kept on a flat surface in storage before insertion in the concrete. No warped or damaged material shall be used.
- D. Curing Compound: Curing compound shall be wax resin, white-pigmented, conforming to the requirements of ASTM C309, Type 2. It shall be ready-mixed for immediate use without alteration other than stirring. It shall adhere firmly to concrete, either partially set or hardened.
- E. Granular Base Course: Base course materials shall comply with the materials specification paragraphs in Section 32 05 00 of these specifications.

# 2.2 CONCRETE BUMPERS

- A. Cement: ANSI/ASTM C150, Portland Type I; gray color
- B. Concrete Materials: ASTM 33 and ASTM330 for water and sand.

- C. Reinforcing Steel: ASTM A615/A615M, 40 ksi yield grade, plain billet bars, uncoated finish, strength and size commensurate with precast unit design.
- D. Air Entrainment Admixture: ANSI/ASTM C260.
- E. Concrete Mix: Minimum 5000 psi, 28-day strength, air entrained to 5% to 7%.
- F. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
- G. Embed reinforcing steel, and drill or sleeve for 2 dowels.
- H. Cure units to develop concrete quality, and to minimize appearance blemishes including nonuniformity, staining, or surface cracking.

## 2.3 BUMPER ACCESSORIES

A. Dowels: Cut reinforcing steel, <sup>5</sup>/<sub>8</sub>-inch diameter, 36-inch long, pointed tip.

## PART 3 - EXECUTION

## 3.1 CONSTRUCTION

- A. Curb and Gutter Conformation: The Contractor shall construct curb and gutter to the conformations shown for Standard Curb and Gutter in detail shown on the Plan detail sheets except for drive-over curb, where noted on the Plans or ordered by the Engineer in the field and where sidewalk ramps are required. If curb and gutter terminates at a ditch, the Contractor shall construct a flared flume to match the topography.
- B. Line and Grade:
  - 1. Line and grade shall be as shown on the Plans and as shown on the Plan detail sheet. The Contractor shall notify the Engineer at least three (3) working days in advance of his need for lines and grades. Stakes will be provided at 25-foot intervals at an offset convenient to the Contractor. All stakes and reference marks shall be carefully preserved by the Contractor. If these marks are disturbed, they shall be replaced at the Contractor's expense.
  - 2. Care shall be taken to provide a uniform grade. The Contractor shall carefully check the grade and shall report irregularities to the Engineer. Deviations from established lines and grades shall be cause for rejection of all or part of the work.
- C. Clearing and Grubbing, Removal of Obstructions
  - 1. The Contractor shall coordinate with the local postmaster regarding relocation of mailboxes during the construction period. The Contractor shall, incidentally to the curb & gutter bid items, temporarily move such mailboxes as required by the local postmaster and shall permanently reinstall such mailboxes in locations and at elevations acceptable to the local postmaster and the property owner.
  - 2. The Contractor shall cut and dispose of trees and shrubs, remove and dispose of roots, stumps, old curb and gutter, sidewalks, driveways, pavements, drains and other obstructions in the curb area, as necessary to complete the construction as shown on the

Plans. Roots of trees shall be cut at a point at least one (1)-foot from the nearest surface of the curb and gutter. Any items or materials of apparent value, such as culvert pipes, shall be salvaged for the Owner and transported to a location designated by the Owner, such location being within the municipality. Holes remaining from the removal of obstructions shall be filled with granular subbase course or crushed aggregate base course, and such fill material shall be thoroughly compacted.

- D. Excavation, Backfilling and Grading
  - 1. The Contractor shall excavate or backfill as necessary to meet the line and grades established in the field by the Owner, shown on the Plans, defined in the Special Conditions, or defined in these specifications. All existing sod, pavement, and other surface materials obviously unsuitable for subgrade materials must be removed and disposed.
  - 2. The costs of excavation and backfill shall be incidental to the unit bid price for curb & gutter being constructed in that location, unless the materials being excavated are being removed after the surface sod, pavements, etc., have been removed, are below the subgrade, are unsuitable for subgrade materials and are ordered removed by the Engineer. In such cases, an extra payment shall be negotiated as provided in the General Conditions.
  - 3. Obstructions shown on the Plans or visible from the ground surface prior to clearing and grubbing and which can reasonably be expected to be removed in order for construction of new curb & gutter will not be basis for extra payment. Nor will extra payment be allowed for excavations below grade or for backfill materials required to fill such excavations when such excavation is caused by negligence of the Contractor.
  - 4. Backfilling shall be accomplished by placing <sup>3</sup>/<sub>4</sub> inch crushed aggregate material in lifts not to exceed 12 inches. Each lift shall be mechanically compacted to a density greater than or equal to 95% of maximum density as determined by the Modified Proctor test or by AASHTO Designation: T99, Method C, with replacement of the Fraction of material on the <sup>3</sup>/<sub>4</sub>-inch sieve with No. 4 to <sup>3</sup>/<sub>4</sub>-inch material. The Owner shall pay for the first series of compaction tests, if such tests are ordered by the Engineer. If the compaction tests fail, the Contractor shall re-compact those areas and shall pay for the compaction tests on the re-compacted areas.
- E. Base Preparation
  - 1. The Contractor shall fill all holes and depressions with crushed aggregate base course, compact this backfill, and smooth the surface of the subgrade. The Contractor shall place four (4) inches of crushed aggregate base course under the entire curb and gutter area and to a point one (1)-foot beyond the front and back faces of the curb and gutter.
  - 2. If it is specified in the Special Conditions that the base course will be placed by another contractor in the process of construction of a new street, the Contractor shall grade and thoroughly compact the base to the foundation elevation necessary to construct the curb and gutter. The Contractor shall thoroughly moisten the surface of the base course and lightly oil the forms immediately before placing the concrete.
  - 3. The Contractor shall also, before placing the concrete, adjust valve boxes, curb stops, storm water inlets, manhole frames and other utility structures to finished grade of new construction in a manner such that the new construction will not interfere with proper operation of the structures. Storm water inlets and manhole frames shall be adjusted by removing or adding concrete adjusting rings or masonry and then fixing them in place with a collar of concrete masonry. Storm water inlets shall be adjusted with a 1" PVC drainage pipe being incorporated from the base course on the street side of the inlet, through the adjusting ring to the inside of the inlet.

# F. Forms

- 1. The Contractor shall set the forms to the required lines and grades and brace and secure the forms to assure rigidity. The Contractor shall use sufficient forms to allow continuous progress of the work and to permit the forms to remain in place for at least six hours after concrete placement.
- 2. The vertical face of the forms shall not vary from the established line by more than one (1) inch, and the change in line of the vertical face shall not exceed <sup>1</sup>/<sub>4</sub>-inch in 10 lineal feet of curb. The top of the curb shall not vary from the established grade more than <sup>1</sup>/<sub>2</sub> inch, and the change in grade of the top of the curb relative to the established grade shall not exceed <sup>1</sup>/<sub>8</sub>-inch in 10 lineal feet.
- 3. Slip forming methods shall produce equivalent results.

## G. Joints

- 1. The Contractor shall construct expansion, contraction, and construction joints with faces perpendicular to the curb surface and at right angles to the curb line.
- 2. Expansion joints shall be constructed at each end of radius sections; at about three (3) feet from one side of abutting storm water inlets, at abutting walks, structures, and other fixed objects; and at 300-foot centers. Where practical, expansion joints in the curb should be placed at the same locations as existing expansion joints in adjacent pavements.
- 3. The Contractor shall extend joint fillers the full width and depth of expansion joints. Such fillers shall terminate not less than ½-inch or more than one (1) inch below the undersurface of the curb and gutter. Joint fillers shall be in one piece, wherever possible. Where more than one piece is required, the Contractor shall lace or clip joint filler sections together.
- 4. The Contractor shall construct contraction joints consisting of a slot or groove at least two (2) inches in depth by <sup>1</sup>/<sub>4</sub>-inch in width, at not less than six (6) nor more than twelve (12)-foot intervals, and at two (2) feet from the top of the flare on each side of driveway aprons, at about three (3) feet from the side of street inlets opposite the side on which the expansion joint is placed. When machine methods are used for forming and finishing, the Contractor shall saw construction joints or create planes of weakness by insertion of partial separator plates having a minimum depth of two (2) inches. The depth of cut and the equipment used in sawing shall be done as soon as practical after the concrete has set sufficiently to preclude raveling during the sawing and before any shrinkage cracking takes place in the concrete. If this method results in random cracking, the Contractor shall use separator plates. Separator plates shall be removed as soon as practical after the concrete has been struck off, consolidated, and set sufficiently to preserve the shape and width of the joint.
- H. Curb Ramping: The Contractor shall provide transitions and gutter sections to accommodate ramps at all intersections. (See the Plan Detail sheet.)
- I. Driveover Sections: At all driveway and alley entrances and at other locations designated on the Plans the Contractor shall construct driveover sections as shown on the Plan detail sheet.
- J. Curb and Gutter Terminations: Where curb and gutter ends, including at the ends of radius sections, the Contractor shall create a transition section in which the curb back is brought down to the gutter elevation. The length of the transition shall be as indicated in Part 4 and on the Plan Detail. These transition sections may not be shown on the Plans and will be in addition to the length shown on the Plans. The transition section shall be separated from the standard curb and gutter by means of a contraction joint.

- K. Concrete Placement: The Contractor shall comply with the requirements of Section 03 30 01 for proportioning, mixing, testing, and placing concrete. The Contractor shall not place concrete until the base on which the curb and gutter will be poured and the forms have been checked for line and grade. The Contractor shall clean the forms before each use and coat them with non-staining form release agent to insure separation from concrete without damage, or discoloration to the concrete. He shall moisten the base, as required to provide a dampened condition at the time concrete is placed. Concrete shall not be placed around structures and frames until they have been brought to the required grade and alignment.
- L. Finishing
  - 1. The Contractor shall test the surface for trueness with a 10-foot straightedge. He shall distribute concrete as required to remove surface irregularities and honeycombed areas, and shall float repaired areas to provide a continuous, smooth finish.
  - 2. The work shall be performed in a manner that results in curb and gutter uniform in appearance and structurally sound. Curbs found with unsightly bulges, ridges, low spots in the gutter or other defects shall be removed and replaced at the Contractor's expense if the Engineer considers them to be irreparable.
  - 3. The faces of the curb and gutter shall be thoroughly troweled and brushed. The Contractor shall round the edges of gutters, the back edge of curb and edges adjacent to expansion and contraction joints with a <sup>1</sup>/<sub>8</sub>-inch to <sup>1</sup>/<sub>4</sub>-inch radius edging tool. The Contractor shall then eliminate any tool marks on the concrete surface.
  - 4. The Contractor shall create a brushed or broomed finish unless otherwise designated on the Plans or in the Special Conditions. After excess moisture (surface sheen) has disappeared, the Contractor shall provide this finish by drawing a fine-hair broom across concrete surfaces perpendicular to the line of traffic. The brooming operation shall be repeated if required to produce a fine-line texture.
  - 5. After removal of forms, the Contractor shall repair honeycombed and defective area with Portland cement grout.
- M. Curing: The concrete shall be protected against excess loss of moisture and rapid temperature changes by use of approved curing methods. The Contractor shall wet cure the concrete using waterproof paper or white polyethylene sheets, or shall cure-finish the concrete with curing compound. If curing compound is used the Contractor shall apply it at a rate of 200 square feet per gallon to all formed surfaces immediately after the forms are removed. If the curing compound is damaged by rain or any other cause, it shall be restored to the original condition by reapplication.
- N. Restoration of Adjacent Areas: The Contractor shall restore all surfaces or disturbed areas accordance with the provisions of Section 32 90 00, but at least to the condition which existed before construction. Restoration shall continue from the curb to the blend lines or points shown on the plans or plan cross-sections. If only blend points are shown on the plan cross sections the Contractor shall, for bid purposes, interpolate between adjacent sections. For blend areas where topsoil cover will be greater than two (2) inches, the existing sod shall be removed before new topsoil is placed. Contractor shall leave a small amount of additional topsoil on each side of driveways to be restored with asphalt to allow property owners to blend topsoil to the edge of the driveway after the paving has been completed. If base course exists on the street side of the gutter the Contractor shall backfill and compact this base course adjacent to the new gutter so that the base course is suitable for subsequent paving and as necessary to protect the new curb and gutter. He shall backfill and grade the complete area from the curb to the sidewalk or property line. He shall provide four (4) inches of topsoil and shall apply fertilizer, seed, and mulch.

- O. Bumper Installation
  - 1. Install units without damage to shape or finish. Replace or repair damaged units
  - 2. Install units in alignment with adjacent work.
  - 3. Fasten units in place with two (2)  $\frac{5}{8}$ -inch dowels for each bumper.

#### 3.2 **PROTECTION**

A. The Contractor shall protect curbs from damage until acceptance of the work. He shall exclude traffic from curbs for at least seven (7) days after placement and shall repair or replace broken or defective curbs as directed. He shall make provisions for pedestrians and vehicular traffic both during construction and during the seven (7) day traffic exclusion period using whatever barricades, warning signs, lanterns and lights may be necessary.

#### 3.3 GUARANTEE

A. The Contractor shall, for a period of one (1) year following acceptance of the work as indicated by the Owner's approval of the final payment application, guarantee that the curb and gutter will not chip, crack, or spall from natural causes. Should such defects occur, the Contractor shall return to the job site and replace the defective sections of curb and gutter at his own expense.

## 3.4 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 Quality Requirements
- B. Refer to Section 01 70 00 Execution Requirements and Project Closeout

# PART 4 - MUNICIPAL REQUIREMENTS

#### 4.1 TAPER LENGTHS

A. Where curb & gutter ends or transitions are being made for ramps and driveway cuts, the taper length shall be two feet, unless otherwise noted on the Plan Detail drawings.

END OF SECTION 32 13 13

# SECTION 32 90 00 – LANDSCAPE RESTORATION

# PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Final grade topsoil for finish landscaping.
  - 2. Site contouring.
  - 3. Finish ground cover.

#### 1.2 SUBMITTALS

- A. Section 01 33 00 Submittals: Submittal procedures
- B. Materials Source: Submit name of imported materials source.

## 1.3 QUALITY ASSURANCE

A. Furnish each topsoil material from single source throughout the Work.

# PART 2 - PRODUCTS

#### 2.1 MATERIAL

- A. Topsoil
  - 1. Topsoil shall conform to the requirements of section 31 05 00 Soils, Aggregates and Geotextiles.

#### B. Lime

- 1. Lime used for soil amendment shall be agricultural grade limestone ground sufficiently fine so that 80% passes a No. 8 sieve. Lime shall contain 80% calcium carbonate equivalent. Moisture shall not exceed 10%.
- C. Fertilizer
  - 1. Fertilizer used in conjunction with seeding shall be dry, free-flowing granular fertilizer suitable for application by agricultural fertilizer spreaders or blower equipment, or non-volatile liquid commercial fertilizer, having an analysis of 20-10-10 (Nitrogen-Phosphoric Acid-Potash), or approved equal.
- D. Grass Seed for Lawns
  - 1. Grass seed shall be delivered to the site in bags, tagged or labeled to show the percentage of purity and germination. The seed shall have been tested by a recognized seed testing

32 90 00 Landscape Restoration	
November 2, 2017 – Master	
Page 1 of 6	

laboratory within one year prior to the date of seeding and shall conform to the latest laws of the U.S. and the State of Wisconsin. Upon request the Contractor shall furnish to the Engineer copies of the test results. Permanent seed mixtures shall consist of the following percentages of various varieties of grass seed, each of which shall have the designated minimum percent purity and germination:

Species	Purity Min. %	Germination Min. %	Mixture Proportions, Percent
Kentucky Bluegrass	85	80	35
Creeping Red Fescue	97	85	20
Improved Hard Fescue	97	85	20
Improved Fine Perennial Ryegrass	96	85	25

\*Pure Live Seed. These grasses shall contain no improved varieties

- 2. The "Madison Parks" mix may be used as a permanent seed mixture.
- 3. As a companion seeding to the above seed mixture annual ryegrass of the same purity and germination standards shall be provided.
- E. Grass Seed for Large Non-Lawn Areas
  - Grass seed shall be delivered to the site in bags, tagged or labeled to show the percentage of purity and germination. The seed shall have been tested by a recognized seed testing laboratory within one (1) year prior to the date of seeding and shall conform to the latest laws of the U.S. and the State of Wisconsin. Upon request the Contractor shall furnish to the Engineer copies of the test results. Permanent seed mixtures shall be seed mixture No. 10 for average soil conditions, including clay or loam soils and soils in moist conditions and seed mixture No. 20 for light, well drained, sandy or gravelly soils and for slopes and ditches, except on ditches between the edge of the shoulder and the bottom of the ditch where seed mixture No. 30 shall be used, all as specified in the Standard Specifications for Highway and Structure Construction published by the Wisconsin Department of Transportation.
  - 2. A companion seeding to the above seed mixture of the same purity and germination standards shall be provided and applied as set forth in Part 3. Between May 15th and July 15th oats or Sudan grass shall be used as the companion seeding. From July 15th to September 15th use annual ryegrass as the companion seeding. After September 15th use winter wheat as the companion seeding.
- F. Straw Mulch
  - 1. Unless otherwise specified in the Special Conditions to the specifications, mulch shall be straw, free of grain, weed, seed and mold. Mulch materials shall not contain excessive moisture which might prevent feeding through a mulch blower machine.
- G. Sod
  - 1. Sod shall be fresh, predominantly bluegrass sod from an approved sod farm.

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 30 00 Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify substrate base has been contoured and compacted.
- C. Complete all seeding by September 15<sup>th</sup>.
- D. After preparation and prior to seeding notify Engineer so that the prepared surface may be inspected. Seeding or sodding shall not take place until the prepared surface is inspected by Engineer.

#### 3.2 PREPARATION

- A. Protect landscaping and other features remaining as final Work.
- B. Perform a soil test to determine fertilizer needs and if lime is necessary.

## 3.3 SUBSTRATE PREPARATION

- A. Eliminate uneven areas and low spots.
- B. Remove weeds, debris, roots, branches, stones, and dust clumps in excess of ½-inch in size or lawn areas and in excess of 1-inch in size on non-lawn areas. Any topsoil containing gravel shall be removed and replaced with fresh topsoil. Remove contaminated subsoil.
- C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

#### 3.4 PLACING TOPSOIL

- A. Place topsoil in areas where seeding and sodding is required to nominal depth of at least 4 inches. Place topsoil during dry weather.
- B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- C. Remove roots, weeds, rocks, and foreign material while spreading.
- D. Manually spread topsoil close to plants and buildings to prevent damage.
- E. Lightly compact the placed topsoil.
- F. Remove surplus subsoil and topsoil from site.
G. Leave stockpile area and site clean and raked, ready to receive landscaping.

# 3.5 FERTILIZER AND LIME APPLICATION ON LAWNS

A. Fertilizer shall be applied with a hydroseeder, power-drawn drill or spreader, or blower equipment either separately from or concurrently with the grass seed. Fertilizing shall not be done with "broadcast"-type equipment during windy weather, and not at all when the ground is frozen or excessively moist. Fertilizer shall be applied at the following rates:

Nutrient	Per Acre	Per 1000 Square Feet
Nitrogen (N)	100 pounds	2.3 pounds
Phosphoric Acid (P <sub>2</sub> O <sub>5</sub> )	50 pounds	1.2 pounds
Potash (K <sub>2</sub> O)	50 pounds	1.2 pounds

B. If the soil test indicates lime addition is necessary, apply at the rates indicated by the test.

# 3.6 FERTILIZER AND LIME APPLICATION ON NON-LAWN AREAS

A. Fertilizer and lime shall be applied with a hydroseeder, power or spreader, or blower equipment either separately from or concurrently with the grass seed. Fertilizing shall not be done with "broadcast"-type equipment during windy weather, and not at all when the ground is frozen or excessively moist. Fertilizer and lime shall be applied at the rate specified by the soil test, or at 400 to 600 pounds per acre in lieu of a soil test.

# 3.7 LAWN SEEDING

- A. The Contractor shall apply the seed using a hydroseeder, a power-drawn drill or spreader, or approved blower equipment with an adjustable disseminating device capable of maintaining a constant measurement rate of material discharge that will insure an even distribution of seed and fertilizer.
- B. Permanent seed mixture shall be applied at the rate of 2 pounds/1000 square feet. A companion seeding of annual ryegrass, oats or winter wheat, depending upon the season, shall also be made at an application rate of 1 pound/1000 square feet.
- C. After the seeding is completed and prior to mulching the Contractor shall rake the surface with an inverted leaf rake to set the seed.

# 3.8 SEEDING LARGE NON-LAWN AREAS

A. The Contractor shall apply the seed using a hydroseeder, a power-drawn drill or spreader, or approved blower equipment with an adjustable disseminating device capable of maintaining a constant measurement rate of material discharge that will insure an even distribution of seed and fertilizer.

- B. Permanent seed mixture shall be applied at the rate of 1.5 pounds/1000 square feet. A companion seeding of annual ryegrass, oats or winter wheat, depending upon the season, shall also be made at an application rate of 0.8 pounds/1000 square feet.
- C. After the seeding is completed and prior to mulching the Contractor shall rake the surface with an inverted leaf rake to set the seed.

# 3.9 APPLICATION OF MULCH

- A. The Contractor shall furnish, haul and evenly apply straw mulch at a rate not less than 1<sup>1</sup>/<sub>2</sub> tons per acre to a loose depth of one (1) to two (2) inches. Seventy to ninety percent of the surface shall be covered. The mulch spreading equipment shall utilize forced air to blow mulch material onto the seeded area, unless otherwise approved by the Engineer. Mulching shall not be conducted during very windy conditions.
- B. The mulch shall not be left in clumps and shall not be blown onto healthy grass, trees, shrubs, curbs, pavements, vehicles, etc. Any mulch which blows onto areas not intended to be mulched, such as those defined above, shall be <u>immediately</u> removed.
- C. Following application of the mulch, the Contractor shall anchor the straw mulch by cutting the mulch into the soil with notched edges of a weighted disc so that the mulch is partially embedded in the soil, or by other methods acceptable to the Engineer.
- D. Wood cellulose fiber, the use of which is as mulch is permissible only on large non-lawn areas, shall be applied at a rate <sup>3</sup>/<sub>4</sub> to 1-ton per acre. Wood cellulose fiber mulch need not be anchored.
- E. Hay or "marsh hay", the use of which as mulch is permissible only on large non-lawn areas, shall be applied at the same rates and to the same criteria as straw mulch.

## 3.10 SODDING

- A. Sod shall be delivered to the site and installed on the same day. The Contractor shall place sod with edges in close contact and with joints staggered. Sod placement on slopes shall commence at the bottom of the slope, and the rows shall be laid perpendicular to the slope. The edge of the sod at the tops of slopes shall be turned slightly under, and a layer of soil shall be compacted over the edge to direct surface drainage over the edge onto the top of the sod. Sod placement in areas other than on slopes shall be made so that the top sod surface is flush with adjoining surfaces.
- B. On slopes steeper than 1:4, vertical to horizontal, the Contractor shall stake the sod with split cedar shingles, or other equally effective stakes, spaced from 18 to 36 inches apart along the longitudinal axis of the sod strip. These stakes shall be placed near the top edge of the sod strip and shall be driven flush with the sod.
- C. After the sod is placed, it shall be rolled or firmly tamped to press the sod onto the underlying soil. The Contractor shall thoroughly soak all sodded areas by sprinkling them with water at the end of the day in which the sod is laid.

32 90 00 Landscape Restoration
November 2, 2017 – Master
Page 5 of 6

#### 3.11 WATERING OF SEED BEDS

A. The sod shall be maintained in a moist growing condition. The Contractor shall soak the sod by sprinkling with water on the seven successive calendar days following completion of the seeding unless at least <sup>1</sup>/<sub>4</sub>-inch of rainfall has occurred on that day.

### 3.12 WATERING OF SOD

A. The sod shall be maintained in a moist growing condition. The Contractor shall soak the sod by sprinkling with water on the seven successive calendar days following completion of the seeding unless at least <sup>1</sup>/<sub>4</sub>-inch of rainfall has occurred on that day.

#### 3.13 TOLERANCES

A. Top of Topsoil: Plus or minus <sup>1</sup>/<sub>2</sub>-inch.

## 3.14 PROTECTION AND MAINTENANCE OF INSTALLED WORK

- A. Section 01 70 00 Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Prohibit construction traffic over topsoil, both before and after grass restoration.
- C. Where paved drainage ways, curbs & gutters, culverts, storm sewers or other structures exist on the site the Contractor shall clean all soil, silt, mulch or debris and fully restore such drainage ways, devices and structures to their intended operating condition.
- D. After the restoration operation is completed, the Contractor shall provide and distribute to each property owner a sheet of instructions on how to care for the restored surface and how to ensure acceptable grass growth.

END OF SECTION 32 90 00

# SECTION 33 05 13- MANHOLES AND STRUCTURES

# PART 1 - GENERAL

### 1.1 SUMMARY

- A. Description of Work Covered by This Section
- B. This section establishes the Contractor's responsibility for providing all necessary materials and equipment to construct manholes and structures for sanitary sewer and storm sewer systems where shown on the Plans. This section covers all materials, labor, tools and equipment necessary to construct the manholes, structures and all appurtenances, complete and in place.
- C. Section Includes:
  - 1. Modular precast concrete manholes and structures with tongue-and-groove joints and transition to cover frame, covers, anchorage, and accessories.
  - 2. Drainage system catch basins.
  - 3. Drainage system inlets.
  - 4. End walls.
  - 5. Frames and covers.
  - 6. Masonry manhole and structure sections with masonry transition to cover frame, covers, anchorage, and accessories.
  - 7. Doghouse manhole connections to existing sanitary and storm sewer lines.
  - 8. Raising manhole frames and covers.
  - 9. Replacing manhole frames and covers.

#### 1.2 REFERENCE STANDARDS

- A. American Association of State Highway Transportation Officials
- B. American Concrete Institute
- C. ASTM International
- D. American Welding Society
- E. National Precast Concrete Association

#### 1.3 SUBMITTALS

- A. Refer to Section 01 33 00 Submittals
- B. Product Data: Submit data for manhole covers, component construction, features, configuration, and dimensions.
- C. Shop Drawings:
  - 1. Indicate structure locations, configurations and elevations.

33 05 13 Manholes and Structures
November 29, 2017 – Jefferson Master
Page 1 of 8

- 2. Indicate sizes and elevations of piping penetrations
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 70 00 Execution Requirements and Project Closeout.
- B. Project Record Documents: Refer to Article 7.11 in Section 00 70 00 General Conditions

#### 1.5 QUALITY ASSURANCE

A. Perform work in accordance with these Specifications and all applicable local, State and Federal regulations.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to Article 7.03 in Section 00 70 00 - General Conditions

# PART 2 - PRODUCTS

## 2.1 MANHOLES AND STRUCTURES

- A. Concrete Manhole Materials
  - 1. For the vertical walls of the manholes, the Contractor shall provide forty eight (48) inch internal diameter precast reinforced concrete rings conforming to ASTM C478. Joint shape shall be compatible with the joint materials specified below. Only where noted on the Plans or where specified in the Special Conditions shall rings of greater internal diameter than forty eight inches be used.
  - 2. Joints between manhole riser sections and/or between manhole riser and manhole top shall be sealed with a preformed butyl sealant. The butyl sealant shall meet or exceed the requirements of Federal Specification SS-S-210(210A), AASHTO M-198 and ASTM C990. The sealant shall be ConSeal CS-102 or CS 202, E-Z Stik by Press-Seal Gasket Corp, or approved equal.
  - 3. Precast bases shall be a minimum of eight (8) inches thick, integral with the first riser section. Cast in place concrete bases shall be cast with the first riser section embedded at least four (4) inches into the base. Concrete for cast in place manhole bases shall be Type CC, as specified in Section 03 30 01.
  - 4. The manhole top shall be a precast eccentric cone, with a chimney of precast reinforced adjusting rings. The chimney shall not be greater than 9 inches high. Where space does not permit a cone top, a slab top with an eccentric opening may be used.
- B. Manhole Pipe Seals Sanitary Sewer Manholes Flexible, watertight, rubber wedge ring, O ring compression, or boot type clamp on seals for pipe entrance holes meeting the requirements of

33 05 13 Manholes and Structures	
November 29, 2017 – Jefferson Master	
Page 2 of 8	

ASTM C923 shall be installed in the manholes. Grouting in pipes will not be allowed. Wedge ring type seals shall be Press Seal II, manufactured by the Press Seal Gasket Corporation, or approved equal. O ring type seals shall be Res Seal, by Scales Manufacturing Corporation, A-LOK or approved equal. Boot type external clamp on seals shall have a stainless steel, external, adjustable clamp and shall be Kor N Seal, by NPC, Inc., or approved equal. Pipe to manhole connectors shall be of a size specifically designed for the pipe material and size specified on the plans.

- C. Manhole Pipe Seals Storm Sewer Manholes Pipe to manhole connections for storm sewer shall be made by thoroughly grouting the connection both inside and outside the manhole to provide a smooth surface.
- D. Manhole frames, lids, and grating shall be cast iron, ASTM A48, Class 35 B, of uniform quality, free from blow holes, porosity, hard spots, shrinkage defects, cracks or other serious defects. Castings shall have no jagged edges, shall be blast cleaned and shall be coated with a tar pitch varnish which will make a smooth, tough coating, not tacky under any weather conditions. Lids for sanitary manholes shall have concealed pick holes. The type of castings shall be as designated on Construction Details in the Plans or in Part 4 of this specification section.
- E. Manhole steps shall consist of a <sup>1</sup>/<sub>2</sub>-inch grade 60 steel reinforcing rod meeting the requirements of ASTM A615 encapsulated by an injection molded copolymer polypropylene meeting the requirements of ASTM D4101. Steps shall meet the requirements of ASTM C478 and shall be ML-10 steps as manufactured by American Step Company, Inc., steps provided by M.A. Industries, Inc., or approved equal.

## 2.2 INTERNAL MANHOLE CHIMNEY SEALS

- A. This section includes the materials and procedures required for the internal sealing of the entire chimney area of sanitary manholes.
- B. Definitions
  - 1. Chimney The cylindrical variable height portion of the manhole structure used to support and adjust the finished grade of the manhole frame. The chimney extends from the top of the cone to the base of the manhole frame.
  - 2. Cone That portion of the manhole structure which slopes upward and inward from the barrel of the manhole to the required chimney or frame diameter.
- C. System Description
  - 1. Design Requirements The manhole frame seal shall be designed to prevent leakage of water through the above described portions of the manhole throughout a 25-year design life. The seal shall also be designed so that it can be installed in manholes where the diameters of the frame and chimney differ by up to 20%.
  - 2. Performance Requirements The frame seal shall be capable of repeated vertical movement of not less than two inches and/or repeated horizontal movement of not less than 2 inch after installation and throughout its design life.
- D. Submittal
  - 1. Shop drawings shall be submitted in accordance with Section 01 33 00

33 05 13 Manholes and Structures	
November 29, 2017 – Jefferson Master	
Page 3 of 8	

- 2. Test Report A test report from an approved testing agency, showing that the seal meets the performance requirements of Section 1.3(B) shall be provided by each frame seal manufacturer or supplier.
- E. Manufacturer: The chimney seals shall be manufactured by Cretex, Inc., or approved equal.
- F. Frame Seal shall consist of a flexible internal rubber sleeve and extension and stainless steel compression bands, all conforming to the following requirements:
  - 1. Rubber Sleeve and Extension The flexible rubber sleeve, extensions and wedge strips shall be extruded or molded from a high grade rubber compound conforming to the applicable requirements of ASTM C-923, with a minimum 1500 psi tensile strength, maximum 18% compression set and a hardness (durometer) of 48<sup>+</sup>/-5.
    - a. The sleeve shall be either double or triple pleated, with a minimum unexpanded vertical height of 8 inches and 10 inches respectively and a minimum thickness of <sup>3</sup>/<sub>16</sub>-inch. The top and bottom sections of the sleeve shall contain an integrally formed expansion band recess and multiple sealing fins.
    - b. The top section of the extension shall have a minimum thickness of <sup>3</sup>/<sub>32</sub>-inch and shall be shaped to fit into the bottom band recess of the sleeve under the bottom chimney seal band, and the remainder of the extension shall have a minimum thickness of <sup>3</sup>/<sub>16</sub>-inch. The bottom section of the extension shall contain an integrally formed expansion band recess and multiple sealing fins matching that of the rubber sleeve.
    - c. Any splice used to fabricate the sleeve and extension shall be hot vulcanized and have a strength such that the sleeve shall withstand a 180° bend with no visible separation.
    - d. The continuous wedge strip used to adapt the rubber sleeve to sloping surfaces shall have the slope differential needed to provide a vertical band recess surface, be shaped to fit into the band recess and have an integral band restraint. The length of the wedge strip shall be such that, when its ends are butted together, it will cover the entire inside circumference of that band recess needing slope adjustment.
  - 2. Expansion Bands The expansion band used to compress the sleeve against the manhole shall be integrally formed from 16 gauge stainless steel conforming to ASTM A-240 Type 304, with no welded attachments and shall have a minimum width of 1<sup>3</sup>/<sub>4</sub>-inch.
    - a. The bands shall have a minimum adjustment range of 2 diameter inches and the mechanism used to expand the band shall have the capacity to develop the pressures necessary to make a watertight seal. The band shall be permanently held in this expanded position with a positive locking mechanism. Any studs and nuts used for this mechanism shall be stainless steel conforming to ASTM F-923 and 594, Type 304.
- G. Installation Equipment: The Contractor shall have a manufacturer's recommended expansion tool and all other equipment/tools necessary to install the frame seals.
- H. Cementitious Grout: Cementitious grout shall be premixed, non-metallic, high strength, nonshrink grout which meets the requirements of ASTM C-191 and C-827 as well as CRD-C588 and C621. When mixed to a mortar or 'plastic' consistency, it shall have minimum one day and 28day compressive strength of 6,000 and 9,000 psi, respectively.
- I. Field Measurements: The Contractor shall measure the manhole to determine the information required on the manufacturer's 'Sizing and Ordering' procedure. This information is needed to

33 05 13 Manholes and Structures	
November 29, 2017 – Jefferson Master	
Page 4 of 8	
 1	

obtain the proper size of bands, the size and shape of the rubber sleeve and the need for and size of any extensions.

- J. Surface Preparation: All sealing surfaces shall be reasonably smooth, clean and free of any form offsets or excessive honeycomb. The top internal portions of the cone shall have a minimum 3-inch high vertical surface. The preparation of this vertical surface when none exists shall be in accordance with the frame seal manufacturer's instructions.
- K. Installation of Frame Seal: The internal frame seals and extensions shall be installed in accordance with the manufacturer's instructions. Where sanitary manholes are within the pavement surface, the seal shall only be installed after the lower course of pavement has been placed, unless specifically indicated in the Special Conditions.

## 2.3 DESIGN REQUIREMENTS

- A. Design structures for minimum loads conforming to ASTM C857 and ASTM C890.
- B. Roof Live Load: Comply with following loading conditions, including impact load:
  - 1. ASTM C857, A-16 and AASHTO HB-17, HS20-44
  - 2. Maximum 16,000 lb. each wheel

#### 2.4 FABRICATION

- A. Fabricate precast concrete utility structures conforming to ACI 318 (318M) and NPCA Quality Control Manual for Precast and Prestressed Concrete Plants.
- B. Fabricate precast concrete utility structures knock-out panels and openings to size and configuration as indicated on the Plans and Shop Drawings.
- C. Reinforcing:
  - 1. Install reinforcement by tying or welding to form rigid assemblies.
  - 2. Position reinforcement to maintain minimum <sup>1</sup>/<sub>2</sub>-inch cover.
  - 3. Secure reinforcement to prevent displacement while placing concrete.
- D. Position and secure embedded items to prevent displacement while placing concrete.
- E. Deposit concrete in forms and consolidate concrete without segregating aggregate.
- F. Provide initial curing by retaining moisture using one of following methods:
  - 1. Cover with polyethylene sheets.
  - 2. Cover with burlap or other absorptive material and keep continually moist.
  - 3. Apply curing compound according to manufacturer instructions.
- G. Provide final curing according to manufacturer's standard.
- H. Remove forms without damaging concrete.

33 05 13 Manholes and Structures
November 29, 2017 – Jefferson Master
Page 5 of 8

## PART 3 - EXECUTION

#### 3.1 CONSTRUCTION

#### A. Manhole Construction

- 1. The Contractor shall construct manholes in the locations shown on the Plans, using the precast or cast in place bases, precast risers, adjusting rings, and precast top sections specified in Part 2. Precast bases shall be set on firm, compacted level granular bedding. Compaction shall be to a density of 95% of Modified Proctor density. If over excavation occurs, the Contractor must backfill with gravel and compact the backfill to a density of 95% of Modified Proctor density.
- 2. If the Contractor uses cast in place concrete bases, they shall be poured on a 12 inch thick layer of compacted crushed aggregate over undisturbed earth. The first riser section shall be supported on brick and be embedded in the base a minimum of four (4) inches.
- 3. Risers, top sections, adjusting rings, and castings shall be joined using compatible rubber rings or plastic gasket materials specified in Part 2. When plastic gasket material is used, the joining surfaces shall receive the manufacturer's approved primer. Under the weight of superimposed riser sections, the gasket material shall form a tightly packed, watertight seal in the annular joint space.
- 4. Lift plugs shall be completely grouted shut and smoothed to match the inner surface of the manhole. Adjusting rings shall be grouted in place, with grout being placed so that the outer and the inner surfaces are completely covered with a thin layer of grout.
- 5. No visible leakage shall occur at any joint.
- B. Pipe Connection to Manholes
  - 1. Smooth flow channels connecting inlet and outlet pipes, with smooth radius transitions when manholes have more than one entrance pipe and when there are changes in alignment or grade at the manhole shall be constructed. For sanitary sewers, the flow channel of the invert may be precast where possible. It shall be troweled smooth and the bench shall be finished with a brush.
  - 2. For sanitary sewer construction, the Contractor shall install pipe seals in accordance with the recommendations of the manufacturer of the seals. For storm sewer construction, the pipe to manhole connections shall be thoroughly grouted to form a smooth, watertight surface both inside and outside the manhole.
  - 3. The Contractor shall take extreme care to support the pipes immediately outside manholes until those pipes reach undisturbed soil.
  - 4. Connections for future sanitary sewers, where indicated on the Plans, shall consist of a short piece of sewer terminating with a bell end and stopper, or bulkhead, not more than one (1) foot or one stub diameter outside the manhole wall, unless otherwise shown on the Plans. If no elevation is given, the Contractor shall set the invert of the stub equal to the invert of the main sewer entrance.
  - 5. Variations of greater than 0.02 feet from the manhole pipe inverts shown on the plans shall be cause for rejection of the manhole. Unless shown otherwise on the plans a minimum drop of 0.10 feet shall be provided from the lowest incoming sanitary sewer invert to the outgoing sanitary sewer invert.
- C. Pipe Drop Connection
  - 1. Where the vertical distance from the invert of the incoming sewer to the spring line of the out going sewer is equal to or greater than two (2) feet, manhole connections shall be drop connections, with concrete encasement, constructed according to the Construction Detail

33 05 13 Manholes and Structures	
November 29, 2017 – Jefferson Master	
Page 6 of 8	

sheets in the Plans. The drop assembly shall consist of a tee or wye connecting to the inflowing sewer, a drop pipe of the same diameter as the inflowing sewer, and a 90-degree bend at the bottom. Unless otherwise indicated, the entire assembly shall rest on the manhole base or an extension of the manhole base. When encasement is required, in order to allow for some in-field adjustment of pipe inverts, the upper pipe connection shall be encased in concrete in the field and shall not be pre-cast. The lower pipe connection may be pre-cast to a point no closer than six inches below the upper pipe connection. The final upper pipe connection shall have a removable bulkhead or cap on the inside of the manhole.

- D. Setting of Castings
  - 1. Manhole castings shall be set by the Contractor to the elevations shown on the plans. On street construction projects, if the surface asphalt will not be constructed in the same year as the manhole, the casting shall be adjusted according to one of the following methods as called for on the plan details:
    - a. Method I: Set to final plan grade. Asphalt binder shall be constructed by raising paving screed to match the casting. The raised binder area shall be milled prior to surface course construction.
    - b. Method II: Set to asphalt binder course grade. Sawcut casting out and adjust to final grade prior to surface course construction.
    - c. Method III: Set to final plan grade. Construct asphalt ramp surrounding casting. Ramp diameter shall be sufficient to not impede snowplowing operations, minimum ten feet diameter. The ramp shall be removed prior to surface course construction.
    - d. Method IV: Set to grade equal to final plan elevation less the thickness surface course. Install appropriate thickness prefabricated "cheater rings" prior to surface course construction.
  - 2. Should no method be called out in the Plans, Specification Special Conditions or the Measurement and Payment section, Method I shall be used.

## 3.2 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 Quality Requirements
- B. Refer to Section 01 70 00 Contract Close-Out & Clean-Up

## PART 4 - MUNICIPAL REQUIREMENTS

#### 4.1 MANHOLE CASTINGS

A. The type of sanitary manhole castings shall be as designated in the Construction Details of the Plans. The City of Jefferson will provide sanitary manhole castings and the Contractor shall install them. The Contractor shall provide and install all storm manhole castings.

## 4.2 MANHOLE FRAME ADJUSTMENT RINGS

A. Adjustment rings shall be Cretex, hard rubber.

33 05 13 Manholes and Structures	
November 29, 2017 – Jefferson Master	
Page 7 of 8	

### 4.3 MANHOLE CHEATER RINGS

A. Cheater rings are permitted for use only for final asphalt adjustments.

## 4.4 MANHOLE STEPS

A. Steps shall meet the requirements of ASTM C 478 and shall be ML-10 steps as manufactured by American Step Company, Inc., M.A. Industries, Inc., or approved equal.

#### 4.5 CHIMNEY SEALS

A. Internal manhole chimney seals are required for all sanitary sewer manholes.

END OF SECTION 33 05 13

# SECTION 33 11 00 WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Water main pipe and fittings
  - 2. Valves and boxes
  - 3. Hydrants
  - 4. Services
  - 5. Insulation

#### B. Related Sections:

- 1. Section 31 23 33 Trench Excavation and Backfill
- C. Method of Measurement:
  - 1. Water Main:
    - a. Measure by distance in linear feet.
    - b. Measure along pipe axis with no deduction for fittings or valves.
    - c. Measure in the horizontal plane unless pipe grade exceeds 15 percent.
  - 2. Fittings:
    - a. a. Measure by weight in pounds.
    - b. b. Basis of Weight:
      - 1) Meet AWWA C153.
      - 2) Exclude weights of glands, gaskets, rods, bolts, and other accessories.
  - 3. Valves and Boxes: Measure valve and box of each size and type as a unit.
  - 4. Wet Taps: Measure each Wet Tap of each size and type as a unit.
  - 5. Hydrant Assembly:
    - a. Measure hydrants of each size and type as a unit.
    - b. Unit includes installation of hydrant, base, blocking, and crushed rock. It also includes installation of a 6-inch accessory gate valve and box.
  - 6. Corporation Stops: Measure corporation stops of each size and type as a unit.
  - 7. Curb Stops and Boxes: Measure curb stops and boxes of each size and type as a unit.
  - 8. Service Pipe:
    - a. Measure by distance in linear feet.
    - b. Measure each size separately.
    - c. Measure from center of water main to center of curb stop plus 1-foot for slack.
  - 9. Insulation: Measure by area in square yards.
- D. Basis of Payment:
  - 1. Payment for acceptable quantities of water main and appurtenances shall be at the Contract Unit Price as listed on the Bid Form. All associated Work items shall be considered incidental.
  - 2. Connect to Existing Water Main Pipe shall be compensation in full to furnish and install sleeves or fittings required to connect new ductile iron pipe water main to existing trunk water main pipe or hydrant lead pipes.

33 11 00 Water Distribution Systems
July 11, 2019 – Jefferson Master
Page 1 of 10

3. Connect to existing water service shall be compensation in full to furnish and install fillings required to connect the new copper water service to the existing water service at the curb stop or as directed by the Engineer.

# 1.2 REFERENCES

- A. ASTM:
  - 1. A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings
  - 2. A536 Ductile Iron Castings
  - 3. B88 Seamless Copper Water Tube
  - 4. B152 Copper Sheet, Strip, Plate, Rolled Bar
  - 5. D429- Tests for Rubber Adhesion to Rigid Surfaces
  - 6. D2842- Test for Water Absorption of Rigid Cellular Materials
  - 7. D1248- Polyethylene Plastics Extrusion Materials for Wire and Cable
- B. AWWA:
  - 1. C105- Polyethylene Encasement for Ductile -Iron Pipe Systems
  - 2. C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
  - 3. C150- Thickness Design of Ductile Iron Pipe
  - 4. C151 -Ductile-Iron Pipe, Centrifugally Cast for Water or other Liquids
  - 5. C153- Ductile-Iron Compact Fittings for Water Service
  - 6. C502 Dry-Barrel Fire Hydrants
  - 7. C504- Rubber-Seated Butterfly Valves
  - 8. C509 Resilient-Seated Gate Valves for Water Supply Service
  - 9. C515 Reduced-Wall, Resilient-Seated Gate Valves, for Water Supply Service
  - 10. C600 Installation of Ductile Iron Water Mains and their Appurtenances
- C. State of Wisconsin:
  - 1. Current Edition of the Standard Specification for Sewer & Water Construction in Wisconsin.
  - 2. Current edition of WisDOT- Standard Specifications for Public Works Constructions.

## 1.3 SUBMITTALS

- A. Submit Certificate of Compliance for products listed under Article 1.04.
- B. Submit proposed method of joint conductivity.

## 1.4 QUALITY ASSURANCE

- A. Provide Certificates of Compliance from the manufacturer certifying that the following products meet the respective requirements listed in Article 1.02:
  - 1. Pipe
  - 2. Gate Valves and Boxes
  - 3. Fittings
  - 4. Hydrants
  - 5. Appurtenances listed in Part 2 of this Specification
  - 6. Tracer wire

# 1.5 DELIVERY, STORAGE, AND HANDLING

## A. Inspection:

- 1. Inspect all pipe and products during the unloading process.
- 2. Notify Engineer of any cracked, flawed or otherwise defective products.
- 3. Remove all products found to be defective by the Engineer from the Site.
- B. Handling and Storage: Handling and storage of products shall be in accordance with Section 2.2 of AWWAC600.

## PART 2 - PRODUCTS

## 2.1 WATER MAIN PIPE

- A. Ductile Iron: AWWA C151.
- B. Cement-Mortar Lining: AWWA C104.
- C. Thickness Class: 52.
- D. Joints: Push-On.
- E. Joint Conductivity:
  - 1. Conductive gaskets as manufactured by American Ductile Iron Pipe Co.
  - 2. Field Application Methods:
    - a. Burndy Thermoweld by Burndy Corp., Norwalk, Connecticut.
    - b. Cadweld by Erica Products Co., Cleveland, Ohio.
  - 3. Copper Jumpers:
    - a. Minimum 1/16-inch by ½-inch wide flat copper strip.
    - b. Annealed round copper wire conforming to ASTM B152, Type DHP.
  - 4. Nuts and Bolts: Silicon Bronze.
  - 5. Repair damaged pipe coatings with a heavy coat of Koppers 50 or 505 as approved by the Engineer.
  - 6. The use of lead tipped gaskets is prohibited.

## 2.2 FITTINGS

- A. Ductile Iron: AWWA C153.
- B. Cement-Mortar Lining: AWWA C104.
- C. Joints: Mechanical with ASTM F593.
- D. Nuts and Bolts: Cor-Blue T-Bolts as manufactured by NSS industries.

# 2.3 VALVES AND BOXES

- A. Gate Valves:
  - 1. Resilient Seated: AWWA C509, or AWWA C515
  - 2. Mueller A-2360-20
  - 3. Working Pressure: 200 psi
  - 4. Ends: Mechanical Joint with ASTM F593 and F594 type 304 Stainless Steel fasteners
  - 5. Rubber encapsulated wedge
  - 6. Operating Stem:
    - a. Non-Rising with 0-ring Seals.
    - b. Bronze Mounted.
  - 7. Operating Nut: 2-inch Square, Open Left (counter clockwise)
  - 8. Resilient-soaked cast iron or ductile iron body
  - 9. Markings to be cast on the bonnet or body:
    - a. Open indicating arrow
    - b. Manufacturer's name
    - c. Pressure rating
    - d. Year of manufacture
    - e. Size
- B. Boxes:
  - 1. Cast Iron,  $5^{1/4}$ -inch shaft
  - 2. Vertical, 3 piece, Buffalo type
  - 3. Box length to provide for 6 feet of pipe cover
  - 4. Adjustable to 6 inches up or down from standard box length
  - 5. Cover shall be labeled "Water"

## 2.4 HYDRANTS

- A. Dry Barrel: AWWA C502.
- B. Mueller super centurion.
- C. Hose Connections: 2 each at 2<sup>1</sup>/<sub>2</sub>-inch diameter.
- D. Steamer Connection: 1 each at 4<sup>1</sup>/<sub>2</sub>-inch diameter.
- E. Threads: National Standard.
- F. Operating Stem: Open Left with 0-ring Seals.
- G. Traffic flange.
- H. Hub: 6-inch Mechanical Joint with ASTM F593 and F594 type 304 Stainless Steel bolts and nuts.
- I. Main Valve Opening: 5-inch diameter.
- J. Barrel Diameter: 5-inch.

- K. Drain to operate only when hydrant is closed.
- L. Drain holes to be tapped and plugged at the factory.
- M. Bury Depth: 6 feet min. (ground to bottom of hub).
- N. Minimize use of extensions.
- O. Minimum Nozzle Height (from flange): 18 inches.
- P. Cap Nuts: Pentagon.
- Q. Color: Red.
- R. Provide permanent markings which indicate:
  - 1. Manufacturer's name.
  - 2. Year of manufacture.
  - 3. Bury depth.

#### 2.5 SERVICE PIPE

- A. Copper: ASTM B88
- B. Type: K, Soft.

## 2.6 CORPORATION STOPS

- A. Type: Mueller H-15008 or equal (<sup>3</sup>/<sub>4</sub>-inch through 2-inch sizes)
  - 1. Inlet: AWWA taper thread
  - 2. Outlet: Conductive compression connection

## 2.7 CURB STOPS AND BOXES

- A. Valve:
  - 1. Mueller A-15209 Mark Ill Oriseal, or M-300 full port (<sup>3</sup>/<sub>4</sub>-inch through 2-inch sizes).
    - a. Inlet: Conductive compression connection.
    - b. Outlet: Conductive compression connection.

## B. Box:

- 1. Type Mueller H-10385 (<sup>3</sup>/<sub>4</sub>-inch and 1-inch sizes), extension
- 2. Type: Mueller H-10386 (1<sup>1</sup>/<sub>2</sub>-inch and 2-inch valves), extension
- 3. Arch Pattern Base
- 4. Provide stationary rods for all sizes.

#### 2.8 INSULATION

- 1. Rigid, extruded polystyrene board insulation.
- 2. Thermal Resistance (R): 5.0.
- 3. Thickness: 2-inch.
- 4. Board Size: 48-inch by 96-inch.
- 5. Compressive Strength: Minimum 25 psi.
- 6. Water Absorption in accordance with ASTM D2842: 0.1 percent by volume, maximum.
- 7. Edges: Square.

#### 2.9 ENCASEMENT

- A. Polyethylene Sheet: AWWA C105 Low Density1. Required only in unsuitable soils
- B. Thickness: 8 mil

## PART 3 - EXECUTION

## 3.1 CONSTRUCTION REQUIREMENTS

- A. Connection to Existing System:
  - 1. Pressure Tap:
    - a. Install tap in location shown on the Drawings.
    - b. Use approved tapping machine designed specifically for tapping under pressure.
    - c. Install tapping sleeve and gate valve as part of assembly.
    - d. Install blocking as required.
  - 2. Cut-In Connection:
    - a. Isolate segment of pipe to be cut and drain water from the line.
    - b. Connect tee and sleeve assembly to pipe ends.
    - c. Install blocking as required.
  - 3. Connect to In place Fitting:
    - a. Isolate segment of in place pipe and remove blocking as required.
    - b. Remove plug and drain water from the line.
    - c. Install blocking as required.
- B. Pipe Installation:
  - 1. Install pipe at the alignment and grade shown on the Drawings.
  - 2. Provide a minimum of 6 feet of cover over the pipe.
  - 3. Install appurtenances in the locations shown on the Drawings.
  - 4. Remove all dirt and foreign material from the pipe interior prior to installation.
  - 5. See Section 31 23 33 for pipe foundation and backfill procedures.
  - 6. See Section 31 23 33 in case of conflicts with existing pipes.
- C. Valve and Box Installation:
  - 1. Verify that subgrade material is adequate to support valve assembly.
  - 2. Install valves with stems vertical and plumb.
  - 3. Install boxes plumb and centered over the valve nut. Value box adapters shall be utilized as manufactured by Adapter Inc. of Oak Creek, Wisconsin.

33 11 00 Water Distribution Systems
July 11, 2019 – Jefferson Master
Page 6 of 10

- 4. Verify that box remains plumb and centered during backfill.
- 5. Adjust box cover to match existing grade (1/4-inch below pavement surface).
- 6. All valves installed at greater than 7 feet of depth shall have a value stem extension to bring operating nut to an equivalent 6 feet of depth. The extension shall be secured to the operating mat and have a dewatering ring at the top of the extension.
- D. Hydrant Installation:
  - 1. Verify that subgrade material is adequate to support hydrant.
  - 2. Generally locate hydrants every 500 feet and at each street intersection.
  - 3. Place thrust block, crushed rock and tar paper in accordance with Drawing details.
  - 4. Install and maintain hydrant in a plumb position.
  - 5. Where groundwater is present, plug drain hole and affix "Pump After Use" tag to the hydrant.
  - 6. Cover new hydrants during construction with polyethylene bags, securely fastened in place, until after the water main has been tested and placed on service.
- E. Joint Conductivity:
  - 1. Provide electrical bond across all joints between pipes and appurtenances.
  - 2. Install copper jumpers by either shop or field applications.
  - 3. Fasten multiple jumper strips with silicon bronze bolts and nuts.
  - 4. Welding:
    - a. Grind surfaces to be welded to remove coating and oxide and to provide clean metal surface.
    - b. Use metallic-arc process for stop applications.
    - c. Use exothermic process for field applications.
    - d. Refinish welded area with protective coating after connection is made.
- F. Thrust Restraint:
  - 1. Install thrust restraints at all bends, tees and plugs.
  - 2. Concrete Blocking:
    - a. Place between the fitting and undisturbed trench wall.
    - b. Minimum thickness: 12 inches.
    - c. Minimum area in square feet shall be in accordance with the following:

	1			0
Pipe	Tee or Plug	1/4 Bend	1/32 and 1/8 Bend	1/16 Bend
6-inch	2.9	3.1	1.6	0.8
8-inch	3.7	5.3	2.9	1.4
10-inch	5.7	8.1	4.4	2.2
12-inch	8.1	13.4	6.6	3.2
16-inch	15.1	21.4	11.6	5.9
20-inch	23.2	30.2	18.1	9.3
24-inch	33.6	48.5	26.1	13.3

- d. Size blocking based on the larger main.
- e. Verify that bolts are accessible after concrete is poured.
- 3. Timber Blocking:
  - a. Use for temporary blocking only for maximum 8-inch mains.
  - b. Minimum timber size: 4-inch by 4-inch.

- 4. Restrained Joints:
  - a. Submit method and type to Engineer for approval.
  - b. Install in accordance with "Thrust Restraint Design for Ductile Iron Pipe".
- G. Service Installation:
  - 1. Corporation Stops:
    - a. Provide watertight connection with approved tapping machine.
    - b. Install under main pressure.
    - c. Place a double wrap of Teflon tape around the threads prior to installation.
    - d. All 1<sup>1</sup>/<sub>2</sub>-inch and 2-inch stops shall be installed using a tapping saddle.
  - 2. Copper Service Pipe:
    - a. Install pipe between corporation stop and curb stop with no joints or unions.
    - b. Bury Depth: 6 feet.
    - c. Provide minimum 1-foot of slack in the pipe to allow for settlement and movement.
  - 3. Curb Stop and Box:
    - a. Install at the location shown on the Drawings. Generally, locate the curb box centered between the curb and sidewalk.
    - b. Verify that subgrade material is adequate to support the curb box assembly.
    - c. Install boxes plumb and centered over the tee head.
    - d. Verify that box remains plumb and properly aligned during backfill.
    - e. Adjust box cover to required grade.
    - f. Key all curb stops after backfill to ensure proper operation.
- H. Encasement:
  - 1. Comply with AWWA C105.
  - 2. Wrapping all pipe and fittings is not necessary unless unsuitable soils are encountered. If wrapping is necessary as directed by the Engineer, the following items shall apply:
    - a. Clean all surfaces of pipe and appurtenances prior to wrapping.
    - b. Provide sufficient slack to prevent damage during backfill.
    - c. Provide minimum 6-inch overlap at joints.
    - d. Secure overlap and joints with compatible adhesive tape.
    - e. Repair damaged wrap with tape or polyethylene patch.
- I. Backfill materials

1.

1. Granular backfill shall be used up to the bottom of the subgrade. Native materials composed of granular, non-clay soils may be utilized as approved by the Engineer.

## 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests upon completion of the system and prior to being placed into service:
  - Pressure and Leakage test:
    - a. Perform pressure and leakage test in accordance with AWWA C600.
    - b. Test Pressure: 150 psi.
    - c. Test Duration: 2 hours.
    - d. Gage Requirements:
      - 1) Size:  $4\frac{1}{2}$ -inch dial.
      - 2) Range: 0 to 200 psi.

- 3) Gradation: 2 psi.
- 4) Accuracy: 1/2 percent.
- 5) Do not allow pressure to vary more than 5 psi during the test.
- 6) Do not allow pressure to vary more than 2 psi during the last hour of the test.
- 7) Allowable Leakage: one-half of the volume allowed by AWWA C600 in accordance with the following:

 $\frac{L = SD\sqrt{P}}{266,400}$ 

L = Allowable Leakage in Gallons Per Hour

S = Length of Pipe Tested in Feet

D = Nominal Diameter of Pipe in Inches

P = Average Test Pressure During Test in Pounds/Square Inch (Gage)

- 2. Testing Services:
  - a. Perform separate pressure and leakage test on the services with the corporation stops open.
  - b. Test Pressure: 100 psi.
  - c. Allowable Leakage: None.
  - d. At Contractor's option, service testing may be done concurrent with the main testing.

## 3.3 DISINFECTION

- A. Disinfect all newly installed water mains, appurtenances and services in accordance with AWWA C651.
  - 1. Tablet, Continuous feed or powder chlorine method:
    - a. Hold chlorine solution in pipe for a minimum period of 24 hours.
      - 1) Initial dosage: 50 ppm minimum.
      - 2) Residual dosage after hold period: 10 ppm minimum.
- B. Flush system within 24 hours after disinfection is completed.
- C. Sampling and Testing:
  - 1. After final flushing, obtain 2 sets of samples taken a minimum of 24 hours apart.
  - 2. Each sample set shall include: ·
    - a. One sample for every 1,200 feet of main.
    - b. One sample at each dead-end.
    - c. Ensure that one sample is obtained from each branch of main.
    - d. Minimum sample required: 2
  - 3. Perform coliform tests on each sample.
  - 4. Rechlorinate if any sample tests positive for coliform.
- D. As directed by the Engineer. All piping installed outside the water main test segments shall be disinfected by swabbing with a 1 percent hypochloride solution and thoroughly flushed.

33 11 00 Water Distribution Systems
July 11, 2019 – Jefferson Master
Page 9 of 10

# PART 4 - GENERAL NOTES

### 4.1 EXISTING UTILITY INTERRUPTION

- A. Do not interrupt utilities occupied by Owner or others without written permission by Engineer or Owner.
- B. Notify Owner or Engineer not less than 24 hours in advance of proposed utility interruptions.
- C. Residential water service shall not be shut down for a period longer than eight (8) hours after 4:30 p.m., or weekends without approval from Owner. Commercial water service shall not be shut down for a period longer than two (2) hours without approval from the Owner.

#### 4.2 OPERATION OF VALVES

A. The Owner shall operate water main valves on existing infrastructure unless the owner authorizes such practice or in emergency situations.

#### 4.3 TRACER WIRE

- A. Shall be installed along all water main and services.
- B. Shall be 10 gauge multiple stranded, insulated, copper wire.
- C. Shall be blue in color.
- D. Shall be taped at the spring line of the main a minimum of 5-foot intervals.
- E. Shall be extended to the ground surface, terminaling to an access box located directly in back of all hydrants. Access box shall be flush with the ground surface and have 18 inches of slack in the wire. For services, the access box shall be located adjacent to the curb stop.
- F. Access boxes shall be manufactured by C.P. Test Service Valvco Inc. or equal.
- G. Tracer wire shall be tested for electrical conformity prior to acceptance.

END OF SECTION 33 11 00

# SECTION 33 31 13 - SANITARY SEWERAGE PIPING

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Description of Work Covered by This Section
  - 1. This section covers the construction, televising and acceptance testing of sanitary sewers, including materials specifications, instructions for handling and installing pipe and tests for acceptance of the work. The work done under this section includes furnishing all materials, labor, tools and equipment to construct the sanitary sewers, service laterals and all appurtenances, complete and in place.
- B. Abbreviations and Acronyms
  - 1. ASTM: American Society for Testing & Materials
  - 2. Poly: Polyvinyl Chloride
  - 3. PVC: Polyvinyl Chloride
- C. Section Includes:
  - 1. Sanitary sewerage pipe and fittings
  - 2. Pipe markers
  - 3. Connection to existing manholes
  - 4. Wye branches and tees
  - 5. Sanitary laterals
  - 6. Bedding and cover materials
  - 7. Leakage testing
  - 8. Alignment and grade testing
  - 9. Deflection testing
  - 10. Testing of pressure piping

#### 1.2 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials
- B. ASTM International

#### 1.3 COORDINATION

- A. Refer to Section 01 30 00 Administrative Requirements.
- B. Coordinate Work with users connected to system.
- C. Notify affected homeowners and residents at least 24 hours in advance of expected disruption of sanitary sewer service.

33 31 13 Sanitary Sewerage Piping	
January 28, 2019 – Master	
Page 1 of 9	

#### 1.4 PREINSTALLATION MEETINGS

A. Refer to Article 2.04 in Section 00 70 00 – General Conditions.

#### 1.5 SUBMITTALS

- A. Refer to Section 01 33 00 Submittals
- B. Product Data Piping: Submit data indicating pipe, pipe accessories, structures and materials incorporated into the work.
- C. Shop Drawings:
  - 1. Refer to Section 01 33 00 Submittals
  - 2. Indicate piping layout, including piping specialties
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer Instructions:1. Indicate special procedures required to install specified products.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 70 00 Execution Requirements and Project Closeout.
- B. Project Record Documents: Refer to Article 7.11 in Section 00 70 00 General Conditions.
- 1.7 QUALITY ASSURANCE
  - A. Perform work in accordance with these Specifications and all applicable local, State and Federal regulations.
- 1.8 DELIVERY, STORAGE, AND HANDLING
  - A. Refer to Article 7.03 in 00 70 00 General Conditions.
  - B. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
  - C. Store polyethylene and PVC materials out of sunlight.
  - D. Storage:
    - 1. Store materials according to manufacturer instructions.

33 31 13 Sanitary Sewerage Piping
January 28, 2019 – Master
Page 2 of 9

### 1.9 EXISTING CONDITIONS

- A. Field Measurements:
  - 1. Verify field measurements prior to shop drawing submittal and fabrication.
  - 2. Indicate field measurements on as-built drawings.

# PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. General Requirements for Sanitary Sewer Materials
  - 1. Unless otherwise shown on the Plans or specified elsewhere in these specifications the Contractor shall use PVC pipe in accordance with subsection B.
  - 2. The Engineer may order that samples of the pipe proposed or furnished be taken for the purpose of performing tests to verify compliance with this section. The Contractor will be responsible for delivery of all test specimens to the test laboratory designated by the Engineer at no additional cost to the Owner. The cost of the pipe selected for sampling shall also be borne by the Contractor. The costs of the initial tests shall be borne by the Owner. When every specimen tested conforms to the standards outlined in the appropriate subsections below all pipe in the shipment represented by those specimen shall be considered acceptable. However, when any test specimen fails to meet these requirements all pipe represented by that specimen shall be subject to rejection. Pipe that has been rejected by the Engineer shall be removed from the site of the work by the Contractor and replaced with pipe that meets the requirements, without additional cost to the Owner. The Contractor shall take samples of the replacement pipe for testing by an independent laboratory approved by the Engineer. The costs of these additional tests shall be borne by the Contractor.
  - 3. The Engineer may request copies of the manufacturer's or vendor's factory test results demonstrating compliance with these specifications. Copies of such test reports shall be submitted to the Engineer, at no cost to the Owner, before the pipe is installed in the project. Such tests shall have been conducted within the two (2) years previous to the date of the Engineer's request.
  - 4. Each length of pipe shall bear the name or trademark of the manufacturer, the class, and the wall thickness designation or strength designation of the pipe. No pipe handling holes shall be allowed.
  - 5. Acceptance of pipe and fittings shall be based upon visual inspection by the Engineer at the job site. Pipe and fittings may be rejected for fractures or cracks passing through the pipe wall; cracks or fractures on the interior of the pipe; defects that indicate improper proportioning, mixing and molding; variations in alignment, insecure attachment of branches, damaged ends and extensive patching or painting of any surface of the pipe.
- B. PVC Pipe and Joints
  - Pipe furnished under this classification shall meet the requirements of ASTM D3034, SDR 35 (Pipe Stiffness 46, i.e. PS 46). PVC plastic material shall have a cell classification designated in ASTM D3034 and ASTM D1784, Cell Class 12364 or Cell Class 12454. Joints shall be bell and spigot elastomeric gasketed joints meeting the requirements of the Department of Natural Resources. SDR 35 may be used only for cover depths of 15 feet or less. For cover depths in excess of 15 feet SDR 26 (Pipe Stiffness 115, i.e. PS 115) pipe shall be used.

33 31 13 Sanitary Sewerage Piping	
January 28, 2019 – Master	
Page 3 of 9	

- C. Wyes
  - 1. Wyes, except as permitted below, shall consist of a short length of main sewer with a factory-fabricated spur attached. They shall be made in such a manner as will provide strength and water tightness at least equal to the class of the main pipe to which they are joined and shall conform to all other requirements specified for pipe of corresponding class and internal diameter. Fabricated branch fittings shall be flush with the inside surface of the main pipe. Wye branches shall have their axis approximately 45° from the longitudinal axis of the main pipe. Wyes shall be used for risers and for all laterals. Tees may not be used unless specifically approved by the Engineer. Saddle-type connections may not be affixed using solvent cement and two steel bands for each connection.
  - 2. Wyes shall be 6 inches in diameter, unless otherwise noted on the plans or specified in the Special Conditions or Bid Proposal.
- D. Lateral Pipe:
  - 1. Sanitary sewer laterals shall be 6-inch diameter pipes, unless otherwise indicated in the Plans, Special Conditions or Bid Proposal.
  - 2. The type of pipe for the sewer main and the lateral shall be the same.

# PART 3 - EXECUTION

## 3.1 CONSTRUCTION

- A. The sanitary sewer trench shall be excavated according to Section 31 22 17 of these specifications. If the maximum trench width specified therein is exceeded the Contractor shall, at his own expense, furnish a stronger pipe or a concrete cradle, cap or envelope, whichever is acceptable to Engineer.
- B. Line and Grade
  - 1. The Owner shall pay the cost of providing initial line and grade on stakes, nails or markings set at an offset convenient for the Contractor. The Contractor shall be responsible for the preservation of the line and grade stakes, nails or markings. If such line and grade stakes, nails or markings are disturbed the Contractor shall pay for replacement.
  - 2. The Contractor shall, at his own expense, transfer the line and grade from the offset stakes, nails, or markings to the sewer by means of laser beam equipment, or other methods approved by the Engineer. The Contractor shall inform the Engineer of the methods he proposes to use. The Engineer may order any method discontinued if he determines that the method or the equipment being used does not produce accurate control for setting line and grade. The Contractor shall constantly check line and grade and, in the event they do not correspond with the line and grade provided by the Owner, shall stop work and notify the Engineer.
  - 3. All pipe shall be laid uniformly to the required line and grade. Variances from the required grade of more than 0.04 feet at any point shall be cause for rejection. Variances on the slope shall be no greater than 1/20th of the slope shown on the plans. No variations shall be allowed which result in a level or reverse-sloping invert.
- C. Laying Sewer Pipe
  - 1. The laying of sewer pipe shall commence at the lowest point in the proposed sewer line, unless otherwise approved by the Engineer. Pipe shall be laid with the bell end or receiving

33 31 13 Sanitary Sewerage Piping
January 28, 2019 – Master
Page 4 of 9

groove end pointing upgrade. If a laser is to be used, the Contractor shall calibrate the laser in a manner acceptable to the Owner's Authorized Representative before pipe laying operations begin.

- 2. If applicable, the Contractor shall cut in and connect to existing manholes. When a new sewer is to be connected to an existing sewer, which does not terminate in a manhole, the Contractor shall uncover the end of the existing sewer and contact the Engineer if any adjustments are necessary to make the existing sewer connection conform to the required grades.
- 3. Pipe laying shall begin only after trench excavation and bedding preparation as specified in Section 31 22 17 of these specifications, except that bedding shall always be placed in accordance with Class I or Class II of ASTM D2321. Bedding material shall then be placed below and around the pipe up to the spring line in such a manner as to provide adequate side support and to prevent lateral movement or deflection of the pipe. Care shall be exercised when handling pipe. Ropes, slings, or other devices shall be used for lowering the pipe into the trench. Only pipe that is suitable for use is to remain on the site of the work. Damaged or broken pipe shall be immediately separated from acceptable pipe.
- 4. All pipe shall be laid uniformly to line and grade on a prepared bedding so that the finished sewer presents a uniform bore. Care shall be taken to insure that the pipe does not rest directly on the bell, but is uniformly supported throughout its entire length. No pipe shall be laid on frozen ground.
- 5. As work progresses the interior of the pipe shall be cleared of all dirt and debris. No pipe shall be laid in wet trench conditions, unless approved by the Engineer. At all times when the work is not in progress all open ends of the pipe fittings shall be securely closed so that no trench water, earth, or other substances enter the pipe. Laterals, pipe branches, stubs, or other open ends that are not to be immediately connected shall be blocked with the pipe manufacturer's approved stopper so as to withstand the pressure of leakage tests.
- D. Jointing
  - 1. The recommendations of the pipe manufacturer shall be followed in assembling joints.
  - 2. Rubber-type (elastomeric) gasket joints shall be installed as follows: Thoroughly clean the receiving bell or groove and spigot or tongue of any sand or dirt. Spread a liberal amount of lubricant sealer of vegetable origin on the outside of the gasket and the inside of the bell groove of the last pipe laid. Care shall be taken to properly align the pipe before joints are forced completely home. During insertion of the tongue or spigot into gasketed joints the pipe shall be partially supported by hand, sling, or crane to minimize unequal lateral pressure on gaskets and to maintain concentricity until the gasket is properly positioned. Position the spigot or tongue end to the bell or groove end of the pipe previously laid and, using slight pressure with the end of a bar and wood block or a shovel, force the pipe section home. Care shall be taken that the entering pipe is completely home.
  - 3. Lubrication can be made with a non-vegetable origin lubricating adhesive furnished or recommended by the manufacturer.
  - 4. Solvent-cemented joints may not be used for sewer mains or laterals.
  - 5. If pipe is to be laid in cold weather, the Contractor shall heat the pipe and jointing materials to assure the tightness of the joint and to prevent freezing of joints. The Engineer reserves the right to order that pipe laying be discontinued when, in the Engineer's judgement, there is a danger of cold weather impairing the quality of the work.
- E. Placing Cover Materials
  - 1. Cover material shall be placed after the pipe has been properly bedded and jointed. Placement of cover material in the initial backfill zone shall be by hand, or equally careful

33 31 13 Sanitary Sewerage Piping	
January 28, 2019 – Master	
Page 5 of 9	

means, so as to avoid jarring or pushing the pipe and to assure that no large stones or foreign materials are allowed to come into contact with the pipe.

- 2. Cover material for PVC pipe shall be placed in two stages, one stage being to the top of the pipe, the other being to a level of 12 inches above the pipe. Each stage of cover material shall be compacted by hand or mechanical tamping.
- F. Risers, Cradles, Wyes and Laterals
  - 1. Wyes shall be installed at all the locations shown or noted on the Plans or as specified in the Special Conditions. Wye fittings shall be installed at an angle of 45° up from the horizontal, unless otherwise specified. If the connection is to be fitted with a riser-type extension, such an extension shall be made at an angle 45° up from the horizontal unless otherwise specifically allowed by the Engineer. Plan Details show how wyes, risers, and laterals are to be installed. The Contractor shall accurately record lateral locations and provide these as-built measurements on an annotated plan set. Final payment will not be made until this plan set is provided.
  - 2. Lateral tracing systems shall be installed on all new laterals as required by Wisconsin Statutes and Wisconsin Administrative Code. If no bid price is provided for such tracing systems they shall be incidental to the sanitary lateral unit price. Sanitary lateral tracing systems shall be installed on existing laterals being replaced if so required in the Special Conditions or Measurement and Payment sections.
  - 3. The Contractor shall provide concrete cradles or envelopes where shown on the Plans or where specified in the Special Conditions. Concrete used for such purposes shall be Class CC, as specified in Section 03 30 01 of these specifications.

# 3.2 ACCEPTANCE TESTING

- A. Acceptance Testing General
  - 1. All acceptance tests shall be performed after service laterals have been constructed and backfilled, and after adjacent water main and storm sewer systems, where applicable, have been completed and backfilled.
- B. Acceptance Testing for Gravity Sewers Leakage
  - 1. The rate of infiltration of water into the completed and backfilled sewer, manholes and appurtenances shall not exceed 200 gallons per day per inch diameter per mile of sewer over the entire project. In addition, the rate of infiltration between any two adjacent manholes shall not be greater than 200 gallons per day per inch diameter per mile of sewer.
  - 2. The Contractor is required to repair all visible leaks, even if the infiltration limits are met. Manhole allowances shall be computed using the vertical feet of manholes and the actual inside diameter of the manholes.
  - 3. The Contractor shall provide all equipment, manpower and materials necessary to conduct leakage tests of the sewer. He shall notify the Owner at least one (1) working day in advance of conducting such tests so that the Owner may have a representative present to observe the test.
  - 4. The test method shall be as follows:
    - a. Low Pressure Air Test The Contractor shall furnish test plugs, an air compressor, test gauge, stopwatch, and personnel experienced in conducting the acceptance test. The Contractor may fill the pipe being tested with water to permit normal absorption into the pipe walls. The Contractor shall be responsible for all tees, wyes, laterals, and plugs being sealed and braced to withstand the test pressures. Air shall be added to the pipe to raise the pressure inside the pipe to 4.0 pounds per square inch gauge

33 31 13 Sanitary Sewerage Piping
January 28, 2019 – Master
Page 6 of 9

(psig) greater than the highest expected inservice groundwater level that may be above the top of the pipe. After a pressure of 4.0 psig is obtained, the Contractor shall regulate the air supply so that the pressure is maintained between 3.5 and 4.5 psig above the average groundwater backpressure for a period of two (2) minutes. After the two (2) minute air stabilization period, the air supply shall be disconnected, and the test pressure shall be allowed to decrease to 3.5 psig. The Contractor shall measure the time required for the test pressure to drop from 3.5 psig to 2.5 psig. The pipe shall be acceptable if this time is greater than or equal to the following table:

Pipe	Min.	Max.	Time for	Specification Time for Length Shown, minutes & seconds							
Dia.,	Test	Length	Lengths	100	150	200	250	300	350	400	450
(inches)	Time,	that Can	when Tested	feet	feet	feet	feet	feet	feet	feet	feet
	(minutes	Be Tested	Length, L, >								
	&	Using	Max. Length								
	seconds)	Min. Test	for Min. Test								
		Time	Time								
		(feet)	(seconds)								
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.694L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768L	51:17	76.55	102:34	128:12	153:50	179:29	205.07	230:46

Time which must be exceeded for a 1.0 psig pressure drop for size and length of pipe indicated.

- C. Acceptance Testing for Gravity Sewers: Alignment and Grade
  - 1. Alignment and grade shall be checked by the laser method. Using a construction laser, Contractor shall demonstrate, in the presence of the Engineer, that a laser beam is visible from one end of each manhole-to-manhole sewer segment to the other end. If the laser beam is not visible, the defects shall be corrected by the Contractor before final acceptance.
- D. Acceptance Testing for Gravity Sewers: Deflection
  - 1. All sanitary sewers shall be tested for deflection after completion of backfill and compaction. The test shall be conducted by pulling an appropriately sized mandrel through the completed pipeline. The Contractor shall, at his own expense, locate and repair any section rejected on this basis.
  - 2. The dimensions of the testing device shall be as shown in the following table which is based on 5%, or 7.5% deflection of the ASTM 679 base inside diameters. Note: The base I.D. is a minimum pipe I.D. derived by subtracting a statistical tolerance package from the pipe's average I.D. The tolerance package is defined as the square root of the sum of squared standard manufacturing tolerances.

33 31 13 Sanitary Sewerage Piping	
January 28, 2019 – Master	
Page 7 of 9	

Nominal Size	ASTM D 3034					
(Inches)	Minimum Diameter (Inches)					
	Base I.D.	5% Defl.	7.5% Defl.			
8 SDR 35	7.67	7.28	7.09			
10 SDR 35	9.56	9.08	8.85			
12 SDR 35	11.36	10.79	10.51			
15 SDR 35	13.90	13.20	12.85			
8 SDR 26	7.49	7.11	6.93			
10 SDR 26	9.34	8.87	8.64			
12 SDR 26	11.10	10.55	10.27			
15 SDR 35	13.58	12.90	12.56			
NT 1 1 C1	<b>ASTM F 679</b>					
Nominal Size		ASTM F 679				
Nominal Size (Inches)	Minii	ASTM F 679 <u>mum Diameter (</u>	Inches)			
Nominal Size (Inches)	Miniı <u>Base I.D.</u>	ASTM F 679 num Diameter ( 5% Defl.	Inches) 7.5% Defl.			
Nominal Size (Inches)	Minii <u>Base I.D.</u>	ASTMF 679 num Diameter ( 5% Defl.	Inches) 7.5% Defl.			
Nominal Size (Inches) 18 PS 46	Minii <u>Base I.D.</u> 17.05	ASTM F 679 num Diameter ( 5% Defl. 16.20	Inches) 7.5% Defl. 15.77			
Nominal Size (Inches) 18 PS 46 21 PS 46	Minii <u>Base I.D.</u> 17.05 20.10	ASTM F 679 num Diameter ( 5% Defl. 16.20 19.09	Inches) 7.5% Defl. 15.77 18.59			
Nominal Size (Inches)           18 PS 46           21 PS 46           24 PS 46	Minii <u>Base I.D.</u> 17.05 20.10 22.59	ASTM F 679 num Diameter ( 5% Defl. 16.20 19.09 21.46	Inches) 7.5% Defl. 15.77 18.59 20.89			
Nominal Size (Inches)           18 PS 46           21 PS 46           24 PS 46           27 PS 46	Minii Base I.D. 17.05 20.10 22.59 25.45	ASTM F 679 num Diameter ( 5% Defl. 16.20 19.09 21.46 24.18	Inches) 7.5% Defl. 15.77 18.59 20.89 23.53			
Nominal Size (Inches)           18 PS 46           21 PS 46           24 PS 46           27 PS 46           18 PS 115	Minii Base I.D. 17.05 20.10 22.59 25.45 16.69	ASTM F 679 num Diameter ( 5% Defl. 16.20 19.09 21.46 24.18 15.85	Inches) 7.5% Defl. 15.77 18.59 20.89 23.53 15.44			
Nominal Size (Inches)           18 PS 46           21 PS 46           24 PS 46           27 PS 46           18 PS 115           21 PS 115	Minii Base I.D. 17.05 20.10 22.59 25.45 16.69 19.67	ASTM F 679 num Diameter ( 5% Defl. 16.20 19.09 21.46 24.18 15.85 18.68	Inches) 7.5% Defl. 15.77 18.59 20.89 23.53 15.44 18.19			
Nominal Size (Inches)           18 PS 46           21 PS 46           24 PS 46           27 PS 46           18 PS 115           21 PS 115           24 PS 115	Minii Base I.D. 17.05 20.10 22.59 25.45 16.69 19.67 22.10	ASTM F 679 num Diameter ( 5% Defl. 16.20 19.09 21.46 24.18 15.85 18.68 21.00	Inches) 7.5% Defl. 15.77 18.59 20.89 23.53 15.44 18.19 20.44			
Nominal Size (Inches)           18 PS 46           21 PS 46           24 PS 46           27 PS 46           18 PS 115           21 PS 115           24 PS 115           27 PS 115           27 PS 115	Minii Base I.D. 17.05 20.10 22.59 25.45 16.69 19.67 22.10 24.90	ASTM F 679 num Diameter (1 5% Defl. 16.20 19.09 21.46 24.18 15.85 18.68 21.00 23.65	Inches) 7.5% Defl. 15.77 18.59 20.89 23.53 15.44 18.19 20.44 23.03			

TESTING DEVICE DIMENSIONS FOR PVC PIPE

- 3. The Contractor shall furnish the testing device, all materials, equipment and labor for making this acceptance test.
- 4. The test shall be conducted after backfill has been placed and compacted to at least street subgrade level, with a minimum of five feet of cover over the pipe. The 95% device shall be used if testing is done less than 30 days after consolidation. The 92.5% may be used if testing is done 30 days or more after consolidation. Any section of the completed sewer failing to pass this test shall be repaired and retested. All testing shall be done under the observation of the Engineer.
- E. Acceptance Tests for Gravity Sewer Televising
  - 1. Contractor shall clean by jetting and shall televise all completed sewer sections. Contractor shall provide a color DVD and a written televising report, including notations of all service lateral locations. The televising procedure shall include turning the camera to look up each lateral connection. The Contractor shall bear all costs of correcting any deficiencies found during television inspection, including recleaning and retelevising if the initial television inspection shows the sewers were not effectively cleaned prior to the first televising, and additional television inspection to verify that other required correction efforts were successful.

#### 3.3 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 Quality Requirements
- B. Refer to 01 70 00 Execution Requirements and Project Closeout

33 31 13 Sanitary Sewerage Piping	
January 28, 2019 – Master	
Page 8 of 9	

#### 3.4 **PROTECTION**

- A. Refer to Paragraph 3.3 in Section 01 70 00 Execution Requirements and Project Closeout.
- B. Any existing mains and manholes to be abandoned shall be either completely removed and disposed of or completely filled with blown sand or flowable fill. Any existing laterals shall be either completely removed and disposed of or exposed at the wye and plugged with hydraulic cement.

## PART 4 - MUNICIPAL REQUIREMENTS

#### 4.1 LATERAL TRACER WIRE BOXES

A. Lateral tracer wire boxes are required and shall be full-depth, 2½-inch diameter cast iron curb boxes for the termination of the lateral tracer wire. Boxes shall be Bingham & Taylor Figure 4901-B with lid marked "SEWER".

#### 4.2 LATERAL TRACER WIRE

A. Lateral tracer wire is required and shall be solid copper, 10-gauge minimum, plastic-coated. All tracer wire connections shall be soldered, split-bolt connections.

#### 4.3 LATERAL PIPE

- A. Sanitary sewer laterals shall be 4-inch diameter pipes, unless otherwise indicated on the Plans or specified in the Special Conditions.
- B. The type of pipe for the sewer main and the lateral shall be the same.

END OF SECTION 33 11 13

# SECTION 33 41 13 - PUBLIC STORM UTILITY DRAINAGE PIPING

# PART 1 - GENERAL

### 1.1 SUMMARY

- A. Description of Work Covered by This Section
- B. The Contractor shall furnish all materials, labor, tools, and equipment to construct, complete in place, storm sewer and all appurtenances.
- C. This section specifies materials to be used in storm sewer construction and how to handle and install the pipe, and contains general information regarding line and grade, testing for acceptance and measurements for payment.
- D. Part 4 of this specification section may limit the types of pipe and castings that are acceptable. Any conflicts between Parts 1, 2 and 3 and Part 4 shall be resolved in favor of Part 4.

#### E. Section Includes:

- 1. Storm drainage piping
- 2. Piping accessories
- 3. Pipe culverts and accessories
- 4. Corrugated steel pipe culvert
- 5. Concrete pipe culvert
- 6. Joints and accessories
- 7. Slope protection at pipe end
- 8. Catch basins and area drains
- 9. Bedding and cover materials

#### 1.2 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials
- B. ASTM International

#### 1.3 COORDINATION

- A. Refer to Section 01 30 00 Administrative Requirements
- B. Coordinate Work of this Section with users connected to system.
- C. Notify affected homeowners and residents at least 24 in advance of expected disruption of water or sanitary sewer service.

33 41 13 Public Storm Utility Drainage Piping
November 29, 2017 – Master
Page 1 of 10

#### 1.4 PREINSTALLATION MEETINGS

A. Refer to Article 2.04 in Section 00 70 00 – General Conditions

### 1.5 SUBMITTALS

- A. Refer to Section 01 33 00 Submittals
- B. Product Data: Submit data indicating pipe, pipe accessories, liner material, structures and other materials incorporated into the work..
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Shop Drawings: Submit installation and anchoring requirements, fasteners, and other details.
- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 70 00 Execution Requirements and Project Closeout.
- B. Project Record Documents: Refer to Article 7.11 in Section 00 70 00 General Conditions

#### 1.7 QUALITY ASSURANCE

A. Perform work in accordance with these Specifications and all applicable local, State and Federal regulations.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Article 7.03 in Section 00 70 00 General Conditions
- B. Storage:
  - 1. Store materials according to manufacturer instructions.
  - 2. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

#### C. Protection:

- 1. Keep UV-sensitive materials out of direct sunlight.
- 2. Provide additional protection according to manufacturer instructions.

33 41 13 Public Storm Utility Drainage Piping
November 29, 2017 – Master
Page 2 of 10

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT

- A. Sewer Pipe:
  - 1. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the plant, and the date of the manufacturer. Each length shall likewise be marked to designate the class, wall thickness designation, and strength of the pipe. The markings shall be made on the exterior or interior of the pipe barrel and shall be clearly visible. Pipe with either elliptical or quadrant reinforcement shall have the words "top" or "bottom" clearly stenciled on the inside of the pipe at the correct place to indicate the proper position for installation.
  - 2. Pipe handling holes are permitted only on reinforced concrete storm sewer pipe 21 inches in diameter, or larger. One (1) handling hole is permitted on straight lengths of pipe less than 48 inches in diameter, and two (2) on pipe 48 inches in diameter and greater. After the pipe has been installed the handling holes shall be promptly plugged with mortar.
  - 3. Pipe shall be subject to rejection for:
  - 4. cracks passing through the pipe wall, or socket
  - 5. chips or fractures on the interior of the pipe
  - 6. defects that indicate improper proportioning, mixing and molding
  - 7. variations of more than <sup>1</sup>/<sub>8</sub>-inch per lineal foot in alignment of pipe intended to be straight
  - 8. damaged ends which would, in the opinion of the Engineer, prevent or make difficult the completion of a satisfactory joint
  - 9. extensive patching or painting of any surface of the pipe
  - 10. Unless a specific pipe material and type is designated on the Plans or in the Special Conditions, the Contractor shall use Reinforced Concrete Pipe, as specified below, for all areas under pavement. Joints shall be of the designated type, unless otherwise approved by the Engineer.
  - 11. The Engineer may require that standard ASTM specification tests be made on pipe supplied. These tests shall be made by an independent laboratory, at no extra cost to the Owner, and a certified test report shall be furnished to the Engineer.
  - 12. Reinforced Concrete Pipe: Reinforced concrete pipe shall conform to ASTM C76 for circular pipe or ASTM C507 for elliptical pipe. If the class of pipe is not specified elsewhere Class III will be the minimum strength class acceptable.
  - 13. The following types of pipe are permissible only in areas where they are not under pavement and where they are called out on the Plans or specified elsewhere in the specifications.
  - 14. Smooth Interior Wall Polyethylene
    - a. Polyethylene pipe shall be smooth interior wall, corrugated exterior wall pipe, and joined with gasketed, water-tight, integral bell & spigot joints, meeting the following specifications:
    - b. AASHTO M252, Type S, eight (8) inches and 10 inches
    - c. AASHTO M294, Type S, 12 inches to 60 inches
    - d. ASTM F2306
    - e. Such pipe shall be ADS N-12WT, or approved equal. Saddle gaskets are not allowed. All endwalls shall be concrete.

33 41 13 Public Storm Utility Drainage Piping	
November 29, 2017 – Master	
Page 3 of 10	

- 15. Smooth Interior Wall Polypropylene
  - a. Polypropylene pipe shall be smooth interior wall, corrugated exterior wall pipe, and joined with gasketed, water-tight, integral bell & spigot joints, meeting the following specifications:
  - b. AASHTO M330
  - c. ASTM F2736 (12" 30")
  - d. ASTM F2881 (36" 60")
  - e. Such pipe shall be ADS HP, or approved equal. All endwalls shall be concrete.
- 16. Corrugated Metal Pipe, Pipe Arch, and Structural Plate -
  - Corrugated metal pipe (CMP) and pipe arch shall meet the requirements set forth in AASHTO M-36. Structural plate shall meet the requirements of AASHTO M-167.
- B. Joints, Coupling Bands and Gaskets

a.

- 1. Concrete pipe shall have flat internal compression type rubber ring gaskets, external joint wrap-around gaskets, or flexible plastic gaskets.
- 2. Flat internal compression gaskets shall conform to ASTM designation C443. These flat internal joint gaskets shall have at least two (2) rubber sealing fins and shall be of such conformation that the gaskets are compressed as the pipe is seated. Flat internal compression gaskets shall be Press-Seal, Tylox Type CR, or approved equal.
- 3. External wrap-around gaskets for concrete pipe, where required on the Plans or specified in the Special Conditions, or if used in lieu of flat gaskets shall consist of an outer layer of polypropylene, with an under layer of rubberized mastic that is reinforced with a woven polypropylene fabric. There shall be a peelable protective paper against the mastic that is to be removed when the collar is applied to the joint. The gasket shall have a minimum width of not less than twice the depth of the groove of the pipe, or as follows:

Pipe Diameter	Gasket Width	Permissible Joint Opening If Gasket Is Used Alone
21-33 inches	7 inches	<sup>3</sup> / <sub>8</sub> -inch
36-54 inches	9 inches	<sup>1</sup> / <sub>2</sub> -inch
60-78 inches	11 inches	<sup>3</sup> /4-inch
84 inches and larger	13 inches	1-inch

- 4. The length of the gasket shall be equal to the outside circumference of the pipe plus the width of the gasket so that adequate overlap is achieved.
- 5. Flexible plastic gasket joints for concrete pipe shall comply with the physical requirements for Type "B" gaskets in AASHTO Designation M198, or Federal Specifications SS-S-00210.
- 6. Joints for polyethylene pipe shall be watertight, meeting the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477, and shall be provided by the pipe manufacturer.
- 7. Joints for polypropylene pipe shall be watertight, meeting the requirements of ASTM F2736 and ASTM D3212. Gaskets shall meet the requirements of ASTM F477, and shall be provided by the pipe manufacturer.
- 8. Joints for corrugated metal pipe shall be coupling bands conforming to AASHTO M36, fabricated from the same base material as the pipe. These bands shall be at least seven (7) inches wide for pipe diameters of eight (8) inches to 30 inches, at least 12 inches wide for pipe diameters of 36 inches to 60 inches, and at least 24 inches wide for pipe diameters greater than 60 inches. Bands shall be constructed to lap an equal portion on each pipe section being connected, and shall be connected at the ends by galvanized steel angles

having minimum dimensions of two-inch by two-inch by 3/16-inch (2"x2"x 3/16"). Seven (7)-inch bands shall have at least two (2) galvanized bolts, each not less than ½-inch in diameter. Twelve-inch bands shall have three (3) such ½-inch diameter bolts. Twenty-four-inch bands shall have at least five (5) such ½-inch diameter bolts. Bands shall be gasketed using 3%-inch thick be 12-inch minimum width closed cell synthetic sponge rubber, conforming to the requirements of ASTM D1056, grade SCE-43, fabricated in the form of a cylinder with a diameter of approximately 10 percent less than the nominal pipe diameter. The gasket shall be centered under the band and lapped an equal distance on the ends of the adjoining pipe sections.

## C. Castings

1. Castings for storm water inlets and catch basins, shall be of uniform quality, free from blow holes, porosity, hard spots, shrinkage defects, cracks or other serious defects. They shall be smooth and well cleaned by sand or shot blasting, and coated with a tar pitch varnish which will make a smooth, tough and tenacious coating, not tacky under any weather condition. Iron used shall conform to ASTM A48, Class 30 B. All manhole castings shall be true to pattern with machined bearing faces between the frame and cover. The type of castings shall be as designated in Part 4 at the end of this section.

# D. Endwalls

1. All endwalls shall be precast concrete, unless otherwise stated in the Special Conditions, Measurement & Payment section, Bid Proposal or on the Plans. Endwall grates shall be prefabricated painted steel pipe grates.

## 2.2 ACCESSORIES

A. Drainage Structures:
1. Refer to Section 33 05 13 – Manholes and Structures.

# PART 3 - EXECUTION

# 3.1 CONSTRUCTION

- A. Line and Grade
  - 1. Line and grade on stakes, nails, or markings set at an offset convenient to the Contractor shall be provided at the Owner's expense. The Contractor shall be responsible for the preservation of the line and grade stakes, nails, or markings and if these markings are disturbed, he shall pay the cost of replacement. The Contractor shall give notice to the Engineer at least three (3) working days in advance of the time line and grade is desired.
  - 2. The Contractor shall transfer the line and grade from the offset to the sewer by means of laser beam equipment or other methods approved by the Engineer. The Contractor shall, prior to construction, inform Engineer of this proposed methods and the equipment to be used for transferring grades. The Engineer may order any method discontinued if at any time the method or equipment being used does not produce an accurate control for setting line and grade.

33 41 13 Public Storm Utility Drainage Piping
November 29, 2017 – Master
Page 5 of 10

- B. Laying of Sewer Pipe
  - 1. The Contractor shall begin to lay the sewer at the lowest point of the line. Pipe shall be laid with the bell end or receiving groove edge-up stream in the direction of laying. The Contractor shall cut in and connect to the existing manhole, where applicable. If connecting to an existing sewer the Contractor shall uncover the end of the existing sewer and contact the Engineer if any adjustments are necessary.
  - 2. Laying of the sewer pipe may begin following the trench preparation and bedding provisions of Section 31 22 00, except as noted below for flexible sewer pipe, or unless special bedding types are designated on the Plans.
  - 3. Ropes, slings, or other devices must be used for lowering the pipe into the trench. Pipe shall not be dropped into the trench. Only pipe which is undamaged and is suitable for use is to remain on the site of the work. Damaged or broken pipe is to be immediately separated from acceptable pipe, and the damaged or broken pipe is to be removed immediately from the site of the work.
  - 4. All pipes shall be laid uniformly to line and grade on a prepared bedding which will provide even support along the entire barrel. Bell holes shall be excavated in the bedding material so that the pipe will be resting on the barrel and not on the bell.
  - 5. Each pipe that is laid and graded shall be carefully bedded by hand and shall be backfilled to provide 12 inches of cover before subsequent pipes are laid. The space filled between the pipe and trench wall shall be compacted manually in six (6)-inch layers. Pipe sizes larger than 18 inches in diameter may require mechanical compaction of the bedding material.
  - 6. Bedding and initial backfill for PVC SDR-35, and other designated flexible pipe used in storm sewers, shall be placed in accordance with Class I or II of ASTM D2321.
  - 7. As work progresses, the interior of the sewer shall be cleared of all dirt and debris. No pipe shall be laid where water is above the bedding material. Water may be allowed to flow into the newly installed pipe when pipe laying is not in progress and when provisions are made to prevent dirt from washing in with the water.
- C. Special Requirement for Laying Corrugated Metal Pipe, Pipe Arch, and Structural Plate Sections:
  - 1. Laying of corrugated metal pipe, metal arch pipe and structural plate sections shall be in accordance with the provisions of Specification Section 31 22 17 and of Subsection B above, with the following exceptions:
    - a. The trench shall be wide enough to permit thorough compaction of backfill materials, but the width on each side of the pipe 24 inches in diameter, and larger, shall be one (1) foot. After bedding is completed the pipe shall be backfilled simultaneously on both sides of the pipe to a level even with the top of the pipe with sand or gravel passing a one (1)-inch screen, mechanically tamped in six (6)-inch layers to 85 percent of Standard Proctor density.
    - b. CMP or arch pipe shall not be allowed to deflect during construction more than 5 percent of its nominal vertical dimension. Supports shall be used if necessary to prevent deflection during installation and backfill.
  - 2. When corrugated metal pipe is used as an inlet or outlet section, the lower 90 degree quadrant of the pipe shall be bedded in undisturbed or compacted soil which has been shaped to fit the pipe. The bedding and backfill material around the pipe and to a level one (1) foot above the outside top of the pipe shall be dry, finely broken up clay or loam, brought up simultaneously on both sides of the pipe. The backfill shall be tamped in six (6)-inch layers, except that no tamping shall be done directly over the pipe.

33 41 13 Public Storm Utility Drainage Piping
November 29, 2017 – Master
Page 6 of 10
- D. Construction of Joints
  - 1. Joint procedures shall conform to the manufacturer's recommendations and good pipelaying practice.
  - 2. Rubber ring gasket joints for concrete pipe shall be completed as follows: Thoroughly clean the receiving bell and spigot end of any sand or dirt. Spread a liberal amount of lubricant/sealer of vegetable origin on the resilient material and upon all sliding surfaces. Position the spigot end to the bell end of the pipe previously laid, and, using slight pressure with the aid of a bar and wood block or shovel, force the pipe home.
  - 3. Joints of external wrap-around gaskets shall be made as follows: After the pipes are joined together, the area of the outer pipe barrel at the joint where the gasket will be applied shall be cleaned and pre-wetted. The gasket shall then be formed to the barrel of the pipe by pressing it against the pipe by hand to assure maximum contact with the pipe surface. When the inside joint opening between the ends of pipes exceeds the permissible joint opening, the entire inner joint shall be filled with mortar.
  - 4. Joints for CMP shall be made with coupling bands installed in accordance with the manufacturer's recommendations.
  - 5. Alternate methods of pipe coupling shall be submitted to the Engineer for approval.
- E. Laying Sewer Pipe for Curves
  - 1. Sewers laid on curves shall be constructed by one of the following methods:
    - a. Deflection of Pipe Joints
    - b. Miter or Cut-off Pipe
  - 2. Deflection of pipe joints will be permitted when the joint opening is less than <sup>1</sup>/<sub>4</sub> of the length of the tongue when rubber gasket joints are used. Otherwise cut-off pipe or miter pipe must be used to make the bends.
  - 3. Cut-off pipe shall be molded with the difference between the longest and shortest sides, measured along the outside of the pipe, conforming to the values given in the table below. Only four (4) foot long pipe sections shall be used.
  - 4. Miter pipe shall be manufactured by the removal of the wedge from the center of the pipe to provide for the required angle of deflection. Sufficient additional reinforcement shall be added at the spring lines and top and bottom of the pipe to prevent shearing after installation. Repairs to complete the pipe shall be such that the concrete shall have strength equivalent to that of the remainder of the pipe barrel and shall not spall or separate.
  - 5. Miter pipe shall be used for all elliptical pipe laid on a curve. Miter pipe for circular sewers shall be used only with the approval of the Engineer.

33 41 13 Public Storm Utility Drainage Piping
November 29, 2017 – Master
Page 7 of 10

<b>Cut-Off of Pipe for Curved Sewer (Inches)</b> Radius of Curve (Feet)										
Pipe I.D. (Inches)	40	50	57.3	60	70	80	90	100		
21	$2^{5}/8$	$2^{1}/8$	13⁄4	13⁄4	11/2	$1^{3}/8$	11/4	$1^{1}/8$		
24	$2^{7}/8$	$2^{3}/8$	2	2	13⁄4	11/2	$1^{3}/_{8}$	11/4		
27	31/4	$2^{5}/8$	21/4	$2^{1/8}$	17/8	15/8	11/2	$1^{3}/8$		
30	31/2	$2^{7}/8$	21/2	$2^{3}/8$	$2^{1/8}$	17/8	15/8	11/2		
36	4¼	3 <sup>3</sup> /8	3	$2^{7}/8$	21/2	$2^{1/8}$	$1^{7}/8$	13⁄4		
42	-	3 <sup>7</sup> /8	$3^{3}/_{8}$	31/4	$2^{7}/8$	21/2	21/4	2		
48	-	$4^{3}/_{8}$	3 <sup>7</sup> /8	33/4	31/4	$2^{7}/8$	21/2	21/4		
54	-	-	$4^{3}/_{8}$	4 <sup>1</sup> /8	3 <sup>5</sup> /8	3 <sup>1</sup> /8	$2^{7}/8$	21/2		
60	-	-	-	-	4	31/2	3 <sup>1</sup> /8	23/4		
66	-	-	-	-	$4^{3}/_{8}$	33/4	$3^{3}/_{8}$	3		
72	-	-	-	-	-	$4^{1}/_{8}$	3 <sup>5</sup> /8	$3^{3}/_{8}$		
78	-	-	-	-	-	$4^{3}/_{8}$	4	3 <sup>5</sup> /8		
84	-	-	-	-	-	43/4	41/4	37/8		
96	-	-	-	-	-	-	$4^{7}/_{8}$	$4^{3}/_{8}$		

- F. Catch Basins and Inlets
  - 1. Catch basins, street inlets and inlet manholes shall be constructed as shown on the Detail(s) at the end of this section and placed in the locations shown on the Plans. Adjusting rings shall be grouted into place. A one (1)-inch grout allowance shall be made between the top of the uppermost ring and the bottom of the casting. Steps 16 inches, on center, shall be provided wherever the depth of the structure is greater than five (5) feet. Concrete sections shall be cast-in-place or precast concrete. Castings shall be as shown on the Detail(s) at the end of this section.
  - 2. Standard manhole construction, including standard castings (not inlet castings) stubs for future manhole connections and related accessories shall be constructed in accordance with Section 33 05 13.
- G. Acceptance Testing
  - 1. All storm sewers will be checked by the Engineer for infiltration or bedding leakage. All infiltration sites and bedding leaks shall be repaired by the Contractor at the Contractor's expense.
  - 2. The alignment and grade of the sewer shall be checked by laser or lamping methods, with all equipment to be provided by the Contractor. Defects shall be corrected by the Contractor before final acceptance. If closer inspection is warranted, the Owner may arrange for a televised inspection. The Owner will assume the cost of televised inspection if no serious defect is found. If defects are found which the Engineer attributes to the failure of proper installation or flawed materials, the Contractor shall pay for the test. Defects shall be promptly corrected, and the Contractor shall pay for a second television inspection to demonstrate that such correction has been successful.
  - 3. Deflections in HDPE pipe and polypropylene pipe shall be limited to 5 percent of the base inside pipe diameter within thirty days of backfill and 7 percent thereafter. The Contractor shall supply and hand pull through the sewer an appropriate sized mandrel within thirty days following completion of the street or ground surface above the pipe. If the surface course of asphalt is delayed until the year following the completion of the lower course of

asphalt this acceptance test shall be performed within thirty days following completion of the lower course of asphalt. Failure of the mandrel to freely pass through shall be cause for rejection of the sewer. The Contractor, at his own expense, shall repair or replace the sections which have been rejected and restore all affected surfaces.

## 3.2 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 Quality Requirements
- B. Refer to Section 01 70 00 Execution Requirements and Project Closeout

## 3.3 **PROTECTION**

A. Refer to Article 1.10 in Section 01 70 00 – Execution Requirements and Project Closeout.

## PART 4 - MUNICIPAL REQUIREMENTS

### 4.1 PIPE MATERIALS

- A. Paved and Unpaved Areas
  - 1. Reinforced concrete pipe shall conform to ASTM C76 for circular pipe or ASTM C507 for elliptical pipe. If the class of pipe is not specified elsewhere Class III will be the minimum strength class acceptable.
- B. Unpaved Areas: The following types of pipe are permissible only in areas where they are not under pavement and where they are called out on the Plans or specified elsewhere in the specifications.
  - 1. Smooth Interior Wall Polyethylene: Polyethylene pipe shall be smooth interior wall, corrugated exterior wall pipe, and joined with gasketed, water-tight, integral bell & spigot joints, meeting the following specifications:
    - a. AASHTO M252, Type S, eight (8) inches and 10 inches
    - b. AASHTO M294, Type S, 12 inches to 60 inches
    - c. ASTM F2306

Such pipe shall be ADS N-12WT, or approved equal. Saddle gaskets are not allowed. All endwalls shall be concrete.

- 2. Smooth Interior Wall Polypropylene: Polypropylene pipe shall be smooth interior wall, corrugated exterior wall pipe, and joined with gasketed, water-tight, integral bell & spigot joints, meeting the following specifications:
  - a. AASHTO M330
  - b. ASTM F2736 (12" 30")
  - c. ASTM F2881 (36" 60")
  - d. Such pipe shall be ADS HP, or approved equal.

All endwalls shall be concrete.

3. Corrugated Metal Pipe, Pipe Arch, and Structural Plate: Corrugated metal pipe (CMP) and pipe arch shall meet the requirements set forth in AASHTO M-36. Structural plate shall meet the requirements of AASHTO M-167.

33 41 13 Public Storm Utility Drainage Piping
November 29, 2017 – Master
Page 9 of 10

## 4.2 STREET INLET CASTINGS

A. Castings shall be manufactured by Neenah Foundry, Badger Iron Works or a preapproved equal. The type of casting shall be as designated on the detail(s) in the Plans or at the end of this section.

## 4.3 STREET INLET CASTING ADJUSTMENT RINGS

A. Where adjustments are necessary to set the inlet casting to its required field elevation, precast concrete rings shall be used. Grouted shims are not acceptable. Any alternative ring materials shall be preapproved by the Owner and Engineer.

END OF SECTION 33 41 13

# **STANDARD DETAIL DRAWINGS**



NOTE: ON STREET SURFACES CRUSHED AGGREGATE BASE STONE SERVES AS TRACK PAD

DETAIL CLEAR STONE TRACKING PAD





1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING APPLICATION OF FERTILIZER AND SEED.

- 2. BEGIN AT THE TOP OF THE CHANNEL BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET
- 3. ROLL CENTER BLANKET IN DIRECTION OF WATER FLOW IN BOTTOM OF CHANNEL. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO THE SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS RECOMMENDED BY THE MANUFACTURER.
- 4. PLACE CONSECUTIVE BLANKETS END OVER END (SHINGLE STYLE) WITH A 4-6" OVERLAP. USE A DOUBLE ROW OF STAPLES STAGGERED 4" APART AND 4" ON CENTER TO SECURE BLANKETS.
- 5. FULL LENGTH EDGE OF BLANKETS AT TOP OF SIDE SLOPE MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN A 6" DEEP X 6" WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
- 6. ADJACENT BLANKETS MUST BE OVERLAPPED APPROXIMATELY 4" AND STAPLED.
- 7. A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FOOT INTERVALS. USE A DOUBLE ROW OF STAPLES STAGGERED 4" APART AND 4" ON CENTER OVER ENTIRE WIDTH OF THE CHANNEL.
- 8. THE TERMINAL END OF THE BLANKETS MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN A 6" DEEP X 6" WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.

NOTE: IN LOOSE SOIL CONDITIONS, THE USE OF STAPLES OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.

DETAIL

**EROSION CONTROL MAT - CHANNEL INSTALLATION** 













#### DIMENSIONS:

- A: OUTSIDE DIAMETER OF PIPE PLUS 24" MAXIMUM, EXCEPT NEED NOT BE LESS THAN 36". TRENCH SHIELDS NARROWER THAN 4 FEET INSIDE WIDTH WILL NOT BE REQUIRED UNLESS SPECIFICALLY REQUIRED IN THE PROJECT SPECIFICATIONS.
- B: FOR ROCK, OUTSIDE DIAMETER OF PIPE PLUS 18" MAXIMUM, EXCEPT NEED NOT BE LESS THAN 36".
- C: MINIMUM 6"
- D: MINIMUM 4" BELOW BARREL AND 3" BELOW BELL.









#### NOTES:

- THE CONTRACTOR SHALL BOLT THE PIPE GATE TO THE CONCRETE ENDWALL WITH FOUR 3/8"x6" MACHINE BOLTS WITH NUTS ON INSIDE WALL.

#### PAINTING SPECIFICATIONS:

- THE PIPE GATE SHALL RECEIVER THE FOLLOWING PREPARATION & PAINTING. THE FIRST COAT SHALL BE RUS-OLEUM X-60 RED BARE METAL PRIMER OR APPROVED EQUAL. THE SECOND COAT SHALL BE RUST-OLEUM 960 ZINC CHROMATE PRIMER OR APPROVED EQUAL. THE THIRD COAT SHALL BE RUS-OLEUM 1282 HIGH GLOSS METAL FINISH OR APPROVED EQUAL.

#### PREPARATION STEPS:

1. BARE METAL SURFACES – TREAT WITH THE THREE-COAT PAINTING SYSTEM LISTED AFTER A THOROUGH SCRAPING, WIRE BRUSHING & CLEANING.

2. EACH COAT OF PAINT SHALL BE APPLIED OVER THE ENTIRE GATE SURFACE.

3. ALLOW 24-48 HOURS DRYING TIME AT 60° OR ABOVE BETWEEN COATS.

DETAIL **ENDWALLS** 





MANHOLE	DIMENSION				
SIZE	А	B (MIN.)			
48"	48"	5"			
60"	60"	6"			
72"	72"	7"			
84"	84"	7"			
96"	96"	9"			

NOTES:

CONCRETE SHALL BE 4000 PSI, 28 DAY COMPRESSIVE STRENGTH, 6.5 BAG MIX WITH 1~2% AIR ENTRAINMENT.

MANHOLE STEPS SHALL CONFORM TO ASTM-C478 & SHALL BE NEENAH FOUNDRY R-1981-N OR APPROVED EQUAL. STEPS SHALL BE SPACED 16" ON CENTER.

ADJUST FRAME TO GRADE WITH AT LEAST TWO PRECAST CONCRETE RINGS OF DIFFERENT THICKNESSES. RINGS SHALL BE REINFORCED WITH ONE NO.3 STEEL BAR CENTERED WITHIN EACH RING.

A MINIMUM OF 3" TO A MAXIMUM OF 9" OF ADJUSTING RINGS SHALL BE USED TO ADJUST THE MANHOLE CASTING TO THE FINISHED GRADE. ALL RINGS SHALL BE SEALED TOGETHER USING MASTIC AND ALL JOINTS SHALL BE BACK PLASTERED INSIDE AND OUT WITH CEMENT MORTAR.

MANHOLE CASTING SHALL BE HEAVY DUTY, NEENAH FOUNDRY R-1550-A, WITH TYPE "B" NON-ROCKING LID, GASKET SEAL AND CONCEALED PICK HOLES.

MANHOLE INLET CASTING SHALL BE NEENAH FOUNDRY R-2050 WITH TYPE "C" NON-ROCKING GRATE.

MANHOLE-TYPE CURB INLET CASTING SHALL BE NEENAH FOUNDRY R-3067 WITH REVERSIBLE GRATES WHERE RUNOFF REACHES THE INLET FROM BOTH DIRECTIONS. WHERE RUNOFF REACHES THE INLET FROM ONE DIRECTION A NEENAH R-3067-L CASTING SHALL BE USED. DIRECTIONAL SLOTS TO BE LOCATED TO DIRECT THE FLOW INTO THE CURB INLET.

A 2x3 LID OPENING IS REQUIRED FOR MANHOLE-TYPE CURB INLETS. ADJUSTING RINGS SHOULD THEN BE LIMITED TO 6" MAX.

DETAIL STORM SEWER MANHOLE AND INLET



STANDARD CURB SECTION SEE DETAIL "CONCRETE CURB AND GUTTER"

- TOP OF CURB AND PIPE INVERT ELEVATIONS ARE SHOWN ON THE PLANS.

- THE GRATE ELEVATION SHALL BE DEPRESSED 0.1' FROM STRAIGHT GUTTER GRADE STARTING 5' FROM THE INLET AND EXTENDING IN BOTH DIRECTIONS.

- THE CASTING SHALL BE NEENAH FOUNDRY R-3067 CURB INLET WITH REVERSIBLE GRATES WHERE RUNOFF REACHES THE INLET FROM BOTH DIRECTIONS. WHERE RUNOFF REACHES THE INLET FROM ONE DIRECTION A NEENAH R-3067-L CASTING SHALL BE USED. DIRECTIONAL SLOTS TO BE LOCATED TO DIRECT THE FLOW INTO THE STREET INLET.

- MASTIC BETWEEN RINGS AND BACKPLASTER A SMOOTH LAYER OF GROUT OVER THE ENTIRE INNER AND OUTER SURFACES OF THE RINGS.





STANDARD CURB SECTION SEE DETAIL "CONCRETE CURB AND GUTTER"

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- MASTIC BETWEEN RINGS AND BACKPLASTER A SMOOTH LAYER OF GROUT OVER THE ENTIRE INNER AND OUTER SURFACES OF THE RINGS.



#### DIMENSIONS:

- A: OUTSIDE DIAMETER OF PIPE PLUS 24" MAXIMUM, EXCEPT NEED NOT BE LESS THAN 36". TRENCH SHIELDS NARROWER THAN 4 FEET INSIDE WIDTH WILL NOT BE REQUIRED UNLESS SPECIFICALLY REQUIRED IN THE PROJECT SPECIFICATIONS.
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BUTTRESS FOR DEAD ENDS



CONCRETE BLOCKING MAY BE USED IN LIEU OF POURED CONCRETE FOR 6" AND 8" PIPE SIZES WHEN BLOCKING 221/2" AND 45" BENDS AND TEES PROVIDED THE AREA IN CONTACT WITH THE EARTH IS THE SAME AS SHOWN IN THE TABLE.

DIMENSION "D" SHALL BE AS LARGE AS POSSIBLE, BUT THE CONCRETE SHALL NOT INTERFERE WITH THE MECHANICAL JOINTS.

DIMENSION "C" SHALL BE AT LEAST 6 INCHES, AND LARGE ENOUGH TO MAKE THE "O" ANGLE EQUAL TO OR GREATER THAN 45 DEGREES WITH THE DIMENSION "A" AS SHOWN ON THE TABLE, OR GREATER, AND WITH DIMENSION "D" AS LARGE AS POSSIBLE.

CONCRETE SHALL BE CLASS "CC", SEE SECTION 03301.

BUTTRESS DIMENSIONS									
PIPE_	TEES		22.5° BEND		45°	BEND	90°	BEND	
SIZE *	A	B	A	В	A	B	A	В	
6	1'-3"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-4"	1'-2"	
8	1'-6"	1'-4"	1'-0"	1'-0"	1'-4"	1'-2"	1'-10"	1'-6"	
10/12	2'-3"	2'-0"	1'-4"	1'-4"	1'–10"	1'-10"	2'–8"	2'-3"	
14/16	3'-2"	2'-6"	1'–10"	1'–8"	2'-6"	2'-4"	3'-10"	2'-10"	
18/20	4'-0"	3'-0"	2'-4"	2'-0"	3'–3"	2'-10"	5'-0"	3'-4"	
22/24	5'-3"	3'-4"	2'–10"	2'-4"	4'-0"	3'-3"	6'-4"	3'-10"	
30	6'-3"	4'-3"	3'-6"	3'-0"	5'-4"	3'-10"	8'-0"	4'-8"	

DIMENSIONS IN THE TABLE ARE BASED ON A WATER PRESSURE OF 150 PSI AND SOIL RESISTANCE OF 2000 LBS./SQ.FT.

\* = FOR TEE THIS WILL BE THE BRANCH PIPE

> DETAIL BUTTRESS





NOTES:

- RODS AND WASHERS TO BE ASTM A-575 MERCHANT QUALITY 0.17-0.24 CARBON. NUTS TO BE AMERICAN STANDARD HEAVY, NOT PRESSED.

- TIE RODS, BOLTS, NUTS, BANDS AND WASHERS TO BE FURNISHED AND ASSEMBLED BY THE CONTRACTOR.

- ALL STEEL MATERIAL TO BE GALVANIZED OR THOROUGHLY COATED WITH ENGINEER APPROVED COATING.

- OFFSET FITTINGS REQUIRE CONTINUOUS RODDING IN ALL POSITIONS.

- VERTICAL OFFSETS SHALL NOT CREATE A HIGH POINT IN THE WATER MAIN. VERTICAL OFFSETS REQUIRE THE SAME RODDING AND BUTTRESSING AS SHOWN ABOVE.

- MEGALUG RESTRAINTS MAY BE USED IN LIEU OF RODDING.

DETAIL

OFFSET AND RODDING



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VIEW ALONG PIPELINE

SECTION VIEW

PIPE DIA., INCHES	6	8	10	12	14	16
"X" DIMENSION, INCHES	12	13	17	21	25	30

NOTES:

- SOLID CONCRETE BLOCKS MUST BE USED.

- VALVES SHALL BE SECURED WITH RODDING OR MEGALUGS TO THE NEAREST "TEE" FITTING OR TO THE FIRST JOINT CONNECTING A FULL SECTION OF WATER MAIN PIPE. SEE RODDING DETAIL "OFFSET AND RODDING".

DETAIL VALVE BOX SETTING
