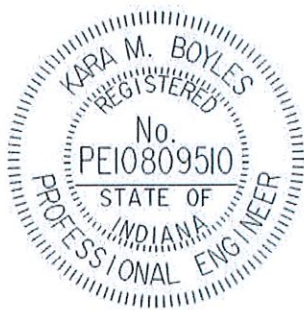






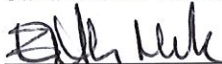
Approved



  
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June 26, 2018

  
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**SECTION 1 – GENERAL – MISCELLANEOUS**

**1-1 PURPOSE**

These construction standards and prevailing specifications have been prepared to establish consistent design elements and other requirements for developers, contractors, utilities, and other private parties as well as for providing guidance for work within or affecting the City’s Right-of-Way.

This document encourages standardization for design elements and consistency to ensure public safety, aesthetic appearance, proper drainage, and economical maintenance. The goal is to provide specific guidance and standards for consultants, contractors, developers, private individuals, and other entities that may require additional information, assistance, or direction through the administrative process for securing necessary City approvals.

These standards and specifications do not and cannot provide for all situations and circumstances. They are intended to establish clear requirements for design and construction of public works throughout the City. These standards are not intended to minimize innovation or the creative skill of the design professional, but rather provide minimum requirements for compliance.

**1-2 STANDING REFERENCES**

The following references and standards are referenced when pertinent, specifically cited, or when required by ordinance or other jurisdictional authority.

1. Local Public Agency Project Development Process Guidance Document for Local Federal-Aid Projects, Indiana Department of Transportation (INDOT), as amended.
2. INDOT [Standard Specifications](#) and [Drawings](#), current edition.
3. *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials (AASHTO).
4. *Resolution No. 69-2015 – A Resolution of the Board of Public Works of the City of South Bend, Indiana Adopting a Complete Streets Policy*, South Bend Complete Streets Policy, 2015.
5. *Indiana Manual on Uniform Traffic Control Devices*, "IMUTCD", as amended and approved by INDOT, current edition.
6. Guide for the Development of Bicycle Facilities, adopted by AASHTO, current edition.
7. *Highway Capacity Manual (Special Report 209)* published by the Transportation Research Board, National Research Council.
8. *Roadside Design Guide* published by AASHTO.
9. *Urban Drainage Design Manual*, U.S. Department of Transportation, HEC-22 circular, current edition.
10. Recommended Standards for Wastewater Facilities, Wastewater Committee of the Great Lakes – Upper Mississippi River.



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11. Recommended Standard for Water Works, Great Lakes Upper Mississippi River Board of State Public Health and Environmental Managers.
12. HERPICC Storm Water Drainage Manual, 2008, Indiana Local Technical Assistance Program.
13. INDOT [Indiana Design Manual](#), current edition.
14. City of South Bend Venues Parks and Arts, South Bend Tree and Lawn Regulations, <http://sbvpa.org/resources/forestry/>
15. For drainage design criteria please reference Sheets D-1 and D-2 of the prior [City of South Bend Design and Construction Standards](#).

### **1-3 VARIANCE PROCESS**

#### **1-3.1 VARIANCES**

The City of South Bend reserves the right to allow variances from these specifications for where unique conditions exist that make implementation either excessive, expensive, or both. Variance requests shall be made in writing and will require supporting documentation and/or justification as requested by the City.

Submitted justifications shall include documentation specifying the criteria that will not be met, existing roadway characteristic, alternatives considered, comparison of safety and/or operational performance, other identified impacts, proposed mitigation measures, and compatibility with adjacent conditions.

### **1-4 FINANCIAL GUARANTEES AND PERMITS**

Parties performing work within the City Right-of-Way are required to provide permits and bonding per [Chapter 18, Article 7 of the South Bend Municipal Code](#). The requirements for obtaining the appropriate and applicable permit(s) (i.e. right-of-way occupancy permit, excavation permit, etc.) are located in the municipal code and discussed in the below sections.

A performance bond equal to 125% of the estimated construction cost, and a maintenance bond equal to ten percent (10%) of the estimated construction cost is required for all city work. Subdivision development and other work that will be later dedicated to the City shall require additional financial guarantees or surety bonds to ensure completion. For these types of projects, it is recommended that the developer meet with city staff for initiating, identifying, and establishing these financial guarantees. All requirements as noted in these construction standards and specifications and [Chapter 21, Article 14 of the South Bend Municipal Code](#) shall be followed by the developer. Below is a list of permits, with hyperlinks to the permit applications, that could be needed for a potential project. These applications are also available from the Division of Engineering.

#### **PERMIT TYPE**

- [Excavation](#)
- [Right-of-Way Occupancy](#)
- [Sidewalk/Construction](#)
- [Curb Cut Application](#)
- [Private Encroachments](#)
- [Special Trucking](#)

## SECTION 1 – GENERAL MISCELLANEOUS

Consultants, and others performing work under a contract for the City directly, are required to secure the above permits, yet are exempt from respective application fees.

### **1-5 LIQUIDATED DAMAGES**

Work that is not completed by the established completion date can be subject to the assessment of liquidated damages in accordance with INDOT Standard Specifications Section 108.09 – Failure to Complete on Time. The liquidated damages assessed will be project specific and noted in the project’s special provisions. If a guarantor chooses to not complete construction, the guarantor will be responsible for damages incurred prior to completion.

### **1-6 QUALIFICATIONS**

Any contractor performing work within the City of South Bend shall be licensed with the State of Indiana and bonded with the City of South Bend Board of Public Works for the type of work being performed. The City of South Bend reserves the right to request all relevant qualifications and certifications from the contractor, their sub-contractors, and their employees.

### **1-7 R/W OCCUPANCY**

Right-of-Way Occupancy and Barricade Permits are administered by the City Engineering Office in accordance with [Chapter 18, Article 7](#) of the South Bend Municipal Code. The application permit shall contain an adequate description of the occupied portion of the City's Right-of-Way, including size, location, purpose, and type of structure to be constructed within said Right-of-Way. [Chapter 18, Article 7, Section 18-60](#) for additional information, required fees, and procedure for application. More information can be located at the [Right-of-Way Permit Office webpage](#).

#### **1-7.1 RIGHT-OF-WAY OCCUPANCY**

Permit applications are required not less than 48 hours prior to the anticipated occupancy of any portion of the City's Right-of-Way or seven days in advance of an anticipated full closure to roadway traffic. The applicant shall pay fees whenever temporary obstructions exceed typical obstruction allowances that are inherent with construction activities as provided within the code. These fees are also further described in [Chapter 18, Article 7, Section 18](#).

#### **1-7.2 TRAFFIC CONTROL**

A permit application is also required prior to any use, restriction, or excavation within the City's Right-of-Way. This shall also include traffic control which is required for any work that restricts, redirects, or impedes vehicle or pedestrian travel in the Right-of-Way. Proposed restrictions shall have advance construction signage in accordance with IMUTCD and shall be submitted with the permit application for review. Extended Right-of-Way occupancy and traffic control may require a long-term occupancy, which requires approval from the Board of Public Works.

#### **1-7.3 PRIVATE ENCROACHMENTS**

Private improvements - both permanent and temporary (e.g. brick mailboxes, building canopies, signs/banners, awnings, planters, underground utilities, signs, etc.) in the public Right-of-Way are subject to an encroachment permit. These types of improvements require a permit application and approval by the Board of Public Works. These improvements have additional indemnification requirements and when complete shall not impair the free flow of traffic within the Right-of-Way. The

## SECTION 1 – GENERAL MISCELLANEOUS

application for Encroachment Revocable Permit is located on the City's website at <https://southbendin.gov/board/public-works/>.

### 1-7.4 FEE EXEMPTIONS

City funded or city utility funded public improvement projects shall not be subject to city permit fees, yet the contractor must apply and receive approval for occupancy and other permits before working in the City's Right-of-Way. For City projects, the Contractor performing the work is required to post bonds, surety, etc. and meet the City's qualifications before performing the work.

### 1-7.5 CURB CUT APPLICATIONS

All new approach construction requiring a curb cut or modification of an existing approach shall require a Curb Cut application which requires review and approval prior to the sidewalk/construction permits being issued. The permits are required before commencing with the work in the City's Right-of-Way. All driveways and approaches shall be constructed in accordance with these standards – including provisions or correction for the pedestrian access route – as further described and provided in [Section 2 - Streets, Walkways, and Paths](#).

Notwithstanding any other provisions, driveways and approaches are not allowed across non-access easements, where prohibited by separate action, or where they are determined by the City Engineer to create a hazard or impede the traveling public on the roadway due to location or other considerations. The application can be found on the City's [Right-of-Way Permit Office webpage](#).

### 1-7.6 ADDITIONAL PERMITS AND FEES

Depending on the nature of the work proposed within the City's Right-of-Way, additional permits and engineering review fees may be required. Additional information can be found on the [City's website](#).

## **1-8 UTILITY WORK**

Utilities located in the City's Right-of-Way shall be installed in accordance with these standards and other applicable ordinances. For general utility permitting, the Utility will be required to install the proposed facility as close as practical to be consistent with the typical sections in [Section 2 - Streets, Walkways, and Paths](#).

### 1-8.1 MAINTENANCE OF TRAFFIC REQUIREMENTS

In the use of the City's Right-of-Way, utilities will be given consideration in conjunction with the traffic requirements of the adjacent roadway and nearby intersections. Both excavation and occupancy require traffic control and permits through the City's Permit Office. Maintenance of traffic for both motor vehicles and pedestrians shall be provided when the proposed work interferes with either or both.

### 1-8.2 PERMITS BEFORE COMMENCING WORK

All utilities – new placement, replacement, and extension – shall secure both state and local permit approvals for the above grade or below grade Right-of-Way occupations. The utility, or its designated agent, shall submit for and receive all necessary permits in accordance with [Chapter 18 – Streets and Sidewalks](#) in the City's Municipal Code and the requirements of this standard.

## SECTION 1 – GENERAL MISCELLANEOUS

### **1-9 GENERAL SUBMISSION REQUIREMENTS**

The Board of Public Works, through the City Engineer's Office, will approve full, complete, and accurate plans and specifications for each project. Each project that is submitted for approval shall also have a prepared opinion of probable construction costs and a copy of all design computations, all of which shall be indexed, paged, and bound as may be appropriate or applicable.

### **1-10 PLAN / CALCULATION REQUIREMENTS**

#### **1-10.1 PLAN SUBMISSIONS**

Any and all work proposed for streets, intersections, alleys, court, walkways, paths, or other public place in the City - or other below grade utilities and other infrastructure which will be maintained by the City of South Bend - must be approved by the City of South Bend Engineering Department. The Engineering Department shall be provided ample time, typically ten (10) working days, for review and approval of submitted plans.

#### **1-10.1 (a) SUBMITTAL REQUIREMENTS**

Improvements impacting the areas under the jurisdiction authority of the City, or affecting adjacent Right-of-Way, shall submit the following for review to the Engineering Department:

1. Detailed plans and specifications submitted in both paper and digital format. The plans shall include the typical section of the facilities, as well as the plan and profile further describing work within the project limits. Supplemental details shall be included for all non-standard or unique elements or to further describe the proposed work not already provided within the City of South Bend Standard Drawings. The City would prefer that drawings be prepared such that when printed on an 11" by 17" paper that the drawing would be a true half size to the noted scale.
2. Design narratives shall be provided to describe the design intent and document decisions made in the design process. Design calculation should be included to support these narratives and the technical analysis for the project. Calculations may need to include engineering sketches to aid reviewers. The calculations should be cumulative, so that the final submittal (if applicable) will contain all the calculations for the project. If calculations are submitted in early stages, these should be revised as necessary to reflect the final design. Calculations must refer to standards cited, as may be appropriate for a specific portion of work. Additional City requirements are further described in each respective section of these specifications.
3. Copy of all necessary permits from other jurisdictional agencies.

#### **1-10.2 RECORD DRAWINGS**

An updated set of record drawings shall be provided to the City Engineer within sixty (60) days of completion of construction. These are required as provided within the City Supplemental Specifications. Record drawings shall include deviations from the approved plans affecting geometry, pavement or sidewalk section, invert and rim elevation(s), pipe size(s), structure type(s), signing, traffic signals, and lighting.

All elevations shall use North American Vertical Datum 88 (NAVD88). If another vertical datum is used, permission from the City Engineer will be required prior to submission.

## SECTION 1 – GENERAL MISCELLANEOUS

All topography, planimetric information, infrastructure, and structures (e.g. manholes, catch basins, inlets, and outfalls) shall also be located by Indiana State Plane: East Zone (NAD83) coordinates. Appropriate equipment and methods of location shall be performed by trained personnel to assure the acceptable relative positional accuracy specified in this standard is met. All coordinate values shall be presented to the nearest hundredth with a relative positional accuracy of 0.25 feet. Coordinate information shall include ties to two known control monuments. Location of manholes shall be at the center of the manhole; casting locations for catch basins shall be at the flowline.

### **1-11 PRIVATE IMPROVEMENTS**

This Section outlines the proper procedure for approval, construction, dedication, and acceptance of storm sewers, sanitary sewers, roads, curbs, sidewalks, drainage, and other related improvements constructed by Developers for dedication to the Civil City of South Bend as Public Right-of-Way.

The Developer shall meet with the City to discuss the project and to develop an agreement specifying the Developer's plan to address the items noted in this Section and other potential concerns from the City. This meeting shall be conducted prior to final plan and specification development as well as prior to the process described below.

#### **1-11.1 PRIVATE IMPROVEMENTS IN UNDEDICATED AREAS**

##### **1-11.1 (a) INITIAL APPROVAL**

1. The Developer must submit to the Board of Public Works, acting through the Department of Engineering, all final plans and specifications related to the proposed Improvements.
2. All plans shall be prepared and sealed by a Professional Engineer registered in the State of Indiana.
3. Accompanying these documents and request for approval, the Developer shall furnish to the Board of Public Works, acting through the Department of Engineering, proof of preliminary plat approval as issued by the appropriate agency.
4. Construction activities shall not begin unless all plans, specifications, and related documents are approved by the Board of Public Works, acting through the Department of Engineering. Any work completed prior to approval by the Board of Public Works, acting through the Department of Engineering, may be required to be removed and replaced at the Board's or its authorized representative's discretion.
5. If the work is not accepted or replaced by the Developer, the surety held by the Board will be used to have the improvements re-installed by a licensed and bonded contractor.
6. Surety shall be posted in perpetuity until the acceptance of the Completion Affidavit, Maintenance Bond, and Waiver of Lien.
7. Surety may be reduced as improvements are accepted by the Board of Public Works. Reductions in surety must be submitted to the Division of Engineering for review.

##### **1-11.1 (b) CONSTRUCTION PHASE**

1. Control of Work: All work shall be done in accordance with these Special Provisions and the Prevailing Specifications.
2. Notification to Engineers: It shall be the responsibility of the Contractor to notify the Engineer of their intent to commence working operations. Said notice shall be issued no less than two

## SECTION 1 – GENERAL MISCELLANEOUS

(2) working days (Monday – Friday) prior to start. No work shall commence within this two (2) day notification period.

### 1-11.1 (c) ACCEPTANCE OF IMPROVEMENTS

#### 1. Upon completion of work

- a. The Developer shall request a Final Inspection and acceptance by the Engineer
- b. The Developer shall submit their request for acceptance of the improvements to the City Engineer's Office along with the following documents:
  - i. As-Built Plans: The as-built plans shall be in accordance with Section 2090 in the Prevailing and Supplemental Specifications.
  - ii. Waiver of Lien: On all workmanship and materials used in connection with these improvements.
  - iii. Maintenance Bond, as per section 103.04 of the City's Prevailing and Supplemental Specifications.
  - iv. Completion Affidavit, as furnished by the Board of Public Works.

Items a and b.ii. above shall list the Developer as the 1st party to all documents. Maintenance Bonds and Completion Affidavits will not be accepted from individual contractors or service firms.

#### 2. Uncompleted Work

- a. A cost estimate for the balance of work will need to be approved by the Department of Engineering. Surety will be posted for 125% of the approved cost estimate. The Developer or Private Party shall contact the City and notify them within six (6) months of the expiration of the Surety.
- b. Should acceptance by the Board of Public Works be requested by the Private Party or Developer prior to the completion of all improvements, a Modified Completion Affidavit may be issued at the discretion of the Engineer. This will require posting with the Board of Public Works one of the following items to insure completion of the balance of all improvements:
  - i. Certified Letter of Credit
  - ii. Certified Check
  - iii. Performance Bond
  - iv. Any equally negotiable instrument equal to (i) or (ii),
  - v. All such instruments in the amount of 125% of the uncompleted improvements.
  - vi. The instrument shall be issued in perpetuity and shall NOT have an expiration date.
  - vii. It will be released upon final acceptance of the proposed improvements and then a Completion Affidavit and Maintenance Bond will need to be submitted to the Board of Public Works for Approval.

**SECTION 2 – STREETS, WALKWAYS, AND PATHS**

**2-1 GENERAL**

2-1.1 PURPOSE

The purpose of this Section is to provide design guidance to developers and designers of projects impacting the Right-of-Way of the City of South Bend. All work within the City’s Right-of-Way shall comply with the following specifications. Work within the City’s Right-of-Way not addressed by the following specifications shall comply with INDOT’s Standard Specifications and Design Manual. Unless otherwise noted in these specifications, testing methods and criteria shall comply with INDOT’s Standard Specifications.

**2-2 DESIGN REQUIREMENTS**

2-2.1 GENERAL

Design of streets, walkways, and paths shall comply with the City of South Bend Zoning Ordinance [Article 14 - Subdivisions](#) (Subdivision Ordinance), the Board of Public Works “Complete Streets Policy” (CSP), the current version of the Indiana Department of Transportation Design Manual (IDM), American Association of State Highway and Transportation Officials Policy on Geometric Design of Highways and Streets (Green Book), Federal Highway Administration’s 13 Controlling Criteria, the United States Access Board Public Right-Of-Way Accessibility Guidelines (PROWAG), and cited product manufacturer’s requirements.

Any public land development adjacent to City streets, or otherwise making improvements within dedicated Right-of-Way upon disturbance or construction, shall be improved in accordance with these standards. When alley access is used, the developer is responsible for improving the alley to City standards consistent with street and public access provisions. Improvements shall extend the width of the developed parcel to the property line.

A traffic impact study, subject to review and approval of the City Engineering Department, may be required for development that will impact safety or operational efficiency of City streets. Cited improvements to the impacted streets from the study shall be in accordance with the City Engineering Department requirements.

All materials and work shall conform to these City Engineering Standards and Indiana Administrative Code (IAC) Requirements.

2-2.1 (a) COMPLETE STREETS

Streets, walkways, and paths are an important part of what makes up South Bend’s neighborhoods. In this light, “Complete Streets” has been adopted to ensure that where possible all elements are provided as part of the city’s transportation facilities. These guidelines address the fundamental elements for safe transportation design yet also require other elements as part of design. Careful consideration shall be extended for the context and expected surrounding land use when reviewing requirements for walks, bike lanes (dedicated or shared), on street parking, and other amenities for proposed transportation facilities. For existing facilities that are being reconstructed or realigned, these additional features shall be considered and included as required with the proposed design. Exceptions from these

## SECTION 2 – STREETS, WALKWAYS & PATHS

requirements provided herein are further described in [Section 1-3 Variance Process](#). These requests require supporting information, justification(s), and rationale for approval by the City.

### 2-2.2 STREET CLASSIFICATION

Typically, street classification in the City of South Bend is based upon the context of the area served by the street and the amount and type of vehicular traffic. As the purpose of the street transitions from transit to commercial to residential, the classification and associated design criteria for the street also changes. Table 2-2.2 (1) below should be used to classify City of South Bend Streets:

**Table 2-2.2(1)**

Classification	AADT	Lanes	Speed (mph)	Notes
Arterial	>15,000	3 to 5	30-40 mph 25 mph*	<i>Major Streets</i> per Subdivision Ordinance Design Vehicle: WB-65 (IDV)
Collector	3,000-15,000	2 to 3	30 mph	Design Vehicle: Incidental WB-40
Residential	<3,000	2	25-30 mph	<i>Minor Streets</i> per Subdivision Ordinance Design Vehicle: SU
Alley	NA	1	15 mph	Design Vehicle: SU

*\* Limited to Central Business District and Complete Streets Considerations.*

Arterial and Collector roadway functional classifications are maintained by the Federal Highway Administration through the Indiana Department of Transportation. In some instances, criteria will not be entirely met for a given classification. In these cases, the City will make the classification determination.

### 2-2.3 TYPICAL SECTION

The typical roadway section for any given classification plays an integral role in achieving the desired functionality of a street. Vehicle speed, traffic volume, parking opportunities, and space available for various amenities are all closely tied to the street typical section. Table 2-2.3(1) below defines the desirable typical section for each street classification within the City:

**Table 2-2.3(1)**

Classification	Right-of-Way	Travel Lanes		2-way Left Turn	Bike Lanes	Parking
		No.	Width			
Arterial	80 - 120 feet	4	11 feet	Varies	No	No
Collector	60.00 feet	2	11 feet	1 – 11 feet*	Optional **	Varies
Residential	50 - 60 feet	2	11 feet	No	Optional	2 – 8 feet
Alley		1	12 feet	No	No	No

\* *Twelve (12) foot lane width should be considered where truck traffic warrants.*

\*\* *Required on City designated bikeways and routes.*

Per the City’s Complete Streets Policy, sidewalks should be included along all streets unless specific exclusion is approved by the City Engineer. Sidewalks should desirably be located inside the Right-of-Way to allow room for repair of the sidewalk. It is strongly recommended that utilities be located underground outside the Right-of-Way in a separate easement. Underground utilities located in the parkway or tree-lawn should be located as near to the curb as possible to allow space for vegetation and ornamental light pole foundations near the sidewalk. Underground utilities within alleyways shall have be located a minimum of 18.00 inches below ground. Above grade



## SECTION 2 – STREETS, WALKWAYS & PATHS

utility facilities within alleyways or other public streets shall not conflict with service vehicle traffic, turning movements, and other property access provisions.

### 2-2.4 DESIGN SPEED

The design speed of a roadway is the posted speed limit or the statutory required speed limit for streets without a posted speed limit. Table 2-2.4(1) below defines desired design speeds for each street classification within the City.

**Table 2-2.4(1)**

<b>Classification</b>	<b>Design Speed</b>
Arterial	40 mph
Collector	30 mph
Residential	30 mph
Alley	15 mph

If a posted speed is present, then the posted speed is the design speed. Based upon context and use, the City Engineer may determine and assign an alternate design speed as appropriate.

### 2-2.5 ROADSIDE SAFETY

In compliance with the CSP, both new construction and spot improvements should “include facilities and amenities that are recognized as contributing to Complete Streets”, including lighting, trees, and other fixtures which are generally considered obstructions in terms of roadside safety. Streets within the City are generally curbed, have design speeds less than fifty (50) mph, and have minimal Right-of-Way. AASHTO makes provisions for curbed facilities, recommending obstructions be located as far from the traveled way as possible. At a minimum, roadside obstructions shall be three (3.00) feet behind the face of curb at intersections and driveway openings, and one and one-half (1.50) feet behind the face of curb elsewhere. Uncurbed facilities should comply with the AASHTO Roadside Design Guide.

### 2-2.6 SIGHT DISTANCE

Stopping and intersection sight distance should be provided on all City streets in accordance with the [Subdivision Ordinance](#) and the IDM. A sight easement may be required for any portion of the sight triangle that falls outside of the Right-of-Way.

### 2-2.7 HORIZONTAL ALIGNMENT

Horizontal alignment for subdivisions is subject to the Subdivision Ordinance. Alignment and horizontal curvature of other roadways shall typically comply with AASHTO’s design guidelines for Low Speed Urban Streets. Superelevation is not desired within the City and an effort should be made to design roadways that use a normal crown section. If a superelevated section is used, it should typically have a maximum rate of four percent (4%). For locations with reverse curves, a minimum tangent between curves of 100 feet for major streets and fifty (50) feet for minor streets is required, per the Subdivision Ordinance.

## SECTION 2 – STREETS, WALKWAYS & PATHS

### 2-2.8 VERTICAL ALIGNMENT

The maximum desirable grade on residential streets and alleys is eight percent (8%). On all other streets, the maximum desirable grade is six percent (6%). The minimum desirable continuous grade is 0.5%. Vertical curvature for sags and crests shall comply with AASHTO's design guidelines, Chapter 302 (44) of the IDM, and the [Subdivision Ordinance](#). Vertical curve length shall desirably be three times the design speed and rounded up to the nearest quarter station [twenty-five (25) feet]. Compound vertical curves are not desirable and should have a tangent section of not less than twenty-five (25) feet between points of vertical curvature.

### 2-2.9 SIDEWALKS AND CURB RAMPS

Sidewalk is required to be installed per City Standards the width of the developed parcel, and extend to the property line. If the site is located on a corner requiring a curb ramp, the developer is responsible for installing curb ramps. This may include the replacement of existing sidewalk or curb ramps if not PROWAG compliant. Curb may be required to be replaced if in poor condition.

Sidewalks should be considered for all projects within the Right-of-Way. When not integral to the curb, the minimum sidewalk width is five (5) feet. When there is less than twelve (12) inches of separation between the sidewalk and the curb face, the minimum sidewalk width is six (6) feet. Sidewalks shall be designed to have a maximum design cross slope of one and one-half percent (1.5%) and a maximum running grade of five percent (5%), unless running parallel to a steeper roadway, in which case the walk profile would run parallel to the roadway grade. Vertical discontinuities will be limited to 0.25 inches or less. All sidewalks shall have a broom finish unless an alternate finish is approved by the City Engineer. Expansion joints shall be placed at a maximum spacing of forty (40) feet. Expansion material is required at all cold joints. Transverse control joints at least one-quarter ( $\frac{1}{4}$ ) of the concrete depth shall be placed at intervals approximately equal to the width of the sidewalk. Repairs or replacement of sidewalk shall be made to the nearest joint and the existing joint spacing shall be maintained.

Curb ramps are required on each side of each intersection where sidewalks are present on opposite sides of the street, in order to provide an accessible route as defined by PROWAG. Cross slopes at curb ramps shall be designed to not exceed one and one-half percent (1.5%). Ramp grades shall be designed to not exceed seven and one-half percent (7.5%). Where turning movements are required at the top or bottom of a curb ramp, a turning area with minimum dimensions of forty-eight (48) inches by forty-eight (48) inches shall be provided, with a maximum slope within the turning area of one and one-half percent (1.5%). Detectable warning elements are required at each curb ramp in accordance with the City's Standard Drawings. Orientation of the detectable warning element should be perpendicular to the direction of pedestrian travel when located less than five (5) feet from the back of curb. Transverse grooving beyond the detectable warning shall not be applied to concrete curb ramps. Other design elements for the curb ramp design shall be in accordance with the City's Standard Drawings, INDOT Standard Drawings, and PROWAG.

Colored concrete for sidewalks, curbs, and curb ramps shall be in accordance with the requirements of [2-5.3 PCCP, COLORED](#). Detectable warning elements shall be a suitable contrasting color where colored concrete is applied.

## SECTION 2 – STREETS, WALKWAYS & PATHS

### 2-2.10 INTERSECTIONS

Intersection geometry shall be designed to accommodate the design vehicle through all maneuvers. Standard Drawings include some typical intersection geometries and treatments, though other options may be used subject to the approval of the City Engineer. Streets should intersect at an angle as close to ninety (90) degrees as possible, but desirably not at an angle less than eighty (80) degrees.

Sight distance should be verified at all intersections impacted by an improvement in accordance with Chapter 46 of the IDM, and obstructions removed in order to provide the required intersection sight distance. See Section [2-2.6](#) Sight Distance for other provisions.

For new developments or modifications to existing sites, intersections should be spaced not closer than 300 feet between the centerlines, except along Major or Arterial streets, where intersections should be spaced not closer than 400 feet. The designer should also consider traffic movements of the roadway and adjacent developments. New intersections should align with other existing roadways as a best practice.

The grading of reconstructed signalized intersections should be tabled for both the major and minor approaches in order to provide smooth travel paths in all directions. Tabling should be accomplished by transitioning the cross slope of each travel lane from the typical slope to the tabled slope without abrupt changes and not exceeding maximum transition longitudinal grades within AASHTO. For two-way stop-controlled intersections, cross slope priority should be given to the uncontrolled approaches. Drainage should be considered for areas where cross-slopes are modified.

### 2-2.11 APPROACHES

Residential approaches are not allowed within fifty (50) feet of an intersection, measured from the intersection of the extended street gutter lines and the point where the nearest side the approach intersects the street gutter line. Residential property lot approaches are limited to one (1) per street and one (1) per alley. “U” driveways will be considered on a case by case basis.

Commercial approaches are not allowed within 100 feet of an intersection, measured between the intersection of the extended street gutter lines and the point where the nearest side the approach intersects the street gutter line. Commercial lots are limited to one (1) approach per street when the access frontage is less than 150 feet. Commercial lots are limited to two (2) approaches per street when the access frontage is greater than or equal to 150 feet, with forty (40) feet minimum distance between the approaches. Alley access shall be for destination use and not for vehicle site circulation or cut through routes. Parking adjacent to alleyways shall have defined approaches. Commercial approaches should be aligned with opposite commercial approaches or intersections and turning movements should be analyzed due to the proposed change in traffic.

Approaches shall not impact the cross slope of sidewalks or pathways so that it exceeds one and one-half percent (1.5%). Ideally, sidewalks shall not change longitudinal grade through a driveway or other approach. Where not possible, affected sidewalks shall be reconstructed to the next joint required by a grade not exceeding five percent (5%). The maximum slope of an approach is eight percent (8%), unless approved by the City Engineer, with grade transitions minimized and a maximum algebraic grade difference of ten percent (10%). The desirable radius is twenty (20) feet and the minimum is ten (10) feet in constrained locations or adjacent to on-street parking.

## SECTION 2 – STREETS, WALKWAYS & PATHS

### 2-2.12 PRIVATE STREETS

Private streets should be developed in accordance with current Green Book and IMUTCD standards, and will not be maintained by the City of South Bend. Intersections of private streets with City streets are subject to the policies within this document and require approval by the City Engineer prior to construction within the City Right-of-Way.

### 2-2.13 RIGHT TURN LANES

Right turn lanes shall be provided where traffic studies indicate they are warranted and/or where directed by the City Engineer. Design shall comply with the relevant sections of the IDM, Green Book, and IMUTCD.

### 2-2.14 CUL-DE-SACS

Cul-de-sacs are required at the termination of dead-end streets and shall comply with the appropriate City Standard Drawing. The geometry should be designed to accommodate an SU design vehicle.

### 2-2.15 SHARED USE PATHS / BICYCLE FACILITIES

Shared use paths and bicycle facilities shall comply with Chapter 307(51) of the IDM. Bicycle racks, benches, lighting, and trail marking signs should be considered as appropriate and coordinated with the Department of Community Investment. Architectural elements require approval by the City Engineer.

## **2-3 SUBGRADE CONDITIONS AND TREATMENT**

Subgrade Preparation shall comply with the requirements of Section 207 of the INDOT Standard Specifications, except as follows:

The natural soil in place may qualify as SUBBASE when the following conditions are met:

- a. Borings - A soil boring at intervals not to exceed 200 lf. (lineal feet) is taken within the limits of construction. The boring shall extend three (3) feet below the natural ground.
- b. Gradation - The soil sample shall be screened for compliance with one of the gradations tabulated in INDOT section 903.04. For the determination of the material passing the Size No. 200 sieve, the sample shall be thoroughly washed and the amount of Loss through Decantation shall be determined. The final gradation of the materials shall comply with the requirements as set forth in INDOT section 903.04 (b).
- c. Analysis - The analysis of the existing material shall be submitted to the Engineer with the signature and seal of a registered professional engineer. The final determination for use of the material as SUBBASE shall be made by the Engineer.

Subgrade treatment types are defined as follows and are further described in the INDOT Standard Specifications:

- Type I twenty-four (24) inches of soil compacted to density and moisture requirements.  
Type IC twelve (12) inches of the subgrade excavated and replaced with coarse aggregate No. 53.

## SECTION 2 – STREETS, WALKWAYS & PATHS

Type II six (6) inches of the subgrade excavated and replaced with coarse aggregate No. 53.

Type III six (6) inches of soil compacted to the density and moisture requirements.

Other subgrade treatment types may be acceptable if recommended in a geotechnical evaluation and approved by the City Engineering Department.

### **2-4 ASPHALT PAVEMENTS**

#### 2-4.1 GENERAL

Asphalt Pavements shall comply with the requirements of Section 400 of the INDOT Standard Specifications, with the following exceptions:

1. All references to Mixture Adjustment Factor (MAF) shall be deleted.
2. Delete all 401 sections except 401.04, 401.05, and 401.08.
3. PG binder used in surface mixtures Type A, B, and C shall be PG 70-22P.
4. PG binder used in surface mixture Type D shall be 76-22P.
5. Maximum binder replacement for all intermediate and base mixtures shall be twenty-five percent (25%).
6. Only limestone will be allowed for use as the coarse aggregate.

No recycled asphalt pavement (RAP) or reclaimed asphalt shingles (RAS) will not be allowed in the HMA surface mixture. The binder in the HMA surface mix shall be PG 70-22.

Tack coat is required between all HMA courses and shall comply with Section 406 of the INDOT Standard Specifications.

#### 2-4.2 HOT MIX ASPHALT PAVEMENT

##### 2-4.2 (a) GENERAL

HMA pavement shall comply with Section 402 as defined in the City of South Bend Prevailing Specifications. An INDOT-approved Design Mix Formula shall be used and provided to the City for approval at least five (5) working days prior to any mix placed. Placement of asphalt will not be allowed to proceed without an approved job mix formula (JMF) and the Division of Engineering must be notified at two working days (Mon.-Fri.) prior to placing any asphalt. Asphalt placed without notification will be subject to removal.

##### 2-4.2 (b) TESTING AND INSPECTION

Daily productions of less than 300 tons/day require a Type D certification.

Daily HMA productions exceeding 300 tons/day require testing for bitumen content in accordance with ITM 586 or ITM 571, and for aggregate gradation in accordance with AASHTO T 209. Additional tests are required when daily production exceeds 800 tons and every 800 tons thereafter. Acceptable tolerances from the JMF are per Table 2-4.2(1).

## SECTION 2 – STREETS, WALKWAYS & PATHS

**Table 2-4.2(1):**

Component	Acceptable Tolerance (%)
Bitumen Content	+/- 0.7
<b>Aggregate Gradation</b>	
Primary Control Sieve	+/- 6.0
200mm Sieve	+/- 1.0

Adjustment Points will be assessed for HMA components which exceed acceptable tolerances as follows:

Bitumen content:	1% for each 0.1% out high 2% for each 0.1% out low
Aggregate Gradation:	
Primary Control Sieve	1% for each 1% out
200mm Sieve	1% for each 0.1% out

Final quantities will be adjusted using the total of these adjustment points for each day's production. The accepted pay quantities for each mixture tested will be:

Less than 300 tons:	tons produced
300 tons or more, less than 800 tons:	(tons produced) x (100% – adjustment points)
Each additional 800 tons:	(tons produced) x (100% – adjustment points)

Test results may be appealed by testing the remaining portion of the sample. The results will be averaged with the original test results to determine acceptance and adjustment points. No further appeals will be granted.

HMA may be placed below temperatures listed in INDOT section 402.12 only when approved in writing by the City Engineer. All HMA failing to meet ninety-two percent (92%) of density requirements shall be removed and replaced.

### 2-4.3 PAVEMENT SECTION

For pavement areas in locations with non-cohesive soils, the minimum HMA pavement section to be used without a unique pavement design, by functional classification, is as shown in Standard Drawing [2-11](#).

If cohesive soils are present, a geotechnical investigation is required, addressing both pavement design and drainage. Geotechnical requirements are identified in Section [2-3](#) of this Specification.

The pavement sections shown in the above referenced standard drawing were developed based upon the AASHTO 93 pavement design method and are based upon subgrade with a California Bearing Ratio (CBR) of five (5). Differing soil conditions, as identified by a Geotechnical Investigation, may result in a modified pavement design. All pavement designs are subject to approval by the City Engineer.

## SECTION 2 – STREETS, WALKWAYS & PATHS

### **2-5 CONCRETE PAVEMENTS**

#### **2-5.1 GENERAL**

Concrete Pavements shall comply with the requirements of Section 500 of the INDOT Standard Specifications.

Coarse Aggregate shall only be Class AP, Size No. 8 unless otherwise specified. Concrete Pavement that deviates from this Coarse Aggregate requirement will not be accepted by the City of South Bend.

The subbase material shall be adequately pre-moistened immediately before the pour to reduce the amount of moisture drawn from the concrete.

Concrete mixing and transportation shall be completed via transit mixed methods. Discharge from a truck agitator or a truck mixer shall be completed within ninety (90) minutes of mixing the water, cement, and aggregates. Concrete shall be uniformly mixed when delivered to the job site. Batch tickets for each load of concrete shall indicate the weight of cement and aggregates, volume of water, and the type and amount of any approved admixtures. When concrete is delivered in transit mixers, additional water shall not be added. Concrete shall be tested for slump before being incorporated into the work. Concrete exceeding four (4) inches slump shall not be used for pavement.

Transverse and longitudinal joints shall be as per the City's Standard Drawings.

Contraction joints shall be neatly sawed at the required spacing as per the City's Standard Drawings.

#### **2-5.2 PORTLAND CEMENT CONCRETE PAVEMENT (PCCP), PLAIN**

PCC pavement shall comply with Section 502 of the INDOT Standard Specifications. A concrete mix design including admixtures shall be provided to the City for approval at least five (5) working days prior to any concrete placed. Placement of concrete will not be allowed to proceed without an approved concrete mix design and the City must be notified at least two working days (Mon.-Fri.) prior to placing any concrete. Concrete placed without notification will be subject removal.

Testing of concrete shall be performed by an approved, independent of the contract testing company, and results shall be provided to the City within five (5) business days of completion of the test(s).

#### **2-5.3 PCCP, COLORED**

PCCP, Colored may be used at accent locations within the City Right-of-Way and shall comply with Section 502 of the INDOT Standard Specifications.

The coloring material shall be applied for full depth of PCCP, and approval of the color by the City Engineer is required. Color samples and finish are subject to approval by the City in advance of

## SECTION 2 – STREETS, WALKWAYS & PATHS

construction. Mainline pavement, aside from pavement patches, shall not be colored.

Coloring of concrete within portions of individual pours and within separate pours throughout a project shall be uniform. Any colored concrete portions deemed by the City to not be uniform will not be accepted.

### 2-5.4 PAVEMENT SECTION

For pavement in locations with non-cohesive soils, the minimum concrete pavement section to be used without a unique pavement design, by functional classification, shall be as shown in Standard Drawing [2-11](#).

If cohesive soils are present, a geotechnical investigation is required, addressing both pavement drainage and design.

### 2-5.5 JOINTS

Concrete joints shall be placed as indicated in the Standard Drawings and in accordance with Section 503 of the INDOT Standard Specifications, without the use of backer rod. Concrete bicycle facilities will not have tolled joints and shall have saw cut joints only with expansion joints at forty (40) foot intervals.

### 2-5.6 FINISH

All concrete pavement shall be tined in accordance with Section 504 of the INDOT Standard Specifications, unless an alternate finish is approved by the City Engineer. Bicycle facilities shall have a broom finish unless approved by the City Engineer.

## **2-6 INCIDENTAL CONSTRUCTION**

### 2-6.1 UTILITY CUT PATCHING

[Chapter 18, Article 2](#), Division 2 of the Municipal Code, City of South Bend, Indiana states:

*Whereas: The Board of Public Works deems it necessary to establish a firm policy for the backfilling of excavations and opening or excavations and replacement of pavement disturbed as a result of making an opening or excavation on any street, these specifications are set forth and the compliance therewith shall be a requirement of obtaining a permit for said opening or excavation under chapter 18, Article 2, Excavations, as set forth in the South Bend Municipal Code.*

It shall be the obligation of any person, firm, or corporation obtaining a permit for an opening or excavation in the public Right-of-Way to backfill the excavation and replace the pavement.

All excavations that extend beyond the full pavement depth shall be backfilled with removable, flowable backfill meeting the requirements of INDOT Section 213. Pavement shall be replaced with a type of construction equal to or better than that which is removed, as approved in writing by the City Engineer.

If it is not possible for pavement to be replaced within twenty-four (24) hours following backfilling of cut due to weather conditions, a coarse aggregate base eight (8) inches thick and a cold asphaltic



## SECTION 2 – STREETS, WALKWAYS & PATHS

surface of four (4) inches shall be applied and maintained as a temporary patch until permanent repairs can be made. Such temporary patches shall be replaced with permanent repairs no later than May 1 of the following year. The permit holder will be responsible for maintaining the temporary patch until final surface restoration is made.

Cold weather concrete shall be used and blanketed when the temperature falls below fifty (50) degrees.

### 2-6.1 (a) CONCRETE AND ASPHALT PAVEMENT PATCHING

Concrete or asphaltic pavement shall be replaced in kind with a thickness equal to that which existed or eight (8) inches, whichever is greater. Concrete used in pavement replacement shall consist of Type A concrete with six percent (6%) air entrainment. Slump shall not exceed four (4) inches. Coarse Aggregate shall be Limestone ONLY. No natural or local gravel aggregate may be used.

Joints in concrete replacement pavement shall match the existing joints in the pavement. Tining shall be performed immediately after placement.

When concrete is used in replacement of asphaltic pavement, a blacking agent such as C 250 Super Black (Color Pigment, Inc.) or approved equal, shall be used. A clear seal membrane shall be utilized once the patch is finished (asphalt only).

White pigment will be the only accepted seal for any concrete work performed in an existing concrete street.

### 2-6.1 (b) BRICK PAVEMENT PATCHING

When excavating brick pavement, the existing brick shall be carefully removed and stockpiled prior to excavation. Salvaged brick shall be used for pavement replacement.

Existing brick pavement designated for removal shall be salvaged undamaged. Care shall be taken to remove any bituminous material from brick pavers, including asphalt patches, asphalt overlay, and bituminous tack coat when directed by city staff. Salvaged brick shall remain the property of the City of South Bend and shall be stored off ground, covered, and on pallets for delivery to a location designated by the City.

Where incorporated into the finished work and cross slope is not maintained due to a depression in the pavers, pavers shall be carefully removed, base material added and compacted, and pavers re-laid to a consistent cross slope in their original undamaged condition.

Brick pavement to be restored shall be cleaned using an acid solution of ten percent (10%) Muriatic Acid and water to remove bituminous products and other foreign materials.

### 2-6.2 MAILBOXES

Mailbox posts shall not be installed within one and one-half (1.50) feet of the face of curb.

## SECTION 2 – STREETS, WALKWAYS & PATHS

Monument or encased mailboxes not mounted on a pole or post may be permitted on residential roadways with speed limits less than thirty (30) mph, provided that the property owner accepts liability related to the mailbox, and the location of the mailbox does not conflict with the intersection sight distance requirements. Mailbox permits may be revoked at the City's discretion. Mailboxes shall be entirely located behind the back of curb and are required to have the address number displayed.

### 2-6.3 DRAINAGE OUTLETS THROUGH CURBS

Drainage outlets for the discharge of rainwater (e.g. yard and roof drains) through the curb face are not permitted. Property owners are required to maintain stormwater runoff on-site. Any discharge to the Right-of-Way requires approval by the Board of Public Works.

### 2-6.4 STAMPED CONCRETE

Stamped concrete may be used within the city Right-of-Way, at locations as approved by the City Engineer. Concrete shall be in accordance with Section 604 of the INDOT Standard Specifications and [2-5.3](#) PCCP, COLORED as applicable. Manufacturers' recommendations shall be followed unless otherwise directed by the Engineer. Test slabs will be required for areas of stamped concrete greater than 100 square yards.

### 2-6.5 PERVIOUS CONCRETE

Pervious concrete may be allowed within the City Right-of-Way for use as base material for decorative pavers, parking areas, sidewalks, and non-motorized shared use facilities. It will not be allowed for use within the City Right-of-Way as street pavement, curbing, or curb ramps. Only limestone may be used as the coarse aggregate. A concrete mix design in accordance with current American Concrete Institute standards will be required for approval.

### 2-6.6 DECORATIVE PAVERS

Decorative pavers may be used for non-motorized facilities and are subject to the design requirements of the application. The paver size, color, layout pattern, drainage characteristics, and pavement section shall be submitted to the City for approval. Paver materials shall be consistently colored throughout the section of each individual paver unit. Surface staining is not permitted. Paver installation without approval may be subject to removal.

### 2-6.7 PERMEABLE PAVEMENT

Permeable pavement (Permeable Articulating Concrete Block/Mats) may be used within City Right-of-Way for non-travel lane applications. A geotechnical report demonstrating soil infiltration that meets the manufacturer's recommendation is required for approval prior to use for the design and approval of the permeable pavement section. Perforated drain tile may be required in areas with marginal soils. A surface inlet is required at sag locations.

A thirty-six (36) month Maintenance Bond shall be provided to the City for permeable pavement installations at the completion of construction. The Maintenance Bond shall be for an amount equal to not less than 10% of all costs associated with the permeable pavement installation. A thirty-six

## **SECTION 2 – STREETS, WALKWAYS & PATHS**

(36) month (minimum) maintenance program shall be provided to the City that includes visual inspection reports with photos and a recommended cleaning schedule.

**SECTION 3 – STORMWATER**

**3-1 STORMWATER QUANTITY MANAGEMENT**

**3-1.1 STORMWATER STORAGE POLICY**

This manual was created to assist engineers planning and designing non-residential (re)development plans. This manual addresses the minimum stormwater quantity design requirements. This manual does not address stormwater quality impacts. However, minimizing a site’s impact to our community waters is strongly encouraged and shall be considered when reviewed by City staff. When unexpected or complex site issues arise, the applicant/applicant’s designer is responsible for identifying such conditions in advance and shall obtain approval of the City Engineer for approach before continuing design.

It is recognized that most streams, drainage channels and storm sewer systems in the City of South Bend do not have sufficient capacity to receive and convey stormwater runoff resulting from continued urbanization. This manual is meant to reduce negative impacts of flooding on private property, local infrastructure, and natural resources. Accordingly, the storage and controlled release of excess stormwater runoff shall be required for all developments and redevelopments where land disturbance is greater than 2,500 square feet.

**3-1.2 CALCULATION OF REQUIRED STORAGE VOLUME: SIMPLE METHOD**

Sites less than 5 acres releasing by infiltration and evaporation only, that do not have a concentrated outfall and that are not located in a wellhead protection area are eligible to use the Simple Method to calculate the amount of required storage volume. Facilities shall be adequately sized to store the entire volume from a 25-year, 24-hour rainfall without any release. All impervious areas, excluding Public right-of-way shall be directed to the storage facility. The storage volume required shall be calculated using the Simple Method as calculated in Table 1. The Simple Method storage volume calculations shall account for off-site runoff that flows through the site. Note that the Simple Method of Required Storage Volume is a special case of the Modified Rational Method, where the release from the storage facility is not considered. If an Engineer wishes to consider the release of infiltrated runoff in the sizing of a storage facility, the Standard Method in Section 4 shall be used.

Table 1: Storage Volume Required

Land Use	(1) Area (square feet)	(2) Runoff Coefficient C	(3) Rainfall Depth 25-yr, 24-hr (inches)	Storage Volume Required (1)x(2)x(3)/12 (cubic feet)
Impervious Surface		0.9	4.90	
Pervious (Grass)		0.2	4.90	
Total =				cft

For sites greater than 5 acres or that have a concentrated outfall refer to Section 4 for Standard Method design criteria.

**3-1.3 CALCULATION OF DESIGN STORAGE VOLUME PROVIDED**

Facilities shall be designed to store the volume required in Section 2. 6% of the calculated storage volume shall be added to the total volume of the storage facility to account for siltation. Dry storage facilities (detention basins, subgrade detention, etc.) shall be designed in such a manner that the

**SECTION 3 – STORMWATER**

storage facility is dry within 48 hours of a 100-year storm event. All wet storage facilities (retention basins) shall be designed to resume the designed water elevation within 48 hours of a 100-year storm event. The storage volume provided by a storage facility is a function of the water elevation. A stage (elevation) storage table should be calculated using the average area method. The following is a formula for the average area method. The interval between intermediate elevations should not exceed one foot.

$$V = \sum \Delta H \frac{(A_1 + A_2)}{2}$$

V= storage volume

$\Delta H$ =Elevation<sub>2</sub>-Elevation<sub>1</sub>

A= surface area at a given elevation

The cumulative storage should be calculated by summing the storage volume at each elevation. For wet storage facilities, only the volume provided above the ordinary water level is considered in the storage volume calculations. A stage storage table showing all storage above the ordinary water elevation should be shown and the total volume of that storage should be equal to or greater than the calculated storage volume required.

**3-1.4 CALCULATION OF REQUIRED STORAGE VOLUME: STANDARD METHOD**

Due to uncertainties of future development patterns and the associated proposed stormwater quantity and quality management systems within a watershed, it is the policy of the City of South Bend to discourage release of runoff from a new development or redevelopment other than by infiltration up to the 100-year storm event. However, the City Engineer may approve a controlled release from a storage facility when the engineer can show that the downstream receiving system has adequate capacity to accept the calculated discharge from the storage facility. At no time shall an increased rate of discharge be directed to a combined sewer system or storm sewers that drain to combined sewers.

**3-1.4 (a) CONTROL RELEASE CALCULATIONS**

- 1.) The same hydrologic method shall be used for runoff peak determination for both pre-developed and post-developed condition calculations.
- 2.) Recommended hydrologic methods
  - i. The Rational Method is acceptable for calculating peak flows when the total tributary drainage area is 5 acres or less and the tributary drainage area has no existing depressional storage. Runoff coefficients for analysis are shown in Table 2 and are adopted from the INDOT Design Manual.

Table 2: Runoff Coefficients for Rational Method

<b>Land Use</b>	<b>Runoff Coefficient "C"</b>
<b>Park, Lawn, Grassy Area</b>	0.2
<b>Residential Single Family</b>	0.4
<b>Apartment or Multi-Unit</b>	0.7
<b>Business, Commercial or Industrial</b>	0.8
<b>Pavement</b>	0.9

ii. Runoff Hydrographs and Flood Routing Analysis

a.) This method shall be required when any of the following apply:

- If the total tributary drainage area is greater than 5 acres
- If there is existing depressional storage
- If offsite flows are detained in storage facilities
- If proposed flows travel through multiple storage facilities

b.) The USDA Natural Resource Conservation Service (NRCS) method (also known as the SCS method) shall be used for calculating runoff and generating hydrographs. Refer to the [USDA NRCS National Engineering Handbook](#) (NEH-4) publication for additional information.

- The use of proprietary software is discouraged.
- Allowable open source software recommended for use include: TR-20, HEC-HMS and EPA-SWMM.

3.) Rainfall Depths shown in Table 3 shall be utilized to determine total rainfall depths for South Bend. These values are derived from [NOAA Atlas 14](#), published by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and National Weather Service.

Table 3: South Bend 24-Hour Rainfall Depth

<b>Frequency (years)</b>	<b>Rainfall (inches)</b>
<b>2</b>	2.81
<b>10</b>	4.09
<b>25</b>	4.90
<b>100</b>	6.27

4.) The rainfall distribution used for the Design Storm should be the median first quartile 24-hour rainfall distribution published in the latest publication of [NOAA Atlas 14](#). The Rainfall Distribution shown in Table 4 shall be utilized in the hydrologic analysis to Design Storm characteristics and the calculation of release rates from the Design Storm.

Table 4: NOAA Atlas 14 First Quartile, Median 24-hr Rainfall Distribution

<b>Cumulative Time (%)</b>	<b>Cumulative Precipitation (%)</b>
0%	0%
5%	12%
10%	27%
15%	40%
20%	51%
25%	61%
30%	68%
35%	73%
40%	78%
45%	82%
50%	85%
55%	88%
60%	91%
65%	93%
70%	95%
75%	97%
80%	98%
85%	99%
90%	99.5%
95%	99.8%
100%	100%

5.) Allowable Concentrated Release Rate

- i. Calculations shall be performed for a 24-hour duration storm for existing and proposed conditions to determine discharge rates produced and storage required.
- ii. The maximum allowable release rate for storage facilities shall not exceed the downstream channel capacity or 10-year predeveloped rate. Note that releases from the storage facility due to infiltration are not considered as part of the release rate requirement because they are not part of the concentrated discharge release at the outlet.
- iii. Discharge control structures shall be multi-stage and capable of limiting 2, 10, and 100-year storms to the minimum requirements outlined in the previous section.

## SECTION 3 – STORMWATER

- iv. It is preferred that runoff from upstream tributary areas (off-site land areas) be bypassed around the storage facility of a site. If this is not feasible, the off-site runoff can be routed through the storage facility but would be subject to the storage release rate requirements as if it were part of the development in question.
  - a.) If the inlet invert is below expected storage facility water elevations, the contributing storm network's hydraulic grade line shall be reevaluated to ensure there are no negative impacts.
- v. Infiltration Routing (dry storage facilities only)
  - a.) If the Engineer wishes to consider the release of runoff through the infiltration process in a dry storage facility, the infiltration rate shall be as recommended in a geotechnical report, certified by a Professional Engineer based upon site specific soil borings. The number of soil borings shall be adequate to represent the storage facility infiltration characteristics. The soil boring(s) shall be positioned at the proposed storage facility location and in-situ soils shall be used with the proposed storage facility.
  - b.) The infiltration discharge shall be the area of inundation along the side slopes of the storage facility for a given elevation. The storage facility bottom shall be excluded from infiltration release calculations.
  - c.) If there is both a proposed concentrated flow outlet (ex. Discharge pipe) and infiltration considered in the elevation-release rate calculations, the total release from the storage facility at a given elevation would be the summation of the infiltration release rate and the concentrated outlet (pipe) release rate. While the routing should consider the total release in order to size the storage facility, the calculations shall clearly provide a tabulation of infiltration release and concentrated pipe release rates for each elevation considered in the routing analysis to ensure that the allowable concentrated release rates have not been exceeded at any outlet.

### 3-1.4 (b) ALTERNATIVES TO REQUIRED STORAGE

- 1.) For a project site that does not lend itself well for stormwater storage or to the entire calculated required storage volume, the engineer shall propose alternative methods to control the release rate and avoid downstream impacts. Any alternative methods shall require the approval of the City Engineer.
- 2.) When the City Engineer approves an alternative method, a fee computed for each acre-foot or part thereof of stormwater storage volume as required but not provided shall be paid as established and allowed by City Ordinance.



3-1.5 FLOOD ROUTING AND EMERGENCY SPILLWAY

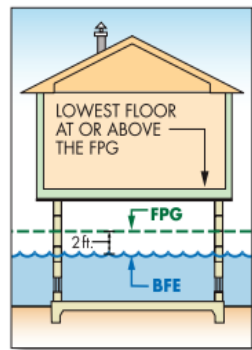
- 1.) Stormwater basins shall have a secondary outfall (emergency spillway) that is designed to pass the peak 100-year inflow.
- 2.) The spillway must direct the emergency overflows away from buildings and other structures.
- 3.) Overflow paths throughout the development resulting from the peak 100-year storm event, shall be determined, clearly shown on the plans and contained in permanent drainage easements.
- 4.) Emergency spillways must be resistant to vertical movement; concrete grade beams, if present, must extend below frost line.

3-1.6 FREEBOARD AND FLOOD PROTECTION GRADE

- 1.) Stormwater storage facilities shall have a minimum of 1-foot freeboard. Freeboard is the vertical difference between the storage facility’s top and the water surface resulting from the peak 100-year passing over the emergency spillway.
  - i. All berms and levees shall not be considered a regulated dam as specified in Indiana Department of Natural Resources’ (IDNR) [Indiana Dam Safety Inspection Manual](#).
- 2.) All buildings adjacent to a stormwater storage facility or in the overflow path shall have a Minimum Flood Protection Grade established. The elevation shall be 2 feet above the water surface elevation of the peak 100-year inflow passing over the emergency spillway (1 foot above the freeboard elevation).

**Indiana Flood Protection Grade (FPG)**

Many special flood hazard areas are shown on FEMA FIRMs without BFEs and/or without the delineated floodways. For sites with an upstream drainage area greater than one square mile, the IDNR Division of Water performs site-specific determinations when a property owner (or representative) submits requests for Floodplain Analysis and Regulatory Assessment (FARA). The FARA results provide the elevation of the regulatory flood, also called BFE, the corresponding Flood Protection Grade (FPG), and floodway limits used for regulatory purposes.



Communities use the FARA results to identify the State’s jurisdiction and establish BFEs for sites. This helps ensure development, including buildings, is permitted in accordance with local ordinances. The FARA results can also be used to support Elevation Certificates, requests for FEMA Letters of Map Change, and flood insurance determinations required by mortgage lenders.

FARA requests can be submitted electronically through the e-FARA Wizard on the Indiana Floodplain Portal at [INFIP.dnr.IN.gov](http://INFIP.dnr.IN.gov). Note that you must first identify the site location on the portal’s map. FARA requests can also be submitted by US Mail or email. Download the Request for Floodplain Information form and follow the directions for submittal. For assistance, call the Division of Water at 317-232-4160, option 1.

**Terms and Definitions**

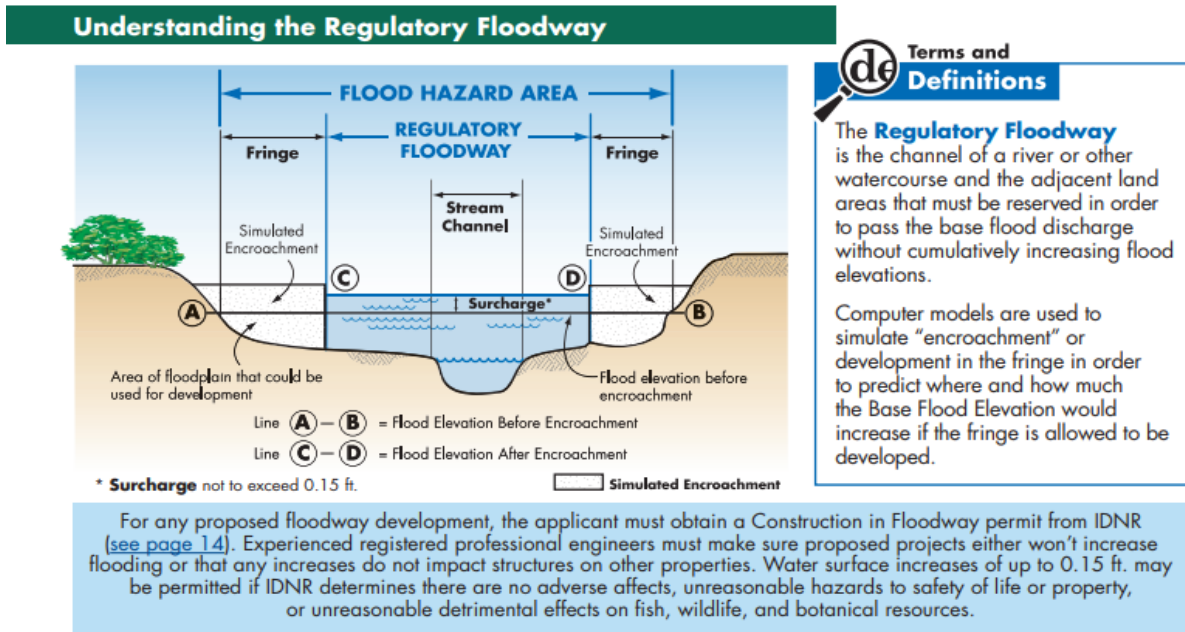
**Flood Protection Grade** is the elevation of the regulatory flood plus two feet at any given location in the Special Flood Hazard Area.

**Regulatory flood** means the flood having a one percent (1%) chance of being equaled or exceeded in any given year, as calculated by a method and procedure that is acceptable and approved by the IDNR and FEMA. The “Regulatory Flood” is also known as the “Base Flood,” the “One-Percent Annual Chance Flood,” and the “100-Year Flood.”

- 3.) Minimum Flood Protection Grade applies to the lowest opening of a building that surface water could enter a basement window, walkout basement doorway or structure’s finished floor, whichever is lower.
- 4.) The plans shall list the proposed Base Flood Elevation on each lot.

3-1.7 FLOODPLAIN AND FLOODWAY

The Flood Control Act (IC 14-28-1) regulates various development activities (i.e. structures, obstructions, deposits, and/or excavations) within the 100-year floodway of any waterway by requiring IDNR approval prior to the beginning of the project. Permits issued under the Flood Control Act are called Construction in a Floodway (CIF) permits. IDNR evaluates projects to protect the floodway from undue restrictions and environmental impacts. A CIF permit could be required for any waterway with an upstream drainage area equal to or greater than one (1.0) square mile.



- 1.) It must be determined whether the development site is affected by the Flood Control Act by evaluating if it is near a waterway with a watershed area in excess of one square mile. The DHS FEMA flood plain maps do not include all flood plains regulated by the IDNR. The City has developed a GIS layer to use as a guide in determining whether a waterway is regulated by the IDNR due to contributing drainage areas. For sites that may be in a waterway regulated by the IDNR, the engineer shall provide the appropriate survey information and calculations to the DNR and obtain concurrence for the calculated the 100-year flood elevation.
- 2.) For sites along waterways with a contributing drainage area greater than one square mile, the developer of such site shall provide the City with a copy of the CIF permit from the DNR prior to final approval, or a letter from the DNR indicating that the site does not appear to require such approval.

3-1.8 STORAGE FACILITY REQUIREMENTS

1.) Detention Basins Design

- i. Minimum longitudinal and transverse bottom slopes of 1.0% unless underdrains are provided
- ii. Vegetated side slopes of the basin shall not exceed 4 foot horizontal to 1 foot vertical (4:1)
- iii. Storage depth shall not exceed 4 feet without approval

2.) Retention Basins Design

- i. A maintenance ledge at least 6 foot in width placed 1 foot vertically above the normal pool elevation
- ii. A safety ledge of at least 6 foot in width placed 1.5 feet vertically below the normal pool elevation
- iii. Side slopes below the safety ledge shall not exceed two foot horizontal to 1 foot vertical (2:1)
- iv. Vegetated side slopes above the maintenance ledge shall not exceed 4:1
- v. The average permanent pool elevation of the basin shall be at least 4 feet in depth with at least 25% of the basin being 8 feet in depth
- vi. [Fencing or a barrier](#) is recommended around the perimeter

3.) Outlet control structures shall be designed to operate as simply as possible without manual operation and shall require little or no maintenance and/or attention for proper operation.

4.) The storage facility owner shall be responsible for storage facility access and maintenance, including the removal of accumulated sediment and debris. The owner shall maintain records of storage facility maintenance operations and provide them to the City upon request. The City may perform periodic inspection of storage facilities and require sediment removal and associated storage facility maintenance at the owner's expense.

5.) A geotechnical investigation should be performed to determine the anticipated soil conditions at the site. If infiltration release is considered in the calculation the geotechnical investigation should provide recommended infiltration rates. At a minimum, soil maps from USGS should be provided, along with the anticipated soil infiltration rates to be encountered. If soils within Soil Groups C or D are indicated, infiltration may not be a viable option.

6.) A storage facility located adjacent to a roadway should be provided with an adequate recoverable slope or clear zone offset from the AASHTO Roadside Design Guide to minimize

## SECTION 3 – STORMWATER

the accidental entry of an errant vehicle. (INDOT Hydraulic and Drainage Design 203-5.03(07)).

### 3-1.9 ADDITIONAL CONSIDERATIONS

- 1.) All impervious area of the site, excluding Public right-of-way, shall drain through a storage facility.
- 2.) If the site is within a [wellhead protection area](#), infiltration may not be used unless specifically allowed by the City Engineer.
- 3.) All compartmentalized chambers of underground storage facilities shall have inspection ports with a minimum clear opening of 24-inch diameter and shall be sized to accommodate physical removal of grease, debris, solids and pollutants that may enter the storage facility .
- 4.) For storage within gravel beds, only the open void space shall be included in the available storage calculation. Use of uniform grade stone with a maximum porosity of 35% shall be used in calculations. Dense graded aggregate shall not be considered for storage.
- 5.) For sites not located within wellhead protection areas, paved parking lots may be designed to provide temporary storage of storm waters that exceed the peak 100-year storm event. Outlets will be designed so as to empty the stored waters slowly. Depths of storage shall be limited to a maximum depth of 4 inches. Ponding should, in general, be confined to those areas of the parking lots furthest from the area served.
- 6.) Refer to Section 17-4 of the Ordinance for information about the City’s Long Term Control Plan, including drain and [downspout disconnect](#) requirements.

### **3-2 STORMWATER QUALITY**

Section under development.

### **3-3 STORMWATER TECHNICAL**

#### 3-3.1 DESIGN REQUIREMENTS

Design of the Stormwater System shall comply with the current version of the City of South Bend Ordinance, Issuance of Permits, Construction and Permit Requirements, and product manufacturer’s requirements.

#### 3-3.2 MATERIALS

##### 3-3.2 (a) PIPES AND FITTINGS – GRAVITY FLOW

Pipe and fitting materials shall conform to the requirements of INDOT Standard Specifications Section 715. Other pipe and fittings not specified herein may be used only when specifically authorized by the City.

## SECTION 3 – STORMWATER

### 3-3.2 (a) (i) PVC PIPE AND FITTINGS (FIFTEEN (15) INCHES AND SMALLER)

PVC (Polyvinyl Chloride) storm sewer pipe, laterals, and fittings shall be SDR 35 conforming to ASTM D-3034. All joints shall be gasketed conforming to ASTM D-3212.

### 3-3.2 (a) (ii) PVC PIPE AND FITTINGS (EIGHTEEN (18) INCHES THROUGH FORTY-EIGHT (48) INCHES)

PVC storm sewer pipe conforming to ASTM F-679; PVC closed profile storm sewer pipe shall have a pipe stiffness of forty-six (46) psi conforming to ASTM F-1803 by “Lamson-Vylon”; SaniTite HP, forty-six (46) psi pipe stiffness per ASTM F-2764 by “ADS” or equal.

### 3-3.2 (a) (iii) RCP PIPE

RCP storm sewer pipe conforming to ASTM C-76; Joints conforming to ASTM C443.

### 3-3.2 (a) (iv) CONNECTION TO EXISTING PIPE

Connections to existing sewer pipe shall be made with “Fernco” shielded couplings, Series 1000 or approved equal.

### 3-3.2 (b) STRUCTURES

#### 3-3.2 (b) (i) PRE-CAST

Manholes, inlets, and catch basins shall conform to ASTM C-478 for round structures and ASTM C-913 for rectangular/square structures.

#### 3-3.2 (b) (ii) CAST-IN-PLACE

- 1.) Reinforcing Steel: Reinforcing steel shall comply with INDOT Standard Specifications Section 703. All reinforcing steel shall be Grade 60 ( $F_y=60,000$  psi).
- 2.) Concrete: Structural concrete shall comply with INDOT Standard Specifications Section 702. All concrete shall have a twenty-eight (28) day compressive strength of 4,000 psi and air content shall be six percent (6%) with a tolerance of plus or minus one percent (+/- 1%).

#### 3-3.2 (b) (iii) JOINT SEALANT

Manhole section joints shall be sealed as noted in Standard Drawings.

#### 3-3.2 (b) (iv) FLEXIBLE CONNECTIONS

All pipe connections to manholes shall be made with integral resilient fittings complying with ASTM C-923.

3-3.2 (b) (v) FLOW CHANNEL AND BENCHING

Manhole flow channel and benching shall be of Class A concrete, refer to Standard Drawings.

3-3.2 (b) (vi) ADJUSTING RINGS

Adjusting rings shall be pre-cast concrete, refer to Standard Drawing [3-5](#).

3-3.2 (b) (vii) CASTING (FRAME AND COVER)

Manhole castings shall be heavy duty (H-20 rated) cast iron, refer to Standard Drawing [3-5](#).

3-3.2 (b) (viii) CURED IN PLACE PIPING (CIPP)

See Specification Section 4-2.5 for CIPP requirements.

3-3.2 (c) BEDDING MATERIALS

The pipe bedding materials shall be as shown on Standard Drawing [3-10](#).

3-3.2 (d) MISCELLANEOUS

3-3.2 (d) (i) CONCRETE SADDLE

The concrete saddle shall be as shown on Standard Drawing [3-4](#).

3-3.2 (d) (ii) PERFORATED PIPE

Perforated pipe shall be as shown on Standard Drawing [3-8](#).

3-3.2 (d) (iii) DRYWELLS

Drywells shall be as shown on Standard Drawing [3-9](#). A geotechnical investigation must be performed to prove that the soil can allow the proper infiltration rate.

3-3.2 (d) (iv) FLOWABLE FILL (REMOVABLE)

Removable flowable fill mix design shall comply with INDOT Standard Specifications Section 213.

3-3.2 (d) (v) MISCELLANEOUS CONCRETE

Where called for, concrete shall be Class A conforming to INDOT Standard Specifications Section 702.

## SECTION 3 – STORMWATER

### 3-3.2 (d) (vi) END SECTION

End Sections shall conform to INDOT Standard Specifications Sections 715.02, 908.06 for metal pipe end sections, and 905.06 for precast concrete end sections.

### 3-3.2 (d) (vii) SLOTTED DRAIN

Slotted drains shall only be installed upon the prior approval of the City Engineer and shall be designed and constructed in accordance with Indiana Design Manual Section 203-4.04(10) and INDOT Standard Specifications Section 908.14, respectively.

### 3-3.2 (d) (viii) HEAD WALL

Headwalls shall be designed in accordance with Indiana Design Manual Section 203-2.06(1).

## 3-3.3 CONSTRUCTION METHODS

### 3-3.3 (a) GENERAL

Schedule for all work shall be provided and coordinated with the City Engineer.

All sewer system component installations are subject to inspection by the Project Representative and civil authorities having jurisdiction.

### 3-3.3 (b) SHUT DOWN OF EXISTING PIPES

#### 3-3.3 (b) (i) GENERAL

Provide for the flow of stormwater around the manhole and section, or sections, of pipe designated for storm pipe installation or replacement, storm manhole installation or replacement, CIPP rehabilitation, manhole structural rehabilitation, and manhole non-structural lining. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole. The pump and bypass lines where applied shall be of adequate capacity and size to handle the flow and submitted by a Professional Engineer registered in the State of Indiana. If the bypass flow is being discharged to a different existing sewer network, the design engineer shall also provide information showing that the sewer network has sufficient capacity for the additional flow. Bypass to a different sewer network must be approved by the City Engineer.

#### 3-3.3 (c) EXCAVATION

##### 3-3.3 (c) (i) GENERAL

Excavation shall comply with INDOT Standard Specifications Section 203.

## SECTION 3 – STORMWATER

### 3-3.3 (c) (ii) REMOVAL OF SURFACE IMPROVEMENTS:

Removal of surface improvements shall be made with neat saw cut lines. Debris shall be properly disposed of by the Contractor. Removal of surface improvements shall comply with INDOT Standard Specifications Section 202.

### 3-3.3 (c) (iii) REMOVAL AND ABANDONMENT OF EXISTING CONDUITS AND STRUCTURES.

Prior to removing or abandoning existing conduits or structures, verify with the utility that they are inactive. Conduits or structures removed shall be properly disposed of by the Contractor. Salvage any useable components to its proper owner. When existing conduits are removed the remaining conduit ends shall be cut smooth and plugged water tight. If a conduit or structure is abandoned in place, it shall be filled with non-removable flowable fill. Tops of structures abandoned in place shall be removed below the subgrade elevation.

### 3-3.3 (c) (iv) MINIMUM AND MAXIMUM PIPE ZONE TRENCH WIDTH

The minimum pipe trench zone shall be as shown in Standard Drawing [3-10](#). The maximum trench width shall be such that adjacent structures, landscaping, utilities, or workers safety are not compromised.

### 3-3.3 (c) (v) MAXIMUM LENGTH OF OPEN TRENCH

The maximum length of open trench while work activities are occurring shall be sixty (60) feet. At the end of each work day or when work activities are not progressing, trench excavation shall be backfilled to the subgrade elevation. The work site shall be protected with orange plastic/vinyl construction fencing, barricades, or temporary fencing.

### 3-3.3 (d) DEWATERING

Water shall not be discharged into the City's sewer system without an approved discharge permit, in adherence to the City's Stormwater Ordinance.

Water shall be kept out of the trench until pipe joining or structure installation is completed. When work is not in progress, open pipe ends, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings.

Dewatering shall be performed such that dry working conditions are maintained for all the excavated trenches and excavations for structures.

The Dewatering System shall be installed in a manner so it does not interfere with traffic maintenance.

Diesel dewatering equipment, including generators, may be used. Any diesel equipment utilized must be sound attenuated. The equipment noise level shall comply with [Article 7 – Noise Control](#), of the City of South Bend Code of Ordinances. A spill containment system (minimum size equal to the fuel tank volume) shall be provided and placed.



## SECTION 3 – STORMWATER

A sediment filter shall be attached to the end of the dewatering discharge pipe. The sediment filter shall be monitored and changed as necessary. The discharge points for the dewatering system shall be approved by the City Engineer prior to commencing construction.

### 3-3.3 (e) STORM SEWER SYSTEM INSTALLATION

#### 3-3.3 (e) (i) INSPECTION FOR DEFECTS

Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material.

#### 3-3.3 (e) (ii) CARE OF PIPE

Handle pipe and accessories so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to damage the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, it shall be repaired immediately.

No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or tuning pipe will be permitted only on the bare ends of the pipe.

The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method.

#### 3-3.3 (e) (iii) PIPE JOINTS

Prior to making pipe joints, clean and dry all surfaces of pipe joints and jointing material. Use lubricants, primers, adhesives, and similar materials as recommended by the manufacturers. Place, fit, joint, and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of water tightness required. As soon as possible after the joint is made, place sufficient backfill material along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

#### 3-3.3 (e) (iv) PIPE LAYING

- 1.) Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belts, slings, or other authorized equipment. Under no circumstance shall any sewer-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating.
- 2.) Except where necessary in making connections with other lines or as authorized by the Engineer, pipe shall be laid with the bells facing in the direction of laying.

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- 3.) The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe shall be firmly set on a good foundation and care shall be taken that pipe does not rest on stones, rock, or any unyielding material. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work.
- 4.) Installation of the storm sewer shall be in accordance with the pipe manufacturer's recommendations.
- 5.) Install RCP to conform to ASTM C-1433.
- 6.) Installation of PVC storm pipe shall conform to ASTM D-2321.
- 7.) Installation of ductile iron pipe shall conform to AWWA C600.

### 3-3.3 (e) (v) PIPE CUTTING

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Engineer, cutting shall be done with an approved type of mechanical cutter. A wheel cutter shall be used when practicable. Squeeze type mechanical cutters shall not be used for ductile iron.

### 3-3.3 (f) STORM SEPARATION OF WATER MAIN

#### 3-3.3 (f) (i) PARALLEL INSTALLATION

Normal Conditions: Storm sewers shall be constructed at least ten (10) feet horizontally from any existing or proposed water main. The distance shall be measured edge-to-edge.

Unusual Conditions: When local conditions prevent the prescribed horizontal separation, then maximum horizontal separation shall be provided with vertical separation of bottom of water line at least eighteen (18) inches above top of sewer. Where this vertical separation cannot be obtained, the sewer shall be constructed of water main-grade pipe and fittings, conforming to AWWA C600 for ductile iron pipe or AWWA C900 or C905 for plastic pipe installations. Storm structures shall have epoxy coating exterior treatment with watertight pipe connections.

#### 3-3.3 (f) (ii) CROSSING

Normal Conditions: A storm sewer crossing any existing or proposed water main shall be laid to provide a minimum vertical separation of at least eighteen (18) inches between the outside of the water line and the outside of the sewer whenever possible.

Unusual Conditions: When existing conditions prevent the prescribed vertical separation, conform to the following:

- 1.) Storm sewer passing over or under water mains shall be constructed of ductile iron pipe (Thickness Class 50) with mechanical joints or PVC pipe (SDR 26 or SDR 21) as described in parallel installation, unusual conditions.

3-3.3 (g) PIPE BEDDING

From the bottom of the excavation to a point one (1) foot above the top of the pipe, bedding material shall be placed as follows:

- Granular material shall be hand placed/shovel sliced in loosely measured four (4) inch layers to the spring-line of the pipe. Each layer shall be thoroughly tamped under and around the pipe, and when sufficient layers have been placed in this manner to cover the pipe, the tamping shall proceed across the width of the trench. Hand, pneumatic, or mechanical tampers may be used. The bedding material shall be moist, but not wet, and it shall not include any stones larger than two (2) inches in any dimension.
- Bedding material and compaction shall conform to the requirements shown in Standard Drawing [3-10](#).

3-3.3 (h) TRENCH BACKFILL

Backfill shall be of select native material or B-Borrow free of debris, organic material, and large stones. Removable flowable fill shall be used for trenches within five (5) feet of pavement and walks.

Backfill placement and compaction shall conform to the requirements shown in Standard Drawing [3-10](#).

3-3.3 (i) TRENCH RESURFACING

3-3.3 (i) (i) TEMPORARY SURFACE RESTORATION

Once the storm sewer trench has been backfilled, temporary resurfacing shall commence. Temporary resurfacing shall include:

- 1.) Compacted aggregate No. 73, compacted aggregate No. 53, limestone conforming to INDOT Standard Specifications 300. Crushed concrete and natural gravel are also acceptable.
- 2.) HMA base conforming to INDOT Standard Specifications Section 402.
- 3.) CMA base conforming to INDOT Standard Specifications Section 403.
- 4.) Temporary resurfacing treatment shall have a thickness equal to the adjacent surface treatment. Temporary resurfacing treatment shall be installed flush with the adjacent surface treatment.
- 5.) The surface restoration shall be capped with CMA or HMA meeting the above noted specifications until the permanent surface is applied. The temporary patch shall be maintained by the Contractor until the permanent surface is applied.

3-3.3 (i) (ii) PERMANENT RESURFACING

Once the storm sewer system has been tested and accepted, temporary resurfacing shall be removed, and permanent resurfacing shall be installed per the respective City Standards and Specifications.

3-3.3 (j) SEWER SYSTEM STRUCTURE INSTALLATIONS

3-3.3 (j) (i) PRE-CAST

- 1.) Pre-cast structure shall be placed on a six (6) inch foundation of compacted B-Borrow as shown in the Standard Drawings, unless directed otherwise.
- 2.) Installation of structure shall be plumb.
- 3.) Pipe connections shall be water tight.
- 4.) Maximum pipe lengths without access structures shall be as follows:
  - 12 inches –18 inches..... 300 feet
  - 24 inches –36 inches..... 400 feet
  - 42 inches and larger..... 500 feet

3-3.3 (j) (ii) CAST-IN-PLACE

- 1.) Cast-in-place structure shall be placed on a six (6) inch foundation of compacted B-Borrow.
- 2.) Reinforcing bars (steel bars, bending, placing, and finishing) shall be installed in conformance with INDOT Standard Specifications Section 703.
- 3.) Concrete work (forming, ties, concrete mix, placement, curing, and testing) shall be installed in conformance with INDOT Standard Specifications Section 702.
- 4.) Pipe connections shall be water tight.

3-3.4 TESTING

3-3.4 (a) TRENCH COMPACTION

3-3.4 (a) (i) TESTING REQUIREMENTS

- 1.) Maximum density shall be determined by AASHTO T-99 (Standard Method) as modified by INDOT Standard Specifications Section 203.24 of the State Specifications using Method A for soil and Method C for granular material.
- 2.) The minimum soil compaction requirements for trench backfill material and pavement subgrade shall be as shown in Standard Drawing [3-10](#).
- 3.) A minimum of one (1) Compaction Test will be required on the backfill for each sewer pipe and force main pipe transverse run that is under the pavement or concrete curb. A minimum of three (3) Compaction Tests will be required on the backfill for sewer pipe or force main pipe run. A pipe run is the length between structures or valves.
- 4.) Location of the Compaction Tests will be selected by the City Engineer’s representative.

3-3.4 (b) SEWER SYSTEM QUALITY ASSURANCE

3-3.4 (b) (i) TESTING REQUIREMENTS

- 1.) Examine each piece of pipe before installing. Remove all defective material from the site. Ductile iron pipe is to be rung with a light hammer to detect cracks.
- 2.) A City Engineering representative must witness all tests. The City Engineer requires three (3) working days prior notice before any test. The sewer pipes must be ready for testing at the time specified. During the inspection process, if any material needs to be replaced, the test must be performed again to include the new material.
- 3.) Record drawings must be on file at the City Engineer office at least three (3) working days prior to the sewer test. These drawings must include all sewer and structures. Proper documentation shall be provided on official letterhead including a detailed list of materials, sizes, and total lengths installed. The City Engineer's office is located at 227 W. Jefferson Boulevard, Suite 1300 N and the phone number is (574) 235-9251.

3-3.4 (b) (ii) MANDREL DEFLECTION TEST

- 1.) A five percent (5%) Mandrel Deflection Test shall be performed on all PVC and HDPE gravity storm sewer pipe.
- 2.) These pipes shall be mandrelled with a ridge device sized to pass five percent (5%) or less deflection (or deformation) of the base inside diameter of the pipe. The mandrel test shall be conducted no earlier than thirty (30) calendar days after reaching final trench backfill grade. Each pipe material/type required to be mandrel tested shall be tested with a mandrel approved by the pipe manufacturer and meeting the requirements of this section. The test shall not be performed with the aid of a mechanical pulling device.
- 3.) The mandrel shall be pulled by hand through all sewer lines in a manner acceptable to the City and any section of sewer not passing the mandrel shall be uncovered, replaced, or repaired to the City's satisfaction and retested.
- 4.) Proving rings shall be provided to check the mandrel. Drawings of mandrels with complete dimensions shall be furnished to the City upon request for each diameter and specification of pipe.

3-3.4 (b) (iii) SEWER TELEVISION

- 1.) Before final acceptance, the gravity storm sewer system shall be televised.
- 2.) Provide television equipment capable of properly documenting the conditions as found within the pipe in a digital video format (DVD). Lighting for the camera shall illuminate the entire periphery of the sewer. The camera shall be radial view type capable of viewing 360 degrees within the pipe and shall provide an unobstructed view of the full pipe.

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- 3.) The video inspection shall begin with a clear identification of the televising location, upstream and downstream manhole designation, and pipe diameter. The DVDs shall provide an accurate length measurement of the entire segment and of the distance to each lateral connection.
- 4.) Televising DVDs shall be submitted to the City Engineer' representative for review and approval. The DVDs shall be clearly and properly labeled. Inspection for individual sewer segments (manhole to manhole) shall be bookmarked.

### 3-3.4 (c) TEST REPORTING

- 1.) Test reports shall be prepared on official company letterhead and shall include relevant information and documentation for each type of test conducted. The test report is not official unless it is signed by a City Engineer representative.
- 2.) Any main line valves and equipment will be operated and witnessed by a South Bend City Engineer representative. Any installed material that is not functioning properly will result in a failed test. The accuracy of the Record Drawings will be checked at this time.
- 3.) All visible leaks shall be repaired and retested. All pipe, fittings, and other materials found to be defective under test pressure shall be removed and replaced.
- 4.) Deviation from the above test procedures shall not be permitted.

**SECTION 4 – SANITARY**

**4-1 GENERAL**

4-1.1 DESIGN REQUIREMENTS

Design of the Sanitary System shall comply with the current version of 327 IAC Article 3 Wastewater Treatment Facilities, Issuance of Permits, Construction and Permit Requirements and Recommended Standards for Wastewater Facilities, Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (10 States Standards), and product manufacturer’s requirements. When extending public facilities such as sanitary sewer, the facilities shall extend the width of the developed parcel to the property line.

Private lift stations or force mains will not be allowed unless approved by the City Engineer. There shall be no private lift stations, private force mains, or private gravity sewers outside of the City Limits connected to the City’s sewer system.

Private sanitary sewer mains will not be allowed unless approved by the City Engineer. A sanitary sewer main is defined as any sewer with more than one lateral connection. For new developments, the sanitary sewer main shall extend the width of the developed parcel to the property line.

**4-2 MATERIALS**

4-2.1 PIPES AND FITTINGS – GRAVITY FLOW

4-2.1 (a) PVC PIPE AND FITTINGS (FIFTEEN (15) INCHES AND SMALLER)

PVC (Polyvinyl Chloride) sanitary sewer pipe, laterals, and fittings shall be SDR 35 conforming to ASTM D-3034. SDR 35 shall be utilized for cover depths less than twelve (12) feet. SDR 26 or SDR 21 shall be used for cover depths of twelve (12) feet or greater or where additional protection is required for the pipe. All joints shall be gasketed conforming to ASTM D-3212.

4-2.1 (b) PVC PIPE AND FITTINGS (EIGHTEEN (18) INCHES THROUGH FORTY-EIGHT (48) INCHES)

PVC sanitary sewer pipe conforming to ASTM F-679; PVC closed profile sanitary sewer pipe shall have a pipe stiffness of forty-six (46) psi conforming to ASTM F-1803 by “Lamson-Vylon”; SaniTite HP, forty-six (46) psi pipe stiffness per ASTM F-2764 by “ADS” or equal.

4-2.1 (c) VCP PIPE AND FITTINGS

VCP (Vitrified Clay Pipe) sanitary sewer pipe and fittings shall conform to ASTM C-700. The VCP shall be at a minimum of “Extra Strength.” Joints shall be of the compression type conforming to ASTM C-425. For pipe sizes greater than 12-inches in diameter shall be VCP, “High Strength.” The maximum cover for VCP shall be less than twelve (12) feet. Use of VCP at a depth greater than twelve (12) feet shall require approval from the City Engineer.

4-2.1 (d) CONNECTION TO EXISTING PIPE

Connections to existing sewer pipe shall be made with “Fernco” shielded couplings, Series 1000 or equal for connections less than or equal to twenty-four (24) inches. Connections greater than twenty-four (24) inches a special detail shall be provided.

4-2.2 PIPES AND FITTINGS – PRESSURE FLOW

4-2.2 (a) PVC PIPE AND FITTINGS (TWELVE (12) INCHES AND SMALLER)

PVC pipe shall conform to ASTM D-2241 for pressure rated pipe. The material shall conform to ASTM D-1784. The joints shall conform to ASTM D-3139. The gaskets shall conform to ASTM F-477. The minimum SDR rating shall be 21 (200 psi).

4-2.2 (b) PVC C900 AND C905 (UP TO FORTY-EIGHT (48) INCHES)

PVC pipe shall conform to AWWA C900 (for pipe size up to twelve (12) inches diameter) and AWWA C905 (for pipe sizes larger than twelve (12) inches diameter). The material shall conform to ASTM D-1784. The joints shall conform to ASTM D-3139. The gaskets shall conform to ASTM F-477. The minimum SDR rating shall be 18 (235. psi). The pipe color shall be green.

4-2.2 (c) HDPE PIPE AND FITTINGS

- 1.) HDPE Pipe: Materials used for the manufacture of HDPE (High Density Polyethylene Pipe) pipe and fittings shall be PE3408 high density polyethylene for sanitary sewer pipe meeting cell classification PE345464C per ASTM D 3350; and shall be listed in the name of the pipe and fitting Manufacturer in Plastics Pipe Institute (PPI) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade HDB rating of 1600 psi at seventy-three (73) degrees Fahrenheit. The Manufacturer shall certify the materials used to manufacture pipe and fittings meets these requirements. Permanent identification of the pipe shall be provided by co-extruding color stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed on the pipe outside surface shall not be accepted. Pipe shall have three equally spaced pairs of longitudinal green stripes.

Polyethylene pipe shall be manufactured in accordance with ASTM F 714-97, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter, and shall be so marked. Each production lot of pipe shall be tested for (from material or pipe) melt index, density, percent (%) carbon, (from pipe) dimensions, and ring tensile strength. The HDPE pipe shall have an equivalent ductile iron pipe sizing. The minimum dimension ratio shall be DR 11.

- 2.) Heat Fusion Joining: Joints between plain end pipes and fittings shall be made by butt fusion (ASTM D3261-03) using only procedures recommended by the pipe and fitting manufacturer. External and internal beads shall not be removed. Socket fusion shall not be used. Electrofusion joints will be allowed in areas which are difficult to access.



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- 3.) Fittings: Ductile iron fittings are preferred. HDPE fittings, as required, shall conform to the same manufacture and material requirements as listed for the HDPE pipe. The electrofusion fittings and couplings shall meet the requirements of ASTM D3350-02 and ASTM F1055 and be of the same resin type as the pipe.
- 4.) HDPE Mechanical Joint Adaptors with Kits: HDPE Mechanical Joint Adaptors with Kits shall be used to connect the HDPE pipe to D.I. fittings. Instead of mechanical joint adapters, the combination of a mechanical joint restrainer and pipe stiffener may be used. Stainless steel pipe stiffeners shall be used for insertion into the HDPE pipe for support at each mechanical joint. The stiffeners shall be constructed of 304 stainless steel and be twelve (12) inches wide with a diameter sized appropriately for the respective pipe.

### 4-2.2 (d) DUCTILE IRON PIPE AND FITTINGS

Eighteen (18) foot lengths of ductile iron pipe shall conform to the requirements of the American National Standards Institute (ANSI) 21.51, or American Water Works Association (AWWA) C151, Thickness Class 50 push-on joint pipe. The ductile iron pipe and fittings shall have a hot coal tar coating in accordance with American Standards Institute for Coal-Tar Dip Coating for Cast Iron Pipe and Fittings. Rubber gasket joints shall conform to the requirements of ANSI A21.11 or AWWA C111. Ductile Iron Pipe that is exposed or located in structures shall have flanged joints per AWWA C115.

Ductile iron fittings shall conform to AWWA C111/ANSI A21.11 and AWWA C110/ANSI A21.10 for full body fittings or AWWA C153/ANSI A21.53-94 for compact fittings. All fittings shall be mechanical joint. All fittings shall be manufactured in the United States. Ductile Iron fittings that are exposed or located in structures shall have flanged joints per AWWA C115.

Ductile iron pipe and fittings used in the sanitary sewer system shall be lined with forty (40) mil of a ceramic epoxy liner “Protecto 401” or equal.

### 4-2.2 (e) POLYETHYLENE ENCASEMENT OF DUCTILE IRON PIPE AND FITTINGS

The ductile iron pressure sewer pipe, valves, and associated fittings shall be encased (wrapped) in polyethylene in accordance with AWWA C105/ANSI A21.5. The polyethylene wrap shall be V-Bio enhanced. It shall consist of three layers of co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness of not less than eight (8) mils. The inside surface of the polyethylene wrap, to be in contact with the pipe exterior, shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

The wrap shall be overlapped one (1) foot in each direction at joints and secured in place around the pipe. Wrap at tap locations shall be taped tightly prior to tapping. Contractor shall make all necessary repairs to the wrap following tapping operations.

4-2.2 (f) JOINT RESTRAINT

Retainer Glands shall be wedge action with set screws. The length of restraint shall be determined by the Design Engineer.

Concrete Thrust Blocks: Concrete thrust blocks shall only be used if designed and certified by a Professional Engineer registered in the State of Indiana.

4-2.3 VALVES

4-2.3 (a) KNIFE GATE VALVE

Knife gates shall have a cast iron body conforming to ANSI Class 150 with 304 or 316 stainless steel wetted parts. The valve shall be of full port design. The resilient seat shall be EPDM suitable for use with wastewater. The actuator type shall be based on the valve's application.

4-2.3 (b) PLUG VALVE

Plug valves shall conform to AWWA C517 with full port opening. Valve bodies shall be cast iron conforming to ASTM A-126 Grade B. The plug shall be cast iron with a resilient coating. Joints shall be flanged (non-buried service) or mechanical joint (buried service). The valve shall have a two (2) inch nut operator and valve box for buried service and a hand wheel operator for non-buried service.

4-2.3 (c) CHECK VALVE

Check valve shall comply with AWWA C508. Valve body and cover shall comply with ASTM A-536 Grade 65-45-12 ductile iron. The disc shall be precision molded Buna N. The swing check valve shall have an outside lever and weight. Joints shall be flanged. Check valve shall be of the non-slam type. The check valve shall provide full flow pipe equivalent area when fully open.

4-2.3 (d) AIR RELEASE VALVE

Air release valves or other air release devices shall be installed at every intermediate apex point where air may accumulate in the force main. Air release valves shall be by "APCO", "Val-Matic", or equal. Air release valves shall be installed inside a structure, refer to Standard Drawing [4-15](#).

4-2.3 (e) VALVE BOX

Valve boxes shall be cast iron. Valve box assemblies shall include bottom section, top section, and lid. Lid shall have the word "SEWER" cast into it. Valve boxes shall have a five (5) foot burial depth.

4-2.4 STRUCTURES

4-2.4 (a) PRE-CAST

Manholes shall conform to ASTM C-478 for round structures and ASTM C-913 for rectangular/square structures. See also [Section 3-3.3](#) for additional information.

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### 4-2.4 (b) CAST-IN-PLACE

- 1.) Reinforcing Steel: Reinforcing steel shall comply with INDOT Standard Specifications Section 703. All reinforcing steel shall be Grade 60 (Fy=60,000 psi).
- 2.) Concrete: Structural concrete shall comply with INDOT Standard Specifications Section 702. All concrete shall have a twenty-eight (28) day compressive strength of 4,000 psi and air content shall be six percent (6%) with a tolerance of plus or minus one percent (+/- 1%).

### 4-2.4 (c) JOINT SEALANT

Manhole section joints shall be sealed as noted in Standard Drawings.

### 4-2.4 (d) FLEXIBLE CONNECTONS

All pipe connections to manholes shall be made with integral resilient fittings complying with ASTM C-923.

### 4-2.4 (e) FLOW CHANNEL AND BENCHING

Manhole flow channel and benching shall be of Class A concrete, refer to Standard Drawings.

### 4-2.4 (f) ADJUSTING RINGS

Adjusting rings shall be pre-cast concrete, refer to Standard Drawing [4-6](#).

### 4-2.4 (g) CASTING (FRAME AND COVER)

Manhole castings shall be heavy duty (H-20 rated) cast iron, refer to Standard Drawing [4-6](#).

## 4-2.5 BEDDING MATERIALS

The pipe bedding materials shall be as shown on Standard Drawing [4-11](#).

## 4-2.6 CURED IN PLACE PIPING (CIPP)

### 4-2.6 (a) CURED IN PLACE PIPING (CIPP)

- 1.) The CIPP (Cured In-Place Pipe) lining products shall conform to ASTM D-5813 and ASTM F-1216 or ASTM F-1743. The CIPP liner manufacturer shall be ISO certified.
- 2.) The cured liner shall meet the following minimum strength requirements:

<b>Property</b>	<b>ASTM Test Method</b>	<b>Polyester System</b>	<b>Filled Polyester System</b>
Flexural Strength	D790	4,500 psi	4,500 psi
Flexural Modulus (initial)	D790	300,000 psi	400,000 psi
Flexural Modulus (50 year)	D790	150,000 psi	200,000 psi

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- 3.) Structural Requirements: Each CIPP shall be designed to withstand continuous internal and/or external loads as dictated by the site and pipe conditions for a minimum fifty (50) year service life. Design of the liner shall take into account the condition of the existing pipe and shall assume no bonding to the original pipe wall. Video inspection reports and videos, when available, can be reviewed at the office of the Engineer. Forty-eight (48) hour notice shall be given to the Engineer, prior to video inspection review. The design thickness of the CIPP shall be arrived at using standard engineering methodology as found in ASTM F1216, Appendix X1, Fully Deteriorated Gravity Pipe Condition. A minimum groundwater depth of five (5) feet above the invert shall be used in the design of the CIPP. The long-term modulus shall not exceed fifty percent (50%) of the short-term value for the resin system and shall be verifiable through testing. A safety factor of at least two (2) shall be used. The design calculations, signed and sealed by a Professional Engineer Registered in the State of Indiana, shall be submitted to the City Engineer prior to fabrication of the tube.

The layers of the finished CIPP shall be uniformly bonded. It shall not be possible to separate any two (2) layers with a probe or point of a knife blade so that the layers separate cleanly or such that the knife blade moves freely between the layers. If separation of the layers occurs during testing of the field samples, new samples will be cut from the work. Any reoccurrence of failure may be cause for rejection of the work.

- 4.) Liner Tube: The tube shall consist of materials meeting the requirements of ASTM F1216 or ASTM F1743 and shall be capable of carrying resin, withstanding installation pressures, and curing temperatures. The tube should be compatible with the resin system. The material should be able to stretch to fit irregular pipe sections and negotiate bends. Projected changes in groundwater level, temperature, and other loading factors shall cause no significant changes in the service characteristics or service life of the CIPP.

The liner shall be fabricated from materials which when cured, will be chemically resistant to reagents in domestic, commercial, and industrial sewage as specified in ASTM F1216, ASTM F1743, and ASTM D543.

The tube should be fabricated under controlled conditions to a size that, when installed, will tightly fit the internal circumference and the length of the original conduit. Allowances should be made for the longitudinal and circumferential stretching that occurs during placement of the tube. Maximum stretching allowances shall be as defined in ASTM F1216 or ASTM F1743. The Contractor shall verify the lengths in the field before cutting the liner to length.

The tube shall be uniform in thickness and when subjected to the installation pressures shall meet or exceed the designed wall thickness.

Any plastic film applied to the tube on what will become the interior wall of the finished CIPP shall be compatible with the resin system used, translucent enough that the resin is clearly visible, and shall be firmly bonded to the felt material.

At the time of manufacture, each lot of liner shall be inspected and certified to be free of defects. The tube shall be marked for distance at regular intervals along its entire length, not to exceed five (5) feet. Such markings shall also include the Manufacturer's name or identifying symbol.

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- 5.) Resin Components: The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein, and those which are to be utilized in the Design of the CIPP for this project. The resin shall produce CIPP which will comply with the structural and chemical resistance requirements of this specification. The resin used shall not contain non-strength enhancing fillers.
- 6.) Bypass Requirements: See Section [4-3.4](#) for requirements.
- 7.) The Contractor shall ensure that resin curing water release over an extended period shall not cause dry weather overflows.

### 4-2.7 STRUCTURE LINING

#### 4-2.7 (a) GENERAL

- 1.) Materials are to be kept dry, protected from weather, and stored under cover.
- 2.) Materials are not to be stored below fifty (50) degrees Fahrenheit. Care should be taken to not store near open flame, heat, or strong oxidants.
- 3.) Materials are to be handled according to their Safety Data Sheets (SDS).

#### 4-2.7 (b) SUBMITTALS FOR STRUCTURAL (SEWER AND STRUCTURES) LINING PROJECTS

Submit the following items to the City Engineer:

- 1.) Pre and Post lining video inspections.
- 2.) Technical data sheet on each product used, including ASTM test results indicating the product conforms to, and is suitable for, its intended use per these specifications.
- 3.) Third party testing verifying the short-term Modulus of Elasticity used on this project, minimum of 735,000 psi.
- 4.) Third party verifying Flexural Strength used on this project, minimum 14,000 psi for structural rehabilitation.
- 5.) Third party testing verifying long term Flexural Modulus of Elasticity, minimum of 529,000 psi. This third-party testing will verify the long-term reduction factor (Creep Analysis) of a minimum of seventy percent (70%). This long-term reduction factor verification shall be conducted utilizing ASTM D2990-01 via a third party, independent certified laboratory.
- 6.) Bypass plan including pump sizing calculations.
- 7.) Traffic Maintenance and Control Plan

- 8.) Safety Data Sheets (SDS) for each product used.
- 9.) Applicator Qualifications:
  - i. Manufacturer certification that Applicator has been trained and approved in the handling, mixing, and application of the products to be used.
  - ii. Certification that the equipment to be used for applying the products has been manufactured or approved by the protective coating manufacturer and applicator personnel have been trained and certified for proper use of the equipment.
  - iii. Proof of any necessary federal, state, or local permits or licenses necessary for the project.

4-2.7 (c) PRODUCTS

- 1.) A Spray Applied Monolithic Liner System (Polyurethane) shall be used to provide structural integrity, infiltration control, and corrosion protection of existing structures and proposed structures from the manhole invert including flow line, through the barrel sections, up to and including the cone.

A flexible polyamine epoxy shall be used for the spacer ring.

The finished structures shall be corrosion resistant to: Hydrogen Sulfide, twenty percent (20%) Sulfuric Acid, seventeen percent (17%) Nitric Acid, five percent (5%) Sodium Hydroxide, as well as other common ingredients of the sanitary sewage environment.

- 2.) Repair Materials: Repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces, etc. as determined necessary by the City Engineer and protective coating applicator. Repair materials must be compatible with the specified polyurethane coating and shall be applied in accordance with the manufacturer's recommendations.

The following products may be accepted and approved as compatible repair basecoat materials for approved top coating for use within the specifications:

- i. Sprayroq SR6100 a 100% solid, solvent-free epoxy grout, or equal, specifically formulated for approved top coating compatibility. The grout manufacturer shall provide instructions for trowel or spray application and for approved top coating procedures.
- ii. Factory blended, rapid setting, high early strength, non-shrink repair mortar that can be troweled or pneumatically spray applied may be approved if specifically formulated to be suitable for approved top coating. Such repair mortars should not be used unless their manufacturer provides information as to its suitability for top coating with the approved top coating. Project specific submittals should be provided including application, cure time, and surface preparation procedures which permit optimum bond strength with the approved coating.
- iii. Grouting Mix: A polyurethane grout shall be used for stopping very active infiltration, filling voids, and shall be mixed /applied according to manufacturer's recommendations.

iv. Approved Manufacturers/Products:

Deneef Hydroactive Cut  
Sealguard  
Approved Equal

- 3.) Protective Coating Material: The resin based material shall be used to form the sprayed structurally enhanced monolithic liner covering interior surfaces of the structure, from the inverts including flow line of manholes through the barrel sections, up to and including the cone. The finished liner shall be SprayWall® as manufactured by Sprayroq, Inc. or approved equal and conform to the minimum physical requirements listed below. The physical requirements must be verified by an independent, certified, third party testing laboratory within the last five (5) years and must be submitted with the bid package. Any bid package not including the verifiable, independent third-party testing shall be ruled non-responsive and will be rejected.

Compressive strength ASTM D 695 > 18,000 psi  
Tensile strength ASTM D 638 > 7,450 psi  
Flexural strength ASTM D 790 > 14,000 psi  
Bond Substrate Failure  
Flexural modulus (initial) ASTM D 790 > 735,000 psi  
Long Term Flexural Modulus ASTM D2990 >529,000 psi  
Density 87 ± pcf  
Tensile Modulus ASTM 638 >425,000 psi  
Chemical Resistance: Severe Municipal Sewer  
Service Successful Pass: SSPWC 211-2

When the wall of the resin-based liner is to be structurally designed to withstand the hydraulic load generated by the groundwater table the long term [fifty (50) year] value of the flexural modulus of elasticity will be utilized to calculate the thickness of the structural liner. A minimum groundwater depth of five (5) feet above the invert shall be used in the design of the liner. The minimum value for coating thickness for both concrete and brick structural rehabilitation shall be 250 mils. The initial flexural modulus of elasticity (short term) of the submitted resin material will be utilized with the long-term deformation percentage as determined by ASTM D2990 in the design equation outlined in ASTM 1216-07b, Appendix X1. The value of the long term flexural modulus of the proposed product will be certified by an independent, certified, third party testing lab, independent of the Manufacturer, and submitted with the bid package. [The definition of long term value will be identified as initial flexural modulus of elasticity less the reduction in value caused by Creep over a fifty (50) year minimum period and verified by third party DMA testing (ASTM D2990).] All design submittals will include this certified third-party DMA testing (ASTM D2990) value in their respective design calculations for each structure being rehabilitated.

A flexible polyamine epoxy shall be used for the spacer rings. The finished liner on this portion of the manhole shall be Parsonpoxy FP or approved equal.

Other Materials: Because of the advantages associated with rapid cure and infinite thickness capabilities, no resin based materials other than polyurethane shall be used to achieve the structural enhancement without prior approval of the City Engineer.

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New manholes, catch basins, and inlets recently installed, shall be lined with a non-structural corrosion barrier. The lining shall be installed to the thickness necessary to qualify as a monolithic (void free) line. The roughness of the substrate will dictate the thickness needed to create the monolithic liner and eliminate any opportunity for voids in the lining. The minimum value for coating thickness for corrosion protection for non-structural lining shall be 125 mils.

### 4-2.8 LIFT STATION

Section under development.

### 4-2.9 MISCELLANEOUS

#### 4-2.9 (a) CONCRETE SADDLE

The concrete saddle shall be as shown on Standard Drawing [4-12](#).

#### 4-2.9 (b) STEEL CASING PIPE

Steel casing pipe shall conform to ASTM A139, Grade B. The minimum wall thickness shall be 0.375 inches for casing pipe diameter up to and including twenty-six (26) inches, minimum wall thickness shall be 0.50 inches for casing pipe diameters between twenty-seven (27) inches and forty-two (42) inches, and minimum wall thickness shall be 0.5625 inches for casing pipe diameters between forty-three (43) and forty-eight (48) inches. Casing spacers shall be stainless steel. The steel casing pipe and casing spacers shall comply with Standard Drawing [4-10](#).

#### 4-2.9 (c) SEWER TAP

The sewer tap shall be as shown on Standard Drawing [4-7](#).

#### 4-2.9 (d) FLOWABLE FILL (REMOVABLE)

Removable flowable fill mix design shall comply with INDOT Standard Specifications Section 213.

#### 4-2.9 (e) MISCELLANEOUS CONCRETE

Where called for, concrete shall be Class A conforming to INDOT Standard Specifications Section 702.

#### 4-2.9 (f) PIPE INSULATION

Section under development.

#### 4-2.9 (g) PIPE DETECTION TAPE

Detection tape shall be placed over PVC or HDPE force main pipe as shown in Standard [4-13](#). Detection tape shall be three (3) inches wide with an overall thickness of five (5) mil. The tape shall have a 0.35 mil solid aluminum foil core. The tape shall have 0.80 mil clear film, reverse



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printed with a repeating warning message and laminated to aluminum foil with a three and three-quarter (3.75) mil clear film backing. The lettering shall be a minimum of one (1) inch. Color shall be APWA green. The warning message shall include the words “Buried Force Main”. Tensile strength of the detection tape shall be 15,000 psi.

### 4-2.9 (h) TRACER WIRE

All PVC and HDPE force main pipe shall be installed with two (2) copper tracer wires, Stranded SS/45 MIL HDPE, 30 Volt, meeting the following requirements:

1.) Wire:

Material: Two (2) – No. 8 gauge Copper Wire  
Rating: 30 Volts maximum. 1,700 lb. yield.  
Thickness: 0.125-inch overall diameter  
(Dimensionally equivalent to AWG8)

2.) Insulating Jacket:

Material: High Molecular Weight, High Density Polyethylene (HMW-HDPE) to be repeated at a minimum interval of every two (2) linear feet.  
Thickness: 0.045-inch maximum (45 mil.)  
Rating: 30 Volts maximum.

Label

(Minimum required): "Pipe Tracer Wire, Stranded SS/45 MIL HMW-HDPE, 30 Volt, HDD Direct Burial Use Only".

Color: Green

## **4-3 CONSTRUCTION METHODS**

### 4-3.1 GENERAL

Schedule and coordinate work with the City Engineer’s Representative. A minimum of two (2) working days (Monday – Friday) notice shall be provided prior to commencing construction.

All sewer system component installations are subject to inspection by the Project Representative and civil authorities having jurisdiction.

### 4-3.2 SHUT DOWN OF EXISTING PIPES

#### 4-3.2 (a) GENERAL

Provide for the flow of sewage around the manhole and section, or sections, of pipe designated for sanitary pipe installation or replacement, sanitary manhole installation or replacement, CIPP rehabilitation, manhole structural rehabilitation, and manhole non-structural lining. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole. The pump and bypass lines shall be of adequate capacity and size to handle the flow. Bypass pump and line sizing calculations shall be submitted to the City Engineer.

4-3.2 (b) PREPARATION

Prior to commencing any bypass operations, submit proposed plan(s) to the City Engineer for review, comment, and approval detailing the methods, materials, and procedures for providing bypass during rehabilitation or replacement process. The Bypass Plan shall include the following minimum information:

- 1.) Map or plan detailing the exact location of the bypass system components.
- 2.) Riser and return assemblies with identified valves, fittings, air relief, and other necessary items and sizes.
- 3.) Map or plan detailing the proposed bypass route with pipe sizes, fittings, and protective measures needed. This plan shall include the proposed time(s) operations will begin and end.
- 4.) Provide calculations and documentation the bypass equipment will have sufficient capacity to handle both existing average daily flow and peak flow rates. For combined sewers and sanitary sewers include plan for bypass pumping during wet weather events.
- 5.) Odor Control Plan.
- 6.) Identify and document how the bypass system will be monitored and controlled.
- 7.) Traffic Control Measures and other traffic restrictions identified.
- 8.) Commercial Property Access Plan.
- 9.) Sewer Spill Response Plan.
- 10.) Bypass Duration Limit.
- 11.) Resin curing water release plan

4-3.2 (c) TEMPORARY BY-PASS PUMPING

- 1.) Under no circumstances shall the flow be interrupted or stopped such that damage is done to either private or public property; or sewage flows or overflows into a storm sewer or natural waterway. All pumps shall be fully automatic self-priming units of either diesel or electric with necessary start/stop controls for each pump. A redundant backup pump shall be on-line, isolated from the primary pump system by a valve. An additional stand-by pump of each size shall be maintained on-site and not connected. A qualified person shall monitor the pumps, piping, and all equipment constituting the bypass pumping system, on-site, at all times, twenty-four (24) hours/ seven (7) days per week during the bypass system operation. Personnel must also inspect the bypass pumping system every two (2) hours, at minimum, to ensure proper operation. All piping, joints, and accessories shall be designed to withstand the maximum bypass system pressure or a minimum of fifty (50) psi, whichever is greater. During bypass pumping, no sewage shall be leaked, dumped, or spilled in or onto any area outside of the existing sanitary sewer system. When bypass pumping operations are complete, all piping shall be drained and flushed into the sanitary sewer prior to disassembly.
- 2.) Equipment shall have proper maintenance to ensure noise is kept to a minimum. All motorized equipment will be required to have mufflers constructed in accordance with the equipment manufacturer's specifications or a system of equivalent noise reducing capacity. Exhaust systems shall be maintained in good operating condition, free from leaks and holes. Any equipment utilizing diesel engines must be sound attenuated. "Quiet Pumps" with sound attenuated enclosures shall be provided. The equipment noise level shall not exceed ninety-five (95) dB and shall be eighty (80) dB or less at twenty (20) feet measured on the A-scale of a standard sound level meter at slow speed. A spill containment system (minimum size equal to the fuel tank volume) shall be provided.
- 3.) If any sewage – liquid or solid – is spilled, discharged or leaked, or otherwise deposited to the open environment as a result of bypass operations, immediately notify the City Engineer. Cleanup procedures and other measures as part of the submitted Sewer Spill Response Plan shall be implemented immediately. Comply with all Local, State, and Federal regulatory requirements regarding spills. Improper disposal of liquids and solids removed from sewers may be subject to fines by regulatory agencies and civil and/or criminal penalties from improper disposal of removed materials under the law.
- 4.) Locate bypass pumping lines so as to not cause undue interference with the use of streets, private driveways, and alleys; to include the possible temporary trenching of bypass pumping or crossing road ramps at critical intersections. If crossing road ramps are used, then channelization drums with low intensity steady burn light – Type D and flashing arrow displays will be required. Multiple ramps employed together for multi-lane applications shall require use of channelization devices to prevent lane changes in advance of ramps. All traffic control measures shall be approved prior to execution. Permanent pavement section (patching) where bypass pumping is trenched shall be in accordance with the City Standards. Bypass pumping operations across multi-lane roadways shall provide for the same through lane configuration. Ramps, where used, shall provide longitudinal grade transitions across using cold mix asphalt in accordance with INDOT Standard Specifications Section 403. Bypass pumping operations in effect during the winter or snow season shall not hinder or adversely affect snow removal

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operations. During snow events and other inclement weather maintenance, extended longitudinal grade transitions shall be provided at Road Ramps to accommodate snow plows.

### 4-3.2 (d) ADVANCE PREPARATION BEFORE CONNECTION TO EXISTING PIPING

Once by-pass pumping activities are complete, coordinate with the City Engineer prior to connecting back to the existing system.

### 4-3.3 EXCAVATION

#### 4-3.3 (a) GENERAL

Excavation shall comply with INDOT Standard Specifications Section 203.

#### 4-3.3 (b) REMOVAL OF SURFACE IMPROVEMENTS

Removal of surface improvements shall be made with neat saw cut lines. Debris shall be properly disposed. Removal of surface improvements shall comply with INDOT Standard Specifications Section 202.

#### 4-3.3 (c) REMOVAL AND ABANDONMENT OF EXISTING CONDUITS AND STRUCTURES

Prior to removing or abandoning existing conduits or structures, verify with owner of said utility that they are inactive. Conduits or structures removed shall be properly disposed. Salvage any useable components to its proper owner. When existing conduits are removed, the remaining conduit ends shall be cut smooth and plugged water tight. If a conduit or structure is abandoned in place, it shall be filled with non-removable flowable fill. Tops of structures abandoned in place shall be removed below the subgrade elevation.

#### 4-3.3 (d) MINIMUM AND MAXIMUM PIPE ZONE TRENCH WIDTH

The minimum pipe trench zone shall be as shown in Standard Drawing [4-11](#). The maximum trench width shall be such that adjacent structures, landscaping, utilities, or workers safety are not compromised.

#### 4-3.3 (e) MAXIMUM LENGTH OF OPEN TRENCH

The maximum length of open trench while work activities are occurring shall be sixty (60) feet. At the end of each work day or when work activities are not progressing, trench excavation shall be backfilled to the subgrade elevation. The work site shall be contained with orange plastic/vinyl construction fencing.

### 4-3.4 DEWATERING

Water shall be kept out of the trench until pipe joining or structure installation is completed. When work is not in progress, open ends, or pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings.

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Dewatering shall be performed such that dry working conditions are maintained for all the excavated trenches and excavations for structures.

The Dewatering System shall be installed in such a manner, so it does not interfere with traffic maintenance.

Diesel dewatering equipment, including generators, may be used. Any diesel equipment utilized must be sound attenuated. The equipment noise level shall comply with [Article 7 – Noise Control](#), of the City of South Bend Code of Ordinances. A spill containment system (minimum size equal to the fuel tank volume) shall be provided and placed.

A sediment filter shall be attached to the end of the dewatering discharge pipe. The sediment filter shall be monitored and changed as necessary. The discharge points for the dewatering system shall be approved by the City Engineer prior to commencing construction.

### 4-3.5 SANITARY SEWER SYSTEM INSTALLATION

#### 4-3.5 (a) INSPECTION FOR DEFECTS

Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material.

#### 4-3.5 (b) CARE OF PIPE

Handle pipe and accessories to ensure delivery to the trench is in sound, undamaged condition. Particular care shall be taken not to damage the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, it shall be repaired immediately.

No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or tuning pipe will be permitted only on the bare ends of the pipe.

The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method.

#### 4-3.5 (c) PIPE JOINTS

Prior to making pipe joints on water main, clean and dry all surfaces of pipe joints and jointing material. Use lubricants, primers, adhesives, and similar materials as recommended by the manufacturers. Place, fit, joint, and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of water tightness required. As soon as possible after the joint is made, place sufficient backfill material along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

Rubber gaskets that are not to be installed immediately shall be stored in a cool dark place.

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### 4-3.5 (d) PIPE LAYING

- 1.) Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belts, slings, or other authorized equipment. Under no circumstance shall any sewer-line materials be dropped, dragged, or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating.
- 2.) Except where necessary in making connections with other lines or as authorized by the Engineer, pipe shall be laid with the bells facing in the direction of laying.
- 3.) The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe shall be firmly set on a good foundation and care shall be taken that pipe does not rest on stones, rock, or any unyielding material. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work.
- 4.) Installation of the sanitary sewer and force main pipe shall be in accordance with the pipe manufacturer's recommendations.
- 5.) Installation of PVC sanitary pipe shall conform to ASTM D-2321.
- 6.) Installation of VCP sanitary pipe shall conform to ASTM C-12.
- 7.) Installation of ductile iron pipe shall conform to AWWA C600.
- 8.) Installation of HDPE Pipe by the open cut method shall conform to pipe manufacturer's written instructions.
- 9.) Service lateral stubs for future connections shall be plugged water tight at the property line.

### 4-3.5 (e) HDPE HORIZONTAL DIRECTIONAL DRILL INSTALLATION

- 1.) Prepare a Plan of Operation for the horizontal directional drilled HDPE sanitary force main installation and submit it to the City Engineer for approval. This plan should show the exact procedures to be used in accomplishing the work (including calibration of the transmitter/receiver, geotechnical information, setup locations, plan for storage of pipe to be placed along with traffic control, drilling fluid plan, the horizontal and vertical tracking/plotting of the pilot bore alignment, and handling and disposal of drilling fluids), and shall show any special activities, and other features of the proposed work. A listing of such subcontractors they intend to use as well as major directional drilling equipment or other specialized equipment to be used shall be included with the submittal.
- 2.) All excavations and trenches for verification of existing utilities, installation of fittings and installation of short segment of pipe shall be properly sloped or braced to furnish and provide proper and safe working conditions for the equipment and personnel in accordance with IOSHA requirements as set forth in Indiana Code IC-22-8-4, Section 238. Provide sheeting to protect adjacent structures when the work is close to existing structures or facilities.

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- 3.) Verify the locations of all utilities and structures prior to any boring. Vacuum excavation or hand excavation shall be used to spot verify locations of existing utilities to minimize disturbance to surrounding facilities.
- 4.) The directional drilling system to be used shall have the following features:

- i. The system shall be remotely steerable and permit electronic monitoring of bore/tunnel depth and location. The system shall be able to control the depth and direction of the pipes and must be accurate to a tolerance of plus or minus six ( $\pm 6$ ) inches.
- ii. Track and plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding thirty (30) feet over the course of the entire horizontal directionally drilled pipe installation. Provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow pressure. The City Engineer shall have access to all data and readouts pertaining to the position of the bore head and the fluid pressures and flows.

The locating system shall, at a minimum, consist of an electronic transmitter (sonde) positioned at the drill head and a receiver which displays the signal strength. The transmitter shall also employ a pitch (inclination) and roll sensor.

- iii. Calibrate the transmitter and receiver system per the manufacturer's specifications for signal strength and verify depth accuracy with a tape measure. Check other parameters such as pitch, roll, battery life, and temperature according to the manufacturer's specifications. Calibration shall be conducted in an area which is clear of possible interference sources.

After calibration of the transmitter and receiver system, walk the bore path to the extent allowable with the receiver "on" and the transmitter "off" in order to check for signal interference. Record the location and particulars of any unusual interference readings and take adequate measures to ensure a proper installation.

- iv. A swivel type apparatus shall be used to connect the sanitary force main pipe to the drill pipe to prevent torsional stresses from occurring in the pipe during installation.
- v. The system shall utilize a fluid cutting process, using liquid clay such as bentonite. This clay shall be totally inert and contain no risk to the environment. Submit to the City Engineer a Drilling Fluid Plan which details types of drilling fluids, cleaning and recycling equipment, estimated drilling fluid flow rates, and procedures for minimizing drilling fluid escape. This Drilling Fluid Plan shall be submitted to the City Engineer before starting the horizontal directional drilling installation process.
- vi. The liquid clay shall remain in the bore hole/tunnel to increase the stability of the bore hole/tunnel and to provide a lubricant to reduce frictional drag when the pipe is installed.
- vii. The HDPE Pipe shall be filled with a fluid during pullback to offset buoyancy.

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- viii. Immediately after installation of the HDPE Pipe, the pipe shall be filled with clean potable water to offset buoyancy.
  - ix. Drilling fluids shall not be discharged into sanitary sewers, storm sewers, or waterways. Pits shall be constructed at the pipe entry and exit points to completely contain the drilling fluid and prevent its escape into waterways.
  - x. The spoils shall be recovered by use of a vacuum system mounted on a vehicle for removal of the spoils. Spoils are not to be discharged into sewers, storm drains, or waterways.
  - xi. Equipment shall be fitted with a permanent alarm system capable of detecting an electrical current. The system will have an audible alarm to warn the operator when the drill head nears electrified cables within a safe operating distance.
- 5.) The Contractor conducting the horizontal directional drilling shall demonstrate experience and expertise in trenchless excavation methods by providing a list of four (4) references for which similar work has been performed prior to commencing any work. These references shall include a name and telephone number for contact, so the City Engineer may verify the claims.
- 6.) All supervisory personnel shall be adequately trained and shall have at least four (4) years of experience in horizontal directional drilling.

### 4-3.5 (f) PIPE CUTTING

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Engineer, cutting shall be done with an approved type of mechanical cutter. A wheel cutter shall be used when practicable. Squeeze type mechanical cutters shall not be used for ductile iron.

### 4-3.5 (g) RESTRAINED JOINTS

Restrained joints on pressure pipe shall be placed at fittings, upstream and downstream of the fitting. Length of restraint shall be determined by the Design Engineer.

### 4-3.5 (h) COVER REQUIREMENTS

The gravity sanitary sewer shall be installed with a minimum depth of cover of three (3) feet. The force main pipe shall be installed with a minimum depth of cover of five (5) feet. The force main may be required to be installed at a deeper depth to maintain the required eighteen (18) inches vertical separation distance from water mains.



4-3.6 SANITARY SEPARATION OF WATER MAIN

4-3.6 (a) PARALLEL INSTALLATION

Normal Conditions: Sanitary sewers and force mains shall be constructed at least ten (10) feet horizontally from any existing or proposed water main, and any manhole or sewer system structure shall be at least eight (8) feet horizontally from water mains whenever possible. The distance shall be measured edge-to-edge.

Unusual Conditions: When local conditions prevent the prescribed horizontal separation, then maximum horizontal separation shall be provided with vertical separation of bottom of water line at least eighteen (18) inches above top of sewer. Where this vertical separation cannot be obtained, the sewer shall be constructed of ductile iron pipe (Thickness Class 50) with mechanical joints or PVC pipe (SDR 26 or SDR21) with compression seals. The pipe should be pressure tested in place per AWWA C600 without leakage before backfilling.

4-3.6 (b) CROSSING

Normal Conditions: Sanitary sewer or force main crossing any existing or proposed water main shall be laid to provide a minimum vertical separation of at least eighteen (18) inches between the outside of the water line and the outside of the sewer whenever possible.

Unusual Conditions: When local conditions prevent the prescribed vertical separation, conform to the following:

- 1.) Sanitary sewer or force main passing over or under water mains shall be constructed of ductile iron pipe (Thickness Class 50) with mechanical joints or PVC pipe (SDR 26 or SDR 21) as described in parallel installation, unusual conditions.
- 2.) Water mains passing over sewer lines shall be laid to provide:
  - i. Vertical separation of at least eighteen (18) inches between top of sewer and bottom of water lines.
  - ii. Adequate structural support for the sewers to prevent excessive deflection of the joints, resulting in the breaking of the water line.
  - iii. Maximum separation of water and sewer line joints.
- 3.) Sanitary and/or force main pipes or sewer system structures:
  - i. No water pipes shall pass through or come in contact with any part of a sewer, force main, or sewer system structure.

4-3.7 PIPE BEDDING

From the bottom of the excavation to a point one (1) foot above the top of the pipe, bedding material shall be placed as follows:

- Granular material shall be hand placed/shovel sliced in loosely measured four (4) inch layers

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to the spring-line of the pipe. Each layer shall be thoroughly tamped under and around the pipe, and when sufficient layers have been placed in this manner to cover the pipe, the tamping shall proceed across the width of the trench. Hand, pneumatic, or mechanical tampers may be used. The bedding material shall be moist, but not wet, and it shall not include any stones larger than two (2) inches in any dimension.

- Bedding material and compaction shall conform to the requirements shown in Standard Drawing [4-11](#).

### 4-3.8 TRENCH BACKFILL

Backfill shall be of select native material or B-Borrow free of debris, organic material, and large stones.

Backfill placement and compaction shall conform to the requirements shown in Standard Drawing [4-11](#).

### 4-3.9 TRENCH RESURFACING

For resurfacing of Public Right-of-Way for laterals or sewer extensions shall include the replacement of the full lane width and full depth of pavement

#### 4-3.9 (a) TEMPORARY RESURFACING

Once the sanitary sewer trench has been backfilled, temporary resurfacing shall commence. Temporary resurfacing shall include:

- 1.) Compacted aggregate No. 73, compacted aggregate No. 53, limestone conforming to INDOT Standard Specifications Section 303. Crushed concrete and natural gravel are also acceptable.
- 2.) HMA base conforming to INDOT Standard Specifications Section 402.
- 3.) CMA base conforming to INDOT Standard Specifications Section 403.
- 4.) Temporary resurfacing treatment shall have a thickness equal to the adjacent surface treatment. Temporary resurfacing treatment shall be installed flush with the adjacent surface treatment.
- 5.) The surface restoration shall be capped with CMA or HMA meeting the above noted specifications until the permanent surface is applied. The temporary patch shall be maintained by the Contractor until the permanent surface is applied.

#### 4-3.9 (b) PERMANENT RESURFACING

Once the sanitary sewer system has been tested and accepted, temporary resurfacing shall be removed, and permanent resurfacing shall be installed per the respective City Standards and Specifications.

4-3.10 SEWER SYSTEM STRUCTURE INSTALLATIONS

4-3.10 (a) PRE-CAST

- 1.) Pre-cast structure shall be placed on a six (6) inch foundation of compacted B-Borrow as shown in Standard Drawings, unless directed otherwise.
- 2.) Installation of structure shall be plumb.
- 3.) Pipe connections shall be water tight.
- 4.) Provide flow channel and benching conforming to 327 IAC 3-6-16 and as shown in Standard Drawings.

4-3.10 (b) CAST-IN-PLACE

- 1.) Cast-in-place structure shall be placed on a six (6) inch foundation of compacted B-Borrow.
- 2.) Reinforcing bars (steel bars, bending, placing, and finishing) shall be installed in conformance with INDOT Standard Specifications Section 703.
- 3.) Concrete work (forming, ties, concrete mix, placement, curing, and testing) shall be installed in conformance with INDOT Standard Specifications Section 702.
- 4.) Pipe connections shall be water tight.
- 5.) Provide flow channel and benching conforming to 327 IAC 3-6-16.

4-3.11 CURED IN PLACE PIPE (CIPP)

4-3.11 (a) NOTIFICATION AND PREPARATION

- 1.) All residents affected by CIPP activities shall be notified in writing at least twenty-four (24) hours prior to any service disruption affecting their service connection. Maintenance of service usage shall be provided throughout the duration of the project.
- 2.) Cleaning, video inspection and recording, and inspection of existing sewer shall be conducted prior to installation of the CIPP. Remove all debris, solids, roots, and other deposits from within the pipe that will interfere with the installation of the CIPP. Provide a dumpsite for such debris removed during the cleaning operations. Any damage done to the sewer pipe during cleaning or installation operations shall be the responsibility of the party performing such work.
- 3.) The City Engineer shall be notified of line obstructions, offset joints, collapsed pipe, or any other condition that will prevent the insertion of the tube or significantly reduce the capacity of the sewer.
- 4.) Protruding laterals or services (if found) shall be trimmed flush with the inside of the main sewer wall prior to lining. Trimming shall not cause damage to the lateral or service beyond the inside face of the main sewer.
- 5.) A maintenance of traffic plan shall be submitted to the City Engineer for review and approval seventy-two (72) hours before the commencement of CIPP work.

4-3.11 (b) TELEVISION INSPECTION

- 1.) Provide television equipment capable of properly documenting the conditions as found within the pipe in a digital video format (DVD). Lighting for the camera shall illuminate the entire periphery of the sewer. The camera shall be radial view type capable of viewing 360 degrees within the pipe and shall provide an unobstructed view of the full pipe.
- 2.) The video inspection shall begin with a clear identification of the televising location, upstream and downstream manhole designation, and pipe diameter. The DVDs shall provide an accurate length measurement of the entire segment and of the distance to each lateral connection. Pan all lateral connections on both the pre- and post-televising recording.
- 3.) Reverse televising set-ups shall be utilized when line obstructions prevent full segment televising from the initial set-up direction.
- 4.) Both a pre-lining and post-lining DVD shall be submitted to the City Engineer for approval. The DVDs shall be clearly and properly labeled. Inspection for individual sewer segments (manhole to manhole) shall be bookmarked. Pre-lining and Post-lining DVDs and inspection reports shall be submitted to the City Engineer within seven (7) days of inspection.

4-3.11 (c) INSTALLATION

- 1.) The CIPP shall be installed in accordance with the practices given in ASTM F1216 (for direct inversion installations) or ASTM F1743 (for pulled-in-place installations). The quantity of resin used for the tube's impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances being made for polymerization shrinkage and the loss of any resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used in conjunction with a roller system to achieve a uniform distribution of the resin throughout the tube.
- 2.) The resin-impregnated tube shall be installed into the host pipe by methods approved by the Manufacturer and proven through previous successful installations. The insertion method shall not cause abrasion or scuffing of the tube. Hydrostatic or air pressure shall be used to inflate the tube and mold it against the walls of the host pipe. There will be no use of sewage in place of clean water for insertion of the tube, or for the curing of the liner.
- 3.) The tube is to be installed in a controlled manner at a rate sufficient to prevent damage to the tube.

4-3.11 (d) CURING

- 1.) After tube installation is completed, supply a suitable heat source and recirculation equipment. The equipment shall be capable of delivering hot water or steam throughout the section to uniformly raise the temperature above the temperature required to effect a cure of the resin.
- 2.) The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat supply. Thermocouples shall be placed between the tube and the host pipe in downstream manholes at or near the bottom to determine the liner temperature during cure.

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Water or air temperature in the pipe during the cure period shall be as recommended by the resin Manufacturer.

- 3.) Initial cure shall be deemed to be completed when inspection of the exposed portions of cured pipe appear to be hard and sound and the remote temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin Manufacturer, as modified for the installation process, during which time the recirculation of the heat and cycling of the heat exchanger to maintain the temperature continues. The heat source shall be shut down during the post-cure.
- 4.) Maintain records of the curing process including water/steam temperatures, lining temperatures, and water head. Readings shall be made and recorded at thirty (30) minute intervals of Boiler water temperature in, Boiler water temperature out, and liner external surface temperatures at manholes.

### 4-3.11 (e) COOL DOWN

Cool down may be accomplished by the introduction of cool water or air into the installation standpipe to replace water or pressurized air being relieved from the manhole. Cool the hardened pipe to a temperature below 100 degrees Fahrenheit before relieving the static head. A minimum period of post-cure shall be maintained under a static head to provide a minimum hoop tension on the tube felt. Care shall be taken in the release of the static head so that a vacuum will not be developed. The water used for the cool down shall be released slowly to prevent dry weather overflow downstream or cause damage to the sewer network downstream of the project.

### 4-3.11 (f) END SEALS

Install hydrophilic end seals to provide a water-tight connection at all pipe and manhole connections. End Seals shall be installed per manufacturer's recommendations.

### 4-3.11 (g) FINISH

- 1.) The finished lining shall be continuous over the entire length of an insertion run between two (2) manholes and be as free as commercially practical from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The lining shall be homogeneous, impervious, and free of any leakage from the surrounding ground to the inside of the lined pipe.
- 2.) During the warranty period, any defects which will affect the integrity or strength of the liner, collect solids, or reduce hydraulic flow capabilities of the product shall be repaired.

### 4-3.11 (h) REINSTATE LATERALS AND SERVICES

- 1.) Accurate location of the lateral and service connections shall be made by inspection of the pre-installation video recording.
- 2.) Upon completion of the main line CIPP installation and the approved infiltration/exfiltration testing, immediately proceed with the reinstatement of the lateral sewers. Reinstatement of lateral sewers shall be completed within twelve (12) hours of service disruption.

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- 3.) After the liner has been installed, all existing active lateral sewers and services shall be reinstated unless otherwise indicated by the City Engineer. The reinstatement of laterals and services shall be done without excavation. Reinstatement of laterals and services will be accomplished from the interior of the pipeline by means of a television camera directed cutting device or by direct personnel entry when feasible. All cut lateral and service connections shall be brushed to ensure they are free of burrs, frayed edges, or any restriction preventing free flow of wastewater. Laterals shall be reinstated to a minimum of ninety percent (90%) of their original diameter and no more than 100% of their minimum diameter. The CIPP liner shall be tightly sealed at the cut openings with no gaps. All coupons cut from the liner as a result of reopening the lateral connections shall be retrieved from the sewer and accounted for.

### 4-3.12 STRUCTURE LINING

#### 4-3.12 (a) GENERAL

- 1.) The rehabilitation and lining shall utilize monolithic spray-application of a high-build, solvent-free polyurethane coating from the manhole invert in working flow line, through the barrel sections, up to and including the cone. A flexible polyamine epoxy shall be utilized for spacer rings. The casting shall not be coated. The purpose is to eliminate infiltration, repair voids, restore structural integrity, and provide corrosion protection. The coating is applied to the wall and bench surfaces of brick/concrete structures.
- 2.) The manufacturer shall provide written certification the Applicator has been trained and certified by the manufacturer to handle and apply their products, as well as appropriate re-certification documentation, as necessary, by the manufacturer.
- 3.) Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE, and SSPC standards and the manufacturer's recommendations.
- 4.) Applicator shall conform to all local, state, and federal regulations including those set forth by OSHA, RCRA, and the EPA and any other applicable authorities.
- 5.) Applicator shall warrant all work against defects in materials and technique for a period of one (1) year, unless otherwise noted, from the date of final acceptance of the project. Applicator shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or technique which may develop during said one (1) year period, and any damage to other work caused by such defects or the repairing of same, at their own expense and without cost to the City.
- 6.) Any active flows shall be dammed, plugged, or diverted as required in Section [4-3.2](#) to ensure that the liquid flow is maintained below the surfaces to be coated.
- 7.) Flows should be completely plugged and/or diverted when coating the invert. All extraneous flows into the manhole or vaults, at or above the area coated, shall be plugged and/or diverted until the polyurethane has set hard to the touch. As an option, hot air may be added to the manhole to accelerate set time of the coating.

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- 8.) Installation of the protective coating shall not commence until the concrete substrate has properly cured in accordance with these specifications.
- 9.) Temperature of the surface to be coated should be maintained between fifty (50) degrees Fahrenheit and 120 degrees Fahrenheit during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, care should be taken to apply the coating when the temperature is falling versus rising (i.e. late afternoon into evening vs. morning into afternoon).

### 4-3.12 (b) SURFACE PREPARATION

- 1.) Applicator shall inspect all surfaces specified to receive a protective coating prior to surface preparation. Applicator shall notify City Engineer of any noticeable disparity in the surfaces which may interfere with the proper preparation or application of the repair mortar and protective coating.
- 2.) All contaminants including oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.
- 3.) All concrete or mortar that is not sound, or that has been damaged by chemical exposure, shall be removed to a sound concrete surface or replaced.
- 4.) Surface preparation method(s) should be based upon the conditions of the substrate, service environment, and the requirements of the polyurethane protective coating to be applied.
- 5.) Surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. Generally, this can be achieved with high pressure water cleaning using equipment capable of 5,000 psi at four (4) gpm. Other methods such as high-pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12), abrasive blasting, shot blasting, grinding, scarifying, or acid etching may also be used. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease, or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound, clean, and neutralized surface that is not excessively damaged.
- 6.) Infiltration shall be stopped by using a material which is compatible with the specified repair mortar and is suitable for top coating with the specified protective coating.
- 7.) The area between the manhole and the manhole ring and any other area that might exhibit movement or cracking, due to expansion and contraction, shall be grouted with a flexible grout or gel.
- 8.) All surfaces should be inspected by the City Engineer during and after preparation and before the repair material is applied.

4-3.12 (c) APPLICATION OF REPAIR MATERIALS

- 1.) Repair materials shall be trowel, or spray applied, by utilizing proper equipment on to specified surfaces.
- 2.) If using approved cementitious repair materials, such shall be troweled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the protective coating. No bugholes or honeycomb surfaces should remain after the final trowel procedure of the repair mortar.
- 3.) The repair materials shall be permitted to cure according to manufacturer recommendations. Curing compounds should not be used unless approved for compatibility with the specified protective coating.
- 4.) Application of the repair materials, if not performed by the coating certified applicator, should be inspected by the protective coating certified applicator to ensure proper finishing for suitability to receive the specified coating.
- 5.) After abrasive blast and leak repair is performed, all surfaces shall be inspected for remaining laitance prior to protective coating application. Any evidence of remaining contamination or laitance shall be removed by additional abrasive blast, shotblast, or other approved method. If repair materials are used, refer to these specifications for surface preparation. Areas to be coated must also be prepared in accordance with these specifications after receiving a cementitious repair mortar and prior to application of the approved coating.
- 6.) All surfaces should be inspected during and after preparation as well as before the protective coating is applied.

4-3.12 (d) APPLICATION OF PROTECTIVE COATING

- 1.) Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.
- 2.) The spray equipment shall be specifically designed to accurately dispense a proper ratio and application of the specified protective coating materials and shall be regularly maintained and in proper working order.
- 3.) The protective coating material must be spray applied by a Certified Applicator of the protective coating manufacturer.
- 4.) Specified surfaces shall be coated by spray application of a solvent-free, 100% solids, polyurethane structural lining as further described herein.
- 5.) Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. Air assisted spray application equipment may be acceptable, especially for thinner coats [ $< 10$  (10) mils], only if the air source is filtered to completely remove all oil and water.



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- 6.) The polyamine epoxy used to coat the manhole adjusting rings shall be applied per manufacturer's recommendations.
- 7.) If necessary, subsequent top coating or additional coats of the protective coating should occur as soon as the basecoat becomes tack free, no later than the recoat window for the specified products. Additional surface preparation procedures will be required if this recoat window is exceeded.
- 8.) At the termination of each material, a construction joint shall be installed to ensure the coating is an airtight barrier to protect the existing structure material.
- 9.) If the upstream and downstream pipe connections have been lined, the protective manhole coating shall be applied to overlap and secure the lining material to the manhole as well as reestablish/reconstruct the inverts.
- 10.) When groundwater loading is not an issue and only a corrosion barrier is required, the rehabilitation lining shall be installed to the thickness necessary to qualify as a monolithic (void free) liner. The roughness of the substrate will dictate the thickness needed to create the monolithic liner and eliminate any opportunity for voids in the lining. The minimum value for coating thickness, for corrosion protection, and for non-structural rehabilitation, shall be 125 mils and 150 mils on average.

### 4-3.13 LIFT STATIONS

Section under development.

## **4-4 TESTING**

### 4-4.1 TRENCH COMPACTION

#### 4-4.1 (a) TESTING REQUIREMENTS

- 1.) Maximum density shall be determined by AASHTO T-99 (Standard Method) as modified by INDOT Standard Specifications Section 203.24 of the State Specifications using Method A for soil and Method C for granular material.
- 2.) The minimum soil compaction requirements for trench backfill material and pavement subgrade shall be as shown in Standard Drawing [4-11](#).
- 3.) A minimum of one (1) Compaction Test will be required on the backfill for each sewer pipe and force main pipe transverse run that is under the pavement or concrete curb. A minimum of three (3) Compaction Tests will be required on the backfill for sewer pipe or force main pipe run. A pipe run is the length between structures or valves.
- 4.) Location of the Compaction Tests will be selected by the City Engineer's representative.

4-4.2 SEWER SYSTEM QUALITY ASSURANCE

4-4.2 (a) TESTING REQUIREMENTS

- 1.) Examine each piece of pipe before installing. Remove all defective material from the site. Ductile iron pipe is to be rung with a light hammer to detect cracks.
- 2.) A South Bend City Engineering representative must witness all tests. The South Bend City Engineer requires three (3) working days prior notice before any test. The sewer pipes must be ready for testing at the time specified. During the inspection process, if any material needs to be replaced, the test must be performed again to include the new material.
- 3.) Prior to performing a sanitary sewer system test, the Contractor shall do the following: Record drawings must be on file at the South Bend City Engineer office at least three (3) working days prior to the sewer test. These drawings must include all sewer and force main pipe, service laterals, and structures. Proper documentation shall be provided on official letterhead including a detailed list of materials, sizes, and total lengths installed. The City Engineer office is located at 227 W. Jefferson Boulevard, Suite 1300 N and the phone number is (574) 235-9251.

4-4.2 (b) GRAVITY SEWER LEAKAGE TEST

- 1.) PVC Pipe shall be tested for infiltration or exfiltration by either a hydrostatic test or an air test. A hydrostatic test shall be performed with a minimum of two (2) feet of positive head. The rate of exfiltration or infiltration shall not exceed 100 gallons per inch of pipe diameter per linear mile per day for any section in the sewer system. An air test shall conform to ASTM F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure for plastic pipe.
- 2.) VCP Pipe shall be tested for infiltration or exfiltration by either a hydrostatic test or an air test. Low pressure air test shall conform to ASTM C-828. Hydrostatic infiltration and exfiltration test shall conform to ASTM C-1091.

4-4.2 (c) MANDREL DEFLECTION TEST

- 1.) A five percent (5%) Mandrel Deflection Test shall be performed on all PVC gravity sanitary sewer pipe.
- 2.) These pipes shall be mandrelled with a ridge device sized to pass five percent (5%) or less deflection (or deformation) of the base inside diameter of the pipe. The mandrel test shall be conducted no earlier than thirty (30) calendar days after reaching final trench backfill grade. Each pipe material/type required to be mandrel tested shall be tested with a mandrel approved by the pipe manufacturer and meeting the requirements of this section. The test shall not be performed with the aid of a mechanical pulling device.
- 3.) The mandrel shall be pulled by hand through all sewer lines in a manner acceptable to the City and any section of sewer not passing the mandrel shall be uncovered, replaced, or repaired to the City's satisfaction and retested.

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- 4.) Proving rings shall be provided to check the mandrel. Drawings of mandrels with complete dimensions shall be furnished to the City upon request for each diameter and specification of pipe.

### 4-4.2 (d) FORCE MAIN PRESSURE TEST (PVC AND DUCTILE IRON PIPE)

- 1.) Pressure pipe shall be subjected to hydrostatic pressure test per AWWA C600 at twice the working pressure of the proposed pipe. Test each section by means of a pump connected thereto. All air shall be expelled from the pipe by satisfactory means.
- 2.) Test all pipe after backfilling and prior to pavement placement. Pressure tests shall not be less than two (2) hours in duration. Leakage is defined as the quantity of water required to maintain a pressure within five (5) psi of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage permitted shall not exceed ten (10) gallons per inch of diameter per mile of pipe per day at the specified pressure.

### 4-4.2 (e) FORCE MAIN PRESSURE TEST (HDPE PIPE)

- 1.) Butt Fusion Testing: Butt fusion testing shall be conducted at least once every day that butt fusions are made. The first fusion of the day shall be a trial fusion. The trial fusion shall be allowed to cool completely to ambient temperature, and then fusion test straps shall be cut out per ASTM D 2657. The test strap shall be a minimum of twelve (12) inches, or thirty (30) times the wall thickness, in length with the fusion in the center and shall be a minimum of one (1) inch, or one and one-half (1.50) times the wall thickness, in width. Bend the test strap until the ends of the strap touch. If the fusion fails at the joint, a new trial fusion shall be made, cooled completely, and tested. Butt fusion of pipe to be installed shall not commence until a trial fusion has passed the bent strap test.
- 2.) Pressure Testing: Pressure testing of the HDPE pipe shall be conducted at twice the working pressure of the proposed sanitary force main for at least two (2) hours according to Technical Note 802 – Leak Testing, July 2006, from Performance Pipe and per the manufacturer's recommendations. A copy of Technical Note 802 may be obtained at [www.performancepipe.com](http://www.performancepipe.com). Pressure testing shall be hydrostatic only. Pneumatic pressure testing shall not be used.
- 3.) Test Duration: The maximum test duration is eight (8) hours including time to pressurize the pipe, time for initial expansion, time for the test at test pressure, and time to depressurize the segment of pipe being tested. If the test is not completed due to leakage, equipment failure, or for any other reason, depressurize the test section completely, and allow for it to relax for at least eight (8) hours before pressurizing the test section again.
- 4.) The hydrostatic test as described in Technical Note 802 is summarized as follows:

Pipe Segment Filling: Fill the test section completely with water from the lowest possible point. Ensure that there is no air trapped in the test section by utilizing vents to expel the air.

Initial Expansion: Gradually pressurize the test section to test pressure and maintain test pressure for three (3) hours. During the initial expansion phase polyethylene pipe will expand

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slightly. Additional test liquid will be required to maintain pressure. The water added during this phase will not be monitored.

Testing: Immediately following the initial expansion phase, monitor the amount of make-up water required to maintain test pressure for two (2) hours. The test pressure shall be measured at the lowest possible point in the section being tested. The amount of make-up water required shall not exceed the allowance shown in Table 2, Technical Note 802.

Lines or joints, which leak, shall be repaired and retested. All pipes, fittings, and other materials found to be defective under test shall be removed and replaced by the Contractor at their own expense.

Depressurizing: At the conclusion of the test, slowly and carefully depressurize the test section by the controlled release of the test liquid.

### 4-4.2 (f) FORCE MAIN TRACER WIRE

Testing for conductivity shall be performed on each section of tracer wire, immediately following installation and prior to final project acceptance.

### 4-4.2 (g) MANHOLE NEGATIVE AIR PRESSURE (VACUUM) TEST

Manholes shall be air tested in accordance with ASTM C1244-93, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test.

### 4-4.2 (h) SEWER TELEVISION

- 1.) Before final acceptance, the gravity sanitary sewer system shall be flushed as required and televised.
- 2.) Provide television equipment capable of properly documenting the conditions as found within the pipe in a digital video format (DVD). Lighting for the camera shall illuminate the entire periphery of the sewer. The camera shall be radial view type capable of viewing 360 degrees within the pipe and shall provide an unobstructed view of the full pipe.
- 3.) The video inspection shall begin with a clear identification of the televising location, upstream and downstream manhole designation, and pipe diameter. The DVDs shall provide an accurate length measurement of the entire segment and of the distance to each lateral connection. Pan all lateral connections.
- 4.) Televising DVDs shall be submitted to the City Engineer for review and approval. The DVDs shall be clearly and properly labeled. Inspection for individual sewer segments (manhole to manhole) shall be bookmarked.

### 4-4.2 (i) CIPP TESTING

- 1.) The City Engineer shall be advised forty-eight (48) hours prior to conducting quality assurance tests.

2.) Material Testing

Collect two (2) samples for processing and testing per each rehabilitated sewer segment. Process and test one (1) sample and provide one (1) sample to the City Engineer's Representative. Chain of Custody procedures shall be used in handling of samples. The samples shall be restrained for all diameter of CIPP eighteen (18) inches or less; and flat plate for diameters of CIPP larger than eighteen (18) inches. The flat plate samples shall be taken directly from the wet out tube, clamped between flat plates, and cured in the downtube. The restrained samples shall be tested for initial physical properties and thickness; the flat plate samples shall be tested for initial physical properties only.

Testing shall be completed by an accredited, independent laboratory. The testing laboratory's accreditation documentation shall be submitted to the City Engineer for review and approval prior to testing. Testing results shall be provided to the City Engineer within twenty-one (21) days of CIPP installation.

Samples shall be conditioned and prepared in accordance with ASTM D618 and ASTM D5813 to ensure consistency in laboratory results.

Thickness shall be measured in accordance with ASTM D5813, latest version.

Flexural testing shall be in accordance with ASTM D790, latest version.

3.) Infiltration/Exfiltration Testing

All CIPP lined pipes shall be subjected to leakage testing in accordance with the requirements of ASTM F126 or ASTM F1743 as applicable. Testing to be conducted prior to lateral reinstatement. The rate of infiltration/exfiltration shall not exceed fifty (50) gallons per inch diameter per mile per day. Low pressure air testing in accordance with ASTM 1417 will be considered as an acceptable alternative test method by the Engineer upon written request.

- 4.) The City Engineer's Representative shall be advised forty-eight (48) hours prior to conducting all tests (including sample preparation). Testing results shall be provided to the City Engineer within twenty-one (21) days of liner installation.

4-4.2 (j) STRUCTURE LINING TESTING

- 1.) The City Engineer's Representative shall be notified forty- eight (48) hours prior to the conducting of all tests.
- 2.) Holiday Detection Test: After the protective coating has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. Surface shall first be dried; an induced holiday shall then be made on the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per one (1) mil [twenty-five (25) microns] of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the

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coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.

- 3.) Adhesion Testing: The adhesion tests shall be performed on a minimum of one (1) or fifteen percent (15%) of all rehabilitated and lined structures, whichever is greater. Adhesion testing shall be conducted after the liner system has cured per manufacturer instruction and in accordance with ASTM D4541 as modified herein. A minimum of one (1) twenty (20) mm dolly shall be affixed to the lined surface of the structure at the upper section or cone area, mid-section, and at the bottom, unless otherwise specified in the Special Provisions. Each testing location shall be identified by the City Engineer. The adhesive used to attach the dollies to the liner shall be rapid setting with tensile strength in excess of the liner material and permitted to cure in accordance with manufacturer recommendations. The lining material and dollies shall be adequately prepared to receive the adhesive. Prior to pull test, utilize a scoring device to cut through the coating until the substrate is reached. Extreme care shall be required while scoring to prevent micro cracking in the coating, since cracks may cause failures at diminished strengths. Failure due to improper dolly adhesive or scoring shall require retesting. The pull tests in each area shall meet or exceed 200 psi and shall include subbase adhered to the back of the dolly or no visual signs of coating material in the test hole. Pull tests with results between a minimum 150 psi and 200 psi shall be acceptable if more than fifty percent (50%) of the subsurface is adhered to the back of the dolly. A test result can be discarded, as determined by the City Engineer, if there is a valid non-statistical reason for discarding the test results as directed by Sections 8.4 and 8.5 of ASTM D4541. If any test fails, a minimum of three (3) additional locations in the section of the failure shall be tested, as directed by the City Engineer. If any of the retests fail, all loosely adhered or unadhered liner in the failed area, as determined by the City Engineer, shall be removed and replaced. If a structure fails the adhesion test, one (1) additional structure or ten percent (10%) of the initial number of structures selected for testing shall be tested at the discretion of the City Engineer.

NOTE: The mil thickness will be measured and confirmed with the scored and pulled test samples.

- 4.) A final visual inspection shall be made by the City Engineer's representative and manufacturer's representative. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by Applicator.
- 5.) The sanitary sewer system shall be put back into operational service as soon as the final inspection has taken place.

### 4-4.3 LIFT STATION START-UP AND TESTING

Section under development.

### 4-4.4 CONCRETE TESTING

#### 4-4.4 (a) STRUCTURAL CONCRETE

Air content test, slump test, and seven (7) day and twenty-eight (28) day compression cylinders shall be provided for each twenty-five (25) cubic yards of concrete construction.

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### 4-4.4 (b) FLOWABLE FILL

- 1.) Removable: The three (3) day average penetration resistance blow count number for removable flowable fill shall not be less than twelve (12) or greater than thirty (30), conforming to INDOT Standard Specifications Section 213.04 (b). The fourteen (14) day removability modulus shall be one (1) or less, conforming to INDOT Standard Specifications Section 213.04 (c).
- 2.) Non-Removable: The three (3) day average penetration resistance blow count number for non-removable flowable fill shall be greater than thirty (30), conforming to INDOT Standard Specifications Section 213.04 (b).

### 4-4.5 TEST REPORTING

#### 4-4.5 (a) REPORTING

- 1.) Test reports shall be prepared on official company letterhead and shall include relevant information and documentation for each type of test conducted. The test report is not official unless it is signed by a City Engineer representative.
- 2.) Any main line valves and equipment will be operated and witnessed by a South Bend City Engineer representative. Any installed material that is not functioning properly will result in a failed test. The accuracy of the Record Drawings will be checked at this time.
- 3.) All visible leaks shall be repaired and retested. All pipe, fittings, and other materials found to be defective under test pressure shall be removed and replaced.
- 4.) Deviation from the above test procedures shall not be permitted.

**SECTION 5 – WATER WORKS**

**5-1 GENERAL**

**5-1.1 DESIGN REQUIREMENTS**

Design of the Water System shall comply with the current version of 327 IAC Article 8 Public Water Supply, Recommended Standards for Water Works, Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (10 States Standards), and pipe manufacturer’s requirements. The minimum size for a water main shall be eight (8) inches. When extending public facilities such as water main, the facilities shall extend the width of the developed parcel to the property line.

Developments of commercial and industrial shall have both domestic and fire services. Each service shall have their own valve.

The current version of the City of South Bend Water Works Rules and Regulations apply. This requirement shall include Water Leak Insurance and Cross-Connection requirements.

All materials and work shall conform to Water Department Standards and to Indiana Department of Environmental Management and Indiana Administrative Code (IAC) Requirements.

**5-2 MATERIALS**

**5-2.1 PIPES TWO (2) INCHES AND SMALLER**

Water service pipe and fittings shall be Type K copper, conforming to ASTM B88 with compression fittings in one (1) inch or two (2) inch diameter.

**5-2.2 PIPES THREE (3) INCHES AND LARGER**

**5-2.2 (a) DUCTILE IRON PIPE**

Eighteen (18) foot lengths of ductile iron pipe shall conform to the requirements of the American National Standards Institute (ANSI) 21.51, or American Water Works Association (AWWA) C151, Thickness Class 50 push-on joint pipe. The ductile iron pipe and fittings shall have a hot coal tar coating in accordance with American Standards Institute for Coal-Tar Dip Coating for Cast Iron Pipe and Fittings. Ductile iron pipe and fittings shall be cement-lined, conforming to ANSI A21.4 or AWWA C104. Rubber gasket joints shall conform to the requirements of ANSI A21.11 or AWWA C111.

**5-2.2 (b) FITTINGS**

Fittings shall be ductile iron conforming to AWWA C111/ANSI A21.11 and AWWA C110/ANSI A21.10 for full body fittings or AWWA C153/ANSI A21.53-94 for compact fittings. All fittings shall be mechanical joint. All fittings shall be manufactured in the United States.



5-2.3 POLYETHYLENE ENCASEMENT

The ductile iron water main pipe, valves, and associated fittings shall be encased (wrapped) in polyethylene in accordance with AWWA C105/ANSI A21.5. The polyethylene wrap shall be V-Bio enhanced. It shall consist of three (3) layers of co-extruded linear low-density polyethylene (LLDPE), fused into a single thickness of not less than eight (8) mils. The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

The wrap shall be overlapped one (1) foot in each direction at joints and secured in place around the pipe. Wrap at tap locations shall be taped tightly prior to tapping. Contractor shall make all necessary repairs to the wrap following tapping operations.

5-2.4 JOINT RESTRAINT

Retainer Glands shall be wedge action. The length of restraint shall be determined by the Design Engineer.

Concrete thrust blocks shall only be used if designed and certified by a Registered Professional Engineer registered in the State of Indiana.

5-2.5 MAIN LINE VALVES

5-2.5 (a) GATE VALVE

Resilient seated gate valves shall be Clow, Mueller, or Kennedy epoxy-coated, resilient wedge, open right, designed for 200 psi working pressure, and meeting the requirement of AWWA C509. Valves shall be bronze non-rising stem, MJ, two (2) inch square operating nut for vertical installation with two (2) O-ring stem seals, and rubber-coated or rubber-sealed gate. Valves shall be Mueller, Clow, or Kennedy.

5-2.5 (b) BUTTERFLY VALVES

Water main valves with sixteen (16) inch diameters and larger shall be butterfly type valves. Butterfly valves shall conform to AWWA C504 – Rubber Seated Butterfly Valves.

5-2.5 (c) INSERT VALVE

Insert valve shall comply with AWWA C509 or AWWA C515. Insert valve shall have a ductile iron body and have a resilient seated wedge for closure. Insert valve shall not be placed on water mains larger than twelve (12) inches in diameter and at the discretion of the Water Works Department. The insert valve shall be EZ Valve System by Advanced Technologies, Inc. or approved equal.

5-2.5 (d) TEMPORARY LINE STOP VALVE

Temporary line stop valve shall be Hydra-Stop or approved equal. After the intended use of the temporary line stop valve, remove the valve mechanism and plug water tight with the Hydra-Stop completion plug and completion blind flange.

## SECTION 5 – WATER WORKS

### 5-2.5 (e) TAPPING VALVES AND SLEEVES

The tapping sleeves shall be built in two (2) sections, designed to be assembled around the existing mains without halting service. Bolts for fastening together the two (2) sections shall be closely spaced, located so as to ensure uniform gasket pressure. End connections of the sleeves shall be a mechanical joint complying with ANSI/AWWA C111. The end connection of the sleeve outlet shall be flanged complying with ANSI B16.1 Class 125 with MSS SP-60.

The tapping valves shall be resilient seated valves of the non-rising stem type. The tapping valves shall conform to ANSI/AWWA-C509. The end connection shall be a mechanical joint complying with ANSI/AWWA-C111. The outlet end connection meeting the tapping sleeve shall be flanged complying with ANSI B16.1, Class 125 and MSS SP-60. The valves shall be tested at twice the working pressure of 200 psi. The valves shall have O-ring seals. The tapping valves shall be provided with an adjustable cast iron valve box.

### 5-2.5 (f) VALVE BOX

Valve boxes shall be cast iron. Valve box assemblies shall include a bottom section, a top section, and a lid. The lid shall have the word “WATER” cast into it. Valve box shall have five (5) foot burial depth.

### 5-2.5 (g) CURB VALVE AND CORPORATION STOP

Curb valves and corporation stops shall be ball type, one-quarter (1/4) turn clockwise from fully open to fully closed and designed for 200 psi. working pressure. Inlet and outlet shall have compressed connections. Curb valve boxes shall allow for valve operation, from the surface, with the box and rod for a five (5) foot depth of curb valve. The tee head should be parallel to the pipe when open, and perpendicular when closed. Only valves manufactured by Mueller, Ford, or McDonald shall be permitted.

### 5-2.6 FIRE HYDRANT ASSEMBLY

Fire hydrant shall conform to the most recent version of AWWA C502; two (2), two and one-half (2.50) inch nozzles with National Standard thread and one (1) , five (5) inch pumper nozzle with South Bend Fire Department special thread; chained nozzle caps; one (1) inch square operating nut to open clockwise; one (1) inch square nozzle caps nuts; 360 degree rotatable upper barrel of break-flange design; painted red, white, and blue; extension for a six (6) foot trench depth; six (6) inch inlet with gasket and wedge action retainer gland. This inlet connection (shoe) shall be oversized to fit old and new pipe, having O.D. range from six and nine-tenths (6.90) inches to seven and one-tenth (7.10) inches.

The nominal five (5) inch pumper nozzle shall have an I.D. of at least four and three-quarter (4.75) inches. The main valve size shall be five and one-quarter (5.25) inches in diameter; the main valve shall close with, and be held closed by, normal water pressure. The inside of the shoe, and the lower plate valve, shall be epoxy-coated where exposed to pressurized water. Hydrants must be Clow Medallion, Mueller Super Centurion, or Kennedy Guardian.

## SECTION 5 – WATER WORKS

### 5-2.7 METER AND METER PIT

Meters are required for all domestic and irrigation lines. Irrigation may be fed off of the domestic service after the meter; however, sewer and water charges will apply for all metered use. Fire service lines are not metered and are billed a flat monthly rate. Meter, meter pit, and vault shall be as shown on Standard Drawings [5-13](#) and [5-14](#).

### 5-2.8 BACKFLOW ASSEMBLY

A cross connection control program was established by local ordinance 8356-93 in support of 327 IAC. The type of backflow preventer shall be determined by a water works field inspector. For commercial and industrial customers, a Reduced Pressure Zone (RPZ) is required for domestic service, double check is required for fire lines, and a pressure vacuum breaker (or RPZ) is required for irrigation systems. For further information contact the City of South Bend Water Works Cross Connection Control Department at (574) 235-7605.

### 5-2.9 STEEL CASING PIPE

Steel casing pipe shall conform to ASTM A139, Grade B. The minimum wall thickness shall be 0.375 inches for casing pipe diameter up to and including twenty-six (26) inches, minimum wall thickness shall be 0.50 inches for casing pipe diameters between twenty-seven (27) inches and forty-two (42) inches, and minimum wall thickness shall be 0.5625 inches for casing pipe diameters between forty-three (43) and forty-eight (48) inches. Casing spacers shall be stainless steel. The steel casing pipe and casing spacers shall comply with Standard Drawing [5-5](#).

## **5-3 CONSTRUCTION METHODS**

### 5-3.1 GENERAL

Schedule and coordinate work with the City Water Department.

All pipe installations are subject to inspection by the Project Representative and civil authorities having jurisdiction.

### 5-3.2 EXCAVATION

Refer to Section [4-3.3](#) for excavation, sheeting/shoring, and trenching requirements.

### 5-3.3 DEWATERING

Refer to Section [4-3.4](#) for dewatering requirements.

Water shall be kept out of the trench until pipe joining is completed. When work is not in progress, open ends, pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings.

5-3.4 WATER MAIN INSTALLATION

5-3.4 (a) INSPECTION FOR DEFECTS

Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material.

5-3.4 (b) CARE OF PIPE

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to damage the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, it shall be repaired immediately.

No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or tuning pipe will be permitted only on the bare ends of the pipe.

The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method.

5-3.4 (c) PIPE JOINTS

Prior to making pipe joints on water main, clean and dry all surfaces of pipe joints and jointing material. Use lubricants, primers, adhesives, and similar materials as recommended by the manufacturers. Place, fit, joint, and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of water tightness required. As soon as possible after the joint is made, place sufficient backfill material along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

Rubber gaskets that are not to be installed immediately shall be stored in a cool dark place.

Mechanical and push-on joints shall be installed in accordance with AWWA C600 for buried lines or AWWA C606 for grooved and flanged pipe above ground or in pits.

5-3.4 (d) PIPE LAYING

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belts, slings, or other authorized equipment. Under no circumstance shall any water-line materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating.

Except where necessary in making connections with other lines or as authorized by the Engineer, pipe shall be laid with the bells facing in the direction of laying.

The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe shall be firmly set on a good foundation and care shall be taken that pipe does not rest on stones, rock, or any unyielding material. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work.

## SECTION 5 – WATER WORKS

### 5-3.4 (e) PIPE DEFLECTION

The maximum allowable deflection is equal to one-half (½) of the deflection allowed in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limits set forth.

### 5-3.4 (f) PIPE CUTTING

Cutting of pipe shall be done in a neat and professional manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Engineer, cutting shall be done with an approved type of mechanical cutter. A wheel cutter shall be used when practicable. Squeeze type mechanical cutters shall not be used for ductile iron.

### 5-3.5 RESTRAINED JOINTS

Restrained joints shall be placed at fittings, upstream and downstream of the fitting, incorporating the length of restraint as determined by the Design Engineer.

### 5-3.6 COVER REQUIREMENTS

The water main shall be installed with a minimum depth of cover of five (5) feet. The water main may be required to be installed at a deeper depth to maintain the required eighteen (18) inches vertical separation distance from sanitary and storm sewers.

### 5-3.7 SANITARY SEPARATION OF WATER MAIN

#### 5-3.7 (a) PARALLEL INSTALLATION

Normal Conditions: Water mains shall be constructed at least ten (10) feet horizontally from any existing or proposed sanitary sewer or storm sewer and at least eight (8) feet horizontally from any manhole or inlet structure whenever possible. The distance shall be measured edge-to-edge.

Unusual Conditions: When local conditions prevent the prescribed horizontal separation, then maximum horizontal separation shall be provided with vertical separation of bottom of water line at least eighteen (18) inches above top of sewer. Where this vertical separation cannot be obtained, the sewer shall be constructed of ductile iron pipe (Thickness Class 50) with mechanical joints or PVC pipe (SDR 26 or SDR21) with compression seals. The pipe should be pressure tested in place per AWWA C600 without leakage before backfilling.

#### 5-3.7 (b) CROSSING

Normal Conditions: Water mains crossing any existing or proposed sanitary or storm sewer shall be laid to provide a minimum vertical separation of at least eighteen (18) inches between the outside of the water line and the outside of the sewer whenever possible.

## SECTION 5 – WATER WORKS

Unusual Conditions: When local conditions prevent the prescribed vertical separation, conform to the following:

1. Sanitary or storm sewers passing over or under water mains shall be constructed of ductile iron pipe (Thickness Class 50) with mechanical joints or PVC pipe (SDR 26 or SDR 21) as described in parallel installation, unusual conditions.
2. Water mains passing over sewer lines shall be laid to provide:
  - a. Vertical separation of at least eighteen (18) inches between top of sewer and bottom of water lines.
  - b. Adequate structural support for the sewers to prevent excessive deflection of the joints, resulting in the breaking of the water line.
  - c. Maximum separation of water and sewer line joints.

Sanitary and/or Combined Sewers, Storm Sewers, or Sewer Manholes: No water pipes shall pass through, or come in contact with, any part of a sewer or sewer manhole.

### 5-3.8 BEDDING

From the bottom of the excavation to a point one (1) foot above the top of the pipe, bedding material shall be placed as follows:

Granular material shall be placed in a loosely measured six (6) inch layer around the pipe. Each layer shall be thoroughly tamped under and around the pipe, and when sufficient layers have been placed in this manner to cover the pipe, the tamping shall proceed across the width of the trench. Hand, pneumatic, or mechanical tampers may be used. The bedding material shall be moist, but not wet, and it shall not include any stones larger than two (2) inches in any dimension.

If the native material is not granular and is unsuitable for pipe bedding, INDOT B-Borrow or Structure Backfill Type 1 shall be installed around the pipe in the manner described above.

### 5-3.9 TRENCH BACKFILL

Refer to Section [4-4.1](#) for trench backfill requirements.

### 5-3.10 HYDRANTS

Hydrants shall be located per the Water Department Standards Details or as directed by the Water Department. When set between the curb and sidewalk or between the sidewalk and property line, no portion of the hydrant or nozzle cap shall be within six (6) inches of the sidewalk. All hydrants shall stand plumb and shall have their nozzles parallel or at right angles to the curb; pumper nozzles shall face the street. Hydrants shall fit the grade with nozzles at least twelve (12) inches above the ground.

Dirt and other foreign matter shall be removed from the hydrants before setting.

Each hydrant shall be restrained with mechanical joint fittings per City of South Bend Standard Details.

## SECTION 5 – WATER WORKS

All hydrants are to be properly supported; and when set, shall be surrounded by 0.50 cubic yards of loose gravel (No. 5 or No. 8), incidental to the hydrant assembly work item.

Hydrants shall be painted as shown in Standard Drawing [5-11](#).

### 5-3.11 COMMERCIAL METERS TWO (2) INCHES AND ABOVE WITH BACKFLOW PREVENTION

The preference of the Water Department is that the meter and associated by-pass line be located inside a building utility room.

Meters and backflow preventers shall be no closer than twelve (12) inches from the floor and no higher than thirty-six (36) inches and the plumbing center line shall be twelve (12) inches from the wall.

Meters require an inlet and an outlet valve with a bypass. The bypass shall be at least one-half (½) the main line size. The bypass is required to have a gate valve.

No jumpers are allowed at any time.

Floor drains shall be installed as close as possible to the meter and backflow preventer setting.

For a turbine meter, a two (2) inch test tee is required downstream of the meter before the outlet valve.

A minimum of ten (10) times the pipe diameter [or five (5) times with a strainer] of straight pipe is required before the inlet valve and the meter. Two (2) times the pipe diameter is required on the outlet side.

Backflow preventers are required on domestic, irrigation, and fire protection lines as specified by state law and local ordinance. An approved backflow preventer shall be installed after the meter.

Reduced pressure zone backflow preventers cannot be installed in pits.

On irrigation systems, Pressure Vacuum Breaker (PVB) devices shall be installed a minimum of twelve (12) inches above the highest head. If this requirement cannot be followed, an RPZ type device shall be installed.

If water service cannot be interrupted, a comparable backflow device shall be installed in parallel.

Failure to follow these guidelines may result in termination of water service.

## **5-4 TESTING**

### 5-4.1 TRENCH COMPACTION

Refer to Section [4-4.1](#) for trench compaction requirements.

## SECTION 5 – WATER WORKS

### 5-4.2 QUALITY ASSURANCE (STATIC TEST AND DISINFECTION)

#### 1. Testing Requirements

Examine each piece of pipe before installing. Remove all defective material from the site. Ductile iron pipe shall be rung with a light hammer to detect cracks.

A South Bend Water Works employee must witness all static pressure tests and collect all bacteria samples. No other results will be accepted. The South Bend Water Works requires three (3) working days prior notice before any test. Each step must be completed before a bacteria test can be taken. The water mains must be ready for static and bacteriological testing at the time specified. No bacteria samples will be collected, or static pressure tests started, after noon on the designated day of testing. During the inspection process, if any material needs to be replaced, the static pressure test must be performed again to include the new material.

#### 2. Prior to performing a static pressure test, the Contractor shall do the following:

As-Built drawings must be on file at the South Bend Water Works drafting office at least three (3) working days prior to the static pressure test. These drawings must include all fire hydrants, main line valves, hydrant valves, and curb stops. The Contractor must provide proper documentation on official letterhead including a detailed list of material and total lengths installed. The drafting office is located at 915 South Olive Street and the phone number is (574) 235-9279.

All hydrants will be live during a static pressure test. Table 6A from the AWWA Standard C600-99 will be used to determine testing allowances.

All hoses used for flushing will have a South Bend Water Works approved backflow/cross connection prevention device. All contractors must keep track of the amount of water used for flushing. All water added to the water main must be from the South Bend municipal water system and water cannot be added during the static pressure test per Table 6A, in the AWWA Standard 600, unless it can be measured.

Pressure pipe shall be subjected to 150 pounds per square inch hydrostatic pressure test per AWWA C600. Test each section by means of a pump connected thereto. All air shall be expelled from the pipe by satisfactory means. The pump, connections, fittings, and all necessary labor and materials for conducting the tests, shall be furnished by the Contractor.

Test all pipe after backfilling and prior to pavement placement. Pressure test shall not be less than two (2) hours duration. Leakage is defined as the quantity of water required to maintain a pressure within five (5) psi of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage permitted shall not exceed ten (10) gallons per inch of diameter per mile of pipe per day at the specified pressure.

#### 3. After a static pressure test, the Contractor shall do the following:

The Contractor shall have a form on official letterhead with the start time and pressure along with the end time and pressure. The static pressure test is not official unless it is signed by a Water utility representative.



## SECTION 5 – WATER WORKS

All hydrants, main line valves, and hydrant valves will be operated by the Contractor and witnessed by a South Bend Water Works representative. Any installed material that is not functioning properly will result in a failed test. The accuracy of the as-built drawings will be checked at this time.

All visible leaks shall be repaired and retested. All pipe, fittings, and other materials found to be defective under test pressure shall be removed and replaced.

Deviation from the above test procedure shall not be permitted.

#### 4. Disinfection

The water main must be flushed so that the chlorine residual is representative of the South Bend Water Works distribution system. No bacteria samples will be taken until the free chlorine residual in the water main is at least 0.50 mg/L and no higher than one and one-half (1.50) mg/L. After the flushing is complete and before a sample is taken, the newly installed water main must be isolated from existing potable water mains by closing the necessary valve(s). The Contractor must open this valve(s) prior to bacteriological testing.

The form of chlorine, concentration, and points of application and sampling shall be as directed by the South Bend Water Department. The chlorination procedure shall be in accordance with AWWA Standard C651 – Disinfecting Water Mains, and as outlined herein.

As per AWWA standard C651-99, a sample will be taken every 1,000 feet of installed water main and at all dead-end water mains. The samples will be collected at the appropriate fire hydrants. Each 1,000 foot section will pass its bacteria test before moving on to the next 1,000 foot section.

Tests shall indicate the water to be completely free from the members of the coliform group.

In the event of a failed bacteria test, the Contractor is responsible for flushing the system and re-chlorinating.

**SECTION 6 – TRAFFIC AND LIGHTING**

**6-1 GENERAL**

6-1.1 PURPOSE

The purpose of this Section is to provide design guidance to developers and designers of projects impacting the Right-of-Way of the City of South Bend. All work within the City’s Right-of-Way shall comply with the following specifications. Work within the City’s Right-of-Way that is not addressed by the following specifications shall comply with INDOT’s Standard Specifications and Design Manual.

6-1.2 ADDITIONAL SUBMITTAL REQUIREMENTS FOR TRAFFIC AND LIGHTING ITEMS

Design calculations shall include traffic signal designs and timing plans; structural design of traffic signal and lighting equipment including criteria for wind loading, maximum horizontal deflection, maximum stresses, fixture loads, material strengths, welds, and bolts; lighting photometric layout sheets illustrating light levels and uniformity checks; voltage drop calculations.

**6-2 SERVICE POINTS**

6-2.1 GENERAL

Service points are to provide electrical power distribution for signals, street and/or pedestrian lighting, landscape irrigation circuits, and any other electrical load requirements with sockets to meter electrical power usage. Cabinets shall have the general shape and color as provided in the City’s Standard Drawings.

6-2.2 SINGLE & DUAL METERS

The single meter installation is for applications needing electrical service for either a traffic signal installation, up to eight (8) lighting circuits. The dual meter is for applications needing electrical service for a combination of a traffic signal and up to eight (8) lighting circuits. The single meter cabinet shall be a Tesco Service Pedestal, Single, 200 AMP, 120 Volt, Model T-24-200 lbs. or approved equal. The dual meter installation option is for instances that permit different usage rates on separate electrical circuits. The dual meter cabinet shall be a Tesco Service Pedestal, Dual, 200 AMP, 120 Volt, Model T-24-200 lbs., or approved equal.

6-2.3 LOCATION

Service points shall be located to provide easy access for maintenance, while minimizing impacts by errant vehicles. Refer to City’s Standard Drawings for guidance on locating service points at signalized intersections. A service point that controls lighting circuits shall take into consideration its location and orientation of the photocell to effectively turn on and off the lights.

## SECTION 6 – TRAFFIC AND LIGHTING

### 6-2.4 CONTROLLER CABINET WRAPS

Section under development.

## **6-3 SIGNALS**

### 6-3.1 GENERAL

For traffic signal installation, an engineering study should be performed to determine the validity of signal installation. New traffic-signal proposals should satisfy at least one (1) or more of the primary warrants listed in IMUTCD Chapter 4C. The IMUTCD provides the criteria and procedures used to determine if the warrant is satisfied. If a traffic signal is not warranted a multi-way “Stop” sign application may be appropriate. The warrants provided in the IMUTCD should be followed. The IMUTCD describes the warrants for where a multiway “Stop” sign installation may be considered. However, it should not be used unless the traffic volume for each approach leg of the intersection is approximately equal.

Signals require a surge protector and battery back-up system with blue light indicator, LED signal indication modules (all colors), back plates on all signal heads, and pole mounted supplementary signal heads for all new signal installations or modernization projects, otherwise existing conditions may be maintained. New signal installations shall also provide fiber optic, Ethernet radio, or cell modem connections to the Centrac central management system. Contact the Bureau of Traffic and Lighting to determine which connection type is appropriate for the intersection location and for specific requirements on equipment and standards.

Pedestrian heads with count down display and push buttons are required where marked crosswalks exist, are planned, or pedestrian volumes warrant.

After the installation and acceptance of a traffic signals by the City of South Bend, the City will become responsible for the operation and maintenance. Therefore, the City should be consulted early in the design process regarding the feasibility of the selected signal equipment and its location, e.g., controllers, cabinets, signal heads, etc. The selected equipment must satisfy the operator’s capability to adjust the signal and maintain. To reduce the City’s need for additional resources and personnel training, the design shall match existing traffic signal hardware and capabilities.

All traffic signal equipment is to be barcoded. Contractor shall provide a list to the Bureau of Traffic and Lighting. The Bureau will create the bar codes which are then to be secured to the equipment by the contractor.

### 6-3.2 TRAFFIC SIGNAL CONTROLLERS

The controller shall be a TS2 Type 2 controller, a malfunction management unit (MMU), and be interchangeable with existing controllers used and maintained by the City of South Bend. The controller shall have a small switch panel and compartment (police door).

## SECTION 6 – TRAFFIC AND LIGHTING

### 6-3.3 TRAFFIC SIGNAL CABINET AND FOUNDATION

A Type P-1 foundation shall be provided for a TS2 Cabinet. All Cabinets shall come provided with all necessary equipment to function properly and shall provide an Ethernet switch. The Type P-1 foundation shall be in accordance with INDOT Standard Drawings.

### 6-3.4 CONTROLLER AND CABINET LOCATION

Traffic signal cabinets shall be located to provide easy access for operation and maintenance while minimizing impacts by errant vehicles. Refer to Standard Drawing [6-5](#) for guidance on location of controller cabinets at signalized intersections. Lighted intersections shall consider a tree canopy for photocell operation.

Each time a controller cabinet door is opened, records are to be kept for why the door was opened. New traffic signal installations shall include a cabinet log for documentation purposes.

### 6-3.5 ACCESSIBLE PEDESTRIAN SIGNALS

The use of an Accessible Pedestrian Signal (APS) shall be considered at locations where a visually impaired pedestrian has made a request or at locations where a visually impaired pedestrian is present. APS shall also be considered at an intersection adjacent to traffic signals that currently have, or will be equipped with, APS. An Accessible Pedestrian Signals (APS) Study Report shall be conducted for any new traffic signal installation and shall be submitted for review to Engineering.

### 6-3.6 SIGNAL HANDHOLES

The maximum spacing between handholes in the same conduit run is not to exceed 200 feet for lighting and 300 feet for fiber circuits. Desirably handholes shall not be located within the pedestrian access route. If site restrictions require, handholes shall have a casting that meets section R302.7 in the ADA PROWAG regarding vertical alignment and surface discontinuities.

No cable splices shall be permitted anywhere below surface grade. The cover of the handhole shall be as shown on Standard Drawing [6-19](#).

Handholes should be located within the tree-lawn area when possible. Other locations may include sidewalks, behind guardrails or non-mountable curb, paved shoulder, or as directed by Engineering. Handholes shall not be located within the curb ramps. The handhole shall be made of concrete in accordance with INDOT Standard Drawings. Handholes made of polymer concrete are not allowed.

A handhole that needs to be placed directly in a travel lane will require a special design and plan detail to provide a means by which the cover and ring are to be secured to the handhole.

### 6-3.7 CONDUIT

Conduit shall have a minimum diameter of three (3) inches or equivalent area with no greater than thirty percent (30%) of the interior area filled by wiring. Two (2) additional conduit runs shall be install from the controller cabinet foundation to first handhole. Conduits for advanced detection may have a minimum diameter of two (2) inches.

## SECTION 6 – TRAFFIC AND LIGHTING

### 6-3.8 DETECTION

Detection at signalized intersections shall be from thermal imaging sensors mounted on traffic signal strain poles or mast arms capable of monitor traffic and bicycle activities in all weather conditions.

Preformed loops shall be used with concrete at locations that are unsuitable for thermal detection and loop detectors with saw cuts should only be used at locations that are unsuitable for thermal detection and preformed loops. Loop detector housings shall be installed outside of the travel lanes, in the shoulders, or in the median if the lane is adjacent to one of these. Refer to Standard Drawing [6-6](#) to locate detector housings on roadways with curbs and no shoulders.

Advanced detection may be required on all approaches with design speeds greater than thirty (30) mph, unless specifically waived by Engineering. Each lane of an approach shall have its own detection channel on the controller. Adjacent lanes of the same movement may not be configured as a single channel. Multiple approach lanes must have individual lane by lane detection.

### 6-3.9 APPROVED EQUIPMENT

All signal components shall be NEMA TS-2 compliant with the following approved equipment used unless otherwise approved by South Bend Bureau of Traffic and Lighting.

Signal cabinets:	Econolite ‘P’, ‘M’, or ‘G’ Cabinets.
Controller:	Econolite ASC/3-2100 with Ethernet port and Purdue Data Logging enabled or Econolite Cobalt 2100 controller
Video Detection:	FLIR thermal sensors processed by Autoscope RackVision Terra
Conflict Monitor:	Reno A&E MMU2-1600GE
Loop Detectors:	New construction, under pavement, Reno A&E PLH Preformed Loop Replacement or Retrofit, saw cut installed, Reno A&E PLB Preformed Loop
In-Pavement Det.:	TrafficWare POD Wireless Detection System
Loop Amplifier:	Reno A&E Model C-1203 with counting enabled
Load Switches:	Reno A&E LS-200
Advance Detection:	Loop or In-Pavement (see above).
Signal Heads:	Econolite, polycarbonate, black aluminum backplates with reflective tape
Pedestrian Head:	General Electric Model GT1 LED sixteen (16) inches by eighteen (18) inches with countdown module Model PS7- CFF1-27A or Leotek TLS-PED-16-CIL-P1
Pedestrian Button:	Campbell Company AAPS with cabinet located APC or Campbell Company AGPS

## SECTION 6 – TRAFFIC AND LIGHTING

Battery Back-up:	Sensata Technologies 48M18-WBE. UPS and batteries housed in separate cabinet mounted on side of controller cabinet.
Conduit:	PVC meeting the requirements of NEMA TC-2, Type 2
LED Modules:	InterTek-ETL certified to meet ITE specifications
Cabinet Fiber/ Ethernet Switch:	MOXA model SFP-1GLXLC-T
Ethernet Radio:	Intuicom Nitro58, 5.8 Ghz Range, Integrated Panel Preferred
Time Switch for Flasher Activation:	Solar Traffic Controls STC-01 Solid-State Time Switch
Speed Limit Indicators:	Traffic & Parking Control Co., Inc. solar powered indicators

### 6-3.10 WARNING BEACON

A warning beacon shall be provided at mid-block crosswalks with a push button for pedestrian activation.

### 6-3.11 SPEED LIMIT SIGN BEACON

A speed limit sign beacon shall be provided with each School Speed Limit Assembly in accordance with IMUTCD Chapter 4C and Standard Drawing [6-7](#). The sign beacons shall be solar powered, secured to a four and one-half (4.50) inch diameter pedestal pole, base, and foundation and equipped with a time switch for flasher activation.

### 6-3.12 SPEED LIMIT INDICATORS

A speed limit indicator, also called “Your Speed” sign, displays the speed of an approaching vehicle and may be installed in conjunction with a Speed Limit sign in accordance with IMUTCD INDOT Standard Specifications, Section 802, and shall be FCC compliant. Speed limit indicators are to be located on roadways, as determined by the City, for slowing down motor-vehicle traffic to improve safety for pedestrians and cyclists. The indicator shall be a solar powered twelve (12) inch amber LED display on a twenty-four (24) inches wide by thirty (30) inches high sign with the words “YOUR SPEED” printed above the LED screen. The legend will have a black legend on a yellow background.

## **6-4 SIGNS**

### 6-4.1 GENERAL

Street name lettering shall be in Highway C font and shall be in Upper and Lower case with medium kerning. Street numbers shall be the same with wide kerning. Standard abbreviations may be used following the street name or number for ground mounted and overhead signs.

The upper-case letter on new installations for overhead signs are to be twelve (12) inches high. The upper-case lettering for existing overhead signs may remain eight (8) inches high.

## SECTION 6 – TRAFFIC AND LIGHTING

The removal of existing signs shall be coordinated with the Bureau of Traffic and Lighting (574-235-9925) and arrangements made for the convenient time to deliver City signs and poles. All salvaged traffic signs shall be delivered to the Bureau of Traffic and Lighting at 731 S. Lafayette Blvd. All deliveries to the Bureau of Traffic and Lighting requires a minimum of two (2) working days prior to returning or delivering any sign and/or sign related material.

The white on black signs located in Historic Districts shall remain unless directed otherwise by the City.

All signs are to be barcoded. The Contractor shall provide a list to the Bureau of Traffic and Lighting. The Bureau will create the barcodes which are then to be secured to the sign by the contractor.

### 6-4.2 MATERIALS

Signs shall be of 0.10 gauge aluminum for widths up to sixty (60) inches and 0.125 gauge aluminum for widths greater than sixty (60) inches. The background color, based on street type, shall be 3M ElectroCut™ Film Series 1170 (1171c Yellow, 1175c Blue, 1177c Green, or 1179c Brown) or approved equal. The white legend shall be Diamond Grade™ DG<sup>3</sup> Reflective Sheeting, Series 4090 (4090 White) or approved equal.

Sign posts shall be two (2) inches by two (2) inches (INDOT Type 2) ASTM designation A570, Grade 50 steel meeting the provisions of Buy America.

## **6-5 TRAFFIC MARKINGS**

### 6-5.1 GENERAL

Longitudinal lines, other than on bridge decks and RCBA's, should be grooved when durable marking materials of thermoplastic, multi-component, or preformed plastic are used. Grooving pavement for longitudinal lines extends the service life of the marking by reducing the likelihood of snow plow damage and improves marking adherence to the pavement surface.

In the central business district where parking is prohibited, curb markings shall be IMUTCD compliant with red located in front of fire hydrants, yellow for no parking regulations, and blue to designate parking spaces for persons with disabilities.

Green pavement markings shall be used in extensions of bicycle lanes through intersections and traffic conflict areas.

### 6-5.2 MATERIALS

#### 6-5.2 (a) THERMOPLASTIC

Thermoplastic is a durable marking material that should be used on asphalt pavements with an Annual Average Daily Traffic (AADT) value greater than or equal to 10,000 to 20,000 Vehicles per Day (VPD) or designated as a Collector and for transverse markings, unless otherwise directed by the City.

## SECTION 6 – TRAFFIC AND LIGHTING

### 6-5.2 (b) MULTI-COMPONENT (EPOXY)

Multi-Component is a durable marking material that can be used on any asphalt or on concrete pavement with an AADT value greater than 20,000 VPD or designated as an Arterial route, unless otherwise directed by the City.

### 6-5.2 (c) PREFORMED PLASTIC

Preformed Plastic markings shall be used where there is a need for more durable, retained retro-reflectivity, increased detection distance, and wet retro-reflectivity characteristics. Preformed Plastic is a durable marking material that can be used on either bituminous or concrete pavement with an AADT greater than 20,000 VPD or designated as an Arterial route, unless otherwise directed by the City. Preformed plastic longitudinal skip line markings with pavement grooves shall be considered on all multi-lane concrete pavement projects.

### 6-5.2 (d) TRAFFIC PAINT

Paint marking material is to be used where the additional cost of durable pavement markings is not warranted as determined by the Engineering Department.

### 6-5.3 GUIDANCE DEVICES

Guidance Devices shall be provided to delineate curb extensions to mark the curb line from damage caused by heavy equipment during snow plowing operations. P.S.B GESMA Inc.'s R-6 curb markers shall be located and installed per manufacturer's recommendation at the intersections to locate the face of curb.

## **6-6 LIGHTING**

### 6-6.1 GENERAL

The lighting criteria shall be the illuminance design method meeting the guidelines listed in AASHTO Roadway Lighting Design Guide. The road surface for asphalt pavements shall be considered an R3 classification, unless directed otherwise. The general land use term "commercial" shall be considered the boundary defined by the central business district. The lighting system shall take into account the effects that trees have on light distribution. The City Engineer shall approve all light fixtures installed within the Right-of-Way.

The electrical power supply shall be single (1)-phase. If only three (3)-phase service is available, then a step down to single (1)-phase is required. The lighting layouts shall have wiring circuits A or B designed to avoid dark zones if either of the wire circuits would fail. Luminaires along a straight section of roadway typically have the A and B connections alternating with the opposite designation across the street. The lighting circuit shall be controlled at the service point by a photocell.

All new lighting luminaire installations shall be a LED light source with color temperature between 4,500 K to 5,000 K without blue light. The bases, poles, mast arm, and fixtures shall be made of cast aluminum or steel with a black powder coat finish.

Provisions for dark skies within the City right-of-way shall be considered.



## SECTION 6 – TRAFFIC AND LIGHTING

Plans should indicate light source type, luminaire wattage, total initial lumen output, estimated light loss factor, the average illumination level, uniformity ratio, equipment location, luminaire table, and service point amp table.

Connections between lights shall be No. 4 gauge copper wire with No. 10 gauge copper wire installed from base of pole to luminaire.

The lighting of a roundabout should be in accordance with AASHTO *Roadway Lighting Design Guide* and NCHRP *Report 672*. Lighting should include the central circulatory roadway and extend at least 400 feet from the circulatory roadway along all approaches. Light of the approaches should also extend through any pedestrian crosswalks and/or splitter islands.

All lighting equipment is to be barcoded. The Contractor shall provide a list to the Bureau of Traffic and Lighting. The Bureau will create the barcodes which are then to be secured to the equipment by the contractor.

### 6-6.2 LIGHTING HANDHOLES

Refer to Section [6-3.6 SIGNAL HANDHOLES](#) for lighting handhole requirements.

### 6-6.3 CONDUIT

Conduit shall be two (2) inch Schedule 80 HDPE and installed with tracer wire for future locates. The HDPE shall be suitable for direct burial applications and shall not be installed when either the temperature or ambient temperature is below negative ten (-10) degrees Fahrenheit. Schedule 40 HDPE conduit may be used in an existing tree-lawn area that is already developed.

## SECTION 7 – EARTHWORK & EROSION AND SEDIMENT CONTROL

### **SECTION 7 – EARTHWORK & EROSION AND SEDIMENT CONTROL**

#### **7-1 GENERAL**

##### 7-1.1 DESIGN REQUIREMENTS

Design of the Erosion and Sediment Control measures shall comply with the current version of the City of South Bend Stormwater Management Ordinance and the Indiana Stormwater Quality Manual, Issuance of Permits, Construction and Permit Requirements, and product manufacturer's requirements.

#### **7-2 CONSTRUCTION METHODS**

##### 7-2.1 GENERAL

All Erosion and Sediment Control items shall be installed in strict conformance with the manufacturer's instructions for proprietary items. On-site construction methods shall conform to these Specifications and City of South Bend Standards and the Indiana Stormwater Quality Handbook.

A typical layout for Erosion and Sediment Control measures on an individual lot is included in Standard Drawing [7-8](#). While this will not encompass every situation, it should be used as a guideline when determining which measures to use and where they should be located.

Prior to site work, Erosion Control measures shall be installed to control erosion and prevent sediment from exiting the site. This shall include but not be limited to silt fences and filter socks, construction entrances, inlet protection, and other items as necessary to control sediment.

Construction operations shall be carried out in a manner so as to minimize erosion and control sediment. Any material excavated from the project shall be contained.

A plan shall be submitted to the Division of Engineering for a site that will be inactive for fifteen (15) days. This plan shall include the method and schedule for stabilizing the site until work can resume and the original erosion and sediment program can be reimplemented.

The Notice of Intent and required rain gauge shall be clearly posted at the site prior to commencing construction activities.

##### 7-2.2 INSPECTION AND MAINTENANCE

###### 7-2.2 (a) GENERAL

Inspection and maintenance of all temporary and permanent measures shall be in accordance with the approved self-monitoring program submitted by the individual lot operator and adhere to Section 7 of the South Bend Standards.

## SECTION 7 – EARTHWORK & EROSION AND SEDIMENT CONTROL

Mud and sediment tracked or washed onto public roads shall be removed immediately by brushing or sweeping, at a minimum, daily. Flushing should only be used if the water is conveyed into an inlet that is protected.

Construction site inspection should occur at least weekly, and within twenty-four (24) hours following each storm event with 0.50 inches of rain or greater.

### 7-2.3 REMOVAL

Upon completion of all earth disturbing activities, all temporary Erosion and Sediment Control measures shall be removed, taking care to prevent any sediment from entering the stormwater system and disposing of any material built-up around the control measure.

Upon completion of a project, the erosion and sediment control measures shall remain in place until the site has stabilized and the erosion and sediment control are no longer necessary.

**SECTION 8 - LANDSCAPING**

**8-1 GENERAL**

8-1.1 PURPOSE

The purpose of this Section is to provide design guidance to protect and enhance the community’s environmental, economic and aesthetic quality, thereby contributing to the overall objective of promoting the public’s health, safety and general welfare. The following design guidance is intended to enhance, preserve and develop the City’s environment by:

- Managing development impacts by planting trees and landscaping in order to increase the real estate values of properties; and
- Creating innovative and environmentally friendly landscape designs that enhance and define the public and private spaces.

The [City of South Bend Forester](#) and Engineering will work together with respect to clarification and guidance during plan reviews. Communication for tree plantings and landscaping requirements shall be through Engineering during these plan reviews.

8-1.2 OVERVIEW

This guidance is to address landscaping applied as part of a development project or to be incorporated as part of the surface restoration from work performed within the right-of-way. This section is not intended to be a substitute for code requirements required in [Chapter 19 - Trees and Vegetation of the Municipal Code](#) found within the Subdivision Ordinance. Where design guidance conflicts between this section and the subdivision ordinance, the more restrictive requirement shall govern.

8-1.3 PLANTING SEASONS

Landscape and other planting work performed within the right-of-way shall be performed in their respective species’ planting season. Typically, these planting seasons are either spring or fall. Spring Planting shall occur from the time the soil first becomes workable up to June 15. Fall Planting shall occur from September 1 to November 15. Evergreen shrub plantings shall occur no later than November 1, and evergreen tree plantings shall occur no later than October 15. Plantings that occur outside of the specified planting seasons shall be approved by the City.

Plantings occurring in the summer season, generally from June through August, or other unseasonable conditions may require watering and additional measures to sustain said plantings. Approval to plant in these unseasonable conditions shall be acquired prior to execution. Proposed plantings shall be placed to the extent possible when conditions are optimal for their long-term viability.

8-1.4 PERMITS

See the [City of South Bend’s Venues Parks & Arts – Forestry](#) page for information regarding permit requirements.

**8-2 DESIGN REQUIREMENTS**

8-2.1 GENERAL

Landscaping features shall be designed in accordance with the Municipal Code City of South Bend [Zoning Ordinance Section 21-09.01 Landscape, Chapter 19 - Trees and Vegetation](#), and the [South Bend Tree & Lawn Regulations](#). Further, all plantings shall be in accordance with ANSI A300 Tree Planting Standards part 6. Placement of landscaping features relative to intersections, drives and other roadway features shall be in accordance with [Section 2 – Streets, Walkways & Paths](#). Wherever possible, landscaping features shall be centered between curb and sidewalk. Unless otherwise specified, trees and shrubs shall be selected from the [Street Tree Master Planting List](#). For a listing of prohibited tree and shrub species, see [Sections 19-13 and 19-14](#).

8-2.2 WATER

An adequate water supply shall be provided as part of any proposed planting or seeded grassed area until these plantings are viable or a stand of grass is in place. Irrigation systems shall be considered and may be required in areas containing planting beds or other similar landscaping features that will be later maintained by City staff or located within the right-of-way.

8-2.3 TOPSOIL

Topsoil shall be stockpiled and reused to the extent possible as part of any construction activity. This topsoil shall be kept separate from other soil material when stockpiling. It shall be clean and free from large roots, sticks, weeds, brush, stones larger than 1 inch in diameter, or other litter and waste products. At least 95 percent must pass the No. 10 sieve and the pH must be between 6.5 and 7.2. Any topsoil imported from off-site sources shall be consistent with the above listed requirements. A minimum topsoil depth of 6 inches for seeded areas and 4 inches for sodded areas shall be provided.

8-2.4 SEEDING

Seeding shall be installed consistent with these standards and in accordance with provisions set forth in INDOT Specifications, Section 621. All seeding shall be Type U, or approved equal. Mulch shall only be hydromulch using wood cellulose fiber on 6 inches of topsoil after fine grading. Straw mulch shall not be used for seeding applications.

8-2.5 SODDING

Nursery sodding shall be installed consistent with INDOT Specifications, Section 621. All lawn areas shall be graded and receive 4 inches of topsoil that complies with [Section 8-2.3](#) prior to sod placement.

Generally, all parkway areas within one foot adjacent and behind the sidewalk and other disturbed areas within the right-of-way shall be sodded. Within these areas, fine grading shall be performed between the curb line and sidewalks and topsoil placed to establish a minimum depth of 4 inches prior to placement of sod.

8-2.6 PERMANENT EROSION CONTROL

Permanent erosion control materials, such as turf reinforcement mats, shall comply with INDOT Specifications, Section 621. All installed turf reinforcement mats shall be biodegradable.

8-2.7 STRUCTURAL SOIL

Structural Soil shall provide a layer suitable for supporting the growth of permanent vegetation. All materials shall be obtained from the existing soils within the construction limits, an approved commercial source, or project-specific borrow pits. The Structural Soil shall be a fertile, friable and loamy soil of uniform quality free from any objectionable plant material or undesirable vegetative debris which would be harmful to plant life. All landscape shrub beds and tree pits within paved areas shall be backfilled with a Structural Soil mix as further described below.

- All materials used to develop the Structural Soil shall consist of 40-45% sand, 7-20% clay, and 35-40% silt and must be placed at the depth of the tree root ball at a minimum depth of 24 inches.
- All components and amendments to the Structural Soil shall be added and mixed with pulverized topsoil and prepared offsite at the supplier’s facility creating a uniform mix.
- Structural Soil shall be installed uniformly in grassed parkway locations and urban environments as may be necessary for the viability of trees and other landscape amenities.

Structural Fill shall be stored in stockpiles at the producer’s or supplier’s facility and be protected from erosion, absorption of excess water, and contamination at all times.

8-2.8 TREE GRATES

The size and location of Tree Grates shall be in accordance with the tree species size classes listed in the [Street Tree Master Planting List](#) and [Section 9-2.3\(c\)](#). All tree grates shall be installed with a metal frame, such as angle iron, on which the grate will rest. At all tree grate locations, a water percolation test shall be conducted to ensure not standing water is present within planting beds for greater than 12 hours. If proper drainage cannot be achieved, underdrains are to be provided where standing water will restrict healthy plant growth.

**8-3 MAINTENANCE AND WARRANTY**

All vegetative features, where applied, shall be warranted for a period not less than 2 growing seasons from project completion. During the warranty inspection period, planting areas will be rated per the following scale:

- Good: 81-100% of foliage, no major structural defects, no insect or disease concern, high vigor
- Fair: 66-80% of foliage, minor structural defects, minor insect or disease concern, medium vigor
- Poor: 26-65% of foliage, major structural defects, mechanical damage, insect or disease noticeable decline, poor vigor – remediation plan and action required
- Dead: 0-25% of foliage – replacement required

Areas rated as “poor” will require a remediation plan and action. Areas rated as “dead” will require replacement.

**SECTION 9– FIXTURES AND FINISHES**

**9-1 GENERAL**

9-1.1 PURPOSE

The purpose of this Section is to provide design guidance to developers, consultants, and others for projects within the right-of-way or otherwise under the jurisdictional authority of the City of South Bend. All work within the City’s limits shall comply with the following standards and guidance provided. These fixtures and finishes standards encourage a more consistent approach for improvements within the City. The improvements covered under this section do not and cannot provide for all conditions nor are they intended to limit innovation. In some circumstances additional guidance, information, assistance, or direction may be needed in coordination with City staff. The design consultant is encouraged to seek this guidance. City Engineering may approve “equals” for any specified manufacturer listed in this section. Variations to the standards shall be submitted in accordance with [Section 1–3 - Variance Process](#) of the standards.

**9-2 DESIGN REQUIREMENTS**

9-2.1 PURPOSE

This Section outlines the fixtures and finishes to be used throughout the City of South Bend based on five distinct districts. The [Typology District Map](#) separates the City into the following districts:

- Downtown
- Neighborhood Center
- Auto-Oriented
- Industrial
- Residential

Where development or redevelopment lie on the edge or within multiple districts, the designer/developer shall work with City staff to select appropriate fixtures and finishes for the site. [Table 9-2.2\(1\)](#) summarizes the standard finishes and fixtures for each district.

If right-of-way improvements or other development is proposed in a [Historic District](#) under the review and jurisdiction of the Historic Preservation Commission (HPC), the [HPC Standards and Guidelines](#) shall hold over the requirements of this section where conflicts may exist. Any development within wellhead protection areas shall comply with the City’s [Wellhead Protection Plan and Ordinance](#).

9-2.2 GENERAL ITEM DESCRIPTIONS

The City of South Bend embraces the concept of “Complete Streets” and incorporates these requirements as further described in [Section 2-2.1\(a\)](#). This Section is intended to explicitly address the context of the District within the community and the expected amenities and street features in place making. [Table 9-2.2\(1\)](#) summarizes the various types of fixtures and finishes associated with their corresponding Districts.

**SECTION 9 – FIXTURES AND FINISHES**

**Table 9-2.2(1)**

Feature	District				
	Downtown	Neighborhood Center	Auto-Oriented	Industrial	Residential
<b>Lighting</b>	Type 1 (A through F)	Type 1 (A through F)  Type 2 (A through D)  Type 3 (A)	Type 5 (A or B)	Type 4 (A)  Type 5 (A or B)	Type 3 (A)  Type 5 (C)
<b>Street Trees</b>	<a href="#">See Section 8 - Landscaping</a>				
<b>On-Street Parking</b>	<a href="#">See Section 2 – Streets, Walkways, &amp; Paths</a>				
<b>Bicycle Facilities</b>	<a href="#">See Section 2 – Streets, Walkways, &amp; Paths</a>				
<b>Bicycle Racks</b>	Type 1 (A or B)				
<b>Pavers</b>	Type 1 (A or B)				
<b>Trash Receptacles</b>	Type 1 (A or B)	Type 1 (A or B)  Type 2 (A or B)		Type 1 (A or B)	
<b>Tree Grates</b>	Type 1 (A)				
<b>Planters</b>	Type 1 (A or B)				
<b>Seating</b>	Type 1 (A or B)	Type 2 (A or B)			

*Notes:*  
 The Historic Preservation Committee [HPC Standards and Guidelines](#) shall govern in designated historic areas.



## SECTION 9 – FIXTURES AND FINISHES

### 9-2.3 STREET FEATURES

#### 9-2.3 (a) GENERAL

This Section provides guidance on the different types of street furniture and amenities within the City of South Bend. Street furniture is intended to make pedestrian activity such as walking, bicycling, and public transit more inviting; improve the street economy and City prosperity; enhance public space; and create a place for social interaction. It is important to avoid excessive quantities of furnishings that will result in clutter, obstruct the pedestrian access route, and potentially reduce access to adjoining properties or other sidewalk functions. Street furniture may be placed on cross streets within 50 feet of the intersection. Street furniture shall be placed in accordance with ADA guidelines and at least 3 feet clear behind the face of curb at intersections and driveway openings.

#### 9-2.3 (b) LIGHTING

See [Section 6-6](#) of the South Bend Standards for lighting design requirements such as mounting height. All proposed lighting poles will be reviewed by City Engineering for approval. Installation of small cell infrastructure equipment shall comply with the City's [Aesthetic Requirements for Small Cell Infrastructure Installations](#) and [IC 8-1-32.3](#).

- Type 1A:** Beacon (8-Pane Luminaire), Singular, Bare
- Type 1B:** Beacon (8-Pane Luminaire), Singular with Banner Arms
- Type 1C:** Beacon (8-Pane Luminaire), Singular with Floral Hanger Arm
- Type 1D:** Beacon (8-Pane Luminaire), Offset Luminaire, Singular with Banner Arms and Floral Hanger Arms
- Type 1E:** Beacon (8-Pane Luminaire), Dual, Bare
- Type 1F:** Beacon (8-Pane Luminaire), Dual with Banner Arms
  
- Type 2A:** Sternberg Lighting (Candy Cane), Singular, Decorative
- Type 2B:** Sternberg Lighting (Candy Cane), Singular, Decorative with Banner Arms
- Type 2C:** Sternberg Lighting (Candy Cane), Dual, Decorative
- Type 2D:** Sternberg Lighting (Candy Cane), Dual, Decorative with Planter Arms
  
- Type 3A:** Sternberg Lighting (4-Pane Luminaire), Singular, Bare
  
- Type 4A:** Lithonia Lighting D-Series LED
  
- Type 5A:** Sternberg Lighting (Cobra Head), Decorative with Pedestrian Downlighting and Banner Arms
- Type 5B:** AEP (Cobra Head), Pedestrian Signal Attached to Pole
- Type 5C:** AEP (Cobra Head), Bare

## SECTION 9 – FIXTURES AND FINISHES

### 9-2.3 (c) TREE GRATES

Tree grates shall be used in all urban environments to protect the soil from compaction and to prevent the root system from becoming a tripping hazard for pedestrians. Tree grates shall be used for all street trees planted within the sidewalk and be ADA compliant. All tree grates shall be from the NEENAH Foundry Avenue Collection. The tree grate sizes may vary pending tree species and space constraints. For additional design requirements see [Section 8 – Landscaping](#).

**Type 1A:** Neenah Foundry R-8712, 5' x 5' Square Cast Iron

### 9-2.3 (d) STREET TREES

See [Section 8 – Landscaping](#) for acceptable species, spacing and additional Street Tree design requirements.

### 9-2.3 (e) ON-STREET PARKING

On-Street Parking has proven to increase pedestrian and vehicular safety while simultaneously making efficient use of available land. On-Street Parking is most common in urban and commercial areas and shall be perpetuated or provided as required.

See [Section 2 – Streets, Walkways & Paths](#) for typical sections and further details regarding On-Street Parking.

### 9-2.3 (f) BICYCLE FACILITIES

In conjunction with the concept of “Complete Streets” and promoting increased pedestrian activity, the City of South Bend is engaged in a continuous effort to promote bicycling as a form of transportation. The [South Bend Bikeway Planning Map](#) illustrates existing facilities that accommodate bicycle traffic. Developments within the areas outlined on the map shall coordinate with City Engineering to ensure compliance for bicycle access provisions throughout the City.

See [Section 2 – Streets, Walkways & Paths](#) for further details on Bicycle Facilities.

### 9-2.3 (g) BICYCLE RACKS

Bicycle racks shall be considered for installation in the public right-of-way primarily within the Downtown and Neighborhood Center Districts. Bicycle racks shall be considered and may be required at commercial establishments and destinations. Bicycle racks shall be installed in the public right-of-way, in proximity to pedestrian traffic signals, a minimum 3 feet clear from back of curb, 3 feet clear from other bike racks, 2 feet clear and not conflict with the pedestrian access route, and a minimum of 6 feet removed from trees or tree grates where provided. All installed bike racks must be surface mounted and perpendicular to the street as space allows.

**Type 1A:** Black Metal Powder Coated Finish; Dero Hitch

**Type 1B:** Black Metal Powder Coated Finish; Dero Hitch in Series

## SECTION 9 – FIXTURES AND FINISHES

### 9-2.3 (h) PAVERS

Pavers shall be used primarily within Downtown and Neighborhood Center Districts. Pavers may be used between the back of curb and edge of sidewalk, parking areas on major roadways, or for local roadways. The use, extent and location of pavers, with drainage and maintenance provisions will require approval by City Engineering prior to use.

**Type 1A:** Sidewalk Pavers, Decorative (see more information in [Section 2-6.6](#))

**Type 1B:** Street Pavers (see more information in [Section 2 – Streets, Walkways & Paths](#))

### 9-2.3 (i) PLANTERS

Planters shall be used where impervious surfaces or underground utilities prohibit the direct planting of vegetation into the ground.

**Type 1A:** WAUSAU TF4111, reinforced precast concrete, Charcoal Weatherstone finish

**Type 1B:** WAUSAU TF4124, reinforced precast concrete, Charcoal Weatherstone finish

**Type 1C:** EarthPlanter EPMV41, Urban Vase 41, Millstone finish

### 9-2.3 (j) SEATING

Seating should be attractive, accessible, and easy to maintain. Seating shall be considered and may be required on streets with ground-floor commercial uses, shared use paths, and medium to high pedestrian volumes. Fixtures shall provide seating for three (3) people, such as one (1) 6-foot bench. Bench design shall consider center armrests or other options to minimize prolonged use. Seating may be adjacent to the building façade and shall be 5 feet clear of the pedestrian access route. Seating should be oriented toward points of interest; this can be the adjacent building, an open space, or the street itself if it's lively. Where sidewalk width permits, seating can also be oriented perpendicular to the curb. All seating shall be surface mounted in paved areas in accordance with manufacturer recommendations.

**Type 1A:** Black Metal Frame with Decorative Back

**Type 1B:** Black Metal Frame with Gray Inserts and Flared Arms

**Type 2A:** Presidio, (Wood Slats), with back and armrests

**Type 2B:** Presidio, (Wood Slats), without back and armrests

## SECTION 9 – FIXTURES AND FINISHES

### 9-2.3 (k) TRASH RECEPTACLES

Trash receptacles should be attractive and easy to maintain. Trash receptacles shall be provided on opposite corners of each intersection along [bus routes](#) within the Downtown and Neighborhood Center districts and adjacent to ground-floor commercial uses. Trash receptacles shall be City standard with small openings, contain easily removable liner bags, be located at least 5 feet clear from seating, pedestrian access route, and in the shade where feasible. Note that Type 2 trash receptacles should be limited to parks and other recreational facilities.

**Type 1A:** Black Metal with Flat Topper

**Type 1B:** Black Metal with Concaved Topper

**Type 2A:** Presidio, Black

### 9-2.4 MISCELLANEOUS FEATURES

#### 9-2.4 (a) BOLLARDS

Bollards shall be placed at the start of the curb ramp at sidewalk grade along protected bicycle lanes or shared use paths as required to protect cyclists and pedestrians at roadway crossing points. Bollards shall be metal with a black powder coated finish and surface mounted per manufacturer recommendations. At select Downtown and Neighborhood Center districts, Sternberg Lighting lighted bollards may be required. Consult with City Engineering where bollard installations are required.

#### 9-2.4 (b) CURB MARKERS

Curb markers shall be placed along roadways containing curb extensions and on-street parking to identify the front face of curb for snowplows. Approved curb markers are manufactured by Produits & Services Balisage Gesma, Inc., Type R-6, orange in color, 36 inch in length. When installed, curb markers shall also include the ground anchoring base and summer plug for when not installed. These shall be installed coincidental with pavement marking locations for perpendicular, angle, or back end parking where curb overhang is anticipated.

#### 9-2.4 (c) FENCING

All fencing shall be approved by City Engineering and compliment the overall aesthetics of the area. Fencing shall comply with all zoning ordinance requirements. On the occasion when a fence is required in the right-of-way to channel or restrict pedestrian movements, additional aesthetic requirements or appearance considerations shall be required.

#### 9-2.4 (d) WAYFINDING KIOSKS

Wayfinding kiosks shall be placed in high pedestrian volume areas. The kiosks shall list nearby attractions with directional arrows and a map of the area with labeled attractions.

## SECTION 9 – FIXTURES AND FINISHES

### 9-2.4 (e) CURB EXTENSIONS/TRAFFIC CALMING MEASURES

Traffic calming measures, such as curb extensions, shall be incorporated into designs to meet the intent of the City of South Bend’s “Complete Streets” vision as described in [Section 2-2.1\(a\)](#). Careful consideration shall be extended for the context and expected surrounding land use when reviewing requirements for walks, bike lanes (dedicated or shared), on-street parking, and other amenities for proposed transportation facilities. For existing facilities that are being reconstructed or realigned, these additional features shall be considered and included as required with the proposed design.

### **9-3 SUBMITTALS**

For all fixtures, developers shall submit the following for City approval for items that are proposed to be installed within the right-of-way:

- Manufacturer cut sheet
- Proposed fixture location(s)
- Proposed fixture orientation
- Clear distance from curbs, signals, pedestrian access route, drives, or other fixed features (including but not limited to utilities vaults, electric poles, water valves, hydrants, signage, landscaping, and buildings)

### **9-4 DOWNTOWN**

#### **9-4.1 GENERAL DESCRIPTION**

The Downtown District consists of a mixture of mid-rise and high rise mixed-use developments, including a variety of compatible building types and urban uses; buildings with active building frontages set at or close to the sidewalk; and pedestrian-oriented scale with wide sidewalks, regularly spaced street trees, and amenities that create an aesthetically pleasing and walkable environment.

#### **9-4.2 STREET FEATURE TYPES**

- **Lighting:** Type 1 (A through F)
- **Bicycle Racks:** Type 1 (A or B)
- **Pavers:** Type 1 (A or B)
- **Trash Receptacles:** Type 1 (A or B)
- **Tree Grates:** Type 1 (A)
- **Planters:** Type 1 (A or B)
- **Seating:** Type 1 (A or B)

See Section 2-Streets, Walkways & Paths [Tables 2-2.2\(1\)](#) and [2-2.3\(1\)](#) for additional information regarding minimum right-of-way, number of lanes, and lane width.

#### **9-4.3 PRIORITIES**

Required priorities are items that must be incorporated into the project. Other considerations are additional items that may be required after an initial development review by the City.

##### **Required:**

- Lighting
- Street Trees
- On-Street Parking
- Bicycle Racks
- Trash Receptacles
- Tree Grates or Planters
- Seating

##### **Other Considerations:**

- Bicycle Facility
- Pavers
- Fencing
- Wayfinding Signage and Kiosk
- Curb Extensions/Traffic Calming Measures

### **9-5 NEIGHBORHOOD CENTER**

#### **9-5.1 GENERAL DESCRIPTION**

Neighborhood Centers contain storefront retail, professional offices, and dwelling units located either in townhouse developments or in the upper stories or rear of mixed-use buildings. Such areas are designed to encourage a pedestrian oriented design throughout the District. They are also designed to maintain an appropriate pedestrian scale, massing, and relationship between buildings and structures within the District.

#### **9-5.2 STREET FEATURE TYPES**

- **Lighting:** Type 1 (A through F), Type 2 (A through D), Type 3 (A)
- **Bicycle Racks:** Type 1 (A or B)
- **Pavers:** Type 1 (A or B)
- **Trash Receptacles:** Type 1 (A or B), Type 2 (A or B)
- **Tree Grates:** Type 1 (A)
- **Planters:** Type 1 (A or B)
- **Seating:** Type 2 (A or B)

See Section 2-Streets, Walkways & Paths [Tables 2-2.2\(1\)](#) and [2-2.3\(1\)](#) for additional information regarding minimum right-of-way, number of lanes, and lane width.

#### **9-5.3 PRIORITIES**

Required priorities are items that must be incorporated into the project. Other considerations are additional items that may be required after an initial development review by the City.

##### **Required:**

- Lighting
- Street Trees
- On-Street Parking
- Bicycle Racks
- Trash Receptacles
- Seating

##### **Other Considerations:**

- Bicycle Facility
- Pavers
- Tree Grates
- Planters
- Fencing
- Curb Extensions/Traffic Calming Measures

**9-6 AUTO-ORIENTED**

**9-6.1 GENERAL DESCRIPTION**

The Auto-Oriented District consists of mixed-use areas outside of the Downtown and Neighborhood Center districts. These areas are more oriented to accommodate vehicular use and mid-range transportation with minor improvements geared toward pedestrian uses.

**9-6.2 STREET FEATURE TYPES**

- **Lighting:** Type 5 (A or B)
- **Bicycle Racks:** Type 1 (A or B)
- **Pavers:** Type 1 (A or B)
- **Trash Receptacles:** Type 1 (A or B), Type 2 (A or B)
- **Tree Grates:** N/A
- **Planters:** N/A
- **Seating:** N/A

See Section 2-Streets, Walkways & Paths [Tables 2-2.2\(1\)](#) and [2-2.3\(1\)](#) for additional information regarding minimum right-of-way, number of lanes, and lane width.

**9-6.3 PRIORITIES**

Required priorities are items that must be incorporated into the project. Other considerations are additional items that may be required after an initial development review by the City.

**Required:**

- Lighting
- Street Trees

**Other Considerations:**

- On-Street Parking
- Curb Extensions/Traffic Calming Measures
- Bicycle Facility
- Bicycle Racks
- Pavers
- Trash Receptacles
- Tree Grates
- Planters
- Seating
- Fencing



### **9-7 INDUSTRIAL**

#### **9-7.1 GENERAL DESCRIPTION**

The Industrial District provides a location for medium to high intensity industrial uses, typically grouped along highways and major streets and separated from residential uses.

#### **9-7.2 STREET FEATURE TYPES**

- **Lighting:** Type 4 (A), Type 5 (A or B)
- **Bicycle Racks:** Type 1 (A or B)
- **Pavers:** Type 1 (A or B)
- **Trash Receptacles:** Type 1 (A or B)
- **Tree Grates:** N/A
- **Planters:** N/A
- **Seating:** N/A

See Section 2-Streets, Walkways & Paths [Tables 2-2.2\(1\)](#) and [2-2.3\(1\)](#) for additional information regarding minimum right-of-way, number of lanes, and lane width.

#### **9-7.3 PRIORITIES**

Required priorities are items that must be incorporated into the project. Other considerations are additional items that may be required after an initial development review by the City.

##### **Required:**

- Lighting
- Street Trees

##### **Other Considerations:**

- On-Street Parking
- Bicycle Facility
- Bicycle Racks
- Pavers
- Trash Receptacles
- Planters
- Seating
- Fencing

**9-8 RESIDENTIAL**

**9-8.1 GENERAL DESCRIPTION**

The Residential District encompasses all properties and land within the City that are not contained within the other districts. These primarily consist of urban and suburban housing.

**9-8.2 STREET FEATURE TYPES**

- **Lighting:** Type 3 (A), Type 5 (C)
- **Bicycle Racks:** Type 1 (A or B)
- **Pavers:** Type 1 (A or B)
- **Trash Receptacles:** N/A
- **Tree Grates:** N/A
- **Planters:** N/A
- **Seating:** N/A

See Section 2-Streets, Walkways & Paths [Tables 2-2.2\(1\)](#) and [2-2.3\(1\)](#) for additional information regarding minimum right-of-way, number of lanes, and lane width.

**9-8.3 PRIORITIES**

Required priorities are items that must be incorporated into the project. Other considerations are additional items that may be required after an initial development review by the City.

**Required:**

- Lighting
- Street Trees

**Other Considerations:**

- On-Street Parking
- Bicycle Facility
- Bicycle Racks
- Pavers
- Fencing
- Curb Extensions/Traffic Calming Measures

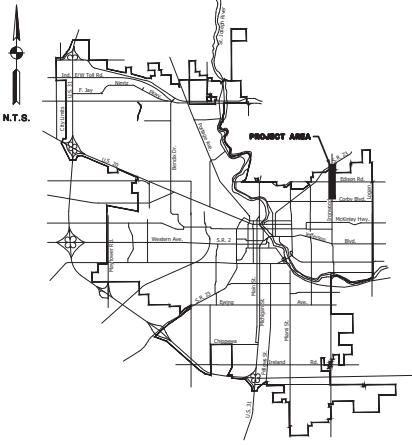
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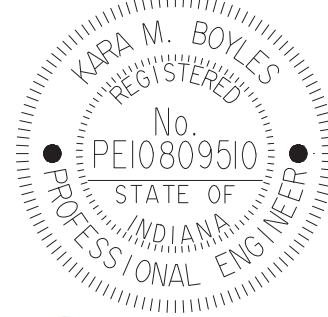
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SECTION 1 - GENERAL - MISC.

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*Kara M. Boyles*      6/26/18  
 Kara M. Boyles, Ph.D., P.E.      Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				CITY OF SOUTH BEND
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION
				STANDARD 1-1
TYPICAL TITLE SHEET				

**SECTION 2 - STREETS AND PATHS**

REFERENCE TABLE									
STREET TYPE	R.O.W.	LANE DISTRIBUTION							TOTAL PAVEMENT WIDTH
		PARKING	BICYCLE	TRAVEL	TWLTL*	TRAVEL	BICYCLE	PARKING	
Residential 1	50'	-	-	12'	-	12'	-	-	24'
Residential 2	60'	8'	-	11'	-	11'	-	8'	38'
Collector	60'	-	5'	11'	11'	11'	5'	-	43'
Commercial Corridor	80' - 120'	8'	5'	11'	11'	11'	5'	8'	59'
Commercial Downtown	80' - 120'	8'	5'	11'	11'	11'	5'	8'	59'
Commercial Multi-Lane	80' - 120'	8'	-	24'	-	24'	-	8'	64'
Industrial	80' - 120'	-	-	12'	13'	12'	-	-	37'
Multi-Purpose Path	20' - 30'	-	-	-	-	-	-	-	10'
Alleyway - Subdivision	20'	-	-	-	-	-	-	-	18'
Alleyway - Urban	14'	-	-	-	-	-	-	-	12'
Parking Lot	VARIES	-	-	-	-	-	-	-	-

\*TWLTL as warranted or otherwise required. Where truck volume exceeds 200 VPD 12 ft. travel lanes should be used for roadways without TWLTL.

**NOTES:**

1. Street types as defined in [Section 2-2](#) or as directed by the Division of Engineering.
2. Pavement width does not include curb offset or curb, where required.
3. A minimum 1 ft. curb offset is required for travel lanes.

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

**REF STD SPEC SEC 2-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

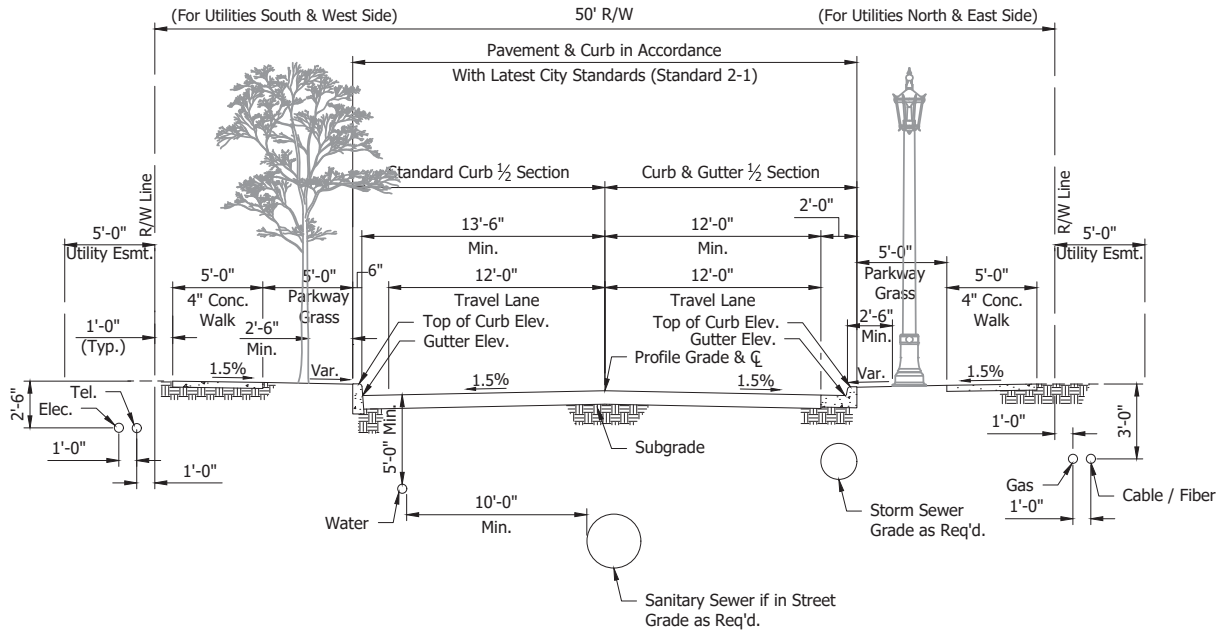
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Item	Revision	Approved Date

**TYPICAL SECTION SCHEDULE**

STANDARD  
**2-1**

# SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Where possible public utilities should be installed between the back of the curb and back of sidewalk or in an available utility easement.
2. Right of Way width in accordance with the approved plat.
3. Sidewalk width is to be 5 ft. minimum.
4. Maximum gradient on residential streets and sidewalks shall be 8%.
5. Minimum gradient shall be not less than five-tenths of one percent (0.50%) at gutter.

REF STD SPEC SEC 2-2

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
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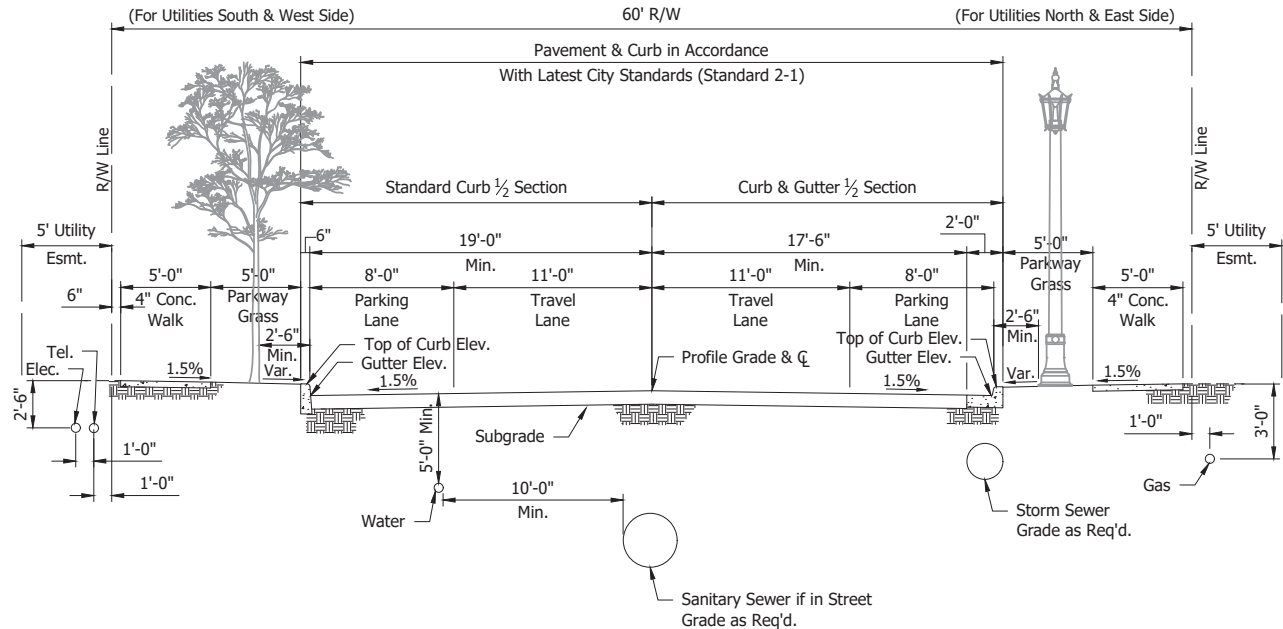
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**TYPICAL SECTION - RESIDENTIAL 1**

STANDARD  
**2-2**



# SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Where possible public utilities should be installed between the back of the curb and back of sidewalk or in an available utility easement.
2. Right of Way width in accordance with the approved plat.
3. Sidewalk width is to be 5 ft. minimum.
4. Maximum gradient on residential streets and sidewalks shall be 8%.
5. Minimum gradient shall be not less than five-tenths of one percent (0.50%) at gutter.

REF STD SPEC SEC 2-2

KARA M. BOYLES  
REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

*Kara M. Boyles*  
Kara M. Boyles, Ph.D., P.E.

6/26/18  
Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

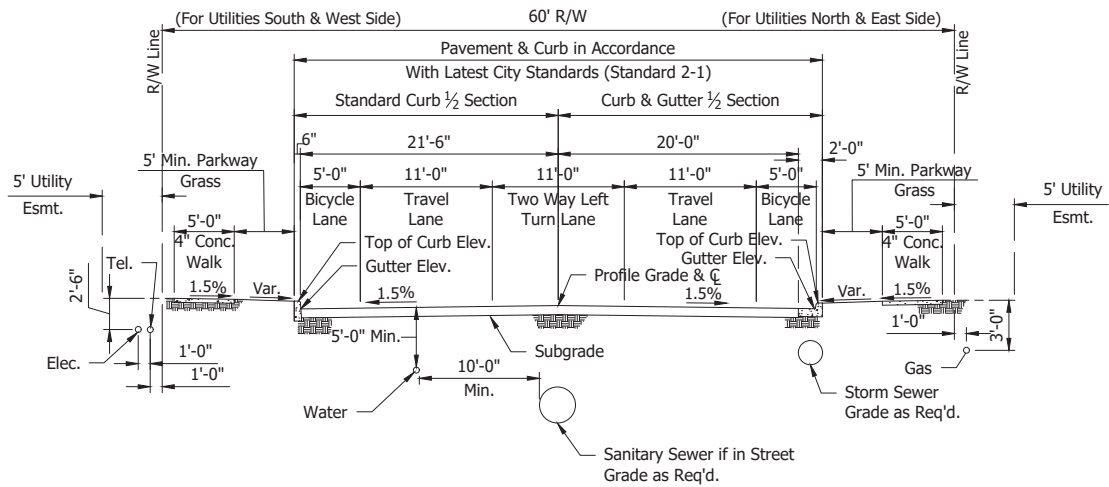
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AND CONSTRUCTION

Item	Revision	Approved Date

**TYPICAL SECTION - RESIDENTIAL 2**

STANDARD  
**2-3**

# SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Where possible public utilities should be installed between the back of the curb and back of sidewalk or in an available utility easement.
2. Right of Way width in accordance with the approved plat.
3. Sidewalk width is to be 5 ft. minimum.
4. Maximum gradient on residential streets and sidewalks shall be 6%.
5. Minimum gradient shall be not less than five-tenths of one percent (0.50%) at gutter.

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REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

*Kara M. Boyles*  
Kara M. Boyles, Ph.D., P.E.

6/26/18  
Date

REF STD SPEC SEC 2-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

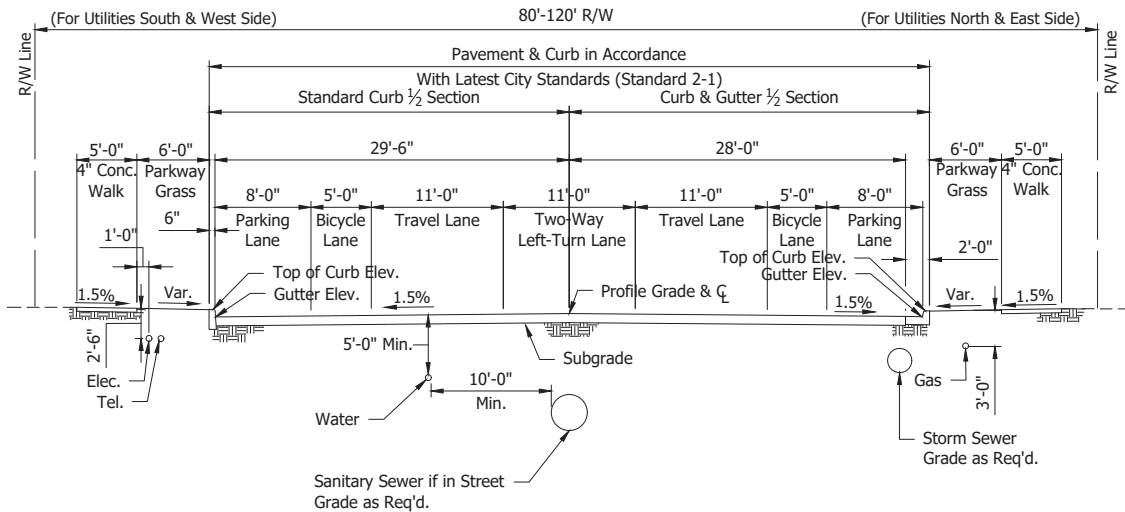
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AND CONSTRUCTION

Item	Revision	Approved Date

**TYPICAL SECTION - COLLECTOR**

STANDARD  
**2-4**

# SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Where feasible it is recommended that public utilities be installed between the back of the curb and back of sidewalk.
2. Right of Way width in accordance with the approved plat.
3. Sidewalk width is to be 5 ft. minimum. Parkway may be infilled to curb in commercial zones. No asphalt shall be used for infill.
4. Maximum gradient on commercial streets and sidewalks shall be 6%. Minimum gradient shall be not less than five-tenths of one percent (0.50%) at gutter.

REF STD SPEC SEC 2-2

*Kara M. Boyles*  
Kara M. Boyles, Ph.D., P.E.  
6/26/18  
Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**TYPICAL SECTION - COMMERCIAL CORRIDOR**

STANDARD  
**2-5**

# SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Where feasible it is recommended that public utilities be installed between the back of the curb and back of sidewalk.
2. Right of Way width in accordance with the approved plat.
3. Sidewalk width is to be 10 ft. minimum. Parkway may be infilled to curb in commercial zones. No asphalt shall be used for infill.
4. Maximum gradient on commercial streets and sidewalks shall be 6%.
5. Minimum gradient shall be not less than five-tenths of one percent (0.50%) at gutter.

REF STD SPEC SEC 2-2

*Kara M. Boyles*  
 Kara M. Boyles, Ph.D., P.E.  
 6/26/18  
 Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
 EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

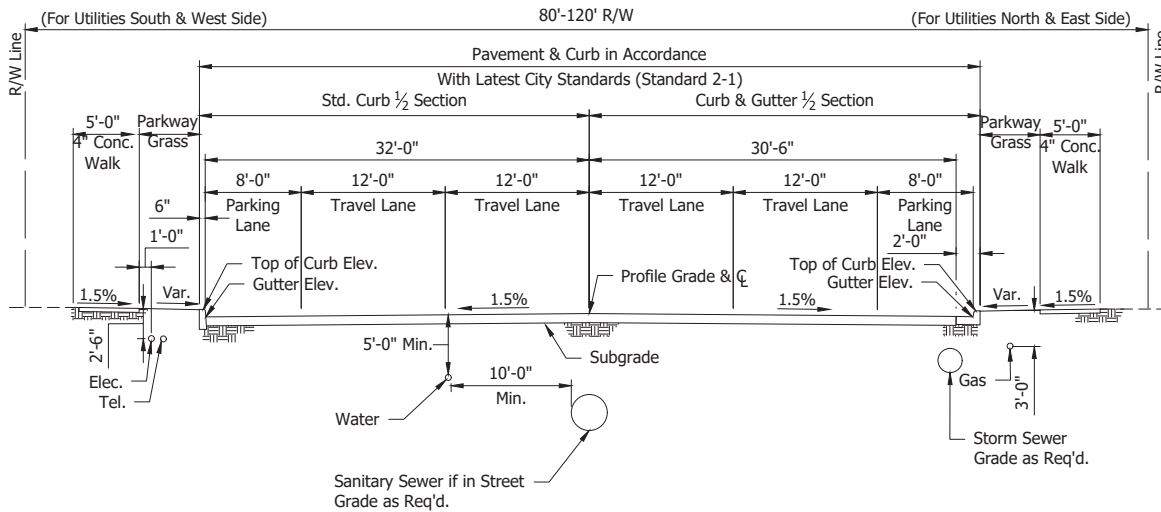
STANDARDS FOR DESIGN  
 AND CONSTRUCTION

Item	Revision	Approved Date

**TYPICAL SECTION - COMMERCIAL DOWNTOWN**

STANDARD  
**2-6**

# SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Where feasible it is recommended that public utilities be installed between the back of the curb and back of sidewalk.
2. Right of Way width in accordance with the approved plat.
3. Sidewalk width is to be 5 ft. minimum. Parkway may be infilled to curb in commercial zones. No asphalt shall be used for infill.
4. Maximum gradient on commercial streets and sidewalks shall be 6%.
5. Minimum gradient shall be not less than five-tenths of one percent (0.50%) at gutter.

REF STD SPEC SEC 2-2

KARA M. BOYLES  
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Kara M. Boyles, Ph.D., P.E.      6/26/18  
 Date

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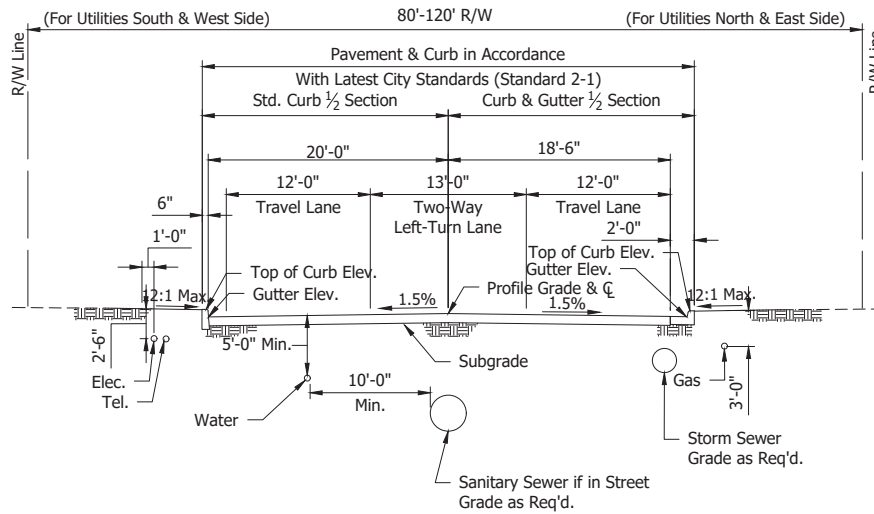
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**TYPICAL SECTION - COMMERCIAL MULTI-LANE**

STANDARD  
**2-7**

SECTION 2 - STREETS AND PATHS



NOTES:

1. Right of Way width in accordance with the approved plat.
2. Maximum gradient on industrial streets shall be 8%.
3. Minimum gradient shall be not less than five-tenths of one percent (0.50%) at gutter.

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REF STD SPEC SEC 2-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



CITY OF SOUTH BEND

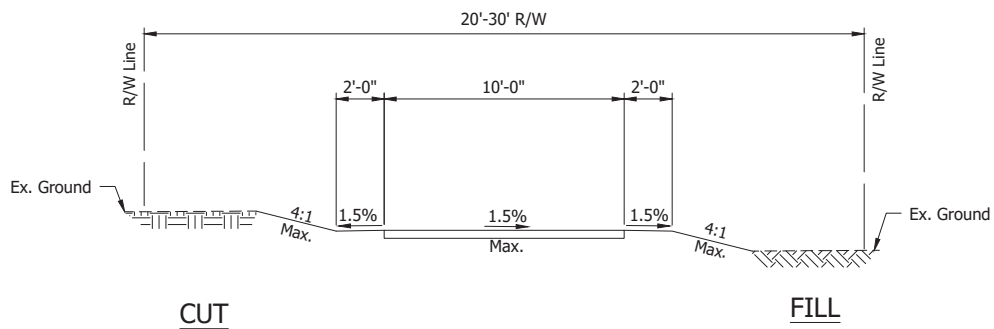
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Item	Revision	Approved Date

TYPICAL SECTION - INDUSTRIAL

STANDARD  
2-8

SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Right of Way width in accordance with the approved plat, but a minimum of 30' required.
2. Width is to be 10 ft. minimum.
3. Maximum gradient on paths should not exceed 5%.
4. When used in conjunction with street a minimum 5 ft. parkway should be available between curb and path. 10 ft. clear space should be available for uncurbed sections.

REF STD SPEC SEC 2-2

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

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EFFECTIVE DATE: June 26, 2018



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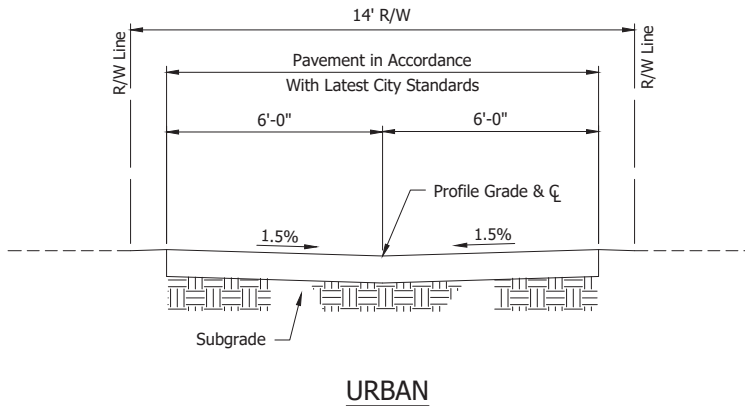
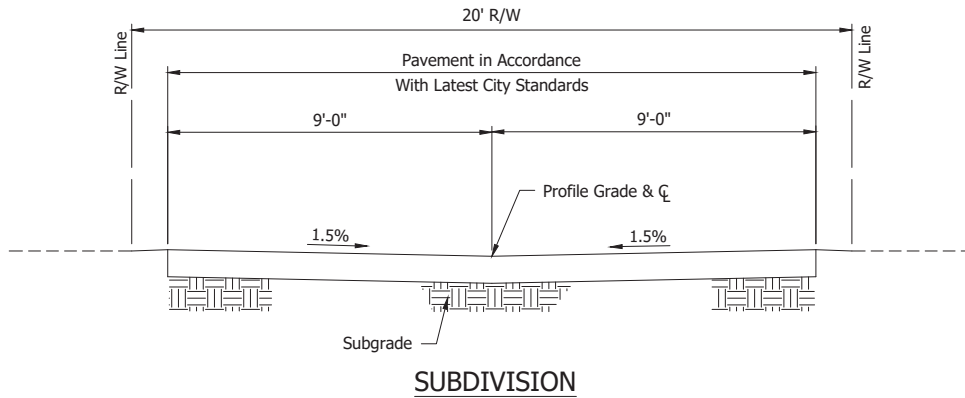
STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TYPICAL SECTION - MULTI PURPOSE PATH**

STANDARD  
**2-9**

Item	Revision	Approved Date

SECTION 2 - STREETS AND PATHS



NOTES:

1. Right of Way width in accordance with the approved plat.
2. Maximum gradient on alleys shall be 6%.
3. Minimum gradient shall be not less than five-tenths of one percent (0.50%).
4. Drainage structures shall be placed 10' from approach limits.
5. Underground utilities within alleyways shall be located a minimum of 18" below ground.

REF STD SPEC SEC 2-2

Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

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CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

TYPICAL SECTION - ALLEYWAY

STANDARD  
2-10



**SECTION 2 - STREETS AND PATHS**

MINIMUM PAVEMENT THICKNESS REQUIREMENT							
STREET TYPE	CATEGORY	SUBGRADE TREATMENT	SUBBASE No. 53	PLAIN CEMENT CONC.	HMA SURFACE	HMA INT.	HMA BASE
Residential	Minor	Type II	6"	7"			
Residential	Minor	Type II	6"		1 ½" (165#/SYS)	2 ½" (275#/SYS)	4" (440#/SYS)
Collector   Commercial	Collector	Type II	6" *	10"			
Collector   Commercial	Collector	Type II	6"		1 ½" (165#/SYS)	2 ½" (275#/SYS)	8" (880#/SYS)
Industrial	Major	Type I	6" *	11.5"			
Industrial	Major	Type I	10"		1 ½" (165#/SYS)	2 ½" (275#/SYS)	8" (880#/SYS)
Multi-Purpose Path	Minor	Type III	4"	5"			
Multi-Purpose Path	Minor	Type II	4"		1 ½" (165#/SYS)	2 ½" (275#/SYS)	
Alleyway	Minor	Type III	6"	6"	1 ½" (165#/SYS)	2 ½" (275#/SYS)	
Parking Lot	Minor	Type III	6"	4-5"***	1 ½" (165#/SYS)	2 ½" (275#/SYS)	

\* If underdrains are recommended per the Geotechnical Report, the Subbase shall include 3" of #8 Coarse Aggregate above the Subbase No. 53 to serve as a drainage layer.  
 \*\* Based on joint spacing.

**NOTES:**

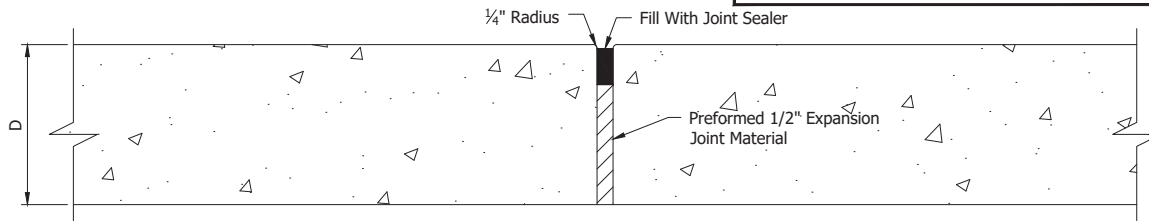
- See prevailing specifications for method of testing existing soil subbase purposes.
- Alternate pavement designs (AASHTO 93) and input parameters shall be submitted to the City Engineer for review.
- Arterial pavements shall meet IAW Mechanistic Empirical Pavement Design Guide requirements.

REF STD SPEC SEC [2-2](#), [2-3](#)

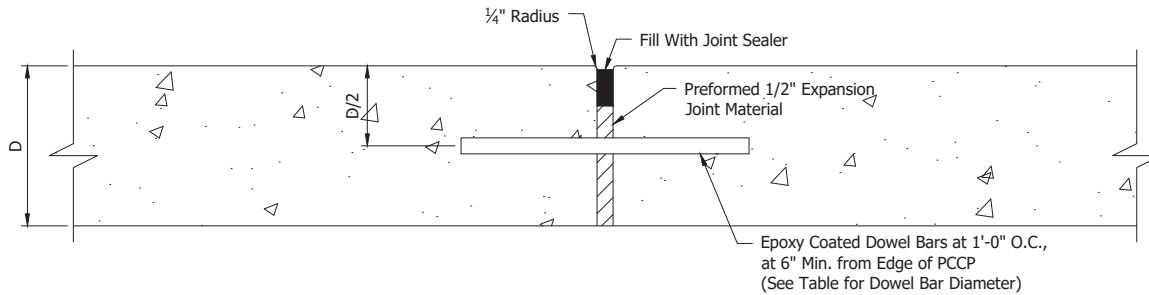
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 Kara M. Boyles, Ph.D., P.E. Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				<b>CITY OF SOUTH BEND</b>
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION
				STANDARD 2-11
<b>MINIMUM PAVEMENT SECTION</b>				

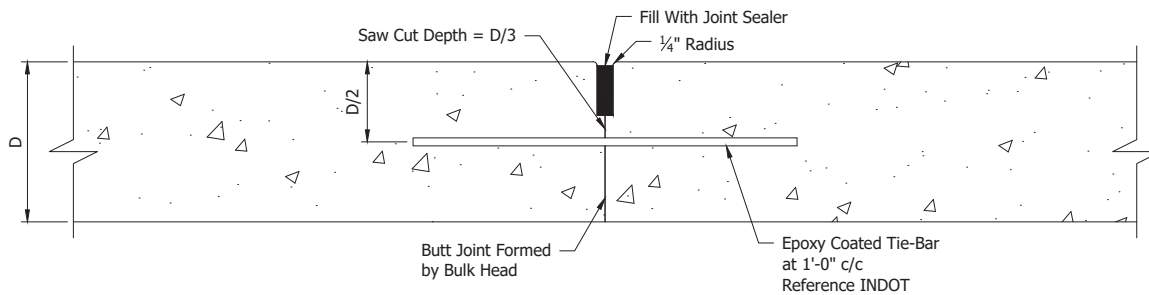
SECTION 2 - STREETS AND PATHS



**TYPE A**  
EXPANSION JOINT



**TYPE A - ALTERNATE**  
EXPANSION JOINT



**TYPE C**  
TRANSVERSE CONSTRUCTION JOINT

TIE-BAR SIZES FOR TRANSVERSE JOINT CONSTRUCTION		
PAVEMENT THICKNESS, D	TIE-BAR SIZE	Min. Length of Embedment, l <sub>e</sub>
Less than 9"	#5	1'-0"
9" Through 12"	#8	1'-8"
Greater than 12"	#10	2'-0"

**NOTES:**

1. Joint sealant shall be hot applied asphalt in accordance with ASTM D6690, Type II.
2. No keyway is to be used on any conc. pavement replacement.

*Kara M. Boyles*  
Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

REF STD SPEC SEC 2-5

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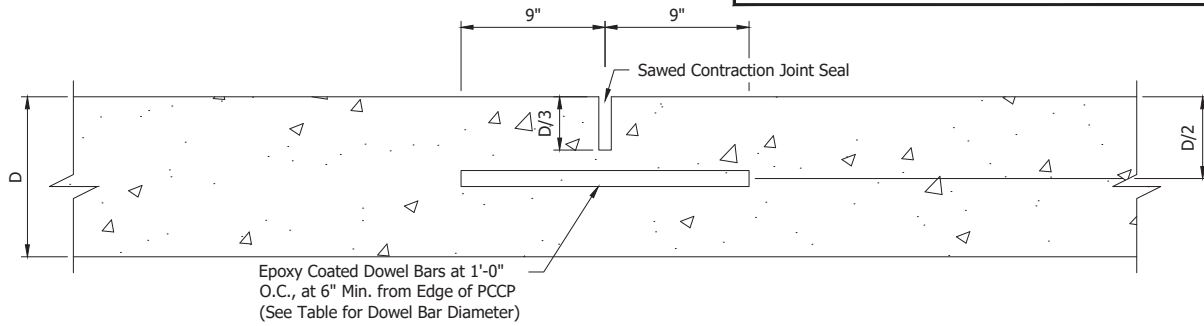
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**PAVEMENT DETAILS - CONCRETE JOINTS**

STANDARD  
**2-12**

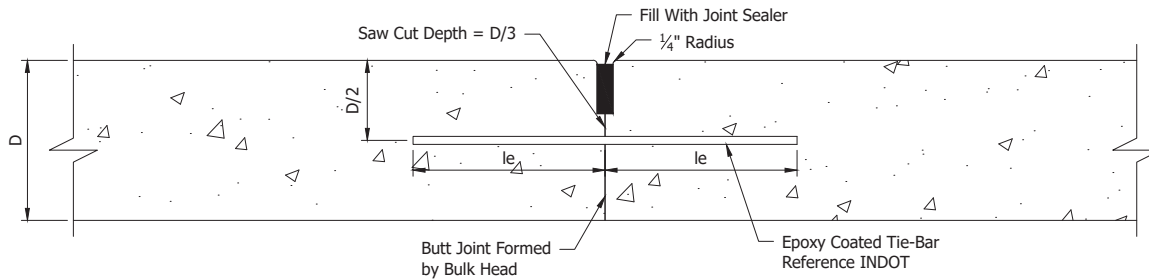
**SECTION 2 - STREETS AND PATHS**



Epoxy Coated Dowel Bars at 1'-0" O.C., at 6" Min. from Edge of PCCP (See Table for Dowel Bar Diameter)

**TYPE D-1  
CONTRACTION JOINT**

DOWEL BAR SIZES	
PAVEMENT THICKNESS, D	DOWEL BAR DIAMETER
Less than 9"	1"
9" Through 12"	1 1/4"
Greater than 12"	1 1/2"



**TYPE E  
LONGITUDINAL CONSTRUCTION JOINT**

PAVEMENT THICKNESS, D	LONGITUDINAL CONSTRUCTION JOINT		
	TIE-BAR SIZE	SPACING	MIN. LENGTH OF EMBEDMENT, le
LESS THAN 9"	#5	3'-0" c/c	1'-0"
9" TO 12"	#6	3'-0" c/c	1'-3"
GREATER THAN 12"	#6 or #7	2'-0" c/c 3'-0" c/c	1'-6"

**NOTES:**

1. Joint sealant shall be hot applied asphalt in accordance with ASTM D6690, Type II.

Kara M. Boyles, Ph.D., P.E. 6/26/18 Date

REF STD SPEC SEC 2-5

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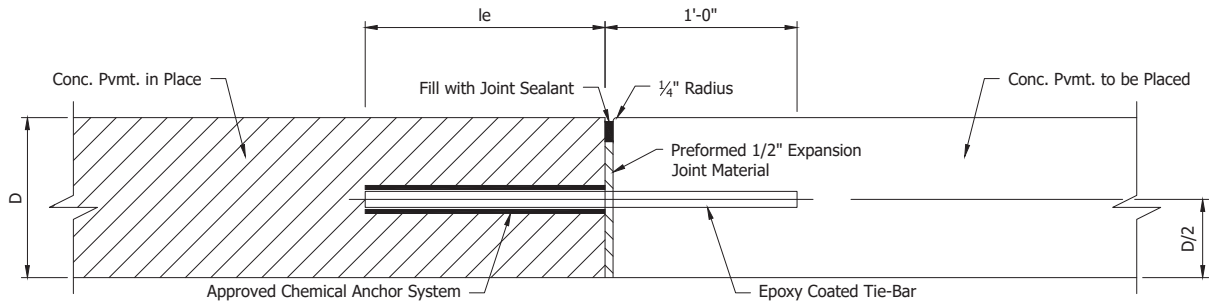
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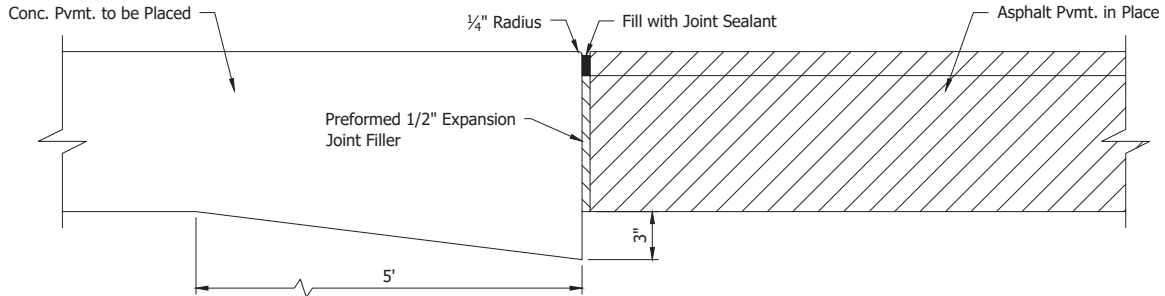
**PAVEMENT DETAILS - CONCRETE JOINTS**

STANDARD  
**2-13**

**SECTION 2 - STREETS AND PATHS**



**TYPE G**  
**TRANSVERSE CONSTRUCTION JOINT**  
**RETROFIT CONSTRUCTION TIE-BAR EMBEDMENT DETAIL**



**TYPE H**  
**BUTT JOINT DETAIL**

**NOTES:**

- 1. Joint sealant shall be hot applied asphalt in accordance with ASTM D6690, Type II.

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 Date

REF STD SPEC SEC 2-5

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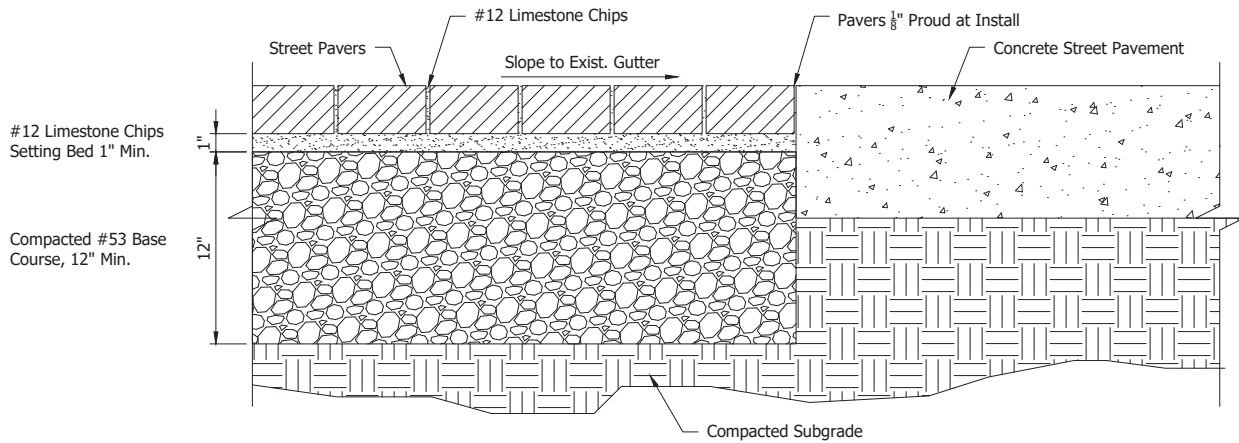
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**PAVEMENT DETAILS - CONCRETE JOINTS**

STANDARD  
**2-14**

SECTION 2 - STREETS AND PATHS

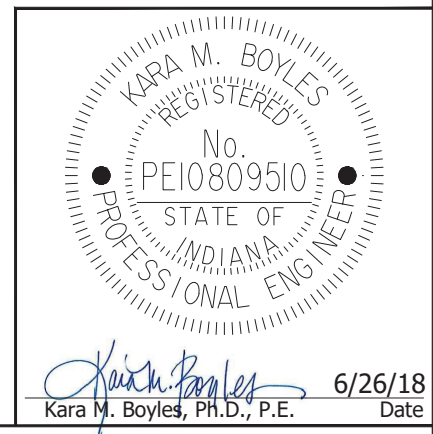


**BRICK PAVER REPLACEMENT DETAIL**

**NOTES:**

**Brick Paver Preparation**

1. Remove organic, unstable or unconsolidated material from site, verify conformance of subgrade preparation, compacted density and elevations to specified requirements.
2. Clean and re-use existing street brick pavers removed during site demolition. Remaining pavers not used will be returned to the City.
3. Place Compacted Aggregate No. 53 to lines and grade.
4. Spread #12 limestone chips evenly over crushed stone base course and screed rails. (Screed to 1 inch minimum thickness)
  - a. Do not spread #12 limestone chips beyond area to be covered by pavers the same day. Prior to recommencement of work, remove, replace and re-screed #12 limestone chips not covered with pavers the previous work day.
  - b. Do not disturb screeded setting bed. Re-screed disturbed setting bed.
4. Lay pavers by hand in pattern(s) matching existing layout.
  - a. Lay full pavers first.
  - b. Mix pavers from at least two pallets to produce uniform color blends.
5. Provide  $\frac{1}{16}$  inch to  $\frac{3}{16}$  inch wide joints between pavers. Adjust pavers to form straight bond lines and appropriate joint widths. Maximum bond line variation shall be  $\pm$  inch over a 50 foot string line.
6. Fill gaps at paved area edges with cut pavers.
  - a. Cut pavers shall not be smaller than  $\frac{1}{3}$  (one-third) of a whole paver except where pattern is to be maintained and a smaller piece is surrounded by a full paver and concrete banding.
7. Do not permit traffic, including construction equipment, on pavers before initial compaction and joint filling. Disturbed areas of pavers shall be taken up, the setting bed re-screeded and pavers re-laid.
8. Vibrate pavers into setting bed using a high frequency/low-amplitude plate compactor capable of 3,000 lbf to 5,000 lbf at a 75 to 100 Hz frequency. Protect pavers from chipping during compaction by using a rubber matt, rubber rollers or other approved materials placed over pavers. Do not compact within 6 feet of unrestrained edges. Remove cracked or damaged pavers and replace with new units.
9. After pavers are fully settled and free from movement, simultaneously spread, sweep and compact dry #12 limestone chips into joints until they are completely filled and chips no longer falls into joints.
10. Protect areas not covered with cut and compacted pavers with waterproof covering overnight.



**REF STD SPEC SEC 2-6**

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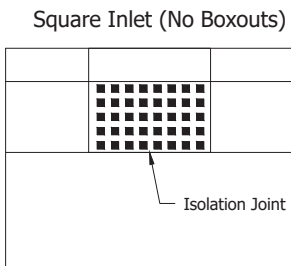
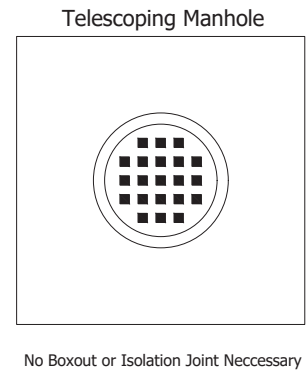
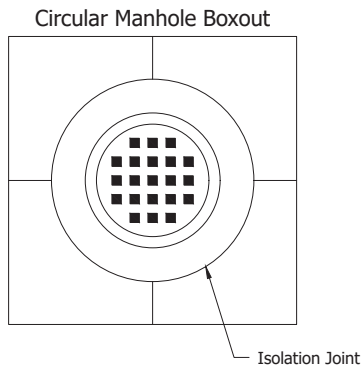
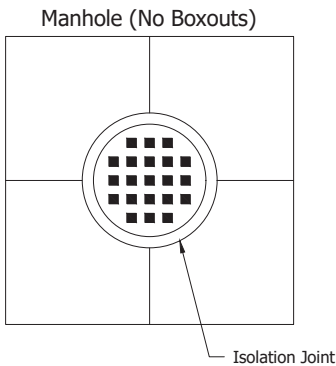
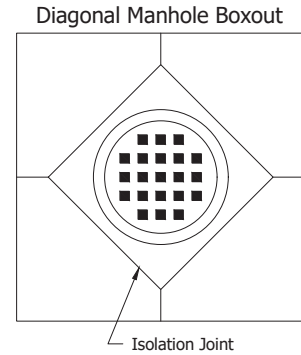
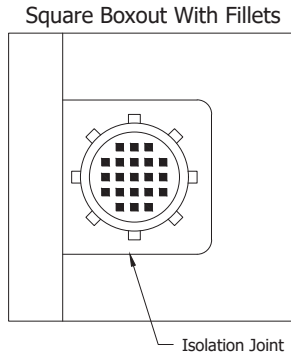
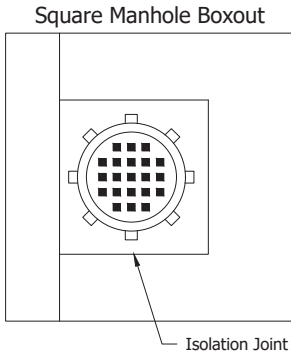
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STANDARD  
2-15

**PAVEMENT DETAILS - BRICK PAVER REPLACEMENT**

Item	Revision	Approved Date

## SECTION 2 - STREETS AND PATHS



### DETAILS FOR BOXING OUT FIXTURES FOR USE WITH CONCRETE PAVEMENT

**NOTES:**

1. Isolation joints shall be filled with preformed 1/2" expansion joint material.
2. Boxouts should be large enough to provide at least 1 ft. clearance between the fixture and surrounding isolation joint.

Kara M. Boyles, Ph.D., P.E.      6/26/18  
Date

**REF STD SPEC SEC 2-5**

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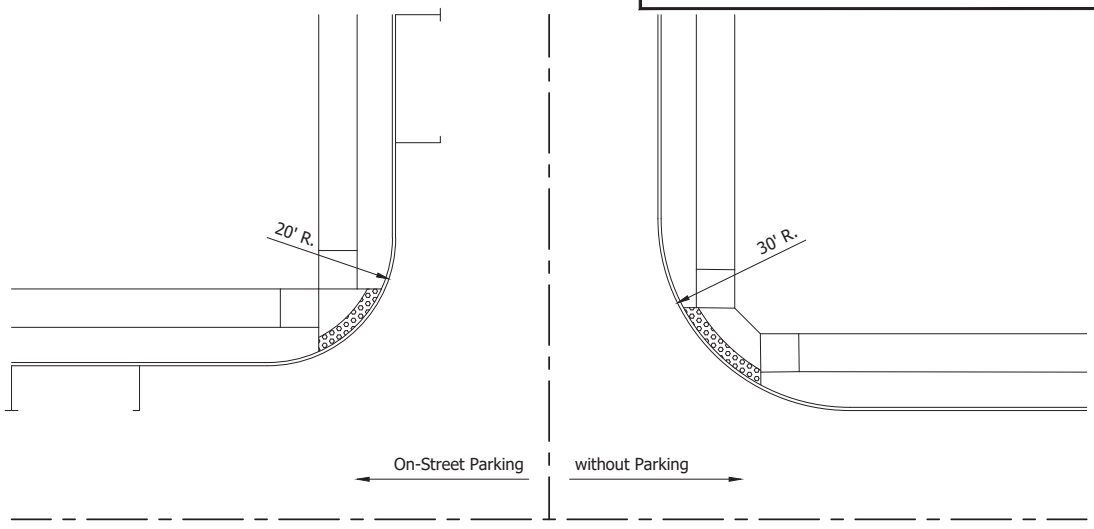
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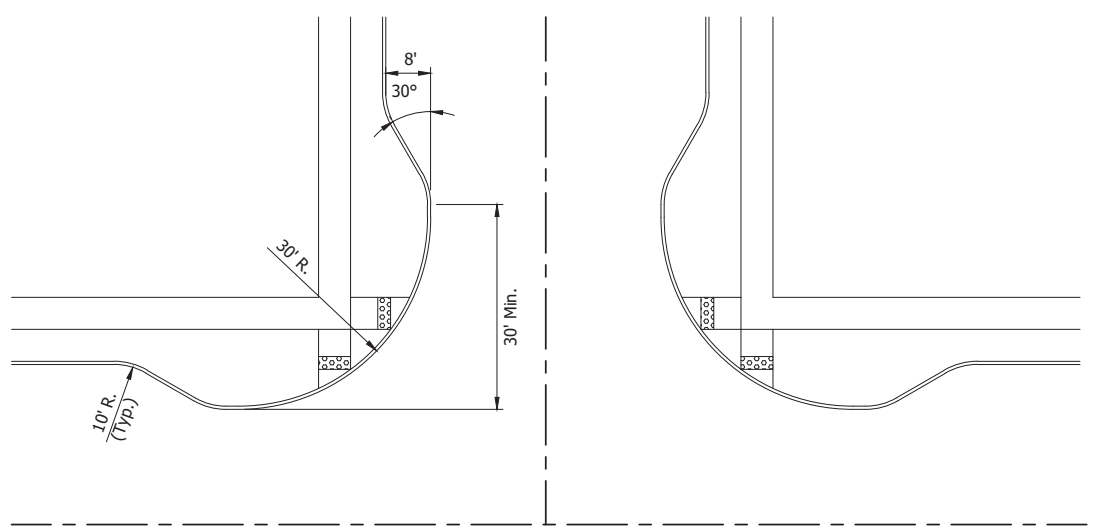
## PAVEMENT DETAILS - STRUCTURE ISOLATION JOINTS

STANDARD  
**2-16**

**SECTION 2 - STREETS AND PATHS**



**STANDARD INTERSECTION**



**INTERSECTION WITH CURB EXTENSIONS**

**NOTES:**

1. See Standards 2-37 through 2-42 for Curb Ramp Details.
2. Drainage structures should be located upstream of curb ramps.
3. Alley to alley approaches shall have approach radii of 30 ft.
4. Approaches at intersecting multi-lane streets shall have 10 ft. radii.
5. See Standard 6-17 for guidance device requirements for Intersections with Curb Extensions.

Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

REF STD SPEC SEC 2-2

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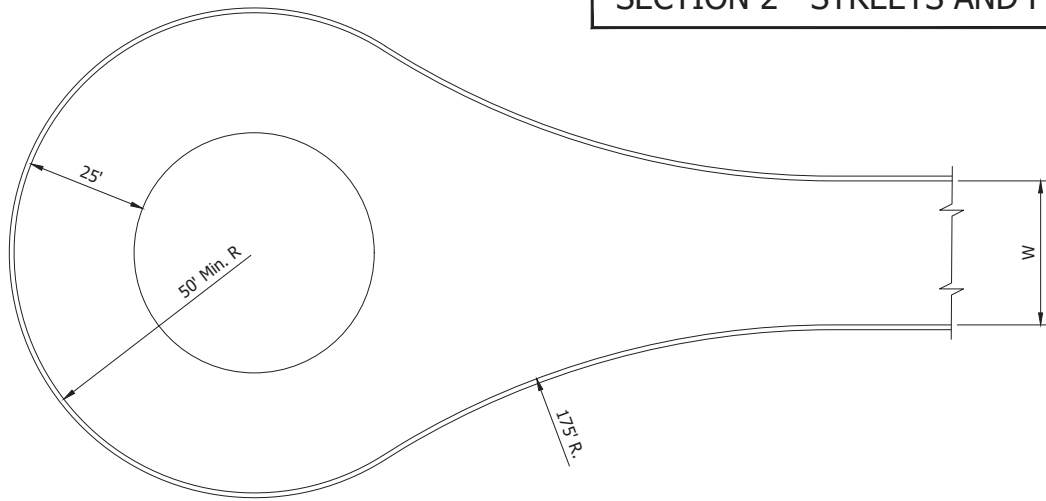
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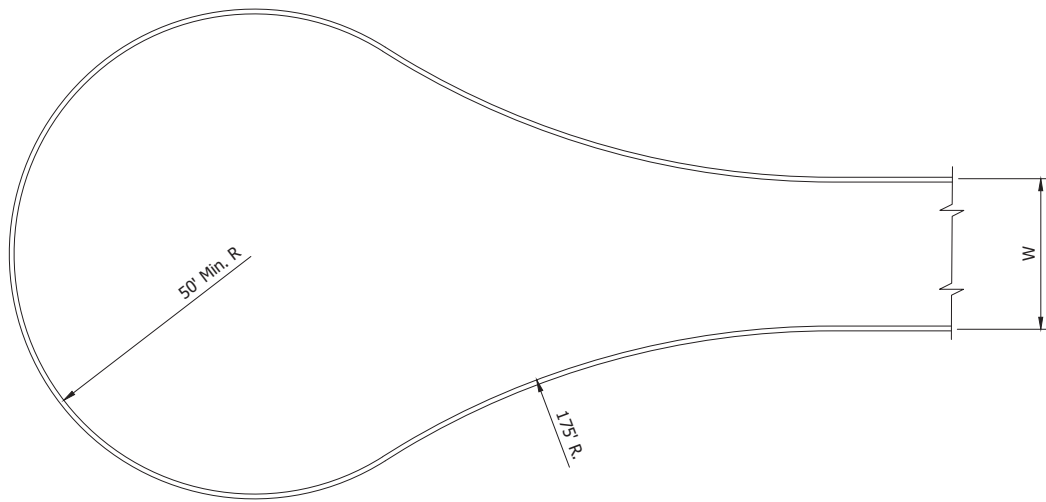
**GEOMETRY - INTERSECTION DETAILS**

STANDARD  
**2-17**

SECTION 2 - STREETS AND PATHS



CUL-DE-SAC OPEN CENTER



CUL-DE-SAC FULLY PAVED

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 2-2

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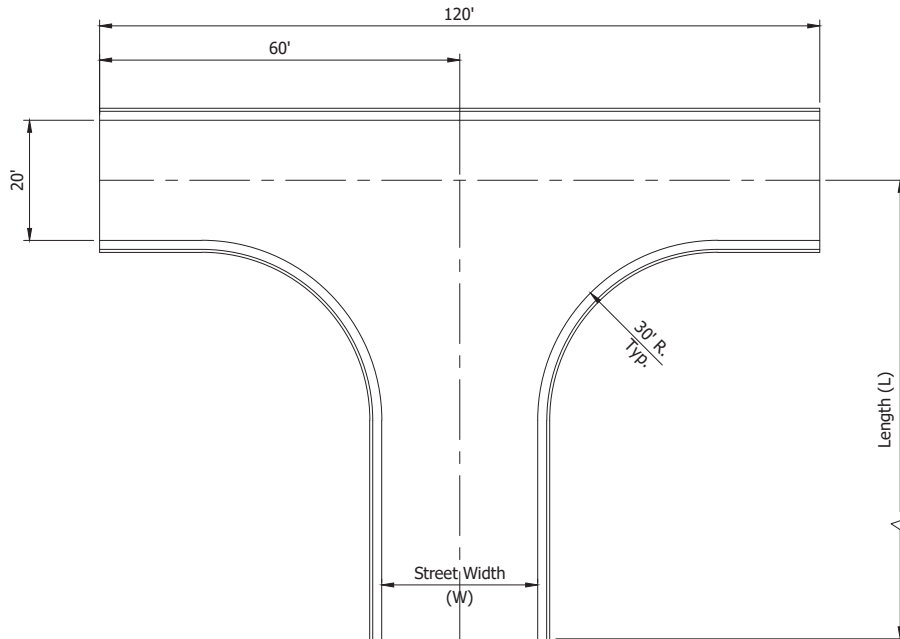
Item	Revision	Approved Date

**GEOMETRY - CUL-DE-SAC**

STANDARD  
**2-18**



SECTION 2 - STREETS AND PATHS



**120' HAMMERHEAD**

LENGTH (FEET)	WIDTH (FEET)	TURNAROUNDS REQUIRED
0' - 150'	20'	None Required
151' - 500'	20'	120' Hammerhead or 100' Dia. Cul-De-Sac
501' - 750'	26'	120' Hammerhead or 100' Dia. Cul-De-Sac
Over 750'	SPECIAL APPROVAL REQUIRED	

**NOTES:**

- Road surfaces must be capable of supporting the imposed load of fire apparatus weighing at the least 75,000 pounds.
- See the International Fire Code for additional information and requirements.

**REF STD SPEC SEC 2-2**

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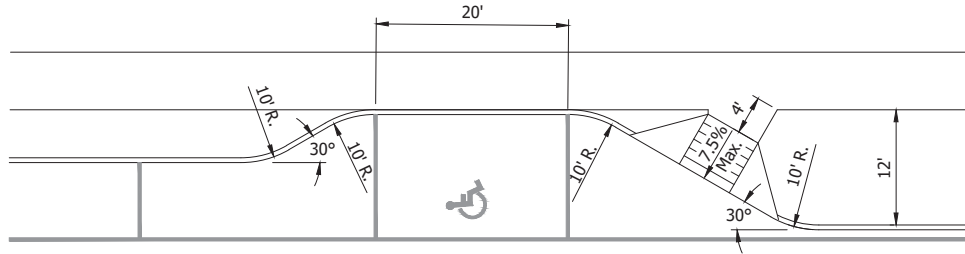
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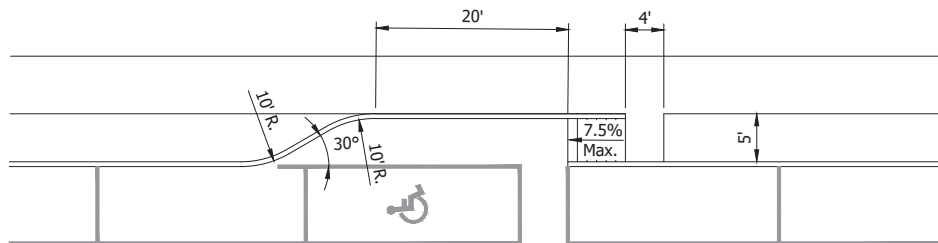
**GEOMETRY - TURNAROUNDS**

STANDARD  
**2-19**

SECTION 2 - STREETS AND PATHS



TYPE A



TYPE B

NOTES:

1. See Standard 6-17 for pavement marking and signing details.

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Date

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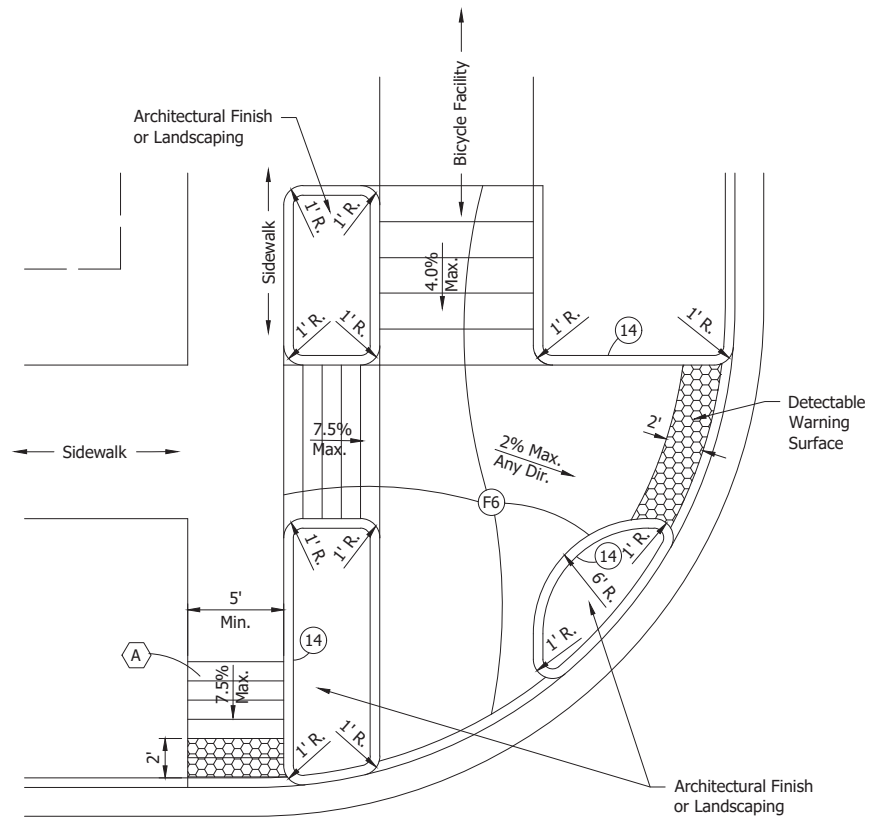
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

DETAILS - VAN ACCESSIBLE PARALLEL PARKING DETAILS





STANDARD  
2-20

SECTION 2 - STREETS AND PATHS



**CURB RAMP DETAIL**  
**PROTECTED BICYCLE FACILITIES**

**LEGEND:**

-  Detectable Warning Surface
-  Concrete Sidewalk, 6 in.
-  Concrete Curb, 6 in.
-  Curb Ramp, Type -

6/26/18  
Date

REF STD SPEC SEC 2-2

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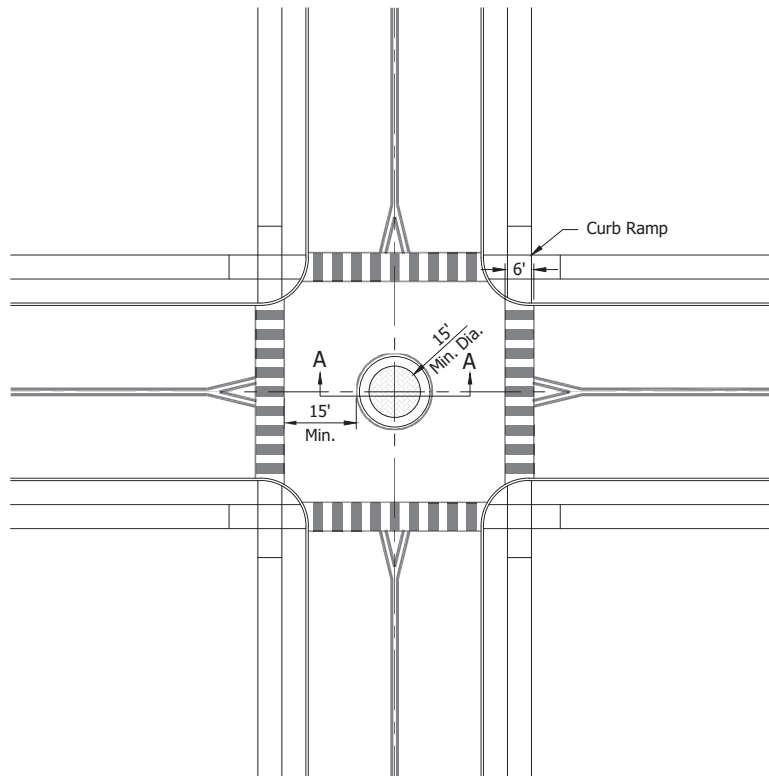
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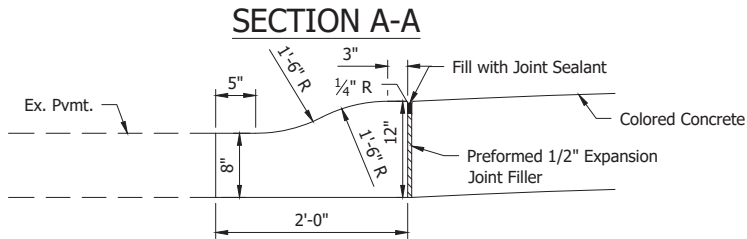
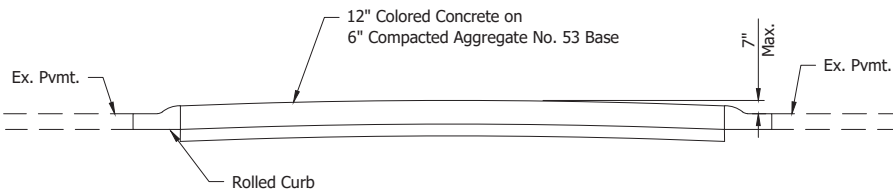
**GEOMETRY - PROTECTED BIKE LANE INTERSECTION**

STANDARD  
**2-21**

SECTION 2 - STREETS AND PATHS



PLAN



CURB DETAIL

NOTES:

- 1. See Standard 6-15 for pavement marking and signing details.

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 2-2

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EFFECTIVE DATE: June 26, 2018



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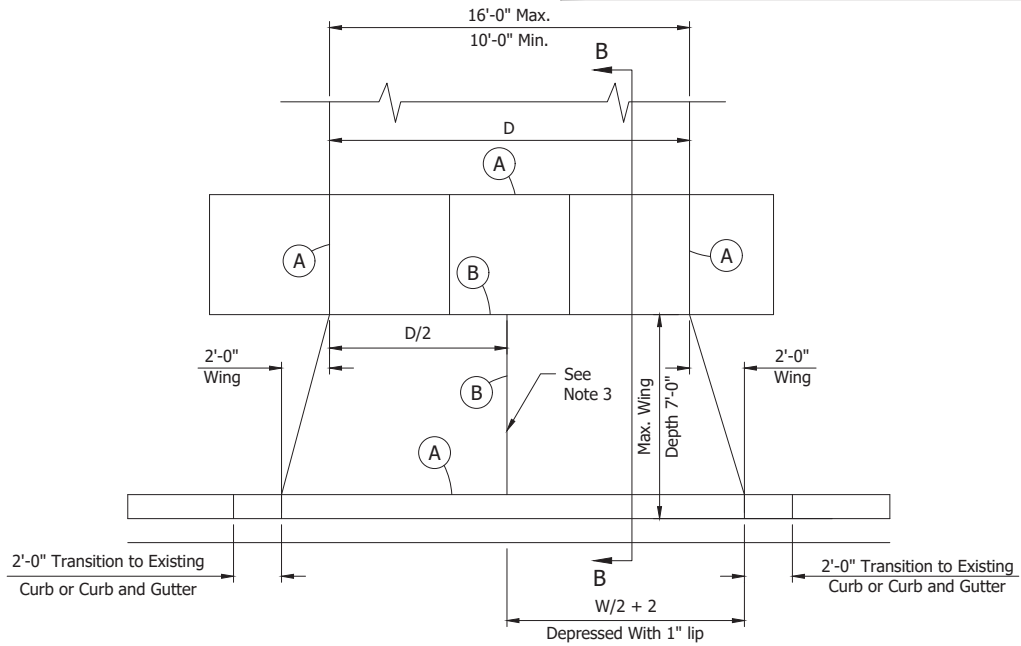
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

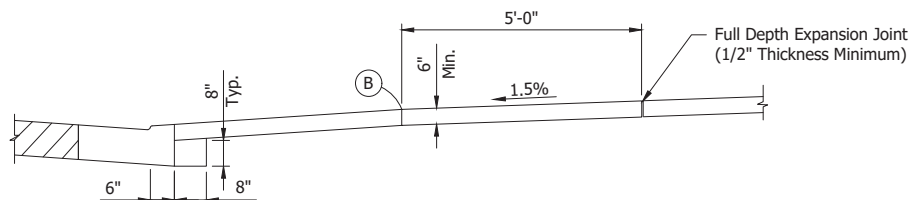
GEOMETRY - MINI ROUNDABOUT

STANDARD  
2-22

## SECTION 2 - STREETS AND PATHS



**RESIDENTIAL APPROACH**



**SECTION B-B**

**NOTES:**

1. Class "A" concrete to be used in all walks and approaches.
2. Radii may be used if approved by the City Engineer.
3. Contraction joint required on approach center when D is 12 ft. or more.
4. "Curing Concrete"- As per [INDOT Standard Specifications](#) Section 501 (Paragraph 501.20). Use a curing compound immediately (White membrane only accepted cure).
5. Concrete forms shall be at least as high as the thickness of the item shown. Lumber of nominal dimension shall not be used to equal the specified dimension.
6. All walks and approaches shall require proper compaction as per [INDOT Standard Specifications](#) Section 200 (Paragraphs 207.02 and 207.05).
7. Curb Casting - Preformed 1/4" expansion joint material shall be placed on each side of curb return.
8. Blankets shall be utilized on concrete when temperature is expected to fall below 50°.
9. No wire mesh or rebar allowed in any concrete (sidewalk, approaches, curbs) placed within the right of way.
10. When a new drive is constructed with existing vertical curb, the existing curb shall be depressed in accordance with the detail for existing vertical curb on Standard 2-24.
11. When a drive is constructed within the limits of new road construction, the curb shall be depressed in accordance with the detail for new curb on Standard 2-24. Rolled Curb and Gutter Type 'A' does not require depression.
12. Max slope for all approaches is 8%, with max algebraic difference of 10%.
13. Drive width shall match existing approach width at the Right-of-Way, not less than 10' wide.
14. The maximum driveway width in suburban areas is not greater than 20'.


**LEGEND:**

- (A) Expansion Joint - Full Depth
- (B) Contraction Joint
- W Width
- D Dimension

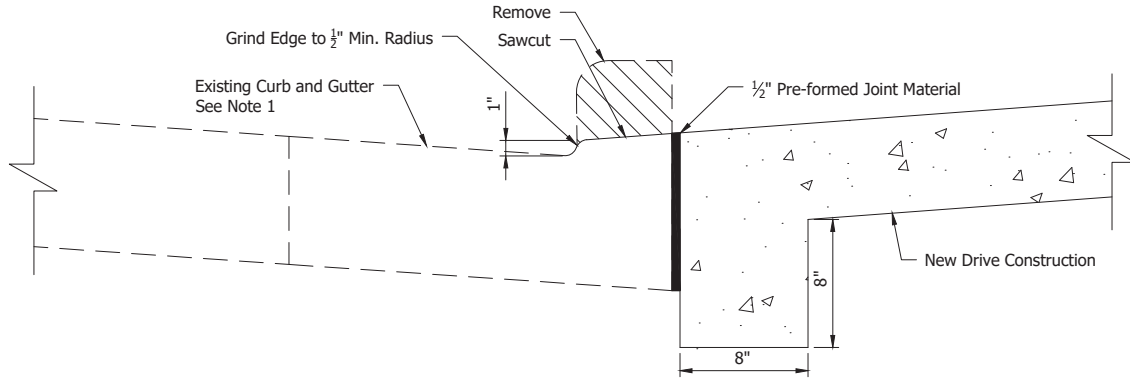
KARA M. BOYLES  
REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

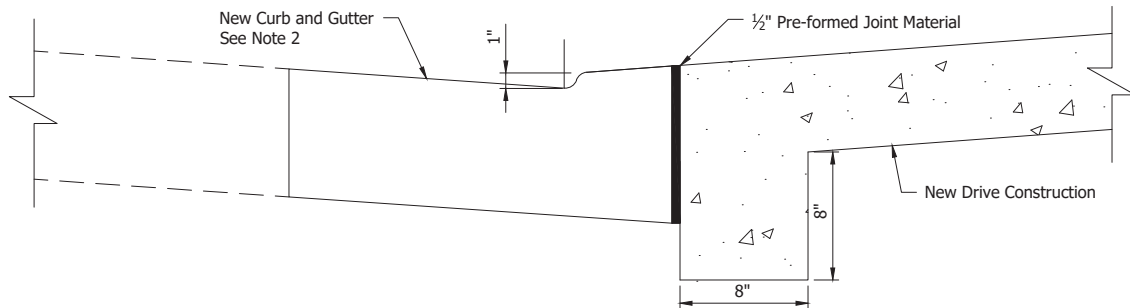
**REF STD SPEC SEC 2-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				<b>CITY OF SOUTH BEND</b>	
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION	
			STANDARD <b>2-23</b>		
<b>DRIVES AND APPROACHES - RESIDENTIAL</b>					

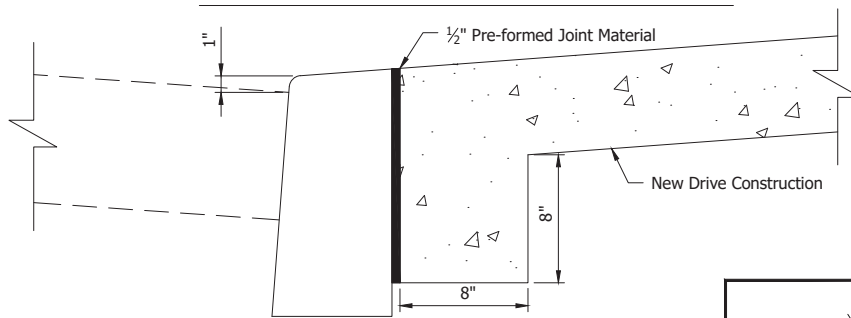
SECTION 2 - STREETS AND PATHS



**EXISTING VERTICAL CURB DEPRESSED FOR NEW RESIDENTIAL DRIVE CONSTRUCTION**



**DEPRESSED CURB AND GUTTER FOR NEW RESIDENTIAL DRIVE CONSTRUCTION**



**DEPRESSED STANDARD CURB FOR NEW RESIDENTIAL DRIVE CONSTRUCTION**

**NOTES:**

1. When depressing existing vertical curb, the gutter pan shall not be removed.
2. New vertical curb shall be depressed for all drives within the limits of new road construction. The depressed curb shall be constructed integral with adjacent curb in order to maintain a consistent gutter line through the drive.

REF STD SPEC SEC 2-2

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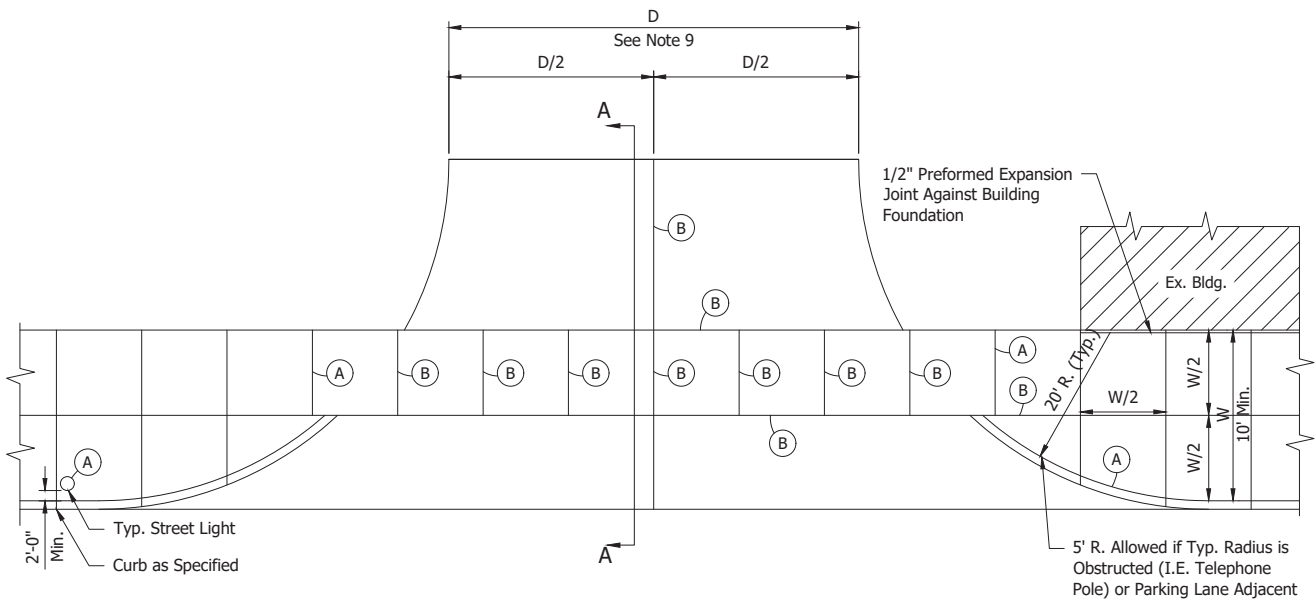
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

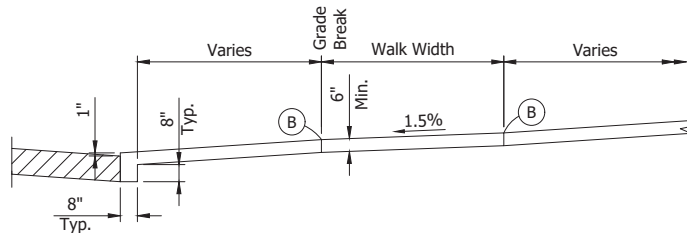
**DRIVES AND APPROACHES - RESIDENTIAL DEPRESSED CURB**

STANDARD  
**2-24**

## SECTION 2 - STREETS AND PATHS



### COMMERCIAL APPROACH



#### LEGEND:

- (A) Expansion Joint - Full Depth
- (B) Contraction Joint
- W Width
- D Approach Width

#### NOTES:

1. Class "A" concrete to be used in all walks and approaches.
2. Radii as specified.
3. Utility poles, hydrants, etc. must be wrapped with  $1/2"$  expansion joint material prior to concrete pour.
4. Contraction joint required on approach center when  $D$  is 12 ft. or more.
5. "Curing Concrete"- As per [INDOT Standard Specifications](#) Section 501 (Paragraph 501.20). Use a curing compound immediately (white membrane only accepted cure).
6. Concrete forms shall be at least as high as the thickness of the item shown. Lumber of nominal dimension shall not be used if less than the design thickness.
7. All approaches shall require proper compaction as per [INDOT Standard Specification](#) Section 207.
8. Blankets shall be utilized on concrete when temperature is expected to fall below  $50^{\circ}\text{F}$ .
9. Business Approach-  $24'-0"$  at throat, with  $20'-0"$  approach curb radius.  $10'$  radius may be used if adjacent to on street parking.

#### REF STD SPEC SEC 2-2

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 Date

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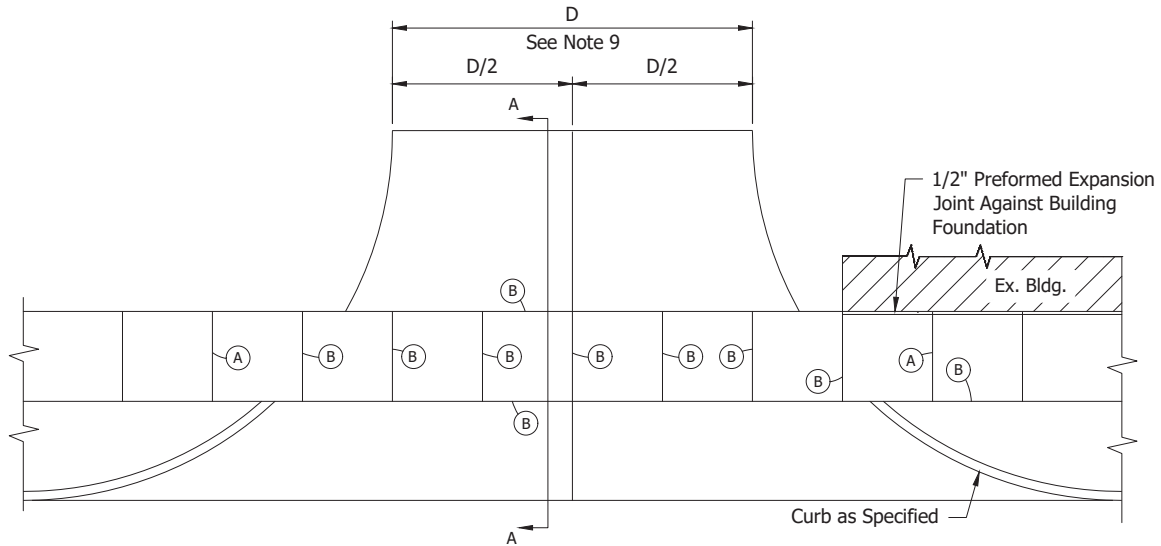
### CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

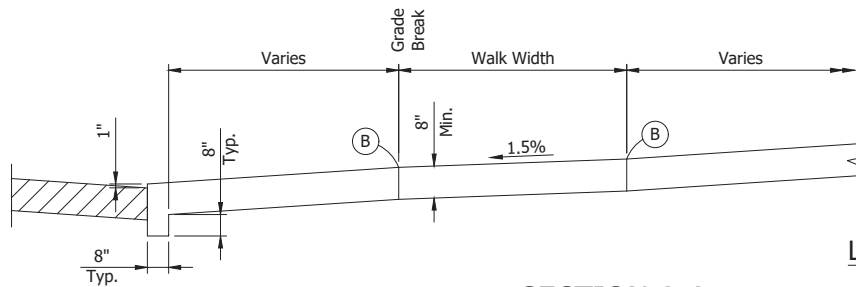
## DRIVES AND APPROACHES - COMMERCIAL

STANDARD  
**2-25**

## SECTION 2 - STREETS AND PATHS



### INDUSTRIAL APPROACH



### SECTION A-A

#### LEGEND:

- (A) Expansion Joint - Full Depth
- (B) Contraction Joint
- D Approach Width

#### NOTES:

1. Class "A" concrete to be used in all walks and approaches.
2. Radii as specified.
3. Utility poles, hydrants, etc. must be wrapped with 1/2" expansion joint material prior to concrete pour.
4. Contraction joint required on approach center when D is 12 ft. or more.
5. "Curing Concrete"- As per [INDOT Standard Specifications](#) Section 501 (Paragraph 501.20). Use a curing compound immediately (white membrane only accepted cure).
6. Concrete forms shall be at least as high as the thickness of the item shown. Lumber of nominal dimension shall not be used if less than the design thickness.
7. All approaches shall require proper compaction as per [INDOT Standard Specification](#) Section 207.
8. Blankets shall be utilized on concrete when temperature is expected to fall below 50°F.
9. Industrial Approach - 30'-0" Max. at throat, 40'-0" Max. radius.

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6/26/18  
Date

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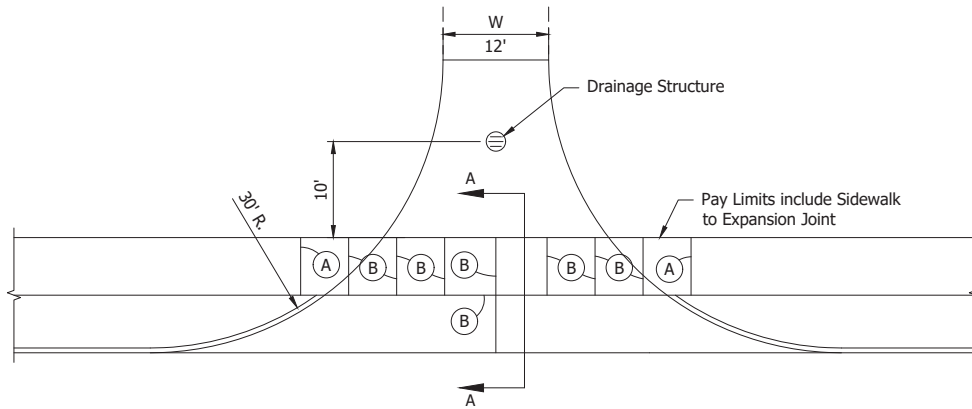
STANDARDS FOR DESIGN  
AND CONSTRUCTION

## DRIVES AND APPROACHES - INDUSTRIAL

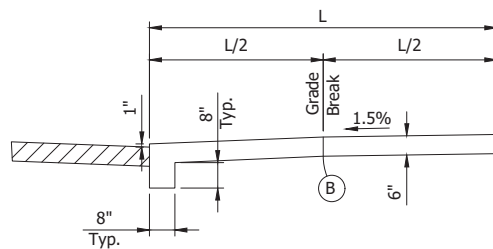
STANDARD  
2-26



# SECTION 2 - STREETS AND PATHS



**ALLEY APPROACH - PLAN**



**LEGEND**

- (A) Expansion Joint - Full Joint
- (B) Contraction Joint
- W Width
- L Length

**ALLEY APPROACH SECTION A-A**

**NOTES:**

1. Class "A" concrete to be used in all approaches.
2. Radii as specified.
3. Sidewalk as per [INDOT Standard Drawings](#).
4. Contraction joints required on approach center when W is 12 ft. or more.
5. "Curing Concrete" - As per [INDOT Standard Specifications](#) Section 501 (Paragraph 501.20) use a curing compound immediately (white membrane only accepted cure).
6. Concrete forms shall be at least as high as the thickness of the item shown. Lumber of nominal dimensions shall not be used if less than the design thickness.
7. All approaches shall require proper compaction, as per [INDOT Standard Specifications](#) Section 207.
8. Blankets shall be utilized on concrete when temperature is expected to fall below 50° F.
9. Radii may be reduced to 20' if travel way is separated by parking.

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Date

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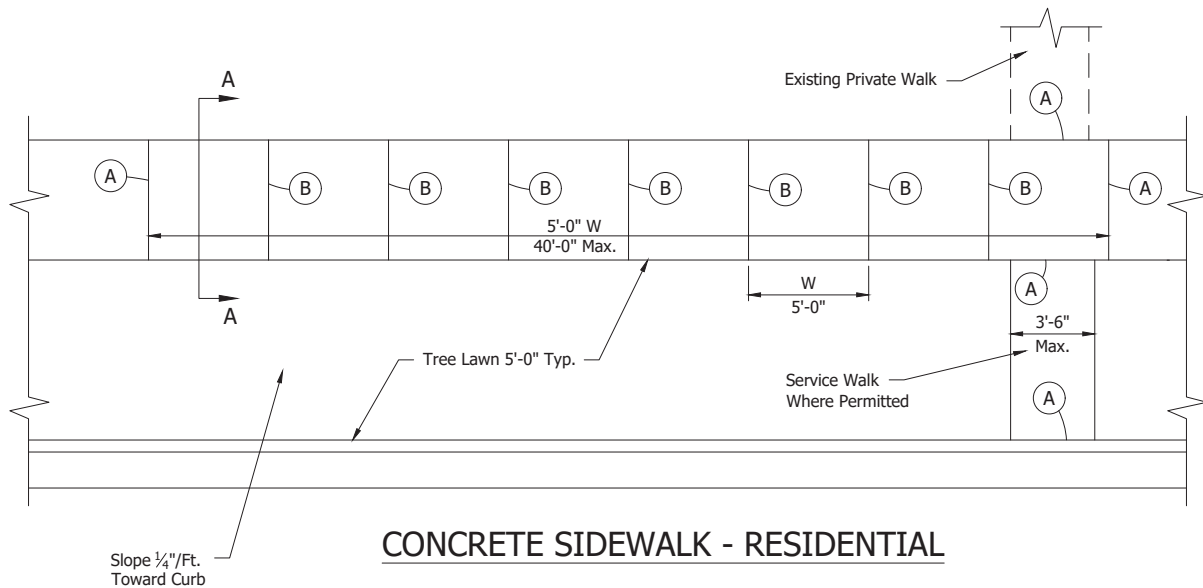
STANDARDS FOR DESIGN  
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**DRIVES AND APPROACHES - URBAN ALLEYS**

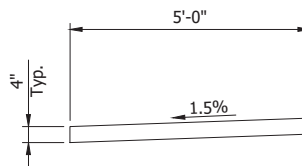
STANDARD  
**2-27**

## SECTION 2 - STREETS AND PATHS



**LEGEND:**

- (A) Expansion Joint - Full Depth
- (B) Contraction Joint
- W Width



**SECTION A-A**

**NOTES:**

1. Class "A" concrete to be used in all walks and approaches.
2. "Curing Concrete"- As per [INDOT Standard Specifications](#) Section 501 (Paragraph 501.20). Use a curing compound immediately (white membrane only accepted cure).
3. Concrete forms shall be at least as high as the thickness of the item shown. Lumber of nominal dimension shall not be used if less than the design thickness.
4. Proper compaction per [INDOT Standard Specification](#) Section 604 (Paragraph 604.03(b)) is required for all walks and approaches.
5. Blankets shall be utilized on concrete when temperature is expected to fall below 50°F.
6. No wire mesh or rebar allowed in any concrete (sidewalk, approaches, curbs) placed within the right of way.

Kara M. Boyles, Ph.D., P.E.      6/26/18  
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**REF STD SPEC SEC 2-2**

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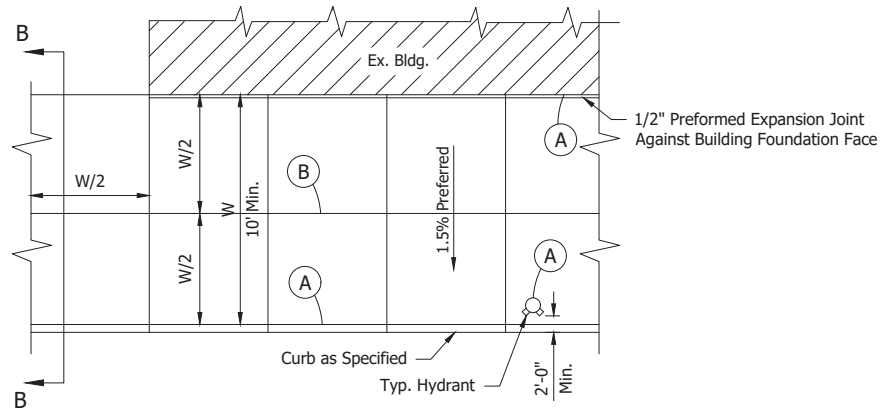
STANDARDS FOR DESIGN  
AND CONSTRUCTION

**DETAILS - RESIDENTIAL SIDEWALK**

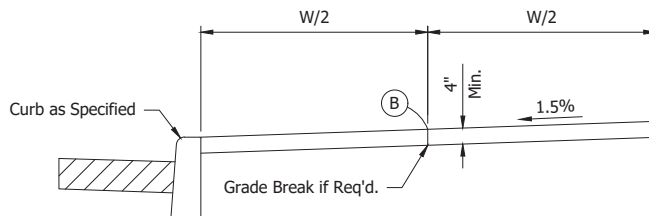
STANDARD  
**2-28**

Item	Revision	Approved Date

## SECTION 2 - STREETS AND PATHS



### CONCRETE SIDEWALK - COMMERCIAL



#### SECTION B-B

**LEGEND:**

- (A) Expansion Joint - Full Depth
- (B) Contraction Joint
- W Width

**NOTES:**

1. Class "A" concrete to be used in all walks and approaches.
2. Utility poles, hydrants, etc. must be wrapped with 1/2" expansion material prior to concrete pour.
3. "Curing Concrete"- As per [INDOT Standard Specifications](#) Section 501 (Paragraph 501.20). Use a curing compound immediately (White membrane only accepted cure).
4. Concrete forms shall be at least as high as the thickness of the item shown. Lumber of nominal dimension shall not be used if less than the design thickness.
5. Proper compaction per [INDOT Standard Specification](#) Section 604 (Paragraph 604.03(b)) is required for all walks and approaches.
6. Blankets shall be utilized on concrete when temperature is expected to fall below 50°F.
7. A Pedestrian Access Route (4'-0" min. width, 1.5% max. cross slope) shall be provided within all commercial sidewalks.

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6/26/18  
Date

**REF STD SPEC SEC 2-2**

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EFFECTIVE DATE: June 26, 2018



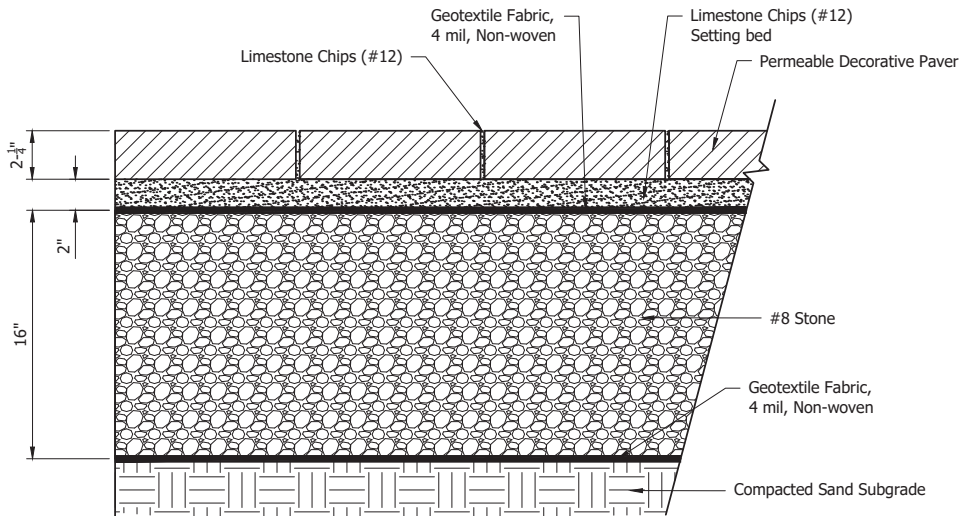
## CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

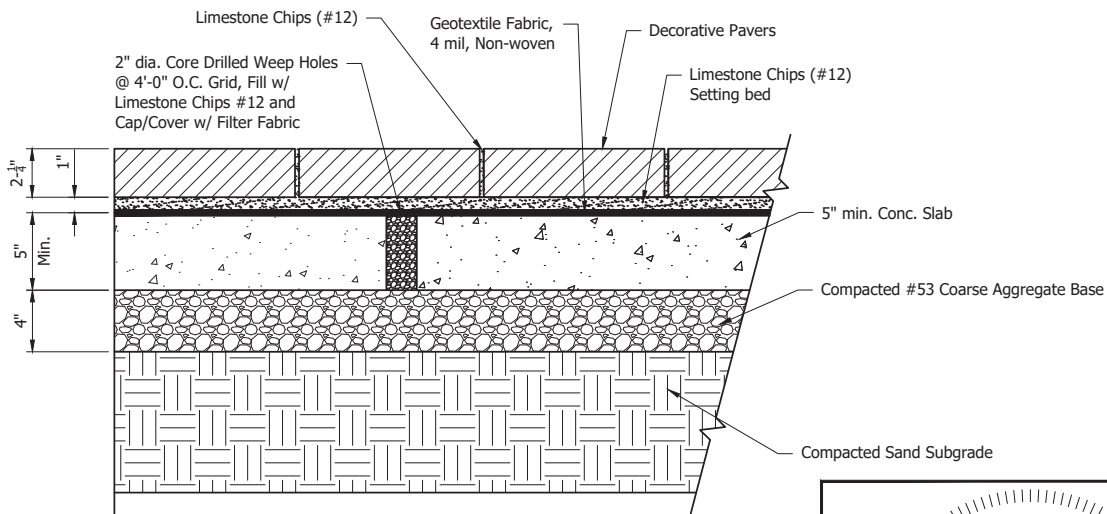
## DETAILS - COMMERCIAL SIDEWALK

STANDARD  
2-29

SECTION 2 - STREETS AND PATHS



**PERMEABLE DECORATIVE PAVERS**



**DECORATIVE PAVERS**

**NOTES:**

1. Permeable decorative pavers may be used where vehicle traffic is not expected.
2. Decorative pavers shall be used when the pavement surface is 8 ft. or greater in width.

**REF STD SPEC SEC 2-6**

6/26/18  
Date

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EFFECTIVE DATE: June 26, 2018



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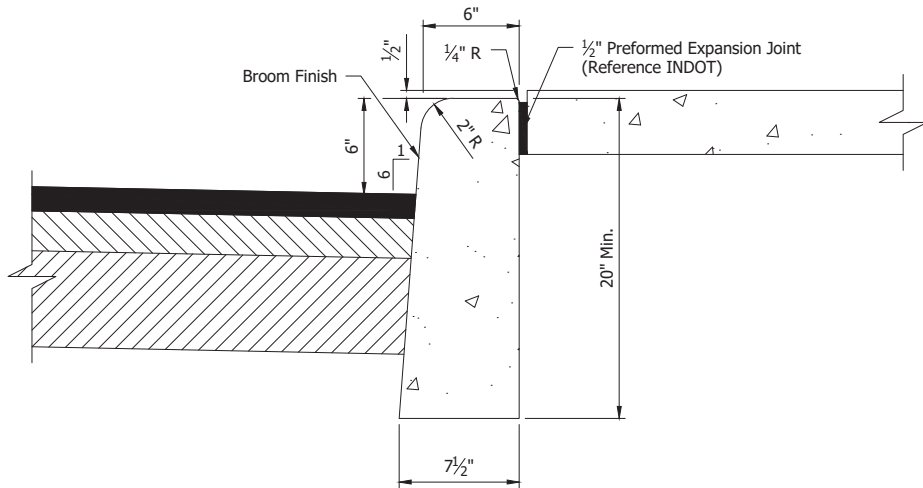
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**DETAILS - DECORATIVE PAVERS**

STANDARD  
**2-30**

SECTION 2 - STREETS AND PATHS



NOTES:

1. All curb to be constructed of class "A" concrete.
2. Control joints to be placed every 10'.
3. Expansion joints to be placed every 80' or as specified on construction drawings.

REF STD SPEC SEC 2-2

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EFFECTIVE DATE: June 26, 2018



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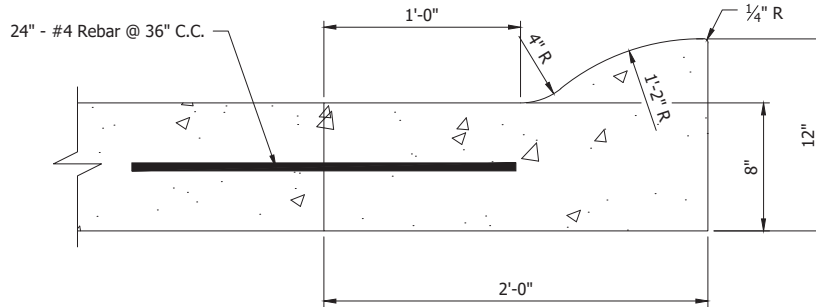
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

DETAILS - STANDARD CURB

STANDARD  
2-31

SECTION 2 - STREETS AND PATHS



NOTES:

1. All curb to be constructed of class "A" concrete.
2. Control joints to be placed every 10'.
3. Expansion joints to be placed every 80' or as specified on construction drawings.
4. Eliminate longitudinal bars if roadway is asphalt pavement.
5. Curb depth at pavement edge shall match pavement depth where concrete is used.

REF STD SPEC SEC 2-2

6/26/18  
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EFFECTIVE DATE: June 26, 2018



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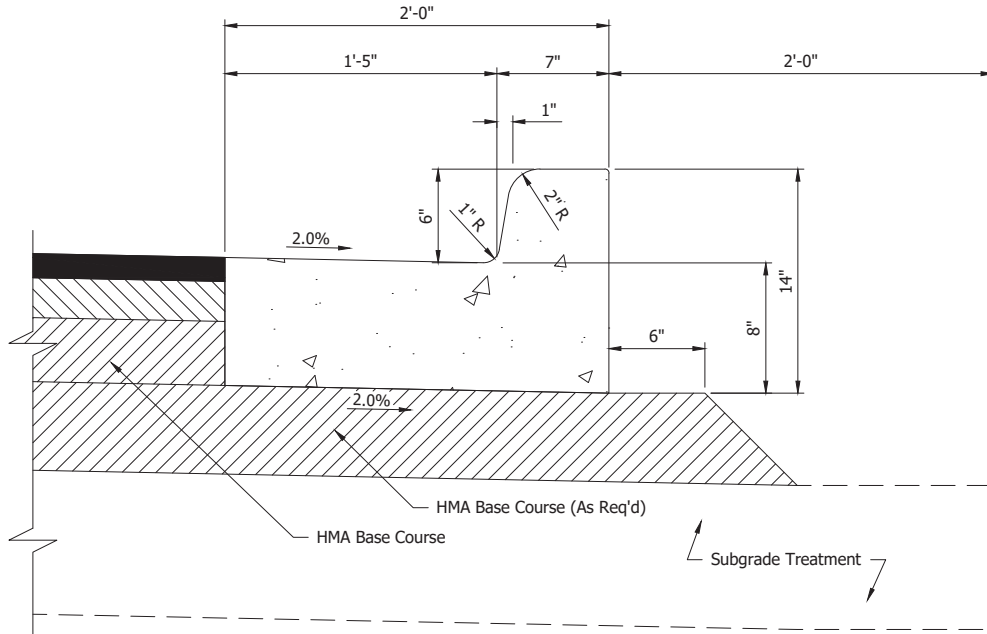
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

DETAILS - COMBINATION CURB AND GUTTER, TYPE A

STANDARD  
2-32

SECTION 2 - STREETS AND PATHS



NOTES:

1. All curb to be constructed of class "A" concrete.
2. Control joints to be placed every 10'.
3. Expansion joints to be placed every 80' or as specified on construction drawings.

REF STD SPEC SEC 2-2

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CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

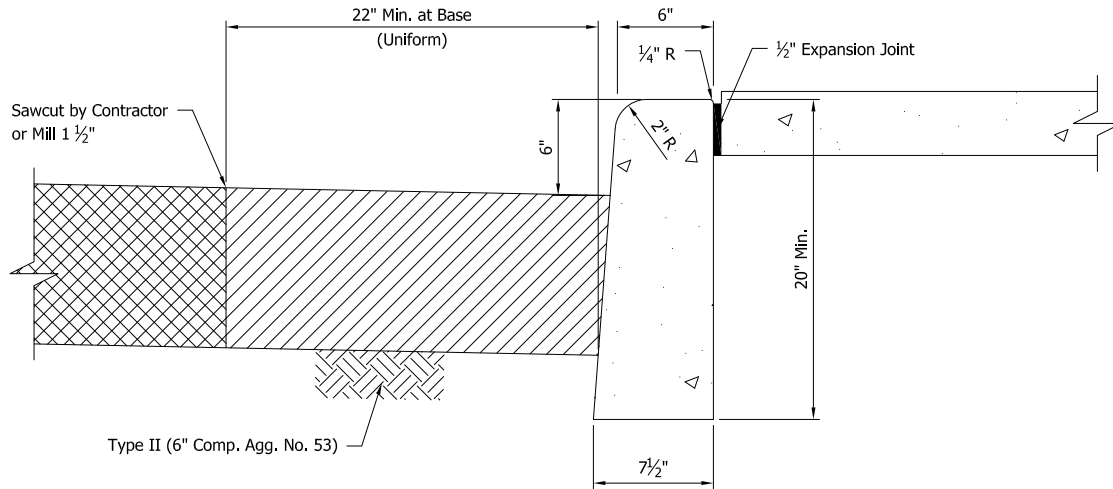
DETAILS - COMBINATION CURB AND GUTTER, TYPE B

STANDARD  
2-33





SECTION 2 - STREETS AND PATHS



**NOTES:**

1. All curb to be constructed of class "A" concrete.
2. Control joints to be placed every 10'.
3. Expansion joints to be placed every 80' or as specified on construction drawings.
4. Curb placed as standard curb with separate poured gutter. Place surface 22" from face of curb at a depth of 1 1/2" or curb and gutter can be placed monolithically.
5. When replacing curb, the patch of new gutter material must match the existing gutter material. The thickness of the patch must match the thickness of the adjacent pavement.

**REF STD SPEC SEC 2-2**

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

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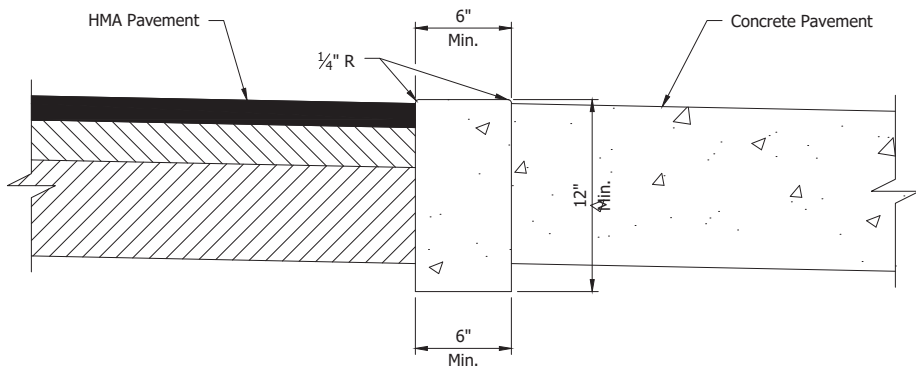
Item	Revision	Approved Date
1	Added Note #5	10/26/2021

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**DETAILS - MODIFIED COMBINATION CURB AND GUTTER**

STANDARD  
**2-35**

SECTION 2 - STREETS AND PATHS



**NOTES:**

1. Used to separate disparate longitudinal types of pavement only.
2. Concrete Header to be constructed of class "A" concrete.
3. Control joints to be placed every 10'.
4. Expansion joints to be placed every 80' or as specified on construction drawings.

REF STD SPEC SEC 2-2

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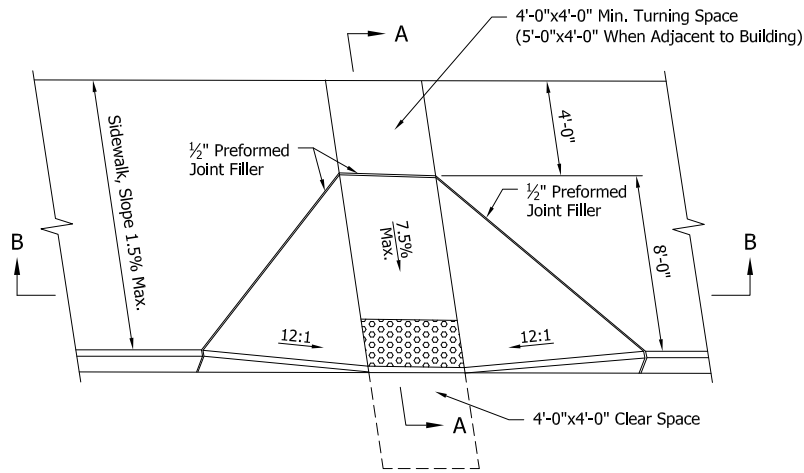
*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

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Item	Revision	Approved Date

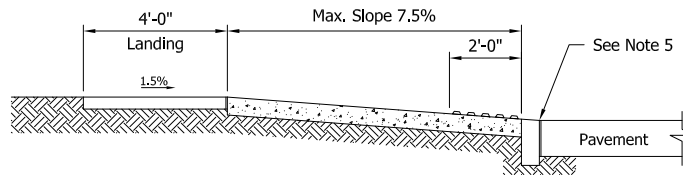
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
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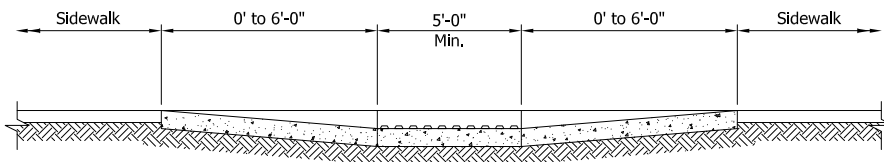
**SECTION 2 - STREETS AND PATHS**



**PERPENDICULAR CURB RAMP  
ADJACENT WALKABLE SURFACE**



**SECTION A-A**



**SECTION B-B**

**NOTES:**

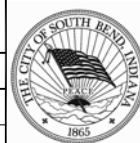
1. Class "A" concrete to be used in all walks and approaches.
2. Proper compaction per INDOT Standard Specification Section 604 (Paragraph 604.03(b)) is required for all walks and approaches.
3. These dimensions are based on a 6 in. curb height. They shall be proportionally adjusted for other curb heights.
4. The bottom edge of the curb ramp shall be flush with the edge of adjacent pavement and gutter line.
5. Landing areas at the top of the curb ramps shall have maximum cross slope of 1.5% in any direction.
6. Drainage inlets should be located uphill from the curb ramps to prevent water ponding within the pedestrian access route.
7. Algebraic difference in grade between the base of curb ramp and the gutter shall be less than 11%. If this is not practical, a 2'-0" wide level strip shall be provided.
8. Minimum width of curb ramp is 5'-0".
9. Proper compaction per INDOT Standard Specification Section 604 (Paragraph 604.03(b)) is required for all walks, approaches, and ramps.
10. Under restrictive conditions, additional details and design modifications may be required and subject to approval by City.

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**REF STD SPEC SEC 2-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018		
Item	Revision	Approved Date
1	4' minimum to 5' minimum curb ramp width	10/26/2021



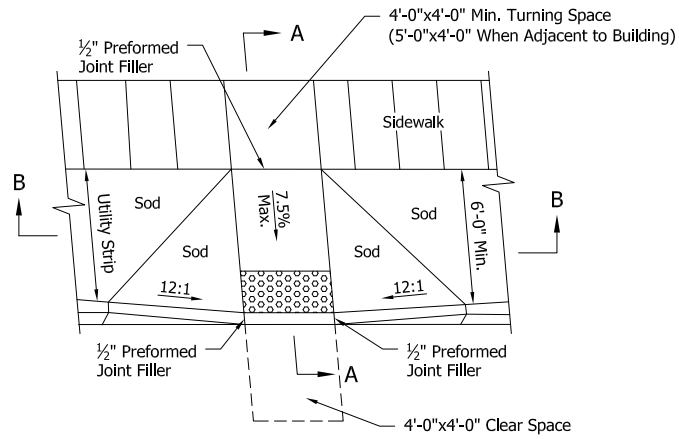
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

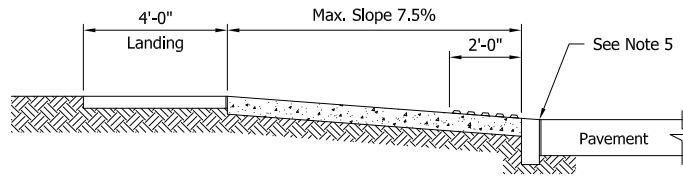
**DETAILS - SIDEWALK CURB RAMP, TYPE A**

STANDARD  
**2-37**

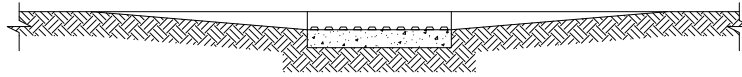
## SECTION 2 - STREETS AND PATHS



### PERPENDICULAR CURB RAMP ADJACENT NON-WALKABLE SURFACE



**SECTION A-A**



**SECTION B-B**

**NOTES:**

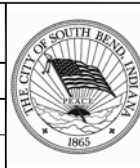
1. These dimensions are based on a 6 in. curb height. They shall be proportionally adjusted for other curb heights.
2. The bottom edge of the curb ramp shall be flush with the edge of adjacent pavement and gutter line.
3. Landing areas at the top of the curb ramps shall have maximum cross slope of 1.5% in any direction.
4. Drainage inlets should be located uphill from the curb ramps to prevent water ponding within the pedestrian access route.
5. Algebraic difference in grade between the base of curb ramp and the gutter shall be less than 11%. If this is not practical, a 2'-0" wide level strip shall be provided.
6. Minimum width of curb ramp is 5'-0".
7. Under restrictive conditions, additional details and design modifications may be required and subject to approval by City.

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**REF STD SPEC SEC 2-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018		
Item	Revision	Approved Date
1	4' minimum to 5' minimum curb ramp width	10/26/2021



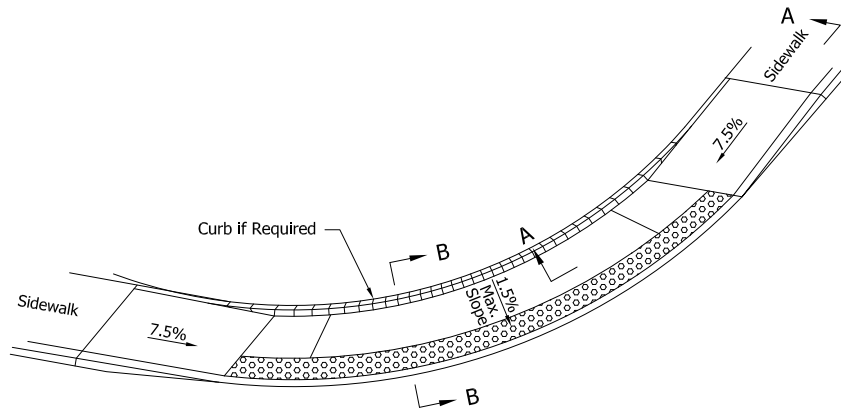
CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

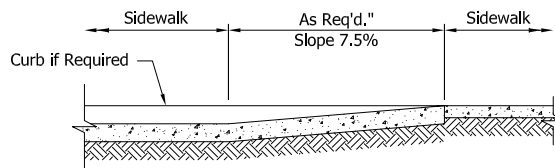
## DETAILS - SIDEWALK CURB RAMP, TYPE B

STANDARD  
2-38

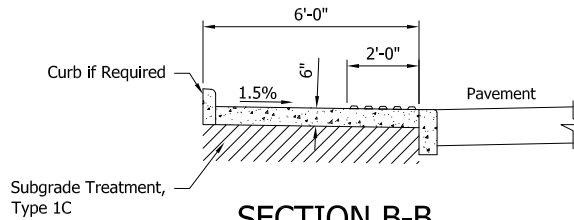
SECTION 2 - STREETS AND PATHS



**BLENDING TRANSITION CURB RAMP**



**SECTION A-A**



**SECTION B-B**

**NOTES:**

1. These dimensions are based on a 6 in. curb height. They shall be adjusted for other curb heights.
2. The bottom edge of the curb ramp shall be flush with the edge of adjacent pavement and gutter line.
3. Landing areas at the top of the curb ramps shall have maximum cross slope of 1.5% in any direction.
4. Drainage inlets should be located uphill from the curb ramps to prevent water ponding within the pedestrian access route.
5. Algebraic difference in grade between the base of curb ramp and the gutter shall be less than 11%. If this is not practical, a 2'-0" wide level strip shall be provided.
6. Minimum width of curb ramp is 5'-0".
7. Curb or wall shall be used when necessary based on field conditions.
8. Under restrictive conditions, additional details and design modifications may be required and subject to approval by City.

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No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

*Kara M. Boyles*  
Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

**REF STD SPEC SEC 2-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018

Item	Revision	Approved Date
1	4' minimum to 5' minimum curb ramp width	10/26/2021



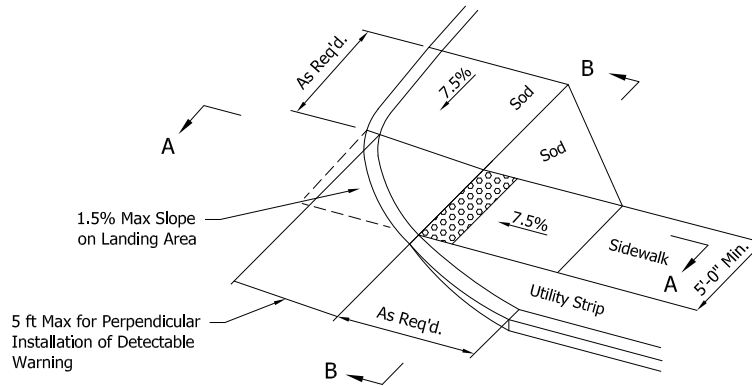
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

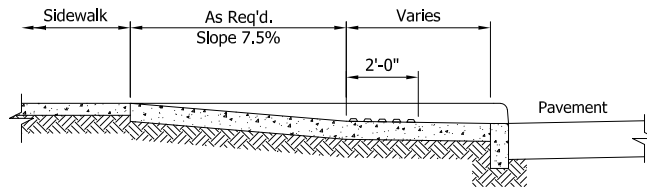
**DETAILS - SIDEWALK CURB RAMP, TYPE C**

STANDARD  
2-39

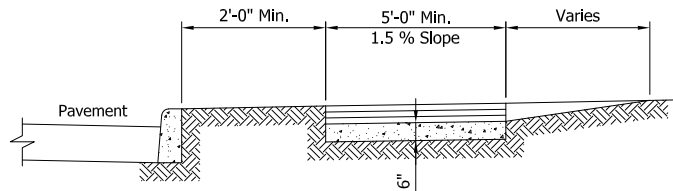
SECTION 2 - STREETS AND PATHS



**ONE-WAY PERPENDICULAR CURB RAMP WITH BUFFER**



**SECTION A-A**



**SECTION B-B**

**NOTES:**

1. These dimensions are based on a 6 in. curb height. They shall be adjusted for other curb heights.
2. The bottom edge of the curb ramp shall be flush with the edge of adjacent pavement and gutter line.
3. Landing areas at the top of the curb ramps shall have maximum cross slope of 1.5% in any direction.
4. Drainage inlets should be located uphill from the curb ramps to prevent water ponding within at the pedestrian access route.
5. Algebraic difference in grade between the base of curb ramp and the gutter shall be less than 11%. If this is not practical, a 2'-0" wide level strip shall be provided.
6. Minimum width of curb ramp is 5'-0".
7. Sidewalk across approach shall be sloped at 1.5% maximum transversely.
8. Under restrictive conditions, additional details and design modifications may be required and subject to approval by City.

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

**REF STD SPEC SEC 2-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018

Item	Revision	Approved Date
1	4' minimum to 5' minimum curb ramp width	10/26/2021



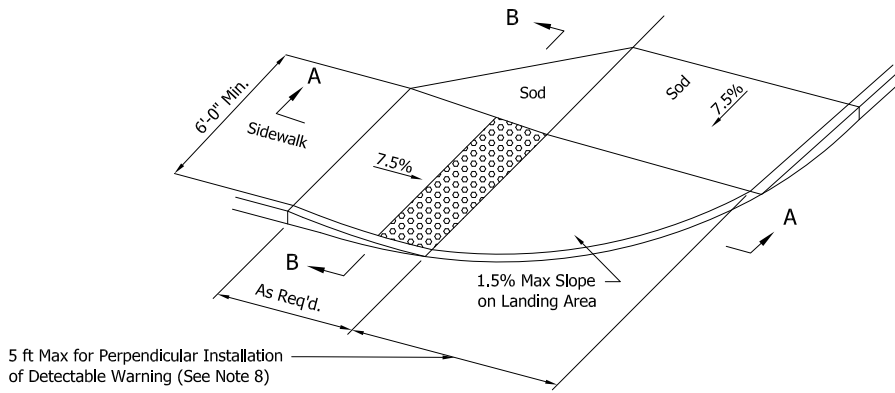
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**DETAILS - SIDEWALK CURB RAMP, TYPE D**

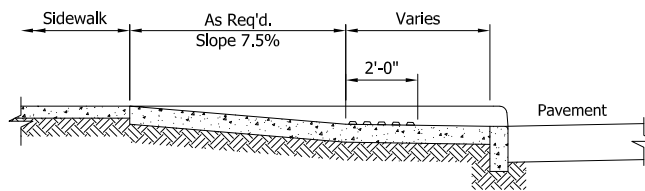
STANDARD  
**2-40**

SECTION 2 - STREETS AND PATHS

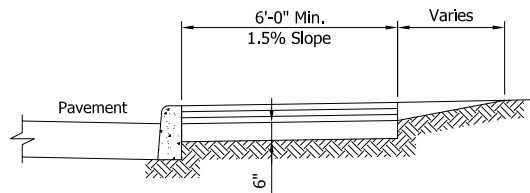


5 ft Max for Perpendicular Installation of Detectable Warning (See Note 8)

**ONE-WAY PERPENDICULAR CURB RAMP ADJACENT CURB**



**SECTION A-A**



**SECTION B-B**

**NOTES:**

1. Class "A" concrete to be used in all walks and approaches.
2. Proper compaction per INDOT Standard Specification Section 604 (Paragraph 604.03(b)) is required for all walks and approaches.
3. These dimensions are based on a 6 in. curb height. They shall be adjusted for other curb heights.
4. The bottom edge of the curb ramp shall be flush with the edge of adjacent pavement and gutter line.
5. Landing areas at the top of the curb ramps shall have a maximum cross slope of 1.5% in any direction.
6. Drainage inlets should be located uphill from the curb ramps to prevent water ponding within at the pedestrian access route.
7. Algebraic difference in grade between the base of curb ramp and the gutter shall be less than 11%. If this is not practical, a 2'-0" wide level strip shall be provided.
8. Minimum width of curb ramp is 5'-0".
9. Sidewalk across approach shall be sloped at 1.5% maximum transversely.
10. If the distance between the back of curb and the back of the lower landing is more than 5'-0", the detectable warning element shall be placed along the curb.
11. Under restrictive conditions, additional details and design modifications may be required and subject to approval by City.

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Date

**REF STD SPEC SEC 2-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018

Item	Revision	Approved Date
1	4' minimum to 5' minimum curb ramp width	10/26/2021



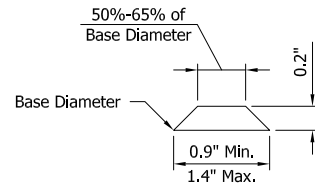
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

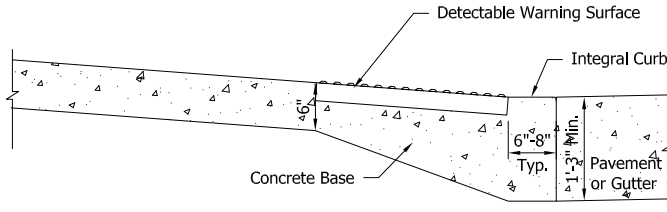
**DETAILS - SIDEWALK CURB RAMP, TYPE E**

STANDARD  
**2-41**

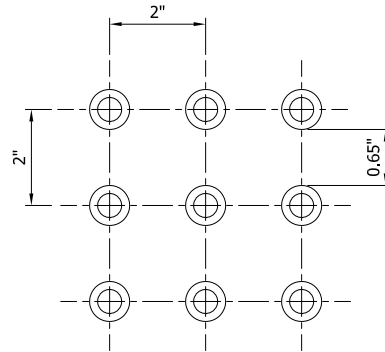
## SECTION 2 - STREETS AND PATHS



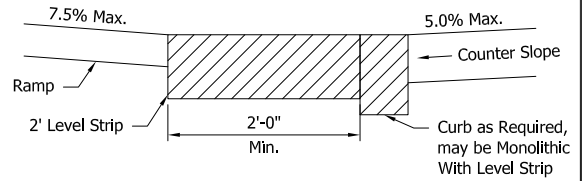
**SECTION A-A**



**TYPICAL RAMP AND TRUNCATED DOME CONSTRUCTION DETAIL**



**TRUNCATED DOMES**



**CHANGE OF GRADE > 11%**

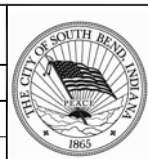
**NOTES:**

1. Detectable warning surface shall consist of truncated domes and shall be aligned in a square or radial grid pattern. Where truncated domes are arrayed radially, they may differ in diameter and center-to-center spacing within the ranges specified.
2. The detectable warning surface shall be manufactured to fit the radii. Field cutting shall not alter the truncated dome spacing between the adjacent panels outside of the allowable range.
3. The detectable warning surface shall contrast visually with adjacent surfaces, either light-on-dark or dark-on-light.
4. The detectable warning surface shall extend a minimum of 2 ft. in the direction of pedestrian travel and extend the full width as shown. The detectable warning surface shall not be placed across a grade break.
5. The maximum counter slope of the gutter or street at the bottom of the ramp shall be 5.00%. Where the algebraic difference between the running slope and the counter slope exceeds 11%, a 2-ft. minimum level strip should be provided at the bottom of the ramp.
6. Where the concrete border is used for forming, the border shall be cast monolithically with the curb ramp concrete. The concrete border shall not exceed 2 in. within the ramp width.
7. Where forming other than a concrete border is used, the edge restraint shall not encroach upon the ramp width.

**REF STD SPEC SEC 2-2**

Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

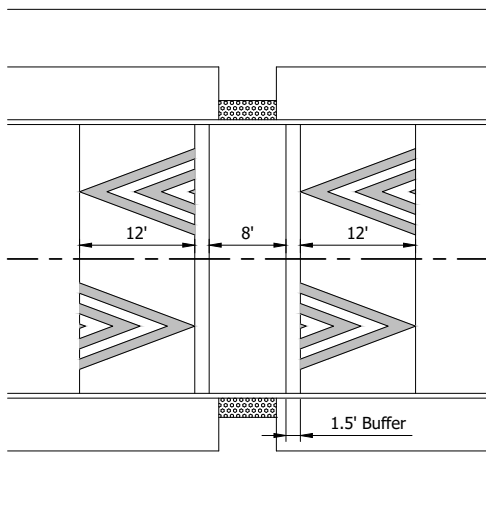
Item	Revision	Approved Date
1	Removed break lines from truncated dome detail	10/26/2021

**DETAILS - SIDEWALK CURB RAMPS: DETECTABLE WARNING SURFACE**

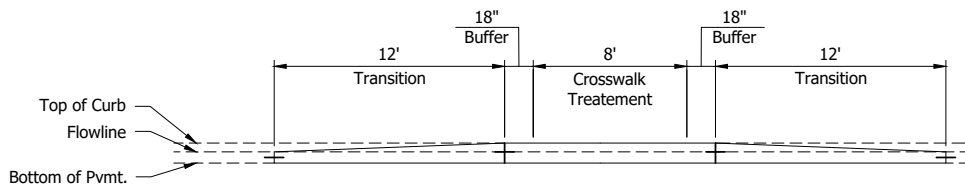
STANDARD  
**2-42**



SECTION 2 - STREETS AND PATHS



PLAN



ELEVATION

- \* Bevel Joints Sawcut in 2'x2' Pattern
- \*\* Smooth Finish, No Broom

NOTE:  
See Standard Drawing 6-16 for pavement markings.

*Kara M. Boyles*  
Kara M. Boyles, Ph.D., P.E.      6/26/18  
Date

REF STD SPEC SEC 2-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



CITY OF SOUTH BEND

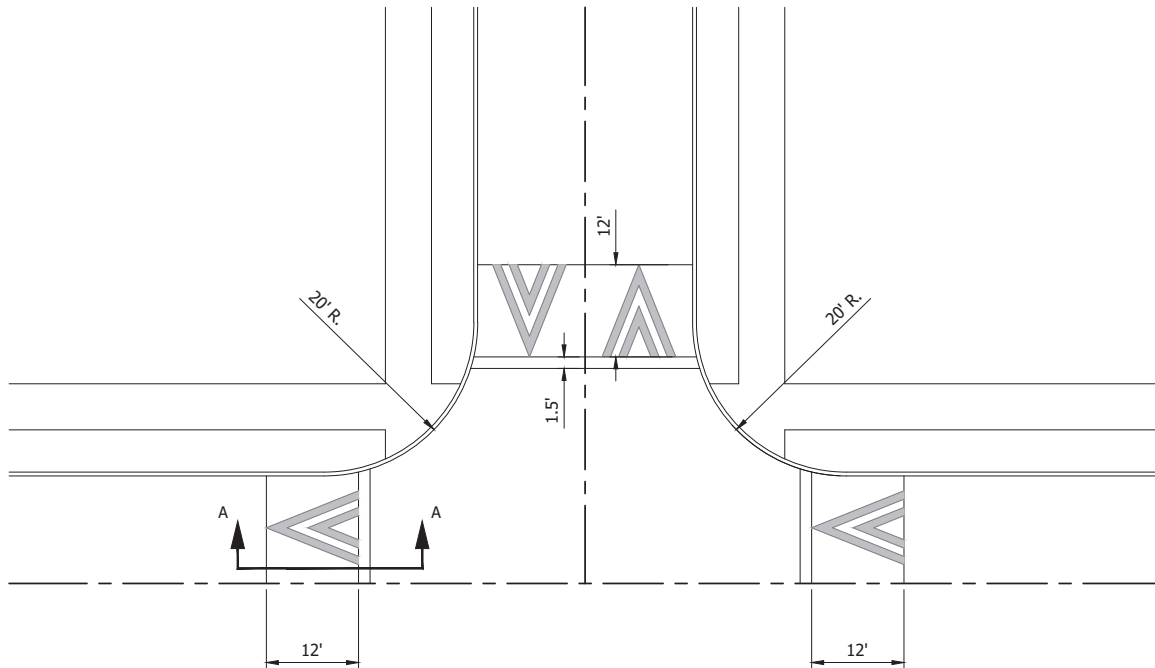
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

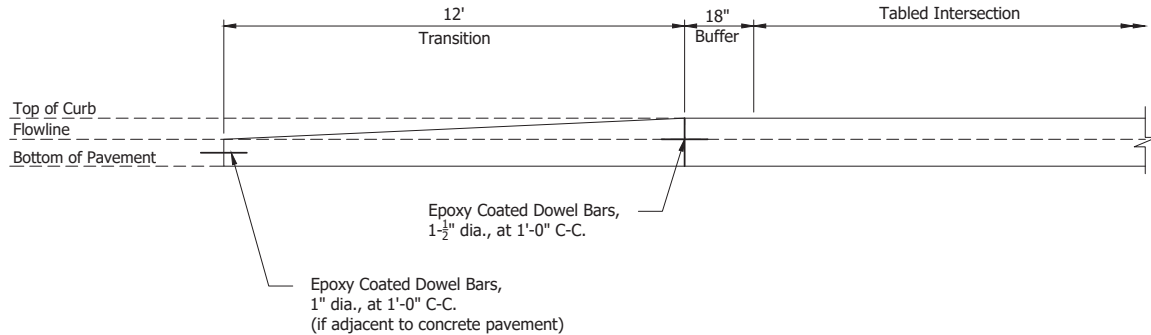
DETAILS - RAISED CROSSWALK

STANDARD  
2-43

SECTION 2 - STREETS AND PATHS



PLAN



SECTION A-A

NOTE:  
See Standard Drawing 6-16 for pavement markings.

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REF STD SPEC SEC 2-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



CITY OF SOUTH BEND

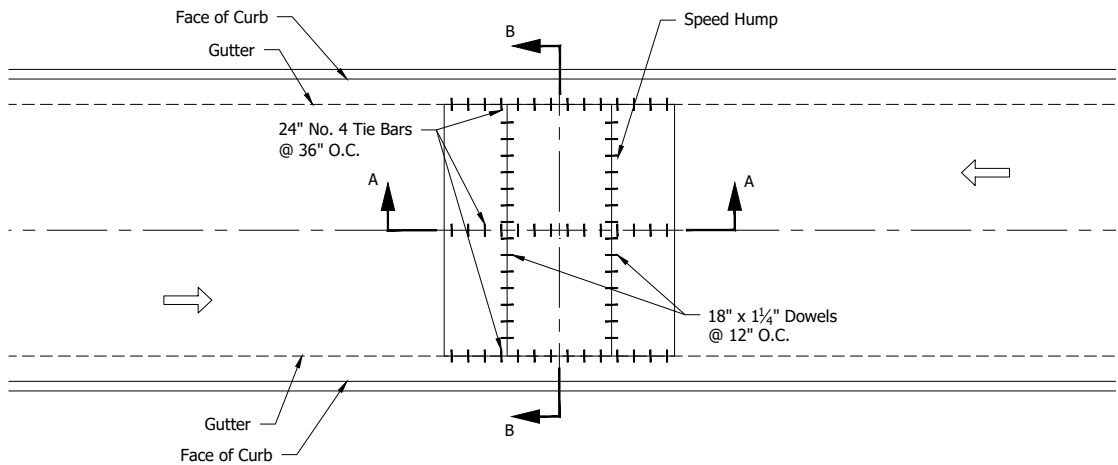
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

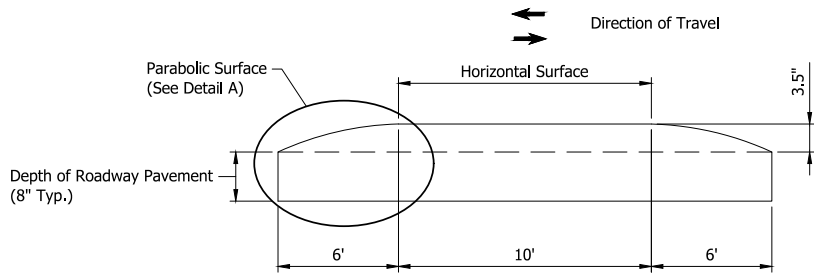
DETAILS - TABLED INTERSECTION

STANDARD  
2-44

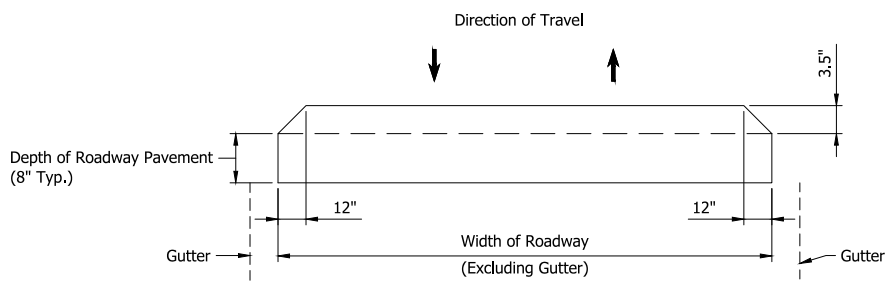
**SECTION 2 - STREETS AND PATHS**



**PLAN VIEW**



**SECTION A-A**



**SECTION B-B**

**NOTES:**

- 1. Speed humps should be at least 50 ft. from an uncontrolled intersection and at least 200 ft. from a controlled intersection.

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REF STD SPEC SEC 2-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: July 28, 2020



**CITY OF SOUTH BEND**

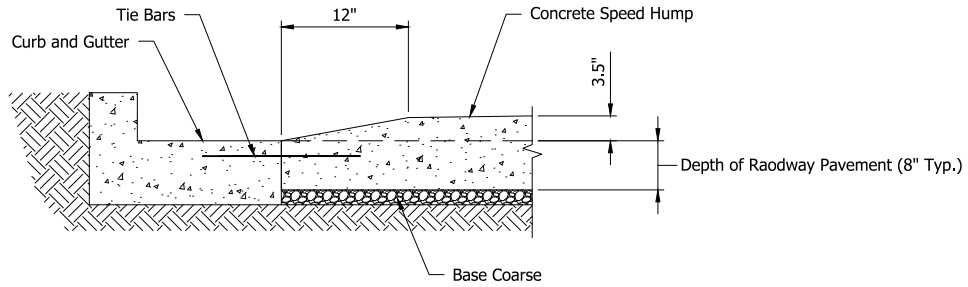
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

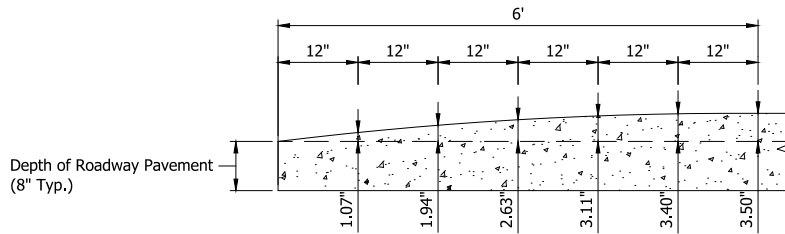
**DETAILS - SPEED HUMP**

STANDARD  
**2-45**

SECTION 2 - STREETS AND PATHS



**CURB DETAIL**



**PARABOLIC SURFACE  
DETAIL A**

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Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 2-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: July 28, 2020



**CITY OF SOUTH BEND**

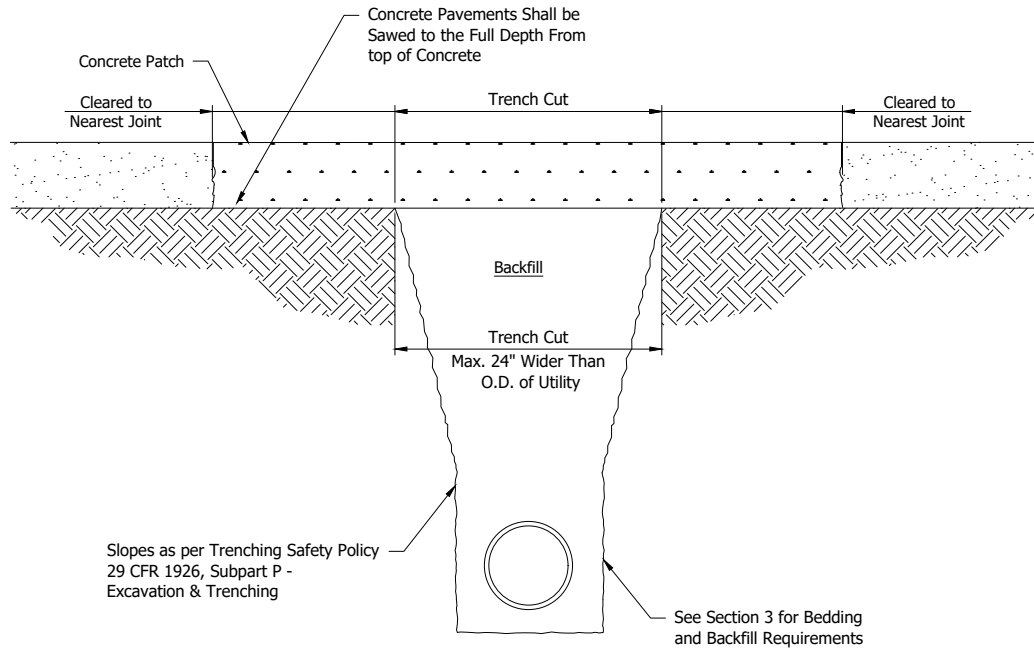
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**DETAILS - CONCRETE SPEED HUMP PLAN AND DETAILS**

STANDARD  
**2-46**

## SECTION 2 - STREETS AND PATHS



### CONCRETE PAVEMENT NOTES:

1. Depth of concrete patch shall be a minimum of 8" or the same depth as original pavement, whichever is greater.

### GENERAL NOTES:

1. Temporary Patch:  
If it is not possible, due to weather conditions, for the contractor to replace the pavement within 24 hours following backfilling of cut, a coarse aggregate base 8" thick and a cold asphaltic surface of 4" shall be applied and maintained as a temporary patch until permanent repairs can be made. When temperature falls below 50°F within 72 hour cure time, concrete to be used shall be 7 bag w/ 2% accelerator. Such temporary patches shall be replaced with permanent repairs no later than June 1 of the following year.
2. All utilities must be located prior to making pavement cut.

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Kara M. Boyles, Ph.D., P.E.      6/26/18  
Date

### REF STD SPEC SEC 2-6

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



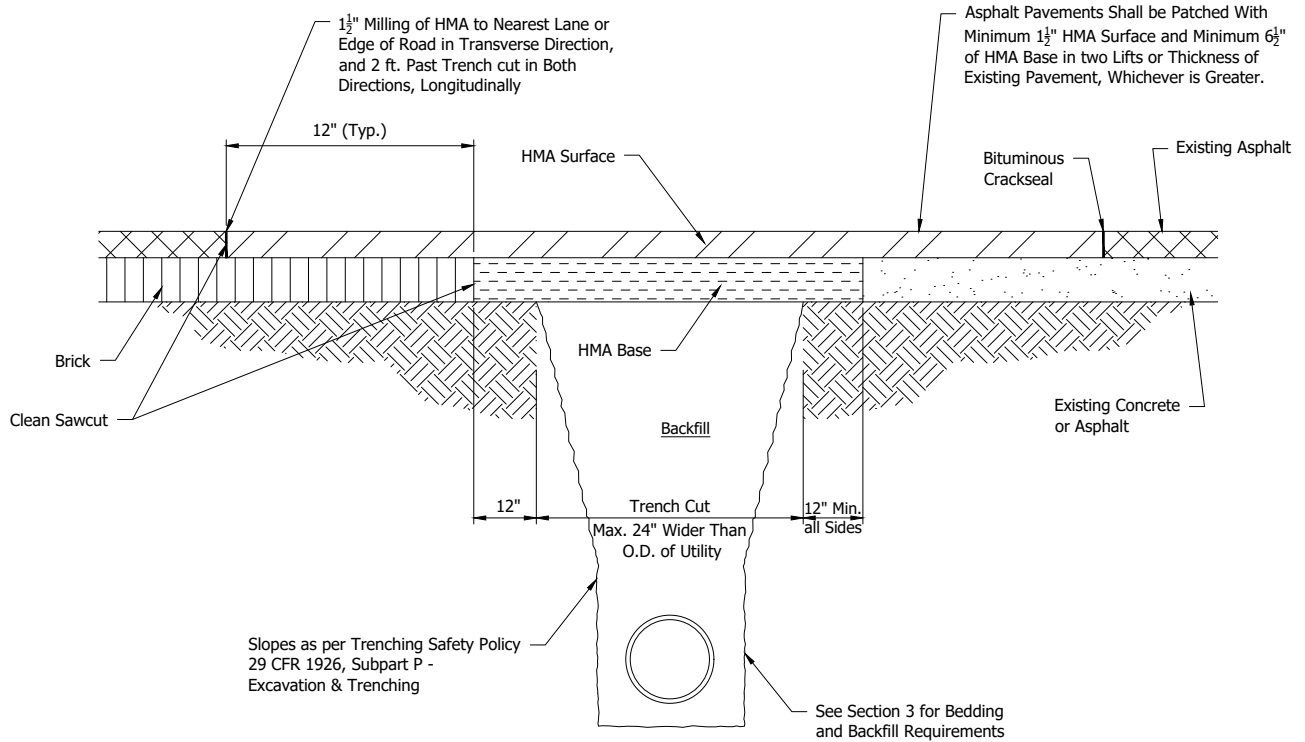
## CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

# PAVEMENT PATCHING AND UTILITY CUTS - CONCRETE

STANDARD  
**2-47**

## SECTION 2 - STREETS AND PATHS



### ASPHALT PAVEMENT NOTES:

1. Depth of asphalt patch shall be a minimum of 8" or the same depth as original pavement, whichever is greater.
2. A concrete patch on asphalt pavement may be allowed by the City Engineer if the road is scheduled to be rehabilitated in the near future or other like circumstances.

### GENERAL NOTES:

1. Temporary Patch:  
If it is not possible, due to weather conditions, for the contractor to replace the pavement within 24 hours following backfilling of cut, a coarse aggregate base 8" thick and a cold asphaltic surface of 4" shall be applied and maintained as a temporary patch until permanent repairs can be made. When temperature falls below 50°F within 72 hour cure time, concrete to be used shall be 7 bag w/ 2% accelerator. Such temporary patches shall be replaced with permanent repairs no later than May 1 of the following year.
2. All utilities must be located prior to making pavement cut.

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6/26/18  
Date

### REF STD SPEC SEC 2-6

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



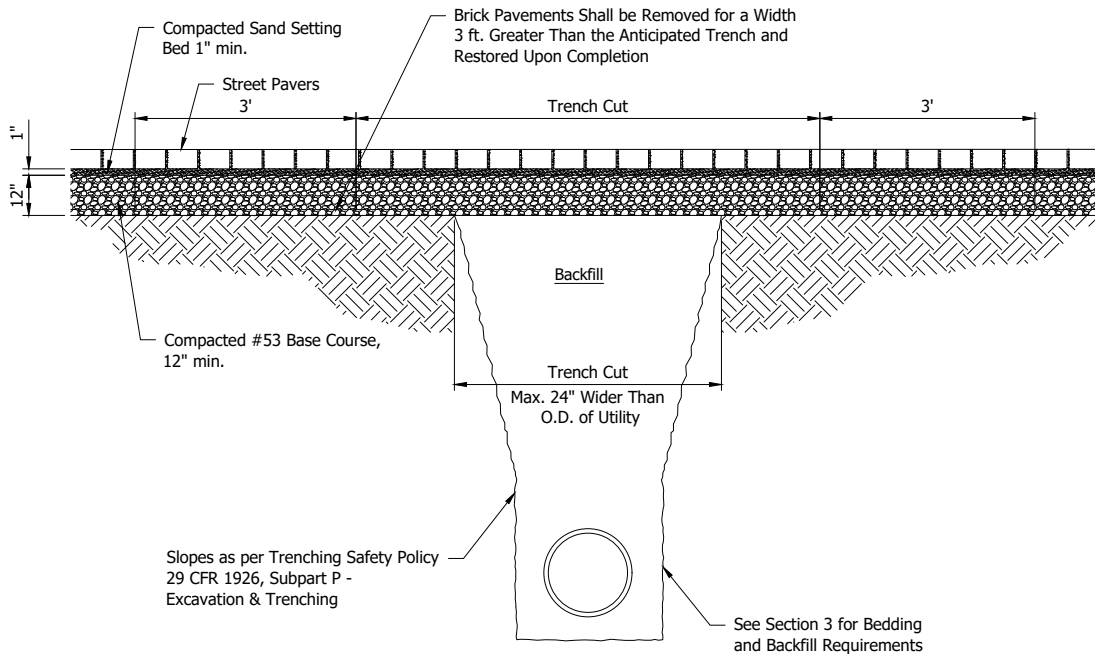
## CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

## PAVEMENT PATCHING AND UTILITY CUTS - ASPHALT

STANDARD  
2-48

## SECTION 2 - STREETS AND PATHS



### BRICK PAVER PREPARATION:

1. Remove organic, unstable or unconsolidated material from site. Verify conformance of subgrade preparation, compacted density and elevations to specified requirements.
2. Clean and re-use existing street brick pavers removed during site demolition. Remaining pavers not used will be returned to the city.

### GENERAL NOTES:

1. Temporary Patch:  
If it is not possible, due to weather conditions, for the contractor to replace the pavement within 24 hours following backfilling of cut, a coarse aggregate base 8" thick and a cold asphaltic surface of 4" shall be applied and maintained as a temporary patch until permanent repairs can be made. When temperature falls below 50°F within 72 hour cure time, concrete to be used shall be 7 bag w/ 2% accelerator. Such temporary patches shall be replaced with permanent repairs no later than May 1 of the following year.
2. All utilities must be located prior to making pavement cut.

*Kara M. Boyles*  
Kara M. Boyles, Ph.D., P.E.

6/26/18  
Date

### REF STD SPEC SEC 2-6

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



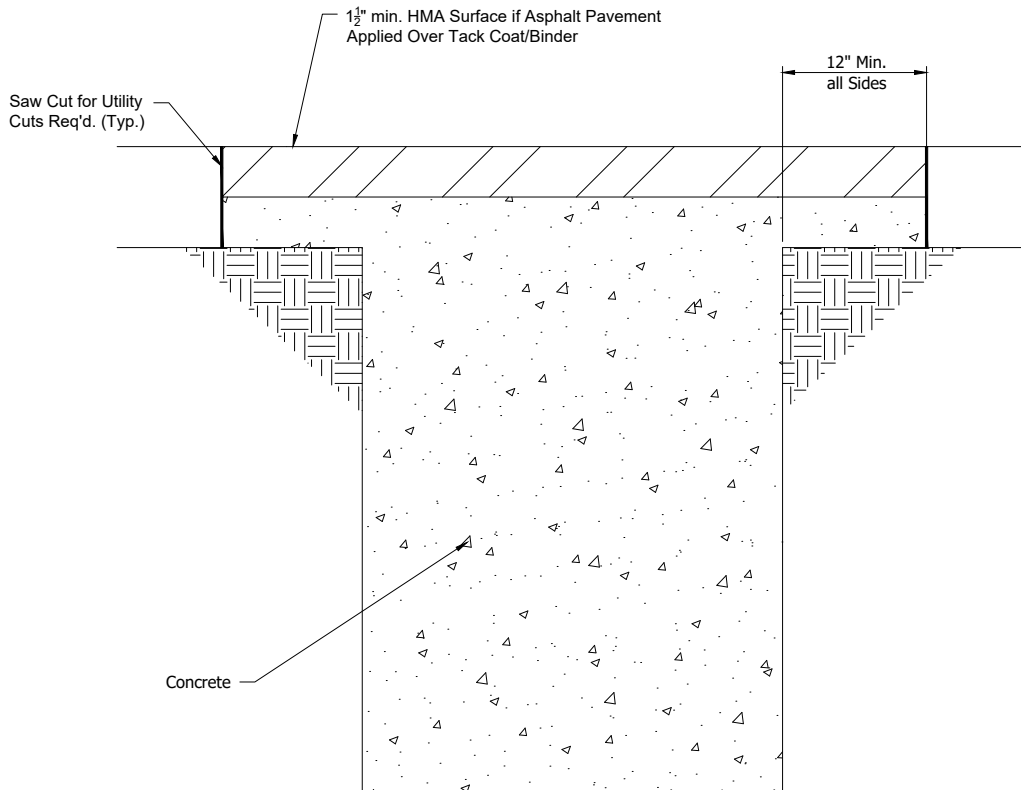
## CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
AND CONSTRUCTION

## PAVEMENT PATCHING AND UTILITY CUTS - BRICK

STANDARD  
2-49

**SECTION 2 - STREETS AND PATHS**



**POT HOLING NOTES:**

1. Maximum pot Hole Diameter of 2 ft., otherwise, asphalt or concrete pavement cut repairs apply.

**GENERAL NOTES:**

1. Temporary Patch:  
If it is not possible, due to weather conditions, for the contractor to replace the pavement within 24 hours following backfilling of cut, a coarse aggregate base 8" thick and a cold asphaltic surface of 4" shall be applied and maintained as a temporary patch until permanent repairs can be made. When temperature falls below 50°F within 72 hour cure time, concrete to be used shall be 7 bag w/ 2% accelerator. Such temporary patches shall be replaced with permanent repairs no later than May 1 of the following year.
2. All utilities must be located prior to making pavement cut.

Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

**REF STD SPEC SEC 2-6**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

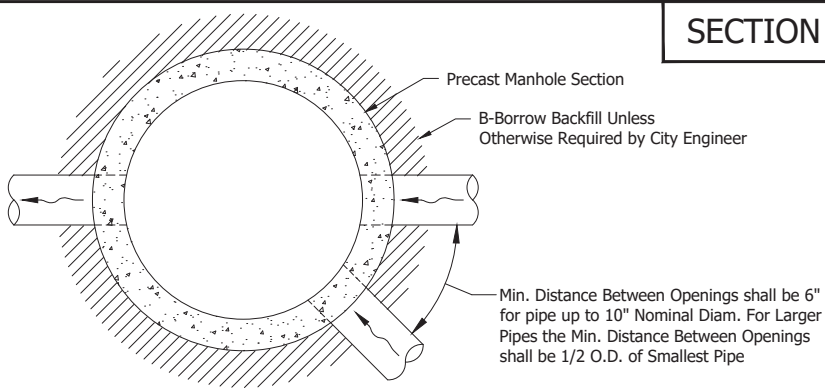
**PAVEMENT PATCHING AND UTILITY CUTS  
INVESTIGATIVE POT HOLE REPAIRS**

STANDARD  
**2-50**

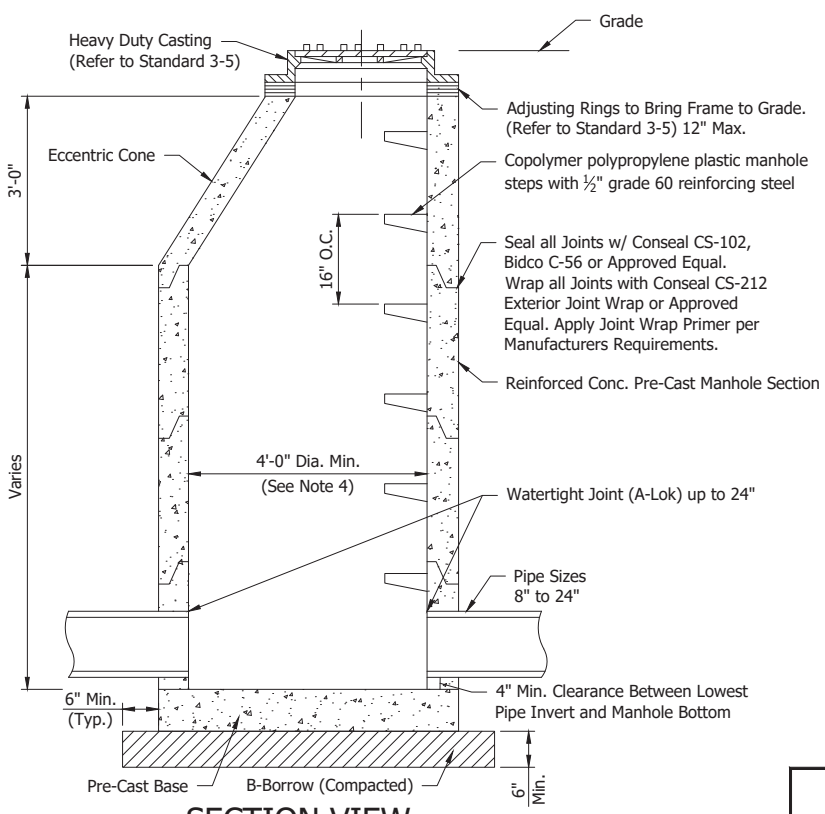
Item	Revision	Approved Date



**SECTION 3 - STORM**



**PLAN VIEW**



**SECTION VIEW**

**NOTES:**

1. All manholes shall be manufactured and installed in compliance with ASTM C-478.
2. All pipe connections shall be made with integral resilient fittings complying with ASTM C-923.
3. Refer to manhole size vs. pipe size chart on Standard 3-2.
4. The Design Engineer to be responsible for setting pipe invert elevations to account for minor losses through the manhole.

REF STD SPEC SEC 3-2, 3-3

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APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

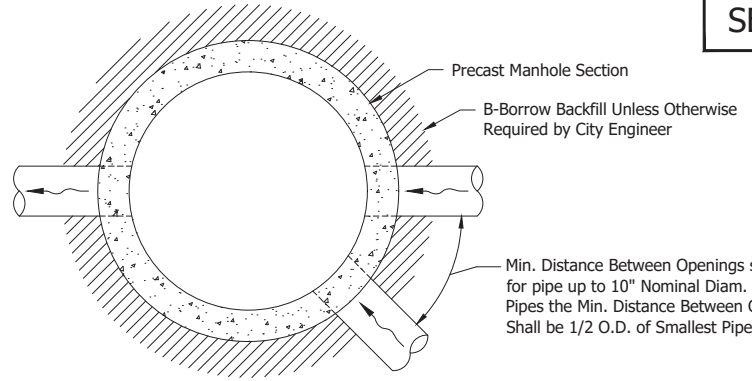
Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TYPE A MANHOLE - STANDARD PRE-CAST**

STANDARD  
**3-1**

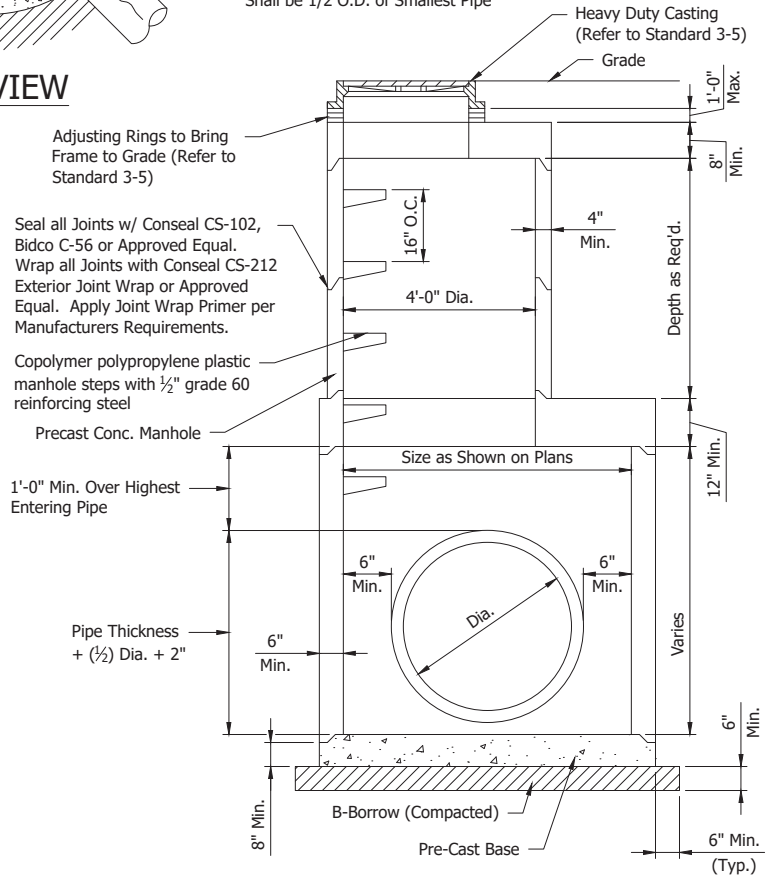
# SECTION 3 - STORM



**PLAN VIEW**

MANHOLE DIAMETER (INCHES)	MAX. NOMINAL PIPE SIZE (INCHES)	
	DIFFERENTIAL ANGLE OF INLET/OUTLET PIPES	
	135° - 225°	90° - 134° or 226° - 270° *
48	24	18
60	30	24
72	42	30
84	48**	36**

\* The Differential Angle of Inlet/Outlet Pipes Shall not be Less Than 90° or Greater Than 270°.  
 \*\* For Larger Pipe Sizes, Provide Pre-Cast Manhole Manufacturer's Sizing Documentation.



**SECTION VIEW**

**NOTES:**

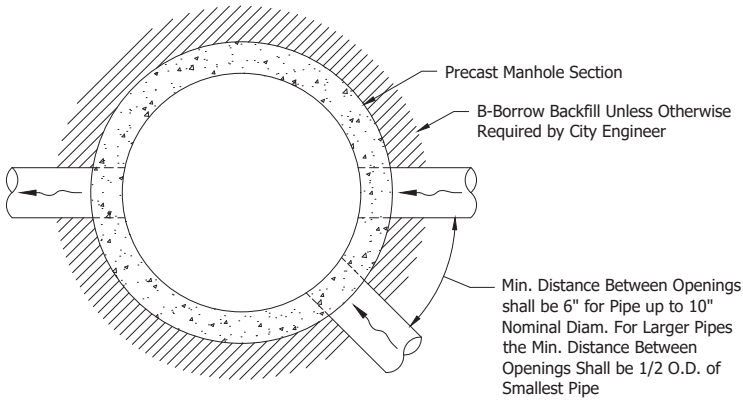
1. All manholes shall be manufactured and installed in compliance with ASTM C-478 (round str.) or ASTM C-913 (rectangle / square str.).
2. All pipe connections shall be made with integral resilient fittings complying with ASTM C-923.
3. The Design Engineer to be responsible for setting pipe invert elevations to account for minor losses through the manhole.

REF STD SPEC SEC 3-2, 3-3

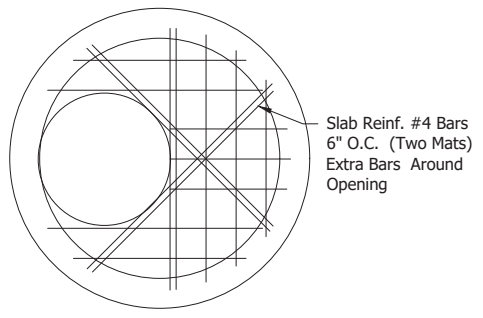
*Kara M. Boyles* 6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				<b>CITY OF SOUTH BEND</b>	
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION	
<b>TYPE B MANHOLE (ROUND OR RECTANGLE/SQUARE)</b>				STANDARD <b>3-2</b>	

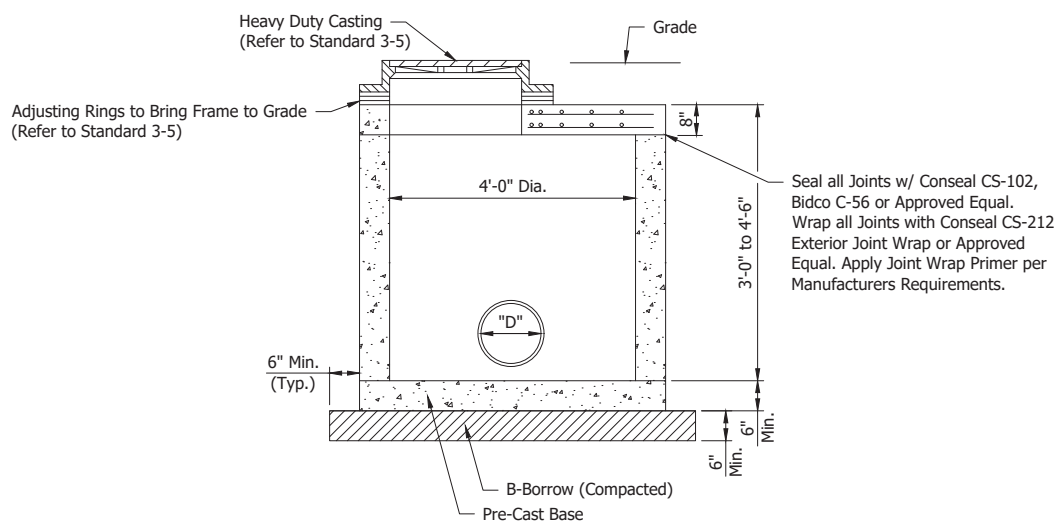
**SECTION 3 - STORM**



**PLAN VIEW**



**PLAN SLAB REINFORCING**



**SECTION VIEW**

**NOTES:**

1. All manholes shall be manufactured and installed in compliance with ASTM C-478.
2. All pipe connections shall be made with integral resilient fittings complying with ASTM C-923.
3. Refer to manhole size vs. pipe size chart on Standard 3-2.
4. The Design Engineer to be responsible for setting pipe invert elevations to account for minor losses through the manhole.

REF STD SPEC SEC 3-2, 3-3

KARA M. BOYLES  
REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER  
Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

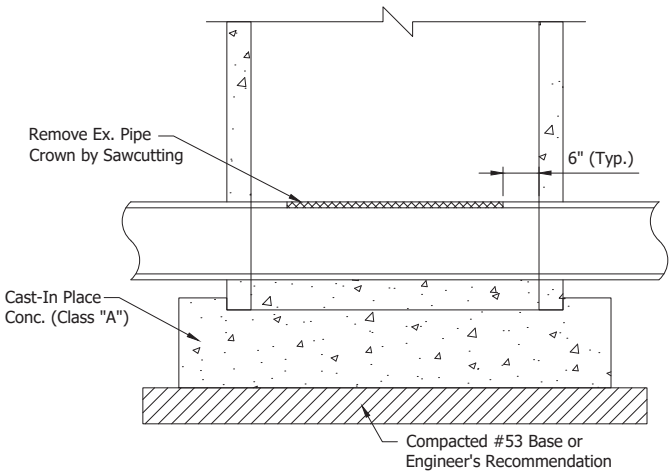
Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

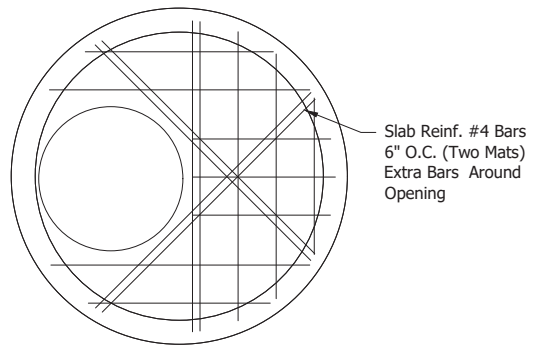
**STANDARD SHALLOW MANHOLE**

STANDARD  
**3-3**

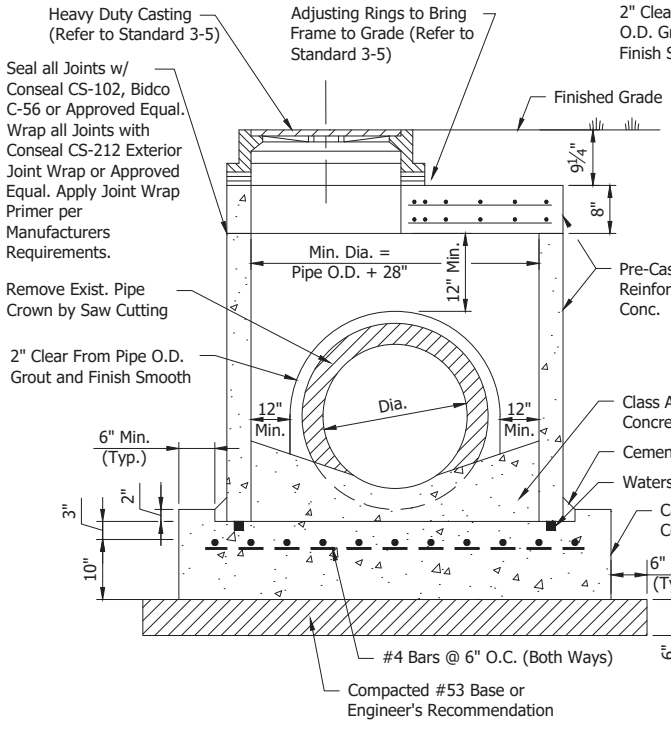
**SECTION 3 - STORM**



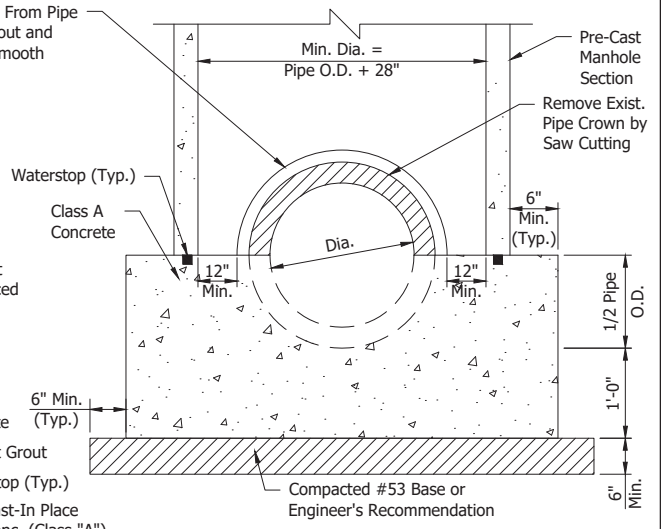
**SECTION VIEW**



**PLAN SLAB REINFORCING**



**END VIEW - TYPICAL**



**END VIEW - ALTERNATE**

**NOTES:**

- 1. All manholes shall be manufactured and installed in compliance with ASTM C-478.

REF STD SPEC SEC 3-2, 3-3

Kara M. Boyles, Ph.D., P.E.

6/26/18  
 Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
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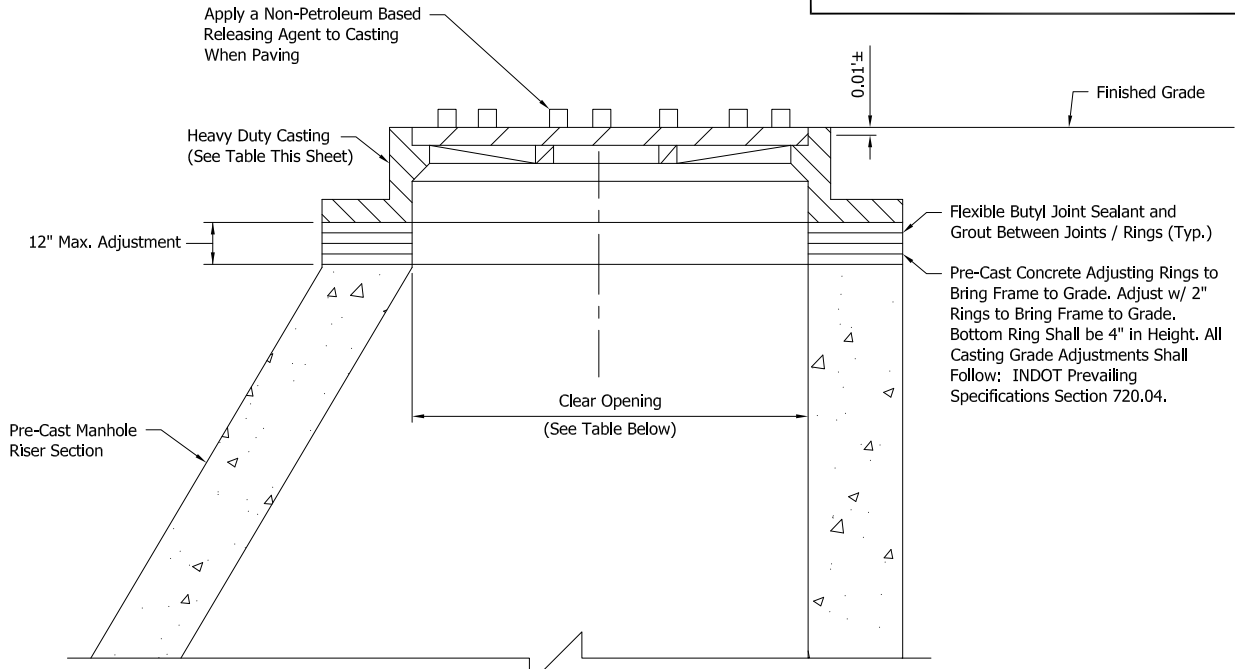
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN AND CONSTRUCTION

**SADDLE STRUCTURE**

STANDARD  
**3-4**

## SECTION 3 - STORM



**SECTION VIEW**

Structure	EJIW	Neenah	US Foundry	Clear Opening (in)
Manhole < 72-in Dia.	1040A	R-1642	USF 206-Ring & TL Cover-INDOT Type 4	24
Manhole >= 72-in Dia.	V-1600-5	R-1741-D	USF 679-AZ Cover	36
Inlet/Catch Basin (Comb. Curb & Gutter)	7010	R-3010	USF 5249-Frame 6029-Grate INDOT Type 8	24
Inlet/Catch Basin (Rolled Curb)	7490-M1	R-3501-N	USF 5385-6285	24
Inlet/Catch Basin (Comb. Curb & Gutter, 8")	7010	R-3010	USF 5249-Frame 6029-Grate INDOT Type 8	24
Type "E" Inlet	5400	R-3808-1	USF 4672-Frame 6262-Grate INDOT Type 12 (single)	24
Drywell (Grass)	1205	R-2561-A	USF 5695 Beehive Grate	24

**NOTES:**

1. Casting lid shall be solid with two (2) concealed pickholes for sanitary or combined sewer manholes and two (2) open pickholes for storm sewer manholes. The text SANITARY shall be cast into the lid for sanitary or combined sewer manholes. The text STORM shall be cast into lid for storm sewer manholes.
2. Other inlet castings may be acceptable as approved by the City Engineer.
3. All inlet grates shall be bicycle safe.
4. Environmental notice required on all storm sewer castings, e.g. "DUMP NO WASTE! DRAINS TO WATERWAY."
5. Inlet/catch basin castings are for use with combined curb and gutter or standard curb installations.
6. All castings shall be heavy duty (H-20 rated).
7. Where directed by the City, casting lids shall bolt down. Bolts shall be provided with an anti-seizing agent.
8. For casting adjustment of existing brick manholes, remove old bricks down to a solid base. Then level with mortar and build up with pre-cast adjusting rings.
9. When manholes are located in gravel or treelawn areas, provide a 5 foot diameter concrete collar, centered on the casting. Concrete shall be Class "A".

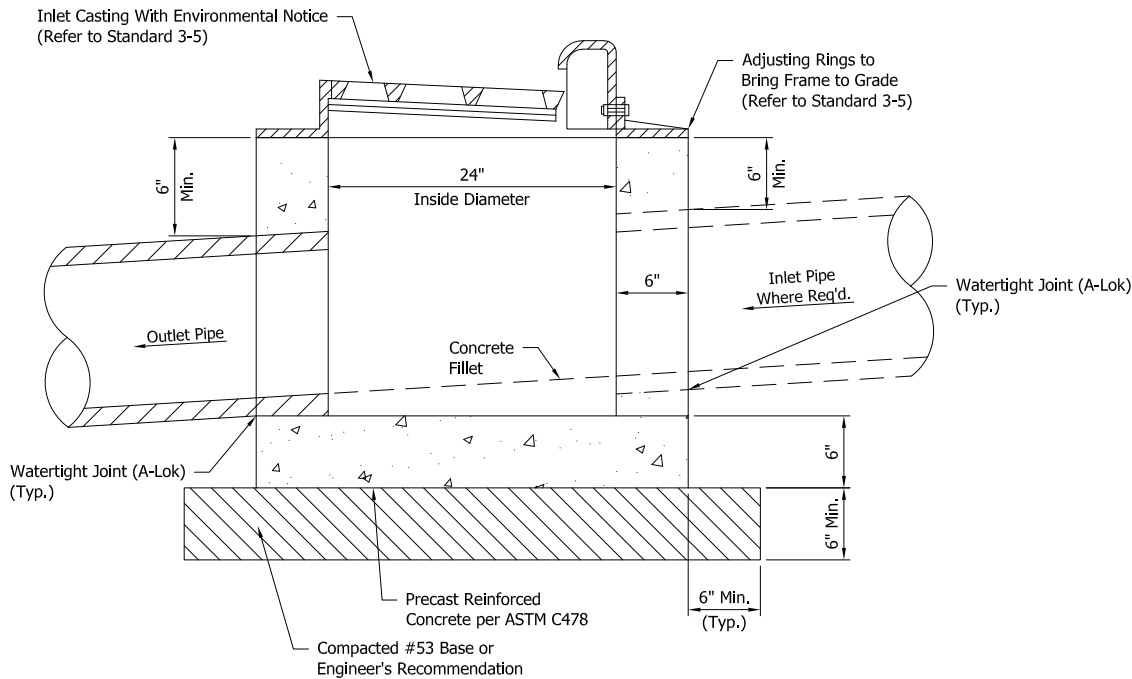
KARA M. BOYLES  
REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

Kara M. Boyles, Ph.D., P.E.      6/26/18  
Date

**REF STD SPEC SEC 3-2, 3-3**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				<b>CITY OF SOUTH BEND</b>
Item	Revision	Approved Date		
1	US Foundry Addition	10/26/2021		STANDARD <b>3-5</b>
<b>TYPICAL STRUCTURE CASTINGS &amp; ADJUSTING RINGS</b>				

**SECTION 3 - STORM**



**Notes:**

1. Hydraulic calculations for high volume / major thoroughfare roadways may require the use of INDOT standard inlets, Type J or M, with Type 10 (Neenah R-3287-10V USF 5239) vaned grates or standard inlets, Type B or C with Type 15 (Neenah R-3287-15V or USF 5137-RI) vaned grates as approved by City Engineer.
2. Inlet and grate shall match installed curb and gutter width.
3. Flexible butyl joint sealant and grout shall be utilized to seal each joint between frame and manhole casting or pre-cast leveling rings (refer to Standard 3-5).

*Kara M. Boyles*      6/26/18  
Kara M. Boyles, Ph.D., P.E.      Date

**REF STD SPEC SEC 3-2, 3-3**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018		
Item	Revision	Approved Date
1	US Foundry Addition	10/26/2021

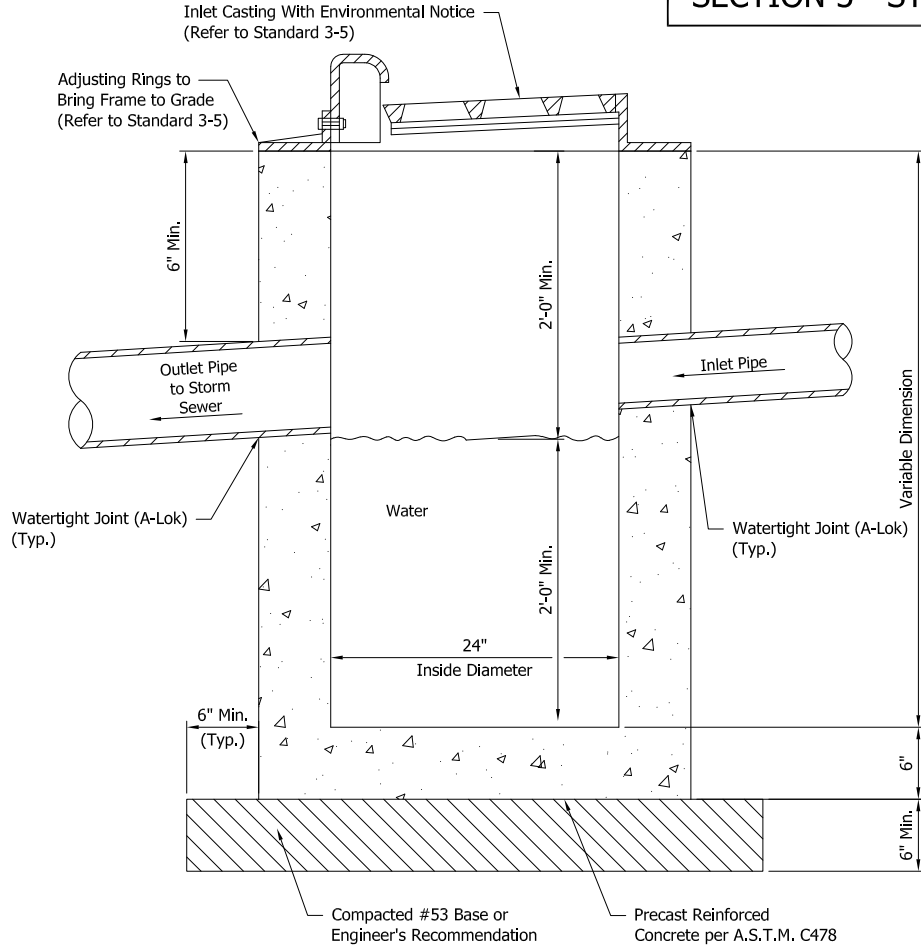


**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

<b>STANDARD INLET</b>	STANDARD <b>3-6</b>
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**SECTION 3 - STORM**



**Notes:**

1. Hydraulic calculations for high volume / major thoroughfare roadways may require the use of INDOT standard inlets, Type J or M, with Type 10 (Neenah R-3287-10V or USF 5239) vaned grates or standard inlets, Type B or C with Type 15 (Neenah R-3287-15V or USF 5137-RI) vaned grates as approved by City Engineer.
2. Inlet and grate shall match installed curb and gutter width.
3. Flexible butyl joint sealant and grout shall be utilized to seal each joint between frame and manhole casting or pre-cast leveling rings (refer to Standard 3-5).

REF STD SPEC SEC 3-2, 3-3

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018

Item	Revision	Approved Date
1	US Foundry Addition	10/26/2021



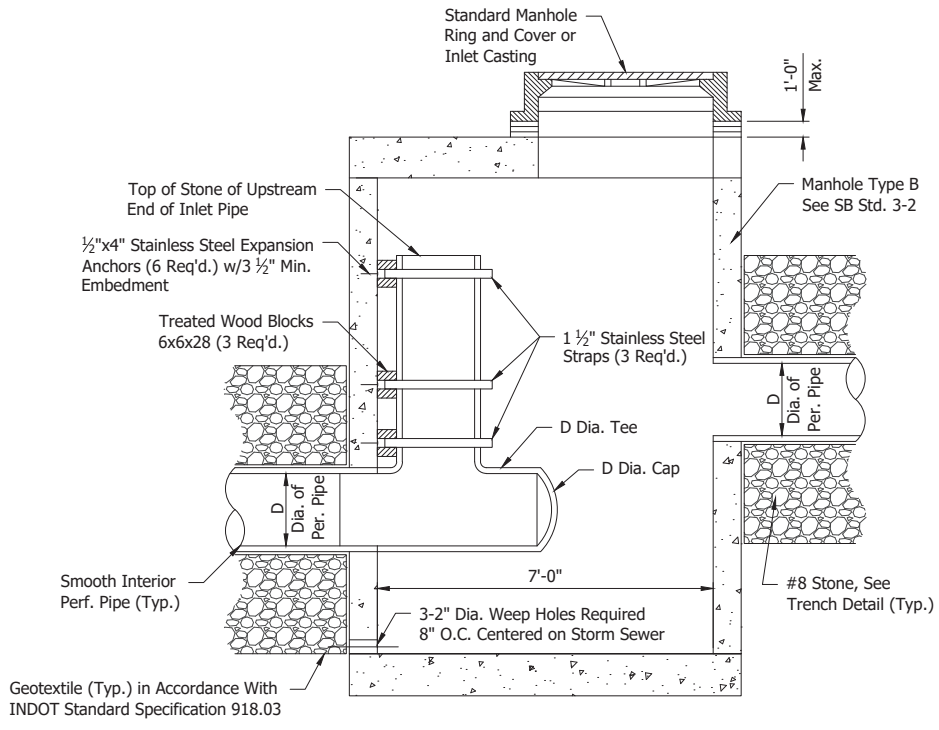
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

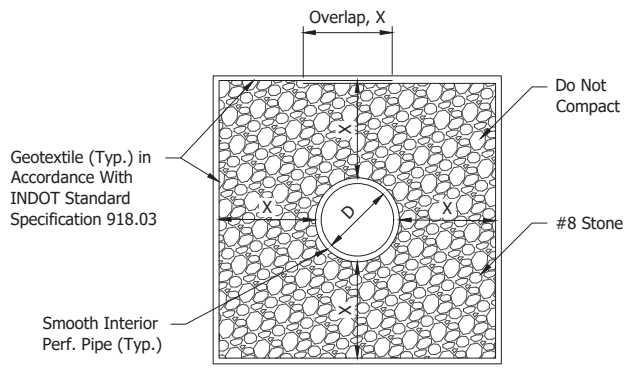
**CATCH BASIN**

STANDARD  
**3-7**

**SECTION 3 - STORM**



**MODIFIED TYPE 'B' MANHOLE**



D, Pipe Size (in)	X (in)
12 (Min.)	12
15	15
18	18
24	24

**TRENCH DETAIL**

**NOTES:**

1. This system is not approved for installation under street pavement.
2. Perforated pipes are not permitted within wellhead protection areas.
3. Stone size to be dependent upon design requirements.
4. Do not compact walls of trench.

REF STD SPEC SEC 3-2, 3-3

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

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**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN AND CONSTRUCTION

Item	Revision	Approved Date

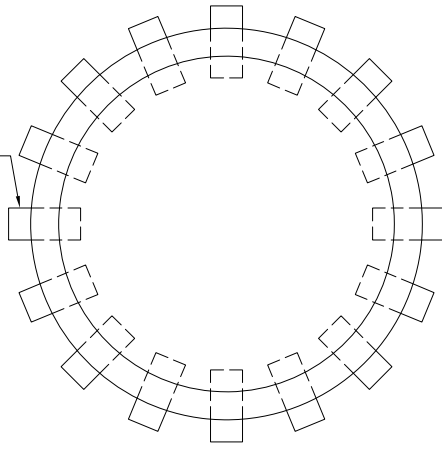
**PERFORATED PIPE DETAIL**

STANDARD  
**3-8**



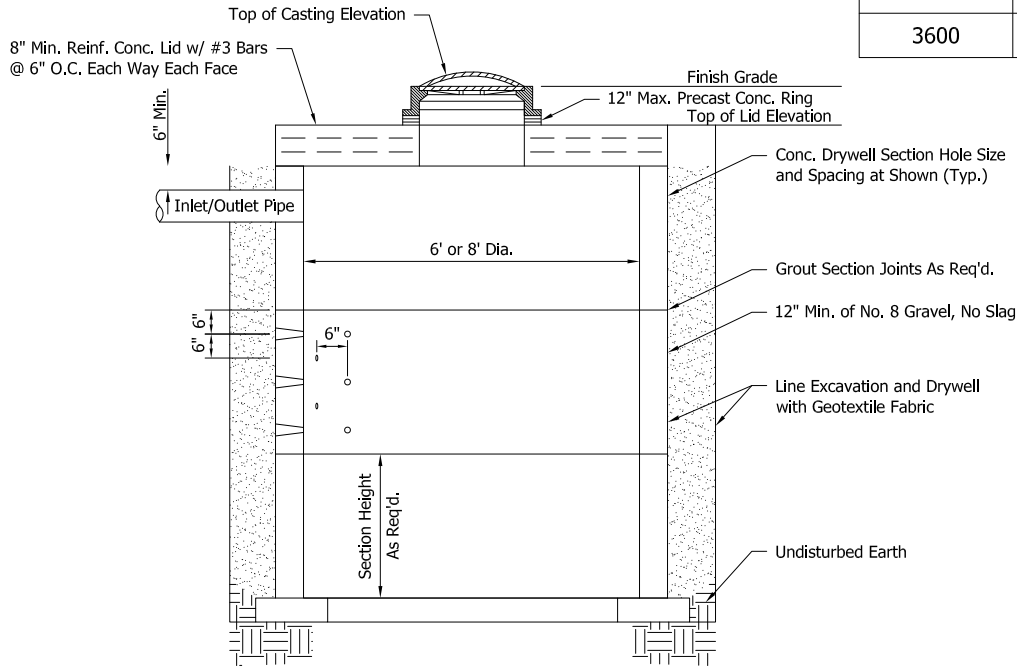
**SECTION 3 - STORM**

6"x8"x16" Solid Concrete Block Laid Radially or Concrete Ring 6" Thick x 12" Wide



**PLAN**

Size (gallon)	Diameter (ft)	Height (in)
600	6	30
900	6	48
1200	6	66
1200	8	40
1500	6	84
1800	6	102
1800	8	60
2500	8	84
3000	8	104
3600	8	124



**SECTION**

**NOTES:**

1. A layer of geotextile fabric, Propex 4545 by Amoco or approved equal shall be placed between the drywell and the No. 8 aggregate and shall line the excavation. Any fabric joints shall have an overlap of 18". The No. 8 aggregate, the geotechnical fabric layers and the frame and grate to be included in the cost of the drywell.
2. To ensure proper infiltration into the soil, after installation of the drywells and backfilling with the No. 8 aggregate, the contractor will surcharge each drywell with a minimum of 3,000 gallons of water prior to any pavement placement. Surcharge water shall be applied at a rate that will completely fill the drywell.
3. Where no casting is req'd. provide concrete removable lid for the 2' dia. opening.
4. In grass, an open grate casting shall be Neenah R-2561-A, USF 5695 Beehive Grate, or approved equal.
5. In pavement, an open grate casting shall be Neenah R-2390, EJIW 1205, or approved equal.
6. In curb, see table on Standard 3-5.
7. Drywells are not permitted within wellhead protection areas.

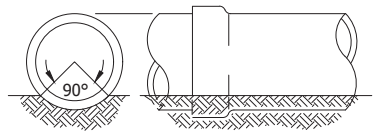
**REF STD SPEC SEC 3-2, 3-3**

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

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1	US Foundry Addition	10/26/2021

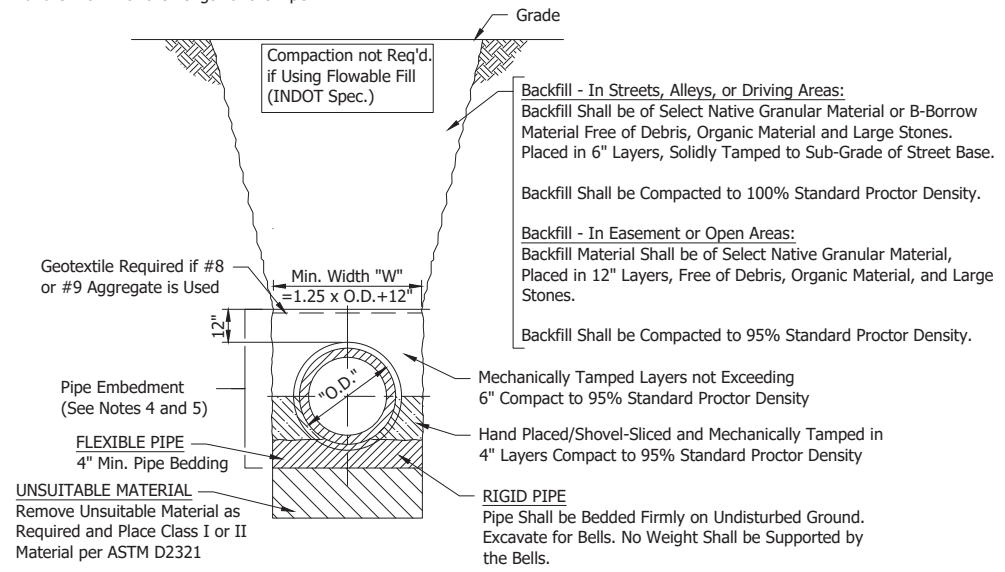
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN AND CONSTRUCTION

**SECTION 3 - STORM**



The Lower 90° Arc of the Barrel of the Pipe Should be in Firm Contact With Undisturbed Earth. The Bedding Shall be Continuous and Uniform for the Length of the Pipe.

Small Excavations Should be Made for the Bells. No Weight Shall be Supported by the Bells. These Should be no Larger Than Necessary to Clear the Bell.



**PIPE BEDDING DETAIL**

**NOTES:**

1. These trench and bedding details are for pipe structural requirements only. The contractor is solely responsible for safety of operations. The contractor shall slope trench walls, provide protective work boxes, and/or shore and brace all excavations as the contractor determines necessary for safety of operations, and in conformance to IOSHA Regulation 29 C.F.R. 1926, Subpart P for Trench Safety Systems.
2. All PVC pipe for sanitary sewers shall be installed in accordance with ASTM D2321.
3. There shall be no rocks or stones greater than 2" in any dimension within 6" of the pipe wall or bell.
4. Flexible Pipe: Embedment materials for bedding, haunching and initial backfill shall comply with the requirements of ASTM D2321, Classes I (INDOT #8 or #9), II (INDOT #53, #73, or B-Borrow), or III and shall be compacted as noted. Removable flowable backfill shall be placed for all areas within 5' of pavement to 12" above pipe crown. Above this limit, structure backfill shall be used. Refer to pipe manufacturers recommended bedding and embedment material class type requirements.
5. Rigid Pipe: Embedment materials for bedding, haunching and initial backfill shall comply with the requirements of ASTM C12 (VCP) Classes A, B, C or crushed stone (INDOT #8, #9 or B-Borrow) and shall be compacted as noted. Removable flowable backfill shall be placed for all areas within 5' of pavement to 12" above pipe crown. Above this limit, structure backfill shall be used.
6. Final backfill shall not contain debris, organic material, frozen material, unstable material or boulders or stones greater than 2" in any dimension. Flowable fill optional.
7. The placement and compaction of backfill shall not cause displacement of the pipe.
8. For multiple pipes in same trench:
  - a. Place bedding to Spring Line of first pipe across entire trench width.
  - b. Placement of next pipe, re-excavate trench as needed. Then place bedding as noted above.
  - c. For additional pipes repeat as required.
9. Refer to [INDOT Standard Specification](#) Section 213 for flowable fill (removable) requirements.

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**REF STD SPEC SEC 3-3**

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Item	Revision	Approved Date

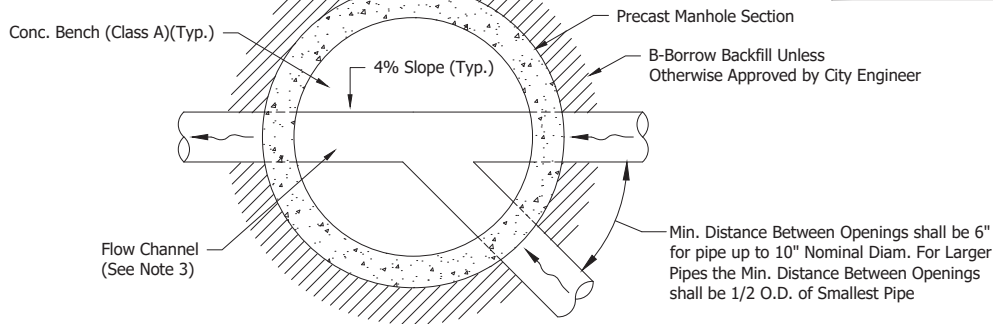


**CITY OF SOUTH BEND**

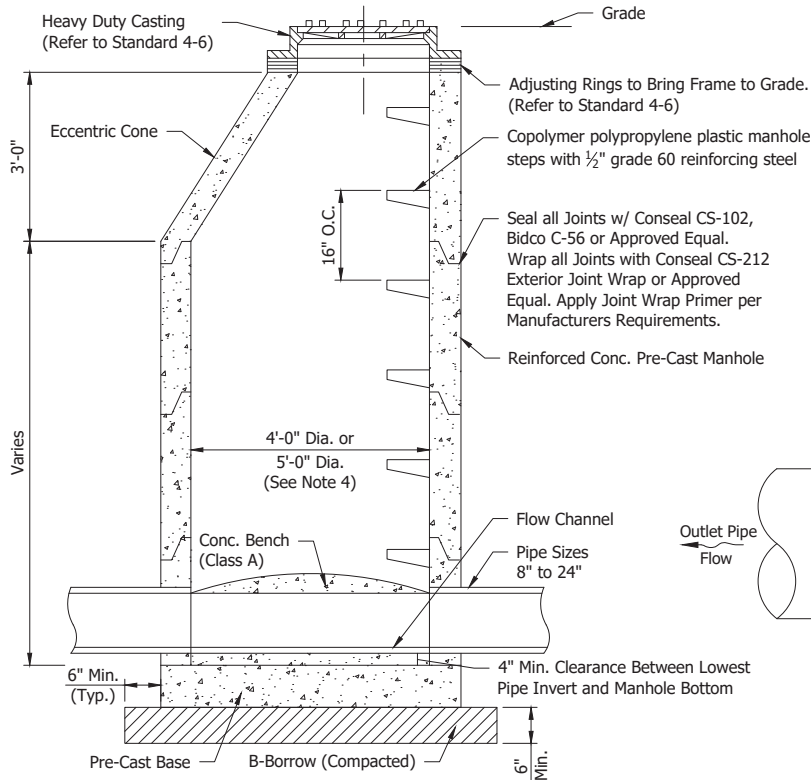
STANDARDS FOR DESIGN  
AND CONSTRUCTION

<b>PIPE BEDDING DETAIL</b>	STANDARD <b>3-10</b>
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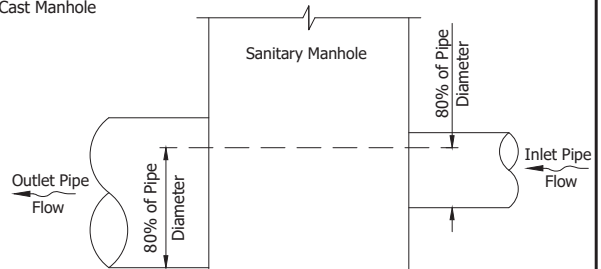
# SECTION 4 - SANITARY



**PLAN VIEW**



**SECTION VIEW**



**DETAIL A**

**NOTES:**

1. All manholes shall be manufactured and installed in compliance with ASTM C-478.
2. All pipe connections shall be made with integral resilient fittings complying with ASTM C-923.
3. Flow channel shall conform to the shape of the connecting sanitary sewer and be made through the bottom surface of the manhole. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer.
4. Refer to manhole size vs. pipe size chart on Standard 4-2.
5. Completed manholes shall be tested with negative air pressure (vacuum) in accordance with ASTM C-1244-93.
6. At manholes where a smaller diameter sewer joins a larger diameter sewer, the invert of the larger sewer shall be lowered such that the elevation at 80% of the pipe diameter of both sewers is matched (Refer to Detail A above).
7. The Design Engineer to be responsible for setting pipe invert elevations to account for minor losses through the manhole.

REF STD SPEC SEC 4-2, 4-3 and 4-4

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**CITY OF SOUTH BEND**

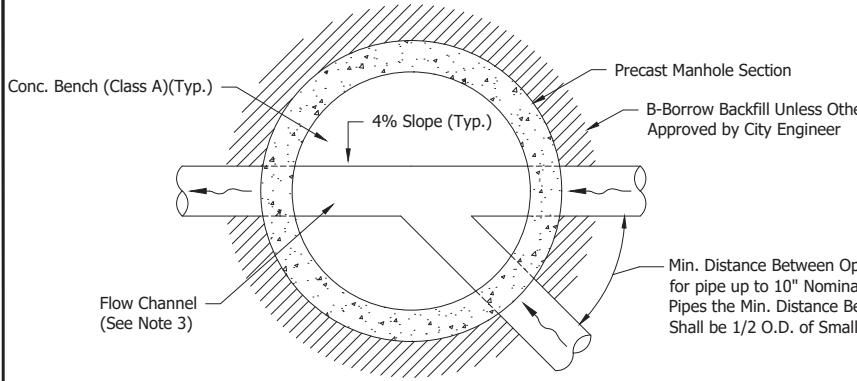
STANDARDS FOR DESIGN  
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Item	Revision	Approved Date

**TYPE A MANHOLE - STANDARD PRE-CAST**

STANDARD  
**4-1**

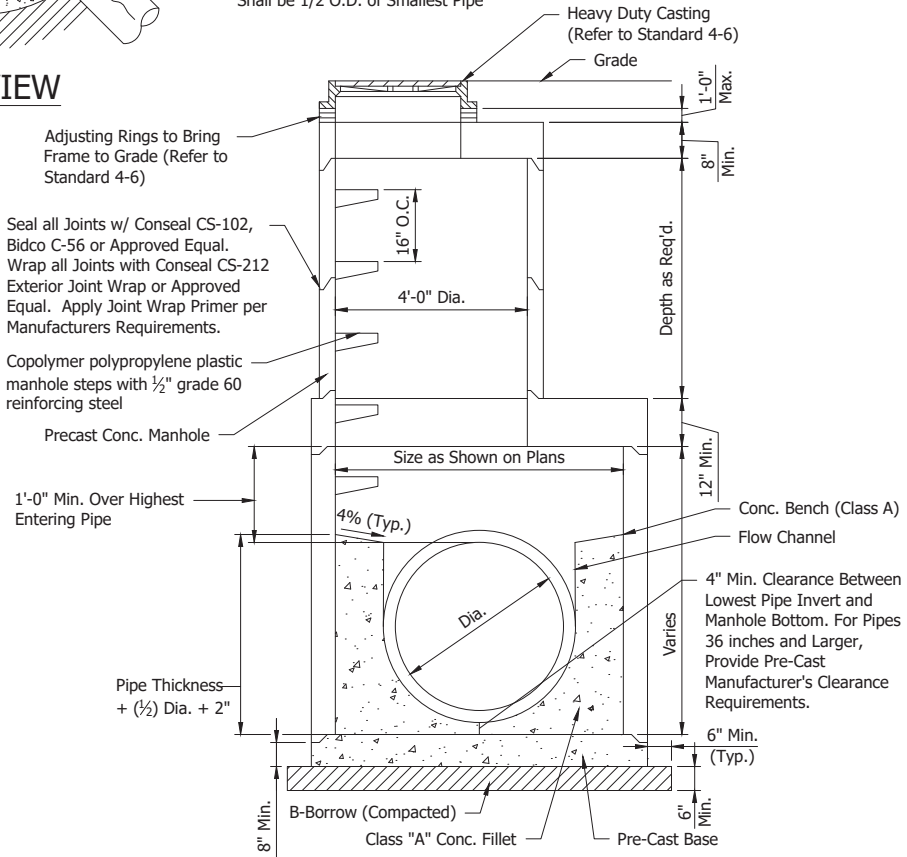
# SECTION 4 - SANITARY



**PLAN VIEW**

MANHOLE DIAMETER (INCHES)	MAX. NOMINAL PIPE SIZE (INCHES)	
	DIFFERENTIAL ANGLE OF INLET/OUTLET PIPES	
	135° - 225°	90° - 134° or 226° - 270° *
48	24	18
60	30	24
72	42	30
84	48**	36**

\* The Differential Angle of Inlet/Outlet Pipes Shall not be Less Than 90° or Greater Than 270°.  
 \*\* For Larger Pipe Sizes, Provide Pre-Cast Manhole Manufacturer's Sizing Documentation.



**SECTION VIEW**

**NOTES:**

- All manholes shall be manufactured and installed in compliance with ASTM C-478 (round str.) or ASTM C-913 (rectangle / square str.).
- All pipe connections shall be made with integral resilient fittings complying with ASTM C-923.
- Flow channel shall conform to the shape of the connecting sanitary sewer and be made through the bottom surface of the manhole. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer.
- Flow channel / invert shall be field cast.
- Completed manholes shall be tested with negative air pressure (vacuum) in accordance with ASTM C-1244-93.
- At manholes where a smaller diameter sewer joins a larger diameter sewer, the invert of the larger sewer shall be lowered such that the elevation at 80% of the pipe diameter of both sewers is matched (Refer to Detail A Standard 4-1).
- The Design Engineer to be responsible for setting pipe invert elevations to account for minor losses through the manhole.

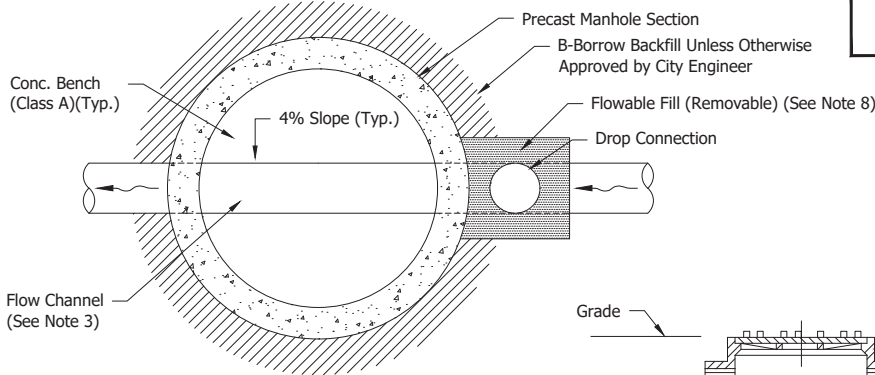
REF STD SPEC SEC 4-2, 4-3 and 4-4

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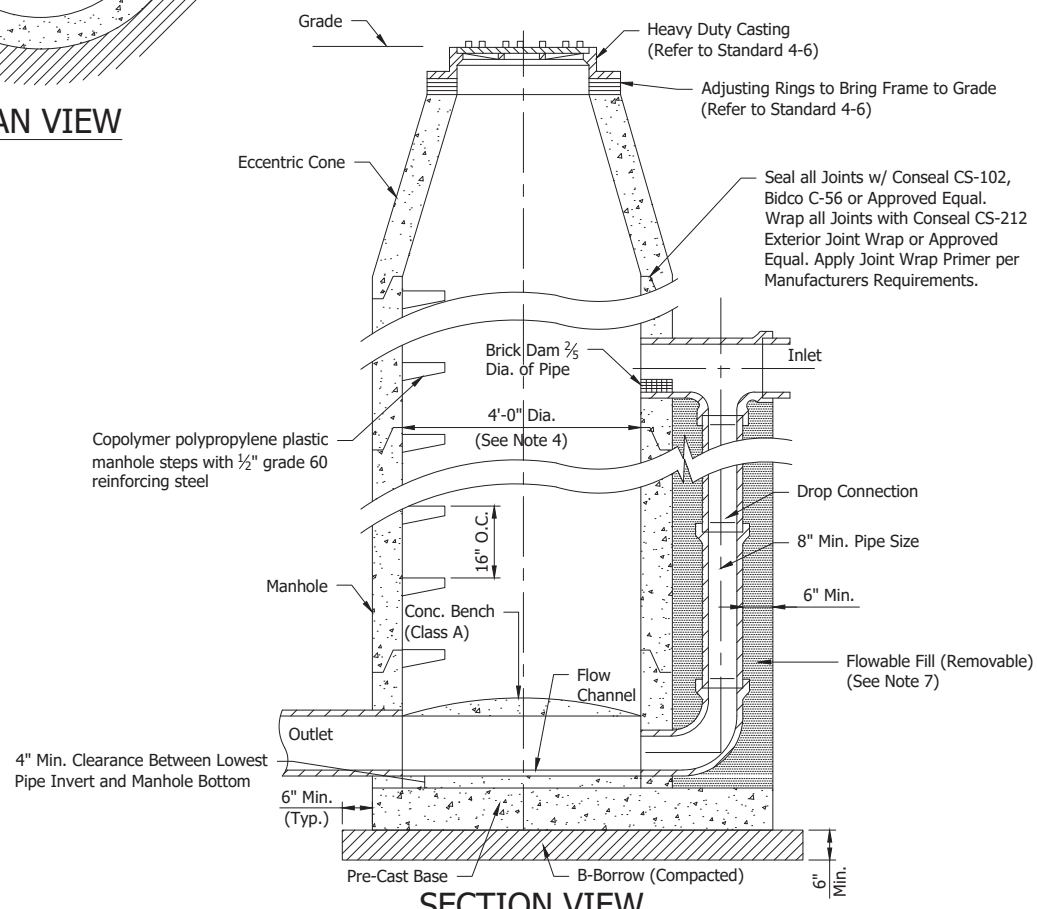
Kara M. Boyles, Ph.D., P.E.      6/26/18  
 Date

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Item	Revision	Approved Date	
			<b>STANDARDS FOR DESIGN AND CONSTRUCTION</b>
<b>TYPE B MANHOLE (ROUND OR RECTANGLE/SQUARE)</b>			<b>STANDARD 4-2</b>

# SECTION 4 - SANITARY



**PLAN VIEW**



**SECTION VIEW**

**NOTES:**

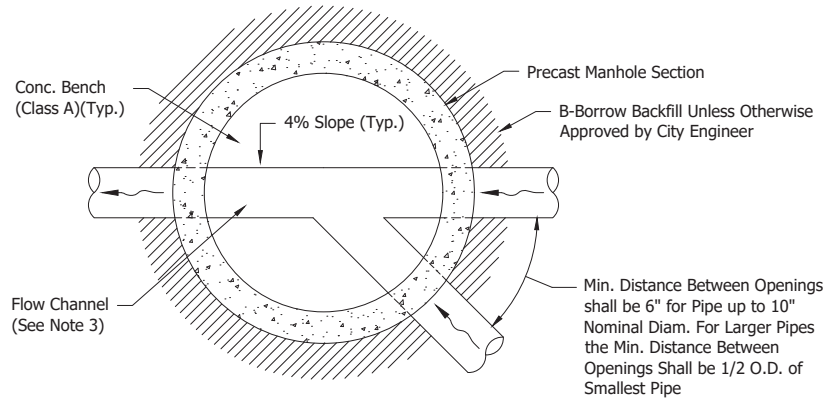
1. All manholes shall be manufactured and installed in compliance with ASTM C-478.
2. All pipe connections shall be made with integral resilient fittings complying with ASTM C-923.
3. Flow channel shall conform to the shape of the connecting sanitary sewer and be made through the bottom surface of the manhole. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer.
4. Refer to manhole size vs. pipe size chart on Standard 4-2.
5. Completed manholes shall be tested with negative air pressure (vacuum) in accordance with ASTM C-1244-93.
6. The Design Engineer to be responsible for setting pipe invert elevations to account for minor losses through the manhole.
7. Refer to [INDOT Standard Specification](#) Section 213 for removable flowable fill requirements.

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

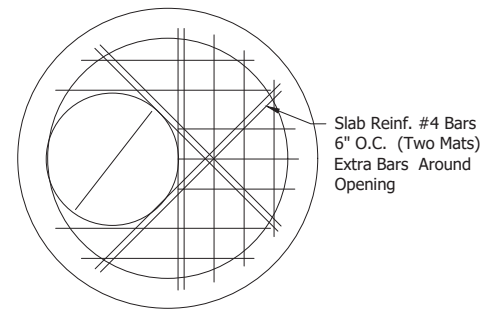
REF STD SPEC SEC 4-2, 4-3 and 4-4

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				<b>CITY OF SOUTH BEND</b>
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION
<b>STANDARD DROP MANHOLE</b>				STANDARD <b>4-3</b>

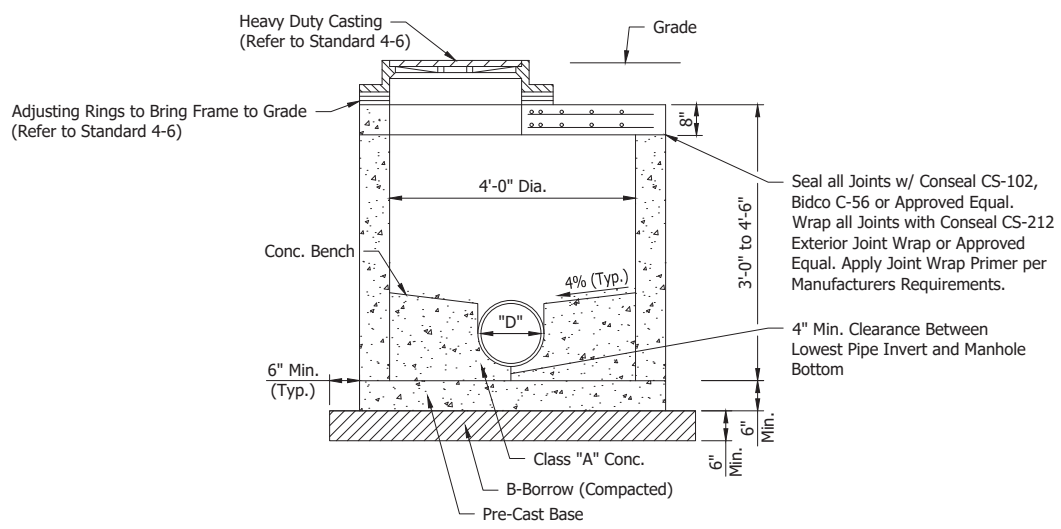
**SECTION 4 - SANITARY**



**PLAN VIEW**



**PLAN SLAB REINFORCING**



**SECTION VIEW**

**NOTES:**

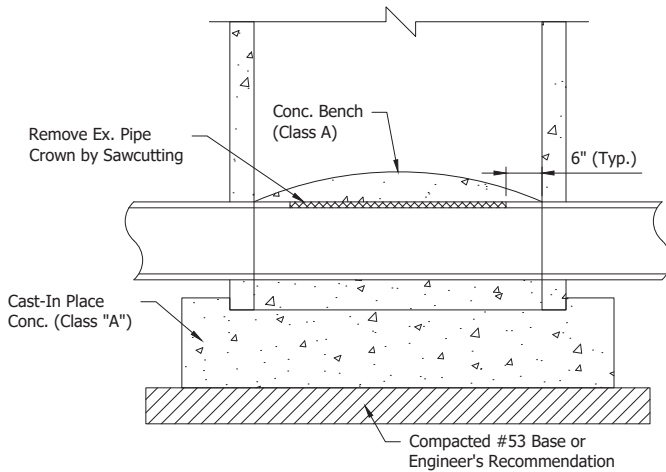
1. All manholes shall be manufactured and installed in compliance with ASTM C-478.
2. All pipe connections shall be made with integral resilient fittings complying with ASTM C-923.
3. Flow channel shall conform to the shape of the connecting sanitary sewer and be made through the bottom surface of the manhole. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer.
4. Refer to manhole size vs. pipe size chart on Standard 4-2.
5. Completed manholes shall be tested with negative air pressure (vacuum) in accordance with ASTM C-1244-93.
6. At manholes where a smaller diameter sewer joins a larger diameter sewer, the invert of the larger sewer shall be lowered such that the elevation at 80% of the pipe diameter of both sewers is matched (Refer to Detail A Standard 4-1).
7. The Design Engineer to be responsible for setting pipe invert elevations to account for minor losses through the manhole.

REF STD SPEC SEC 4-2, 4-3 and 4-4

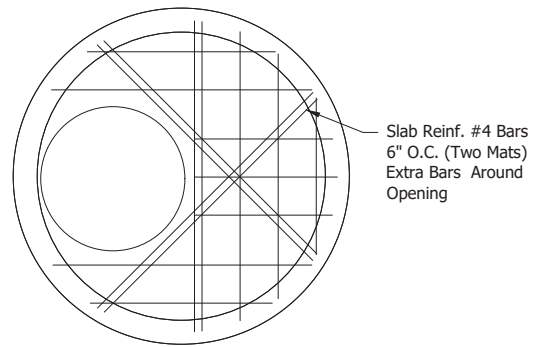
Kara M. Boyles, Ph.D., P.E. 6/26/18 Date

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Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION	
STANDARD SHALLOW MANHOLE				STANDARD 4-4	

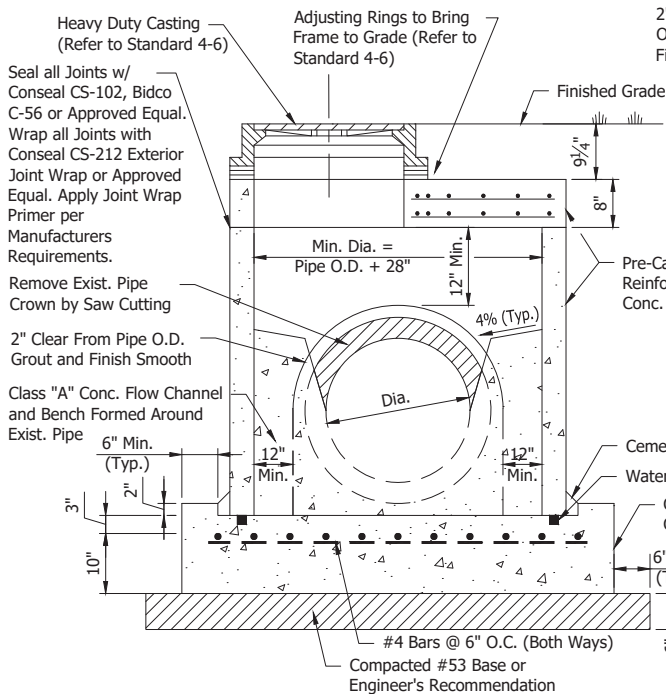
**SECTION 4 - SANITARY**



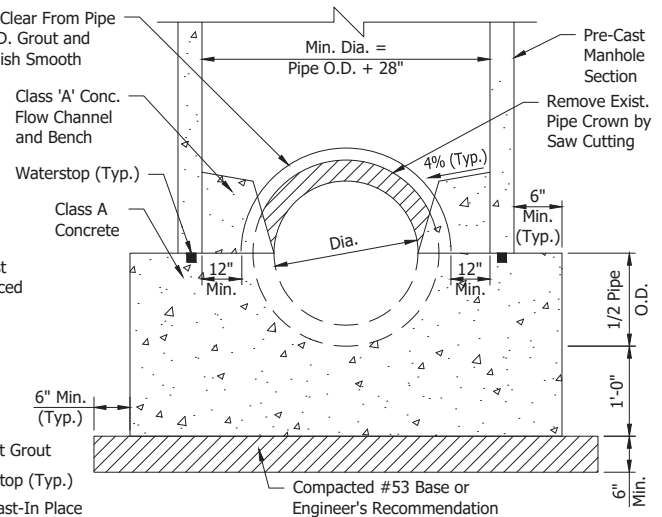
**SECTION VIEW**



**PLAN SLAB REINFORCING**



**END VIEW - TYPICAL**



**END VIEW - ALTERNATE**

**NOTES:**

1. All manholes shall be manufactured and installed in compliance with ASTM C-478.
2. Flow channel shall conform to the shape of the connecting sanitary sewer and be made through the bottom surface of the manhole. The channel walls shall be formed or shaped to the full height of the crown of the outlet sewer.
3. Completed manholes shall be tested with negative air pressure (vacuum) in accordance with ASTM C-1244-93.

**REF STD SPEC SEC 4-2, 4-3 and 4-4**

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

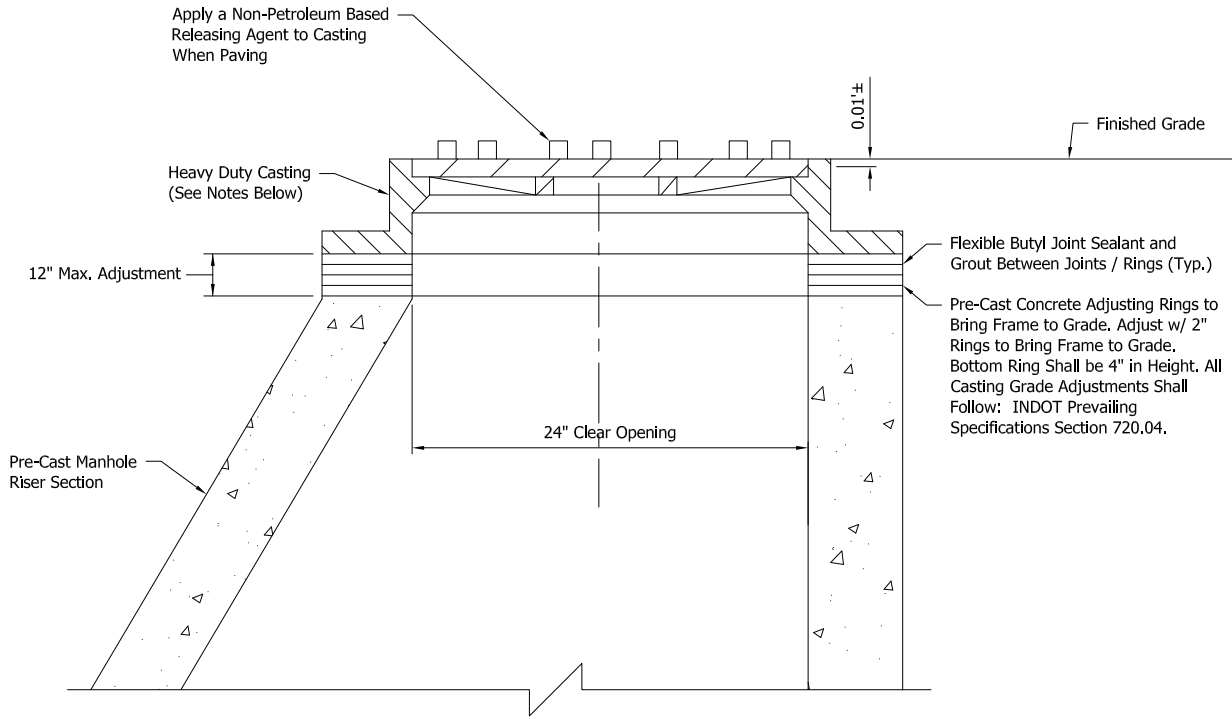
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**SADDLE STRUCTURE**

STANDARD  
**4-5**

**SECTION 4 - SANITARY**



**SECTION VIEW**

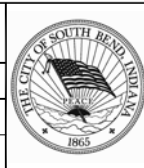
**NOTES:**

1. Manhole castings shall be Heavy Duty (H-20 rated). Castings shall be East Jordan Iron Works 1040A, Neenah R-1642, or US Foundry 206 Ring & TL Cover.
2. Casting lid shall be solid with two (2) concealed pickholes for sanitary or combined sewer manholes and two (2) open pickholes for storm sewer manholes. The text SANITARY shall be cast into the lid for sanitary or combined sewer manholes. The text STORM shall be cast into lid for storm sewer manholes.
3. Where directed by the City, casting lids shall bolt down. Bolts shall be provided with an anti-seizing agent.
4. For manholes 72-inch diameter and larger, the clear opening shall be 36-inch diameter. The casting shall be Heavy Duty (H-20 Rated). Casting shall be East Jordan Iron Works V-1600-5 or Neenah R-1741-D.
5. For casting adjustment of existing brick manholes, remove old bricks down to a solid base. Then level with mortar and build up with pre-cast adjusting rings.
6. When manholes are located in gravel or treelawn areas, provide a 5 foot diameter concrete collar, centered on the casting. Concrete shall be Class "A".

Kara M. Boyles, PH.D., P.E. 6/26/18  
Date

**REF STD SPEC SEC 4-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018		
Item	Revision	Approved Date
1	US Foundry Addition	10/26/2021



**CITY OF SOUTH BEND**

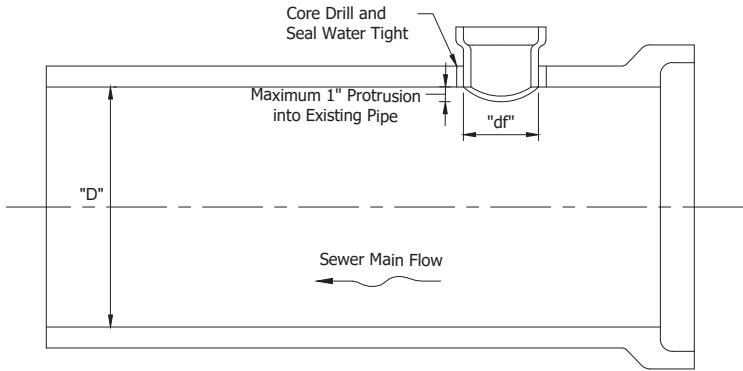
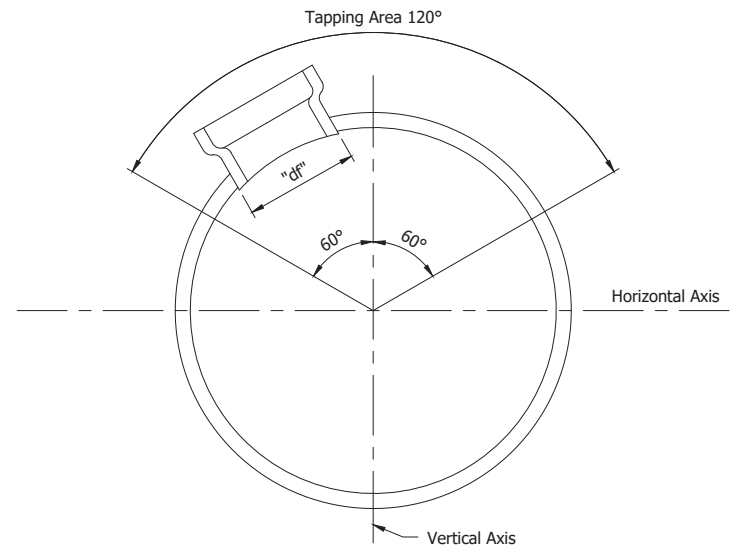
STANDARDS FOR DESIGN AND CONSTRUCTION

**TYPICAL MANHOLE CASTING & ADJUSTING RINGS**

STANDARD  
**4-6**



**SECTION 4 - SANITARY**



**NOTES:**

1. When "df" > 1/3 "D" use wye.
2. When "df" ≤ 1/3 "D" use manufactured saddle or if not available cut tap pipe per sketch.

**REF STD SPEC SEC 4-2**

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

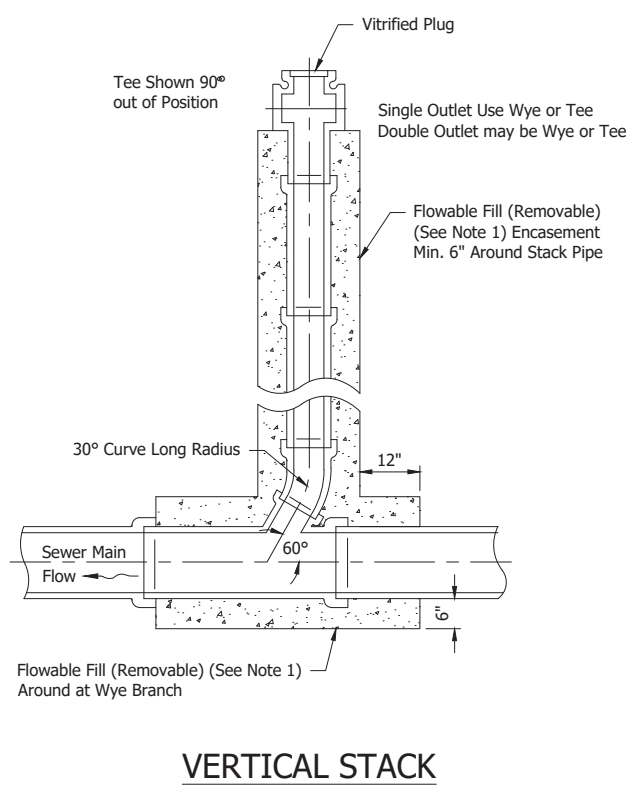
Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

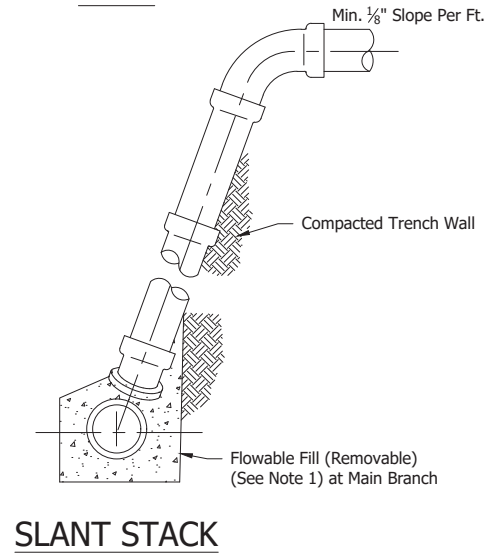
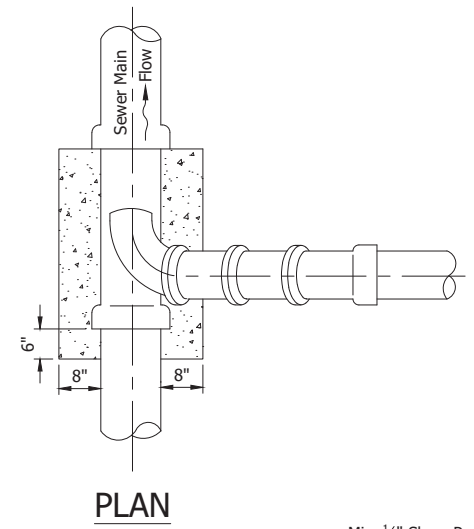
**SEWER TAPPING STANDARD**

STANDARD  
**4-7**

**SECTION 4 - SANITARY**



**VERTICAL STACK**



**SLANT STACK**

**NOTE:**

1. Refer to [INDOT Standard Specification](#) Section 213 for removable flowable fill requirements.
2. Wye replacement: Remove old wye, trim existing as pipe required, install new wye and pipe and connect to existing pipes with Fernco couplings.

**REF STD SPEC SEC 4-2 and 4-3**

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EFFECTIVE DATE: June 26, 2018



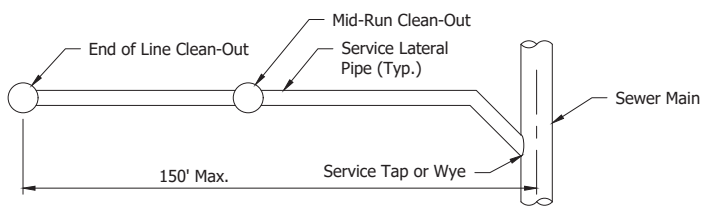
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

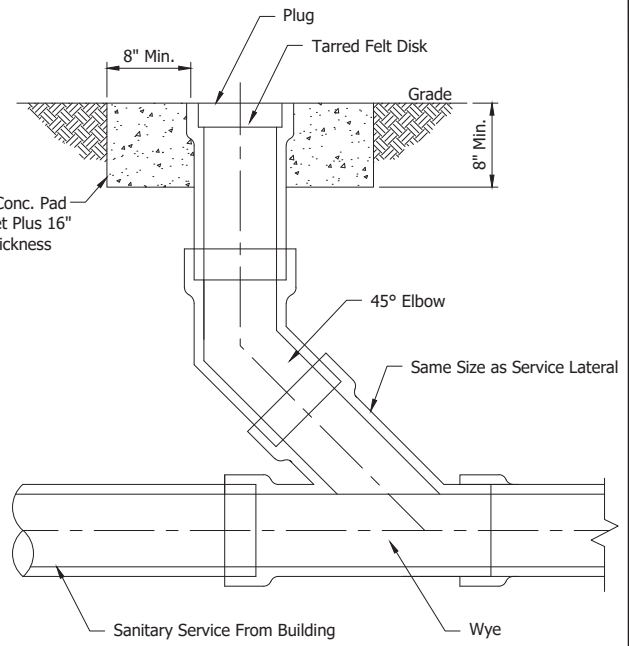
**VERTICAL AND SLANT STACKS**

STANDARD  
**4-8**

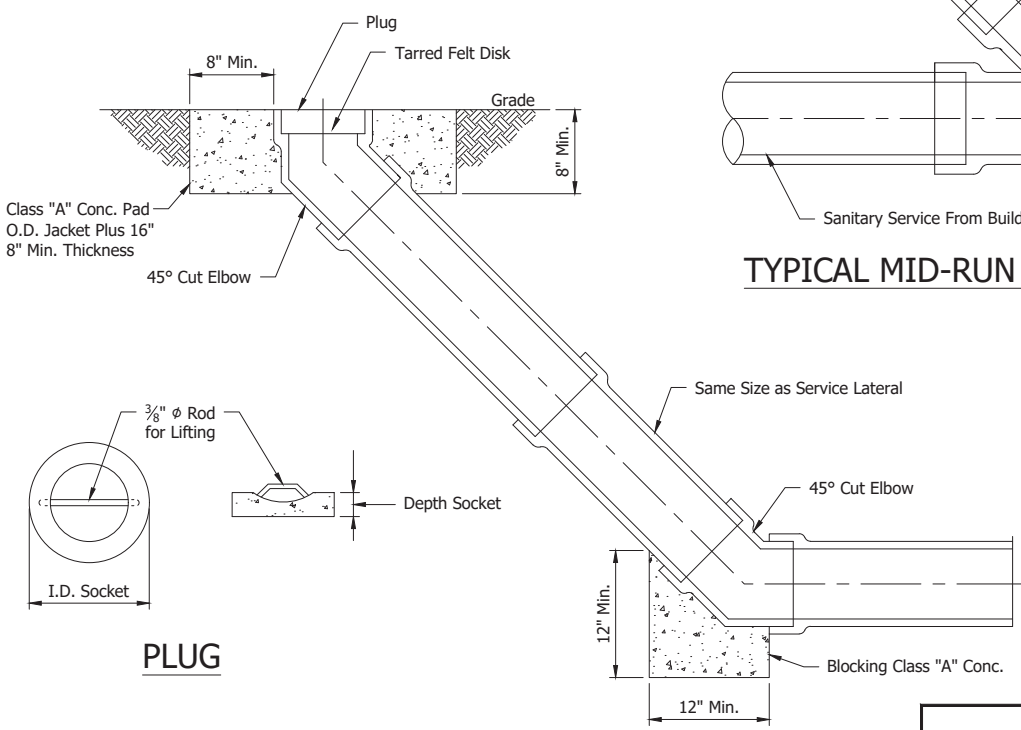
**SECTION 4 - SANITARY**



**PLAN VIEW - SERVICE LINE CLEAN-OUTS**



**TYPICAL MID-RUN CLEAN-OUT DETAIL**



**TYPICAL END OF LINE CLEAN-OUT DETAIL**

**PLUG**

**NOTES:**

1. Insert a manhole in service lateral if its length exceeds 150 ft.
2. The minimum service lateral size shall be 6-inches diameter, placed at a minimum slope of 0.61%. Larger sized service laterals shall be installed according to the minimum slopes required by 317 IAC 3-6-12(a).

**REF STD SPEC SEC 4-2**

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APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

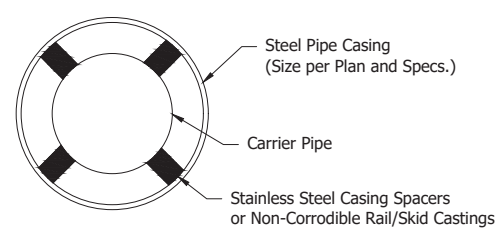
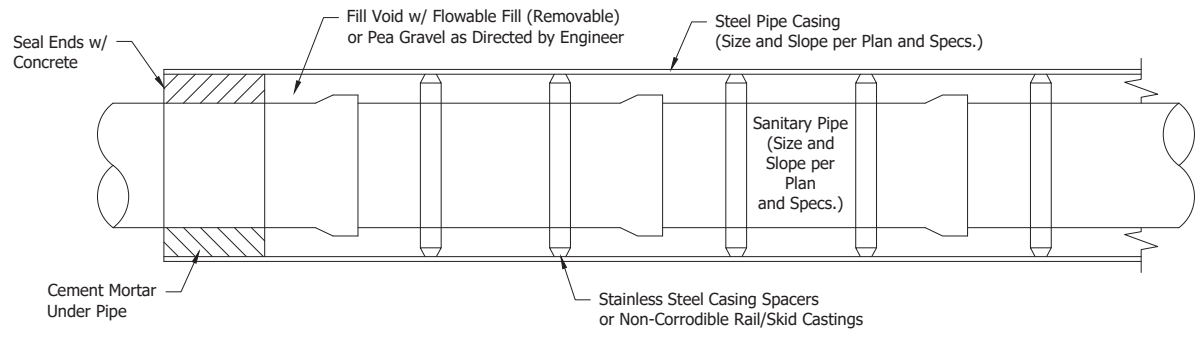
Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TYPICAL CLEAN-OUT**

STANDARD  
**4-9**

**SECTION 4 - SANITARY**



**SECTION**

**NOTES:**

1. All steel casing pipe sizing shall be designed by the Project Engineer. Steel casing pipe, including wall thickness shall conform to [INDOT Standard Specification Section 716](#). Design approval of steel casing pipe shall be granted by the City Engineer.
2. For railroad crossings, steel casing pipe shall conform to the regulating railroad authorities design and permitting requirements.

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

**REF STD SPEC SEC 4-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

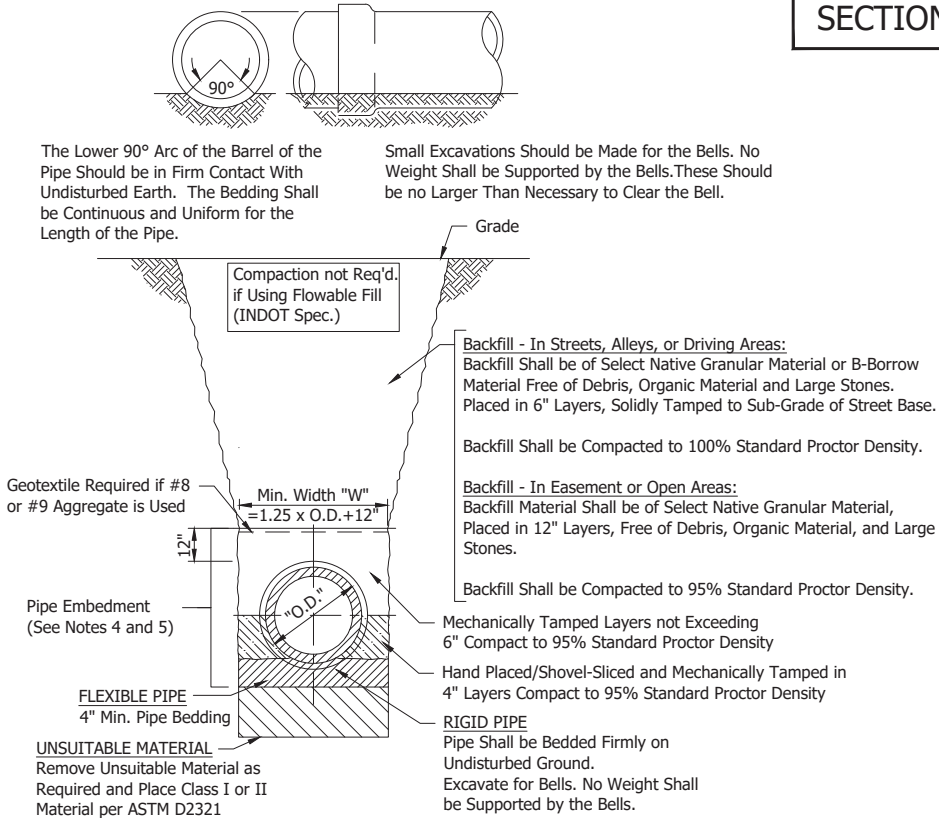
Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TYPICAL SEWER CASING DETAIL**

STANDARD  
**4-10**

**SECTION 4 - SANITARY**



**PIPE BEDDING DETAIL**

**NOTES:**

1. These trench and bedding details are for pipe structural requirements only. The contractor is solely responsible for safety of operations. The contractor shall slope trench walls, provide protective work boxes, and/or shore and brace all excavations as the contractor determines necessary for safety of operations, and in conformance to IOSHA Regulation 29 C.F.R. 1926, Subpart P for Trench Safety Systems.
2. All PVC pipe for sanitary sewers shall be installed in accordance with ASTM D2321.
3. There shall be no rocks or stones greater than 2" in any dimension within 6" of the pipe wall or bell.
4. Flexible Pipe: Embedment materials for bedding, haunching and initial backfill shall comply with the requirements of ASTM D2321, Classes I (INDOT #8 or #9), II (INDOT #53, #73, or B-Borrow), or III and shall be compacted as noted. Refer to pipe manufacturers recommended bedding and embedment material class type requirements. Removable flowable backfill shall be placed for all areas within 5 feet of pavements to 12" above pipe crown. Above this limit structure backfill shall be used.
5. Rigid Pipe: Embedment materials for bedding, haunching and initial backfill shall comply with the requirements of ASTM C12 (VCP) Classes A, B, C or crushed stone (INDOT #8, #9 or B-Borrow) and shall be compacted as noted. Removable flowable backfill shall be placed for all areas within 5 feet of pavements to 12" above pipe crown. Above this limit structure backfill shall be used.
6. Final backfill shall not contain debris, organic material, frozen material, unstable material or boulders or stones greater than 2" in any dimension. Flowable fill optional.
7. The placement and compaction of backfill shall not cause displacement of the pipe.
8. For multiple pipes in same trench:
  - a. Place bedding to Spring Line of first pipe across entire trench width.
  - b. Placement of next pipe, re-excavate trench as needed. Then place bedding as noted above.
  - c. For additional pipes repeat as required.
9. Refer to [INDOT Standard Specification](#) Section 213 for flowable fill (removable) requirements.

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REF STD SPEC SEC 4-2 and 4-3

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

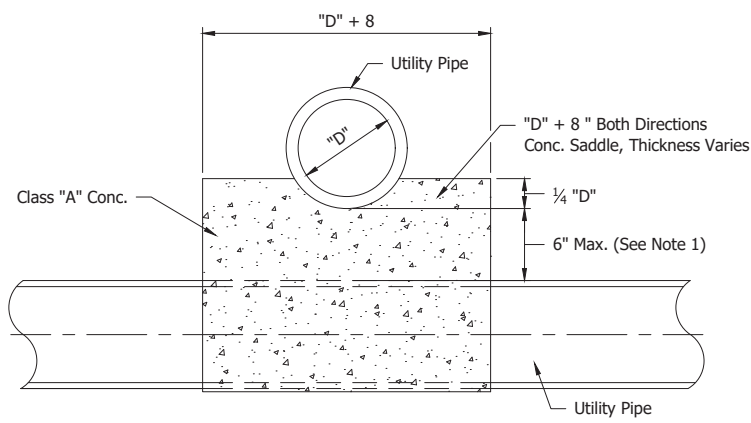
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**PIPE BEDDING DETAIL**

STANDARD  
**4-11**

**SECTION 4 - SANITARY**



**NOTE:**

1. When vertical separation distance between two utility pipes is less than 2 inches, place Styrofoam insulation between the two pipes. The thickness of insulation shall be equal to the distance between the two pipes. The width of insulation shall be equal to the outside diameter of the top pipe. The length of insulation shall be equal to the length of concrete saddle.

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REF STD SPEC SEC 4-2

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EFFECTIVE DATE: June 26, 2018



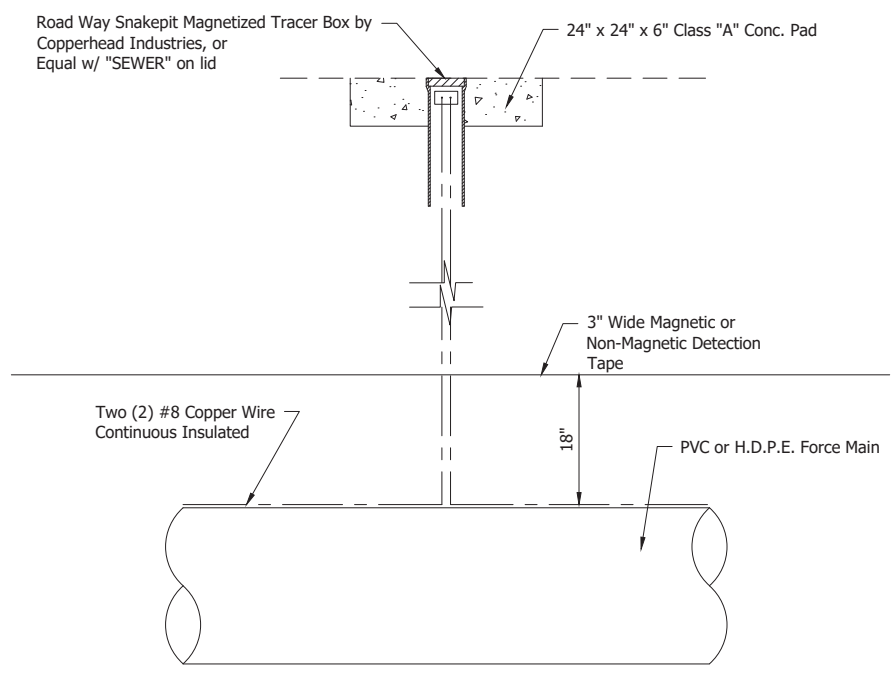
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**CONCRETE SADDLE DETAIL**

STANDARD  
**4-12**

**SECTION 4 - SANITARY**




- NOTES:**
1. All force main pipe shall be installed with an electronically continuous type TW insulated #8 tracing wire.
  2. Markers shall be placed at 400' intervals minimum and all changes in direction. The tracer wire shall be connected to the terminal in each marker.
  3. Forcemain tracing wire shall maintain connectivity throughout the length of the forcemain, including at any changes in direction, structures, air release valves, manholes, pipe markers, etc.
  4. "SEWER" Cast-on lid.
  5. Poured in place concrete pad, 24" x 24" x 6" with perimeter reinforcing.
  6. Wire taped at each side of pipe joint and 6' O.C.

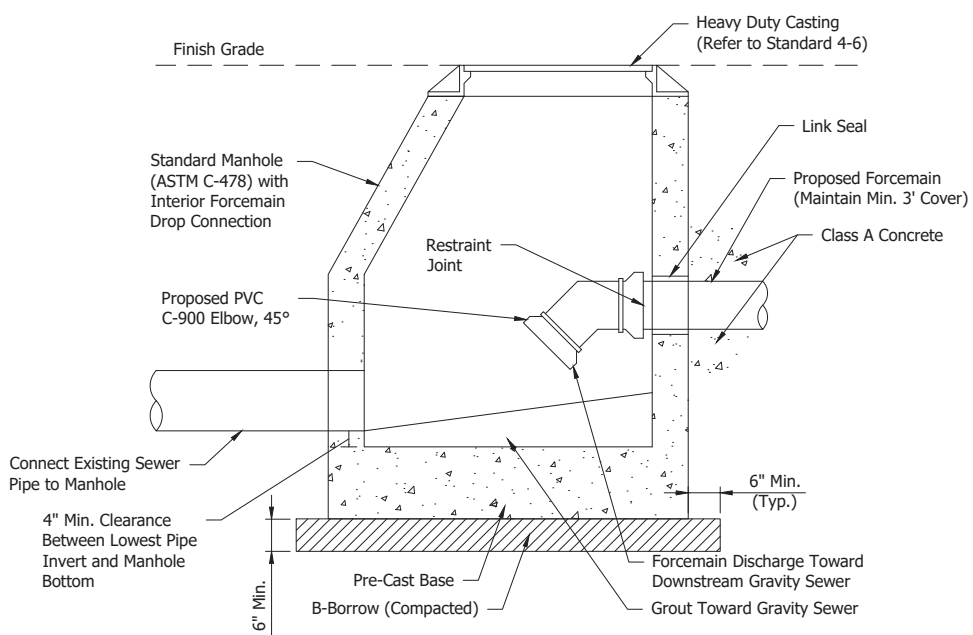
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Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

REF STD SPEC SEC 4-2 and 4-4

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				CITY OF SOUTH BEND	
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION	
			STANDARD 4-13		
FORCE MAIN TRACER WIRE RISER					STANDARD 4-13

**SECTION 4 - SANITARY**



**NOTES:**

1. Manhole above is not to scale and is shown for diagrammatic purposes. Contractor shall verify that new forcemain is properly installed and integrity of manhole is maintained.
2. Class A concrete shall also be placed a minimum of 12" on each side (horizontally) of the forcemain, not shown in this section view.
3. Restraint joint within manhole shall be Megalug Series 2600 or approved equal.

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REF STD SPEC SEC 4-2, 4-3 and 4-4

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
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**CITY OF SOUTH BEND**

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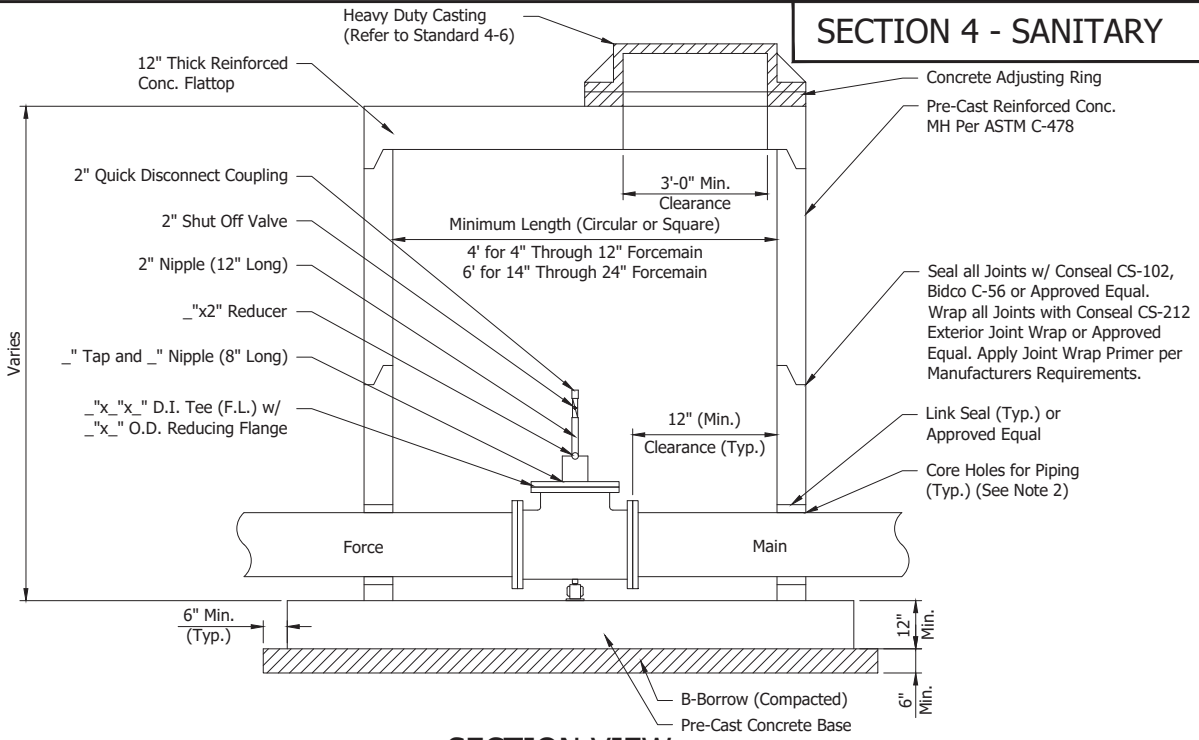
STANDARDS FOR DESIGN  
AND CONSTRUCTION

**DROP MANHOLE WITH FORCEMAIN CONNECTION**

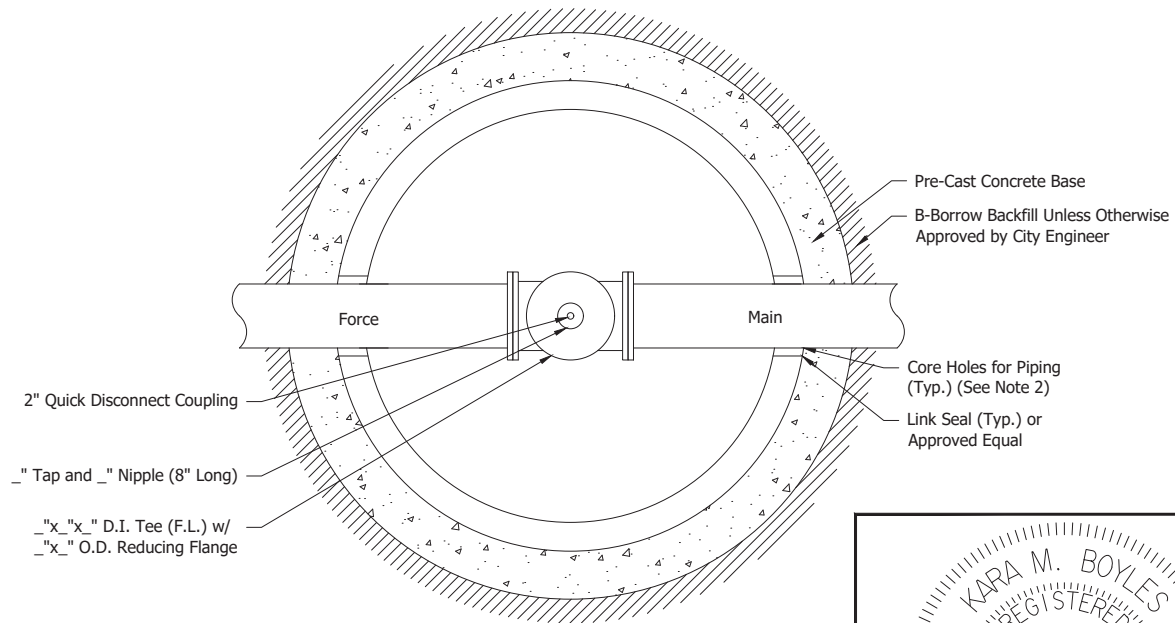
STANDARD  
**4-14**



**SECTION 4 - SANITARY**



**SECTION VIEW**



**PLAN VIEW**

**NOTES:**

1. Pre-Cast concrete structure shall be manufactured and installed in compliance with ASTM C-478 or ASTM C-913 (rectangular or square structure).
2. The cored opening shall be large enough to allow passage of the pipe flange.
3. Place pipe supports at the fittings.
4. Structure dimensions shown are based on ductile iron forcemain pipe. If an alternate forcemain pipe material is used, structure dimensions shall be adjusted to allow for flange adaptors.

**REF STD SPEC SEC 4-2 and 4-3**

6/26/18  
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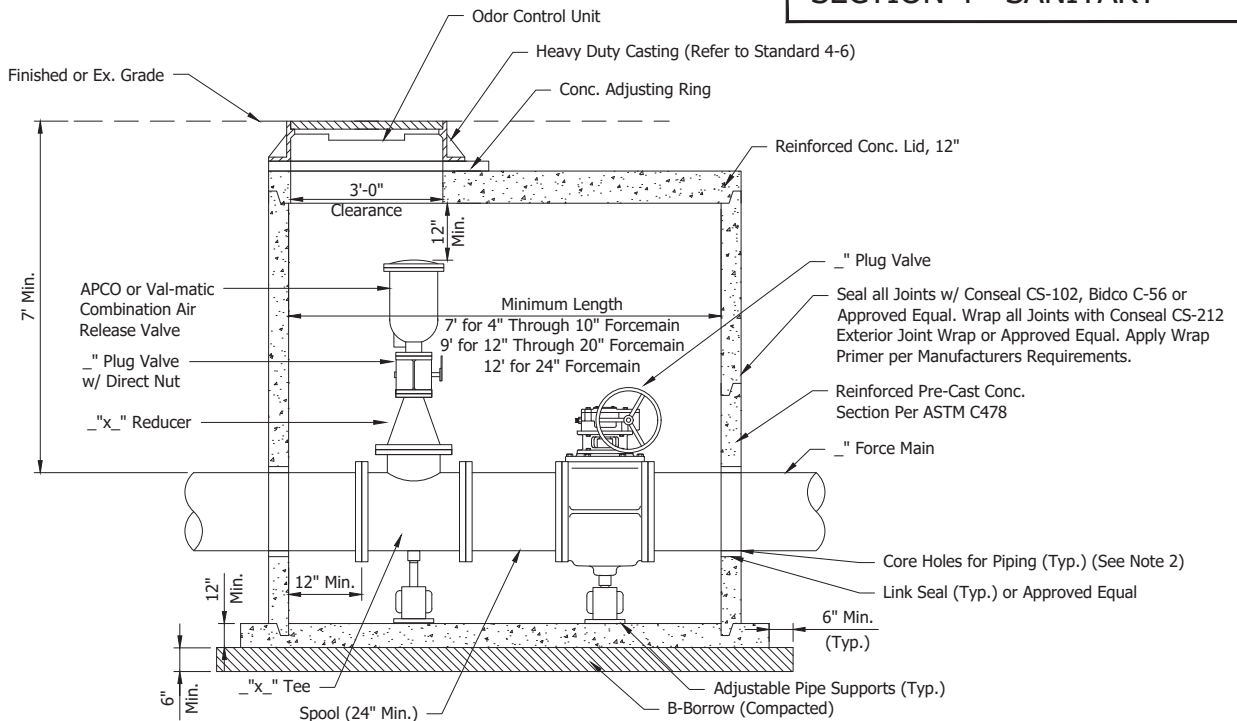
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

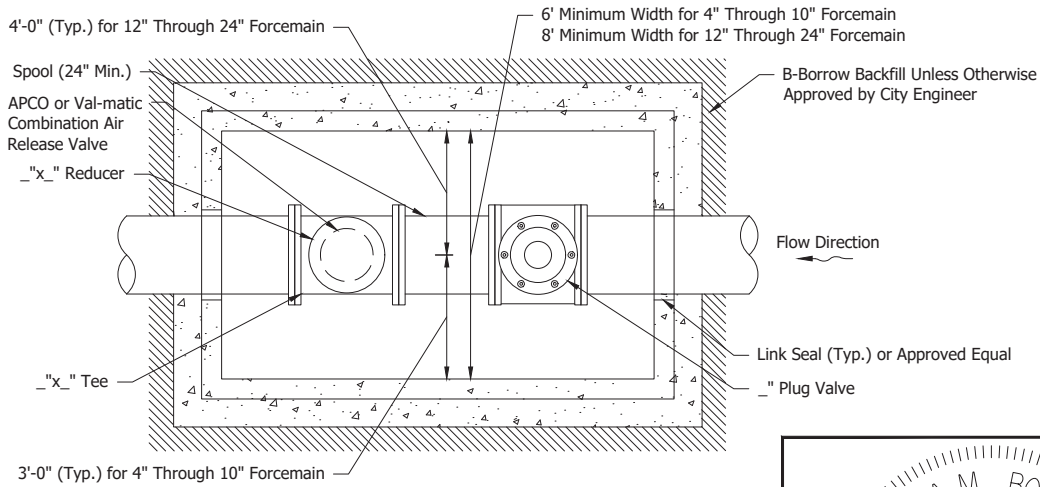
**FORCE MAIN CLEANOUT STRUCTURE**

STANDARD  
**4-15**

# SECTION 4 - SANITARY



**SECTION VIEW**



**PLAN VIEW**

**NOTES:**

1. Pre-Cast concrete structure shall be manufactured and installed in compliance with ASTM C-913 (rectangular or square structure).
2. The cored opening shall be large enough to allow passage of the pipe flange.
3. Place pipe supports at the fittings.
4. Structure dimensions shown are based on ductile iron forcemain pipe. If an alternate forcemain pipe material is used, structure dimensions shall be adjusted to allow for flange adaptors.

**REF STD SPEC SEC 4-2 and 4-3**

Kara M. Boyles, Ph.D., P.E. 6/26/18 Date

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EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

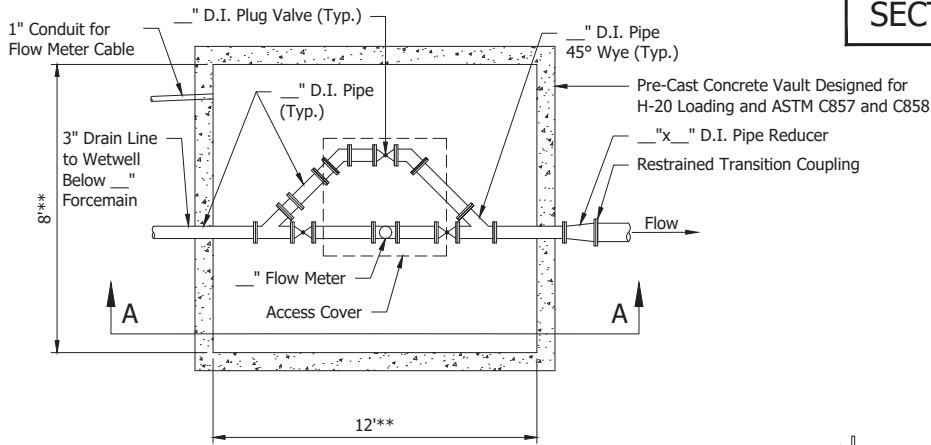
STANDARDS FOR DESIGN  
AND CONSTRUCTION

**AIR RELEASE VALVE STRUCTURE**

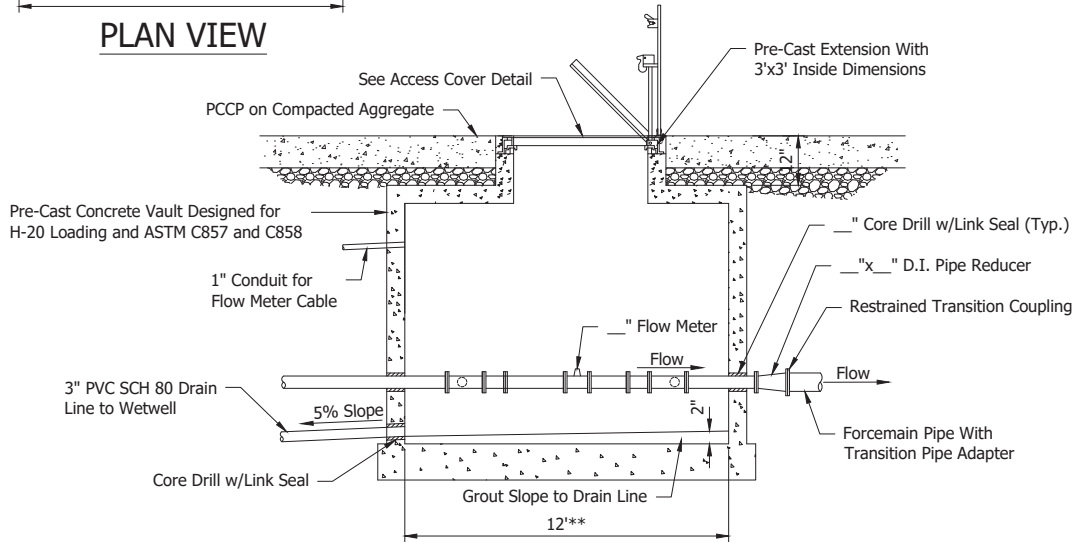
STANDARD  
**4-16**

Item	Revision	Approved Date

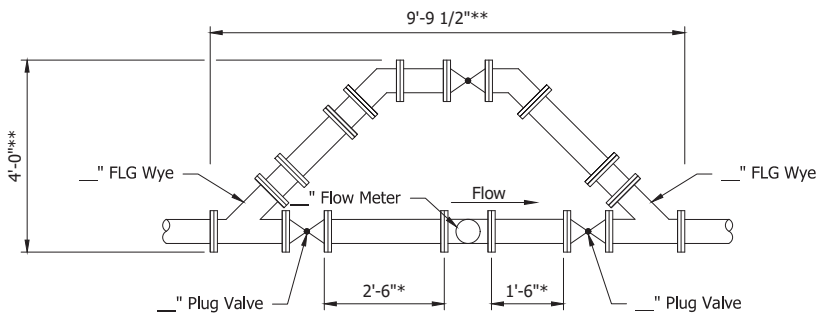
# SECTION 4 - SANITARY



**PLAN VIEW**



**SECTION A-A VIEW**



**FITTING CONFIGURATION**

\* Length Per Meter Manufacturer Recommendations  
 \*\* Varies Per Pipe Size and Meter Size

**NOTES:**

1. For clarity pipe support/stands are not shown. Contractor shall furnish and install all pipe supports per manufacturer's recommendations. Pipe supports shall be made of stainless steel or concrete.
2. Provide stainless steel cable supports for the flow meter power/control cable.
3. All piping and valves in the lift station to the meter vault and inside the meter vault shall be Ductile Iron pipe.

REF STD SPEC SEC 4-2 and 4-3

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
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**CITY OF SOUTH BEND**

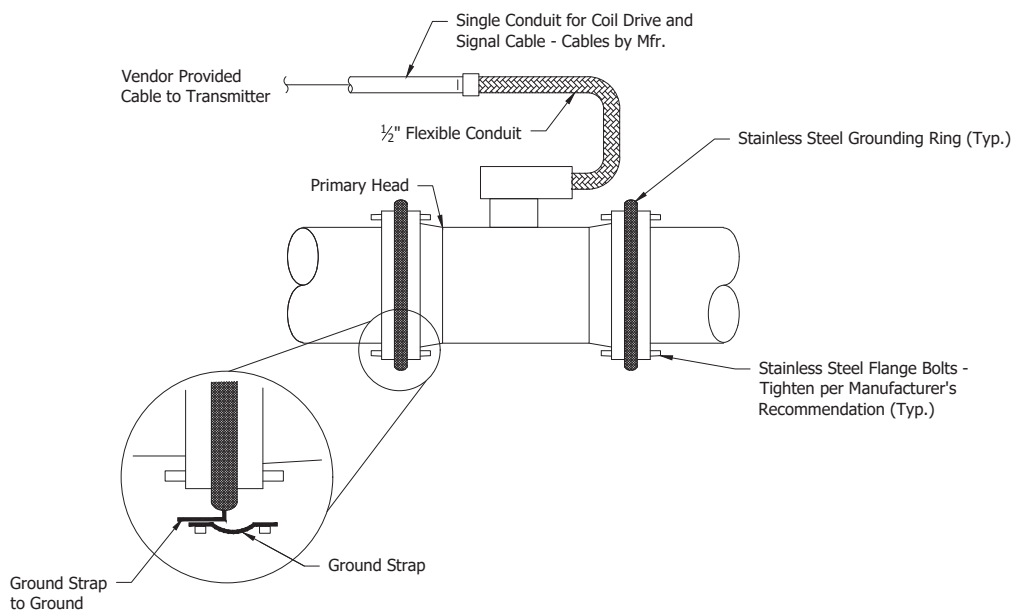
STANDARDS FOR DESIGN  
 AND CONSTRUCTION

Item	Revision	Approved Date

**FLOW METER VAULT**

STANDARD  
**4-17**

**SECTION 4 - SANITARY**



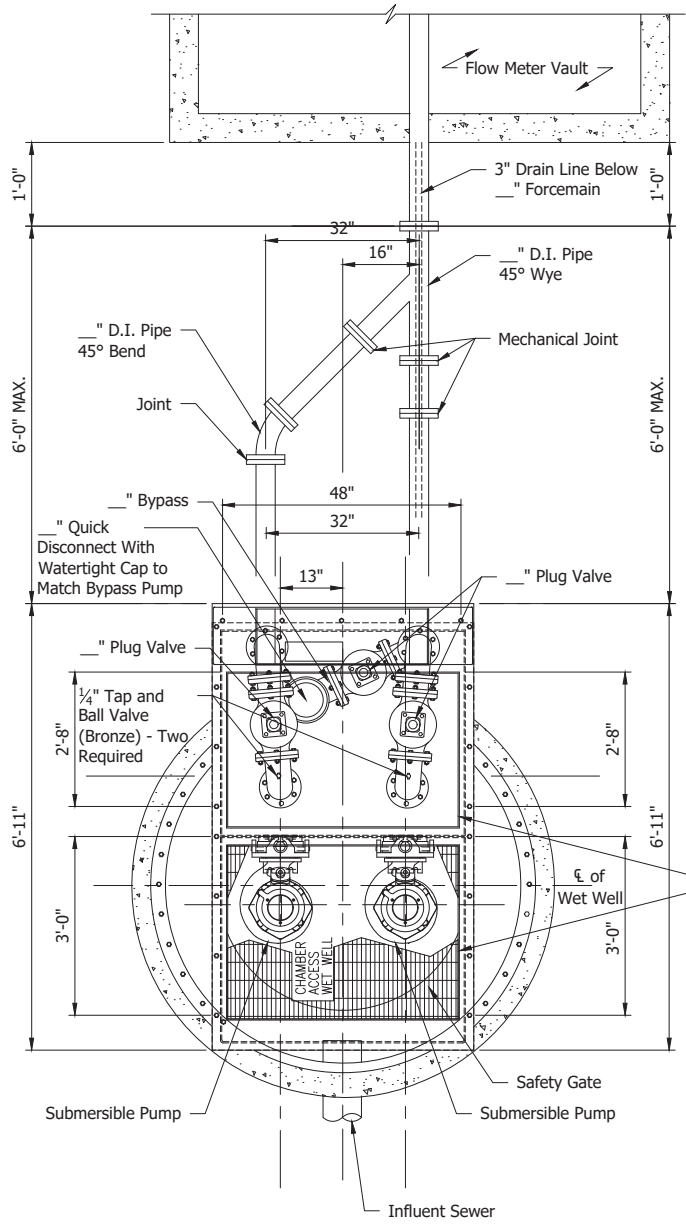
**NOTE:**  
 1. Ground shall be less than 0.5 OHM and 100 millivolt when tested with standard methods.

*Kara M. Boyles*      6/26/18  
 Kara M. Boyles, Ph.D., P.E.      Date

**REF STD SPEC SEC 4-2**

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Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION	
			<div style="display: flex; justify-content: space-between;"> <span><b>ELECTROMAGNETIC FLOWMETER/REMOTE TRANSMITTER</b></span> <span>STANDARD <b>4-18</b></span> </div>		

**SECTION 4 - SANITARY**



300 lb. Load Rated Aluminum Access Cover With Tread Plate Surface, Each Chamber, and 300 PSF Rated Aluminum Safety Gate System, Wet Well Chamber Only.

**NOTE:**  
 1. Dimensions shown will vary based on size of pumps and forcemain pipe.

6/26/18  
 Kara M. Boyles, Ph.D., P.E.      Date

REF STD SPEC SEC 4-2, 4-3 and 4-4

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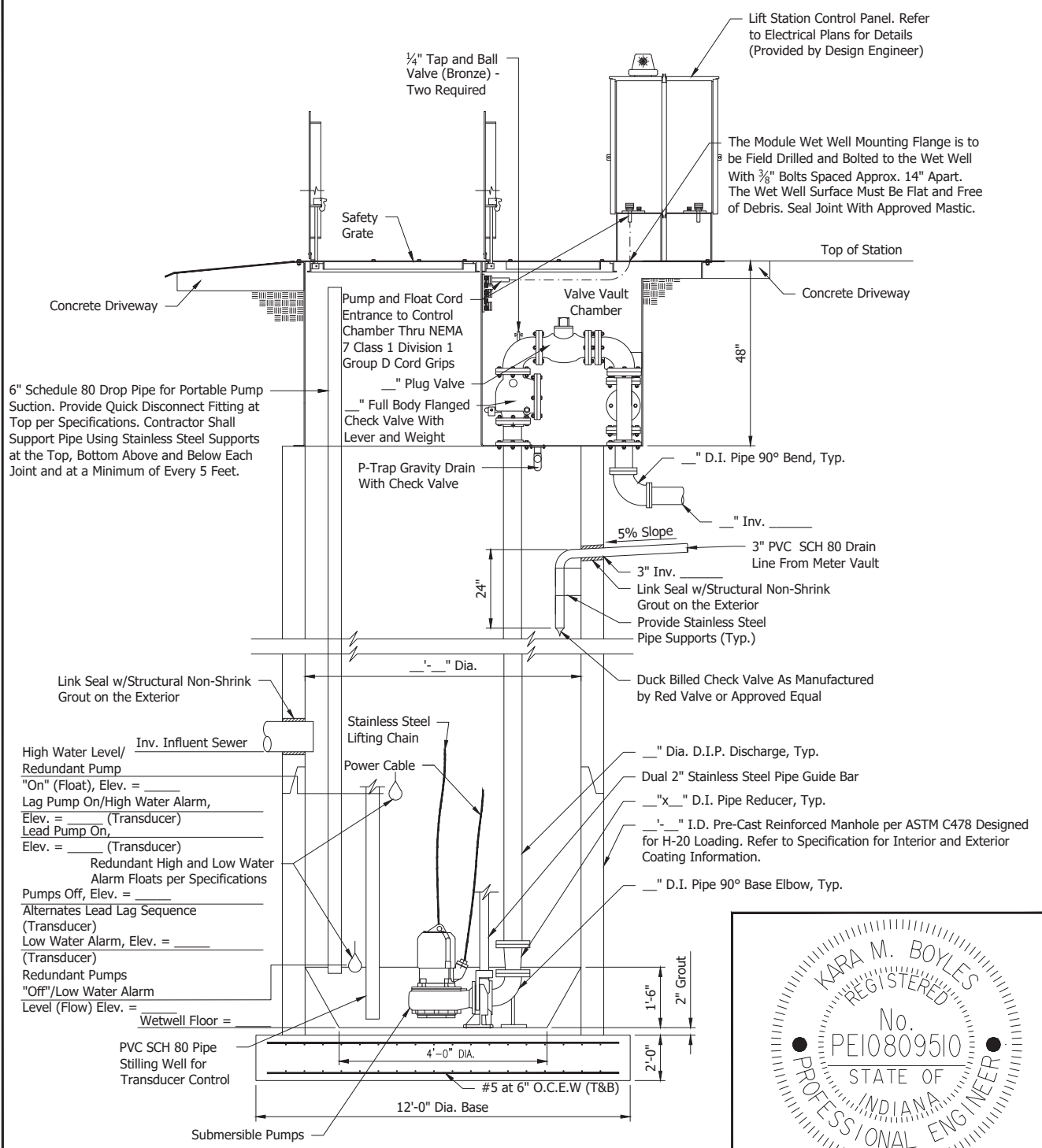
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
 AND CONSTRUCTION

**SAMPLE LIFT STATION PLAN**

STANDARD  
**4-19**

**SECTION 4 - SANITARY**



**NOTE:**  
 1. Dimensions shown will vary based on size of pumps, flow rates, and size of forcemain pipe.

REF STD SPEC SEC 4-2, 4-3 and 4-4

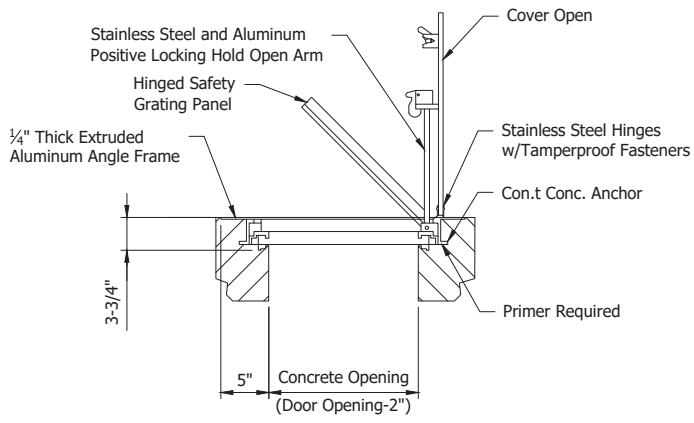
6/26/18  
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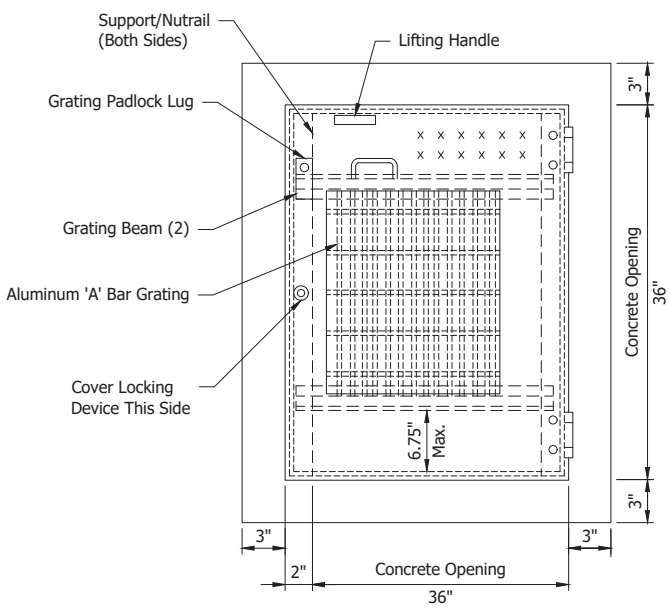
Item	Revision	Approved Date

**CITY OF SOUTH BEND**  
 STANDARDS FOR DESIGN AND CONSTRUCTION

**SECTION 4 - SANITARY**



**SECTION VIEW**



**PLAN VIEW**

**NOTE:**  
1. Access cover shall be H-20 loading rated.

**REF STD SPEC SEC 4-2 and 4-3**

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Date

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EFFECTIVE DATE: June 26, 2018



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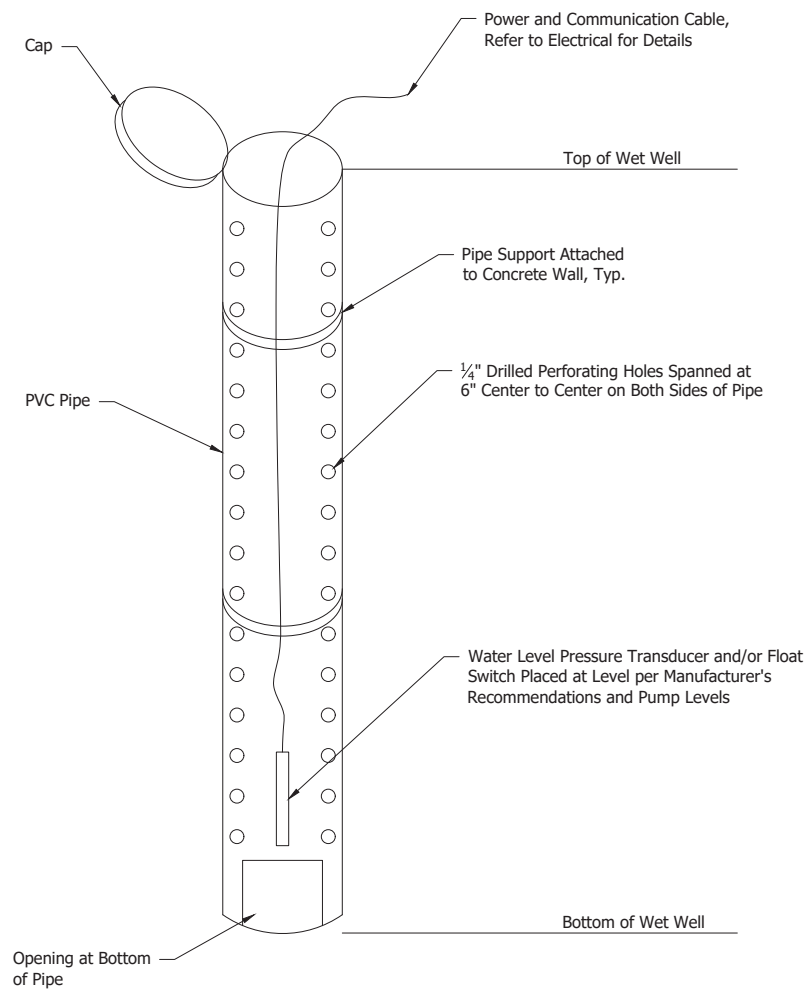
STANDARDS FOR DESIGN  
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Item	Revision	Approved Date

**ACCESS COVER**

STANDARD  
**4-21**

**SECTION 4 - SANITARY**



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Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 4-2 and 4-3

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EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**STILLING WELL**

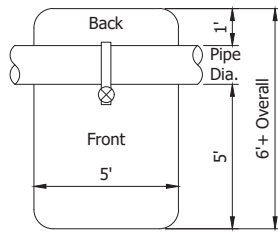
STANDARD  
**4-22**



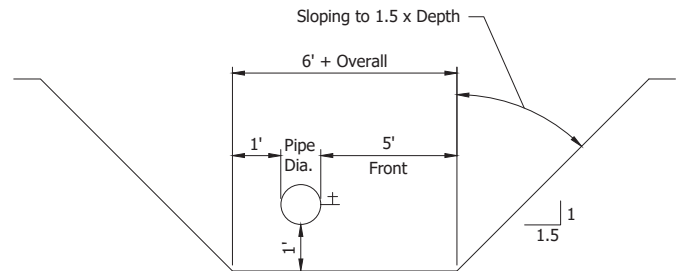
**SECTION 5 - WATER WORKS**

**1" AND 2" TAP**

- \* 1" Tap Shall be Level to 45° up
- \* 2" Taps Shall be Level
- \* Depth Shall be 1' Below Main (at Main)
- \* Tap Shall be a Min. 1' Laterally From Other Taps or Joints
- \* 1' Below Water Main
- \* 1' Behind Water Main
- \* 5' Wide Excavation
- \* 5' in Front of Water Main



**TOP VIEW**

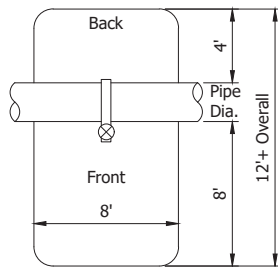


**SIDE VIEW**

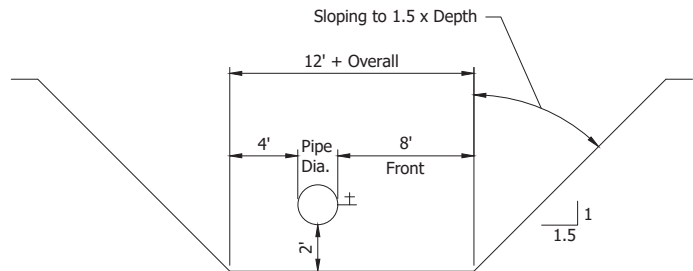
**1" AND 2" TAP EXCAVATION**

**4" TO 12" TAP**

- \* Tap Shall be Level
- \* Depth Shall be 2' Below Main (at Main)
- \* Tap Shall be a Min. 2' Laterally From Other Taps or Joints
- \* Install Tap in Middle of Excavation
- \* 2' Below Water Main
- \* 4' Behind Water Main
- \* 8' Wide Excavation
- \* 8' in Front of Water Main



**TOP VIEW**



**SIDE VIEW**

**4" TO 12" TAP EXCAVATION**

**NOTE:**

Shown are minimum excavations required - sheeting and shielding or sloping to 1.5 x depth is also needed.

**SOUTH BEND WATER WORKS TAPPING REQUIREMENTS:**

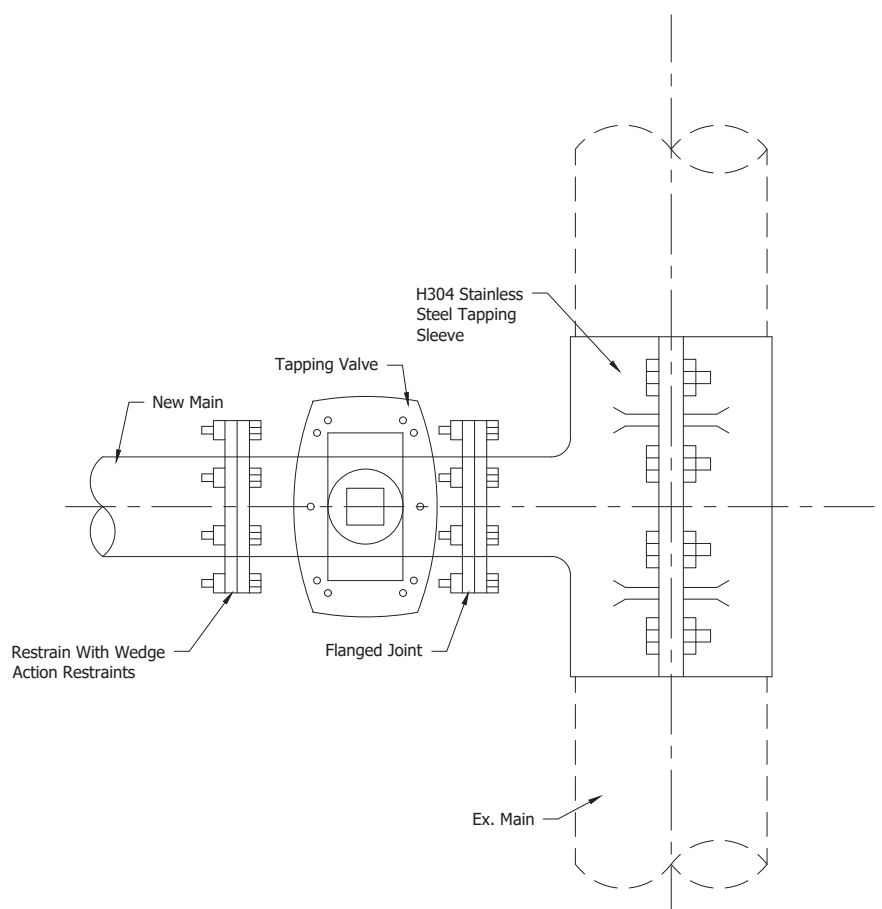
1. Call 811 or (800) 382-5544 for utility locates a minimum of 48 hours prior to excavation.
2. The plumber or contractor must obtain all permits required by the City Engineering Department. (excavation, street cuts, and sidewalk permits)
3. Call Engineering Department (574) 235-9251 a minimum of 48 hours prior to excavation and street closure.
4. Call City Water Works Department at (574) 235-9279 for tap fee requirements. The tap fee is to be paid to the Water Works Engineering Department, 830 N Michigan St.
5. Schedule taps through Field Operations number at (574) 235-9464.
6. Excavate, expose and clean water main for tap.
7. Material supplied by South Bend Water Works:
  - 2" and smaller - corporation stop, curb stop and stop box
  - 4" and larger - tapping sleeve and valve, roadway/valve box
8. All excavations must meet O.S.H.A. excavation standards.
9. Contractor shall provide all sheeting and shielding.
10. Domestic branches off of fire lines are strictly prohibited.
11. Any abandoned service lines within the property frontage of the new tap shall be disconnected at the water main by the contractor during the tap excavation. This applies to services at the same address as well as any other connections.

6/26/18  
Date

**REF STD SPEC SEC 5-2.5(e) and 5-2.5(g)**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				CITY OF SOUTH BEND
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION
				STANDARD 5-1
TAPPING REQUIREMENTS				

**SECTION 5 - WATER WORKS**



**TAP MADE UNDER PRESSURE (WET TAP)  
CONNECTING NEW MAIN TO EXISTING MAIN**

**NOTES:**

1. Tapping valves shall be Clow, Mueller, or approved equal.
2. The physical tapping of the existing water main shall be performed by the city's utility distribution department. All excavation and preparation work shall be performed by the contractor, and the contractor shall provide all materials. The utility will only perform the physical tap. Contractor shall coordinate with the Water Department.

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REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 5-2.5(e)

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

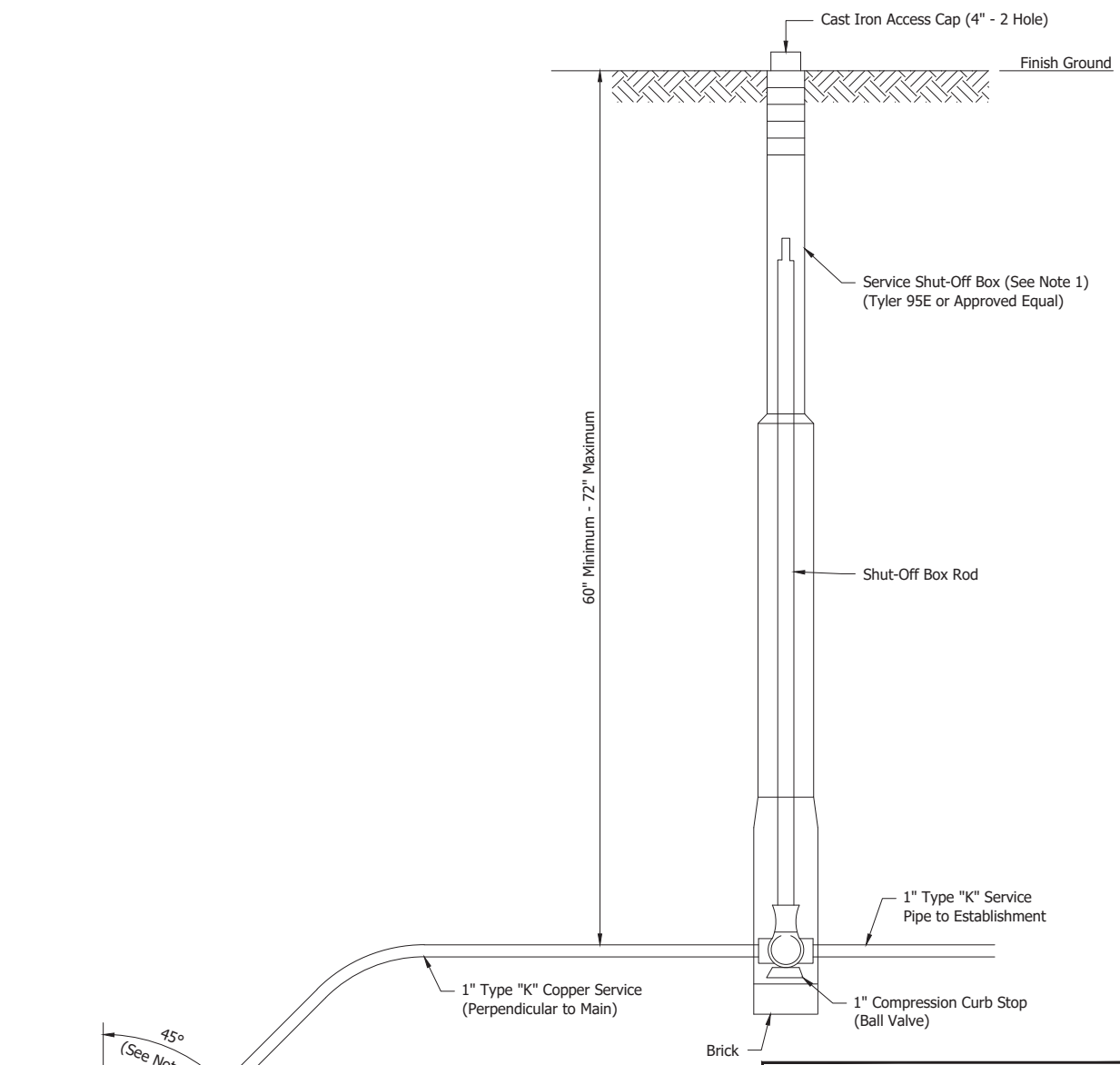
Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TAPPING SLEEVE AND VALVE**

STANDARD  
**5-2**

**SECTION 5 - WATER WORKS**



- NOTES:**
1. Service shut-off box shall be placed in the public right-of-way in grass between curb and sidewalk.
  2. For a 2" service the corporation stop shall be located at 90° (level).

**REF STD SPEC SEC 5-2.1 and 5-2.5(g)**

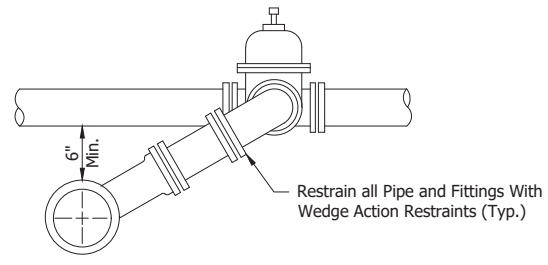
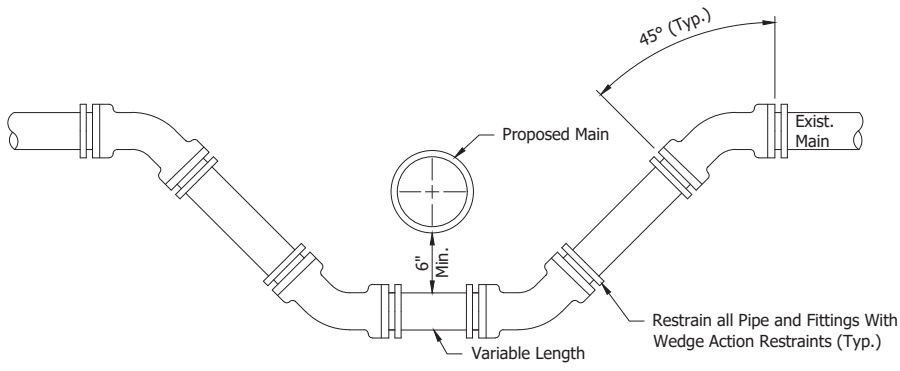
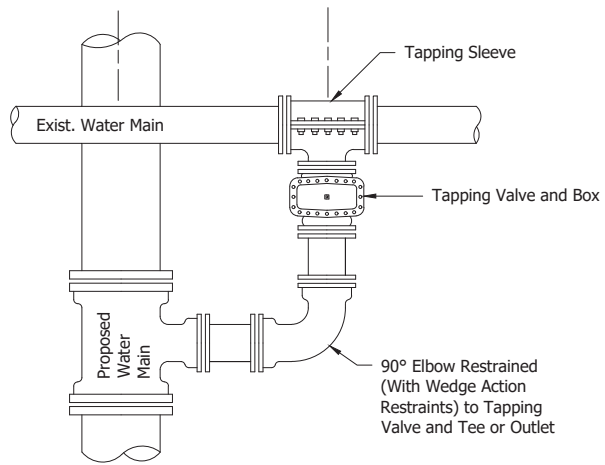
Kara M. Boyles, Ph.D., P.E. 6/26/18 Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018		
Item	Revision	Approved Date



**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN AND CONSTRUCTION

**SECTION 5 - WATER WORKS**



**NOTES:**

1. Proposed main may pass over existing main if existing main is deep enough to provide adequate clearance between main and cover over proposed main.
2. All pipe, fittings and valve joints shall be restrained with wedge action restraints.

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 5-2.2 and 5-2.5(e)

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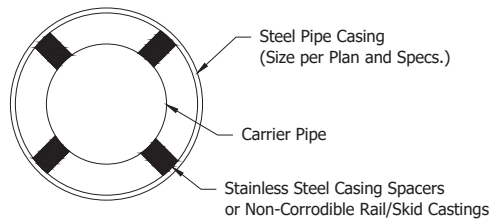
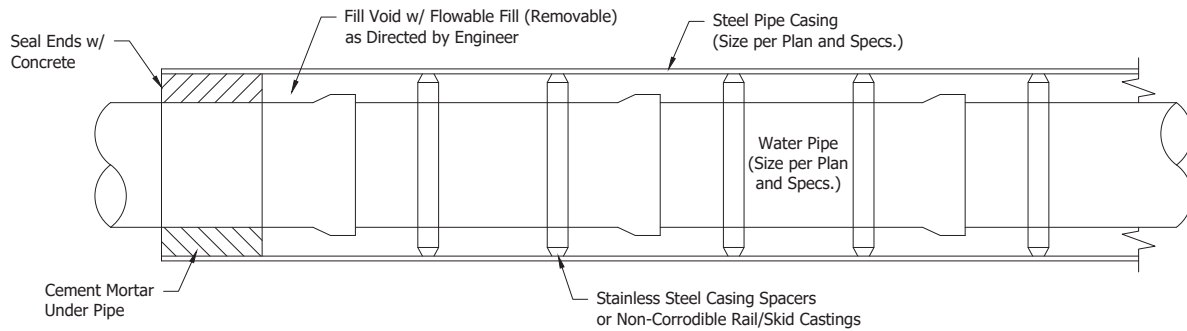
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN AND CONSTRUCTION

Item	Revision	Approved Date

**CROSS OVER**

STANDARD  
**5-4**

**SECTION 5 - WATER WORKS**



**SECTION**

**NOTES:**

1. All steel casing pipe sizing shall be designed by the Project Engineer. Steel casing pipe, including wall thickness shall conform to [INDOT Standard Specification](#) Section 716. Design approval of steel casing pipe shall be granted by the City Engineer.
2. For railroad crossings, steel casing pipe shall conform to the regulating railroad authority's design and permitting requirements.

*Kara M. Boyles*      6/26/18  
 Kara M. Boyles, Ph.D., P.E.      Date

**REF STD SPEC SEC 5-2.9**

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 EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

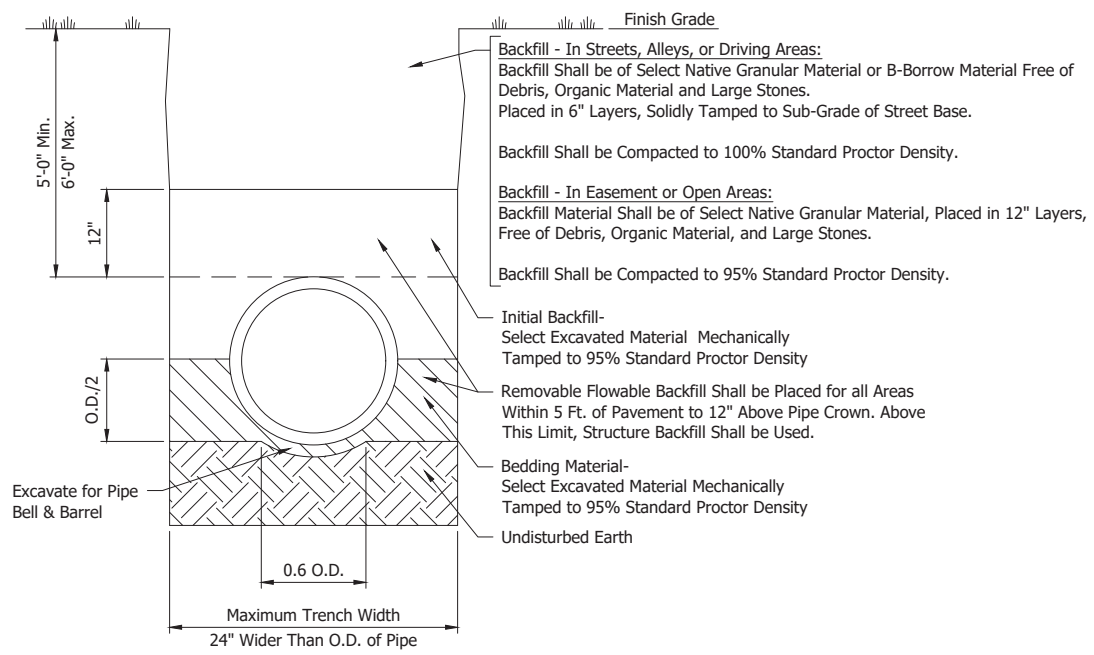
STANDARDS FOR DESIGN  
 AND CONSTRUCTION

Item	Revision	Approved Date

**TYPICAL WATER CASING DETAIL**

STANDARD  
**5-5**

**SECTION 5 - WATER WORKS**



**NOTES:**

1. These trench and bedding details are for pipe structural requirements only. The contractor is solely responsible for safety of operations. The contractor shall slope trench walls, provide protective work boxes, and/or shore and brace all excavations as the contractor determines necessary for safety of operations, and in conformance to IOSHA Regulation 29 C.F.R. 1926, Subpart P for Trench Safety Systems.
2. For multiple pipes in same trench:
  - a. Place bedding to Spring Line of first pipe across entire trench width.
  - b. Placement of next pipe, re-excavate trench as needed. Then place bedding as noted above.
  - c. For additional pipes repeat as required.
3. Minimum easement width for water main shall be 15'.
4. Minimum obstruction setback requirement from water main shall be 10'. Obstructions shall include structures, other utilities, trees, and landscaping.

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6/26/18  
Date

REF STD SPEC SEC 5-3.2 and 5-3.9

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



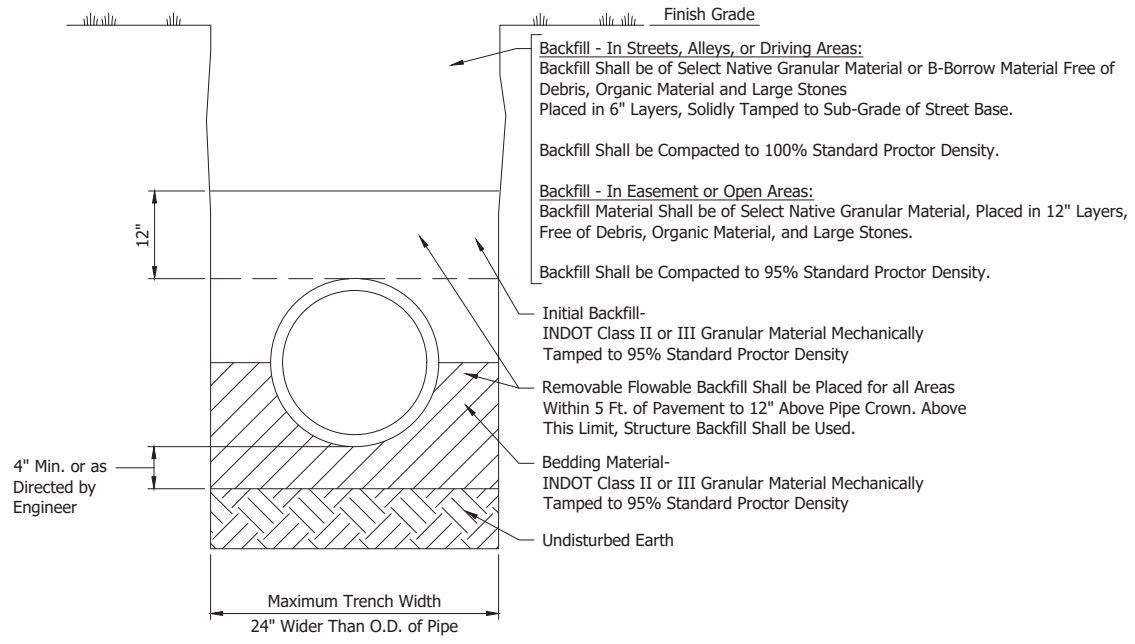
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN  
AND CONSTRUCTION

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**TRENCH DETAIL FOR WATER MAIN IN SUITABLE SOIL**

STANDARD  
**5-6**

**SECTION 5 - WATER WORKS**



**NOTES:**

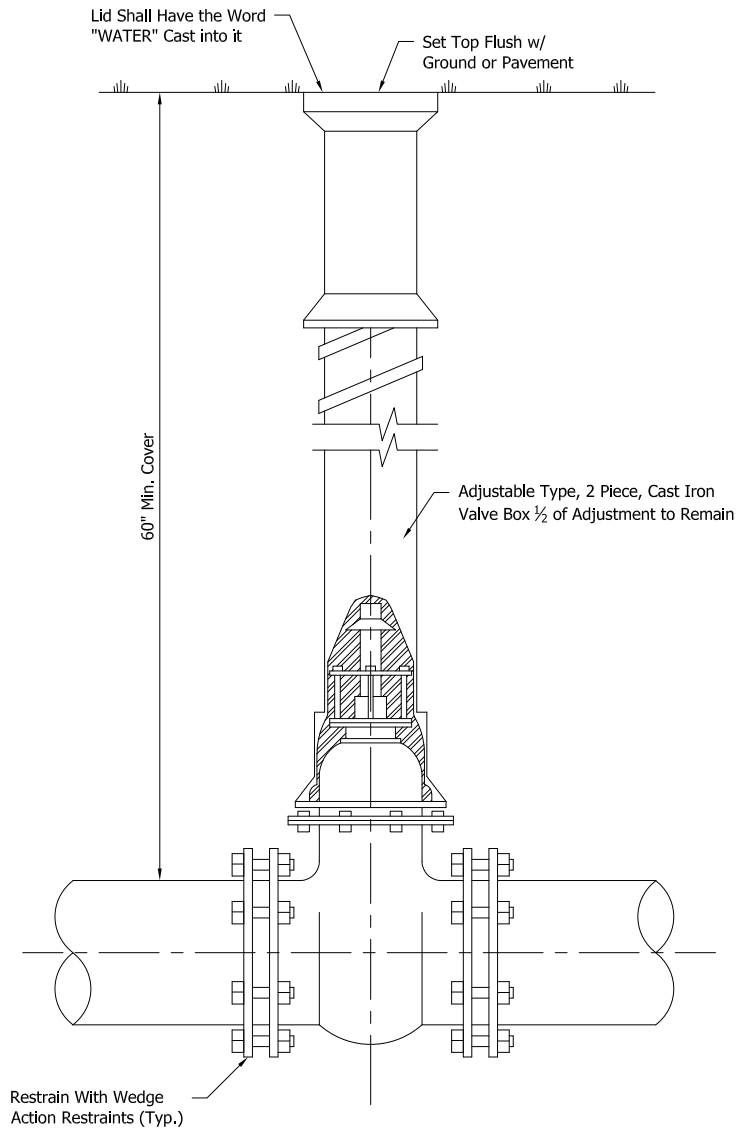
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2. For multiple pipes in same trench:
  - a. Place bedding to Spring Line of first pipe across entire trench width.
  - b. Placement of next pipe, re-excavate trench as needed. Then place bedding as noted above.
  - c. For additional pipes repeat as required.
3. Minimum easement width for water main shall be 15'.
4. Minimum obstruction setback requirement from water main shall be 10'. Obstructions shall include structures, other utilities, trees, and landscaping.

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 5-3.2 and 5-3.9

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<b>TRENCH DETAIL FOR WATER MAIN IN UNSUITABLE SOIL</b>					STANDARD <b>5-7</b>

SECTION 5 - WATER WORKS



**NOTES:**

1. Gate valves shall be manufactured by Clow, Mueller, Kennedy, or approved equal.
2. Valve box shall be manufactured by Tyler Pipe Industries Model 664-S or approved equal.
3. Gate valves shall be used on water main pipe 12-inches and smaller.
4. Valve spacing shall be no greater than 1,000 feet. A main line valve shall be placed at each intersection.
5. Valve locations shall be configured to be within 3 Ft. of adjoining fittings.

REF STD SPEC SEC 5-2.5(a)

*Kara M. Boyles*      6/26/18  
Kara M. Boyles, Ph.D., P.E.      Date

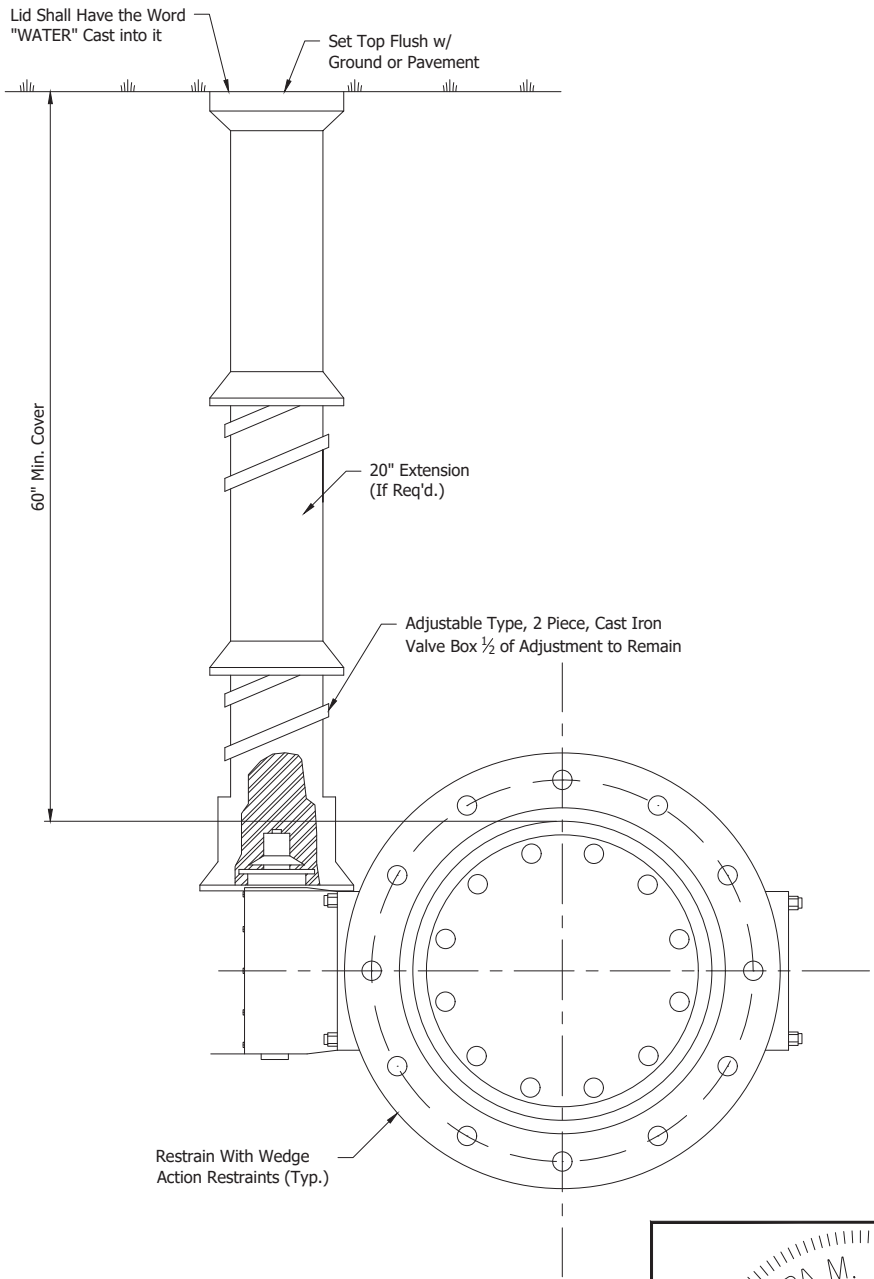
APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018		
Item	Revision	Approved Date
1	Kennedy Addition	10/26/2021

**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION



**SECTION 5 - WATER WORKS**



**NOTES:**

1. Butterfly valves shall be manufactured by Clow, Kennedy, or approved equal.
2. Valve box shall be manufactured by Tyler Pipe Industries Model 664-S or approved equal.
3. Butterfly valve shall be used on water main pipe 16-inches diameter and larger.
4. Valve spacing shall be no greater than 1,000 feet. A main line valve shall be placed at each intersection.

Kara M. Boyles, Ph.D., P.E.      6/26/18  
 Date

REF STD SPEC SEC 5-2.5(b)

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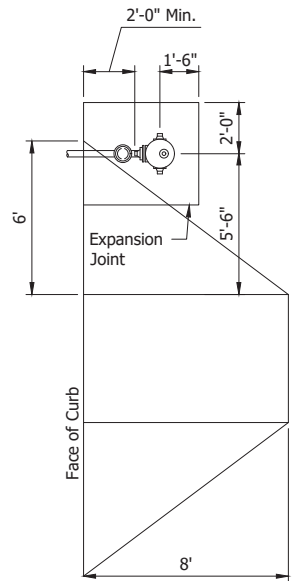
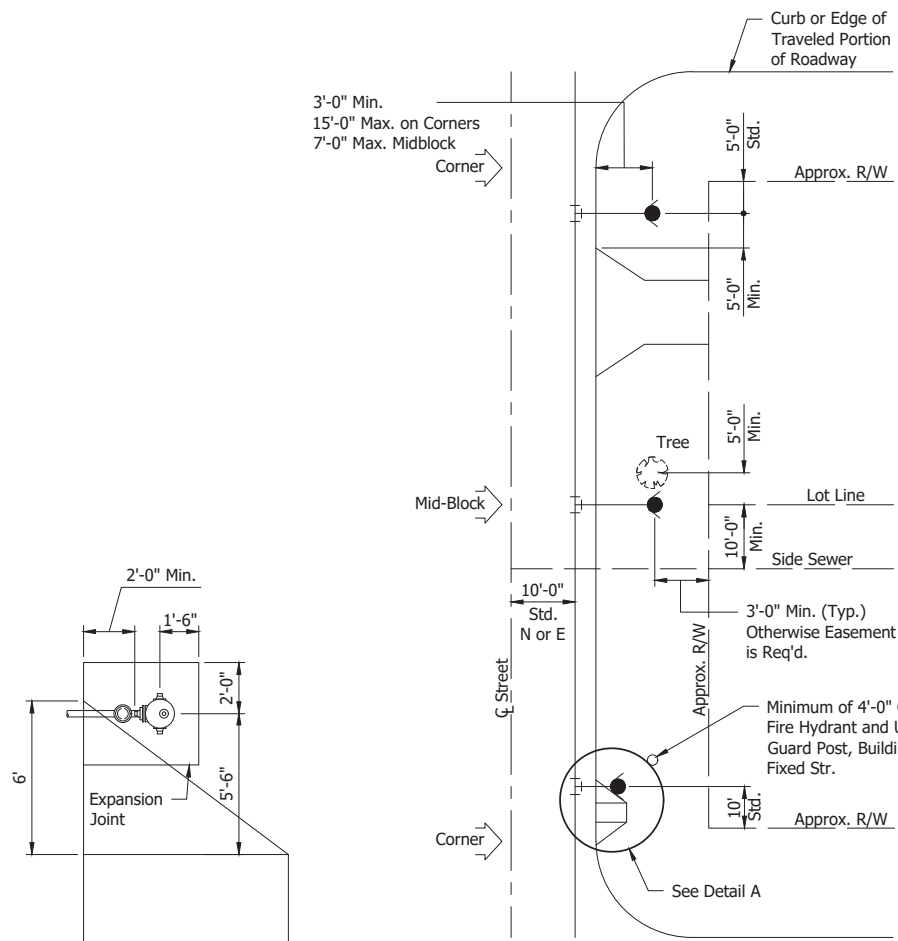
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN  
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**TYPICAL BUTTERFLY VALVE AND BOX**

STANDARD  
**5-9**

**SECTION 5 - WATER WORKS**



**DETAIL A**  
Hydrant Near Curb Ramp

**LEGEND:**  
● Fire hydrant

**NOTES:**

1. No parking zone within 15'-0" radius of fire hydrant.
2. Min. distance from back face of hydrant to front edge of concrete walk shall be 2'-0".
3. Fire hydrant spacing shall be no greater than 500 ft.
4. Fire hydrant shall not be placed within pedestrian access.

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REF STD SPEC SEC 5-2.6 and 5-3.10

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EFFECTIVE DATE: June 26, 2018



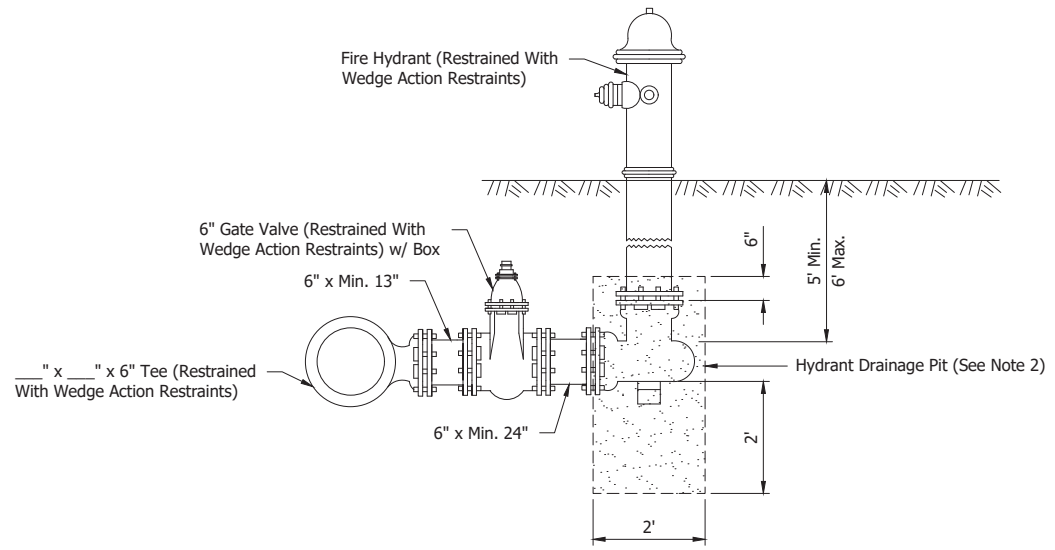
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN  
AND CONSTRUCTION

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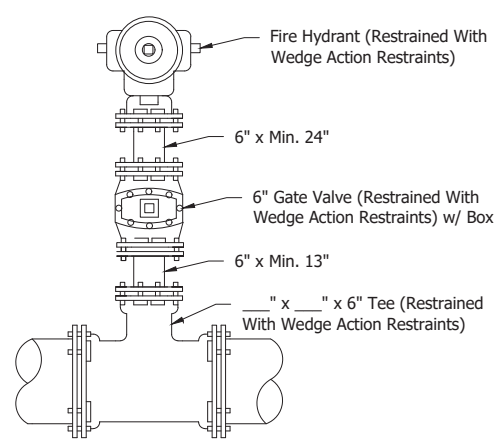
**FIRE HYDRANT LOCATION AND CLEARANCES**

STANDARD  
**5-10**

**SECTION 5 - WATER WORKS**



**ELEVATION**



**PLAN**

**NOTES:**

1. Any subgrade disturbed beneath hydrant shall be thoroughly compacted or suitable material shall be furnished, placed and compacted to provide a firm foundation for the hydrant.
2. Hydrant drainage: To prevent freezing of the hydrant barrel if it were not drained, a drainage pit 2'x2'x2' shall be excavated below the hydrant and filled with coarse gravel or crushed stone mixed with sand to a depth of 6" above the hydrant opening, providing sufficient aggregate void space to more than equal the volume of the barrel. The drainage pit should neither be near, nor have a connection to a sewer.
3. Hydrant painting: Hydrants to be painted red, white and blue per manufacturers paint specs.
4. All pipe, fitting and valve joints shall be restrained with wedge action restraints.

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 5-2.6 and 5-3.10

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EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

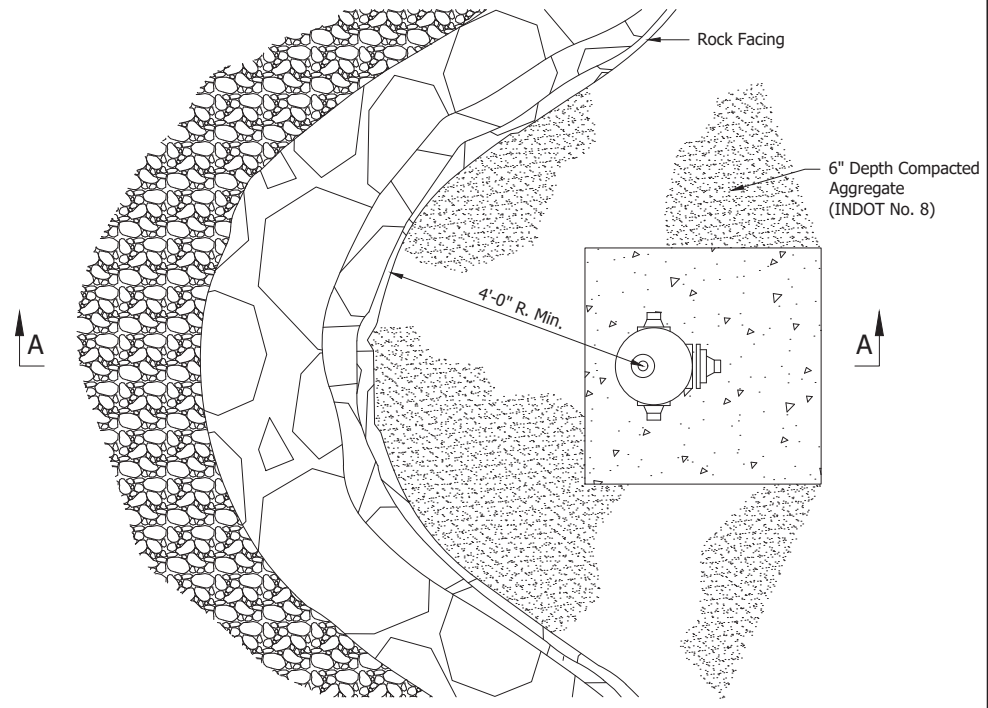
STANDARDS FOR DESIGN  
AND CONSTRUCTION

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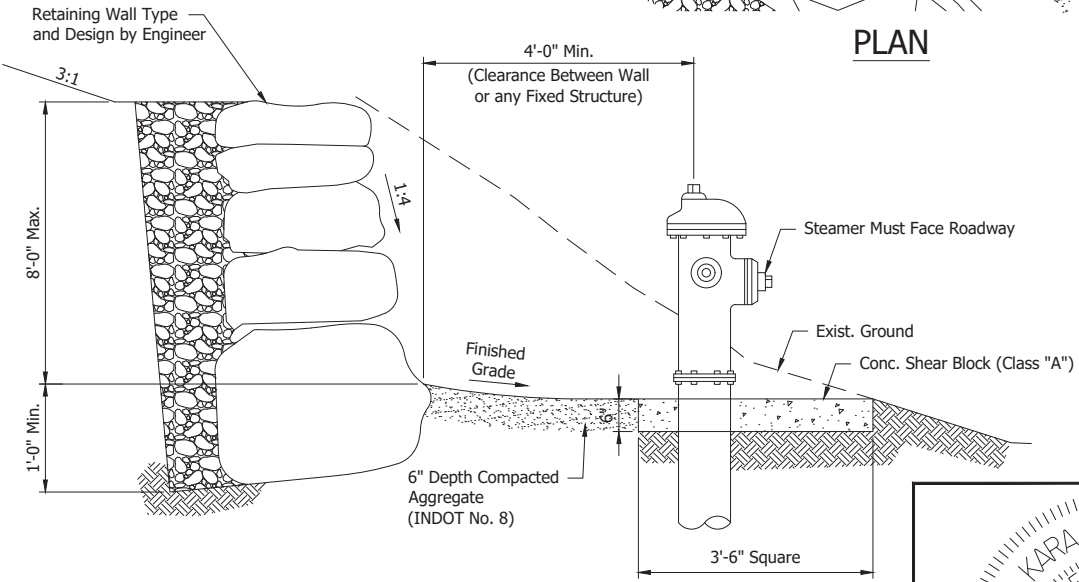
**FIRE HYDRANT ASSEMBLY**

STANDARD  
**5-11**

**SECTION 5 - WATER WORKS**



**PLAN**



**SECTION A-A**

6/26/18  
 Date

Kara M. Boyles, Ph.D., P.E.

REF STD SPEC SEC 5-2.6 and 5-3.10

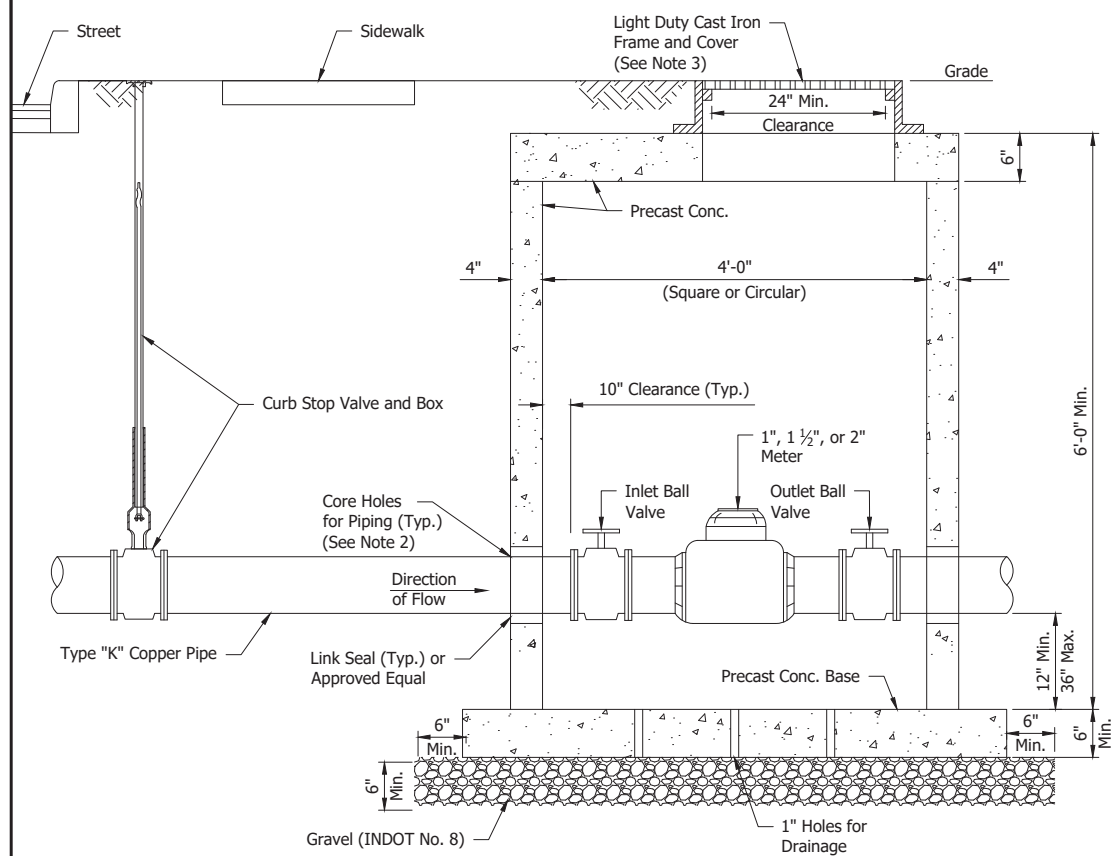
APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
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			<b>CITY OF SOUTH BEND</b>
<b>Item</b>	<b>Revision</b>	<b>Approved Date</b>	STANDARDS FOR DESIGN AND CONSTRUCTION

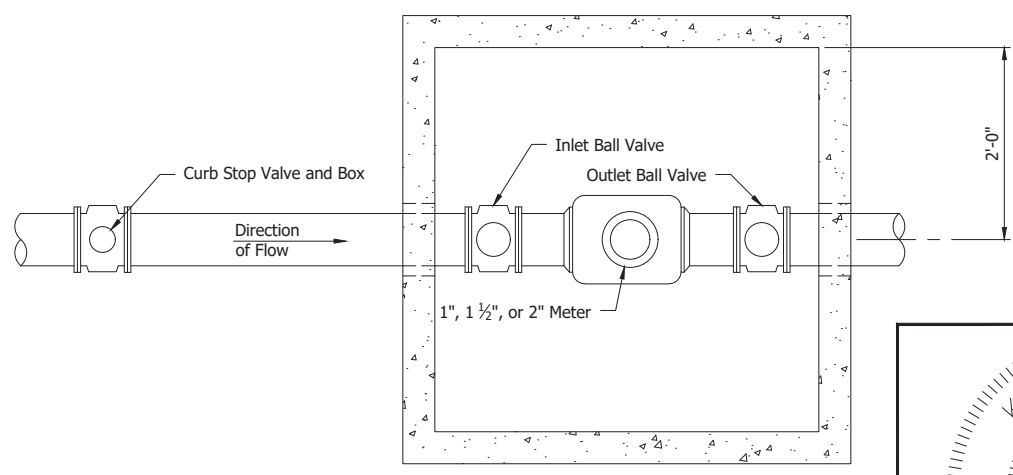
**WALL REQUIREMENTS FOR HYDRANTS**

STANDARD  
**5-12**

**SECTION 5 - WATER WORKS**



**SECTION VIEW**



**PLAN VIEW**

**NOTES:**

1. Precast Conc. structure shall be manufactured and installed in compliance with ASTM C-478 (round str.) or ASTM C-913 (rectangular/square str.)
2. The cored opening shall be large enough to allow passage of the pipe flange.
3. Lid shall have the word "WATER" cast into it. If placed in a paved area, casting shall be heavy duty.

REF STD SPEC SEC 5-2.7

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APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



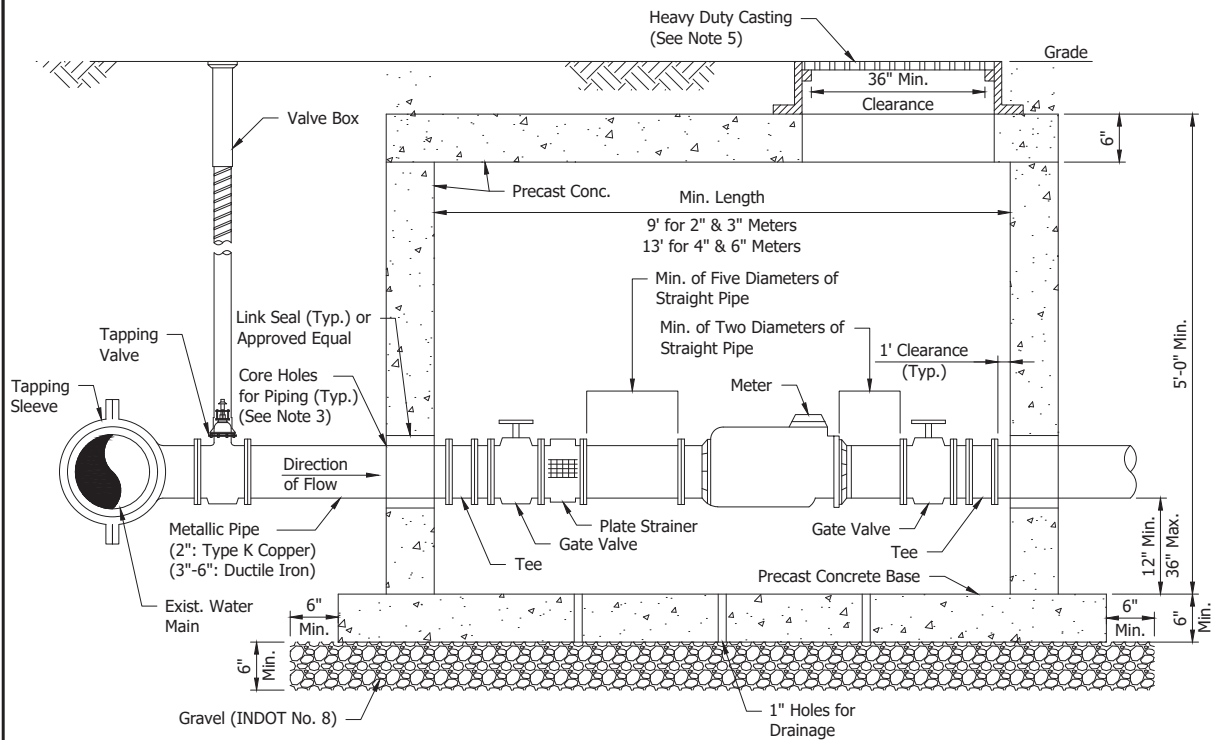
**CITY OF SOUTH BEND**  
STANDARDS FOR DESIGN  
AND CONSTRUCTION

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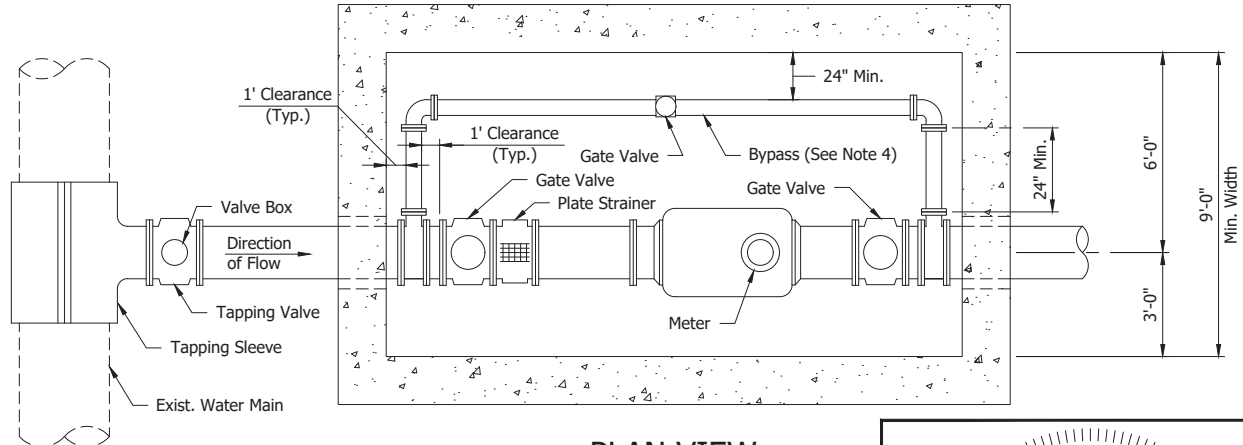
**METER PIT SPECS. FOR 1", 1 1/2", AND 2" METERS**

STANDARD  
**5-13**

**SECTION 5 - WATER WORKS**



**SECTION VIEW**



**PLAN VIEW**

**NOTES:**

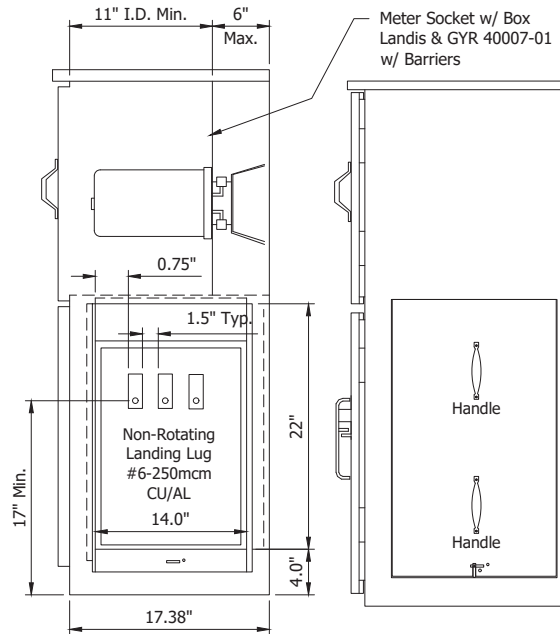
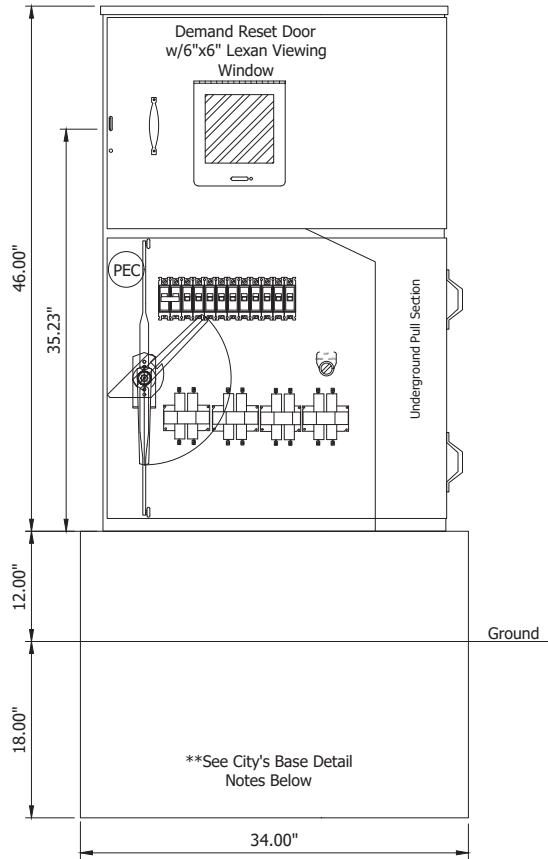
1. The preference of the Water Department is that the meter and associated by-pass line be located inside a building utility room.
2. Precast concrete structure shall be manufactured and installed in compliance with ASTM C-913 (rectangular/square str.)
3. The cored opening shall be large enough to allow passage of the pipe flange.
4. By-pass line shall be a minimum of 1/2 the diameter of the main and of material similar to main.
5. Lid shall have the word "WATER" cast into it.
6. Place pipe supports at the gate valves.
7. All pipe fittings and valve joints inside structure shall be flanged.

REF STD SPEC SEC 5-2.7 and 5-3.11

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				<b>CITY OF SOUTH BEND</b>	
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION	
<b>METER VAULT FOR COMPOUND AND TURBINE METERS</b>				STANDARD <b>5-14</b>	

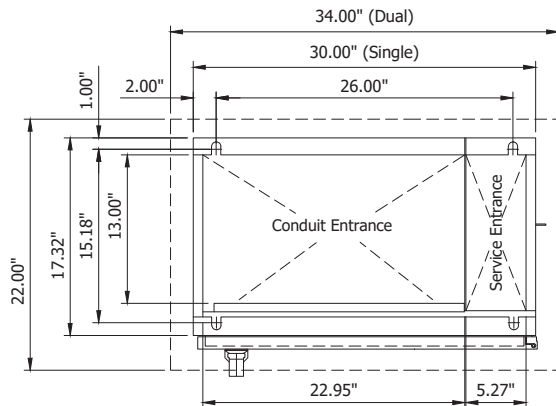
**SECTION 6 - TRAFFIC AND LIGHTING**



**SIDE VIEW**

(Pull Section Cover Removed)  
Section Thru Metering Compartment

**PANEL SIDE VIEW**



**PANEL BASE PLAN**

**CITY BASE DETAIL NOTES**

Base Must be 34" w X 30" h X 22" d  
12" (of 30") Must be Exposed Above Ground  
18" (of 30") Must be Below Ground

**ENCLOSURE CONSTRUCTION NOTES:**

1. Exterior 12 ga. H.D. galv. steel and interior 14 ga. cold rolled steel electrically welded and reinforced where required.
2. Construction will be NEMA 3R, raintight.
3. All nuts, bolts and screws will be stainless steel.
4. Nuts, bolts & screws will not be visible from outside of enclosure.
5. Nameplates will be provided as required.
6. Control wiring will be marked at both ends by permanent wire markers.
7. A plastic covered wiring diagram will be attached to the inside of the front door.
8. Enclosure will be factory wired and conform to required NEMA and UL 508A standards.
9. Color to be: Char Brown or as specified by Engineering Department.

**REF STD SPEC SEC 6-2**

6/26/18  
Date

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EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

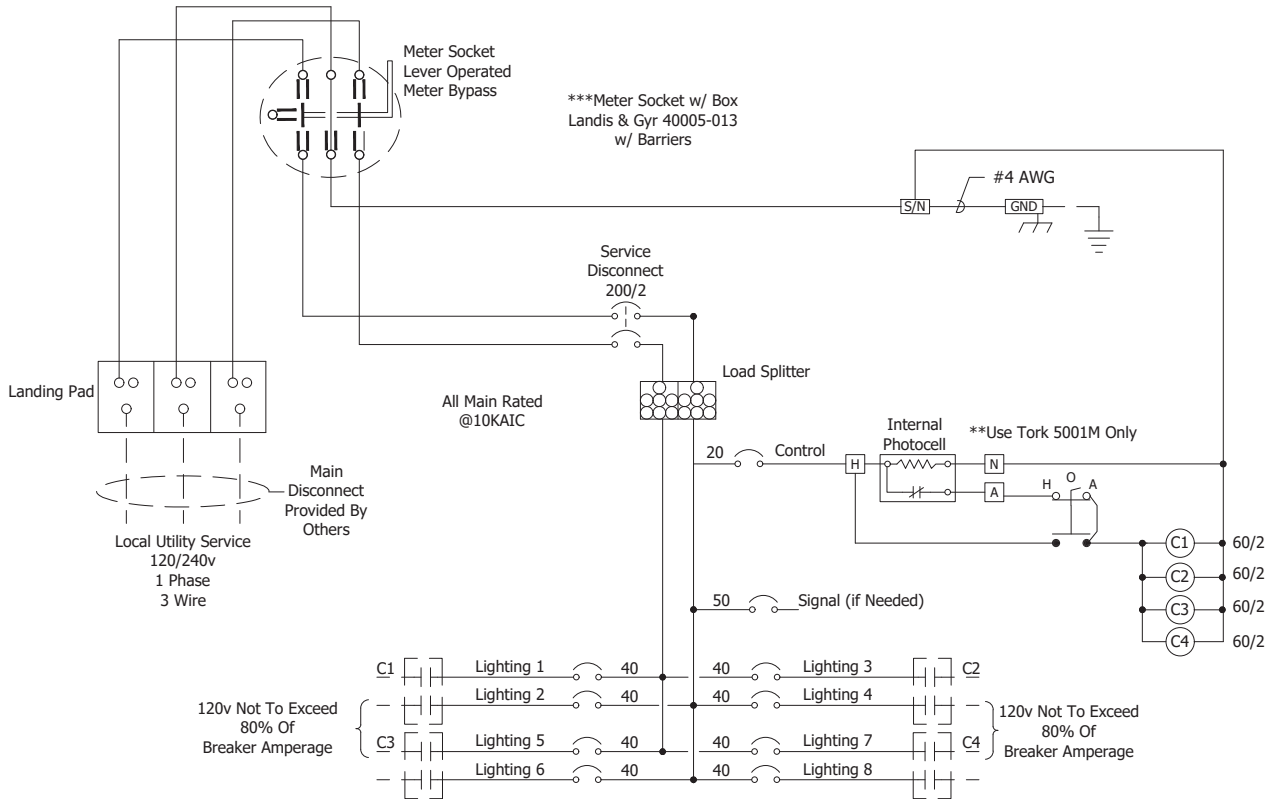
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**SERVICE POINT - SINGLE METER (CABINET AND FOUNDATION DETAILS)**

STANDARD  
**6-1**

SECTION 6 - TRAFFIC AND LIGHTING



**NOTE:**  
Load Current For All Breaker Not To Exceed 80% Of Breaker amperage.

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6/26/18  
Date

REF STD SPEC SEC 6-2

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EFFECTIVE DATE: June 26, 2018



CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
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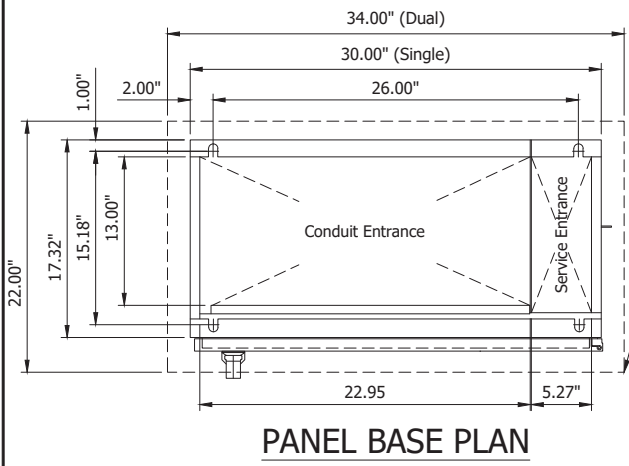
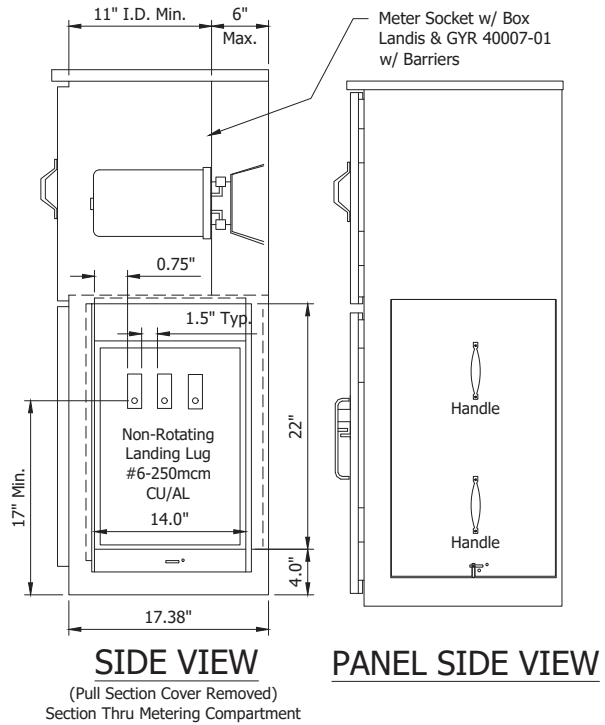
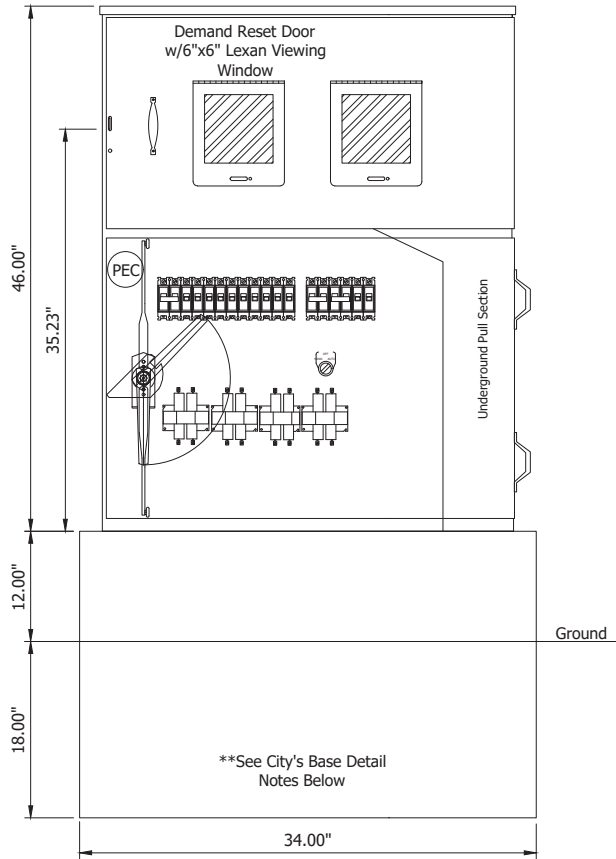
Item	Revision	Approved Date

SERVICE POINT - SINGLE METER (ELECTRICAL SCHEMATIC)

STANDARD  
6-2



**SECTION 6 - TRAFFIC AND LIGHTING**



**CITY BASE DETAIL NOTES**  
 Base Must be 34" w X 30" h X 22" d  
 12" (of 30") Must be Exposed Above Ground  
 18" (of 30") Must be Below Ground


**PANEL BASE PLAN**

**ENCLOSURE CONSTRUCTION NOTES:**

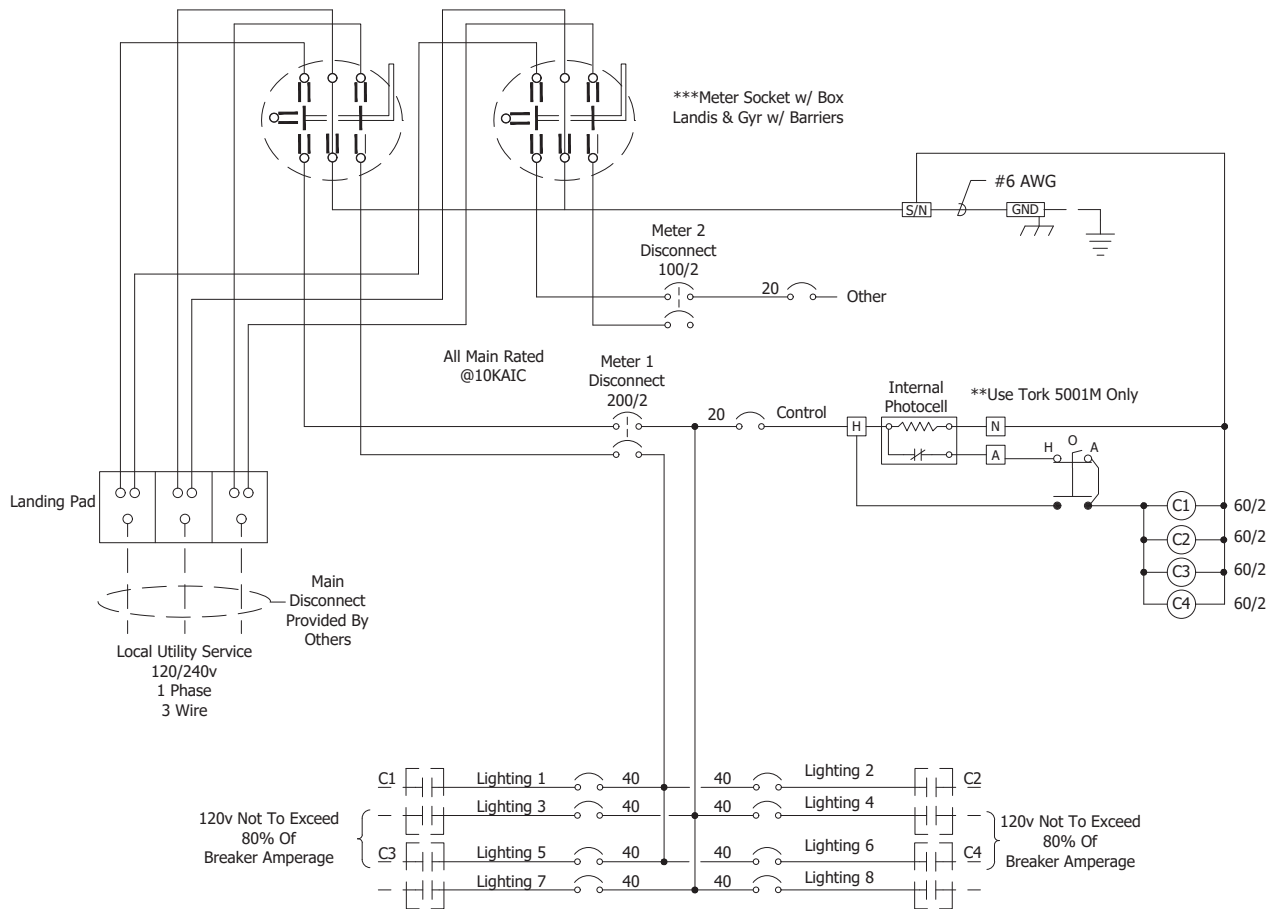
1. Exterior 12 ga. H.D. galv. steel and interior 14 ga. cold rolled steel electrically welded and reinforced where required.
2. Construction will be NEMA 3R, raintight.
3. All nuts, bolts and screws will be stainless steel.
4. Nuts, bolts & screws will not be visible from outside of enclosure.
5. Nameplates will be provided as required.
6. Control wiring will be marked at both ends by permanent wire markers.
7. A plastic covered wiring diagram will be attached to the inside of the front door.
8. Enclosure will be factory wired and conform to required NEMA and UL 508A standards.
9. Color to be: Char Brown or as specified by Engineering Department.

**REF STD SPEC SEC 6-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
 EFFECTIVE DATE: June 26, 2018

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018			 <p><b>CITY OF SOUTH BEND</b></p>
Item	Revision	Approved Date	
			STANDARDS FOR DESIGN AND CONSTRUCTION
<p><b>SERVICE POINT - DUAL METER (CABINET AND FOUNDATION DETAILS)</b></p>			<p>STANDARD <b>6-3</b></p>

# SECTION 6 - TRAFFIC AND LIGHTING



**NOTE:**  
Load Current For All Breaker Not To Exceed 80% Of Breaker amperage.

Kara M. Boyles, Ph.D., P.E.

6/26/18  
 Date

REF STD SPEC SEC 6-2

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EFFECTIVE DATE: June 26, 2018



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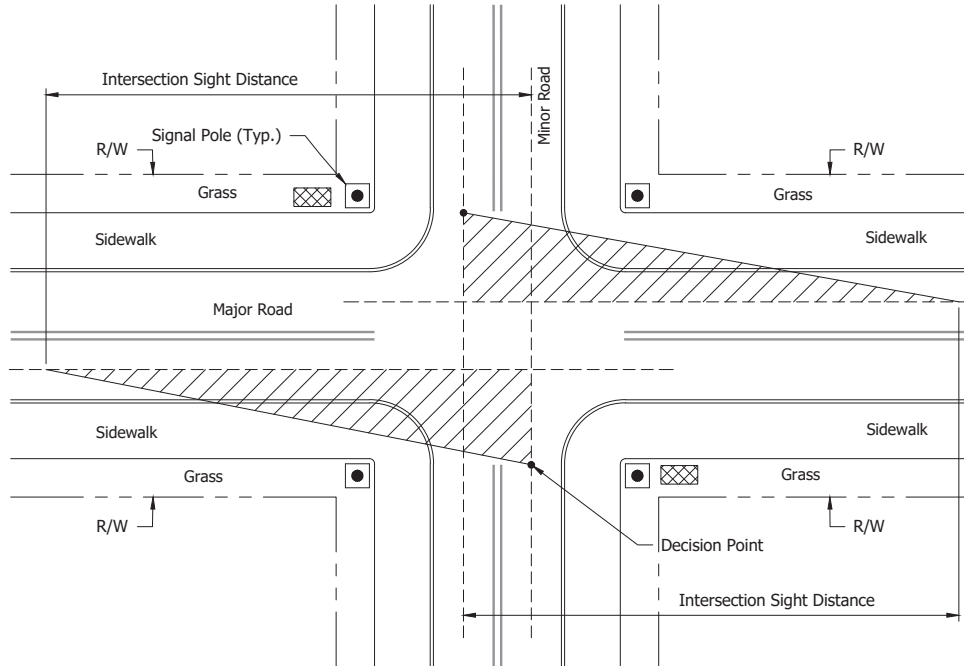
STANDARDS FOR DESIGN  
AND CONSTRUCTION



Item	Revision	Approved Date

**SERVICE POINT - DUAL/COMBINATION METER  
(ELECTRICAL SCHEMATIC)**

STANDARD  
**6-4**

SECTION 6 - TRAFFIC AND LIGHTING

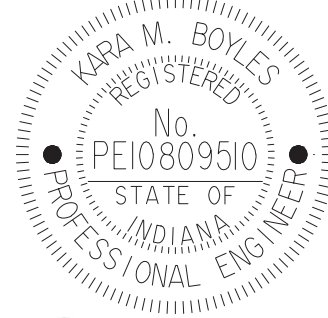


-  Preferred Location of Service and Controller Cabinet
-  Clear Sight Triangle

**NOTES:**

1. Avoid placing service and control cabinet within the clear sight triangle.
2. Preferred location of service and controller cabinet is behind signal pole to reduce the chance of being struck by an errant vehicle from oncoming vehicles of the major road .
3. Service points and controller cabinet shall be located outside of pedestrian access route and positioned so that a technician working in cabinet can see signal indications in at least one direction. Placement of service points and controller cabinets shall consider location of the electrical service from the power company.

REF STD SPEC SEC 6-2



*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

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EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

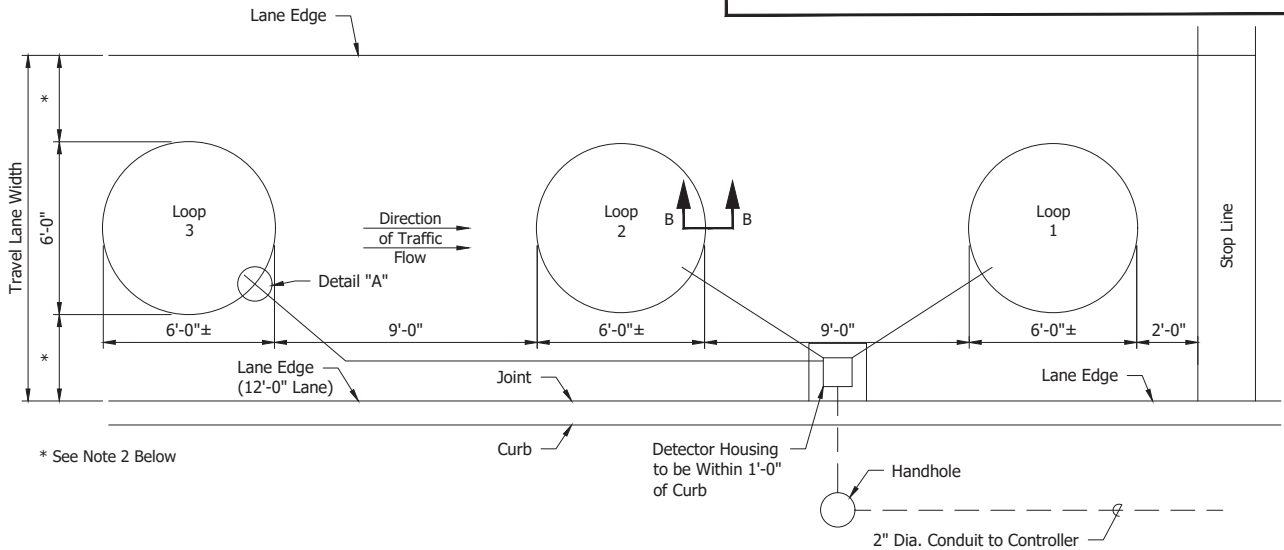
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**SERVICE POINT AND CONTROLLER CABINET LOCATION**

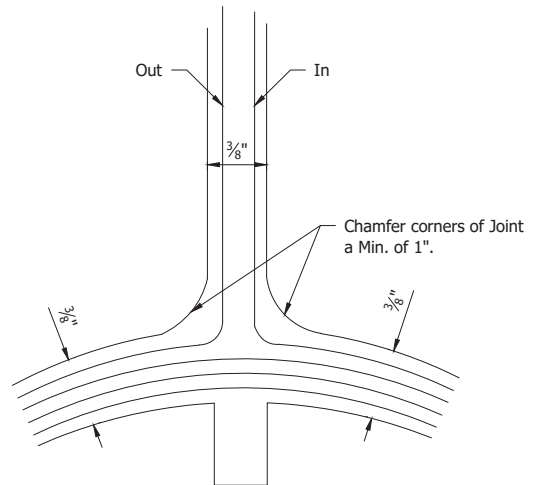
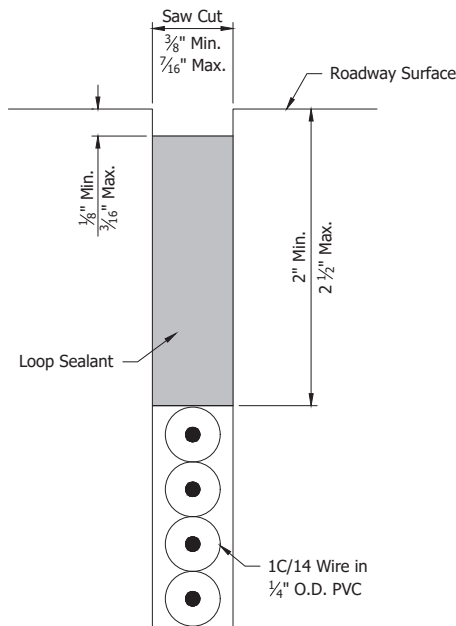
STANDARD  
**6-5**

SECTION 6 - TRAFFIC AND LIGHTING



\* See Note 2 Below

TYPICAL LOOP DETECTION (TWO LANES)



DETAIL "A"

LOOP SAW-CUT DETAIL  
SECTION B-B

NOTES:

1. The 2 ft. distance behind stop line is typical depending on the intersection geometrics; a loop can be in front of the stop line.
2. Loop(s) shall be centered transversely in the travel lane.
3. The saw slot for the line from detector housing to the circular loop shall be approximately perpendicular to the tangent of the loop at the point of intersection.

REF STD SPEC SEC 6-3

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Item	Revision	Approved Date

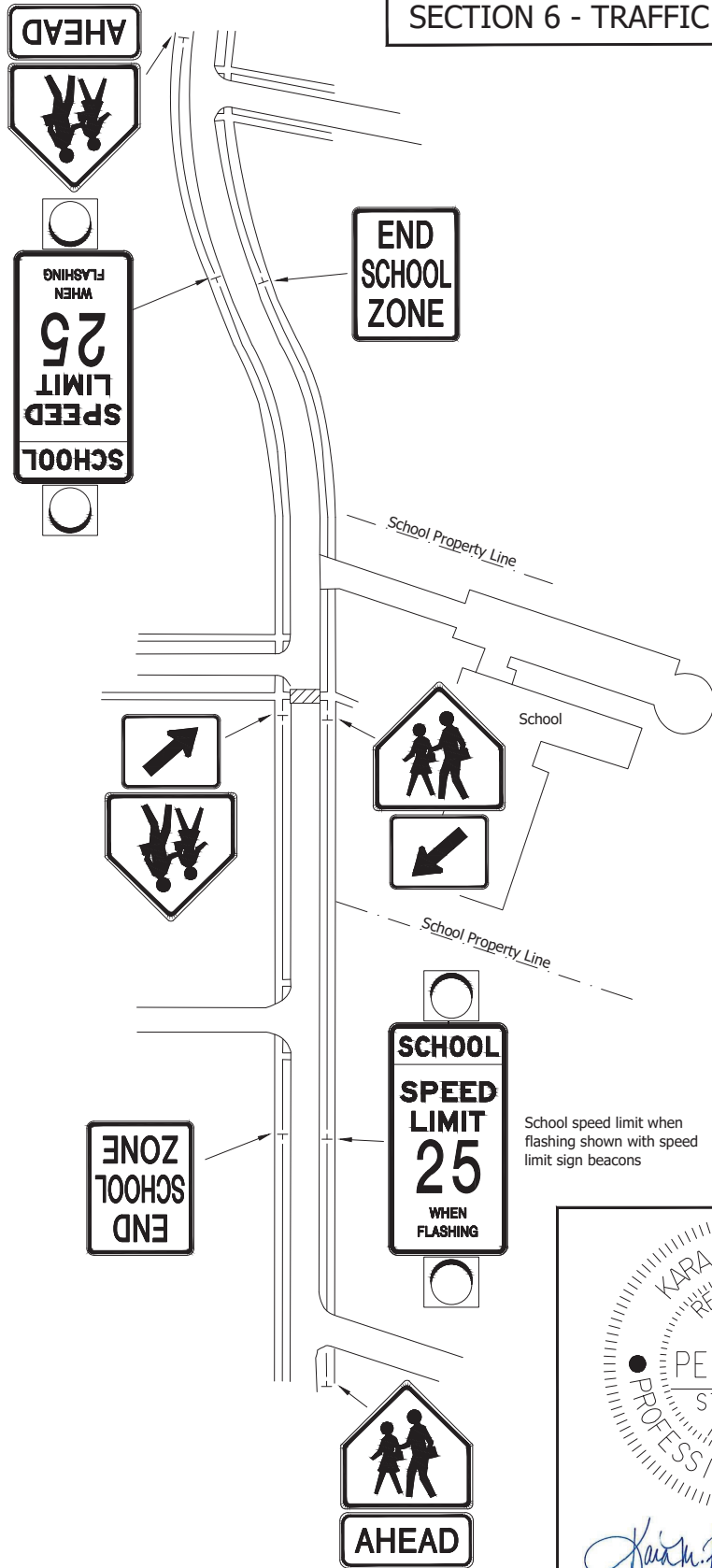
SIGNAL - ACTUATION (LOOP DETECTORS)

STANDARD  
6-6

SECTION 6 - TRAFFIC AND LIGHTING

School speed limit when flashing shown with speed limit sign beacons

School speed limit when flashing shown with speed limit sign beacons



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Date

REF STD SPEC SEC 6-4

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



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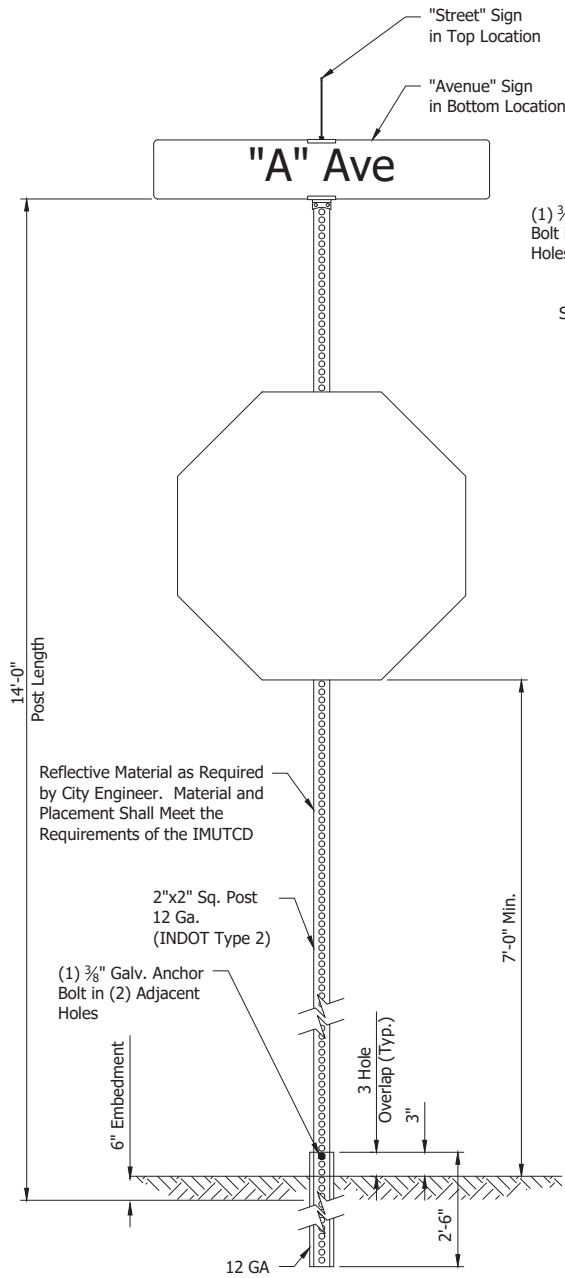
Item	Revision	Approved Date

STANDARDS FOR DESIGN  
AND CONSTRUCTION

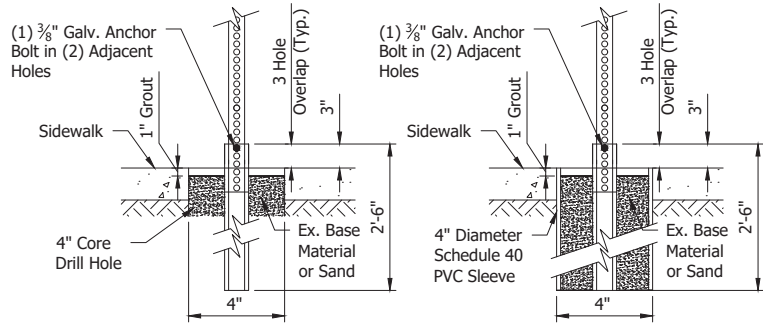
SIGNS - SCHOOL ZONE SIGNAGE

STANDARD  
6-7

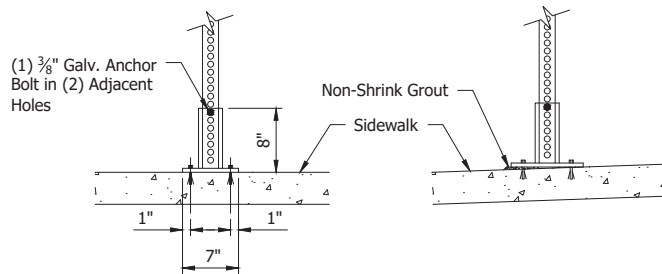
SECTION 6 - TRAFFIC AND LIGHTING



**COMBINATION STOP AND STREET SIGN  
ANCHORED IN GRASS OR SOIL**



**SIGN POST WITH SIDEWALK PENETRATIONS**



**SIGN POST SURFACE MOUNT  
ON EXISTING CONCRETE**

**NOTES:**

1. D3 Sign shall be installed parallel to corresponding street.
2. D3 Sign on any other metal pole shall require review and approval by the Engineer.
3. For unlevel sidewalks insert washers as spacers between plate and sidewalk. Grout all space as shown. If bolt cannot penetrate sidewalk at least 2", contact the engineer.
4. Sign posts mounted to sidewalk requires written approval from City Engineer.

REF STD SPEC SEC 6-4

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EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

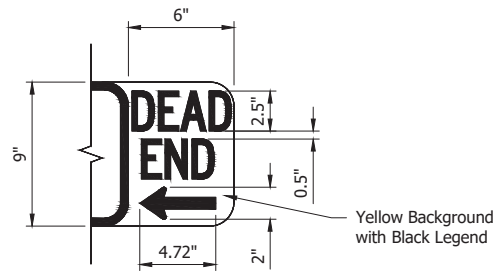
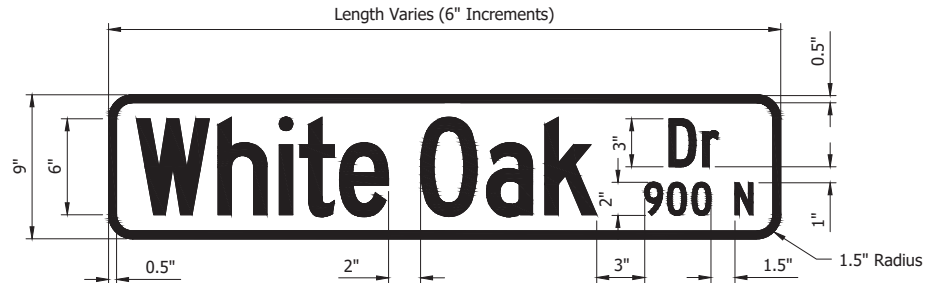
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**SIGNS - STOP SIGN WITH RESIDENTIAL D3 SIGN**

STANDARD  
**6-8**

SECTION 6 - TRAFFIC AND LIGHTING



**NOTES:**

1. Font is Highway C Series, upper & lower case with standard words, numbers and letter spacing.
2. Sign coloring is to be green background with white legend for Standard Streets, brown background with white legend for Honorary Streets and blue background with white legend for Private Streets.
3. Sign layout is based on post-mounted, 2-lane streets for all speeds or multi-lane streets for speeds 40 mph or less. Refer to MUTCD for different conditions.
4. When the "Dead End" is applied to a residential D3 sign, the yellow end shall be closest to the centerline of the street.

**REF STD SPEC SEC 6-4**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

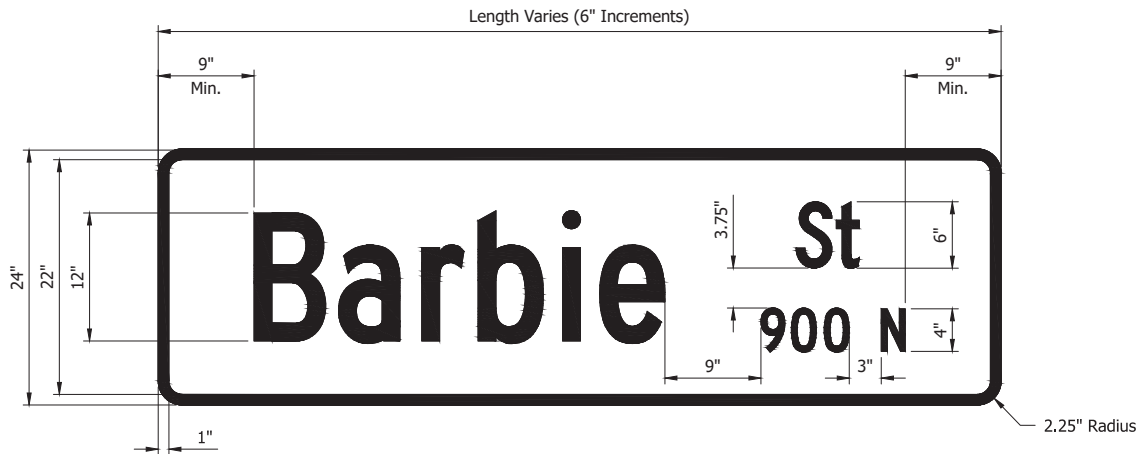
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**SIGNS - RESIDENTIAL D3 SIGN**

STANDARD  
**6-9**

SECTION 6 - TRAFFIC AND LIGHTING



**NOTES:**

1. Font is Highway C Series, upper & lower case with standard words, numbers and letter spacing.
2. Sign coloring is to be green background with white legend for Standard Streets, brown background with white legend for Honorary Streets and blue background with white legend for Private Streets.
3. Sign layout is based overhead-mounting, two or multi-lane streets for all speeds.

REF STD SPEC SEC 6-4

Kara M. Boyles, Ph.D., P.E. 6/26/18  
Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

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AND CONSTRUCTION

Item	Revision	Approved Date

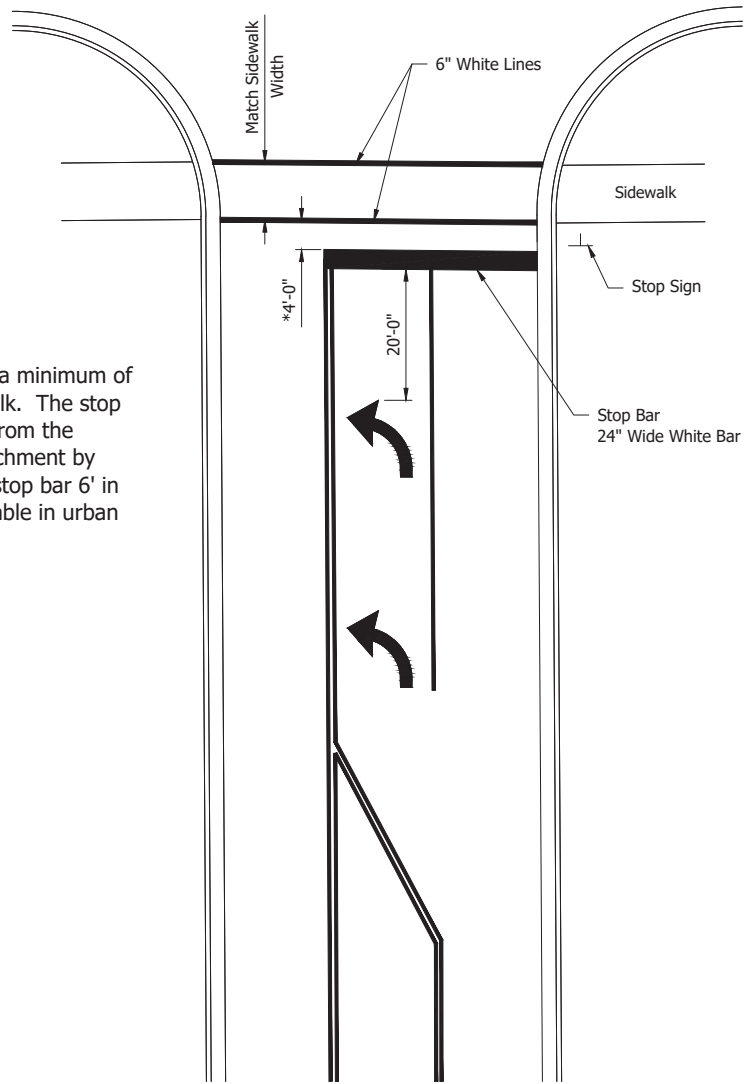
**SIGNS - OVERHEAD RESIDENTIAL D3 SIGN**

STANDARD  
**6-10**

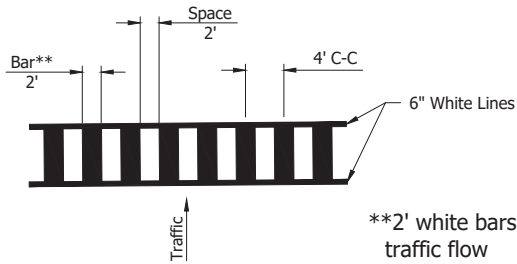


SECTION 6 - TRAFFIC AND LIGHTING

\*Stop bar should be placed a minimum of 4' in advance of a crosswalk. The stop bar may be more than 4' from the crosswalk to avoid encroachment by turning vehicles. Placing stop bar 6' in front of crosswalk is desirable in urban areas.



TRANSVERSE LINE CROSSWALK & TURN LANE ARROW LOCATION



LADDER CROSSWALK

**NOTES:**

1. Ladder Crosswalks shall be installed in areas of high pedestrian users, (i.e. Schools, churches, business districts and roundabouts).
2. See Standard Drawings 2-37 through 2-41 for Curb Ramp details. Landing of curb ramp shall fall within crosswalk markings.

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**REF STD SPEC SEC 6-5**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



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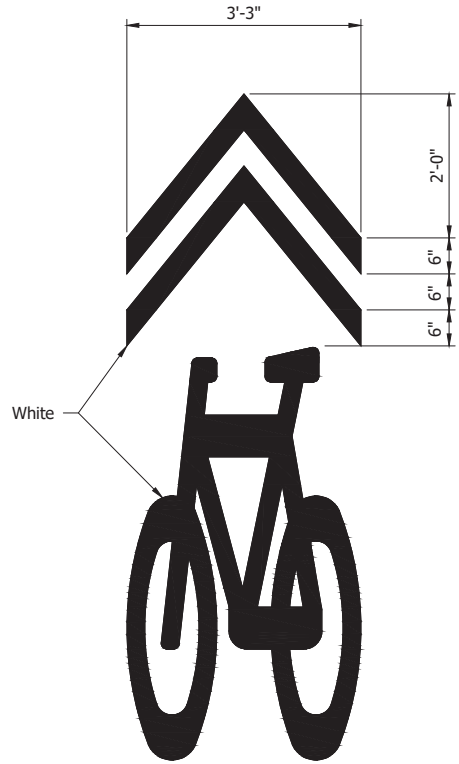
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

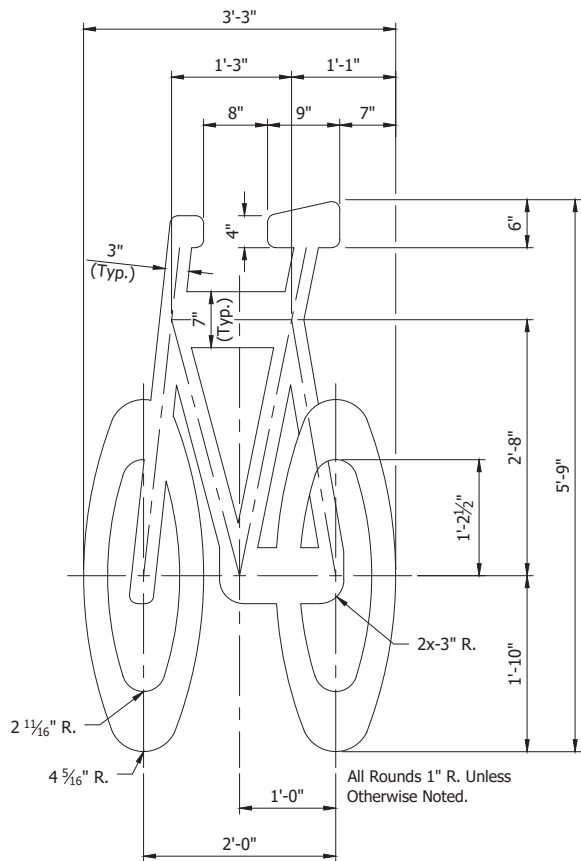
**MARKINGS - CROSSWALK & TURN LANE ARROW**

STANDARD  
**6-11**

SECTION 6 - TRAFFIC AND LIGHTING



SHARED LANE MARKING



BICYCLE SYMBOL

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6/26/18  
Date

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EFFECTIVE DATE: June 26, 2018



CITY OF SOUTH BEND

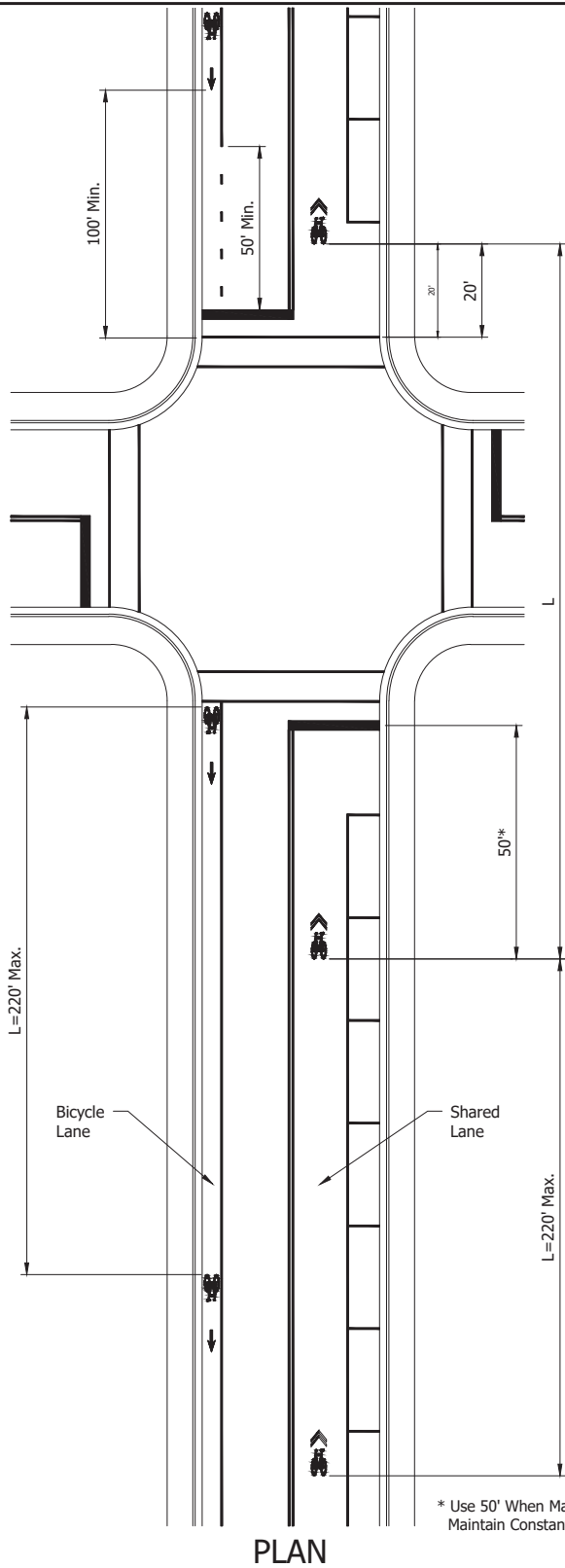
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

MARKINGS - BICYCLE SYMBOL AND CHEVRON

STANDARD  
6-12

SECTION 6 - TRAFFIC AND LIGHTING



NOTES:

1. Shared lane marking is preferred centered in lane. Refer to MUTCD for additional guidance on Shared Lane marking locations.
2. Bicycle lane markings should be placed at the beginning of a bicycle lane.
3. 50 ft. dotted line leading up to intersection may increase up to 200 ft. if bus stop or heavy right turn volume.
4. See Standard Drawing 6-12 for Bicycle Symbol & Chevron.

\* Use 50' When Marked Bikeway ends, Otherwise Maintain Constant Symbol Frequency

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Date

REF STD SPEC SEC 6-5

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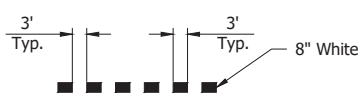
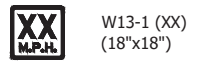
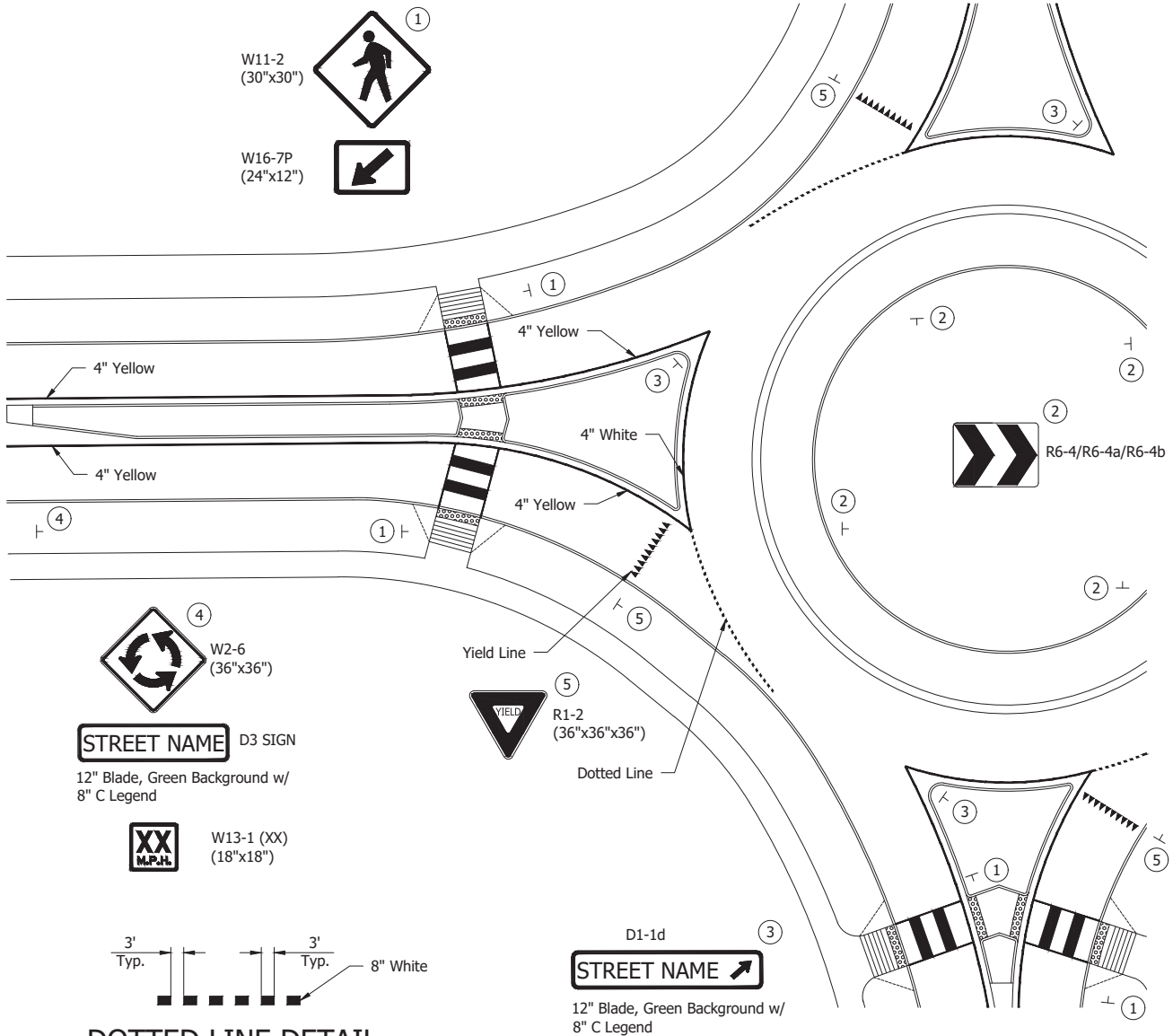
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

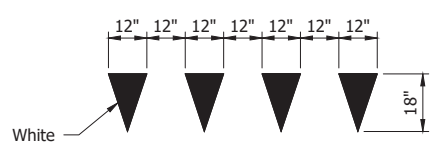
MARKINGS - BICYCLE LANE AND SHARED LANE MARKINGS

STANDARD  
6-13

SECTION 6 - TRAFFIC AND LIGHTING



**DOTTED LINE DETAIL**



**YIELD LINE DETAIL**

- NOTES:**
1. See Standard Drawing 2-37, 2-38, 2-39, 2-40, 2-41 for Curb Ramp details.
  2. See Standard Drawing 6-11 for Crosswalk Markings details.

**REF STD SPEC SEC 6-5**

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EFFECTIVE DATE: June 26, 2018



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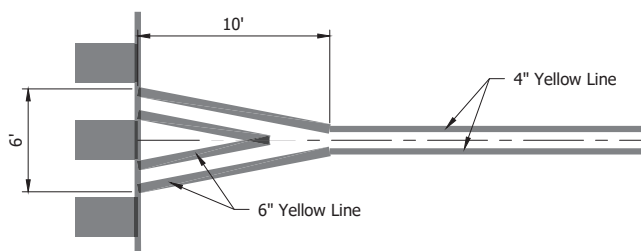
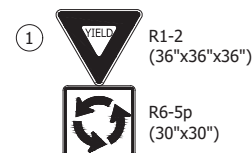
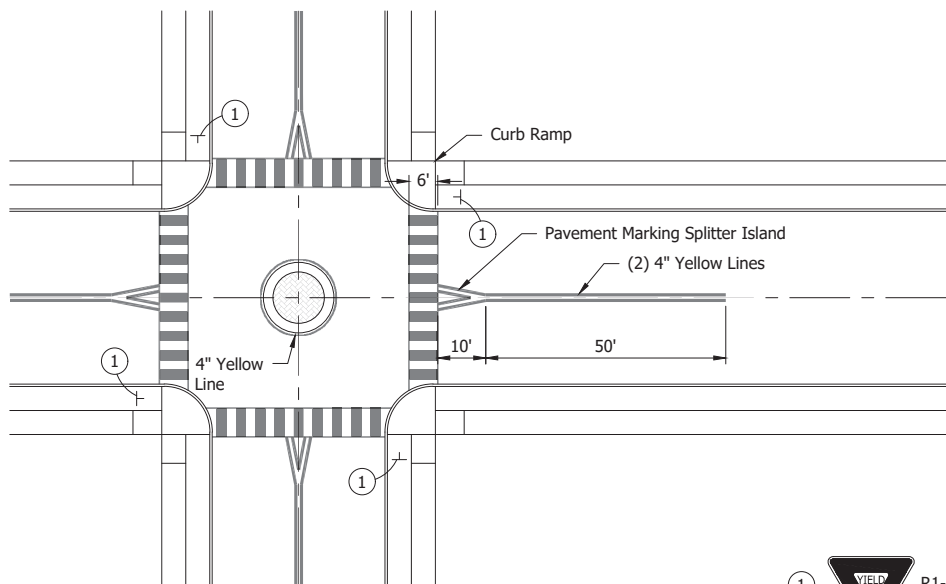
STANDARDS FOR DESIGN AND CONSTRUCTION

Item	Revision	Approved Date

**ROUNDAABOUT - MARKINGS & SIGNING**

STANDARD  
**6-14**

SECTION 6 - TRAFFIC AND LIGHTING



SPLITTER ISLAND MARKINGS DETAIL

NOTES:

1. See Standard Drawing 2-22 for Mini Roundabout geometry.
2. See Standard Drawing 6-11 for Crosswalk details.

REF STD SPEC SEC 6-5

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EFFECTIVE DATE: June 26, 2018



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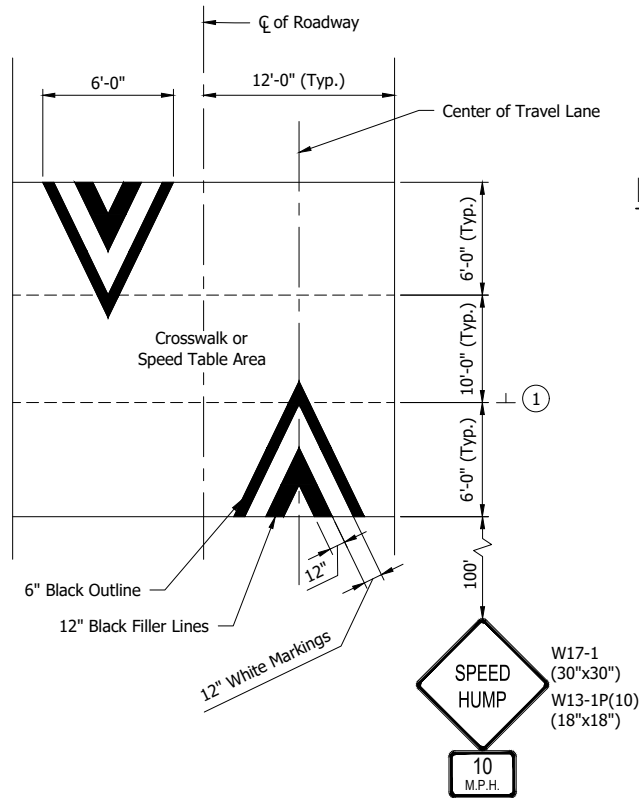
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

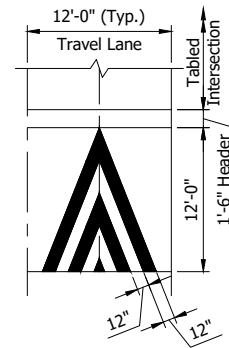
MINI ROUNDABOUT - MARKINGS AND SIGNING

STANDARD  
6-15

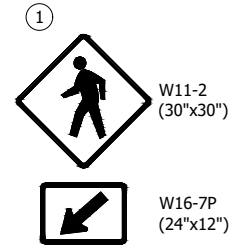
SECTION 6 - TRAFFIC AND LIGHTING



**SPEED HUMP MARKINGS**



**RAISED CROSSWALK MARKINGS**



**NOTES:**

1. Markings shall provide sufficient contrast with the pavement.
2. Asphalt pavement shall use paint or thermoplastic and concrete pavement shall be multi-component.
3. Warning signage shall be provided for opposing traffic in addition to signage shown.
4. See Standard Drawings 2-43, 2-44, and 2-45 for Speed Hump and Tabled Intersection details.

**REF STD SPEC SEC 6-5**

6/26/18  
 Kara M. Boyles, Ph.D., P.E. Date

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EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

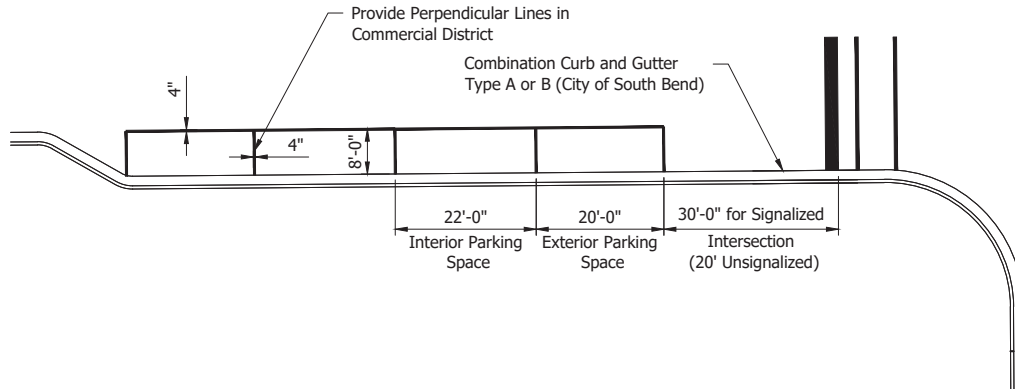
Item	Revision	Approved Date
1.	Speed Hump Dimensions Modified	7/28/20

STANDARDS FOR DESIGN  
AND CONSTRUCTION

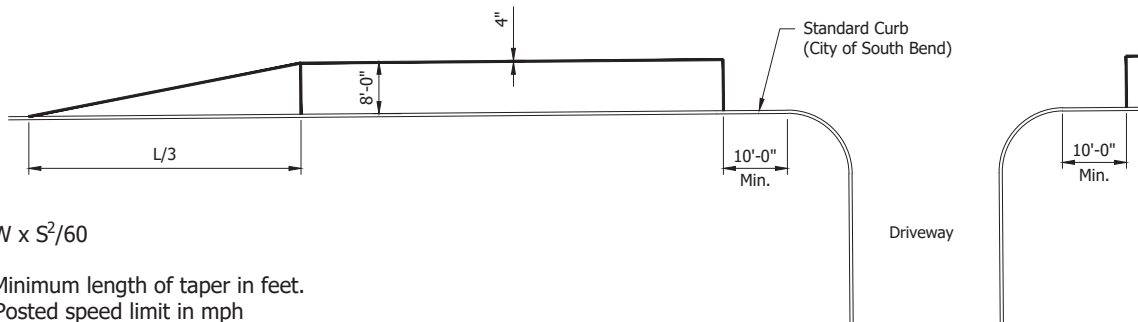
**MARKINGS - SPEED HUMP AND RAISED CROSSWALK**

STANDARD  
**6-16**

SECTION 6 - TRAFFIC AND LIGHTING



PARALLEL PARKING - COMBINATION CURB AND GUTTER



$L = W \times S^2 / 60$

- L = Minimum length of taper in feet.
- S = Posted speed limit in mph
- W = Width of parking space in feet.

PARALLEL PARKING - STANDARD CURB

NOTES:

- See Standards 2-17 for Intersection with Curb Extension Details.
- Provide guidance devices at curb extensions to delineate the curb offset for snow removal operations.

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REF STD SPEC SEC 6-5

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EFFECTIVE DATE: June 26, 2018



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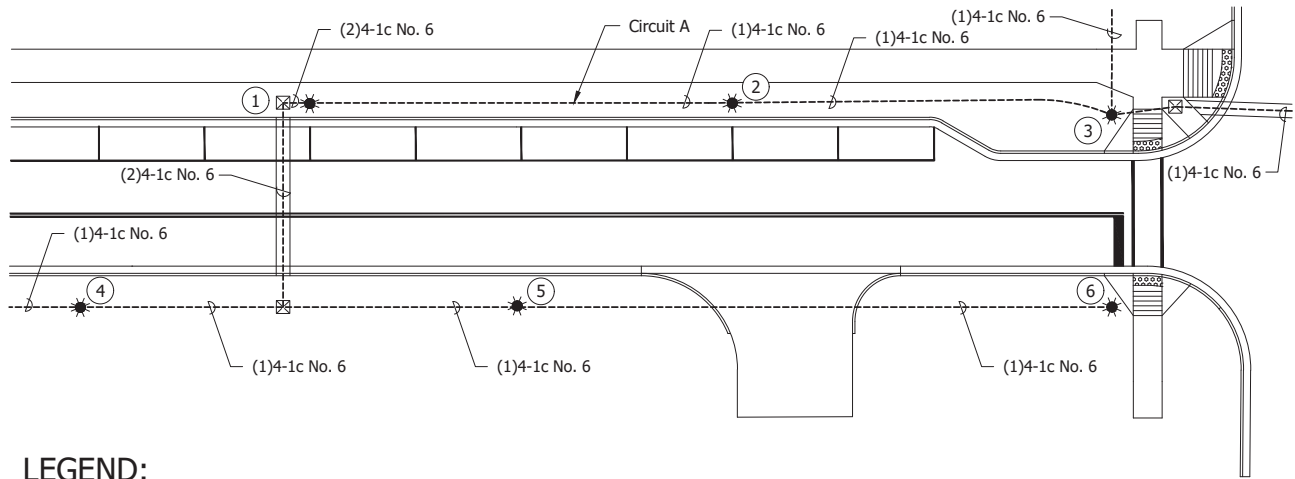
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

MARKINGS - PARKING SPACES

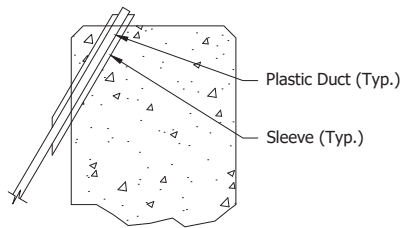
STANDARD  
6-17

# SECTION 6 - TRAFFIC AND LIGHTING

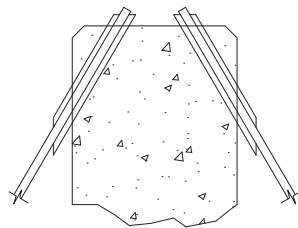


## LEGEND:

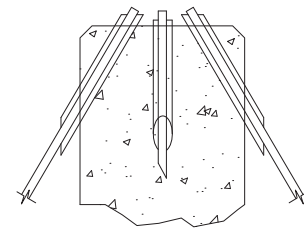
- ① \* Luminaire
- Copper Conductor in Plastic Duct, in Trench
- ===== Copper Conductor in Plastic Duct, in 2" Schedule 80 HDPE Conduit
- ☒ Pull Box



**CONNECTION TYPE 1**



**CONNECTION TYPE 2**



**CONNECTION TYPE 3**

LUMINAIRE SCHEDULE						
Luminaire I.D.	1	2	3	4	5	6
Luminaire Wattage	*	*	*	*	*	*
Connection Type	3	2	3	2	2	1
Circuit "A" Connections	R	B	R	B	R	B
Pole Height	*	*	*	*	*	*

\*- As required to meet Illuminance Design Criteria  
 R- Red Wire  
 B- Black Wire

## NOTES:

- Luminaire spacing shall be based on Illuminance Design Criteria and avoidance of trees with an offset to provide opening doors of parked cars.
- All wire splices shall be above ground and are not allowed in pull boxes.

## REF STD SPEC SEC 6-6

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## CITY OF SOUTH BEND

STANDARDS FOR DESIGN  
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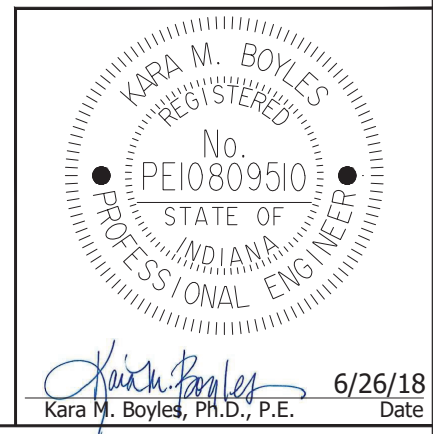
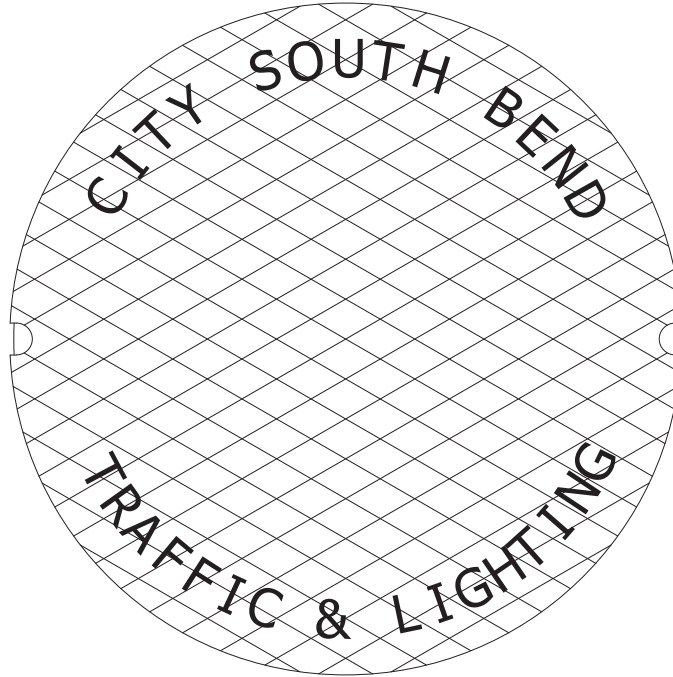
Item	Revision	Approved Date

# LIGHTING - LAYOUT AND DESIGN

STANDARD  
**6-18**



SECTION 6 - TRAFFIC AND LIGHTING



REF STD SPEC SEC 6-3 and 6-6

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018

Item	Revision	Approved Date



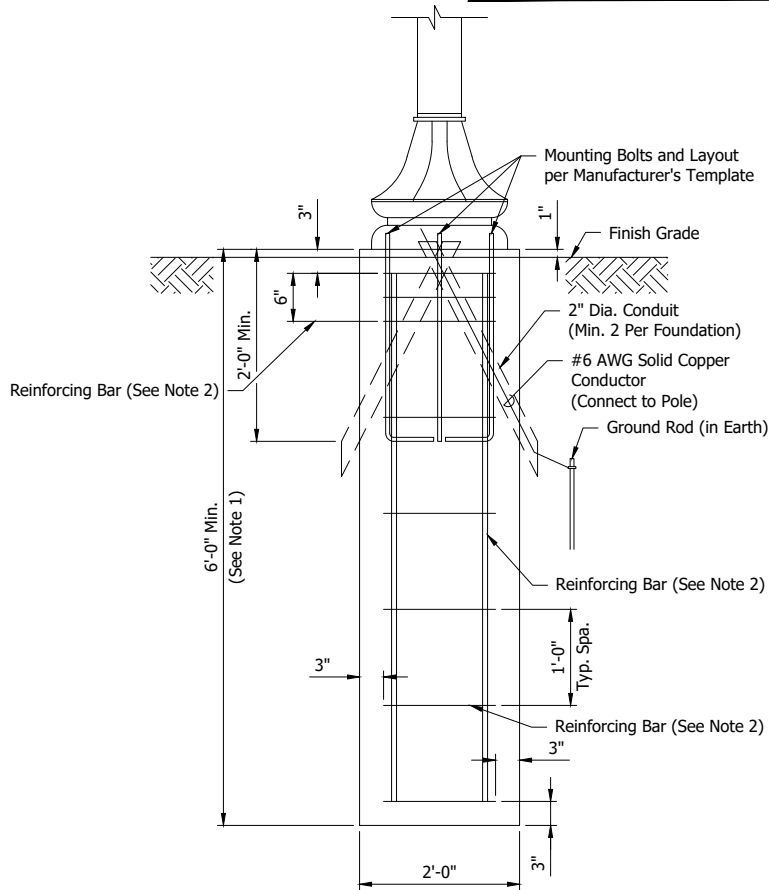
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TRAFFIC & LIGHTING - HANDHOLE COVER**

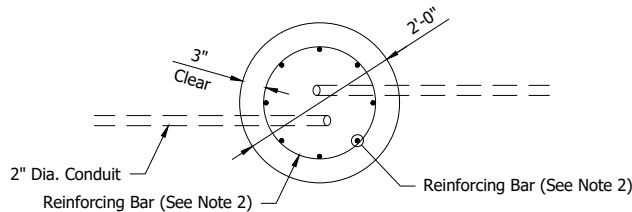
STANDARD  
**6-19**

SECTION 6 - TRAFFIC AND LIGHTING



**LIGHT POLE FOUNDATION**

Maximum \_\_ Ft. Pole Height



**NOTE:**

1. Size and depth of foundation will vary due to pole height, wind loads, Manufacturer's recommendations and other considerations.
2. Horizontal and vertical reinforcement shall be sized and placed in accordance with the foundation design.
3. Break away bolts required when installed within roadway clear zone or as a roadside hazard.

Kara M. Boyles, Ph.D., P.E.      7/20/20      Date

REF STD SPEC SEC 6-6

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: July 28, 2020



**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**LIGHTING - FOUNDATION**

STANDARD  
**6-20**

## SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL

### REQUIREMENTS:

**Material:** 2-3 in. dia. washed stone (INDOT CA No. 2) over a stable foundation.

**Thickness:** 6 in. minimum.

**Width:** See minimums on plan below or full width of entrance/exit roadway, whichever is greater.

**Length:** 50 ft. minimum for small sites (less than 2 acres); 150 ft. minimum for large sites (2 acres and larger).

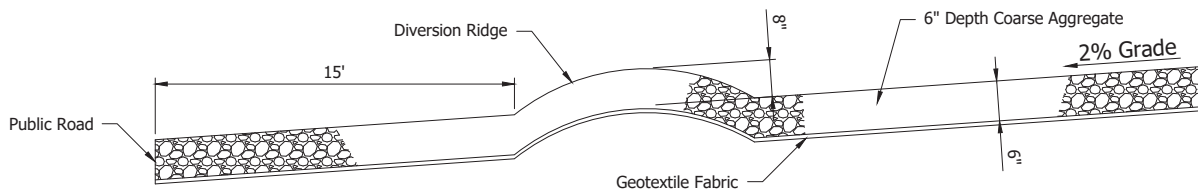
The length can be shorter for small sites such as for an individual home, but shall be of sufficient length to prevent tracking.

**Washing facility (optional):** Level area with 3 in. washed stone minimum or a commercial rack, and waste water diverted to a sediment trap or basin.

**Geotextile fabric underliner:** Required to provide greater bearing strength.

### INSTALLATION:

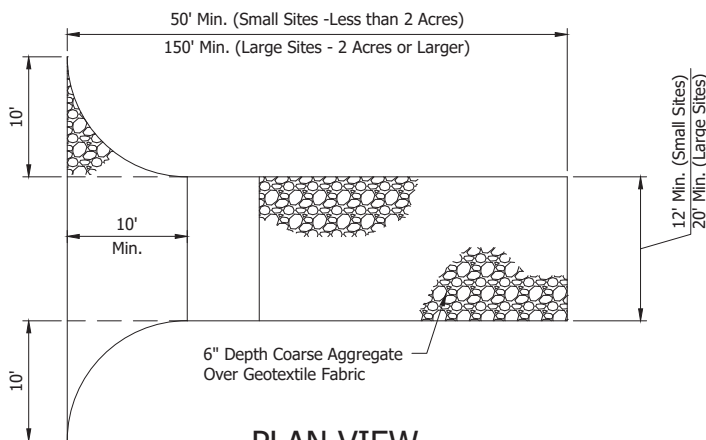
1. Avoid locating on steep slopes or at curves in public roads.
2. Remove all vegetation and other objectionable material from the foundation area, and grade and crown for positive drainage.
3. If slope towards the road exceeds 2%, construct an 8 in. high diversion ridge with 3:1 side slopes across the foundation area about 15 ft. from the entrance to divert runoff away from the road (see profile).
4. Install culvert pipe under the pad if needed to maintain proper public road drainage.
5. Place stone to dimensions and grade shown in the erosion/sediment control plan, leaving the surface smooth and sloped for drainage.
6. Divert all surface runoff and drainage from the stone pad to a sediment trap or basin.



**PROFILE**

### MAINTENANCE:

1. Inspect entrance pad, sediment disposal area, and all other erosion control measures once every seven days and within 24 hours following each ½" storm event or heavy use. Required repairs should be completed immediately.
2. Reshape pad as needed for drainage and runoff control.
3. Topdress with clean stone as needed.
4. Immediately remove mud and sediment tracked or washed onto public roads by brushing or sweeping; at a minimum this should be performed daily. Flushing should only be used if the water is conveyed into a sediment trap or basin.
5. Repair any broken road pavement immediately.



**PLAN VIEW**

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Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 7-1, 7-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



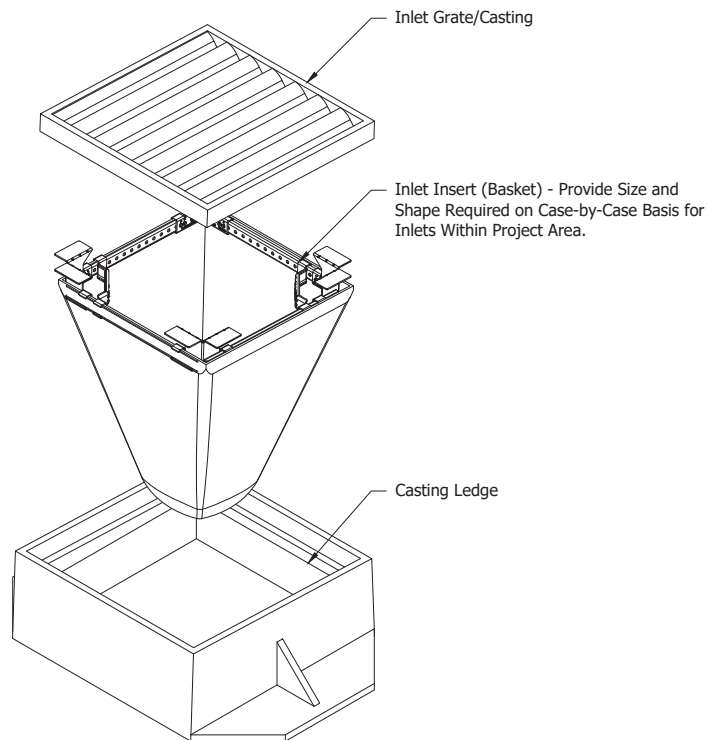
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TEMPORARY GRAVEL CONSTRUCTION ENTRANCE**

STANDARD  
**7-1**

## SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL



**INSTALLATION:**

1. Install per manufacturer recommendations.
2. Remove the grate from the casting or concrete drainage structure.
3. Clean the ledge of the casting frame or drainage structure to ensure it is free of stone and dirt.
4. Drop inlet insert (basket) through the clear opening and be sure the suspension hangers rest firmly on the inside ledge of the casting.
5. Replace the grate and confirm it is elevated no more than thickness of insert hangers.

Inserts/baskets are the only approved method of pavement inlet protection. Other measures to be used only with prior approval of City Engineer.

**MAINTENANCE:**

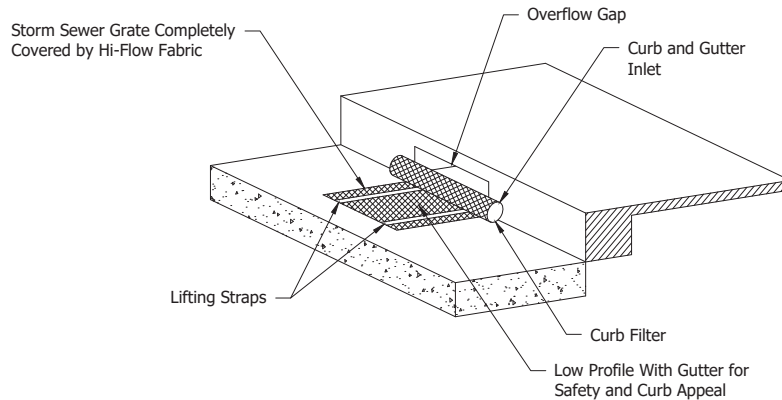
1. Site inspection should occur at least once every seven days and within 24 hours following each ½" or more rain event.
2. Empty the sediment bag if more than half filled with sediment and debris.
3. Remove the grate, engage the lifting bars or handles and lift from the drainage structure.
4. Dispose of the sediment or debris in accordance with EPA guidelines.
5. Remove any caked on silt from the sediment bag and reverse flush the bag with medium spray for optimal filtration.
6. Replace the bag if torn or punctured to ½" diameter or greater on the lower half of the bag.
7. When the contributing drainage area within 50' upstream of the inlet has been stabilized, remove insert (basket) and properly dispose of sediment deposits.

*Kara M. Boyles*      6/26/18  
Kara M. Boyles, Ph.D., P.E.      Date

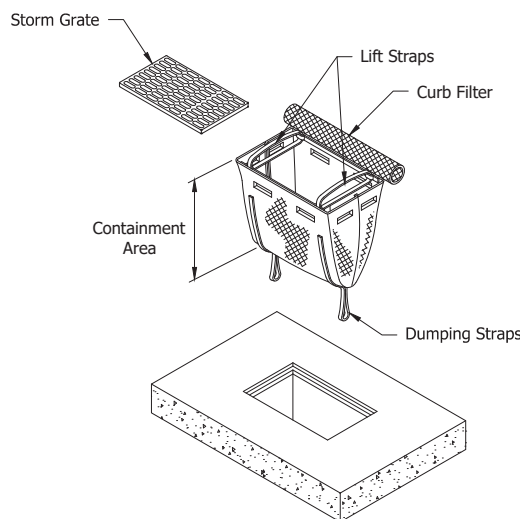
**REF STD SPEC SEC 7-1, 7-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS EFFECTIVE DATE: June 26, 2018				<b>CITY OF SOUTH BEND</b>	
Item	Revision	Approved Date		STANDARDS FOR DESIGN AND CONSTRUCTION	
			STANDARD <b>7-2</b>		
<b>INLET PROTECTION INSERT (BASKET)</b>					

# SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL



## DETAIL OF CURB INLET SEDIMENT CONTROL DEVICE WITH CURB FILTER



## DETAIL OF INLET SEDIMENT CONTROL DEVICE WITH CURB FILTER

### MAINTENANCE:

1. Site inspection should occur at least once every seven days and within 24 hours following each ½" or more rain event.
2. Empty the sediment bag if more than half filled with sediment and debris.
3. Remove the grate, engage the lifting bars or handles and lift from the drainage structure.
4. Dispose of the sediment or debris in accordance with EPA guidelines.
5. Remove any caked on silt from the sediment bag and reverse flush the bag with medium spray for optimal filtration.
6. Replace the bag if torn or punctured to ½" diameter or greater on the lower half of the bag.
7. When the contributing drainage area within 50' upstream of the inlet has been stabilized, remove insert (basket) and properly dispose of sediment deposits.

### REF STD SPEC SEC 7-1, 7-2

KARA M. BOYLES  
REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



## CITY OF SOUTH BEND

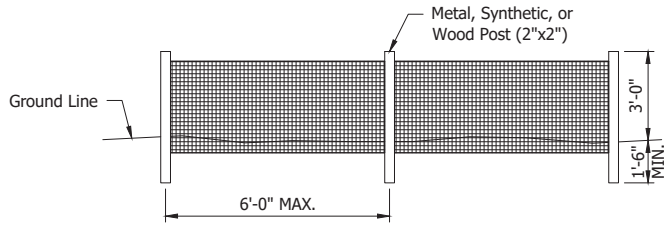
STANDARDS FOR DESIGN  
AND CONSTRUCTION

STANDARD  
7-3

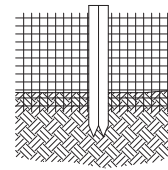
## INLET PROTECTION ALONG CURB

Item	Revision	Approved Date

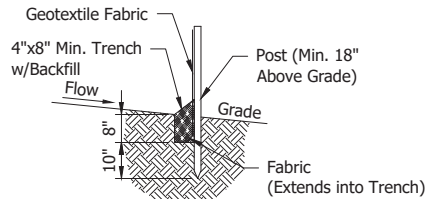
# SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL



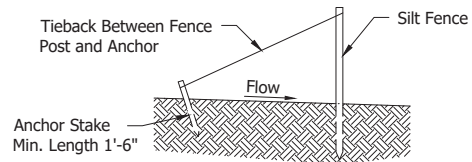
**ELEVATION**



**JOINING FENCES**



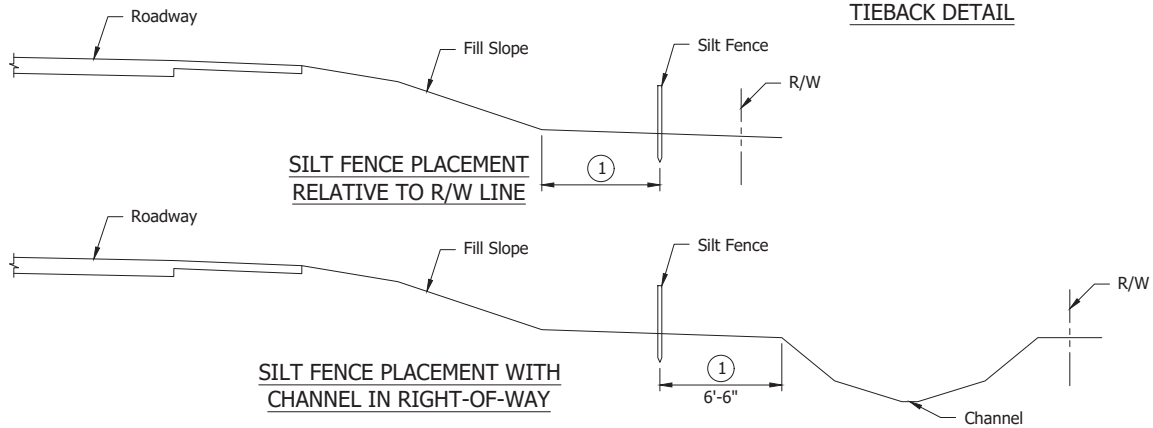
**STAKE INSTALLATION**



**Note:**

The spacing of the tiebacks shall equal the spacing of the posts. Additional post depth or tiebacks may be required in unstable soils.

**TIEBACK DETAIL**



① Dimensions will vary based on right-of-way availability. Silt fence shall be placed as close as possible to edge of construction limits. 10' minimum beyond toe of slope is recommended to provide broad, shallow sediment pool.

**INSTALLATION:**

1. Install fencing parallel to slope contour by digging a minimum 8" deep x 4" width trench along proposed fence line. Pound posts in trench 6"-8" or until secure. Be sure to stretch fabric taut when pounding posts. Fabric to be placed on up slope side of posts. Drape loose end of geotextile fabric into trench. Backfill and compact soil on both sides.
2. Join fences by placing the end post of the second fence inside the end post of the first fence. Rotate both posts at least 180° in a clockwise direction to create a tight seal with the fabric material. Drive both posts about 10" into the ground and bury flap.
3. Turn ends of fence up slope such that point of contact between ground and bottom of fence end terminates at higher elevation than top of fence at lowest point.

**MAINTENANCE:**

1. Inspect within 24 hours following each ½" (Min.) rain event and at least once every seven days. If fence fabric tears, starts to decompose, or in anyway becomes ineffective, replace the affected portion immediately.
2. Remove deposited sediment when it is causing the filter fabric to bulge or when it reaches one-half the height of the fence at it's lowest point. When the contributing drainage area has been stabilized, remove the fence and sediment deposits, grade the site to blend with the surrounding area and stabilize.

**REF STD SPEC SEC 7-1, 7-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

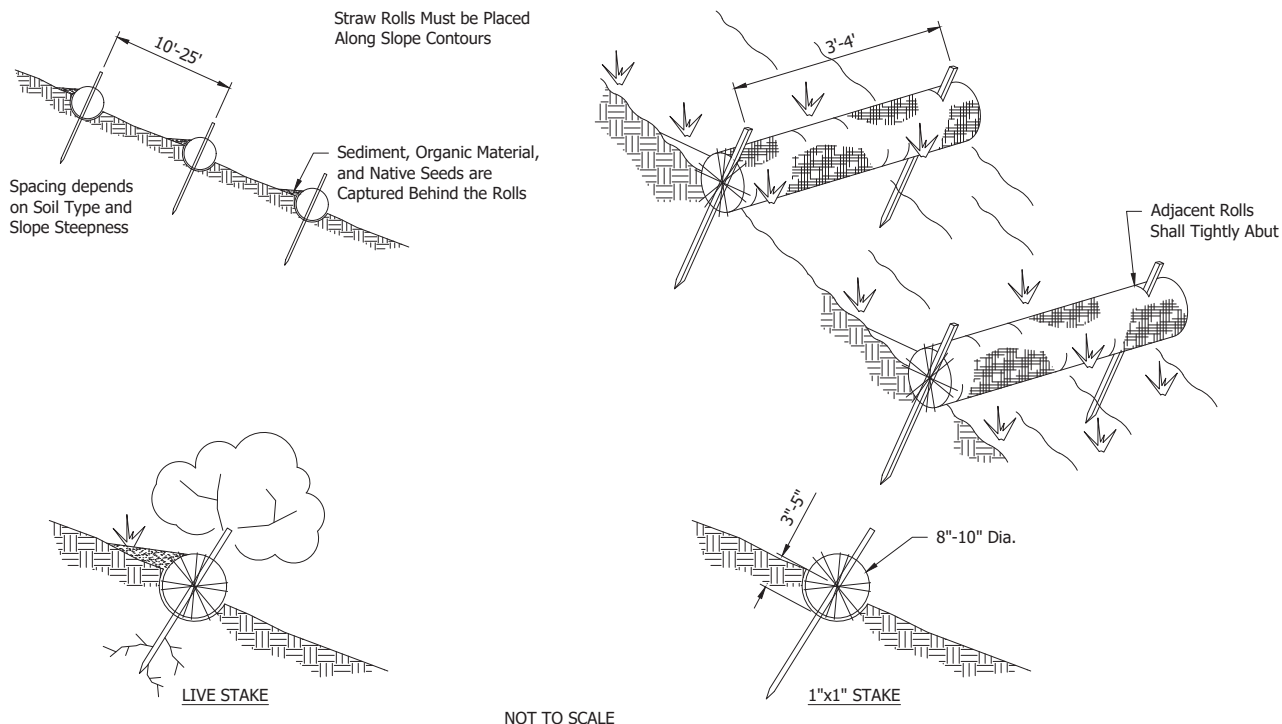
STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TEMPORARY SILT FENCE**

STANDARD  
**7-4**

Item	Revision	Approved Date

# SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL



**DESCRIPTION:**

Filter socks are also known as straw worms, bio-logs, straw noodles, or straw tubes. They are a sediment velocity control device made of tubes of straw, rice, or coconut husk encased in an ultraviolet degradable plastic netting or 100% burlap material.

Filter socks may be suitable along the toe, top, face, and at grade breaks of exposed erodible slopes to shorten slope length and spread runoff as sheet flow; at the end of a downward slope where it transitions to a steeper slope; along sidewalks and curbs to prevent sediment from washing into gutters; around storm drains and drop inlets; down-slope of exposed soil areas; around temporary material spoil and stockpiles, such as topsoil and for stream bank protection.

**INSTALLATION:**

1. Layout a contour line on the slope.
2. Dig a shallow depression (about 3 to 5 inches deep), remove all debris, and lay the filter sock into it.
3. Secure filter sock with wooden stakes.
4. Terminating ends should be turned uphill (min. 6") to prevent runoff from flowing around the ends.
5. Seat the filter sock with foot tamped backfill on the upstream side such that water will not run under it.

Recommended wattle spacing by slope:

Slope	9" Dia.	12" Dia.
Less than 4:1	20 ft.	40 ft.
2:1 to 4:1	15 ft.	30 ft.
2:1 or Greater	10 ft.	20 ft.

Note: Filter Socks may be used in lieu of silt fence if desired.

**MATERIALS:**

Filter socks can be from straw, rice straw, coconut husks or other approved material. The netting consists of biodegradable burlap, or high density polyethylene and ethyl vinyl acetate containing ultraviolet inhibitors. Straw should be certified weed free forage, by a manufacturer whose principle business is wattle manufacturing. Coir (coconut fiber) can be in bristle and mattress form and should be obtained from freshwater cured coconut husk.

**MAINTENANCE:**

Sediment should be removed on a routine basis when the level of the sediment reaches one half the height of the exposed filter sock. Damaged areas should be repaired immediately until vegetation is established and growing through the material.

**REF STD SPEC SEC 7-1, 7-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

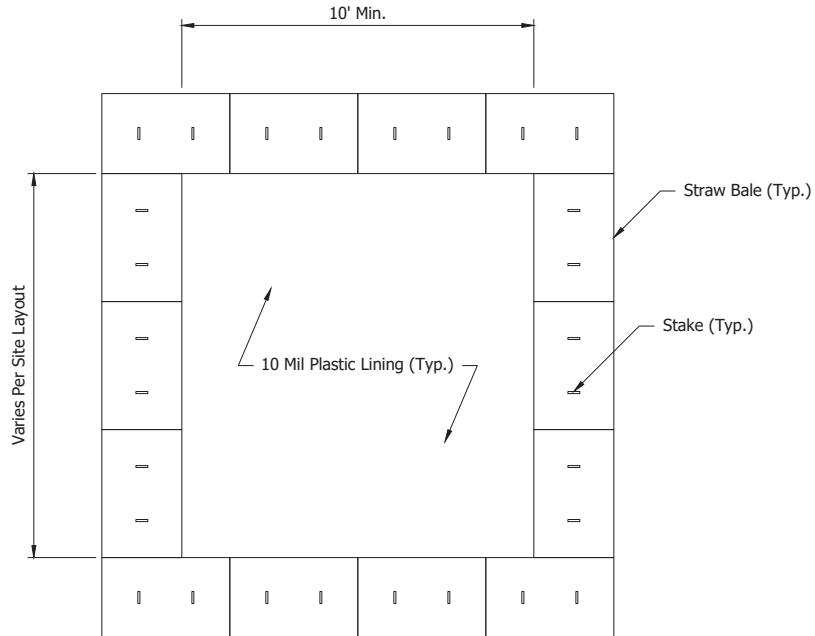
STANDARDS FOR DESIGN AND CONSTRUCTION

STANDARD  
**7-5**

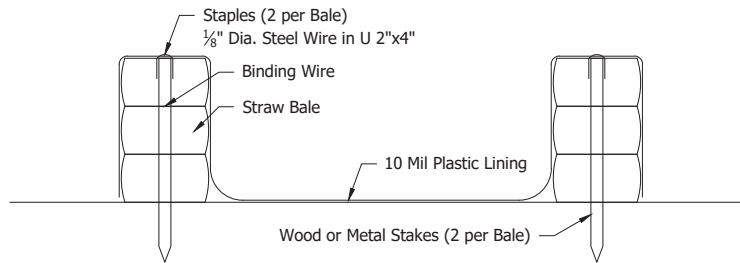
**FILTER SOCK**

Item	Revision	Approved Date

# SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL



**PLAN**



**SECTION**

**NOTES:**

1. Install concrete washout sign within 30' of temporary washout facility.
2. Layout of washout facility may vary depending on space available within construction staging area. Washout facilities shall be designated by the permit holder before work begins and shall be located in an appropriate area where the waste resulting from the washout cannot enter sewer systems or local waterways.
3. Waste from the washout facilities shall be disposed of in an approved manner according to state laws.

*Kara M. Boyles* 6/26/18  
Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 7-1, 7-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

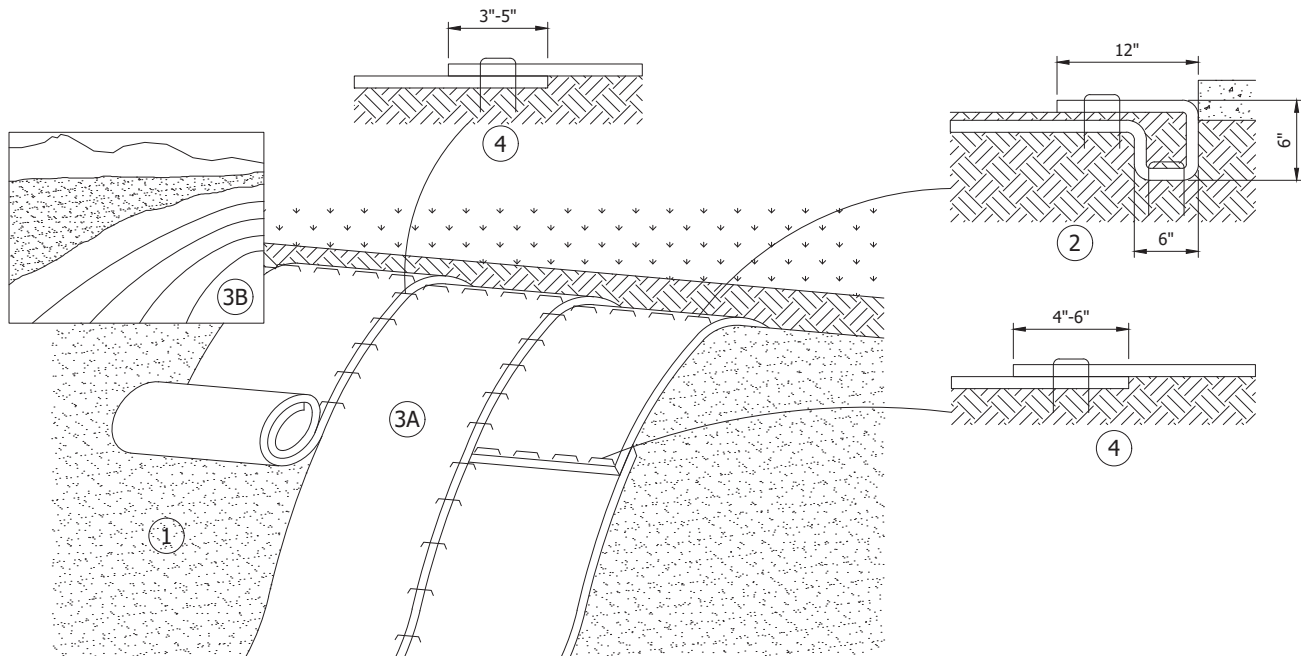
Item	Revision	Approved Date

**CONCRETE WASHOUT**

STANDARD  
**7-6**



## SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL



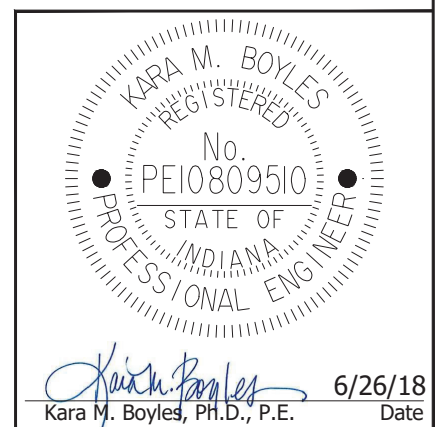
### SLOPE INSTALLATION:

1. Prepare soil before installing blankets, including any necessary application of lime, fertilizer, and seed.
2. Begin at the top of the slope 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 the blankets (A) down or (B) horizontally across the slope. Blankets will unroll with appropriate side against the soil surface. All blankets must be securely fastened to soil surface by placing staples/stakes in appropriate locations as per by manufacturer's recommendation.
4. The edges of parallel blankets must be stapled with approximately 3"-5" overlap. To ensure proper seam alignment, place the edge of the overlapping blanket (blanket being installed on top) even with the colored seam stitch on the previously installed blanket.
5. Splicing consecutive blankets down the slope shall be done in a shingle style with the up-slope blanket overlapping the down-slope blanket 3" minimum. Staple through overlapped area, approximately 12" apart across entire blanket width.
6. In loose soil conditions the use of staple or stake lengths greater than 6" may be necessary to properly secure the blankets.

### GENERAL NOTES:

1. Install erosion control blanket to prevent erosion on slopes 3:1 or steeper, as well as other areas prone to erosion, to aid in establishing vegetation and preventing soil movement.
2. Installation instructions above are provided for reference only. Installation should be completed in accordance with erosion control blanket manufacturer's specifications.
3. Model and manufacturer to be selected based on project slopes, vegetation, and soil conditions.

### REF STD SPEC SEC 7-1, 7-2



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**CITY OF SOUTH BEND**

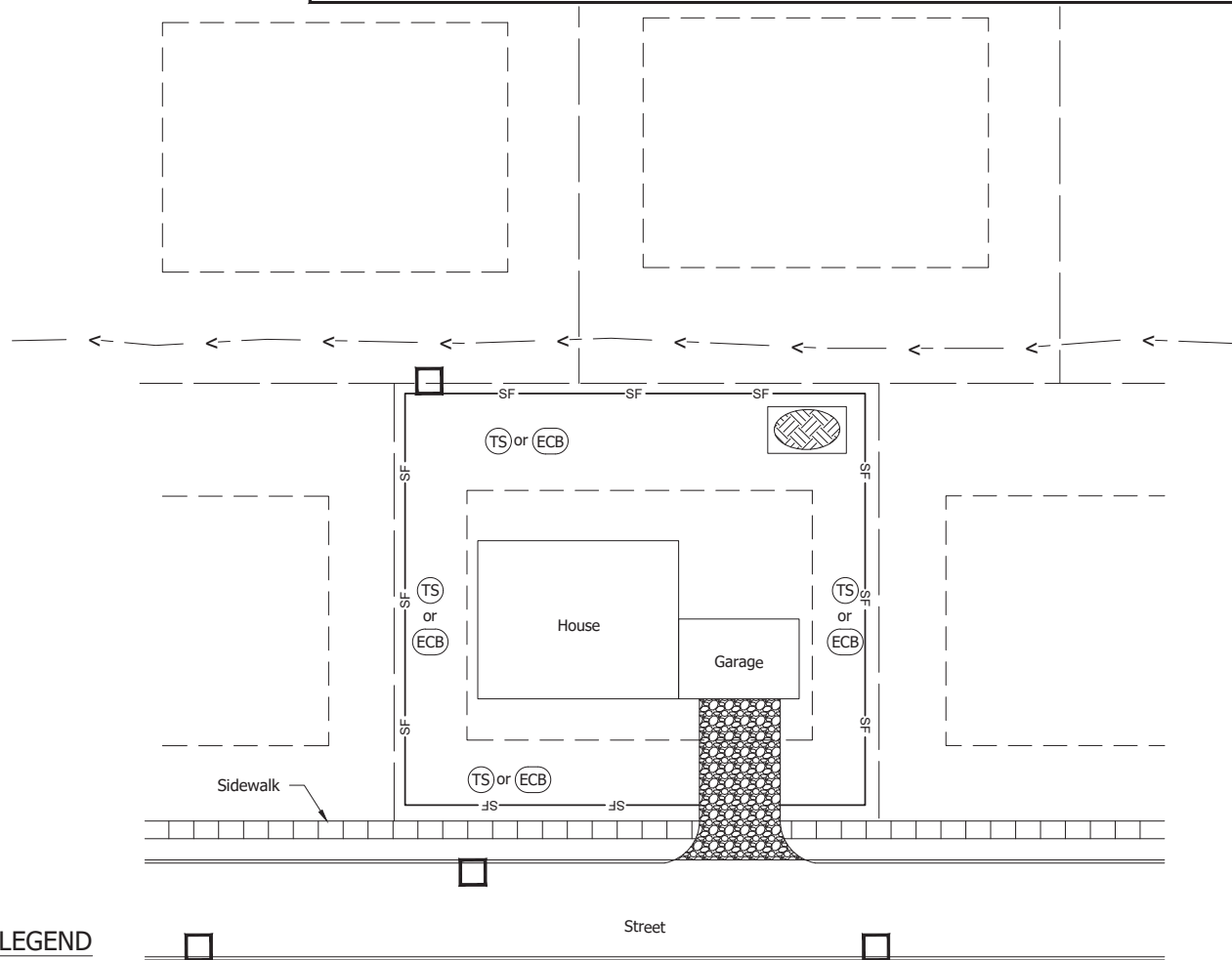
STANDARDS FOR DESIGN  
AND CONSTRUCTION

STANDARD  
**7-7**

**EROSION CONTROL BLANKET**

Item	Revision	Approved Date

# SECTION 7 - EARTHWORK & EROSION AND SEDIMENT CONTROL



## LEGEND

- Property Lines
- Constructed Building Pad
- Silt Fence or Filter Sock
- Stream/Ditch
- Gravel Construction Entrance
- Soil Stockpile Protection
- Inlet Protection
- Temporary Seeding
- Erosion Control Blanket

## NOTES:

1. Erosion control measures must be functional and maintained throughout construction.
2. Erosion Control Blanket shall be used on slopes greater than 3:1 per Std. 7-7.
3. Install Silt Fence or Filter Sock as necessary according to Std. 7-4 and 7-5.
4. Post Notice of Intent and place rain gauge on site prior to start of construction.
5. Remove sediment from street at the end of each work day. Do not flush bulk sediments with water.

REF STD SPEC SEC 7-1, 7-2

KARA M. BOYLES  
REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

Kara M. Boyles, Ph.D., P.E.      6/26/18  
Date

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: June 26, 2018



**CITY OF SOUTH BEND**

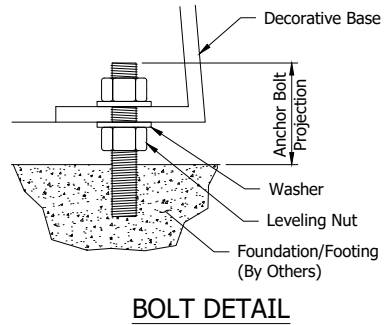
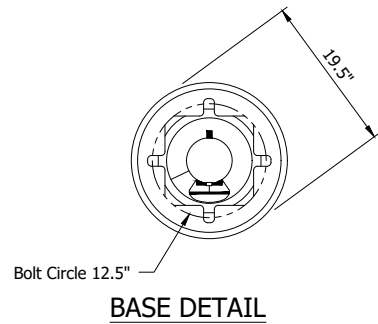
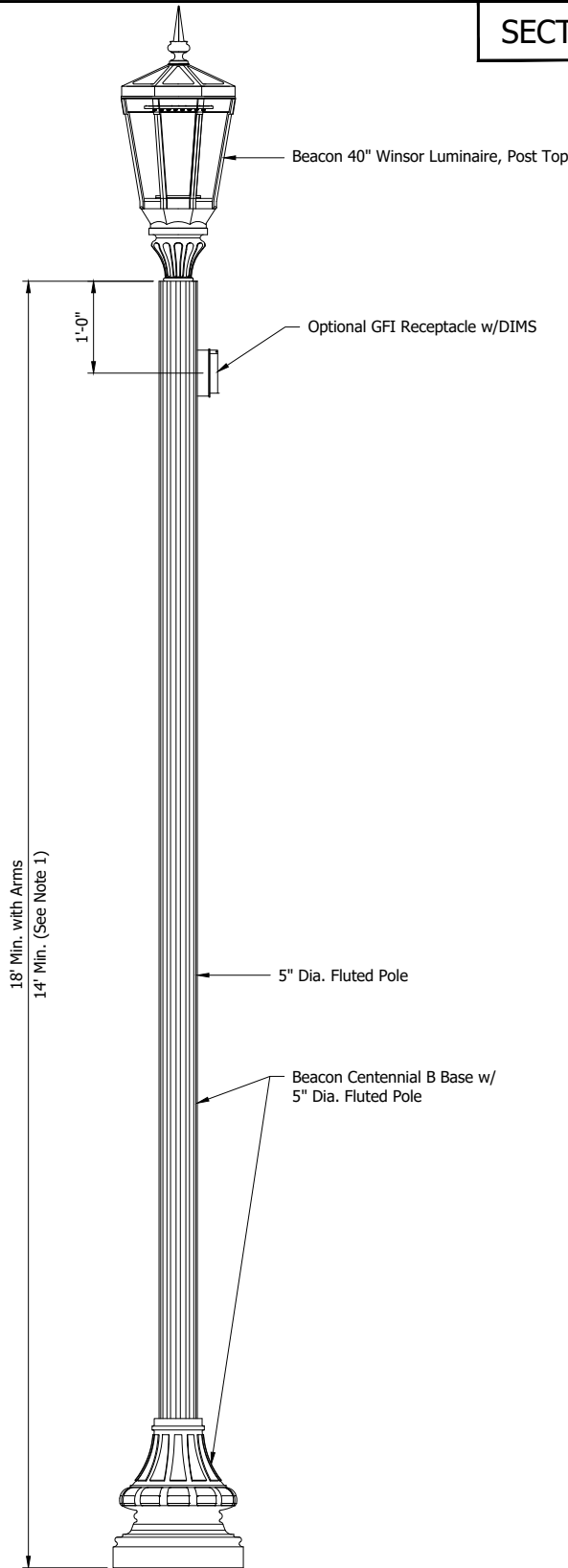
STANDARDS FOR DESIGN  
AND CONSTRUCTION

**TYPICAL INDIVIDUAL LOT EROSION AND  
SEDIMENT CONTROL MEASURES (LESS THAN 1-ACRE)**

STANDARD  
**7-8**

Item	Revision	Approved Date

**SECTION 9 - FIXTURES AND FINISHES**



**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

Kara M. Boyles, Ph.D., P.E.      7/20/20      Date

REF STD SPEC SEC 9-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: July 28, 2020



**CITY OF SOUTH BEND**

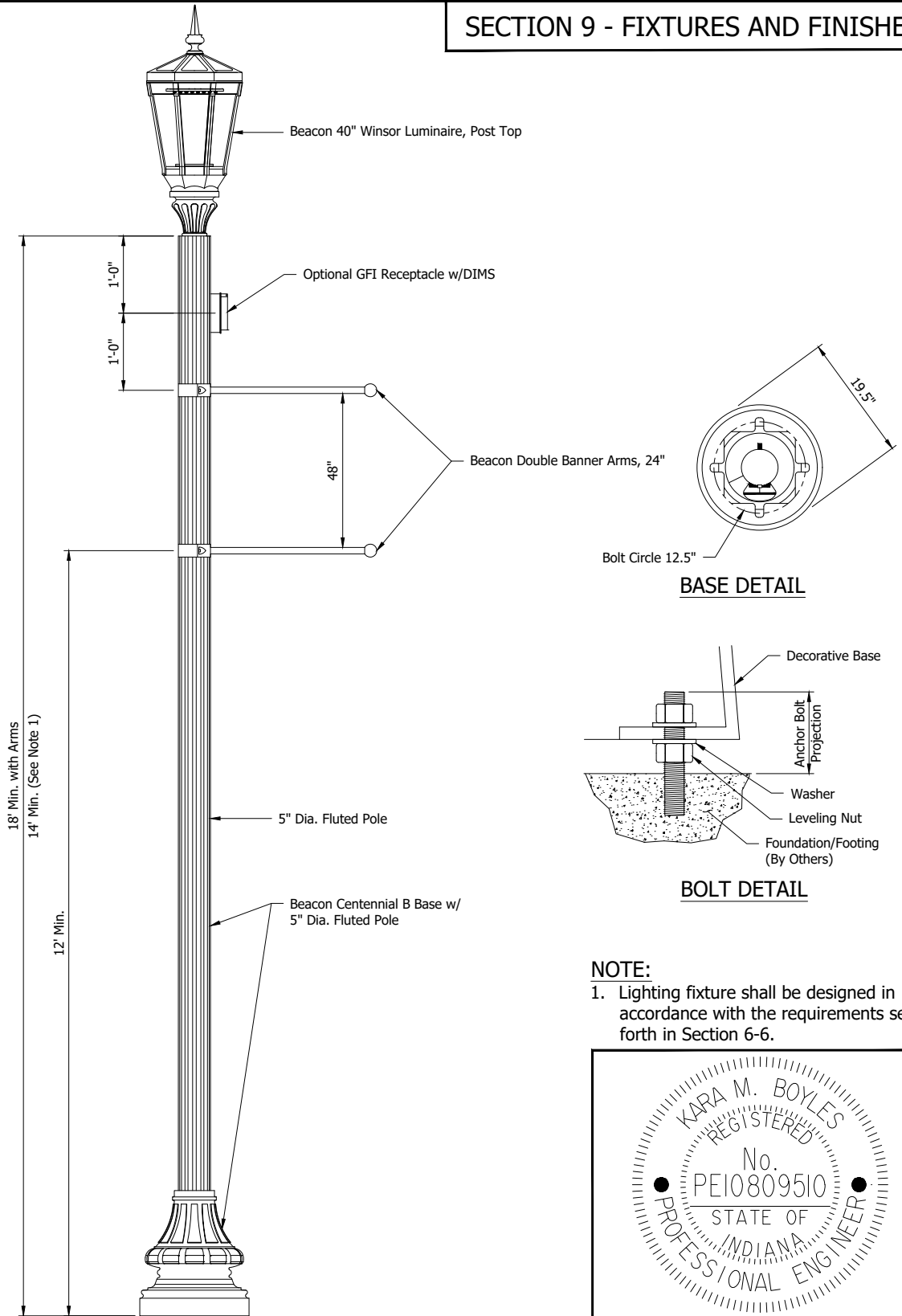
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**LIGHTING - TYPE 1A**

STANDARD  
**9-1**

SECTION 9 - FIXTURES AND FINISHES



**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

Kara M. Boyles, Ph.D., P.E.

7/20/20  
 Date

REF STD SPEC SEC 9-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
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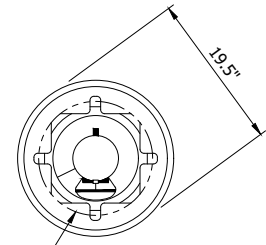
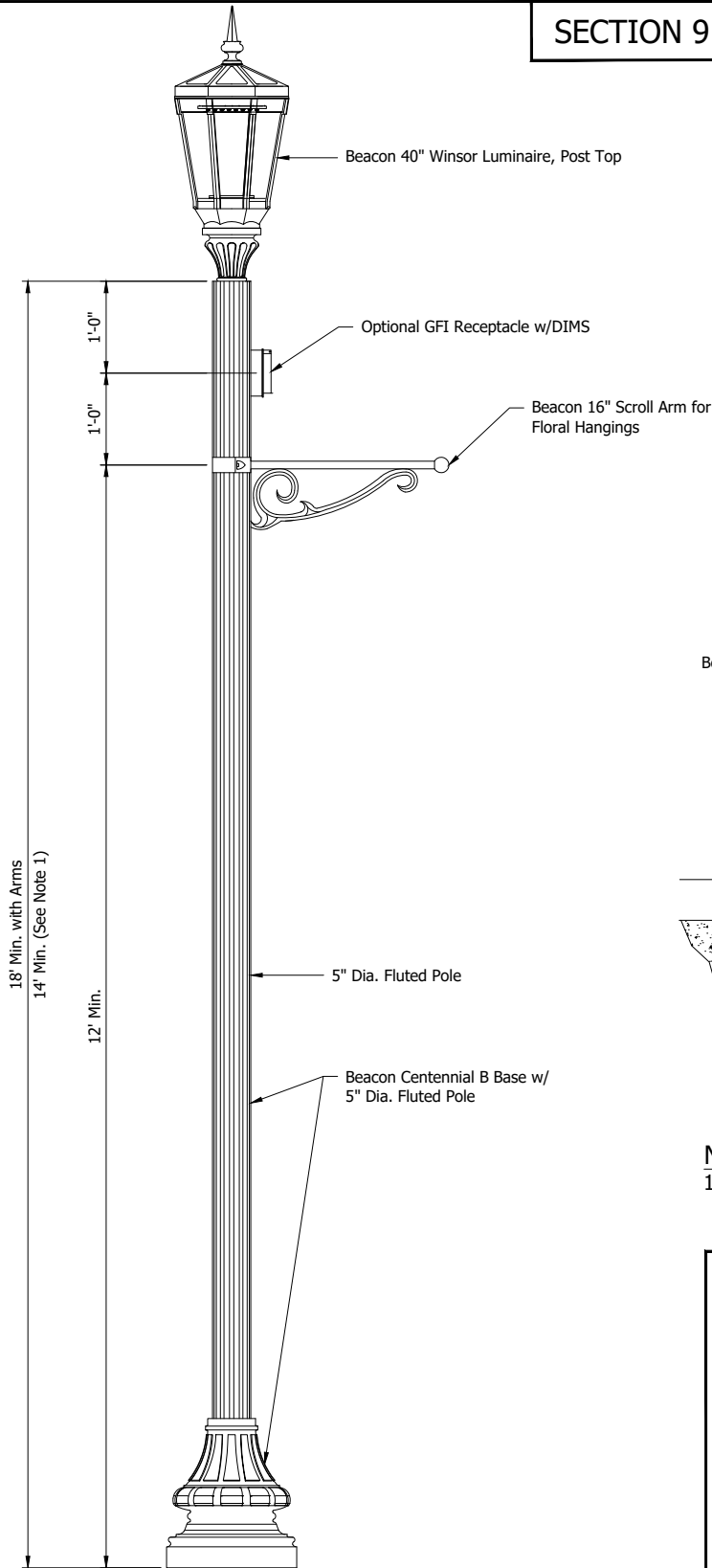
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

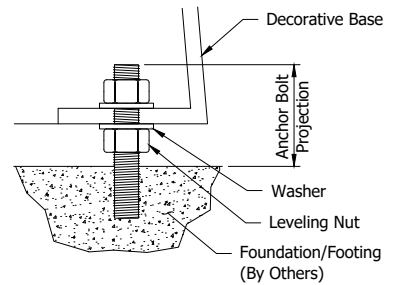
**LIGHTING - TYPE 1B**

STANDARD  
**9-2**

SECTION 9 - FIXTURES AND FINISHES



**BASE DETAIL**



**BOLT DETAIL**

**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

7/20/20  
 Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 9-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: July 28, 2020



**CITY OF SOUTH BEND**

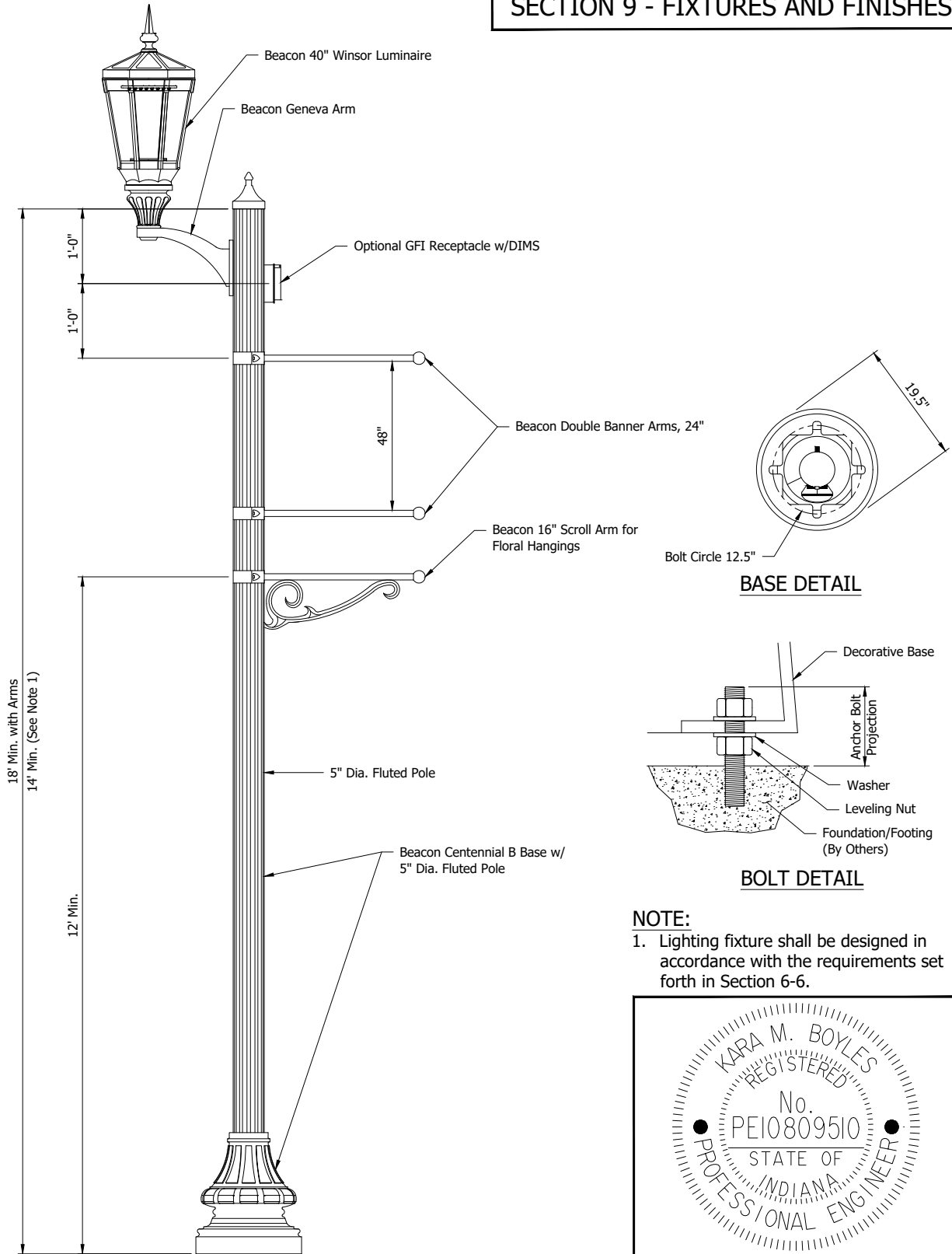
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**LIGHTING - TYPE 1C**

STANDARD  
**9-3**

**SECTION 9 - FIXTURES AND FINISHES**



**BASE DETAIL**

**BOLT DETAIL**

**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

Kara M. Boyles, Ph.D., P.E.

7/20/20  
 Date

REF STD SPEC SEC 9-2

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EFFECTIVE DATE: July 28, 2020



**CITY OF SOUTH BEND**

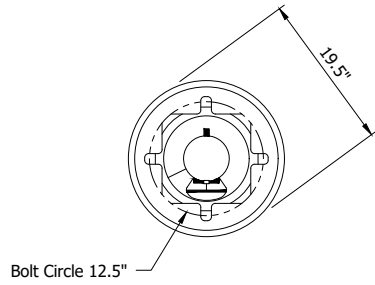
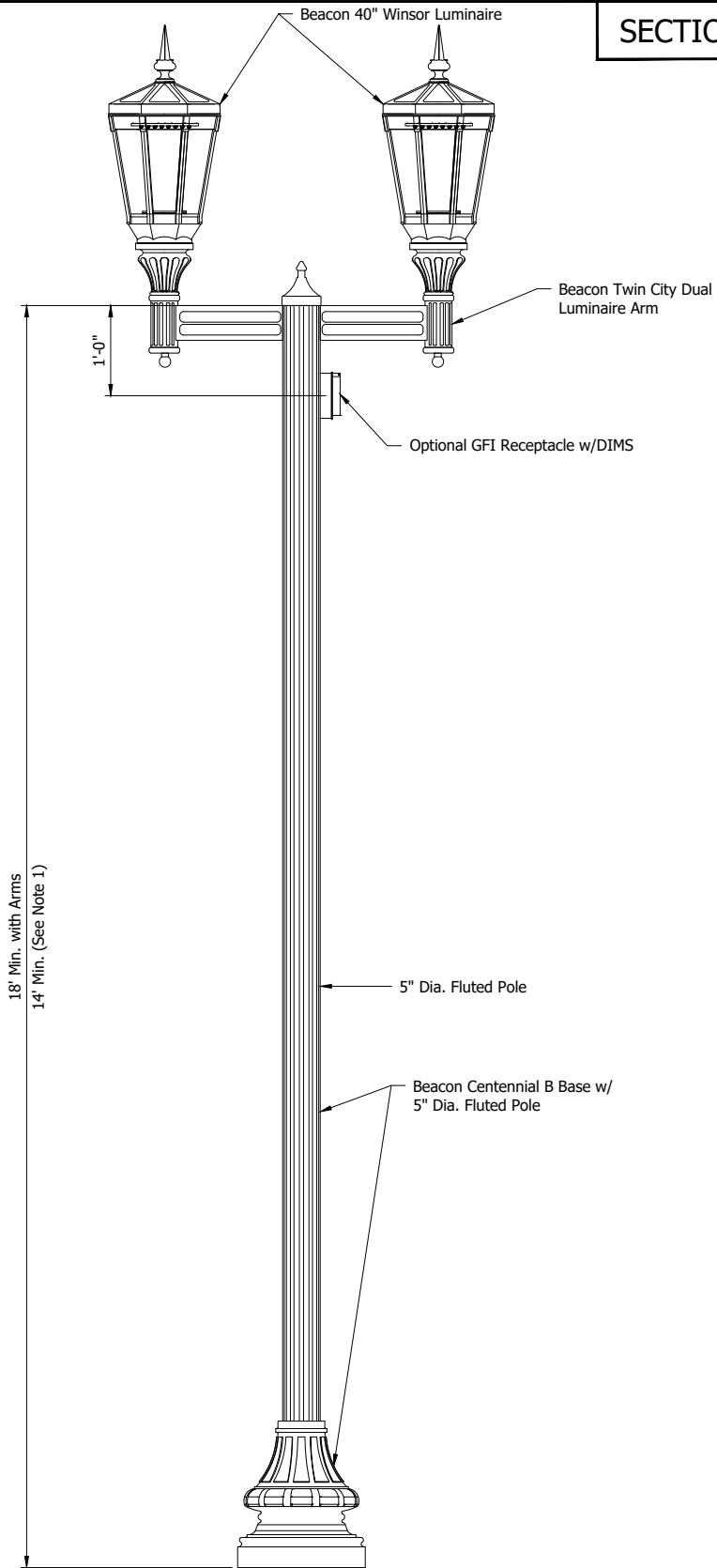
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

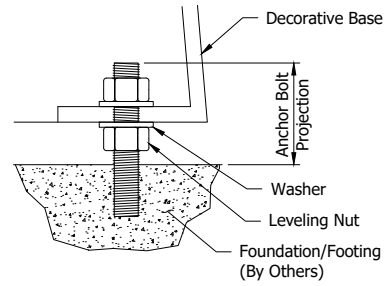
**LIGHTING - TYPE 1D**

STANDARD  
**9-4**

**SECTION 9 - FIXTURES AND FINISHES**



**BASE DETAIL**



**BOLT DETAIL**

**NOTE:**

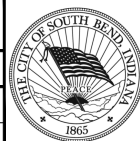
1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

KARA M. BOYLES  
REGISTERED  
No. PE10809510  
STATE OF INDIANA  
PROFESSIONAL ENGINEER

*Kara M. Boyles* 7/20/20  
Kara M. Boyles, Ph.D., P.E. Date

**REF STD SPEC SEC 9-2**

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**CITY OF SOUTH BEND**

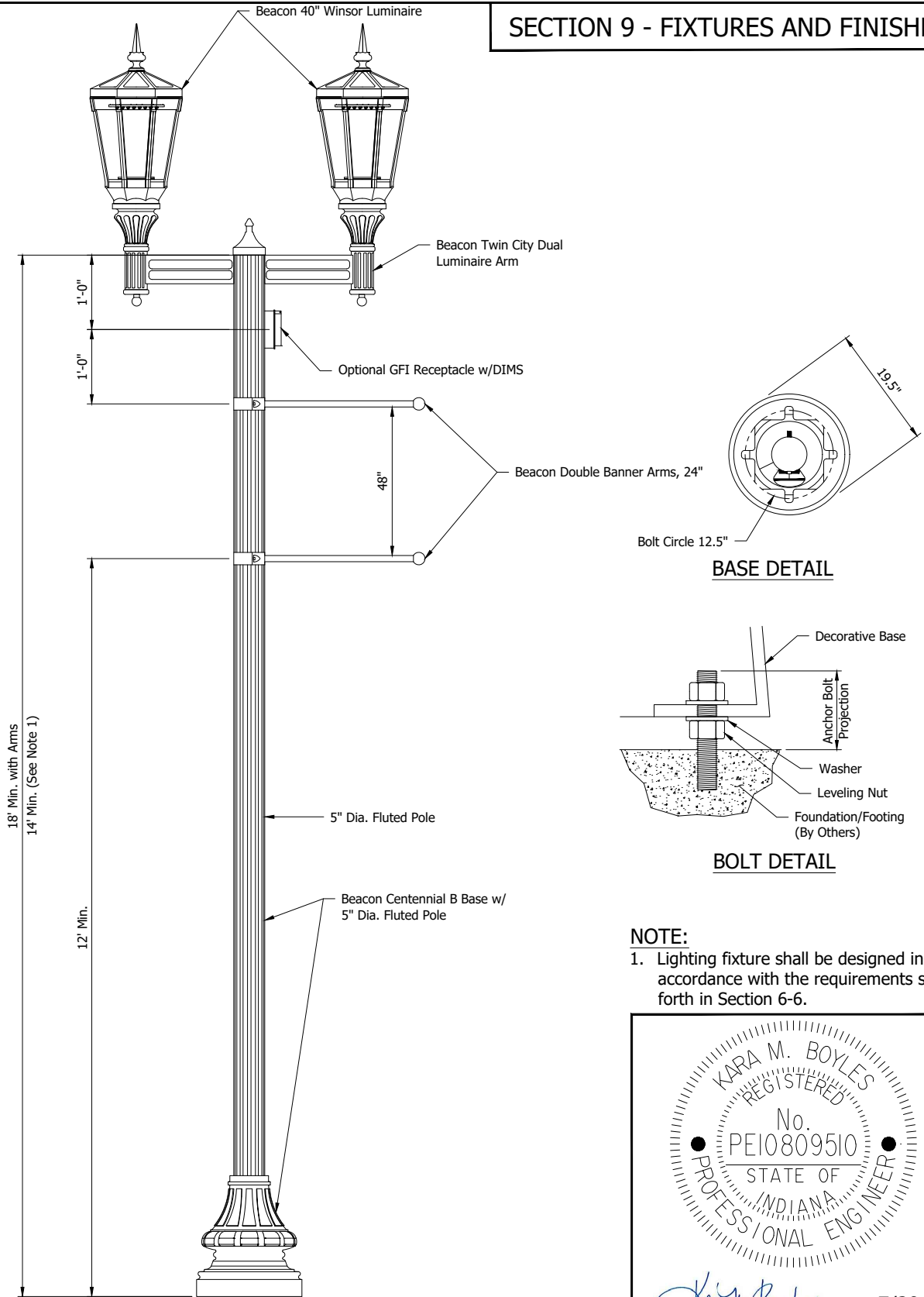
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

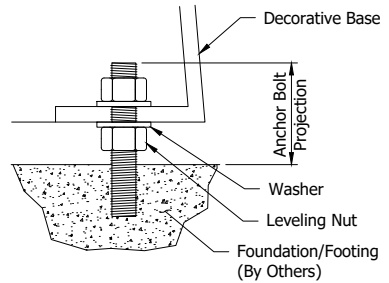
**LIGHTING - TYPE 1E**

STANDARD  
**9-5**

**SECTION 9 - FIXTURES AND FINISHES**



**BASE DETAIL**



**BOLT DETAIL**

**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

Kara M. Boyles, Ph.D., P.E.

7/20/20  
 Date

**REF STD SPEC SEC 9-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
EFFECTIVE DATE: July 28, 2020



**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

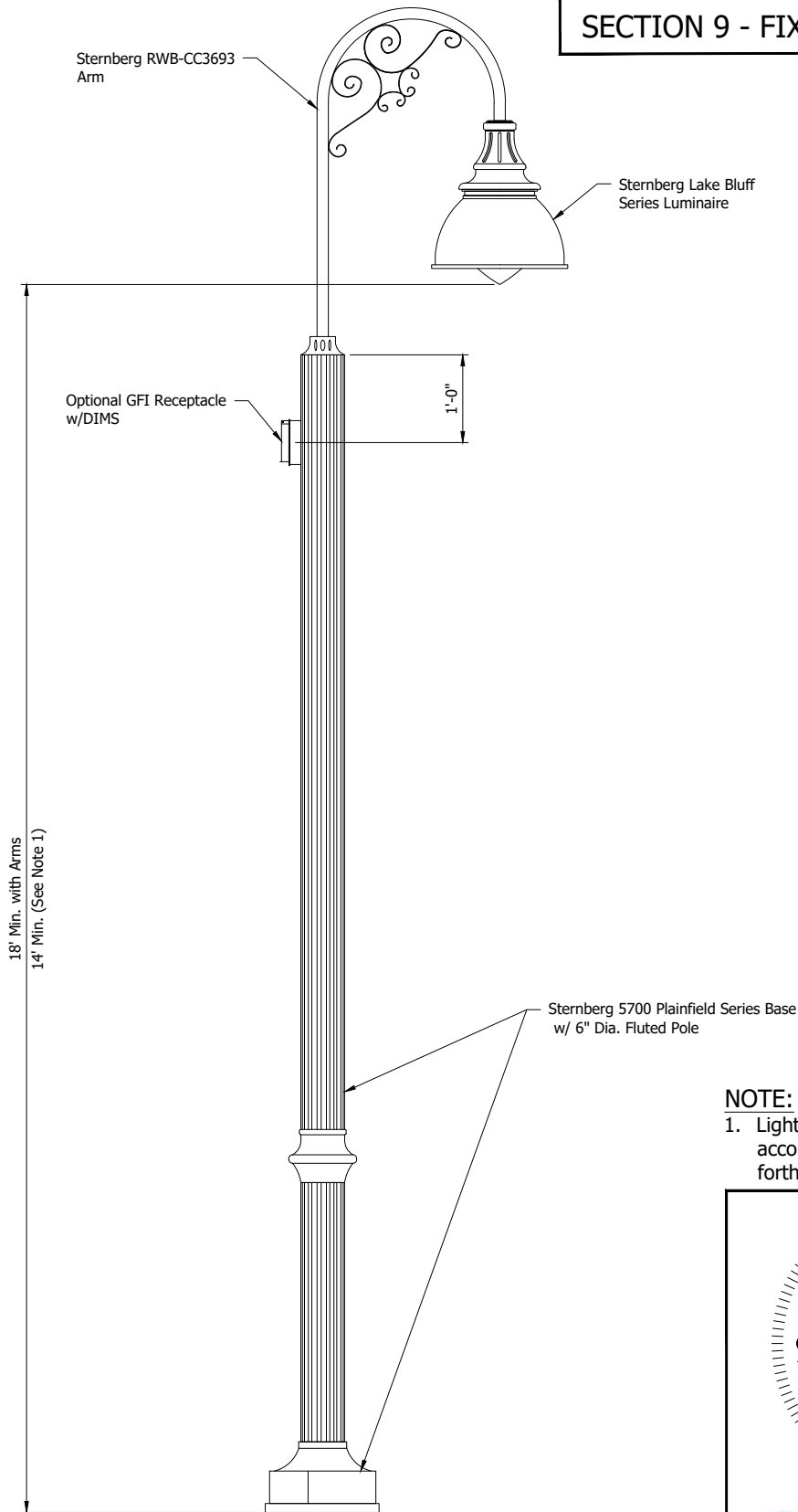
Item	Revision	Approved Date

**LIGHTING - TYPE 1F**

STANDARD  
**9-6**



**SECTION 9 - FIXTURES AND FINISHES**



**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

7/20/20  
 Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 9-2

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**CITY OF SOUTH BEND**

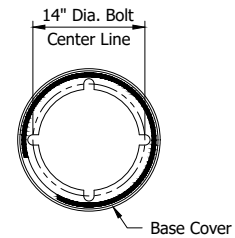
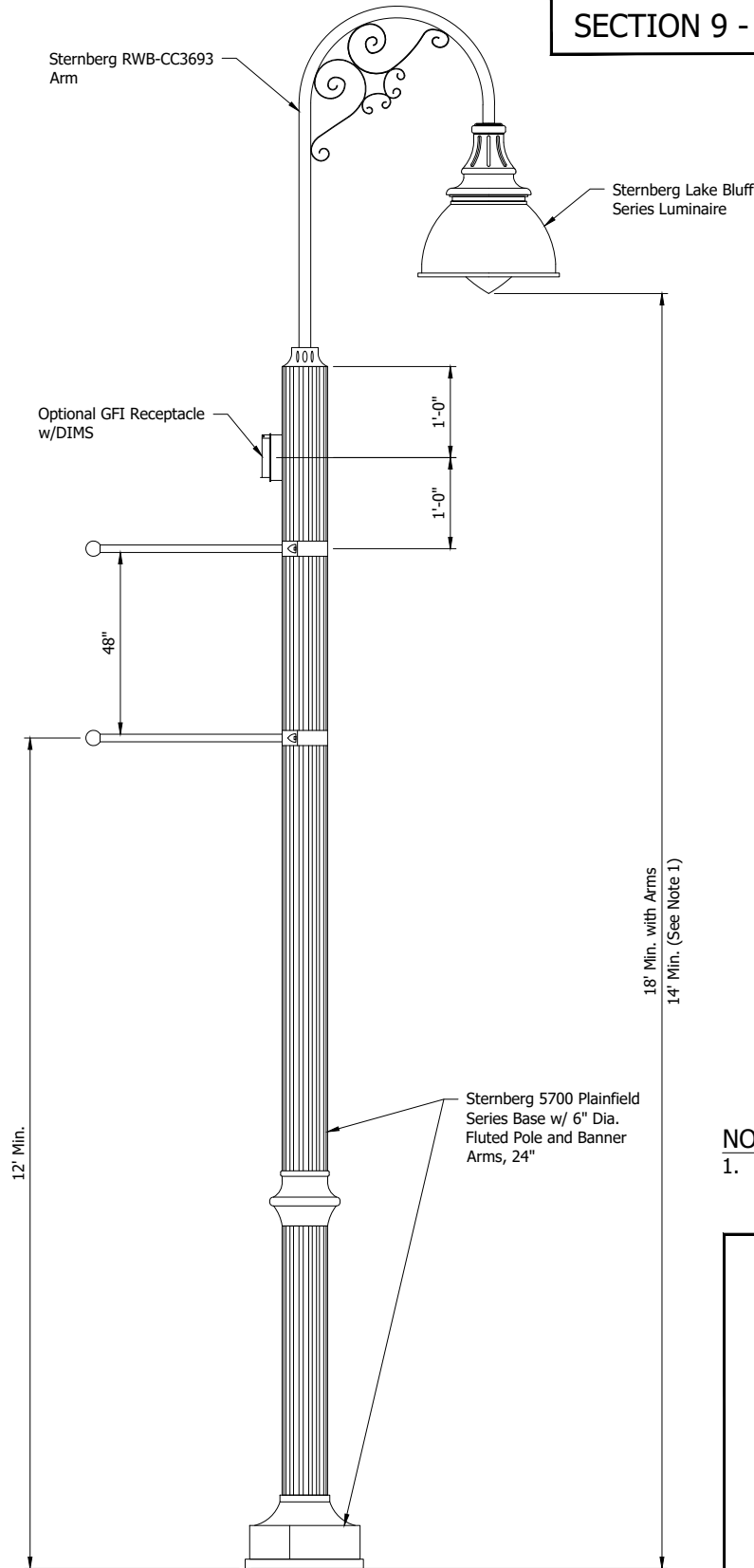
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**LIGHTING - TYPE 2A**

STANDARD  
**9-7**

**SECTION 9 - FIXTURES AND FINISHES**



**BASE DETAIL**

**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

Kara M. Boyles, Ph.D., P.E.      7/20/20  
 Date

REF STD SPEC SEC 9-2

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**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
AND CONSTRUCTION

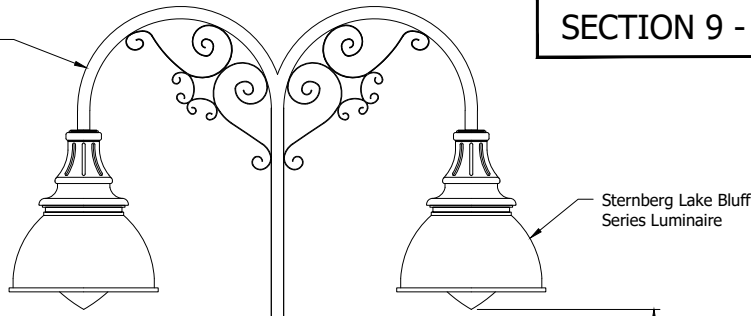
Item	Revision	Approved Date

**LIGHTING - TYPE 2B**

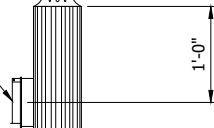
STANDARD  
**9-8**

**SECTION 9 - FIXTURES AND FINISHES**

Sternberg RWB-CC3693  
Double Arm



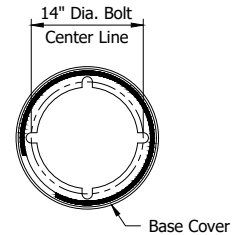
Optional GFI Receptacle  
w/DIMS



1'-0"

18' Min. with Arms  
14' Min. (See Note 1)

Sternberg 5700 Plainfield  
Series Base w/ 6" Dia.  
Fluted Pole and Double  
Banners



**BASE DETAIL**

**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

Kara M. Boyles, Ph.D., P.E.      7/20/20  
 Date

REF STD SPEC SEC 9-2

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**CITY OF SOUTH BEND**

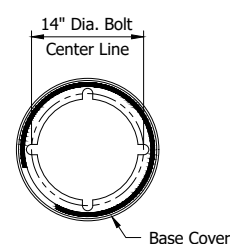
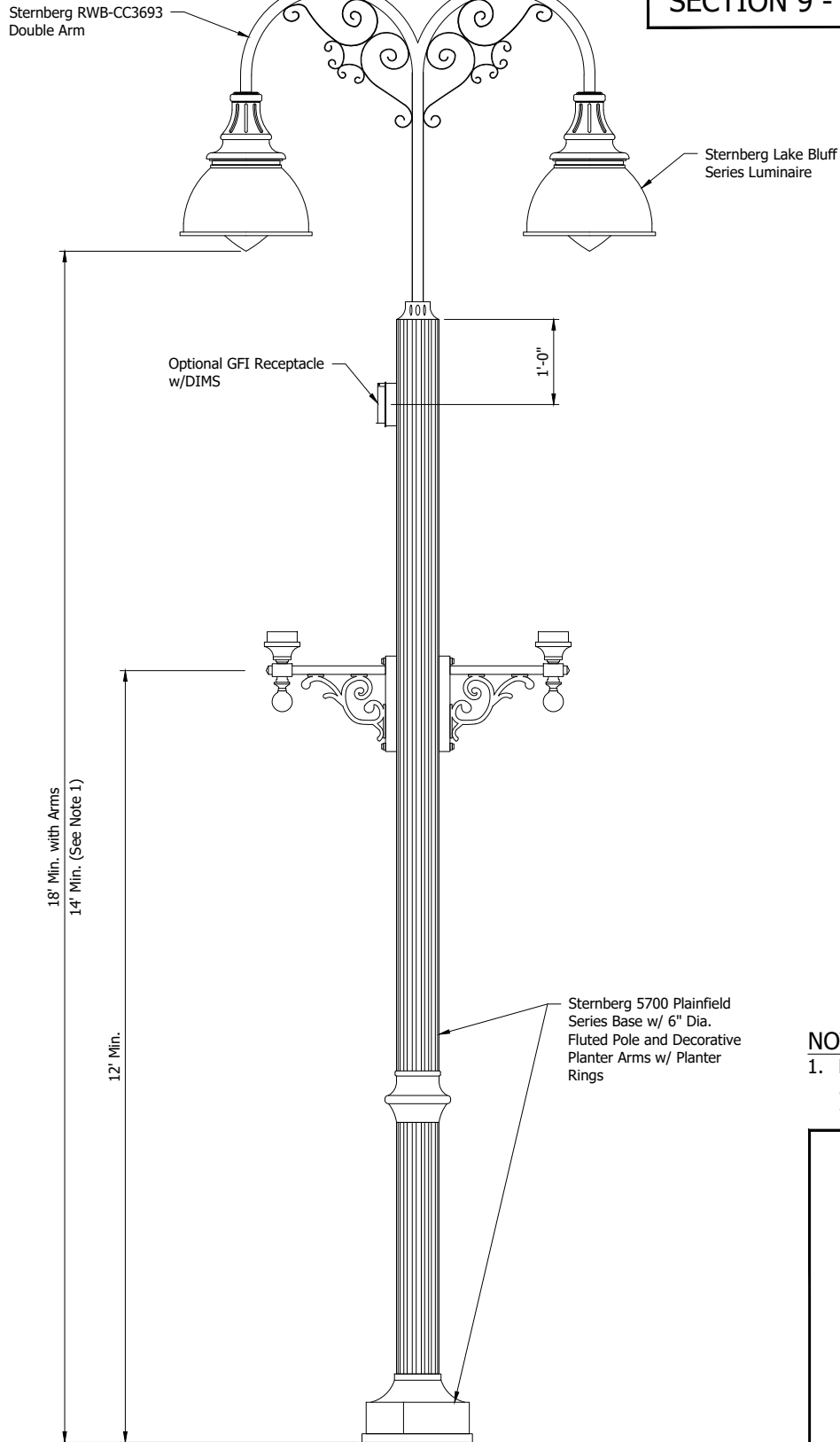
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**LIGHTING - TYPE 2C**

STANDARD  
**9-9**

**SECTION 9 - FIXTURES AND FINISHES**



**BASE DETAIL**

**NOTE:**  
 1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

7/20/20  
 Kara M. Boyles, Ph.D., P.E. Date

REF STD SPEC SEC 9-2

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
 EFFECTIVE DATE: July 28, 2020

Item	Revision	Approved Date



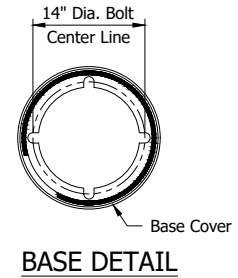
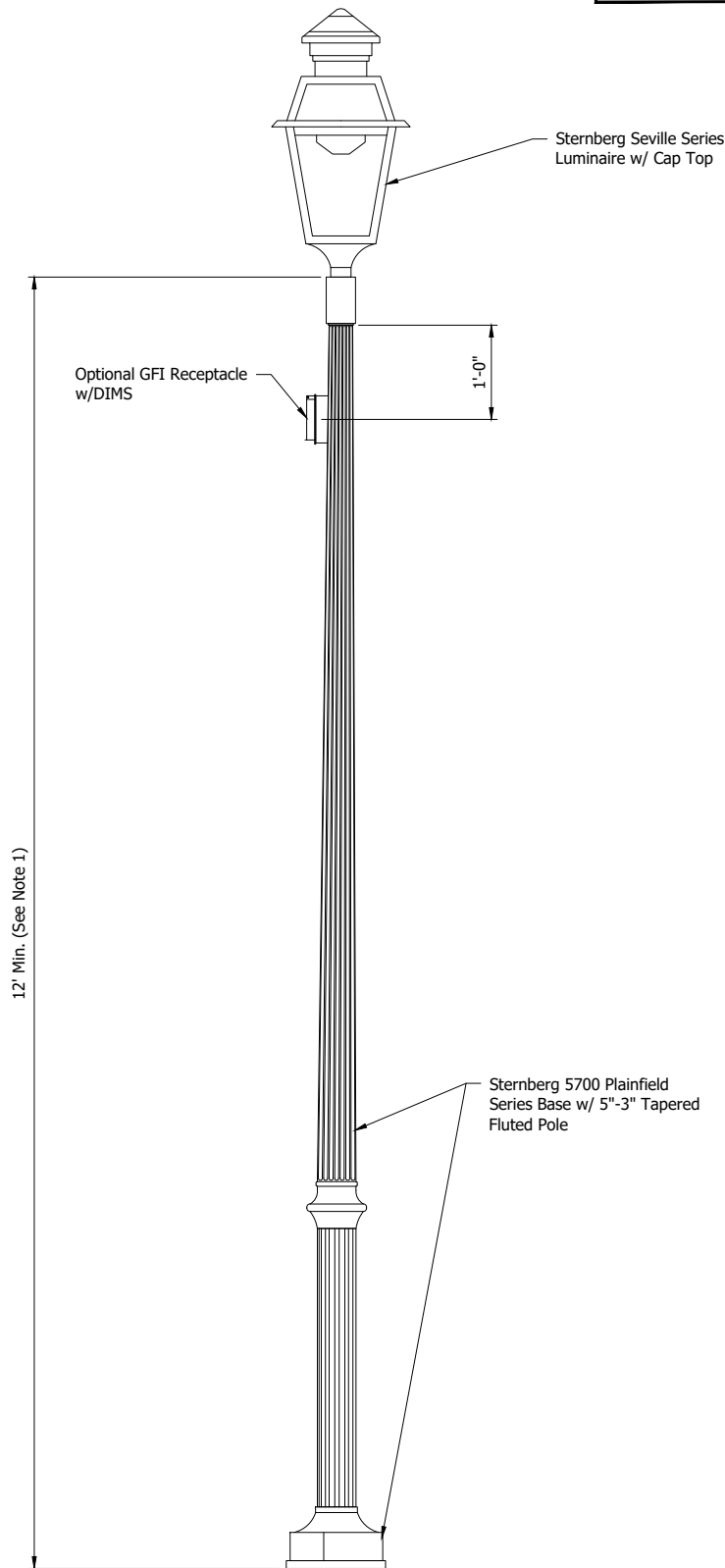
**CITY OF SOUTH BEND**

STANDARDS FOR DESIGN  
 AND CONSTRUCTION

**LIGHTING - TYPE 2D**

STANDARD  
**9-10**

SECTION 9 - FIXTURES AND FINISHES



**NOTE:**

1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

Kara M. Boyles, Ph.D., P.E.      7/20/20  
 Date

REF STD SPEC SEC 9-2

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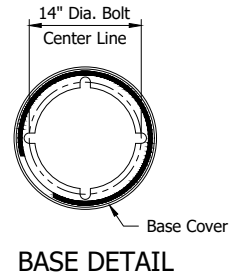
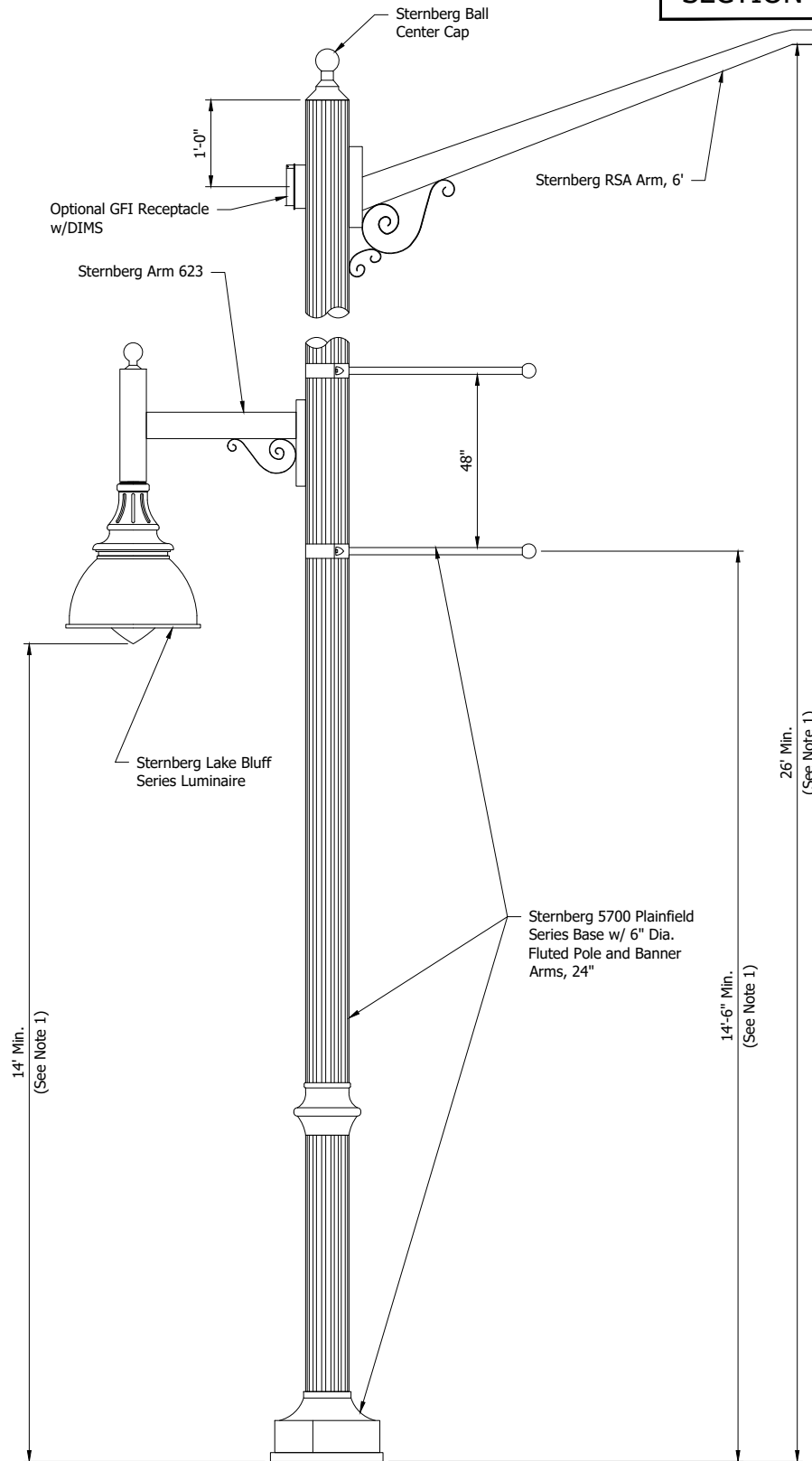
STANDARDS FOR DESIGN  
AND CONSTRUCTION

Item	Revision	Approved Date

**LIGHTING - TYPE 3A**

STANDARD  
**9-11**

**SECTION 9 - FIXTURES AND FINISHES**



**NOTE:**  
 1. Lighting fixture shall be designed in accordance with the requirements set forth in Section 6-6.

7/20/20  
 Kara M. Boyles, Ph.D., P.E. Date

**REF STD SPEC SEC 9-2**

APPROVED/REVISED BY THE BOARD OF PUBLIC WORKS  
 EFFECTIVE DATE: July 28, 2020



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Item	Revision	Approved Date

STANDARDS FOR DESIGN  
 AND CONSTRUCTION

**LIGHTING - TYPE 5A**

STANDARD  
**9-12**