

Requirements and Standards
For the Design and Construction of
STREETS AND ROADWAY FACILITIES

Warren County, Ohio

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GENERAL CONSIDERATIONS

1. **PURPOSE.** The Purpose of these requirements and standards as adopted by the Warren County Board of Commissioners, hereinafter referred to as the “County Commissioners”, is to provide minimum requirements for engineering and surveying standards in Warren County, Ohio. And to define the minimum requirements for engineering and construction as applied to land development and road and bridge construction projects under the jurisdiction of Warren County.
2. **TITLE.** These requirements and standards shall be known as, and may be cited and referred to, as **REQUIREMENTS AND STANDARDS FOR THE DESIGN AND CONSTRUCTION OF STREETS AND ROADWAY FACILITIES, WARREN COUNTY, OHIO**, and shall hereinafter be referred to as these “Standards”.
3. **AUTHORITY.** The County Commissioners and the County Engineer are authorized to adopt general rules and regulations establishing standards for the design and construction of improvements shown on the plats and plans within their jurisdiction by virtue of Chapter 711 and Title 55 of the Ohio Revised Code.
4. **JURISDICTION.** These Standards shall be applicable to work within all public rights-of-way and subdivisions of land as defined by Chapter 711 of ORC hereinafter within the unincorporated areas of Warren County.
5. **INTERPRETATION OF TEXT.** In the interpretation and application of the provisions of these Standards, they shall be held to be the minimum requirements. It is not intended by these Standards to interfere with or abrogate or annul any easements, covenants, or other agreements between parties unless they violate these Standards. When two specific provisions of these Standards conflict with each other or when a provision of these Standards conflicts with any other lawfully adopted rule, regulation, standard, ordinance or resolution, the most restrictive or imposing the higher standard shall apply.
6. **ADOPTION.** These Standards shall become effective after adoption by the County Commissioners. Subdivision sections that are grandfathered from these revised Standards include: i) those sections where construction has not begun but have received plan approval by the County Engineer no earlier than two-years prior to the effective date of these Standards, and ii) those subdivision sections where the developer has made at least the initial complete construction plan submittal to the County Engineer prior to adoption of these Standards by the County Commissioners.
7. **SEPARABILITY.** The invalidation of any clause, sentence, paragraph, or section of these Standards by a court of competent jurisdiction shall not affect the validity of the remainder of these Standards (either in whole or in part).
8. **DEFINITIONS.**
 - A. County Commissioners: The Board of Warren County Commissioners or it’s designated representative.
 - B. County Engineer: The Warren County Engineer or designated representative.
 - C. County: Warren County, State of Ohio
 - D. Developer: (See Subdivider)

- E. ODOT: The Ohio Department of Transportation
 - F. ORC: The Ohio Revised Code
 - G. Professional Engineer: a registered engineer authorized to practice professional engineering by the State of Ohio Board of Registration as specified under Section 4733 ORC.
 - H. Professional Surveyor: a registered surveyor authorized to practice professional surveying by the State of Ohio Board of Registration as specified under Section 4733 ORC.
 - I. Public Utility: any firm, corporation, governmental agency, or board authorized by state law or having a Public Utility Commission permit to furnish to the public, under regulations, electricity, gas, sewer, telephone, transportation, water or other similar public services.
 - J. Regional Planning Commission (RPC): The Warren County Regional Planning Commission or designated representative.
 - K. Street, Private: a privately maintained roadway designed and constructed to these Standards but not accepted by the County Commissioners.
 - L. Street, Public: a roadway within a dedicated right-of-way designed and constructed to these Standards and accepted by the County Commissioners for vehicular transportation use by the public (with or without provisions for pedestrians).
 - M. Subdivider: Any individual, developer, firm, association, syndicate, partnership, corporation, trust or any other legal entity commencing proceedings under these Standards to affect a subdivision of land hereunder for itself or for another or it's designated representative.
 - N. Subdivider's Bond Agreement: An agreement between a Subdivider and Warren County on forms promulgated by the County Commissioners setting forth the financial and performance responsibilities of both parties.
 - O. Subdivision: As defined by Chapter 711 of the Ohio Revised Code.
 - P. Thoroughfare Plan: the Warren County Official Thoroughfare Plan.
9. ADMINISTRATION. The Warren County Engineer, referred to as the "County Engineer" herein, shall administer these Standards. These Standards are based on generally accepted engineering principles and practices. Therefore, any modifications to these Standards must be submitted to the County Engineer for review and approval. The County Engineer may agree to modify these Standards when, in the opinion of the County Engineer, they adhere to sound engineering principles and practices and are not contrary to the public interest.

SECTION 100

CONSTRUCTION PROCEDURE AND MATERIALS

100 CONSTRUCTION PROCEDURE AND MATERIALS

- A. The Subdivider shall design and construct improvements not less than the standards outlined in these Standards. The work shall be done under the County Engineer's supervision and shall be completed within the time fixed or agreed upon by the County Commissioners.
- B. It is the responsibility of the Subdivider and his engineer to investigate local conditions that may require additional improvements.

101 PRE-CONSTRUCTION MEETING

A pre-construction meeting including the Subdivider's contractor and the Warren County Engineer's representative(s) is required prior to the commencement of any construction activities on future public infrastructure and/or any work to be performed within the current road right-of-way areas.

102 WORK AND MATERIALS TO CONFORM WITH THE CURRENT ODOT CMS

All work and materials shall conform to the current edition of the Ohio Department of Transportation (ODOT) Construction and Material Specifications (CMS) and to the Standards and Specifications of Warren County, Ohio. Most, if not all, Ohio Department of Transportation Standard Details are acceptable may be accepted and/or required at the discretion of the County Engineer.

103 INITIAL SUBGRADE INSPECTION

- A. Public road right-of-way areas shall be prepared in accordance with ODOT CMS Item 201 – Clearing and Grubbing and approved by the County Engineer before the Contractor begins to construct their roadway embankment.
- B. Poor subgrade material may result in the need for undercut, granular backfill, and underdrain of the undercut area (if needed) within the scope and limits specified by the County Engineer, or alternately, the use of ODOT CMS #206 - Chemically Stabilized Subgrade. The Subdivider may elect to construct either option where both will provide an effective solution in the opinion of the County Engineer.

104 INSPECTIONS and TESTING

- A. OUTSIDE INDEPENDENT TESTING/INSPECTION: Inspections required of the Subdivider during and after the installation of improvements shall be made by an ODOT prequalified independent testing laboratory to ensure conformity with the approved plans and specifications as required by these Standards. The items that require inspection are as follows:
 - 1. Storm sewers and appurtenances. A video inspection of all storm sewer to be maintained by a public or quasi-public entity (such as a storm water management board), OR storm sewer that will be privately maintained but that the County Engineer has determined to be located such that the private sewer might adversely affect the public drainage system if not adequately constructed, will be submitted to the County Engineer for approval prior to County acceptance of the development infrastructure for public maintenance. The video inspection will be performed no sooner than 90-

days prior to the final punch list walk-thru scheduled with the Developer's request for County acceptance of the development infrastructure for public maintenance. Assessments of storm sewer, culverts, and appurtenances along with the accompanying video inspection reports shall be performed in accordance with ODOT CMS 611 specifications. All sewer mains must be clean with no pulled or slipped joints, and no cracked or damaged pipe. If repairs are required, a follow-up video inspection of the repair area will be submitted documenting that the storm sewer main is in compliance with ODOT CMS 611 specifications unless specifically waived by the County Engineer. All information must be legible, easily read or viewed, and of high quality.

2. 304 Aggregate Base – Test in accordance with ODOT SS 878 or more current related ODOT CMS specification.
 3. 206 Chemically Stabilized Subgrade (when used) – Test in accordance with ODOT SS 878 or more current related ODOT CMS specification.
 4. 301 asphalt concrete base and tack coat - density and pavement load and roll temperatures during construction. Depth checks by measurement of cores, one core every 300-Lin. Ft. of roadway, will be required unless specifically waived by the County Engineer. County Engineer-approved subgrade and 304 aggregate depth logs will be accepted in lieu of pavement cores to check depth on curb/gutter streets.
 5. 448 surface thickness - density and pavement load and roll temperatures during construction. Depth checks by measurement of cores, one core every 300-Lin. Ft. of roadway, will be required unless specifically waived by the County Engineer. County Engineer-approved subgrade and 304 aggregate depth logs will be accepted in lieu of pavement cores to check depth on curb/gutter streets.
 6. Other Testing of Asphalt - At the County Engineer's discretion, additional testing may be required on the pavement cores to verify that the asphalt mix and compacted density conforms with the ODOT CMS specifications.
- B. Inspections during the installation of roadway materials shall be performed by the County Engineer's office. Items that require inspection by the County Engineer's representative are as follows:
1. Street subgrade. 24 hours prior to installation of the curb, 304 aggregate base, and 301 Asphalt Base courses. In subdivisions with curb and gutter streets, a subgrade depth log from curb at a maximum of every 50 linear feet may be required by the County Engineer at the County Engineer's discretion.
 2. Review of Asphalt Tickets and Test Reports. A copy of material delivery tickets shall be delivered to the County Engineer within one week of constructing these items. Copies of the testing results specified in Section 104.A.2, 3, 4, 5 (these items are required by the County Engineer within one week of construction) and the pavement core results (required within one month of construction), will be emailed to the County Engineer's designated representative.
 3. New Roadway Signage Installation. Signage or other devices that are installed in conformance with the Ohio Manual of Uniform Traffic Control Devices as provided in the plans for permanent installation and during construction as specified in Section 108.
- C. All outside inspection costs shall be paid by the subdivider. Inspection performed by the County Engineer's Office staff during normal County Engineer's Office operating hours is provided at no cost to the subdivider. If the County Engineer has determined during the design, construction or within the maintenance period phases, that there are deficiencies in the design, materials or workmanship, the County Commissioners reserve the right to add to the requirements outlined in these Standards as needed to remedy the deficiencies noted by the County Engineer.

- D. Results and/or input from the testing firm or the design consulting engineer provided for the purpose of improving the quality of the project will be considered by the County Engineer with the final decision to be made by the County Engineer.

105 TESTING REPORT SUBMITTAL

Inspection and test reports shall be in writing with copies provided to the County Engineers Office within the timeframes specified above in Section 104.B.2. The reports shall clearly identify the subdivision name, the location of applicable test areas, and street names. Said reports are the basis for performance bond reductions, and/or street acceptance. The Subdivider's request for a bond reduction for roadway base and pavement items can only be processed upon the County Engineer's acceptance and approval of the inspection and test reports provided by the Subdivider.

106 RESPONSIBILITY

The work shall be under the control and supervision of the subdivider until written final acceptance is given by the County Engineer.

107 FINAL INSPECTION

Upon completion of all the improvements the subdivider shall request, in writing, a final inspection by the County Engineer as required under Section 711.091 of the Ohio Revised Code.

108 WORK IN OR ADJACENT TO EXISTING COUNTY OR TOWNSHIP MAINTAINED ROADWAYS

A separate, no-cost permit is required for any work performed within the road right-of-way area of an existing County or Township-maintained street. For the safety of the traveling public and the contractor's workers, the appropriate warning signage will be supplied in good condition and placed by the contractor in conformance with the Ohio Manual of Uniform Traffic Control Devices.

SECTION 200

SUBMISSION OF PLANS

200 PLANS AND PROFILES

- A. Complete plans profiles, signed and approved by a registered engineer, shall be made for all new streets and other improvements to be constructed in any subdivision subject to these Standards. Three (3) sets of prints of the plans and profiles and estimated quantities shall be filed with the County Engineer.
- B. Two of the plan and profile sets shall be printed on either 24" x 36" or 22" x 34" plan profile sheets; the remaining set will be a pdf electronic copy formatted to print to scale on 11" x 17" sheets. Plans and profiles shall show all necessary data in sufficient detail for the complete construction of all work and improvements to be made in the plat.
- C. The Developer will also provide an electronic copy of the curb, pavement, right-of-way, water, and sanitary and storm sewer infrastructure including all appurtenances tied to the state plane coordinate system in a format compatible with the current Warren County GIS program.
- D. All grade elevations shall be based on U.S.G.S., of Miami Conservancy District datum.
- E. More specifically, all plans and profiles shall show and include the following items:

<u>PLAN</u>	<u>GENERAL</u>	<u>PROFILE</u>
1. Show all proposed lots, streets, and curbs, etc.	1. Existing centerline and proposed top of curb profiles.	
2. Existing pavement, headwalls, piers, etc.	2. Centerline stations.	
3. Typical street and curb sections	3. Curb elevations at minimum 50-foot stations.	
4. Construction notes.	4. Label proposed centerline and top of curb profile.	
5. Structural details.	5. Profile of sewers and utilities in easements through lots	
6. North arrow (preferably up or to the right.	6. Stations and centerline elevations intersection streets.	
7. Street names.	7. Label curb elevations intersection streets.	
8. Centerline stations (south to north and west to east where possible.	8. Insert title box in lower right corner.	
9. Easements for utilities and storm		

drainage.

10. Pavement and right-of-way widths.

11. Lot numbers and dimensions.

12. Curb radius at intersections (if not covered in notes.

13. Curve data; station of PC, PT, PCC.

14. Sheet reference.

15. Plat section lines (boundary lines) show stations.

16. Dimension utility locations. Location and/or statement of adequate outlet for underdrains and storm sewer as approved by the County Engineer.

17. For open ditch sections, provide the designed driveway culvert opening size.

18. Cross-sections: To be provided every 100' on open ditch developments unless specifically waived by the County Engineer. Cross-sections may be required by the County Engineer in curb/gutter subdivisions at the discretion of the County Engineer. Specifically, cross-sections will be required in curb/gutter sections where graded slopes are steeper than 3:1.

<u>Storm Sewer</u>	
<u>PLAN</u>	<u>PROFILE</u>
1. Show proposed storm sewers, manholes, laterals, catch basins, headwalls, etc.	1. Show length of span size, grade, and class of pipe.
2. Label each span length and pipe size.	2. Label storm water manholes, junction boxes, etc., and show centerline of streets and stations for each.
3. Station low points of grade and manholes.	3. Show invert elevations of all pipe at manholes, headwalls, junction boxes, etc., except laterals to catch basins.
	4. Show elevation on top of manhole or catch basin, when not in paved street or when in vertical curve portion of street.

Note: See also the Warren County Rules and Regulations for the Design of Storm Sewer and Storm Water Management Systems for additional guidance related to the Storm Water facilities.

Bridges: Bridge Justification Report. See Section 400.E of these Standards.

201 APPROVAL OF PLANS

- A. Construction drawings must be stamped/signed by the Ohio registered professional engineer who prepared the drawings prior to the plans being given final approval by the County Engineer. If a minimum of twenty-five (25) percent of the bonded amount of construction has not been completed, inspected and approved by the County Engineer within a period of three (3) years from the plan approval date, the approval shall be void and re-approval is required.
- B. Construction drawings shall be approved prior to the approval of a final plat.

SECTION 300

INSTALLATION/BONDING OF IMPROVEMENTS

300 BOND FOR INSTALLATION OF IMPROVEMENTS

- A. In order that Warren County has the assurance that the construction and installation of improvements will be completed, the subdivider shall enter into one to the following agreements:
 - 1. The Subdivider construct all improvements directly affecting the subdivision, as required by the Warren County Board of Commissioners, prior to the approval of a final plat; or
 - 2. In lieu of the completion of the improvements, to execute the current approved Security Agreement with the Warren County Board of Commissioners with the amount of the Security based on an estimate approved by the Warren County Engineer.
- B. The following improvements shall be installed, constructed, or bonded: earthwork constructed within existing or future public right-of-way or public easement areas, new streets, improvements to existing streets, street signs, traffic control signs, sidewalks, and other walkways/bicycle paths, stormwater drainage facilities, monuments and lot corner pins, streetlights, mail pickup/drop-off facilities, sanitary sewer facilities (separately – sanitary is not part of these regulations), and water facilities (separately – water utility is not part of these regulations).

301 CONDITIONS

- A. The security shall run for a period of time such that the performance of all bonded work will be completed within a timeframe not to exceed two (2) years from date of execution, or a later date determined by the County Engineer, and shall provide that the subdivider, the subdivider's heirs, successors, agents and assigns, will comply with all applicable terms, conditions, provisions and requirements of these Standards, and will faithfully perform and complete the work of constructing and installing such facilities or improvements in accordance with these Standards.
- B. While the performance (construction) of all improvements is required to be completed within a timeframe not to exceed two (2) calendar years, at minimum, there shall be a road constructed suitable for construction and emergency vehicles through the parcel frontage of any residence or commercial building prior to beginning construction on the building. The minimum width for the construction and emergency access is 16-feet wide and the street section up through the ODOT 301 asphalt base course or as otherwise determined by the County Engineer in conjunction with the local Fire Chief.
- C. Preceding the acceptance of the Subdivider's Security Agreement, an itemized list of materials and their cost shall be submitted to the County Engineer. Construction cost estimates shall reflect realistic and current bid prices to the satisfaction of the County Engineer.

302 COMPLETION OF WORK

As the required improvements are completed, approved, accepted, and the County Engineer has received and approved all material tickets, testing lab results and inspection reports, the County Commissioners may reduce the amount of the security as recommended by the County Engineer.

303 MAINTENANCE BOND

Upon acceptable completion of installation of the required improvements, the subdivider shall execute the current approved Security Agreement for maintenance except that a separate Security Agreement for maintenance is not required if maintenance is included in the performance bond required under Section 300 above.

304 ACCEPTANCE

After two-thirds of the development parcels have been issued a Certificate of Occupancy by the Warren County Building & Zoning Department and all improvements have been constructed to the satisfaction of the County Engineer, the Developer will advise the County Engineer in writing that the development is eligible to begin the 2-year development maintenance period.

At the conclusion of the maintenance period and upon the Developer's completion of the punch list of repairs, monuments and lot corner pins, and as-built drawings to the satisfaction of the County Engineer, the County Engineer will certify to the County Commissioners that all improvements have been completed in accordance with these Standards, and the County Commissioners may then proceed to accept the facilities for which the security was posted.

305 FAILURE TO COMPLY

Whenever public improvements have not been constructed in accordance with these Standards, the County Commissioners may exercise its rights pursuant to the terms of the Security Agreement.

SECTION 400

SUBDIVISION IMPROVEMENT REQUIREMENTS AND IMPROVEMENT DESIGN STANDARDS

400 STREETS AND BRIDGES

- A. The subdivider shall be responsible for the construction of all new streets within a subdivision.
- B. Where a land use change or development on existing road frontage or previously approved street increases traffic volumes or involves safety or new entrances or exits, the development shall be reviewed for any improvements to adjoining, existing streets which may be required of the subdivider in order to mitigate the impacts of the changed conditions consistent with the methods and procedures identified in the Access Management Regulations for Warren County.
- C. The subdivider is responsible to provide those improvements needed to satisfy Section 400.B above and any remaining improvements necessary along the subdivider's road frontage so that the developed section, development side only, is the same or better than the Typical Section provided in the current Official Thoroughfare Plan for Warren County Ohio. Other offsite improvements may be required when the existing road to the proposed subdivision entrance is less than 18.0-foot wide or as determined in the traffic impact study using the methods and procedures identified in the Access Management Regulations for Warren County. This requirement may be waived or reduced in scope by the County Engineer where, in the opinion of the County Engineer, the improvements are less than feasible due to existing conditions such as topography, structures, and/or drainage features. {See also Section 415 OFFSITE IMPROVEMENTS herein.}
- D. Whenever the developer changes the grade of an existing street outside the limits of the plat and the grade changes require adjustment of existing improvements, such adjustments as are necessary will be the responsibility of the developer. If such changes affect private property, the developers shall be responsible for all costs associated with the acquisition of the necessary easements of right-of-way.
- E. A bridge-justification report is required to be reviewed and approved by the County Engineer prior to Warren County accepting a structure meeting the Ohio Revised Code (ORC) Section 5501.74 definition of a bridge for public maintenance (see attached). Structures meeting the ORC definition of a bridge will not be accepted for public maintenance if it can be shown that a culvert of less than 10.0' span will adequately convey the design flow in the opinion of the County Engineer. The bridge justification report will also consider the anticipated service life and replacement cost of the structure and number of residences served. A finance plan may be required if the number of residences served by the proposed structure is not sufficient to justify the cost of the public to maintain the structure.
- F. Additional easement areas will be required for bridges and/or large diameter culverts as determined necessary by the County Engineer for future maintenance including replacement and the potential need for temporary pavement needed for the residents on dead-end roads to navigate through the construction area.

401 STREET DESIGN

Most existing and proposed streets will be classified as one of the following: Subdivision Local I, Subdivision Local II, Subdivision Local III, Private I Private II and Industrial. Higher order streets will be designed and constructed to a standard consistent with the Thoroughfare Plan, and the Ohio Department of Transportation (ODOT) Location and Design (L&D) Manual, AASHTO or other standard as determined by the County Engineer.

- A. Subdivision Local I Streets: A street used primarily for providing access to abutting properties. This street can connect other local streets or be a cul-de-sac, loop, or marginal access street though the total number of single-family residential lots served by a Local 1 street is 50 or below. A road serving less than 50 lots in the proposed development being considered but with the potential to serve additional parcels in a future connecting development may be classified as a Local II or Subdivision Collector Street by the County Engineer. The design speed is twenty-five (25) miles per hour. The design standards for Subdivision Local I streets are specified in Table 1.
- B. Subdivision Local II Streets: A street which provides access to abutting properties and carries traffic from other local streets to collector or arterial streets serving a total of 50 to 250 single family residential lots. The design speed is twenty-five (25) miles per hour. The design standards for Subdivision Local II streets are specified in Table 2.
- C. Subdivision Local III Streets: A low speed higher order local street that serves 250 to 400 single family residential lots and carries traffic from local streets to other collector or arterial streets. Design speed is equal to the legal speed limit as determined by the Ohio Revised Code (ORC). The design standards for Local III streets are specified in Table 3.
- D. Private Streets I: Serves up to 5 single family residences or up to 10 townhomes /condominiums. The design standards for private streets shall be specified in Table 5. If owners of private streets request that the streets be accepted for public maintenance in the future: i) acceptance by the County Commissioners and/or Township Trustees is unlikely, and ii) the owners shall bear the full expense of any reconstruction or any other action necessary to make the streets fully conform to the requirements applicable at that time for public streets, prior to dedication and acceptance.
- E. Private Streets II: Serves up to 40 single family residences or other use up to 400 maximum trips generated per day. The design standards for private streets shall be specified in Table 6. See Private Streets I regarding future requests by owners to transfer private streets to the public road inventory.

402 SPECIAL STREET TYPES

The following requirements shall apply to special street classifications:

- A. One Way Streets: The design standards for one-way streets are contained in Table 5.
- B. Marginal Access Streets: The design standards for marginal access streets shall be the same as those required for local streets or one-way streets as specified in Table 1, 2 or 5.
- C. Dead-End Streets: A 'T' type temporary turnaround shall be provided at the end of a street that is to be extended for future development within a subdivision. The temporary turnaround shall be designed in accordance with the standards specified in Table 8.

A turnaround shall be provided when a street is constructed to a property line, for future access

to the adjacent property, and it provides access to more than one lot on each side. If it is determined by the Regional Planning Commission that the street will ultimately connect to another street in the roadway network, a 'T' type temporary turnaround shall be provided at the end of the street. The temporary turnaround shall be designed in accordance with the standards specified in Table 8. If it is determined by Regional Planning Commission that the roadway will ultimately become a cul-de-sac street with a future extension, then a permanent mid-block turnaround may be required in lieu of the 'T' type turnaround. The location of the mid-block turnaround shall be determined during the review of the preliminary plat for the subdivision. The mid-block turnaround shall be designed in accordance with the standards specified in Table 9.

403 HORIZONTAL STREET ALIGNMENT

When there is an angle of deflection between two (2) centerline tangent sections of a street, a curve of adequate radius shall connect them. The minimum centerline curve radii for Subdivision Local I, Subdivision Local II, Subdivision Collector I, Industrial Street, One-Way, Private I, and Private II streets are specified in Tables 1, 2, 3, 5, 6, and 7 respectively.

404 VERTICAL STREET ALIGNMENT

The minimum length of a vertical curve shall be computed from the following formula:

$$L = KA$$

Where: L = Length of vertical curve in feet

K = A constant for design

A = The algebraic difference in percent of grades

The values to be used for the constant K are provided in Tables 1, 2, 3, 4, 5, 6, and 7.

Use ODOT Location & Design criteria for design thresholds and procedures related to superelevated roadway sections.

405 INTERSECTIONS

The design standards for all intersections are specified in Table 10.

406 CUL-DE-SACS AND MID-BLOCK TURNAROUNDS

- A. The location requirements for mid-block turnarounds on cul-de-sac streets, based on street length, are specified in Table 1. Mid-block turnarounds may also be used on other local streets.
- B. The design standards for cul-de-sacs are specified in Table 9.
- C. The design standards for mid-block turnarounds are specified in Table 9.
- D. Central islands may be included in the design of cul-de-sacs or mid-block turnarounds. Specific uses for central islands shall be approved during the review of the preliminary plat for a subdivision. Uses for central islands include but are not limited to:
 - 1. Landscaping for aesthetic purposes.
 - 2. Vehicle speed reduction.
 - 3. Vehicle parking (recommended if front yard building setbacks are less than fifty (50) feet).

4. Postal facilities.

407 CURBS AND GUTTERS

- A. Combination curbs and gutters may be required for stormwater drainage. A determination of the necessity for curbs and gutters in lieu of roadway side ditches shall be made as part of the stormwater drainage design review.
- B. Curbs and gutters shall be provided for the following special roadway features:
 - 1. Cul-de-sacs: Where a cul-de-sac contains a central island a curb shall be provided along the inside pavement edge around the central island.
 - 2. Mid-Block turnarounds: Where a mid-block turnaround contains a central island, a curb shall be provided along the inside pavement edge, around the central island.
 - 3. A curb shall be provided along the inside pavement edge at all median openings and at the beginning and end of a median area.
 - 4. Curb and gutter will be required on both sides of the street where sidewalks are to be constructed along one or both sides of the roadway unless waived by the County Engineer.

408 POSTAL FACILITIES

Warren County Subdivision Regulations pertaining to Postal Facilities adopted by the Executive Committee of the Regional Planning Commission and the Warren County Commissioners after November 7, 2023, will supersede these Section 408 Postal Facilities requirements provided in A. – F. below where these Section 408 provisions contradict the Warren County Subdivision Regulations.

- A. Postal facilities are privately owned and maintained by the Developer or other non-public entity as assigned by the Developer on the recorded Subdivision Plat. It is the Developer's responsibility to ensure that the postal facilities constructed meet United States Postal Service requirements.
- B. Handicap ramps or other ADA facilities necessary for access to the postal facilities are the responsibility of the party or parties that own and maintain the facilities. However, the County Engineer may require that the Developer or owner of the postal facilities construct ADA ramps, signage, pavement markings within the public road right-of-way that, in the County Engineer's opinion, are necessary to accommodate anticipated pedestrian traffic to/from the postal facility at locations other than roadway intersections.
- C. Vehicle parking or waiting facilities shall be provided to serve combined postal delivery and collection units when they are employed to provide postal service to a subdivision.

All such facilities shall also meet the location requirements of the Warren County Regional Planning Commission as specified in the Warren County Subdivision Regulations Section 415.

- D. To avoid the need for pull off areas in or near the public right-of-way and for public convenience and safety considerations, the mail kiosks not located in areas with parking and separate driveway access will be limited to 36 residences maximum at one location and will be located along streets with less than 1000 ADT (100 residential lots).

- E. Locating mail kiosks on the no parking/fire lane side of the roadway may be preferable in some areas due to improved visibility. Subject to the approval of the local Fire Chief and signed for 5-minute maximum parking if permitted.
- F. Driveways for separate mail kiosk parking areas shall be located 100-feet minimum from the closest intersection measured from the radius return of the intersecting street and nearest edge of pavement of the mail kiosk driveway. Where there are designated turn lanes, the nearest mail kiosk facility drive edge of pavement will be located no closer than 150-feet from the diverging taper for the turn lane.
- G. The Developer and future residents are advised that the maintaining road agency will not be able to alter their snow plowing operations to accommodate mail kiosk locations. There will be an accumulation of plowed snow at mail kiosks located along the roadway and within pull-off areas (if permitted to be constructed as a variance to Section 408.D).

409 SIGNS

All signs within a development are the responsibility of the developer and shall be made and placed in accordance with the standards and requirements of these Standards.

410 SUMP PUMPS

- A. No person shall install any pump, piping, device, apparatus; or other such system for discharging sump pump effluent into a public right-of-way without approval of the County Engineer.
- B. The discharge of sump pump effluent onto a public road surface is specifically prohibited.
- C. Sump pump effluent discharge systems shall conform with one of the following modes of construction after obtaining a permit from the County Engineer: direct connection to a public storm sewer; direct discharge into an approved natural drainage ditch, connection to a yard inlet; direct connection to a public storm drainage culvert. The installation of a master sump pump drainage system may be required where other means of effluent removal are not available or feasible.
- D. #611 Sump line shall be 6" ODOT Type B Conduit non-perforated Type F Schedule 40 PVC (ODOT CMS 702.42 or 702.45)

411 SIDEWALKS

- A. Sidewalks shall be provided in new subdivisions as a system of pedestrian circulation which is separate from streets. All sidewalks shall be inside of the public utility easement which adjoins the road right-of-way.
- B. All sidewalks shall meet the location requirements of the Warren County Regional Planning Commission as specified in the Warren County Subdivision Regulations.
- C. Where a sidewalk is required on both sides of a cul-de-sac street, the sidewalk shall be continuous around the cul-de-sac.

- D. Where sidewalk is required on one side of a cul-de-sac street, the sidewalk may terminate into the cul-de-sac.
- E. All sidewalks shall be designed in accordance with the following standards:
 - 1. Sidewalks along local streets shall be four (4) feet in width and located as shown in the Official Thoroughfare Plan, Warren County Ohio, except that sidewalks located along roadways with a functional classification of collector or higher shall be six (6) feet in width.
 - 2. All walkways located closer than 2-feet from the back of curb shall be a minimum of six (6) feet in width.
 - 3. Intersections of sidewalks and roadways with a functional classification of collector or higher shall be regulated by traffic control devices where the County Engineer determines necessary.
 - 4. A curb ramp meeting the current ADA construction standards shall be provided where a sidewalk intersects a street.
 - 5. Sidewalks shall be constructed of Portland cement concrete. All other walkways shall be constructed of Portland cement concrete or asphaltic concrete.
- F. The construction of required sidewalks located within i) the public road right-of-way or a public utility easement area parallel to the public road right-of-way, and ii) also located along developed (owner-occupied) building lots or non-building lots such as Open Space parcels, shall be completed prior to the County Commissioners accepting the public improvements in the subdivision.

412 STREET AND WALKWAY LIGHTING

- A. Street and walkway lighting shall be provided in all subdivisions.
- B. All street lighting facilities shall meet the location requirements of the Warren County Regional Planning Commission as specified in the Warren County Subdivision Regulations.
- C. The design of street lighting facilities shall be as follows:
 - 1. Street Intersections: An average horizontal illumination shall be maintained in the area described by a circle, the center of which is the centerline intersection, and the radius of which is the distance between the centerline intersection and the furthest point of curb return.
 - 2. Street and mid-Block Walkway Intersections: An average horizontal illumination shall be maintained in the area described by a circle, the center of which is the centerline intersection of the street and walkway, and the radius of which is forty (40) feet.
 - 3. Cul-de-sac Streets: An average horizontal illumination shall be maintained to the edge of pavement of the cul-de-sac turnaround area.
 - 4. Mid-Block Turnaround: An average horizontal illumination shall be maintained to the edge of pavement of the turnaround area.
- D. The standards for minimum average horizontal illumination shall be as specified in Table 11.
- E. Street lighting equipment shall be obtained from the electric utility which serves the subdivision.

- F. All street lighting facilities shall become part of a street lighting district, subject to approval of said district by the trustees of the township in which the subdivision is located.

413 SURVEY MONUMENTS

- A. A minimum of four (4) permanent reference monuments shall be located and placed within the subdivision, and their location noted on the record plat. These monuments shall be placed immediately after final grading of lots is completed and the cost of monuments will be included in the cost of improvements. Additional monuments may be required for subdivisions which involve more than ten (10) lots.
- B. Specification for permanent reference monuments are as follows:
 - 1. An iron rod one (1) inch in diameter and thirty-six (36) inches in length with an identification cap which specifies the name and registration number of the surveyor who set the monument.
 - 2. A concrete monument six (6) inches square and thirty-six (36) inches in length with a suitable center point.
- C. A solid iron pin monument, five-eighths (5/8) inch in diameter and thirty (30) inches long, shall be placed by the surveyor at all points on boundary lines where there is a change of direction, at all lot corners and on all new street centerlines where there is a change of direction. All iron pins shall have an identification cap which specifies the name and registration number of the surveyor who set the pin.
- D. There shall be a certification of placement of all monumentation by the surveyor who set them filed with the County Engineer prior to their release from the performance security.

414 STORM SEWERS AND STORM WATER DRAINAGE

Where an adequate public storm sewer is available at the plat boundary, the subdivider shall construct a storm sewer system and connect with such storm sewer line. If such a storm sewer system is not accessible, natural drainage channels shall be provided.

415 OFF-SITE IMPROVEMENTS

- A. The developer or subdivider may be required to contribute to the improvement of streets not within the boundary of the proposed subdivision if such improvements are necessary to serve the proposed subdivision. {See also Section 400 STREETS above.}
- B. If streets are not available at the boundaries of a proposed subdivision, the developer or subdivider shall be required to obtain the necessary right-of-way and to construct extensions of such street across the development frontage.

416 OVER-SIZING AND EXTENSION OF IMPROVEMENTS

- A. The streets and other land improvements required for the proposed subdivision shall be designed to serve adjacent lands if it is determined that such improvements would provide for the most desirable development pattern for the area.
- B. The subdivider shall be required to extend the necessary improvements to the boundary of the

proposed subdivision to serve adjoining unsubdivided land.

417 PRIVATE DRIVEWAY INSTALLATION

- A. All private drives are to be maintained by the owner of the property served by the drive.
- B. A permit must be obtained by the County Engineer or the appropriate authority. No construction shall start unless a permit is obtained.
- C. The County Engineer, or appropriate authority, shall review and approve the size (diameter) of the culvert pipe required.
- D. No culvert shall be less than 30-feet in length. Longer lengths may be required if the engineer determines necessary.
- E. Designer Note: The recommended maximum residential driveway slope is 10.0%. The designer will advise the County Engineer when, in the opinion of the designer, the driveway slope must be greater than 10.0%. Plan changes may be necessary as determined by the County Engineer to reduce driveway slopes to achieve no more than 10.0% slope. Commercial driveways will be designed in accordance with the current ODOT L&D standards.

TABLE 1

STREET DESIGN STANDARDS
Subdivision Local I Streets (up to 50 single family lots)

Right-of-Way (ROW)	: 50 feet for streets with curbs and gutters
	: 70 feet for streets without curbs and gutters
Public Utility Easement (P.U.E.)	: 10 min feet on each side of ROW
Pavement width	: 2 lanes – 12 feet per lane
Minimum street grade	: 1.0%
Maximum street grade	: 8.0% (9% Rolling/Steep Terrain)
Minimum stopping sight distance	: 155 feet
Minimum centerline radius	: 50 feet with an “eyebrow”, 100 feet without though a ‘no parking’ zone may be needed on one or both sides of the street
Vertical curve ‘K’ values	: 20 for ‘crest’ curves; 28 for ISD
	: 27 for ‘sag’ curves
Maximum bridge length on a cul-de-sac street	: See Section 400.E
Additional ‘turnarounds’ required on cul-de-sac streets for a street length of:	
0 – 1199 feet	: None
1200 to 1799 feet	: 1
1800 to 2399 feet	: 2
2400 to 2999 feet	: 3
3000 feet or greater	: 4

****Pavement Composition:**

- 1 ¼" Item 448 surface – surface
- 2" Item 448 surface – intermediate
- 4" Item 301 Base Course (3" with Stabilized Subgrade to ODOT CMS 206 Specifications)
- 5" (average) Item 304 Aggregate Base (6" with Stabilized Subgrade per ODOT CMS 206)
- Underdrain both sides

- Notes: 1 – Consult the maintaining Township for parking requirements.
 2 – Design speed = 25 MPH
 3 – Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2.0 feet. This criterion shall apply to both horizontal and vertical sight distance.
 4 – See TABLE 6 for cul-de-sac turnaround design standards.

TABLE 2

STREET DESIGN STANDARDS
Subdivision Local II Streets (51 to 250 single family lots)

Right-of-Way (ROW)	: 50 feet for streets with curbs and gutters : 70 feet for streets without curbs and gutters
Public Utility Easement (P.U.E.)	: 10 min feet on each side of ROW
Pavement width	: 2 lanes – 12 feet per lane
Minimum street grade	: 1.0%
Maximum street grade	: 8.0% (9% Rolling/Steep Terrain)
Minimum stopping sight distance	: 155 feet
Minimum centerline radius	: 175 feet – Note that parking may be required through the curve for > than 750 ADT as determined by length of lot frontage (or density of parked vehicles anticipated) and the stopping sight distance available along the roadside edge of parked vehicles six feet from the curb/edge of pavement.
Vertical curve 'K' values	: 20 for 'crest' curves : 27 for 'sag' curves

Pavement Composition:

- 1 ¼" Item 448 surface – surface (1.5" with Stabilized Subgrade to ODOT CMS 206 Specifications)
- 2" Item 448 surface – intermediate
- 5" Item 301 Base Course (3.5" with Stabilized Subgrade per ODOT CMS 206)
- 6" (average) Item 304 Aggregate Base w/Underdrains

- Notes: 1 – Consult the maintaining Township for parking requirements.
 2 – Design speed = 25 MPH
 3 – Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2.0 feet. This criterion shall apply to both horizontal and vertical sight distance.
 4 – See TABLE 6 for cul-de-sac turnaround design standards.

TABLE 3

STREET DESIGN STANDARDS
Subdivision Local III Streets (251 to 400 single family lots)

Right-of-Way (ROW)	: 60 feet for streets with curbs and gutters*
	: 80 feet for streets without curbs and gutters *
Public Utility Easement (P.U.E.)	: 10 min. feet on each side of ROW
Pavement width	: 2 lanes and 1 turning lane (as required)– 12 feet per lane*
	*Coordinate with the County Engineer and Regional Planning Commission. Final determination based in part on development type and Thoroughfare Plan requirements.
Minimum street grade	: 1.0%
Maximum street grade	: 6.0% (8% Rolling/Steep Terrain)
Minimum stopping sight distance	: 250 feet (35 MPH)**
Minimum centerline radius	: 350 feet 25 mph, 450 feet 35 mph
Vertical curve 'K' values	: 42 for 'crest' curves; 54 for ISD (35 MPH) **
	: 49 for 'sag' curves (35 MPH) **
	** Criteria will be reduced if 25 MPH design is appropriate in the opinion of the County Engineer.

***Pavement Composition:

1 ½ inches Item 448 surface - surface
 2 inches Item 448 surface – intermediate
 5.5" Item 301 Base Course (4" with Stabilized Subgrade per ODOT CMS 206)
 6" (average) Item 304 Aggregate Base
 Underdrain both sides

***ODOT Pavement Design method will be utilized to confirm that section is adequate where the ADT < 4000 (400 single family residential units or equivalent)

Notes:

- 1 – Design speed = 35 MPH_Legal Speed**
- 2 – Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2.0 feet. This criterion shall apply to both horizontal and vertical sight distance.

TABLE 4

STREET DESIGN STANDARDS
Industrial Street

Right-of-Way (ROW)	: 74 feet for streets with curbs/gutters*
	: 80 feet for streets without curbs/gutters *
Public Utility Easement (P.U.E.)	: 15 min. feet on each side of ROW
Pavement width	: 36 feet*
	*Coordinate with the County Engineer and Regional Planning Commission. Final determination based on a number of factors including development type and Thoroughfare Plan requirements.
Minimum street grade	: 1.0%
Maximum street grade	: 5.0%
Minimum stopping sight distance	: 305 feet (40 MPH)**
Minimum centerline radius	: 450 feet **
Vertical curve 'K' values	: 44 for 'crest' curves (40 mph SSD); 54 for ISD (35 MPH) ** : 49 for 'sag' curves (35 MPH) **
	** Coordinate with the County Engineer prior to design.

Notes (Street Standards):

1 – Design speed = 35 MPH_

2 – Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2.0 feet. This criterion shall apply to both horizontal and vertical sight distance.

Minimum Pavement Structural Number (with confirmation of assumptions):

Warehouse Development	Untreated Subgrade	Chemically Treated Subgrade
Up to 1 million SF	SN = 5.3	SN = 4.7*
Up to 3 million SF	SN = 5.8	SN = 5.2*
Up to 5 million SF	SN = 6.4	SN = 5.8*
Greater than 5 million SF	(By site specific design)	

*SN/inch of ODOT 304 material is increased to 0.17 from 0.14.

Notes (Pavement Design):

1. Flexible pavement composition will include a minimum of 6-inches and maximum of 10" ODOT 304 aggregate base.
2. Underdrains per Section 205.1 of ODOT's PDM and PDM Figure 205-1. 6" diameter (PDM Section 205.1.1) and ODOT Type A Geotextile fabric (CMS 712.09-1). Where underdrains cannot be accommodated on uncurbed sections due to outfall grade, aggregate drains may be used per ODOT PDM 205.1.4.
3. Confirm in lab (rather than ODOT GB-1 spreadsheets) that the California Bearing Ratio (CBR) is 4 or better. CBR values less than 4 will require additional consideration.
4. For proposed roadway sections with two lanes ingress and two lanes egress, divide the total square feet of warehouse space by 1.50 and apply that number to the Minimum Pavement Structural Number table.
5. ODOT Pavement and Design Manual Figures 402-2 and 402-3 values: Reliability = 95%, Standard Deviation = 0.49, Design Serviceability Loss = 2.0.
6. Additional consideration is required for truck volumes greater than 750/day/1 million square feet of warehouse.
7. Check ODOT PDM Section 400 Asphalt Mix Design for surface and intermediate course recommendations for anticipated truck volumes. Notably, the January 2020 edition of the ODOT PDM recommends an upgraded binder mix for high stress areas where trucks are starting/stopping, turning.
8. Testing Requirements: ODOT CMS specifications listed below or their current equivalents.
 - a. ODOT SS 1120 to determine the final design of the chemically treated subgrade.
 - b. Check for high sulfate concentration per ODOT GB-1
 - c. SS 878, ODOT CMS 206 testing during construction of the treated subgrade.
 - d. Proof roll
 - e. SS 878 for compaction of ODOT 304 base.
 - f. Asphalt proctor/density tests per ODOT 448.

TABLE 5

STREET DESIGN STANDARDS
One-Way Streets

Right-of-Way (ROW)	: 45 feet for streets with curbs and gutters
	: 55 feet for streets without curbs and gutters
Public Utility Easement (P.U.E.)	: 10 feet on each side of ROW
Pavement width	: 19 feet {Assuming driveway access perpendicular to the roadway}
Minimum street grade	: 1.0%
Maximum street grade	: 8.0%
Minimum stopping sight distance	: 155 feet
Minimum centerline radius	: 175 feet
Vertical curve 'K' values	: 20 for 'crest' curves; 28 for ISD
	: 27 for 'sag' curves

Notes:

- 1 – No on-street parking is permitted where driveways are located on both sides of the street. For driveways on one side of the street only, parking may be permitted on the residence side though also subject to the maintaining Township parking requirements. The pavement width needed to back out of driveways perpendicular to the roadway dictates the minimum pavement width of 19-ft.
- 2 – Design speed = 25 MPH
- 3 – Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2.0 feet. This criterion shall apply to both horizontal and vertical sight distance.

TABLE 6

STREET DESIGN STANDARDS*
Private I Streets

* Suggested minimum standards for privately maintained streets. The professional design engineer registered in the State of Ohio affixing their stamp and signature on the plans may consider other standards with input from the County Engineer and the local Fire/EMS Department when requested by the permitting authority. Warren County makes no warranties/ guarantees pertaining to the design or construction of privately maintained roadways.

Lot/Easement width	: 30 feet minimum
Utility easement	: Per Utility Owner(s)
Pavement width	: 2 lanes – 8 feet per lane
Minimum street grade	: 1.0%
Maximum street grade	: 12.0%
Minimum stopping sight distance	: 155 feet
Minimum centerline radius	: 50 feet*
Vertical curve 'K' values	: 10 for 'crest' curves*
	: 18 for 'sag' curves*
	*Maintain minimum stopping sight distance
Maximum bridge length on a cul-de-sac street	: See Section 400.E
Additional 'turnarounds' required on cul-de-sac streets for a street length of:	: See Local I Street

Pavement Composition:

Aggregate Base

- 1 ½ inches Item 448 surface - surface
- 1 ½ inches Item 448 surface – intermediate
- 3" Item 301 Base Course
- 5" Item 304 Aggregate Base

Full Depth Pavement

- 1 ½ inches Item 448 surface - surface
- 2 inches Item 448 surface – intermediate 5" Item 301 Base Course

Professional Engineer Stamped/ Certified Design Option:

Professional engineer to certify that the proposed pavement section is designed to support emergency vehicles, construction vehicles and has a design life of more than 20-years.

- Notes:
- 1 – No on-street parking is permitted.
 - 2 – Design speed = 15 MPH (Stopping Sight Distance 25 mph)
 - 3 – Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2.0 feet. This criterion shall apply to both horizontal and vertical sight distance.
 - 4 – See TABLE6 for cul-de-sac turnaround design standards.

TABLE 7

STREET DESIGN STANDARDS*

Private II Streets

* Suggested minimum standards for privately maintained streets. The professional design engineer registered in the State of Ohio affixing their stamp and signature on the plans may consider other standards with input from the County Engineer and the local Fire/EMS Department when requested by the permitting authority. Warren County makes no warranties/ guarantees pertaining to the design or construction of privately maintained roadways.

Lot/Easement width	: 45 feet for streets with curbs and gutters
	: 60 feet for streets without curbs and gutters
Public Utility Easement (P.U.E.)	: Per Utility Owner(s)
Pavement width	: 2 lanes – 10 feet per lane
Minimum street grade	: 1.0%
Maximum street grade	: 10.0%
Minimum stopping sight distance	: 155 feet
Minimum centerline radius	: 50 feet with an “eyebrow” or 100 feet
Vertical curve ‘K’ values	: 20 for ‘crest’ curves; 28 for ISD
	: 27 for ‘sag’ curves
Maximum bridge length on a cul-de-sac street	: Private Maintenance
Additional ‘turnarounds’ required on cul-de-sac streets for a street length of:	: See Local I Street

Pavement Composition (3 Options):

Aggregate Base

- 1 ½ inches Item 448 surface - surface
- 1 ½ inches Item 448 surface – intermediate
- 3” Item 301 Base Course
- 6” Item 304 Aggregate Base

Full Depth Pavement

- 1 ½ inches Item 448 surface - surface
- 1 ½ inches Item 448 surface – intermediate
- 5 ½ inches Item 301 Base Course

Professional Engineer Stamped/ Certified Design Option:

Professional engineer to certify that the proposed pavement section is designed to support emergency vehicles, construction vehicles and has a design life of more than 20-years.

- Notes:
- 1 – See County or Township Zoning Requirements (as applicable) for Parking
 - 2 – Design speed = 25 MPH
 - 3 – Stopping sight distance is measured from an eye height of 3.5 feet to an object height of 2.0 feet. This criterion shall apply to both horizontal and vertical sight distance.
 - 4 – See TABLE 6 for cul-de-sac turnaround design standards.

TABLE 8

STREET DESIGN STANDARDS
"T" Type Turnarounds

Pavement width	: 20 feet
Width of 'T' section	: 50 feet + street pavement width
Curb radius	: 15 feet
Street extension beyond 'T'	: 15 feet

Pavement composition for T-Type Turnarounds is equal to the Local 1 standard.

TABLE 9

STREET DESIGN STANDARDS
Cul-de-sacs and Mid-block Turnarounds

Right-of-Way (ROW) radius	: 55 feet for C/G and 60 feet for ditch
Outside pavement radius	: 42 feet
Lane width with central island	: 18 feet
Curb return radius (edge/pavement)	: 25 feet
Public Utility Easement (P.U.E.)	: 10 feet outside of ROW

TABLE 10

INTERSECTION DESIGN STANDARDS

Intersection sight distance	Per ODOT L&D Manual for the design speed. 25 mph: 280' (K Crest = 28). Fig 201-5E {See Note 4 below for proposed roadway connections to an existing roadway.}
Street pavement grades at intersections (See Note 3 below)	: 5% maximum for the major street within 150 feet of the centerline intersection.
Angle of intersection	: 90 degrees (75 degrees minimum when justified).
Minimum curb radius (higher street classification determines radius)	Private streets - 25 feet Subdivision Local streets - 35 feet Subdivision Collector streets - 35 feet Mainline Collector and Above – 50 feet

Notes:

- 1 – 'Major' and 'minor' streets shall be determined by street classification. Where both streets are of the same classification, the major street shall be the 'through' street or the street which connects to another street in a higher classification. In most cases, the minor street will be controlled at intersections.
- 2 – The centerline grade of the major street shall be maintained through the intersection. The point of vertical intersection between the pavement cross slope grade of the major street and the centerline grade of the minor street shall be a minimum of fifty (50) feet from the centerline intersection of the two streets.
- 3 – When locating a proposed intersection near a vertical or horizontal curve, consider the following scenarios in addition to the sight distance available for vehicles turning from the proposed intersection onto the existing road.
 - a. Left turning motorists often make their decision on the approach ahead of the intersection. Measure the sight distance available to the motorist on the mainline approaching the proposed intersection 100-feet from the proposed nearest edge of pavement (based on observations at existing intersections near crest curves). Measure the sight distance available 100-feet from the nearest edge of pavement

for the approach in the opposite direction if a second future connection is possible opposite of the proposed connection being evaluated.

- b. For vehicles approaching the left turning motorist stopped in the mainline road, measure the stopping sight distance available for a vehicle on the mainline road approaching the queued left-turning vehicle.

Per AASHTO Green Book Section 9-5 (24-feet wide roads):

ISD recommended for left turn onto the mainline road: $7.5 \text{ seconds} \times \text{design speed (ft/s)}$

SSD recommended for vehicles approaching behind queued left turning vehicle: Per ODOT L&D Fig. 201-1.

ISD available for left turn from mainline into the proposed subdivision street: $5.5 \text{ seconds} \times \text{design speed (ft/s)}$

Add 0.5 seconds to above for each additional 12' lane crossing.

For roadway profile grades greater than +/- 3.00%, consider adjustment factors provided in AASHTO Green Book Table 9-5.

TABLE 11

STREET LIGHTING INTENSITY
Average Maintained Horizontal Illumination
(Footcandles/Lux)

<u>Roadway Classification</u>	<u>Land Use</u>		Residential Less Than <u>1 Unit/Acre</u>
	<u>Commercial/Industrial</u>	Residential 1 <u>Unit/Acre or</u> <u>Greater</u>	
Arterial	1.4/15	1.0/11	0.7/8
Collector	0.9/10	0.7/8	0.5/5
Sub-Collector	0.9/10	0.7/8	0.5/5
Local	0.7/8	0.6/6	0.4/4
Roundabouts	Per AASHTO Recommendations		

1 – Taken from American National Standards Practice for Roadway Lighting, Illuminating Engineering Society of North America, 1983.

2 – Conversion factors: one (1) footcandle equals 10.76 lux; one (1) lux equals 0.0929 footcandles.

3 – Illumination shall be based on the highest classification of street in the intersection.

APPENDIX A

Improvement Bond Checklist

#	DESCRIPTION	QTY	UNITS	UNIT	TOTAL	UNCOMP	UNCOMP
				COST	COST	QTY	ITEMS
1	Clearing and Grubbing		LS		\$0.00		\$0.00
2	Excavation & Embankment		CY		\$0.00		\$0.00
3	Storm Sewer (by size & type)		LF		\$0.00		\$0.00
4	Culverts (by size & type)		LF		\$0.00		\$0.00
5	Manhole		EA		\$0.00		\$0.00
6	Catch Basin (type)		EA		\$0.00		\$0.00
7	Headwall (type)		EA		\$0.00		\$0.00
8	Curb & Gutter (type)		LF		\$0.00		\$0.00
9	Master Sump Line		LF		\$0.00		\$0.00
	304 Aggregate Base (X")		CY				
	Underdrains		LF				
10	Street Base (X" - 301)		CY		\$0.00		\$0.00
11	Asphalt, Intermediate leveling course (X" - 448)		CY		\$0.00		\$0.00
12	Tack Coat		Gal		\$0.00		\$0.00
13	Street Surface (1 1/2" - 448)		CY		\$0.00		\$0.00
14	Existing Road Improvements		LS		\$0.00		\$0.00
15	Street Name Signs (Including Post)		EA		\$0.00		\$0.00
16	Traffic Signs (Including Post)		EA		\$0.00		\$0.00
17	Guard Rail		LF		\$0.00		\$0.00
18	Street Lighting		LS		\$0.00		\$0.00
19	Wheelchair Ramps		EA		\$0.00		\$0.00
20	Sodding		SY		\$0.00		\$0.00
21	Seeding & Mulching		SY		\$0.00		\$0.00
22	Monuments		EA		\$0.00		\$0.00
23	Lot Corner Pins		EA		\$0.00		\$0.00
24	Improvements to Public Infrastructure related to Mailbox Kiosks		EA		\$0.00		\$0.00
25	Sidewalk		SF		\$0.00		\$0.00
	TOTAL COST UNCOMPLETED COST				\$0.00		\$0.00
	MAINTEN. AMOUNT BOND AMOUNT				\$0.00		\$0.00

APPENDIX B

Standard Drawings



William F. Tunison, P.E., P.S.
Warren County Engineer
100 W. Main St.
Paris, Ohio 45336
(614) 695-3301 Phone
(614) 695-2967 Fax

Classification	Surface	Intermediate	301 Base	304 Base		Total	Demand
Subdivision Local I	1 - 1/4"	2"	4"	4"	6"	12 - 1/4"	≤ 50 lots
Subdivision Local II	1 - 1/4"	2"	5"	5"	7"	14 - 1/4"	50-250 lots
Subdivision Collector	1 - 1/2"	2"	5 - 1/2"	5"	7"	15"	251-400 lots
				D1	D2		

- For cases of demand >400 lots (equivalent to 4000 ADT), the larger of the Subdivision Collector value, from the above table, and the ODOT Pavement Design value is to be chosen.
- Classification as per Table 1.2.3 in the Requirements and Standards for the Design and Construction of Streets and Roadway Facilities, Warren County, Ohio

DATE	AUG. 2022						
SCALE	No scale	DRAWN BY:	JRL	CHECKED BY:	DMB		
		DRAWING LOCATION:	L:\DESIGN\Design Standards\2022				
<div style="float: right;"> SHEET _____ OF _____ <small>Sheet Name Pavement Schedule.dwg</small> </div>							
PROJECT:		WARREN COUNTY ENGINEER'S OFFICE					
REVISIONS		DESIGN STANDARDS					
NO.	DATE	BY	DESCRIPTION				



**Warren
County
Engineer's
Office**

Neil F. Turison, P.E., P.S.
Warren County Engineer
210 W Main St
Lebanon, Ohio 45036
(513) 695-3301 Phone
(513) 695-2967 Fax

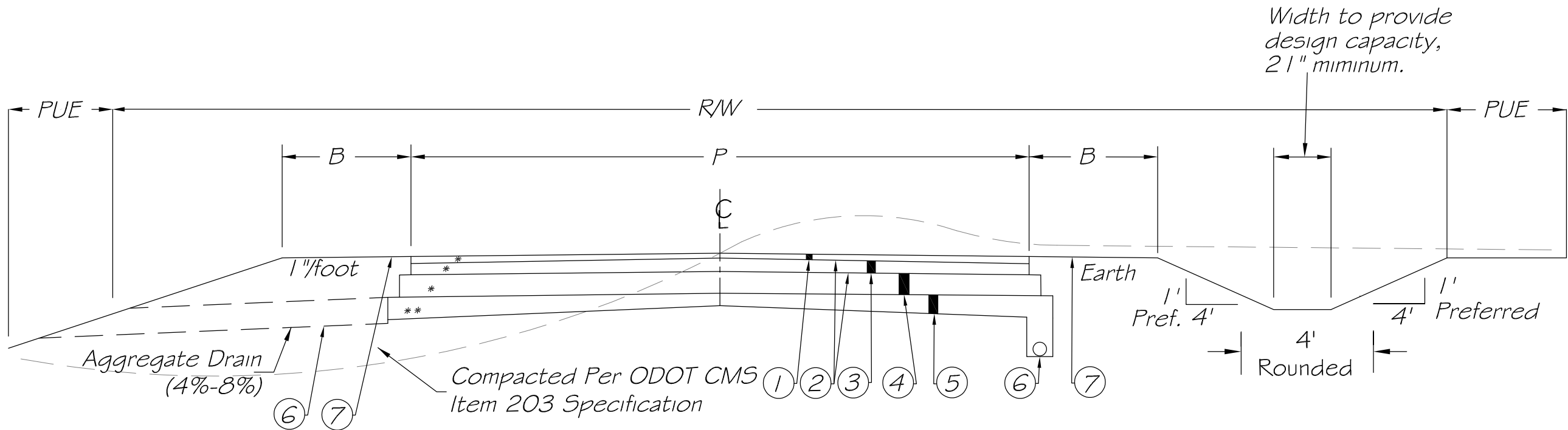
TYPICAL SECTION-
WITHOUT CURB & GUTTER

PLATE 1 Typical Section Without Curb & Gutter.dwg

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

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No scale	AUG. 2022	1			JRL	
DESIGNED BY:	JRL	CHECKED BY:	DMB	DATE:	08/08/22	
DRAWING LOCATION:	L:\DESIGN\Design Standards\2022					
SHEET	1 OF 1					



STREET CLASSIFICATION	R/W	P	B	PUE
Local Subdivision Street	70'	24'	4'	10' min
Collector-Residential Rural	80'	36'	6'	10' min

STANDARD PAVEMENT COMPOSITION (LOW VOLUME ROADS)

- ***ODOT Item 441, Asphalt Concrete Surface Course, Type 1 (448), PG 64-22.
- ODOT Item 407, Non-Tracking Tack Coat.
- ***ODOT Item 441, Asphalt Concrete Intermediate Course, Type 2 (448), PG 64-22.
- ***ODOT Item 301, Asphalt Concrete Base, PG 64-22.
- ***ODOT Item 304, Aggregate Base, Variable Thickness (D1 @ CL, D2 @ E/P)
- ODOT Item 605, 6" Underdrain OR Aggregate Drain
- ODOT Item 659, Seeding and Mulching

GENERAL NOTES

- *2.1% Cross Slope
- **4.2% Cross Slope on Sub-grade
- ***Item thickness to be determined by Standard Pavement Design Schedule
- Street Classification as per Official Thoroughfare Plan, Warren County, Ohio Figures A.7, A.13



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TYPICAL SECTION-
WITH CURB & GUTTER

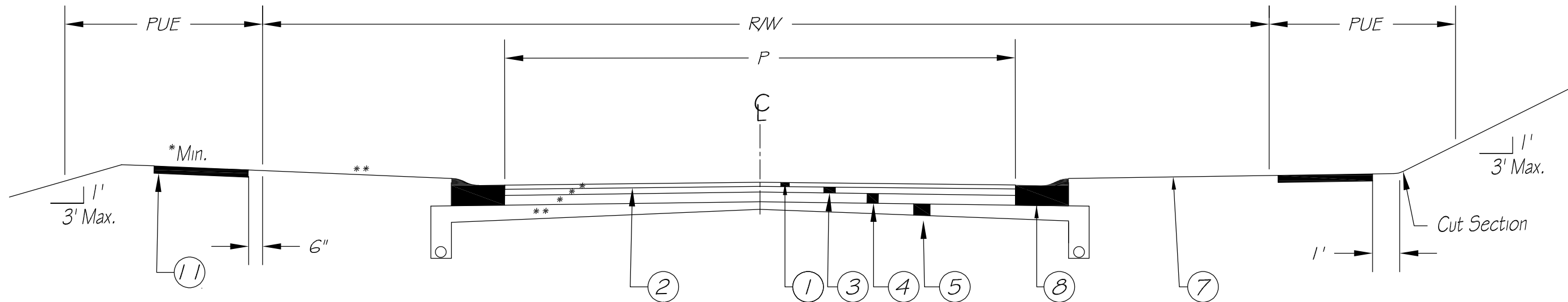
Drawing Name:
PLATE 2_Typical Section With Curb & Gutter.dwg

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

REVISIONS		DATE	BY	DESCRIPTION
NO.	DATE			
1	08/01/2022	JRL		

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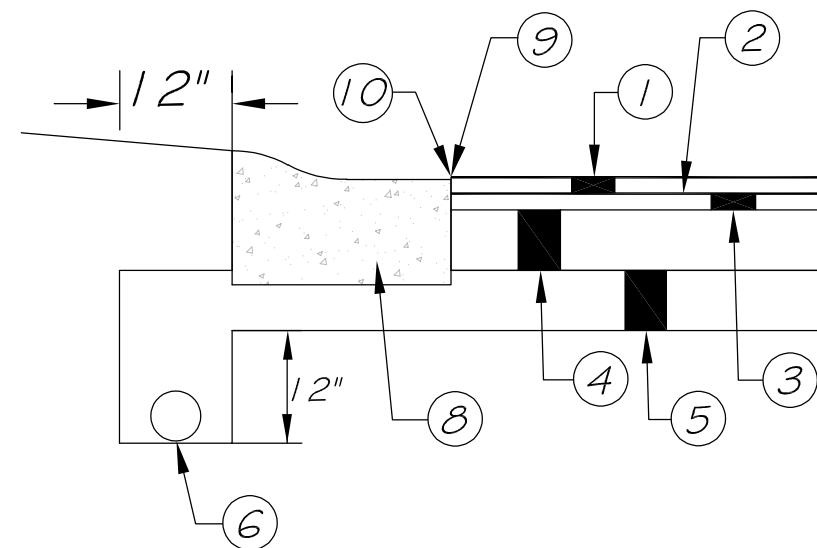


STREET CLASSIFICATION	R/W	P	PUE
Local Subdivision Street	50'	24'	10' min
Collector - Residential Urban	60'	36'	10' min

STANDARD PAVEMENT COMPOSITION (LOW VOLUME ROADS)

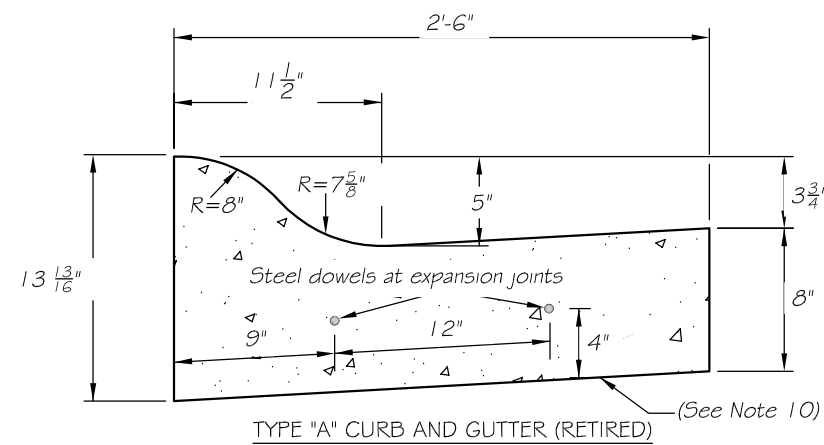
- ***ODOT Item 441, Asphalt Concrete Surface Course, Type 1 (448), PG 64-22.
- ODOT Item 407, Non-Tracking Tack Coat.
- ***ODOT Item 441, Asphalt Concrete Intermediate Course, Type 2 (448), PG 64-22.
- ***ODOT Item 301, Asphalt Concrete Base, PG 64-22.
- ***ODOT Item 304, Aggregate Base, Variable Thickness (D1 @ CL, D2 @ E/P for P=24')
- ODOT Item 605, 6" Underdrain OR Aggregate Drain
- ODOT Item 659, Seeding and Mulching
- ODOT Item 609, ODOT Type 3 Curb
- Asphalt Lip $\frac{1}{4}$ " (+/- $\frac{1}{8}$ ") above gutter plate.
- Joint Sealer to be applied to the face of curb.
- ODOT Item 608 - 4" Concrete Walk

STANDARD PAVEMENT COMPOSITION



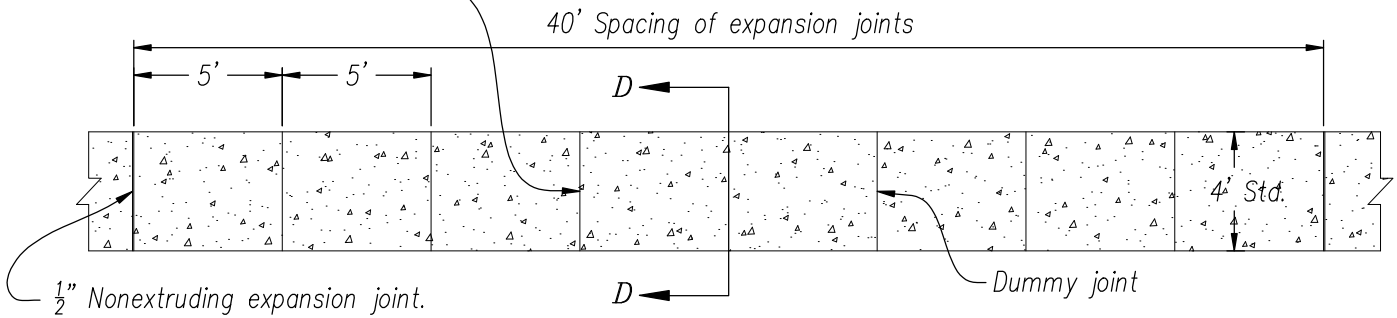
GENERAL NOTES

- *2.1% Cross Slope
- **4.2% Cross Slope on Sub-grade
- ***Item thickness to be determined by Standard Pavement Design Schedule
- Street Classification as per Official Thoroughfare Plan, Warren County, Ohio Figures A.7, A.13



All exposed edges shall be rounded with a $\frac{3}{8}$ " radius with an edger.

Sidewalk sections shall be at least 4 feet in length. Break joints near end to meet this requirement.

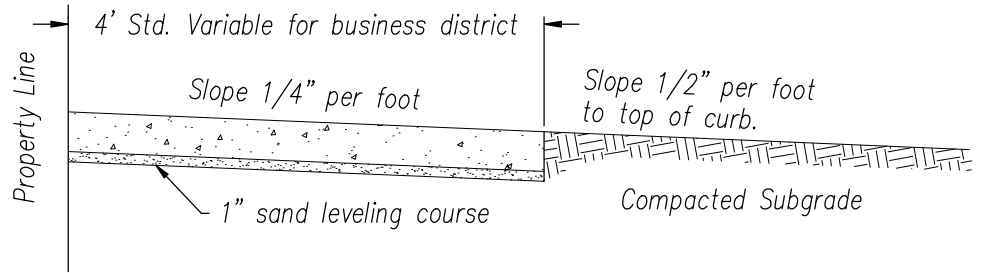


NOTES

- (1) Concrete for sidewalk shall be ODOT Class "C".

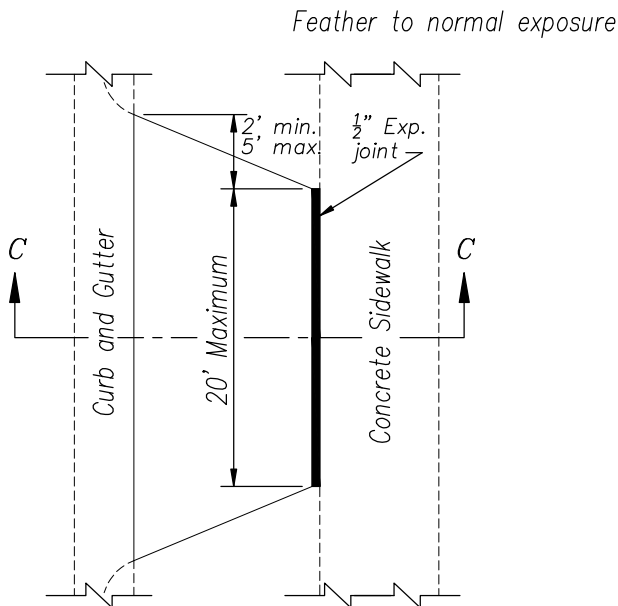
(2)

Flexible forms shall be used on all curves having radii of 275 feet or less.



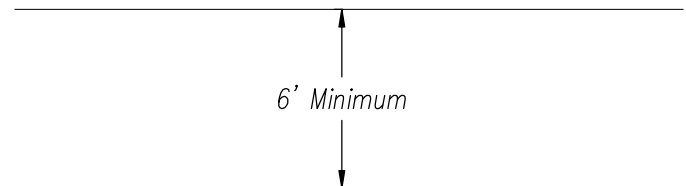
Sidewalks shall be continuous with no separation at driveways.

SECTION D-D



NOTE

Cutting or depressing curb is not necessary when Type "C" curb and gutter is used.

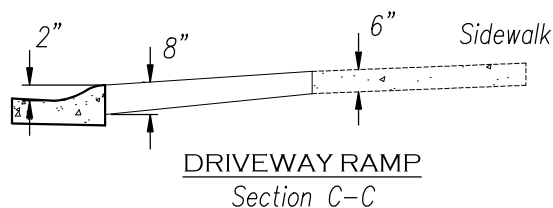


ASPHALT WALK

Hiker/Biker System Only

NOTES

- (1) Asphalt for hiker-biker system shall be ODOT Item 404, 4" thickness.
- (2) Typical cross slope. (See section D-D above.)



WARREN COUNTY ENGINEERS OFFICE DESIGN STANDARDS

TYPICAL SECTION - Sidewalk, Concrete & Asphalt

Filename: Plate 04_Typical Section Sidewalk.dwg

File location: L:\DESIGN\DWG's\Design Standards\2017

Date: Jan. 1986

Revised: 03/23/2017

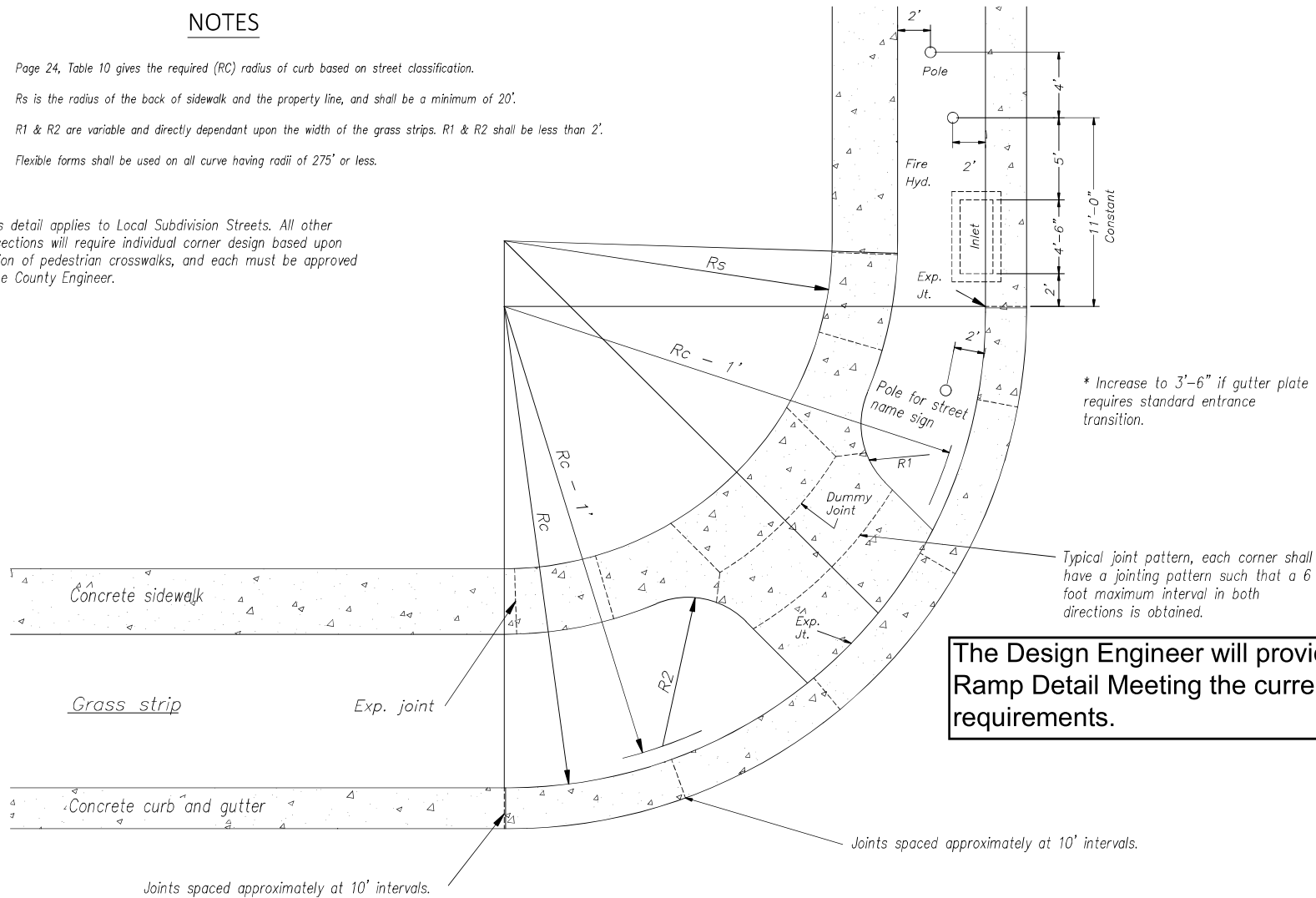
Approved by: x

Scale: As shown

NOTES

- (1) Page 24, Table 10 gives the required (RC) radius of curb based on street classification.
- (2) R_s is the radius of the back of sidewalk and the property line, and shall be a minimum of 20'.
- (3) R_1 & R_2 are variable and directly dependant upon the width of the grass strips. R_1 & R_2 shall be less than 2'.
- (4) Flexible forms shall be used on all curve having radii of 275' or less.

* This detail applies to Local Subdivision Streets. All other intersections will require individual corner design based upon location of pedestrian crosswalks, and each must be approved by the County Engineer.



The Design Engineer will provide a Ramp Detail Meeting the current ADA requirements.



Warren County Engineer's Office

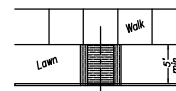
Neil F. Tunison, P.E., P.S.
Warren County Engineer
105 Markey Road
Lebanon, Ohio 45036
513 695 1364 Phone
513 695 2967 Fax

TYPICAL SECTION -
Street corner detail

WARREN COUNTY
ENGINEER'S OFFICE

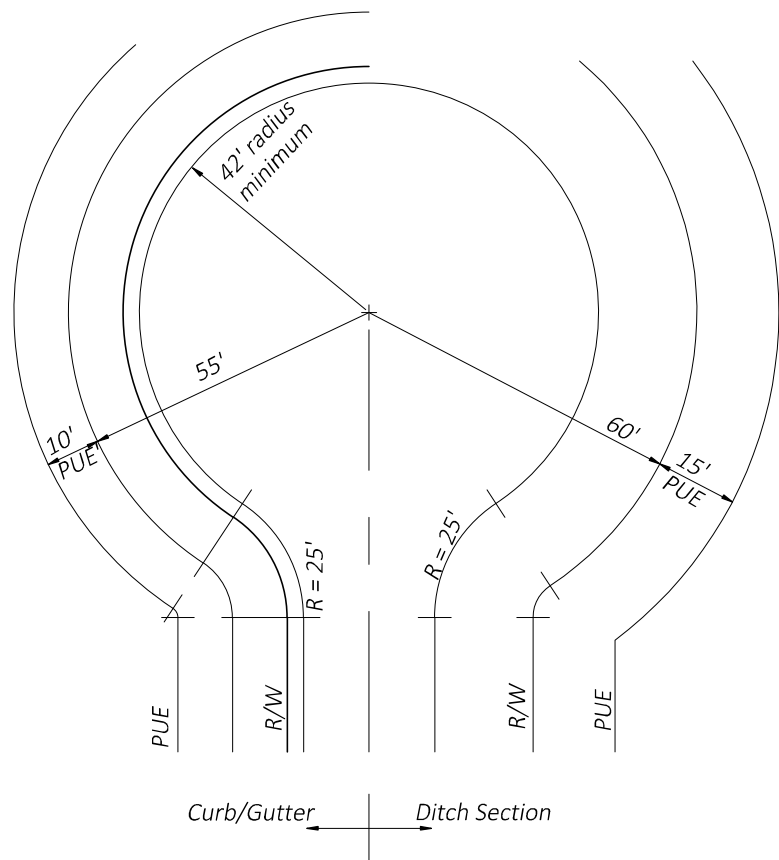
DESIGN STANDARDS

NO.	DATE	REVISIONS
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- The Design Engineer will provide a Ramp Detail Meeting the current ADA requirements.

		Warren County Engineer's Office	
Neil R. Tomlinson, P.E. Warren County Engineer 105 Markey Road Lebanon, Ohio 45036 513 695 1364 Phone 513 695 2967 Fax		Curb Ramps - Location and Notes	
PROJECTS		DESIGN STANDARDS	
REVISIONS		DRAWING NUMBER	
NO.	DATE	BY	DESCRIPTION
1	04/08/2018		
DATE: Jan. 1986 SCALE: 1/8" = 1'-0" DRAWN BY: JJP CHECKED BY: NRT FILE:		DRAWING LOCATION PROJECT NO.:	
STANDARD SPECIFICATIONS 2018		7 - 43	



Curb and Gutter

For Local Streets

Scale: 1" = 30'

Local street right-of-way width
curb and gutter locations
new developments: 50' R/W
Grandfathered Developments:
30' R/W
Ditch Sections: 60' R/W

Notes

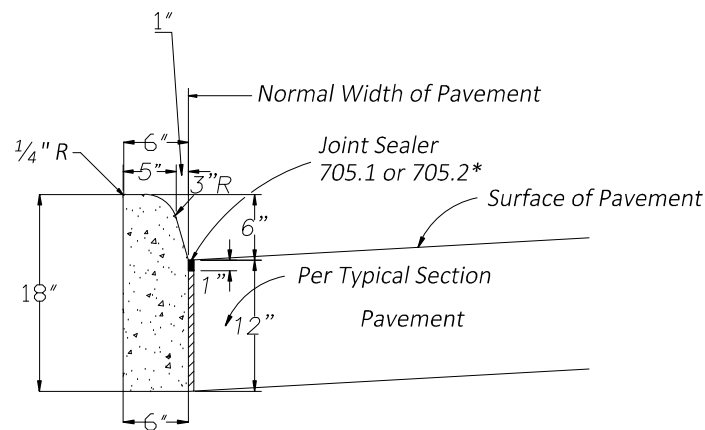
PUE: Public Utility Easement

Grandfathered developments may use the same 30' R/W plus 15' PUE widths plotted in prior sections of the same development

These details apply to those streets functionally classified as "Local streets" only

Concrete Curb Detail

Scale: 1/2" = 1'



* Expansion Joint material and joint sealer is not required when curb is adjacent to flexible type pavement.



Warren County Engineer's Office

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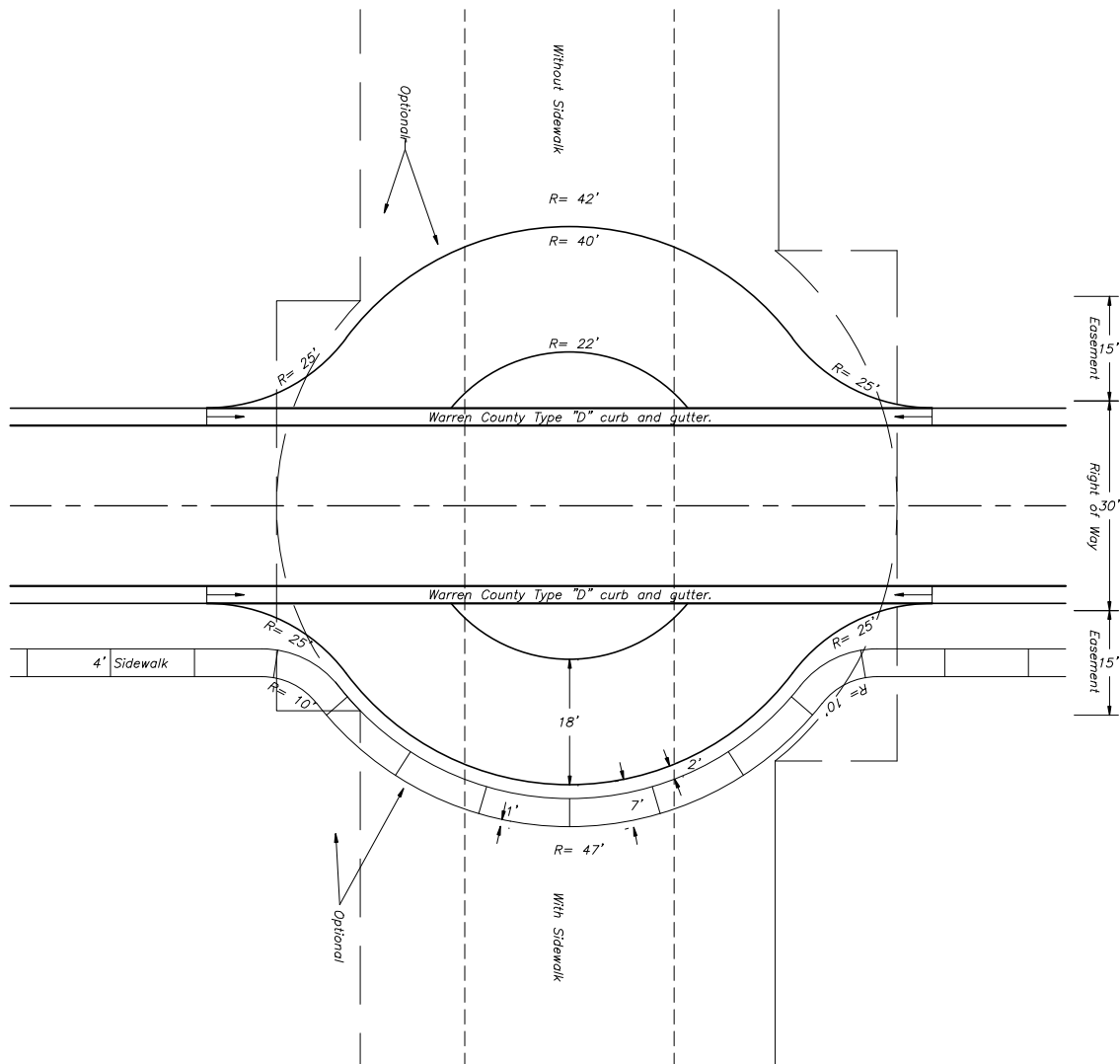
Cul de Sac Median Area-
Two Options

Plan: 08, Cul de Sac Median Area - Two Options.dwg

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

REVISIONS			
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See the latest approved Official Thoroughfare Plan, Warren County, Ohio for the current subdivision road R/W width requirements.



Warren County Engineer's Office
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 Warren County Engineer
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 Lebanon, Ohio 45036
 513 695 1364 Phone
 513 695 2967 Fax

Mid-Block Turnaround (Curb & Gutter Section)		Warren County Engineer's Office		DESIGN STANDARDS	

REVISIONS

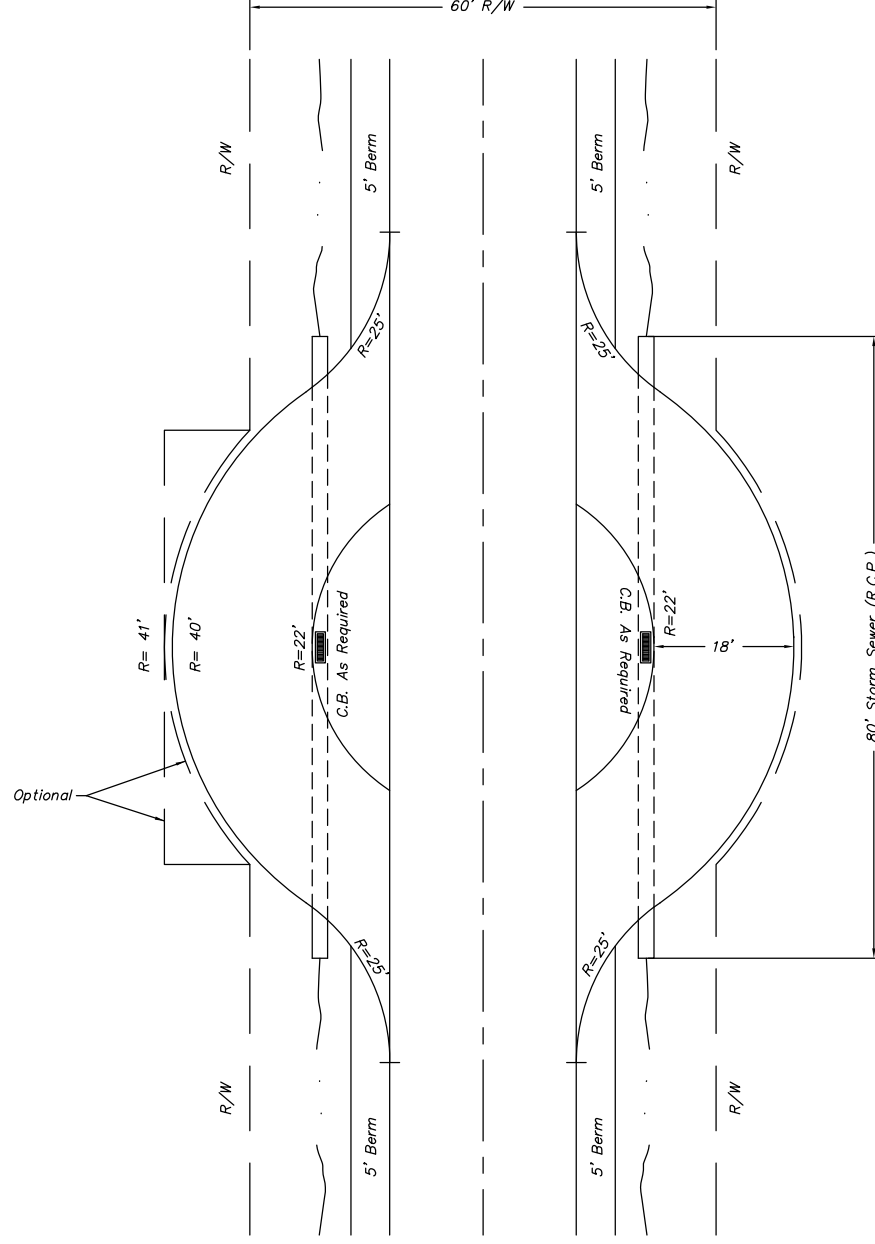
NO.	DATE	BY	REVISION
1	06/11/2017		

DATE 06/11/2017 **PROJECT** 10101 **BY** NFT **CHECKED** NFT

DESIGNED NFT **PROJECT** 10101 **BY** NFT **CHECKED** NFT

DESIGNED NFT **PROJECT** 10101 **BY** NFT **CHECKED** NFT

DESIGNED NFT **PROJECT** 10101 **BY** NFT **CHECKED** NFT



See the latest approved Official Thoroughfare Plan, Warren County, Ohio for the current subdivision road R/W width requirements.



Warren County Engineer's Office

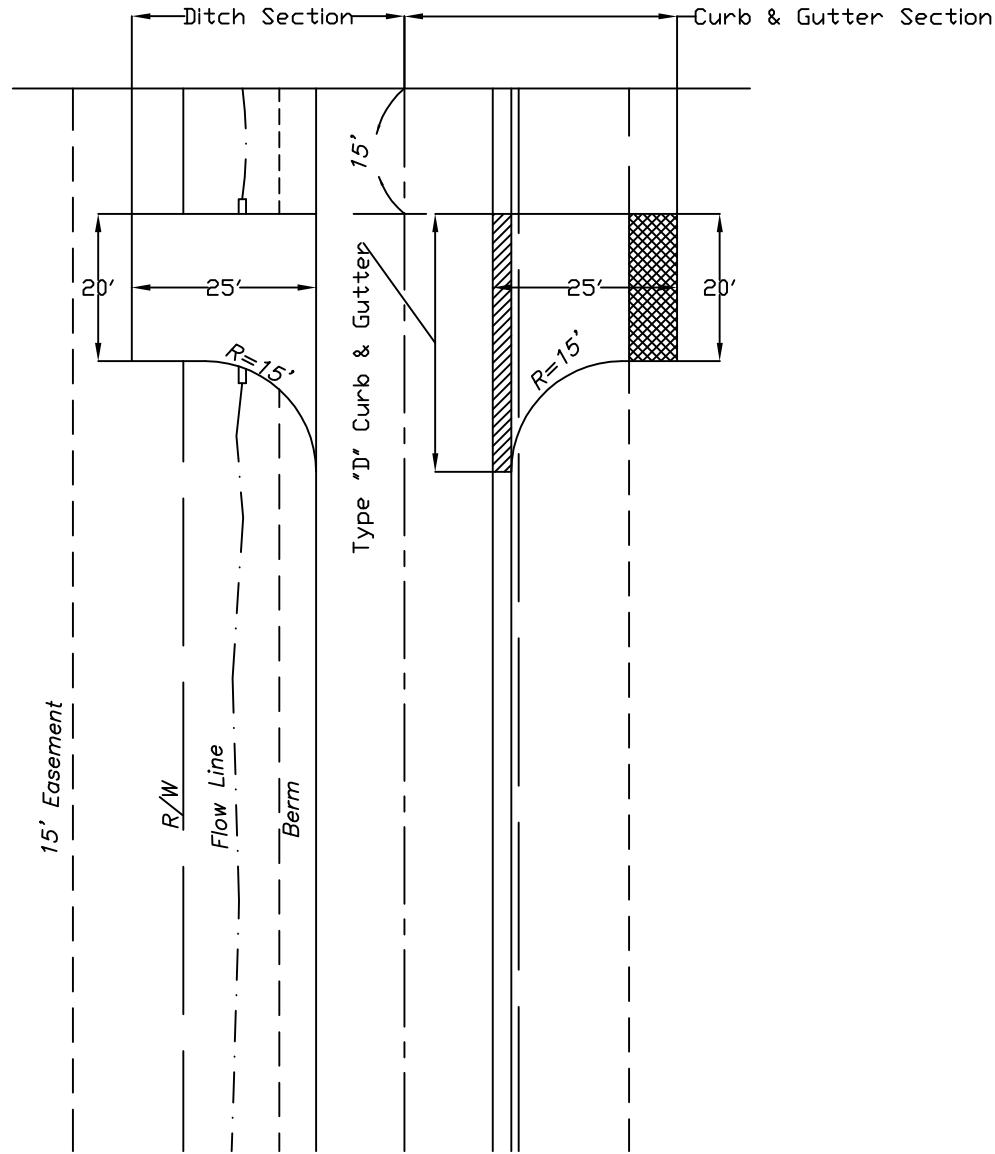
Nell R. Tunison, P.E., P.S.
 Warren County Engineer
 210 W. Main St.
 Lebanon, Ohio 45036
 513 695-3301 Phone
 513 695-7714 Fax

Project Name
 Mid-Block Turnaround (Ditch Section)
 Project No.
 18 Mid Block Turnaround (Ditch Section)

WARREN COUNTY ENGINEER'S OFFICE
 DESIGN STANDARDS

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 DRAWN BY: JRP
 CHECKED BY: JRP
 PROJECT NO.: 18
 SHEET: 10 of 42



Pavement Section for the Temporary Turnaround is equal to the Pavement Section for the roadway



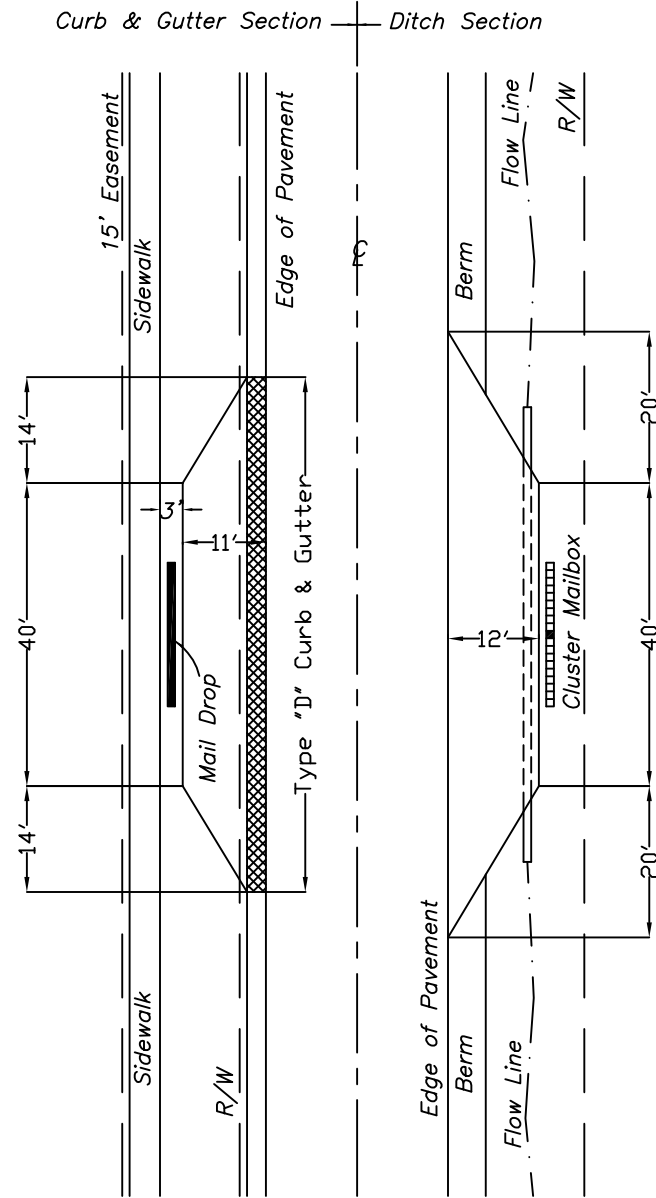
Warren County Engineer's Office

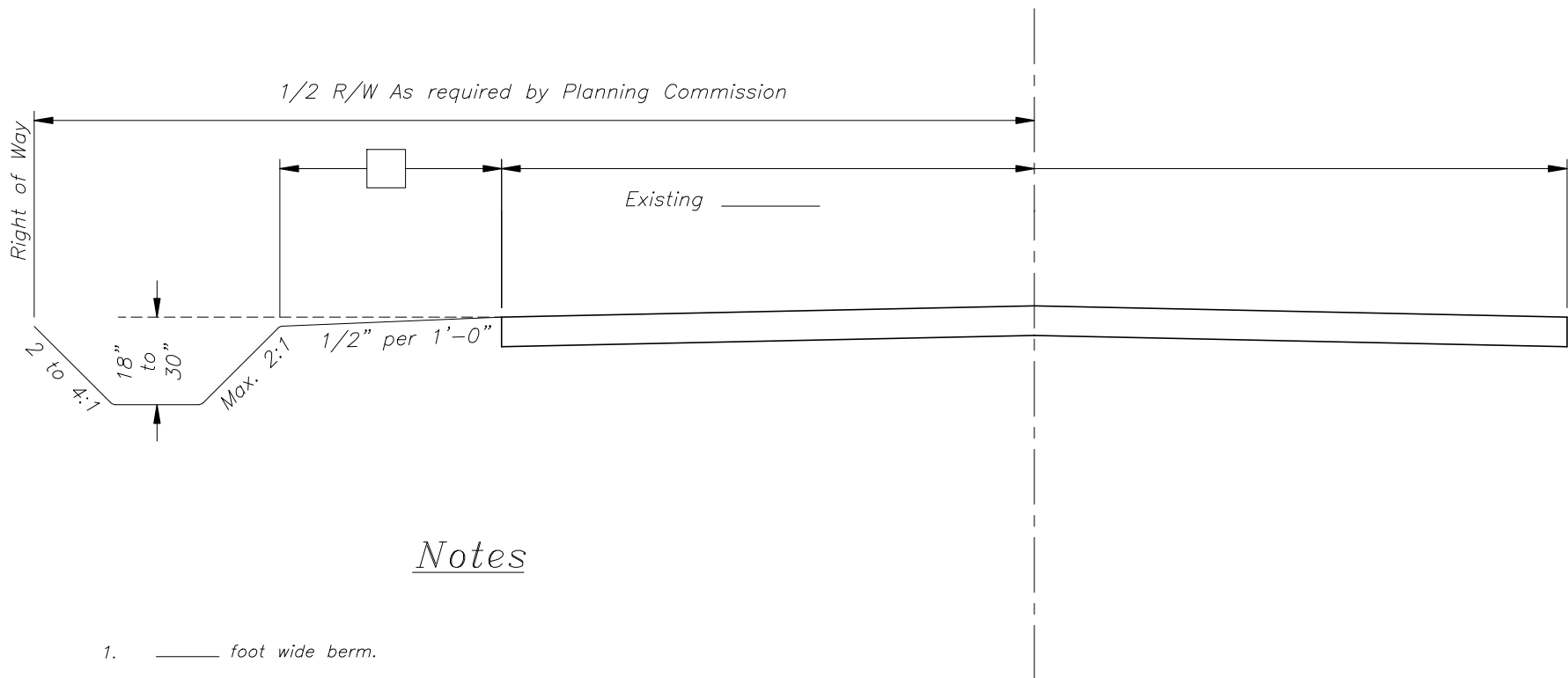
Neil F. Tunison, P.E.
Warren County Engineer
210 W. Main St.
Lebanon, Ohio 45036
513 695-3501 Phone
513 695-7714 Fax

Temporary Turnaround
Project: Temporary Turnaround

WARREN COUNTY ENGINEER'S OFFICE

REVISIONS			
NO.	DATE	BY	REVISIONS
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Notes

1. _____ foot wide berm.
2. Re-ditch for roadside drainage or install curb & gutter and storm sewer.
3. Curb & gutter requirements may be waived by Planning Commission on recommendation of the County Engineer.
4. Dedicate required Right of Way from the center of the existing roadway.



**Warren
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Frontage Subdivision
Road Improvement

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

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NO.	DATE	BY	DESCRIPTION
	04/11/2017		

DATE	JAN. 1986
SCALE	1/4" = 1'-0"
DRAWN BY	JGP
CHECKED BY	WJT
PROJECT NO.	FILE

DESIGNED BY	
CHECKED BY	
DATE	1/8 OF 42

1. KSCDM (Design Standards) 2018



STANDARD GRATE as shown in the plan view shall be provided unless the plans specifically require grate L. Place grate so the diagonal bars direct drainage flow towards the curb. All bar edges to be rounded to $\frac{3}{8}$ " radius.

CASTINGS shall meet the requirements of 604. The design shall be essentially the same and equally as strong as those shown hereon.

Minimum weights are:
Curb casting 305 pounds
Two gutter grates 254 pounds
Gutter frame 590 pounds

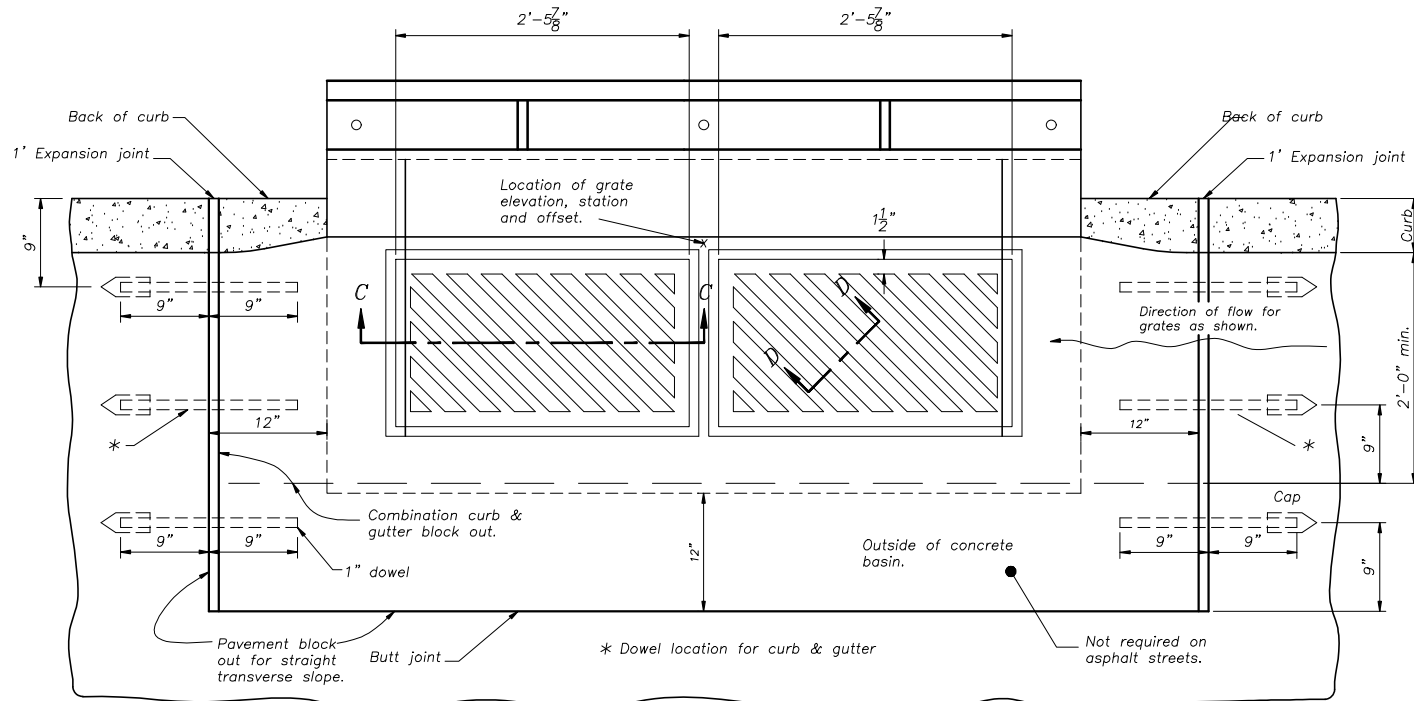
BEARING AREAS of frame and grate shall be so fitted and finished as to provide a firm and even seat for all portions of the grate in the frame, without rocking.

DOWELS: Four 1"x18" dowels are required for concrete pavement or gutter blockout. See BP-4 for dowel details.

BRICK OR CONCRETE BLOCK side walls, when used in place of concrete, shall be 8 inches nominal thickness.

BLOCKOUT shall be paved with Class C concrete in PCC pavement or gutter and paid for as part of the pavement or gutter with no deduction on pavement, curb or gutter quantities because of castings. A Class C concrete apron the size of the 2' gutter blockout shall be cast in place in asphalt pavement (no dowels required) with the cast included in the catch basin bid price. No deduction to be made in curb quantities.

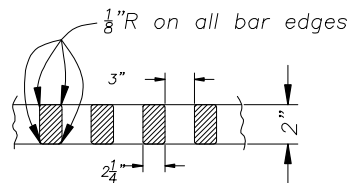
PRECAST construction is permitted except for the apron, and concrete shall meet the requirements of 706.13 with 6% plus or minus 2% entrained air. Steel reinforcing shall be sufficient to permit shipping and placement without damage.



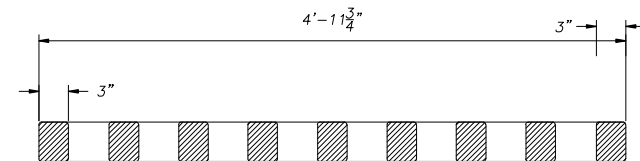
PLAN OF CATCH BASIN AND PAVEMENT JOINTS

NOTE: Number of letter designations, refer to O.D.O.T.

Scale: As shown



SECTION D-D



Grate size: $2'-5\frac{7}{8}" \times 1'-4\frac{3}{4}" \times 2"$
(2 required)

SECTION C-C



Warren County Engineer's Office

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210 W. Main St.
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513 695-3301 Phone
513 695-7714 Fax

Catch Basin Type 1A		Project Name Pavement - Type 1A
WARREN COUNTY ENGINEER'S OFFICE		DESIGN STANDARDS

REVISIONS	DATE	BY	DESCRIPTION
1	04/17/2017	NEF	REVISED
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**Notes for
Type 2 Catch Basin**

Basins to be constructed of 0001 Class "C" concrete only.

Bottom of basin to have 6" minimum thickness and shall extend beneath sidewalks. Provide keyed construction joint beneath sidewalks.

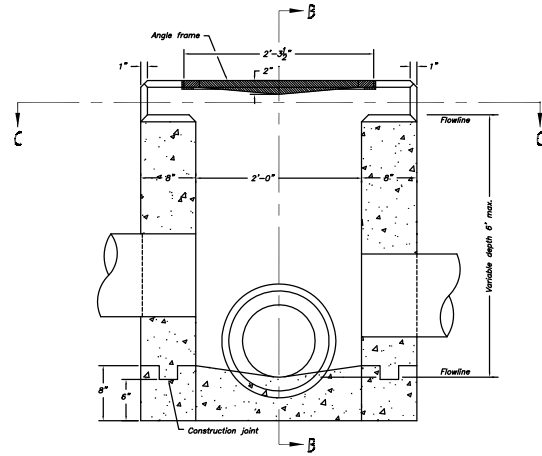
Side inlets shall be provided on both sides of the Type 2 Basin in top and on upstream side only where the ditch has a continuous down grade past the catch basin. Side inlets to be placed 4 to 6 inches below normal elevations of ditch flow line, returning to normal 10ft. each side of the basin.

Type 3 grate elevation to be 4 to 6 inches below normal ditch elevation, returning to normal 10 ft. each side of catch basin.

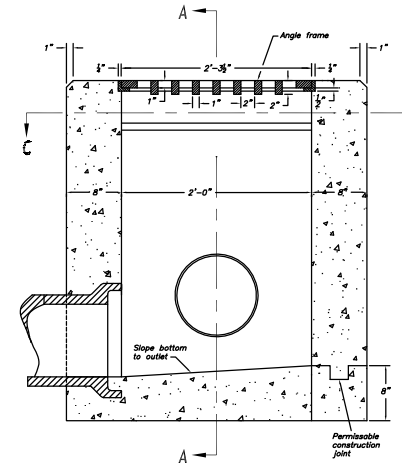
A precast concrete basin of this type may be used when approved by the engineer.

See this sheet for details of grates and frames.

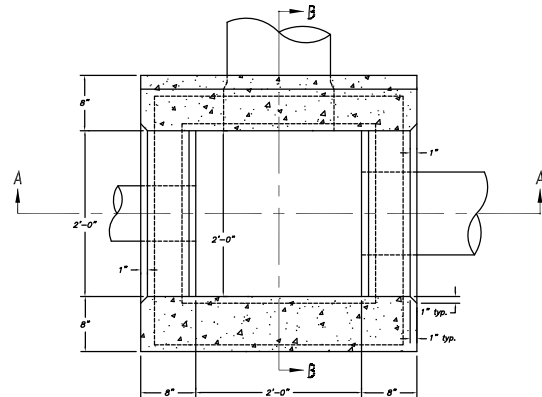
Maximum distance between catch basins shall not exceed 400 feet.



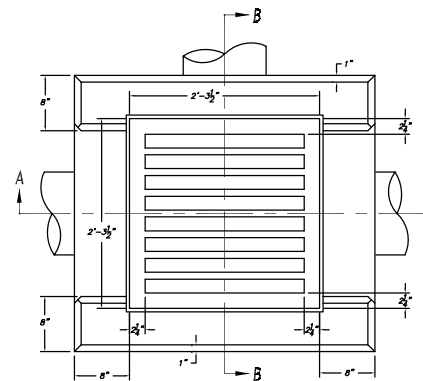
Section A-A



Section B-B



Section C-C



Plan View



**Warren
County
Engineer's
Office**

Nell R. Tunison, P.E., P.S.
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210 W. Main St.
Lebanon, Ohio 45036
513 695-3301 Phone
513 695-7714 Fax

Catch Basin
Type 2
Project Name
Plan 18 Catch Basin - Type 2-14-19

WARREN COUNTY
ENGINEER'S OFFICE
DESIGN STANDARDS

REVISIONS			
NO.	DATE	BY	DESCRIPTION
15	05/02/2017		
16			
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DATE: As shown
DRAWN BY: JEP
CHECKED BY: JEP
PROJECT NO.:
SHEET 20 of 42

Basins to be constructed of
ODOT Class "C" concrete only.

Bottom of basin to have 6" minimum thickness and shall extend beneath sidewalls. Provide keyed construction joint beneath sidewalls.

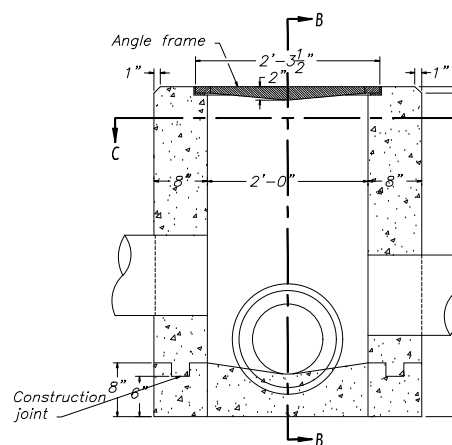
Side inlets shall be provided on both sides of the Type 2 Basin in sags and on upstream side only where the ditch has a continuous down grade past the catch basin. Side inlets to be placed 4 to 6 inches below normal elevations of ditch flow line, returning to normal 10ft. each side of the basin.

Type 3 grate elevation to be 4 to 6 inches below normal ditch elevation, returning to normal 10 ft. each side of catch basin.

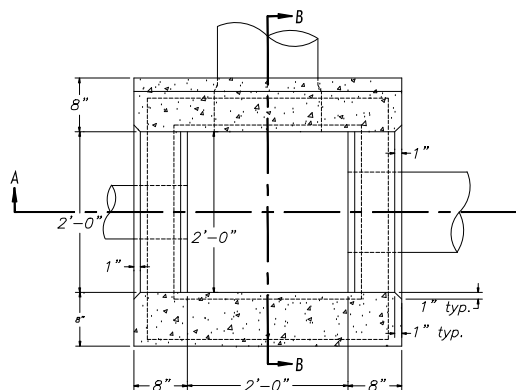
A precast concrete basin of this type may be used when approved by the engineer.

See this sheet for details of
grates and frames.

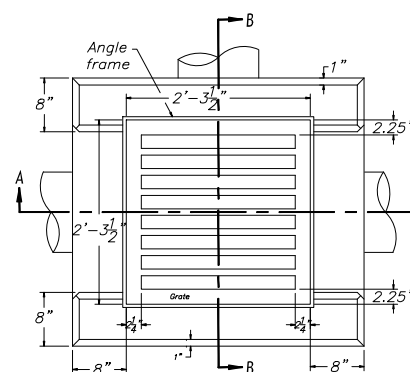
Maximum distance between catch basins shall not exceed 400 feet.



Section B-B



Section C-C



Plan View



**Warren
County
Engineer's
Office**

Neil F. Tunison, P.E., P.S.
Warren County Engineer
210 W. Main St.
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513 695-3301 Phone
513 695-7714 Fax

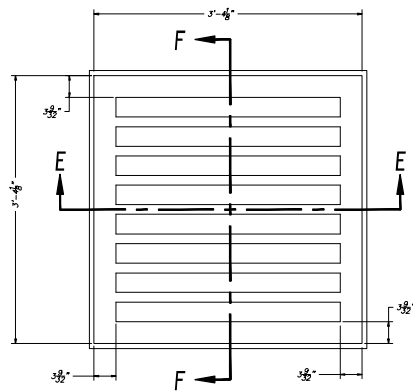
Catch Basin
Type 3

Plate 20 Catch basin - Two Joints

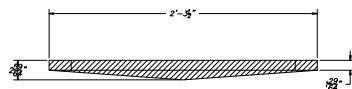
WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

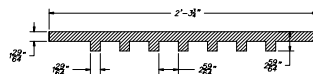
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Plan View

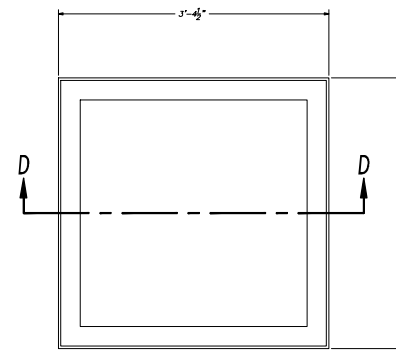


Section E-E

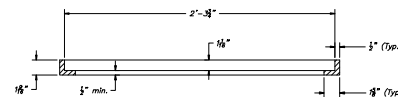


Section F-F

Grate



Plan View



Section D-D

Angle
Frame

Notes

1. Grate and frame shall meet the requirements of ODOT Specifications, Section 711.12, Gray Iron Castings, or approved equal.
Weight of Grate: 120# min.
Weight of Frame: 40# min.
2. All grate edges shall be routed to $\frac{1}{4}$ " radius.
3. Grate and Frame shall be bituminous coated.



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Grate & Angle Frame for
Catch Basins - Type 2 & 3

Sheet 22_Grte & Angle Frame.dwg
Project Name
Drawing Number

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

REVISIONS

NO.	DATE	BY	APP.	DESCRIPTION
1	02/02/2017			
2				
3				
4				
5				

DATE: 02/02/2017

DESIGNED BY: N.F.T.

PROJECT NO.

PROJECT LOCATION

PROJECT STANDARD: 2017

SHEET 20 OF 30



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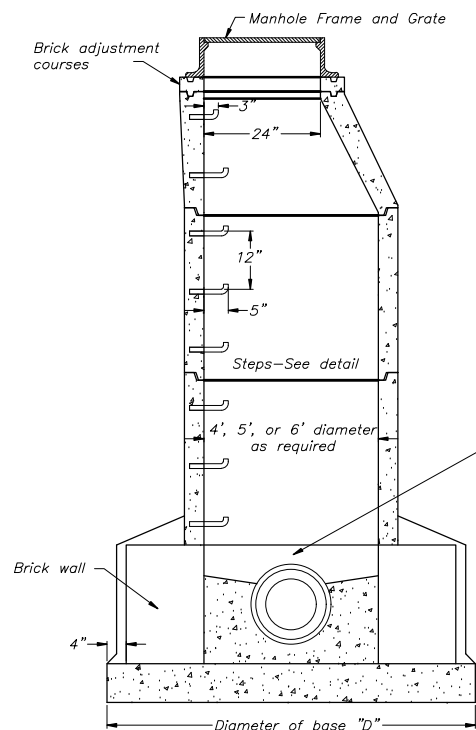
Precast Concrete Manhole

Sheet 22, Precast concrete manhole

**WARREN COUNTY
ENGINEER'S OFFICE**

DESIGN STANDARDS

REVISIONS				DATE		BY	
NO.	DESCRIPTION	DATE	BY	DATE	BY	DATE	BY
1	15/02/2017						
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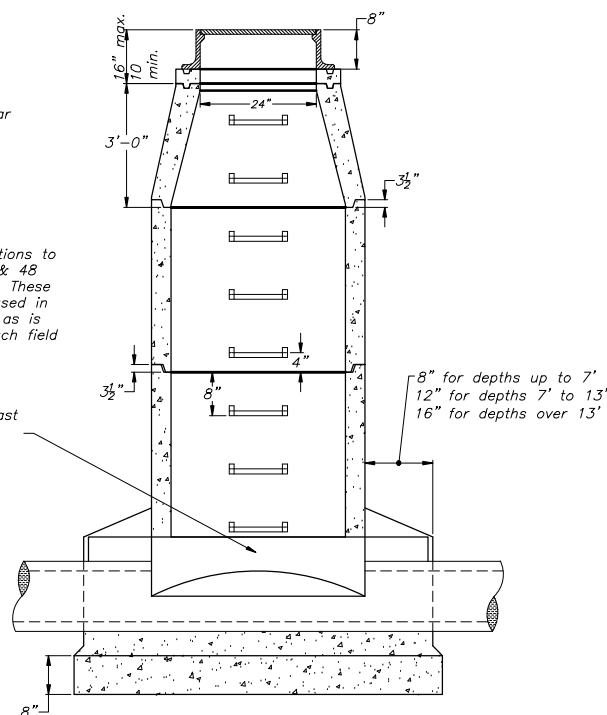
Section C-C

Precast manhole sections shall meet the requirements of ASTM Spec. C-478-63T

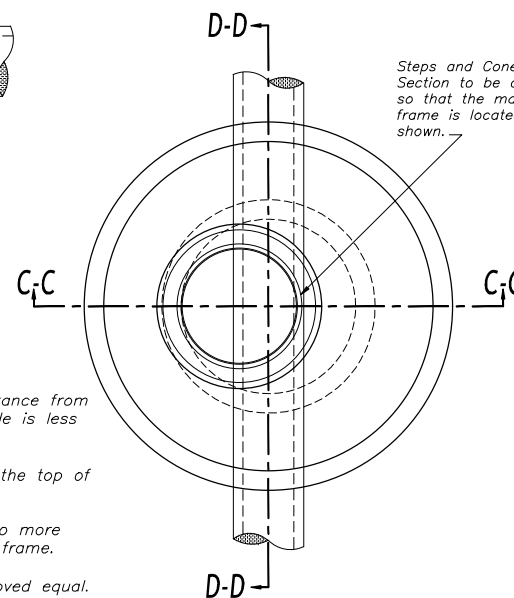
Joints to be completely filled with cement mortar before setting pipe.

Manhole barrel sections to be in 12, 24, 36 & 48 inch laying lengths. These sections shall be used in such combinations as is necessary to fit each field condition.

Brick wall to at least one course above highest pipe in manhole.



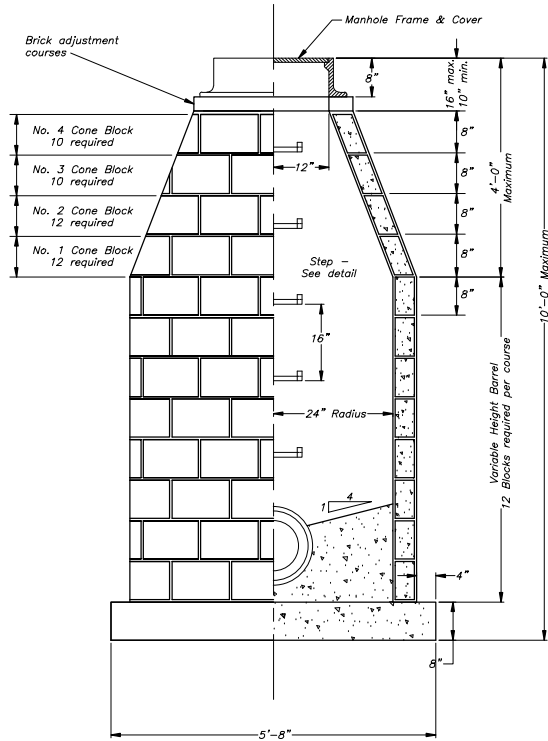
Section D-D



Plan View

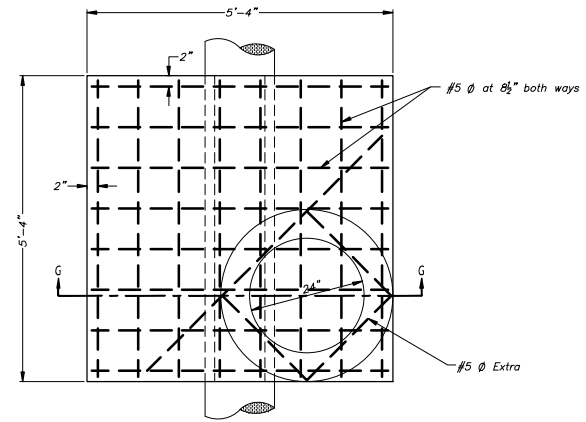
1. Manhole bases to be constructed of Class "C" Concrete and shall extend at least 4" beyond walls. Base to be relocated if manhole depth exceeds 14'. (Class "C" refers to ODOT specs.)
2. Manhole inverts to be constructed of ODOT Class "C" Concrete.
3. Steps to be placed over outlet pipe.
4. Manhole frame to be set in bed of mortar.
5. All masonry construction of manholes to be smoothly skim coated on interior.
6. Slab top manhole to be used when the distance from the top of the highest pipe to finished grade is less than 4'-0".
7. The depth of a manhole is measured from the top of the casting to the flow line of the sewer.
8. Manhole shall be constructed to allow for no more than 3 brick adjustment courses under the frame.
9. Castings shall be 8" depth (round) or approved equal.
10. Slab top for manholes to be precast, Class "C" Concrete only.

Manhole blocks to be the type manufactured by Price Brothers Company or approved equal.

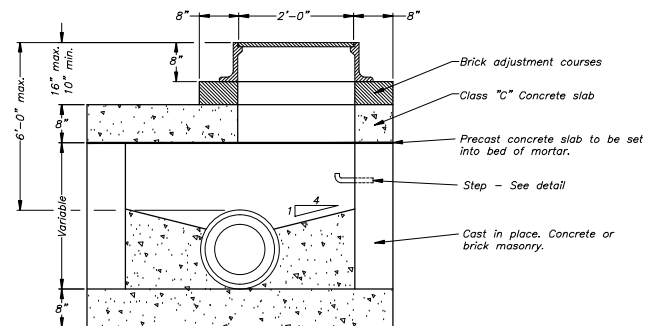


General Notes

1. Only whole barrel blocks and cone blocks shall be used.
2. Chinks around pipe inlets shall be filled with 2"x4"x8" concrete block.
3. Concrete Block Manhole construction is permitted only for 4' diameter storm sewer manholes, 10' or less in depth.



Plan



Section G-G



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Concrete Block & Square Manholes

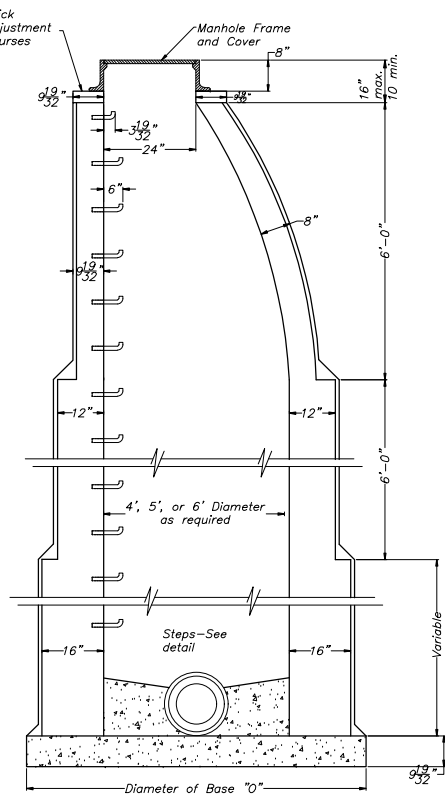
Warren County Engineer
Neil F. Tunison, P.E., P.S.

**WARREN COUNTY
ENGINEER'S OFFICE**

DESIGN STANDARDS

REVISIONS	DATE	BY	REASON
1	05/13/2017	NEF	Initial Design
2			
3			
4			
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TOTAL	10	100%
DESIGNED BY	NEF	
CHECKED BY	WGP	
PROJECT NO.		
DATE	05/13/2017	
BY	NEF	
REVISIONS		
1	05/13/2017	Initial Design
2		
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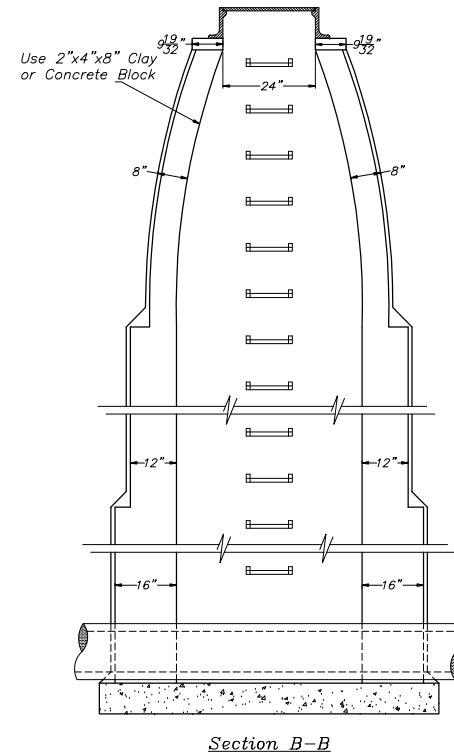
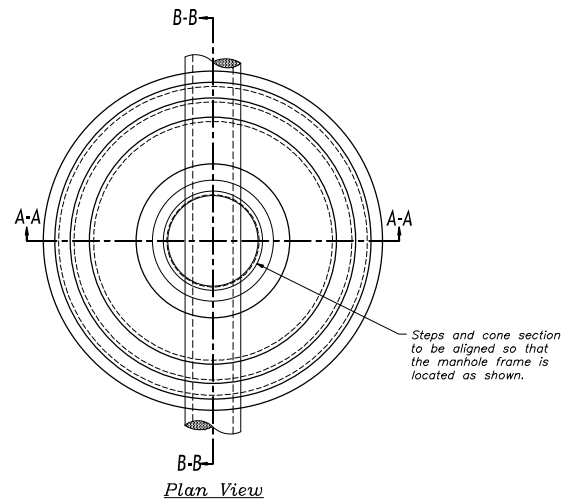


NOTE: Brick manholes to be used only on storm sewers.

Section A-A

General Notes

1. Manhole bases to be constructed of Class "C" Concrete and shall extend at least 4" beyond walls. Base to be reinforced if manhole depth exceeds 14' (Class "C" Concrete refers to ODOT Specs.)
2. Manhole inverts to be constructed of ODOT Class "C" Concrete.
3. Steps to be placed over outlet pipe.
4. Manhole frame to be set in a bed of mortar.
5. All necessary construction of manholes to be smoothly skim-coated on interior.
6. Slab top manhole to be used when the distance from the top of the highest to finished grade is 4'-0"
7. The depth of a manhole is measured from the top of the casting to the flow line of the sewer.
8. Manhole shall be constructed to allow for no more than 3 brick adjustment courses under the frame.
9. Castings shall be 8" depth (round) or approved equal.
10. Slab tops for manholes to be precast, Class "C" Concrete only.



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Brick Manhole

WARREN COUNTY
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DESIGN STANDARDS

REVISIONS			
NO.	DATE	BY	REVISION
1	05/02/2017		
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DATE	10/01/2016	DESIGNED BY	JPT	FILED	
DRAWN BY	JPT	CHECKED BY		DATE	
PROJECT NO.		SCALE			
DRAWING NO.					
BY	24	OF	30		



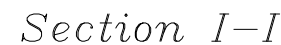
1. Round frame and cover shall be of the best quality grey cast iron and shall be free of pits and other imperfections.

Weights: *Cover* 150–160
 Frame 210–220

2. Frame and cover shall be bituminous coated.
3. Usage lettering shall be $4\frac{3}{8}$ " \pm in height, having a line thickness of $\frac{3}{8}$ " \pm in width and having a line depth of $\frac{1}{8}$ ". Lettering shall read "STORM" for storm sewers.



Round Frame



Round Cover



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Manhole - Frame and Cover

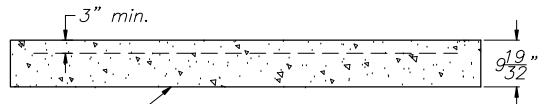
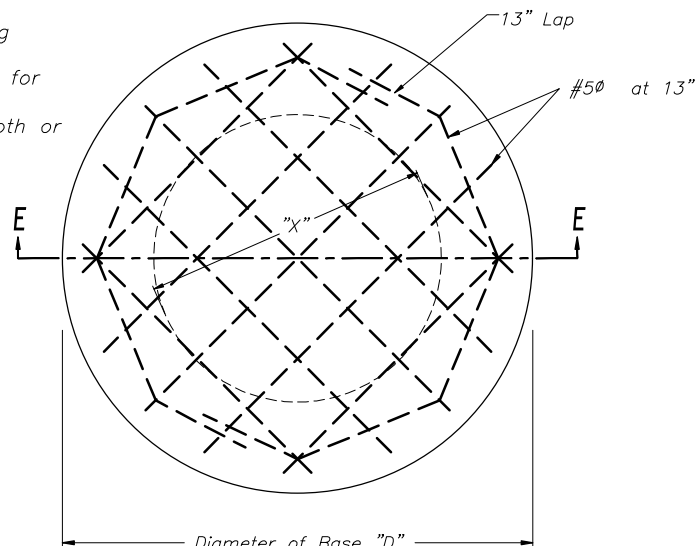
Study Name:

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

[illegible]

NOTE: Reinforcing steel used only for manhole 14' in depth or over.



Section F-F

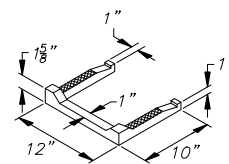
NOTE: If a number of pipes enter a manhole, the manhole diameter shall be increased above the minimum tabular value so that proper clearance is obtained.

MANHOLE BASE DIAMETER "D"			
Dia. of M.H.	8" Walls	12" Walls	16" Walls
4'	72" Dia.	80" Dia.	96" Dia.
5'	84" Dia.	82" Dia.	100" Dia.
6'	96" Dia.	104" Dia.	112" Dia.

MANHOLE DIAMETER "X"	
Pipe size	Manhole Dia.
8"-24"	4'
27"-42"	5'
48"-54"	6'

MANHOLE BASE

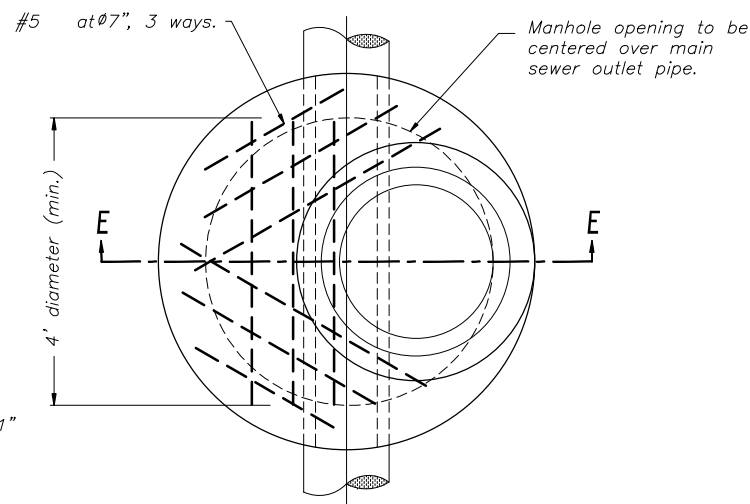
Scale: $\frac{1}{4}" = 1'-0"$



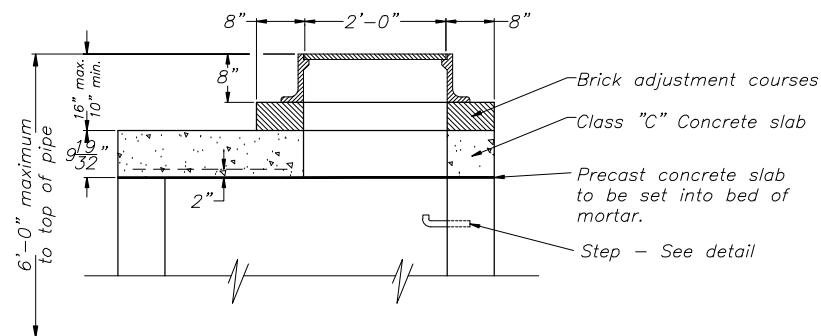
NOTE: Manhole step shall be Neenah R-1981-J or approved equal.

MANHOLE STEP

No scale



Plan



Section E-E

Slab top for Round Manhole

Scale: $\frac{1}{4}" = 1'-0"$



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Manhole - Step, Base, Slab

Project 72 Manhole, Step, Base, Slab, Aug

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

Revisions

NO.	DATE	BY	REVISIONS
1	09/12/2017	WFT	As shown
2			
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DATE: As shown

DESIGNED BY: WFT

CHECKED BY: WFT

PROJECT NO.: 72

REVISIONS: 1

DATE: 09/12/2017

BY: WFT

CHECKED BY: WFT

PROJECT NO.: 72

REVISIONS: 1

DATE: 09/12/2017

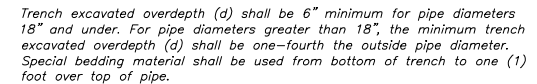
BY: WFT

Concrete Pipe - Minimum Size 12"

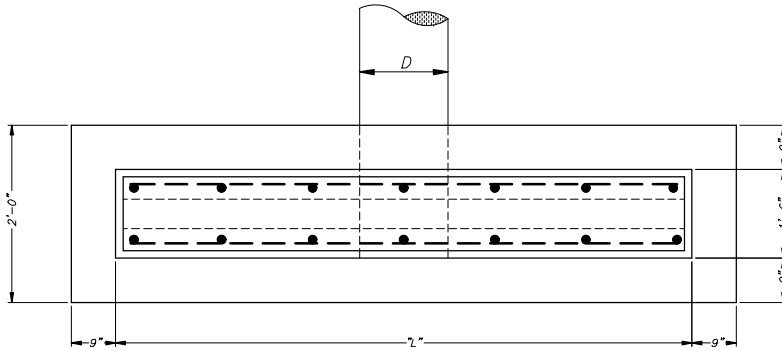
Bituminous plastic cement, which meets the requirements of ODOT Spec. 706.10 and which is applied in conformance with the requirements of ODOT Spec. 603.06 shall be accepted as a jointing material equal to the above mentioned joint.

NOTES

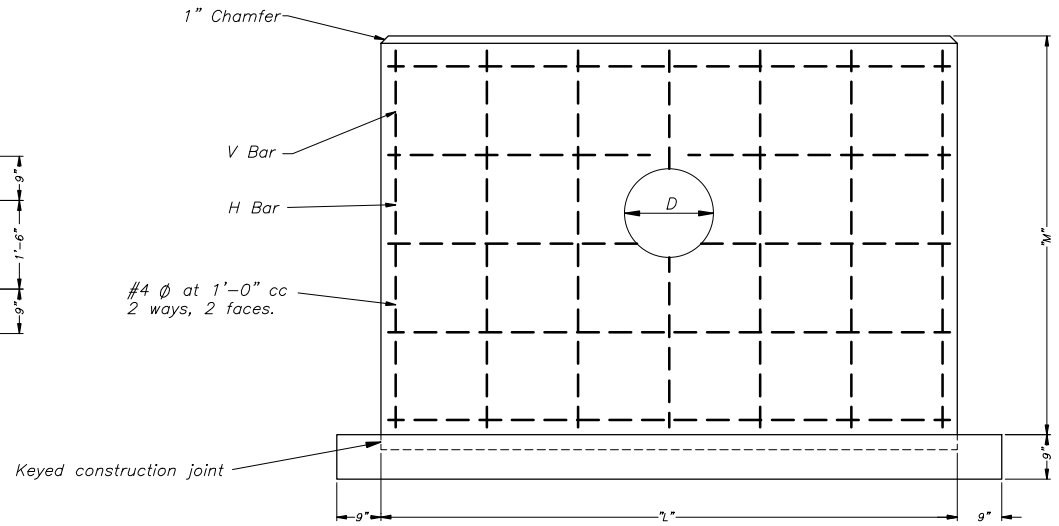
For depths greater than those shown in table, concrete cradles or concrete encasement shall be used.



Dia. of Pipe	Maximum width of trench at top of pipe	MAXIMUM DEPTH - BOTTOM OF PIPE IN FEET						
		Standard Strength C-14-57	Extra Strength C-14-57	Reinforced Concrete Pipe C-76-57				
				Class 1	Class 2	Class 3	Class 4	Class 5
12	O.D. + 16"	12	26		8.3	12.2	30.5	No Limit
15	" "	12	26		9.9	14.9	35.0	" "
18	" "	12	29		11.0	16.5	38.3	" "
21	" "	12			11.8	17.4	39.4	" "
24	" "	12			12.5	18.3	39.3	" "
30	" "				13.9	19.4	38.4	" "
36	O.D. + 24"				13.1	17.1	27.0	64.4
42	" "				13.9	18.3	28.8	61.7
48	" "				14.9	19.3	30.0	60.2
54	" "				15.8	20.2	30.7	58.0
60	O.D. + 24"			14.0	16.6	21.2	31.5	57.2
66	" "			14.7	17.2	21.8	31.9	56.4
72	" "			15.6	17.9	22.6	32.8	56.7
78	" "			16.1	18.6	23.5	33.5	
84	" "			16.7	19.3	24.1	33.9	

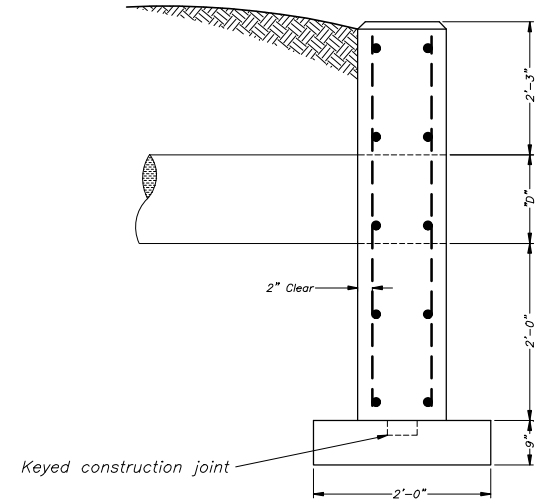


PLAN



ELEVATION

"D" Dia. of Pipe	MATERIAL REQUIRED FOR ONE HEADWALL									
	"L"	"M"	H BAR			V BAR			TOTALS	
			No.	Length	Weight/lbs.	No.	Length	Weight/lbs.	Rebar/lbs.	Conc. cu./yds.
12"	5'-0"	4'-0"	10	4'-6"	30	12	4'-3"	34	64	1.06
18"	5'-9"	5'-0"	12	5'-3"	42	12	4'-6"	36	78	1.25
21"	6'-9"	5'-3"	12	6'-3"	50	14	4'-9"	44	94	1.51
24"	7'-6"	5'-6"	12	7'-0"	56	16	5'-0"	53	109	1.73
27"	8'-6"	5'-9"	12	8'-0"	64	18	5'-3"	63	127	2.02
30"	9'-3"	6'-0"	14	8'-9"	82	20	5'-6"	73	155	2.25
36"	11'-0"	6'-6"	14	10'-6"	98	24	6'-0"	96	194	2.83



SIDE



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Headwall - Reinforced Concrete

Reinforcing Steel - Reinforced Concrete

WARREN COUNTY
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DESIGN STANDARDS

PROJECT

REVISIONS

BY

DATE

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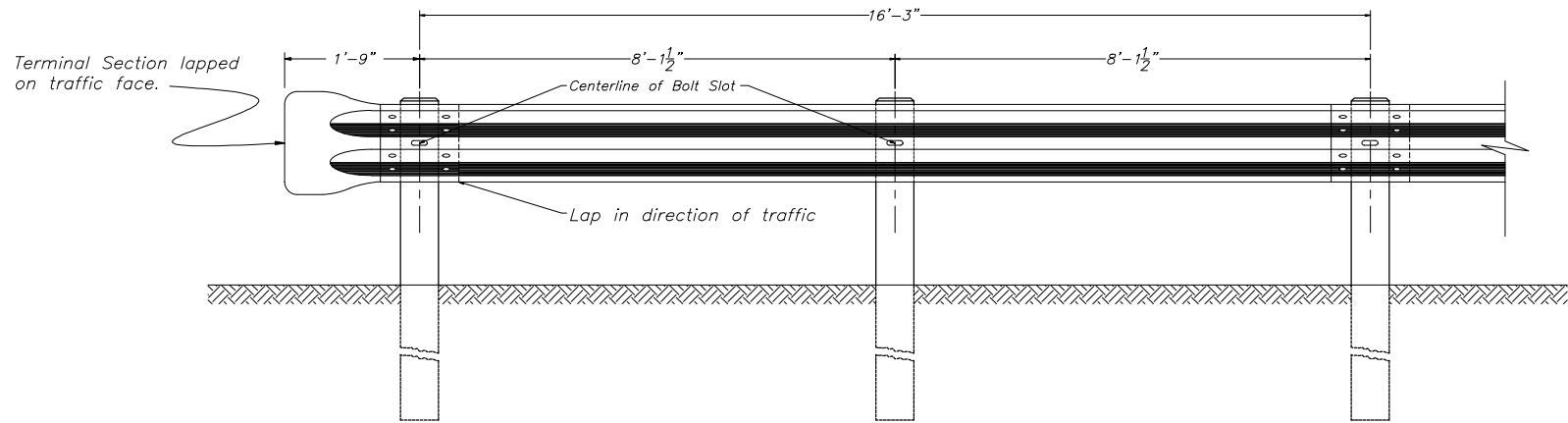
Neil F. Tunison, P.E., P.S.
Warren County Engineer
210 W. Main St.
Lebanon, Ohio 45036
513 695-1301 Phone
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Standard Guardrail

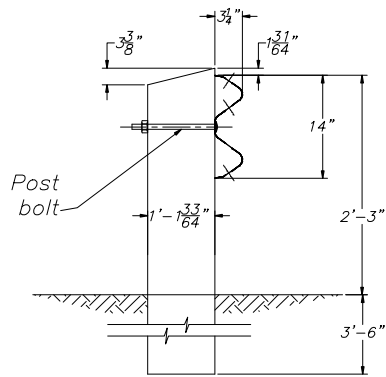
Project Name
Post: St. Standard Guardrail

WARREN COUNTY
ENGINEER'S OFFICE
DESIGN STANDARDS

REVISIONS		DATE	BY	REASON
1		05/19/2017		
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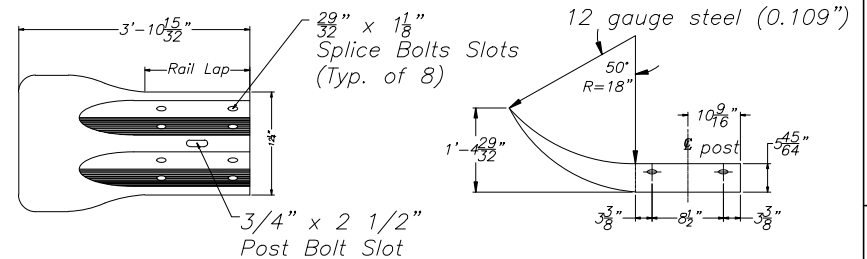


ELEVATION



General Notes

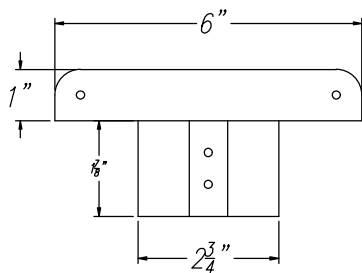
1. Post shall be 6" x 8" x 5'-9" long, meeting the requirements of Section 710.12 of ODOT Specs. Posts shall be entirely pressure treated with Pentachlorophenol in accordance with the requirements of Section 710.14 of the ODOT Specs.
2. Rail shall be galvanized steel beam, deep type, not less than 12 gage in thickness and meet the requirements of Section 606.01, Type 4, 710.06 of the ODOT Specs.
3. Construction methods shall conform to the applicable portions of itme 606 ODOT Specs.
4. All holes in posts, all cuts and all abrasions shall be Pentachlorophenol pressure treated as specified in Section 606.03 ODOT Specs.
5. Splice bolts shall be 5/8" ϕ , splice holes shall be slotted 29"x 1 1/8" post blot slots shall be 3/4" x 1 1/2", Post bolts shall be 5/8" ϕ , x 10 1/2" long.



ELEVATION

PLAN

Technical drawing of a mechanical part. The part is a long, thin rectangular block with a central circular hole. The overall length is 6". The width is 3/4". The hole has a diameter of 2 7/16". The distance from the left edge to the center of the hole is 2 3/4". The distance from the right edge to the center of the hole is 2 3/4". The part is shown in a perspective view with a top view and a side view. The top view shows the rectangular shape and the circular hole. The side view shows the thickness of the part, which is 3/4".



Technical drawing of a mechanical assembly, showing a side view and a top view.

Side View (Top): Shows a vertical shaft passing through a horizontal plate. The plate has a central slot. The shaft has a central hole. The plate is secured by two black rectangular components (possibly bolts or washers) on the shaft.

Top View (Bottom): Shows the rectangular plate with rounded ends. The plate has a central slot and two circular holes (one on each side of the slot). Dimensions are indicated:

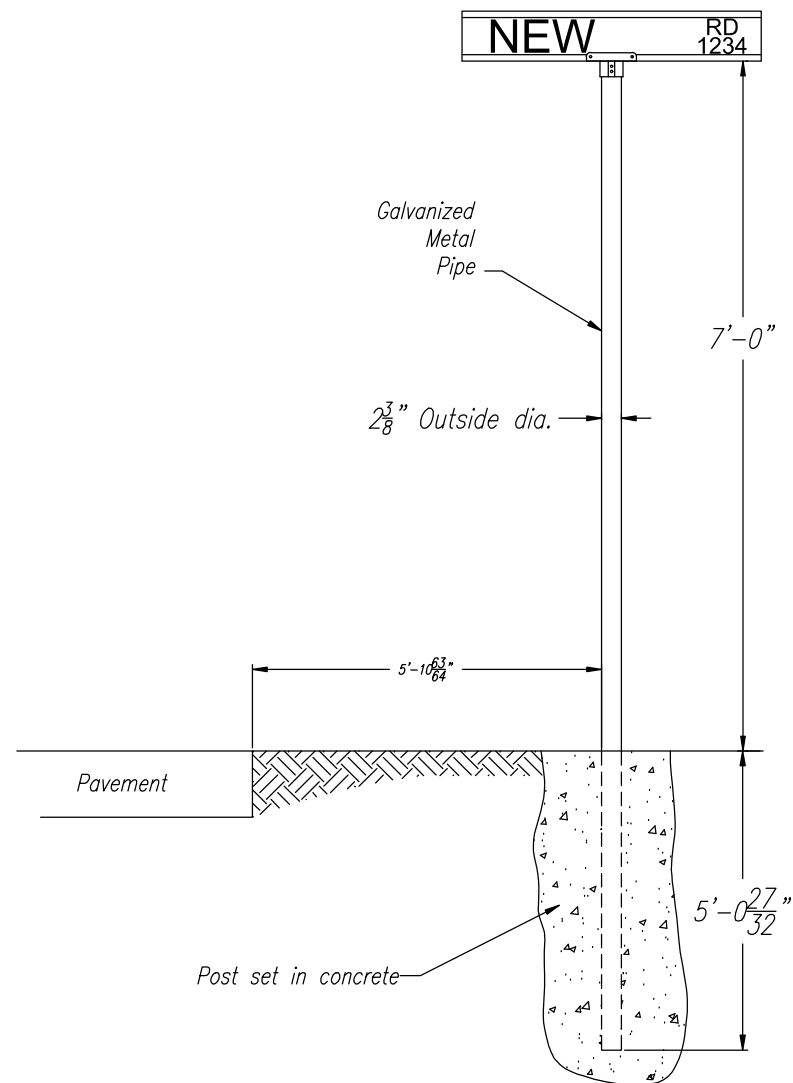
- Overall length of the plate: $6''$
- Width of the plate: $1\frac{7}{8}''$
- Width of the central slot: $\frac{3}{4}''$
- Depth of the central slot: $\frac{1}{4}''$

No Scale



2', 2½', or 3'
Plate: Green Reflector
Lettering: Silver Reflector

No Scale

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SIGNS - Name & Post

Plate II Signs - Name and Posting

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

[illegible]

Posts

Height of Signs

A diagram of a standard octagonal stop sign. The sign is white with a thick black border and the word "STOP" in large, bold, black capital letters in the center. To the right of the sign, there are two vertical dimension lines. The outer one indicates a total height of 30 inches, with a note "30" x 30" to its right. The inner one indicates a height of 10 inches for the central text area.



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Stop Sign & Height Requirement

Plate 34_Stop sign and height requirement.dwg

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DESIGN STANDARDS

[illegible]



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Typical Location - Stop Sign

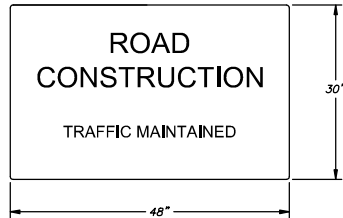
Reading Room
Plate 36. Typical location - Stop sign

WARREN COUNTY
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DESIGN STANDARDS

REVISIONS					REASON
NO.	DATE	BY	APP'D		
1	04/23/2018				

OC-4



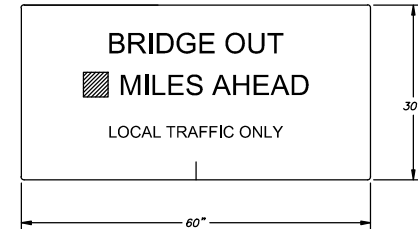
SEE NOTES B & C

R-76A



SEE NOTES B & C

R-76B



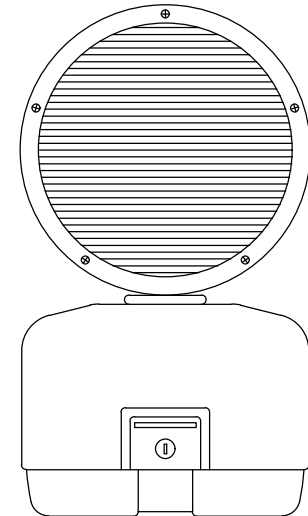
SEE NOTES B & C

NOTES

- A. The R-75 sign shall be attached to the gate, centered vertically and horizontally on the 6" x 12" x 1" boards.
- B. The R-76A or R-76B sign shall be attached to the Type III barricade and centered vertically and horizontally on the 6" x 12" x 1" boards.
- C. The R-75, R-76A and the R-76B signs shall be fabricated of 0.80 guage aluminum blanks and have a reflective white background with black lettering and numerals.
- D. Barricades shall be painted white and orange on a 45° angle.
- E. Barricades shall be constructed with spikes long enough to clinch and made secure.
- F. Type III and Type IV barricades shall have two (2) flashers on each side of 2x4 at the highest point.
- G. The Type III barricades with proper sign on it shall be placed in the center of the roadway of the nearest intersection.
- H. The Type IV barricade shall be along the berm of the roadway when roadside work is being done.
- I. The Type IV barricade may be substituted for the commercial equivalent.
- J. The Type II and gate shall have one (1) flasher each centered horizontally on top of boards.
- K. Flasher shall have red lenses.
- L. The gate shall be a standard farm gate with 2" O.D. pipe as a frame with wire fence filling center.
- M. The OC-4 sign shall be used on the Type I barricade centered vertically and horizontally on the 6" x 12" x 1" boards when the barricade is used for establishing a construction zone.
- N. When the Type I barricade is used to establish a construction zone, one will be placed on each side of the roadway facing traffic with the inside post installed one (1) foot from the berm.

NOTE:

2 Lens Faces,
55-75 flashes
per minute.
10% duration.
8" diameter lens.
M.O.U.T.C Spec.



SEE NOTES F, K, & J



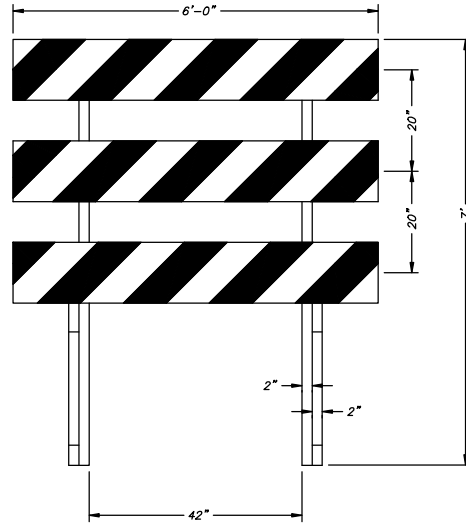
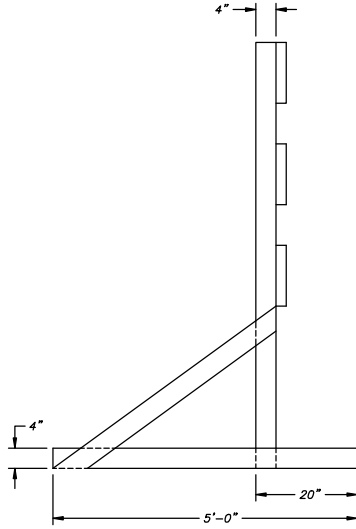
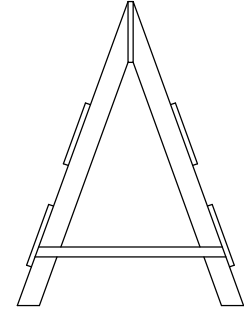
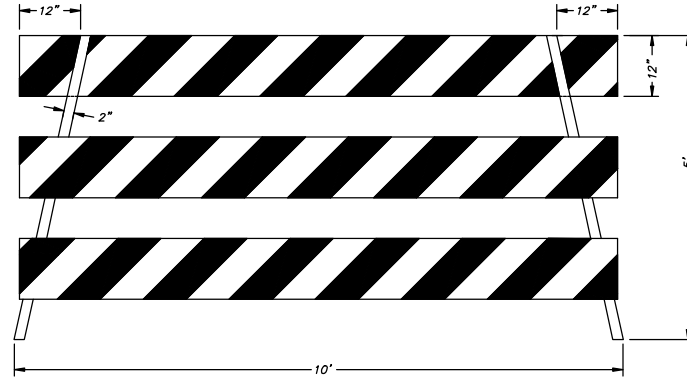
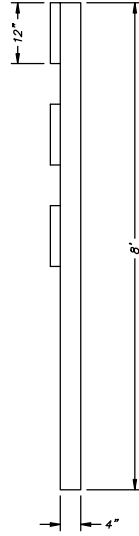
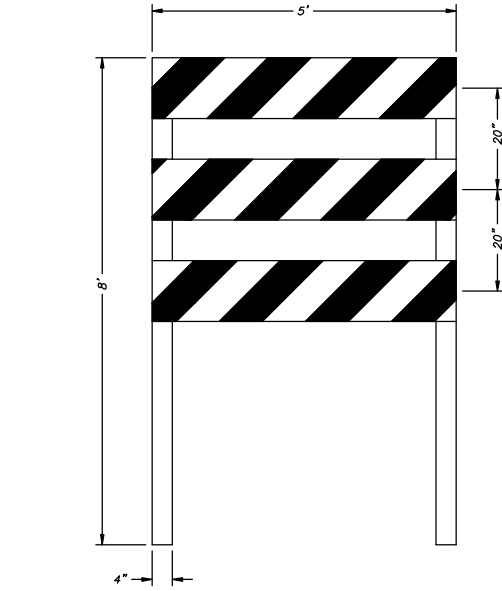
**Warren
County
Engineer's
Office**

Neil F. Tunison, P.E., P.S.
Warren County Engineer
210 W. Main St.
Lebanon, Ohio 45036
513 695-3301 Phone
513 695-7714 Fax

Traffic Control During Construction
Signs, Flashers, & General Notes
Plate 12 Traffic Control During Construction Signs, Flashers, General Notes

WARREN COUNTY
ENGINEER'S OFFICE
DESIGN STANDARDS

REVISIONS			
NO.	DATE	BY	APP.
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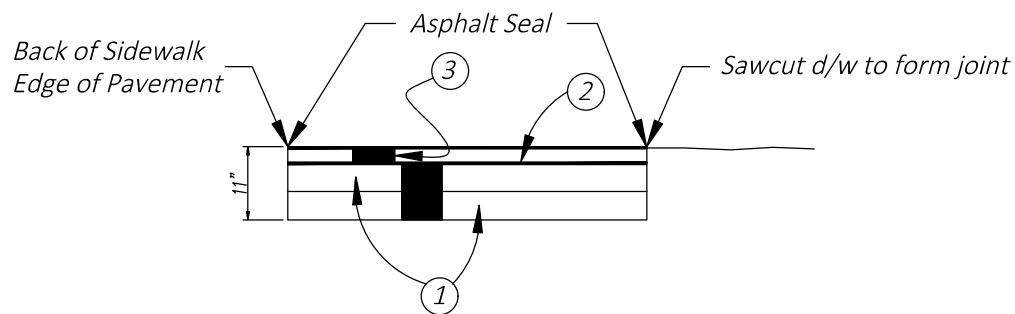
Warren County Engineer's Office

Neil F. Tunison, P.E., P.S.
Warren County Engineer
210 W. Main St.
Lebanon, Ohio 45036
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513 695-7714 Fax

Traffic Control During Construction
Signs, Flashers, & General Notes
Please J2 Traffic Control During Construction Signs, Flashers, General Notes

WARREN COUNTY
ENGINEER'S OFFICE
DESIGN STANDARDS

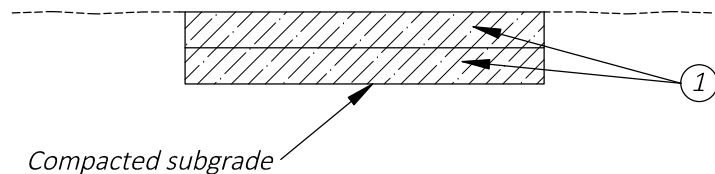
REVISIONS			
NO.	DATE	BY	REVISION
1	04/20/2018	JFT	Initial Design
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ASPHALTIC CONCRETE

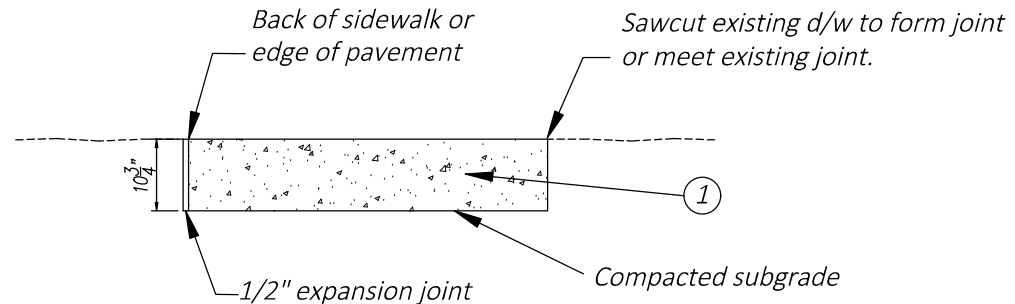
- (1) Two $2\frac{1}{2}$ " thick layers of Item 304 Aggregate Base Course.
- (2) 0.5 to 0.8 gallons per square yard prime, RT-2 or RT-3, or approved equal.
- (3) 2" thickness ODOT Item 448, Asphaltic Concrete.

Reconstruct to the existing driveway to the greater of the above section or existing.



GRAVEL

- (1) Two 3" layers of ODOT Item 304 Aggregate Base Course thoroughly compacted.



PORTLAND CEMENT CONCRETE

- (1) 6" thickness of ODOT Class "C" concrete.



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Driveway Replacement

Project: 44-0100000000000000

WARREN COUNTY
ENGINEER'S OFFICE

DESIGN STANDARDS

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Scale

Notes

Revisions

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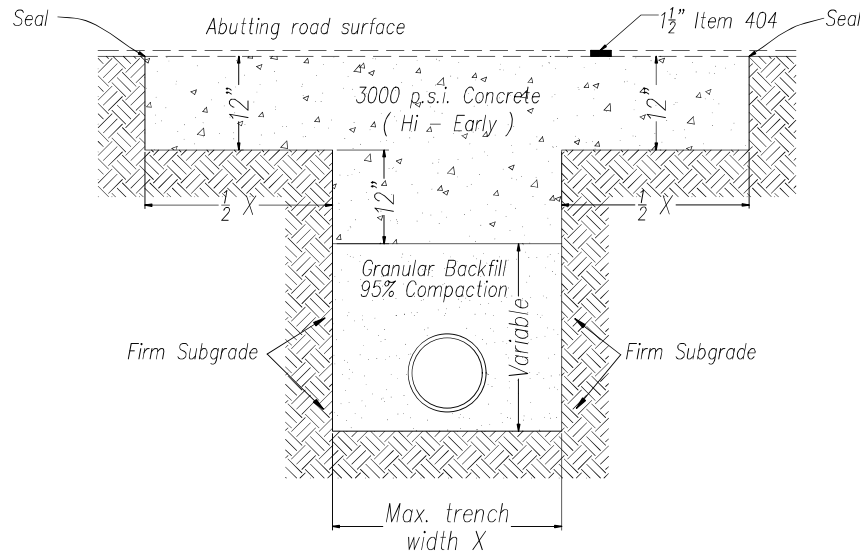
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Traffic must be maintained at all times. Lights, signs, barricades, and if necessary, watchmen be on the jobsite for the protection of the public.

The trench must be backfilled with ODOT Item 310 granular material to a minimum distance of 5 feet beyond the edge of pavement.

The concrete shall be 3000 psi "Hi-Early" (Not to exceed 4" slump) and shall be bridged over by steel "street plates" for a period of 72 hours.

NOTE: Roadway open cut requires special permission by the County Engineer.
The Warren County Engineer's Office is to be notified 24 hours prior to construction.



Warren County Engineer's Office

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Warren County Engineer
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Roadway Open Cut Restoration

Project: Roadway Open Cut Restoration

WARREN COUNTY ENGINEER'S OFFICE

DESIGN STANDARDS

REVISIONS			
NO.	DATE	BY	REVISION
1	01/01/2018	NEF	Initial Design
2	01/01/2018	NEF	Final Design
3	01/01/2018	NEF	As Shown