JASPER
Indiana

CITY OF JASPER
Design Standards and Specifications Manual

City of Jasper, Indiana

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City of Jasper Common Council
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1.0 INTRODUCTION

A. These Design Standards and Specifications are intended to provide uniform criteria for all construction projects under the jurisdiction of the City of Jasper. These specifications, together with the City of Jasper Standard Construction Details, and the 2012 INDOT Standard Specifications and all Supplemental Specifications, **hereinafter referred to as the "INDOT Standard Specifications"**, unless otherwise required by these standards, form the basis by which all construction must conform.

B. All design plans must be prepared by a Professional Engineer licensed in the State of Indiana. All final plans must be dated, signed and sealed by preparer.

C. At the time of platting a subdivision, proposing Storm Drainage changes/improvements, proposing Right-of-Way changes/improvements and/or application for project plan approval, all proposed projects are required to comply with the latest revision of standards and details.

D. These Design Standards and Specifications are adopted for the following reasons:

1. To guide public and private policy and action in order to assure an adequate and efficient transportation network.

2. To provide the most beneficial relationship between the uses of land and buildings and the circulation of traffic throughout the area with regard to the avoidance of congestion in the streets and highways, and pedestrian traffic movements appropriate to the various land uses and buildings.

3. To insure that public facilities (namely roads, streets and storm drainage systems) are available and properly designed to provide sufficient capacity to serve the uses throughout the area.

E. The City of Jasper does hereby exercise the power and authority to review, approve conditionally, postpone, or disapprove plans for road and street improvements (namely roads, streets and storm drainage systems) within the jurisdictional limits of the City of Jasper, pursuant to these Standards and other applicable laws, statutes and regulations of the State of Indiana.

F. These regulations shall apply to all roads, streets and storm drainage systems, either within platted subdivisions or not, that lie within the corporate limits of the City of Jasper.

2.0 DEFINITIONS

Applicant/Owner/Developer	Individual or entity proposing improvements
City	City of Jasper, Dubois County, Indiana
City Inspector	Individual appointed by City/LPA to oversee construction
Consulting Geotechnical Engineer	Approved geotechnical engineering firm employed by Owner and/or Developer to oversee subgrade preparation
Contractor	Individual or entity hired by Owner/Developer to construct improvements
DMF	Design Mix Formula
ESAL	Equivalent single axle load
Easement	A grant by the property owner of the use of a strip of land by the public, a corporation, or persons, for specified uses.
Engineer	The City Engineer of Jasper, or a qualified engineer designated by the City of Jasper
Engineering Consultant	Professional Engineer of record working for the Owner/Developer to consult with Owner/Developer and to design proposed improvements
HMA	Hot Mix Asphalt
LPA	Local Public Agency (City of Jasper)(City Engineer)
PCCP	Portland Cement Concrete Pavement
Right-of-way	A dedicated and accepted strip of land designed for public use as a street, highway, driveway, alley or walkway or for any drainage or public utility purposes or other similar use.
STREETS	The dedicated and accepted space or area between the lot lines, abutting upon a right-of-way and designed as a way for vehicular traffic, whether designated as an alley, street, highway, throughway, freeway, expressway, road, avenue, boulevard, lane, place or however otherwise designated. Streets shall be classified as follows:
•Urban Arterial Streets	Major traffic arteries designed to handle fast or heavy traffic and generally connecting points of major traffic generation.

•Urban Collector Streets	Streets that carry traffic from local streets to the arterial street system, including the principal entrance streets of a residential development and streets for circulation within such a development
•Local Streets	Streets that are used primarily for access to the abutting properties, but do not provide for through traffic.
•Marginal Access	Local streets which are parallel to and adjacent to arterial streets and highways, and which provide access to abutting properties and protection from through traffic.
•Cul-de-Sac	A minor street with only one outlet, having a paved, circular turn-around area at the closed end
•Alley	A minor way that is used primarily for vehicular service access to the back or side of properties otherwise abutting on a street

REFERENCE DOCUMENTS

AASHTO	American Association of State Highway Transportation Officials
ASTM	American Standards for Testing & Materials
INDOT	Indiana Department of Transportation
INDOT Design Manual	State Standard Design Procedures
INDOT Standard Specifications	Specifications by which all INDOT projects are built, 2012 Edition
INDOT Supplemental Specifications	Supplemental Specifications by which all INDOT projects are built, updated periodically
MUTCD	Manual of Uniform Traffic Control Devices

3.0 PROCEDURAL REQUIREMENTS

3.01 STREET AND ROAD IMPROVEMENTS

A. Scoping Meeting. The developer is encouraged to request a meeting with the Local Public Agency (LPA) to discuss how a proposed project will be reviewed. For example, the LPA will review a preliminary master plan submittal to determine whether the streets contained within said plan will be classified as arterials (major or minor), collector (major or minor), local, or cul-de-sac street. From this determination, the number of lanes, lane widths, and parking lane configurations will be determined *(refer to Standard Details Sheets 1 and 2 showing typical cross sections).*

B. All streets within the project will be further classified as Industrial, Commercial or Residential. A classification will be assigned to each road, which will determine which pavement section will be required *(refer to Standard Details Sheets 3, 4, 5, and 6, showing street construction cross sections)*.

C. Other traffic improvements along existing public streets that front the development (such as deceleration lanes, passing blisters, or other similar improvements) will also be discussed and any requirements regarding such set forth.

D. In addition to roadway classification the LPA will determine if any special design features (i.e., underdrains) will be required due to issues surrounding geotechnical features that exist on the subject site.

E. After review of the proposed project, the LPA will submit to the applicant a design summary sheet outlining the key requirements for proper development of the site. These site design requirements shall be made a part of any subsequent submittal to the LPA for approval.

F. The Owner/Developer shall not provide a design for approval based on other specifications and details unless a unique situation exists. In such case, a written request for design exception shall be submitted to the LPA for approval.

G. For developments five (5) acres and larger, the LPA may require the Owner/Developer to submit a Traffic Impact Study to assist in the evaluation and determination of road classification, composition and other requirements. For larger developments, a 30 day review period may be required by the LPA to make said determination.

H. Other Design Elements. Once the road classification and composition have been determined, the project may be designed by the Owner/Developer's engineer. Other design requirements for street construction and storm drainage are set forth in these specifications and other recognized authoritative agencies as referred to herein.

3.02 EXCAVATIONS IN PUBLIC STREETS, RIGHT OF WAY PERMITS, INCLUDING DRIVEWAYS (This is the current ordinance as of the date of approval of these specifications. Please contact the City of Jasper for a current Right of Way Permit and for the most current version of the Street Cut Ordinance.

Code Chapter 13.20

A. Conditions. It is unlawful for any person, firm, or corporation to cut into, tunnel under, or make any excavation in any street, alley or other public place (including driveways and storm sewers) in the City of Jasper without having obtained a Right of Way Permit as required by Ordinance (Ord. 2003-19, S1, June 5, 2003) (Ord. 788 S1, 1974).

B. Application, Filing Time. Applications for such permits shall be made to the Building Commissioner, the City Engineer, or their designated representative of the City of Jasper and shall describe the location of the intended cutting, tunnel or excavation, the size thereof, the purpose therefore, and the person, firm or corporation doing the actual cutting, tunneling or excavation work and the name of the person, firm or corporation for whom or which the work is being done and shall contain an agreement that the applicant will comply with all ordinances and laws relating to the work to be done. All applications for permits shall be filed not less than two working days prior to the date of such excavation, tunneling or cutting. A copy of each permit issued by the Building Commissioner or City Engineer or their designated representative shall be forwarded to the Street Commissioner, the Safety Director and to the applicant (Ord. 2003-29, S1, June 25, 2003) (Ord. 2003-19, S2, June 5, 2003).

C. Excavation fees:

	Concrete or Asphalt
For each square foot of trench, cut into pavement	$7.02 per sq. ft.
Revisit due to improper backfill compaction	$3.30 per sq. ft.

It is unlawful to make any such cutting, tunneling or excavation in any way contrary to or at variance with the terms of the permit therefore. No damage shall be done to any pipes, cables or conduits in the making of such cuttings, excavations or tunneling; and notice shall be given to the persons maintaining any such pipes, cables or conduits, or to the City Department in charge therefore before such pipes, cables or conduits are disturbed (Ord. 2003-19, S3, June 5, 2003) (Ord. 788 S3, 1974).

D. Certificate of Insurance. No such permit shall be issued unless the applicant has met all City of Jasper insurance requirements for any such cutting, excavation or tunneling. A bond may be required to be posted by applicant in favor of the City of Jasper. If such bond is required, it must be on file with the Clerk-Treasurer of the City of Jasper before a permit is issued (Ord. 2003-19, S4, June 5, 2003) (Ord. 788 S8, 1974).

E. Backfill and Resurfacing. All excavated material shall be hauled away. Pipe, wire, or conduit will be placed on proper bedding. Utility trenches in the roadway, including the curb, and five (5) feet beyond, if disturbed, shall be backfilled with

"Flowable Fill". Flowable Fill shall be for utility trench backfill and achieve a minimum compressive strength of 75 PSI and a maximum compressive strength of 250 PSI at 14 days as tested with a standard penetrometer (ASTM C-403). All products must be tested and the test results shall be submitted to, and approved by, the City of Jasper Engineering Department, prior to its use in the roadway or right-of-way. A list of approved mix designs of flowable fill is available at the City of Jasper Engineering Department. Flowable fill shall remain diggable with a standard backhoe. Trenches shall be filled with flowable fill to within four (4) inches from the surface. Material shall be protected from traffic until adequate strength has been achieved. Backfill outside of the flowable fill area shall be backfilled with excavated material and compacted lifts. However, if the excavation exceeds 25 cubic yards, the application may request an exception to the use of flowable fill from the Engineering department. Final blacktopping of the trench will be completed by the City of Jasper Street Department after notification by the applicant that the street cut work is complete. It shall remain the responsibility of the applicant to maintain the street cut in a safe condition until such time as the Street Department paves said cut. Any additional work required by the Street Department after the final blacktop is placed, due to improper backfilling, will be billed to the applicant as an addition to the original fee.

F. Supervision and Inspection. The Street Commissioner of the City of Jasper or designated representative, shall from time to time inspect or cause to be inspected all excavations, cuttings, and tunnels being made in or under any public street, alley or other public place to see to the enforcement of the provisions of this chapter. Notice shall be given to the Street Commissioner at least ten hours before the work of refilling any such tunnel, cutting or excavating begins (Ord. 2003-19, S6, June 5, 2003) (Ord. 788 S5, 1974).

G. Barriers and Warning Devices. It shall be the duty of every person cutting or making an excavation or tunnel in or upon any public place, to place, supply and maintain barriers and warning devices necessary for the safety of the general public (Ord. 2003-19, S7, June 5, 2003) (Ord. 788 S6 1974).

H. Cleanup and Repair. All cleanup, repairing of damaged pipes, cables or conduits, replacement of and cost of replacement or repair materials shall be the expense of the Applicant. The Applicant shall, at his or its expense, clean up and remove all refuse and unused materials of any kind resulting from said work. The applicant shall also control and maintain debris from leaving the work site onto the streets or storm sewers. (Ord. 2003-19, S8, June 5, 2003) (Ord. 788 S7, 1974).

I. Violation, Penalty. Any person, firm or corporation violating any of the provisions of this section may be fined not less than Fifty Dollars ($50.00) nor more than One Hundred Dollars ($100.00) for each offense; and a separate offence shall be deemed committed on each day during or on which a violation occurs or continues (Ord. 2003-19, S9, June 5, 2003) (Ord. 788 S9, 1974).H

3.03 DRIVEWAYS

A. All proposed driveway designs shall be accompanied by an Application for a Right of Way Permit.

B. TEMPORARY DRIVEWAY

1. Barrier Back-Stand up Curb
   The existing back of barrier back/stand back curb shall be cut 1 ½" from surface of existing gutter pan and large open grade stone shall be placed behind the curb for a temporary construction entrance. Once construction is completed the curb and gutter shall be removed and a new curb gutter or permanent drive entrance shall be constructed according to City of Jasper Standards.

2. "V" Back Curb
   Large open grade stone shall be used behind the curb at the temporary construction drive. No rock, stone or boards shall be placed on the curb to aid in the protection of the curb.

PERMAMENT DRIVEWAY

C. 1. Gutter pan lip must be no more than one and one half inches of height from gutter pan. If no lip is desired the gutter pan/driveway approach must be poured to maintain flow of water in the gutter pan.

2. Flow line of new gutter pan must match existing gutter pan

4.0 INTRODUCTION - STREET AND DRAINAGE SPECIFICATIONS

A. Design Requirements

1. Minimum requirements for street construction shall be in accordance with INDOT Standard Specifications, including all current Supplemental Specifications. Copies of said "INDOT Standard Specifications" are on file in the office of the Street Commissioner and the Board of Public Works & Safety, Engineering Department.

2. This section of the Design Standards and Specifications includes special provisions that are to be used in conjunction with the INDOT Standard Specifications and all current INDOT Supplemental Specifications.

3. All portions of the INDOT Standard Specifications not specifically addressed herein shall be deemed applicable. Only those specifications for which the City wishes to implement different procedural requirements are described in greater detail herein.

4. The dimensions and thicknesses of all roadways constructed that are to be accepted for maintenance by the City shall conform to the dimensions and thicknesses as shown on the Standard Details which are a part of this manual.

B. Testing

Owner/Developer may be required to employ an independent testing firm to perform compaction tests on all lifts as required by INDOT Standard Specifications and as described in 4.1 EARTHWORK section of these specifications.

C. Design Drainage Criteria

All culverts and storm sewers shall be designed in accordance with the criteria set forth in 4.5 STORM SEWERS section of these specifications.

D. Underdrains

In areas where streets are cut into hillsides and the potential for ground water surfacing into road cuts is likely or where other saturated subgrade conditions exist, the City may request underdrains be installed in conjunction with the roadways. The underdrain shall outlet into area drains where possible or at other approved outlet points. Along roads with steeper longitudinal grades, cross-drains placed at 200 foot intervals shall also be installed. Refer to typical sections for details of underdrain installation.

4.1 EARTHWORK

A. For general earthwork requirements, refer to INDOT Standard Specifications Section 200. For special procedures regarding placement of embankment and subgrade, the following shall apply.

B. Subgrade Preparation

This work shall consist of clearing, grubbing, removing, and disposing of all vegetation and disposing of all vegetation and debris, except such objects as are designated to remain or are to be removed in accordance with other sections of these specifications, within the construction limits show on the plans. If no construction limits are shown, the right-of-way and easement areas will be the construction limits. This work shall include the preservation from injury or defacement of all vegetation and objects designed to remain.

After all earthwork is substantially complete and all drains installed, the subgrade shall be brought to the lines and grades shown on the plans or as may be otherwise approved in accordance with these standards.

C. Compaction shall be checked by the Street Commissioner or designated representative before construction, during construction and upon completion of the subgrade.

D. The subgrade shall be prepared sufficiently in advance to permit proper inspection throughout the entire embankment construction and with sufficient time allocated for the final elevation to be checked with a scratch template or surveyed to confirm cross slope is correct.

E. Unless otherwise provided, the upper six inches (6”) of all subgrade shall be uniformly compacted to at least ninety-five percent (95%) modified density as determined by the provisions of AASHTO, T99, “Compaction and Density of Soils”. During subgrade preparation and after its completion, adequate drainage shall be provided at all times to prevent water from standing on the subgrade. Subgrades shall be so constructed that it will have a nearly as possible uniform density throughout. After compaction and final grading, the subgrade shall be finished with a three-wheel roller weighing not less than ten (10) tons. At areas not accessible to the roller, the required compaction shall be obtained with mechanical tamps or vibrators.

F All soft, yielding or otherwise unsuitable material that will not compact properly shall be removed. All rock encountered shall either be removed or broken off to conform to the required cross section. Any holes or depressions resulting from the removal of such unsuitable material shall be filled with satisfactory material and compacted to conform to the surrounding subgrade surface. No placement of pavement shall be permitted on uninspected or unapproved subgrade and at no time when the subgrade is frozen or muddy. No hauling shall be done nor equipment moved over the subgrade when its condition is such that undue distortion results. If these conditions are present, the subgrade shall be protected with adequate plank runways, mats or other satisfactory means if hauling done thereon.

G. All utility excavations under the proposed pavement and within 5 (five) feet of said pavement shall be backfilled with #53 stone or “B” Borrow as per INDOT Standard Specifications, Section 211. All water and gas service lines shall be backfilled with flowable fill as per INDOT Standard Specifications, Section 213. These excavation locations shall be shown on the construction drawings as submitted to the LPA.

H. Subgrade for Cement Concrete Base and Pavement. This subgrade shall first be in accordance with INDOT Standard Specification Section 207, after which a more nearly true elevation and cross section shall be obtained with approved equipment. Any loose material remaining on the subgrade shall be compacted or removed as may be necessary. The process of checking and correcting shall continue until the subgrade is firm and true.

I. Subgrade for HMA Base Courses. If subgrade fine aggregate, subbase or other nonrigid course is to be placed directly on an earth subgrade, the requirements of INDOT Standard Specification Section 207 shall be met. The subgrade shall be kept prepared as herein described for at least 1000 feet ahead of initial paving operations, distance permitting.

J. The grade and cross section of the earth subgrade as finished shall be within a tolerance of not to exceed 1/2 inch from a true subgrade. It is permissible to finish within this tolerance by blading or other mechanical means without the use of side forms. If these methods do not finish within this tolerance, side forms may be required.

K. The procedure for determining maximum density for compaction shall be in accordance with ASHTO T99. A field density test may be required by LPA, made by an independent testing agency hired by the Owner/Developer. All testing shall be in accordance with INDOT Standard Specifications. The number of tests shall be in accordance with the INDOT Frequency Manual. Results of density tests including the location and elevation of each test shall be submitted to the LPA.

L. Intermediate Subgrade Inspection. Density test: Whether or not the LPA is present, a field compaction test shall be run on earth lifts and the required compaction obtained on each lift before the next lift is placed. Any test that shows unacceptable results shall be submitted to the LPA prior to reworking the area in question. The Contractor shall then rework subject area as directed by the consulting geotechnical engineer and under his supervision until subsequent test results show acceptable values.

M. Final Subgrade Inspection. A final subgrade inspection will include a proof roll of the subgrade performed with a fully-loaded (18 tons minimum) tri-axle truck. There shall be one or two complete coverages as directed by the City Inspector and consulting geotechnical engineer. The Owner/Developer shall contact the City Inspector no less than 48 hours prior to initiating said proof roll. No paving shall be done until approval has been given by the LPA or Street Commissioner.

N. Areas indicating roller marks and irregularities in the subgrade surface shall be considered failures and shall be corrected prior to paving.

O. The Owner/Developer's representative shall be present during said testing and will delineate all areas that need to be corrected.

P. Special Subgrade Treatment

Special subgrade treatment will be required in all areas that do not meet the specified subgrade compaction required (95% modified proctor) or do not pass the final proof roll test (Refer to INDOT Standard Specifications Section 207).

Q. Chemical Modification of Soils

This work shall consist of the modification of soils by uniformly mixing dry Portland cement, fly ash, lime, or a combination of the materials with soil to aid in achieving the workability of soils having excessive moisture content (Refer to INDOT Standard Specifications Section 215).

4.2 EROSION CONTROL

The Owner/Developer's Engineer shall develop and submit to the appropriate authorities all required plans, forms, NOI, advertisement, filing fees, etc. required for Rule 5 and Rule 13, as they apply.

A. The erosion control plan shall address and include all requirements as set forth in Section 205 of the INDOT Standard Specifications and in Ordinance No. 2004-44, and any amendments thereto (also referred to as *14.3 Construction Site Runoff Control* in the Jasper Code of Municipal Ordinances).

B. Any project within the city limits of the City of Jasper must submit an erosion control plan to the City of Jasper in accordance with Ordinance No. 2004-44, and any amendments thereto (also referred to as *14.3 Construction Site Runoff Control* in the Jasper Code of Municipal Ordinances).

C. The erosion control plan shall address all those elements contained within the ordinance and on the City of Jasper Construction/Stormwater Pollution Prevention Plan, Technical Review & Comment form. All three sections of said form, Parts A, B and C, shall be addressed in all erosion control plans.

D. Any project within the jurisdictional limits of the City of Jasper but outside of the city limits must submit an erosion control plan to the Dubois County Soil and Water Conservation District office in accordance with Rule 5.

E. The erosion control plan shall address all those elements contained within the DNR Construction/Stormwater Pollution Prevention Plan, Technical Review & Comment (Form 1) All three sections of said form, Parts A, B and C, shall be addressed in all erosion control plans.

F. The Owner/Developer will be solely responsible for obtaining Notice of Sufficiency from the LPA and IDEM prior to initiating any work.

G. A copy of the approved erosion control plan shall be submitted to the City.

H. If there are any erosion control issues that remain unresolved upon completion of the work, the City of Jasper reserves the right to withhold acceptance of streets until issues are resolved.

4.3 STREET CONSTRUCTION

A. This section includes Portland Cement Concrete streets, hot-mix asphalt streets, curb and gutters, sidewalks, and street patches.

B. All construction shall be in accordance with applicable details published in City of Jasper Design Standards and Specifications Manual, latest revision. The LPA must approve any other alternative method, discrepancy, omission, or duplication of specification standards.

C. Streets, sidewalks, curb and gutters and pathways, where provided, shall be completed to grades shown on plans, profiles, and cross sections approved by the LPA. They shall be provided by Owner/Developer, prepared by a registered professional engineer or registered land survey and approved by the City of Jasper LPA.

D. Streets patches shall be field located as directed by City Inspector. Any proposed street repair shall be accompanied by the necessary permit application, in accordance with **Section 3.0 Procedural Requirements;** sub-paragraph **3.2 Excavations in Public Streets**, of these standards and specifications, as established by Ordinance 2004-55 and its amendments.

E. Pavement widening of existing streets that abut a proposed development shall be constructed of similar materials of the same thickness as the existing street, unless otherwise approved by LPA.

1. Streets within the development may be of Portland cement concrete or hot mix asphalt concrete
2. Sidewalks shall be Portland cement concrete
3. Curb and Gutters shall be of Portland cement concrete
4. Pathways may be of Portland cement concrete or hot mix asphalt concrete

F. The LPA shall receive written notification no less than 48 hours prior to beginning paving operations. Accompanying said notification, the following submittals are required:

1. Portland concrete cement mix design
2. Hot mix asphalt mix design (HMA)

G. During construction, the following submittals may be required:

1. Portland concrete cement tickets that indicate mix design or hot mix asphalt tickets that indicate mix design
2. For concrete pavements, as soon as information is available, testing reports that include, but are not limited to, temperatures, slump, air entrainment, density and cylinder compressive strength.

H. PAVEMENT DESIGN

1. The preferred pavement type shall conform to the section composition approved by the LPA for this project.

2. All pertinent existing specifications and standard details shall apply.

I. HOT MIX ASPHALT, HMA, PAVEMENT

1. HMA pavement shall consist of one or more courses of HMA base, intermediate, or surface mixtures and miscellaneous courses for rumble strips and wedge and leveling, as described in greater detail in the latest INDOT Standard Specifications 402, 403, 404, 405, 406, 407, 408 and 409.

2. Design Mix Formula (DMF). A DMF shall be prepared in accordance with INDOT Standard Specifications Section 402 and submitted in a format acceptable to the LPA one week prior to use. The DMF shall state the maximum particle size in the mixture, the calibration factor and test temperature to be used for the determination of binder content using ITM 586, or ITM 571, and a MAF. Approval of the DMF will be based on the ESAL and mixture designation as follows:

Table 4.3-1
Design Mix Formula Parameters

	For Use on Minor Collectors & Local Streets	**For Use on Arterials & Major Collectors**
Mixture Type	**Type A**	**Type B**
Design ESAL	200,000	2,000,000
Surface	9.5 mm	9.5 mm
Surface – PG Binder	64° – 22°	64° – 22°
Intermediate	19.0 mm	19.0 mm
Intermediate – PG Binder	64° – 22°	64 – 22
Base	25.0 mm	25.0 mm
Base – PG Binder	64° – 22°	64° - 22°

J. PORTLAND CEMENT CONCRETE PAVEMENT (PCCP)

1. Concrete Pavement shall consist of Portland cement concrete pavement, PCCP, as described in greater detail in Section 502 of the INDOT Standard Specifications.

2. Concrete Mix Criteria. The fine aggregate shall be at least 35%, but not more than 45%, of the total mass (weight) of the aggregate in each cubic meter (cubic yard). Proportions will be based upon saturated surface dry aggregates.

Portland Cement Concrete. The CMD shall produce workable concrete mixtures, with the minimum amount of water, and having the following properties:

Portland cement content	564 lbs/yd^3
Maximum water/cementitious ratio	0.487
Maximum substitution of fly ash for Portland cement	20%
Fly ash/portland cement substitution ratio	1.25 by mass (wgt)
Maximum substitution of GGBFS for Portland cement	30%
GGBFS/portland cement substitution ratio	1.00 by mass (wgt)
Slump, slipformed	1.25 in. to 3 in.
Air Content	6.5% ± 1.5%
Minimum flexural strength, third point loading with fly ash	550 psi at 28 days
Relative yield	0.98 to 1.02

K. PCCP JOINTS

1. The construction of PCCP joints, dowel bar assemblies, and joint sealing operations shall be in accordance with Section 503 of the INDOT Standard Specifications, with the following exceptions:

   a. Type D-1 contraction joints will be required on arterials and major collectors only.

2. Joint spacing shall be as follows:

   a. Longitudinal joint spacing shall not exceed 12 feet
   b. Transverse construction joints shall not exceed:
      10 ft. for 6 in. thick pavement
      11 ft. for 7 in. thick pavements
      12 ft. for 8 in. thick pavements
      16 ft. for 12 in. thick pavements

L. PCCP FINISHING, CURING and SEALING

1. All PCCP surfaces shall be finished, cured and sealed in accordance with Section 504 of the INDOT Standard Specifications.

2. Curing products must be a white pigment wax based curing compound and applied as soon as the final finishing is done or when the concrete has reached a “No Mar” state.

3. A clear, water-based 20% silane penetrating, protecting sealer that should be applied 28 days after the curing process.

M. TESTS AND PROCEDURES

1. Test methods and procedures shall be in accordance with Section 505 of the INDOT Standard Specifications.

N. PCCP PATCHING

1. PCCP patching shall be in accordance with Section 506 of the latest INDOT Standard Specification.

O. PCCP RESTORATION

1. PCCP restoration shall be in accordance with Section 507 of the INDOT Standard Specifications.

4.4 SIDEWALKS AND RAMPS

A. Minimum requirements for sidewalks, curb ramps, steps and handrails shall be in accordance with INDOT Standard Specifications, Section 604, unless otherwise required by these standards, and in accordance with the standard details published herein

B. Detectable warning elements in accordance with ANSI A 108.1.

C. HMA sidewalks are not to be used unless approved by the LPA and Board of Public Works and Safety.

D. Walks shall be five inches (5") thick.

E. Walks placed at drives shall be a minimum of six inches (6") thick or equal to the adjoining drive thickness, whichever is greater. For commercial and industrial driveways, reinforcement, No. 4 bars at 24" o.c. shall be utilized in the walk. If the walk is poured independently of the drive, No. 4 bars at 24" o.c. shall be placed to tie the adjacent pours together.

F. Walks placed monolithic with drives shall be placed in accordance with ADA Standards and shall not have a cross slope greater than 2%.

G. Curing products must be a white, pigment wax based curing compound and applied as soon as the final finishing is done or when the concrete has reached a "No Mar" state.

H. A clear, water-based 20% silane penetrating, protecting sealer should be applied 28 days after the curing process.

4.5 UNDERDRAINS

A. Minimum requirements for underdrains (when required) shall be in accordance with INDOT Standard Specifications Section 718, unless otherwise required by these standards, and in accordance with the standard details published herein.

B. All subsurface drains and/or French drains shall use rigid NPDE pipe. (ADS N12 or approved equal)

C. All sub-surface and French Drains will remain the property owner's responsibility.

4.6 **OVERLAY OF ROADWAY**

A. For projects where overlays of existing road surfaces are proposed, the City may request the existing road be milled, in part or in its entirety, prior to placement of new roadway surface. In addition, if new proposed pavement will join existing pavements, milling to create butt joints is required.

B. Minimum requirements for milling shall be in accordance with Section 306 of the INDOT Standard Specifications, unless otherwise required by these standards, and in accordance with the standard details published herein.

4.7 STORM SEWERS

This section includes storm sewer conveyance systems, retention, and detention basins.

A. All construction shall be in accordance with applicable Design Standards and Construction Details, published as part of this manual. The LPA must approve any other alternative method, discrepancy, omission, or duplication of specification standards.

B. Due to public safety and maintenance reasons, deep, open ditches are not permitted within the City right-of-way. Storm sewers shall be designed into all projects to avoid these situations. Open channels of lesser depth and flatter slopes are permissible on a case-by-case basis and are described in more detail in **4.8 Open Channels.**

C. Easements shall be required for locations that convey storm water through the parcel. The property owner or an established entity, such as a homeowner's association, shall be responsible for the maintenance of easements. The easements will allow the LPA to enter and inspect drainage structures. They will also prevent buildings and other structures from encroaching onto the easements.

1. Pipe Easements and Right-of-Ways

a. All storm sewer pipes not located within dedicated street rights-of-way shall be contained within an easement dedicated for the purpose of accessing the storm sewer facilities to perform maintenance thereon.

b. Pipes installed in Right-of Ways and PU & DE areas must be installed to City of Jasper specifications as listed further in this manual and the City of Jasper Drainage Permit

1. Drainage pipe must be a minimum of 4"HDPE N-12 dual wall or PVC

2. No "roll pipe" or single wall corrugated pipe of any diameter will be allowed.

3. No pipe under 12" diameter will be accepted by the City of Jasper

4. Installed pipe and/or drainage structures will require City of Jasper Board of Public Works approval prior to acceptance by the City of Jasper

2. Pipe Centered in Easements

a. The easement lines generally shall be parallel with and equidistant from the centerline of the pipe run.

b. In cases where the pipe is not centered in the easement, the outside wall of the pipe shall be no closer to the closest easement line than one half the vertical distance from the flowline of the pipe to the dirt grade; and pipe alignment and location shall be shown clearly on the as-built plans.

3. Minimum Easement Width

a. Easements shall be a **minimum** of twenty (20) feet in width for pipes up to and including twenty-four (24) inches in diameter. For pipes larger than twenty-four (24) inches in diameter, a total of twenty (20) feet, plus the diameter of the pipe (in lineal feet), with the total rounded off to the next larger even number of feet.

b. Easements for retention and detention basins shall include the basin, all sloped embankments and a 10 foot minimum flat area immediately adjoining said embankments.

4. Off-Centered and Combination Easements

a. The adequacy of design for combination easement housing storm sewers with other utilities shall be evaluated by the LPA on a case-by-case basis.

D. Design Criteria: the storm sewer system shall comply with the following:

1. The interior street drainage system for a project, including inlets, catch basins, street gutters, and curbs shall be designed so that storm water during a 10 year return period storm shall not exceed twenty-five hundredths (0.25) foot (3 inches deep), as measured at the gutter line ten (10) feet either side of a maximum inlet rim sump of one-tenth foot (0.10).

2. For the street drainage calculations, rainfall duration shall be equal to the time of concentration of one hour, if the time of concentration is less than one hour.

3. Minimum Requirements to be satisfied:

a. All culverts shall be capable of accommodating peak runoff of 25-year or a 50-year return period storm when draining an area greater than one (1) square mile, or when crossing under a road, which is part of the INDOT urban or rural functional classification system, and is classified as a principal or minor arterial, major or minor collector road.

b. A storm water drainage system, or any part thereof, draining a tributary area greater than one (1) square mile shall be designed to carry the volume of storm water runoff calculated to occur during a 50-year return period storm entirely within the easement for that storm water drainage system.

E. Other Design Parameters

1. Minimum Radius and Pipe Size for Curved Installations:

a. Where long radius curves are necessary to conform to street layout, the minimum radius of curvature shall be no less than fifty (50) feet, and allowable for sewers forty-eight (48) inches in diameter and larger only. For installation around Cul-De-Sacs 22 degree or 11 degree fittings shall be required.

b. Deflection of pipe sections shall not exceed the maximum deflection recommended by the manufacturer of the specific pipe to be installed, and that manufacturer's recommendation shall accompany the submittal; and only the type and size of pipe specified in such a submittal shall be installed.

c. The deflection shall be uniform, if used; and the finished installation shall follow a smooth curve.

2. Prefab 45 Degree Structures

a. Prefabricated forty-five degree (45°) structures for sewers 48" and larger may be allowed with only one manhole access or inlet to one of the laterals thereof, if it can be shown that by using such a structure that one or more ninety degree (90°) turn(s) is/are eliminated.

b. Designs for other special prefabricated junctions may be submitted for approval to the LPA.

3. Drainage Inlets

Drainage inlets shall be installed to provide access to continuous underground storm sewers for the purpose of inspection and maintenance. Inlets shall be provided at the following locations:

a. Where two or more storm sewers converge.

b. For sewers 48" and larger designed to conform to Paragraphs 2.a. above.

c. At the point of beginning of, or at the end of, a curve; and at the point of reverse curvature (PC. PT. & PRC).

d. Where pipe size changes

e. Where an abrupt change in horizontal alignment occurs

f. Where a change in storm sewer profile grade occurs

g. At suitable intervals in otherwise straight sections of storm sewer runs, as specified in Paragraph 8 below.

4. Maximum Distances Between Drainage Inlets

The maximum distance between storm sewer drainage inlets shall be as follows:

Table 4.7-1
Maximum Distance Between Drainage Inlets

Size of Pipe in Inches	Maximum Distance in Feet
12 thru 42	200
48 and larger	400

5. Maximum Distance Between Street Inlets

a. The maximum distance between inlets for street drainage shall be four hundred (400) feet measured in the gutter.

6. Pipe Collars, Headwalls, Aprons, and Bulkheads

a. A collar, headwall, and/or drop box shall be provided on all culverts.

b. Bulkhead, where indicated on plans, must be constructed using a minimum of 3500 psi concrete and one of the following methods.

1. Non-Formed Poured-in-Place Concrete Bulkhead

a. Concrete bulkhead will be formed with no mechanical means.

b. Bulkheads are to formed in such a manner to ensure that the product is placed “dry” enough to facilitate the placement of the product using basic hand tools

c. Pouring is to begin on one side of the pipe with the product flowing under the pipe and through the trough until concrete can be seen on the side opposite the Pour side.

d. Pouring should be momentarily stopped so concrete so concrete can be agitated to insure no air voids remain in pour.

e. Pouring can continue, placing concrete to completely encase both sides and up to and including 12” over the pipe. Care should be taken to prevent concrete from slumping down. Placement of concrete must ensure that voids around new pipe to structure connection are sealed.

f. Bulkhead will be finished using hand tools in a manner to create a smooth finished bulkhead.

g. Volume of concrete to be used should be calculated as to ensure enough product to completely construct the bulkhead but not in excess as to create the large, unnecessary placement of concrete.

2. Formed Poured-in-Place Concrete Bulkhead

a. Pipe to structure bulkhead to be formed using metal or plywood forms

b. Sufficient cribbing and/or blocking is to be placed to insure proper support for the Bulkhead structure while concrete is being poured.

c. Use a method by which the concrete is placed on one side of the pipe and allowed to pour down until concrete flows under the pipe and can be seen on the side opposite of where the concrete is being poured.

d. Pour should then be momentarily stopped and concrete Should be vibrated down to insure no air voids remain in poured concrete.

e. Pouring can again begin, filling the rest of the form up to and including a minimum of 12” over the top of the pipe. placement of concrete must insure that voids around new pipe to structure connection are sealed.

f. Volume of concrete to be used should be calculated as to ensure enough product to completely construct the bulkhead but not in excess as to create the large, unnecessary placement of concrete.

7. Inlets

   a. Inlets, or other collecting drainage structures, shall be designed and utilized to collect surface water through grated openings; and convey it into storm sewers, channels, or culverts.

   b. The inside of all pipe to structure connections must be grouted with a non-shrink grout for the entire circumference.

8. Use of INDOT Design Manual

   a. Inlet design and spacing shall be in accordance with the INDOT Design Manual, or other approved design manuals and procedures.

   b. The source of inlet design shall be documented in the plan submittal and approved by the LPA.

9. Minimum Openings and Flow Rates

   a. The inlet grate openings provided for street drains must be adequate to pass the design 10-year flow.

   b. Sag inlets shall pass the design flow with a maximum gutter depth of 0.25 feet during a ten (10) year return period storm, as measured ten feet distance either side of the inlet.

10. Overload Channels to Prevent Street Flooding Required

    a. An overload channel from sag inlets to an overflow channel or basin shall be provided at sag inlets so that the maximum depth of water that is ponded in the street sag shall not exceed one-half (0.5) foot during a twenty-five (25) year return period storm with the inlet plugged, as measured at a point four (4) feet in-street from and perpendicular to the gutter line,.

11. The storm sewer system for a project subject to the requirements of these standards, whether such storm sewer system is to remain private or public, and whether constructed on private or public property, shall conform to the design standards and requirements contained, attached to, or referred to in these standards.

12. Manning's Equation:

The hydraulic capacity of storm sewers shall be determined using Manning's Equation:

$$Q = Av = A \frac{1.486}{n} R^{2/3} S^{1/2}$$

Q = discharge in cubic feet per second (cfs)
A = cross sectional area of pipe
v = mean velocity of flow in feet per seconds
R = the hydraulic radius in feet R = A/p
S = the slope of the energy grade line in feet per foot
n = the roughness coefficient of the conduit surface (2)

The hydraulic radius (R) is defined as the cross sectional area of flow divided by the wetted flow surface or wetted perimeter.

Roughness coefficient (n) values and maximum permissible velocities for storm water materials are listed in Table 4.7-2 (on the following page).

The use of texts and references must be documented in all submittals of hydraulic calculations.

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Table 4.7-2
Typical Values of Manning's "n"

Type of Material	Manning's "n"		Max. Velocity fps
Closed Conduits/Culverts:			
PVC Storm Sewer Grades	0.010		15
Concrete (circular or elliptical	0.011		15
Smooth Flow HDPE	0.012		15
Precast Concrete Boxes	0.013		15
C.1 or D.1 S.J. (type/cement lined)	0.013		15
	Manning's "n"		**Max. Velocity fps**
Corrugated Metal Pipe:	**Circle Weld**	**Spiral Weld**	
Unpaved	0.024	0.021	7
25% Paved	0.021	0.018	7
50% Paved	0.018	0.015	7
100% Paved	0.013	0.013	7
Other Concrete Culverts		0.013	
Open Channels:	**Manning's "n"**		
Concrete, Trowel Finish	0.013		
Concrete, Broom or Float Finish	0.015		
Gunite	0.018		
Riprap, Placed	0.030		
Riprap, Dumped	0.035		
Gabions	0.028		
New Earth	0.025		
Mature Earth, Some Weeds	0.030		
Mature, Dense Weeds	0.040		
Mature, Weeds & Brush	0.040		
Swale, Grass Cover	0.035		
OTHER "N" VALUES SHALL BE TAKEN FROM MANUFACTURERS' DATA			

13. Where existing natural drainage ways offer a suitable means of storm drainage, the street right-of-way may be widened to accommodate them, or they may be located in an easement. The location must be approved by LPA before acceptance will be made.

14. Construction plans shall indicate receiving drainage structures with enough detail to show that there is an adequate discharge route and receiving system. Offsite design and work may be required to adequately accept the anticipated discharge.

15. Other Drainage:

    a. All perforated drainage pipe, if required, shall be installed as per the standard details.

    b. Last section or minimum of 10(ten) feet of pipe entering a structure must be pre-perforated pipe, perforated tile with sock or section of pipe with 3/8" holes drilled at a minimum of every 60 degrees around the circumference, and having all #8 backfill installed before entering the drainage structure.

    c. Area inlets shall be designed and installed in such a manner to adequately conduct the runoff from a twenty-five (25) year return period storm into the underground storm sewer system; and shall be designed to preclude safety hazards.

    d. Best Management Practice (BMP): All storm sewer systems shall be designed in a manner that utilizes some form of pre-manufactured, LPA approved, BMP within the system prior to the storm water discharge leaving the site.

16. Retention Basins: All retention basins (ponds) shall have a low flow drainage consideration. This situation may be a paved invert, a perforated tile, or a French drain. The minimum slope across the bottom of a retention pond shall be 1% toward a centrally located paved invert or perforated tile having a minimum slope of 0.5%. All retention and detention basin shall be designed to hold a 50 year, post-developed return event and discharge at a 10 year, pre-developed return event rate. Rainfall rates shall be based on the Indiana Department of Natural Resources frequencies for a 24 hour event.

17. Pipes and Pumps:

    a. If the building structures could potentially have sump pumps, a hard pipe storm sewer system shall be provided to each lot. A "sump pump discharge plan" shall be included with the design drawings. Discharge piping shall not be outlet into any improved area of a street. Streets requiring underdrains shall be installed with tees in underdrain piping to receive said drains. Drain tile tees shall be included in the road design plans and locations

clearly marked in the field with permanent type markers, such as a metal T-post.

b. No blind bends shall be allowed. At a minimum, each bend shall have a cleanout installed equal to the diameter of the main pipe.

18. The minimum pipe size for all storm sewers shall be twelve (12) inch inside diameter.

19. Orifice Plates and Flow-Limiting Devices:

a. Where a twelve (12) inch pipe will not limit the rate of release to that rate required to meet detention storage requirement, an orifice plat, or other device subject to the approval of the LPA, shall control the rate of release.
b. When an orifice plate or other devise is used inside of the pipe or enclosed system, the opening in the plate or device shall not be less than eight (8) inches in diameter, or eight (8) inches on a side.
c. If a controlling device less that eight (8) inches on a side, or in diameter is required to restrict the release rate, the controlling device shall be installed above-ground, and in a place easily accessible for maintenance, and protected from tampering.

20. Storm Sewer Grade: Following are minimum requirements for storm pipe grade:

a. Grade Related to Pipe Cover: Storm sewer grades generally shall be such that minimum cover as shown on the pipe bedding detail is achieved and maintained over the top outside surface of all pipe in projects subject to the provisions of these standards.
b. Uniform Pipe Grades Required: Uniform grades shall be maintained in subsurface pipes between inlets to the subsurface storm sewer system, and between manholes connecting the pipes and inlets of the storm sewer system..
c. Grade Related to Capacity and Velocity: Final grade(s) shall be set with full consideration of the capacity required, sedimentation problems expected, and other storm sewer design parameters.
d. Slopes: The slopes for storm sewers shall be calculated from end of pipe to end of pipe (not center of manholes). In no case shall the design velocity be less than 2.5 feet per second (fps), or greater than 15 fps. The gravity sewer pipe shall not be constructed below the following minimum grades:

Table 4.7-3
Minimum Grades for Sewer Pipe

(inches)	Minimum Grade (percentage)
12	0.25
15	0.25
18	0.25
21	0.15
24	0.15

21. Swale/Ditch Slopes: All swales/ditches shall be designed at a grade that minimizes concern for erosion. The minimum slope for a non-paved ditch shall be 2%. Swale/Ditch bottoms having a long slope (less than 2.0%) shall have a two (2) foot wide concrete channel flowline to assist in dewatering the ditch and preserving the flowline. Subsurface drainage, paved inverts or perforated tile shall have a minimum slope of 0.5%. No proposed ditch slopes of less than 0.5% will be allowed. Swale/Ditch bottoms shall be lined with sod or erosion control blanket. Swale/Ditches having a slope more than 3% will not typically be considered unless special conditions warrant and storm sewer piping will not provide a viable solution.

F. Products and Materials

1. The storm sewer system shall be built only of components specifically designed, engineered, manufactured, specified, and supplied to be fitted together to form a first quality storm sewer system.

2. The installation of any material within the storm sewer system, which installation is found to be not in accordance with these standards, or with the approved Plans, or with these Specifications and Standard Details, instructions, details and specifications, shall be considered a misrepresentation, and a violation of the conditions of plan approval. Said materials shall be removed and replaced with an installation in conformance with these specifications and standards, at the project owner's expense.

3. Sewer Pipe Materials

   a. HDPE pipe is acceptable in all locations (even beneath roadways). Pipe shall have a smooth interior and annular exterior corrugations. (Including Perforated HDPE pipe.)
      (1) 4" – 10" shall meet AASHTO M252, Type S
      (2) 12" – 60" shall meet AASHTO M294, Type S
      (3) 60" shall meet AASHTO MP7
      (4) Manning's "n" value for use in design shall not be less than 0.012.
      (5) ADS N12, Hancor SureLok, or approved equal.

b. Reinforced Concrete Pipe (RCP) shall conform to current ASTM C-14 and C-76, Class III.

c. Polyvinyl Chloride (PVC) pipe shall conform to ASTM D-3034 and D-1784, with a SDR of 26, and a compound designation Class No. 12454-B.

d. Flared end sections shall be made of concrete or metal. Plastic end sections may be allowed with prior approval from the LPA.

4. Joints and Couplings

a. Reinforced Concrete Pipe joints shall be flexible rubber with gaskets conforming to ASTM C-443. The method coupling the pipe shall be in strict accordance with the gasket manufacturer's recommendations.

b. Polyvinyl Chloride (PVC) joints shall be bell and spigot with an elastomeric rubber gasket supplied by the pipe manufacturer.

c. Polyethylene pipe shall use a bell and spigot coupling conforming to ASTM F-477 with an O-ring type gasket assembly.

5. Curb Inlets, Area Drains and Catch Basins

a. Precast concrete catch basins shall conform to current ASTM C-76 for reinforced concrete sewer pipe,

b. Precast concrete blocks shall conform to ASTM C-139 for concrete curb inlets, area drains and catch basins. Base pad must be cast-in-place concrete with a minimum thickness of 6 inches. Must level top surface or have a precast base conforming to ASTM C-76 and/or C-478.

c. Cast-In-Place Concrete – 4500 psi

d. Curing Material – Liquid Membrane – C-309, Type 1

e. Inlet Frame and Grates – ASTM A-48.

f. All yard risers must be plastic HDPE N-12 and one piece for risers up to 10 feet in overall height. Overall height is calculated from invert to finished grade. Risers over 10' feet in height must be connected with split-band coupling or bell/spigot coupling with rubber O-ring. Backfill with number 8 stone to one (1) foot above coupling.

6. Manholes

   a. Cast-In-Place Concrete – 4500 psi

   b. Precast concrete blocks shall conform to ASTM C-139 for concrete curb inlets, area drains and catch basins. Base pad must be cast-in-place concrete with a minimum thickness of 6 inches. Must level top surface or have a precast base conforming to ASTM C-76 and/or C-478.

   c. Precast reinforced concrete manhole sections – ASTM C-478.

   d. Precast "Moorbase" sections

   e. Joints: Use butyl rubber gasket and joint wrap, with both interior and exterior of joint, to be grouted with Portland Cement Mortar.

   f. Manhole Castings: Manhole frame and cover, ASTM A-48, latest edition, Class 20 with 24 inch diameter lid.

7. Riprap

   a. Riprap will only be used under special circumstances and approved by LPA.

   b. Riprap must be uniform as per INDOT Standard Specifications.

   c. Where higher velocities are anticipated, uniform riprap in gabion mattresses may be required.

   d. Revetment riprap will not be allowed unless approved by LPA.

8. Raising New or Existing Structure to Finish Grade

   a) Reinforced pre-cast concrete riser rings with tar strip or approved manufactured poly/plastic risers with tar strip to be used between existing structure, pre-cast risers and lid or casting.

   b) A poured riser on top of new or existing box structure will require a form to be constructed around the inside and outside perimeter of the existing box. Number 4 rebar will be drilled into existing structure every 16" on center. Number 4 rebar will be laid horizontally around the entire box with at least 6" of overlap of bars. No splice of bars will be allowed at the corners. Bars must be bent or fabricated to bend around corners. A horizontal bar must be added for 12" of poured riser depth. One (1) horizontal bar placed in the middle of the pour shall be sufficient for pours under 12" in depth. Horizontal bars must be tied to the vertical bars.

c) No whole or pieces of brick,block,wood or stone shall be approved as shims to raise structure

d) Structure can be raised by approved plastic or rubber risers according to manufacturer's specifications. Maximum height of riser not to exceed 12"

e) 6" and 8" block structures can be raised to finished grade by laying the appropriate size block in a stagger joint fashion. The existing structure top must be drilled every 18" and have # 4 rebar inserted to a depth of which the rebar extends 2" below and above the last course laid. At this point the concrete block can be filled with concrete. No mortar will be allowed.

G. Rejection of Products and Materials

1. Rejection of Damaged HDPE

a. High Density Polyethylene Pipe (HDPE) possessing the following defects will be rejected for installation:

(1) Variations from straight centerline.
(2) Elliptical shape in pipe intended to be round.
(3) Illegible pipe markings
(4) Deep or excessive gouges or scratches on the pipe wall.
(5) Fractures, punctures, or cracks passing through the pipe wall.
(6) Damaged or cracked ends where such damage would prevent making a satisfactory joint.

2. Rejection of Damaged PVC

a. Polyvinyl Chloride Pipe (PVC) possessing the following defects will be rejected for installation:

(1) Variations from straight centerline.
(2) Elliptical shape in pipe intended to be round.
(3) Illegible pipe markings
(4) Deep or excessive gouges or scratches on the pipe wall.
(5) Fractures, punctures, or cracks passing through the pipe wall.
(6) Damaged or cracked ends where such damage would prevent making a satisfactory joint.

3. Rejection of Damaged RCP

a. Reinforced Concrete Pipe (RCP) possessing the following defects will be rejected for installation:

(1) Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
(2) Defects that indicates proportioning, mixing, and molding not in compliance with Section 10.1 of ASTM C 76.
(3) Surface defects indicating honey-combed or open texture.
(4) Damaged or cracked ends where such damage would prevent making a satisfactory joint.
(5) Any continuous crack having a surface width of greater than 0.01 inch and extending for a length of 12 inches or more, regardless of position in the wall of the pipe.
(6) Visible spacers or longitudinal reinforcement used to position the reinforcing cage shall not be cause for rejection of reinforced concrete pipe sections.

4. Rejection of Damaged Concrete Box Sections

a. Individual box sections will be rejected due to any of the following:

(1) Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
(2) Honeycombed or open texture that would adversely affect the function of the box section.
(3) The ends of the box sections not being normal to the walls and centerline of the box section, within the specified acceptable tolerances.
(4) Hole cast into box does not line up with inlet and outlet pipes.

H. Installation

1. Preconstruction Conference: Before the start of any construction on the project site, a conference must be scheduled with the LPA. A Storm Water Drainage Permit shall be required when installing new storm sewer or when connecting to any existing storm water structure or curb.

2. Utility Location: The Contractor must determine the location of existing utilities 48 hours prior to any construction or excavation. The Contractor shall call Indiana Underground Plant Protection Service (IUPPS) prior to any construction or excavation 811.

3. Safety:

   a. The Contractor shall examine areas and conditions under which storm system's materials and products are to be installed. Do not proceed with work until satisfactory conditions are present.

   b. The Contractor is responsible for safety at the job site. The Contractor shall make provisions for a safe working environment for the crews, as well as City personnel and inspectors. The project site shall be in compliance with all State and Federal safety regulations, including but not limited to construction trench safety and confined safety entry regulations.

   c. The Contractor shall stop work immediately should unknown active utilities be broken during excavation work. Do not proceed with work until decision has been reached regarding repair, removal or relocation of utilities. Notice must be made to the appropriate utility.

4. All flexible storm sewer pipe and culvert material (excluding HDPE N12 or equal) shall be covered by a minimum of two (2) feet of cover unless the Applicant submits detailed plans accompanied by manufacturer's recommendations specifying allowable cover less than two (2) feet in depth.

5. All non-flexible storm sewer pipe and culvert material (including HDPE N12 or equal) shall be covered by a minimum of one (1) foot of cover, from top of pipe to bottom of pavement, unless the Applicant submits detailed plans accompanied by manufacturer's recommendations specifying allowable cover less than one (1) foot in depth.

6. Alignment and Grade. Lay and maintain all pipe at the required lines and grades shown on the drawings.

7. Laying Pipe

   a. Lay pipe in finished trenches commencing at the lowest point so that spigots point in the direction of flow and the bell ends point opposite the direction of flow.

   b. Lay all pipe with ends abutting and true to line and grade. Fit and match pipe so that when laid it forms a sewer with a smooth uniform invert.

   c. Check invert elevation of the pipe immediately upon completion of the joint to assure that it is properly laid to grade and alignment.

   d. Place a rubber stopper or other approved device in the open ends of the pipe at all times when pipe laying is not actually in progress.

e. Correct any over excavation with a minimum of six (6) inches of No. 2 stone. Contractor may top the No. 2 stone with No. 8 stone, if needed.

f) No drainage pipe will be allowed to discharge above ground where inlet structure or storm water pipe is present.

8. Pipe Connections

a. Connections of New Sewer to Existing Sewer Mains

(1) Connect new sewer pipe from structures to the existing sewer main with a wye branch or by cutting into the side of the sewer pipe and installing an approved collar.

(2) Exercise caution in making connection to avoid damage to existing mains which are to remain in service.

(3) When tapping into a HDPE or PVC mainline storm sewer or plastic inlet, an approved fitting must be used. No concrete, adhesive, foam or caulk bulkheads will be permitted without authorization from the City of Jasper

(4) When tapping into a Corrugated Metal, Aluminum, Reinforced Concrete or Vitrified Clay mainline storm sewer or structure the method of tapping and sealing the tap will be determined on a case by case basis and approved by the City of Jasper

(5) Connections must be made with care as to not allow the protrusion of the inserted pipe to go beyond a maximum of twenty five percent (25%) of the main line storm sewer.

(6) Where applicable, pipe connections with the Main Lines must be made above the springline elevation.

(7) Prior to making connection, Contractor must contact the City of Jasper Street Department for guidance and recommendations.

(8) All private drains must be tapped into storm sewer or riser if one is present.

b. Connection of New Sewer Pipe to Existing Manholes or Inlets

(1) Connect new sewer pipe into existing structure by cutting into the side of the structure at the invert elevation shown on the drawings.

(2) Patch interior and exterior of existing structure with a grouted concrete collar.

c. Connection of New Inlets to Existing Sewer Laterals

(1) Cut old sewer pipe at a section as close as practical to the removed inlet or catch basin so that a tight connection may be made at this section.

(2) When removing portions of the existing sewer pipe, provide a neat junction with the extension and leave undamaged that portion of the existing sewer pipe remaining in service.

(3) Repair any damage to the portion remaining in service.

(4) Make connection of new pipe to inlet or existing sewer line with an approved collar to prevent leakage.

9. Construction of Manholes

a. Construct manholes true to line and grade at location indicated on drawings in accordance with the details shown on drawings.

b. Place manholes and catch basins on a minimum of six (6) inches of No. 5 crushed stone that has been mechanically compacted. Where unstable or poor soil conditions exist, place No. 2 crushed stone or Class B concrete shall be placed to form a stable base. The remainder of the manhole shall be backfilled using No. 53 or No. 8 stone. Stone shall be placed in six (6) inch lifts and mechanically compacted to 95 percent maximum dry density as determined by ASTM D 698 (Catch Basin Installation).

10. Poured Concrete Base Sections

a. Moisten subgrade if needed prior to concrete placement.

b. During placement, concrete shall be thoroughly spaded, vibrated or tamped.

11. Construction of Inlets, Area Drains and Catch Basins

a. Follow general guidelines as called out for manholes.

b. Construct all inlets and area drains in accordance with the details shown on the drawings and at the elevations and locations so indicated or established by the Engineer.

c. Grout the interior of the pipe entering structures, using a “Non - Shrink” grout around the connection to prevent leakage.

d. Install casting true to lines and grades indicated on drawings.

e. Frames shall be set to proper alignment and grade and grouted to box with a 1-¼"Butyl rubber preformed flexible adhesive gasket.

12. Piping Beneath Roadways and Walks

a. Flowable fill shall be placed under and within five (5) feet of any street, sidewalk or paved path. A Right of Way Permit will be required for all excavation within the Right of Way.

13. Testing

All storm sewers and manholes shall be soil-tight. The Contractor shall repair all visible points of possible bedding and/or backfill infiltration into the system to the satisfaction of the Inspector. When necessary, the Contractor shall remove and reconstruct as much of the work as is necessary to obtain a system that passes the following minimum tests.

Rigid Wall Pipes

a. After backfilling to at least one foot depth over any section of the sewer that should have uniform grade and straight alignment, flash a light from manhole to manhole. If the view through the line does not show a vertical axis in full pipe diameter and the horizontal axis is at least 7/8 pipe diameter, the pipe shall be removed and replaced as necessary to meet such requirements.

b. If testing indicates work does not meet specified requirement, Contractor must remove work, replace, and retest at no cost to the City.

Flexible Pipes

c. All gravity flow storm sewers constructed of flexible pipe (PVC or HDPE) may be mandrel tested at the City of Jasper's discretion. The Street Department and City Inspector shall notify the contractor of the proposed testing times and location forty-eight (48) hours in advance. Arrangements for the cost and supply of all equipment necessary to perform mandrel tests shall be the responsibility of the Contractors/Developer. The City will provide the mandrels necessary for testing.

(1) A seven and one-half percent (7-1/2%) “GO-NO-GO” Mandrel Deflection Test shall be performed on all flexible gravity storm sewer pipe. These pipes shall be mandrelled with a rigid device sized to pass 7-1/2% or less deflection (or deformation) of the base inside diameter of the pipe. The mandrel test shall be conducted no earlier than thirty (30) days after reaching final trench backfill grade. The mandrel device shall be cylindrical in shape and constructed with nine (9) or ten (10) evenly spaced arms or prongs. Variations of mandrel diameter dimensions due to pipe wall thickness tolerances or ovality shall not be deducted from the diameter dimension of the mandrel but shall be counted as part of the 7-1/2% or lesser deflection allowance. The mandrel diameter dimension shall carry a minimum tolerance of 0.01 inches.

(2) The mandrel shall be hand pulled through all sewer lines and any section of sewer not passing the mandrel shall be uncovered, replaced or repaired and retested. The contact length (L) shall be measured between points of contact on the mandrel arm.

14. Inspection

a. The City Inspector is not required to observe the entire construction activity, but shall be notified and given ample opportunity to inspect the following activities:

(1) Pipe materials prior to installation
(2) Pipe after installation
(3) Before any backfill is installed in pipe
(4) Immediately after aggregate backfill is installed (if applicable)
(5) During the compaction of backfill under paved surfaces (if applicable)
(6) During any testing of the system or backfill density

b. Prior to release of applicable bonds, the storm sewer piping may be video inspected by the City Inspector. The Contractor/ Developer, at their expense, shall be responsible to replace or repair any defects found.

4.8 OPEN CHANNELS

This section includes open channel design criteria. All open channels, if approved by the LPA as a substitute for storm sewers, are subject to the requirements of these standards, whether private or public, and whether constructed on private or public land, shall conform to the design standards and other design requirements contained herein.

A. All construction details shall be as shown on City of Jasper Standard Construction Details, latest revision. The LPA must approve any other alternative method, discrepancy, omission, or duplication of specification standards.

B. Manning's Equation: The waterway for channels with uniform flow shall be determined using Manning's Equation:

$$Q = Av = A \frac{1.486}{n} R^{2/3} S^{1/2}$$

Q = discharge in cubic feet per second (cfs)
A = waterway area of channel in square feet
v = mean velocity of flow in feet per seconds
R = the hydraulic radius in feet R = A/p
S = the slope of the energy grade line in feet per foot
n = the roughness coefficient of the conduit surface(2)

The hydraulic radius (R) is defined as the cross sectional area of flow divided by the wetted flow surface or wetted perimeter.

Roughness coefficient (n) values and maximum permissible velocities for storm water materials are listed in Table 4.8-1 (on the following page).

C. Channel Cross Section: The required channel cross section and grade are determined by the design capacity, the material with which the channel is to be constructed and the requirements for maintenance.

D. Minimum Channel Depth: A minimum channel depth of one (1) foot is required; however, additional depth may be required to provide adequate outlets for tributary drains.

E. All open channel flow shall be capable of accommodating peak runoff for a 50-year return period storm within the drainage easement designated for this channel.

Table 4.8-1
Typical Values of Manning's "n"

Type of Material	Manning's "n"		Max. Velocity fps
Closed Conduits/Culverts:			
PVC Storm Sewer Grades	0.010		15
Concrete (circular or elliptical	0.011		15
Smooth Flow HDPE	0.012		15
Precast Concrete Boxes	0.013		15
C.1 or D.1 S.J. (type/cement lined)	0.013		15
	Manning's "n"		**Max. Velocity fps**
Corrugated Metal Pipe:	**Circle Weld**	**Spiral Weld**	
Unpaved	0.024	0.021	7
25% Paved	0.021	0.018	7
50% Paved	0.018	0.015	7
100% Paved	0.013	0.013	7
Other Concrete Culverts		0.013	
Open Channels:	**Manning's "n"**		
Concrete, Trowel Finish	0.013		
Concrete, Broom or Float Finish	0.015		
Gunite	0.018		
Riprap, Placed	0.030		
Riprap, Dumped	0.035		
Gabions	0.028		
New Earth	0.025		
Mature Earth, Some Weeds	0.030		
Mature, Dense Weeds	0.040		
Mature, Weeds & Brush	0.040		
Swale, Grass Cover	0.035		
OTHER "N" VALUES SHALL BE TAKEN FROM MANUFACTURERS' DATA			

F. Minimum Bottom Width: A minimum flat bottom width of two (2) feet is required for all open drainage channels. Vee-shaped channel bottoms are not allowed.

G. Velocity: The channel grade shall be such that the velocity in the channel is high enough to prevent siltation, but low enough to prevent erosion.

H. Minimum Velocity Set: Velocities less than two (2.0) feet per second should be avoided because siltation will take place and ultimately reduce the channel cross section.

I. Low Velocity Channel Liner: In cases where minimum required grade and/or velocity requirements cannot be met, the LPA shall require concrete channel liners, and/or other methods of maintaining channel grade and cross section integrity.

J. Minimum Grade for Ribbon Liner: All channels constructed within drainage easements with grades less than two percent (2.0%) shall have, as a minimum requirement, flow line grades established with concrete ribbon liners with dimensions as follows:

1. A minimum depth of four (4) inches and

2. A minimum width of twenty-four (24) inches

K. Maintenance of Ditch Grade and Condition: Open channels in storm water drainage systems shall be constructed in such a way that design flow line grades and alignments are clearly defined, and so that alterations to the constructed flow line grades and alignments can be detected readily.

L. Control of Designed Condition:

1. Channels that are likely to become altered or obstructed after construction due to natural or human acts shall have some method of marking the flow line grades and alignments worked into the design and construction of such channels. Such methods include:

a. Ribbon Liners as described in paragraph I above.

b. Invert Elevations: Pipe inlet/outlet locations and invert elevations exactly denoted on the as-built final plans

c. Other Methods: Other methods of marking grades, elevations and alignments as may be developed by the design engineer and/or the advisors to the LPA.

M. Inspection and Ditch Condition Responsibility

1. Periodic Ditch Inspections: The City Inspector shall inspect periodically, or cause to be inspected periodically, all channels to determine the existing condition and to assure that the “as-built” condition is maintained.

2. Obstructions or Alterations: If the City Inspector's inspection determines that the grade, alignment, or general integrity of a channel has been altered, obstructed, or adversely affected by actions of a person not authorized by the LPA to take such actions, the LPA shall order any obstruction or alteration be removed and the channel restored to its approved, or as-built condition according to approved plan(s), and at the expose of the property owner of record.

3. Notification of violation. The order to remove an obstruction or alteration, and/or restore the channel to its approved, designed, or as-built condition shall be mailed to the property owner of record at the address to which county property tax statements are mailed.

4. Timely Completion. If work to restore the channel to its approved condition is not started within ten (10) days, and is not completed within thirty (30) days of the mailing of the notice, the LPA shall contract for the work to be completed, and shall bill the cost to the property owner of record.

N. Waterway Stabilization and Cover: The County Soil and Water Conservation District should be consulted for recommendations on open channel construction and vegetative cover.

1. Grass Mix: The choice of grass mixture for stabilizing open channels shall be based upon specific site condition, such as shade and sun tolerance, velocity tolerance, and waterway maintenance requirements.

2. Timely Seeding: Grass-lined channels should be permanent seeded within two (2) days of finish grading to promote proper seed germination.

O. Erosion Control

1. The bottoms of seeded, grass-lined channels shall have erosion control blankets properly installed.

2. Channels with grades greater than two (2) percent and up to six percent (6%) shall have bottoms lined in staked sod.

3. All channels with grades greater than six percent (6%) shall have bottoms lined with six inch uniform riprap.

4. Side banks of grass-lined channels with a grade of two percent (2%) or greater shall be protected by erosion control blankets installed coincidental with seeding, and in accordance with manufacturer's recommendations.

P. Low Flow Troughs: The bottom width of trapezoidal grass-lined channels shall not exceed fifteen (15) feet unless a paved lower flow liner is provided to prevent flowline meandering.

Q. Trickle Troughs: Grass-lined channels intended to convey a continual trickle flow shall be provided with a paved, low flow liner to prevent chronic wetness.

R. Concrete Channel Liners: Other than in ribbon lined channels as in Paragraph "I" above, concrete channel liners may be used in cut situations in ditches having slopes greater than 3%. If utilized in this type of application, it shall be built as reinforced concrete flumes with cut-off walls at the beginning and end of the liner, poured monolithically with the liner to a depth of eighteen inches (18") below grade; and lugs poured monolithically to a depth of eighteen inches (18"), and spaced at the following intervals:

1. Up to 6% grade: use 100 foot spacing between lugs

2. Greater than 6%: use 50 foot spacing between lugs

S. Open Channel Side Slopes:

1. Earthen Side Slopes: Earthen side slopes shall be no steeper than three to one (3:1); and flatter side slopes may be required to prevent erosion and facilitate maintenance. Other slopes may be approved by the LPA.

2. The LPA will consider other methods of channel lining and other side slope ratios on a case-by-case basis; and render decisions based on submitted designs, applicable standards, manufacturer's recommendation, and other pertinent data.

T. Utilities: Except for approved utility installations crossing open drainage channels, no trench wall shall be allowed within three feet (3') of the top of bank of any open channel; and no utility appurtenance shall be allowed to protrude greater than two inches (2") above finished dirt grade within six feet (6') of the top of bank of any channel.

U. Fencing and Fixtures Restricted: Fencing, landscaping appurtenances, other fixtures, whether publicly or privately owned, as well as designs for combination easement housing public utilities or private appurtenances together with drainage facilities may be allowed by the Board of Public Works and Safety on a case-by-case basis when the plan includes adequate provisions for the perpetual maintenance of unobstructed storm water drainage, after compliance with City of Jasper Easement Encroachment Policy and Procedure.

4.9 TRAFFIC CONTROLS FOR CONSTRUCTION

A. Minimum requirements for traffic controls and maintenance operations shall be in accordance with INDOT Standard Specifications, Sections 801 and 802, unless otherwise required by these standards, and in accordance with the standard details published herein.

B. For small projects, typical sign placement, INDOT Standard Details E801 series drawings shall be made a part of the project. Owner's Engineer shall make note of such on plans and direct potential contractor to include them in their work.

C. For larger projects, the City may request a formal maintenance of traffic plan be developed by the Owner/Developer's Engineer. Said plan shall conform to MUTCD.