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CHAPTER 1 - INTRODUCTION

1.1 Purpose

The purpose of these standard specifications is to outline the work which the contractor will undertake on construction projects within the Fort Wayne service area. These specifications are meant to cover general work in Fort Wayne. Should any construction or requirements not covered by these specifications be anticipated on any proposed work, special provisions for the same will be prepared and included in the contract documents, which special provisions shall be considered as a part of the specifications the same as though contained fully herein.

1.2 Description and Use

1.2.1 Compliance with Other Standards

Compliance with this standard does not eliminate the need to comply with other applicable City, County, State and Federal ordinances, regulations, and construction requirements. This includes, but is not limited to, specifications as outlined by IDEM, INDOT or other governmental agencies.

1.2.2 Conflicting Standards

The provisions of this document shall be deemed as additional requirements to minimum standards required by other applicable ordinances and standards. In the case of conflicting requirements, the most restrictive shall apply.

1.2.3 Waivers and Variance from Standards

Alternative specifications on occasion may be warranted, and a variance from these standards may be permitted. A written request for variance must be made to Water Resources. The request must be based upon sound engineering practice and judgement, and must be supported by adequate justification and data. If a variance is granted, it will apply only to the specific project for which approval is sought. Variance from other City, State and Federal regulations and standards can not be granted by Water Resources.

1.3 Definitions and Symbols

1.3.1 Definitions

The following are definitions and symbols commonly used in the standard specifications.

Backfill – Earth and/or other material used to replace material removed from trenches or other excavations during construction activities. The backfill lies above the pipe bedding.

Bedding – The portion of backfill which encases the sewer pipe to a minimum depth above and below the barrel of the pipe. The bedding serves as the pipe support.

Board – The Board of Public Works for the City of Fort Wayne and any subordinate employee to whom the BOPW shall specifically delegate the responsibility authorized by these standards.

Flexible Pipe – Pipe sufficiently flexible to develop horizontal restraining pressures equal to the vertical pressures if the backfill is well compacted (i.e. CMP, PVC, HDPE); Pipes allowing some degree of deformation.

Force Main – A pipe under internal pressure created by forces on the discharge side of a pump.

Manhole – Sanitary sewer structure through which a person may enter to gain access to an underground sanitary sewer or enclosed structure.

Monolithic – Cast-in-place as one unit.

Plans – Official drawings or reproductions of drawings pertaining to the work associated with specific project.

Precast – An item which is formed or molded and distributed by the manufacturer as a complete unit.

Rigid Pipe – Pipes which do not readily deform (i.e. copper, DI, RCP).

Sanitary Sewer – A pipe or conduit designed to convey wastewater. Storm, surface, and ground waters together with unpolluted industrial wastewaters are not permitted within sanitary sewers.

Storm Sewer – A sewer designated or intended to convey only stormwater, surface runoff, street wash waters, and drainage, and not intended for sanitary sewage and industrial wastes other than unpolluted cooling water. The portion of a sewer intended to carry stormwater only, which begins at the grating or opening where water enters the sewer, through the sewer and any other conduits to the outlet structure where water enters a channel, natural watercourse or combined sewer.

Water Main – Water conduits three inches (3”) in diameter and larger, together with all appurtenances, any necessary valves, fire hydrants, and associated materials receiving potable water and distributing it to more than one customers.

1.3.2 Abbreviations

AASHTO – American Association of State Highway and Transportation Officials

ANSI – American National Standards Institute

ASTM – American Society of Testing Materials

AWWA – American Water Works Association

IDEM – Indiana Department of Environmental Management

INDOT – Indiana Department of Transportation.

NSF – National Sanitation Foundation

1.4 Additional References

Additional references for use with and supplemental to these standard specifications include:

<u>Reference No.</u>	<u>Publication</u>
1	Indiana Department of Transportation Standard Specifications, latest edition.

END CHAPTER 1

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CHAPTER 2 – GENERAL EXCAVATION

2.1 Description

For the purpose of this section, underground conduits shall be considered storm and sanitary sewer pipe, water pipe, or any other pipe conduit indicated on the plans. Wherever the term “pipe” or “pipe line” is used, it shall mean underground conduit.

Excavation and backfill shall include all excavation, backfilling, surface removal, disposal of surplus material, restoration of all disturbed surface, and all other work incidental to the construction of trenches, including any additional excavation which may be required for manholes or other structures forming a part of the pipeline.

2.2 Underground Facilities and Other Utility Structures

The locations of underground facilities shown on the project plans are based on the most accurate information available to Water Resources. The Contractor shall use due caution to avoid damage thereto and shall be responsible for the location and damage to all underground pipes, ducts, conduits, structures, etc.

2.3 Protecting Underground and Surface Structures

Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, water mains and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense to the satisfaction of the Inspector or Engineer.

2.4 Alignment and Grade

All pipe shall be laid and maintained to the required lines and grades. No deviation shall be made from the required line or grade without the written consent of the Engineer or Water Resources.

2.5 Survey Lines and Grades

All survey lines and grades shall be set by the Engineer, unless otherwise specified. The stakes shall be carefully preserved by the Contractor and in case of their continuous or malicious destruction or removal by him, or any of his employees or equipment, such stakes will be replaced by the Engineer at the Contractor’s expense. The cost of replacing such stakes will be computed at an hourly rate per man employed by the Engineer, to be determined at the time of letting of the contract, and shall be deducted from the final payment to the Contractor. No liability will be accepted by the Owner for the time lost by the Contractor through the above.

2.6 Clearing

Areas within the project limits shall be cleared of logs, stumps, brush, vegetation, rubbish and other perishable matter. All rubbish or unsuitable material shall be removed completely. Material unsuitable for filling may not be disposed of on the project site.

Trees shall not be damaged or removed unless such trees interfere with the construction of the work or are detailed as being removed on the project plans. In such cases, the trees shall be removed completely.

The Contractor shall accept the site as he finds it and shall do all work as specified on the drawings or implied thereby.

Open burning of natural growth will not be permitted.

2.6.1 Brush Removal and Disposal

2.6.1.1 Material to be Removed

The term brush shall include all trees and other saplings, and all fallen timber, logs, weeds, driftwood, dead material, rubbish and debris of any nature whatsoever. The removal of brush from any area shall be understood to be the complete removal from job site of all foreign matter, as directed by the Engineer.

2.6.1.2 Limits of Removal

Brush shall be removed as follows: On the improvement, all brush shall be removed from both banks of the drain and to a distance of fifteen feet (15') outside the top of each finished bank, unless otherwise specifically shown; brush shall be removed from the right-of-way. In all cases those items of brush which consist of fallen trees, dead material, rubbish or debris shall be removed within the entire right-of-way whenever any improvement is made. All saplings or heavy brush shall be cut off close to the ground and in no case shall any stump be left to extend above the surface of the ground more than three inches (3"). Whenever any stump on a bank is loosened by excavation, it shall be fully removed and disposed of as brush, and the earth cut away to solid soil and removed from the drain as directed by the Engineer.

Brush shall be disposed of as follows: All trash shall be removed from the improvement to a place agreed upon by the Contractor and Engineer. No open burning will be permitted. The Contractor may elect to dispose of certain material by "chipping"; the material is to be disposed in a manner acceptable to the Engineer as noted above.

2.7 Removal of Excavated Material

All material removed from the trench and not found suitable for use shall be hauled away from the site of the work or excavation and shall be disposed of at a facility provided by the Contractor.

2.8 Manner of Piling Excavated Material

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Fire hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Gutters shall be kept clear or other satisfactory provisions shall be made for street drainage. Natural water sources shall not be obstructed for a period to exceed the normal working day.

2.9 Surface Removal

Along the proposed pipe lines, as indicated on the plans, the Contractor shall remove the surface materials only to such widths as will permit a trench to be excavated, which will afford sufficient room for proper efficiency and proper construction. Where sidewalks, driveways, pavements and curb and gutter are encountered, care shall be taken to protect such against fracture or disturbance beyond reasonable working limits. All pavements shall be cut with an abrasive saw. Concrete streets, driveways, walks, alleys, etc., shall be cut to the nearest joint, or as required by the Engineer.

2.9.1 Care of Surface Material for Reuse

If local conditions permit their reuse, all surface materials suitable for reuse in restoring the surface shall be kept separate from the general excavation materials.

2.10 Width of Excavation

The width of trenches in earth for pipe sewers, basin connections, house connections, water mains and other structures shall be such as to provide a clearance of not less than six (6") inches or more than fifteen (15") inches on each side of the structure.

Sidewalls of pipe trenches shall be vertical from the bottom of the trench to a point not less than twelve (12") inches above the top of the pipe. Above that point, sidewalls may be battered to such slopes as approved by the Engineer. Trench bracing shall be employed, if necessary, to maintain these maximum widths of trench. The bottom of the trench excavation shall conform to the details shown on the plans.

2.11 Excavation Below Grade

In cases where the excavation is carried beyond or below the lines and grades given by the Engineer, the Contractor shall, at his own expense, refill all such excavated space with suitable granular base material.

2.12 Trench Excavation for Change in Grade

If so called out in the contract documents, the Contractor shall include in his bid proposal a unit price of "Trench Excavation". This unit price shall be used in computing the additions or deductions in price per foot of pipe for any adjustments in grades from those which are shown on the plans in excess of nine (9") inches up or down. In calculating the cubic yardage, the maximum trench width of outside pipe diameter plus thirty (30") inches and the change in grade in the excess of nine (9") inches shall be used.

2.13 Subsurface Exploration

All available information and/or written reports on subsurface exploration in the vicinity of proposed pipe line construction will be made available by the Owner for examination by prospective bidders upon request. However, it is expressly understood and agreed that the Owner shall in no way be held responsible for interpretation of this information, its accuracy, or its

thoroughness. Prospective bidders may make such subsurface explorations as they believe necessary to verify and supplement information received from the Owner. The Contractor's bid shall reflect the cost for such work as part of the project cost.

2.14 Short Tunnels or Jacking

In some instances, trees, fire hydrants, sidewalks and other obstructions may be encountered, the proximity of which may be a hindrance to open cut excavation. In such cases, the Contractor shall excavate by means of short tunnels or jacking of pipe in order to protect such obstructions against damage. Unless a bid item appears, all such work shall be considered incidental to the construction of the pipe line and shall not be grounds for extra payment.

2.15 Trenching by Machine or by Hand

The use of trench-digging machinery will be permitted except in places where operation of same will cause damage to trees, buildings, or existing structures above or below ground; in which case, hand methods shall be employed.

2.16 Trenches to be Dry

All water shall be removed from the trench to a depth below the outside of the pipe bell prior to the laying of the pipe or to a depth to prevent boiling of the base material, whichever is greater.

No sanitary sewer shall be used for disposal of trench water, unless specifically approved by the Engineer and then only if the trench water does not ultimately arrive at existing pumping or sewage treatment facilities.

2.17 Base Stabilization

After the trench is excavated to grade, the Engineer will examine the base and determine whether or not it is satisfactory for pipe laying. If the base is not satisfactory, it shall be removed and replaced with crushed stone as ordered by the Engineer. The crushed stone shall have minimum size of one inch (1") and a maximum size of two and one-half inches (2 1/2") and extend a minimum depth of six inches (6") below the barrel of the pipe. Should the base still not be suitable for adequate support of the pipe (i.e. a boiling or quicksand condition, muck, etc.), the Contractor shall bring alternate methods of suitable construction technique to the Engineer for approval; at which time, compensation for additional work shall be negotiated with the Owner, unless specific stabilization techniques are made part of the pay items.

2.18 Dewatering

Dewatering sufficient to maintain the water level below the surface of the trench bottom shall be accomplished prior to pipe laying and jointing, if not done prior to excavation and placement of the bedding as called for. The dewatering operation, however accomplished, shall be carried out so that it does not destroy or weaken the strength of the soil under or along the side of the trench. When the dewatering operation is ended, the trench shall be replaced in such a manner so as not to disturb the pipe and its foundation.

No sanitary sewer shall be used for disposal of trench water, unless specifically approved by the Engineer.

2.19 Dust Control

The Contractor shall maintain filled surfaces which are subject to vehicular traffic in a dust-free condition by the use of approved treatment by the Engineer until final paving or other final treatment of surface is accomplished. The cost of the treatment is considered as incidental and shall not be grounds for extra payment.

2.20 Deviations Occasioned by Other Structures or Utilities

Wherever obstructions are encountered during the progress of the work and interfere to such an extent that an alteration in the plan is required, the Engineer shall have the authority to change the plans and order a deviation from the line and grade or arrange with the owners of the structures for the removal, relocation or reconstruction of the obstructions. Where sewer, gas, water, telephone, electrical or other existing utilities are an impediment to the vertical or horizontal alignment of the proposed pipe line, the Engineer shall order a change in grade or alignment or shall direct the Contractor to arrange with the owners of the utilities for their removal or relocation.

2.21 Interruption to Utilities

The Contractor shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing utility line, he shall immediately notify a responsible official from the organization operating the utility interrupted. The Contractor shall lend all possible assistance in restoring service and shall assume all costs, charges or claims connected with the interruption and repair of such service.

2.22 Interference with and Protection of Streets

When any highway is crossed by open cut, tunneling or otherwise, the specifications and precautionary construction measures required by the respective highway officials shall be followed.

The Contractor shall not close or obstruct any portion of a street without first notifying in writing the Board, Fire Department, Police Department, Transportation Engineering and the City Engineer, unless being handled otherwise in the contract.

The Contractor shall give notice to the Permit Engineer of the Highway or Street Department, a minimum of five (5) working days in advance of starting any work on or affecting the road property or facilities. Additional advance notification may be required by the permitting authority.

Streets, roads, private ways and walks shall be maintained passable by the Contractor at his expense, and the Contractor shall assume full responsibility for the adequacy and safety of provisions made.

2.23 Construction in Easements (Permanent and Temporary)

In easements across private property, the Contractor shall confine all operations in the easement area and shall be responsible and liable for all damage outside of the easement area. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements outside the easement. In general, the easement area is intended to provide reasonable access and working area for efficient operation by the Contractor. When requested, the Owner shall make available to the bidders and furnish to the Contractor a copy of the construction easements.

2.24 Bedding and Backfill Requirements for Underground Conduits

2.24.1 General Requirements

In general, each pipe shall be bedded as specified in the project plans and the Standard Drawings found in Unit VI of this Manual.

All backfill material shall comply with INDOT standards. This shall be designated as granular backfill material, unless otherwise specified by the Engineer or through the project's Special Provisions. The excavated material may be used for backfilling the trench provided the material meets the provisions as set forth in this Manual and is approved by the Engineer as being suitable material.

“Special Backfill” material shall be placed as noted on the plans where the excavated material has been determined not satisfactory for backfill.

2.24.2 Backfilling Compaction

All backfill material shall be compacted to a density of 95 percent as determined by the standard proctor test, which shall be obtained by mechanically tamping the backfill material in six inch (6”) lifts. The Contractor shall show proof of obtaining the required compaction prior to the placement of any permanent surfacing.

The manner in which the Contractor achieves proper compaction shall be demonstrated at the beginning of the project and such method shall be used for the duration of the project.

2.24.2.1 Water Jetting for Compaction

In limited instances and only when approved by Water Resources backfill may be deposited in the trench and compacted by jetting with water. The Contractor shall provide and install weepholes in all structures as shown on the plans and as directed by the Engineer. The water when taken from the City mains and used in this operation shall be paid for by the Owner.

2.24.2.1.1 Jet Holes for Backfill

The holes through which water is injected into the backfill shall be centered over the trench backfill and at longitudinal intervals of not more than six feet (6’). Additional holes shall be provided if

deemed necessary by the Engineer to secure adequate settlement. All holes shall be jetted and shall be carried to a point of one foot (1') above the top of the pipe. Drilling the holes by means of augers or other mechanical means will not be permitted. Care shall be taken in jetting so to prevent direct contact with or disturbance of the pipe.

2.24.2.1.2 Water Jetting

The water shall be injected at a pressure and rate just sufficient to sink holes at a moderate rate. After a hole has been jetted to the required depth, the water shall continue to be injected until it begins to overflow the surface. The Contractor shall, at his own expense, bore test holes at such locations as the Engineer may designate in order to determine the effectiveness of the water jetting. An approved soil auger shall be used for boring test holes. As soon as the jetting has been completed, all holes shall be filled with soil and compacted. Surface depressions resulting from backfill subsidence caused by jetting shall be filled and recompacted by tamping or rolling to the satisfaction of the Engineer.

2.24.3 Payment for "Special Backfill"

All "Special Backfill" material called for herein shall be paid for in cubic yards calculated by the following formulae and shall include the cost for the complete removal and hauling away of the unsuitable material and placement of the "Special Backfill":

$$1. \quad CY = \frac{(L + D) (D) (W)}{27}$$

$$2. \quad CY = \frac{(L) (D) (W)}{27}$$

Where:

- CY = The maximum cubic yards of backfill to be paid
L = The actual length of cut at the surface in feet requiring backfill material
D = The vertical distances in feet from the surface to a point one foot (1') above the top of the pipe.
W = The width of the trench, in feet, having a maximum pay width of OD + 30 inches (OD = outside diameter of installed pipe), also subject to actual trench width, whichever is less.

Equation No. 1 is used when the trench is cut perpendicular to the road rights-of-way and Equation No. 2 is the general equation for cuts parallel to the rights-of-way and driveway crossings.

The cost of any surface replacement required over this backfill material shall not be included in this bid item.

2.25 Barricades, Guards and Safety Provisions

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, warning lights, and guards as required shall be placed and maintained during the progress of the construction work and until it is safe to use the construction area for its normal purposes. Wherever required, the Contractor shall provide a watchman to prevent accidents. Rules and regulations of all authorities having jurisdiction over safety provisions shall be observed.

2.26 Traffic and Utility Controls

Excavations for pipe laying operations shall be conducted in a manner to cause the least interruption to traffic. Where traffic must cross open trenches, the Contractor shall provide suitable bridging, especially at street intersections and driveways. Fire hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire or police call boxes, or other utility controls shall be left unobstructed and accessible during the construction period. Traffic control signs may only be removed after proper notification to the Traffic Engineering Division of the respective Highway Department.

2.27 Flow of Drains and Sewer Maintained

Adequate provisions shall be made for the flow of sewers, drains and water courses encountered during construction. The structures which may have been disturbed shall be satisfactorily restored upon completion of the work.

2.28 Property Protection

Trees, fences, poles and all other property shall be protected unless their removal is authorized. Any property damaged shall be satisfactorily restored by the Contractor, at the Contractor's expense.

2.29 Interruption of Water Service

No valve or other control on the existing water system shall be operated for any purpose by the Contractor without prior approval from Water Maintenance. Water Maintenance and all consumers affected by such operation shall be notified by the Contractor at 48 hours before the operation and advised of the probable time when the service will be restored.

2.30 Braced and Sheeted Trenches

2.30.1 Placement of Sheeting

All sheeting shall be closely driven and to such a depth below the bottom of the sewer as directed. The sides of the trenches and excavation shall be firmly supported by the sheeting and bracing. When ordered by the Engineer and in such a manner as directed, the sheeting shall be cut and left in place for the protection of pipes and other structures.

2.30.2 Contractor's Responsibility for Sheeting

The Contractor will be held accountable and responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the

improper quality, strength, placing, maintaining or removing of the same. In no case shall sheeting be removed until the trench backfill has reached within two feet (2') of the top of the trench, except that the lower course of sheeting may be removed from a double-sheeted trench. In all cases, sheeting shall be driven ahead of excavation.

2.30.3 Payment for Sheeting

Payment for sheeting and bracing, and all work incidental to sheeting and bracing, shall be paid on the price per square foot basis.

END CHAPTER 2

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CHAPTER 3 – STORM AND SANITARY SEWER INSTALLATION AND TESTING

3.1 Laying Pipe

All pipe shall be reinspected for soundness and damage due to handling immediately before being lowered into the trench. Any pipe found to be unsound or damaged will be rejected, and shall be removed immediately from the site of work.

All pipe shall be laid accurately to the required line and grade given by the Engineer and in such manner as to form a close, concentric joint with the adjoining pipe and to bring the invert of each section to the required grade. Bell holes shall be dug in advance of the pipe being laid as required. The supporting of the pipe on blocks will not be permitted.

Pipe laying shall proceed upgrade, beginning at the lower end of the sewer, unless otherwise approved by the Engineer.

All open ends of pipe and branches shall be sealed with plugs or bulkheads firmly held in place in a manner acceptable to the Engineer. No special payments will be made for the placement or removal of said plugs or bulkheads. At the end of each day's work, the open ends of all pipes shall be satisfactorily protected against the entrance of animals, earth or other materials.

Each length or section shall be properly pulled or shoved "home" with a wench or "come-a-long" against the section previously laid to make a proper joint. The pipe shall then be securely held in position during the backfill operations. Joints shall not be pulled or cramped more than the design of the joint will permit and so as not to damage the conduit.

3.2 Sewer Line Connections

Sewer line connections to trunks, mains, laterals or side sewers shall be left uncovered until after an acceptance inspection has been made by the Engineer or Inspector. After approval of the connection, the bare pipe shall be covered with compacted granular material to a minimum depth of twelve (12") inches above the crown of the pipe. The trench shall then be fully backfilled as required. No existing storm sewer, storm drain or drain tile shall be connected to a sanitary sewer.

Sump pumps discharging foundation drains only are considered storm sewers. Sump pumps for foundation drains that also contain sanitary water from sinks, washers, showers or other sources of wastewater should be separated.

3.3 Service Risers (Deep Connections)

Where the depth of the sewer is greater than ten (10') feet below the surface of the ground, or otherwise specified by the plans and/or Engineer, a service riser shall be constructed to an elevation of eight (8') feet below the ground elevation or as directed by the Engineer.

The service riser shall be constructed as shown in the Standard Drawings in Unit VI.

The riser pipe shall extend to the proper elevation and shall terminate with an approved plug. A 2" x 4" x 36" wooden stake shall mark the point of the riser's terminus for a future extension.

Extreme care shall be taken in backfilling around the risers. Where the excavated material is not suitable for this purpose, in the opinion of the Engineer, acceptable granular material shall be placed around the riser.

3.4 Method of Payment

3.4.1 General

The method of payment throughout shall be on the unit prices which appear on the bid sheet, and the Contractor shall prepare and submit his bid proposal accordingly, unless otherwise directed by the Engineer.

3.4.2 Payment for Pipe

The unit pipe price (lineal feet) shall include all the following work: excavation, disposal of the excavation, base stabilization, dewatering, the pipe, approved joints, class of bedding, backfill material and placement, utility adjustments, temporary surface, pavement removal, testing of materials and any other requirements to complete the construction in accordance with the contract plans and specifications, unless otherwise broken down by the Engineer as a separate bid item.

The final payment shall be based upon the actual field measurement of pipe footage installed. The field measurements shall be from the inside face of one manhole or structure to the inside face of the next manhole or structure. The footage within the manhole or structure shall not be paid for as lineal footage of pipe placed and shall be included in the unit price bid per manhole or structure.

3.4.3 Payment for Tees, Wyes and Service Risers

Payment for tees, wyes, fittings and service risers with cap and/or plugs shall be at the unit contract price "per each" for each size, class and type. No additional compensation will be allowed for providing the cap and plug.

3.5 Manholes for Sanitary and Storm Sewers

3.5.1 Description

Manholes shall be built where shown on the plans, or where the Engineer may direct. They must be built according to the detail drawings supplied by the Engineer and in accordance with these specifications and the Standard Drawings found in Unit VI.

The top(s) of the manhole(s) shall be flush with the proposed elevation(s) on the plans, unless otherwise directed by the project plans or the Engineer. All manholes shall be equipped with approved steps, made and placed as shown on the Standard Drawings.

Cones and barrel sections shall be substantially free from fractures, large or deep cracks and surface roughness. Slabs shall be sound and free from gravel pockets.

Monolithic concrete manholes shall conform to the contract drawings and/or the drawings as set out in Unit VI of this Manual. Walls and base dimensions shall be of approved thickness.

3.5.2 Manhole Construction Details

3.5.2.1 Dewatering

Dewatering of the site shall conform to the same requirements as for sewer trench dewatering.

Sub-base preparation is an adequate foundation for all manhole structures and shall be obtained by removal and replacement of unsuitable material with four inch (4") minimum crushed stone, or by such other means as provided for foundation preparation of the connected sewers, or as required in the Special Provisions.

3.5.2.2 Bedding

Precast base sections shall be placed on a well graded granular bedding course conforming to the requirements for sewer bedding, but not less than four inches (4") in thickness and extended to the limits of the excavation. The bedding course shall be firmly tamped and made smooth and level to assure uniform contact and support of the precast element.

3.5.2.3 Cast-in-Place Bases

Unless otherwise specified, cast-in-place bases shall be at least six inches (6") in thickness and shall extend at least six inches (6") radially outside of the outside dimensions of the manhole section. The cast-in-place base shall be made of 4,000 psi concrete, 28 day compression test, and shall be reinforced as shown on the Standard Drawings in Unit VI, or as otherwise specified.

3.5.2.4 Lift Holes and Joints

All lift holes and all joints between precast elements in manholes shall be thoroughly wetted and then be completely filled with mortar, smoothed and painted both inside and out, to ensure water tightness.

All joints between precast elements in manholes shall be made with an approved mastic material and/or an approved rubber gasket in accordance with ASTM C-443, latest edition.

Precast sections shall be placed and aligned to provide vertical sides and vertical alignment of the ladder rungs. The completed manhole shall be rigid, true to dimensions and be watertight.

3.5.2.5 Placing of Castings

Castings placed on concrete surface shall be set in full mortar beds. The mortar shall be mixed in proportion of one (1) part Portland Cement to two (2) parts sand, by volume, based on dry materials. Castings shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary or unless otherwise specified by the Engineer.

3.5.2.5.1 In Paved Streets

Where work is in paved streets or areas which have been brought to grade, not more than fifteen inches (15") shall be provided between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to finished street grade.

3.5.2.5.2 In Unpaved Streets or Alleys

Where work is in the unpaved streets or alleys, not less than twelve inches (12") of adjusting rings shall be provided between the top of the cone or slab and the underside of the manhole casting for adjustment of the casting to finished grade. The top of the manhole casting shall be flush with the finished grade, unless otherwise directed by the Engineer.

3.5.2.5.3 Within Cultivated and Non-Cultivated Areas

Where work is in cultivated areas, the top of the manhole casting shall be exposed one foot (1') and in non-cultivated areas the casting shall be flush with the finished grade, unless otherwise directed by the Engineer.

3.5.2.5.4 Reducing Cones

Where the last manhole section is a reducing cone and it is set to final grade as required by the Engineer, then if as part of the continuous work it becomes necessary to lower this casting and it entails going below the cone, compensation to the Contractor will be allowed for said adjustment and changing of the manhole stacks.

3.5.2.5.5 Adjusting Rings

When adjusting rings are used to set the castings to grade they shall be pointed up and made watertight by using ½" preformed sealant or equivalent approved in the center of the ring along with the necessary grout inside and out.

3.5.3 Channels and Inverts

Channels and inverts shall be made to conform accurately to the sewer characteristics and grades and shall be brought together smoothly with well-rounded junctions, satisfactory to the Engineer and in conformance with the Standard Drawings, unless otherwise directed.

3.5.4 Pipe-Manhole Connection

Pipe joints are to be firmly full of jointing material to ensure watertightness. The pipes shall not protrude into the inside face of the manhole, as measured along the horizontal center of the pipe unless the pipe is placed through the entire diameter of the manhole.

Pipe connections shall be in accordance with the Standard Drawings found in Unit VI of this Manual. When new holes are required in the manhole they shall be core drilled in a circle of the required diameter and then knocked out. In no instance shall new holes be sledge hammered out.

3.5.5 Controls and/or Flow Measuring Manhole

An inspection manhole having a minimum diameter of forty-eight inches (48") and conforming to the Standard Drawings is required for all commercial and industrial buildings, unless otherwise designated by the Engineer. The manhole shall be constructed on the building service sewer, on private property, before it connects to the sewer main, and preferably shall not be closer than five feet (5') to the building being served. There shall be no flow into the inspection manhole except flow from the building for which the inspection manhole is intended. Manholes constructed on public sewer, or on sewers receiving other flows, are not considered inspection manholes. (All "Control Manholes" shall conform to the Municipal Code Chapter 24).

3.5.6 Payment for Manholes

This unit price, per each manhole, shall include all the following work: pavement removal, excavation, disposal of excavation, base stabilization, dewatering, sheeting, precast manhole sections or poured in place concrete, castings, steps, backfill material and placement, utility adjustments, temporary pavement replacement if necessary, and any other requirements to complete the construction in accordance with the contract plans and specifications, unless otherwise broken down by the Engineer as a separate bid item.

3.6 Catch Basins, Inlets and Special Structures

3.6.1 Description

This work shall consist of catch basins, inlets and special structures, together with the necessary gray cast iron or ductile iron frames, grates, or lids, all construction in accordance with the specifications where indicated or directed by the Engineer, and conforming in all respects to lines, grades, and dimensions shown on the plans and the Standard Drawings, unless otherwise directed by the Engineer.

3.6.2 Material

All materials shall conform to the material requirements and standard drawings for manholes found in Units V and VI of this Manual.

3.6.3 Construction Methods

3.6.3.1 Concrete

Poured or precast concrete structures shall be constructed in accordance with applicable provisions of Unit V – Materials and Unit VI – Standard Drawings.

3.6.3.2 Precast Reinforced Concrete Sections

Precast reinforced concrete sections shall be laid in mortar, composed of one (1) part cement to three (3) parts sand, by volume, based on dry materials, or on an approved mastic material.

3.6.3.3 Placing of Castings

Castings placed on concrete or precast concrete surfaces shall be set in full mortar beds. The mortar shall be mixed in proportions of one (1) part cement to three (3) parts sand, based on dry materials. Castings shall conform to the Standard Drawings and shall be set accurately to the finished elevation so that no subsequent adjustment will be necessary.

3.6.3.4 Cleaning

All newly constructed catch basins, inlets and special structures shall be cleaned of any accumulation of silt, debris, or foreign matter of any kind, and shall be free from such accumulations at the time of final inspections.

3.6.4 Payment for Catch Basin, Inlets and Special Structures

This work will be at the contract unit price each for catch basin, inlet or special structure and shall include all the following work: pavement removal, excavation, disposal or excavation, base stabilization, dewatering, sheeting, precast sections or poured in place concrete, channels, inverts, castings, steps, backfill material and placement, utility adjustments, temporary pavement replacement if necessary, and any other requirements to complete the construction in accordance with these contract plans and specifications, unless otherwise broken down by the Engineer as a separate bid item.

3.7 Building Service Sewer

Pipe material for building sewers shall be in accordance with the provisions outlined in Unit V of this Manual. All Contractors who connect, install, repair and/or replace building service sewers shall be required to have a valid sewer license or registration to do work with the City of Fort Wayne. Examinations shall be required for new applicants and those whose licenses have been expired for more than one (1) year. The examination will require the knowledge of installation, workmanship, materials, safety and health regulations, liability, City standards and specifications, Fort Wayne Municipal Code Chapter 51 and any other necessary information to determine the experience and knowledge of the Contractor to install a building service sewer. After successfully passing the examination, the Contractor purchases a license to install building service sewers good for the current calendar year and renewable annually on the first of each

succeeding year. The Contractor is also responsible for posting a performance bond and certificate of liability insurance with the City of Fort Wayne. Values of the performance and liability insurance will be established in City Municipal Code and the General Rules and Regulations of the Board of Public Works.

The type of building service sewer pipe to be used shall be as shown on the plans, described in the Special Provisions and/or indicated in writing when the building service sewer permit request is made by the Contractor.

3.7.1 Fittings and Plugs

Unless otherwise specified, tee or wye fittings shall be provided in the sanitary sewer main for service sewer connections. A log of all tee or wye fitting locations shall be kept by the Contractor during installation, and one (1) legible copy of such log shall be turned over to the Engineer and/or his representative prior to completion. Tees or wyes shall be six inches (6") minimum inside diameter, unless otherwise approved by Water Resources. All fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface. Building service sewers shall be connected to the tee, wye, or riser provided in the public sewer where such is available, utilizing approved fittings, or adapters. Where no tee, wye or riser is provided or available, connections shall be made by a method approved by Water Resources. All fittings shall be capped with a plug of the same material as the pipe and gasketed with the same gasket material as the pipe joint, or be of a material approved by the Engineer. The plug shall be able to withstand all test pressures involved without leakage.

3.7.2 Construction Details for Building Service Sewers

Building service sewer construction shall conform to all applicable ordinances or regulations, unless otherwise stated in the Special Provisions. The Contractor, or his representative, will obtain any necessary permits for a building service sewer construction.

Unless otherwise authorized by the Engineer and approved by the main Contractor, construction of a building service sewer shall proceed only after the main sewer at the point of connection, has been accepted by the Board.

Excavation and backfilling for building service sewers shall conform to the requirements of other sewers, and the Water Resources Standard Specifications, except that no backfilling excess of that required to hold the pipe in true alignment shall be placed prior to inspection.

3.7.2.1 Width of Excavation

The width of trenches for pipe sewers, basin connections, house connections, and other structures shall be such as to provide a clearance of not less than six inches (6") or more than fifteen inches (15") on each side of the structure. All pavements shall be cut with an abrasive saw and concrete driveways, walks, alleys, etc., cut to the nearest joint.

Sidewalls of pipe trenches shall be vertical from the bottom of the trench to a point not less than twelve inches (12") above the top of the pipe. Above that point, sidewalls may be battered to such slopes as approved by the Engineer.

Trench bracing shall be employed, if necessary, to maintain these maximum widths of trench. The bottom on the trench excavation shall conform to the details shown to the plans.

3.7.2.2 Pipe Laying and Jointing

Pipe laying and jointing, except as hereinafter provided, shall, in general, conform to the requirements for sanitary sewers. During the pipe laying and jointing, the service shall be kept free of any water, dirt or objectionable matter. Pipe shall be laid in a straight line at a uniform grade between fittings, on a uniform horizontal or vertical curvature achieved by deflecting pipe joints within the limits recommended by the manufacturer of the pipe used, unless otherwise designated by the Engineer. The pipe cover material shall be as previously specified under the sanitary sewer backfill requirements. The minimum depth of the pipe cover for service connections, above the top of the outside of the pipe, shall be three feet (3') for frost protection.

3.7.2.3 Sewer Line Connections

Sewer line connections to trunks, mains, laterals or side sewers shall be left uncovered until after an acceptance inspection has been made by the Engineer. After approval of the connection, the bare pipe shall be covered with compacted granular material to a minimum depth of twelve inches (12") above the crown of the pipe. The trench shall then be fully backfilled as required. No existing sewer, storm drain, or drain tile shall be connected to a sanitary sewer.

3.7.2.4 Cleanouts

Cleanouts shall be provided at locations and in accordance with details shown on the plans or according to these standards. The maximum length of a building service sewer will preferably be one hundred feet (100'). If that length is exceeded, an intermediate manhole or cleanout shall be built, unless otherwise approved by Water Resources.

3.7.3 Inspection

Prior to backfilling the service pipe, every building service sewer regardless of size shall be inspected by a representative of the Engineer. A minimum of three (3) hours notice shall be given to the New Water/Sewer Permit Department of the City of Fort Wayne at phone number (219) 427-1161 for completing this inspection. The hours for sewer tap inspections are from 8:00 a.m. to 3:00 p.m., five (5) days a week, excluding holidays.

3.8 Tests for Sanitary Sewer

3.8.1 Sewer Pipe Test

All sewer pipe shall meet the requirements for the appropriate ASTM, ANSI, or AWWA tests, latest edition, requirements for the pipe. The number of specimens to be tested shall not exceed one percent (1%) of the number of pipes of each size furnished, except that no less than three (3) specimens shall be tested.

3.8.2 Pipe Joints Tests

All gasket type joints shall either conform to the requirements of ASTM or ANSI, latest edition, for the sewer pipe. The manufacturer of the joint or joint material shall certify to the Owner as to the performance of the joint which shall not exceed the infiltration requirements for the sewer.

3.8.3 Low Pressure Air Test (Gravity Sewers)

3.8.3.1 Air Test for Acceptance

For all gravity sewers, unless otherwise designated, the Contractor shall furnish all special plugs, compressor, gauges, relief valves, etc., as required, and perform a low pressure air test under observation and subject to the approval of the Engineer or his representative. The section of pipe between successive manholes shall be sealed with suitable plugs. One of the plugs shall have an orifice through which to pass air into the section of pipe being tested. The air supply line shall have a positive on-off valve and suitable means for readily disconnecting it at the control panel. A second orifice in the plug shall be used for constantly reading the internal pressure of the pipe. This orifice shall be continuously connected to a pressure gauge having a range from 0 to 10 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of plus or minus 0.04 psi. The line under test shall be pressurized to approximately 4 psi. The air supply will then be shut off and the pressure will be allowed to stabilize for a minimum of 2 minutes. If during this period the pressure has dropped below 3.5 psi, more air shall be introduced to raise the pressure to a minimum of 3.5 psi. After this stabilization period the air supply line shall be disconnected and timing will begin. The time of the test in minutes will be equivalent to one-half of the nominal diameter of the pipe being tested. As an example, for an 8-inch pipe the time period will be four (4) minutes; for a 10-inch pipe, five (5) minutes; etc. The maximum allowable pressure drop during the specified time period will be 1.0 psi.

NOTE: The low pressure air test is an acceptance test intended to enable detection of pipe damaged during installation of improper jointing and not intended to be an indicator of possible water leakage under service conditions. The infiltration or exfiltration test as detailed in following sections shall apply when required by the Engineer.

3.8.3.2 Payment

Payment for the cost of low pressure air testing of sewers shall be included in the contract unit price per lineal foot of main line sewer for the various sizes of sewer as set out in the proposal.

3.8.4 Deflection Test (Mandrel Test)

Deflection test shall be required for all flexible conduits before final acceptance of the work and shall be performed not earlier than thirty (30) days after the installation and complete backfilling of the conduit. A properly sized "go-no go" Mandrel device shall be used to perform the deflection test. The allowable conduit deflection (reduction in

vertical inside diameter) shall not exceed five percent (5%). In the event that the deflection exceeds the five percent (5%) limit, the Contractor, at his expense, shall be directed by the Engineer to excavate and repair the conduit by either re-bedding it or completely replacing it.

3.8.4.1 Payment

Payment for deflection testing of flexible sewers shall be included in the Contractor's unit price per lineal foot of sewer pipe complete in place.

3.8.5 Tests for Flexible Conduits

Flexible conduits shall be tested by any one or more of the following methods before acceptance by the City.

Infiltration/Exfiltration	- 200 gpd/mile/in of diameter
Air Test	- Not to exceed 1 psi loss in air pressure from 3.5 psi in 4 minutes *
“Mandrel” Test	- 5% maximum deflection of actual inside diameter (Go/No Go)
TV	- Visual acceptance

* For Eight (8) inch pipe

3.8.6 Water Test of Sewer

3.8.6.1 Amount of Test

The entire sewer may be tested at the option of the Engineer for leakage of water, as a measure of infiltration under service as specified herein. Such tests shall be made under the supervision of the Engineer and subject to his approval.

3.8.6.2 Section Test

Successive sections of completed sewer, each including not less than one (1) manhole structure, shall be tightly bulkheaded at each end, filled with water, checked for leakage and pumped out so that the entire sewer, including all structures constructed under this contract, shall be tested and rendered acceptable in accordance with the following standards and procedures. Any section found to have leakage in excess of that permitted herein shall be repaired and retested until leakage shall be within the limits specified.

3.8.7 Infiltration Tests

If required by the contract documents, the tests for infiltration shall be performed by the Engineer or his representative. Tests will be made for each pipe size and over the entire

length of that size pipe, with the standard V-Notch weir installation. The tests can at the option of the Engineer, be made between manholes until the trouble area or areas have been located and corrected to within the allowable of 200 gpd/mile/inch of diameter of the pipe for each section of pipe.

3.8.8 Exfiltration Tests

If required by the contract documents, this test shall be made between two (2) successive manholes by closing the lower end of the sewer to be tested and the inlet sewer of the upper manhole with stoppers and filling the pipe and manhole with water to a point four feet (4') above the top of pipe of the open sewer in the upstream manhole. The Engineer shall note the drop in head and calculate the leakage.

3.8.9 Infiltration/Exfiltration Tests for Sanitary Sewers

The allowable infiltration/exfiltration for any portion of the sanitary sewer shall not exceed 200 gpd/mile/inch of diameter of the pipe. In accordance with these specifications, the maximum allowable quantity shall be as set forth in the following tabulations:

<u>PIPE DIAMETER</u> (inches)	=	<u>ALLOWABLE QUANTITY</u> (in Gal/Day/1 ft)
6" x 0.037878787	=	0.2273
8" x 0.037878787	=	0.3030
10" x 0.037878787	=	0.3788
12" x 0.037878787	=	0.4545
15" x 0.037878787	=	0.5682
18" x 0.037878787	=	0.6818
21" x 0.037878787	=	0.7955
24" x 0.037878787	=	0.9091
27" x 0.037878787	=	1.0227
30" x 0.037878787	=	1.1364
33" x 0.037878787	=	1.2500
36" x 0.037878787	=	1.3636
42" x 0.037878787	=	1.5909
48" x 0.037878787	=	1.8182
54" x 0.037878787	=	2.0455
60" x 0.037878787	=	2.2727
66" x 0.037878787	=	2.5000
72" x 0.037878787	=	2.7273
78" x 0.037878787	=	2.9546
84" x 0.037878787	=	3.1818
90" x 0.037878787	=	3.4091
96" x 0.037878787	=	3.6364
102" x 0.037878787	=	3.8636

If the infiltration/exfiltration in any section of the sewer is greater than the above-mentioned figure, the Contractor shall not be paid for that section of sewer until said

section is made watertight such that the infiltration is equal to or less than the above-mentioned figure.

3.8.10 Water Test Procedures

Test procedures for each section shall be as follows:

3.8.10.1 Bulkhead

Bulkhead each end of section tightly and securely, including at least one (1) manhole structure between the bulkhead.

3.8.10.2 Fill

Fill section of sewer with water to a level not lower than a joint four (4') feet above the top of the sewer pipe at the upstream manhole, and not lower than four (4') feet above existing ground water level at the section. Water for test purposes may be pumped from streams or taken from municipal water supply at the option and expense of the Contractor.

3.8.10.3 Maintain Water Level

Maintain water level at the elevation determined above for a period of twenty-four (24) hours, by the measured addition of water. An accurate record of the amount of water, in gallons, required to maintain the constant level as stated above shall be kept by the Contractor and made available to the Engineer.

3.8.10.4 Pump Out

Pump out all water from the sewer at the end of the test and discharge same into the nearest stream. When a stream is not reasonably available for such discharge, water may be disposed of in the vicinity as directed by the Engineer.

3.8.10.5 Repair

Repair to the satisfaction of the Engineer any section of sewer found to permit leakage beyond the limits set forth herein and retest. No portion of the sewer, which fails to meet these test requirements, will be accepted.

3.8.10.6 Payment

Payment for the cost of the infiltration or exfiltration test shall be included in the Contractor's unit price per lineal foot of sewer pipe complete in place.

3.8.11 Testing Force Main

3.8.11.1 Procedure

The force main, or sections thereof, shall be tested by the Contractor in the presence of the Engineer and all leaks shall be made tight to meet the requirements below. The Contractor shall furnish all pipe, bulkheads, taps,

pumps, gauges, and other equipment required to carry out the tests, using water from City water mains. The section of main to be tested shall be filled with water and the entrained air within the pipe removed or absorbed and pumped up to a pressure of 100 psi, and the test period shall start immediately thereafter. The line shall then be maintained under this test pressure for a continuous period of six (6) hours by pumping water into the line at frequent intervals. The volume of water so added shall be measured and considered to represent the leakage from the line under test during the interval. The leakage under the conditions of test shall not exceed the value of one hundred (100) gallons per twenty-four (24) hours per mile of pipe per inch normal diameter for pipe in twelve to sixteen foot (12-16') lengths, seventy-five (75) gallons for pipe in sixteen foot (16') lengths and greater.

3.8.11.2 Repair

In the event that the leakage exceeds the specified amount, the joints in the line shall be carefully inspected for leaks and recaulked or repaired where necessary. Any pipes or special castings found to be cracked shall be removed and replaced by new pieces by the Contractor. After this work has been done, the test shall be repeated. Final acceptance of the lines will not be made until satisfactory tests have been passed.

3.8.11.3 Payment

Payment for pressure testing of force mains shall be included in the Contractor's unit price per lineal foot of force main complete in place.

3.9 Underground Conduit Constructed in Tunnels

3.9.1 Permits

Where shown on the plans or where specifically authorized by the Engineer, pipe lines shall be constructed in tunnels. This work will be made in accordance with the requirements of any permits obtained from railroads, State, County, or City Highway Department, or in accordance with the following paragraphs.

3.9.2 Materials

Pipe materials shall be as shown on the plans or as described in the Special Provisions or as described in Unit V of this Manual for tunneling support.

3.9.3 Excavation and Laying

Requirements for excavation and laying and for joints shall be those applicable for the type of pipe line involved, unless otherwise specified.

3.9.4 Method of Construction

When it is necessary to install a sewer line beneath a highway or railroad track by tunneling methods, the methods of tunneling shall be an acceptable type approved by the Highway Department or the railroad affected.

3.9.5 Use of Casing Pipe

The Contractor shall use steel casing or linear plates as a tunnel liner. The diameter, gauge and type of such pipe, method of placing and method of installing pipe within it shall be subject to the plans and approval of the Engineer. The entire void space between tunnel liners and pipe shall be filled with pressure grout or other approved materials.

3.9.6 Boring of Pipe

Contractor shall bore and/or auger sewer at the locations as specified on "Contract Drawings". Boring and/or augering shall be done by using a steel casing pipe and to the grade tolerance specified.

3.9.7 Jacking of Pipe

The Contractor may, subject to the approval of the Engineer, use specifically designated reinforced concrete pipe jacked into position with or without tunnel liners. In such cases, all conditions of the performance of the work shall be subject to the approval of the Engineer.

3.9.8 Measurement and Payment

Underground conduit constructed in tunnels will be paid for at the unit price bid for "Tunneling", "Boring", or "Jacking". The pay item will cover the various type and pipe sizes for the actual length of tunnel work as shown on the plans. Payment shall include all labor, materials, and equipment necessary to construct the conduit and tunnel, complete in place, including excavation and backfill grouting, shoring and bracing.

3.10 Concrete Cradle and Encasement

3.10.1 Application

Where subgrade conditions, in the opinion of the Engineer, warrant extra precautions for the bedding or encasement of pipe, the Engineer may order the construction of a concrete cradle and/or encasement to be installed in conformance with the size and dimensions indicated on the plans. All concrete used in the concrete cradle shall have a minimum compressive strength of 4,000 psi at 28 days.

3.10.2 Measurement and Payment

Payment for furnishing concrete when ordered by the Engineer shall be made at the contract unit price per cubic yard for concrete. The contract price for concrete shall also include the cost of removing and disposing of the material replaced by the concrete.

END CHAPTER 3

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CHAPTER 4 – WATER MAIN INSTALLATION AND TESTING

4.1 Handling Pipe and Accessories

4.1.1 Care

All materials furnished by the Contractor or furnished by the Utility and hauled to the site of construction by the Contractor, including pipe, fittings, valves, hydrants and other accessories, shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the Contractor. They shall at all times be handled with care to avoid damage. In loading and unloading, they shall be lifted by hoists or slid and rolled on skidways in such manner as to avoid shock. Under no circumstances shall they be dropped. Pipe handled on skidways must not be allowed to roll against pipe already on the ground.

4.1.2 Care of Pipe Coating and Lining

Pipe shall be handled so as to avoid damage to the coating and lining. If, however, any part of the coating or lining is damaged, repair shall be made by the Contractor at his expense in a manner satisfactory to the Engineer or Inspector assigned to the project, before such damaged pipe is installed.

4.1.3 At Site of Work and Bell Ends, How Faced

Pipe should be distributed on the site of the work parallel with and opposite or near the place it is to be laid in the trench and with bell ends facing the direction in which the work will proceed, unless otherwise directed.

4.1.4 Frost Protection

Valves and fire hydrants, before installation, shall be drained and stored in a manner that will protect them from damage by freezing.

4.2 Alignment and Grade

All pipe shall be laid and maintained to the required lines and grades; with fittings, valves, and fire hydrants at the required locations; with joint centered and spigot home; and with all valve and fire hydrant stems plumb. No deviation shall be made from the required line or grade without the written consent of the Engineer or Water Resources.

4.3 Excavation and Preparation of Trench and Tunnels

4.3.1 Description

The trench shall be dug to the alignment and depth required but only so far in advance of pipe laying as the Engineer or Inspector shall permit. The trench shall be so braced and drained in such that workmen may perform their duties therein safely and efficiently. It is essential that the discharge from pumps be led to natural drainage channels, to drains, or to storm sewers if approved by Water Resources.

4.3.2 Width

The trench width may vary with and depend upon the depth of trench and the nature of the excavated material encountered; but in any case, shall be of ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly.

The minimum width of unsheeted trench, if the soil shows a tendency to cave or slide, shall be one foot (1') greater than the nominal diameter of the pipe, except by consent of the Engineer. The maximum clear width of trench shall not be more than fifteen inches (15") greater than the external diameter of the pipe.

4.3.3 Pipe Foundation

Unless otherwise specified all water mains are to be installed with an AWWA C150, Type 4 laying condition.

4.3.4 Bell Holes Required

Bell holes of ample dimensions shall be dug in earth trenches at each joint where gravel bedding is not provided to permit the jointing to be made properly.

4.3.5 Braced and Sheeted Trenches

Wherever necessary to prevent caving, excavations in sand, gravel, sandy soil, or other unstable material shall be adequately sheeted and braced. Where sheeting and bracing are used, the trench width shall be increased accordingly. Trench sheeting shall remain in place until the pipe has been laid, tested for defects and repaired if necessary, and the earth around it compacted to a depth of at least two feet (2') over the top of the pipe.

4.4 Pipe Laying

4.4.1 Materials Inspection

Before lowering any materials in to the trench for assembly, the pipe, fitting, valve or fire hydrant shall be thoroughly inspected in an appropriate manner so as to determine any defects or damage. Any unsound pipe, valve, fire hydrant or fitting shall be rejected.

4.4.2 Unsuitable Conditions for Laying Pipe

No pipe shall be laid in water, or when the trench conditions or the weather is unsuitable for such work, except by permission of the Engineer.

4.4.3 Pipe to be Clean

When the pipe is laid, it shall be free of all foreign matter. Pipes twenty inches (20") and under in diameter may be cleaned by flushing in place under the supervision of the Engineer or Inspector if in his opinion, the pipe contains dirt that can be removed; if not, then the pipe shall be cleaned by swabbing and flushing before it is placed in the trench. All pipes larger than twenty inches (20") in diameter shall be swabbed out and thoroughly cleaned, to the satisfaction of the Engineer or Inspector, before placing in the trench.

4.4.4 Manner of Handling Pipe and Accessories into Trench

Proper implements, tools and facilities satisfactory to the Engineer or Inspector shall be provided and used by the Contractor for the safe and convenient prosecution of the work.

All pipe, fittings, valves, and fire hydrants shall be carefully lowered into the trench piece by piece by means of derrick, ropes, or other suitable tools or equipment, in such manner as to prevent damage to pipe or pipe coating and/or pipe lining. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

4.4.5 Laying the Pipe

Unless the Engineer or Inspector shall permit otherwise, after placing a length of pipe in the trench, the gasket material for the joint shall be properly positioned. The spigot end shall then be centered in the bell, the pipe forced "home" and brought in to true alignment. It shall then be secured with backfill carefully tamped under and on each side, except at the bell holes. Care should be taken to prevent dirt from entering the joint space.

4.4.6 Preventing Trench Water from Entering Pipe

At times when pipe laying is not in progress, the open ends of pipe shall be closed by approved means, and at no time shall trench water be permitted to enter the pipe.

4.4.7 Cutting Pipe

Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe. Wherever it is necessary to cut cast-iron pipe, which pipe is equipped with a slip joint type bell end, the cut end of the pipe shall be adequately beveled so as to prevent the edge of the cut pipe from cutting or tearing the gasket as the spigot end is inserted into the bell of the adjoining pipe or fitting.

4.4.8 Bell Ends to Face Direction of Laying

Unless otherwise directed, pipe shall be laid with bell ends facing in the direction of laying. Where lines are on an appreciable slope, bells shall, at the discretion of the Engineer or Inspector, face upgrade.

4.4.9 Backfill Material

All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks, stones, frozen soil, or other material that in the opinion of the Engineer, is unsuitable. Backfill material shall be one of the following three (3) types, as directed by the Engineer.

4.4.9.1 Type "A" Backfill

Shall be #53 or #73 stone meeting the gradation set forth in INDOT 903.

4.4.9.2 Type “B” Backfill

Granular material meeting the gradation set forth in INDOT Section 311, Special Fill and Backfill (“B” Borrow), except that no more than 12 percent (12%) or less than five percent (5%) shall pass the No. 200 sieve (silt or clay).

4.4.9.3 Type “C” Backfill

Excavated material of acceptable quality, free from rocks, boulders, large or frozen lumps, wood or other extraneous material.

4.4.9.4 Backfill Zones

For purposes of defining the specific backfill requirements, the excavated trench section is divided into three (3) backfill zones: pipe zone, backfill zone and restoration zone.

4.4.9.4.1 Pipe Zone

The pipe zone is that area of the trench from the undisturbed soil below the pipe to the top of the bedding material. Unless otherwise specified all water mains are to be installed with an AWWA C150, Type 4 laying condition. The pipe is to be bedded in sand, gravel or crushed stone to a depth of 1/8 pipe diameter, or a minimum of four inches (4”) below the pipe. Backfill is to be compacted, minimum 80 percent (80%) Standard Proctor, to top of pipe.

4.4.9.4.2 Backfill Zone

The backfill zone is that area above the pipe zone and below the restoration zone, or surface. Backfill material used in this area may be Type “A”, Type “B”, or Type “C” as defined by the Engineer and/or approved by the regulatory authority having jurisdiction of the area. Unless otherwise specified, written approval must be obtained from Water Resources prior to using Type “C” backfill.

4.4.9.4.3 Restoration Zone

The restoration zone is that area from the surface to a point 15 inches (15”) below the top of the trench. Materials to be used in this area will depend upon the type of restoration required. In paved areas, the top surface shall be restored to 4/3 the depth of the existing surface and the balance of the restoration zone shall be Type “A” backfill. In trenches not requiring pavement restoration, or parallel with sidewalks, Type “B” or Type “C” material may be used as directed. Final restoration shall be made in accordance with these specifications and/or the permit requirements of the regulatory authority.

4.4.9.5 Rock and Boulder Exclusion

No rock, boulders or stone larger than eight inches (8") in its greatest dimensions may be used in backfilling within one foot (1') of the top of the pipe.

4.4.9.6 Deficiency of Backfill

Any deficiency in the quantity of material for backfilling trenches, making restoration, or filling depressions caused by settlement of caused by the rejection of the unsuitable excavated material, shall be provided by the Contractor.

4.4.10 Compaction

Type "A" and "B" backfill material shall be com[pe]cted to ninety-five (95%) density as determined by the Modified Proctor Test. Compaction may be obtained by mechanical tamping the material in six inch (6") lifts.

It shall be the Contractor's responsibility to prove that he has achieved the required 95 percent (95%) test compaction. This may require the employment of an outside independent testing laboratory. No additional payment will be made to the Contractor for such tests.

4.4.11 Boring, Tunneling and Jacking

When it is necessary or required to install a water main beneath a highway or railroad trackage by boring tunneling, or jacking methods, the water main (carrier pipe) shall be placed in a casing pipe that is acceptable to and approved by the respective highway department or railroad company affected.

4.4.11.1 Highway Crossing

The Contractor shall give notice to the Permit Engineer of the respective highway department a minimum of five (5) days in advance of starting any work on or affecting the highway property or facilities. Additional, advance notification may be required by the permitting authority.

During the installation of the casing pipe, the tunnel and the excavated materials' pit shall be adequately dewatered so as to prevent damage to highway property and to insure safe and reasonable working conditions.

Tunneling methods, supports and operations shall be subject to the approval of the representative of the respective highway department assigned to inspect the work. Proper backfilling must be done around the tunnel lining in order to prevent any settling of the pavement and right-of-way.

No open cut shall be permitted paralleling any highway and within six feet (6') of or within the area below a 1:1 slope from the edge of the pavement or stabilized shoulder, unless adequate shoring and bracing is provided to prevent caving and/or undermining of the highway or its subbase of sub-structures.

The length and location of casing pipes under highways shall be as indicated on the plans. For 30 inch (30") and larger water mains, the casing shall be of the liner plate type installed by tunneling methods. Placement of the sections of the liner plate shall be made as tunneling progresses. For 24 inches (24") and smaller water mains, the casing shall be of the steel pipe type, placed by boring methods.

4.4.11.2 Railroad Crossing

When any railroad is crossed, all precautionary construction measures required by railroad officials shall be followed.

The Contractor shall give notice to the Division Engineer of the railroad a minimum of 48 hours in advance of starting any work on or affecting the railroad property or facilities. Additional, advance notification may be required by the permitting authority.

During the installation of the casing pipe, the tunnel and the excavated materials' pit shall be adequately dewatered so as to prevent damage to railroad property and to insure safe and reasonable working conditions.

No open cut shall be permitted along any railroad trackage and within 13 feet of the centerline of the trackage unless adequate shoring and bracing is provided to prevent caving and/or undermining of the railroad structures or trackage.

Water mains installed under railroad trackage shall be placed in a casing pipe, the length and location of which is indicated on the plans. For 30 inch (30") and larger water mains, the casing shall be of the liner plate type installed by tunneling methods. Placement of the sections of liner plate shall be made as tunneling progresses. For 24 inch (24") and smaller water mains, the casing shall be of the steel pipe type, placed by boring methods.

4.4.11.3 Boring

The clear inside diameter of the casing pipe shall be such that the water main can be placed without damage to coating on either the casing or the water main, and so there will be a minimum of two inches (2") of clearance between the bell of the water main and the clear inside of the casing pipe after placement of the water main. Chocks or skids shall be placed on the water main to ensure approximate centering within the casing pipe and to prevent damage during installation. Metal-to-metal contact should be avoided.

Such casing pipe shall be bituminous coated inside and outside. Thickness or gauge of metal shall be as specified by the highway department or railroad affected.

4.4.11.4 Tunnel Liners

Tunnel liner plates shall be of the corrugated type (Armco offset-type liner plate or approved equal). The liner plate sections shall be 18 inches (18") wide

and a minimum of 36 inches (36”) in length. All plates shall be punched for bolting on both longitudinal and circumferential seams and shall be so fabricated as to permit complete erection from the inside of the tunnel. The liner plates shall have a neutral axis diameter and section modulus corresponding to the requirements shown hereafter in the “Liner Plate Section Modulus Table” for the respective sizes of water main and depths of cover. The Section modulus as given in this table is in inches cubed per inch of plate width based on the average for one ring of plates. The thickness of the metal for these steel plates shall be adequate to give the minimum section modulus as hereafter described, allowing for standard deductible mill tolerances. The liner plates shall be furnished new and unused, made of black iron and equipped with an adequate number and size of grout holes so as to grout the void which may occur outside the liner plate as hereafter prescribed. The liner plate tunnel shall be designed based on the requirements for “Continuous Load-Carrying Structures – E-72 Loading.”

Liner Plate Section Modulus Table

Water Main Nominal Dia. (inches)	Liner Plate Neutral Axis Dia. (inches)	Min. Section Modulus for various height of cover over tunnel (cover in feet – section modulus in inches cubed/inch of plate width)					
		4'-5'	6'-10'	11-15'	16-20'	21-25'	26-30'
30	60	0.0457	0.0457	0.0457	0.0457	0.0457	0.0457
36	66	0.0590	0.0457	0.0457	0.0457	0.0457	0.0590
42	72	0.0590	0.0457	0.0457	0.0457	0.0457	0.0590
48	78	0.0726	0.0590	0.0590	0.0590	0.0590	0.0276
54	84	0.0726	0.0590	0.0590	0.0590	0.0590	0.0726
60	90	0.0798	0.0726	0.0726	0.0726	0.0726	0.0798

After the installation of the various sections of liner plate, and when required by highway and/or railroad officials, the void between the liner plate and the tunnel wall shall be completely filled with grout, mixed eight (8) parts dense sand and one (1) part Portland cement.

The water main (carrier pipe) shall be placed in the tunnel so that it will be centered laterally and placed on timer skidways such that the minimum distance between the flanges of the liner plate and the bells of the pipe shall be two inches (2”). After placement of the water main pipe, and after the grouting of any joints of the water main pipe, the area between the liner plates and the water pipe shall be backfilled with dense sand, blow or tamped in place so as to completely fill the area between the water main pipe and the casing pipe.

4.4.11.5 Ends of Casing Pipes and Tunnels Bulkheaded

The ends of the casing pipes and tunnel liners shall be bulkheaded in such manner as to prevent entrance of foreign material, but not tightly sealed as to prevent escape of water in case of failure of the water main.

4.5 Jointing Pipe

4.5.1 Preparation of Pipe Ends

Before laying the pipes, all lumps, blisters, and excess coating shall be removed from the bell and spigot ends of each pipe. The pipe ends shall then be wire brushed and wiped until clean and dry. Where mechanical joints or slip joints are specified, oil and grease also shall be removed. Pipe ends shall be kept clean until joints are made. The spigot end of pipe for mechanical joints shall be lubricated with a soapy solution before installing the gaskets and the soapy solution brushed over the gaskets just prior to installation in the bell.

4.5.2 Making Up Slip-Joints

After the preparation of the pipe ends for a slip-joint, the gasket shall be inserted in the bell or on the spigot, as appropriate. Both the bell and the spigot ends of the pipe, including the gasket shall be lubricated with the proper joint lubricant and the spigot shall be centered and pushed or jacked "home". In the case of prestressed concrete pipe, the gasket shall be checked to insure its proper seating and the joint shall be mortared, both inside and outside as recommended by the supplier.

4.5.3 Making Up Mechanical Joints

After the preparation of the pipe ends for a mechanical joint, the gasket shall be inserted in the bell by drawing the gland toward the bell. The bolts shall be drawn up uniformly on opposite sides of the pipe with a ten inch (10") torque wrench, to 57 to 90 foot-pounds for 3/4" diameter bolts and 100-120 foot-pounds for one inch (1") diameter bolts.

4.6 Setting Valves, Valve Boxes, Fittings, and Blow-Offs

4.6.1 Valves

Gate valves, butterfly valves, and pipe fittings shall be set and jointed to new pipe in the manner heretofore specified. All valves shall be located such that they will be within parkstrip areas (grass area between sidewalk and curb) unless specifically noted to be located elsewhere on the plans or unless written approval is granted by Engineer to place them in other locations. All effort should be made to avoid placement of valves in street pavement areas.

4.6.2 Valve Boxes

Cast iron valve boxes shall be firmly supported, and maintained centered and plumb over the operating nut of the valve, with box cover flush with the surface of the finished pavement or finished grade of the surrounding area or at such other level as may be directed.

4.6.3 Back-Siphonage to be Prevented

Drainage branches or blow-offs shall not be connected to any sewer or submerged in any stream or be installed in any other manner that will permit back-siphonage of contaminated water into the distribution system.

4.7 Setting Fire Hydrants

4.7.1 Anchorage for Fire Hydrants

All fire hydrants shall be restrained to the auxiliary valve and the valve restrained in accordance with the applicable construction standards of the Water Utility.

4.7.2 Cleaning

Hydrants shall be thoroughly cleaned of dirt, or foreign matter before setting.

4.8 Plugging Dead Ends

Standard plugs shall be inserted into the bells of all dead ends of pipes, tees, or crosses, and at locations specified on the plans, and spigot ends shall be capped. Plugs shall be jointed to the pipe or fitting in the manner specified in these specifications.

4.9 Anchorage of Bends, Tees and Plugs

Adequate precautions shall be taken to prevent the separation of joints at tees, elbows and plugged ends. This shall be done by the use of restrained joints, as shown in the Standard Drawings in Unit VI, on the appropriate plans, described in the Special Provisions or supplementary specifications for the project, or as directed by the Engineer or Inspector.

4.9.1 Restrained Joints

Restrained joints, details of design, construction, application, installation and number of joints necessary for the restraint of a given thrust shall meet the Water Resource Standards. The design shall also include the strengthening of the pipe walls such that they will also withstand the added longitudinal tensile loading as necessary. These details shall be approved by Water Resources in writing before their manufacture and shipment to the site of construction for installation.

4.9.2 Material for Reaction Blocking

Where reaction or thrust blocking is permitted, it shall be of concrete of a mix not leaner than one (1) cement, two and one-half (2 ½) sand, five (5) stone, having compressive strength of not less than 2,000 pounds per square inch, after 28 days. Blocking shall be placed between solid undisturbed ground and the fitting to be anchored; the area of bearing on pipe and on ground in each instance shall be that required in the Standard Drawings. The blocking shall, unless otherwise directed, be so placed that the pipe and fitting joints will be accessible for repair. Concrete blockings shall be acceptable only when specified on plans and/or after written approval of the Engineer is received.

4.9.3 Metal Harness

Steel rods, clamps, and washers shall be cadmium plated, with a minimum of 6.0 mils thickness, placed after threads are cut, and shall be coated with yellow chromate, or otherwise rustproof treated.

4.10 Restoration and Clean-Up

4.10.1 Restoration of Working Area in General

The Contractor shall be responsible for the restoration of pavement, curbs and gutters, sidewalks, shrubbery, trees, fences, sod, driveways, or any other damage he may have caused during the course of installation of the water line. The Contractor shall make a diligent effort to protect property adjacent to his zone of operations.

4.10.2 Maintenance of Surface

Following final payment and acceptance by the Utility and in accordance with the Maintenance Bond provided, the Contractor shall maintain the surface of the repaved areas, curbs, gutters, unpaved trenches, shrubbery, fences, sod, seeded areas, and other surfaces disturbed for a period of one (1) year.

4.10.3 Replacement of Drainage and Sewer Lines and Structures

The Contractor shall replace or repair all drainage and sewer lines and structures removed or damaged in the course of constructing the water main in accordance with the plans for the project and to the satisfaction of the Engineer and/or the governing agency.

4.10.3.1 Drainage or Sewer Pipe or Structure Replacement

All drainage or sewer structures damaged or removed shall be replaced in accordance with details shown on the project plans, as directed by the Engineer, or as detailed in this Manual.

4.11 Cleaning up

Surplus pipe line material shall be returned to the Water Utility's yards where the Water Utility supplied the material, and to the Contractor's yards where the Contractor supplied the materials. Tools and temporary structures shall be removed by the Contractor, and all dirt, rubbish, and excess earth from excavations shall be hauled to a disposal facility provided by the Contractor and the construction site shall be left clean, to the satisfaction of the Engineer or Inspector.

4.12 Hydrostatic Tests

4.12.1 Time For Making Test

Pipes jointed may be subjected to hydrostatic pressure, inspected, and tested for leakage at any convenient time after completion of backfill and after adequate curing time has been allowed if reaction blocking is used.

4.12.2 Pressure During Test

After the pipe has been laid and backfilled, all newly laid pipe, or any valved section of it shall, unless otherwise specified, be subjected to hydrostatic pressure of 125 pounds per square inch.

4.12.3 Duration of Pressure Test

The duration of each pressure test shall be at least two (2) hours.

4.12.4 Procedure

Each valved section of the pipe shall be slowly filled with water and all foreign matter flushed out of the section(s) of pipe to be tested. The specified test pressure shall then be applied by means of a pump connected to the pipe in a satisfactory manner. The pump pipe connection, and all necessary apparatus shall be furnished by the Utility. The Utility will furnish gauges and measuring devices for the test and will make all taps into the pipe, but the Contractor shall furnish all necessary assistance for conducting the tests if required by the Utility.

4.12.5 Expelling Air Before Test

Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made by the Utility, if necessary, at points of highest elevation, and afterward tightly plugged.

4.12.6 Correction Due to Failure of Test

Leakage detected at mechanical joints shall be stopped by tightening the gland, and leaking slip joints shall be equipped with bell joint clamps to stop the leakage. Any cracked or defective pipes, fittings, valves or fire hydrants discovered as a result of this pressure test shall be removed and replaced by the Contractor with sound material and then the test shall be repeated until satisfactory to the Engineer.

4.12.7 Leakage

Leakage is defined as the quantity of water to be supplied in to the newly laid pipe, or any valved section of it, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

4.12.7.1 Permissible Leakage

Suitable means shall be provided by the Utility for determining the quantity of water lost by leakage under static pressure test. No mechanical or slip-joint pipe installation will be accepted until or unless this leakage is less than the limits set out below for corresponding pipe diameter.

Allowable Leakage per 1000 feet of pipeline at 125 psi Test Pressure
(gallons per hour)

<u>Size</u>	<u>Leakage</u>	<u>Size</u>	<u>Leakage</u>
4"	0.34	24"	2.01
6"	0.50	30"	2.52
8"	0.67	36"	3.02
10"	0.84	42"	3.53
12"	1.01	48"	4.03
16"	1.34	54"	4.53
20"	1.68		

The above table is based on mechanical or push-on joint with 18-foot nominal lengths. Allowable leakage for pipe with 20-foot nominal lengths, shall be determined by multiplying the above leakage by 0.9.

4.7.12.2 Variation from Permissible Leakage

Should any test of combined sections of pipe laid disclose leakage greater than that specified in the above sections, or if individual sections shown leakage greater than 25 percent above the specified limit, the Contractor shall, at his own expense, locate and repair the defective joints until the leakage is within the specified allowance.

4.13 Disinfection of Mains

Disinfection of mains shall be performed by the Utility, but the Contractor will be expected to aid in this work if requested by the Engineer. This work is to begin after the main, or sections thereof, has been filled with water for testing as specified. Disinfection shall be according to the latest revision of American Water Works Association's Standard C 651, "Standard for Disinfecting Water Main", or other accepted standards. The Utility shall furnish the chlorine, all necessary equipment for its application, the water, and make all bacteriological analysis.

END CHAPTER 4

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CHAPTER 5 – CONCRETE INSTALLATION AND TESTING

5.1 Portland Cement

The cement shall conform to the “Standard Specifications for Concrete Aggregates” (ASTM C33), provided, however, that aggregates which have been shown by test or actual service to produce concrete of the required strength, durability, watertightness, fire-resistance and wearing qualities may be used under Article 7, Method 2, where authorized by the Engineer.

5.2 Aggregate

The maximum size of the aggregate shall not be larger than one-fifth (1/5) of the narrowest dimension between forms of the member for which the concrete is to be used nor larger than three-fourths (3/4) of the minimum clear spacing between reinforcing bars.

5.3 Water

Water used in mixing concrete shall be clean and free from deleterious amounts of alkalis, acids, or organic materials.

5.4 Storage of Materials

Cement and aggregates shall be stored at the work in such a manner as to prevent deterioration or intrusion of foreign matter. Any material which has deteriorated or which has been damaged or mixed with other aggregates or foreign matter shall not be used for concrete.

5.5 Concrete Quality and Working Stresses

5.5.1 Concrete Quality

The working stresses for the design of this work are based on the specified minimum ultimate 28-day compressive strength of the concrete. The concrete shall be constructed of six percent (6%) air entrained, six (6) bag mix and a twenty-eight (28) day compressive strength of 4,000 psi. In no case shall the water used, including any free water in the aggregate, exceed 5.8 gallon per bag (94#) of cement used.

5.5.2 Concrete Proportions and Consistency

5.5.2.1 Method of Mixing

The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will readily flow into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to collect on the surface. The combined aggregates shall be of such composition of sizes that when separated on the No. 4 standard sieve, the weight passing the sieve (fine aggregate) shall not be less than 30 percent (30%) nor greater than 50 percent (50%) of the total, unless otherwise required by the Engineer, and with the exception that these proportions do not necessarily apply to lightweight aggregates.

5.5.2.2 Measurement of Materials

The methods of measuring concrete materials shall be such that the proportions can be accurately controlled and easily checked at any time during the work. Measurement of materials for ready-mixed concrete shall conform to the "Standard Specifications for Ready-Mixed Concrete" (ASTM C94).

5.5.2.3 Weight of Materials

Measurements of concrete materials shall be by weight, unless specifically directed by the Engineer.

5.5.3 Removal of Water from Excavation

Water shall be removed from the place of deposit before concrete is placed, unless otherwise directed by the Engineer. Any flow of water into the place of deposit shall be diverted through proper side drains to a pump, or be removed by other approved methods which will avoid washing the freshly deposited concrete. Water vent pipes and drains shall be filled by grouting or otherwise after the concrete has thoroughly hardened.

5.5.4 Cleaning Forms and Equipment

Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned. All debris and ice shall be removed from the space to be occupied by the concrete. Forms shall be thoroughly wetted (except in freezing weather) or oiled, and clay or cement tile that will be in contact with concrete shall be well drenched (except in freezing weather). Reinforcement shall be thoroughly cleaned of ice or other coatings.

5.5.5 Inspection

Concrete shall not be placed until the forms and reinforcement have been inspected and approved by the Engineer or his authorized representative.

5.5.6 Transporting Concrete

5.5.6.1 Control

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent the separation or loss of the ingredients. It shall be deposited nearly as practicable in its final position to avoid rehandling or flowing. Under no circumstances shall concrete that has partially hardened be deposited in the work.

5.5.6.2 Method of Handling

Carts, buggies or conveyors shall generally be used for transporting concrete from mixer to final place of deposit. Delivery carts or buggies shall be kept on temporary runways. Runway supports shall not bear upon reinforcing steel or fresh concrete.

5.5.6.3 Dumping Concrete

Concrete shall not be dumped into carts or buggies from mixer with a free fall of more than three feet (3').

5.5.6.4 Use of Chute

Chuting of concrete shall be allowed only with special approval of the Engineer or his representatives. In such cases, the slope of the chute shall be such as to allow the concrete to flow without separation of the ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. When the operation is intermittent, the chute shall discharge into a hopper. The chute shall be thoroughly flushed with water before and after each run. The water used for this purpose shall be discharged outside the forms.

5.5.7 Placing Concrete

5.5.7.1 Care of Handling

Special care must be exercised to prevent splashing the forms or reinforcement with concrete, and any such splashes or accumulations of hardened or partially hardened concrete on the forms or reinforcement above the general level of the concrete already in place must be removed before the work proceeds. Concrete shall be placed in the forms for all exterior walls and other places where the concrete is to be exposed in such a way as to prevent segregation. All concrete for walls shall be placed through openings in the inside form spaced at frequent intervals or through "elephant trunks" (heavy duck canvas or galvanized iron trunks) equipped with suitable hopper heads. Trunks shall be of variable lengths so that the free fall shall not exceed three feet (3') and a sufficient number shall be placed in the forms to insure the concrete is being kept level at all times.

5.5.7.2 Puddling and Vibration

Concrete shall be thoroughly compacted by puddling with suitable tools during the operation of placing, and thoroughly worked around the reinforcement, around embedded fixtures, and into the corners of the forms. All concrete placed in forms shall be vibrated by a mechanical vibrator of a type that comes in contact with the concrete only and is in no way in contact with the forms or reinforcing steel. Sufficient machines shall be provided to vibrate thoroughly all concrete placed; provided, however, there shall be at least two (2) machines in good working order on site of the work at all times. In thin wall construction, the type of vibrator used shall be limited to that concrete which has been freshly placed for a period of not more than twenty (20) seconds; and in no case shall it be extended to previously placed batches. Use of mechanical vibrators does not take the place of puddling or spading by hand; rather, it shall be considered an additional placing operation.

5.5.7.3 Unusual Conditions for Puddling

Where conditions make puddling difficult, or where the reinforcement is congested, batches of mortar containing the same proportion of cement to sand

used in the concrete shall first be deposited in the forms and the operation of filling with the regularly specified mix be carried on at such a rate that this mix is at all times plastic and flows readily into the spaces between the bars.

5.5.7.4 Continuous Placement

When concreting is once started, it shall be carried on as a continuous operation until the place of the section or panel, limits of which are defined on the drawings by construction joints, is completed.

5.5.7.5 Record

A record shall be kept on the work site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the Engineer.

5.5.8 Construction Joints and Stoppages

5.5.8.1 Limits of Placement

The placing of concrete shall be carried on continuously between construction joints shown on the drawings. If for any reason it shall become necessary to stop placing concrete at points other than those indicated on the drawings, such points shall have the approval of the Engineer, and the manner of making the joint shall be approved.

5.5.8.2 Leveling

The surface of the concrete shall be level whenever a run of concrete is topped. To insure a level, straight joint on the exposed surface of walls, a strip of one-inch (1") sheathing shall be tacked to the forms at the outside surface of the wall. The concrete shall be carried about one-half inch (1/2") above the underside of the strip. About one (1) hour after the concrete is placed, the strip shall be removed, and any irregularities in the joint line shall be leveled off. All lattice shall be removed and the surface broomed. Wherever horizontal construction joints are made, stud bolts shall be provided three to four inches (3-4") below the joint which is used to tighten the forms for the next lift against the hardened concrete.

5.5.8.3 Vertical Stops

Vertical stops shall be placed at interior corners only, unless otherwise shown on the drawings or approved by the Engineer.

5.5.8.4 Elapse Time Between Placements

At least twelve (12) hours must elapse after depositing concrete in the columns or walls before depositing in beams, girders or slabs supported thereon. Beams, girders, brackets, column capitals and haunches shall be considered as part of the floor system and shall be placed monolithically therewith.

5.6 Depositing Against Other Concrete

Before depositing new concrete on or against concrete which has hardened, the forms shall be retightened. The surface of the hardened concrete shall be roughened, as required, thoroughly cleaned of foreign matter and lattice, and moistened with water. The new concrete placed in contact with the hardened or partially hardened concrete shall contain an excess of water to insure bond. To insure sufficient mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and moistened surface of the hardened concrete, including vertical and inclined surfaces, shall first be slushed with a two inch to three inch (2-3") coating of cement grout against which the new concrete shall be placed before the grout has attained its initial set.

5.7 Protecting and Curing

All forms containing concrete and the top of the concrete, shall be kept moist continuously as directed by the Engineer, until removal of said forms. All exposed concrete shall be maintained in a moist condition for not less than seven (7) consecutive days after removal of forms.

Weather conditions may modify curing requirements, in which case the Contractor shall be governed accordingly, subject to approval of the Engineer.

5.8 Design of Forms

Forms shall conform to the shape, lines and dimensions of the member as called for on the plans. They shall be substantial and sufficiently tight to prevent leakage of mortar and shall be properly braced or tied together so as to maintain position and shape and assure safety to workmen and passers-by. Temporary openings shall be provided where necessary to facilitate cleaning and inspection immediately before depositing concrete.

Form faces for exposed concrete shall be of tamped "Masonite", or equal, and properly oiled with a non-staining form oil.

5.9 Form Ties

Form ties shall be of such type that the tie rods can be completely removed from the concrete and the holes plugged as hereinafter specified. In order to facilitate the removal of the ties, they shall be coated with an approved cup grease. Care shall be taken in removing the ties, pulling them in such a manner as to avoid spoiling the exposed surface. Cutting ties back from face of wall will not be permitted. Ties having cone-shaped spreaders shall not be used in exposed walls.

5.10 Removal of Forms

The removal of forms shall be carried out in such a manner as to assure the complete safety of the structure. Where the structure as a whole is supported on shores, removable floor forms, beams and girder sides, column and similar vertical forms may be removed within twenty-four (24) hours providing the concrete has hardened sufficiently to permit their removal with safety. Shoring shall not be removed until the member has acquired sufficient strength to support safely its weight and the load upon it.

5.11 Making, Placing and Curing Concrete

5.11.1 Making, Placing and Curing Concrete in Warm Weather

All concrete work performed during warm weather shall comply with Indiana State Highway Standards and Specifications, latest edition.

5.11.2 Making, Placing and Curing Concrete in Cold Weather

When placing concrete at or below a temperature of forty degrees (40°) Fahrenheit or whenever, in the opinion of the Engineer, atmospheric temperatures will probably fall below this limit within the next twenty-four (24) hour period, the mixing water and aggregates shall be heated, and the freshly placed concrete shall be protected by adequate housing or covering and heating.

5.11.2.1 Equipment for Covering and Heating

The Contractor shall have on the job, ready to install, adequate equipment for heating the materials and the freshly placed concrete, and for enclosing the work in accordance with the requirements specified herein.

5.11.2.2 Temperature of the Concrete

Concrete when placed in the forms shall have a temperature of not less than seventy degrees (70°) Fahrenheit, nor more than ninety degrees (90°) Fahrenheit. Freshly laid concrete and the surrounding air shall be maintained at a temperature of fifty degrees (50°) Fahrenheit or greater for a period of seventy-two (72) hours after placing. The methods of protection and curing shall be such as to prevent evaporation of moisture from the concrete and injury to the surface.

5.11.2.3 Temperature Records

During pouring and curing periods, a permanent temperature record shall be kept showing the date, hour, outside temperature and temperatures at several points within the enclosure to show the most favorable and unfavorable conditions to which the concrete is subjected. Thermometer readings shall be taken at the start of the work in the morning and again in the late afternoon, and the data so obtained shall be recorded in such a manner that it will show the location of each reading and any conditions which might have an affect on the temperature. A copy of the temperature record shall be made available to the Engineer.

5.11.2.4 Protection of Temperatures

Before concreting any section of a structure, the section shall be completely housed or enclosed in a manner that will insure the maintenance of the specified temperatures. The housing shall be left in place for the curing period specified, except that sections may be temporarily removed as required to accommodate the placing of column forms or concrete, provided that they are replaced immediately after the form or concrete is in its final position.

5.11.2.5 Open Areas of Exposure

In placing floor slabs, tarpaulins supported on horses or other framework shall follow closely the placing of the concrete so that only a few feet of the finished slab is exposed to the outside atmosphere at any one time. Such tarpaulins shall be arranged so that heated air from the space below can circulate freely in the space between the tarpaulin and the freshly placed concrete. If necessary, in order to maintain the proper temperatures between the slab and the tarpaulins, temporary openings may be left in the floor and forms to facilitate the circulation of warm air in this space. Such openings shall be at the center of panels and shall not exceed eighteen inches (18") in their greatest dimension.

5.11.2.6 Exposure Time

Top covers may be removed between the hours of 8:00 a.m. and 5:00 p.m. on days when the temperature is above thirty-five degrees (35°) Fahrenheit to permit erection of forms, but they shall be replaced not later than 5:00 p.m.

5.11.2.7 Moisture Control

Within the enclosure, such means of artificial heat shall be provided as will maintain the temperatures specified continuously and with a reasonable degree of uniformity in all parts of the enclosure. All exposed concrete surfaces within the heated area will be wet down with a hose stream at least once every twenty-four (24) hours during the hardening period, except where a steam curing is provided.

5.11.2.8 Fire Protection

The Contractor shall provide adequate fire protection accessible at all times where heating is in progress and shall maintain watchmen or other attendants to keep the heating units in continuous operation.

5.11.2.9 Heating Appliances

Heating appliances shall not be placed in such a manner as to endanger form work or centering or expose any area of concrete to drying out or other injury due to excessive temperatures.

5.11.2.10 Heating of Materials

Either aggregates or water, or both, as may be necessary, shall be heated with steam coils or other devices so that the average temperatures of the concrete as it is deposited in a form shall fall within the limits specified above. Aggregates containing frozen lumps, ice or snow shall not be allowed to enter the mixer.

5.11.2.11 Anti-Freeze Compounds

The use of salts, chemicals, or other foreign materials in the mix to lower the freeze point of the concrete is strictly prohibited.

5.11.2.12 Accelerators

Admixtures intended to accelerate the hardening of the concrete or to produce higher than normal strengths at early periods will be permitted only upon written approval of the Engineer and then only in percentages which will not have an injurious affect on the normal quantities of the concrete.

5.11.2.13 Preparation of Forms

Before placing the concrete in any form or on any surface, or around reinforcement, heat shall be applied in such a manner that ice or snow will be completely removed.

No concrete shall be placed on a sub-grade that is frozen or on one that contains frozen materials.

5.11.2.14 Removal of Forms

Forms shall remain undisturbed until the concrete has attained sufficient strength to sustain its own weight in addition to any temporary or permanent load that may be placed upon it during the building of the structure. Beam sides, column forms or forms for walls may be removed as soon as the concrete has attained sufficient strength to sustain its own weight, provided, that such action does not endanger any part of the structure.

One day prior to the proposed removal of any form or centering, the Contractor shall submit to the Engineer the date on which the concrete in this particular section was placed, record of temperature conditions prevailing at the section during the interval since placement, and any pertinent facts concerning the proposed further loading of the section in question.

If in the opinion of the Engineer, based on the records and the condition of the concrete, the removal of the forms is likely to endanger the whole or any part of the structure, forms shall remain in place for such additional period of time as may be necessary to insure safety; provided, however, that no form shall be wholly or partly removed in less than five (5) days, except as noted above, and no slab or beam support in less than twenty-one (21) days, unless supported to the satisfaction of the Engineer.

5.12 Concrete Reinforcing Steel

5.12.1 Scope of Work

5.12.1.1 Steel Placement

The Contractor shall furnish and place all concrete reinforcement, as indicated on the drawings or herein specified. Concrete reinforcement in sizes No. 3 (3/8") inch and larger shall be deformed steel bars of the shapes and sizes indicated on the drawings.

5.12.1.2 Size

Bar sizes designed on the drawings are the ASTM Specifications by number and shall be in accordance with the following tabulation:

<u>Dimensions</u>				
<u>Bar Designation</u> (No.)	<u>Unit Weight</u> (pounds)	<u>Diameter</u> (inches)	<u>Cross Section</u> (Sq. In.)	<u>Perimeter</u> (inches)
2	0.167	0.250	0.05	0.786
3	0.376	0.375	0.11	1.178
4	0.668	0.500	0.20	1.571
5	1.043	0.625	0.31	1.963
6	1.502	0.750	0.44	2.356
7	2.044	0.875	0.60	2.749
8	2.670	1.000	0.79	3.142

5.12.2 Quality

5.12.2.1 Age and Kind of Stock

The steel shall be newly rolled stock, substantially free from mill scale, rust, dirt, grease, or other foreign matter. Bars shall be billet steel or rail steel. Axle steel shall be used only with the approval of the Engineer.

5.12.2.2 Specifications of Steel

Billet-steel bars shall be intermediate grade conforming to the ASTM A15 "Specifications for Billet Steel Bars for Concrete Reinforcement", latest edition.

5.12.2.3 Alternate Steel "a"

Rail-steel bars shall conform to the ASTM A16 "Specifications for Rail-Steel Bars for Concrete Reinforcement", latest edition.

5.12.2.4 Alternate Steel “b”

Axle-steel bars, if approved, shall be intermediate grade conforming to the ASTM A160 “Specifications for Axle-Steel Bars for Concrete Reinforcement”, latest edition.

5.12.2.5 Certification of Steel

In the case of rail-steel and axle-steel bars, the bars shall be rerolled by an approved mill. The Contractor shall submit at his expense certified copies of tests of rail-steel and axle-steel bars furnished. The tests shall be as specified in the appropriate ASTM Specifications above referred to, and shall be made by an approved laboratory. To be accepted for use, the bars shall show an elongation in eight inches (8”) of at least that required by the ASTM Specifications, but not less than ten and one-half percent (10.5%).

5.12.3 Deformations

Deformations on bars for concrete reinforcement shall conform to the ASTM A305 “Specifications for Minimum Requirements for the Deformations of Deformed Bars for Concrete Reinforcement”, latest edition.

5.12.4 Welded Steel Wire Fabric

Welded steel wire fabric shall conform to the ASTM A185 “Standard Specifications for Welded Steel Wire Fabric for Concrete Reinforcement”, latest edition. Gauge and spacing of wires shall be as indicated on the drawings.

5.12.5 Drawings and Schedule

The Contractor shall submit for approval, butting and bending drawings and schedules for all reinforcement to be furnished by him.

5.12.6 Fabricating Reinforcement

5.12.6.1 Forming

Reinforcement shall be accurately formed to the dimensions indicated on the drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than two (2) times the minimum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than six (6) times the minimum thickness, except for bars larger than one inch (1”), in which case the bends shall be made around a pin of eight (8) bar diameters. All bars shall be bent cold.

5.12.6.2 Uniform Size Bars

Bars shall be shipped to the work, with bars of the same size and shape, fastened in bundles with metal identification tags, giving size and mark, securely wired.

5.12.7 Placing Reinforcement

5.12.7.1 Clean Bars Required

Before being placed in position, reinforcement shall be thoroughly cleared of loose mill and rust scale, dirt and other coatings, including ice, that reduce or destroy bond. Where there is a delay in depositing concrete after reinforcement is in place, bars shall be reinspected and cleaned when necessary.

5.12.7.2 Position of Rods

Reinforcement shall be accurately positioned as indicated on the drawings, and secured against displacement by using annealed iron wire ties or metal supports, spacers, or hangers. Wood blocks, stone, brick, chips, etc., shall not be used.

5.12.7.3 Excess Exposure of Steel

Reinforcement, which is to be exposed for a considerable length of time after having been placed, shall be painted with a heavy coat of cement grout if required.

5.12.7.4 Heating of Bars Not Permitted

Metal reinforcement shall be bent or straightened in a manner that will not injure the material. Bars with kinks or bends not shown on the plans shall not be used. Heating or reinforcement for bending will not be permitted.

5.12.7.5 Placement of Metal

Metal reinforcement shall be accurately placed and secured and shall be supported by concrete or metal chairs or spacers or metal hangers. Horizontal bent bars shall be provided for the corners of all concrete structures.

5.12.8 Splices and Offsets in Reinforcements

5.12.8.1 Splicing Locations to be Approved by Engineers

In slabs, beams and girders, splices of reinforcement shall not be made at points of maximum stress without the approval of the Engineer. Splices, where permitted, shall provide sufficient lap to transfer the stress between bars by bond and shear (minimum 24 diameters). Each bar being surrounded completely by concrete, the minimum distance, center to center, shall be two and one-half (2 ½) diameters for round bars and three (3) diameters for square bars.

5.12.8.2 Lab Allowance for Column Bars

Splices in column bars shall provide a lap of not less than 24 diameters for deformed bars and 30 diameters for plain bars.

5.13 Testing for Concrete Acceptance

5.13.1 Materials Tests

Tests will be made of materials received at the job site, unless otherwise provided in these specifications. A test may be required, by the Engineer, of any material used in the work covered by this specifications; and unless specifically states otherwise, the ASTM test and specification for the type and class of material indicated shall be used for test. All the standard tests specified in this Section and elsewhere shall be arranged for by the Contractor. They shall be conducted by an approved independent laboratory and will be made at the expense of the Contractor, unless specifically noted otherwise. Usually the manufacturer's certificate of tests will be accepted.

5.13.2 Cement

Tests shall be made to the entire cement requirement by an approved independent laboratory on car samples, or bin (sealed) samples, as may be desired. ASTM C150 or Federal Specification SS-C-191a shall apply.

5.13.3 Fine Aggregate (for use in Cement Concrete)

Tests shall be made in advance of concrete by an approved independent laboratory in accordance with ASTM C33 and ASTM C40 on each fine aggregate proposed to be used. Colorimetric tests being satisfactory, the aggregate may be used pending results of 28-day mortar strength tests. Tests shall also be made as the work progresses to assure uniformity.

5.13.4 Coarse Aggregate (for use in Cement Concrete)

Tests shall be made in advance of concreting by an approved independent laboratory on each grading of each coarse aggregate proposed to be used, in accordance with ASTM C33. Tests shall also be made as the work progresses to assure uniformity.

5.13.5 Concrete Tests

Where twenty-five (25) or more cubic yards of concrete are to be placed, and where necessary to maintain desired consistency of the concrete, a slump test may be made as specified in ASTM C143. A slump test shall also be made on each sample of concrete used in fabricating test specimens. The Contractor shall furnish and have available the slump cone and rod necessary for making this test.

5.13.6 Advance Concrete Tests

Where more than 100 cubic yards of concrete are required for the entire project, advance tests of concrete shall be made by an independent laboratory in accordance with ASTM C39 and the ASTM standard tests required in ASTM C33. Eight (8) standard six (6) inch compression cylinders, four (4) to be tested at seven (7) days and four (4) at twenty-eight (28) days, shall be made with the proportioning and materials proposed to be used in the major part of the project. Subsequent tests may be made on seven (7) day basis if relation

to the twenty-eight (28) day test is established. Water contents shall be varied to produce values for water content-strength curve. The tests made on aggregates, as required above, may be made a part of these tests as suitably referenced on the reports which shall be issued at seven (7) and twenty-eight (28) days. These tests shall be repeated if there are changes in materials or unsatisfactory results. Strength requirements shall be as stated in the specifications or on the drawings.

5.13.7 Field-Cured Control Tests

5.13.7.1 Specimens

Field compression specimens, cured as specified in ASTM C31, shall be embodied as an additional requirement. Beam (flexure) tests made in the field may be substituted for compression cylinders tested in the laboratory, following ASTM C78, "Flexural Strength of Concrete (Using Simple Beams with Third Point Loading)." Actual curing in the structure shall be closely paralleled. Compressive strengths shall be procured later on the same specimens, with extending curing, either in the field or in the laboratory, following the modified cube method, ASTM C116, latest edition.

5.13.7.2 Specimens in Question

In all cases where the average strength of the laboratory control cylinders shown by these tests for any portion of the structure falls below the minimum ultimate compressive strengths called for on the plans, the Engineer shall have the right to order a change in the mix or in the water content for the remaining portion of the structure. In cases where the average strength of the cylinders cured on the job falls below the required strength, the Engineer shall have the right to require conditions of temperature and moisture necessary to secure the required strength and may require load tests to be made on the portions of the work so affected.

5.13.8 Reinforcing Metal

Inspection and tests by an independent laboratory for conformance with the latest editions of the following specifications:

- ASTM A15 - For Billet-Steel Bars –Intermediate
- ASTM A16 - For Rail-Steel Bars
- ASTM A160 - For Axle-Steel Bars-Intermediate
- ASTM A82 - For Wire Reinforcement
- ASTM A184 - For Bar or Rod Mats, Fabricated Steel, as shown on the drawings
- ASTM A185 - For Wire Fabric, Welded Steel, as shown on the drawings

END CHAPTER 5

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CHAPTER 6 – STREET PAVING AND NEW SURFACES

6.1 Portland Cement (P.C.) Concrete Pavement Surface

6.1.1 Street Surface

Where the existing street pavement surface is Portland Cement Concrete, the street pavement replacement shall consist of ten (10") inch High Early PC concrete pavement or as indicated on the plans. Where High Early concrete is specified, it may be substituted with normal concrete providing that traffic is not permitted on the concrete for at least fourteen (14) days. Minimum curing time for High Early Concrete pavement shall be four (4) days under ideal conditions.

6.1.2 Driveway and Alley Approaches

All existing PC Concrete driveway or alley approaches which are removed entirely for construction of the sewer shall be replaced with eight inches (8") of plain concrete except that in the case of a residential driveway which shall be constructed of six inch (6") plain concrete.

6.1.3 Strength of Concrete

All Portland Cement Concrete shall conform to the applicable provisions of these specifications and shall have a compressive strength of 4,000 psi at twenty-eight (28) days. Construction methods for Portland Cement concrete pavement shall conform to the current requirements of the INDOT Standard Specifications for Portland Cement concrete pavement.

6.2 Asphalt Pavement Surface

6.2.1 Application

All streets, which are to be permanently replaced with fourteen inch (14") deep strength asphalt, shall be laid in three (3) lifts of 5", 5", 3" base material, and one (1) final top surface of one inch (1"). Each lift shall be thoroughly compacted.

6.2.2 Authority

Any new material shall be placed where applicable in accordance with the Street Specifications for the City of Fort Wayne, Indiana, or with the County Road Department as set forth in Allen County Highway Specification.

6.2.3 Driveway and Alley Approaches

All existing asphalt driveway or alley approaches which are removed entirely for construction of the sewer shall be replaced with eight inches (8") of plain concrete except that in the case of a residential driveway which shall be constructed of six inch (6") plain concrete. All existing asphalt driveway or alley approaches which are not removed completely shall be reconstructed with the same type of material which was removed except that the asphalt shall have a six inch (6") stone base with four inches (4") of hot asphaltic surface applied in two (2) layers.

6.2.4 Subgrade

If for any reason the soil or subgrade is disturbed in such a manner as to cause it to slough off leaving pavement cantilevered over the opening, the pavement shall be cut back in a neat straight line far enough so as to have the edge of the cut portion of the pavement on solid subsoil.

6.3 Brick Pavement Surface

Unless otherwise specified, when the existing pavement includes a brick surface, a replacement shall consist of ten inches (10") of Portland Cement concrete pavement as previously described.

6.4 Concrete Sidewalks, Driveways, Curb, Curb and Gutters

6.4.1 Replacement

Concrete sidewalks, driveways, curbs and curb and gutter shall be replaced with concrete, meeting the applicable provisions of these specifications and having a compressive strength of not less than 4,000 psi at twenty-eight (28) days. Minimum thickness shall be five inches (5") for all sidewalks.

6.4.2 Matching and Jointing

Curb or curb and gutter dimensions and cross-sections shall conform, nearly as practicable, with the existing installations. One-half inch (1/2") preformed expansion joints shall be placed at intervals not exceeding fifty feet (50') and at the junction with existing work. Sidewalks shall be finished to match existing adjacent sidewalk surfaces, unless otherwise specified or directed by the Engineer.

6.5 Restoration of Surfaces Outside Immediate Working Area

Contractor, at his expense, shall be responsible to repair and resurface with one inch (1") of hot asphaltic surface in accordance with the INDOT Standard Specifications all streets outside the immediate area, if in the opinion of the Owner these streets were damaged due to contractor's negligence. These repaved streets shall be opened to traffic as soon as possible.

6.6 Payment

6.6.1 Pavement and Driveways

Payment for replacement of permanent type pavements and driveways shall be made at the contract unit price per square yard for the type of pavement, alley, or driveway replaced. All asphalt or concrete pavement and driveway replacements shall be paid for by the following formula:

$SY = \frac{(W)(T)}{9}$ = square yards of pavement to be paid for

W = width of pavement, drive or other surface, or length of trench in paved streets

T = Trench width allowable or actual width, if less than allowable

Trench width allowable is OD + 30 inches except where ordered by the Engineer to place extra (OD = outside diameter of pipe).

6.6.2 Payment for Concrete Walk, Curb and Gutters

Payment for replacement of concrete sidewalk shall be made at the contract unit price per square foot for concrete sidewalk replacement. Payment for replacement of concrete curb or concrete curb and gutter shall be made at the contract unit price per lineal foot for curb or curb and gutter replacement. The contract unit price for each of these items shall be considered payment in full for furnishing all labor, equipment, material and supervision to remove and reconstruct the respective surface in the manner specified.

6.7 Replacing Existing Unimproved Street and Alley Surface

6.7.1 Definition of Unimproved Surfaces

For the purpose of this Specification, the following street and alley surfaces shall be considered unimproved: compacted earth, cinders, shale, mixtures of gravel and earth or crushed stone and earth, whether or not these respective materials are further stabilized by road oil or bituminous surface treatment.

6.7.2 Conduits Under Unimproved Surfaces

Where conduits are constructed under unimproved street or alley surfaces, or where such surfaces are used for the placement of backfill material or are disturbed by construction operations, the Contractor shall reconstruct, by grading and shaping, the entire width of roadway and any drainage facilities which may have been existing, to the original condition at the Contractor's expense.

Where, in the opinion of the Engineer, the conduit is located in the traveled portion of the unimproved street or alley, a new temporary crushed stone surface shall be constructed over the trench. After this surface has been placed, it shall be maintained by the Contractor until final restoration is authorized. Just prior to final restoration, the entire width of the street to be restored shall be scarified. For final surface restoration, the Contractor shall apply an asphaltic surface to the entire width of the traveled surface, as ordered by the Engineer. The asphaltic surface shall consist of the application of an asphalt prime coat and an asphaltic surface corresponding to the materials and construction methods described in the INDOT Standard Specifications.

6.7.3 Omission of Asphalt

The Engineer reserves the right to order the omission of asphaltic surface in any locations where such omission may be, in his opinion, in the public interest.

6.7.4 Payment

The cost of final restoration of the surface shall be paid for at the contract unit price per square yard for the final surface, of the type specified. Such price shall include the cost of all labor and materials necessary to provide the asphaltic surface as specified.

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CHAPTER 7 – RESTORATION OF SURFACES AND LANDSCAPING

7.1 Restoration of Surfaces

7.1.1 General

Restoration of surfaces shall include the construction of new surfaces as indicated on the plans or special provisions. The type of surface restoration required shall be shown on the plans or described in the special provisions.

7.1.2 Temporary Surface over Trench

Whenever conduits are constructed under traveled roadways, driveways, sidewalks or otherwise improved surfaces, a temporary surfacing shall be placed over the top of the trench during seasonal periods when final surface materials are not available. The type of temporary surface shall be approved by the Engineer, or approved in accordance with authorized cut permits. The temporary surface shall be maintained at the Contractor's expense until final restoration of the street surface is completed as specified. Permanent restoration will be completed within thirty (30) days after installation of the utility, if in proper construction season. All temporary surface replacement shall be included in the pay items of permanent pavement.

7.1.3 Replacement of Permanent Structures

The Contractor shall restore (unless otherwise specified or ordered by the Engineer) all permanent type pavements, sidewalks, driveways, curbs, gutters, fences, poles and other property and surface structures removed or disturbed during or as a result of construction operations, to a condition which is equal in appearance and quality to the condition that existed before the work began. The surface of all improvements shall be constructed of the same material (unless otherwise specified) and match in appearance the surface of the improvement which was removed. Where selected granular backfill is used, the restoration shall be made as soon as possible after and compaction of the backfill has been completed.

7.1.4 Seeding and Sodding

At locations on the plans or where designated by the Engineer, the Contractor shall prepare seed beds, furnish and spread fertilizers, and furnish and plant the seed as specified herein on disturbed areas. Seed and topsoil shall be per the requirements of Unit VI of this Manual.

7.1.4.1 Preparation of Seed Bed:

- A. Soil Preparation – After the areas to be seeded have been brought to proper grades, the areas shall be fully tilled to a depth of at least two inches (2”) by discing, harrowing, or other proved methods until the condition of the soil is free from unsightly variations, humps, ridges, or depressions. If, as a result of rain, a crust is formed over the prepared surface the surface shall be placed in suitable condition for planting. The required depth of new topsoil will then be applied.

- B. Planting – Planting shall be done at the time designated by the Engineer; the recommended planting seasons are from March 1 to June 1 and from August 15 to October 30. Planting during any other time may be done with Engineer’s approval. No seed shall be sown during high winds nor until the surface is suitable for working and is in proper condition for seeding.

All seeded areas shall be mulched at the rate of one and one-half (1 ½) bales per 1,000 square foot of area of straw, wet down and prevented from displacement. Contractor shall obtain from Engineer sufficient number of door hangers and place one on every house affected by the restoration.

- C. Clean Up – As seeding operations proceed, all rope, wire, burlap, empty containers, rocks, clods, and all other debris shall not be allowed to accumulate but shall be removed daily and the site kept as tidy as possible at all times. Any soil, peat, manure, or similar materials which has been brought onto paved areas and gutter lines by work operations or otherwise shall be removed promptly by sweeping, and, if necessary, by washing, keeping the areas clean at all times. Other excess soil shall be disposed from the site. All ground areas disturbed as a result of planting operations shall be restored to their original condition or to the desired new appearances.

- D. Guarantee – The Contractor shall guarantee a good stand of grass in seeded areas by watering, regrading and reseeding eroded areas and otherwise maintaining all seeded areas until final acceptance. Any areas which do not show a uniform stand or have bare spots shall be reseeded and remulched at the Contractor’s expense with the same seed mixture and mulch as originally used thereon and such reseeding and remulching shall be repeated until all affected areas are covered with grass. Final acceptance of all lawn areas may be required by the Contractor after 60 days from the date of installation. The above does not release the Contractor from the standard provisions included in the maintenance bond agreement.

7.1.4.2 Hydroseeding

All areas of receiving seed shall be raked smooth and free from depressions or undulations. Grass seed shall be sown evenly by the hydroseed method (combing water, seeds, wood fiber mulch and fertilizer in one application) at the rate of seven (7) pounds per 1,000 square foot. Fertilizer shall be applied as specified at a rate of two and one-half (2 ½) to four (4) pounds of nitrogen per 1,000 square foot.

7.1.4.3 Replacement of Sodded Areas

At locations specified, or as shown on the plan, the Contractor shall cut, remove and carefully store the existing sod. Upon compaction of the trench, in a manner satisfactory with the Engineer, the sod strips shall be laid carefully by hand in the designated direction. The sod shall be fitted to the surrounding grade and fixed objects. The sod strips shall be butted together closely to avoid open joints. After laying and initial watering, the sod shall be tamped or rolled as directed to insure contact with the soil underneath and shall conform with the surrounding surface. After compaction, the sod shall present a smooth even surface free from

lumps and depressions. On any slope 3:1 or flatter, the use of broken sod strips will be permitted. Where broken pieces are laid, no overlaps will be allowed.

Sod placed in ditches with grades steeper than one percent (1%) and on slopes 3:1 and steeper shall be pegged. The pegs shall be spaced not over two feet (2') apart in each strip measured lengthwise of the strip. Pegs shall be driven down until no more than one inch (1") protrudes above the surface of the sod. Grades and slopes flatter than specified herein shall be pegged as directed.

Pins shall be driven flush with the top of the sod. Any growing deficiency in the sod necessary to restore the surface to the condition which existed before construction operations began will be furnished by the Contractor unless otherwise specified. The Contractor shall maintain the sodded areas until certification of the completion by the Engineer.

7.1.4.4 Payment

Measure of surfaces sodded or seeded shall be made of the area within the rights-of-way or easements designated by the Engineer for restoration. Payments shall be made at the contract unit price per square yard for sodding and seeding, which shall include all required fertilizer, topsoil and mulch, unless these items are broken down separately in the contract documents.

7.1.5 Disposal of Surplus Excavated Material

Surplus excavated material not needed for backfill shall be promptly removed from the site by the Contractor. The cost of removal and disposal of surplus excavated materials will be included in the total contract price, and no additional payment will be allowed therefor.

7.1.6 Cleanup

All surplus materials and all tools and temporary structures shall be removed from the site by the Contractor. All dirt, trees, scrub brush, rubbish, etc., shall be hauled away from the project site, unless other suitable arrangements are provided for on site and approved by the Engineer. The construction site should be left clean and acceptable to the Engineer at the earliest possible date.

After all backfill has been completed, the ground surface shall be shaped to conform to the contour of adjacent surfaces, unless otherwise specified by the Engineer. General cleanup of the entire construction area shall otherwise conform to applicable requirements specified.

7.2 Trees

7.2.1 Professional Service

The Contractor shall hire a professional arborist who will trim or fertilize all trees planted or to be retained in the constructed area of the project. Any tree which is in direct

conflict with the proposed construction shall be removed from project site by the Contractor. Special consideration may be directed by the Engineer to tunnel under some trees if it practical and necessary. At the time the Engineer calls for Contractor to tunnel, a price per foot of tunnel will be negotiated.

7.2.2 Removal and Replacement

Wherever existing three inch (3") or less diameter trees are encountered, the Contractor is required to provide for their temporary removal, resetting and/or replacing with an appropriate diameter tree of like quality. The Contractor, through his arborist, shall be responsible for properly fertilizing the disturbed trees to guarantee their survival. All costs to be included in the cost per foot of pipe unless broken out as a separate pay item.

7.2.3 Guidelines for Trenching around Trees

7.2.3.1 Upper Limits

Trenching must be no closer than having the inside wall of the trench six feet (6') from the trunk of trees, 15 inches (15") in diameter and larger.

7.2.3.2 Lower Limits

On trees 15 inches (15") and smaller, the inside wall of the trench must be no closer than three feet (3').

7.2.3.3 Dripline Protection

Tunnels under trees must be started at the drip line (dripline is at the outer tips of the limbs), with a vertical depth of twenty-four inches (24") before tunneling under the trees.

7.2.3.4 Removal

When trenching is to be done closer than six feet (6') on trees 15 inches (15") and larger and closer than three feet (3') on trees fifteen inches (15") and smaller, the trees and stumps should be removed by a competent tree specialist who is insured and licensed by the City.

7.2.3.5 Replacement of Trees

On public land or rights-of-way, all trees removed for trenching will be replaced with new trees by a reputable tree specialist with a minimum of one (1) year's growth guaranteed. The size and type must be approved by the Park Department of the City of Fort Wayne.

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CHAPTER 8 – MISCELLANEOUS SPECIFICATIONS

8.1 Safety

8.1.1 Barricades, Guards, and Safety Provisions

The Contractor shall, before closing roads or pedestrian access ways, furnish and erect standard barricades and signs to protect the public. These barricades and signs shall be placed and adequately maintained in accordance with the Indiana State Highway Specifications, or the City and County Road Department's Cut Permit or Traffic Control requirements.

The Contractor shall provide adequate protection with barricades, warning signs, lights, and surround with a forty-two (42") inch high brace fence all sewer trenches which are left open over night.

8.1.2 Existing Underground Structures

Existing storm sewers, sanitary sewers, water mains, gas mains, electric ducts, telephone ducts, steam mains and other underground structures and their building connections have been shown on the plans according to the best available information. The exact location and protection of these facilities and structures, their support and maintenance in operation during construction (in cooperation with the proper authorities of the utility involved) is the express responsibility of the Contractor in the performance of his contract and in the preparation of his bid.

8.1.3 Structure Protection

Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his expense and under the direction of the Engineer. The structures, which may have been disturbed, shall be restored upon completion of the work or as required by the Engineer.

8.1.4 Protection of Property and Surface Structures

Trees, shrubbery, fences, poles and all other property and surface structures shall be protected during construction operations, unless their removal for purposes of construction is authorized as of the contract. Any fences, poles or other man-made surface improvements, which are moved or disturbed by the Contractor that are outside the construction right-of-way, and/or permanent easement shall be restored to their original condition at the Contractor's expense. Any trees, shrubbery or other vegetation, which are approved for removal or ordered for removal by the Engineer in order to facilitate construction operations, shall be removed completely, including stumps and roots, by the Contractor. Responsibility for any damage or claims for damage, caused by construction operations, to shrubbery or other landscape improvements, which were not authorized for removal, shall be assumed by the Contractor. Settlement of any damage or claims for damage shall be made by the Contractor as soon as possible and in a manner satisfactory to the damaged party and/or Engineer.

8.1.5 Caution in Excavation

The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged through fault by him.

8.2 Wage Rates

8.2.1 Prevailing Wage

Any firm, individual, partnership or corporation awarded a contract by a municipal corporation and/or public works for the construction of any utility and/or public work, and any subcontractor thereon, shall be required to pay for each class of work on such project a scale of wages no less than the prevailing scale of wages being paid in the immediate locality all in accordance with Indiana Code 5-16-7-1 and in compliance with the provisions of Chapter #319 of the Acts of the General Assembly of Indiana, 1935.

8.2.2 Wage Schedule

All Contractors and/or subcontractors shall be required to submit a wage schedule in accordance with I.C. 5-16-7-2 – 5-16-7-4, and in compliance with the provisions of Chapter 319 of the Acts of the General Assembly of Indiana, 1935.

8.2.3 Posted Wage Schedule

The Contractor and/or subcontractor shall post at appropriate conspicuous points at the site of the project a schedule showing all determined minimum wage rates for the various classes of laborers and mechanics to be engaged in work on the project under this contract and all deductions, if any, required by law to be made from unpaid wages actually earned by the laborers and mechanics so engaged.

8.3 Nondiscrimination in Employment

8.3.1 General

Pursuant to I.C. 5-16-6-1 (53-103) Indiana Statutes Annotated, the Contractor shall agree that during the performance of this contract:

8.3.1.1 Discrimination

The Contractor, or any subcontractor, or any person acting in behalf of the Contractor or any subcontractor, shall not, in the hiring of employees for performance of work under this contract or any subcontract hereunder, discriminate by reason of race, religion, color, sex, national origin or ancestry against any citizen of Indiana who is qualified and available to perform the work to which the employment is related;

8.3.1.2 Intimidation

The Contractor or any subcontractor or any person acting on behalf of the Contractor or subcontractor, shall not, in any manner, discriminate against or intimidate any employee hired for performance of work under this contract on account of race, religion, color, sex, national origin or ancestry;

8.3.1.3 Individual Penalty

There may be deducted from the amount payable to the Contractor by the Owner, under this contract, a penalty of five (\$5.00) Dollars for each person for each calendar day during which such person was discriminated against or intimidated in violation of the provisions of this contract; and

8.3.1.4 Contractor Penalty

The contract may be cancelled or terminated by the Owner and all money due or to become due hereunder may be forfeited for a second or subsequent violation of the terms or conditions of this section of this contract.

8.3.1.5 Local Code

Article III Chapter 15 of the Municipal Code of the City of Fort Wayne, Indiana of 1974 and all subsequent amendments shall apply under all Municipal and Public Work Contracts.

8.4 Rock Excavation

8.4.1 Classification of Rock

Wherever "rock" is used as the name of an excavated material, it shall mean igneous, metamorphic, and sedimentary rock, concrete, or masonry measuring one-half (1/2) cubic yard or more, hard shale or solid ledge rock, which cannot be excavated without the continuous use of pneumatic tools or drilling and blasting.

8.4.1.1 Payment for Removal

Before payment is allowed for rock excavation, the Contractor shall be required to demonstrate the material cannot be removed by "hand pick" or by a power operated excavator or shovel. No payment will be made for rock excavation, unless air tools or explosives were used by the Contractor. No payment will be made for rock excavation, unless the Engineer approves such payment in writing in advance upon being satisfied that the material meets the above criteria.

8.4.2 Rock Excavation in Trenches

8.4.2.1 Limit of Removal from Trenches

Where rock is encountered in the trench, the Contractor shall open the trench to full depth for at least fifty (50') feet in advance of the pipe. The minimum dimensions of the excavation in rock for a manhole, catch basin or flush tank shall be those of a prism with vertical sides and a horizontal section six (6") inches wider on each side than the smallest rectangle which will enclose such structures and their foundations. The rock shall be excavated three (3") inches below the outside surface of pipe. Rock shall be stripped in sections of not less than fifty (50') feet in length, and the Engineer or his representatives shall be notified in order that all precautions may be taken before blasting begins or pipe is laid. The end of the last pipe, together with as much of the barrel as cannot be conveniently covered with fill, shall be protected by sand bags. This precaution is to prevent flying stones damaging sections of pipe already installed.

8.4.2.2 Bedding in Rock

An equalizing bed of selected sand, well compacted, shall be placed under the pipe, and the pipe shall be laid in this bed so that the entire length of at least the lower third of each pipe shall be supported uniformly by the bed, all in accordance with Class "B1" Bedding as shown in the Standard Drawings.

8.4.3 Measurement for Payment

Where rock excavation is to be measured for payment, quantities will be determined by the Engineer. Rock required to be removed shall be computed by the cubic yard. Width for pay purposes shall be equal to the maximum widths specified for the trench at the top of the pipe. Depth for pay purposes shall be the difference in elevation between the top and bottom of the rock as determined by the Engineer. Where rock is encountered in the bottom of the trench, the maximum depth for payment purposes will be three (3") inches below the bottom of the pipe. Where the proposal does not contain a pay item for rock excavation, the additional cost of rock removal, as defined by these specifications shall be paid on an extra work basis.

8.4.4 Payment

Payment shall be made at the contract unit price per cubic yard for rock excavation. These prices shall be full compensation for furnishing all materials; for all preparation and excavation of rock; and for all labor, equipment, tools and incidentals necessary to complete the item.

8.5 Blasting

8.5.1 Operation of Blasting

8.5.1.1 Requirements

All blasting operations shall be executed in strict accordance with existing laws, ordinances and regulations relative to rock blasting and the storage and use of explosives. Blasting shall be done under the direction of a competent, experienced and licensed foreman.

8.5.1.2 Material Storage and Handling

If there are no local ordinance governing blasting and the storage of explosives, all blasting supplies shall be storage in such a manner as to create the least possible hazard to the community. Such storage shall be subject to the approval of the Engineer. Percussion-cap or similar detonators shall be separated from dynamite or other explosives by a distance of at least 100 feet. Any blasting excavation within five feet (5') of a water or gas main or electrical conduit or building shall be done with light charges of explosives and utmost care shall be given to avoid disturbing such utilities. Sufficient warning shall be given to all persons in the vicinity of the work before blasting, and at least two (2) men with red flags shall be stationed to warn approaching persons that a blast is about to occur.

8.5.1.3 Safety Precautions

The site of the blast shall be covered with heavy timbers, chain mats, or other device to prevent flying rock or earth from damaging adjoining property. The time of the blasting and the number and size of the charges shall be subject to the approval of the Engineer. Any damage caused by blasting shall be repaired by the Contractor at his expense.

8.6 Riprap

Riprap shall be in accordance with Unit V of this Manual.

8.6.1 Payment

The accepted quantities of dumped riprap and revetment riprap obtained from outside the right-of-way will be paid for at the contract unit price per ton; per square yard for hand-laid or grouted riprap of the specified depth; per square yard for placing revetment or dumped riprap of the specified depth; per square yard for precast concrete riprap; and per square yard for slopewall of concrete slopewall; all complete in placing including excavation below the finished riprap or slopewall surface.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Revetment Riprap	ton or square yard
Hand-Laid Riprap (Depth) in Inches	square yard
Grouted Riprap (Depth) in Inches	square yard
Riprap	square yard
Precast Concrete Riprap	square yard

8.6.2 Removal and Placement Payment

If the contract includes a pay item for removing from within the contract limits materials which are used as hand-laid or grouted riprap, the cost of such removal will be paid under the removal riprap pay item and the cost of placing the material will be included under the placing riprap item.

END CHAPTER 8