

**APPENDIX F**  
**STANDARDS FOR IMPROVEMENTS CONSTRUCTION**

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## APPENDIX F

### STANDARDS FOR IMPROVEMENTS CONSTRUCTION

#### 100 GENERAL STANDARDS

##### 101 SCOPE

All improvements required to be built, placed, erected or planted within existing or proposed Township roads or rights-of-way or on private property eligible for use by the public, shall conform to these standards for improvements construction.

##### 102 REFERENCES

Throughout these standards, references will be made to various standard specifications. When such standards are referenced, they shall be considered as being the most current publication, and fully incorporated into these standards.

##### 103 CONTROL OF WORK

The Township and/or its agents, employees or consultants, have no direct or indirect supervisory control over improvements construction. Construction methods, procedures and safety provisions are the responsibility of the developer.

##### 104 SAFETY

In particular, compliance with all local, state and Federal regulations regarding safety of all operations, of all workers and of the general public, is the responsibility of the developer.

##### 105 INSPECTION

Township inspection of improvements construction will be made to check general compliance with the material and workmanship criteria of these standards. Such inspection shall not relieve the developer from full responsibility for the quality of his work product or the layout of improvements to the lines and grades on the approved plans.

##### 106 NOTIFICATION

It shall be the responsibility of the developer to notify the appropriate inspection consultant for the Township or designated authority at least twenty-four (24) hours prior to commencing any construction activity.

##### 107 CONFLICTS

Where a conflict exists between the requirements of these standards and the requirements of another jurisdiction, it shall be the responsibility of the developer to resolve the conflict prior to proceeding with construction. The developer shall inform the Township, in writing, of any conflicts, and his methods of resolving same.

## 200 STREETS

### 201 GRADING

Streets shall be graded to the full width of the right-of-way, surfaced and improved to the grades and dimensions shown on the plans, profiles and cross-sections submitted by the developer and approved by the Township.

### 202 SUB-BASE AND PAVEMENT SPECIFICATIONS

Streets shall be constructed to the following specifications. Sections 202.1, 202.2 and 202.3 are minimum requirements. A traffic analysis shall be performed and evaluated for all proposed streets, to determine the construction requirements for those streets. If the analysis reveals a heavy concentration (25 or more trips per day, on average) of commercial vehicles (26,000 pound gross weight or higher) then the proposed street design shall be based on the requirements of PennDOT Publications Nos. 13M, 70M, 72M, 242 and 408, and their most recent revisions. Final design of these streets shall be approved by the Township. This requirement shall apply regardless of the proposed street classification.

#### Sub-base and Underdrain

An eight (8) inch compacted subbase consisting of Type "C" or better PennDOT No. 2A stone shall be constructed on a properly prepared subgrade for all roads. Subbase shall be constructed in accordance with the requirements of Section 350 PennDOT Form 408, current edition. A geotextile membrane shall be installed above the sub-grade, below the sub-base material. The geotextile membrane shall be suitable for this application and installed to the manufacturers specifications. Cut sheets shall be provided to the Township for approval prior to installation. The use of pavement base drain shall be required along both edges of cartway. The pavement base drain shall be constructed in accordance with Section 610 of PennDOT Form 408, current edition Specifications, and Publication 70-Guidelines for Design of Local Roads and Streets.

#### Base Course

For all classifications of streets, base course shall be constructed of four (4) inches compacted depth bituminous base course (25 millimeter size) constructed in accordance with PennDOT Superpave Standards .

#### 202.4 Surface Course

Tack Coat - Tack Coat conforming to Section 460 of PennDOT Form 408, current edition shall be required on all bituminous pavement surfaces prior to placement of surface course(s) paving, if in the opinion of the Township Engineer, the base course has become non-adherent.

Primary Wearing Course – Within three (3) months after placement of the Bituminous Base Course, a one (1) inch compacted depth primary top course (9.5 millimeter size) shall be applied. This course shall be in accordance with PennDOT Superpave Standards.

Finish Wearing Course – The final wearing course shall consist of one and one-half (1 ½) inches compacted depth bituminous wearing course (12.5 millimeter size) conforming to PennDOT Superpave Standards. This finish course shall not be applied until the subdivision or land development has achieved eighty (80) percent build-out, unless otherwise approved by the Township.

### 202.5 Requirements for Paving

It shall be the responsibility of the developer or their agent to establish reasonable current and future use assessments of the proposed streets. This is necessary for the preparation of a bituminous material job mix formula. No less than five days prior to the placement of any bituminous material, a job mix formula shall be submitted by the developer to the Township for approval. The Township may require developer to have random core samples extracted and tested (at an approved testing facility) subsequent to paving material application. Developer shall supply to Township, daily bituminous certifications on either form TR-4665 or CS-4171 within 24 hours of placement of bituminous materials for each day's placement.

### 203 PAVEMENT MARKINGS

All pavement markings (stop bars, arrows, hatching, etc.) shall be thermoplastic, either cold in-laid or hot applied, conforming to current PennDOT Standards. Long lines, such as street centerline striping or edge of shoulder markings, shall be thermoplastic, either cold in-laid or hot applied, conforming to current PennDOT Standards.

## 300 **CURBING**

### 301 TYPE

Curbing where required (except for PennDOT roadways) shall be plain cement concrete, upright design, having a height of twenty-two (22) inches and tapering from a top width of six (6) inches to a base width of eight (8) inches. - At street intersections where curbing and sidewalks are required, the curb shall be depressed for the full sidewalk width for handicapped access. The curb reveal at these intersections shall not exceed one-half (1/2) inch.

### 302 SUBGRADE

The subgrade shall be substantially dry, unfrozen, firmly compacted soil. Thorough compaction shall be attained by using an approved pneumatic compactor or self-contained compactor, capable of delivering 800 to 1,000 pounds at the shoe.

### 303 FORMS

Forms shall be made of approved substantial material, preferably of steel, and shall be smooth, free of warp and sufficiently rigid and supported to resist springing out of shape. These forms shall be of a depth equal to that of the proposed curb. Prior to pouring the concrete, all forms and templates shall be thoroughly cleaned and treated with an approved material to prevent the concrete from adhering thereto. Material which will adhere to or discolor the concrete shall not be used.

### 304 CONCRETE

Concrete shall meet the requirements of PennDOT Form 408, current edition, Section 704 for Class A Cement concrete. No concrete shall be mixed or placed when the air temperature is below 40 F or above 90 F.

### 305 POURING

Curbs shall be carefully poured monolithically without segregation of constituents, tamped and screeded true to grade and section, eliminating all voids and bring sufficient mortar to the surface for finishing in a smooth, neat, even manner using approved tools.

306 JOINTS

Each curb section shall be constructed in lengths of ten (10) feet where practicable; in no case shall a section be less than five (5) feet long. Each section shall be separated when pouring by a one-eighth (1/8) inch steel template equal to the full depth of the curb.

Expansion joints of approved one-half (1/2) inch pre-molded bituminous material shall be placed for the full curb depth at all points adjoining sidewalk and existing curb, at point of tangency of street returns and intersecting curbs, and in no case more than thirty (30) feet apart.

307 FINISHING

Forms may be removed no earlier than twelve (12) hours after placement of the concrete. All construction joints shall then be filled with approved dry, sharp sand. Minor defects and honeycombing shall be corrected by patching with mortar; no plastering will be permitted. All exposed concrete shall be rubbed to a smooth surface and edges at joints finished with a suitable tool.

400 SIDEWALKS

401 SUBGRADE

The subgrade shall substantially be dry, unfrozen, firmly compacted soil. Thorough compaction shall be attained by using an approved pneumatic compactor or self-contained compactor capable of delivering 800 to 1,000 pounds at the shoe.

402 BASE

A stone bed shall be placed and thoroughly compacted to a depth of four (4) inches using the above-mentioned compactors. The stone shall be PennDOT No. 2A.

403 FORMS

Forms shall be made of approved substantial material, preferably of steel, and shall be smooth, free of warp and sufficiently rigid and supported to resist springing out of shape. These forms shall be of a depth equal to that of the proposed sidewalk. Prior to pouring the concrete, all forms and templates shall be thoroughly cleaned and treated with an approved material to prevent the concrete from adhering thereto. Material which will adhere to or discolor the concrete shall not be used.

404 CONCRETE

Concrete shall meet the requirements of PennDOT Form 408, current edition, Section 704 for Class A cement concrete. No concrete shall be mixed or placed when the air temperature is below 40 F or above 90 F.

405 POURING

Sidewalks shall be carefully poured monolithically without segregation of constituents to a depth of five (5) inches and cross-over six (6) inches - see details, and screeded true to grade and sections, eliminating all voids and bringing sufficient mortar to the surface for finishing in a smooth, neat, even manner using approved wood floats.

406 CONSTRUCTION

Sidewalk shall slope toward the street at the rate of one-fourth (1/4) inches, per foot. It shall be constructed in separate slabs of thirty (30) feet in length, except for closures. These slabs shall be separated for their full depth by expansion joints of approved one-half (1/2) inch premoulded

bituminous material. This premoulded material shall also be placed longitudinally at the joint where sidewalk slabs abut concrete curb and existing sidewalk. Between the transverse expansion joints, the slabs shall be divided into blocks five (5) feet in length by using 1/8 inch steel templates equal in depth to that of the slab. Where existing light standards, poles, fire hydrants, etc., are within the sidewalk area, concrete around such structures shall be scored to a depth of one-fourth (1/4) the slab thickness, in a block eight (8) inches wider than the maximum dimension of the structure at a sidewalk elevation. Prior to placing the concrete, one-fourth (1/4) inch premoulded expansion joints shall be placed completely around the structures for the full depth of the sidewalk. All joints shall be edged with an edger having a one-fourth (1/4) inch radius.

407 HANDICAPPED RAMP

At all intersections, sidewalks shall be extended through the planting strip to abut depressed concrete curbing on the curve return, to facilitate a handicapped ramp to the cartway.

500 **SANITARY SEWERS**

501 INTRODUCTION

All work shall be done in accordance with the requirements of the Lower Nazareth Township Board of Supervisors Sewer Extension Rules and Regulations, and these Specifications.

The work shall be executed in the best and most workmanlike manner by qualified, conscientious, and experienced workmen.

502 DEFINITIONS

The following definitions shall be applicable in these Specifications:

502.1 Township shall mean the Lower Nazareth Township Board of Supervisors.

502.2 Contractor shall mean any individual, partnership, or corporation performing sewer construction work for the Developer.

502.3 Developer shall mean any landowner, agent of such landowner, or tenant with the permission of such landowner, who makes or causes to make a subdivision of land or a land development, or who constructs, or causes to be constructed a sanitary sewer extension, or who files a Sewer Extension Agreement Application with the Township.

502.4 Engineer shall mean the Consulting Engineer that represents the Township. The term may also include a construction inspector employed by the Township or the Engineer.

502.5 Equal shall mean equal as approved by the Engineer.

502.6 Subdivision shall mean the division or redivision of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels, or other divisions of land. For the purpose of these specifications, this shall also include any non-residential development of a parcel of land, which involves a sewer extension.

502.7 Work shall mean labor, services, materials, and equipment as required for the successful completion of the project for the extension of sanitary sewer lines pursuant to the Lower Nazareth Township Board of Supervisors Rules and Regulations.

503 RESPONSIBILITY OF THE DEVELOPER

503.1 It shall be the responsibility of the Developer to accomplish and bear all costs for the connections of his work to the existing Township facilities. The Developer shall place

service lines to existing properties or homes when the new facilities are extended enroute to the Development.

- 503.2 The Developer shall make himself familiar with the laws and regulations of the State of Pennsylvania, and the ordinances of Northampton County and Lower Nazareth Township, including those concerning the employment of labor and the performance of Work; and also he should be familiar with the Lower Nazareth Township Board of Supervisors Sewer Extension Regulations. The Developer should obtain a copy of the Standard Specifications for Developers, Sanitary Sewerage System Improvements and Additions, latest edition, and the Sewer Extension Rules and Regulations, latest edition, of the Lower Nazareth Township Board of Supervisors, and he shall follow and pursue the same with no deviations or changes there from without prior written approval by the Township or the Engineer.
- 503.3 The Developer will be responsible for the payment of all Excise or Use Taxes and all other taxes required by law on all materials, tools, apparatus, equipment, fixtures, and incidentals that he purchases or uses for the purpose of fulfilling the Work.
- 503.4 The Developer shall procure all necessary permits and licenses. He shall pay all charges and fees therefor, and shall give all notices necessary and incidental to the proper and lawful prosecution of the Work.
- 503.5 Any contractor installing facilities for the Developer shall obtain a copy of these Specifications and shall construct all work in accordance with these Specifications. Use of the word "Developer" in these Specifications shall mean "Contractor", where applicable. However, the Developer shall be ultimately responsible for the satisfactory completion of the project and for the Work done by his contractor.
- 503.6 All pipelines should be constructed in public streets, unless Township agrees otherwise. Where Township agrees in writing to permit pipeline construction in non-public streets, or in streets not yet accepted by the Township, Developer shall provide Township permanent rights-of-way thirty (30) feet wide, which rights-of-way shall be shown on Developer's plans. The same shall be clearly marked and identified as Sewer Line Right-of-Way to be granted to Lower Nazareth Township Board of Supervisors. Developer shall show the course and distance around the perimeter of said rights of way. Developer shall also provide a separate written perimeter legal description of each separate right-of-way, starting with a point of beginning oriented with a fixed point of record. Developer shall also provide a right-of-way drawing plat. Both the plat and the legal description shall be in conformance with the Township Rules and regulations. In addition to the rights-of-way being depicted upon Developer's plan, he shall execute a Right-of-Way Agreement for the same unto Township for purposes of being recorded, with rights-of-way plat and description attached, all in form satisfactory to Township.
- 503.6 Procedure to be followed upon completion of the lines, and for maintenance of lines thereafter is set forth in Lower Nazareth Township Board of Supervisors Regulations.

504 SUBMISSION AND REVIEW PROCEDURES

- 504.1 The Developer shall obtain a copy of the "Standard Specifications for Developers", latest edition, from the Lower Nazareth Township Board of Supervisors and the Lower Nazareth Township Board of Supervisors Sewer Extension Rules and Regulations, latest edition, and comply with the same. If any conflict appears between the above, the more



restrictive requirements shall control. The Township shall have the final determination concerning any interpretation of these specifications. The Township reserves the right to require any additional information and or amend these standards as it deems necessary in addition to what is outlined and required in the Rules and Regulations, and these Specifications.

- 504.2 The requirements for commencing a sanitary sewer extension starting with items on application, and for filing preliminary and final sewer extension plans is set forth in Lower Nazareth Township Board of Supervisors Sewer Extension Rules and Regulations. These Rules and Regulations include plans required, insurance and written agreements required, filing fees, initial, construction escrow deposit, and fees to cover expenses of the Township for administration expenses, legal expenses, and engineering expenses, as outlined in the Pennsylvania Municipalities Planning Code, Act of 1968, P.L. 805, No. 247 as reenacted and amended, and will include, but are not limited to:
  - 504.2a All Engineering costs involved with the review and approval of design plans, specifications, and shop drawings
  - 504.2b Assistance in preparation and review of sewer permit applications as necessitated by State Law.
  - 504.2c Construction inspection of all work covered by the plans and specifications.
  - 504.2d Township's legal and administrative costs.
  - 504.2e Preparation of Record Drawings.
- 504.3 The number of preliminary plans and final plans to be filed is set forth in the Lower Nazareth Township Board of Supervisors Sewer Extension Regulations. They must be numbered, dated including revisions and sealed and signed by the Design Engineer, and shall be clear and legible and be prepared in accordance with acceptable drafting standards.

- 504.4 Where the sewer extension involves a subdivision, Developer must file with the Township a copy of the signed and approved Subdivision Plan showing the location of the proposed sewer extension if the extension is applied for after subdivision approval is granted.
- 504.5 After agreement has been signed, the Developer must submit detailed drawings (two copies) to the Township for review. All drawings shall be signed and sealed by the Design Engineer and shall be clear and legible.
- 504.6 The Township has adopted the following scales for submission of all drawings: Horizontal Scale 1" = 50' and Vertical Scale 1" = 5'. In the event the drawings are not submitted as per aforementioned scale, the Developer will have to bear the cost of transcribing said drawings to the said scale when record drawings are prepared. All plans shall be prepared on the same size sheet. As a minimum, the following requirements shall be met:
- 504.6a Utility plan size, 24" x 36" (including plan and profile drawings).
  - 504.6b All utility profiles shall be placed on sheets with corresponding plan views. All utility plans, and plan and profile drawings shall have match lines and clearly reference corresponding plan numbers.
  - 504.6c All utility plans illustrating proposed lot locations shall illustrate lot numbers.
  - 504.6d All utility plans shall illustrate north arrow.
  - 504.6e All utility plan and profile drawings shall illustrate sanitary sewer locations, including all manholes and laterals (graphical location and tabular listing), as well as all proposed gas mains, water mains, storm sewers, electric conduits, and any other underground pipelines. All utilities shall be shown together on the same drawings.
  - 504.6f All utility plans and profiles shall illustrate manhole rim and invert elevations.
  - 504.6g All utility plans and profiles shall numerically illustrate slopes, pipe sizes, manhole rim and invert elevations, distances and piping material proposed illustrated along the utility line. Proposed sanitary sewers shall be stationed starting from the downstream manhole and proceeding upstream from each manhole, and the minimum design gradient of all sanitary sewers shall be one-half (½) percent slope (0.005 ft/ft).
  - 504.6h All utility plan views shall illustrate flow arrows in the direction of flow.
  - 504.6i All utility plans shall illustrate manhole numbers. All manholes shall be numbered alpha-numerically as approved by the Engineer.
  - 504.6j All utility plans shall indicate basement elevations of dwellings to be served.
  - 504.6k All plans shall include the following statement:
- NOTE: Sanitary sewer system extension is to be designed and constructed in accordance with the Lower Nazareth Township Sanitary Board of Supervisors's Standard Specifications for Developers, Additions and Improvements to the Sanitary Sewerage System, Lower Nazareth Township Board of Supervisors, Northampton County, Pennsylvania, latest revision, and the Lower Nazareth Township Board of Supervisors Sewer Extension Rules and Regulations.

- 504.6l All plans are to be signed and sealed by a Professional Engineer, Registered in the Commonwealth of Pennsylvania, and dated, including all revision dates.
- 504.6m All utility plans are to illustrate easements and rights-of-way.
- 504.6n All utility plans are to illustrate lands to be dedicated to the Township and/or the Township.
- 504.6o All plans presented shall also include an overall utility plan illustrating the following:
- Key map and relative location in the Township
  - Lot numbers
  - North arrow
  - Sanitary sewer system extension
  - Manhole numbers
  - Flow arrows
  - Pipe sizes
  - Storm sewer and all storm sewer structures
  - Water mains
  - Gas mains
  - Electric mains
  - Corresponding Utility Plan and Profile Drawing Numbers
  - Development and Construction Phasing
- 504.6p The overall utility plan will not be subject to the previously stated horizontal scale, but be prepared at a scale approved by the Engineer which will allow all required information to be shown on a single plan.
- 504.6q The overall utility plan must remain independent of the grading plan(s) and the soil erosion and sedimentation control plan(s).
- 504.6r All utilities shall be shown on the grading plans for the Development.
- 504.6r1 After review of all information provided above, the Township or Engineer will submit written comments to the Township and provide a courtesy copy to the Developer.
- 504.6r2 Developer shall resubmit final drawings (three copies) to the Township office showing any changes reflected by the Township's review. At this time, the Developer shall also submit all permit applications and required attachments, exhibits and drawings as required by the Pennsylvania Department of Environmental Resources. Two copies of these applications shall be provided above and beyond those required for submittal to DEP.
- 504.6r3 Sewer construction shall not begin until all requirements of the Lower Nazareth Township Board of Supervisors Sewer Extension Regulations have been met and are complied with by letter from the Township solicitor.

504.6r4 After construction is completed but prior to final acceptance of the new facilities by the Township, the Developer shall submit record construction drawings to the Township for the review and approval of the Engineer. Record drawings shall be legible and neat and shall show actual elevations and horizontal and vertical locations of the new facilities in form and content as approved by the Engineer. Final drawings shall be reproducible and will become the property of the Township. The Developer will submit two (2) sets of Mylar drawings signed and sealed by the Design Engineer, and one (1) set of drawings on electronic media in an AutoCAD<sup>®</sup> compatible format acceptable to the Engineer.

505 INSURANCE BY THE DEVELOPER

- 505.1 Developer shall provide a Certificate of Insurance for a current policy in force for a term not to expire until the Township Maintenance Bond is released, and shall name the Township and its Engineers as additional insured, the Township as the Certificate Holder, and for the coverages and amounts as provided in the Lower Nazareth Township Board of Supervisors Sewer Extension Regulations and as set fourth hereafter, whichever is greater.
- 505.2 The Developer shall take out and maintain in amounts required by law, Workmen's Compensation Insurance for all his employees employed at the site of the project, and in case any Work is sublet, the Developer shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all the latter's employees. The Developer shall, at all times, indemnify and save harmless the Township and the Township, including their employees, of and from all claims for Workmen's Compensation which may be made by any of the employees of the Contractor or by the employees of any subcontractor.
- 505.3 The Developer shall take out and maintain such Public Liability and Property Damage Insurance as shall protect him, the Township, and Engineer from claims for damages for personal injury, including accidental death, as well as from claims for property damages, which may arise from operations by the Developer whether such operations are by himself or by any subcontractor or by anyone directly or indirectly employed by either of them. Hazards insured against for property damage liability shall include explosion, collapse, underground object, and blasting, to the extent that any such exposure exists.

505.4 The Developer shall carry or cause to be carried the following forms of insurance applying to all operations undertaken by him, his agent, employees, and subcontractors in the minimum amounts indicated hereunder.

<u>Form</u>	<u>Minimum Limits</u>
1. Workmen's Compensation	Statutory
2. Contractor's Public Liability (including specific contractual Liability) and Contractor's Property Damage Liability (including explosion, collapse Hazard, underground damage hazard, Blasting, products and completed Operations. (XCU Coverages)	\$1 Million /per occurrence with a \$2 Million aggregate  \$1 Million per occurrence \$2 Million aggregate combined
3. Automobile Bodily Injury Automobile Property Damage	\$1 Million/combined single limit
4. Business Catastrophe Liability* (* This policy must be carried with the same insurance carrier which underwrites the underlying policies.	\$1 million
5. If subcontractors are employed Contractor's Protective (Contingent) Liability Protection – Bodily Injury Property Damage	\$1,000,000/\$2,000,000 \$1,000,000/\$2,000,000

505.4a The Developer shall file with the Township properly executed certificates of insurance or copies of the insurance policies prior to the time construction has begun. All such insurance shall be in sound insurance companies, satisfactory to the Township, and authorized to do business in the Commonwealth of Pennsylvania.

505.4b All insurance companies must be a licensed Pennsylvania insurance carrier having an "A" or better rating, as determined by A.M. Best Co.

506 CONDUCT OF WORK AND SAFETY

506.1 The Developer shall make use of all reasonable means to maintain the normal flow of traffic on Township and State Highways during all phases of construction. Should it become necessary to close any street or highway, the Developer shall obtain permission to do so from the applicable governing agency. The Developer shall notify the Township a minimum of three working days prior for a request for any street closing. The Developer shall erect warning lights and signs at each end of street closures, and shall also erect directional signs to advise motorists of detour routes as required by law or agencies having jurisdiction. All traffic control devices shall meet the requirement of PennDOT Publication 203.

- 506.2 Caution shall be exercised at all times for the protection of persons and property in accordance with applicable laws and codes. Compliance with the safety provisions of applicable laws and building and construction codes are completely the Developer's responsibility.
- 506.3 The Developer and his subcontractor shall take all precautions and furnish and maintain all guards, barricades, handrails, lights, and other appurtenances, etc., for the protection of the traveling public and property at or near the project.
- 506.4 The Developer shall be responsible for and shall see that all equipment, tools, and supplies are operated or handled in such a manner that at no time will they be permitted to contact power, telephone, or other utility lines.
- 506.5 The Developer alone shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation.
- 506.6 The Developer shall take care to repair all works in the Township affected by construction. These works shall have an appearance or condition equal to or better than that condition that existed prior to the construction..

507 EQUIPMENT AND MATERIALS

- 507.1 Whenever any item of equipment or material is designated by reference to a particular brand, manufacturer, or trade name in these Specifications or Plans, it is understood that an approved equal product may be substituted, if acceptable to the Engineer.
- 507.2 Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the Work. The Developer shall supply the Township with a certificate of such inspection.
- 507.3 The use of any equipment and materials other than as specified or beyond the scope of these specifications (for example, metering stations or sewage pumping stations) must be approved, in writing, by the Engineer.

508 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT AND MATERIALS

The Developer and/or his contractors shall:

- 508.1 Transport and handle products in accordance with manufacturer's instructions.
- 508.2 Promptly inspect shipments to assure that products comply with requirements and products are undamaged.
- 508.3 Provide equipment and personnel to handle and store products by methods to prevent soiling, disfigurement, or damage.
- 508.4 Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weathertight, climate-controlled enclosures.
- 508.5 Protect products from vandalism by man and animal, contamination by dirt, dust or water, damage from heat or cold, and damage from direct sunlight.

509 LOCATION AND PROTECTION OF EXISTING UTILITIES

The Developer will be responsible for locating all existing utilities including, but not limited to water, steam, oil, gas mains, sanitary and storm sewers, telephone and electric conduits which may be encountered during the construction operation. This will include complying with Pennsylvania Act 287 of 1974 as amended by Act 187 of 1996, 73 P.S. § 176 et. seq., also known as PA One-Call. He shall also be responsible for locating all underground structures. He shall, at his own expense, arrange with the owners of such utilities for locating them. The Developer shall be responsible for providing adequate protection against damage to utilities encountered during the course of construction and shall be responsible for repair of any utilities damaged during the course of his construction.

510 EMERGENCY MAINTENANCE DURING CONSTRUCTION

510.1 The Developer shall have available at all times, including nights and holidays, and emergency maintenance crew and a person of Township and responsibility to act in cases of emergency such as flooding, cave-ins, or other disorders, resulting from the construction of this development. Such person(s) shall be made known to the Township. The Developer will be responsible for the cost of any such emergency work.

510.2 The Developer is responsible for all costs incurred for any emergency work performed by the Township or others on the Developer's behalf.

511 INSPECTION

511.1 The Developer shall afford every facility for inspection of materials and workmanship and shall prosecute the Work in a systematic manner. The absence of the Engineer or an inspector will not in any way lessen the obligation of the Contractor for construction in accordance with the Specifications.

511.2 The Engineer is to make final inspection within thirty (30) days after written notification by the Developer that the Work is completed and final inspection is requested. Defective Work or Work not conforming to the Specifications is to be repaired or replaced to the satisfaction of the Engineer. The Engineer shall be the ultimate judge of defective Work or Work not conforming to the specifications.

511.3 The cost of any inspection performed by the Engineer, including final inspection, shall be borne by the Developer.

512 POSSESSION AFTER TESTING

After new facilities have been tested and approved, as stipulated in the following sections herein, the Township may use the completed facilities. Possession prior to completion, however, will not imply final acceptance. The Developer shall be responsible for the maintenance of all completed facilities, whether used by the Township or not, until the final inspection is made and following acceptance by the Township.

513 MAINTENANCE AND COMPLETION

513.1 The Developer shall, after final inspection but prior to acceptance by the Township, execute and deliver unto Township a bill of sale for lines, but subject to Developer's obligation to maintain and repair the line and trench, including permanent paving for a period of eighteen (18) months, as outlined in the Township Rules and Regulations, following date of acceptance certificate, and rebuild or replace the same in whole or in part if defective. Upon written notice from the Engineer or Township, the Developer shall immediately make any repairs that may be necessary, or in case the same are not effected promptly, such repairs will be made by Township, at expense of Developer.

513.2 Developer must ascertain from Township whether or not a moratorium is in existence regarding connecting new sewer extensions to live sewer lines in use. If a moratorium is in existence, the sewer line extension must be a capped system. At such time as the Township is notified officially that the moratorium is lifted, the subject lines must be uncapped under engineer's direction and the line reinspected and if acceptable to engineer, the lines may be connected at both ends to live in-use lines.

514 FINAL ACCEPTANCE OF WORK

Following issuance of an Acceptance Certificate by Township and acceptance of the Bill of Sale for said facilities from Developer, the Township shall then become the owner of said facilities, subject to the duty of Developer to maintain, repair, rebuild, or replace referred to above under Paragraph M and the requirements set forth in the Lower Nazareth Township Board of Supervisors Sewer Extension Rules and Regulations.

**MATERIALS**

515 MINERAL

515.1 Unless otherwise specified, all materials used in the work shall as a minimum conform to the requirements of the current Specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), and/or American National Standards Institute (ANSI). All materials shall as a minimum be tested in accordance with the requirements of these Specifications. It is understood and agreed that wherever the word "current" is used relative to the Specifications and methods of testing, it refers to the Standard or Tentative Standard bearing the latest date.

515.2 No material shall be used until it has been inspected and approved on the site of the work. When required by the Engineer, any or all materials entering into the construction of any work shall be tested by a reputable testing laboratory. Such inspection shall not relieve the Developer of any of his obligations in this respect, and any defective material or workmanship shall be at all times liable to rejection when discovered, until the final completion of the Work.

515.3 Where a manufacturer's name is used in these Specifications, it is used to designate a standard of quality. The use of said manufacturer's name does not eliminate other manufacturer's equipment and materials equally as good and efficient.

515.4 Prior to the start of construction, a minimum of five (5) working days, the Developer shall submit to the Engineer at least three (3) copies of shop drawings, catalog cuts, etc., for all materials to be used on the project.



515.5 The Developer shall submit to the Engineer prior to the start of construction a notarized certificate certifying that the pipe was manufactured and tested in accordance with the Specifications.

516 CEMENT

516.1 Cement used for general construction shall conform to the requirements of ASTM Designation C 150, Type I for Portland cement. Where air-entrainment, moderate or high resistance to sulphates, high early strength or low heat of hydration types are required, they shall conform to the following requirements.

<u>Standard</u>	<u>ASTM Designation</u>
1. Air-entraining Portland cement Vinsol resin additive to entrain air Between 3 to 6 percent by volume	C 175, Type IIA  C 226
2. High early strength Portland cement	C 150, Type III

516.2 High early strength Portland cement shall not be substituted for normal strength Portland cement without the approval of the Engineer. The Engineer may, as he deems necessary, require the use of hydraulic cement of such a type as US Mix Quick Hydraulic Cement.

516.3 Cement shall not be used which has been retrieved or reclaimed from used bags, or partly hydrated. Cement that has been stored at the Work site for more than three (3) months shall not be used. The temperature of all cement at time of delivery to the mixer shall not exceed 125°F. Cement used in any individual structure shall not be obtained from not more than one (1) source of supply for each type of cement required.

516.4 Cement shall not be stored in excess of eight (8) bags in height and shall be covered with tarpaulins. When permission is given by the Engineer to store temporarily in the open, a platform and ample waterproof covering shall be provided by the Developer and used as directed by the Engineer.

516.5 The Engineer reserves the option to take check samples for the purpose of testing the quality of the product, and such check test shall be the basis of acceptance or rejection regardless of previous decisions.

516.6 Cement shall be rejected if it fails to meet any of the requirements of the Specifications referred to herein. Samples of each lot shall be required to show practically uniform results of tests. Marked deviations from such results may be considered cause for rejection even though the test requirements may be otherwise fulfilled.

516.7 When directed by the Engineer, a non-shrink Portland cement grout shall be used. The non-shrink grout shall meet or exceed the material and placement requirements of ASTM C-1107, ASTM C-939, and Corps of Engineers Specification CRD-C 621

517 CONCRETE AGGREGATES

All concrete mixtures shall use fine and coarse aggregate to conform to the requirements of ASTM Designation C33.

518 WATER FOR CONCRETE

The water for use in cement concrete mixtures shall be clean, and free from injurious amounts of vegetable matter, oil, acid, and alkali. The tensile strength of a mortar molded in a standard briquette mold, composed of one part of cement and three parts of standard Ottawa sand, proportioned by volume, using the water sample under test shall be at least equal to that developed with distilled water when mixed in the same proportion with the same cement and sand.

519 CONCRETE

519.1 Class A concrete shall have a minimum compressive strength of 3500 pounds per square inch at 28 days.

519.2 Class B concrete shall have a minimum compressive strength of 2500 psi at 28 days.

519.3 The mixed concrete shall be of uniform consistency. The allowable slump as determined by the Engineer shall be kept as low as possible consistent with practical workability of the concrete and shall be between one (1) and three (3) inches per vibrated concrete and between two (2) inches and three and one-half (3 ½) inches per non-vibrated concrete. The method of determining this slump shall be in accordance with ASTM Designation C143.

519.4 Under emergency conditions requiring a hand-mixed batch of ½ cu yd or less, the water contained per 94-lb. sack of cement shall not exceed the following quantities:

<u>Strength – psi</u>	<u>Non-Air-Entrained</u>	<u>Air-Entrained</u>
Class A – 3500 lbs.	6 ½ gal	5 ¼ gal
Class B – 2500 lbs.	7 ¼ gal	6 ¼ gal

519.5 Concrete not air entrained and to be exposed to the action of freezing weather shall have a water content not exceeding six (6) gallons per 94 lb. sack of cement.

520 READY-MIXED CONCRETE

520.1 Ready-mixed concrete may be used for all Work involving concrete providing it conforms to the requirements of ASTM Designation C94, with the following conditions specified:

1. Basis of Purchase                      Net weight of the concrete in the batch as delivered.
2. Materials                                As listed in Paragraphs B and C.
3. Quality                                    Developer responsible for concrete meeting requirement for compressive strength as listed on the Drawings.
4. Mixing                                     Central, or transit-mixed.

520.2 No mixed or agitated concrete shall be used which has remained in the drum, truck agitator, or truck mixer more than ten minutes without mechanical agitation.

- 520.3 The interval between loads shall be controlled in order that concrete in place shall not become partially hardened prior to placing succeeding batches and in no case shall exceed 20 minutes.
- 520.4 The method and time of delivery shall be controlled by plant slips issued to the driver. This slip shall contain the name and location of the plant, the size and proportions of the batch, the time the vehicle left the plant, and the recording of the revolution counter on the drum of the transit truck mixers. Upon arrival at the Work site, the driver shall deliver the slip to the Engineer or his representative.

521 REINFORCEMENT

- 521.1 Bars – material for reinforcing bars shall conform to the requirements of the “Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement”, ASTM A615, Grade 60.
- 521.2 Steel Wire Fabric – material for welded wire fabric or cold drawn wire for concrete reinforcement shall conform to the requirements of the “Specifications for Steel Wire, Plain, for Concrete Reinforcement”, ASTM A82, or the “Specifications for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement”, ASTM A185.
- 521.3 Metal reinforcement, at the time concrete is placed, shall be free from rust, scale, oil, paint, or other coatings that will destroy or reduce the bond.

522 MORTAR

- 522.1 Mortar for laying masonry shall conform to the requirements of the Specification for the Mortar of Unit Masonry, ASTM C270 and shall be composed of the following:

<u>Material</u>	<u>ASTM Designation</u>
1. Portland Cement	C 150, Type IIA
2. Masonry Cement (if specified)	C 91, Type II
3. Aggregates	C 144
4. Water	Paragraph D
5. Hydrated Lime	C 207, Type S
6. Quicklime (lime putty if specified)	C 5 Appendix

- 522.2 No lime chemicals, or other mixtures of any type, shall be used unless so specified or permitted by the Engineer. In mortar where no destructive chemical action is anticipated, hydrated lime may be used.
- 522.3 When required, color tinting shall be made from inert, pure mineral pigments determined by the Engineer.

- 522.4 The ingredients must be in proportions that can be controlled and accurately maintained by measurement and not by estimation. All cementitious materials and aggregates shall be mixed for a minimum period of three (3) minutes, with the amount of water required to produce the desired workability, in a drum-type batch mixer. Hand mixing of the mortar may be permitted on small jobs with the approval of the Engineer. Hand mixing procedure shall be outlined in the request for approval. No greater quantity of mortar shall be prepared than is required for immediate use, and any mortar that has not set shall not be retempered or used in any way. Mortar which has been mixed more than one (1) hour shall not be used.
- 522.5 Mortar conforming to the proportion specifications shall be proportioned by volume within the limits of the types specified:
- 522.5a Sewer Manholes – one part Portland cement, two parts fine aggregate and water.
- 522.5b Grouting – one part Portland cement, two parts fine aggregate and water or Embeco pre-mixed grout as manufactured by American-Marietta Company or equal to prevent shrinkage.
- 522.6 When hydrated lime is permitted, the mortar shall be composed of one (1) part of a combination of Portland cement and one-quarter ( $\frac{1}{4}$ ) part hydrated lime, with two (2) parts of fine aggregate and water. The combination shall be composed of ninety (90) percent by volume of cement and ten (10) percent by volume of hydrated lime.

523 SEWER AND MANHOLE BRICK

- 523.1 Brick intended for use in drainage structures for the conveyance of sewage, industrial wastes, and related structures such as manholes, catch basins, inverts, and sewers shall conform to the requirements of ASTM Designation C32. The proper grade of brick shall be used for the intended purpose as specified in ASTM C32. The Engineer shall approve all uses of brick.
- 523.2 Brick shall conform to one set of the following dimensions based on their availability in the area of the project in the normal size specified:
- 523.2a 4" x 8  $\frac{1}{2}$ " x 2  $\frac{1}{2}$ " (3" or 3  $\frac{1}{2}$ ")
- 523.2b 3  $\frac{3}{4}$ " x 8" x 2  $\frac{1}{4}$ "
- 523.3 Lugged paving brick, cored brick, or brick having recesses or openings extending through the body of the brick shall not be used.

524 POLYVINYL CHLORIDE (PVC) PIPE FOR GRAVITY SEWERS

- 524.1 Polyvinyl Chloride (PVC) Pipe for gravity sewers shall be of the bell and spigot type and shall be manufactured in accordance with ASTM D3034. Pipe and fittings shall meet the extra strength minimum requirements for SDR 35.
- 524.2 The joint shall be a rubber gasket meeting the requirements of ASTM D1869, C361, and C443, and shall provide an adequate compressive force against the bell and spigot to effect a positive seal and to provide for expansion and contraction while preventing displacement. The rubber ring gasket shall be the only element depended upon to make the joint flexible and watertight. Solvent cement joints are not acceptable.

524.3 The pipe and fittings shall be made of PVC plastic having a cell classification of 12454-B or 12454-C as defined in ASTM D1784.

524.4 All pipe shall be marked clearly at intervals of five feet or less with the manufacturer's name, cell classification, SDR 35, and ASTM Designation D3034.

525 POLYVINYL CHLORIDE (PVC) FOR FORCE MAIN SEWERS

525.1 Polyvinyl Chloride (PVC) Pipe for force mains shall be of the bell and spigot type and shall meet the requirements for Class 150 pipe in accordance with ASTM D2241 and AWWA C900. Pipe and fittings shall meet the minimum requirements of SDR 18.

525.2 All pipe shall be suitable for use as a pressure conduit. Provision must be made for expansion and contraction at each joint by means of a rubber ring gasket in accordance with ASTM D1869, C361, and C443. Joints shall be flexible and watertight.

525.3 The pipe shall be marked in accordance with Paragraph J.

525.4 The Engineer must approve the use of PVC Pipe for pressure applications.

526 DUCTILE IRON PIPE

526.1 Ductile iron pipe may be used for gravity sewers, force main sewers, or water mains.

526.2 All ductile iron pipe shall be push-on joint type except as otherwise specified by the Township. Pipe shall be manufactured in accordance with ANSI A21.51 (AWWA C151) for Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand Line Molds.

526.3 Fittings shall be compact mechanical joint fittings except where detailed otherwise on the plans conforming to ANSI A21.10 and ANSI A21.11 with a pressure rating of two hundred and fifty (250) pounds per square inch (psi).

526.4 Push-on joints for ductile iron pipe shall be of a type that employs a single rubber gasket to affect the joint seal.

526.5 The Class for all ductile iron pipe shall be for one hundred and fifty (150) pounds per square inch (psi) normal working pressure, thickness Class 52. The diameter shall be shown on the Drawings.

526.6 All ductile iron pipe and fittings shall be double cement lined and coated outside with a bituminous seal coat in accordance with ANSI A21.4 (AWWA C104), and coated inside with a coal tar epoxy coating or approved equal sulfide resistant coating. The thickness of the linings shall not be less than one-eighth inch (1/8").

526.7 All ductile iron pipe shall be furnished in lengths of sixteen (16), eighteen (18), or twenty (20) feet with the year of manufacture and class designation stamped on it.

527 MANHOLES

- 527.1 All manholes shall be constructed of Precast Reinforced Concrete manhole sections having an inside diameter of 48". All manholes shall be delivered free from chipped, cracked or broken edges and surfaces, and all surfaces, particularly channels, shall be smooth and continuous. Two (2) beads of an approved, minimum one (1) inch wide, butyl joint material shall be placed between all precast manhole sections, as shown on Drawing TBSA-SD-01 of these specifications. The pipe shall conform to the requirements of ASTM Designation C478. The pipe shall have tongue and groove joints that utilize either rubber ring gaskets or preformed plastic sealing compound, to produce watertight joints.
- 527.2 The bottom section shall fit into the concrete base and the top section shall be an eccentric tapered section, tapering from forty-eight inches inside diameter (48" I.D.) to thirty inches inside diameter (30" I.D.).
- 527.3 The entire exterior surfaces of all manholes shall be coated with one (1) coat, producing a dry film thickness of 0.016 inches (16 mils) of Bitumastic Super Service Black, as manufactured by Koppers Company, Inc., or approved equal.
- 527.4 Polyetheleyne manhole steps shall be set in the barrel of the manhole at the point of manufacture.
- 527.5 All manhole bases shall be poured in place or precast. Concrete used for manhole bases shall be Class A as defined in Paragraph E of these Specifications. Concrete in manhole bases shall be placed on undisturbed earth with the required aggregate beneath and shall meet the dimensional requirements and approval of the Engineer.
- 527.6 The invert channel(s) of the manhole shall be shaped to allow a smooth transition from inlet to outlet pipes, and side channels shall have the largest possible sweep radius where transitioning to the main channel.
- 527.7 Pre-cast bases with a rubber compression seal cast integrally into the manhole wall to effect a watertight seal between pipe and manhole may be used in lieu of a poured-in-place base. The seal shall be such as ECONOSEAL, or approved equal, and should meet the requirements of ASTM 443 and ASTM C425. The dimensions must generally meet the minimum requirements shown on the detailed drawings for manholes. A channel shall be formed from Class A concrete after the base has been set and shall be shaped to allow a smooth transition from inlet to outlet pipe.
- 527.8 Castings for manhole frames and covers shall conform in design to East Jordan Foundry Company Catalog Numbers 1320Z and 140AGS as shown on Drawing TBSA-SD-06 in Section VIII of these specifications, or approved equal. Castings for frames and covers shall conform to the requirements of ASTM Designation A48, Class 20. Manhole covers shall be "self-sealing" by means of a continuous round gasket designed to fit within a precisely machined groove on the underside of the lid.
- 527.9 Where located in streets or subject to traffic loads, castings shall be capable of safely supporting an "H-S" loading with due allowance for impact included in the design. The American Association of State Highway and Transportation Officials (AASHTO) Specifications designate "H-S" loadings as designed for a tractor-truck and trailer for loaded lengths up to forty (40) feet or more (H 20 – S 16 and H 15 – S 12).

- 527.10 Castings shall be true to pattern in form and thickness; free from cracks, gas holes, flaws, excessive shrinkage, sound, cleaned by means of sandblast and neatly finished. Runners, fins, risers, and other cast-on pieces shall be removed. All castings shall be tough and of even grain. All parts of castings shall be thoroughly coated at the factory with one coat of black asphaltum paint or other impervious preparation approved by the Engineer.
- 527.11 Castings shall be commercially machinable with the metal bearing areas machine ground finished to insure satisfactory seating so that it will be impossible to rock the cover after it has been sealed in the proper position in the frame.
- 527.12 Watertight manhole frames and covers or manhole inserts will be used on all manholes which are located in areas prone to flooding, including manholes which are located in low-lying, flood-prone areas as well as manholes which are located in and along curbed roadways. The Township may require the Developer to install watertight manhole frames and covers or manhole inserts wherever the Township deems such installations to be required.
- 527.13 All manhole covers shall have the word "SANITARY SEWER" cast in raised letters. Letters shall have a height and width of not less than two inches (2").
- 527.14 Manhole steps shall be constructed of a number 4 (1½ inch diameter) grade 60 steel reinforcement covered with a copolymer polypropylene plastic, manufactured by M. A. Industries or approved equal, as shown on Standard Detail TBSA-SD-07.
- 527.15 For non-residential uses which generate excessive amounts of grease, a pre-cast concrete tank type grease trap shall be placed between the facility to be served and the sanitary sewer, in addition to any grease traps as may be required inside the facility. An inspection manhole shall be placed immediately downstream of the external grease trap. The need for a grease trap and inspection manhole shall be solely determined by the Township.

528 BASE COURSES AND BITUMINOUS PAYMENTS

All paving materials used shall conform to the requirements of the Pennsylvania Department of Highways Specifications, Publication 408, subject to approval by the Engineer.

529 BACKFILL AND PIPE BEDDING

- 529.1 Backfill Material: Excavated material free of cinders, ashes, refuse, vegetable, or organic material, boulders, rocks, stone, or other material which, in the opinion of the Engineer, is unsuitable. Backfill material shall conform to the requirements established under "Classification of Backfill Materials", specified below.
- 529.2 Aggregate Backfill and Bedding: Fine aggregates and coarse aggregates conforming to PennDOT Sections 703.1 and 703.2. Aggregate Backfill requirements established under "Classification of Backfill Materials", specified below.

### 529.3 Classification of Backfill and Bedding Materials

Pipe Bedding – AASHTO No. 57 or PennDOT No. 2A Coarse Aggregate, Type A.

#### Initial Backfill

PVC Pipe (all types) – AASHTO No. 57 or PennDOT No. 2A Coarse Aggregate, Type A.

Ductile Iron Pipe – Excavated material conforming to the requirements for backfill material, but containing no stones larger than two (2) inches in maximum dimension.

Aggregate Backfill (to Restoration Depth) - PennDOT No. 2A Coarse Aggregate, Type A, within State Highway and existing Township road rights-of-way or as otherwise directed by Engineer.

Backfill Material (to Restoration Depth) - Excavated material approved by the Engineer and containing no stones larger than eight (8) inches in maximum dimension. A maximum of twenty percent (20%) of the backfill volume may be stones so long as the stones are evenly distributed within the material. Use outside existing paved areas only. Spoil from blasting or other bedrock removal operations shall not be considered suitable backfill material.

## TESTING

### 530 LABORATORY TESTS

Where otherwise required by these Specifications or as directed by the Engineer, all materials specified may require advance and periodic laboratory tests. Materials shall be sampled and tested in accordance with the methods of the ASTM, AWWA, or ANSI Standard, designated or as directed by the Engineer. When required by the Township, laboratory test results shall be submitted at least two (2) weeks prior to starting delivery of such materials to the site of the project. The testing laboratory shall furnish both the Engineer and the Developer with two (2) copies of the reports showing the results of such tests, and the reports shall be considered as sufficient evidence of the acceptance or rejection of the quality of the materials tested. The specifications for and the method of testing will be found under the detailed Specifications for the particular material involved.

### 531 SHOP TESTS

531.1 The materials listed below shall be tested at the shop or plant of, and by, the producer. Each manufacturer of such materials shall be fully equipped to carry out the test herein designated. Upon demand of the Engineer, the manufacturer shall perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use.



531.2 The Engineer shall be furnished with certified records or reports of the results of all tests, such records or reports to contain a sworn statement that the tests have been made as specified. The Engineer may require additional tests by an independent testing laboratory.

<u>Material</u>	<u>Test Method</u>	<u>Number of Tests</u>
Polyvinyl Chloride (PVC)	ASTM D-3034	As specified in ASTM D-3034
Ductile Iron Pipe	ANSI 21.51	As specified in ANSI 21.51

532 FIELD TESTS

The installation of all sewers shall be tested in the field, in the presence of the Engineer or his authorized assistant together with a representative of the Contractor in the manner prescribed herein.

532.1 Leakage Tests for Sewers

All sewers constructed under these Specifications shall be tested for leakage by either the low-pressure air test method or the exfiltration test method. The method of test shall be solely the decision of the Township.

532.1a Exfiltration Testing

As soon as a section of sewer, together with all laterals connected thereto, has been constructed between manholes and the manholes have been completed, a suitable plug manufactured for that purpose shall be inserted at the lower manhole, and the section filled with water to the top of the manhole rim elevation in the upper manhole. The drop in water level in the upper manhole shall be measured and timed in order to calculate the actual rate of exfiltration.

When the difference in sewer elevations between the upper and lower manholes exceeds ten (10) feet, the Developer will be allowed additional exfiltration at the rate of 10% for each additional two (2) feet of head over ten (10) feet, as computed by the Engineer.

The test shall be run for a period of one (1) hour. Any section of sewer showing leakage in excess of the amounts above specified shall be repaired or replaced at the expense of the Developer.

The test will be passed if the exfiltration is less than fifty (50) gallons per inch of pipe diameter per mile of pipe per day for PVC pipe and one hundred (100) gallons per inch of pipe diameter per mile of pipe per day for all other types of pipe.

If a section of sewer line to be tested contains vertical risers for house connections, the Township may direct that the entire line be tested by air.

In making the above tests, all equipment and labor shall be furnished by the Developer and at the Developer's expense.

532.1b Low Pressure Air Test

The Contractor shall test each section of pipeline between manholes using low-pressure air. The pipe shall be considered acceptable if the air loss rate does not exceed 0.0030 Cu-ft per minute per square foot of internal pipe surface when tested at an average pressure of 4.0 psig greater than the average back pressure exerted by the ground water of the backfilled pipe line. The time for the air pressure to decrease 0.5 psig from 4.0 psig to 3.5 psig greater than the average groundwater backpressure shall not be less than the time indicated in the following list. If these rates of leakage are exceeded, the Developer shall, at his own expense, determine the source of leakage and make all necessary corrections and retest.

8 in. pipe diameter	3:57 minutes:seconds
10	4:43
12	5:40
15	7:05
18	8:30
21	9:50
24	11:20
27	12:45
30	14:10
36	17:00
42	19:50
48	22:40

A minimum period of one minute shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. In areas of high groundwater conditions, the Developer shall determine the height of the groundwater above the pipe by piezometric tube or other approved methods.

Any section of sewer showing leakage in excess of the amounts above specified shall be repaired or replaced at the expense of the Developer.

532.2 Leakage Test for Water Mains

Whenever sewer work is paralleling a water main and the water line has never been exposed in the course of construction, tests of the main shall be made at the Contractor's expense, upon completion of the sewer work along each section of water main between line valves, to determine if any leakage has been caused by the Contractor's operations. In case leakage is shown by the test, the Contractor shall have same repaired at his own expense.

532.3 Pressure Test for Force Main

532.3a After the pipe has been laid and partially backfilled between joints, each section of pipe between valves shall receive the following hydrostatic test:

- 532.3b The pipe shall be slowly filled with water and tested to fifty (50) percent above the normal operating pressure based on the elevation of the lowest point of the line or section under test. The pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. A meter to measure make-up water shall also be installed. The pump, pipe connections, taps into the pipe, and all necessary apparatus except gages shall be furnished by the Contractor.
- 532.3c Before applying the specified test pressure, all air shall be expelled from the pipe. The Contractor shall furnish and install corporation cocks as may be required so that air can be expelled as the line is filled with water.
- 532.3d All exposed pipes, fittings, valves, and joints shall be carefully examined during the open-trench test. Any cracked or defective pipes, fittings, or valves discovered in consequence of this pressure test shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the Engineer. Should the Contractor elect to backfill the entire trench or any portion thereof, prior to testing, it shall be his responsibility to locate and repair any leaks that occur during this test.
- 532.3e While the test pressure is being maintained, all exposed pipes, fittings, valves, and joints shall be inspected for leaks, which shall not exceed ten (10) gallons per inch of pipe diameter per mile of per day. The test pressure shall be maintained for a period of not less than one (1) hour if joints are exposed and four (4) hours when joints are covered.
- 532.3f The test section of pipe shall not exceed one thousand (1,000) feet where practical.

#### 532.4 Leakage Test for Manholes

- 532.4a All newly constructed manholes will be subjected either to a vacuum test or hydrostatic test. The hydrostatic test shall be conducted in accordance with the procedures specified in Section C.1 above, and shall meet all standards contained therein.
- 532.4b The vacuum test shall be conducted in accordance with the following:
- 532.4c The Contractor shall provide tools, materials (including water), equipment, and instruments necessary to conduct vacuum manhole testing as specified herein. Vacuum testing equipment shall include:

Vacuum apparatus equipped with necessary piping, control valves, and gauges to control air removal rate from manhole and to monitor vacuum.

An extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.

Vacuum testing equipment and associated testing apparatus subject to Engineer's approval.

Seal plate with vacuum piping connections for inserting in manhole frame.

- 532.4d Prior to testing manholes, the Contractor shall thoroughly clean and seal openings. Openings shall be sealed using properly sized plugs.
- 532.4e The test shall be performed with frames installed. The joint between the manhole and the manhole frame shall be included in the test. If the seal between the frame and cone section is broken after a manhole has been tested, it shall be retested
- 532.4f The Contractor may elect to make a test prior to backfilling for his own purposes. However, the tests of the manholes for acceptance shall be conducted after the backfilling has been completed.
- 532.4g The Contractor shall follow the vacuum test procedure as follows:
  - 532.4g1 Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.
  - 532.4g2 Draw a vacuum of ten inches of mercury and close the valves.
  - 532.4g3 Consider manhole acceptance when vacuum does not drop below nine inches of mercury for the following manhole sizes and times:
    - Four-foot diameter – 4:20 minutes:seconds
    - Five-foot diameter – 5:25
    - Six-foot diameter – 6:30
  - 532.4g3a Should a manhole not satisfactorily pass the test, the Contractor shall discontinue manhole construction and determine the source or sources of leaks. The Contractor shall then repair by a method approved by the Engineer or replace defective materials and workmanship, as is the case, and conduct such additional manhole acceptance tests and such subsequent repairs and retesting as required until manholes meet test requirements.
  - 532.4g3b If any part of the manhole is dislodged or in any way disturbed or damaged after successful testing, the manhole will be reset or repaired and retested at the Developer's expense.
  - 532.4g3c The materials and methods used to make manhole repairs must meet with Engineer's approval prior to use.

#### 532.5 Deflection Test

Deflection tests shall be required on all flexible pipe. Tests shall be run not less than 30 days after backfill has been placed. No pipe shall exceed 5% deflection. Test shall be run using a go/no go mandrel having a diameter equal to 95% of the inside diameter of the pipe. Tests shall be performed without the use of mechanical pulling devices. The mandrel size shall be verified by the use of a proving ring supplied by the Engineer. If the mandrel passes through the proving ring, it is not acceptable, and shall be replaced. If in the Engineer's opinion it is warranted, any section of pipe shall be re-mandrel tested at any time prior to acceptance by the Township.

532.6 Television Inspection

Prior to acceptance of the sewer system by and at the sole discretion of the Township, the Township may require closed-circuit internal video inspection of portions or all of the sewer installed by the Developer. Such television inspection will be in addition to the tests specified in this Section. Additionally, immediately prior to the end of the required eighteen (18) maintenance period after acceptance by the Township, all portions of the system shall be televised by the Developer. All closed circuit video will be performed in color. Prior to any televising, all portions of the system will be pressure flushed, minimum eight hundred pounds per square inch (800 psi), and cleaned of all debris. The Developer shall bear the entire cost of television inspection process.

533 COMPACTION TESTS

When required by the Township or the Engineer, the Developer shall have soils compaction testing performed in accordance with these specifications. Testing shall be performed by laboratory approved by the Engineer. Two copies of all results shall be furnished to the Engineer.

534 FLUSHING AND CLEANING

The Developer shall clean and flush the newly installed system employing the means of pressure, minimum eight hundred pounds per square inch (800 psi), flushing and vacuuming equipment, as approved by the Engineer. This shall be done prior to the expectance of the system by the Township, prior to televising the system at the end of the eighteen (18) month maintenance period, and at any other time the Township may deem necessary.

**TRENCH EXCAVATION AND BACKFILL**

535 GENERAL

535.1 The Developer shall excavate, protect, and backfill all trenches that may be necessary for completing the Work. All excavation shall be in open trenches, except where and to such extent as the Engineer may authorize or direct that same be done in tunnel, or where such is specified in the Special Requirements or Contract Plans. The use of excavation 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. No tunneling, boring, or forcing will be allowed without special permit form the Engineer. The excavated material must be so piled as not to encroach onto private property, endanger the work, obstruct sidewalks, nor interfere with proper drainage. Trenches may be, in general, excavated and backfilled by either by machinery, or by hand as the Developer may elect, provided however, that the Engineer shall be empowered, wherever he shall decide that such necessity exists, to direct that hand excavation shall be done to the extent hereinafter specified. All trenches shall be backfilled at the end of the working day. No trenches shall remain open overnight for any reason.

535.2 The term "sub-grade" as used herein shall mean the bed of the trench, prepared as specified to receive aggregate bedding and the sewer pipe.

536 REMOVAL OF EXISTING PAVEMENT AND STORAGE OF MATERIALS

- 536.1 The Developer shall remove all pavements, road surfaces, curbing, driveways, and sidewalks within the lines of excavation. Portland cement concrete pavements shall be opened by sawing and asphalt pavements by cutting to neat, straight lines with channeling machine, hand-operated pneumatic tools, or by such other methods as will furnish a clean cut in the pavement and base without undue shattering, as approved by the Engineer. All such Work as above designated shall be done at the Developer's expense and in accordance with the rules and regulations of the municipality in which the work is done. The use of "pear" or weight dropped on pavement for breaking will not be allowed except by written permission of the Engineer.
- 536.2 The Developer shall grub and clear the surface and remove all surface materials, of whatever nature, over the line of the trench; and he shall properly separate and classify the materials removed, store, guard, and preserve such of said materials as may be required for use in backfilling, resurfacing, repaving, or for other purposes. All the rock, earth, sand, curbing, gutter, and flagstones, and all sectional paving units which may be removed, together with all materials taken from the trenches, shall be stored, in such parts of the street or roadway, or such suitable place, and in such manner, as shall be approved. The Developer shall be responsible for any loss of or any damage to paving materials through his own or his employees' careless removal or neglectful or wasteful storage, disposal, or use of same.
- 536.3 In the business districts or in streets that are important thoroughfares, or in narrow streets or other places so designated by the Engineer, the material excavated from the first one hundred (100) feet of any opening, or from such additional length as may be required, shall, upon Order of the Engineer, be removed from the street as soon as excavated. The material subsequently excavated shall be used to refill the trench.
- 536.4 All surplus excavated material shall be removed and deposited upon lands abutting the improvement if such fill is requested by the property owners. If no filling on abutting property is desired, the Developer shall dispose of such surplus wherever he can arrange for rights to fill.
- 536.5 In case more material is excavated from any trench than can be backfilled over the completed pipelines or can be stored on the street or within the limits of the right of way, leaving space for the traffic and drainage as herein provided, the excess material shall be removed to some convenient place, provided by the Developer. The Developer shall, at his own cost and expense, bring back so much of the material so removed, as may be required to properly backfill the trench, if of the proper kind; or, if so directed by the Engineer, the Developer shall, at his own cost and expense, furnish such other material as may be necessary. When it is necessary to haul soft or wet material over the streets, the Developer shall provide suitable tight vehicles.

537 TRENCH DIMENSIONS

- 537.1 Banks of trenches shall be kept as nearly vertical as possible, and the trenches shall be eight (8) inches wider on each side than the outside diameter, at the barrel, of the pipe to be laid therein. The trenches shall be excavated true to line so that a clear space eight (8) inches in width is provided on each side of the barrel of the pipe to a height not less than the top of the pipe. If sheeting is required at the level of the pipe, the dimensions in the foregoing sentence shall be applicable to the inside faces of the sheeting.
- 537.2 The width of unsheeted trench shall be sixteen (16) inches wider than the outside diameter of pipe at the spring line.
- 537.3 Wherever necessary to prevent caving, excavation in sand, gravel, sandy soil, or other unstable material shall be adequately sheeted and braced. Where sheeting and bracing is used, the trench width shall be increased accordingly. Trench sheeting shall remain in place until the pipe has been laid and the earth around it compacted to a depth of two (2) feet over the top of pipe.
- 537.4 In rock, shale, or any unyielding material, or where called for on the plans, or when ordered by the Engineer, requiring the bottom of the trench to be excavated in excess of eight (8) inches below the outer bottom of the pipe; the space below the outer bottom of the pipe shall be filled with crushed stone or concrete.
- 537.5 The draining of the trench shall be so effected that no water can run through newly laid pipe, nor accumulate in the trench until after the concrete has thoroughly set. All concrete work shall be set up hard before any backfilling work is started.
- 537.6 In no case shall more than forty (40) feet of trench be opened at any one place in advance of the completed sewer. Trench excavation shall be fully completed, except for the shaping of the bottom of the trench, at least twenty (20) feet in advance of the pipe placement, and shall be kept free from constrictions, except that at the close of the Work at night, or at the discontinuance of Work, the pipe laying may be completed to within five (5) feet of the end of the opened trench. The amount of pipe laid in advance of backfilling shall not exceed twenty (20) feet.
- 537.7 The Engineer shall be empowered, at any time, to require the refilling of open trenches over complete pipelines, if, in his judgement, such action is necessary.

538 ACCOMMODATION OF TRAFFIC

- 538.1 The Work on all streets and highways shall be governed by Publication 203 of the Pennsylvania Department of Transportation (PennDOT), and the Developer shall familiarize himself with this publication.
- 538.2 The Developer shall comply with all State, Township, or local regulations concerning opening of trenches in streets or highways.
- 538.3 Streets shall not be unnecessarily obstructed, and unless the Engineer, in writing, shall authorize the complete closing of the street, the Developer shall take such measures at his own expense, as may be necessary, to keep the street or road open and safe for traffic.

- 538.4 The Developer shall construct and maintain such adequate and proper bridges over excavations, as may be necessary, for the safe accommodation of pedestrians or vehicles. The Developer shall furnish and erect, without cost to the Township, substantial barricades at crossings of trenches, or along the trench, to protect the traveling public.
- 538.5 Driveways shall be bridged across open trenches where so shown on the plans or as so directed.
- 538.6 The Developer shall not obstruct fire hydrants.
- 538.7 The roadway on one side of the line of Work shall be kept open at all times.
- 538.8 A straight and continuous passageway on sidewalks and over crosswalks, at least three (3) feet in width, shall be preserved from all obstruction, where the Work to be performed does not lie under the sidewalk.
- 538.9 Where deemed necessary, such additional passageway as may be directed shall be maintained free of obstruction.
- 538.10 In the narrow or congested streets or alleys, when so directed, the Developer shall complete his Work up to a point designated by the Engineer before opening the Work ahead, in order to give access to garages and other places.
- 538.11 The Developer shall in all cases so arrange his Work as to cause the least inconvenience to property owners consistent with the proper prosecution of the Work as determined by the Engineer.

539 ACCOMMODATION OF DRAINAGE

- 539.1 The pipe trench must in all cases be kept substantially free from storm, surface, and subsoil water or sewage, so that all masonry joints may have ample time to set and harden. No joints shall be made under water.
- 539.2 Gutters, sewers, drains, and ditches shall be kept open at all times for surface drainage. No draining or ponding of water in gutters or other waterways will be permitted, except where stream crossings are necessary and then only to an extent that the Engineer shall consider necessary. The Developer shall not direct any flow of water across or over pavements except through approved pipes or properly constructed troughs, and he shall, when so required, and at his own cost and expense provide pipes or troughs, of such sizes and lengths as may be required, and place the same as directed. The grading in the vicinity of trenches shall be controlled so that the ground surface is properly pitched to prevent water running into the trenches.
- 539.3 In open water courses, ditches, or pipes, encountered during the progress of the Work, the Developer shall, at his own expense, provide for the protection and securing of a continuous flow in such courses or pipes and shall repair any damage that may be done by reason of them.



540 PUMPING

The Developer shall keep all excavation free from water, at his own expense, while structural Work is in progress, and to such extent as may be necessary while excavation Work alone is being carried on. The Developer shall build all dams and other devices necessary for this purpose, including lowering the water table below trench bottom by well points and pumping, and provide and operate pumps of sufficient capacity for dewatering the excavations. He shall provide for the disposal of the water removed from excavations in such manner as shall not cause injury to the public health, to public or private property, to the Work of other contractors, to any portion of the Work completed or in progress, or produce any impediment to the use of highways, roads, lanes, and streets by any public.

541 EXPLOSIVES AND BLASTING

- 541.1 Only small amounts of explosives shall be kept at any place, and they shall be kept under lock, the key to be only in the hands of a licensed blaster. Great care shall be taken in handling dynamite and similar explosives during the freezing weather. Caps and exploders shall not be kept in the same place as explosives. Blasts shall be properly matted and securely covered.
- 541.2 The Developer shall be responsible for any damage resulting from blasting. A pre-blast survey shall be performed prior to and seismic recordings made throughout the blasting procedure by qualified testing professionals. The Developer's method for procedure relative to blasting shall conform to State Laws and to local municipal ordinances. All existing sewer lines within a one hundred (100) foot radius of any blasting activity shall be televised prior to and after any blasting.
- 541.3 The Developer shall be solely responsible for injury to persons or property that may result from his use of explosives, and the exercise of, or failure to exercise control on the part of the Engineer shall in no way relieve him of responsibility for injury or damage resulting from their use.
- 541.4 All blasting shall be done under the supervision of a competent blasting expert, and subject to the state, county, or local regulations for blasting. Whenever any pipe main or conduit is encountered in the trench, the right is reserved to direct that all rock within an approved distance from the same be removed by some method other than blasting.

542 TUNNELING/BORING

- 542.1 No tunneling or boring will be permitted except with the permission of and in accordance with methods approved by the Engineer. Permission will be given only in cases where a line is laid behind a curb, across a paved street, or under railroad tracks, or because of the proximity of adjacent walls or structures due to excessive depths. Tunnels shall be backfilled tightly by mechanical tamping from each end provided, however, that regulations of the governing Township, or railroad, do not provide for other means of backfilling.
- 542.2 If tunneling or boring is permitted for the installation of lines beneath paved roads, the tunneling or boring shall be done according to the Specifications of the Pennsylvania Department of Transportation.

543 EMBANKMENT

- 543.1 Where embankment is necessary to support the foundations of pipelines, it shall be made to the height, width, and slopes shown on the drawings or as directed. The entire embankment shall be made prior to the construction of the pipeline or the foundation thereof.
- 543.2 After carefully grubbing and clearing the ground, removing all loose rock and stone, and all muck and improper material, the embankment shall be built up of material conforming to the requirements for backfill as set forth in the materials section of this specification.
- 543.3 In case material that is unsatisfactory for the foundation of an embankment is encountered, said material shall be removed to such depth, and for such length and width, as may be required to achieve an adequate capacity of the subsoils as determined by the Engineer.

544 PIPE BEDDING

- 544.1 Bedding: The trench shall be excavated to a depth of six (6) inches below the outside diameter of the pipe barrel, or deeper if so specified. The resultant subgrade shall be undisturbed, or compacted as approved by the Engineer if disturbed. The bedding shall then be prepared by placing a thoroughly compacted aggregate pipe bedding material, as specified hereinafter. Bedding shall provide uniform and continuous bearing and support for the pipe at every point between bell holes. All bedding shall be compacted as approved by the Engineer.
  - 544.1a Aggregate Bedding: Refer to Type A bedding shown on Standard Detail TBSA-SD-14.
  - 544.1b Concrete Bedding: Refer to Type B bedding shown on Standard Detail TBSA-SD-14.
- 544.2 Unstable Subgrade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the Engineer, should be removed, the Developer shall excavate and remove such unsuitable material to the width and depth recommended by the Engineer.
  - 544.2a Before pipe is laid, the subgrade shall be made by backfilling with aggregate material, as directed by the Engineer, in layers not to exceed twelve (12) inches (uncompacted thickness) thoroughly tamped and the bedding prepared as hereinbefore specified.
  - 544.2b When the bottom of the trench is wet, the Developer has the option, upon the approval of the Engineer, of using No. 57 coarse aggregate in lieu of 2A coarse aggregate for pipe bedding material.
  - 544.2c Special foundations: Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Engineer, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Developer shall construct a foundation for the pipe, consisting of piling, timbers, or other materials, in accordance with the construction drawings.

544.2d Excavation in Fill: When the pipe is laid in fill, the compacted embankment shall be brought to a height of at least nine inches above the proposed top of the pipe before the trench is excavated.

545 BACKFILLING

- 545.1 General: Backfilling shall not be done in freezing weather except by permission of the Engineer, and it shall not be done with frozen or wet material. Do not backfill when the material already in the trench is frozen or wet.
- 545.1a Where aggregate backfill is not indicated on the Drawings or specified herein, and in the opinion of the Engineer or the Township should be used in any part of the Work, the Developer shall furnish and backfill with aggregate as directed by the Engineer.
- 545.1b In State Highways all backfill shall be in accordance with the requirements of PennDOT Chapter 459 and Publication 408.
- 545.2 Initial Backfill on Sides and Over Pipe: From the pipe bedding to a depth of one (1) foot above the top of the pipe, the trench shall be backfilled by approved mechanical methods. The Developer shall use special care in placing this portion of the backfill so as to avoid injuring or moving the pipe. The backfill shall be placed in layers not exceeding twelve (12) inches (uncompacted thickness) and compacted by mechanical tamping. The Engineer shall approve all methods of mechanical compaction.
- 545.3 Aggregate Backfill to Restoration Depth (Existing Paved Areas including Driveways): From one (1) foot above the top of the pipe to restoration depth, the trench shall be backfilled by approved mechanical methods. Backfill in this section of the trench shall be coarse aggregate material subject to limitations specified and compacting by tamping in six (6) inch layers or other approved mechanical methods unless otherwise specified. Any compaction method utilizing water such as jetting or puddling shall not be permitted. Compaction shall proceed from the center of the trench to the sides to prevent arching.
- 545.4 Backfill Material to Restoration Depth (Outside Existing Paved Areas): From one (1) foot above the top of the pipe to restoration depth, the trench shall be backfilled by approved mechanical methods. Backfill in this section of the trench shall be excavated material subject to limitations specified and compacted by tamping in twelve (12) inch layers or other approved mechanical methods unless otherwise specified. Any compaction method utilizing water, such as jetting or puddling shall not be permitted. Compaction shall proceed from the center of the trench to the sides to prevent arching.
- 545.5 Underground Warning Tape: For the purposes of early warning and identification of buried pipes during future trenching or other excavation, provide continuous identification tapes in trenches. Install in accordance with printed recommendations of the tape manufacturer, and as modified herein. Bury tape at a depth of twelve inches below grade; in pavements, measure twelve inches from subgrade of pavement.
- 545.6 Compacting: During the course of backfilling and compacting work, the Engineer may, at any location or depth of trench, make tests to determine whether the Developer's compaction operations are sufficient to meet specified requirements. Compact trench backfill as follows:

545.6a All trench excavation and backfill within State Highway right-of-way will be performed in accordance with the requirements of and subject to inspection by representatives of, the Commonwealth of Pennsylvania, Department of Transportation.

545.6b Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill at the bottom of each layer of not less than 95 percent as determined by AASHTO T 99. Perform field determinations of density, when requested by the Engineer, in accordance with AASHTO T 191.

546 TEMPORARY REPAVING AND MAINTENANCE OF TRENCH SURFACES

546.1 The Developer shall maintain the surfaces of temporary repaving of all backfilled trenches until permanent repaving is placed hereon. The Developer shall provide such maintenance until the date of Approved Completion, and thereafter until the maintenance period expires.

546.2 The Developer shall be responsible for any injury or damage resulting from lack of required trench maintenance during the prescribed maintenance period.

546.3 Pennsylvania Department of Transportation requirements referred to in these Specifications shall be those contained in the current issue of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, and Regulating Occupancy of State Highway Right-of-Way Form 945-B. The references pertain only to the materials, equipment, methods, and labor.

546.4 Those trenches falling Under the jurisdiction of the Department of Transportation shall be backfilled and temporarily repaved in accordance with State Highway regulations as covered in Pennsylvania Code, Title 67, Chapter 459 (Occupancy of Highways by Utilities), latest edition.

546.5 Those trenches that are not under the jurisdiction of the State Highway Department shall be backfilled and temporarily repaved as depicted on Standard Detail TBSA-SD-16 of these Specifications or in accordance with local government requirements.

546.6 The Developer shall maintain the surfaces of temporary repaving of all backfilled trenches until permanent repavement is placed thereon. The Developer shall provide such maintenance until the date of the Certificate of Completion and acceptance of the Work, and thereafter until the maintenance period expires.

546.7 The Developer shall be responsible for any injury or damage resulting from lack of required trench maintenance during the prescribed maintenance period.

547 RESPONSIBILITY FOR CONDITION OF EXCAVATION

547.1 The Developer shall be responsible for the condition of all excavations made by him, at whatever time and under whatever circumstances that may occur.

547.2 The neglect, failure, or refusal to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheeting, bracing, jacks, wales, rangers, etc., shall not in any way or to any extent relieve the Developer of any responsibility concerning the condition of excavation or of any of his obligations, nor shall any delay, whether caused by any action of the Township, or his agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve the Developer from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of his obligations relating to injury of persons or property, nor entitle him to any claim for extra compensation.

548 PROTECTION OF PROPERTY AND STRUCTURES

548.1 The Developer shall, at his own expense, sustain in their places, and protect from direct or indirect injury, all trees, shrubs, lawns, landscaping, pipes, tracks, walls, buildings, and other structures or property in the vicinity of his Work, whether above or below the ground, or that may appear in the trench. He shall at all times have a sufficient quantity of timber and plank, chains, roper, etc., on the ground and shall use them as necessary for sheeting his excavation and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened.

548.2 The Developer shall take all risks attending the presence or proximity of pipes, poles, tracks, walls, buildings, and other structures and property, of every kind and description, in or over his trenches, or in the vicinity of his Work, whether above or below the surface of the ground; and he shall be responsible for all damages and assume all expenses for direct or indirect injury, caused by his Work, to any of them, or to any person or property by reason of injury to them, whether such structures are or are not shown on the Design Drawings.

548.3 Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piles alongside of the trench from falling on private property outside the right of way, a safe and suitable fence shall be placed alongside the trench.

548.4 The Township reserves the right to stop the excavation or any other part of the Work, and to require the Developer to complete the work and the backfilling up to such a point as the Engineer may direct before proceeding further with the excavation.

549 REMOVAL OF OBSTRUCTIONS

The Developer shall not interfere with any persons, firms, or corporations, or with the Township in protecting, removing, changing, or replacing their pipes, conduits, poles, or other structures; but he shall suffer said persons, firms, or corporation, or the Township, to take all such measures as they deem necessary or advisable for the purpose aforesaid, and the Developer shall thereby be in no way relieved of any of his responsibilities.

550 CLEARING STREET, CLEANING UP, AND REPAIRS

550.1 The Developer shall remove surplus excavated material or construction material as the Work progresses, and shall keep the street in a safe and convenient condition for travel.

- 550.2 The Developer shall be responsible for maintaining roads and highways in a clean and dust-free condition insofar as the dust and dirt related to his work.
- 550.3 Before final acceptance of the Work, and also immediately prior to the expiration of the eighteen (18) month maintenance period, the Developer shall, by means of high pressure flushing, clear the sewers of any mortar, bituminous compound, dirt, or other refuse or debris that may have been left or accumulated in the sewers. All manholes, inlets, and other structures shall be cleared of all forms, scaffolding, centering, surplus, mortar, rubbish, or dirt, and left in a clean and proper condition. During flushing, any and all debris or other refuse will be captured to prevent introduction into and damage of the Township's system.
- 550.4 All surplus material, tools, equipment, and temporary buildings shall be removed from the site of the work, and all street surfaces, gutters, walls, lawns, rights of way, or other property shall be restored to as good a condition as originally found. The Developer, at his own expense, shall repair, any and all damage he has caused to the street, sidewalk, or adjoining property.

551 SHEETING, BRACING, AND SHORING

All timber plank used for sheeting and sheet piling and all timber used for braces, shores, and stringers or waling-strips shall be sound, straight, free from cracks, shakes, and large or loose knots, and of the required dimensions throughout. Plank shall be tongued and grooved and splined, if so required.

**SANITARY SEWER INSTALLATION**

552 GENERAL

Included in this Section are the Specifications for the installation of all sanitary sewers to be constructed; including interceptor sewers, collection sewers, force mains, and service connections of whatever size, material, or type required as designated on the approved Construction Drawings.

553 MATERIALS

- 553.1 Gravity sanitary sewers shall consist of approved sections of PVC, ductile iron, or in special cases other materials, of the diameters and with jointing materials shown on the approved drawings or specified, and conforming to the requirements of the Materials Section of these Specifications.
- 553.2 Sanitary force main shall consist of approved sections of PVC, ductile iron, or in special cases other materials of the diameters and with jointing materials shown on the drawings shown on the approved drawings or specified, and conforming to the requirements of the Materials Section of these Specifications.

554 CONSTRUCTION METHODS

554.1 Laying Pipe

Following the trench excavation and preparation of the crushed stone bedding, pipe laying shall proceed upgrade with pipe laid carefully, bells upward, spigot ends fully entered into adjacent bells, and true to lines and grades shown on the drawings. Each length or section of pipe shall be carefully inspected before installation and those containing cracks or other defects shall be removed from the site or destroyed. Extreme care must be exercised to prevent breakage when the pipe is handled. Bells and spigots shall be carefully cleaned before pipes are lowered into trenches. The pipes shall be lowered so as to avoid unnecessary handling in the trench. Each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses prepared where required to accommodate bells and joints. Each pipe shall be firmly held in position so that the invert forms a continuous grade with the invert of the pipe previously placed. The interior of all pipe and the inside of the bell and outside of the spigot shall be thoroughly cleaned of all foreign matter before being lowered into the trench, and shall be kept clean during laying operations by means of plugs or other approved devices.

- 554.2 Under no conditions shall pipe be laid in water or on subgrade containing frost, and no pipe shall be laid when trench conditions are unsuitable for such work. In all cases, water shall be kept out of the trench until concrete cradles or supports, where used, and materials in the joints have hardened. The Township shall make the final determination if trench conditions are suitable for this work.
- 554.3 Walking or working on the completed pipeline except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least two (2) feet over the top of the pipes.
- 554.4 Any pipe that has its grade or joint disturbed after laying shall be taken up and relaid. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe.
- 554.5 Prior to the excavation of any trench for sewer construction, the Contractor shall stake out the proposed sewer line. Cutsheets showing the required excavation (cuts and fills) for the proposed sewer line shall be prepared and submitted to the Township for approval a minimum of five (5) working days prior to the start of construction. This shall apply to all phases and sections of sanitary sewer construction. No work shall be performed without approved cutsheets.
- 554.6 If the Contractor elects to use grade bars, he shall set a minimum of three grade bars at twenty-five foot centers. Each pipe shall be laid to line and grade indicated by a line drawn tightly between the grade bars, by using a rod or pole of fixed length as a gauge between working line and the pipe in trench. A plumb bob shall be used to check the line of pipe. If the grades are flat and the Engineer so orders, the Contractor shall place intermediate bars between those set to avoid sag in the working line. All methods of establishing line and grade shall be approved by the Engineer.
- 554.7 Prior to proceeding further with construction and regardless of the method of establishing pipeline grades, the Contractor shall verify elevations at all manhole structures using an engineer's level and level rod with the Engineer present.

- 554.8 Satisfactory means shall be used to hold the pipe in line while the pipes are being joined, and due precaution shall be taken to insure that the spigot end of the pipe being laid is pushed home into the groove of the preceding pipe. Pipe can be placed in the trench by hand, but must be joined mechanically, such as with the use of a pushing bar or other aid, to ensure the spigot end is completely pushed home into the bell end, creating a flush joint.
- 554.9 No pipe shall be laid within ten feet of the machine excavating the trench nor within seventy-five (75) feet of any place where blasting is being done. In all cases, the mouth of the pipe shall be provided with a stopper, or other means of sealing the end of the pipe as approved by the Engineer, carefully fitted to the pipe to prevent all earth or other substances from washing into the pipe. In rock excavation, the mouth of the pipe shall be carefully protected from all blasts.
- 554.10 Concrete thrust blocks shall be provided on all force mains at curves deflecting eleven and one-quarter (11¼) degrees or more. Blocks shall be poured against undisturbed earth and shall be in accordance with the Standard Detail Drawings of these specifications. Additional points for thrust blocking may be determined in the field and as directed by the Engineer.
- 554.11 Stream crossings shall consist of concrete-encased pipe as shown on Standard Detail Drawing TBSA-SD-14, Type B, at various locations shown on the Drawings.
- 554.12 Concrete slope anchors shall be installed on slopes greater than 0.1500 to the dimensions and requirements as shown on Drawing TBSA-SD-13.
- 554.13 In placing concrete cradles, slope anchors or thrust blocks the methods used shall be such as to prevent mud, earth, clay, or other foreign materials from becoming mixed with the concrete.
- 554.14 In no case shall "dry-mix" concrete be placed in the trench without permission of the Engineer.
- 554.15 All parts of the sanitary sewer system will be installed starting from the extreme downstream portion of the sewer system and proceeding upstream. Under no circumstances will any portion of the sewer system be started upstream from any uninstalled or unconnected portion of the system, nor with any gaps between same.
- 554.16 The extreme lower portion of the newly installed sewer system shall be continuously plugged at the connection to the Township's existing system. The plug will only be removed after the entire system has been flushed and cleaned using high velocity equipment as outlined previously.

554.17 Joints

All joints shall be watertight and any leaks or defects discovered shall be immediately repaired. After joints are made, any superfluous material inside the pipe shall be removed by means of an approved follower or scraper. Prior to construction, the contractor shall obtain the Engineer's approval of the type of joint to be used. Under no circumstances will the use of a flexible type repair coupling be used to join sections of new pipe.



#### 554.18 Branches

Wye branches shall be installed at the locations indicated by the Engineer. In general, connection to mains shall be made with commercially manufactured branches and one-eighth (1/8) bends. Cutting of pipes shall be set at such vertical angle as required to bring the service connection to the proper depth. Wye lateral fittings shall be located no closer to each other than four (4) feet on center to provide for a minimum of two (2) feet of pipe between each fitting.

#### 554.19 Stubs

Where directed by the Engineer, or when indicated on the Drawings, a stub or single length of pipe shall be built into manholes for connections to future extensions. The outer end of such connections shall be closed with a stopper.

#### 554.20 Service or House Connections

554.20a The Contractor shall build complete to the curb line or other designated points, all service connections to existing or proposed houses. Unless otherwise approved, these connections shall be built of pipe of the same materials and quality as the main sewers, and shall be a minimum of six (6) inches in diameter. The ends of all service connections shall be closed with a stoppered test tee. Service connections shall be laid and joined with the same care and in the same manner as main sewer pipes.

554.20b Sewer service connections shall be constructed as shown on the Standard Drawings; and shall be laid in accordance with the specifications for pipe sewers from the main sewer to the curb line or as ordered by the Engineer. All curb connections shall be closed at the outer end with stoppered test tees. Unless otherwise directed, service connections shall be brought to the curb or property line at a minimum slope of one quarter inch (1/4") per foot (2%)(0.02 ft/ft).

554.20c Excavation for service connections shall be opened for the entire length of each connection before any pipe is laid therein. If rock is encountered within ten (10) feet of any building, it must be removed by drilling and wedging or some other approved method other than blasting.

554.20d Where there are no existing buildings, connections will be stopped at the curblines at such depths and at such locations as the Engineer may direct.

554.20e Where service connections are specified to be made to an existing sewer at such locations where there are no wye branches or laterals provided in the sewer lines, a wye saddle must be installed. This installation is made by cutting a neat regular hole in existing pipe and hone to accommodate wye saddle. Centerline of hole shall be a minimum of 18" from any joint in either direction. The hole shall be placed at the springline of the main pipe and not extend below horizontal centerline of existing pipe. A provided rubber gasket shall be placed around the connection between the wye saddle and existing sewer line to produce a watertight connection. Saddle shall be held in place with bands or clamps. Earth shall be removed from joint area to allow concrete encasement of the entire joint for a distance extending twelve inches from the center of the joint laterally and provide a minimum thickness of six inches of concrete above, under, and around the outside of the pipe. A watertight joint is required. The

saddle connection shall be connected so that lateral flow is in same direction of main pipe flow. Type of saddle to be used shall be SEALTYTE Type "PVC/U" Tee Sewer Saddle or approved equal. A forty-five degree (45°) fitting shall be placed immediately upstream of the saddle for connecting the SDR-35 lateral pipe.

554.20f In the case of a non-residential service connection to serve an establishment involved in the preparation of food or some other use, which generates significant amounts of grease, a grease trap, as approved by the Engineer, shall be placed upstream of the connection to the sewer system. Additionally, a monitoring manhole shall be placed between the main connection and grease trap. Both the monitoring manhole and grease trap shall be placed on private property and the maintenance of both shall be the sole responsibility of the property owner.

#### 554.21 Standpipes or Risers

554.21a Where directed and approved by the Engineer, house connections will enter the sewer through risers. Risers shall be of the same material to which they are being fitted, unless otherwise directed, and shall enter the sewer through wye branches. The upper ends of standpipes shall be either wye branches or bends, as may be directed. The maximum return angle on all branches or fittings shall be forty-five degrees (45°).

554.21b The riser pipes shall be recessed into the bank of the sewer trench and encased with Class A concrete for their full height as directed by the Engineer.

#### 554.22 Concrete Cradles

Where required by these Specifications or the Engineer, pipes shall be placed in a concrete cradle for bedding and encasement. Concrete cradles shall consist of Class A concrete placed in trenches to support pipes. All cradling or encasement shall be done in accordance with the details shown on Drawing TBSA-SD-14.

#### 554.23 Clay Caps or Dams

In wet areas where crushed stone backfill is required, the Township may require the Developer to construct such caps or dams at strategic locations within the backfill. A clay material meeting standard impervious criteria as approved by the Engineer shall be used for such construction. The method by which the Contractor achieves the required dam imperviousness shall be approved by the Engineer.

#### 554.24 Concrete Curb Markers

At the time vertical concrete curb placement, the Contractor will be provided with permanent concrete curb markers to mark the location of sanitary laterals. The markers shall be placed in the center of the horizontal curb face where the lateral serves that property. The marker shall be placed slightly recessed in the fresh concrete to prevent damage. If the markers are not installed during curb placement, the Contractor shall drill the curbing and set the markers using a non-shrink or epoxy grout as approved by the Engineer. The Developer shall be solely responsible for the expense of the curb markers and their placement.

555 MANHOLE CONSTRUCTION

555.1 Manholes shall be built at such points on the lines of the sewers as are shown on the Drawings or as directed by the Engineer. Manhole bases will be installed level with the manhole frame and lid adjusted to meet the slope of the proposed roadway, if applicable.

555.2 Drop manholes will be located on sewers only at such points and with such drops as are shown on the Drawings.

555.2a Materials

Manholes shall be precast reinforced concrete only. Polyethylene steps shall be built into each manhole at the point of manufacture. Steps shall be spaced a maximum of 12" apart with the first (topmost) step placed no greater than 24" from the manhole frame rim elevation, and a maximum of twelve (12) inches from the bottom step to the manhole bench. The internal step location shall be on the vertical, non-tapered, side of the manhole and be approved by the Engineer.

555.2b Manholes shall be built on a Class A concrete base or precast base, as approved, with cast iron frames and covers, constructed in accordance with the design shown on the Drawings, and conforming to the requirements of these Specifications.

555.2c Excavation for manholes shall be made to a vertical plane one (1) foot outside of the manhole walls to provide space for proper application of Bitumastic coating, with the exception that existing pavement shall be cut to a rectangular shape with dimensions two (2) feet greater than the diameter of the manhole base.

555.2d Foundations of bases shall be at least twelve (12) inches thick and the diameter as shown on the Detailed Drawings. When necessary to build wide or deeper foundations than specified or shown, such foundations shall be built as directed by the Engineer. Pipe sewers and connections shall be built-in and trimmed as shown on the Drawings. A metal ring furnished by the manhole manufacturer shall be used to form the joint between the base and first section of the manhole.

555.2e Invert channels shall be formed directly in the manhole base, by the installation of concrete, Ready-Mix Concrete, and mortar, all in accordance with Section II of these Specifications. Changes in size and grade shall be made gradually and evenly. Changes in direction of the sewer and entering branches shall have a smooth curve of as large a radius as the size of the manhole will permit. Steep slopes outside the invert channel shall be avoided. Where there are more than one (1) pipe entering a manhole, the side channels shall make a smooth vertical and horizontal elevation transition to the main channel invert. Side channel intersection(s) of ninety degrees (90°) or less shall be prohibited to prevent main channel flow discontinuity. Side channels shall be no greater than fifteen (15) inches above the main channel invert elevation.

- 555.2f Connections to placed concrete manhole bases (not precast) – All sewer line connections to cast in-place manhole bases shall be encased with Class A concrete for a minimum distance of five (5) feet or until the specified width of trench is reached.
- 555.2g The top of the walls of precast manholes shall be properly contoured to the street surface so as to form a flat surface upon which the cast iron manhole ring is to rest. If precast sections do not conform to the required grade, precast concrete grade rings shall be used. Grade rings shall be laid to line in header courses, in full and close joints of mortar which at the inside face shall not exceed one-quarter (¼) of an inch in width. Grade rings shall be neatly plastered and troweled smoothly inside and outside with cement mortar as specified in these Specifications. The maximum allowable adjustment with grade rings shall be twelve (12) inches.
- 555.2h Coating – After manhole is set, the entire outer surface of all manholes shall be coated with Bitumastic coating. This coating shall be Koppers Bitumastic Super Service Black or approved equal.
- 555.2i Backfilling around manholes – Spaces outside the manholes shall be backfilled with material conforming to the requirements for backfill in uniform layers not exceeding six (6) inches in depth. Each layer shall be thoroughly compacted mechanically to the density specified.
- 555.2j Frames and covers – Cast iron frames and covers shall be furnished and set by the Contractor. The Contractor shall furnish and set in mortar upon the top of each manhole, a cast iron manhole frame and cover. The frame and cover shall conform to Section II, Paragraph M, and the Standard Detail Drawings. When the manhole is located in a street cartway, the fame and lid shall be adjusted to match the roadway gradient.
- 555.2k. Drop manholes – Where shown on the Drawings, drop manholes of precast concrete and of the design shown shall be constructed. Drops shall be encased in concrete to the full dimensions shown. The minimum vertical dimension of any drop shall be twenty-four (24) inches. Drop manholes shall be coated outside with Koppers Bitumastic Super Service Black or approved equal.
- 555.2l Watertight Manholes – Where directed by the Engineer, the Contractor shall supply and install a two-band external manhole sealing kit for the outside of the precast concrete cone section and the casting. The sealing kit shall consist of butyl rubber material with mastic designed to adhere to both the precast cone section and the casting. The kit shall be as manufactured by Infi-Shield, Inc., Model #MHAB27, or equal. Also to be furnished is a primer, as recommended by the manufacturer, to be applied to the precast section and casting prior to placement of the sealing kit. Installation shall conform to the manufacturer's recommendations and specifications, and be placed to cover the joint between the casting and the precast cone section. Manhole frame and cover shall be installed as shown on the Standard Details.

- 555.2m Aggregate roadway base course placement and paving around newly installed manholes shall not be performed prior to the inspection and successful testing of the manhole. Any aggregate placement or paving performed prior to the Engineer's approval to do so shall be removed at the Contractor's expense.
- 555.2n No stone or bituminous base materials for new roadways shall be placed prior to the complete inspection and testing of the manholes, and acceptance of same, by the Township. Additionally, no select backfill materials shall be placed within one (1) foot of the top of the manhole cone section prior to the inspection and testing.

## RESTORATION OF PAVEMENTS

### 556 GENERAL

- 556.1 All pavements, road surfaces, sidewalks, driveways, or curbs, which the Developer is required to replace, shall be replaced in accordance with these Specifications or as specified by the Engineer. The Developer shall satisfy himself as to any requirements other than those herein set forth which may affect the type, quality, and manner of carrying on the restoration of surfaces.
- 556.2 The Engineer shall make an examination of all surfaces where work has been constructed, and shall note any depressions due to breakage, settlements, washouts, or other causes that may be attributed to the construction. The Developer shall repair same where directed by the Engineer.
- 556.3 The Developer shall repair breaks, refill depressions, remove any surplus that has previously been left upon the trenches, or make other repairs or replacements which are necessary as determined by the Engineer or the Township.
- 556.4 When excavating within existing roadways, the entire existing roadway surface in the immediate area of the excavation, and where directed by the Engineer, shall be cleaned with a wet broom type sweeper at the end of each working day until the roadway is cleaned of all mud and debris.

### 557 MATERIALS

Materials used in replacing pavements, driveways, shoulders, walks, curbs, gutters, etc. shall comply with the requirements set forth in the Materials Section of the specifications. Before use, samples of all materials shall be submitted for test, and no material shall be used until approved. All trenches within existing roadways shall be backfilled completely with aggregate materials. No materials removed from within the roadway during excavation shall be used as backfill unless approved by the Engineer.

### 558 PERMANENT REPAVING

- 558.1 All pavements, road surfaces, sidewalks, driveways, or curbs which the Developer is required to replace shall, at the expiration of the period of temporary paving maintenance, be replaced in the same manner as the original installation or as specified by the Engineer. The Developer shall satisfy himself as to any requirements other than those herein set forth which may affect the type, quality, and manner of carrying on the restoration of surfaces.

- 558.2 The temporary paving shall be removed, in the case of cold mix asphalt, or compacted, in the case of hot mix asphalt, to the limits as specified herein and on the Standard Detail Drawings. The existing pavement shall then be sawcut back a distance of twelve inches on both sides of the trench the entire length of the trench or excavation in a neat and straight line. The entire area of the trench cutback shall be compacted with heavy-duty rollers or tampers. Permanent repaving shall be performed as specified herein.
- 558.3 In connection with the placing of ID-2 Bituminous Surface Course of permanent paving, the Developer is advised that the Township reserves the right to require the Developer to place only the binder course, and to place the wearing course thereof at such other time designated by the Engineer. In the event the Township elects to defer the placing of the wearing course, the Developer, prior to placing the wearing course, will be required to satisfactorily clean the previously constructed binder course or total paved section if applicable of any foreign material, and treat the surface thereof with a tack coat consisting of a thin application of bituminous material. Under certain conditions, this may be required by the Pennsylvania Department of Transportation.
- 558.4 Construction methods used for repaving the roadway or restoring the shoulders of all streets, roads, or highways which may be under the control or jurisdiction of the Pennsylvania Department of Transportation shall conform to the current specifications and special requirements of that Department. On all other streets, roads, highways, or thoroughfares where repaving or restoration is required, the construction methods used shall be in accordance with the local government requirements, or as specified herein.
- 558.5 On Township Roads all repaving or resurfacing shall be done in accordance with the standard requirements of the Township Road Specifications for all road and street areas affected, over which the Township exercises control, or in accordance with other methods as may be prescribed by the Township Supervisors.
- 558.6 At expiration of the eighteen (18) month maintenance period, the Engineer shall make an examination of all surfaces where pipelines have been constructed, and shall note any depressions due to breakage, settlements, washouts, or other causes that may be attributed to the construction of pipelines. Upon written order from the Engineer, the Developer shall again go over the work and repair breaks, refill depressions, remove any surplus material that has previously been left upon the trenches, or make other repairs or replacements which are necessary to place all the work in first class condition.
- 558.7 In addition to the work outlined above, the Developer shall replace road shoulders and guard fence so that they will be at least equal both in quality of material and quality of workmanship, to the original structures before they were disturbed.
- 558.8 This Specification shall also apply to materials going into the restoration of road shoulders and guard fencing.
- 558.9 Those trenches falling under the jurisdiction of the State Department of Transportation shall be permanently repaved as specified herein and as depicted on Standard Detail Drawing TBSA-SD-16 of these Specifications, or in accordance with local government requirements.

559 REPLACEMENT OF SPECIAL SURFACES AND MISCELLANEOUS ITEMS

- 559.1 Sidewalks, curbs, driveways, and other special surfaces shall be replaced in accordance to the prevailing local government rules and regulations. In lieu thereof, the Engineer shall detail special items on the Drawings prior to the start of Work, and in the absence thereof, the surfaces destroyed shall be replaced by the Developer to a condition better than, or equal to, that which existed prior to the start of the Work.
- 559.2 Following the usual period of settlement, lawns and shrubbery damaged during construction shall be brought to grade with topsoil; all weeds and debris shall be removed, transplanted shrubbery replaced, and the entire area re-seeded or sodded as required to remove traces of damage to the lawns or other areas damaged.
- 559.3 In unpaved highways, lanes, driveways, or sidewalk areas, the backfill shall be brought up to the previous surface, and, where pedestrians will normally walk, cinders, stone, or crushed stone screenings shall be spread across the surface to provide a temporary traffic surface.
- 559.4 In general, except in the case of cultivated fields, wherever the surface of the ground has been disturbed, the final graded surface shall be stabilized, by seeding, sodding, planting, or other methods approved by the Engineer to prevent erosion.
- 559.5 Mailboxes, street lighting poles and fixtures, ornamental works, guard rails, fencing, culverts, drains (both natural and manmade), catchbasins, manholes, and walls shall also be restored when disturbed.

600 **WATER SUPPLY AND DISTRIBUTION**

601 SPECIFICATIONS

Materials, workmanship and acceptance criteria shall be in accordance with the latest revision of Water System Specifications of the Controlling Authority.

602 LOWER NAZARETH TOWNSHIP PRE-EMPTION - BACKFILL REQUIREMENTS

After proper installation of the pipe and special envelope, backfilling with select material may be performed. All backfill shall be compacted through the use of approved mechanical tampers and water jetting as directed. In existing roads and the first six (6) feet of shoulder areas or sixteen and one-half (16 ½) feet from centerline, whichever is greater, the entire width and depth shall be backfilled with PennDOT No. 2-A Modified crushed stone and shall be mechanically tamped in layers not to exceed twelve (12) inches. In new developments where new roads are being constructed, the trench may be backfilled with earth backfill material which shall not contain rock pieces in excess of six (6) inches in any dimension and shall be mechanically tamped in six (6) inch layers. The trench, backfilled with earth, shall be temporarily surfaced and maintained with bituminous cold patch material, and allowed to settle for at least 180 days, after which the bituminous coated base course may be applied. If this 180 day lag time is not acceptable, the full stone backfill requirement shall apply.

## 603 PAVEMENT RESTORATION PROCEDURES

The following restoration procedures shall be followed within the paved areas of all Township streets.

### 603.1 Mechanical Cutting of Existing Pavement

Prior to performing any trench excavation, the Contractor shall determine the location and width of all proposed water mains. The outline shall be marked on the existing pavement and cut by mechanical means, such as a saw, or jackhammer. All cuts shall be full pavement depth, straight and true.

If during the actual trench excavation the pavement edge is damaged or lost, the area shall be recut to provide a straight edge.

### 603.2 Subgrade Preparation

After the trench has completely settled, the area shall be excavated to the required depth, shaped and thoroughly compacted in accordance with the requirement of Section 210 of PennDOT Publication 408 (latest edition). If the materials of subgrade are wet or unsuitable, they shall be removed and replaced with suitable material, placed and compacted in accordance with Section 350 of PennDOT Publication 408 (latest edition).

### 603.3 Base Course

On the prepared subgrade, the contract shall place an eight (8) inch crush aggregate base course in accordance with Section 310 of PennDOT Publication 408 (latest edition).

### 603.4 Bituminous Surface Course

Immediately after the crushed aggregate base course is placed, and before traffic is allowed over the area, the contractor must place bituminous paving material in accordance with Section 202.2 and Section 202.3 of this Ordinance. The binder course shall comply with applicable sections of PennDOT Publication 408 (latest edition). The bituminous wearing course shall have a SRL value of M or better.

If the bituminous wearing course is not placed on the binder course within 48 hours, the area shall be tack coated as specified in Section 460 of PennDOT Publication 408, (latest edition).

### 603.5 Joint Sealing

Where the bituminous wearing course is placed adjacent to existing drives and pavements, these joints should be sealed with hot PennDOT Class AC-2000 asphalt cement. The seal shall be applied to the surface by means of squeegees immediately after final rolling to completely fill the surface voids and provide a watertight joint. Excess asphalt shall be removed from the surface in an approved manner.



## 700 STORM DRAINAGE SYSTEM

Storm drainage systems shall be installed in accordance with the design standards and requirements set forth in Section 770 of the Subdivision and Land Development Ordinance.

### 701 STORM PIPING

Storm sewers shall have a minimum diameter of fifteen (15) inches. Storm sewers within all roads and road rights-of-way shall be made of reinforced concrete, Class III or better. All other storm sewers shall either be made of - or reinforced concrete, Class III or better. Sewers shall be installed on sufficient slopes to provide a minimum velocity of three (3) feet per second when flowing full.

Reinforced cement concrete and - shall comply with PennDOT Form 408, Section 600, current edition .

### 702 INLETS AND MANHOLES

Inlets shall be placed at points of abrupt changes in the horizontal or vertical directions of storm sewers, at points where the flow in swales exceeds three (3) inches, and at a maximum distance of six hundred (600) feet apart. Inlets shall normally be located beyond the curb radius points. For inlet location at corners, the depth shall be considered for each gutter. The Manning Equation shall be used to calculate the capacities of gutters. Pennsylvania Department of Transportation 2' x 4' and 2' x 6' special inlets or equivalents should be and can be considered to have capacities of 3.0 c.f.s. and 5.0 c.f.s., respectively. Inlets shall be depressed two (2) inches below the grade of the gutter or ground surface. Manhole may be substituted for inlets at locations where inlets are not required to handle surface runoff.

Inlets and manholes shall be of precast concrete construction in accordance with Section 605 of PennDOT, Form 408, Specifications, current edition, except that masonry inlets or manholes are specifically prohibited.

### 703 HEADWALLS/WINGWALLS

Headwalls shall be used where storm runoff enters the storm sewer horizontally from a natural or manmade channel. The capacity of such storm sewers shall be calculated for both steady flow and culvert design.

The lower values of the two (2) shall be used to determine the capacity of the storm sewer.

Headwalls and wingwalls shall be of precast or poured in place concrete construction in accordance with Section 605 of PennDOT, Form 408, current edition. The headwall length shall be long enough to facilitate a transverse return from the culvert invert to the top of embankment behind the wall at a slope not exceeding three (3) horizontal to one (1) vertical.

### 704 OPEN CHANNELS

Open channels shall be designed to handle, without overflowing, the calculated runoff from a storm of ten (10) year to one hundred (100) year frequency, as specified in Section 773. The capacities of any modifications to natural channels shall be computed using the Manning Equation. If the open channels to be constructed are within a watershed with an approved Storm Water Management Plan enacted pursuant to Act 167, the criteria in the applicable plan shall be used.

705 INSTALLATION

All pipe laying shall carefully progress uphill with hubs up grade and ends fully and closely jointed. Trench widths shall not exceed the outside diameter of the pipe plus sixteen (16) inches, and depths shall be as required. Trench walls shall be vertical and bottoms shall be horizontal.

706 BEDDING

Prior to laying the pipe in the trench, a bedding of PennDOT No. 2A crushed stone shall be placed on the trench bottom. This material shall be a minimum of four (4) inches in depth and thoroughly compacted with approved mechanical tampers. The bedding shall be graded to provide a uniform and continuous bearing support for the pipe throughout its entire length. Bell holes shall be provided at the ends of pipe length to prevent bearing on the joints.

707 BACKFILLING

After proper installation of the pipe and special envelope, backfilling with select material may be performed. All backfill shall be compacted through the use of approved mechanical tampers as directed. In existing roads and the first six (6) feet of shoulder areas or sixteen and one-half (16 ½) feet from centerline, whichever is greater, the entire width and depth shall be backfilled with PennDOT No. 2-A crushed stone and shall be mechanically tamped in layers not to exceed twelve (12) inches. In new developments where new roads are being constructed, the trench may be backfilled with earth backfill material, which shall not contain rock pieces in excess of six (6) inches in any dimension and shall be mechanically tamped in six (6) inch layers. The trench, backfilled with earth, shall be temporarily surfaced and maintained with bituminous cold patch material, and allowed to settle for at least 180 days after which the bituminous coated base course may be applied. If this 180-day lag time is not acceptable, the full stone backfill requirement shall apply.

**800 EROSION AND SEDIMENTATION CONTROL**

Improvements installed to control soil erosion and sedimentation shall be in accordance with design standards set forth in Section 791 of the Subdivision and Land Development Ordinance.

801 RESPONSIBILITIES

The responsibility for soil erosion and sedimentation control during the installation of improvements and the development of subdivision or land development shall be in accordance with the following requirements:

801.1 Sedimentation Control

Whenever sedimentation is caused by stripping vegetation, regrading or other development, it shall be the responsibility of the person, corporation or other entity causing such sedimentation to remove it from all adjoining surfaces, drainage systems and water courses and to repair any damage at his expense as quickly as possible.

801.2 Facilities Maintenance

Maintenance of all drainage facilities and water courses within any subdivision or land development is the responsibility of the developer until they are accepted by the Township Board of Supervisors or some other official agency, after which they become the responsibility of the accepting agency.

### 801.3 Restoration

It is the responsibility of any person, corporation or other entity doing any act on or across a communal stream, water course or swale, or upon the flood plain or right-of-way thereof, to maintain as nearly as possible in its present state the stream, water course, swale, flood plan or right-of-way during the pendency of the activity and to return it to its original or equal condition after such activity is completed.

### 801.4 Maintenance on Private Property

Maintenance of drainage facilities or water courses originating and completely on private property, are the responsibilities of the owner to their point of open discharge at the property line or at a communal water course within the property.

### 801.5 Encroachment Prohibited Without Permit

No person, corporation or other entity shall block, impede the inflow or alter, construct any structure, or deposit any material or thing, or commit any act which will affect normal or flood flow in any stream or water course without having obtained prior approval from the Township Board of Supervisors or the Pennsylvania Department of Environmental Resources, whichever is applicable.

## **900 TREE PLANTING AND LANDSCAPING**

### 901 LANDSCAPE PLAN

A landscape plan shall be required for any subdivision or land development which proposes the planting of trees and shrubbery. The plan shall locate and provide specifications for all landscaping proposed by the developer.

### 902 PLANT MATERIALS

Street trees, conifers and shrubs shall be of nursery stock quality, grown under the same climatic conditions as at the development site. All materials shall be of the size indicated on the plans and required by the Subdivision and Land Development Ordinance. They shall be of hearty and symmetrical growth, free of insect pests and disease.

### 903 PLANTING

All planting shall be at the location and spacing indicated on the plans and required by the Township Zoning and/or Subdivision and Land Development Ordinances and shall be done in conformance with good nursery and landscape practice.

### 904 GROUND COVER AND SEEDING

#### 904.1 Detention Basins

Detention basin subgrade shall be sealed with a top course of impermeable clay over the entire pond bottom and returning a minimum of one (1) foot up the pond banks. A minimum of six (6) inches of topsoil shall then be placed and fine graded to the design grades. Seed on the pond bottom shall be PennDOT Formula "D" placed at 21 pounds per 1,000 square yards with PennDOT Formula "C" at 9 pounds per 1,000 square yards on the side slopes and berm. Fertilization and mulching shall be in accordance with Section 804 of PennDOT Form 408, current edition.

#### 904.2 Planting Strips and Recreation Areas

A minimum of four (4) inches of topsoil shall be placed and fine graded to the design grades. PennDOT Formula "B" seed mix at 21 pounds per 1,000 square yards shall be placed. Fertilization and mulching shall be in accordance with Section 804 of PennDOT Form 408 Specifications, current edition.

### **1000 TRAFFIC SIGNALIZATION AND CONTROLS**

#### 1001 CONTROLLER ASSEMBLY AND CABINET

Controller Assembly shall meet the following minimum standards:

Be compatible with Peek Traffic Systems Model 3000 or newer capable of accommodating Emergency Vehicle Preemption and closed loop operation.

Nema TS2 controller in a TS2 Type 1 base mounted cabinet.

Cabinet shall be Hennessy Products M36 or equal base mount, with MMU 16 malfunction management unit, 3- BIU Interface units, 12 position rear panel, 24 volt cabinet power supply, detector rack, and TS2 – 2 channel loop amplifiers. TS2 type 2 controller shall include optional D module to provide for downward compatibility with TS1 cabinets.

The cabinet shall be installed meeting the requirements of PennDOT PUB 148 base mounting "Type I" base mounting arrangement.

Provide surge protection package, SHP 300, as manufactured by EDCO Incorporated of Florida, or an approved equal. Install per manufacturer's specifications.

Cabinet shall be supplied with communication module and panel for future closed loop system operation.

Cabinet shall be wired for 3M Opticom, Emergency vehicle preemption, the most current version.

Cabinet shall contain receptacle, 30 amp, 120 volts, Hubble model #2615, or approved equal, for attachment of alternative power source (emergency generator). The neutral wire of the alternative power source circuit should be connected with the neutral buss of the controller unit. All switches necessary to facilitate change over from public to generated power supply shall be provided.

Appropriate overload and short circuit protection shall be provided within the controller assembly. A 30-amp circuit breaker should be utilized.

Cabinet vent fan shall be weather and vermin proof and thermostatically controlled.

The controller shall be capable of providing the signal timing and sequences as shown on the permit.

At the time of traffic signal start up, the developer shall have a traffic signal technician from the installer be present to ensure proper signal function. All functions of the traffic signal system shall be fully operational at this time and shall be to the satisfaction of PennDOT and Lower Nazareth Township.

Police panel shall be equipped with a hand control switch.

1002 SIGNALS

Vehicular and pedestrian signal heads and mounting assembly / hardware shall be in accordance with the condition diagram and PennDOT Pub 408.

Signal head housings shall be of polycarbonate material with aluminum reflectors.

All illumination devices shall be LED type.

1003 DETECTORS

Detectors shall be solid-state type, self-contained.

Loop detector sensor wire shall be 14 AWG minimum in accordance with IMSA Spec. 51-5.

Epoxy embedding material must be approved per PennDOT Bulletin 15.

The loop detectors shall be capable of detecting various types of vehicles ranging from motorcycles to tractor-trailers.

1004 JUNCTION BOXES

Junction Boxes shall be in accordance with PennDOT Standards and shall be Type JB-27 with the following exception:

1004.1 If junction box is located in cartway or stone or paved shoulder, the unit shall be installed with top surface finishing at or just below finish grade and shall meet H-20 traffic loading standards.

1005 WIRING

Signal cable conductors shall be 14 AWG stranded color coded with thermo-plastic jacket in conformance with IMSA specification number nineteen (19).

The number of conductors shall be the specific quantity as required on the condition diagram plus one spare conductor.

1006 ELECTRICAL SERVICE / METER

All service equipment shall meet the requirements of the utility company.

Service disconnect enclosure shall be aluminum or stainless steel.

Power service equipment shall be capable of supporting the traffic signal operation with proper over-current protection.

Meter socket as specified by utility company.

1007 EMERGENCY VEHICLE PREEMPTION

All traffic signal installations shall provide a fully functional "Emergency Vehicle Preemption" system meeting the following requirements:

Shall be the latest 3M Opticom Priority Control System Series.

Installation and location of optical detectors shall be to the satisfaction of PennDOT and the Township

Optical detectors shall be aimed and adjusted at the time of signal start up for optimum performance

Shall have data encoding capability.

Shall be warranted for five (5) years.

At each detector location, shall be equipped with flashing white fail-safe indication light facing street or approach where emergency vehicle is approaching.

1008 WARRANTY

All equipment furnished under these specifications shall be new.

Equipment shall be warranted for a period not less than one (1) year from the date of acceptance, except where otherwise noted.

All inspections, as required by the provider of electric service, shall be performed by a certified electrical inspection agency.

1009 DOCUMENTATION

Furnish three copies of warranties, guarantees, instruction manuals, wiring diagrams, and parts lists with each different type material.

Provide in the controller assembly cabinet one instruction manual for each controller unit, time clock, and co-ordination unit.

1010 LUMINARIES

Each intersection constructed within the scope of a project shall be illuminated. If highway lighting exists adjacent to the installation, the Township may waive the need for luminaries. Illumination shall be achieved in the following manner:

Installation of a 400-watt sodium vapor fixture on signal mast arm support or strain pole in accordance with the requirements of PennDOT and the Township.

Lighting device installation shall be coordinated and in accordance with the electric utility providing service in that area. A separate electric service shall be provided for luminaries from the traffic signals.

It is the intention of the Township that this lighting device becomes incorporated into the highway lighting program between the Township and the respective utility.

1011 KEYS

Provide three sets of keys for each controller cabinet and Police door included in the project.

1012 MISCELLANEOUS

Installation shall meet or exceed PennDOT Publication 148 (TC-7800) Standards

Cut-sheets for ALL equipment, including traffic signal supports, shall be submitted to township for pre-approval.

## 1100 MISCELLANEOUS IMPROVEMENTS

### 1101 MONUMENTS

Permanent concrete monuments shall be accurately placed, at the intersection of all lines forming angles and at changes in directions of lines in the boundary of the property subdivided, and along all interior streets at changes in direction, at beginning and end of curves and at intermediate points where topographical considerations make it impossible to sight between two (2) adjacent monuments.

Monuments shall be of reinforced concrete construction, a minimum of four (4) inches in diameter and a minimum of twenty-four (24) inches long.

Monuments shall be set flush with adjacent grade.

All monuments shall be set by a Professional Land Surveyor in the Commonwealth of Pennsylvania.

### 1102 MARKERS

Markers consisting of a minimum three-quarter ( $\frac{3}{4}$ ) inch diameter pipe, bar or reinforcing rod at least thirty (30) inches long shall be set at all lot corners not occupied by a concrete or stone monument.

Markers shall be set flush with adjacent grade.

### 1103 STREET AND TRAFFIC CONTROL SIGNS

Street name signs shall be installed at all street intersections. Street names shall be pre-approved by the Township. The nomenclature shall be such that it can fit on a plate size not exceeding 30 inches in length. Street name sign plates shall be 9 inch extruded aluminum with a green background with white letters. Traffic control signs shall be set at all locations shown on the approved plans. The size, type and placement of all signs shall be subject to PennDOT standards or, in the event no standard applies, signs shall set at the locations requested by the Township. All *signs*, sign supports and mounting devices shall be approved by the Township prior to placement and shall be installed meeting the requirements of PennDOT Publications 68, 236M and 108. All sign supports and hardware shall be PennDOT approved 2" x 2" square posts galvanized "Qwik-Punch" style.

### 1104 STREET LIGHTS

In accordance with the conditions to be agreed upon by the developer and the Township Board of Supervisors, street lights installed in subdivisions and land developments shall be in accordance with specification of the applicable electric supplier.

### 1105 HANDICAPPED PARKING

The latest Federal standards for handicapped parking developed by the American National Standards Institute are referenced.

Any lot including at least 6 off-street parking spaces shall include a minimum of one handicapped space. A minimum of 3 percent of all off-street parking spaces required for a use shall be handicapped spaces.

Handicapped parking spaces shall be located where they would result in the shortest possible accessible distance to an accessible building entrance.

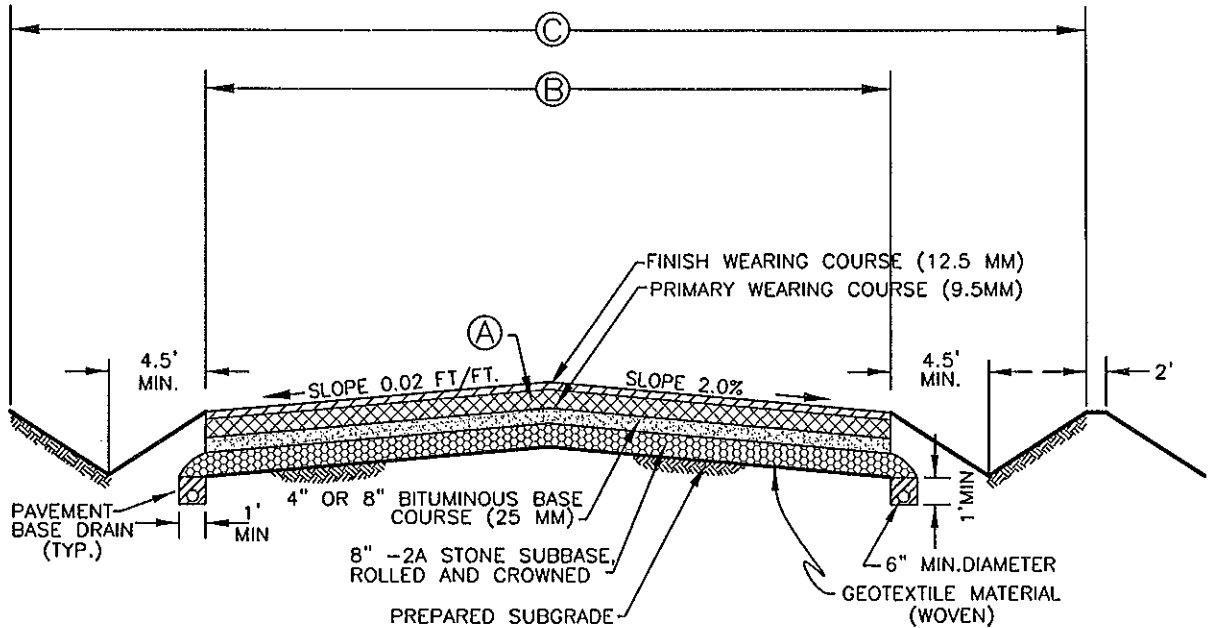
Size. 13 by 18 feet for each space.

Slope. Handicapped parking spaces shall be located in areas of less than 5 percent slope in any direction.

Markings and Signage. Each handicapped parking space and required walkways shall have pavement markings in a contrasting color (preferably blue) than the standard spaces. Also, each handicapped parking space shall be marked with a separate post-mounted sign, to Township standards with the fine for violations posted.



# TYPICAL STREET SECTION WITH ROADSIDE SWALE



## NOTES:

- 1 THE APPLICANT / DEVELOPER SHALL PROVIDE THE TOWNSHIP WITH A DESIGN ANALYSIS TO DETERMINE THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED STREETS.
- 2 ALL BITUMINOUS SURFACES SHALL CONFORM TO PENN DOT SUPERPAVE STANDARDS AND THE TOWNSHIP'S STANDARDS FOR IMPROVEMENTS CONSTRUCTION (APPENDIX F).
- 3 STREETS REQUIRING AN 8" BITUMINOUS BASE COURSE SHALL BE CONSTRUCTED OF TWO (2) LIFTS OF FOUR (4) INCHES COMPACTED DEPTH.
- 4 GEOTEXTILE MATERIAL SHALL BE PROVIDED AROUND THE PAVEMENT BASE DRAIN STONE ENVELOPE.

### A PAVEMENT SPECIFICATIONS

MINIMUM REQUIREMENTS ACCORDING TO PUB70, PUB13, RCO-100 ALONG WITH GUIDE RAIL STANDARDS.

4" OR 8" BITUMINOUS BASE COURSE (25MM SIZE) (PER DESIGN ANALYSIS)

1" PRIMARY WEARING COURSE (9.5 MM SIZE)

1 ½" FINISH WEARING COURSE (12.5 MM SIZE)

### B CARTWAY WIDTHS

LOCAL STREET - 32 FEET

COLLECTOR STREET - 36 FEET

ARTERIAL STREET - AS PER AASHTO AND PENNDOT STANDARDS

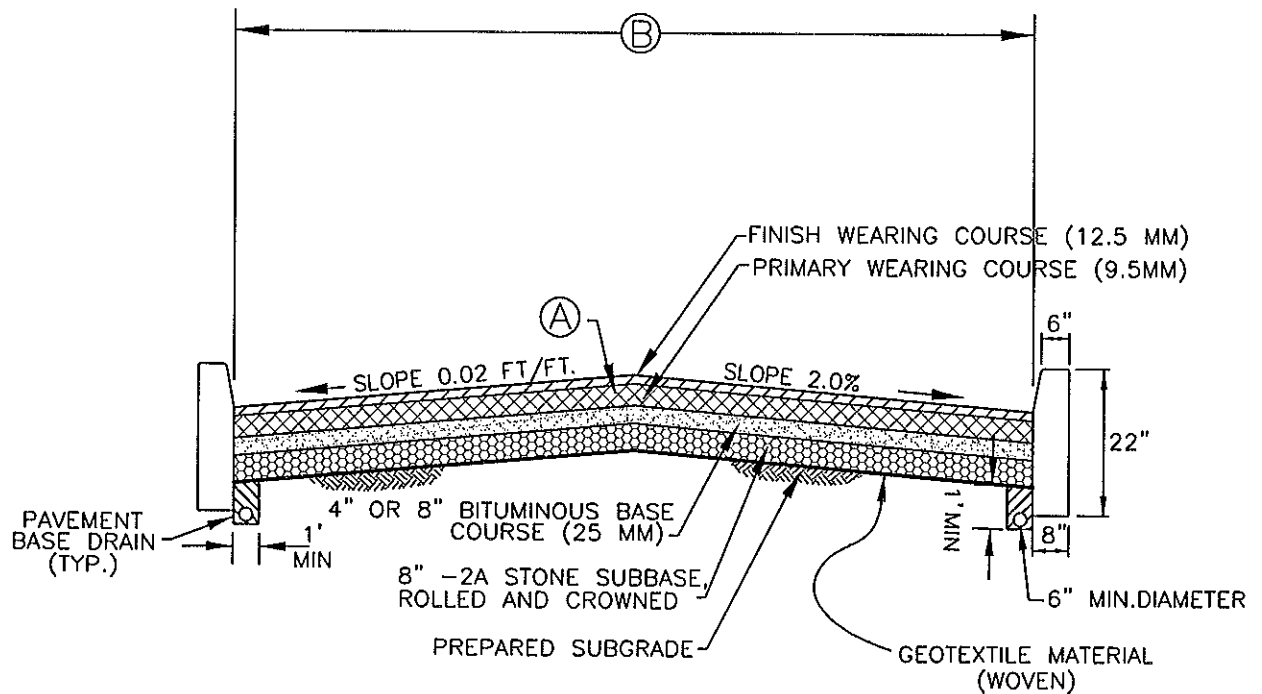
### C RIGHT-OF WAY WIDTHS

LOCAL STREET - 50 FEET

COLLECTOR STREET - 60 FEET

ARTERIAL STREET - 80 FEET

## TYPICAL STREET SECTION WITH CURBING



### NOTES:

- 1 THE APPLICANT / DEVELOPER SHALL PROVIDE THE TOWNSHIP WITH A DESIGN ANALYSIS TO DETERMINE THE CONSTRUCTION REQUIREMENTS FOR THE PROPOSED STREETS.
- 2 ALL BITUMINOUS SURFACES SHALL CONFORM TO PENN DOT SUPERPAVE STANDARDS AND THE TOWNSHIP'S STANDARDS FOR IMPROVEMENTS CONSTRUCTION (APPENDIX F).
- 3 STREETS REQUIRING AN 8" BITUMINOUS BASE COURSE SHALL BE CONSTRUCTED OF TWO (2) LIFTS OF FOUR (4) INCHES COMPACTED DEPTH.
- 4 GEOTEXTILE MATERIAL SHALL BE PROVIDED AROUND THE PAVEMENT BASE DRAIN STONE ENVELOPE.

### A PAVEMENT SPECIFICATIONS

MINIMUM REQUIREMENTS ACCORDING TO PUB70, PUB13, RCO-100 ALONG WITH GUIDE RAIL STANDARDS.

4" OR 8" BITUMINOUS BASE COURSE (25MM SIZE) (PER DESIGN ANALYSIS)

1" PRIMARY WEARING COURSE (9.5 MM SIZE)

1 1/2" FINISH WEARING COURSE (12.5 MM SIZE)

### B CARTWAY WIDTHS

LOCAL STREET - 32 FEET

COLLECTOR STREET - 36 FEET

ARTERIAL STREET - AS PER AASHTO AND PENNDOT STANDARDS

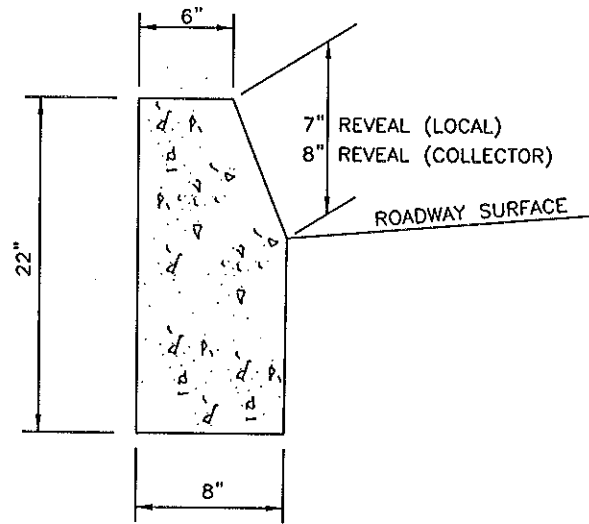
### C RIGHT-OF WAY WIDTHS

LOCAL STREET - 50 FEET

COLLECTOR STREET - 60 FEET

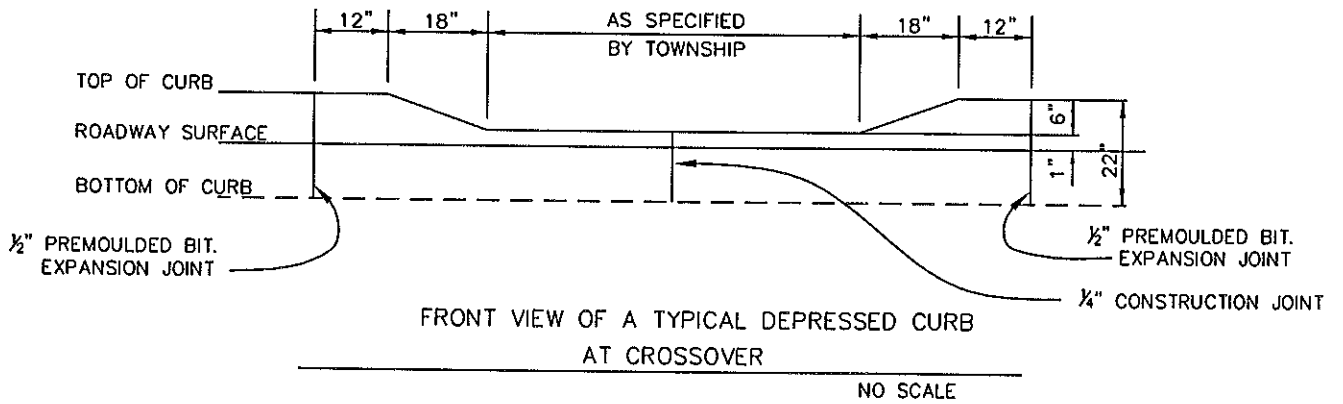
ARTERIAL STREET - 80 FEET

STANDARD DETAIL  
FOR  
VERTICAL CURB



TYPICAL SECTION

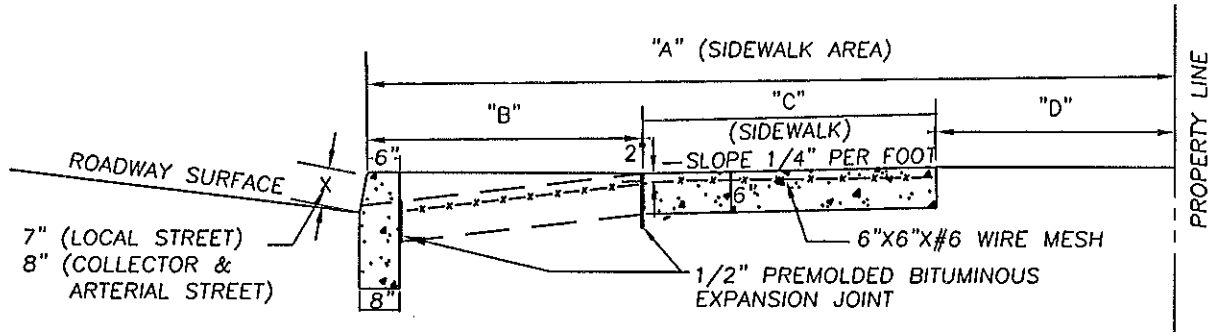
NO SCALE



FRONT VIEW OF A TYPICAL DEPRESSED CURB  
AT CROSSOVER

NO SCALE

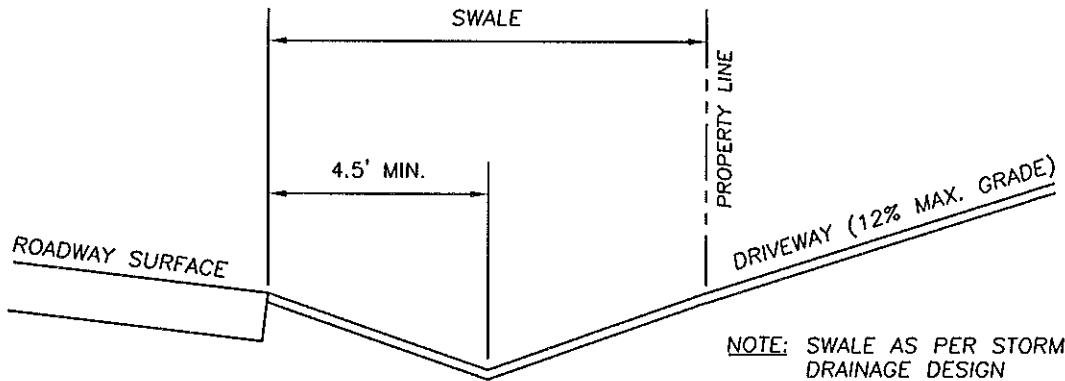
**DRIVEWAY CROSSOVER DETAILS**



NOTE: ALL LETTERED DIMENSIONS SHALL BE SPECIFIED BY THE TOWNSHIP

**STREETS WITH CURB AND SIDEWALK**

N.T.S.



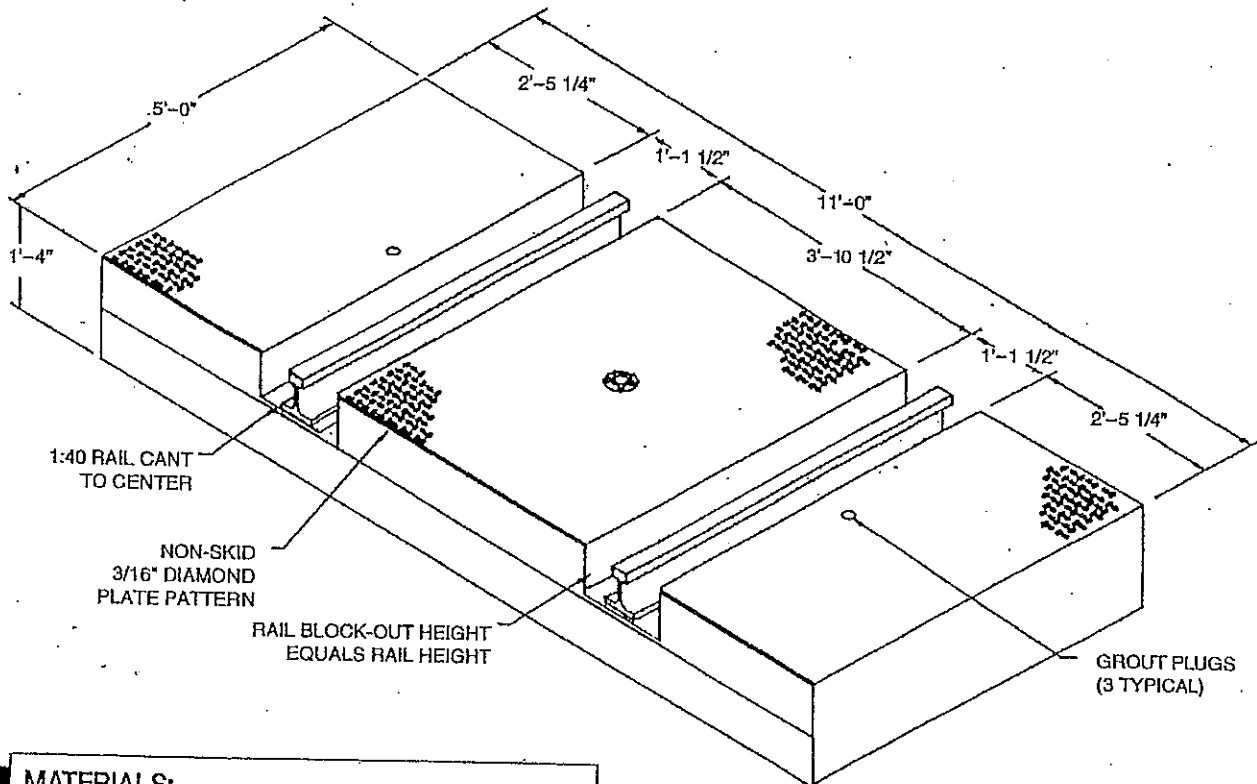
NOTE: SWALE AS PER STORM DRAINAGE DESIGN

**STREETS WITH ROADSIDE SWALES**

N.T.S.

## 1300 RAILROAD GRADE CROSSINGS

- 1301 All at-grade rail crossings shall meet the requirements of the Pennsylvania Public Utilities Commission (PUC) and Lower Nazareth Township.
- 1302 All newly constructed grade crossings shall be signalized. A determination on the type of signalization shall be made by the Township and the PUC.
- 1303 All at-grade crossings shall be constructed to the following specifications and be Star Track II HD or equal.



### MATERIALS:

CONCRETE: THE MINIMUM 28 DAY STRENGTH SHALL BE 6000 PSI.

*Optional: Special design mix utilizing Micro-Silica.*

*Optional: W. R. Grace's "D.C.I." additive in lieu of epoxy reinforcing*

REBAR: ASTM A615 GRADE 60.

*Optional: Epoxy-coated*

SHOULDERS: "PANDROL" #5274 CAST SHOULDER DUCTILE - IRON GRADE #65-45-12

RUNNING STRIPS: 3/16" UHMW POLYETHYLENE

CLIPS: "PANDROL" #E2055 CLIPS - SPRING STEEL

INSULATORS: "PANDROL" #4263 THERMOPLASTIC / NYLON

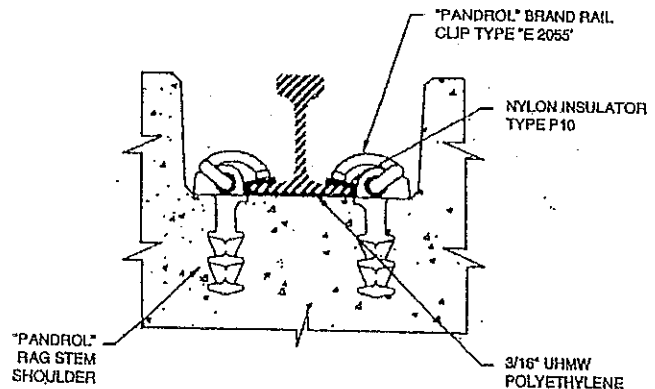
EXPOSED SURFACE: FORM CAST CONCRETE.

*Optional: Hydrozo "Enviroseal" #40 Surface Treatment*

### DESIGN LOADING:

COOPER E-80 WITH 60% IMPACT

4/96



RAIL DETAIL