

# City of Wentzville

**Wentzville** Missouri  
*The Crossroads of the Nation*

## **Standard Specifications and Construction Details**

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# City of Wentzville

## Standard Specifications and Construction Details

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**Division 100  
GENERAL PROVISIONS**

**SECTION 100**

**General**

**100.1** All sanitary sewerage systems, water systems, drainage works, streets or roads, or other improvements which may be used by or accessed by the public, and which are constructed, altered or reconstructed by any person or corporation, public or private, within the corporate limits of the City of Wentzville, shall comply with the requirements of the City. Improvement plans, prepared by a Professional Engineer, shall be submitted to the Engineering Division for review and approval. Improvement plans which are found to be acceptable to the City Engineer shall be marked approved, and a Construction Permit shall be issued covering these plans. During construction, an approved set of plans, and the most current edition of these Specifications, shall be available on the project site. Construction work shall closely follow the approved plans, and any deviation from these plans must first be approved by the City Engineer. All construction work shall be inspected by the City Engineer who shall be notified 48 hours prior to commencement of any work being undertaken. In these specifications, wherever City Engineer is used, it shall mean the City Engineer of the City of Wentzville, as well as any person working for him who shall carry his full authority in the inspection of any work carried out under his jurisdiction.

**END OF SECTION**

## SECTION 101

### Scope of Work

**101.1 Intent of Plans** The intent of the approved plans is to provide for the construction and completion in every detail of the work thereon described. The contractor shall furnish all labor, materials, equipment, tools, transportation, supplies, inspection and testing required to complete the work in accordance with the approved plans and these specifications to the satisfaction of the City Engineer.

**101.2 Alteration of Plans.** Under no circumstances shall alterations of plans or of the nature of the work be undertaken without first obtaining the approval of the City.

**101.3 Maintenance of Traffic and Roadbed.** When ever the work undertaken for the improvements requires access to existing public right-of-way or roads, the contractor shall furnish to the Engineering Division, plans showing provision for detours, barricades, signage, and all other work necessary to maintain existing traffic movements in a safe manner. Road closings, regardless as to extent, shall first be approved by the City Engineer.

The contractor shall maintain traffic, such that the roadbed and driveways are substantially free of ruts, holes and detrimental surface deformations and shall provide and maintain in a safe condition approaches, crossings and intersections with trails, roads and streets. Such maintenance shall be performed as necessary from the day the contractor starts work until the acceptance of the work. Snow removal will not be required of the contractor.

**101.4 Opening Sections of Streets.** When it is to the advantage of the City, projects involving pavement may be opened to traffic as soon as the surface has been sufficiently cured, even though the shoulders and other items of work may not be completed. The contractor will be required to complete any remaining construction items under traffic prior to final acceptance.

**101.5 Rights In and Use of Materials Found on the Work.** The contractor may use any stone, gravel, sand or soil found on the project site, so long as the material meets the requirements of the specifications for materials as may be approved by the Geotechnical Engineer for the project. Unless authorized in writing by the City Engineer, the contractor shall not excavate or remove from within existing right-of-way any material which is not within the excavation limits as indicated by the approved plans.

**101.6 Mailboxes, Signs and Markers.**

- a. Mailboxes: Mailboxes within the construction limits shall be removed by the contractor before work is begun whenever deemed to be necessary by the City Engineer. They shall be set temporarily on supports that comply with AASHTO guidelines and are approved by the engineer. The temporary mailboxes shall be placed at approved sites for the various phases of construction where they will be accessible to both the mail carrier and the patron. After final grading is completed, the contractor shall permanently reset the mailboxes at designated locations before final acceptance of the work by the City. Permanent mailbox supports shall also comply with AASHTO guidelines and be approved by the City Engineer. The contractor shall be responsible for the maintenance of all temporarily set mailboxes during project construction and shall replace all

damaged mailboxes, with all costs to be born entirely by contractor. At no time will a lapse in mail delivery be allowed.

- b. Signs and Markers: Signs and markers within the limits of operations shall be removed by the contractor before work is begun. All such signs and markers required for safe control and guidance of traffic shall be temporarily reset where they are readily visible to traffic, and shall be maintained in a satisfactory condition. If the nature of the work makes temporary relocation impractical, the signs shall be placed on movable supports and maintained properly. Stop and Yield signs at intersecting roadways shall be maintained where they are readily visible to traffic at all times. Other individual signs may be moved aside only when they interfere with actual operations. All required signs and markers must be properly located to control traffic during the hours of darkness. Final removal of signs and markers will be permitted only when permanent signs and markers have been installed. All signs and markers remain the property of the City and shall, after final removal, be delivered without damage to one or more locations within the project limits as directed by the City Engineer. Contractor shall bear all costs associated with the removal, relocation, temporary supports, maintenance, or final removal and delivery of signs and markers.

**101.7 Final Cleaning Up.** Before final acceptance of a project, all areas, and all ground on or adjacent to the work site, occupied by the contractor in connection with the work shall be cleaned of all rubbish, excess materials, temporary structures, and equipment. All parts of the work shall be left in an acceptable condition.

The contractor shall cut all brush, grain, grass, and weeds from the entire work site except for improved or selected areas shown on the approved plans or designated by the City Engineer, and shall clean and remove from the work site all abandoned fences, telephone and power line facilities, surplus and discarded material, any perishable matter, rubbish, and temporary structures. The vegetation on the work site outside of the construction limits shall not be removed by blading. The contractor shall restore in an acceptable manner all property, both public and private, which may have been damaged on account of the prosecution of the work, and shall leave the work site neat and presentable. All areas outside the grading limits, on which the existing turf is damaged by the contractor's operations, shall be restored by the contractor, at his expense, by seeding and mulching such areas at the rates as directed by the City Engineer.

Contractor shall open and clean all existing channels and culverts, located within or adjacent to the work site, leaving them free from all excess mud or silt, drift, brush or debris of any kind.

## **END OF SECTION**

## SECTION 102

### Control of Work

**102.1 Authority of the Engineer.** The City Engineer will decide all questions which may arise as to the quality and acceptability of materials furnished and work performed and as to the rate of progress of the work; all questions which may arise as to the interpretation of the plans and specifications; all questions of classification; and his estimates and decisions shall be final, binding, and conclusive upon all parties.

The City Engineer will have the authority to suspend the work wholly or in part in accordance with the provisions of Section 105.2.

**102.2 Plans and Working Drawings.** Plans will show details of all structures, lines, grades, typical cross sections of the roadway and location and design of all structures.

The plans will be supplemented by such working drawings as are necessary to adequately control the work. Working drawings for structures shall be prepared, sealed and signed by a Professional Engineer registered in the State of Missouri. The drawings shall be furnished by the contractor and shall consist of such detailed plans as may be required to adequately control the work and which are not included in the approved plans. Required working drawings must be approved by the City Engineer and such approval shall not relieve the contractor of his responsibilities.

The contractor is responsible for furnishing all working drawings.

**102.3 Conformity with Plans and Specifications.** All work performed and all materials furnished shall be in conformity with the lines, grades, cross section, dimensions, and material requirements, including tolerances, shown on the approved plans or indicated in the specifications.

If the City Engineer finds the materials or the finished product in which the materials are used not in conformity with the plans and specifications, but that reasonably acceptable work has been produced, he will then make a determination if the work will be accepted and remain in place. In this event, the City Engineer will document the basis of acceptance.

If the City Engineer finds the materials or the finished product in which the materials are used or the work performed have resulted in an unacceptable product, the work or materials shall be removed and replaced or otherwise corrected by and at the expense of the contractor.

**102.4 Coordination of Plans, and Specifications.** These specifications, the approved plans, working drawings, shop drawings and other project documents are intended to be complementary and necessary to fully describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions. All discrepancies shall be resolved to the entire satisfaction of the City Engineer.

**102.5 Cooperation by Contractor.** The contractor should be supplied with a minimum of two sets of approved plans, by the owners consultant, one set of which the contractor shall keep available on the work at all times.

The contractor shall give the work the constant attention necessary to facilitate the progress thereof, and shall cooperate with the City Engineer and other contractors in every way possible.

The contractor shall have on the work at all times, as his agent, a competent superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed, who shall receive instructions from the owner's consultant and the City Engineer or their authorized representatives. The superintendent shall have full authority to execute orders or directions of the City Engineer without delay, and to promptly supply such materials, equipment, tools, labor, and incidentals as may be required. Such superintendence shall be furnished regardless of the amount of work.

**102.6 Cooperation Between Contractors.** The City reserves the right at any time to contract for and perform other or additional work on or near the work site.

Each contractor shall conduct his work so as not to interfere with or hinder the progress or completion of the work being performed by other contractors. Contractors working on the same project shall cooperate with each other as directed.

Each contractor involved shall assume all liability, financial or otherwise, in connection with his responsibilities and shall protect and save harmless the City from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by him because of the presence and operations of other contractors working within the limits of the same project.

The contractor shall arrange his work and shall place and dispose of the materials being used so as not to interfere with the operations of the other contractors within the limits of the same project. He shall join his work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

**102.7 Cooperation with Utilities.** The contractor shall notify all railroad and utility owners, all pipe line owners, or other parties affected, and endeavor to have all necessary adjustments of the public or private utility fixtures, pipe lines and other appurtenances within or adjacent to the limits of construction, made as soon as practicable.

- a. Water lines, gas lines, wire lines, service connections, water box, light standards, cableways, signals and all other utility appurtenances within the limits of the proposed construction which are to be relocated or adjusted shall be moved by the owners except as otherwise provided or as noted on the plans.
- b. The contractor shall coordinate his operations with the work of owners making necessary adjustments, removals, or construction of new fixtures, and shall permit free access to the site for such work.
- c. Contractor shall take into consideration the permanent and temporary utility appurtenances in their present or relocated positions in the scheduling of his work, whether or not shown on the plans and shall bear all responsibility for any delays, inconvenience, or damage sustained by him due to any interference from the said utility appurtenances or the operation of moving them.
- d. The general location of railroad facilities, of principal water mains, sewer pipes, telephone conduits, gas mains, pipe lines, pole lines, and other public and private utility facilities which will affect construction operations are indicated on the plans insofar as their locations are known. Some of these utilities may remain in place; others may be removed entirely or in part by the owners for relocation elsewhere.

- e. When the failure of the owners of utility facilities to cooperate and coordinate their work with that of the contractor results in actual delay to the contractor in the overall completion of his work, such delay will be considered by the City Engineer regarding progress of work, and/or cessation of work.
- f. Should there be located within the right-of-way any public or private utility facilities which are to remain in place and which will interfere with the contractor's proposed methods of operation, the contractor shall make all necessary arrangements with the owners for any temporary or permanent removal or relocation of such facilities desired for his convenience. Any cost involved shall be borne by the contractor.
- g. The contractor shall use every precaution necessary to prevent damage to all public and private utility wires, lines, pipes, poles, cables and conduits within the project limits. The contractor shall be responsible for all damage to any utility facility due directly to his operations regardless of location and he shall repair and replace as necessary any such damaged facility or make payment to the owner for repair or replacement.

**102.8 Construction Stakes, Lines, and Grades.** The contractor shall be responsible for giving the owner's consultant reasonable notice of intent to perform work in a particular area of the project in order to afford the consultant sufficient time to set construction stakes establishing lines, slopes, and profile grade. For roadway work, the consultant will set construction stakes establishing lines, slopes and profile grade and will furnish the contractor with all necessary information relating to these lines, slopes and grades. These stakes and marks will constitute the field control by and in accordance with which the contractor shall establish other necessary controls and perform the work. For structures, the consultant will stake and reference those center lines and layout lines used as dimensional references on the plans and provide a bench mark at each structure location. The Consultant will also provide and mark haunching information for the contractor's use in forming of all bridge decks. The contractor shall be responsible for providing all other lines, locations, alignment, grade elevations, and any other necessary controls by use of engineering instruments or other tools or methods as required to build the structure.

The contractor shall be responsible for the preservation of all stakes and marks.

Should the City Engineer or his representative determine that additional staking is required on the work, or that re-staking is necessary, the contractor will be notified, who should then make necessary arrangements for this staking to be carried out.

**102.9 Inspection of Work.** All materials and each part or detail of the work shall be subject to inspection by the City Engineer. The City Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the contractor as is required to make a complete and detailed inspection.

- a. If the City Engineer requests it, the contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the contractor shall restore said portions of the work to the standards required by the specifications. No work shall be done and no materials shall be used without suitable inspection by the City Engineer.

- b. Any work done or materials used without supervision and inspection by an authorized City representative may be ordered removed and replaced at the contractor's expense.
- c. When any unit of government or political subdivision is involved in any portion of the work, its respective representatives shall have the right to inspect the work.
- d. When any work is being done on, over, or under railroad right-of-way or adjustments are being made to any public or privately owned utility facility, the respective representatives shall have the right to inspect the work.
- e. Inspections authorized in any section of these specifications by any unit of government or political subdivision or public or privately owned utility, shall not be a cause for the contractor to make a claim that the plans have been changed, unless said change has been approved by the City Engineer.
- f. Adequate lighting, meeting the approval of the City Engineer, shall be provided by the contractor to permit satisfactory construction and inspection of all work done and materials produced at night.
- g. All construction of extensions or modifications shall be inspected by the City Engineer. Any work performed without inspection may not be accepted by the City Engineer. The City Engineer shall be notified 48 hours in advance of any construction, for coordination and inspections. The City Engineer shall be notified when work stops and when the contractor will not be continuing work. The City Engineer shall be notified twenty-four (24) hours prior to the continuation of work. Work performed after hours on Monday through Friday or on Saturdays will result in the contractor being billed for the overtime of the City Inspector. All overtime or after hours work shall be coordinated with the City Engineer 24-hours in advance. In no event, however, will work be scheduled for Sundays or City-observed holidays, as listed in 102.10.

**102.10 Public Legal Holidays observed by The City of Wentzville:**

New Year's Day (January 1)  
Martin L. King's Birthday (Third Monday in January)  
Presidents' Day (Third Monday in February)  
Good Friday  
Memorial Day (Last Monday in May)  
Independence Day (July 4)  
Labor Day (First Monday in September)  
Columbus Day (Second Monday in October)  
Veteran's Day (November 11)  
Thanksgiving Day (Fourth Thursday in November)  
Day after Thanksgiving Day (Fourth Friday in November)  
Christmas Eve (December 24)  
Christmas Day (December 25)



When any holiday listed above falls upon Saturday, the previous Friday shall be considered the holiday. When any holiday listed above falls upon a Sunday, the following Monday shall be considered the holiday.

**102.11 Unauthorized and Defective Work.**

- a. Work done without lines and grades being given, or work done beyond the lines and grade shown on the plans or as given, will be considered unauthorized.
- b. All changes in the work or departures from the plans, shall first be approved by the City Engineer.
- c. The City Engineer may order unauthorized work removed and replaced at the contractor's expense.
- d. All construction and materials which have been rejected or declared unsatisfactory shall be remedied or removed and replaced in an acceptable manner by the contractor at his expense. Upon failure of the contractor to remedy or remove and properly dispose of rejected materials or work, or to replace them immediately after receiving written notice from the City Engineer, the City may employ labor to rectify the work, and the cost of rectification shall be invoiced to the contractor, and/or deducted from any escrow amount retained by the City.

**102.12 Load Restrictions.**

- a. The contractor's movement of equipment and vehicles over bridges and pavements within the limits of the project is subject to the load limit regulations for highways as prescribed by City Ordinance in existence when the movement occurs and special permits from the Engineering Division will be required prior to the movement of any such equipment or vehicles with a gross weight in excess of the load limits permitted by Ordinance. All costs of obtaining special permits shall be borne by the contractor. Width, length, and weight regulations as prescribed by State Statutes and City Ordinances must be adhered to by the contractor in the movement of equipment and vehicles over any part of the State, County or City highway system outside the project limits, and the contractor shall not move or operate any such equipment or vehicles which exceed the prescribed width, length, or weight limits without special permit. Material which cannot be transported by truck without exceeding an overall length of 120 feet must be shipped by means of other transportation to the destination or the nearest shipping terminal. Permits may be granted for extra length loads for short hauls where there will be no undue interference with normal traffic movements. All permits required by ordinance for movements on the streets of any municipality must be obtained by the contractor from the municipal authority.
- b. Crawler type equipment having a gross weight of 38,000 pounds or less fairly evenly distributed over the treads may be moved over bridges not posted for lesser loads or rigid type pavements without special permits. Such equipment having a gross weight in excess of 38,000 pounds must have a special permit before moving. Crawler type equipment having a gross weight in excess of

75,000 pounds will not be permitted on bridges or rigid type pavements except in rare instances.

- c. Crawler type equipment operating within the project which is subject to unequal distribution of weight, (such as cranes and paving mixers), and which have a gross weight in excess of 18,000 pounds but less than 38,000 pounds may be operated upon bridges not posted for lesser loads and rigid type pavements, provided special precautions satisfactory to the City Engineer are taken to distribute the weight evenly over the treads. Such equipment in excess of 38,000 pounds will require a Special Use Permit from the Engineering Division.
- d. The contractor shall not move or operate any type of equipment of such weight or so loaded that it will cause damage to highway facilities either being constructed or in existence. Crawler type equipment and vehicles with steel lugs will not be permitted to operate directly at any time on bridges or pavements that are to be left in place.
- f. When it is required that material from roadway or borrow excavation be hauled across existing pavement, the contractor may move the material across the pavement with equipment that results in overweight loading, provided the following requirements are met at the contractor's expense:
  - 1. The contractor and the City Engineer shall select the location or locations where the crossing of the existing pavement is to be made. The width of the crossing shall be clearly marked on the pavement by painted lines and the contractor's equipment will be required to operate within the limits of the marked crossing.
  - 2. The contractor shall obtain written permission, including description of location of the crossing, from the City Engineer prior to movements of overweight loading across the existing pavement.
  - 3. The existing pavement shall be kept open at all times for highway traffic except for short periods of time when individual pieces of equipment are crossing pavement. The pavement shall be kept reasonably free from earth or other material during hauling operations and shall be cleaned off and kept clean during periods when no hauling across the pavement is in progress.
  - 4. The pavement and shoulders within the crossing area shall be maintained by the contractor in a condition satisfactory to the City Engineer.
  - 5. The contractor shall provide flagmen to direct traffic when hauling across the pavement.
  - 6. If any hauling across the pavement is done during other than daylight hours, the contractor shall provide adequate lighting to illuminate the crossing.
  - 7. If the existing pavement at the crossing is intended by the plans to be used in place after the job is completed, the contractor shall, upon completion of the hauling operations, remove the existing shoulders, pavement, and base

between the limits of the crossing and replace it with the same type, width, and thickness of shoulders, pavement, and base.

8. The contractor shall construct and maintain all necessary bypasses or temporary connections required for the proper handling of traffic during the removal and replacement of the pavement in the crossing area.
- g. Nothing contained herein or in any special permit will relieve the contractor of liability for any damage caused to highway facilities from the movement or operation of equipment and vehicles over the highway system.

**102.13 Maintenance During Construction.** The contractor shall maintain the work during construction until accepted. This maintenance shall be prosecuted with adequate equipment and forces so that the roadways, structures and utilities are kept in satisfactory condition at all times.

**102.14 Failure to Maintain Work.** If the contractor at any time fails to maintain work, the City Engineer will notify the contractor of such non-compliance. If the contractor fails to remedy unsatisfactory maintenance within 24 hours after receipt of such notice, the City Engineer may immediately proceed to maintain the project, and the entire cost of this maintenance will be charged to the contractor or appropriate deductions made from the escrow amount set up by the developer.

**102.15 Acceptance.**

- a. Partial Acceptance: If, at any time during the prosecution of the work the contractor completes a category of work, the contractor may request the City to make final inspection of that work so completed. If the City Engineer finds upon inspection that the work has been completed in compliance with the approved plans, the Engineering Design Criteria and these specifications, the City Engineer may accept that category of work, and arrange for the release of that portion of retained escrow previously established to guarantee the completion of the work so completed.
- b. Final Acceptance: Upon presumptive completion of all categories of work, the City Engineer will make an inspection. If all construction contemplated by the approved plans has been completed to his satisfaction, that inspection will constitute the final inspection. The City Engineer will make final acceptance and notify the contractor in writing of this acceptance as of the date of the final inspection, and will then arrange for the dedication of said public improvements to the City, with final release of remaining escrow amounts.

**102.16** The contractor's equipment and vehicles shall be parked on the work site at the close of each day and at the termination of operations for each job site unless other arrangements have been made by the contractor. If the contractor elects to park equipment and vehicles on private or non City maintained Public property, other than the work site he shall produce and submit a letter of authorization from the affected property owner at least one (1) working day prior to the time he intends to use the property for that purpose.

**END OF SECTION**

## SECTION 103

### Control of Material

#### **103.1 Source of Supply and Quality Requirements.**

- a. All material needed in the work shall be furnished by the contractor, and as indicated on the approved plans. The contractor shall assume full responsibility for ordering materials of the quality and quantity required.
- b. The materials used on the work shall meet all quality requirements of these specifications. They shall be obtained from sources of supply that meet the approval of the City Engineer. If it is found that a uniform product is not being furnished from a source of supply or if, for any reason, the product from any source at any time proves to be unsatisfactory; the contractor may be required to furnish approved material from other sources. The City Engineer shall have the right to reject the entire output of any source from which he finds it is impracticable to secure a continuous flow of uniformly satisfactory materials.
- c. Any work incorporating materials that have not had prior approval of the City Engineer shall be performed at the contractor's risk and may be considered as unacceptable and unauthorized and, if so considered, will not be allowed to be incorporated into the work. If change in source will affect the control or appearance of the work, the use of any one kind of class of material for a specific project from more than one source is prohibited, except by permission of the City Engineer. Such permission, if granted, will set forth the conditions under which the change may be made.
- d. Materials are subject to inspection or test at any time during production or manufacture or at any subsequent time prior to or after incorporation into the work. The points of inspection will be determined by the City Engineer. Initial inspection, testing, and approval or rejection will be made as early as practicable. The City Engineer may waive any of the requirements regarding determination of quality and accept material on certifications or visual inspection if, in his judgment, the quantity involved is too small or its use not sufficiently important to warrant tests.
- e. To expedite the inspection and testing of material, the contractor shall notify the City Engineer of his proposed sources of materials prior to delivery.

#### **103.2 Local Materials Sources.**

- a. Designated Sources: The City may acquire and make available to the contractor the right to take materials from sources designated on the plans together with the right to use designated property if so specified, for plant site, stockpiles, and hauling roads. In general, the quality of material contained in such sources is considered to be acceptable, but the contractor shall determine for himself the method of operation, equipment, and work required to produce a material meeting the specifications. It shall be understood that it is not feasible to ascertain from samples the limits for an entire deposit and that variations shall be considered as usual and are to be expected. The engineer may order

procurement of material from any portion of a deposit and may reject portions of the deposit as unacceptable.

- b. Contractor Furnished Sources: If sources of material are not designated on the plans or if the contractor desires to use material from sources other than those designated, he shall acquire the necessary rights to take materials from the sources and shall pay all costs related thereto. All costs of exploring and developing such other sources shall be borne by the contractor. The use of material from other than designated sources will not be permitted until written authority is issued for the use thereof. When sources of material or material deposits are provided by the contractor, the City Engineer may test the samples and determine the suitability of the material. Where practicable, borrow areas, gravel pits, and quarry sites shall be located so that they will not be plainly visible from the highway.
- c. Operation of Sources: Whether sources of materials are acquired and made available by the City or are furnished by the contractor, the areas shall be excavated or worked in such manner to avoid or minimize siltation of streams, lakes, ponds, and reservoirs.
- d. Final Condition of Sources: Unless otherwise permitted, pits and quarries shall be so excavated that water will not collect and stand therein. Sites from which material has been removed shall be left in such condition to avoid or minimize siltation of streams, lakes, ponds, and reservoirs, and if plainly visible from the completed highway, shall be left in a neat and presentable condition upon completion of the work.

**103.3 Samples, Tests and Cited Specifications.** Samples for tests will be taken by the contractor, in accordance with these specifications. When a specification of a recognized national standard agency (ASTM, AASHTO, AWWA, AWS, etc.) is designated, the material shall meet the designated specification of the latest revisions thereof in effect. Tests of samples of materials will be made by the laboratory, or testing firm, approved by the City Engineer in accordance with the methods specified in the latest methods in effect. Such national standard specifications and methods of tests shall include those designated as tentative, interim, or amended and officially approved and published by the sponsoring agency. When appropriate methods have not been so prescribed, tests shall be performed in a manner determined by the engineer.

Contractors and subcontractors will be required to produce letters of certification or certified test reports from material producers and suppliers in order to determine compliance with specifications for designated materials prior to the incorporation thereof into the work.

The City Engineer will determine which materials are to be tested. The form and content of these reports shall be in accordance with recognized standards and practices for this work or as otherwise determined by the engineer.

**103.4 Plant Inspection.** The City Engineer may undertake the inspection of materials at the source. In the event plant inspection is undertaken the following conditions shall be met:

- a. The City Engineer shall have the cooperation and assistance of the contractor

and the producer with whom he has contracted for materials.

- b. The City Engineer shall be permitted free access to all parts of the plant as required for adequate inspection and selection of samples. Every reasonable facility shall be furnished for the procurement of samples, performance of the tests, and for the protection of testing equipment and supplies when tests are made at the source of production.
- c. Where bituminous shipments are considered by the City Engineer to be sufficiently heavy to justify testing at the source, laboratory facilities and testing equipment meeting requirements of the prescribed methods shall be provided by the supplier. The space and equipment shall be adequate for the order and proper testing of materials without interference to or by the refinery personnel.
- d. The City will refuse to provide plant inspection at sources where adequate safety measures are not provided and maintained.
- e. The City reserves the right to have retested all materials prior to or after incorporation into the work and to reject all materials, which, when retested, do not meet the requirements of the specifications.

**103.5 Storage of Materials.** The contractor shall be responsible for proper storage and handling of all materials to insure preservation of required quality. The City Engineer may direct that materials be placed on wood platforms, or other hard, clean surfaces, or that they be protected from the weather. Materials in storage shall be so arranged as to facilitate inspection.

**103.6 Handling Materials.** All materials shall be handled in such manner as to preserve their quality and fitness for the work. Aggregates shall be transported from the storage site to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring, in order that there may be no inconsistencies in the quantities of materials intended for incorporation in the work as loaded, and the quantities as actually received at the place of operations.

**103.7 Unacceptable Materials.** All materials not conforming to the requirements of the specification when initially inspected and tested will be considered as defective, and all such materials, whether in place or not, will be rejected and, unless remedied, shall be removed from the site of the work. Any material having once been inspected and approved that is subsequently found to deviate from the specification requirements to a degree which, in the judgment of the City Engineer, renders it unsuitable for use will be rejected even though it has previously been approved. Defective materials, including any material furnished by the City, which has been damaged by the contractor after delivery, shall be replaced or reconditioned by him at his expense. Rejected material, which has been reconditioned or corrected so that it satisfactorily and meets the specifications, shall not be used without the City Engineer's written approval.

**103.8 Material Furnished by the City.** When any material is furnished by the City, the location of delivery will be at a location or locations as indicated by the City. The contractor will be held responsible for all material furnished to him.

## **END OF SECTION**

## SECTION 104

### Legal Relations and Responsibility to the Public

**104.1 Laws to be Observed.** The contractor shall at all times observe and comply with all Federal, State, County and City laws, ordinances, orders, decrees, and regulations existing at the time of or enacted subsequent to the start of construction, which in any manner affect the prosecution of the work. The contractor and his surety shall indemnify and save harmless the City and all of its officers, engineers, representatives, agents, and employees against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by himself, his employees, or his subcontractors.

**104.2 Authentication of Certain Documents.** When plans, plats, detailed drawings, or specifications for falsework, cofferdams, or any other work are required to be submitted to the City Engineer, they shall be signed, sealed, and stamped in accordance with the laws relating to architects and professional engineers (Chapter 327, RSMo).

**104.3 Permits and Licenses.** The contractor shall procure all permits and licenses, shall pay all charges and fees, and shall give all notices necessary and incidental to the due and lawful prosecution of the work.

**104.4 Patented Devices, Materials, and Processes.** If the contractor is required or desires to use any design, device, material, or process covered by letters patent or copyright, he shall arrange and provide for such use by suitable agreement with the patentee or owner, and a copy of the agreement may be required by the City. The contractor shall indemnify and save harmless the City from any suits, claims, or damages arising from the infringement upon or use of any patented or copyrighted design, device, material, or process.

**104.5 Safety Controls.** In order to provide safety controls for protection to the life and health of employees and other persons; for prevention of damage to property, materials, supplies and equipment; and for avoidance of work interruptions in the performance of the job; the contractor will comply with all pertinent provisions of the manual "Manual of Accident Prevention in Construction", as revised, especially written by the Associated General Contractors of America, Inc., Washington, D.C., for construction superintendents and foremen, and will also take or cause to be taken such additional measures as the City Engineer may determine to be reasonably necessary for the purpose. The contractor will maintain an accurate record of, and will report to the City in the manner and on the forms prescribed by law, exposure data and all accidents resulting in death, traumatic injury, occupational disease, and/or damage to property, materials, supplies and equipment incidental to the work. The City Engineer will notify the contractor of any non-compliance with the foregoing provisions and the action to be taken. The contractor shall, after receipt of such notice, immediately correct the conditions. Such notice, when delivered to the contractor or his representative at the site of the work, shall be deemed sufficient for the purpose. If the contractor fails or refuses to comply promptly, the City Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the item lost, excess costs or damages due to any such stop order shall be made the subject of any claim or claims to the City. Compliance with the provisions of these Safety Provisions by subcontractors will be the responsibility of the contractor.

- a. Accident Prevention: In addition to legal or industry wide requirements for the prevention of accidents, the contractor shall comply with all procedures

prescribed by the City Engineer for the control and safety of persons visiting the job site and will comply with such requirements to prevent accidents as may be issued by the City Engineer.

- b. Employee Accommodations: The contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements and regulations of the St. Charles County Department of Community Health and the Environment, State Division of Health or of other bodies or tribunals having jurisdiction over public health and sanitation. He shall permit no public or private nuisance.

All sanitary facilities and safety devices shall be furnished free to employees and the cost of same shall be born by the contractor.

**104.6 Public Convenience and Safety.** The contractor shall conduct the work in a manner that will insure, as far as practicable, the least obstruction to traffic and shall provide for the convenience and safety of the general public and residents along and adjacent to the highway in an adequate and satisfactory manner.

- a. Work Schedule: To insure that the work will proceed continuously through the succeeding operations to its completion with the least possible interference to traffic and inconvenience to the public, the contractor shall, when requested by the City Engineer, submit for approval a complete schedule of his proposed construction procedure, stating the sequence in which various operations of work are to be performed.
- b. Temporary Ways and Structures: The contractor shall provide and maintain at his expense such temporary roads, pedestrian walkways and other items as may be necessary to provide access to residential properties and commercial establishments abutting the highway under construction, as well as temporary approaches to and crossings of intersecting roads and railroads, unless otherwise indicated on the plans. To accommodate traffic on the roadway under construction, the contractor shall at his expense provide and maintain in a passable condition all necessary bypasses around culverts. Temporary bridges will be required only where specified in the plans.
- c. Obstructions Prohibited: Materials stored upon the highway shall be placed so as to cause no unnecessary obstruction to public travel. Fire hydrants on and adjacent to the highway shall be kept accessible to fire fighting apparatus at all times and no obstruction shall be placed within 10 ft. of any such hydrant. Footways, gutters, sewers, outlets, inlets, and portions of highways adjoining the work under construction shall not be obstructed more than necessary. Pavements over which hauling is performed shall be kept reasonably clean of spilled or tracked-on materials at all times and shall be thoroughly cleaned daily within one hour after the suspension of hauling operations if in use by traffic.

**104.7 Barricades and Warning Devices.** The contractor shall build and maintain barricades conforming to City or MoDOT standards at locations designated by written order of the City Engineer. At all times until final acceptance of the work on either a road which is closed to all through traffic or on a road over which traffic is to be handled, the contractor shall provide and maintain at his expense such signs, lights, watchmen, and barriers other than



barricades, as may be necessary to properly protect the work and provide for safe and convenient public travel in accordance with the current Manual on Uniform Traffic Control Devices.

**104.8 Use of Explosives.** When explosives are used in the prosecution of the work, the contractor shall use the utmost care to prevent injury to persons and property. All explosives shall be stored and used in a safe manner and in compliance with all existing statutes and in accordance with the provisions of the Explosives and Blasting Regulations, Chapter 515, City of Wentzville Municipal Code, as amended and all places used for such storage shall be marked clearly "DANGEROUS EXPLOSIVES." The contractor shall warn all persons in the vicinity of the danger area when explosives are being used. The contractor shall save the City and its agents, officers, and employees harmless from any claim growing out of the use of such explosives. Removal of any item or material of any nature by blasting shall be done in such manner and at such time as to avoid damage affecting the integrity of the design and to avoid damage to any new or existing structure included in or adjacent to the work. Unless the plans, special provisions, or the City Engineer restricts such operation, it shall be the contractor's responsibility to determine a method of operation to insure the desired results and the integrity of the completed work.

**104.9 Preservation of Monuments and Artifacts.**

- a. Monuments: The contractor shall not disturb or damage any land monument or property landmark unless authorized by the City Engineer.
- b. Artifacts: The contractor shall be responsible for the preservation of all artifacts, fossils, and other items of archaeological or geological significance discovered within the work site during his operations, and shall handle such items in conformity with the requirements contained within Division 200 of these specifications.

**104.10 Park Protection.** In performing work within or adjacent to public parks, the contractor shall comply with all regulations of the appropriate authorities respecting sanitation, protection, and preservation of parks and the carrying out of work within or adjacent to them. The contractor shall take all reasonable precautions to prevent fires in such places, shall extinguish any fires resulting from his operations, and shall promptly notify the proper authorities of any fires discovered by him.

**104.11 Protection of Streams, Lakes, Ponds, and Reservoirs.** The contractor shall take sufficient precautions to prevent pollution of streams, lakes, ponds, and reservoirs, with fuels, oils, bitumens, calcium chloride, or other harmful materials. He shall schedule and conduct his operations so as to avoid or minimize siltation of streams, lakes, ponds, and reservoirs. In areas particularly subject to erosion, the contractor shall, subject to the approval of the City Engineer, conduct his operations in such manner to reduce exposure of the uncompleted portions of the project to the shortest time practicable.

**104.12 Responsibility for Claims for Damage.** The contractor shall indemnify and save harmless the City, its officers, agents, and employees from all claims or suits made or brought for injury to persons or property caused by the contractor's negligence or his failure to perform the work in accordance with the plans and specifications. The City may retain from any payment due or to become due the contractor such sums as are deemed necessary to protect

its interests until all such claims or suits have been settled or disposed of and suitable evidence to that effect furnished to the City.

**104.13 Contractor's Responsibility for Work.** Until work is accepted by the City Engineer, and dedicated to the City, it shall remain in the custody and under the charge and care of the contractor. The contractor shall rebuild, repair, restore, or make good, at his expense, any work before its completion and acceptance, caused by the action of the elements or from any other reason

**END OF SECTION**

## SECTION 105

### **Prosecution and Progress**

#### **105.1 Character of Workmen, Methods and Equipment.**

- a. The contractor shall at all times employ sufficient labor and equipment for prosecuting the work to full completion in the manner required by these specifications. All workmen shall have sufficient skill and experience to perform properly the work assigned to them.
- b. The City Engineer may demand the dismissal of any person employed by the contractor in, about, or upon the work who misconducts himself or is incompetent or negligent in the due-and-proper performance of his duty, or who neglects or refuses to comply with any proper directions given. Such person shall not again be employed thereon without the written consent of the City Engineer. Should the contractor continue to employ or re-employ any such person, the City Engineer may suspend the work until the contractor complies with such orders.
- c. All equipment used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the project shall be such that no injury to the project site, roadway, adjacent property, or other highways will result.
- d. The methods and equipment to be used by the contractor in accomplishing the construction are not prescribed in these specifications and are solely under the control and discretion of the contractor.
- e. Should the contractor employ methods and equipment in the performance of the work which results in the work to be found deficient by the City Engineer, said deficient work shall be removed and replaced using methods and equipment that will satisfactorily accomplish the work in a manner that is approved by the City Engineer.
- f. The contractor and all subcontractors shall furnish evidence to the City that, with respect to the operations to be performed they will employ licensed personnel (City of Wentzville Fusion License, Licensed Master Plumber, Licensed Electrician, etc.) in accordance with the provisions of the latest revision of City Ordinances providing for the registration of tradesmen for the various types of work involved. The contractor and all subcontractors shall cause all workmen, for whom licensing is a requirement of work within the City of Wentzville, to have their respective licenses continued and extended throughout the life of the job and until all claims hereunder have been settled. The contractor and subcontractors may contact the City Engineer to determine the extent and type of registration and licensing required.

**105.2 Temporary Suspension of Work.** The City Engineer has authority to suspend work wholly or in part for such period as he may deem necessary due to the failure of the contractor to correct conditions unsafe for the workmen or general public; when weather or other conditions are such that in the judgment of the City Engineer the work may be done at a later time with advantage to the City; for failure to carry out orders; for conditions considered

unsuitable for the prosecution of the work; for failure on the part of the contractor to comply with any of the provisions of these specifications; or for any other condition or reason deemed to be in the public interest. Should it become necessary to stop work for an indefinite period, the contractor shall store all materials in a manner that will protect them from damage and will not necessarily obstruct traffic; shall take every precaution to prevent damage to or deterioration of the work performed; and shall provide suitable erosion control and drainage of the roadway by opening ditches, shoulder drains, etc; and by placing temporary seeding and by erecting temporary structures where necessary. The contractor may suspend work for reasonable cause upon the written approval of the City Engineer.

**END OF SECTION**

**DIVISION 200  
EARTHWORK AND TRENCHING**

**SECTION 200**

**General Requirements**

**200.1 Location.** All grading, trenching and similar type work shall be in accordance with the approved plans and these specifications.

**200.2 Easements.** All water, sanitary sewer and storm sewers shall be constructed in Public Right of Way, or in easements granted to the City of Wentzville, and as shown on the approved set of improvement plans. Utilities installed as a part of a development may record the easements on the record plat. All other utility easements will require easement documents which shall be approved by the Engineering Division.

**200.3 Pre-construction Meeting and Construction Permit.** No construction of extensions or modifications shall begin before plans are approved for construction and a Grading/Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the Engineering Division. Any construction done prior to this Notice may be summarily rejected or refused without further investigation.

**200.4 Inspections.** All construction work, including grading, trenching and installation of utilities and/or modifications shall be inspected by the Engineering Division, in accordance with the requirements contained in Section 102.9. Any work performed without inspection will not be accepted by the City of Wentzville. The City of Wentzville shall be notified a minimum of 48 hours in advance of any construction for coordination and inspections

**200.5 As-built Drawings.** As-built drawings shall be required for all new construction. See Division 1100 for as-built drawing requirements.

**200.6 Field Changes.** Minor field changes may be accepted by the City Inspector. More substantial changes shall require a submittal to the Engineering Division for approval.

**END OF SECTION**

## SECTION 201

### Clearing and Grubbing

**201.1 Description.** This work shall consist of clearing, grubbing, removing, and disposing of vegetation from within the project limits shown on the approved plans, except such vegetation as is designated to remain or to be selectively treated. Should grave sites be found during clearing or grading, the contractor will stop all construction work in the immediate area and notify the Engineering Division.

#### **201.2 Construction Requirements.**

- a. The developer's consultant will establish right-of-way and construction lines and will designate all trees, shrubs, and plants that are to remain. The consultant will also designate the trees, shrubs, and plants, in developed or undeveloped areas, that are to be removed and are not designated on the plans. No tree shall be removed from developed areas without express approval of the Engineering Division. The contractor shall preserve without damage the vegetation designated to remain. All trees, stumps, brush, and hedge not designated to remain shall be cleared, grubbed, or cleared and grubbed as required and shall be disposed of in an acceptable manner. Stream buffer zones are not proper disposal areas.
- b. Stumps and roots in cut areas shall be grubbed to a depth of not less than 12 in. below the finished earth grade. Grubbing of Osage orange or locust hedge shall include removal of roots. In embankment areas, undisturbed stumps and roots extending not more than 6 in. above the ground line may remain, provided they are a minimum of 3 ft. below the finished earth grade or the slope of the embankment. Except in areas to be excavated, stump holes shall be backfilled with suitable material and compacted to the approximate density of the adjacent area. In lieu of grubbing, stumps outside of the slope stake limits may be cut off not more than 3 in. above the ground. Grubbing of borrow areas, channel changes, and inlet and outlet easements will be required only to the extent necessitated by the proposed construction.
- c. Disposal of Combustible Materials: When burning is permissible under controlling air pollution regulations, all burning of products of clearing and grubbing shall be done under the care of a competent watchman at such times and in such manner that neither vegetation on adjacent property nor that designated to remain within the construction limits will be jeopardized. The burial of stumps and debris will not be permitted in the construction limits. Products of clearing and grubbing may be removed from the construction limits and disposed of out of sight from the roadway provided an acceptable written agreement with the property owner on whose property the products are placed is submitted by the contractor.
- d. All timber not designated to remain and that has not been removed from the right-of-way prior to the beginning of construction shall become the property of the contractor. Low hanging and unsound or unsightly branches on trees or shrubs designated to remain shall be removed as directed and in accordance with good tree surgery practices.

- e. The contractor shall scalp all areas where excavation or embankment is to be made, except that mowed, burned over sod need not be removed where the embankment to be constructed is 4 ft. or more in height. Scalping shall include the removal of material such as sod, grass, residue of agricultural crops, sawdust, and decayed vegetable matter from the surface of the ground without removing more earth than is necessary. The products of scalping shall be deposited at the toe of embankments where such areas are available within the limits of the roadway balance affected. If such areas are not available, the products shall be suitably removed in accordance with this section.
- f. Cemetery headstones to be removed shall be tagged, marked, and stored in a safe location to prevent breakage or vandalism. Care will be taken to adequately identify the grave-site and its headstone for resetting of the headstones after construction has been completed.
- g. After construction has been completed, each mailbox shall be permanently reset at locations as hereinafter specified:
  - 1. Reset the mailbox laterally with front face 2 in. from the edge of the pavement, and 42 in. above the elevation of the edge of pavements with no curb.
  - 2. Reset the mailbox laterally with front face 7 ft. from the edge of the pavement at mailbox turnouts in the roadway shoulder, and 42 in. above the elevation of the edge of the pavement.
  - 3. At sidewalks and curbs, reset the mailbox laterally with front face 1 ft. from the outside edge of the sidewalk or curb, and 42 in. above the elevation of the finished grade.
  - 4. Special locations for mailboxes will be designated on the plans. No direct payment will be made for this work.

**END OF SECTION**

## **SECTION 202**

### **Temporary Project Stormwater Pollution Control**

**202.1 Description.** This work shall consist of temporary control measures as shown on the plans or ordered by the Engineering Division to control water pollution, through use of berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features specified on the approved plans to the extent practical to assure economical, effective, and continuous sediment and erosion control throughout the construction and post-construction period.

#### **202.2 Materials.**

- a. Mulches may be hay, straw, fiber mats, netting, wood cellulose, corn or tobacco stalks, bark, corn cobs, wood chips, or other suitable material acceptable to the Engineering Division and shall be reasonably clean and free of noxious weeds and deleterious materials.
- b. Slope drains may be constructed of pipe, fiber mats, rubble, portland cement concrete, bituminous concrete, plastic sheets, or other material acceptable to the Engineering Division that will adequately control erosion or remove sediment from runoff.
- c. Grass shall be a quick growing species (such as rye grass or cereal grasses) suitable to the area providing a temporary cover which will not compete with the grasses sown later for permanent cover. Refer to Section 805.
- d. Fertilizer and soil conditioners shall be a standard commercial grade, acceptable to the Engineering Division.
- e. Others as specified by the Engineering Division.

#### **202.3 Construction Requirements.**

- a. The Engineering Division has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, the surface area of erodible earth material exposed by excavation, borrow, and fill operations and to direct the contractor to provide immediate permanent or temporary pollution control measures to prevent contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment. Such work may involve the construction of temporary berms, dikes, dams, sediment basins, slope drains, and use of temporary mulches, mats, seeding, stabilized construction entrances, or other control devices or methods as necessary to control sediment or erosion. The Engineering Division may also designate chemical-free buffer zones around water bodies. Cut slopes shall be seeded and mulched as the excavation proceeds to the extent considered desirable and practicable to provide sediment and erosion control.



- b. At the preconstruction conference or prior to the start of the applicable construction, the contractor shall submit for acceptance his schedules for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, bridges, and other structures at watercourses, construction, and paving. He shall also submit for acceptance his proposed method of erosion control on haul roads and borrow pits and his plan for disposal of waste materials. No work shall be started until the erosion control schedules and methods of operations have been accepted by the Engineering Division.

The Engineering Division may increase or decrease the amount of surface area of erodible earth material to be exposed at one time by clearing and grubbing, excavation, borrow, and fill operations as determined by his analysis of project conditions.
- c. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other Federal or State or local agencies, the more restrictive laws, rules, or regulations shall apply.
- d. The contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in his accepted schedule. If no schedule is provided, permanent vegetation shall be established during the next seeding period after grading/clearing is complete or suspended for more than 30 days, in accordance with City of Wentzville Code Section 515.040 Sediment and Erosion Control. Temporary pollution control measures will be used to correct conditions that develop during construction that were not foreseeable during the design stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project. Fertilizer and soil conditioners shall not be applied during or before a rain event, unless otherwise directed on the manufacturer's instructions.
- e. Where erosion is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages. Under no conditions shall the surface area of erodible earth material exposed at one time by clearing and grubbing exceed 750,000 sq.ft. without approval by the Engineering Division.
- f. The Engineering Division will limit the area of excavation, borrow, and embankment operations in progress to commensurate with the contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent pollution control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

- g. Under no conditions shall the amount of surface area of erodible earth material exposed at one time by excavation, borrow, or fill within the right-of-way exceed 750,000 sq.ft. without prior approval by the Engineering Division.
- h. In case of repeated failures on the part of the contractor to control erosion, pollution, and/or siltation, the Engineering Division reserves the right to employ outside assistance or to use its own forces to provide the necessary corrective measures. Such incurred direct costs will be charged to the contractor or appropriate deductions made from the escrow amount set up by the developer.

**END OF SECTION**

## SECTION 203

### Removals

#### **203.1 Removal of Bridges**

- a. Description: This work shall consist of the removal and disposal of existing large structures noted on the approved plans.
- b. Construction Requirements: Unless otherwise indicated on the plans, the entire structure including all substructure units shall be removed to a point 2 ft. below the finished ground line or streambed.

All guard rail material shall remain the property of the City and shall be stored on the right-of-way as directed by the Engineering Division.

Existing structures used for handling temporary traffic shall not be removed until the replacement structures are open to traffic. The contractor may make use of existing structures or portions of them during construction, but no material designated to be salvaged shall be removed from the project, cut, bent, broken, or otherwise damaged.

Any portion of an existing structure below the ground line which falls within the limits of excavation for new structures will be removed and paid for as excavation for structures.

#### **203.2 Removal of Improvements**

- a. Description: This work shall consist of the removal and disposal of all existing improvements, except those designated or permitted to be left in place or to be removed under other items of work, from the right-of-way and within the limits of any construction area outside the right-of-way. Improvements, to be left in place within construction limits, must be adequately protected and remain in operating condition.

Removal of improvements shall include removing all buildings, drainage structures, all rigid, reinforced, flexible or combination pavements, surfacing, and base courses of all types, curb, curb and gutter, sidewalk approaches (residential, commercial and street) and house walks, steps, retaining walls, foundation walls, columns, footings, floors and any other types of building appurtenances, cisterns, catch basins, manholes, drainage and sewer pipes, box culverts, water and gas main pipes, other objects or structures including scattered or piled bricks, stones, broken masonry, rubbish, debris, etc. from building demolition work, and other existing improvements. This item shall also include the salvaging of materials and the backfilling of the resulting trenches, holes and pits, and any grading work required to shape, smooth, and finish the disturbed areas. All guard rail materials within the right-of-way shall remain the property of the City and shall be stored on the right-of-way as directed by the Engineering Division.

The plans may not show a complete list of all items to be removed as there may be an undetermined number of abandoned utilities, basement or foundation walls, columns, footings, other types of building appurtenances, or other improvements encountered. The contractor shall determine for himself the extent of the work to be performed under this item and shall base his bid accordingly. When portions of existing buildings are to be removed and portions are to remain, the contractor shall exercise extreme care to protect the portions of the buildings that are to remain. The contractor shall confine his activities within the construction limits and the slope license line shown on the plans.

- b. Construction Requirements: All buildings, disused structures, old pavements, base courses, abandoned sewers or pipe lines, or other obstructions to the construction or within the limits of the right-of-way and not designated or permitted to remain, shall be removed or disposed of by the contractor as required. Existing structures or pavements used for handling temporary traffic shall not be removed until the replacement structures are open to traffic. The contractor may make use of existing structures, roadways, or portions of them during construction, but no material designated for use elsewhere shall be removed from the project, cut, bent, broken, or otherwise damaged.

Material designated to be salvaged from existing structures shall be removed without damage, in sections which may be readily handled or transported, and shall be piled neatly at an accessible point. Material not designated for salvage will be considered the property of the contractor, unless owned and claimed by any political subdivision or utility company. Salvaged materials becoming the property of the contractor shall not be stored upon the right-of-way, nor shall any portion of the right-of-way be used by the contractor as a sales yard. All discarded material or debris shall be disposed of at locations furnished by the contractor, or at locations on the right-of-way approved by the Engineering Division. Discarded material or debris shall be disposed of in a manner acceptable under Missouri State Law. It is the contractor's responsibility to obtain any necessary permits for disposal. Disposal of material on private property, even with the owner's consent may be illegal. Material shall not be deposited on private property unless authorized in advance by the Director. Property owners interested in obtaining waste products shall be instructed to write the Director, City of Wentzville Department of Public Works, giving particulars of their request.

In removing pavement, curb, curb and gutter, gutters, sidewalk, and other similar improvements, and where a portion of such improvements are to be left in place, they shall be removed to an existing joint or to a joint sawed to a minimum depth of one inch with a true line and vertical face. Sufficient removal shall be made to provide for proper grades and connections in the new work regardless of any limits which may be indicated on the plans.

Removal of concrete pavement or base course, concrete floors, basement floors, and concrete sidewalk may consist either of breaking up and disposing of the broken concrete in embankments or in disposal areas furnished at the contractor's expense, or of breaking the slab into pieces not exceeding 4 sq.ft. where new embankment exceeding 24 in. high is to be placed over the slab. At locations designated on the plans where piling is to be driven, existing

pavements, sidewalks, footings, foundations, walls, and all other types of removal items shall be completely removed for a sufficient distance to permit piling to be driven. Existing improvements not removed in their entirety shall be removed to a minimum depth of 12 in. below the finished grading section or natural ground.

All sewers and drainage pipes which have been or are to be abandoned in place shall be completely filled with a sand-cement material which shall consist of a mixture of portland cement and sand combined in the proportions of 376 pounds of cement to one cubic yard of sand mixed with sufficient water to form a plastic mortar like mixture of a consistency appropriate for pumping into place with pressure pumping equipment. The sand and cement shall be mixed in a mixer of a type approved by the Director, after which water shall be added and the mixing continued until a consistency of mixture has been attained which can be pumped into the sewer openings under sufficient pressure, to insure the filling of all openings free of voids and air pockets or at the request of the contractor and with the approval of the Engineering Division, the existing pipe may be crushed in place or removed. All floor drains shall be sealed by bulkhead in an acceptable manner by concrete meeting the requirements of Section 501.9 or brick masonry as directed by the Engineering Division.

All trenches, holes, and pits resulting from the removal of improvements shall be filled with earth, or with broken masonry and earth. No broken masonry shall extend closer than 12 in. to the finished surface. The material shall be placed in the same manner and compacted to approximately the same density as that required in adjoining areas.

Removing and disposing of abandoned fences will be considered as included in final cleaning up of the right-of-way.

### **203.3 Removal of Rigid Pavement**

- a. Description: This work shall consist of the removal and disposal of concrete pavement or concrete base courses, and curb and gutter sections, except those designated or permitted to be left in place, from the right-of-way and within the limits of any construction area outside the right-of-way. The plans may not show a complete list of all items to be removed, the contractor shall determine for himself the extent of the work to be performed under this item. When portions of existing rigid pavements are to be removed and portions are to remain in place, the contractor shall exercise care to protect the portions of the rigid pavements that are to remain.
- b. Construction Requirements: All concrete pavement, concrete base courses, curb and gutter sections, and driveways within the limits of the right-of-way and not designated or permitted to remain, shall be removed and disposed of by the contractor as required. Existing rigid pavements used for handling temporary traffic shall not be removed until the replacement pavements are open to traffic. The contractor may make use of the existing rigid pavements or portions of them during construction, but no material designated for use elsewhere shall be removed from the project.

In removing concrete pavement, concrete base courses, and curb and gutter sections where a portion of such improvements are to be left in place, they shall be removed to an existing joint or to a joint sawed to a minimum depth of one inch with a true line and vertical face. Sufficient removal shall be made to provide for proper grades and connections in the new work regardless of any limits which may be indicated on the plans.

Removal of concrete pavement or concrete base courses, and curb and gutter sections shall consist either of breaking up and disposing of the broken concrete in embankments or in disposal areas furnished at the contractor's expense, or of breaking the slab into pieces not exceeding 4 sq.ft. in area when new embankment exceeding 24 in. in height is to be placed over the slabs. At locations designated on the plans where piling is to be driven, existing rigid pavements shall be completely removed for sufficient distance to permit piling to be driven.

#### **END OF SECTION**

## SECTION 204

### Roadway and Drainage Excavation, Embankment, and Compaction

**204.1 Description.** This work shall consist of excavation, disposal, or compaction of all materials encountered within the limits of the work not being removed under some other item. This work shall be performed in accordance with the specifications and in conformance with the lines, grades, thicknesses, and typical cross sections shown on the plans, or established by the Engineering Division. All excavation will be classified as hereafter described.

- a. Class A Excavation: Class A Excavation will consist of all roadway and drainage excavation not classified as Class C, Sandstone, or Igneous Rock.
- b. Class C Excavation: Class C Excavation will consist of the removal of stone in ledges 6 in. or more in thickness. A ledge will be considered to be a continuous deposit of rock that may or may not include thin, interbedded seams of soft material or shale. The vertical limits of each ledge will be determined by beds of soft material or shale more than 12 in. thick. The beds of soft material or shale will be included in the measurement of Class A Excavation only. Boulders or other detached stones each having a volume of 2 1/2 cu.yd. or more will be considered as Class C Excavation.

Shale, fire clay, chert (joint flint rock) broken by intermittent clayey partings or clay seams, stratified chert cemented with clay seams (hardpan), and plain or bituminous-bound bases or surface courses of macadam, gravel, broken stone, or similar materials will not be considered as Class C Excavation or Sandstone Excavation.
- c. Sandstone Excavation: Sandstone Excavation will consist of the removal of material determined to be sandstone in ledge formation. Laboratory analysis will be made, if necessary, to aid in the determination.
- d. Igneous Rock Excavation: Igneous Rock Excavation will consist of the removal of rock of igneous origin (porphyry, granite, rhyolite) occurring in continuous formation, or of detached boulders having a volume of 2 1/2 cu.yd. or more.
- e. Unclassified Excavation: Unclassified Excavation will consist of the excavation of all materials of whatever character encountered in the work. Unless specified in the approved plans or by the Engineering Division all material excavated will be considered as Unclassified Excavation.
- f. Borrow and Waste: Borrow will consist of approved material required for the construction of embankment or for other portions of the work, and shall be obtained either from borrow areas shown on the plans, from areas designated by the Engineering Division, or from other approved sources. The contractor shall notify the Engineering Division sufficiently in advance of opening any borrow areas in order that the necessary soil sampling, cross sections, or measurements may be taken. Borrow will be classified in the same manner as roadway

excavation. Borrow areas will be given a final dressing and seeding prior to completion of the job, so as to provide a pleasing appearance to the overall area. The use of borrow or waste area other than those shown on the plans or designated by the Engineering Division may be approved, provided:

1. The material and area is equally satisfactory.
2. The final cost to the County including the cost of easements is not greater than the cost as originally designated.
3. The substitution is to the best interest of the City.

When borrow areas are on private property a letter of permission must be obtained from the property owner before any material may be removed. Following final grading and seeding of the borrow area a letter of release from liability must be obtained from the property owner.

#### **204.2 Construction Requirements.**

- a. Prior to beginning excavation and embankment operations in any area, all necessary clearing, grubbing, and stripping in that area shall have been performed. The excavation and embankment for roadway, intersections, and entrances shall be made to the designated alignment, grade, and cross section. Side slopes, cuts, and fills shall be finished to a reasonably smooth and uniform surface that will merge with the adjacent terrain without variations readily discernible from the road. Finishing by hand methods will not be required, except that all brush, weeds, excess mud and silt, or other debris shall be removed from culverts and channels even though such structures are used in place. Areas disturbed by the contractor outside the limits of construction shall be restored at the contractor's expense to a condition similar to that prior to construction operation.
  1. *Field Stone:* All loose field stone within the limits of the right-of-way, field stone necessary to be removed before commencing operations on light grading sections, and small rocks and boulders resulting from the operations of subgrade scarifying and finishing a graded earth roadway shall be disposed of as directed by the Engineering Division.
  2. *Shoulders:* Earth shoulders shall be constructed of suitable material to the grade and cross section shown on the plans and shall be compacted by use of a steel wheeled roller weighing not less than 5 tons. The construction of shoulders shall start when sufficient surfacing has been completed and attained satisfactory strength to permit continuous shouldering operations. Equipment that will damage the surfacing will be prohibited from operating on the surfacing during shouldering operations. Surfacing and curbs shall be protected where equipment is crossing or turning.
- b. Maintenance: During construction, the roadway shall be maintained by the contractor in such condition that it will be passable and well drained at all times.



Roadway ditches, channel changes, inlet and outlet ditches, and any other ditches in connection with the roadway shall be cut and maintained to the required cross section. All drainage work shall be performed in proper sequence with other operations. All ditches and channels shall be kept free of debris or obstructions. All slides shall be removed and material disposed of as directed by the Engineering Division.

- c. Drilled and Dug Wells: The contractor will notify the Engineering Division 24 hours in advance of his intent to plug the well. Drilled well casings shall be cut off flush with the existing ground line or 12 in. below the finished grading section, whichever is lower. The well shall then be plugged from the bottom of the well to the top of the casing with a mixture of commercial concrete or 4:1 sand-cement grout. If the mixture is to be placed below water, it shall be placed by means of a tremie, where feasible. If the use of a tremie is not considered feasible, the mixture shall be placed in two stages. During the first stage, the mixture may be deposited directly through the water to plug the well from the bottom to an elevation 10 ft. below the bottom of the casing or to an elevation 80 ft. below the top of the casing, whichever is lower. After a minimum period of 48 hours, the well shall be dewatered and the remaining mixture placed in the dry. The mixture used to plug wells less than 80 ft. in depth shall be placed by tremie or completely in the dry. Dug wells and cisterns shall be pumped out, the bottom broken and the well or cistern filled to the ground line or within 12 in. of the finished grading section, whichever is lower, with suitable earth compacted in 6 in. layers to the approximate density of the adjacent soil.
- d. Subgrade Scarifying: The Engineering Division may order subgrade scarifying performed to remove oversized material if the upper 6 in. of the subgrade as tentatively completed contains material of a dimension greater than 4 in. sufficient in quantity to make it unacceptable as a road bed for the proposed type of surfacing.
- e. Excavating in Rock: Excavating and undergrading in rock (i.e., material conforming to the description of Class C, Sandstone or Igneous Rock) shall be performed in a manner to produce material of such size as to permit being placed in embankments in accordance with the requirements. Rock within the roadbed limits shall be removed to the limits of undergrading insofar as practicable and in such manner as to leave no undrained pockets in the surface. The contractor will be required to obtain the necessary permission from all governmental entities before considering blasting as a means of rock excavation. Care shall be taken to avoid overshooting when blasting. Any loose or shattered rock, overhanging ledges, and boulders above the roadbed which might dislodge shall be removed. When the approved plans provide a specific use for rock from roadway excavation, the work shall be performed in such order and manner as may be necessary to insure that the desired quantity of such material may be placed as required.
  - 1. The contractor, at his option, may perform the excavating of rock cuts by the technique of "pre-splitting" on the neat line of the proposed excavation, with the results subject to the approval of the Engineering Division. Holes for pre-splitting shall be drilled to the full depth of the cut

or to a pre-selected bench elevation as shown on the plans or as determined by the Engineering Division. The spacing and diameter of holes and the amount, type, and spacing of the explosive charges in the holes shall be the full responsibility of the contractor. Pre-splitting shall be done according to accepted practice to produce a clean face on the excavated cut.

2. *Undergrading.* Areas of required undergrading shall be backfilled with one of the following materials with preference in the order given, dependent on availability:
  - i. Rock fragments or spalls.
  - ii. A granular type material having a plasticity index not to exceed 10 and a gradation such that at least 50 percent of the material will be retained on the No. 4 sieve.
  - iii. A material having a low plasticity index and designated by the Engineering Division as suitable.
3. *Overbreak.* The areas of overbreak resulting from excavating rock below the required limits of undergrading shall be backfilled with spalls or rock fragments. If spalls are not available and if the contractor does not elect to use rock fragments, the use of either of the following will be satisfactory.
  - i. Material meeting the requirements of Section 701.
  - ii. A granular type material having a plasticity index not to exceed 10 and a gradation such that at least 50 percent of the material will be retained on the No. 4 sieve.
- f. Where excavation to the finished graded section results in a subgrade or slopes of unsuitable material, the Engineering Division may require the contractor to remove the unsuitable material, and backfill to the finished graded section with approved material. The contractor shall conduct his operations in such manner that the Engineering Division may make the necessary measurements before the backfill is placed. Required backfill shall be provided to furnish a stable foundation for the roadway. The Engineering Division may order additional excavation beyond the pay limits established for roadway excavation in order to remove material found unsuitable for roadway construction. 2 or 3 in. clean stone shall be used as backfill for such excavations. The gradation of the material will be determined by the Engineering Division.
- g. Borrow material shall not be placed until after material from roadway excavation has been placed in the fill, except as approved otherwise by the Engineering Division. The contractor shall not excavate beyond the dimensions and elevations established, and no material shall be removed prior to staking and cross sectioning the site. If the contractor places more borrow than required and thereby causes a waste of excavation, such waste will be deducted from the

borrow volume as measured in the borrow area. All borrow areas shall be bladed and left in such shape as to permit taking the necessary cross sections after excavating has been completed. The finished borrow areas shall be approximately true to line and grade, and shall be finished, where practicable, so that no water will collect or stand therein. When necessary to remove fencing in order to obtain borrow material, it shall be replaced in as good condition as it was at the time of removal. The contractor shall be responsible for confining livestock when a portion of the fence is removed.

- h. Obliteration of old roads shall be performed in areas shown on the plans and shall include all grading operations necessary to incorporate the old road into the work. The obliteration shall provide a pleasing appearance.
- i. Artifacts: When remains of prehistoric sites or artifacts of historical or archaeological significance are encountered, the excavation operations shall be temporarily discontinued. The Engineering Division will determine the disposition of such sites or artifacts. When directed by the Engineering Division, the contractor shall excavate the site in such manner as to preserve the artifacts encountered.
- j. During the process of excavating cuts, the Engineering Division may order specific excavated material placed in stockpiles in order to have suitable material available to complete the upper portion of embankments and to backfill portions of undergraded cuts.
- k. Embankment Construction: Embankment construction shall consist of constructing roadway embankments, including preparation of the areas upon which they are to be placed, constructing dikes and berms, placing and compacting approved materials within roadway areas where unsuitable material has been removed, and placing and compacting of embankment material in holes, pits, and other depressions within the roadway area. Only approved materials free of trees, stumps, rubbish, and any other deleterious material shall be used in the construction of embankments and backfills. Rocks, broken concrete, or other solid material shall not be placed in embankment areas where piling is to be placed or driven.
  - 1. Embankments requiring surcharges, restricted loading rates, embankment control stakes, or pore pressure measurement devices, shall be constructed to the design template progressively for the full height. Failure of embankments or embankment foundations, or damage to structures which occur when the contractor fails to observe restricted loading rates, or fails to construct slopes initially to the design template, shall be repaired as directed by the Engineering Division at the contractor's expense.
  - 2. Construction of embankments shall not be started on foundation soil or partially completed embankments having more than 2 in. of frost. When such conditions exist the surface must be thoroughly broken and mixed with non-frosted material to the satisfaction of the Engineering Division. No frozen material may be incorporated into the embankment. No

material shall be placed on frost layers encountered within 12 in. of the top of the proposed grading section. Frozen material on foundation soil or partially completed embankment not meeting the above requirements shall be removed before placing material for the embankment. The removal of frozen material from the foundation of an embankment, or from any layer of the embankment, and the replacement with satisfactory material shall be at the expense of the contractor.

- l. When embankment is to be placed on hillsides or when new embankment is to be constructed against existing embankments, the existing slopes that are steeper than 6 to 1 when measured at right angle to the roadway shall be continuously benched in not less than 12 in. rises over those areas where it is required as the work is brought up in layers. Benching shall be of sufficient width to permit placing and compacting operations. Each horizontal cut shall begin at the intersection of the ground line and the vertical side of the previous bench. Existing slopes shall also be stepped to prevent any wedging action of the embankment against structures. No direct payment will be made for the material thus cut out or for its compaction along with the new embankment material.
- m. Scalping shall be performed in accordance with Section 201.2. Where an embankment less than 4 ft. in height is to be made, all sod and vegetable material shall be removed from the surface upon which the embankment is to be placed, and the cleared surface completely broken up by plowing, scarifying, or stepping to a minimum depth of 6 in. This area shall be compacted in the same manner as that required for the embankment placed on the area. Sod not required to be removed shall be thoroughly disked before construction of embankment. Where an embankment less than 3 ft. in height is to be made over a compacted road surface containing bituminous or granular material, the old road surface shall be scarified to a depth of at least 6 in. This scarified material shall be recompacted.
- n. If embankment is deposited on one side only of abutments, wing walls, piers, or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning of or excessive pressure against the structure. Equipment of such weight as may cause damage to culverts or other structures will not be permitted to work over or immediately adjacent to such structures. The fill adjacent to the end bent of a bridge shall not be placed higher behind than in front of end bents until the superstructure is in place. When embankment is to be placed on both sides of a concrete wall or box type structure, operations shall be so conducted that the embankment is kept at approximately the same elevation on each side.
- o. Surcharged embankments shall be built in accordance with the plans and shall remain in place for such time as required by the approved plans. The requirements for placing and compacting will be waived on the surcharge material above the specified completed area.
- p. Surplus roadway material shall be removed and stored at the stockpile area indicated. The stockpiled material will be confined within the area shown, and necessary precautions will be taken to insure that surface drainage or storm

culvert drainage is not interrupted. Prior to completion of the job, the contractor shall give the stockpile area a final dressing and seeding so as to provide a pleasing appearance to the overall area.

Surplus roadway excavation and waste materials resulting from removals shall be disposed of in areas obtained by the contractor. The contractor shall comply with the following requirements in securing waste areas and in depositing waste products thereon.

1. The site shall not be in a flood plain or within areas protected by the City's Natural Watercourse Protection Ordinance (Wentzville Code Section 410.461).
2. Letters of permission and release are required from the affected property owner or owners.
3. Obtain any permits applicable under local, state, or federal law.
4. Precautions shall be taken to insure that surface water and storm culvert drainage are not interrupted or contaminated.
5. The waste disposal area or areas shall be given a final dressing and seeding to provide a presentable appearance and to prevent soil erosion.
6. Other siltation control measures such as straw bales shall be applied during construction as directed by the Engineering Division.

The permit letter provided from the property owner shall be submitted for approval a minimum of five (5) working days prior to the start of operations that will result in waste products or excess excavation. The letter of release will be required before the retained percentage will be released. The contractor will be required to haul over city streets and any hauling operations of the contractor shall be subject to the requirements of such permits and other applicable city regulations and ordinances. No direct payment will be made for complying with the requirements of this specification.

- q. Roadway embankment shall be placed in layers not exceeding 8 in. (loose measurement) and shall be compacted as specified before the next layer is placed. The layers shall be placed approximately parallel to both the proposed profile grade and to the finished roadbed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. Continuous leveling and manipulating will be required during compacting operations. Construction equipment shall be routed uniformly over the entire surface of each layer.

1. Occasional stones or rock fragments exceeding the thickness of the 8 in. layer shall be disposed of by being incorporated into the embankment outside the limits of the proposed surfaced traffic lanes. The thickness of the layer in these areas may be increased if necessary to accommodate the stones, but shall not exceed 12 in. in thickness (loose measurement). The stones or rock fragments are to be placed so there will be no nesting.

2. Lifts may be increased to a maximum of 12 in. in thickness (loose measurement) for berms, filling of old channels, waste, or similar areas. These areas shall be compacted by uniformly distributing the hauling over the entire area and specific density control will not be required. No direct payment will be made for compaction performed in these areas.
- r. When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the thickness prescribed, such material shall be placed in the embankment in layers having a thickness of the approximately average size of the larger rocks, but not to exceed 24 in. Rocks or boulders too large to permit placing in a 24 in. layer shall be reduced in size as necessary to permit this placement. Rock shall not be dumped in place, but shall be distributed by blading or dozing in a manner to insure proper placement in final position in the embankment. The spalls and smaller stone fragments shall be left on the surface of each layer as formed. The uppermost portion of rock embankments placed in this manner shall be constructed as follows:

Where the specified or proposed surfacing consists of a rigid or flexible type pavement, the top consolidated rock layer for the full width between roadbed slopes shall be finished to the same limits as shown on the plans for undergrading in rock cuts. When rigid pavement is to be constructed without an aggregate base, the material requirements of Section 203.2 shall govern for the construction of the area between the bottom of the pavement and the top of the top consolidated rock layer. Any embankment necessary outside the limits of the pavement shall be constructed of suitable earth.

**204.3 Compaction of Embankment and Treatment of Cut Areas with Moisture and Density Control.** AASHTO T 99, Method C, replacing any material retained on a 3/4 in. sieve, as provided therein, will be used as the Standard Compaction Test for determining the moisture density relations of soils. The optimum moisture as determined by the Standard Compaction Test may be used as a guide in determining the proper moisture content at which each soil type should be compacted. Water shall be added or removed as necessary to permit obtaining the required density and moisture control. The field density of the embankment after compaction will be determined, using the total material, in accordance with AASHTO T 191 (Sand Cone Method), or AASHTO T 238, Method B Direct Transmission, for wet density. When nuclear density methods are used, moisture content will be determined in accordance with AASHTO T 239. The volume of the test hole may be reduced as necessary to accommodate available testing equipment. The calculated density obtained in this field density test will be compared with the maximum density as established by the Standard Compaction Test to determine the percent compaction attained.

- a. Compaction to at least 95 percent of maximum density, as determined by the Standard Compaction Test, will be required in the following areas:
  1. All roadway embankments except as otherwise provided in the following sections: Section 203.2 and 203.3.
  2. All backfilled undergraded cuts, except as modified by Section 203.3.

3. Certain portions of the roadbed in cuts specified in Section 203.3 except as modified.
- b. The moisture content of the soil at the time of compaction shall be as herein specified.
    1. When necessary to eliminate rubbery condition of the embankment, it may be required that some soils have a moisture content below the optimum during compacting work. Clays, heavy clays, and other Class A materials having liquid limits of 40 or more shall not be placed as embankment when the moisture content of the soil surpasses its optimum moisture by three (3) percent. Existing embankments shall be disked, aerated, or reworked to comply with the moisture requirements of this provision subsequent to the resumption of embankment placement operation.
    2. Loessial soils shall have moisture controlled so as not to exceed optimum plus three percentage points when placed in embankments of less than 30 ft. in height. Such soils when placed in embankments of 30 ft. or more in height shall have moisture controlled so as not to exceed optimum moisture. If wet foundation conditions contribute to the embankment moisture while compacting, the Engineering Division may waive this specified moisture content for a height not to exceed 3 ft. above the embankment foundation. In the event of conflict of provisions of this paragraph and the previous paragraph, the previous paragraph shall govern.
  - c. When a flexible type surface is proposed, at least 95 percent of maximum density will be required for the upper 18 in. of the earth subgrade extending the full width between roadbed slopes.
  - d. Roadway embankment within 100 ft. of each end of a structure on which the top slab or deck is to be used as the riding surface, and the spill fill under such a structure, shall be compacted to not less than 95 percent of maximum density.
  - e. Density requirements will not apply to portions of embankments constructed of material so rocky that they cannot be satisfactorily tested in accordance with AASHTO T 191 or T 205. Material of a gradation having more than approximately 20 percent retained on a 3/4 in. sieve will generally be considered too rocky for satisfactory density testing. In lieu thereof, compactive effort on rock and rocky material shall consist of making four complete coverages of each layer with a tamping-type roller or two complete coverages of each layer with a vibratory roller. The tamping-type roller shall have tampers or feet protruding not less than 6 in. from the surface of the drum and have a minimum load on each tamper of 250 psi of tamping area. The vibratory roller shall have a manufacturer's rating of 16 to 20 tons compacting power.
  - f. Compacting in Cut: Cut compaction shall be performed in areas designated by the Engineering Division, after removal of the roadway excavation material to the required pavement or lowest base course, shall be temporarily exposed for the

full width between roadway inslopes. The exposed material, to a depth of 6 in., shall be manipulated and compacted to not less than the required density. The material above this compacted plane shall be respread in layers not exceeding 8 in. loose thickness, each layer being wetted or dried as necessary and compacted to the specified density. The entire volume of materials so handled and compacted, including the 6 in. layer compacted in place will be considered as Compacting in Cut. All Class A material having a liquid limit of 40 or more including the 6 in. layer compacted in-place, shall be compacted at not less than optimum moisture content.

1. In areas designated by the Engineering Division, the existing ground for the full width between roadway slopes under embankments of less than 18 in. in height shall be treated in accordance with Section 203.3 to only such depth as to insure having 18 in. of material of the required density and moisture below the top of the finished subgrade.
  2. The entire volume of materials so handled and compacted as specified in Section 203.3, including the 6 in. layer compacted in-place, will be considered compacting in cut.
- g. Each layer shall be wetted or dried, as necessary, and shall be compacted to the required density. Regardless of the type of equipment used, the roadway shall be compacted uniformly and the surface kept reasonably smooth at all times. When large pieces of heavy clay are encountered, the material shall be broken down by suitable manipulation to permit satisfactory embankment construction. When shale is encountered, it shall be broken down as much as is practicable and compacted at or above optimum moisture.
- h. Compaction to at least 95 percent of maximum density will be required for that portion of any embankment below an elevation 50 ft. below the top of the finished subgrade. If, because of embankment foundation conditions, the 95 percent of maximum density cannot be obtained after reasonable compactive effort has been expended, the Engineering Division may waive the 95 percent requirement for a height not to exceed 3 ft. above the embankment foundation.
- i. When a pavement is to be constructed directly on a soil base, at least 95 percent of the maximum density will be required for the upper 18 in. of the earth subgrade extending the full width between roadbed slopes.

**204.4 Compaction of Embankments Not Constructed with Density or Moisture and Density Control.** The compactive effort on each layer shall consist of distributing all equipment movements over the entire fill area and of at least three complete coverages with a tamping-type roller over the entire area to be compacted. The tamping-type roller shall have tampers or feet projecting not less than 6 in. from the surface of the drum and shall have a minimum load on each tamper of 250 psi. Compactive effort shall be continued, if necessary, until the tamping feet penetrate not more than 2 in. into the layer of material being compacted. Continuous leveling and manipulating will be required during compacting operations and the moisture content shall be adjusted as is necessary, in the judgment of the Engineering Division, to permit proper consolidation.



- a. Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until compaction complying with these requirements has been secured. Unstable areas in the embankment shall be removed and replaced with suitable material at the expense of the contractor.
- b. Each layer of embankment constructed of rock or rocky material shall also be compacted by three complete coverages of the tamping-type roller. A vibratory roller may be used on approval of the Engineering Division.

**204.5                    Compaction of Embankments without Specified Compaction Results or Specified Compaction Equipment.** Only when specifically designated on the plans, compaction will not be required other than that obtained by distributing equipment movements over the entire fill area.

**END OF SECTION**

## SECTION 205

### **Embankment and Compaction**

**205.1 Description.** This work shall consist of placing and compacting embankment on the project utilizing any necessary excavation or borrow required to construct the roadway to the plan configuration. This work will conform to the lines, grades and thickness and typical cross sections shown on the plans and will be performed in accordance with the specifications or as established by the Engineering Division.

**205.2 Construction Requirements.** Embankment in place will be constructed utilizing the material excavated on the project or supplied from an approved borrow area. Excavation from the project will include Class A, Class C, Sandstone and Igneous Rock excavations as defined in Section 203.1 and any material derived from excavation for structures, excavations for sewers, cleanout of existing sewers, on site utility adjustments or from other of the contractor's on site operations may be used in construction of the roadway embankments if such materials are approved by the Engineering Division prior to use.

- a. Borrow will consist of approved material required for the construction of embankment or for other portions of the work, and shall be obtained from approved sources. Borrow areas shall be given a final dressing and seeding prior to completion of the job, so as to provide a pleasing appearance to the overall area.
  1. The use of borrow or waste area other than those shown on the plans or designated by the Engineering Division may be approved provided:
    - i. The material and area is equally satisfactory.
    - ii. The final cost to the City including the cost of easements is not greater than the cost as originally designated.
    - iii. The substitution is to the best interest of the City.

When borrow areas are on private property, a letter of permission must be obtained from the property owner before any material may be removed. Following final grading and seeding of the borrow area, a letter of release from liability must be obtained from the property owner prior to final payment.

- b. Material designated by the Engineering Division as unsuitable for embankment construction shall be disposed of off site by the contractor at his expense in accordance with the provisions of Section 204.2. No direct payment will be made for such excavation unless otherwise noted on the plans, or for the disposal of excess or unsuitable material.
  1. Prior to beginning embankment operations in any area, all necessary clearing, grubbing, and stripping in that area shall have been performed. The excavation and embankment for roadway, intersections, and entrances shall be made to the designated alignment, grade, and cross section. Side slopes, cuts, and fills shall be finished to a reasonably smooth and uniform surface that will merge with the adjacent terrain without variations readily discernible from the road. Finishing by hand

methods will not be required, except that all brush, weeds, excess mud and silt, or other debris shall be removed from culverts and channels even though such structures are used in place. Areas disturbed by the contractor outside the limits of construction shall be restored at the contractor's expense to a condition similar to that prior to construction operation.

2. *Field Stone.* All loose field stone within the limits of the right-of-way, field stone necessary to be removed before commencing operations on light grading sections, and small rocks and boulders resulting from the operations of subgrade scarifying and finishing a graded earth roadway shall be disposed of as directed by the Engineering Division.
  3. *Shoulders.* Earth shoulders shall be constructed of suitable material to the grade and cross section shown on the plans and shall be compacted by use of a steel wheeled roller weighing not less than 5 tons. The construction of shoulders shall start when sufficient surfacing has been completed and attained satisfactory strength to permit continuous shouldering operations. Equipment that will damage the surfacing will be prohibited from operating on the surfacing during shouldering operations. Surfacing and curbs shall be protected where equipment is crossing or turning.
  4. *Maintenance.* During construction, the roadway shall be maintained by the contractor in such condition that it will be passable and well drained at all times. Roadway ditches, channel changes, inlet and outlet ditches, and any other ditches in connection with the roadway shall be cut and maintained to the required cross section. All drainage work shall be performed in proper sequence with other operations. All ditches and channels shall be kept free of debris or obstructions. All slides shall be removed and material disposed of as directed by the Engineering Division.
- c. Subgrade Scarifying: The Engineering Division may order subgrade scarifying performed to remove oversized material if the upper 6 in. of the subgrade as tentatively completed contains material of a dimension greater than 4 in. sufficient in quantity to make it unacceptable as a road bed for the proposed type of surfacing.
- d. Undergrading: Areas of required undergrading shall be backfilled with one of the following materials with preference in the order given, dependent on availability:
- i. Rock fragments or spalls.
  - ii. A granular type material having a plasticity index not to exceed 10 and a gradation such that at least 50 percent of the material will be retained on the No. 4 sieve.
  - iii. A material having a low plasticity index and designated by the Engineering Division as suitable.

1. *Overbreak.* The areas of overbreak resulting from excavating rock below the required limits of undergrading shall be backfilled with spalls or rock fragments. If spalls are not available and if the contractor does not elect to use rock fragments, the use of either of the following will be satisfactory:
  - i. Material meeting the requirements of Section 701.
  - ii. A granular type material having a plasticity index not to exceed 10 and a gradation such that at least 50 percent of the material will be retained on the No. 4 sieve.
- e. Where excavation to the finished graded section results in a subgrade or slopes of unsuitable material, the Engineering Division may require the contractor to remove the unsuitable material, and backfill to the finished graded section with approved material. The contractor shall conduct his operations in such manner that the Engineering Division may make the necessary measurements before the backfill is placed.
- f. Borrow material shall not be placed until after acceptable material from roadway excavation has been placed in the embankment, except as otherwise approved by the Engineering Division. The finished borrow areas shall be approximately true to line and grade and shall be finished, where practicable, so that no water will collect or stand therein. When necessary to remove fencing in order to obtain borrow material, it shall be replaced in as good condition as it was at the time of removal. The contractor shall be responsible for confining livestock when a portion of the fence is removed. No direct payment will be made for removing and replacing such fence or for the confining of livestock.
- g. Obliteration of old roads shall be performed in areas shown on the plans and shall include all grading operations necessary to incorporate the old road into the work. The obliteration shall provide a pleasing appearance. Obliteration of existing pavements will be paid for as Removal of Improvements.
- h. Artifacts: When remains of prehistoric sites or artifacts of historical or archaeological significance are encountered, the excavation operations shall be temporarily discontinued. The Engineering Division will determine the disposition of such sites or artifacts. When directed by the Engineering Division, the contractor shall excavate the site in such manner as to preserve the artifacts encountered.
- i. During the process of excavating cuts, the Engineering Division may order specific excavated material placed in stockpiles in order to have suitable material available to complete the upper portion of embankments and to backfill portions of undergraded cuts.
- j. Embankment Construction: Embankment construction shall consist of constructing roadway embankments, including preparation of the areas upon which they are to be placed, constructing dikes and berms, placing and compacting approved materials within roadway areas where unsuitable material has been removed, and placing and compacting of embankment material in

holes, pits, and other depressions within the roadway area. Only approved materials free of trees, stumps, rubbish, and any other deleterious material shall be used in the construction of embankments and backfills. Rocks, broken concrete, or other solid material shall not be placed in embankment areas where piling is to be placed or driven.

1. Embankments requiring surcharges, restricted loading rates, embankment control stakes, or pore pressure measurement devices, shall be constructed to the design template progressively for the full height. Failure of embankments or embankment foundations, or damage to structures which occur when the contractor fails to observe restricted loading rates, or fails to construct slopes initially to the design template, shall be repaired as directed by the Engineering Division at the contractor's expense.
  2. Construction of embankments shall not be started on foundation soil or partially completed embankments having more than 2 in. of frost. When such conditions exist, the surface must be thoroughly broken and mixed with non-frosted material to the satisfaction of the Engineering Division. No frozen material may be incorporated into the embankment. No material shall be placed on frost layers encountered within 12 in. of the top of the proposed grading section. Frozen material on foundation soil or partially completed embankment not meeting the above requirements shall be removed before placing material for the embankment. The removal of frozen material from the foundation of an embankment, or from any layer of the embankment, and the replacement with satisfactory material shall be at the expense of the contractor.
- k. When embankment is to be placed on hillsides or when new embankment is to be constructed against existing embankments, the existing slopes that are steeper than 6 to 1 when measured at right angle to the roadway shall be continuously benched in not less than 12 in. rises over those areas where it is required as the work is brought up in layers. Benching shall be of sufficient width to permit placing and compacting operations. Each horizontal cut shall begin at the intersection of the ground line and the vertical side of the previous bench. Existing slopes shall also be stepped to prevent any wedging action of the embankment against structures. No direct payment will be made for the material thus cut out or for its compaction along with the new embankment material.
- l. Scalping shall be performed in accordance with Section 201.2. Where an embankment less than 4 ft. in height is to be made, all sod and vegetable material shall be removed from the surface upon which the embankment is to be placed, and the cleared surface completely broken up by plowing, scarifying, or stepping to a minimum depth of 6 in. This area shall be compacted in the same manner as that required for the embankment placed on the area. Sod not required to be removed shall be thoroughly disked before construction of embankment. Where an embankment less than 3 ft. in height is to be made over a compacted road surface containing bituminous or granular materials, the old road surface shall be scarified to a depth of at least 6 in. This scarified material shall be recompacted.

- m. If embankment is deposited on one side only of abutments, wing walls, piers, or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that it will cause overturning of or excessive pressure against the structure. Equipment of such weight as may cause damage to culverts of other structures will not be permitted to work over or immediately adjacent to such structures. The fill adjacent to the end bent of a bridge shall not be placed higher behind than in front of end bents until the superstructure is in place. When embankment is to be placed on both sides of a concrete wall or box type structure, operations shall be so conducted that the embankment is kept at approximately the same elevation on each side.
- n. Surcharged embankments shall be built in accordance with the plans and shall remain in place for such time as required by the approved plans. The requirements for placing and compacting will be waived on the surcharge material above the specified completed area.
- o. Surplus roadway material shall be removed and stored at the stockpile area indicated. The stockpiled material will be confined within the area shown, and necessary precautions will be taken to insure that surface drainage or storm culvert drainage is not interrupted. Prior to completion of the job, the contractor shall give the stockpile area a final dressing and seeding so as to provide a pleasing appearance to the overall area.
- 1. Surplus roadway excavation and waste materials resulting from removals shall be disposed of in areas obtained by the contractor. The contractor shall comply with the following requirements in securing waste areas and in depositing waste products thereon.
  - i. The site shall not be in a flood plain.
  - ii. Letters of permission and release are required from the affected property owner or owners.
  - iii. Precautions shall be taken to insure that surface water or storm culvert drainage is not interrupted.
  - iv. The waste disposal area or areas shall be given a final dressing and seeding to provide a presentable appearance and to prevent soil erosion.
  - v. Other siltation control measures such as straw bales shall be applied during construction as directed by the Engineering Division.

The permit letter provided from the property owner shall be submitted for approval a minimum of five (5) working days prior to the start of operations that will result in waste products or excess excavation. The letter of release will be required before the retained percentage will be released.

The contractor may be required to haul over city streets and any hauling operations of the contractor shall be subject to the requirements of such permits and other applicable city regulations and ordinances. No direct

payment will be made for complying with the requirements of this specification.

- p. Roadway embankment shall be placed in layers not exceeding 8 in. (loose measurement) and shall be compacted as specified before the next layer is placed. The layers shall be placed approximately parallel to both the proposed profile grade and to the finished roadbed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. Continuous leveling and manipulating will be required during compacting operations. Construction equipment shall be routed uniformly over the entire surface of each layer.
  - 1. Occasional stones or rock fragments exceeding the thickness of the 8 in. layer shall be disposed of by being incorporated into the embankment outside the limits of the proposed surfaced traffic lanes. The thickness of the layer in these areas may be increased if necessary to accommodate the stones, but shall not exceed 12 in. in thickness (loose measurement). The stones or rock fragments are to be placed so there will be no nesting.
  - 2. Lifts may be increased to a maximum of 12 in. in thickness (loose measurement) for berms, filling of old channels, waste, or similar areas. These areas shall be compacted by uniformly distributing the hauling over the entire area, and specific density control will not be required. No direct payment will be made for compaction performed in these areas.
- q. When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the thickness prescribed, such material shall be placed in the embankment in layers having a thickness of the approximately average size of the larger rocks, but not to exceed 24 in. Rocks or boulders too large to permit placing in a 24 in. layer shall be reduced in size as necessary to permit this placement. Rock shall not be dumped in place, but shall be distributed by blading or dozing in a manner to insure proper placement in final position in the embankment. The spalls and smaller stone fragments shall be left on the surface of each layer as formed. The uppermost portion of rock embankments placed in this manner shall be constructed as follows:

Where the specified or proposed surfacing consists of a rigid or flexible type pavement, the top consolidated rock layer for the full width between roadbed slopes shall be finished to the same limits as shown on the plans for undergrading in rock cuts. When rigid pavement is to be constructed without an aggregate base, the material requirements of Section 203.2 shall govern for the construction of the area between the bottom of the pavement and the top of the top consolidated rock layer. Any embankment necessary outside the limits of the pavement shall be constructed of suitable earth.

**205.3            Compaction of Embankment and Treatment of Cut Areas with Moisture and Density Control.** AASHTO T 99, Method C, replacing any material retained on a 3/4 in. sieve, as provided therein, will be used as the Standard Compaction Test for determining the moisture density relations of soils. The optimum moisture as determined by the Standard Compaction Test may be used as a guide in determining the proper moisture content at which

each soil type should be compacted. Water shall be added or removed as necessary to permit obtaining the required density and moisture control. The field density of the embankment after compaction will be determined, using the total material, in accordance with AASHTO T 191 (Sand Cone Method) or AASHTO T 238, Method B Direct Transmission, for wet density. When nuclear density methods are used, moisture content will be determined in accordance with AASHTO T 239. The volume of the test hole may be reduced as necessary to accommodate available testing equipment. The calculated density obtained in this field density test will be compared with the maximum density as established by the Standard Compaction Test to determine the percent compaction attained.

- a. Compaction to at least 95 percent of maximum density, as determined by the Standard Compaction Test, will be required in the following areas:
  - 1. All roadway embankments except as otherwise provided in the following sections: Sections 204.2 and 204.3.
  - 2. All backfilled undergraded cuts.
  - 3. Certain portions of the roadbed in cuts specified in Section 204.3 except as modified.
- b. The moisture content of the soil at the time of compaction shall be as herein specified.
  - 1. When necessary to eliminate rubbery condition of the embankment, it may be required that some soils have a moisture content below the optimum during compacting work. Clays, heavy clays and other Class A materials shall not be placed as embankment when the moisture content of the soil surpasses its optimum moisture content by 3 percent. Existing embankments shall be disked, aerated or reworked to comply with the moisture requirements of this provision subsequent to the resumption of embankment placement operation.
  - 2. Loessial soils shall have moisture controlled so as not to exceed optimum plus three percentage points when placed in embankments of less than 30 ft. in height. Such soils when placed in embankments of 30 ft. or more in height shall have moisture controlled so as not to exceed optimum moisture. If wet foundation conditions contribute to the embankment moisture while compacting, the Engineering Division may waive this specified moisture content for a height not to exceed 3 ft. above the embankment foundation. In the event of conflict of provisions of this paragraph and the previous paragraph, the previous paragraph shall govern.
- c. When a flexible type surface is proposed, at least 95 percent of maximum density will be required for the upper 18 in. of the earth subgrade extending the full width between roadbed slopes.



- d. Roadway embankment within 100 ft. of each end of a structure on which the top slab or deck is to be used as the riding surface, and the spill fill under such a structure, shall be compacted to not less than 95 percent of maximum density.
- e. Density requirements will not apply to portions of embankments constructed of material so rocky that they cannot be satisfactorily tested in accordance with AASHTO T 191. Material of a gradation having more than approximately 20 percent retained on a 3/4 in. sieve will generally be considered too rocky for satisfactory density testing. In lieu thereof, compactive effort on rock and rocky material shall consist of making four complete coverages of each layer with a tamping-type roller or two complete coverages of each layer with a vibratory roller. The tamping-type roller shall have tampers or feet protruding not less than 6 in. from the surface of the drum and have a minimum load on each tamper of 250 psi of tamping area. The vibratory roller shall have a manufacturer's rating of 16 to 20 tons compacting power.
- f. Compacting in Cut: Cut compaction shall be performed in areas designated by the Engineering Division, after removal of the roadway excavation material to the required pavement or lowest base course, shall be temporarily exposed for the full width between roadway inslopes. The exposed material, to a depth of 6 in. shall be manipulated and compacted to not less than the required density. The material above this compacted plane shall be respread in layers not exceeding 8 in. loose thickness, each layer being wetted or dried as necessary and compacted to the specified density. The entire volume of materials so handled and compacted, including the 6 in. layer compacted in place will be considered as Compacting in Cut. All Class A material having a liquid limit of 40 or more including the 6 in. layer compacted in place shall be compacted at not less than optimum moisture content.
  - 1. In areas designated by the Engineering Division, the existing ground for the full width between roadway slopes under embankments of less than 18 in. in height shall be treated in accordance with Section 204.3 to only such depth as to insure having 18 in. of material of the required density and moisture below the top of the finished subgrade.
  - 2. The entire volume of materials so handled and compacted as specified in Section 204.3 including the 6 in. layer compacted in place will be considered Compacting in Cut.
- g. Each layer shall be wetted or dried, as necessary, and shall be compacted to the required density. Regardless of the type of equipment used, the roadway shall be compacted uniformly and the surface kept reasonably smooth at all times. When large pieces of heavy clay are encountered, the material shall be broken down by suitable manipulation to permit satisfactory embankment construction. When shale is encountered, it shall be broken down as much as is practicable and compacted at or above optimum moisture.
- h. Compaction to at least 95 percent of maximum density will be required for that portion of any embankment below an elevation 50 ft. below the top of the finished subgrade. If, because of embankment foundation conditions, the 95 percent of

maximum density cannot be obtained after reasonable compactive effort has been expended, the Engineering Division may waive the 95 percent requirement for a height not to exceed 3 ft. above the embankment foundation.

- i. When a pavement is to be constructed directly on a soil base, at least 95 percent of the maximum density will be required for the upper 18 in. of the earth subgrade extending the full width between roadbed slopes.

**205.4            Compaction of Embankments.** Not constructed with density or moisture and density control. The compactive effort on each layer shall consist of distributing all equipment movements over the entire fill area and of at least three complete coverages with a tamping-type roller over the entire area to be compacted. The tamping-type roller shall have tampers or feet projecting not less than 6 in. from the surface of the drum and shall have a minimum load on each tamper of 250 psi on tamping area. Compactive effort shall be continued, if necessary, until the tamping feet penetrate not more than 2 in. into the layer of material being compacted. Continuous leveling and manipulating will be required during compacting operations and the moisture content shall be adjusted as is necessary, in the judgment of the Engineering Division, to permit proper consolidation.

- a. Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until compaction complying with these requirements has been secured. Unstable areas in the embankment shall be removed and replaced with suitable material at the expense of the contractor.
- b. Each layer of embankment constructed of rock or rocky material shall also be compacted by three complete coverages of the tamping-type roller. A vibratory roller may be used on approval of the Engineering Division.

**205.5            Compaction of Embankments without Specified Compaction Results or Specified Compaction Equipment.** Only when specifically designated on the plans, compaction will not be required other than that obtained by distributing equipment movements over the entire fill area.

**205.6            Not Used**

**205.7            Not Used**

**205.8            Embankment Control Stakes.**

- a. Description: This work shall consist of furnishing, setting, and monitoring embankment control stakes for detection of earth movement.
- b. Materials: Embankment control stakes shall conform in type of materials and dimensions to the requirements shown on the plans. The stakes and cross arms shall be painted white and the horizontal arm on each control stake shall have scale graduations in black for measuring movement.
- c. Construction Requirements:

1. The stakes shall be set firmly in a vertical position by placing in predrilled holes and backfilling with a lean concrete mixture. Stakes shall be set at locations shown on the plans or as directed by the Engineering Division and shall be set in straight lines or straight line segments. A straight line segment shall consist of not less than three vertical stakes aligned so as to form, with the horizontal cross arms, planes of visual reference for detection of earth movement. Cross arms need not be at constant elevation, but shall be aligned along a constant line of sight plane. Adjacent or intersecting straight line segments may have common stakes.
2. Unless located on an embankment slope or berm, control stakes shall be placed prior to construction of the adjacent embankment except that, with the Engineering Division's approval, embankment not to exceed 5 ft. high may be placed prior to installation of the stakes, if deemed necessary to minimize disturbance from equipment working in close proximity to the stakes.
3. It shall be the contractor's responsibility to maintain and protect the stakes from damage and to notify the Engineering Division if movement is detected. Stakes damaged or misaligned by accident due to the contractor's negligence shall be replaced or realigned at the direction of the Engineering Division, at the contractor's expense.
4. If movement is detected in the embankment control stakes, the Engineering Division may require that embankment construction be discontinued for a period not to exceed 10 days until corrective measures can be determined.

#### **205.9 Settlement Gauges.**

- a. Description: Settlement gauges shall consist of pipe gauges installed for the purpose of obtaining foundation settlement data during the placing, and following completion, of embankment and surcharge construction. An estimated number of settlement gauges may be indicated on the approved plans; however, the exact number and location will be determined by the Engineering Division.
- b. Materials: A settlement gauge shall consist of the following:
  1. A steel plate with a galvanized riser pipe attached perpendicular to the plate at its center by a continuous weld.
  2. Lengths, to be approved by the Engineering Division, of 3/4 in. threaded galvanized riser pipe and couplings.
  3. Lengths, to be approved by the Engineering Division, of galvanized 1/2 in. threaded pipe and couplings to act as a cover or guard for the riser pipe.
- c. Construction Requirements:

1. The first section of the 3/4 in. pipe shall be welded to the plate. The distance from the top of plate to the top of pipe will be accurately measured and recorded by the Engineering Division.
2. An excavation, slightly larger than the plate, shall be made to a depth approximately 18 in. below the natural ground surface. Care shall be exercised during excavation to insure that the bottom of the pit is level and that the material at this location is undisturbed. The pit bottom shall be covered with a layer of portland cement mortar, approximately 3 in. thick, and the plate bedded therein in such position that the riser pipe is vertical. After the mortar has set, the cover pipe, cut approximately 6 in. shorter, shall be slipped over and centered around the riser pipe. The backfill shall then be placed in 6 in. layers and thoroughly compacted. The contractor shall notify the Engineering Division when the installation is complete. No embankment shall be placed around the gauge until the elevation of the top of the riser has been determined by the Engineering Division.
3. Embankment material in the immediate vicinity of the settlement gauge pipe shall be placed and compacted in accordance with the project requirements. When the elevation of the embankment reaches a level approximately one foot below the top of the cover pipe, the Engineering Division shall be notified and the next section of riser pipe and cover pipe shall be installed in his presence. As the height of the embankment increases, this procedure shall be repeated until the embankment and surcharge is completed, and the pipe sections, both riser and cover, extend approximately 2 ft. above the surface of the completed embankment and surcharge.
4. All necessary precautions shall be taken to keep the alignment of the riser pipe and cover pipe maintained in a vertical position at all times. The contractor shall operate his equipment so that the settlement gauges are not damaged or displaced. Protective barriers shall be erected when so directed by the Engineering Division. Settlement gauges shall be maintained in a satisfactory operating condition until after placing of the embankment and surcharge and until, in the judgment of the Engineering Division, the settlement readings are no longer necessary. Any gauges that are damaged shall be repaired or replaced by the contractor at his expense.
5. The Engineering Division will obtain and record all measurements and elevations necessary for accurate determination of settlement data during and after completion of embankment and surcharge.

#### **205.10 Pore Pressure Measurement Devices.**

- a. Description: This work shall consist of placing and maintaining pore pressure measurement devices as shown on the plans and obtaining foundation pore pressure measurements during the placement of embankment. Pore pressure

measurement devices, locations, elevations, and limits of embankment subject to control by each device will be shown on the plans.

b. Equipment: Pore pressure measuring devices shall consist of the following types:

1. *Type A.* This device consists of a pneumatic transducer sealed within a sand chamber which is set into the foundation to the indicated elevations. The transducer is attached to jacketed plastic tubing which extends to the surface for connection to pressurizing and gauging equipment.
2. *Type B.* This device consists of a 1/2 in. PVC standpipe extending to the surface of the embankment from a sand chamber set into the foundation to the indicated elevations.

The material for the Type A installation shall be furnished by the contractor. All materials for the Type B installation shall be furnished by the contractor, except an electrical sounding device.

c. Construction Requirements:

1. The contractor shall be responsible for making the installation, for furnishing all incidental materials, for providing all necessary protection of the installation, and for replacement in the event of damage. In the event of damage to the installation, the Engineering Division may require suspension of embankment construction in the controlled area until the contractor has restored the installation to satisfactory working order. Installation of the pore pressure measurement device shall precede placement of any embankment by at least two weeks to allow time for testing of the completed installation and replacement in the event of malfunction. No embankment may be placed until the installation is complete and tested to the satisfaction of the Engineering Division.
2. A hole of not less than 5 in. in diameter, nor more than 8 in., shall be drilled to Elevation B as defined in the plans. If necessary, casing shall be used to prevent sloughing of material from the walls of the hole and contamination of the walls or bottom of the hole by sloughed material. Casing shall be no smaller in its outer diameter than the diameter of the hole and shall have no externally coupled joints in the bottom 10 feet.
3. If casing is required, the hole shall be washed to the bottom with clean water circulated through the bit until the discharge is clear. Clean sand shall then be poured into the hole to the approximate depth shown on the plans. The assembled pore pressure measurement device shall then be lowered to its indicated position with care to avoid contamination with soil from the side of the hole and additional sand shall be placed around it to Elevation A as shown on the plans. During these steps, any casing shall be pulled ahead of the backfill in increments of 6 in. to 24 in. as necessary to prevent collapse or sloughing of the hole. The hole shall be maintained full of clean water during these steps to at least the elevation

of the top of the sand chamber. Every effort shall be made to prevent the creation of pockets of soil, air, or voids in the sand backfill.

4. After sand is placed to the indicated elevation, the hole shall be backfilled with wetted, plastic bentonite clay as the casing is withdrawn, for not less than 4 ft. above the top of the sand filled chamber. If necessary, the clay shall be worked by hand into plastic balls to be dropped into the hole and tamped into a coherent mass. An acceptable alternate is the use of preformed dry bentonite pellets. In dry installation, dry granular bentonite may be tamped in place. The remainder of the hole shall be filled with a thick slurry of bentonite.
5. At natural ground level, or as otherwise directed by the Engineering Division, four layers of 3/4 in. exterior grade plywood, 4 x 4 ft., nailed and clinched together with rust proof nails, and with 3 in. diameter hole cut at the center shall be centered over the installation after the ground is smoothed and leveled with sand. A closet flange or other suitable receptacle shall be securely fastened to the plywood over the 3 in. diameter hole so as to securely receive a 5 ft. length of 3 in. iron or steel casing. Earth or sand shall be compacted about the casing in 6 in. lifts with care to avoid misalignment after the Engineering Division has established the elevation of the plywood slab and the top of the casing.
6. Upon completion, each installation shall be tested. Type A installation shall be tested in accordance with recommendations of the transducer manufacturer. Type B installations shall be tested by dropping a weighted line through the standpipe to check for possible obstructions. The standpipe shall then be filled with water and periodic readings made of the water level in the standpipe until the level of natural ground water is reached. If less than a 70 percent drop in head is experienced in the first 24 hours, the standpipe shall be flushed and retested. Records of rate of head loss shall be kept for subsequent evaluation of possible time lags in response of water levels to embankment placement.
7. The Engineering Division may require the installation of additional pore pressure measurement devices, within any area subject to control by such devices, at any time during the construction of the embankment. The Engineering Division will determine the type of device, location, and elevation of additional installations. Any such additional pore pressure measurement device shall govern the rate of construction in the same manner as the original devices. The reference pressure levels for additional devices shall be either that of the original devices or as determined from boreholes located outside the loaded area, as directed by the Engineering Division.

d. Pore Pressure Measurements and Records:

1. The Engineering Division will make and record all observations and measurements required to determine natural ground water pressures and pore water pressures induced by embankment construction. The

pressure of the natural ground water existing at the time of installation and prior to placement of any embankment will be used as a reference to determine pore pressures induced by subsequent embankment placement. However, the Engineering Division may, at his discretion, subsequently make borings outside the loaded area to facilitate observations to determine if the natural ground water table has lowered due to seasonal or climatic variations. Such observations may be used to lower, but not raise, the initial reference ground water pressure.

2. The Engineering Division will make all records of ground water and pore water pressures readily available to the contractor for his guidance in the planning of his work.
3. If foundation pore pressure, in excess of pressure from the natural water table, equals or exceeds 35 percent of the unit pressure of the embankment in place over the installation at any time, placement of embankment shall be immediately suspended. Construction shall not resume until such excess pressure declines to 25 percent of embankment pressure, unless otherwise authorized by the Engineering Division.
4. After the embankment reaches an elevation equal to 60 percent of the maximum height, the contractor shall control his rate of construction in such a manner that foundation pore pressure, in excess of pressure from the natural water table, will not exceed 35 percent of the unit pressure of the embankment in place over the installation at any time. (An example of pressure relationships follows: Soil embankment with an average wet density of 125 lb/ft<sup>2</sup>. is equal to twice the unit weight of water. 1 ft. of such embankment thus has a potential to create, at most, 2 ft. of water rise in a standpipe, or a 0.87 psi increase in a Type A installation. The contractor may thus anticipate the maximum possible effect of any load to be added.) The contractor is cautioned that Type B installations are prone to some time lag in rate of response to a pressure increment. Records of pore pressure response during placement of the first 60 percent of embankment height shall be examined for evidence of such lag. The time required for dissipation of head during testing will also be indicative of the rate of response.
5. When embankment has advanced to within approximately 1 ft. of the top of the casing, the casing and the 1/2 in. PVC pipe for the Type B installations shall be advanced in 5 ft. increments. No extension shall be made without the Engineering Division's approval. PVC pipe extensions shall be made using solvent welded couplings exercising care to make smooth, squared cuts with all burrs removed, in accordance with recommendations of the pipe and solvent cement manufacturers. Pneumatic tubing leads used with Type A installations shall be long enough to permit extension, without connections, to the top of the embankment or surcharge. Excess tubing shall be stored in a steel container attached to the last casing extension as shown on the plans.

- e. Settlement Records: The Engineering Division will make and record all measurements and elevations necessary, including elevations of the plywood plate and all casing extensions, for use in establishing a settlement record at the site of the pore pressure measurement device. The 3 in. outer steel casing will be used for this purpose. Care shall be taken to insure the tightest possible coupling connections, using pipe wrenches, without rotating the bottom pipe. Settlement records obtained in this manner may be used to satisfy such settlement rate requirements.

**END OF SECTION**



## SECTION 206

### Excavation for Structures

**206.1 Description.** This work shall consist of the necessary excavating for the foundations of all structures, the removing and disposing of all excavated materials, the backfilling around the completed structures, and all related work. Any removal work which might endanger new structures shall be completed before any work on the new structure is started. Partial removals of any structure or adjustments of any utility shall be made with care to preserve the value of the retained portions. Work around any live utility shall be done in such manner that uninterrupted service can be maintained. Excavated material which is unsuitable for backfill and embankments, and excess material not required for either, shall be disposed of as approved by the Engineering Division.

**206.2 Depth of Excavation.** The elevation of the bottoms of footings as shown on the plans shall be considered an approximate elevation, and the Engineering Division by written order may make such changes in plan elevations and dimensions of footings as may be necessary to secure a satisfactory foundation.

When blasting is approved in accordance with Section 203.2, the lower limit of blasting allowed will be 18 in. above the bottom of footing elevation. In the event that over fracturing of the underlying rock below bottom of footing occurs, the removal of loose rock and the backfilling of the resultant void with fill concrete will be at the contractor's expense.

**206.3 Foundation Stabilization and Tests.** The contractor shall furnish and place sand, rock, gravel, or other suitable backfill material to replace unsuitable material encountered below the foundation elevation of the structures. He shall stabilize suitable foundation material or form the bottom of pile footings if necessary to obtain a stable foundation. He shall furnish assistance in driving sounding rods or drilling test holes to permit an adequate inspection of the foundation. The depth of the excavation, the character of the material, and the condition of the foundation shall be approved by the Engineering Division before any concrete is placed in the footing.

#### **206.4 Construction Requirements.**

- a. Methods shall be used in excavating for foundations of structures that will insure maintaining the stability of the material adjacent to the excavation. Sheeting, cribbing, timbering, or bracing shall be placed by the contractor where indicated on the plans and wherever considered necessary. The contractor will be held responsible for the adequacy of all sheeting, cribbing, timbering, or bracing used. Shop drawings prepared, sealed and signed by a Professional Engineer registered in the State of Missouri showing bracing or cribbing to be employed by the contractor must be submitted for approval prior to any installation on the project.
- b. Foundations for structures and retaining walls shall be free of loose, shelly, or disintegrated rock, and the footing shall be placed on undisturbed material. Footings shall be keyed not less than 6 in. into hard, solid rock and not less than 18 in. into soft rock or shale or other suitable material specified for spread footings. Excavation in rock or shale for the key shall be made as near as practicable to the size of the footing, or of the key as shown on the plans. When

placing the footing, the key portion shall be cast against the vertical, undisturbed face of the rock or shale. When side forms are necessary for footings, they will be adequately braced and they shall be removed approximately 24 hours after placing the concrete, and the excavation shall immediately be backfilled to the top of the footing. All cavities or crevices or low areas below the bottom of footing elevation shall be cleaned out and filled with concrete as approved by the Engineering Division.

- c. Care shall be taken to avoid disturbing the material below the bottom of the footings when the structure is founded on material other than rock, and final removal of grade shall not be made until just prior to placing concrete. Where foundation piles are required, the excavation of each pit shall be completed before the piles are driven, and after the driving is completed all loose and displaced material shall be removed.
- d. If rock is encountered under a portion of the bottom slab of a concrete box-type structure, the rock shall be removed to at least 6 in. below the bottom of the slab and curtain walls, and backfilled with material similar to that under the remainder of the structure.
- e. Concrete footings for structures shall be placed on reasonably dry foundation material. The contractor shall perform all draining, bailing, or pumping operations, drive any sheeting, and construct any cofferdams or cribs necessary to obtain this condition. Pumping from the interior of any foundation enclosure shall be done in a manner to preclude the possibility of the movement of water, or other fluids or semi-fluids, through any fresh concrete. If necessary, the footing form shall be made watertight and shall be sealed around the bottom, and all pumping done between the footing form and the wall of the enclosure.
- f. All holes, pits, or sumps resulting from excavating operations shall be kept drained or pumped out until the completion of the work. No ponding of water around footings on other than rock will be permitted.
- g. Cofferdams: Cofferdams shall, in general, be carried well below the bottom of the footings, and shall be well braced and as watertight as practicable. The interior dimensions of cofferdams shall provide sufficient clearance for the construction of forms and ample room for a sump and for pumping outside the footing forms. Cofferdams which have been tilted or moved laterally during the process of sinking shall be corrected to provide the necessary clearance. They shall be constructed to protect the work against damage from sudden rising of the stream and to prevent damage to the foundation by erosion. Cofferdams, with all sheeting and bracing, shall be removed after the completion of the substructure unit, unless specific authority is given for them to be left in place. The contractor shall submit drawings showing his proposed method of cofferdam construction and other details open to his choice or not fully shown on the plans.
- h. Seal Courses: Seal courses will be required when indicated on the plans or when conditions are encountered which, in the judgment of the Engineering Division, render it impracticable to unwater the foundation area. The dimensions of the seal course shall be adequate to seal the foundation area. Pumping will

not be permitted while excavating, driving piling, or placing the seal course, and not until, by determination of the Engineering Division, the seal course has attained sufficient strength to withstand the hydrostatic pressure. In case seal courses are shown on the plans, and it develops that the footings may be satisfactorily placed without sealing, the contractor will be required to unwater any completed excavation for investigation purposes. Seal courses, other than those on the plans, will not be authorized or permitted except for extreme cases where it is impracticable to unwater the footing area by other means, and then only with the written permission of the Engineering Division.

- i. Backfill: Backfill material shall be of an acceptable quality and shall be free from large or frozen lumps, wood, or other extraneous material. All spaces excavated and not occupied by the new structure or by porous backfill shall be refilled with earth to the original ground surface or to the finished ground lines shown on the plans. All backfill shall be thoroughly compacted and its top surface neatly graded. The backfill at end bents, walls, or other units which falls within the limits of the roadbed shall be placed in successive 6 in. layers and compacted to the same density required for the adjacent roadbed. Large rock, broken concrete, asphalt or other solid material shall not be used as backfill within 18 in. of the fill face of culverts, retaining walls or end bents. Special precaution shall be taken to prevent any wedging action against the masonry. The slope bounding the excavation, if steeper than six horizontal to one vertical, shall be stepped or serrated. Backfill placed around culverts and piers shall be kept at approximately the same elevation on opposing sides. Drains consisting of 5 cu.ft. of coarse aggregate shall be placed at weep holes except where porous backfill is required. Backfill material shall not be placed against end bents or bridges, sides of box culverts or back of retaining walls until the concrete has attained the strength specified the approved plans. Backfill material shall not be placed higher behind than in front of end bents until the superstructure is in place. Until the grade is in place, drainage shall be maintained away from the end bent backwall by constructing a 6 to 1 or steeper slope away from the backwall for a minimum distance of 3 ft. and providing a lateral path for all water to flow off of the roadway section.
- j. Porous Backfill: Porous backfill shall be placed back of abutments, wings, and retaining walls where specified and shown on the plans. It shall be 18 in. thick and shall extend from the bottom of weep holes or other drainage devices to within 2 ft. of the finished ground line. The remaining 2 ft. shall be backfilled with earth. Porous backfill shall be so placed and consolidated in successive 300 mm (12 in.) layers that it will not become mixed with other backfill material.
- k. Excavation Classification: Unless otherwise shown on the plans, excavation for structures will be classified as Class 1 or Class 2. In general, Class 1 and Class 2 Excavation will apply to excavation for bridges and large retaining walls. Class 1 Excavation will include all excavation above a specified elevation indicated on the plans while Class 2 Excavation will include all excavation below this specified elevation. The classification of excavation for all structures will be shown on the plans.

## END OF SECTION

## SECTION 207

### Linear Grading

**207.1 Description.** This work shall consist of that grading work necessary to bring the roadway to the required grade and cross section within reasonable tolerances. It shall also include; the construction of all inlet and outlet ditches and ditch blocks within the linear grading limits unless otherwise provided for on the approved plans, the construction of entrances and approaches, and the breaking up and satisfactorily removing or incorporating into the roadway of all gravel, macadam, or bituminous surfaces.

All linear grading will be classified as hereafter described.

- a. Linear Grading - Class 1: Class 1 linear grading shall consist of grading where the topography is such that the excavation necessary to bring the roadway to the designated cross section will approximately make the nearby fills with a minimum of drifting or hauling, and where it will not be necessary to control the finished grade line for purposes other than to obtain minimum cover over culverts.
- b. Linear Grading - Class 2: Class 2 linear grading shall consist of grading where it is necessary to excavate and haul material to bring the roadway to the desired grade and may involve work on high banks and side hills.
- c. The class of linear grading designated on the plans will apply only to those sections which have been specifically indicated as such on the plans and will not be subject to change during construction.

### **207.2 Construction Requirements.**

- a. The roadway shall be brought to the required grade and cross section within reasonable tolerances by backsloping, ditching, removing stone and boulders from the roadbed surface, or any other work necessary, including drifting and hauling of any excavated material. A reasonable tolerance in alignment means a maximum gradual deviation of 2 ft., free of sharp breaks, to take advantage of favorable topography. Gradual deviation in alignment will also be permitted, if necessary to center an existing drainage structure that is to be used in place. A reasonable tolerance in grade means a final grade that is uniform in appearance, free of sharp breaks or humps, and within 0.5 ft/ of plan grade
- b. Stumps, roots, rubbish, or any other deleterious material shall not be placed in embankments. Where an embankment of less than 2 ft. in height is to be constructed, all vegetable matter shall be cut and removed from the surface upon which the embankment is to be placed. The cut-over surface shall be thoroughly broken. All ditches including inlet and outlet ditches shall be cut to grades that will properly drain. The required cross section for inlet and outlet ditches leading to or from structures shall be of a width not less than the width of the floor or the diameter of the structure being served. Finishing operations shall continue until the roadbed is free from sharp breaks in alignment and grade, and until it has been shaped to the required cross section. Material considered unsuitable for the subgrade shall be disposed of on nearby slopes or as otherwise directed by the Engineering Division.

- c. If obliteration of old roads is designated on the approved plans to be performed on a linear grading basis, such obliteration shall include all grading operations necessary to fill the ditches and blend the old road with the natural ground to provide a pleasing appearance.
- d. The Engineering Division has the authority to direct the contractor to provide immediate permanent or temporary pollution control measures to prevent off-site sedimentation or contamination of adjacent streams or other water bodies. Such work may involve the construction of temporary berms, sediment basins, and use of temporary silt fencing, mats, stabilized construction entrances, or other control devices or methods as necessary to control sediment or erosion.

**END OF SECTION**

## **SECTION 208**

### **Interception Ditch**

**208.1 Description.** This work shall consist of all work necessary to construction interception ditch, or levee, or both, in accordance with the typical sections at locations shown on the plans, or as directed by the Engineering Division.

**208.2 Construction Requirements.** Interception ditches shall be constructed in a manner to provide a profile free from sharp breaks or irregularities. Hand finishing will not be required but the work shall be finished to a reasonably smooth and uniform surface. Loose rock and boulders (pick-up rock) shall be removed from the finished surfaces.

**END OF SECTION**

## SECTION 209

### Subgrade Preparation

**209.1 Description.** This work shall consist of preparing the earth subgrade upon which a base course is to be constructed or a surfacing placed.

**209.2 Equipment.** A self-propelled steel wheel roller weighing not less than 10 tons shall be used in preparing any subgrade for flexible type surfacing and weighing not less than 5 tons when preparing any subgrade for portland cement concrete base course or pavement.

**209.3 Construction Requirements.** The earth subgrade shall be substantially uniform in density throughout its entire width. It shall conform to the lines, grades, and typical cross sections shown on the plans, or as established by the Engineering Division. The earth subgrade shall be constructed to drain surface water to the side ditches and all ditches shall be kept open by the contractor. Where hauling results in ruts or other objectionable irregularities, the contractor shall reshape and reroll the earth subgrade before the base or surfacing is placed. If an old traveled roadway comprises any part of the roadbed, the contractor shall loosen the compacted portions to a depth of at least 6 in. and shall reshape the roadbed.

- a. All earth subgrades, except those for aggregate type surfacing, shall be rolled. The earth subgrades shall be checked after rolling, and if not at the proper elevation at all points, sufficient material shall be removed or added and compacted to bring all portions of the subgrade to the required elevation and density. The moisture content of the top 6 in. of the finished earth subgrade at the time the base is placed, or at the time the pavement is placed if no base is provided under the pavement, shall be not less than the minimum specified for compacting in Section 203. If the moisture content has not been maintained, the earth subgrade shall be scarified, wet to the required moisture content, and compacted. An occasional maximum deviation of 1/2 in. from the required elevation will be permitted on the surface of the finished earth subgrade. The extent of acceptable areas of deviation will be determined by the Engineering Division.
- b. Prior to laying base or setting paving forms on projects where grading and paving are included, the subgrade shall conform to the density requirements for compaction. Soft spots and unsuitable material shall be removed to a depth determined by the Engineering Division and backfilled with approved stable material. It is the intent of this specification that the required backfill be provided to furnish a stable foundation for the roadway. The Engineering Division may order additional excavation beyond the pay limits established for roadway construction. 2 in. or greater clean stone shall be used as backfill for such excavations. The gradation of the material will be determined by the Engineering Division.
- c. The earth subgrade for portland cement concrete pavement shall be compacted, and brought to true shape by an approved subgrade machine. Any material added shall be satisfactorily incorporated and compacted. Before the concrete is placed, a true subgrade shall be shaped by an approved subgrade planer rolling on the forms and any resulting loose material on the earth subgrade behind the

planer shall be recompact with the 5 ton steel wheel roller. The planer shall be adjustable to produce earth subgrade of the exact elevation and cross section. After all grading or planing operations have been completed and immediately before the concrete is placed, the earth subgrade shall be checked with an approved heavy metal template which shall be rolled on the forms. Scratch templates with spikes or teeth will not be permitted. A taut line across the top of side forms and a ruler may be used in lieu of a template for checking the subgrade on irregular areas or variable widths. Extreme care shall be taken in forming the crown and shaping the subgrade to assure that the specified thickness of concrete will be attained in the finished pavement.

The finished earth subgrade at the time of paving shall be moist, but sufficiently firm to resist rutting or deforming under construction traffic.

- d. In the event the contractor elects to use slip forming method for pavement construction, additional earth subgrade preparation will be in conformance to specifications heretofore; however, no direct payment will be made for such additional earth subgrade preparation requirements.

#### **END OF SECTION**



## **SECTION 210**

### **Subgrade Compaction**

**210.1 Description.** This work shall consist of compacting earth subgrade that is yielding or not substantially uniform in density or which does not contain the proper moisture content in the top 6 in. This item of work shall be performed when (1) the subgrade density, following the use of the roller required by Section 209.2 is less than that required under Section 203 or (2) the moisture content is less than the minimum specified in Section 203. Subgrade Compaction, Type 1, is defined as compaction of the subgrade for the full width of the roadbed. Subgrade Compaction, Type 2, is defined as compaction of the subgrade for a width extending not less than 18 in. beyond the edge of the pavement. The contractor shall perform this work on the subgrade at all locations approved by the Engineering Division. Tentative locations of subgrade compaction will be shown on the plans, but the Engineering Division will specify all locations and depths of this work by written order. Any overrun, or partial or complete underrun, shall not be a basis for claim.

#### **210.2 Construction Requirements.**

- a. The subgrade shall be scarified to a depth of at least 6 in., and the scarified material brought to a uniform moisture content either by drying or by adding water, and manipulating with suitable equipment. At the contractor's option, the upper 6 in. of soil may be removed and replaced with satisfactory material, or removed and manipulated with suitable equipment before replacing. The material shall be compacted to produce a subgrade having a density not less than the density required and within the moisture contents specified under Section 203 by the use of approved equipment producing satisfactory results.
- b. When it is determined that the required subgrade density cannot be obtained by moisture control and compaction of the upper 6 in., the unsuitable material shall be excavated to a depth not to exceed 18 in., and replaced with satisfactory material in layers not to exceed 6 in., except as otherwise permitted by the Engineering Division. Each 6 in. layer shall be processed, wetted or dried as necessary, and compacted to the required density.
- c. If an unsatisfactory subgrade has developed through negligence on the part of the contractor, he will be required to restore it to a satisfactory condition at his expense.

**END OF SECTION**

## **SECTION 211**

### **Subgrade Scarifying**

**211.1 Description.** This work shall consist of loosening the surfacing of the roadbed and removing all rocks larger than 4 in. Although locations of subgrade scarifying may be shown on the plans, the contractor shall perform this work at such locations only as are specified in writing by the Engineering Division.

**211.2 Construction Requirements.** When subgrade scarifying is ordered by the Engineering Division, the contractor shall perform all work necessary to loosen the surface of the roadbed over its full width to a depth of 6 in. below the finished grading section, and remove all rocks larger than 4 in. Oversized material shall be disposed of as directed by the Engineering Division. After all of the oversized material has been removed, the roadbed shall be brought back to a satisfactory grade and cross section by the addition of extra material, if needed, without rocks that exceed 4 in. in size.

**END OF SECTION**

## **SECTION 212**

### **Subgrade and Shouldering**

#### **212.1 Description.**

- a. Subgrading and shouldering, Class 1, shall consist of preparing the earth subgrade for the surfacing and shoulders by fine-grading and shaping the existing roadbed of a previously graded roadway, and shaping fill slopes, inslopes, and ditches as required to complete a finished roadway conforming to the typical section.
- b. Subgrading and Shouldering, Class 2, in addition to the above, shall include the construction and final shaping of earth shoulders.

#### **212.2 Construction Requirements.**

- a. Subgrading and Shouldering will normally be restricted to the roadway from ditch to ditch or to the roadbed and upper portions of fill slopes. All ditches shall be graded to drain. The median, if any, shall be shaped to conform to the typical section. No work will be required on backslopes except that necessary to blend the lower portion of the existing backslope with the regraded ditch. The work on fill slopes shall be confined to the upper 10 ft. of the slope, measured along the slope line. Minor drifting of excavated material to bring the subgrade, shoulders, and ditches to proper grade and section is to be expected. Minor drifting shall be considered the moving of material that one 10 cu. yd. scraper can shift without delay to normal subgrading operations.
- b. When the subgrade as prepared in accordance with Section 209, Subgrade Preparation, has less density than that required under Section 203.3, the Engineering Division may order the item of Subgrade Compaction to be performed. When lack of satisfactory density results from improper maintenance by the contractor, the subgrade density shall be restored at the contractor's expense. Earth shoulders shall be constructed in accordance with the requirements of Section 203.2.
- c. Finishing of ditches, side slopes, cuts, and fills shall be to a reasonably smooth and uniform surface that will merge with the adjacent slopes. Finishing by hand methods will not be required, except that all brush, weeds, excess mud and silt, or other debris shall be removed from all channels and culverts within the scope of the work even though such structures are used in place.
- d. Any additional material required to complete the subgrade or shoulders to proper grade and section shall be obtained from within the right-of-way limits as directed by the Engineering Division. Direct payment will not be made for minor drifting of excavated material or for any additional material required; nor will overhaul be allowed for such operations. Excess excavation shall be used for widening shoulders on fill sections or wasted within the limits of the right-of-way as directed.

**END OF SECTION**

## SECTION 213

### Shaping Shoulders

**213.1 Description.** This work shall consist of grading and shaping existing shoulders to conform to the typical sections shown in the approved plans and SCD's.

- a. Shaping shoulders, Class 1, is defined as shaping shoulders where, in general, the material required to bring the roadway to the designated cross section can be obtained, or disposed of within the right-of-way limits as directed by the Engineering Division.
- b. Shaping shoulders, Class 2, is defined as shaping shoulders where it may be necessary to go outside the limits of the right-of-way for additional material to construct the shoulders to the designated cross section or where it may be necessary to dispose of waste material outside the limits of the right-of-way.

### **213.2 Construction Requirements.**

- a. Shoulders shall be constructed of suitable material to the cross section shown on the typical section. Ditches are to be provided in cut sections as indicated on the plans. Such additional ditch work as is necessary to insure proper drainage shall also be performed. Vegetation on existing shoulders and slopes shall be mowed or cut in areas of grading work, and such cuttings shall be disposed of prior to the placing of any shoulder material. Shoulder material shall be compacted by a roller weighing not less than 5 tons. Finishing of shoulders of slopes, and ditches where necessary, shall be to a reasonably smooth and uniform surface. Only that work will be required on backslopes as is necessary to blend the lower portion of the existing backslopes with any regraded ditch. Finishing by hand methods will not be required.
- b. If additional material is required for shaping shoulders to the minimum width, it shall be obtained from the backslopes as directed by the Engineering Division, or from borrow areas outside the limits of the right-of-way in areas provided by the contractor at his expense. If excess excavation results, it shall be disposed of by uniformly widening shoulders on embankment sections, or wasted outside the limits of the right-of-way in areas provided by the contractor at his expense. The contractor shall provide the Engineering Division with an acceptable written agreement with any property owner from whose property additional material is to be obtained or on which excess excavation is to be disposed.
- c. A temporary shoulder having a minimum width of 2 ft. shall be constructed on the high side of superelevated curves immediately upon completion of the wedge course and base widening of the curve. The contractor shall also roughly shape the shoulders and provide for surface drainage when work is to be discontinued for an extended period.
- d. Shaping shoulders shall also include adjusting grades on existing entrances and approaches as necessary to meet shoulder grades. Such adjustments shall extend to the right-of-way line, if necessary to provide a satisfactory approach grade.

- e. Shaping shoulders shall start when enough of the final surfacing course has been placed and cured that the operation of shaping shoulders can be practicably continuous. In no case shall the work of shaping shoulders be delayed after one mile of surfacing has been completed and has cured sufficiently to support equipment for shaping shoulders without damage to the surface.

**END OF SECTION**

## **SECTION 214**

### **Water**

**214.1** Water shall be applied as specified. The source and quality of water shall meet the approval of the Engineering Division.

**214.2** Water quantities required shall be included as part of dust control and subgrade preparation.

**END OF SECTION**

## **SECTION 215**

### **Shaping Slopes**

**215.1 Description.** This work shall consist of grading and shaping existing slopes in conformity with the lines, grades, and typical sections shown on the plans or established by the Engineering Division.

- a. Shaping slopes, Class 1, is defined as shaping slopes where, in general, the material required to bring the roadway to the designated cross section can be obtained or disposed of within the right-of-way limits as directed by the Engineering Division.
- b. Shaping slopes, Class 2, is defined as shaping slopes where it may be necessary to go outside the limits of the right-of-way for additional material to construct the slopes to the designated cross section or where it may be necessary to dispose of waste material outside the limits of the right-of-way. The contractor shall provide the Engineering Division with an acceptable written agreement with any property owner from whose property additional material is to be obtained or on which excess excavation is to be disposed.

**215.2 Construction Requirements.** Slope areas to be shaped by the addition of material shall be scarified to allow bonding with the added material. The density shall be that obtained from a reasonable compaction effort consisting of not less than three passes with a roller approved by the Engineering Division.

**END OF SECTION**

## **SECTION 216**

### **Grading, Shaping and Compacting**

**216.1 Description.** This work shall consist of grading the scarified road surface and existing subgrade material to a maximum depth of 18 in. Grading shall be confined within the limits of the ditch inslope and must incorporate into the roadbed all gravel, macadam or bituminous remains of the original surfacing or base. Shaping of the subgrade material shall be required to bring the roadbed to the required typical section, upon which a base course is to be constructed.

Locations of grading, shaping and compacting will be shown on the plans.

**216.2 Construction Requirements.** The graded material shall be brought to a uniform moisture content either by drying or by adding water and manipulating with suitable equipment. The material shall be compacted to produce a subgrade having a density of not less than the density required under Section 203.3. Equipment requirements shall conform in all respects to those set out in Section 203.4.

**END OF SECTION**



## SECTION 217

### **Excavation and Trenching for Utilities**

**217.1 Description.** This section covers excavation and trenching work and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; site restoration; and other appurtenant work.

**217.2 General Requirements.** Excavation shall provide adequate working space and clearance for the work to be performed therein. In no case shall excavation faces be undercut.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed undercut.

Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineering Division. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed by the Engineering Division.

**217.3 Classification of Excavated Materials.** No classification of excavated materials will be made for payment purposes except for rock excavation as specifically noted in the project proposal. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition or condition thereof except for rock excavation. Payment for rock excavation shall be based on a trench width equal to twice the nominal pipe diameter for pipe having a nominal pipe diameter of greater than 10 inches. For pipe with a 10-inch diameter or less the payment for rock excavation shall be based on a trench width of 2 feet. Payment for rock excavation at manholes or other structures shall be based on the outside diameter or dimensions plus 4 feet to allow a working space of 2 feet beyond each exterior wall.

**217.4 Site Preparation.** All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. In addition, subgrades for fills and embankments shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of the contractor. Topsoil shall be stripped and stockpiled for reuse as specified herein.

**217.5 Clearing.** The contractor shall do all clearing necessary for access, stringing of pipeline materials, and construction of the pipelines and appurtenant structure. Clearing along creek banks, ditches, swales, etc. shall be kept to a minimum as necessary for sewer or force main installation, to minimize bank erosion prior to riprap installation.

**217.6 Use of Explosives.** The contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use

of explosives and the protection of life and property. The contractor shall be responsible for all damage caused by his blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed.

Use of explosive shall be prohibited without a blasting permit from the appropriate governing agency.

**217.7 Unauthorized Excavation.** Except where otherwise authorized, shown, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the contractor, with concrete placed at the same time and monolithic with the concrete above.

**217.8 Dewatering.** The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed herein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for concrete structures or trenches which extend down to or below ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations 12 inches or more below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

**217.9 Shielding and Shoring.** Except where banks are cut back on a stable slope, excavation for structures and trenches shall be sheeted, braced, and shored, as necessary, to prevent caving or sliding.

All trench slopes, shielding and shoring shall follow the current O.S.H.A. requirements and guidelines at a minimum.

**217.10 Stabilization.** Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Subgrades for concrete structures or trench bottoms, which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than 4 inches, which shall be furnished and installed as specified for granular fills. Not more than 1/2-inch depth of mud or muck shall be allowed to remain on stabilized

trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

All stabilization work shall be performed by and at the expense of the contractor.

**217.11 Trench Excavation.** The contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. The maximum length of open trench on any line under construction shall be 400 feet.

Except where tunneling is indicated on the drawings, or is permitted by the Engineering Division, all trench excavation shall be open cut from the surface.

- a. Alignment and Minimum Cover: The alignment of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.
- b. Limiting Trench Widths: Trenches shall be excavated to a width which will provide adjacent working space and sidewall clearances for proper pipe installation, jointing, and embedment.
  1. Minimum Sidewall Clearance. Minimum permissible sidewall clearance between installed pipe and each trench wall, expressed in inches, shall be as follows:

Nominal Pipe Size (inches)	Minimum Side Wall Clearance (inches)
8	5
10	5
12-36	6

The stipulated minimum sidewall clearances are not minimum average clearance, but are minimum clear distances which are required.

2. Maximum Trench Widths. The maximum trench width for sanitary sewer pipe shall be the nominal pipe diameter plus 24 inches.

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes which shall not extend lower than one foot above the top of the pipe.

- c. Unauthorized Trench Widths: Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables: either; pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by the loading conditions and with the concurrence of the Engineering Division, shall be furnished and installed by and at the expense of the contractor.

- d. Mechanical Excavation: The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below the ground. In all such locations, hand excavation methods shall be used.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation of one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

- e. Excavation Below Pipe Subgrade: Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe, as shown on the applicable Embedment of Pipe Detail, to provide for the installation of granular embedment pipe foundation material.
- f. Artificial Foundations in Trenches: Whenever so ordered by the Engineering Division, the contractor shall excavate to such depth below grade as the Engineering Division may direct and the trench bottom shall be brought to grade with crushed stone foundation material, or such material as the Engineering Division may order installed. All timber, concrete, or other foundations made necessary by unstable soil shall be installed as directed by the Engineering Division.

Where crushed stone artificial foundations in trenches are required, the material shall be placed on suitably prepared subgrades and compacted by vibration, and shall be crushed rock or gravel free from dust, clay, or trash, graded 1-1/2 inches to No. 4 as defined in ASTM C33.

- g. Bell Holes: Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

**217.12 Final Backfill.** After the pipe or conduit has been properly bedded, jointed and inspected, and all measurements to record locations of Y-junctions, tees, valves, etc. have been made by the City, and sufficient time has elapsed for the joint materials or for any concrete or mortar to set and harden, upon permission of the Inspector, and backfill may be placed.

- a. Trenches backfilled and water jetted: Backfill in trenches which are not within or immediately adjacent to pavements, but are located where prevention of backfill settlement is essential, and where mechanical compaction is not required on the Project Plans or by the Engineering Division, and where granular fill is not desired, shall be water jetted. Non-granular job-excavated material shall be free from debris, organic matter, perishable compressible materials, and shall contain no stones or lumps of rock fragments larger than six (6) inches in dimension, nor be in such amount that will interfere with the consolidating properties of the fill

material. Care shall be taken that stones or lumps are kept separated and well distributed, and that all voids are completely filled with fine materials. The upper three feet of backfill in sodded or planted areas shall be free of such rocks or lumps larger than one (1) inch in diameter with the upper six (6) inches being free of all objectionable material.

All jetting shall be performed with a probe route on not greater than 7.5-foot centers with the jetting probe centered over and parallel with the direction of the pipe. Trench widths greater than 10 feet will require multiple probes every 7.5-foot centers. Trench backfill depths less than 8 feet in depth shall be probed to a depth extending to half of the trench backfill, but not less than 3 feet. Trench backfill greater than 8 feet in depth shall be probed to half the depth of the trench backfill but not greater than 8 feet. Jetting shall be performed from the low surface topographic point and proceed toward the high point, and from the bottom of the trench backfill towards the surface. The flooding of each jetting probe shall be started slowly allowing slow saturation of the soil. Water is not to be allowed to flow away from the ditch without first saturating the trench. Contractor shall identify the locations of surface bridging (the tendency for the upper backfill crust to arch over the trench rather than collapse and consolidate during the jetting process). The contractor shall break down the bridged areas using an appropriate method such as the wheels or bucket of a backhoe. When the surface crust is collapsed; the void shall be backfilled with the same material within the sunken/jetted area shall be compacted such that no further surface subsidence occurs.

- b. Trenches backfilled and mechanically compacted: Backfill in trenches which are not within or immediately adjacent to pavements, but are located where prevention of backfill settlement is essential, and where required on the Project Plans or by the Engineering Division, and where granular fill is not desired, shall consist of selected job-excavated earth thoroughly compacted with suitable mechanical tampers to the density of the adjacent undisturbed earth. Non-granular job-excavated material shall be free from debris, organic matter, perishable compressible materials, and shall contain no stones or lumps of rock fragments larger than six (6) inches in dimension, nor be in such amount that will interfere with the consolidating properties of the fill material. Care shall be taken that stones or lumps are kept separated and well distributed, and that all voids are completely filled with fine materials. The upper three feet of backfill in sodded or planted areas shall be free of such rocks or lumps larger than one (1) inch in diameter with the upper six (6) inches being free of all objectionable material. The approved backfill materials shall be placed in layers not exceeding one (1) foot before compaction.
- c. Trenches backfilled with granular material: Backfill in trenches through pavements or wherever prevention of backfill settlement is considered essential, and where the Project Plans require, or the Engineering Division orders, shall be made with water jetted granular fill from the level six (6) inches above the top of pipe to the subgrade elevation of the pavement. Granular backfill shall consist of  $\frac{3}{4}$ " minus crusher-run limestone. Granular material shall be free from wood, paper, cans, ashes, and other weak, unstable, perishable, or compressible materials, and from such quantities of any material, clay or loam, either finely

divided or in lumps, as will interfere with the free-flowing and compacting properties of the composite fill. "Pea gravel" or similar granular materials approximately uniform in size and without bonding properties shall not be used.

**END OF SECTION**

**DIVISION 300  
SANITARY SEWERS**

**SECTION 300**

**General Requirements**

**300.1 Location.** Sanitary sewer mains, force mains, manholes and lateral connections shall be placed in accordance with the approved plans. Standard Construction Detail (SCD) 500.01 provides a detail of standard utility locations. Gas, water, and other underground utilities shall not conflict with the depth or horizontal location of existing and proposed sanitary and storm sewers including laterals.

**300.2 Sanitary Sewer Easements.** All sanitary sewers shall be constructed in Public Right of Way, or in easements granted to the City of Wentzville, and as shown on the approved set of improvement plans. Sewers installed as a part of a development may record the easements on the record plat. All other sanitary sewer easements will require easement documents.

**300.3 Pre-construction Meeting and Construction Permit.** No construction of extensions or modifications shall begin before plans are approved for construction and a Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the Engineering Division. Any construction done prior to this Notice may be summarily rejected or refused without further investigation.

**300.4 Inspections.** All construction work, involving sanitary sewer extensions and/or modifications shall be inspected by the City of Wentzville, in accordance with the requirements contained in Section 102.9. Any work performed without inspection will not be accepted by the City of Wentzville. The City of Wentzville shall be notified a minimum of 48 hours in advance of any construction for coordination and inspections

**300.5 As-built Drawings.** As-built drawings shall be required for all new construction. See Division 1100 for as-built drawing requirements.

**300.6 Field Changes.** Small field changes may be accepted by the City Inspector. Larger changes shall require a submittal to the Engineering Division for approval.

**END OF SECTION**

## SECTION 301

### Sanitary Sewer Mains

**301.1 Description.** This section covers sanitary sewer pipe and fittings to be furnished complete with all jointing materials and appurtenances. Pipe shall be installed and tested in accordance with Section 303.

**301.2 Materials for Public Sewer Lines.** Pipe and fittings, jointing materials, and appurtenant materials shall be shown on the drawings and as specified herein.

- a. Polyvinyl Chloride (PVC) Pipe: For gravity sewer mains and laterals having less than 20 feet of cover to finish grade, the minimum gravity sewer pipe shall be SDR35. Pipe up to 15 inches in diameter shall conform to ASTM D-3034 (latest revision) Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. Pipe with a diameter of 18 inches or larger shall conform to ASTM F679 (latest revision), Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.

For gravity sewer mains and laterals having greater than 20 feet of cover to finish grade or if the sewer pipe does not have proper horizontal and vertical separation as described in Section 303.16 of these Specifications, the minimum gravity sewer pipe shall be AWWA, C900 PVC. Pipe 6 to 12 inches in diameter shall conform to PC 150(latest revision). Pipe larger than 12", shall conform to AWWA, C905 PVC, PC 165(Latest revision). Where only a portion of a reach has greater than 20 feet of cover, the entire reach extending between manholes shall be installed with C900/C905 PVC pipe.

Joints shall be elastomeric gasket joints providing a water tight seal. Joints shall conform to ASTM D3212 (latest revision) Standard Specification for Joints for Drain and Sewer Plastic Pipes and Fittings Using Flexible Elastomeric Seals. No glued joints on main line sewer will be allowed.

Care shall be taken to assure that no PVC pipe be installed or stored such that it will remain exposed to sunlight or any other conditions that may allow it to deteriorate. UV damaged pipe is not acceptable, and will be rejected.

- b. Ductile Iron Pipe (DIP): DIP shall conform to ANSI/AWWA C151/A21.51 (latest revision) American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water, with the thickness class given by the Project Plans and Specifications.

Approved ring gasketed slip-type joints shall be used on the ductile iron pipe unless otherwise noted in the project specifications.

Fittings shall conform to ANSI/AWWA C110/A21.10 (latest revision) American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.

- c. Polyethylene Pipe: All force mains shall conform to AWWA C901/C906 (latest revision), and shall be DR13.5 with green striping on the exterior. Pipe, tubing



and fittings shall be homogeneous throughout, and free of visible cracks, holes, foreign inclusions, blisters, dents, or other injurious defects. The pipe, tubing, and fittings shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

- d. Tracer Wire: A coated number 12 AWG copper tracer wire shall be installed the entire length of the force main as per SCD 304.01. The tracer wire shall be accessible from the surface at intervals not to exceed 500 feet by the use of test stations as indicated on SCD 302.17. The tracer wire shall be extended through all valve vaults (pump station valve vault, air release vault, etc.), leaving a minimum of 5 feet of coiled wire, for access/connection through the manhole opening at ground surface. Any project with over 1500 feet of pipe shall use a 2500' roll of tracer wire. 3M splice kits shall be utilized for all tracer wire splicing.
- e. Butt Fusion Fittings: Fittings shall be PE3408/ 4710 HDPE, Cell Classification of 345464C as determined by ASTM D3350 (latest revision). Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have the same or greater pressure rating as the pipe being fused or as otherwise specified on the plans. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. Electrofusion fittings may only be used as approved by the Engineering Division.

### **301.3 Valves.**

- a. Air release valves: When required, all air release valves shall conform to AWWA C512 (latest revision) Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service and shall be the short-body style and specifically manufactured for wastewater applications. The body and cover of the valve shall be constructed of reinforced nylon that has a pressure rating greater than or equal to the force main pipe material. Bolts, pipe, nipples and plugs shall be stainless steel.

Acceptable manufacturer and model: A.R.I. Model D-025 Combination Valve, 2" NPT or approved equal.

All air valves shall be installed in a vertical position and plumbed with an HDPE fusion saddle with brass 2"NPT adapter, a corporation stop-2" NPT, and a brass cam and groove quick coupler-2" NPT. All air valves shall be enclosed in a concrete vault having a minimum diameter 48" and a cast iron access cover as indicated in SCD 302.08. The exposed main shall be bedded with 1" clean rock.

- b. Check valves: When required, check valves shall be full body flanged type, with a domed access cover and only one moving part, the flexible disc, conforming to AWWA C508 (latest revision), Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS.

The valve body shall have full flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the

bottom of the valve to allow for field installation of a backflow actuator without special tools or removing the valve from the line.

The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operation in lines containing high solids content. The disc shall be of one-piece construction, precision molded with an integral o-ring type-sealing surface, and contain steel and nylon reinforcement in the hinge. The flex portion of the disc shall be warranted for twenty-five years. Non-Slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action. The valve shall be cycle tested 1,000,000 times with no signs of wear or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures. The test results shall be independently certified.

The valve body shall be construction of ASTM A126 Class B cast iron. Optional body material includes ASTM A536 Grade 65-45-12 ductile iron. The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.

Valves shall be provided with flanges in accordance with ANSI B16.1, Class 125.

The exterior of the valve shall be coated with a universal alkyd primer. The valve interior shall be coated with an epoxy coating approved for potable water.

Acceptable manufacturer and models: Val-Matic, Swing-Flex® Check Valves Series #500.

- c. Gate Valves: When required, gate valves shall be cast iron body resilient seated gate valves conform to AWWA C509 (latest revision), Resilient-Seated Gate Valves for Water Supply Service. The gate valve shall be of the non-rising stem, open left (counterclockwise), bronze stem type. All valves shall have an epoxy coating, minimum 5 mils, on the interior and exterior surfaces. Gate valves, for direct bury, shall be installed vertically, and fitted with a valve box and cover. Valve operators shall be supplied with stainless steel stem extensions, stem guides and 2" square wrench nut or hand wheel as shown on drawings.

Acceptable manufacturer and models: Mueller Co., series 2360; U.S. Pipe Metroseal 250; American Flow Control Series 2500; Kennedy model KS-FW or approved equal.

## **END OF SECTION**

## SECTION 302

### Sanitary Sewer Manholes

**302.1 Description.** This section covers standard and drop manholes. Manholes shall be constructed complete with covers, steps, vents, fittings, and other appurtenances, in accordance with the Standard Construction Details and approved improvement plans

All standard and drop manholes shall be constructed of precast concrete sections. Only concentric precast concrete cones will be acceptable. Brick shall not be allowed in the construction of sanitary sewer manholes. All sanitary sewer manholes without top elevations provided by the approved improvement plans will be the responsibility of the contractor, to install to the finished grade of the project.

### **302.2 Materials.**

<u>Concrete</u>	Materials, handling, forms, finishing, curing, and other work as specified in concrete section, except that only calcareous materials shall be used. Granitic materials shall not be used.
<u>Precast Section</u>	Circular precast concrete; ASTM C478 and C497, except as modified. See SCD 302.01
Minimum Barrel Diameter	42" for pipe 8" in diameter 48" for pipe 10" to 21" in diameter, single inside drop and terminal manholes 60" for pipe 24" to 36" in diameter and double inside drop
Minimum Wall Thickness	5" minimum
Reinforcement	As indicated on the standards. See SCD 302.01.
<u>Portland Cement</u>	ASTM C150
<u>Hydrated Lime</u>	ASTM C270, Type S
<u>Sand</u>	Concrete sand (fine aggregate) sieved through 8 mesh screen
<u>Shrinkage-Correcting Aggregate</u>	Master Builders "Embeco", Sika "Kemox", Sonneborn "Ferrolith G-DS", or equal
<u>Mortar</u>	One part portland cement, ½ part hydrated lime, 3 parts sand
<u>Non-shrinking Mortar</u>	Premixed or job mixed; job mixed shall be one part shrinkage-correcting aggregate, one part portland cement, one part sand

### Gaskets

Mastic	Fed Spec SS-S-210; K.T. Snyder "Ram-Nek", Hamilton-Kent "Kent-Seal No. 2", Bidco "C-56", Conseal "CS-102" or equal
Rubber	Neoprene or other synthetic, 40 (plus or minus 5) hardness when measured by ASTM D2240, Type A durometer

### Grey Iron Castings

Manhole castings shall conform to the requirements of the Specifications for Gray Iron Castings ASTM A48 (latest revision) Castings shall be fabricated of Class 30B cast iron. Bearing surfaces shall be such that the cover or grating shall seat in any position onto the frame without rocking. Bearing surfaces for manhole frames and covers shall be machined.

### Manhole Steps

Manholes steps shall be cast into the full depth of the wall section or installed by an approved alternate method. See SCD 302.12.

**302.3 Precast Concrete Sections.** Precast sections shall conform in all respects to applicable requirements of SCD 302.12, and shall contain reinforcing steel to prevent cracking during handling.

- a. Handling: Precast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces. Use of lifting holes will not be permitted. Lift notches that are not deeper than one half of the wall thickness will be allowed. Lifting notches shall be repaired by cementing a properly shaped concrete plug in place with epoxy cement, or by other methods acceptable to the Engineering Division.
- b. Inspection: Precast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units rejected.

**302.4 Precast Concrete Base.** The requirements of precast concrete sections shall apply to precast concrete bases. Precast bases shall be furnished with "A-Lok" or Z-Lok" water stops, conforming to ASTM C923 (latest revision) Resilient Connector Between Reinforced Concrete Manhole Structures and Pipes. The concrete invert may be furnished with the precast unit; or alternatively the concrete invert fill may be installed in the field and shall conform exactly to the invert elevations of the connecting piping after installations.

The connecting pipe shall be plain end, square cut spigots and shall not protrude more than one inch inside the manhole wall. A clear distance of at least one inch from the end of each connecting pipe and around the pipe shall be provided when the concrete invert fill is installed.

This shall be provided under the pipe by a boxout with sides which are at right angles with each other. After completion of the manhole, the boxout shall be filled with suitable non-shrink grout, completely filling the space beneath the pipe and completely filling the space around the pipe. The non-shrink grout material shall provide a smooth, uniform surface between the inside diameter of the pipe and the manhole invert.

**302.5 Cast-in-Place Concrete Bases.** Cast-in-place concrete manhole bases shall be allowed when it is required to construct a new manhole over an existing sanitary sewer line. When a cast-in-place concrete base is utilized the remainder of the manhole shall consist of precast manhole sections. When precast manhole sections with horseshoe-shaped boxouts are used, a water stop, as recommended or supplied by the pipe manufacturer shall be installed at the center of the manhole walls and grouted in place as specified in this section.

**302.6 Construction.** All pipes shall have positive drainage through manholes. No flat base structures will be allowed. All terminal manholes shall have positive drainage. All mortar shall be used within 40 minutes after mixing. Mortar which has begun to take initial set shall be discarded and shall not be mixed with additional cement or new mortar. In no case shall the invert section through a manhole be greater than that of the outgoing pipe. The shape of the invert shall conform exactly to the lower half of the pipe it connects. A bench shall be provided on each side of the invert when pipe diameter(s) are less than the manhole diameter. The bench should be sloped no less than one half inch per foot (0.5 in/ft). Side branches shall be connected with as large radius of curve as practicable. All inverts shall be troweled to a smooth clean surface.

**302.7 Waterproofing.** All manholes shall be constructed watertight. Any lifting holes, grade adjustment rings, and precast section joints shall be sealed watertight.

Circular precast sections shall be provided with a flexible rubber mastic or bitumen mastic in compliance with ASTM C990 to seal joints between sections. Two solid strips of mastic shall be used between manhole sections 180 degrees apart. The written installation recommendations of the mastic gasket manufacturer shall be available at the site of the work, and shall be strictly followed. For manhole risers, mastic gaskets with a nominal cross section as shown in the following table shall be furnished unless a different cross section is recommended in writing by the manufacturer.

<u>Minimum Manholes Diameter</u> (inches)	<u>Nominal Cross Section</u> (inches)
48	1 X 3
60	1 X 3
72	1 X 3-1/2

The outside surfaces of each manhole shall be waterproofed. Acceptable products include SS1H, Slow Setting Emulsion, as manufactured by Missouri Petroleum, Bi-State Emulsions, Inc., or approved equal.

All exterior joints shall be sealed with a pressure sensitive sealing tape conforming to ASTM C877 when the manhole structure is located within the Floodway. The tape shall be Boa Tape

as manufactured by Pipeline Seal & Insulator or approved equal. Chimney seals shall be installed per the manufacturer's instructions.

**302.8 Corrosion Protection.** Corrosion protection shall be provided on the inside of every manhole or structure where there is anticipated to be a septic condition or other possible forms of corrosion. The entire surface shall be coated with a two part epoxy coating, with a dry film thickness of at least 6 mil. Manholes which receive the discharge from a sewer force main and the next two downstream manholes shall be so coated, and as noted on SCD 304.01. Other manholes and/or structures which may be subject to corrosion shall also be likewise coated/protected.

**302.9 Grade Adjustment Rings.** Grade adjustment rings shall be used in lieu of brick construction. Grade adjustment rings shall have minimum dimensions of 26.5 inches opening, 3 inch height and 8 inch width. No more than one grade ring shall be used per adjustment unless the total height of adjustment is 6 inches or greater. A maximum of two grade adjustment rings shall be allowed, and a maximum of 12", total, of grade adjustment rings shall be allowed. Only Concrete adjustment rings shall be allowed on Sanitary Sewer Manholes.

If grade rings are used, a chimney seal shall be used to provide watertight seal from the frame to the cone section. The seal shall be a pressure sensitive tape conforming to ASTM C877. The tape shall be Boa Tape as manufactured by Pipeline Seal and Insulator, Inc. or approved equivalent. Chimney seals shall be installed per the manufacturer's instructions.

**302.10 Drop Manhole Structures.** All sanitary sewer drop manholes shall be inside drop type structures.

Structures with an elevation difference between the inflow and outflow pipe less than 2 feet shall be a continuous sweep fall type inside drop structures as shown in SCD 302.03.

Drop structures with an elevation difference between the inflow and outflow pipe of 2 feet or more shall conform to SCD 302.02. The first twenty (20) feet of the incoming drop sewer pipe shall be ductile iron pipe. Manholes with one inside drop shall be 48 inches in diameter and sanitary manholes with two inside drops shall be 60 inches in diameter. No more than two inside drops per manhole unless otherwise approved by the Engineering Division.

## **END OF SECTION**

## SECTION 303

### Sewer Pipe Installation and Testing

**303.1 Description.** This section covers installation and testing of all sewer pipe. Except where modified by specific requirement in this section, the written installation recommendations of the sewer pipe manufacturer shall be strictly followed. Sewer pipe materials are specified in other sections.

Trenching, excavation and backfilling operations shall be conducted in accordance with Section 217.

**303.2 Handling.** Equipment used to handle, lay and joint pipe shall be so equipped and used as to prevent damage to the pipe and its jointing materials. All pipe and fittings shall be carefully handled and lowered into the trench by means of an approved nylon sling in such a manner as to prevent damage to the pipe, fitting or assemblies. Under no circumstances shall pipe, fittings, or assemblies be lowered into the trench by means of a metallic cable, chain or sling. Also, under no circumstances shall pipe or accessories be dumped, dropped or rolled into the trench. Plastic pipe shall be shaded if necessary to prevent curvature due to thermal expansion. Damaged pipe shall be removed from the site.

**303.3 Cleaning.** The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted. All joint surfaces shall be kept clean until the joint is completed. Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing, or other materials shall be placed in the pipe.

**303.4 Excavation, Trenching and Backfilling.** All sanitary sewer trench excavation and backfilling shall conform to the requirements of Section 217. Ledge rock, boulders, and large stones shall be removed to provide a minimum clearance as shown in SCD 300.01.

**303.5 Laying Pipe.** Pipes shall be laid true to the lines and grades given on the plans. The bell or groove end shall be laid upstream with the ends abutting to form a concentric joint without shoulders or unevenness of any kind along the invert of the pipe. Bell holes shall be dug to relieve the bell of all load and to be no larger than necessary. Straight alignment shall be checked by using a laser beam.

Where a sewer main or lateral crosses over or under another pipe, and a vertical clearance of eighteen (18) inches for waterlines and twelve (12) inches for others, cannot be maintained between them, the following concrete encasement shall be required: When the sanitary sewer is the lower pipe, it shall be encased for its entire periphery with Class A concrete for a distance of ten (10) feet on each side of the higher pipe. When the sanitary sewer is the higher pipe, it shall likewise be encased for its entire periphery with Class A concrete for a distance of ten (10) feet on each side of the lower pipe, in addition the lower pipe shall be encased from the springline of the pipe, for the width of the trench, up to the encasement of the upper pipe.

Suitable means shall be used to force the spigot end of the pipe into the bell end without damage to the pipe and its jointing materials, and without disturbing the previously laid pipes and joints.

**303.6 Jointing.** All joint preparation and jointing operations shall comply with the instructions and recommendations of the pipe manufacturer. Immediately before joints are pushed together, all joint surfaces shall be coated with the lubricant furnished with the pipe. The position and condition of each rubber gasket (unbonded gaskets) shall be checked with a feeler after the joint is completed.

**303.7 Bedding, Haunching and Initial Backfill.** Special care shall be taken to ensure that the pipes are solidly and uniformly bedded, cradled, or encased in accordance with the type of bedding, cradle or encasement required by the project plans and specifications and as shown in the SCD 300.01, 300.02 and 300.05. No pipes shall be brought into position until the preceding length has been bedded and secured in place.

Embedment of sanitary sewer gravity pipe construction shall be ASTM 2321 Class 1A. Bedding shall be all stone or crushed limestone and shall be sound, durable and free from cracks and other structural defects that would cause it to deteriorate. It shall not contain any soapstone, shale, or other material easily disintegrated. The bedding shall be placed as shown in the Standard Construction Details, and conform to the following gradations:

For 27 inch diameter and smaller (% by Weight Passing)		
Sieve	Maximum	Minimum
1 inch	100	100
¾ inch	100	90
½ inch	60	35
# 100	10	0

For 30 inch diameter and larger (% by Weight Passing)		
Sieve	Maximum	Minimum
1½ inch	100	100
1 inch	70	60
¾ inch	50	40
½ inch	35	25
# 100	10	0

Sanitary sewer force mains of C906 polyethylene shall be bedded in native soils without roots, limbs, large rocks, boulders, clumps, or frozen clods or any object that could damage the pipe. Unstable soil or muck shall be removed from the trench bottom. Water shall be removed from the trench before bringing the bedding material and pipe to grade and backfilling. When a trench is cut through rock, it shall be excavated to 6" below the pipe bottom grade, and bedded with non-angular bedding material. All slabs of rock, boulders and large rocks shall be removed.

**303.8 Concrete Encasement or Cradle.** Where concrete encasement is required, the pipe shall be supported at not more than two places with masonry supports or selected cut hardwood as approved by the Engineering Division of minimum size sufficient to provide the required clearance and to prevent displacement during placing of concrete. See SCD 300.02 Concrete Encasement and SCD 300.03 Concrete Cradle.



**303.9 Steep Slopes & High Velocities.** Wherever sanitary sewers are installed at slopes greater than 20 percent or where velocities greater than 15 feet per second exist, concrete collars/anchors are to be installed as shown in SCD 300.04.

**303.10 Protection of Pipe.** Whenever pipe laying is stopped for any significant length of time, such as at the end of the workday, the unfinished end shall be protected from displacement, flotation, cave-in, in-wash of soil or debris, or other injuries. A suitable temporary tight-fitting plug, stopper, or bulkhead shall be placed in the exposed bell, groove or socket end. Whenever sanitary force main is left unattended for more than 4 hours, the ends shall be capped with duct tape and shall be visible. Care shall be taken to protect C906 Polyethylene pipe from damage.

**303.11 Water in Excavation.** Water shall not be allowed to rise in the excavation until the joint materials and any concrete cradle or encasement is hardened and cannot be damaged by the water. Particular care shall be used to prevent disturbance or damage of pipe and the joints during backfilling or at any other time.

**303.12 Future Connections.** Wye and Tee-branches, slants, stubs or other fittings installed in the pipe for future connections shall be closed at the outer end. Care in backfilling shall be used so that such closure and its seal will not be disturbed.

**303.13 Pipe slope less than 1%.** For sewer pipe with a design grade less than one percent (1%), verification of the pipe grade will be required for each installation reach of sewer, prior to any surface restoration or installation of any surface improvements. The contractor's field supervisor will be required to provide daily documentation verifying that the as-built pipe grade meets the design grade through the submittal of signed cut sheets to the Engineering Division upon request. The contractor will be required to remove and replace any sewer reach having an as-built grade which is flatter than the design grade by more than 0.1%. Sewers with grades greater than the design slope may be left in place, provided no other sewer grade is reduced by this variance in the as-built grade. The Engineering Division also reserves the right to require the contractor to remove and replace any sewer (at any time prior to construction approval) for which the as-built grade does not comply with the grade tolerance herein stated. Field surveyed verification must be made under direction of the licensed land surveyor or registered professional engineer. The sewer contractor shall be responsible for any cost associated with the field verification of the sewer grade, or removal and replacement of the sewer pipe or associated appurtenances.

**303.14 Creek Crossings.** Sanitary sewers which cross creeks below the flowline of the watercourse shall conform to SCD 304.02. The installation of the sanitary sewer creek crossing from manhole to manhole (the creek crossing limits), including rip-rap and site restoration, shall be completed within seven (7) calendar days from the time the creek is initially disturbed. Preventative measures shall be utilized to minimize siltation and erosion during the installation process.

**303.15 Aerial Crossings.** All sanitary sewer aerial crossings shall conform to SCD 304.03 – 304.07.

**303.16 Standard Water and Sewer Separation.** All sanitary sewer mains shall be installed in the following manner, so as to protect public water supplies.

Sewer mains shall be laid at least ten (10) feet horizontally from any existing or proposed water main. The distances shall be measured edge-to-edge. In cases where it is not practical to maintain a ten-foot (10') separation, consideration may be given to allow a deviation on a case-by-case basis. If less than 10 feet will separate the water and sanitary sewer, then the water main will need to be installed in a separate trench, or on an undisturbed earth shelf located on one side of the sewer. In both cases the bottom of the water main will need to be at least 18 inches above the top of the sewer. If it is not possible to obtain the proper horizontal and vertical separation as described above, the sewer must be constructed with AWWA, C900 PVC pipe pressure rated to at least 150 psi from manhole to manhole. The sewer must also be concrete encased for the entire length of the sewer so installed. This pipe must then be pressure tested to ensure water tightness.

Manholes will need to be located a minimum of 10 feet from any water main. If this is not possible, then the water main will need to be relocated to ensure this separation is maintained.

**303.17 Casing.** All bores shall have a steel casing pipe conforming to AWWA C200 (latest revision) and AWWA M11 (latest revision), and if fabricated shall be constructed of A36 steel with a minimum yield point of 36 ksi; or if manufactured shall conform to Grade B with a minimum yield point of 35 ksi. It may be shipped in random lengths between 18 and 22 feet and shall have one end cut square and one end beveled. All casing pipe is to be joined with 360 degree welds. It shall be mill primed and coated with coal tar epoxy coating before installation. Where coating is damaged during installation, it shall be repaired and replaced by thorough brushing or scraping to sound material and applying two coats of the coating material.

The carrier pipe shall be prevented from contact with the casing pipe by means of polyethylene spacers, placed at a maximum spacing of 10 feet along the carrier pipe. (20 foot joints of pipe will require 3 spacers for each pipe lengths, while 13 foot joints will require 2 spacers for each pipe length.) Polyethylene spacers shall be RACCI Type F60, Ranger II, APS or other approved equal. HDPE force main may be installed without the use of casing spacers.

**303.18 Polyethylene Pipe Fusion License** – C901/ C906 polyethylene pipe fusion operations must be conducted by an individual in possession of a valid City of Wentzville Fusion License.

**303.19 Joining of Polyethylene Pipe to Valves.** Polyethylene pipe shall be joined to all valves by means of a MJ adapter and back-up ring for each valve face. Where MJ adapters are to be used, MJ faced valves shall also be used.

**303.20 Polyethylene Pipe Fusion.** Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 to 450 degrees Fahrenheit, alignment, and an interfacial fusion pressure of a minimum of 60 PSI to a maximum of 90 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records. A copy of all data logger records shall be provided to the City prior to the main being placed into service.

- a. Securing the pipe: Each component that is to be fused must be held in position so that it will not move unless it is moved by the clamping device.
- b. Facing the pipe: The pipe ends must be faced to establish clean, parallel mating surfaces. Facing is continued until a minimum distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaws. This operation shall provide for a perfectly square face, perpendicular to the pipe centerline on each pipe end and with no detectable gap.
- c. Aligning the pipe: The pipe profiles must be rounded and aligned with each other to minimize mismatch (high-low) of the pipe walls. This can be accomplished by adjusting clamping jaws until the outside diameters of the pipe ends match. The jaws must not be loosened or the pipe may slip during fusion.
- d. Melting the pipe: Heating tools that simultaneously heat both pipe ends are used to accomplish this operation. These heating tools are normally furnished with thermometers to measure internal heater temperature so the operator can monitor the temperature before each joint is made. However, the thermometer can be used only as a general indicator because there is some heat loss from internal to external surfaces, depending on factors such as ambient temperatures and wind conditions. A pyrometer or other surface temperature-measuring device should be used periodically to ensure proper temperature of the heating tool face. Additionally, heating tools are usually equipped with suspension and alignment guides that center them on the pipe ends. The heater faces that come into contact with the pipe should be clean, oil-free and coated with a nonstick coating as recommended by the manufacturer to prevent molten plastic from sticking to the heater surfaces. Remaining molten plastic can interfere with fusion quality and must be removed according to the tool manufacturer's instructions. Plug in the heater and bring the surface temperatures up to the temperature range (400-450°F) (204-232°C). Install the heater in the butt fusion machine and bring the pipe ends into full contact with the heater. To ensure that full and proper contact is made between the pipe ends and the heater, the initial contact should be under moderate pressure. After holding the pressure very briefly, it should be released without breaking contact. Continue to hold the components in place, without force, while a bead of molten polyethylene develops between the heater and the pipe ends. When the proper bead size is formed against the heater surfaces, the heater should be removed. The bead size is dependent on the pipe size.

The approximate melt bead sizes shall be as follows:

<u>Pipe Size</u>	<u>Approximate Melt Bead Size</u>
2" through 3"	1/16"
3" through 8"	1/8" – 3/16"
8" through 12"	3/16" – 1/4"
12" through 24"	1/4" – 7/16"
24" through 36"	7/16"

- e. Joining the pipe: After the pipe ends have been heated for the proper time, the heater tool is removed and the molten pipe ends are brought together with sufficient force to form a double rollback bead against the pipe wall. The fusion force is determined by multiplying the interfacial pressure, 60-90 psi (4.14-6.21 bar), by the pipe area. For manually operated fusion machines, a torque wrench may be used to accurately apply the proper force. For manual machines without force reading capability of a torque wrench, the correct fusion joining force is the force required to roll the melt beads over to the pipe surface during joining. For hydraulically operated fusion machines, the fusion force can be divided by the total effective piston area of the carriage cylinders to give a hydraulic gauge reading in psi. The gauge reading is theoretical; the internal and external drag need to be added to this figure to obtain the actual fusion pressure required by the machine.
- f. Holding the pipe: The molten joint must be held immobile under pressure until cooled adequately to develop strength. Allowing proper times under pressure for cooling prior to removal from the clamps of the machine is important in achieving joint integrity. The fusion force should be held between the pipe ends until the surface of the bead is cool to the touch. The pulling, installation or rough handling of the pipe should be avoided until the joint cools to ambient temperature (roughly an additional 30 minutes).
- g. Electro-Fusion Couplings/Saddles: Electro-fusion couplings and saddles may only be used as may be approved by the Engineering Division.

**303.21 Testing.** Each manhole and reach of sewer shall meet the requirements of the following acceptance tests. All defects shall be repaired to the satisfaction of the Engineering Division. Contractor shall furnish, at no additional cost to the owner, all necessary equipment and appurtenances to perform the acceptance tests.

- a. Deflection Testing: Gravity Mains. 100% of the total projects footage will be mandrel tested. This test must be completed prior to air and vacuum testing. Not less than thirty (30) days after final backfill, or City approved jetting, the Contractor shall perform a deflection test with a City of Wentzville inspector present. Testing shall be completed by using a rigid ball or mandrels with diameters equal to ninety-five percent (95%) of the inside diameter of the pipe. The mandrel must have nine (9) or more odd number of flutes or points. Tests shall be performed without mechanical pulling devices. No pipe shall exceed a deflection of five percent (5%). All pipe exceeding five percent (5%) deflection, shall be excavated and replaced.

- b. Low-pressure Air Testing: Gravity Mains. 100% of the total projects footage will be air tested. All testing must be completed in accordance with ASTM F1417. After completion of the system but prior to the connection of residential units, low-pressure air testing shall be performed on sewer lines and laterals. Isolate the section of sewer line to be tested. All branches, laterals, tees, and wyes must be plugged and braced adequately to withstand the test pressure. Air pressure must be introduced into the system to achieve four (4) psi and then stabilized to a minimum of three and one-half (3 ½) psi in excess of ground water pressure above the top of the sewer for at least two (2) minutes and then the air supply disconnected. The test will be considered as passing, if after a minimum test time as determined by the table below, the pressure has not dropped more than 0.5 psi.

Pipe Dia. (in)	Min Time (mm:ss)	Length for Min Time (ft)	Time for Longer Length (sec)	Time to test (mm:ss) per Length of pipe (ft)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
8	3:47	298	0.76 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57

- c. Vacuum Testing: For the purpose of ensuring that all manholes are constructed watertight, 100 percent of the all sanitary sewer manholes shall be vacuum tested. Manholes to be vacuum tested will be identified by City Staff at 100 percent completion of the project and before testing begins.

All vacuum testing shall be in accordance with Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test, ASTM C-1244 (latest revision). Sanitary sewer lines within the manhole must be plugged during the testing. A vacuum of ten (10) inches of mercury shall be drawn on the manhole. After the pressure has stabilized, a maximum of 1 inch of mercury drop in a minimum of one minute will be allowed. If the vacuum test fails to meet the above requirements, repeat the test after all defects have been repaired. Each failure will require testing of an additional 20 percent of the project manholes. A third failure of vacuum testing, including repeat tests, will require testing of 100 percent of the project manholes.

- d. Pressure Test: All sanitary sewer force mains must be pressure tested in accordance with the requirements of ASTM F2164, Field Leak Testing of

Polyethylene Pressure Piping Systems Using Hydrostatic Pressure. A pressure of the greater of 1.5 times the normal operating pressure at the lowest point in the system or 50 psi over the normal operating pressure will be achieved and maintained for two hours without any pressure drop. The City may require a higher pressure for this test if deemed necessary. All connections made to existing mains which are currently in service shall have the integrity of the saddle tested under pressure to the rating of the saddle, prior to making the tap on the main.

- e. Continuity Test: The tracer wire installed along the entire length of force main, shall be tested by a method acceptable to the Engineering Division which should show that the wire is continuous without break in the wire, and that the fore the main can be easily located by the City. Failure to pass the test may result in the Contractor being required to find and replace breaks in the wire, or alternatively replace the wire, as required by the Engineering Division.
- f. Blasting: Should blasting be conducted within 100 feet of any sewer main, lateral, forcemain, or manhole, after said improvement has been tested, the previously tested improvement will need to be retested.
- g.

***Note: Sanitary Sewers shall not be connected to a live sewer line until the sewer system has passed all inspections and testing.***

**END OF SECTION**

## SECTION 304

### Sanitary Sewer Laterals

**304.1 Description.** This section covers installation of all sanitary sewer laterals. Except where modified by specific requirement in this section, the written installation recommendations of the sewer pipe manufacturer shall be strictly followed.

**304.2 Materials.** Pipe and fittings, jointing materials, and appurtenant materials shall be shown on the drawings and as specified herein.

- a. New Laterals: All new sewer lateral pipe shall be 6" diameter, SDR35 Polyvinyl Chloride (PVC) pipe conforming to the requirements of ASTM D-3034 (latest revision) Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. Where main is installed as C900, due to depth, laterals should be installed using the same material, extending to the tail stake.
- b. Replacement Laterals: All replacement sewer lateral pipe shall be SDR35 Polyvinyl Chloride (PVC) pipe conforming to the requirements of ASTM D-3034 (latest revision) Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. Replacement laterals may be 4" diameter if the existing lateral is 4" diameter, otherwise, the minimum diameter must be 6". A rubber boot may be used for connection to the existing pipe. Concrete must be poured over and under the boot to prevent the joint from moving.
- c. Joints: Joints shall be elastomeric gasket joints providing a water tight seal. They shall conform to the requirements of the Specification for joints for Drain and Sewer Plastic Pipes and Fittings Using Flexible Elastomeric Seals, ASTM D3212 (latest revision).

Care shall be taken to assure that no PVC pipe be installed to remain exposed to sunlight or any other conditions that may allow it to deteriorate.

**304.3 Sanitary Sewer Lateral Construction.** All sanitary sewer lateral connection to the City of Wentzville sanitary sewer system shall be made at an approved connection point to the sanitary sewer main. For new construction, this connection should be made at the "wye" location installed with the sanitary sewer main. Where no "wye" is available, the connection to the main shall be made by the following methods

- a. Plastic Main (PVC): Connection shall be made with an approved plastic saddle tee or wye fitting (see SCD 302.13a, 302.13b, or 302.14)
- b. All Other Material Mains: Connection to sanitary sewer mains without an available connection, constructed of materials other than PVC, shall be made by the "roll-in" method (see SCD 302.13.c).

All sanitary sewer laterals shall be constructed such that the minimum vertical distance from the low point of the basement to the flow line of the sanitary sewer at the corresponding house connection shall not be less than two and one half feet (2-1/2') plus the diameter of the sanitary sewer.

All laterals 100 feet in length and longer shall have a cleanout installed every 100' and at any change in alignment. 90° elbows will not be allowed on sanitary sewer lateral construction.

All sanitary sewer laterals shall be constructed with a minimum of 2% slope unless otherwise approved by the City of Wentzville.

All connections to the sanitary sewer main shall be made at locations as shown on SCD 302.13a or 302.14. Connections shall be made on the same side of the main facing the service location.

Each new sanitary sewer shall have the tailstake location marked clearly for location when the final service connection is made.

### **END OF SECTION**



## SECTION 305

### Grouting

**305.1 Description.** This section covers grouting miscellaneous baseplates and other uses of grout as indicated on the drawings. Unless otherwise specified, all grouting shall be done with non-shrinking grout.

**305.2 Materials.**

Non-shrinking Grout: Master Builders "Masterflow LL-713 Grout",  
Sauereisen Cements "F-100 Level Fill Grout",  
U.S.Grout "Five Star Grout", or USM "Upcon",  
or equal.

Water: Clean and free from deleterious substances.

**305.3 Non-shrinking Grout.** Non-shrinking grout shall be furnished factory premixed so only water is added at job site. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

- a. Preparation: The concrete foundation to receive non-shrinking grout shall be saturated with water for 24 hours prior to grouting.
- b. Placement: Grout shall be placed in strict accordance with the direction of the manufacturer so all spaces and cavities are completely filled without voids.
- c. Edge Finishing: The grout shall be finished smooth in all locations where the edge of the grout will be exposed to view after it has reached its initial set.
- d. Curing: Non-shrinking grout shall be protected against rapid loss of moisture by covering with wet rags or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 7 days.

Holes shall be prepared for grouting as recommended by the grout manufacturer.

### **END OF SECTION**

**DIVISION 400  
SANITARY SEWAGE PUMP STATIONS**

**SECTION 400**

**General Requirements**

**400.1 Location.** Sanitary Sewage Pump Stations and related appurtenances shall be placed in accordance with the approved plans. Gas, water, and other underground utilities shall not conflict with the depth or horizontal location of existing and proposed sanitary and storm sewers including laterals.

**400.2 Sanitary Sewage Pump Station Easements.** All Sanitary Sewage Pump Stations shall normally be constructed in easements granted to the City of Wentzville, and as shown on the approved set of improvement plans. Pump Stations installed as a part of a development may record the easements on the record plat. All other easements will require easement documents.

**400.3 Shop Drawings.** Shop drawings shall be furnished for approval by the City. The submittals shall include all materials, equipment, fittings, structures including reinforcement, complete, so as to show conformance with these specifications, the approved improvement plans, and Standard Construction Detail's (SCD's) 400.01, 400.02, 400.03 and 400.04. Approval of the submittals in no way relieves the developer/contractor from the responsibility of providing a working system, nor from insuring that all components are compatible with other components of the system.

**400.4 Pre-construction Meeting and Construction Permit.** No construction of pump stations or modifications shall begin before improvement plans and shop drawings are approved for construction, and a Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the City. Any construction done prior to this notice may be summarily rejected or refused without further investigation.

**400.5 Inspections.** All construction work, involving pump stations, force mains, and sanitary sewer extensions and/or modifications shall be inspected by the City of Wentzville, in accordance with the requirements contained in Section 102.9. Any work performed without inspection shall not be accepted by the City of Wentzville. The City of Wentzville shall be notified 48 hours in advance of any construction for coordination and inspections

**400.6 As-built drawings.** As-built drawings shall be required for all new construction. See Division 1100 for as-built requirements.

**400.7 Field Changes.** Small field changes may be accepted by the City Inspector. Larger changes shall require a submittal to the City for approval.

**END OF SECTION**

## SECTION 401

### Structure Requirements

**401.1 Description.** This section covers the pump station structure construction consisting of the wet well, valve vault, control panel pad, and retention pipe (storage) to be furnished complete with all jointing materials and appurtenances.

**401.2 Design of Concrete Structures.** All reinforced concrete structures shall be designed using the Working Stress Method. At a minimum this includes the wet well, valve chamber, and control panel pad. The structures may be either pre-cast or cast-in-place as approved by the City. Structure shall be installed so that it is off no more than 3 inches per 25 vertical feet.

**401.3 Joining Chambers.** The valve chamber shall rest on a haunch poured integral with the wet well walls. Both chambers shall be tied together with a minimum of two (2) threaded tie bolts. The designing engineer shall specify the bolt diameter and material strength. Bolts are to be 18" down from top of structure. For top slab thicknesses greater than 10", place the bolts down 6" from bottom of top slab. One-half inch (1/2") thick 6"x6" backing plates shall be used as washers on each of the tie bolts. Both structure tops shall be at the same elevation and drawn tightly together against a 1" square "E.Z." stick expansion strip. The tie bolts and the 6"x6" backing plates shall be stainless steel.

**401.4 Access Hatches.** Access lids shall be cast in the top sections of each chamber. The top elevation of structures shall be 1" higher than the surrounding ground elevation. Surrounding ground shall be sloped away from the structure for proper drainage. The hinged side of the valves and pump chamber lids shall be located on the walls opposite from each of their respective common tie walls so that they open from the chamber tie walls. Hatch specifications may be found in Section 404.7.

**401.5 Access Openings.** In addition to the openings for the incoming gravity lines and pump discharge lines, the following accesses will be included:

- a. A 3" and 6" PVC couple shall be cast in the center of the wet pit tie wall and a corresponding 4" and 8" hole cast in the valve chamber tie wall; centerline shall be located 20" down from the structure top. After the two chambers have been tied together a 3" and 6" PVC stub shall be glued in the coupler on the valve chamber side through the 4" and 8" holes. The annular space of the conduit between the pump and float wires shall be sealed using Polywater FST Duct Sealant or Engineer approved equivalent. The 3" opening will be used for low voltage wire passage between the chambers. The 6" opening will be used for high voltage wire passage between chambers.
- b. A 6" hole shall be centered at the bottom of the valve chamber floor in the tie wall. A 4" PVC coupler shall be cast in the wet pit tie wall and centered with the valve chamber 6" hole. After the two chambers have been tied together, two 4" PVC stubs shall be glued into the coupler on each side of the tie wall. These stubs will be used for the valve chamber drain piping.

- c. Two 3" holes and 2" hole shall be placed on each side of the valve chamber side walls 18" from the tie wall and 18" from the top of the structure. For top slab thicknesses greater than 10", place the holes down 8" from bottom of top slab. Two 2-1/2" and one 1-1/2" PVC coupler shall be cast in the respective holes. One set of the openings is to be used for the power, control wires, and flow meter from the control panel. Two opening sets are provided for flexibility. The openings not used shall be stubbed and capped with a piece of 1-1/2" or 2-1/2" PVC or grout filled/plugged. The annular space of the conduit between the wires shall be using Polywater FST Duct Sealant or Engineer approved equivalent.

**401.6 Gravity Pipes.** All incoming gravity lines and discharge piping will have a "Z-lok" or "A-lok" type compression fitting cast in place where the piping passes through the valve and wet well chamber walls. The maximum angle of deflection allowed for pipe gaskets is as follows:

- a. "Z-lok"  $\leq$  25 degree
- b. "A-lok"  $\leq$  7 degree

All openings for pipe shall be located a minimum of 1 foot above or below structure joints.

**401.7 Valve Chamber Floor.** The valve chamber floor shall be sloped with a three-sided invert towards the 4" drainpipe using a 2" fillet. Gravity and retention pipes may not be run beneath the valve chamber.

**401.8 Valve Chamber Supports.** Valve chamber piping shall be supported as follows:

- a. After discharge piping and valves have been installed in the valve chamber, adjustable pipe cradle jacks shall be placed under the gate valves and tees, so that they have a 10" clearance between the floor and valve flanges. The supports shall be firmly bolted to the valve chamber floor.
- b. An adjustable pipe cradle jack shall be placed against the back of the discharge tee and then bolted to the common chamber tie wall to prevent piping thrust movement. The thrust jack shall be shown on the chamber plan drawing.

**401.9 Entrance Steps.** Precast wet well entrance steps shall comply with SCD 302.12 and shall be located as follows:

- a. They shall not be placed in front of incoming gravity lines.
- b. They shall not be placed in conflict with floats.
- c. They shall not be located under or next to any obstructions.
- d. Entry steps should provide a clear-in-line visible unobstructed access from the top of the chamber to the bottom of the station.
- e. Steps should be placed on one (1) of the station sidewalls approximately centered with the hatch cover.

**401.10 Sealing of Wet Well & Valve Chamber.** The inside and outside of the wet well and the outside of the valve chamber shall be sealed with a commercial grade water proofing sealer.

Acceptable manufacturer and model: SS1H, Slow Setting Emulsion, as manufactured by Missouri Petroleum, Bi-State Emulsions, Inc., or approved equal.

**END OF SECTION**

## SECTION 402

### Piping and Valves

**402.1 Description.** This section covers installation of the pump station piping and valves. Flanged end and grooved piping shall be the acceptable means of connecting piping, valves and fittings.

The standard pump station piping arrangements called out in this specification book has proven to be of sound design in typical pump station installations. Special bracing or water hammer protection devices have not been included or called for. However, when the surrounding terrain or station site is such that extreme hydraulic conditions may be created, it is the responsibility of the designing engineer to anticipate such conditions and design for the probability of excessive pressure, stress and/or movement in the piping system. The engineer shall be responsible for including whatever restraints, relief valves or surge protection, deemed necessary for the protection of the valve and piping system.

**402.2 Discharge Riser Piping Material.** The piping from the individual pump discharge bases, through the header tee and out of the valve vault to the connection point to the force main, shall be in accordance with the following:

- a. Four inch (4") diameter piping and larger: Flanged Installation – Ductile Iron pipe ANSI A-21.51 (AWWA C151), Class 53.

Grooved end installation – 4" diameter and above, ductile iron pipe Class 53 A.N.S.I. A-21.51 (A.W.W.A. C 151) with rigid radius grooves for end preparation in accordance with A.W.W.A. C606. Mechanical couplings shall be of ductile iron conforming to ASTM A-536, grade S nitrile gasket compounded to conform to ductile iron pipe surfaces with stainless steel nuts and bolts.

- b. Three inch (3") diameter piping and smaller: Flanged Installation – ASTM D 1785 Schedule 80 PVC.

Grooved installation – 3" diameter and below, ASTM 1785 schedule 80 PVC roll grooved pipe in accordance with C-606. Mechanical couplings shall be of ductile iron conforming to ASTM A-536, grade T nitrile compound gaskets conforming to ASTM D-2000 designation 5BG615A14B24 with stainless steel nuts and bolts.

- c. When plastic pipe is utilized for the pump discharge riser and the riser exceeds 12 foot in length, a stainless steel support brace must be installed between the riser and wet well wall. The brace shall be placed approximately on the middle of the riser but kept above the normal operating level of the well. Two (2) braces will be need on lengths in excess of 20 feet.

**402.3 Force Main Material.** Specifications for the force main from the transition piping to the discharge point are included in Division 300.

**402.4 Transition Piping.** A transition pipe must be used to make the transition between the header tee inside the valve chamber and the C906 polyethylene force main outside the station structure. The following methods shall be used:

- a. Four Inch (4") diameter piping and larger: Both pump discharge lines shall be joined to a ductile iron flanged tee. A ductile iron flanged x plain end pipe shall be bolted to the tee and then passed through the A-Lok or Z-Lok gasket installed in the valve chamber discharge wall. The C906 polyethylene force main shall be attached to the DIP at an MJ Gate valve, located on the outside of the Valve vault. The MJ adopter end of the HDPE pipe will be restrained by use of the restraining gland and the plain end of the DIP will be restrained by use of a Mega-Lug retainer on the DIP.
- b. Three inch (3") diameter piping and smaller: Both pump discharge lines shall be joined to PVC flanged tee. A PVC flanged x plain end pipe shall be bolted to the tee and then passed through the A-Lok or Z-Lok gasket installed in the valve chamber discharge wall. The C906 polyethylene force main shall be attached to the PVC at an MJ Gate valve, located on the outside of the Valve vault. The MJ adopter end of the HDPE pipe will be restrained by use of the restraining gland and the plain end of the PVC pipe will be restrained by use of a Mega-Lug retainer on the PVC pipe.

#### **402.6 Gate and Check Valves.**

- a. Valves located inside the valve vault shall be provided with flanges meeting the requirements of ANSI/AWWA C509.01, and ANSI/AWWA C110/A21.10, Class 125 Flanges. Valves located outside the valve vault shall be provided with MJ ends meeting the requirements of ANSI/AWWA C509.01, and ANSI C111/A21.11 Mechanical joint ends.
- b. Gate valves: Gate valves shall be ductile iron body resilient seated gate valves conform to AWWA C509 (latest revision), Resilient-Seated Gate Valves for Water Supply Service. The gate valve shall be of the non-rising stem, open left (counterclockwise), bronze stem type. The interior and exterior surfaces shall be coated using a fusion epoxy, 10 mil thickness. Epoxy shall meet or exceed ANSI/AWWA C550 Standard, and certified to ANSI/NSF 61.. Valve operators shall be by manufacturer's standard hand wheel. All valve hardware, stem extensions and guides shall be stainless steel.

Acceptable manufacturer and model: Mueller Co., Series 2360, or approved equal.

- c. Check valves: Check valves shall be full body flanges type, with a domed access cover and only one moving part, the flexible disc, conforming to AWWA C508 (latest revision), Swing-Check Valves for Waterworks Service, 2 inch (50 mm) Through 24 inch (600 mm) NPS. Valves shall be provided with flanges in accordance with ANSI B16.1, Class 125.

The valve body shall have full flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator without special tools or removing the valve from the line.

The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operation in lines containing high solids content. The disc shall be of one-piece construction, precision molded with an integral o-ring type-sealing surface, and contain steel and nylon reinforcement in the hinge. The flex portion of the disc shall be warranted for 25 years. Non-slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action.

The valve body shall be construction of ASTM A126 Call B cast iron. Optional body material includes ASTM A536 Grade 65-45-12 ductile iron. The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.

Valves shall be provided with flanges in accordance with ANSI B16.1, Class 125.

The interior and exterior surfaces shall be coated using a fusion epoxy, 10 mil thickness. Epoxy shall meet or exceed ANSI/AWWA C550 Standard, and certified to ANSI/NSF 61.

Acceptable manufacturer and model: Val-Matic, Swing-Flex Check Valves Series #500.

**402.7 Valve Chamber Drain Valve.** A backwater check valve shall be installed on the valve chamber drain line. The valve shall be installed as follows:

A 4" diameter PVC stub shall be glued into the 4" diameter coupler cast into the wet pit wall at the valve chamber floor line. A 90° elbow shall be glued to this stub and directed toward the wet well floor. A (4"x3') PVC stub shall be glued into the other end of the elbow. The check valve shall then be slipped on to the stub and attached with 2 stainless steel clamps to be supplied by the vendor.

Acceptable manufacturer and model: The valve shall be a "Tide Flex" series TF-2, 4" (slip on) check valve, by Red Valve Co., EVR Type CPO-4".

**402.8 Gravity Lines Entering the Station.** Ductile iron pipe shall be used on sections of gravity lines running from:

- a. The last manholes preceding the station up to the station.
- b. The outfall of the retention pipe up to the station.

Concrete or PVC gravity lines in these areas will not be acceptable.

**402.9 Retention Pipe.** Retention pipe shall be Class 2-O'ring type RCP. Class 3-O'ring type RCP shall be used at installations where there will be vehicular traffic over the pipe. The retention pipe ends shall be bulk-headed using pre-cast bulkheads with an "A-Lok" gasket installed in the outfall side for the 12" gravity line of the station. The inside & outside of the pipe shall be sealed with a commercial grade water proofing sealer. All joints shall be sealed using Fernco flexible coupling, Mar Mac brand Mac Wrap, or approved equivalent.



Acceptable manufacturer and model: SS1H, Slow Setting Emulsion, as manufactured by Missouri Petroleum, Bi-State Emulsions, Inc., or approved equal.

**402.11 Emergency Bypass Connection.** The Valve Chamber shall include a 4" bypass connection with cam lock and gate valve. Emergency bypass shall be oriented toward the hatch of the Valve Chamber.

**END OF SECTION**

## SECTION 403

### Submersible Wastewater Pumps

**403.1 Description.** This section covers the specifications for submersible wastewater pumps installed in pump stations. Sewage pumps shall meet the following requirements.

Acceptable manufacturer(s): Flygt Company, Fairbanks Morse Company, ABS Company, or pre-approved equal.

**403.4 Pump Construction.** Major pump components shall be of gray cast iron, Class 30, with smooth surfaces devoid of blowholes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be of ASTM A 167 304 stainless steel. All surfaces coming into contact with sewage, other than stainless steel, shall be protected by an approved sewage resistant coating.

All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in controlled compression of nitrile rubber O-rings without requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

The cable entry water seal design shall preclude specific torque requirements to ensure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable.

The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign materials gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

The junction chamber, containing the terminal board, shall be sealed from the motor by elastomer compression seal (O-rings). Where a seal junction chamber is not used, the motor chamber shall be fitted with a moisture detection probe. The probe shall be connected to and activate a warning light in the control panel. Specialized relays/sensors, if required by the pump manufacturer, shall be supplied to the control panel manufacturer by the pump manufacturer prior to panel construction.

Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board and thus perfectly leak proof.

Each unit shall be provided with an adequately designed cooling system. When thermal radiators (cooling fins) are used, they shall be integral to the stator housing and shall be adequate to provide the cooling required by the motor. When water jackets are used, the water jacket shall encircle the stator housing. The water jacket shall be provided with a separate

circulation of the pumped liquid. Cooling media channels and parts shall be non-clogging by virtue of their dimensions. Provision for external cooling and flushing shall be provided. Regardless of the cooling system used, the motor must be capable of pumping under full load continuously with the water level only to the top of the volute. Motors with intermittent full load ratings or motors requiring oil for cooling will not be allowed.

When double shrouded impellers are used, a wear ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert which is drive fitted to the volute inlet and rotating stainless steel ANSI 304 ring which is drive-fitted to the impeller eye.

When single shrouded impellers are used, the volute shall be fitted with an adjustable replaceable front plate. The front plate shall be designed with a wave shaped inlet and an outward spiraling V-shaped groove on the side forcing the impeller to shred and force stringy solids outward from the impeller and through the pump discharge.

The volute shall be of single piece design and shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller.

The pump motor cable, installed, shall be suitable for submersible pump application. Cable sizing shall conform to National Electric Code (NEC) specifications for pump motors.

Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three (3) thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel. Specialized relays/sensors, if required by the pump manufacturer, shall be supplied to the control panel manufacturer by the pump manufacturer prior to panel construction.

The pump motor shall be squirrel-cage, induction, shell type design, housed in an air-filled watertight chamber. The stator winding and stator leads shall be insulated with moisture resistant NEMA Class F insulation, which will resist a temperature of 311° F (155° C). The stator shall be dipped and baked three times in NEMA Class F varnish. The motor shall be designed for continuous duty; capable of sustaining a minimum of ten (10) starts per hours. The rotor bars and short circuit rings shall be made of aluminum.

Each pump shall be provided in an oil chamber for the shaft sealing system. The drain and inspection plug, with positive anti-leak seal, shall be accessible from the outside.

The pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row deep groove ball bearing and the lower bearing a two row angular contact ball bearing.

The pump shaft shall be stainless steel or hard chrome plated carbon steel.

Each pump shall be provided with a tandem mechanical shaft seals system consisting of two totally independent seal assemblies. Seals shall run in an oil reservoir. Lapped seal faces must be hydrodynamically lubricated at a constant rate. The lower seal unit, between the pump and oil chamber, shall contain one stationary and one positively driven rotating silicon carbide or tungsten carbide ring. The upper seal unit, between the oil sump and motor housing shall

contain one hard metal ring and one carbon ring, or angled to the shaft lip type seal in grinder pump applications. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The following mechanical seal types shall not be considered acceptable:

- a. Shaft seals without positively driven rotating members
- b. Conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units. This conventional system requires a pressure differential to offset external pressure and to effect sealing.

The impeller shall be of gray cast iron, ASTM A48 Class 30, dynamically balanced, single or double shrouded non-clogging design having a long thrulet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications. The pump manufacturer shall, upon request, furnish mass moment of inertia data for the proposed impeller. Excluding grinder pump applications, the impeller shall be capable of passing a minimum 3-inch solid sphere. The fit between the impeller and shaft shall be a sliding fit with one key.

#### **END OF SECTION**

## SECTION 404

### Interior

**404.1 Description.** This section covers pump station interior appurtenances.

**404.2 Slide Rails.** All pump lifting slide rails shall be made of 316 or 304 schedule 40 stainless steel pipe. Slide rails shall be installed and sized per manufacturer's instructions. The slide rails shall be firmly braced to the wet well wall with stainless steel support brackets placed every 15 feet.

**404.3 Lifting Chain.** Pump lifting chain, clevises and shackles shall be made of 316 or 304 stainless steel. The chain shall be sized to accommodate the installed pump weight, but shall not be sized smaller than 1/4" stainless steel diameter links.

**404.4 Bolts.** All field installed bolts, nuts and washers used inside either the pump or valve chamber shall be made of 316 or 304 stainless steel.

**404.5 Fasteners.** All concrete fasteners used for installation of braces, brackets or boxes shall be stainless steel wedge type stud anchors. Anchor holes shall be drilled to the manufacturer's recommended depth. Pump base anchor studs shall be sized as follows:

- a. Grinder and 4" pumps = 5/8" minimum diameter
- b. 6" and 8" pumps = 1" minimum diameter
- c. Pumps larger than 8" shall be installed with stainless steel anchors sized per the pump manufacturers' instructions.

Acceptable manufacturer and model: Anchors shall be Hilti Kwik Bolt Three.

**404.6 Floats and settings.** Floats and settings shall conform to the following requirements:

- a. Floats shall not be located near steps.
- b. All floats shall be located away from the turbulence of the incoming flow.
- c. Sewage shall not rise to the level of the incoming gravity lines or the twenty-four hour retention pipe during normal pump operation for either single or dual pump operation.
- d. The following levels shall guide the setting of float levels:
  - 1. Twenty-four hour retention alarm – Set to a level equivalent to 75% of the retention tank capacity.
  - 2. High Level Alarm – No less than 2-1/2' above the top of pump motor and no more than 1" below the 12" pipe to the twenty-four hour retention mark.
  - 3. Second Pump – No less than 2 feet above top of pump motor.
  - 4. First Pump – No less than 1-1/2' above top of pump motor.

5. Off Float – The entire pump shall be covered at the off level.
- e. Float leads shall be hung with stainless steel kelling grips from a stainless steel bracket supplied by Halliday. The bracket shall be firmly bolted to the concrete immediately below the wet well hatch cover.
- f. Floats shall be provided with sufficient length cord to run between the sensors and the valve chamber junction box unspliced.
- g. Float wires shall be neatly routed away from the pump access hatch opening then through the chamber access sleeve, without excessive wire strain or pull. Wire length on all float wires shall be such that each float may be adjusted to the bottom of the station wet well. Excess wire shall be coiled & neatly hung on a bracket.
- h. Installed pump top and bottom elevations as well as the float elevations shall be shown on the pump station interior drawing.

Acceptable manufacturer and model: Flygt model ENM-10, or Anchor Scientific Roto floats, Type S.

**404.7 Access Hatches.** All pump and valve chambers shall be provided with aluminum access hatches as follows:

- a. The access hatches shall be aluminum accesses rated for a 300 pound loading. Door size shall be as indicated on the drawings. The access frame and cover shall be flush with the top of the concrete, complete with hinged and flush locking mechanism, upper guide holder and level sensor cable holder. Frame shall be securely placed, mounted above the pumps. Hatches shall be equipped with form skirts, sized for the slab top thickness. Doors shall be provided with padlock lugs.
- b. All access hatch construction materials and appurtenances shall be manufactured from stainless steel, aluminum or brass.
- c. All access hatches shall be provided with a fall protection grating panel from the hatch manufacturer.

Acceptable manufacturer and model: Bilco Type PCM or PDCM, or Halliday Series S1S or S2S.

**404.8 Locking Hardware.** All equipment enclosures, access hatches, entrance gates and service disconnect arms shall be provided with locks manufactured by "Best Access Systems". Locks shall have 2" high shackles with 5/16" diameter shanks. Temporary construction cores and keys will be provided by Best Access Systems until such time as the facility is inspected and accepted for maintenance by City. All temporary keys and cores will be turned over to City personnel.

Acceptable manufacturer and model: Best Access Systems. Best stock 21B772 with brass body.

**404.9 Pressure Sensor Units.** Pressure sensors may be of the full flange design with thru bolt holes or one-piece water style with carbon steel flanges. Sensors shall clamp between standard ANSI pipeline flanges. All exposed surfaces to be epoxy painted or a non-corrosive material. Sensor shall be flow thru design with flexible Buna-N Elastomer Sensing Ring around the full circumference.

Pressure switches shall have NEMA-7 Housings with Single Pole Double Throw, snap-action switching elements. Switches shall be wired normally closed (open on pressure), with adjustable pressure settings. The pressure range shall be specified for each specific installation.

Sensors shall be provided to the installer, assembled complete, from the supplier. The units shall be filled with a 50/50 ethylene glycol and water mixture and have no entrapped air in the system. The supplier shall send the unit out pretested at the minimum operable sensing level of the switch.

Acceptable manufacturer and model: Gauges to be 2-1/2" dial, SPAN model LFS 220 with 1/4" connection. Switches shall be Neo-dyn model 132P4-8C. Pressure sensors shall be Red Valve series 40 flanges or series 48 wafer sensor or EVR Products series WPS. Accessory piping and fittings to be 1/2" or 1/4" Parker hex stainless steel with reducing fittings where necessary to connect instruments.

**404.10 Intrinsic Barriers.** The wet well area of the pump station is considered by the NFPA to be a hazardous area. Therefore, intrinsic barriers shall be installed where the level floats terminate in the control panel. This will prevent any explosions from occurring due to electrical arcing in the wet well area.

**404.11 Pump Chamber Inspection.** Following placement of the wet well pumps and prior to allowing sewage into the pump station, the pump station floor shall be inspected by the City. The wet well floor and retention chamber must be clean and dry for this inspection. The contractor/developer shall be responsible for coordinating the inspection with the City.

## **END OF SECTION**

## SECTION 405

### Electrical

**405.1 Description.** This section covers the requirements for pump station electrical work and associated appurtenances.

**405.2 Pump Station Control Panel.** The selected pump supplier shall be directly responsible for all panel fabrication, component installation, and integration into the City's existing SCADA system. The pump control panel shall meet the following specifications:

#### **405.2.1 General Control Panel Requirements.**

- a. It is the intent of these specifications that all motor control and control components be supplied by a single supplier/Systems Integrator. Controls shall not be assembled on site. Systems Integrator/control panel manufacturer shall be a UL 508 certified facility and shall be regularly engaged in the manufacture of controls for the municipal water/wastewater industry. The pump control panel shall be assembled by a company having at least ten years experience in the construction of such control equipment. The City shall be the sole judge as to whether the alternate equipment is to be considered as an approved equal. Approval of an alternate system by the City will not relieve the alternate system of strict adherence to these specifications.
- b. The control panel with SCADA system integration shall be the responsibility of a single manufacturer/supplier, hereafter designated as the Systems Integrator. All aspects of the system including fabrication, programming, start-up, and training shall be by one entity. Sub-letting of work shall not be accepted. The Systems Integrator shall provide a fully complete system operating in a satisfactory manner including adding the site to the existing SCADA computer.

#### **405.2.2 Control Panel Operation.**

- a. Demand: Basic operation of the pumps shall be as a pump-down, lead/lag, common off system with high level alarm. Panel shall accommodate connection of floats (level sensors to be provided by pumping equipment supplier) with the following functionality at a minimum:

Retention Tank High Level  
Wetwell High Level  
Lag Demand  
Lead Demand  
Stop

- b. Control: Each pump shall be controlled through a "Hand-Off-Auto" switch. In the Hand position, the pump shall run continuously until the selector switch is turned to Off or Auto. In the Off position, the pump shall not run.

In the Auto position, the pump shall be controlled by the floats in the wetwell. A demand for each pump shall be delayed through adjustable time delay relays



with a range of .1 - 10 seconds. Initially, the time delay for the first pump demand shall be set at 8 seconds, with required additional pump demand time delays being staggered 8 seconds apart. Operation of the lag pumps shall not be run through the lead demand float.

- c. Control Panel Alarms: The following alarms shall operate individual pilot lights as described under General Control Panel Equipment.
  - 1. Pump Fail: A pump failure (timed from pressure switch indicating pressure after pump is demanded) shall be annunciated only by the individual pilot light. This alarm shall stop the pump from running, and only be resettable when the pump Hand-Off-Auto selector switch is placed in the "Off" position.
  - 2. Seal Fail: A pump seal failure shall be annunciated only by the individual pilot light. This alarm shall not stop the pump from running.
- d. SCADA System Annunciated Alarms/Status: The following alarm points shall be connected to the MOSCAD unit for display on the City's SCADA System computer network. Any discrete input shall cause a change-of-state transmission to the central SCADA unit except for pump run. Pump run/elapsed time (cumulative and previous day), and flow/totalization (where applicable) indication shall be transmitted when any other point causes a transmission, or when interrogated by the central.

Discrete Input:

- 1. Points #1,2,3, and 4 – Pump Run

These four (4) points are reserved for up to four different pumps. Each pump shall have an auxiliary contact closure from the motor starter to indicate pump running. The run indication is used to maintain pump elapsed time for display on the City's SCADA computer.

Point #1 - Pump 1 Running  
Point #2 - Pump 2 Running  
Point #3 - Pump 3 Running  
Point #4 - Pump 4 Running

- 2. Points #5,6,7, and 8 – Pump Failure

These four (4) points are reserved for up to four different pumps. Each pump shall have a pressure switch flow indicator or check valve proximity switch to indicate a positive flow has been established when a pump has been called upon to start. The flow indicator will be wired to a one-five minute adjustable time delay relay. If a positive flow has not been established in the present time, the pump will be wired to shut down and lock out. A pump failure signal will be transmitted to the central station through a closed set of contacts from the time delay relay.

Point #5 - Pump 1 Failed

Point #6 - Pump 2 Failed  
Point #7 - Pump 3 Failed  
Point #8 - Pump 4 Failed

3. Point #9 - Retention Alarm

This point is to indicate that the retention tank has reached 75% capacity. A float with contacts shall be hung in the wet well at an elevation which is equivalent to a 75% level in the retention tank. Connection shall be directly to the MOSCAD in the pump control panel without the use of an interposing relay.

4. Point #10 – High Water Level

If the influent water level rises above the normal maximum operating level, a float with a normally open set of contacts shall close. The contact closure will indicate a failure on Point #10. Connection shall be directly to the MOSCAD in the pump control panel without the use of an interposing relay.

5. Point #11 – Intrusion

There shall be a set of contacts placed on the pump control panel door(s) with the contacts positioned to close when the door is opened. This contact will indicate entry into the station by a signal on Point #11 of the central station indicator. Connection shall be directly to the MOSCAD in the pump control panel without the use of an interposing relay.

6. Point #12 – SPD Fault

SPD failure via dry contact closure on the SPD.

7. Points #13 - Generator Run, (for stations that have a permanent generator)

9. Points #14-#16 - Spare

All spare discrete inputs shall be wired to terminal blocks for future use by the City.

10. Additionally, via software programming, communication status and AC-Power fail of the Moscad unit shall be displayed on the Intellution SCADA computer.

11. Connection of the 12 alarm points shall be considered as the minimum requirement for all pump stations. Additional alarm points may be required on certain individual pump station locations. Any additional alarm points that may be required will be requested when the pump station plans are submitted for review.

Analog Input:

1. Channel #1 – Station Flow (where applicable)

This Channel is to indicate station flow via a 4 – 20 ma analog input from flow meter.

- e. Automatic or Manual Transfer Switch: All lift stations with backup generators shall have an automatic transfer switch. All other lift stations shall incorporate a double throw, UL 1008 listed, manual transfer switch with a generator quick-connect plug. Install the switch in a NEMA 4X stainless steel enclosure. Coordinate with the City to determine the type of quick connect plug required. The manual transfer switch shall be rated for the same electric load as the Service Disconnect. The automatic transfer switch or manual transfer switch with the generator receptacle shall be located on the back of the center section of the "H" panel.

**405.2.3 General Control Panel Equipment.** Pump control panels shall meet the following specifications:

- a. Enclosure: Enclosure shall be a multi-door NEMA 3R enclosure constructed from 12 gauge 304 stainless steel with #4 finish, open bottom construction in sections 1 and 3, with 2" x 2" x 1/4" (304) stainless steel angle iron frame on inside bottom of sections. Holes shall be drilled in this frame as indicated in drawing. Enclosure shall consist of three sections in an "H" shape cabinet, with total overall dimension of 64" high by 70" wide by 30" deep. All sub-panels shall be constructed from 12 gauge mild steel painted white. All seams and sections shall be welded together such that a weathertight seal exists between the three sections and at all seams. All seams shall be continuously welded, with the exception of exterior inside corner seams. All exterior seams shall be M.I.G. welded then ground smooth and brushed finished. Exterior inside corner seams shall be T.I.G. welded (i.e. seams connecting section 2 to sections 1 and 3). Drip shields shall be an extension of the enclosure. All exterior doors shall be held closed with door latch mechanism fastened to enclosure.

All hardware on exterior of panel shall be stainless steel with the exception of the lifting eyes on top of the enclosure. No screws, bolts, etc. shall protrude through the exterior of the enclosure with the exception of the temporary lifting eyes on top of the enclosure. Enclosure shall have removable lifting eyes (5/8" - 11tpi, 1" long threaded shaft) as shown on top of enclosure sections #1 and #3. Stainless steel nuts which the lifting eyes are screwed in to shall be welded to the inside top of the enclosure. Note: provide gasketed stainless steel bolts (5/8" - 11 tpi, 1" long threaded shaft) for eye replacement after installation. All exterior handles shall be stainless steel, Austin #48-5655SSX or pre-approved equal. Pressure sensitive adhesive gasket shall be supplied for sections 1 and 3 to seal between bottom of sections and concrete pad. Gasket shall be 1/4" x 2", Rubatex corporation #R425N or pre-approved equal.

Panel edges shall be turned down to form a 3/4" lip. All sub-panels shall be mounted on 3/8" - 16 standoff studs per NEC and UL-508. Gasket to seal between all outer doors and enclosure shall be self gripping to the flange around door opening in enclosure. Gasket shall be made of EPDM material with wire reinforced base - EMKA #1011-05, or self-adhesive neoprene (PSA type, no retainers), or pre-approved equal.

Section #1 shall have a drip shield and an exterior door hinged from the left hand side with full length continuous stainless steel hinge welded to enclosure and a white painted steel inner sub-panel. A section of the back of section #1 shall be cut out allowing access to section #2, when the sub-panel of section #1 is removed. The cut out section shall be approximately 38" X 10" to provide a 1" stiffening perimeter around section 1 and adjacent side of section #2 for enclosure stability. Exterior door shall have full length stainless steel hinge welded to enclosure. Door held shut with three-point latching mechanism on interior of door and stainless steel latching padlockable handle on exterior of door. Section shall be open bottom construction with 2" x 2" x 1/4" (304) stainless steel angle iron frame around inside bottom opening. Provide stainless steel drip shield for section T.I.G. welded continuously along top and sides. Bottom of door shall be 8" above bottom of enclosure. Two pieces of formed 14 gauge T304 light channel welded open face towards top, shall be mounted to the interior top of section running from front to back (used to mount fluorescent light). Spacing shall be 11 7/8" center to center. A full size inner door shall be mounted 2.5" from outer door with continuous hinge on left side of door. Inner door held shut with single point latch/knob EMKA #1000-U78 AND CAM #1000-50.

Section #2 shall be a single door stainless steel NEMA 3R enclosure with stainless steel drip shield T.I.G. welded continuously to enclosure along top and sides, steel sub-panel painted white. Exterior door hinged from the left hand side shall have full length continuous stainless steel hinge welded to enclosure, and be able to be opened more than 90 degrees. Outer door held shut with three-point latching mechanism on interior of door and stainless steel latching padlockable handle on exterior of door. A section of each side of section #2 shall be cut out allowing access to section #1, and section #3, when the sub-panel of section #1 and section #3 is removed. The cut out section shall be approximately 38" X 10" to provide a 1" stiffening perimeter around side of section #1, 2, and #2, 3 for enclosure stability. Two pieces of formed 14 gauge T304 light channel welded open face towards top, shall be mounted to the interior top of section running from front to back (used to mount fluorescent light). Spacing shall be 11 7/8" center to center. Front of this exterior door shall be flush with sections 1 and 3.

Section #3 shall have a drip shield and an exterior door hinged from the right hand side with full length continuous stainless steel hinge welded to enclosure and a white painted steel inner sub-panel. A section of the back of section #3 shall be cut out allowing access to section #2, when the sub-panel of section #3 is removed. The cut out section shall be approximately 38" X 10" to provide a 1" stiffening perimeter around section #3 and adjacent side of section #2 for enclosure stability. Exterior door shall have full length stainless steel hinge welded to enclosure. Door held shut with three-point latching mechanism on

interior of door and stainless steel latching padlockable handle on exterior of door. Section shall be open bottom construction with 2" x 2" x 1/4" (304) stainless steel angle iron frame around inside bottom opening. Provide stainless steel drip shield for section T.I.G. welded continuously along top and sides. Bottom of door shall be 8" above bottom of enclosure.

A hole 10 11/16" wide x 7 3/16" high shall be cut in the exterior door to provide a space for a window to be mounted. The center of this cut-out shall be 12 1/4" from the top and 8 3/4" from the right side of section #3. Mount Electromate window #E-PWK95NFSS in this hole.

Intrusion switch mount: A piece of metal 3" x 3" shall be installed for exterior doors in section 1, 2 and 3. Metal shall hang vertically from top of enclosure and run front to back. Metal shall be mounted in door opening 6" from side opposite hinge. Front edge of metal shall be 4" back from exterior door.

Section #1 shall be used as an entrance point from beneath the concrete mounting pad for:

- i. Below ground pump, control, and flow meter conduits coming from the valve chamber.
- ii. Below ground antenna alarm coax conduit running from the antenna pole.
- iii. Below ground phase converter conduit, if using external converter option.

Section #3 shall be used as an entrance point from beneath the concrete mounting pad for incoming power from the utility.

- b. Power Distribution Block: Provide a main power distribution block sized for incoming power to the panel, and other power distribution blocks as required. Each pole of the block shall be supplied with a clear cover for operator protection. Power distribution block shall be Ferraz Shawmut series 63000, 67000, or 69,000, ABB, Mersen, or equal, as required.
- c. Phase Monitor: Where three-phase motors are controlled, provide a plug-in or base-mount style phase monitor designed to monitor phase loss, under voltage, and phase sequence with a SPDT contact to interrupt all control power in the event of phase loss. Phase monitor shall be supplied with fused protection of the three phase sensing circuit. Phase monitor shall be Diversified Electronics SLU series, Symcom or approved equal. Fuseholder shall be three-pole Ferraz Shawmut USM\_3 series, or approved equal. Fuses shall be fast-acting Ferraz Shawmut ATM series, or approved equal.
- d. Surge Suppression Device: A surge arrester shall be provided and connected to the incoming power distribution block or externally to the incoming power disconnect. The SPD shall be sized to incoming power and shall be provided in addition to the SCADA SPD. Surge suppressor shall be as manufactured by Innovative Technologies, Surge Suppression Incorporated, Cutler-Hammer,

Eaton, Atlantic Scientific, or approved equal. A contact closure indicating SPD failure shall be connected to the SCADA system.

- e. Power Conditioning: Control systems utilizing microprocessor technology shall have power conditioning for incoming power to these pieces of equipment. The power conditioning equipment shall be Amber Industries model AI-102A-CM or Islatrol model IC+102. The TELEMETRY UNIT, at a minimum, shall be protected by this surge suppressor.

The following equipment, at a minimum, shall be protected by this surge suppressor (where applicable):

- i. Intrinsically safe relays
- ii. Level display/process controller
- iii. Solid state starter 24 VDC power supply
- iv. PLC
- v. Telemetry Unit
- vi. Flow Meter

- f. Circuit Breakers: All pump station control panels shall be provided with a minimum 100-amp service.

Provide individual, properly sized, thermal-magnetic circuit breaker for each motor. Combination circuit breaker and overload mechanism shall not be allowed. Circuit breakers for motors and other loads shall have a minimum rating of 14,000 AIC (480 vac breakers).

Provide 1-pole, 15-amp circuit breakers for the following loads:

- 1. Control circuit
- 2. Panel GFI receptacle, condensation heater, service lights

- g. Interior Service Light: Incandescent light fixtures shall not be acceptable. Provide 15 watt interior fluorescent service light(s) w/ safety lens fastened to the inside top of the enclosure with integral "Off-On" control. Light(s) shall be mounted without penetrating the panel outer skin with screws or fasteners in enclosure Sections #1 and #2.

- h. Motor Starter: A magnetic across the line horsepower/current rated motor contactor with ambient temperature compensated overload relay shall be provided for each motor load served that is less than 20 H.P. Contactor shall be Cutler-Hammer CE 15 Series, Eaton XTC Series, ABB Series A, or approved equal. Overload relay shall be Cutler-Hammer #C316, Easton XTO Series, ABB Series TA or approved equal.

Pumps 20 HP and larger shall be supplied with soft starters and or VFD's with bypass contactors. Solid state starter shall be Cutler-Hammer IT series with line side surge protector, PST series, Danfoss or approved equal.

If VFD's are used, (VFD) rated for 50 degrees C operation shall be supplied for each motor as required. VFD's shall be provided with 6-year manufacturer's

warranty, including component failure and surge damage to the VFD. VFD shall be Danfoss VLT Aqua series or pre-approved equal. An appropriately sized air condition shall be provided for VFD's that are installed in an exterior control panel.

- i. Transformer: If 120 volt, single phase is not available, a minimum 5 KVA, dry-type transformer shall be supplied with primary and secondary circuit breaker protection. Control power shall be 120 volt. Control circuit shall be connected so that a power outage of any duration does not require manual re-start of system.
- j. Receptacle: Provide a 15-amp G.F.I. duplex receptacle connected to a separate circuit breaker, and mounted on the control panel inner door.
- k. Condensation Heater: Provide a 100 watt, 120 vac silicone rubber self-adhesive condensation heater mounted on a flange with integral 40° F. thermostat. Heater shall be Watlow #020100C1-EV11B, or equal. Heater(s) shall be mounted in enclosure Sections #1, #2, and #3. If VFD's are used, approx. 800 watt heater shall be provided in VFD section of enclosure.
- l. Fuseholders and Fuses: Provide a fuse for the control circuit, minimum rating 5 amps (ampacity not to exceed relay contact rating). Fuseholders for control fuses shall be fingersafe with neon light indication for a blown fuse. Control fuse fuseholders shall be Gould USM\_I series, or approved equal. Control fuses shall be Ferraz Shawmut TRM series or equal for 250 vac and under. Circuit breakers may be used in lieu of fuses.
- m. Terminal Blocks: Numbered terminal blocks shall be supplied for all field terminations. Current capacity of terminal strips shall be equal to the load served. Terminal blocks shall be suitable for minimum 12 AWG wire at not less than 300 volts. Terminal blocks for control interface shall be Entrelec model 115116.07, Curtis 2PSWTC, PWH or approved equal.
- n. Time Delay Relays: Time delay relays shall be dial or DIP switch selectable, and shall have contact ratings of not less than 5 amps. Switch settings shall be labeled on the relay. Time delay relays shall be Diversified Electronics TB series, Finder series 85, or approved equal.
- o. Relays: Relays shall be general purpose plug-in relays with standard mounting configurations. The relays shall have the number of poles as shown on the drawings with neon indicating lamp and test button integral to each relay. Relay contact ratings shall be minimum 10 amps. Control relays shall be Finder series 55, or equal.
- p. Alternator: Provide an automatic electronic alternator for alternating pump operation on successive automatic cycles. Relay shall incorporate LED position indicators and a toggle switch to select pump #1 or pump #2 as the lead pump, or to allow automatic alternation. Alternator shall be Diversified Electronics AR series, Symcom, or approved equal. Alternation may be accomplished via intrinsically safe pump controller in lieu of dedicated alternator.

Intrinsically Safe Relays:

- i. Relays provided for float level sensors shall be the intrinsically safe type, and shall be properly barriered from other system components. Intrinsically safe devices within the panel shall be mounted and wired in accordance with NEC, Article 504, with all required voltage barriers in place. Submittals should indicate the relative position of all such components and the panel manufacturer's recommended area for conduit entrances for power and intrinsically safe wiring. Contractor shall adjust the conduit arrangement entering the enclosure and the terminal box below to coincide with the panel manufacturer's recommendations, if necessary, to ensure that power and intrinsically safe wiring remain separated and do not cross. Alternation function and lead select capability shall be included in intrinsically safe relay controller, where possible.
  - ii. Intrinsically safe relay controller shall be Diversified Electronics ARM series, Symcom ISS-105, or approved equal, as pertains to the quantity of pumps being controlled.
- q. Selector Switches: Selector switches shall be 30 mm oil tight type with lever operators and 10 amp contacts. Knob operators will not be accepted. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 vac and 10 amps. Control switches shall be Cutler-Hammer Series E34 or equal. Contact blocks shall be Cutler-Hammer type 10250T. Provide selector switches for the following functions (per pump where applicable):
- |                      |                |
|----------------------|----------------|
| Pump "Hand-Off-Auto" | Three-position |
|----------------------|----------------|
- r. Pilot Lights: Pilot lights shall be push-to-test, oil-tight industrial units utilizing 120 volt bulbs (unless otherwise specified). Lenses shall be colored as shown on the drawings. Control panel lights shall be modular construction as manufactured by Cutler Hammer E34RPB\* or approved equal. Contact blocks shall be Cutler-Hammer type 10250T. LED type lights will not be acceptable. Provide pilot lights for the following functions (per pump where applicable):
- |                |       |
|----------------|-------|
| Pump Run       | Green |
| Pump Seal Fail | Amber |
| Pump Fail      | Red   |
- s. Elapsed Time Meters: Provide an elapsed time meter for each pump controlled. Meter shall be 6-digit, non-resettable, reading in hours and tenths of hours. Elapsed time meter shall be Fourth Dimension, ECC, or equal.
- t. Seal Fail Relay: Provide a conductance actuated moisture sensing relay for each submersible pump controlled with field adjustable sensitivity. Seal Fail Relay shall be Syrelec/Crouzet model PNRU110A, Diversified Electronics, SymCom, or approved equal.



- u. Ground Buss/Lugs: Provide a ground lug sized for incoming power ground near the power distribution block. Provide a ground lug sized for pump ground near pump power wire terminations. Provide a ground buss for control equipment grounding, minimum 6 termination points.
- v. Wiring: Power distribution wiring on the line side of panel fuses or circuit breakers shall be sized for the load served, minimum 12 AWG. Control wiring shall be minimum #16 gauge switch board wiring type stranded wire for internal control panel circuits. All control wires shall be numbered at each termination corresponding to the master wiring diagram with clip-sleeve or heat-shrink type wire markers. Wrap-on or adhesive wire markers shall not be allowed. 120 vac wiring (except for neutrals) shall have red insulation. 120 vac neutral wiring shall have white insulation. 50 vac or less shall have yellow insulation. 12/24 vdc wiring shall have blue insulation.
- w. Nameplates: Provide adhesive backed printed labels for all internal devices such as contactors, circuit breakers, and relays. Labels shall be adhered to the subpanel. No labels shall be adhered to wire cover. Provide engraved phenolic nameplates, with black letters on white background, for door-mounted devices such as selector switches, push-buttons, circuit breaker toggles, and pilot lights. Nameplates shall be secured firmly to the panel.
- x. Entry Switch: An entry switch shall be mounted in the panel, which will close a contact wired to the telemetry unit when the exterior door of the enclosure is not closed. Switch shall be HoneyWell-MICROSWITCH #1AC2, or equal.
- y. Telemetry Unit: Each pump station shall have a Motorola ACE RTU conforming to the City's existing system. All hardware components for the RTU shall be supplied, installed, and programmed as an integral component of the control panel. The City's SCADA system operates on 159.600 MHZ utilizing a Motorola MOSCAD Central Station Transceiver for interrogation and acknowledgement of alarms.

The following telemetry equipment shall be supplied in the control panel, unless otherwise indicated:

- (1) Motorola-ACE RTU with 20 watt conventional radio
- (1) Mixed I/O Card (4 AI, 16 DI, 4 DO), Motorola #V245 OR 16 DI Card, Motorola #V265
- (\*) Other I/O cards as required to meet this specification
- (1) 6.5 AH battery, Motorola #V261
- (1) Coaxial Surge Arrestor, Polyphaser #IS-50NX-C2-ME

The following telemetry equipment shall be supplied loose for installation by the electrical contractor:

- (1) Antenna: A radio antenna with N-connection shall be supplied, utilizing antenna types as appropriate for the site at which the antenna is located. Antenna shall be capable of being mounted to

a 1.5" to 2.5" diameter mast. Acceptable types are omnidirectional and yagi. Antenna shall be as manufactured by Decibel, Comtelco, or equal, as recommended by radio manufacturer.

- (1) Antenna Mast: See Section 405.10.b.
- (\*) Coaxial Cable Type RG213/U: Belden #8267, Laird #LMR-400/Belden #9913 or equal, quantity as required\*.
- (\*) Coaxial cable connectors: RF Industries #RFN-1002-1S (Male), #RFN-1024-1 (Female), Andrew 400APNM-C (male) or 400APNF-C (female) quantity as required\*.
- (1) Cold Shrink: 3M #8425-8 (or as required for coaxial cable size)

z. Flow Meter:

- i. For lift stations with pump's that are 25 hp and greater, provide a flow meter with 4 – 20 mA transmitter providing instantaneous flow indication for installation by the Contractor. Flow transmitter shall be mounted in the control panel, mounted to the subpanel, or on bracket for wall-mount installation by the Contractor (if in building). Where the flow transmitter is installed separately from the flow tube, two types of cable (standard cable and special cable) shall be supplied for installation between the flow tube and flow transmitter. Where the flow tube is to be installed in an area where it may become wet or submerged (such as in a metering vault), a submersible kit shall be provided and installed by the Contractor after wiring terminations are complete.
- ii. Equipment shall be as manufactured by Siemens, series 5000, or approved equal.
- iii. Provide equipment for the following flows:
  - a. Station Flow

**405.2.4 Software Programming/Start-up Services.** All programming and start-up services shall be included and completed by the Systems Integrator, such that the MOSCAD in the control panel communicates all information as specified to the central MOSCAD, and that the information is displayed in the computer central and other SCADA network computers. It shall be the responsibility of the Systems Integrator to obtain/update the radio frequency license(s) necessary for the installation and successful operation of the SCADA site.

**405.2.5 Documentation.**

- a. Submittals: A master wiring diagram for the control panel(s) shall be submitted for City review and approval before beginning construction. This diagram shall be drawn in standard ladder logic format. All ladder rungs shall be numbered in the left hand margin, and all relay contacts referenced to these numbers in the right hand margin. Each electrical node in the control schematic shall have a different wire number. A bill of materials and a layout drawing of the enclosure and inner door layout components shall appear on this drawing with a listing of nameplates pertaining to the components. Included in the submittal package

shall be data sheets of all equipment used in the control panel, as listed in the bill of materials. Submittal drawings may be on 11" x 17" paper.

- b. As-Built Drawing: Final As-Built drawings shall be on full-size 17" x 22" or 24" x 36" paper, as required. A waterproof reduced copy of the master "as built" wiring diagram shall be laminated in clear plastic and permanently fastened to the inside of the panel door. A full-size as-built drawing shall be placed in the panel.

#### **405.3 Power Requirement/Phase Convertor.**

- a. There are two possible avenues for the electrical distribution at the pump station. First, is the Ameren-UE/Cuivre River Electric supplied 3 phase source which is preferred, and the other is the Ameren-UE/Cuivre River Electric supplied single-phase source.
- b. All pumps will operate using 480 VAC three phase power.
- c. Any site requiring a total three phase station load in excess of 50 HP will require Ameren-UE/Cuivre River supplied three-phase power.
- d. Any site requiring a total three-phase load less than 50 HP may use a phase converter design upon approval of the City. Approval of such a system will be based on the cost analysis presented by the designer/owner, with approval granted on a case-by-case basis. The analysis shall compare the cost and feasibility of having three-phase power brought onto the site, as compared to the use of a phase converter. The Ameren-UE/Cuivre River Electric three-phase power shall be used unless installation costs overwhelmingly justify the use of the phase converter. If a converter is to be used, submitted plans shall detail the converter installation. The converter shall be sized to meet the load demand of the station, supplied in a NEMA 3R aluminum enclosure and installed external to the control panel by the electrical contractor.

**405.4 Alternate Backup Power Supply and Transfer Switch.** When an alternate power supply is required, the following shall be the minimum requirements:

- a. An alternate power supply may be provided through service from a alternate electrical supplier (Ameren-UE or Cuivre River Electric), or by service from one supplier via two separate primary feeds.
- b. If an alternate power supply is not available, then a backup power supply shall be furnished by way of a Diesel Generator system. This system shall meet the following requirements:
  - 1. Generator shall be designed and built at ISO 9001 certified facility.
  - 2. Generator system shall be fully factory tested to design specifications.
  - 3. Size of generator shall be such that the current and future loads at the lift station can be satisfied, without causing an overload of the generator. Unit should be able to supply 10 percent overload power for 1 hour in 12 hours.

4. Generator shall come equipped in a heavy duty sheet steel weather protective enclosure, with lockable hinged doors.
5. Generator that shall be capable of starting under all weather conditions.
6. Generator shall be furnished with LCD display, AC metering, DC metering, Fail to stat shutdown, low oil pressure shutdown, high engine temperature alarm, low/high battery voltage, underspeed/overspeed, loss of engineer speed detection, 2 spare fault channels, 20 event fault log, 2LED status indicators, lockdown emergency stop push button.
7. Generator shall be furnished with a digital control panel, which enables local or remote operation of unit, as well as automatic operation during a power outage from the primary power source. An integral power transfer switch shall be furnished to allow for an automatic switching of power, when the primary power source is lost during lift station operation.
8. Sound levels shall not cause existing City Codes to be exceeded at property lines.
9. A submittal shall be made showing all features included for approval by the City.

Acceptable manufactures: Kohler, Onan, Caterpillar or approved equal.

**405.5 Station Interior Wiring.** The following electrical requirements shall be followed for wiring installed in the station interior:

- a. Wet well level control float leads shall be hung with stainless steel kellum grips from a series J Halliday stainless steel cable holder. The bracket shall be bolted to the inside of the wet well hatch, immediately below the hatch cover. The bracket shall be located so as not to interfere with the pump chamber entrance steps. Pump power cables shall be hung by separate series J Halliday stainless steel brackets. All wires shall be neatly passed from the bracket to the 4" PVC raceway. Excess wire shall be rolled up and left inside the valve chamber.
- b. Passage of the pump and float wires from the pump chamber to the valve chamber shall be made through the open ended length of a 3" and 6" PVC conduit installed between the valve and pump chamber. The 3" PVC conduit shall convey the low voltage wires and the 6" PVC conduit shall convey the high voltage wires. The annular space of the conduit between the pump and float wires shall be sealed using Ryachem Rayflate duct Sealing System RDSS, Polywater FST Duct Sealant, or approved equivalent.
- c. There shall be no electrical connections made in the pump chamber. All wiring shall run unbroken from the pump chamber to the valve chamber through the 3" and 6" PVC raceways and terminated at a properly sized terminal board inside of two provided 16" x 14" x 6" stainless steel hardware, NEMA 4X Nonmetallic, watertight junction boxes.

Acceptable Manufacturer: General Electric Enclosure #VJ1614HWLL2 or approved equal.

- d. Valve chamber junction box connections are to be made with plastic rubber gromited portable cord connectors Thomas & Betts #2521.

- e. All wiring in the valve chamber shall be routed and fastened securely along the chamber walls with non-corrosive wire straps and fasteners.

**405.6 Check Valve Pressure Switch Wiring.** Wiring from the pressure switches shall be #18 AWG STO portable cord. Thomas & Betts #2521 portable cord connectors shall be used on the switch end as well as the junction box end of the wire. The cord shall be neatly routed along the discharge pipe with ties, to the chamber joining walls and then run along the walls to the junction box.

**405.7 Field Wiring Specifications.** Control panel wiring shall be as follows:

- a. All wiring installed on the line and load side of the electric meter shall be THHN insulated copper wire.
- b. Electric service to the station shall be sized to provide the maximum total station amperage with all installed pumps running under a fully loaded condition.
- c. All pump station control panels shall be provided with a minimum 100 amp service.

**405.8 Conduit specifications.** The following conduit sizes are to be used on any combination of pumps with a total station power requirements of less than 60 HP. For larger HP stations, the proposed conduit sizes shall be approved by the City.

- a. A 2 1/2" conduit shall be used to run from the power supply to the electric meter and through the disconnect mounted in control panel section #3.
- b. A 2" conduit shall be used to run all pump cord wires from the bottom of section #1 in the control panel, to the back of the junction box in the valve chamber.
- c. A 1" conduit shall be used to run all flow meter from the bottom of section #1 in the control panel, to the valve chamber.
- d. A 2" conduit shall be used to run all phase converter wires between control panel and phase converter, if phase converter is required and supplied external to the control panel.
- e. A 2" conduit shall be used to run all float wires from the bottom of section #1 in the control panel, to the back of the junction box in the valve chamber. A separate 1" conduit shall be used to run non-intrinsically safe wiring to the control panel.
- f. A 1" conduit shall be used to run the antenna coax from beneath the antenna pole to section #1 of the control panel.
- g. All conduit running to or from the control panel, shall be run underground at a minimum depth of 18 inches below finished grade.

- h. All below ground conduit and fittings shall be PVC schedule 80 conduit, unless a phase converter is utilized, then the conduit shall be PVC coated rigid steel including all fittings and transition points.
- i. Gas and water seal all electrical conduit between wet well and valve vault, and between the valve vault and the control panel, using a silicone seal.

**405.9 Control Panel Mounting.** The station pump control panel shall incorporate the pump controls, alarm system and incoming utility power into one pre-fabricated stainless steel structure. The panel shall be placed as follows:

- a. The control structure shall be set on a 4" thick poured concrete pad reinforced with 8 gauge, 6"x6" welded wire mesh. The concrete shall be laid over a well-compacted 4" thick stone base.
- b. The pad shall be poured next to the pump station, shall be located in accordance with the approved plans. Pad dimensions shall be a minimum of 6'x11'x4" thick.
- c. Conduits shall be run into the power supply cabinet from beneath the structure.
- d. The panel shall be centered on the concrete pad and be set 4" in from the rear edge of the pad.
- e. Prior to setting and securing the panel to the concrete mounting pad, a strip of 2"x1/4" solid rubber gasket material shall be placed against the bottom angle iron frame to create a seal between the concrete mounting pad and the panel bottom.
- f. A minimum of four (4), Hilti Qwik bolts shall be used to secure the panel to the concrete pad.

**405.10 Telemetry Equipment Installation.** The following specifications shall be used for installation of the pump station telemetry equipment:

- a. Antenna:
  - 1. The minimum acceptable transmission strength shall be determined as +20 db. above the threshold of the closest satellite receiver.
  - 2. The antenna azimuth shall be in the direction of the nearest satellite receiver  $\pm$  15 degrees.

The actual working antenna height is to be determined by the Systems Integrator. The minimum height allowable per City is 10' from finished grade. If the 10' height does not provide for an adequate and functioning system an alternative design must be submitted for approval by the City.

- b. Antenna Mast: Antenna mast type should be determined from the following two options based on site conditions along with concurrence from the Engineering Division:

1. Fiber Glass Pole Option. The antenna shall be mounted a minimum of 20' from finished grade on a minimum 24' long fiberglass street light type pole. The pole base shall be set 4' below ground with 4 ½' deep and 1 ½' round concrete base poured around it. The pole must be installed so that it is vertical + 1 degree. The top of the pole shall be sealed against water penetration with a cover cap. All antennas must be protected by a grounding rod installed at the base of the tower. Grounding rod length shall follow national electric code requirements.
2. Metallic Pole Option. Stainless steel or aluminum heavywall conduit firmly secured at a minimum of at least two points along the length of the pole may be used. Pole shall be mounted to stainless steel strut on back of control panel enclosure section. Mast shall extend about 10 feet above panel.

Antenna poles shall be installed to the rear of the control panel as indicated on the control panel drawings.

- c. Coaxial Cable: The radio coaxial cable is to be run in one continuous length with no splices. The coax shall be terminated at the antenna connector on one end and a lightning arrestor on the other end. Another cable shall be connected from the Polyphaser to the connector on the outside of the radio cabinet as indicated on the approved plans. All R.F. cable connectors outside of the radio cabinet shall be properly terminated and sealed with 3M Cold Shrink.

#### **END OF SECTION**

## SECTION 406

### Station Paving, Fencing, and Other Requirements

**406.1 Description.** This section covers the paving of the area around the pump station as well as the access road to the pump station site, site fencing, entrance road barrier & yard hydrant. SCD's 400.01, 400.02, 400.03 & 400.04 should be used as a guide, in addition to the approved plans for layout of required pump station site improvements.

#### **406.2 Paving**

- a. Pump Station Area: All pump and valve chambers shall have a 6' (minimum width) paved apron placed around the pumping structures. The pavement shall be sloped so as to permit surface water to drain away from the station. Pavement shall extend a minimum of 1 foot beyond the fence perimeter.
- b. Pump Station Access Road: Any pump station located farther than 7' from the center of the wet chamber to the edge of a service road shall have a 12 foot wide paved access road provided to the station. The access road shall:
  3. Be designed to limit the access road grade to a 10% maximum.
  4. Protection barriers will be required.
  3. Have a turn around area at the station end of the access road large enough to accommodate a 16 foot service van when:
    - i. The access road exceeds 75' in length.
    - ii. The access road exceeds a 3% grade.
    - iii. The access road does not travel to the pump station in a straight line.
  4. Shall have a platform located at the entrance to the pump station, a minimum length of 20 feet, which should not exceed a slope of greater than 2%.
  5. If the access road is not constructed in a straight line, and there is a turn around area, the minimum radius of curves should not exceed 32 feet, measured on the inside of the pavement.

The centerline of the entrance road should bisect the gated entrance, valve and wet pit structures. Should this type entry not be feasible for a particular site, the closest structure to the gate and road will be the wet pit.

- c. Pavement Specifications: Pavement design may be either asphaltic concrete or Portland Cement Concrete, as specified hereafter.
  1. Asphaltic concrete: The access road and area surrounding the station shall be paved with 2" of type "C" asphaltic concrete laid over 6" of type "X" asphaltic concrete, on a 6" compacted crushed limestone base.



2. Portland Cement Concrete: Concrete pavement shall be Class A 6" thick, six sack mix with a maximum 4" slump. Pavement shall be reinforced with 8 gauge, 6 x 6 welded wire mesh. The concrete shall be laid over a well compacted 4" stone base.

#### **406.3 Fencing**

- a. General Requirements: Fencing shall be located around the pump station so that:

1. There should be a minimum 4' space between all auxiliary pump station equipment, panels, alarm poles, etc. and the perimeter fence.
2. The access gate shall be located so that hoisting or cleaning equipment can easily access the valve and wet pit chambers.

- b. Materials:

1. Wire fabric for the fence shall be brown or green vinyl clad 6' high chain link fabric. Wire shall be No. 11 gauge woven in a 2" mesh. Fencing shall not be barbed.
2. All post and other appurtenances used in the construction of the fence shall be green or brown vinyl clad schedule 40 steel pipe. All posts shall be equipped with tops. Fiberglass fencing components will not be acceptable.
3. A 12' wide entrance gate and service gate will be provided for access to the station grounds.
4. Poles shall be sized and set as follows:

<u>TYPE</u>	<u>SIZE</u>	<u>PULL</u>
Top Rails & Brace	1 ¼" Nominal (1.66" O.D.)	2.27 lb./ft.
Line Post & Gate Frame	1 ½" Nominal (1.9" O.D.)	2.72 lb./ft.
End corner or Pull Post	2" Nominal (2.375" O.D.)	5.79 lb./ft.
Gate Post	3 ½" Nominal (4" O.D.)	9.11 lb./ft.

#### **CONCRETE BASES:**

<u>TYPE</u>	<u>DIAMETER</u>	<u>DEPTH</u>
Line Post	12"	3' 6"
End Corner Gate	16"	4'
Pull Post	16"	4'

Poles shall be set in the concrete bases so that the pole bottom rests 6" higher than the concrete base bottom.

5. Horizontal support bars shall be installed half way between the top rail and the ground on all fence sections.
6. A #7 tension wire shall be installed at the bottom of the fencing fabric and stretched taught enough so as to not allow the bottom of the fencing fabric to be lifted away from the fencing poles and/or ground.
7. Privacy slats shall be installed in all fence sections, with color to match that of the fencing material.

**406.4 Entrance Road Barrier.** All stations requiring entrance roads shall have two 36" tall removable bollards installed at the road entrance. Removable posts shall not exceed 40 pounds in weight. Post holes shall be stainless steel and locking. The post hole cover shall be flush mount when the post is removed. For safety purposes, a 4"x12" reflective plate shall be attached to the chain at the span center.

Acceptable manufacturer and model: Trafficguard Locking Round Post Lock Series [RPL4] Bollard or approved equal.

**406.5 Yard Hydrants.** All stations shall be equipped with a Freezless Yard Hydrant as shown on SCD 502.11, located as shown on SCD 400.01. Installation shall include the installation of a 1" meter setting, and necessary length of 1" Type "K" Copper Service line to the Yard Hydrant.

**END OF SECTION**

## SECTION 407

### Testing and Acceptance Procedures

**407.1 Testing.** Before final approval of or acceptance of any pumping station facility by the City, there shall be a field inspection made by the City. The field inspection shall show that such works have been installed and constructed in accordance with the plans, designs and specifications approved by the City before the start of the construction. The Developer and Contractor are responsible for verifying the pump station is ready for each stage of inspection.

However, operation and maintenance of any private, semi-public or industrial pumping station shall be subject to inspection by the City.

Inspection of the pump station structure, gravity system, force main, internal piping, pumps, electrical and all pump station related appurtenances shall be coordinated through the Engineering Division's construction personnel.

Representatives from the pumping equipment manufacturer and the installing electrical contractor shall be present at the pump station site for final inspection and start up with the Engineering Division.

Upon completion and prior to acceptance of the installation, the Contractor shall subject the pumping equipment to such operating tests as may be required by the City to demonstrate satisfactory performance of the equipment to meet these specifications. If tests do not demonstrate satisfactory performance of the equipment, deficiencies shall be corrected.

Since sufficient wastewater to test the pump will probably not be available when the test is scheduled, the Contractor shall arrange to obtain water from the public water supply for the test. The minimum quantity of water to be pumped for the test is equivalent to 1.5 minutes of continuous pumping at rated pump capacity for each pump operating alone. Each pump shall be tested a minimum of two times.

Final inspection shall be arranged through the Engineering Division. Pump stations shall only be considered as acceptable by the City upon written confirmation by the Engineering Division's construction personnel. The City will assume operation and maintenance only after 100% acceptance.

The pump shall be tested at start-up with the voltage, current and other significant parameters being recorded. The manufacturer shall provide a formal test procedure and forms for recording data. The recorded data shall be submitted to Engineering Division in conjunction with the as-built electrical schematics before the pump station inspection is called for.

The radio shall be activated by a reputable Systems Integrator familiar with the MOSCAD System. After activation, a full service report shall be provided that is signed off by the Systems Integrator.

The City shall be notified a minimum of three days before activation to incorporate it into the system. The radio system will not be accepted unless activated and demonstrated completely with City personnel present.

**407.2 Final Acceptance.** Within thirty (30) days after the final inspection and acceptance of the pump station by the City, the following documentation must be submitted to the City of Wentzville.

1. Four sets of as-built schematics
2. A copy of all utility account numbers, and street address of property.
3. Stamped as-built survey of the pump station site and any station access areas, providing certification that all structures, grounds and roads have been located within the bounds of the recorded easement.
4. Letter of completion from the installing paving contractor, guaranteeing all pavement and pavement sub-surfaces to be installed per approved plan specifications.
5. A complete set of as-built drawings in AutoCAD format(.dwg) shall be supplied on 3.5 inch and CD media.

Four sets of as-built plans shall be forwarded to the Pump Station Division. One set of 11"x17" control panel schematics shall remain on site laminated to the inside of the control panel exterior door.

**DIVISION 500  
WATER MAINS**

**SECTION 500**

**General Requirements**

**500.1 Location.** Water mains shall be laid and fittings, valves and fire hydrants shall be placed in accordance with the approved plans. Standard Construction Detail (SCD) 500.01 provides a detail of standard utility locations. Gas, water, and other underground utilities shall not conflict with the depth or horizontal location of existing and proposed sanitary and storm sewers including sanitary laterals. Water mains shall be located 5 feet behind the street curb unless otherwise shown on the approved plans. All water mains shall have a minimum of 42 inches of cover.

**500.2 Water Main Easements.** All water mains shall be constructed in Public Right of Way, or in easements granted to the City of Wentzville, and as shown on the approved set of improvement plans. Mains installed as a part of a development may record the easements on the record plat. All other water main easements will require easement documents.

**500.3 Pre-construction Meeting and Construction Permit.** No construction of water mains or related improvements or modifications shall begin before improvement plans and shop drawings, if required, are approved for construction, and a Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the City. Any construction done prior to this notice may be summarily rejected or refused without further investigation.

**500.4 Inspections.** All construction work, involving water mains, valves, fire hydrants, large meter vaults and/or modifications shall be inspected by the City of Wentzville, in accordance with the requirements contained in Section 102.9. Any work performed without inspection shall not be accepted by the City of Wentzville. The City of Wentzville shall be notified 48 hours in advance of any construction for coordination and inspections

**500.5 As-built drawings.** As-built drawings shall be required for all new construction. See Division 1100 for as-built requirements.

**500.6 Field Changes.** Small field changes may be accepted by the City Inspector. Larger changes shall require a submittal to the City for approval.

**END OF SECTION**

## SECTION 501

### Materials

**501.1 Description.** This section covers water main pipe and fittings to be furnished complete with all jointing materials and appurtenances.

Pipe shall be installed and tested in accordance with Section 502.

**501.2 Pipe.** Pipe and fittings, jointing materials, and appurtenant materials shall be shown on the drawings and as specified herein.

- a. Polyethylene Pipe: Water mains shall meet the requirements of Polyethylene (PE) Pressure Pipe and Fittings, 4 inch Through 63 inch for Water Distribution and Transmission, AWWA C906 (latest revision), and shall be DR13.5 with blue striping on the exterior. All mains up to 12 inch in diameter shall be IPS and all mains 12 inch in diameter or larger shall be DIPS. Pipe, tubing and fittings shall be homogeneous throughout, and free of visible cracks, holes, foreign inclusions, blisters, dents, or other injurious defects. The pipe, tubing, and fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.
- b. Polyethylene Pipe Fittings:
  1. Butt Fusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.
  2. Electrofusion Fittings - Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99. Electrofusion Fittings shall have a manufacturing standard of ASTM F-1055. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Electrofusion couplings and saddles may only be used with the approval of the City.
- c. Copper Tubing: Copper water tubing ¾" to 2" shall conform to ASTM B88. Tubing for water service installation shall be seamless Type "K".
- d. Polyvinyl Chloride (PVC) Pipe: Casings for water service lines shall be 2 inch in diameter, schedule 40 PVC, and shall be installed prior to street paving at locations as shown on the approved plan.

**501.3 Casing Pipe and Spacers.** All bores shall have a steel casing pipe conforming to all applicable requirements of AWWA C200-86 and AWWA M11, and if fabricated shall be constructed of A36 steel with a minimum yield point of 36,000 psi; or if manufactured shall conform to Grade B with a minimum yield point of 35,000 psi. It may be shipped in random lengths between 18 and 22 feet and shall have one end cut square and one end beveled. All

casing pipe to be joined with 360 degree welds. It shall be mill primed and coated with coal tar epoxy coating before installation. Where coating is damaged during installation, it shall be repaired and replaced by thorough brushing or scraping to sound material and applying two coats of the coating material. Steel casing pipe shall have a minimum wall thickness as indicated on the table below.

Casing Pipe Diameter	Casing Pipe Minimum Wall Thickness
6" thru 12"	0.188"
14" thru 22"	0.250"
24" & 26"	0.281"
28" thru 34"	0.312"
36" thru 48"	0.344"

The carrier pipe shall be prevented from contact with the casing pipe by means of polyethylene spacers, placed every 10 feet maximum along the carrier pipe. Closer spacing may be necessary based upon recommendations of the manufactures of the spacers. Polyethylene spacers shall be: RACI Spacers, Pipeline Seal & Insulator, Inc.; Ranger Type II, Advance Products & Systems, Inc. Model SSI or CI.

The City may approve the installation of HDPE carrier pipe, in a casing, without the use of casing spacers

**501.4 Fire Hydrants.** Fire hydrants shall conform to Dry Barrel Fire Hydrants, AWWA C502 (latest revision), and shall have the following requirements. Fire hydrants shall have a national standard pentagon operating nut, open counter clockwise, be of the "safety" or "traffic" model with breakaway flange and coupling assembly, have two (2) 2-½ inch hose nozzles with National Standard hose thread and one 4-1/2 inch pumper nozzle with National Standard hose thread, and be equipped with 5-1/4" main operating valve and a 6" mechanical joint base. All public fire hydrants shall be painted, in the field, using Industrial Enamel Alkyd Yellow B54 Y37 617 4072 by Sherwin Williams.

Acceptable manufacturers and models: Mueller Company Super Centurion 250, Kennedy K81D or approved equal.

#### **501.5 Valves.**

##### **a. Gate valves:**

1. Gate valves for water mains shall be NRS resilient wedge for buried service, conforming to Resilient-Seated Gate Valves for Water Supply Service, AWWA C509 (latest revision); 2 inch square operating nut; open left; MJ X MJ.

Acceptable manufacturer and models: Mueller Co. series 2360/2361, U.S. Pipe USP0/USP1, American Flow Control Series 2500, Kennedy Style 8000 or approved equal.

2. Gate valves for fire hydrant assemblies shall be resilient wedge gate valves conforming to Resilient-Seated Gate Valves for Water Supply Service, AWWA C509 (latest revision); 2 inch square operating nut; open left; MJ x MJ.

Acceptable manufacturer and models: Mueller Co. series 2360/2361, U.S. Pipe USP0/USP1, American Flow Control Series 2500, Kennedy Style 8000 or approved equal.

- b. Air Relief Valves: Where required, all air release valves shall conform to Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service, AWWA C512 (latest revision). Acceptable manufacturer and models: ARI Model D-040NT Air Release Valve – 2" NPT Nylon Combination Valve or approved equal.
- c. Tapping Valves: Tapping valves for water main wet taps shall be NRS resilient wedge gate valves for buried service, conforming to Resilient-Seated Gate Valves for Water Supply Service, AWWA C509 (latest revision); 2 inch square operating nut; open left; FLxMJ. Acceptable manufacturer and models: Mueller Co. series 2360/2361, U.S. Pipe USP0/USP1, American Flow Control Series 2500, Kennedy Style 8000 or approved equal.
- d. Valve Boxes: All valve boxes shall be SDR 21 or Sch 40 6" PVC water pipe. During construction the valve boxes shall extend from 2 to 3 feet above grade to remain visible to other construction trades and traffic. Once final grade has been established, the valve boxes shall be cut to grade. It shall be the contractor's responsibility to ensure the valve boxes are cut to grade. All valve boxes shall be vertical, clear of mud and debris and capped with a valve box cover. The box shall be centered over the 2" valve operating nut. Valve boxes shall have a cast iron top and cover of the "top hat" style, labeled "WATER". Trace wire shall be extended up the outside of the box, and then "tucked" under the "top hat."

#### **501.6 Tapping Sleeve.**

- a. Tapping PVC, DIP or AC pipe: Tapping Sleeves shall be manufactured from all stainless steel group 18-8, material 304 including sleeve, outlet neck, outlet flange, and all bolts and nuts; top of shell shall be a minimum of 11 Ga. plate and bottom of shell shall be a minimum of 14 Ga. plate; seal to be full circumferential gridded and approved for potable water; flanged outlets shall be indexed per MSS-SP 60 to accept tapping valves with an ANSI 150 lb. drilling IAW AWWA C207; neck to accept full sized cutter.

Acceptable manufacturers are: Mueller Company; Smith-Blair; Ford Meter Box or approved equal.

- b. Tapping HDPE pipe: Tapping Sleeves shall be manufactured from HDPE material, rated for hot fusion connection to HDPE pipe, and wet tap of main. Stainless steel or other non HDPE material tapping sleeves shall not be used when tapping HDPE C906 Polyethylene main. Electrofusion couplings and saddles may only be used with the approval of the City.



**501.7 Restraints.** Mechanical joint fittings shall be restrained by a device, which consists of multiple individually activated gripping surfaces built into a mechanical joint follower gland. Device shall be manufactured from ductile iron conforming to ASTM 536.80. The restraining device shall be such that it can replace a standardized mechanical joint gland and can be used with any standard mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and to ANSI/AWWA C153/A21 of the latest revision. The device shall utilize torque sensitive, "twist off nuts" that shall be incorporated in the design or the wedge activation screws to insure proper torque. The restrained device shall have a published working pressure rating 350 PSI in sizes through 16" and 250 PSI above 20".

This type of restraint is only suitable for use on DIP or PVC pipe. When connecting to HDPE pipe, the use of standard MJ Adapter with a Ductile Iron MJ gland, is the only acceptable method for connecting from HDPE pipe to valves and/or fittings.

Acceptable manufacturers and models: Restraint device for mechanical joints shall be Uni-flange series 1500 manufactured by the Ford Meter Box Company of Wabash, Indiana, or 2000 series Megalug Manufactured by EBAA Iron Sales, Inc. of Eastland, Texas or approved equal.

**501.8 Tracer Wire.** A coated number 12 AWG copper tracer wire shall be installed the entire length of the water main as per SCD 502.01. The tracer wire shall be run up the outside of all valve boxes and tucked under the lid, and shall be run inside all air release valve vaults, and shall continue through the vault. A minimum of 5 feet of wire should be neatly coiled inside vault, for connection to tracing equipment, as shown in SCD 502.07.

Any project with over 1500 feet of pipe shall use a 2500' roll of tracer wire. 3M splice kits shall be utilized for all tracer wire splicing.

Any project where fire hydrants, or valves, are over 600' apart, tracer wire with a connecting box must be installed every 500'. The connecting box will be either a standard valve box, to be used in improved areas or a Carsonite Scepter Telecommunications Test Station, as shown in SCD 500.03, with white post and cap made of Lexan material, for use in unimproved areas.

**501.9 Concrete.** All concrete work shall meet ASTM Standards C150 (type 1), C260, and C33. Concrete shall be Class A, 6 sack mix, with a maximum 5-inch slump, 3,000 psi minimum compressive strength in 28 days.

**501.9 Undercoating.** All main line fittings t-bolts and nuts shall be sprayed with rubberized undercoating. All bolts and nuts that come pre-installed with gate valves shall also be sprayed with rubberized undercoating. Undercoating shall be a rubberized protective spray coating to protect bare metal surfaces from corrosion and moisture. Acceptable manufacturers and models: Rust-Oleum Undercoating (248657), Tough Guy Rubberized Seal Coating (22F189), or approved equal.

## END OF SECTION

## SECTION 502

### **Water Main Installation and Testing**

**502.1 Description.** This section covers installation and testing of all water mains. Except where modified by specific requirement in this section, the written installation recommendations of the water main pipe and appurtenant manufacturer shall be strictly followed. Water main pipe materials are specified in other sections.

#### **NOTE: ALWAYS KEEP THE WATER MAIN ON EASEMENT.**

**502.2 General.** All work shall be in the best practices of the water utility industry and the American Water Works Association, and in accordance with all applicable Federal, State and local codes and regulations. Further, it shall be the responsibility of the Contractor/Developer to obtain all permits necessary for the performance of the work plus completion of the following:

- a. The Contractor/Developer shall conduct his work so as not to interfere with the present operation of the existing City's system. If any work interference is encountered between the City and the Contractor/Developer, the City will receive priority in scheduling.
- b. No work shall be performed under conditions, which in the opinion of the City would adversely affect the quality of the finished job.
- c. Any damage done to the City's system by the Contractor/Developer or his affiliates shall immediately be repaired, to the satisfaction and direction of the City by the Contractor/Developer at their own expense.

**502.3 Handling.** Equipment used to handle, lay and join pipe shall be so equipped and used as to prevent damage to the pipe and its jointing materials. All pipe and fittings shall be carefully handled and lowered into the trench. In loading and unloading, they shall be lifted by hoist in such a manner as to avoid shock. Under no circumstances shall they be dropped.

**502.4 Cleaning.** The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean by the Contractor until the pipe has been placed into service. All joint surfaces shall be kept clean until the joint is completed. Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing, or other materials shall be placed in the pipe.

**502.5 Trenching and Excavation.** All trenching for the installation of water mains shall conform to Section 217.

**502.6 Laying Pipe.** Pipes shall be laid true to the lines and grades given on the plans. Proper implements, tools and facilities satisfactory to the City shall be provided and used by the Contractor/Developer for the safe and convenient completion of the work. All polyethylene pipe, fittings, valve assemblies, and hydrant assemblies shall be carefully lowered into the trench by means of an approved nylon sling, in such manner as to prevent damage to pipe, fitting or assemblies. Under no circumstances shall pipe, fittings or assemblies be lowered

into the trench by means of a metallic cable, chain or sling. Also, under no circumstances shall pipe or accessories be dumped, dropped or rolled into the trench.

- a. Water Main – Sanitary Sewer Parallel Installation: Water mains shall be laid at least ten feet horizontally from any existing or proposed sanitary sewers or sanitary sewer force mains. In cases where this is not practical, upon approval from the City, the water main and sanitary sewer may be laid closer than 10 feet, if the water main is laid in a separate trench, or on an undisturbed earth shelf located on one side of the sewer, and such that the water main is at least 18 inches above the top of the sanitary sewer. In cases where this is not possible, either the sanitary sewer or the water main shall be constructed using hot fusion welded HDPE pipe, or the sanitary sewer main should be constructed or reconstructed using Mechanical Joint D.I. main, using Mega-Lug connectors. Currently, all new sanitary sewer force mains and all new water meter mains are constructed using hot fusion welded HDPE pipe, so separations would normally not be a problem. However, when sanitary sewer is being installed near existing water main which was constructed using jointed pipe, then the sanitary sewer would need to be constructed using jointed pipe, then the sanitary sewer would need to be constructed using M.J. D.I. main with Mega-Lug restraints. In all cases where less than 10 feet separation is to be met, the sanitary sewer will be encased in a continuous concrete casing for the entire length of the sewer where it is less than the desired distance from the water main. Water mains shall in all cases be laid a minimum of 10 feet from any part of sanitary sewer manhole (SCD 502.02). The casing of the sewer is for its protection and to provide structural reinforcement of the pipe near the water main.
- b. Water Main – Sanitary Sewer Crossings: Water mains crossing sanitary sewers shall be laid so as to provide a minimum vertical separation of 18 inches between the outside of the water main and the outside of the sanitary sewer. This shall be the case where the water main is either above or below the sewer. While the current standard for water main is continuous hot fusion welded HDPE, there should not be any joints, closer than 10 feet from the sanitary sewer. In cases where this separation is not possible, and the water main is hot fusion welded HDPE pipe, this will be considered on a case by case basis by the City. Should a proposed sewer main cross an existing jointed water main, either the water main will be replaced with hot fusion welded HDPE pipe, the water main will be adjusted to provide for the separation, or a minimum length of 60 feet of the sewer main should be constructed using Mechanical Joint D.I. pipe, with Mega-Lug connectors. In no event will a separation of less than 9 inches be allowed. In any case where the pipes are to be laid with less than 18 inch separation, the sanitary sewer main should be encased in concrete for the width of the sewer trench and for 5 feet on either side of the water main trench (SCD 502.02.). The casing of the sewer is for its protection and to provide structural reinforcement of the pipe near the water main.
- c. Surface Water Crossings: In general, above water crossings will not be allowed. Underwater crossings shall be provided with a minimum cover of four (4) feet over the pipe for the entire width of the crossing. Other Federal, State or County requirements, if more restrictive shall be followed. Where less than 4 feet of cover will not be provided, then a minimum of one foot of concrete, for the

width of the pipe trench shall be installed over the main, to protect it from possible damage. The standard pipe used for water mains in the City is hot fusion welded HDPE pipe which provides for a flexible, watertight construction, and therefore no special pipe different from this pipe is necessary. Should crossings be in critical areas, or the pipe be subject to extreme pressure surges, extra thickness pipe may be required by the City. A gate valve shall be provided on both ends of water crossings, and located a minimum of 25 feet beyond the top of bank, and in accessible locations. The crossing shall be protected with a minimum 18" thick rip-rap blanket, extending across the channel, and at least 3/4 of the way up both banks, terminating in 3 foot deep toewalls. The upper 1/4 of each bank shall be graded to a 3 horizontal to 1 vertical slope, and sod installed over the entire area of disturbance. If slopes greater than this are required, then the rip-rap shall be extended to the top of bank. To the extent possible, the stream banks and bottom shall be restored to their original condition. When the pipe is installed by open cutting the streambed, the pipe shall be weighted in such a manner as to prevent it from floating, and so as to protect the pipe from being crushed or otherwise damaged from the weight(s) used. A 3/4" meter shall be installed adjacent to the upstream gate valve, with taps made on either side of the valve. This meter will be used to detect leaks in the main, by shutting off both the upstream and downstream gate valves. (SCD 502.12)

**502.7 Polyethylene Pipe Fusion.** Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground.

The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of between 60 & 90 PSI, which is dependant upon pipe diameter. The butt fusion joining shall produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records. A copy of all data logger records shall be provided to the City prior to the main being placed into service.

- a. Securing the pipe: Each component that is to be fused must be held in position so that it will not move unless it is moved by the clamping device.
- b. Facing the pipe: The pipe ends must be faced to establish clean, parallel mating surfaces. Facing is continued until a minimum distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaws. This operation shall provide for a perfectly square face, perpendicular to the pipe centerline on each pipe end and with no detectable gap.
- c. Aligning the pipe: The pipe profiles must be rounded and aligned with each other to minimize mismatch (high-low) of the pipe walls. This can be accomplished by adjusting clamping jaws until the outside diameters of the pipe ends match. The jaws must not be loosened or the pipe may slip during fusion.

- d. Melting the pipe: Heating tools that simultaneously heat both pipe ends are used to accomplish this operation. These heating tools are normally furnished with thermometers to measure internal heater temperature so the operator can monitor the temperature before each joint is made. However, the thermometer can be used only as a general indicator because there is some heat loss from internal to external surfaces, depending on factors such as ambient temperatures and wind conditions. A pyrometer or other surface temperature-measuring device should be used periodically to insure proper temperature of the heating tool face. Additionally, heating tools are usually equipped with suspension and alignment guides that center them on the pipe ends. The heater faces that come into contact with the pipe should be clean, oil-free and coated with a nonstick coating as recommended by the manufacturer to prevent molten plastic from sticking to the heater surfaces. Remaining molten plastic can interfere with fusion quality and must be removed according to the tool manufacturer's instructions. Plug in the heater and bring the surface temperatures up to the temperature range of between 400-450°F (204-232°C). Install the heater in the butt fusion machine and bring the pipe ends into full contact with the heater. To ensure that full and proper contact is made between the pipe ends and the heater, the initial contact should be under moderate pressure. After holding the pressure very briefly, it should be released without breaking contact. Continue to hold the components in place, without force, while a bead of molten polyethylene develops between the heater and the pipe ends. When the proper bead size is formed against the heater surfaces, the heater should be removed. The bead size is dependent on the pipe size.

The approximate melt bead sizes shall be as follows:

<u>Pipe Size</u>	<u>Approximate Melt Bead Size</u>
2" through 3"	1/16"
3" through 8"	1/8" – 3/16"
8" through 12"	3/16" – 1/4"
12" through 24"	1/4" – 7/16"
24" through 36"	7/16"

- e. Joining the pipe: After the pipe ends have been heated for the proper time, the heater tool is removed and the molten pipe ends are brought together with sufficient force to form a double rollback bead against the pipe wall. The fusion force is determined by multiplying the interfacial pressure, 60-90 psi (4.14-6.21 bar), by the pipe area. For manually operated fusion machines, a torque wrench may be used to accurately apply the proper force. For manual machines without force reading capability of a torque wrench, the correct fusion joining force is the force required to roll the melt beads over to the pipe surface during joining. For hydraulically operated fusion machines, the fusion force can be divided by the total effective piston area of the carriage cylinders to give a hydraulic gauge reading in psi. The gauge reading is theoretical; the internal and external drag need to be added to this figure to obtain the actual fusion pressure required by the machine.
- f. Holding the pipe: The molten joint must be held immobile under pressure until cooled adequately to develop strength. Allowing proper times under pressure for

cooling prior to removal from the clamps of the machine is important in achieving joint integrity. The fusion force should be held between the pipe ends until the surface of the bead is cool to the touch. The pulling, installation or rough handling of the pipe should be avoided until the joint cools to ambient temperature.

- g. Electrofusion Couplings and Saddles: Electrofusion couplings and saddles may only be used with the approval of the City.

**502.8 Polyethylene Pipe Fusion License** – C906 polyethylene pipe fusion operations must be conducted by an individual in possession of a valid City of Wentzville Fusion License.

**502.9 Joining of Polyethylene Pipe to Valves.** Polyethylene pipe shall be joined to all valves by means of a MJ adapter and back-up ring for each valve face. Where MJ adapters are to be used, MJ faced valves shall also be used.

**502.10 Bedding.** Water mains of C906 polyethylene shall be bedded in native soils without roots, limbs, large rocks, boulders, clumps, or frozen clods or any object that could damage the pipe. Unstable soil or muck shall be removed from the trench bottom. Water shall be removed from the trench before bringing the bedding material and pipe to grade and backfilling. When a trench is cut through solid rock, it shall be excavated to 6" below the pipe bottom grade, and bedded with 3/4" minus material. All slabs of rock, boulders and large rocks shall be removed.

**502.11 Protection of Pipe.** Whenever pipe laying is stopped for any significant length of time, such as at the end of the workday, or when unattended for more than four (4) hours, the unfinished end shall be protected from displacement, flotation, cave-in, in-wash of soil or debris, or other injuries. A suitable temporary tight-fitting cap or plug shall be placed on the exposed end. Duct tape IS NOT ACCEPTABLE for capping the end of a main during construction.

**502.12 Water in Excavation.** Water shall not be allowed to rise in the excavation until the joint materials and any concrete cradle or encasement is hardened and cannot be damaged by the water. Particular care shall be used to prevent disturbance or damage of pipe and the joints during backfilling or at any other time.

**502.13 Fire Hydrant Assemblies.** Fire hydrant assemblies shall conform to the technical specifications and SCD 502.04.

Fire hydrants shall be located 1 ½ feet to 3 feet behind the street curb, as measured from the back of curb to the edge of the fire hydrant. The fire hydrant shall be set in such a manner as to provide access to the flange bolts, and the 5-1/2" pumper (steamer) nozzle is facing the street. See SCD 502.05.

Fire hydrant assemblies shall include a fire hydrant and gate valve. The valve shall be connected to the tee with either an approved mechanical joint and polyethylene MJ adaptor if installed with the main, or flanged to the tapping sleeve if a tap is made from an existing main, and anchored to the hydrant swivel. See SCD 502.04. All fire hydrant assembly leads shall be 6 inch diameter, minimum.

**502.14 Boring.** All roadway, highway and railroad bores shall conform to SCD 502.10 or the agency having authority over the system to be bored. All casings and casing spacers shall conform to the requirements of Section 501.3.

**502.15 Testing.** Each water main shall meet the requirements of the following acceptance tests. All defects shall be repaired to the satisfaction of the Engineer. Contractor shall furnish, at no additional cost to the owner, all necessary equipment and appurtenances to perform the acceptance tests.

- a. Leakage Test: Pipe shall be subjected to and successfully meet a Field leakage test conducted in accordance with ASTM F2164. Flushing of the pipe to be tested should be completed prior to testing. The line shall be slowly filled with water and all air expelled through the air valves or other means. A suitable test pump, furnished by the Contractor, shall be connected to the line by means of a tap in the line (or other suitable methods) and pressure shall be gradually increased until maximum test pressure of 1.5 X the system design pressure is reached. Make-up water shall be added as necessary to maintain maximum test pressure for 4 hours. Pressure should then be reduced by 10 psi and monitored for 1 hour. If no visual leakage is observed and pressure remains within 5% of test pressure, then a passing test is indicated. Any leaks shall be immediately repaired. Notify the City of Wentzville Inspector 24-hours prior to testing so the test can be witnessed. Pressure gauges used shall be calibrated in no less than 2 psi increments. All connections made to existing mains which are currently in service shall have the integrity of the saddle tested under pressure to the rating of the saddle, prior to making the tap on the main.
- b. Chlorine Test: Before any potable water main is placed in service, it shall be thoroughly flushed out to remove any contamination that may have accumulated. Prior to flushing being scheduled, the Contractor shall obtain authorization to flush from the City of Wentzville Engineering Division. The Contractor shall fill the system with a chlorine solution. The chlorine solution shall be supplied at one end of the main as water is being withdrawn from the other end, resulting in Twenty-five (25) ppm or greater of free chlorine throughout the main. The solution shall remain in the pipe for twenty-four (24) hours, at which time it shall have a free chlorine residual concentration of at least ten (10) ppm throughout the main, or the process shall be repeated.
- c. Bacteriological Test: The line will then be flushed until the chlorine content at the extremity of the new system matches the chlorine concentration of the public water supply being used for flushing. To prevent any possibility of contaminated water flowing back into the existing system, all water flowing into the new main shall pass through an approved backflow device. Again, the system will be isolated for 24-hours. At the end of the required 24-hours, after being filled with system water, the contractor or engineer will contact the City of Wentzville Inspector to verify that the chlorine residual is within acceptable limits. There will be no additional flushing of the system prior to completion of bacteriological sampling. Contractor shall record the size of nozzle used for flushing and length in minutes that the water main was flushed.

The contractor shall then collect a minimum of 2 sets of samples at least 24 hours apart after completion of the final flushing as indicated above. Samples shall be taken at a minimum of one every 1200-feet, one on every branch, and one at the end. If these samples are not good then the disinfection process must be repeated. The Contractor must then collect two (2) acceptable bacteriological samples. These samples shall be taken to a private laboratory, which is certified by MoDNR, for the analysis of Total Coliform. Appropriate chain of custody protocol shall be followed from the collection of the sample to the laboratory. Again, there will be no flushing of the system during the sampling period. The Contractor will then submit the certified lab reports to the City. These reports shall include the free chlorine residual value, as well as results for total fecal and non-coliform bacteria. Disinfecting and testing shall conform to AWWA Standard C651 (latest revision). The Contractor shall furnish all necessary materials, and shall minimize the use of water. The Contractor shall be responsible for directing the flow of flushing water into a suitable storm drain. If there is the possibility that high concentrations of chlorine may enter a wetland or other body of water during the flushing operation, the Contractor shall provide for the dechlorination of all discharged water.

- d. Continuity Test: The tracer wire installed along the entire length of water main, shall be tested by a method acceptable to the City which should show that the wire is continuous without break in the wire, and that the fore the main can be easily located by the City. Failure to pass the test may result in the Contractor being required to find and replace breaks in the wire, or alternatively replace the wire, as required by the City.
- e. Blasting: Should blasting be conducted within 100 feet of any sewer main, lateral, forcemain, or manhole, after said improvement has been tested, the previously tested improvement will need to be retested.

***Note: Water mains shall not be tapped for service connections or be utilized for jetting of trenches until the system has passed all inspections and testing and authorized for service by the City of Wentzville.***

**END OF SECTION**



## SECTION 503

### Water Service Installation

**503.1 Description.** This section covers the tapping of in-service water mains for individual services and the installation of the service line from the main through the water meter.

**503.2 Meter setups.** All residential meter setups shall be double meter setups except as shown on the approved plans and as approved by the City. For residential services, the water meter box shall be set on the common property or lot line, as shown on the approved plans, and shall be 14' behind the curb and as indicated on the approved plans. All other non-residential meter setups shall be as shown on the approved plans and as approved by the City. The following meter supplies, for 2" and smaller size, shall be obtained from the City of Wentzville Water Department:

- a. Saddle
- b. Setter with Compression Ends
- c. "Y" Branch (for double meter setups)
- d. Corporation Stop
- e. Meter Box (If meter setting is in paved area, Contractor shall furnish a concrete pyramid box, location as approved by the City.)
- f. Meter
- g. Frame & Cover

For 3" and larger meters, the City of Wentzville Water Department shall furnish the meter only. All other materials shall be furnished by the Contractor, after having received approval of shop drawings by the City.

Supplies can be picked up at the City of Wentzville Water Department, 200 East Fourth Street, Wentzville, MO 63385 between the hours of 8:00 and 8:30 a.m. and 12:00 and 12:30 p.m. Call 636-327-5102 or 636-332-5102 to pick up meter and supplies. You must give a **minimum of 24 hours notice for supplies to be issued.**

**503.3 Service Line.** All service lines for services on the opposite side of the roadway from the water main shall be provided with a Sch 40 PVC casing, installed at a minimum of 30 inches in depth (see Section 501.02 d).prior to pavement being installed. For ¾" and 1" service lines the casing shall be 2" size, for 2" service lines the casing shall be 4" size. For larger service lines, casing size and need for same shall be as determined by the City, and as shown on the approved plans. The service line shall be "K" copper from the water main tap to the meter setter, for 2" and smaller meters. For 3" and 4" meters, the service line shall be 4" DIP, and for larger size meters, the service line shall be HDPE pipe.

**503.4 Service Taps.** All service connections shall be coordinated with the City of Wentzville Water Department. Taps are to be made at the 10:00 and 2:00 o'clock positions only. Back loops will not be allowed (see SCD 503.01). **Water is to be turned off and on by City employees only.** Same day service is provided between 3:30 p.m. and 5:00 p.m. When a known service is installed for a commercial development, a tee shall be installed with the main at the service location in lieu of a wet tap. When an existing main is to be tapped, the location and means of performing the tap, shall be as approved by the City.

**503.5 Construction Water Usage.** The contractor will meter water and pay for it, or they may purchase one (1) day usage tags. Daily tags are available from the Public Works office. Call 636-327-5102 for current daily tag pricing. Hydrant meters are required for all usage over 5 days and for batch plant operations. Hydrant meters are available at Public Works which requires a deposit. Call 636-327-5102 for current water usage charges and meter deposit amount. ***NOTE: All jetting requires appropriate backflow protection and is only allowed on mains which have been previously placed into service.***

**END OF SECTION**

**DIVISION 600  
STORMWATER DRAINAGE FACILITIES**

**SECTION 600**

**General Requirements**

**600.1 Location.** Storm drains shall be laid and structures placed in accordance with the approved plans.

**600.2 Easements.** All stormwater drainage structures shall be constructed in Public Right of Way, or in easements to the City of Wentzville, and as shown on the approved set of improvement plans. Sewers installed as a part of a development may record the easements on the record plat. All other stormwater drainage easements will require easement documents.

**600.3 Pre-construction Meeting and Construction Permit.** No construction of extensions or modifications shall begin before plans are approved for construction and a Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the Engineering Division. Any construction done prior to this Notice may be summarily rejected or refused without further investigation.

**600.4 Inspections.** All work shall be inspected in accordance with the requirements contained in Section 102.9

**600.5 As-built drawings.** As-built drawings shall be required for all new construction. See section 1100 for as-built drawing requirements.

**600.6 Field Changes.** Small field changes may be accepted by the City Inspector. Larger changes shall require a submittal to the City of Wentzville Engineering Division for approval.

**END OF SECTION**

## SECTION 601

### Storm Drain Pipe

**601.1 Description.** This section covers storm sewer pipe and culverts to be furnished complete with all jointing materials and appurtenances.

Pipe shall be installed and tested in accordance with Section 603.

**601.2 Materials for Public Storm Lines.** Pipe and fittings, jointing materials, and appurtenant materials shall be shown on the drawings and as specified herein.

- a. Reinforced Concrete Pipe (RCP): Pipe twelve inches (12") to one hundred-eight inches (108") in diameter shall be pre-cast and shall conform to the requirements of Standard Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, ASTM C76 (latest revision) or ASTM C655 (latest revision) with shell thickness designated "Wall B" and with circular reinforcement in circular pipe or to the requirements of Reinforced Concrete Elliptical Culvert Storm Drain and Sewer Pipe, ASTM C507 (latest revision)

All storm sewer pipe located within the City of Wentzville right of way shall be Class III, minimum, or as required on the project plans.

- b. High Density Polyethylene (HDPE) Pipe: Pipe twelve inches (12") to forty-eight inches (48") in diameter shall conform to the requirements of ASSHTO M 294 (latest revision). The pipe shall have a full circular cross-section with a corrugated surface on the outside and a smooth inner liner of the same material fused to the inside of the pipe. The pipe shall not be perforated.
- c. Pre-cast Concrete Flared End Sections: Flared end sections shall meet all applicable requirements of Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, ASTM C76 (latest revision) or ASTM C655 (latest revision) Class II or higher classes of pipe, in accordance with SCD 602.14.

Acceptability of end sections for all diameters shall be determined by inspection of the finished end sections, including quantity and placement of reinforcement, to determine the conformance with the design and to ensure freedom from defects. HDPE flared end sections are not acceptable.

- d. Joints for Reinforced Concrete Pipe:
  1. Flexible Compression Joints: Flexible compression joints may be made with rubber gasket, rubber "O" rings which shall conform to Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets, ASTM C 443 (latest revision).
  2. Plastic Joint Compound for Concrete Pipe: This compound shall be a homogeneous blend of bituminous or butyl rubber material, inert filler, and suitable solvents or plasticizing compounds thoroughly mixed at the factory to a uniform consistency suitable for sealing joints of vitrified clay

and concrete pipe. The compound shall conform to the following requirements:

Bitumen, soluble in CS <sub>2</sub> , or Butyl Rubber, (Hydrocarbon Blend), ASTM D 482 with 650 EC (1200EF) max test temperature,	
percent by weight, min . . . . .	45
Ash, percent by weight . . . . .	15-50
Penetration, standard cone, 150 g, 5 sec., 25 C (use 250 ml sample tin)	
Trowel grade. bulk type . . . . .	110-250
Extruded rope or flat tape type . . . . .	50-120

The above penetration ranges include test tolerances. Primer, as recommended by the manufacturer, shall be used with extruded rope or flat tape types, if required to maintain the material in position while pipe sections are being joined.

- e. Joints for HDPE pipe: Gaskets shall be silt tight and shall meet the requirements of Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe, ASTM F477 (latest revision) D3212

**END OF SECTION**

## SECTION 602

### **Storm Sewer Manholes, Inlets & Junction Chambers**

**602.1 Description.** This section covers standard manholes, inlets and junction chambers (storm sewer structures). Storm sewer structures shall be constructed complete with covers, steps, and other appurtenances, in accordance with the details.

All standard manholes, inlets and junction chambers shall be constructed of precast concrete sections, brick or cast in place concrete. Only concentric precast concrete cones will be acceptable where precast structures are used. All storm sewer structures without top elevations provided by the engineer will be the responsibility of the contractor.

#### **602.2 Materials.**

<u>Concrete</u>	Materials, handling, forms, finishing, curing, and other work as specified in concrete section, except that only calcareous materials shall be used. Granitic materials shall not be used.
<u>Precast Section</u>	Circular precast concrete; ASTM C478, except as modified.
Minimum Barrel Diameter	42"
Minimum Wall Thickness	5" minimum
Reinforcement	As indicated on the standards
<u>Portland Cement</u>	ASTM C150
<u>Hydrated Lime</u>	ASTM C270, Type S
<u>Sand</u>	Concrete sand (fine aggregate) sieved through 8 mesh screen
<u>Shrinkage-Correcting Aggregate</u>	Master Builders "Embeco", Sika "Kemox", Sonneborn "Ferrolith G-DS", or equal
<u>Mortar</u>	One part portland cement, ½ part hydrated lime, 3 parts sand
<u>Non-shrinking Mortar</u>	Premixed or job mixed; job mixed shall be one part shrinkage-correcting aggregate, one part portland cement, one part sand

### Gaskets

Mastic	Fed Spec SS-S-210; K.T. Snyder "Ram-Nek", Hamilton-Kent "Kent-Seal No. 2", Bidco "C-56", Conseal "CS-102" or equal
Rubber	Neoprene or other synthetic, 40 (plus or minus 5) hardness when measured by ASTM D2240, Type A durometer

### Steel Castings

Manhole castings shall conform to the requirements of Medium-Strength Carbon-Steel Castings for General Application, ASTM A27 (latest revision)

### Manhole Steps

Manholes steps shall be cast into the full depth of the wall section or installed by an approved alternate method.

**602.3 Pre-cast Concrete Structures.** Pre-cast reinforced concrete storm sewer structures shall conform to the standard specifications for pre-cast reinforce concrete manhole sections, ASTM C478 (latest revision) and the approved Standard Construction Details.

The minimum inside diameter for the base and riser sections shall be 42" diameter.

Cone sections shall be concentric and base sections shall have the base riser section integral with the floor. Flat slabs and eccentric cones will only be allowed with special permission. The concrete invert may be furnished with the precast unit; or alternatively the concrete invert fill may be installed in the field and shall conform exactly to the invert elevations of the connecting piping after installations.

For 60" pipe and larger, "Tee" sections may be used for the riser, with the riser being on one side of the pipe, extending up through an eccentric cone section to the cover. This is so that the steps may extend straight down from the cover, to below the spring line of the pipe, to a height of no more than 24" above the flow line of the pipe.

Manhole steps shall be cast into the full depth of the wall section or installed in an approved alternate method.

- a. Handling: Pre-cast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces. Use of lifting holes will not be permitted. Lift notches that are not deeper than one half of the wall thickness will be allowed. Lifting notches shall be repaired by cementing a properly shaped concrete plug in place with epoxy cement, or by other methods acceptable to the City Engineer.
- b. Inspection: Pre-cast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units rejected.

The connecting pipe shall be plain end, square cut spigots and shall not protrude more than one inch inside the manhole wall. When the concrete invert fill is installed in the structure, the annular space around the pipe shall be grout filled, so as to provide a smooth transition between the pipe and the structure along all sides.

## **602.5 Cast-in-Place Concrete Storm Sewer Structures.**

### **a. Materials:**

1. Concrete: Where concrete structures are required or otherwise indicated on the project plans, they shall be built of 3500 psi (6-sack) concrete.
2. Reinforcement: Any required reinforcement shall be of the kind, type, and size, and shall be located, spaced, bent and fastened as shown in the approved plans or shop drawings. Concrete reinforcing shall be approved by the City Engineer before any concrete is placed.

### **b. Construction Requirements:**

- a. The structures shall be built on prepared foundations, conforming to the dimensions and shape shown on the approved plans. The construction shall conform to the methods, forms, mixture, placement, and curing for concrete as specified in Section 704.
- b. All invert channels shall be accurately constructed and shaped so as to be smooth, uniform, give minimum resistance to flow and shall slope downward toward the outlet.

**602.6 Brick Masonry Construction.** This section covers storm sewer structures constructed of masonry brick.

### **a. Materials:**

1. Sewer Brick: All brick shall conform to the specifications for sewer brick, ASTM C32 (latest revision) for Grade SM. Bricks shall conform to the following dimensions, unless otherwise approved by the City Engineer.

Sewer Brick	Depth (inches)	Width (inches)	Length (inches)
Standard Size	2 1/4	3 3/4	8
Allowable Variation	± 1/4	± 3/8	± 1/2

All brick shall be new and whole, of uniform standard size and with substantially straight and parallel edges and square corners. Bricks shall be of the compact textures, burned hard entirely through, tough and strong, free from injurious cracks and flaws and shall have a clear ring when struck together. No soft or salmon brick shall be used in any part of the work. Brick shall be culled after delivery, if required, and no culls shall



be used except at such places, to such extent, and under such conditions as may be approved by the City Engineer.

The contractor may be required to furnish the City Engineer with at least five bricks of the character and make the contractor proposes to use, at least one week before any bricks are delivered for use. All brick shall be of the same quality as the accepted samples.

2. Mortar: Shall consist of a uniform mixture of portland cement and masonry sand with the minimum amount of water necessary to produce the required consistency for the particular required use. No ad-mixtures shall be used without the permission of the City Engineer. Mortar for brick masonry and plastering shall consist of one volume of cement and three volumes of sand. One sack of ninety-four pounds of portland cement shall be considered to have a volume of one cubic foot. Mortar shall be prepared in suitable mixing equipment for small amounts, on a hard impervious surface. It shall be kept free at all times from soil, debris, contamination or other deleterious substances. Retempered or partially set mortar shall not be used.

b. Construction Requirements:

1. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed. This shall be of the materials and dimensions shown in the approved project plans and specifications.
2. All brick shall be thoroughly clean. The bed which is to receive the bricks shall be thoroughly cleaned and damp, but should be free of water before placing mortar thereon. All bricks shall be laid in courses in freshly – made mortar, using the shoved-joint method so as to thoroughly bond them into the mortar and always with the joints completely filled with mortar. The bricks shall be laid in a workmanlike manner, and true to the lines and grades indicated on the plans. The arrangement of headers and stretchers shall be such as will thoroughly bond the masonry. Unless otherwise indicated, brick masonry shall be of alternate headers and stretchers with consecutive courses breaking joints. The course shall be laid continuously with joints broken or alternating evenly with the joints in the preceding courses. Horizontal joints shall average three-eighths inch, but shall be not less than one-fourth inch nor more than on-half inch in thickness. Face joints shall be flush and neatly struck, and all joints on unexposed faces shall be solidly filled. No spalls or bats shall be used except in shaping around irregular openings or connections or when unavoidable to finish out a course. In this case, a full brick shall be used at the corner with the bat in the interior of the course. If any brick is moved or a joint broken during laying, the brick shall be removed, the mortar thoroughly cleaned from the brick, bed, and joints, and the brick relaid in fresh mortar. Where required by the approved project plans and specifications, the inside and outside surfaces of brick masonry shall be neatly plastered with mortar to a thickness not less than one-half inch, and be finished to a true, uniform, continuous, smooth surface. All

plastering shall be applied as the structure is constructed as opposed to plastering upon completion. On completion of each brick structure, all waste mortar and debris shall be immediately removed from the structure and any necessary repairs or required pointing shall be completed.

3. Brick masonry, plastering, and mortar shall be protected against damage from freezing or lack of moisture. Brick masonry shall not be constructed when the temperature is 40 degrees F or lower without permission of the City Engineer nor without adequate approved means for protection against freezing. Brick masonry shall have sufficient moisture for proper curing and be protected from drying. Requirements for protection of brick masonry and masonry materials are the same as required for concrete structures.

**602.7 Grade Adjustment.** Grade adjustment rings shall have minimum dimensions of 26.5 inches opening, 3 inch height and 8 inch width. No more than one grade ring shall be used per adjustment unless the total height of adjustment is 6 inches or greater. A maximum of two grade adjustment rings shall be allowed, and a maximum of 12", total, of grade adjustment rings shall be allowed. A maximum of 18 inches from the top of cone to the top of frame is allowed. No metal or plastic adjustment rings will be allowed. (Brick or concrete only.)

**602.8 Inlet Stones, Sills and Blocks.** Inlet stones, sills and blocks and other pre-cast units shall be made to the dimensions and with the reinforcement as shown in the SCD and in accordance with these specifications. Inlet stones shall slope towards street.

They shall be made of 5000 psi air-entrained concrete, and cast in one operation. Immediately after casting, the concrete next to the forms shall be thoroughly spaded and the whole thoroughly compacted by tamping or vibrating in order to provide dense concrete with uniform surfaces free from honeycombing. All inlet stones, sills and blocks shall have a minimum of a six sac mix to include an additional admixture of EMSAC F-100T Micro Silicas or an approved equivalent. The admixture shall have a minimum weight of 10% of the total weight of cement. Care shall be taken not to disturb the reinforcement. All efforts shall be made to insure the highest degree of density in an effort to obtain maximum durability of the finished concrete units against weathering and attack from sodium chloride. Acceptable additives may be required.

The top surface of the inlet stones shall be cast against patterned steel forms to achieve an approved non-skid surface and the upper surfaces of inlet sills shall be steel-trowelled or cast against steel forms. Each inlet stone, sill, and block shall be lifted, moved and set into place on the finished concrete or brickwork on a solid bed of mortar, and/or mastic, in such manner as not to injure the stone or brick masonry. Concrete castings which are damaged in moving will be rejected and shall be removed from the site of the work.

**602.9 Setting of Castings, Frames, Fittings and Steps.** All castings, frames, and fittings shall be placed in the position shown in the SCD, on the approved plans, or as directed by the City Engineer, and shall be set true to line and to correct elevation upon a full bed of mortar. If frames or fittings are to be bolted or anchored in concrete or brick masonry, all anchors or bolts shall be set and held in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has hardened to adequate strength.

When frames or fittings are to be placed upon previously constructed masonry, the bearing surface of masonry shall be brought true to line and grade to present and even bearing surface clean and free of debris particles. The unit shall be set in a full mortar bed as shown in the SCD or the approved project plans. All units shall be firmly and securely seated.

Frames and covers, frames and grates, or other similar pairs of items shall have true common bearing surfaces such that the covers or grates will seat firmly without rocking or shifting. The grates or covers shall be placed after the frames or fittings have been installed and after the concrete or mortar has been allowed to harden for at least twenty-four (24) hours and will not be damaged.

Steps shall be installed as shown in the SCD. When the steps are set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has set and cured for at least seven (7) days.

#### **END OF SECTION**

## SECTION 603

### **Storm Sewer Pipe Installation and Testing**

**603.1 Description.** This section covers installation and testing of all storm sewer pipe and pipe culverts. Except where modified by specific requirement in this section, the written installation recommendations of the sewer pipe manufacturer shall be strictly followed. Storm sewer pipe materials are specified in other sections.

#### **NOTE: ALWAYS KEEP THE STORM SEWER ON EASEMENT.**

**603.2 Handling.** Equipment used to handle, lay and joint pipe shall be so equipped and used as to prevent damage to the pipe and its jointing materials. All pipe and fittings shall be carefully handled and lowered into the trench. Damaged pipe shall be removed from the site.

**603.3 Excavation, Trenching and Backfilling.** All storm sewer trench excavation and backfilling shall conform to the requirements of Section 217.

**603.4 Laying Pipe.** Pipes shall be laid true to the lines and grades given on the plans. Pipe laying shall commence from the low point of the project and commence upgrade, unless otherwise expressly permitted by the City Engineer. The bell or groove end shall be laid upstream with the ends abutting to form a concentric joint without shoulders or unevenness of any kind along the invert of the pipe. They shall be carefully centered so that when laid they will form a sewer with a uniform invert. Bell holes shall be dug to relieve the bell of all load and shall be no larger than necessary.

Suitable means shall be used to force the spigot end of the pipe into the bell end without damage to the pipe and its jointing materials, and without disturbing the previously laid pipes and joints.

Where the storm sewer line crosses over or under another pipe, and a vertical clearance of eighteen (18) inches for waterlines and twenty four (24) inches for others, cannot be maintained between them, Class B concrete encasement shall be provided as follows:

- Storm Sewer & Water Main – Width of both trenches from springline of lower pipe to bottom of higher pipe.
- Storm Sewer & Storm Sewer – Width of both trenches from springline of lower pipe to bottom of higher pipe.
- Storm Sewer & Sanitary Sewer – Sanitary sewer shall be fully encased for a distance of 10 feet from the intersection with the storm sewer, regardless as to it's being above or below the storm sewer. The Storm sewer, if beneath the sanitary should be encased from it's springline to the bottom of the sanitary sewer for the width of the sanitary sewer trench. The Storm Sewer, if above the sanitary, should be encased from the bottom of it's trench up to it's springline, and extending five (5) feet beyond the width of the sanitary sewer trench.

**603.5 Jointing.** All joint preparation and jointing operations shall comply with the instructions and recommendations of the pipe manufacturer.

- a. Neoprene Rubber Gaskets: Joints for reinforced concrete pipe with neoprene rubber gaskets shall be made in accordance with the manufacturer's recommendations. Bell and spigot, or tongue and groove ends of the pipe shall first be wiped clean before actual jointing operations are started.

Immediately prior to jointing, all surfaces of the joint shall be thoroughly cleaned and lubricated with soapy water or in accordance with the manufacturer's recommendations. The tongue end shall be centered on grade into the groove end of the last downstream length of pipe and shoved completely home and properly seated with the application of steady pressure by a lever, winch, or other suitable device. Care shall be used to prevent displacement of the gasket during jointing.

- b. Bituminous Mastic Joint: In sealing concrete pipe with bituminous mastic joint compound, trowel grade compound shall be applied to the mating surfaces of both the tongue and groove, or to the entire interior surface of the bell and the upper portion of the spigot, or alternatively two (2) one (1)-inch pieces of rope or tape-type plastic compound shall be applied in accordance with the manufacturer's recommendations. The joints shall be forced together with excess compound extruding both inside and outside the joint. Excess compound shall be removed from the interior surfaces where accessible. The joint between the bell and spigot shall be uniform for the full circumference and care shall be taken to prevent the bell from supporting the spigot.

**603.6 Bedding, Cradling, or Encasement.** Special care shall be taken to insure that the pipes are solidly and uniformly bedded, cradled, or encased in accordance with the type of bedding, cradle or encasement required by the project plans and specifications and as shown in the SCD. No pipes shall be brought into position until the preceding length has been bedded and secured in place.

Where concrete encasement is required, the pipe shall be supported at not more than two places with masonry supports or selected cut hardwood as approved by the City Engineer. The size of supports shall be of sufficient size to provide the required clearance and to prevent displacement during placing of concrete.

Bedding for storm sewer pipe construction shall be Class C. Bedding shall be all stone or crushed limestone and shall be sound, durable and free from cracks and other structural defects that would cause it to deteriorate. It shall not contain any soapstone, shale, or other material easily disintegrated. The bedding shall be placed as shown in the SCD, and conform to the following gradations:

For 27 inch diameter and smaller (% by Weight Passing)		
Sieve	Maximum	Minimum
1 inch	100	100
¾ inch	100	90
½ inch	60	35
# 100	10	0

For 30 inch diameter and larger (% by Weight Passing)		
Sieve	Maximum	Minimum
1 ½ inch	100	100
1 inch	70	60
¾ inch	50	40
½ inch	35	25
# 100	10	0

**603.7 Protection of Pipe.** Whenever pipe laying is stopped for any significant length of time, such as at the end of the workday, the unfinished end shall be protected from displacement, flotation, cave-in, and in-wash of soil or debris.

**603.8 Water in Excavation.** Water shall not be allowed to rise in the excavation until the joint materials and any concrete cradle or encasement is hardened and cannot be damaged by the water. Particular care shall be used to prevent disturbance or damage of pipe and the joints during backfilling or at any other time.

**603.9 Pipe slope less than 1%.** For sewer pipe with a design grade less than one percent (1%), verification of the pipe grade will be required for each installation reach of sewer, prior to any surface restoration or installation of any surface improvements. The contractor's field supervisor will be required to provide daily documentation verifying that the as-built pipe grade meets the design grade through the submittal of signed cut sheets to the City Inspector upon request. The contractor will be required to remove and replace any sewer reach having an as-built grade which is flatter than the design grade by more than 0.1%. Sewers with grades greater than the design slope may be left in place, provided no other sewer grade is reduced by this variance in the as-built grade. The City Engineer also reserves the right to require the contractor to remove and replace any sewer (at any time prior to construction approval) for which the as-built grade does not comply with the grade tolerance stated in this paragraph. Field surveyed verification must be made under direction of the licensed land surveyor or registered engineer. The sewer contractor shall be responsible for any cost associated with the field verification of the sewer grade, or removal and replacement of the sewer pipe or associated appurtenances.

**603.10 Testing.** Each reach of HDPE sewer pipe shall meet the requirements of the following acceptance tests. All defects shall be repaired to the satisfaction of the City Engineer. Contractor shall furnish all necessary equipment and appurtenances to perform the acceptance tests.

Deflection Testing: 100% of the total projects footage will be mandrel tested. Not less than thirty (30) days after final backfill, or City Engineer approved jetting, the contractor shall perform a deflection test with a City Inspector present. Testing shall be completed by using a rigid ball or mandrels with diameters equal to ninety-five percent (95%) of the diameter of the pipe. Tests shall be performed without mechanical pulling devices.

## END OF SECTION

## SECTION 604

### Rock Blankets & Stone Revetment

**604.1 Description.** This section covers material and placement of rip rap rock blanket and heavy stone revetment.

**604.2 Materials.**

- a. Rock Blanket: The material for rock blanket shall be durable stone or broken concrete containing a combined total of not more than 10 percent of earth, sand, shale, and non-durable rock. It is preferable that the material contain a large percentage of pieces as large as the thickness of the blanket will permit, with enough smaller pieces of various sizes to fill the larger voids. For Type 1 Rock Blanket, at least 40 percent of the mass shall be of pieces having a volume of 1 cu.ft. or more. For Type 2 Rock Blanket, at least 60 percent of the mass shall be of pieces having a volume of 1 cu.ft. or more. Acceptance of quality and size of material will be made by visual inspection at the job site.
- b. Light Stone Revetment: Stone for light stone revetment shall be sound, durable, and free from cracks and other structural defects that would cause it to deteriorate. It shall not contain any soapstone, shale, or other material easily disintegrated. The stone shall be in blocks at least 7 in. in thickness perpendicular to the slope and have approximately rectangular faces 7 in. or more in width. All blocks shall weigh not less than 25 lb., and at least 75 percent shall weigh not less than 50 lb.
- c. Heavy Stone Revetment: The stone for heavy stone revetment shall conform to the requirements of Sec 604.2b, except that the blocks shall be at least 12 in. in thickness and all blocks shall weigh not less than 50 lb. and at least 60 percent shall weigh not less than 100 lb.

**604.3 Construction Requirements.** Unless otherwise approved, the slopes upon which revetment is to be placed shall conform to the section shown on the approved plans. The slopes shall be compacted to a uniform density as required for adjacent material. The revetment shall be started in a trench below the toe of the slope shown on the approved plans and shall progress upward. Each stone or broken concrete block shall be firmly bedded against the slope and against adjoining stones or broken concrete, and shall be laid with well broken joints. After revetment has been placed, the voids shall be filled in such a manner that all revetment stones or broken concrete are tightly wedged. The finished surface shall present a uniform appearance true to line, grade, and section.

**END OF SECTION**

## SECTION 605

### Grouting

**605.1 Description.** This section covers grouting miscellaneous baseplates and other uses of grout as indicated on the drawings. Unless otherwise specified, all grouting shall be done with non-shrinking grout.

#### **605.2 Materials.**

- a. Non-shrinking Grout: Master Builders "Masterflow LL-713 Grout", Sauereisen Cements "F-100 Level Fill Grout", U.S.Grout "Five Star Grout", Glacier Northwest "Speed Crete Red Line", USM "Upcon", or equal.
- b. Water: Clean and free from deleterious substances.

**605.3 Non-shrinking Grout.** Non-shrinking grout shall be furnished factory premixed so only water is added at job site. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

- a. Preparation: The concrete foundation to receive non-shrinking grout shall be saturated with water for 24 hours prior to grouting.
- b. Placement: Grout shall be placed in strict accordance with the direction of the manufacturer so all spaces and cavities are completely filled without voids.
- c. Edge Finishing: The grout shall be finished smooth in all locations where the edge of the grout will be exposed to view after it has reached its initial set.
- d. Curing: Non-shrinking grout shall be protected against rapid loss of moisture by covering with wet rags or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 7 days.

Holes shall be prepared for grouting as recommended by the grout manufacturer.

### **END OF SECTION**



**DIVISION 700  
ROADWAYS AND STREETS**

**SECTION 700**

**General Requirements**

**700.1            Location.** Roadways and streets shall be placed in accordance with the approved plans, with respect to profile, grade, and alignment.

**700.2            Pre-construction Meeting and Construction Permit.** No construction of roadway or streets shall begin before plans are approved for construction and a Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the City En. Any construction done prior to this notice may be summarily rejected or refused without further investigation.

**700.3            Inspections.** All construction work involving roadways and streets shall be inspected by the City of Wentzville, in accordance with the requirements contained in Section 102.9. Any work performed without inspection will not be accepted by the City of Wentzville. The City of Wentzville shall be notified a minimum of 48 hours in advance of any construction for coordination and inspections

**700.4            Field Changes.** Minor field changes may be accepted by the City Inspector. Major changes shall require a submittal to the City of Wentzville Engineering Division for approval.

**END OF SECTION**

## SECTION 701

### Aggregate Base Course

**701.1 Description.** This section describes the work of furnishing and placing one or more courses of aggregate on a prepared subgrade in accordance with these specifications and in conformity with the lines, grades, thickness, and typical cross sections shown on the plans, established by the Owner's consultant and as approved by the City. The type of aggregate to be used will be specified on the approved construction plans or on the applicable Standard Construction Detail (SCD).

**701.2 Materials.** All materials shall conform to the specifications listed below.

- a. Type 1 Aggregate: Type 1 Aggregate for base shall be essentially limestone or dolomite. The crushed stone shall contain not more than 15 percent deleterious rock and shale. Sand may be added to the crushed stone only for the purpose of reducing the plasticity index of the fraction passing the 475  $\mu$ m (No. 40) sieve in the finished product. Any sand, silt, and clay, and any deleterious rock and shale shall be uniformly distributed throughout the weight. The aggregates shall conform to the following gradation requirements:

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
1 in. (25 mm)	100
½ in. (12.5 mm.)	60-90
No. 4 (4.75 mm)	40-60
No. 40 (475 $\mu$ m)	15-35

The fraction passing the 475  $\mu$ m (No. 40) sieve shall have a plasticity index not greater than 6.

- b. Type 2 Aggregate: Type 2 Aggregate for base shall consist of crushed stone, sand, and gravel, or chat, with or without soil binder as may be required to conform to the requirements of these specifications. If crushed stone is used, sand may be added only for the purpose of reducing the plasticity index of the fraction passing the 475  $\mu$ m (No. 40) sieve in the finished product. It shall not contain more than 15 percent deleterious rock and shale. Deleterious rock, shale, sand, or binder if required, shall be uniformly distributed throughout the weight. The aggregate, combined with binder if required, shall conform to one of the following gradation requirements:

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>	
	<i>Gradation A</i>	<i>Gradation B</i>
1 in. (25 mm.)	100	----
¾ in. (19 mm)	----	100
½ in. (12.5 mm)	60-90	----
No. 4 (4.75 mm)	40-60	55-85
No. 10 (2.00 mm)	----	40-65
No. 40 (475 $\mu$ m)	15-35	20-45

The fraction passing the No. 200 (75  $\mu$ m) sieve shall, when sand and gravel aggregate is used, be less than 2/3 of the fraction passing the No. 40 (475  $\mu$ m)

sieve. The fraction passing the No. 40 (475  $\mu$ m) sieve shall have plasticity indices as follows:

	Minimum	Maximum
Crushed stone or chat	0	6
Sand and gravel	2	6

Binder shall consist of soil or similar fine material with such cohesive properties as to impart the desired plasticity to the finished base course. The binder shall be obtained from a deposit approved by the City.

- c. Type 3 Aggregate: Type 3 aggregate for base shall consist of crushed stone, limestone screenings, sand and gravel, sand, chat, or sandstone, or combinations of these materials, with or without soil binder as may be required. It shall contain not more than 15 percent deleterious rock and shale. The material shall conform to the following gradation requirements and in addition shall be so graded that it will readily compact to the specified density and withstand construction traffic without distortion and displacement.

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
1½ in. (38 mm)	100
No. 40 (475 $\mu$ m)	15-35
No. 200 (75 $\mu$ m)	Not more than 35

The fraction passing the No. 40 (475  $\mu$ m) sieve for Type 3 aggregate shall have a plasticity index not greater than eight (8). If chat is used, it shall meet the requirements of this section and in addition shall have at least 20 percent passing the No. 40 (475  $\mu$ m) sieve. If soft sandstone, sand, or sand-gravel mixtures are used, they shall meet the requirements of this section and in addition the fraction passing the No. 40 (475  $\mu$ m) sieve shall have a plasticity index not less than two (2) nor greater than eight (8).

Binder shall consist of soil or similar fine material with such cohesive properties as to impart the desired plasticity to the finished base course. The binder shall be obtained from a deposit approved by the City.

- d. Type 4 Aggregate: Type 4 aggregate for base shall consist of a uniform mixture of washed sand and gravel, crushed stone, or chat. Aggregate shall consist of sound durable particles. When the aggregate is tested in accordance with AASHTO T 96 (Los Angeles Abrasion), the percentage of wear shall not exceed 55. The percentage of deleterious substance shall not exceed the following values and the sum of these percentages shall not exceed 8 percent.

<i>Item</i>	<i>Percent by Weight</i>
Deleterious rock	8.0
Shale and mud balls	4.0

The material shall at all times during loading, hauling, and placing, contain sufficient moisture to prevent segregation and to aid in obtaining compaction.

Washed sand and gravel mixtures shall meet the following gradation requirements:

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
1 in. (25 mm)	100
½ in. (12.5 mm)	55-90
No. 10 (200 mm)	25-50
No. 40 (475 µm)	10-30
No. 100 (150 µm)	0-10
No. 200 (75 µm)	0-3

Crushed stone shall consist of limestone or dolomite and shall be graded to meet the following gradation to meet the following gradation requirements:

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
1 in. (25 mm)	100
½ in. (12.5 mm)	55-90
No. 4 (4.75 mm)	8-40
No. 10 (2.00 mm)	0-15
No. 200 (75 µm)	0-4

A tolerance not to exceed two (2) percent passing the No. 200 (75 µm) sieve will be permitted for samples taken at the point of delivery on the roadway.

Chat shall be graded to meet the following requirements:

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
¾ in. (19 mm)	100
½ in. (12.5 mm)	90-100
No. 10 (200 mm)	20-50
No. 40 (475 µm)	5-30
No. 200 (75 µm)	0-5

- e. Type 5 Aggregate: Type 5 aggregate for base shall consist of crushed stone or sand and gravel. It shall not contain more than 15 percent deleterious rock and shale. If crushed stone is used, sand may be added only for the purpose of reducing the plasticity index of the fraction passing the No. 40 (475 µm) sieve in the finished product. The fraction passing the No. 40 (475 µm) sieve shall have a plasticity index not to exceed six (6). Any sand, silt, and clay, and any deleterious rock and shale shall be uniformly distributed throughout the mass. When sand and gravel aggregate is used, the fraction passing the 75 µm (No. 200) sieve shall be less than ½ that of the fraction passing the No. 30 (600 µm) sieve.

Type 5 aggregate shall conform to the following gradation requirements and in addition shall be so graded that it will readily compact to the specified density and withstand construction traffic without distortion and displacement.

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
1 in. (25 mm)	100
½ in. (12.5 mm)	60-90
No. 40 (475 µm)	40-60
No. 30 (600 µm)	15-35
No. 200 (75 µm)	0-15

**701.3 Subgrade.** All work on that portion of the subgrade on which the base is to be constructed shall be completed in accordance with the requirements of Division 200 prior to the placing of any base material on that portion. Aggregate base shall not be placed on frozen subgrade.

**701.4 Mixing.** Unless otherwise specified, base material, any additional material required and sufficient water to obtain the desired compaction, shall be thoroughly mixed and delivered to the road as a combined product.

**701.5 Placing.** The maximum compacted thickness of any one layer shall not exceed 6 in. (150 mm). When the specified compacted depth of the base course exceeds 6 in. (150 mm), the base shall be constructed in two or more layers of approximately equal thickness. The compacted depth of a single layer of the base course may be increased to 8 in. (200 mm) for shoulders and lightly traveled areas.

Types 1, 2, 4 and 5 aggregate used for shoulders adjacent to rigid or flexible type pavement, including pavement resurfacing, shall be simultaneously deposited and spread on the subgrade with an approved spreading machine. Aggregate shall not be deposited on the pavement and bladed or dozed into place.

**701.6 Shaping and Compacting.** Immediately before spreading the mixture, the subgrade shall be sprinkled with water as directed by the City. The mixture shall be uniformly spread in successive layers of such depth that when compacted, the base will have the approximate thickness specified on the approved plans or the applicable SCD. Aggregate base course shall be compacted to not less than the standard proctor maximum dry density (ASTM D 698). Each layer shall be compacted to the specified density before another layer is placed, with the following exception. If difficulty is encountered in obtaining the specified density after reasonable compactive effort has been expended on the first lift placed over Type 4 aggregate, the City may permit placing another layer. The testing for density will be made on the combined layers.

## END OF SECTION

## SECTION 702

Reserved

## SECTION 703

Reserved

## SECTION 704

### Portland Cement Concrete Pavements

**704.1 Description.** This section describes the work consisting of the construction of portland cement concrete placed with or without reinforcement on an approved base. The type and dimensions of the pavement will be as indicated on the approved construction plans.

**704.2 Materials.**  
All materials shall conform to this section as specified below.

- a. Portland Cement Concrete for Curb, Gutter and Street Pavements in Public Rights-of-Way: Only concrete mix design specifications that have been vetted and approved by the Eastern Missouri Pavement Consortium (EMPC) shall be used for construction of curb, gutter and street pavements in public rights-of-way. This includes roadways that are not yet public, but are intended to become public roadways upon dedication and acceptance by the City.

All concrete mix designs for placement within the City of Wentzville shall be submitted to and approved by the EMPC. Approved mix designs will be stored on their website for use. Specifications for concrete pavement are also provided and shall be followed. A new mix design that is submitted may take several weeks before approval is issued.

The website to access the EMPC specifications and approved mix designs is: <http://www.empcpavement.org>. In order to view information on the website, a free account is required and can be created by visiting the website.

- b. Portland Cement Concrete for Sidewalk and Driveways in Public Rights-of-Way: Portland cement concrete shall consist of a mixture of portland cement, fine aggregate, coarse aggregate, and water combined in the proportions specified for the various classes of concrete. Admixtures for the purpose of entraining air, retarding or accelerating the set, tinting and other purposes may be added as specifically required or permitted.
  1. Portland Cement: Portland cement shall conform to the requirements of ASTM Specifications C 150 and C 175, Type 1 or Type 1-A cement shall be used for all concrete work unless otherwise specified by the City. The Contractor shall submit evidence to the City that the portland cement conforms to ASTM Specifications C 150 and C 175. Type 1 & 1-A shall be used with an air entraining admixture added at the plant to produce three to six percent (3% - 6%) air in the concrete.

2. Coarse Aggregate: All coarse aggregate for concrete shall consist of sound, durable rock particles, free from objectionable coatings and frozen and cemented lumps. The percentage of deleterious substances shall not exceed the following values and the sum of percentages of all deleterious substances, exclusive of Items 5 and 6, shall not exceed 6 percent.

<i>Item</i>	<i>Percent By Weight</i>
Deleterious rock . . . . .	6.0
Shale . . . . .	1.0
Chert in limestone . . . . .	4.0
Other foreign material . . . . .	0.5

Material passing No. 200 (75 µm) sieve:

- a. Coarse fraction, Limestone, Gradation A . . . . . 1.5
- b. Fine fraction, Limestone, Gradation A . . . . . 2.5
- c. Limestone, Gradations B, D, & E . . . . . 2.0
- d. Other aggregates . . . . . 1.0
- e. Thin or elongated pieces . . . . . 5.0

The above requirements apply to each size or fraction of aggregate produced.

Crushed stone shall be obtained from rock of uniform quality and when tested in accordance with AASHTO T 96 (Los Angeles Abrasion), the percentage of wear shall not exceed 50.

Gravel shall be washed and when tested in accordance with AASHTO T 96 (Los Angeles Abrasion), the percentage of wear shall not exceed 45.

Coarse aggregate for concrete pavement or base course shall be divided into three classifications as follows:

*Aggregate No. 1*: Any aggregate containing more than 30 percent of any one, or a combination of two or more, of the following materials: Chert gravel, crushed flint, or any other essentially siliceous material.

*Aggregate No. 2*: Any gravel of essentially glacial origin similar in character to that found in deposits in Missouri at LaGrange and Sampsel.

*Aggregate No. 3*: Crushed limestone or any other accepted aggregate not falling under the designations for Aggregate No. 1 or Aggregate No. 2.

Aggregate No. 3 shall be used unless otherwise specified.

If coarse aggregate for concrete pavement or base is furnished, handled, and batched in two separate sizes or fractions, one fraction shall consist of material retained on the 3/4 in. sieve, and the other fraction shall

consist of material passing the 3/4 in. sieve. A tolerance not to exceed 15 percent may be permitted on the 3/4 in. sieve for each fraction. The two fractions will be combined in a ratio as near as possible to the proportions in which the two fractions are furnished by the contractor to make a uniformly well-graded coarse aggregate graded within the following limits:

#### *Gradation A*

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
2 in . . . . .	100
1 1/2 in . . . . .	95-100
3/4 in . . . . .	35-70
3/8 in . . . . .	10-30
No. 4 . . . . .	0-5

Coarse aggregate may be divided into more than two fractions if approved by the City.

If crushed flint is used as coarse aggregate, it shall meet the above requirements, and in addition 100 percent shall pass the 1 1/2 in. sieve.

If coarse aggregate for concrete pavement or base is furnished, handled, and batched in one size or fraction, it shall be graded to meet Gradation B, or Gradation D.

#### *Gradation B*

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
1 1/2 in . . . . .	100
1 in . . . . .	95-100
1/2 in . . . . .	25-60
No. 4 . . . . .	0-8
No. 10 . . . . .	0-3

#### *Gradation D*

<i>Sieve Size</i>	<i>Percent Passing by Weight</i>
1 in . . . . .	100
3/4 in . . . . .	90-100
3/8 in . . . . .	15-45
No. 4 . . . . .	0-8

**Soundness:** When testing in accordance with AASHTO T 104 the loss of coarse aggregate in 5 cycles of the accelerated soundness test shall not be greater than 12% when sodium sulfate is used. Aggregates to be tested shall be made available for testing a minimum of ten calendar days



prior to the intended time of use. It shall be the responsibility of the contractor to notify the City when samples are available.

A soundness test taken on aggregate sampled from a well defined quarry ledge or gravel pit may be considered to represent that entire ledge or pit, and any fine or coarse aggregate fractions from that ledge or pit. Should any change in ledge or pit characteristics be observed, retesting may be required at the discretion of the engineer.

If approval of a stockpile is requested, the stockpile shall contain material for 5 days of the intended usage or 500 metric tons (tons), whichever is greater. No material shall be removed from or added to the stockpile during the testing period. Unapproved material shall be segregated from approved materials in stockpiles at all times.

This specification shall not apply to siliceous sands from the Missouri, Mississippi or Meramec Rivers.

*Absorption:* The absorption value of the aggregate used in pavement concrete shall not exceed 2.0 percent measured by weight.

3. Fine Aggregate: Fine aggregate for portland cement concrete shall be a fine granular material naturally produced by the disintegration of rock of a siliceous nature, except that by specific approval of the City, fines manufactured from igneous rock or chert gravel may be used. Fine aggregate shall be free from cemented or conglomerated lumps and shall not have any coating or injurious material. The quantity of deleterious substances shall not exceed the following limits:

<i>Item</i>	<i>Percent By Weight</i>
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Clay lumps . . . . .	0.25
Coal and lignite . . . . .	0.25
Total lightweight particles, Including coal and lignite . . . . .	0.50

Material passing No. 200 (75 µm) sieve:

a. Natural sand . . . . .	2.0
b. Manufactured sand . . . . .	4.0

Other deleterious substances . . . . .	0.10
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Lightweight sand particles are not considered deleterious lightweight particles.

The total lightweight particle requirement shall not apply to angular chert sand or manufactured sand.

Fine aggregate subjected to the mortar strength test shall produce a mortar having a tensile strength at the age of 7 days of at least 90 percent of that developed at the same age by mortar of the same proportions and consistency made of the same cement and Standard Ottawa sand. Tests shall be made in accordance with procedures set out in AASHTO T 132. Cement used in the tests shall be Type 1.

Fine aggregate subjected to the colormetric test for organic impurities and producing a color darker than the standard will be rejected unless it passes the mortar strength test specified above.

Fine aggregate for ornamental concrete, when such concrete is designated on the plans, and for concrete to be used in sidewalks and drive approaches shall in addition to meeting the requirements of this section, be free from coal and lignite materials as determined by AASHTO T 113.

4. Concrete Admixtures: These specifications cover air-entraining admixtures, water reducing admixtures, retarding admixtures, and accelerating admixtures for concrete.

- i. Air Entraining Add Mixtures: Air-entraining admixtures shall conform to the requirements of AASHTO M 154 except as modified herein.

The manufacturer shall submit a certification and guarantee to the City, showing the brand name and designation; the composition and description of the admixture; the manufacturing ranges for specific gravity at 77° F, percent total solids, and pH; the infrared spectrum; the manner in which it will be identified on containers; and certifying that it will conform to the requirements of these specifications. The certification shall include or have attached specific test results as required below.

For an air-entraining admixture that is an aqueous solution of vinsol resin, manufactured by neutralizing the resin with caustic soda (sodium hydroxide), the certification shall include results of tests showing the ratio of sodium hydroxide to vinsol resin, and the percentage of solids based on the residue dried at 221° F. The certification or test report shall also state that no other additive or chemical agent is present in the solution.

For all other air-entraining admixture, the certification shall include results of tests conforming to the requirements of AASHTO M 154. Tests for bleeding, bond strength, and volume change will not be required.

The manufacturer shall also guarantee that as long as material is furnished under that brand and designation it will be of the same

composition as originally approved and will in no way be altered or changed.

Upon approval of the air-entraining admixture and the manufacturer's certification and guarantee, that brand and designation will be accepted for use without further certification. If, in actual field use, there is evidence of unsatisfactory results, variability or change in composition, or misbranding, the material will be rejected and approval for further use withdrawn, until it is again approved. Samples of air-entraining admixture offered for use may be taken at any time considered necessary by the City.

The containers in which air-entraining admixtures are delivered shall be plainly marked with the manufacturer's name, the brand name and designation of the material, lot number, and net quantity. Bulk shipments shall be accompanied by a delivery ticket showing this information. If the manufacturer supplies air-entraining admixtures in more than one concentration, one concentration shall be designated as standard and others as double strength or triple strength with the containers marked accordingly in letters at least one inch high, or for bulk shipments in a prominent manner on the delivery ticket.

- ii. **Water Reducing, Retarding and Accelerating Admixtures:** These admixtures will not normally be accepted for use in portland cement concrete to be utilized for construction of public roadways and streets. If they are proposed, a complete submittal must be made and approved by the City.

- 5. **Water:** Water for use in mixing and curing concrete shall be reasonably clean; shall be free from injurious amounts of oil, acid, alkali salt, organic mater, vegetable matter, or other deleterious substances; and shall meet the requirements of AASHTO T 26.

Water approved by the City of Wentzville for drinking purposes may be accepted without being tested. Requirements for testing water for mixing or curing purposes may be waived when, in the judgment of the City, the water is considered satisfactory for the purpose.

- c. **Concrete Curing Material:** This specification covers acceptable materials for the curing of portland cement concrete.

- 1. **Liquid Membrane-Forming Compounds:** This specification covers liquid membrane-forming compounds suitable for curing portland cement concrete. The compounds are suitable for use as curing media not only for fresh concrete, but also for further curing of concrete after removal of forms or after initial moist curing.

Liquid membrane-forming compounds shall conform to the requirements of AASHTO M 148 for Type 1-D, clear or translucent with fugitive dye, or

Type 2, white pigmented, curing compounds. The vehicle shall be Class A.

The liquid membrane-forming compounds shall be storable for at least 6 months without deterioration, except that compounds of the water-emulsion type will not be expected to resist freezing. The compound shall not settle to the extent that it cannot be readily restored to uniformity by moderate stirring or by agitating with compressed air.

The liquid membrane-forming compound shall be delivered in the manufacturer's original clean, sealed containers. Each container shall be legibly marked with the name of the manufacturer, the brand name of the compound and class of vehicle, the nominal percentage of nonvolatile material, the manufacturer's batch or lot number and the place of manufacture. The contents of the containers shall in all respects be the same as the sample tested.

The contractor shall furnish a manufacturer's certification in triplicate for each lot of white pigmented curing compound delivered showing typical results of tests for reflectance; or the manufacturer shall have filed a prescribed certification and guarantee with the Testing Laboratory. Upon approval of the material and of the certification and guarantee, material of that brand name may be accepted without further certification for reflectance properties. To obtain such approval, the manufacturer shall submit a notarized certification and guarantee setting forth the brand name and designation, the composition or description of the curing material, and the manner in which it will be identified on the container. The manufacturer shall further certify that the material conforms to the requirements of these specifications and shall list typical values of current tests for consistency, drying time, reflectance, and moisture retention. The manufacturer shall also guarantee that as long as material is furnished under that brand and designation, it will be of the same composition as that originally approved, and in no way will be altered or changed.

Each lot or batch of liquid membrane-forming compound shall be sampled, tested, and approved prior to use.

2. Waterproof Paper: This specification covers waterproof paper for curing portland cement concrete.

Waterproof paper shall consist of two sheets of kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions of the paper. It shall conform to the requirements of AASHTO M 171.

3. Polyethylene Sheeting: This specification covers white polyethylene sheeting for curing portland cement concrete and white, clear, or color tinted polyethylene sheeting for moisture barrier under portland cement concrete pavement.

Polyethylene sheeting shall be a single sheet manufactured to meet the requirements of either AASHTO M 171 or National Bureau of Standards Voluntary Product Standard, PS 17.

Polyethylene sheeting for curing portland cement concrete shall be white and shall conform to all requirements of either AASHTO M 171 or PS 17.

Polyethylene sheeting for moisture barrier under portland cement concrete pavement shall have a nominal thickness of 100 Fm (4.0 mils) and a plain surface finish. The sheeting may be white, clear, or color tinted. White or clear sheeting shall conform to the requirements of either AASHTO M 171 or PS 17, with the exceptions listed below. Color tinted sheeting shall conform to PS 17, with the exceptions listed below.

- (i) Reflectance requirements of AASHTO M 171 and PS 17 shall not apply.
- (ii) Moisture loss requirements, AASHTO M 171, shall not apply.
- (iii) Water vapor transmission requirements, PS 17, shall not apply.
- (iv) Luminous transmittance requirements, PS 17, shall not apply.
- (v) Minimum net weight requirements, PS 17, shall not apply.

The contractor shall furnish a manufacturer's certification in triplicate that the material supplied conforms to the requirements specified. The City reserves the right to sample, test, and approve or disapprove material at any time after it is offered for use.

4. White Polyethylene-Burlap Sheeting: This specification covers white polyethylene-burlap sheeting for curing portland cement concrete.

White polyethylene-burlap sheeting shall consist of burlap bonded on one side with white opaque polyethylene. The polyethylene sheeting shall conform to the requirements of Section. 704.2.2 c, and shall be securely bonded to the burlap so there will be no separation of the materials during use. The material shall be free from deleterious matter harmful to concrete.

5. Burlap and Mats: This specification covers burlap and mats of jute or cotton for use in curing portland cement concrete.

Burlap shall be fabric made from jute or other suitable fibers. Jute mats shall consist of two plies of burlap stitched together to maintain the shape and stability of the unit. Cotton mats shall consist of filler or cotton bats covered with unsized cloth or burlap, and tufted or stitched to maintain the shape and stability of the unit. Burlap and mats shall, in the judgment of the engineer, be of such construction and in such condition as required to adequately maintain free moisture on the surface of the concrete with the type of system being used to provide the water. Material shall be free from deleterious matter harmful to concrete.

- d. Materials for Joints: This section covers specifications for joints for Concrete Pavement, Base, Median, Median Strip, Paved Approach, Curb, Curb and Gutter, Gutter, and Sidewalk.

1. Dowel Bars: Dowels for transverse joints shall meet the requirements for AASHTO M 31, AASHTO M 42, or AASHTO M 53 for Plain Rounds. They shall be epoxy coated with a minimum thickness of 5 mils. The cut ends are not required to be coated. They shall be free of cutting burrs and other projections. The free end of the dowel bar for a length of at least 11 in. shall be coated with an approved graphite grease. Graphite grease shall contain a minimum of 25 percent graphite and shall be certified by the manufacturer or shown on the container label. It shall be applied in manner that will result in a thorough covering of that section of the bar with a thin uniform coating. Dowel supporting units shall conform to SCD 700.21
2. Tie Bars: Tie bars for longitudinal joints and construction joints shall be round, deformed, and shall meet the requirements of AASHTO M 31, AASHTO M 42, or AASHTO M 53, except that tie bars which are to be bent and straightened shall conform to the requirements of AASHTO M 31, Grade 40.
3. Joint Sealants: Material for sealing joints in new concrete shall be a polymer based hot pour elastic type meeting specification requirements of ASTM D 3405. The product shall be comprised of at least 5 percent crumb rubber. The sealant shall be supplied in solid form which, when melted and properly applied, forms a resilient and adhesive compound that will effectively seal cracks and joints in both asphalt and portland cement concrete pavements. The sealant shall have a minimum pot application life of twelve (12) hours and have a re-heat capability of at least one (1) time after initial heat-up.

Material for sealing joints containing grey foam rubber expansion material shall be a one component, pourable grade polyurethane sealant which is self leveling. The product must be supplied ready-to-use in approximately 1 qt. cartridges with no premixing requirement. The material shall be capable of adhering to a prepared joint without the use of primers and provide serviceable joint sealant at temperatures between -40° F and 180° F°. The material shall be supplied in either limestone or grey color.

**704.3 Equipment.** Equipment and tools including portable mixers necessary for handling materials and performing all parts of work shall be approved by the City as to design capacity, and mechanical condition. The equipment shall be at the job site sufficiently ahead of the start of construction operations to be examined thoroughly for approval and shall comply with the following requirements.

- a. Batching Plant and Mixer: The mixer, water measuring equipment, and weighing and batching equipment shall be approved by the City.

Central or truck mixed concrete shall be produced and delivered from not more than three (3) plants per day for any individual project or subdivision.

- b. Hauling: Batch trucks used for transporting unmixed batches from the plant to the paver shall have compartments of size and construction adequate to prevent loss of material and spillage or contamination from one compartment to the other. Cement shall be handled in such manner as to prevent loss during the loading, hauling, and unloading process. To prevent loss of cement, the material shall be transported by:
1. Batch trucks equipped with separate metal or metal-lined bulk cement containers kept closed while the material is in transit, or
  2. batch truck compartments equipped with rigid, tight-fitting covers to be kept closed while the material is in transit and opened when the batches are being discharged, and in which at least a portion of the aggregate is placed prior to placing the cement, or
  3. placing the cement on the coarse aggregate and adequately covering with sand when rigid compartment covers or separate cement containers are not used, or
  4. other methods specifically approved by the City.

Trucks for transporting mixed concrete shall be approved by the City. Consideration will be given for the use of an approved type of non-agitating equipment for transporting central mixed concrete provided the discharge of the concrete is completed within 30 minutes after the introduction of the mixing water to the cement and aggregates. Bodies of non-agitating hauling equipment shall be smooth, mortar-tight, metal containers capable of discharging the concrete at a satisfactory, controlled rate without segregation. Covers shall be provided when needed for protection or to comply with Statutes.

- c. Forms: Side forms, except as otherwise permitted, shall be of metal, of an approved section, with a base width not less than the height, except a 9 in. base width will be permitted for 10 in. pavement. The height shall be equal to the edge thickness of the pavement. Each form section shall be straight and free from bends and warps. No section shall show a variation greater than 1/8 in./10 ft. from the true plane surface on the top, and 1/4 in./10 ft. along the face of the form. The method of connecting form sections shall insure a tight, neat joint. Built-up metal forms when allowed may be used by rigidly attaching a wood or metal section of suitable width and thickness to the bottom of the form providing an increase in depth of not more than 20 percent. Each 10 foot (3 m) form section will be securely held in position by a minimum of three approved form pins.

Forms for curved form lines shall comply with the grade and alignment requirements of Section 704.5 except that straight steel form sections 10 ft. or less in length may be used for form lines having a radius greater than 200 ft. Special forms of wood or steel will be permitted for curved form lines having a radius of 200 ft. or less, and may be permitted if approved by the City in other special cases where it is not practicable to use standard pavement forms. Straight steel form sections 5 ft. in length will be acceptable for curved form lines

having a radius of not less than 100 ft. Forms shall be of sufficient rigidity to prevent distortion in edge alignment due to pressure of the concrete. Wood forms may be used with a minimum thickness of 1 in. Radius of 32 ft. or less will be formed with segmented steel or wood forms with a minimum thickness of 1 in. and will be held securely with approved form pins as required by the City. Wood forms shall not be used as a track for operating paving and finishing equipment. All forms will be set on compacted subgrade without support devices.

- d. Form Line Grader: Except as considered impracticable by the City for the type or quantity of work involved, the form line for all forms supporting mechanical finishing equipment shall be excavated substantially to line and grade by a machine designed for this purpose. In lieu of the form line grader, consideration will be given for granting approval for use of other methods producing similar results.
- e. Mechanical Form Tamper: Except as considered impracticable by the City for the type or quantity of work involved, a mechanical form tamper constructed in such manner that each side of the form will be tamped simultaneously shall be used on all forms supporting mechanical finishing equipment.
- f. Subgrade Machine: The subgrade machine shall be of a type approved by the City. Approval may be given for the use of a subgrade planer in lieu of the subgrade machine if the planer is considered adequate for the particular work involved, except as considered impracticable for the type or quantity of work involved.
- g. Subgrade Planer: A subgrade planer shall be of a type approved by the City. The subgrade planer rolling on the side forms should be provided, except as considered impracticable for the type or quantity of work involved.
- h. Check Template: A heavy metal check template, approved by the City, rolling on the side forms shall be provided. The template shall have a square edge for checking the subgrade surface. Scratch templates with spikes or teeth will not be permitted. In instances of small concrete pavement pours, the use of a string line or an approved portable template to check the subgrade may be used with the approval of the City.
- i. Strike-off for Reinforcement: An strike-off template, approved by the City, to level the concrete prior to placing tie bars shall be provided when a mechanical concrete spreader is not used.
- j. Vibrators: Vibrators, for full width vibration of the concrete, may be either the surface pan-type or the internal-type with either tube or multiple spuds. Specific vibrator to be used shall be approved by the City. They may be attached to the spreader or the finishing machine, or may be mounted on a separate carriage. They shall not come in contact with the reinforcement, load transfer devices, subgrade, or side forms. Vibrating equipment shall be operated in accordance with the manufacturer's recommendation at a frequency to provide satisfactory results, but the frequency of the surface vibrators shall not be less than 3600 impulses per minute and the frequency of the internal-type shall not be less than



4500 impulses per minute. Hand vibrators shall have a frequency of not less than 4500 impulses per minute. The contractor shall have a satisfactory tachometer available at all times for checking the vibration frequency.

- k. Wire Comb: A wire comb shall be not less than 10 ft. long with a single line of wires exposed to a length of approximately 4 in. The wire shall be blue tempered and polished spring steel with nominal dimensions of 0.028 in. thick and 0.100 to 0.125 in. wide. The wires shall be spaced to provide 1/2 in. clear space between wires and securely mounted in a rigid head with the width of each wire parallel to the longitudinal center line of the head. The wire comb shall be mechanically operated with the length of the comb parallel to the pavement centerline and capable of traversing the full width of pavement in a single pass at a uniform speed and at a uniform depth. Final approval of the wire comb will be based on satisfactory performance during actual use. Texturing equipment, other than a wire comb, may be approved provided it produces a texture equivalent to that produced by a wire comb and upon satisfactory performance during actual use. Hand use of a wire comb of standard dimension will be permitted with prior approval of the City. An unsatisfactorily combed area will be refloated and textured.
- l. Concrete Saw: When sawed joints are required, equipment complete with either an abrasive wheel or a diamond-edge water-cooled blade capable of providing a groove of the specified dimensions in the hardened concrete shall be provided.
- m. Equipment for Sealing Joints: An approved double boiler-type heating kettle equipped with a mechanical agitator and a satisfactory temperature indicating device will be required. The equipment shall be capable of heating the joint sealing material uniformly without damage.
- n. Auxiliary equipment shall be available at all times as follows:
  - 1. Two footbridges so designed that they can be readily transported from place to place and which have no part in contact with the pavement. Contractors performing paving in residential subdivisions will be permitted to proceed without footbridges if they choose.
  - 2. Two or more 10 ft. straightedges of an approved type. The blades will be composed of aluminum or magnesium, reinforced on the upper edge and rigidly jointed to the handle. The blades shall be capable of producing the proper section and slope. Blades shall be replaced when edges become wavy or warped.
  - 3. Long-handled floats, each having a blade of 3 ft. in length and 6 in. in width.
  - 4. Metal dies with beveled face numerals not less than 3 in. nor more than 5 in. high and thick enough to make an indentation of 1/4 in. A satisfactory die shall be used for marking the point designated by the even station number and all equations. This equipment is required for arterial road pavement only.
  - 5. Sufficient burlap, waterproof paper, or plastic film for the protection of the pavement in case of rain or breakdown of the curing equipment.

6. A manually operated long-handled wire comb approximately 0.6 m (2 ft.) wide with wire size and spacing in accordance with the requirements of Section 704.3.11. For residential subdivision paving a burlap drag finish is required.

**704.4 Weather Limitations.** Concreting operations shall not normally continue: (1) when either the air temperature or the temperature of the surface on which the mixture is to be placed is below 35° F, (2) on any wet or frozen surface, (3) when weather conditions prevent the proper handling or finishing of the mixture, or (4) during critical temperature periods (below 35° F) unless authorized by the City. If approval has been granted for the contractor to place the concrete while the ambient temperature is at or lower than 40° F, the contractor shall take precautionary measures to prevent damage by freezing, such as heating mixing water, heating aggregates, or applying heat directly to the contents of the mixer. Aggregates shall not be heated higher than 150° F and the temperature of the aggregates and mixing water combined shall be not higher than 100° F, when the cement is added. Unless otherwise authorized, the temperature of the mixed concrete when heating is employed shall not be less than 50° F and not more than 80° F at the time of placement. Cement or fine aggregate containing lumps or crusts of hardened material or frost shall not be used. Under no condition shall the mix be used when mix temperature is over 100° F at time of placement.

Concrete paving from November 15th to March 15th will not commence unless approved by the City. Pouring operations will not begin until the ambient air temperature has reached 35° F and rising with a predicted high temperature of over 40° F and will discontinue operations when the ambient temperature falls to 40° F.

Protection: All concrete shall be effectively protected from freezing for a period of at least five (5) days after it has been placed and until a minimum compressive strength of 3000 psi has been attained. Protection will be required for not more than ten (10) days. Regardless of precautions taken, the contractor shall assume all risks, and all frozen concrete shall be removed and replaced at his expense.

Newly completed subdivision pavement placed between November 15th and March 15th shall be blocked off from all vehicles and construction traffic after paving is completed for a period of three (3) weeks or 21 days. At no time will any vehicle equipment or construction materials, paving forms, etc. be allowed on the new pavement during the three (3) week period specified above. If any violation of the protective specifications as modified relating to concrete placed between November 15th and March 15th is observed or detected, the penalty for such violation will be the full escrowed amount per square yard (square meter), or the violated area shall be removed and replaced.

**704.5 Setting Forms.** Forms shall be set so that they rest firmly throughout their length upon the thoroughly compacted subgrade. Any subgrade which is more than 1/2 in. below the established grade at the form line shall be brought to grade for a sufficient width, outside the area required by the pavement, to support the forms adequately, and shall be compacted to specified density. Any variations, whether below or above grade, shall be brought to true grade.

Forms shall be staked into place with not less than three pins for each 10 ft. section. A pin shall be placed at each side of every joint. Form sections shall be tightly locked, free from play or

movement in any direction. If the subgrade becomes soft and yielding after the forms have been set and before the concrete is placed, the forms shall be reset on a stable foundation.

Both straight and curved forms shall be supported in such position that the face of the form shall be vertical on tangents and perpendicular to the superelevated section on curves. The top of the form shall not vary more than 1/8 in. from the true grade line during placing, compacting, and finishing operations. The form alignment shall not vary more than 1/4 in. from the true alignment.

Unless otherwise permitted, sufficient forms shall be provided so that at least 500 ft. of forms on each side of the roadbed are accurately set at all times in their required final position in advance of the point where concrete is being placed. Each time forms are used; they shall be cleaned thoroughly and oiled before reuse.

**704.6 Conditioning Subgrade.** When forms have been securely set to grade, the subgrade shall be brought to proper cross section in accordance with Division 200. The final checking for proper crown and elevation of the subgrade by means of the check template required in Section 704.3.8 shall be performed in the presence of the City after all equipment traffic on the subgrade has ceased and as close as is practicable to the area of current concrete placement. If calibrated rod measurements taken when the surface of the pavement has been finished indicate that pavement thickness is less than specified on the plans, the subgrade planer and template shall be immediately adjusted.

Low areas of treated bases shall be filled only with concrete integral with the pavement. No direct payment will be made for the concrete used to fill these low areas.

**704.7 Proportioning and Mixing Concrete.** Concrete shall be proportioned and mixed in accordance with Section 704.2, by one of the following methods:

- a. Paving Mixers: Semi-automatic control will be required for cement and aggregate batching for concrete mixed in paving mixers at the point of deposition. This shall consist of controlling the flow of materials by means of gates or valves which may be separately and manually opened to allow material to be weighed, but which are closed automatically when the pre-determined weight of each material is reached. The batching equipment shall be interlocked so that: (1) The charging mechanism of any weigh hopper cannot be opened until the scale has returned to zero and the discharge mechanism of the weigh hopper has closed; (2) the discharge mechanism of the weigh hopper cannot be opened if the charging mechanism is open; (3) The discharge mechanism cannot be opened until all ingredients have been batched to their designated weights, within the specified tolerances; (4) If separate aggregate components are weighed cumulatively in a single hopper, the aggregates will be weighed in the selected sequence and the cement weighed in a separate hopper. The cement shall be kept separate from the aggregates until the batch ingredients are released for discharge.
- b. Truck or Central Mixers: In addition to the above requirements, automatic, fully interlocked, batching control will be required for concrete mixed in truck or central mixers and hauled to the point of deposition as a mixed product. This shall

consist of batching all aggregate, cement, and water by means of automatic or metering, with all additives dispensed automatically and interlocked with the automatic weighing or metering controls. For central mixed concrete, the mixing cycle shall be timed and interlocked with the weight batch cycle. The weight-setting controls shall be suitably enclosed in a compartment equipped so that it may be locked when directed by the City. The automatic batching equipment shall be capable of conversion to manual operation if necessary. In the event of an automatic equipment breakdown, manual operation of the plant will be permitted until the end of the workday.

Mixers will not be permitted to operate on any existing or newly constructed rigid type pavement except as specified herein and then only if damage does not occur. A 16E mixer may be operated on existing pavement if it is supported on rubber tires of such size and number that it will operate within the legal load limit requirements and does not conflict with the prescribed requirements for handling traffic. If the concrete being mixed is for concrete pavement resurfacing or for the purpose of widening existing pavement that is to be resurfaced with either asphaltic or portland cement concrete, any mixer may operate on the existing pavement provided the gross weight does not exceed 75,000 lb. and delivery of concrete from mixer to its place of use is such that it will eliminate the concentration of the load on the mixer tracks that is generally created by use of a bucket operating on a boom. A method of delivery shall be developed that will be free of segregation tendencies.

**704.8 Placing Concrete.** The concrete shall be deposited full depth over the entire width of the subgrade between forms in such manner as to require as little re-handling as practicable. Where concrete is being placed for mainline pavement, mechanical spreading equipment shall be required. Concrete shall be thoroughly vibrated along the forms or sides and along expansion and key type longitudinal joints. Attachments on finishing machines to vibrate the concrete adjacent to forms and longitudinal joints will be permitted provided satisfactory results are attained. Care shall be taken that the vibrator does not penetrate the subgrade or dislodge or move the joints. The vibrating shall be sufficient to produce a smooth pavement edge. Honeycombed edges may be cause for rejection of the pavement.

Subdivision Paving: The concrete shall be deposited full depth over the entire width of the subgrade between forms in such manner as to require as little rehandling as practicable. Where concrete is being placed for non-arterial mainline slip form paving, the concrete may be directly deposited from trucks onto the subgrade providing the paving equipment is capable of properly spreading the concrete.

**704.9 Strike-off of Concrete and Placement of Reinforcement.** Following the placing of the concrete, it shall be struck off so that when the concrete is properly consolidated and finished, the surface of the pavement will be at the proper elevation and cross section.

Tie bars shall be supported in the proper position by chairs driven into the subgrade, or may be placed by approved mechanical methods prior to the consolidation of the concrete after it has been struck-off.

Tie bars shall be free from dirt, oil, paint, grease, loose mill scale, and thick rust which could impair bond of the steel with the concrete. Thin, powdery rust need not be removed.

Keyway shall be placed to the proper height as shown in the plans and supported by attached legs resting on the subgrade. The keyway must be held firmly against the form to prevent infiltration of mortar or misalignment. Keyway sections will be butted tightly except at expansion or contraction joints where they will be gapped. Infiltration mortar shall be removed to produce a clean, fillable joint.

**704.10 Final Strike-off, Consolidation, and Finishing.** Machine finishing by vibrating and screeding processes will be required for all pavement except as permitted by Section 704.10.i. After the final course of the concrete has been placed it shall be struck off and thoroughly vibrated until concrete of a uniform and satisfactory density is obtained. The surface of the pavement shall be screeded as many times and at such intervals as necessary to leave a surface of uniform texture to the proper grade and typical section. Excessive screeding over a given area shall be avoided. Finishing machines shall be kept in satisfactory repair and adjustment and shall be operated without lift, wobbling, or other variation tending to affect a precision finish. While operating, a roll of concrete shall be maintained in front of the full length of all screeds so that the vibrating and screeding work will be fully effective.

- a. Consolidation: Concrete shall be consolidated by vibrating the mass promptly following placement. Vibrating tubes shall extend into the concrete the distance necessary to provide adequate consolidation. Approved pan-type vibrators operated on the surface of the concrete may be used in lieu of tube-type internal vibrators. Vibrators shall be operated only when the machine to which they are attached is moving.
- b. Machine Floating: After the finishing machine operations have been completed, the concrete surface on arterial roadway pavement shall be smoothed and consolidated by mechanical floating, either longitudinal or transverse, leaving the pavement finished to the required cross section, elevation and surface smoothness. Mechanical floats shall be adjusted and so operated that the float or screed will have a small quantity of concrete in front of its full length at all times for filling depressions. The screed or float shall not be raised or lowered for the purpose of maintaining the proper quantity of concrete in front of the float. The longitudinal float shall pass over each area of pavement. Manually operated floating will be required following machine floating and in advance of straightedge testing.
- c. Added Finishing Water: Added finishing water shall be applied only as ordered by the City and only in the form of a fine pressure spray by hand methods. Under normal working conditions moisture shall not be applied to the surface of the pavement in any form.
- d. Straight-Edge Testing and Surface Correction: Immediately following the machine floating and while the concrete is still plastic, the contractor shall test the slab surface for trueness by means of a 10 ft. straightedge as specified in Section 704.3.14 (b). Straightedging shall be done by holding the straightedge in contact with the concrete surface, parallel to the road centerline, and drawing the straightedge lightly across the surface. Advance along the road shall be in successive stages of not more than one-half the length of the straightedge. All variations shall be eliminated by filling depressions with freshly mixed concrete or striking off projections, and the areas so corrected shall be consolidated and

refinished by means of a long-handled float. The surface shall again be checked by the contractor by means of the 10 ft. straightedge and any irregularities eliminated.

e. Surface Finish:

1. *Non-Tinted Concrete.* After surface irregularities have been removed, the concrete shall be given a uniformly roughened surface finish by use of a wire comb or other approved texturing device which produces a texture similar to that produced by a wire comb. The texturing operation shall be executed so that the transverse corrugations will be uniform in appearance. Successive passes of the comb or other approved device shall be overlapped the minimum necessary to obtain a continuously textured surface. The surface texture produced shall have the characteristics of a texture produced using a wire comb as specified in Section 704.3.11, and which has an average texture depth of approximately 1/8 in. Texturing shall be completed while the concrete is in such condition that it will not be torn or unduly roughened, and before it has attained its initial set. The texturing device shall be cleaned or replaced as often as necessary to obtain the required surface texture. Upon completion of texturing, the pavement surface shall be uniform in appearance and free from surplus water, rough or porous spots, irregularities, depressions, and other objectionable features. Small or irregular areas, or areas not suitable for machine texturing when adjacent surrounding concrete is ready for texturing, shall be textured with a hand operated device producing a textured surface equivalent to that required for machine combing. Subdivision pavement shall be surface textured with a wet burlap drag unless otherwise directed by the City.
2. *Tinted Concrete.* If concrete is to be tinted according to the approved plans, surface irregularities shall be removed prior to giving the concrete a uniformly roughened surface finish by the use of a fabric drag or a broom. The damp fabric drag shall be dragged in a longitudinal direction. Brooms shall be drawn across the surface from the centerline toward each edge with the broom held perpendicular to the surface, each stroke slightly overlapping the preceding stroke. The brooming operation shall be executed so that the corrugations will be uniform in appearance and not more than 1/16 in. deep. A machine capable of producing a finished surface similar to that required for hand brooming may be used. Brooming or dragging shall be completed before the concrete is in a condition that it will be torn or unduly roughened and before the concrete has attained its initial set. The brooms or the fabric shall be cleaned or replaced as often as necessary to attain the required surface texture. Upon completion of brooming or dragging, the surface of the pavement shall be uniform in appearance and shall be free from surplus water, rough or porous spots, irregularities, depressions, and other objectionable features.

- f. Edging at Forms and Joints: After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each form line, and of each

side of transverse expansion joints and construction joints shall be worked with an edging tool having a radius of approximately 3/8 in. A well-defined and continuous radius having a smooth, dense finish shall be produced. The surface of the slab shall not be unduly disturbed by tilting of the tool during use. Tool marks on the slab shall be eliminated by floating. In doing this, the rounding of the corner of the slab shall not be disturbed. All concrete on top of the joint filler shall be completely removed. All joints shall be tested with a straightedge before the concrete has set, and correction made if one side of the joint is higher than the other.

- g. Station Numbers: The contractor shall stencil station numbers into all arterial roadway pavement immediately following the final finishing operations and before the concrete takes its final set. The numbers shall be placed at alternating full stations as ascertained by measurements determined by the City. Equations in stationing shall also be marked in the pavement. On undivided pavement, the station numbers shall be on the left side of the pavement with respect to the ascending stationing and shall be on the pavement edge unless an integral curb is involved, in which case the numbers shall be placed on the face of the curb. On divided pavement, station numbers shall be placed on the median side of each pavement. The numbers shall be placed facing the centerline of the pavement, or the centerline of each pavement in the case of divided pavements. The numbers shall be placed on a troweled area of the finished surface.
- h. Modified Machine Finishing: For isolated pavement lanes less than 1000 ft., all machine finishing equipment will be required except that a manually operated longitudinal float may be used in lieu of the machine float.
- i. Hand Finishing: Compacting and finishing pavement by hand methods will be permitted:
  - 1. For all curves having a form line radius of less than 200 ft. or where wood forms are used.
  - 2. For all tapered and irregular shaped areas.
  - 3. For isolated pavement lanes when approved by the City.
  - 4. For pavement lanes of less than 8 ft. in width and 200 ft. in length.
  - 5. When a breakdown of the mechanical compacting and finishing equipment occurs or in the event of some other emergency. After a breakdown, only material which has already been proportioned which is within time limits as determined by time stamped on material ticket, and which may become unsatisfactory for use may be finished by hand.
  - 6. For bridge approaches and pavement to first expansion joint.

Hand finishing shall consist of all operations required under Section 704.10 except mechanical finishing equipment will not be required. If the mechanical finishing machine is not used, a vibrating screed or a tamping template, the face of which is at least 4 in. wide, having a length slightly in excess of the width of the pavement, and having sufficient rigidity to maintain the true cross section of the pavement shall be used. If a mechanical float is used, a manually operated longitudinal float worked from each side of the pavement shall be used.

In irregular shaped areas of subdivision paving such as "cul-de-sacs", "eyebrows" and the handwork portion of "Tee" intersections the contractor will be allowed to use a 10 ft. long float to strike off and finish the concrete surface. The contractor will be required to use a vibratory screed in subdivision pavement widenings and taper lanes adjacent to mainline pavement. The screed shall also be used on any mainline pavement not poured with a slip form paver other than in the irregular shaped areas mentioned above.

**704.11 Joints.** Joints shall be of designated type and dimensions, as shown on SCD 700.07, and constructed at the locations shown on the approved plans or as approved by the City. Where joints are preformed, the form or joint shall be set and securely fastened to insure the joint being in the required position when the concrete is finished. Dowels and tie bars in their final position shall be parallel to the subgrade and perpendicular to the line of the joint. Dowel supporting assemblies shall conform to SCD 700.21. The concrete shall be placed so that it will not displace or disarrange the joint installations. Transverse grooving for subdivision streets shall be allowed provided the groove is a minimum of 1 1/4 in. deep and that all concrete deposited above the level of the finished pavement surface, due to the grooving procedure, be refinished. The City shall have the option of requiring sawcut joints in subdivision paving wherever deemed necessary.

- a. Expansion Joints: Type A2 expansion joints, as shown on SCD 700.07, shall extend for the full cross section and full depth of the concrete pavement. The filler shall be premolded. Filler placed prior to the placement of the concrete shall be installed with a removable cap or edging bar to serve leaving a void no more than 3/8 in.  $\pm$  1/8 in. as a guide for edging the joint and protection for the filler during the placing and finishing of the concrete. Joints constructed after the placement of concrete shall be sawed full depth and the exposed edges shall be ground to a chamfer of 3/8 in. The filler shall rest snugly on the subgrade from form to form. The joints shall be sealed as required in Section. 704.11.4. Upon removal of the forms, any struts or fins of concrete extending across the joint shall be removed to the full width of the joint and the full thickness of the pavement.
- b. Construction Joints: Construction joints shall be made at the close of each day's work or when the work is stopped or interrupted for more than 30 minutes. No transverse construction joint shall be constructed within 10 ft. of an expansion or contraction joint. Construction joints shall be constructed perpendicular to the top surface and the centerline of the pavement. Construction headers at the end of the day will always be placed at a contraction joint containing a load transfer device. The joint shall be so formed as to consist of a two piece header of 2 in. nominal wood or a standard paving form which will produce a smooth face on a vertical joint and shall be firmly held in place with approved staking pins placed on an interval which will rigidly hold the form in place. The required header shall conform to the cross section of the pavement. Before paving operations are resumed, the header shall be removed carefully and all surplus concrete and other refuse shall be removed from the subgrade. Construction joints at all other locations will be so formed as to produce a vertical smooth joint and shall be composed of a nominal 2 in. thick wooden or standard paving form predrilled for 5/8 in. diameter deformed reinforcing steel dowels 30 in. in length embedded 15 in. into the proposed slab. An alternate construction joint may be obtained by



placing bent bars in position against a vertical form of required dimension. Both methods will incorporate a keyway in combination with the dowels.

- c. Sawing: Unless otherwise provided, all transverse contraction and all longitudinal joints in the pavement and curbs shall be sawed with the joint groove cut to the dimensions shown on the approved plans, and SCD 700.09b. When the groove for poured type transverse joints is cut prior to removal of the forms, the groove shall be cut as close as is practicable to the pavement edge, and the resulting crescent shaped plug in the groove, immediately adjacent to the form, will be acceptable. For intersections and irregular pavement, joints shall be sawed at locations as directed by the City. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive ravelling. All joints shall be sawed before uncontrolled shrinkage cracking takes place. The sawing of any joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. In general, all joints should be sawed in sequence unless otherwise directed. The City reserves the right to have the contractor install premolded type joints on multiple width construction when the use of sawed joints fails to prevent random cracking. Construction joints may be formed by full depth sawing.
- d. Sealing Joints: All sawed contraction joints and sawed or formed expansion joints shall be sealed with joint sealing material before the pavement is opened to traffic, including construction traffic, and as soon after completion of a minimum curing period of 24 hours providing vehicles are not placed on the pavement when performing the sealing operation. Immediately prior to sealing, the joints shall be thoroughly cleaned and dried. The sealing material shall be heated to the pouring temperature recommended by the manufacturer. Any material which has been heated above the maximum safe heating temperature will be rejected. The sealing mixture material shall be installed in such a way as to fill the joint opening completely and uniformly from the bottom to the top, and any excess material shall be removed from the pavement surface. Sawed joints in vertical curb shall be sealed with gray colored silicone caulk.
- e. Adding New Pavement: New pavement constructed parallel to existing pavement shall be tied to the existing pavement with the existing longitudinal tie bars. The tie bars shall be straightened and incorporated into the new abutting slabs. Where tie bars do not exist, a 1 in. minimum hole will be drilled 18 in. deep on 30 in. centers into the existing pavement. New 5/8 in. diameter bars, 30 in. long, will be placed into the drilled holes using an epoxy bonding material, approved by the City. Existing pavement joints shall be duplicated in the abutting slabs.

**704.12 Curing.** Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface and exposed edges of the newly placed concrete shall be covered and cured in accordance with one of the following methods. The concrete shall not be left exposed for more than 1/2 hour between stages of curing or during the curing period.

- a. White Pigmented Membrane: After the free water has left the pavement surface, the entire surface shall be sealed by hand or machine spraying having a uniform pressure capable of providing a uniform application of white pigmented membrane curing material. The contractor shall provide satisfactory equipment to insure uniform coverage of curing material, without loss, on the pavement at the rate of 1 gal./150 sq. ft. If rain falls on the newly coated pavement before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the contractor will be required to apply additional curing material to the affected portions. All areas cut by finishing tools subsequent to the application of the curing material shall immediately be given new applications at the rate specified above. If hair-checking develops before the membrane can be applied, the concrete shall be initially cured with wet burlap as specified in this section before the membrane is placed. Red pigmented membrane shall not be used on arterial roadways unless approved by the City.
- b. Waterproofed Paper, Polyethylene Sheeting, and Polyethylene Burlap Sheeting: As soon as the concrete has set sufficiently to prevent marring, the top surface of the pavement shall be covered with units of waterproofed paper, white polyethylene sheeting, or white polyethylene-burlap sheeting, which shall be lapped not less than 18 in. If polyethylene-burlap sheeting is used, the burlap shall be thoroughly dampened prior to placing and shall be placed next to the concrete. All coverings shall be so placed and weighted that they remain in contact with the pavement surface and edges for not less than 72 hours after the concrete has been placed. If hair-checking develops before the covering can be applied, the concrete shall be initially cured with wet burlap as specified in Section. 704.12.4 before the covering is placed.
- c. Mats of Jute or Cotton: New mats of jute or cotton, and any such mats that have been used for purposes other than curing of concrete, shall be thoroughly washed before being used. The use of mats contaminated with earth or other deleterious substances will not be permitted. The top surface of the pavement shall be completely covered with mats as soon as the concrete has set sufficiently to prevent marring of the surface. Prior to being placed, the mats shall be damp throughout and shall be placed with the wettest side down. The mats shall be handled in such manner that contact with earth or other deleterious substances is avoided, and they shall be so placed that they remain in contact with the pavement surface and edges. The covering shall be kept wet and maintained in position for not less than 72 hours after the concrete has been placed. If hair-checking develops before the mats can be applied, the concrete shall be initially cured with wet burlap as specified in Section. 704.12.4 before the mat covering is placed.
- d. Burlap: The top surface of the pavement shall be temporarily covered with thoroughly damp burlap after the concrete has set sufficiently to prevent marring of the surface. Burlap shall be handled in such manner that contact with earth or other deleterious substances will be prevented. All new or contaminated burlap and all burlap which has been used for purposes other than the curing of concrete shall be thoroughly washed before being used. The burlap shall be kept thoroughly wet until removed for application of the final curing material. Neither the top nor the edge of the pavement shall be left unprotected for more than 1/2

hour. When the burlap is removed, curing shall be continued by one of the approved methods.

- e. Straw: The pavement shall be initially cured with wet burlap. As soon as the burlap is removed, the surface shall be covered with not less than 6 in. of straw, the thickness being measured after wetting. The straw shall be kept saturated for not less than 72 hours after the concrete has been placed. When removed, the straw shall be disposed of so as to leave the road in a sightly condition, but shall not be burned on the pavement or in close proximity to the edges.

**704.13 Removing Forms.** Forms shall be removed carefully so as to avoid damage to the pavement. Removed forms will not be placed on pavement during the 72 hour curing period. Honeycombed areas will be considered as defective work and shall be immediately repaired. If the forms are removed prior to 72 hours after placing concrete, the sides of the slab shall be cured by one of the methods specified above. Any trench excavated for the forms shall be entirely backfilled so no water will stand next to the pavement.

**704.14 Surface Tolerance.** As soon as practicable, after placement the pavement surface may be straightedged by the City. On arterial roadways and collector streets all variations exceeding 3/8 in./10 ft. will be plainly marked. At transverse joints, all surface variations exceeding 1/4 in./10 ft. will be marked. Areas of pavement which exceed these allowable tolerances shall be removed by an approved device consisting of multiple cutting edges leaving a grooved surface finish comparable to that produced by the finishing tool. The use of a bush hammer or other impact device will not be permitted. In areas where conditions necessitate that surface grinding be performed to a depth that leaves the final pavement more than 8 mm (0.3 in.) deficient from plan thickness, the effected slab(s) will be removed and replaced in their entirety.

**704.15 Opening to Traffic.** The concrete pavement may be opened for light traffic or construction traffic when it is at least 72 hours old, has attained a minimum compressive strength of 3000 psi, and is in compliance with all other requirements of these specifications. The pavement shall not be opened to all types of traffic until the concrete is at least 120 hours old and has attained a minimum compressive strength of 3500 psi. If high early strength concrete is used, the pavement may be opened to all types of traffic when the concrete has attained a minimum compressive strength of 3500 psi. In either case a 28 day compressive strength of 4000 psi must be obtained for all concrete pavements. Compressive strength will be determined by tests made in accordance with applicable ACI or ASTM methods, as approved by the City. Pavement shall be cleaned and joints sealed prior to opening to traffic. All street and stop signs must be in place prior to opening to traffic.

**704.16 Slip-Form Construction.** At the option of the contractor, pavement may be constructed by the use of sliding form methods. All applicable provisions of this section (704) shall be followed. In addition, the following provisions shall apply.

- a. Subgrade and Base: Where an aggregate base course is required for the pavement, it shall be constructed in accordance with the requirements of Section. 701, Aggregate Base Course. The slip-form paver shall operate on the aggregate base. After the grade or base has been placed and compacted to the required density, the areas which will support the paving machine shall be cut to the proper elevation by means of an approved machine. The subgrade on which the

pavement is to be constructed shall be brought to the proper profile by means of an approved subgrade machine or subgrade planer. An approved check template shall be used to determine if the finished subgrade conforms to the required cross section. The use of a check template may be waived by the City when the subgrade is prepared by full-width equipment using automatic controls operating from an established grade reference line on both sides of the machine.

- b. Placing Concrete: A self-propelled concrete spreader equipped with a power-driven device for spreading the concrete uniformly across the subgrade transversely shall be used to place the concrete. The spreader shall also be equipped with an adjustable strike-off blade capable of striking off the surface of the concrete in the longitudinal direction of the pavement at any required elevation. For isolated pavement lanes over 200 ft. long but less than 2000 ft. long, a mechanical spreader will not be required. The final surface texture may be applied manually with a wire comb meeting the requirements of Section 704.3.14. A mechanical spreader will not be required in subdivision paving operations.
- c. Consolidating and Finishing Equipment: The concrete shall be consolidated and finished by an approved slip-form paver designed to spread, consolidate, and shape the concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogenous pavement in conformance with the plans and specifications. The slip-form paver shall be fully energized, self-propelled, and crawler mounted. It shall be of sufficient weight and power to construct the maximum specified concrete paving lane width as shown on the plans at an adequate forward speed, and without transverse, longitudinal, or vertical instability or displacement. Automatic controls operating from grade reference lines located on both sides of the paver shall be used to establish finished pavement elevations. The slip-form paver shall provide one oscillating transverse belt or other approved device that will produce a surface reasonably free of surface voids and tears. The machine shall vibrate the concrete for the full width and depth of the pavement being placed. Such vibration shall be accomplished with vibrating tubes or arms working in the concrete or with a vibrating screed or pan operating on the surface of the concrete. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The forms shall trail behind the paver for such distance that no apparent slumping of the concrete will occur. The slip-form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall be so coordinated as to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately.
- d. Forms: Unless otherwise permitted by the City, approved side forms will be required 20 to 30 ft. back and ahead of transverse expansion and construction joints. The forms shall incorporate a keyway where required and shall be sufficiently rigid to produce a pavement with plan section.

Longitudinal tongue and groove joints of the designated type and size shall be constructed at locations indicated by the plans or approved by the City. Groove type joints shall be formed with approved metal forms that will produce a keyway with plan location and dimensions. The form shall remain in place for sufficient time to prevent slump and may be left in place with permission of the City.

Where tie bars are required, they shall be used with groove type joints. The bars shall be machine positioned before pavement consolidation. Hand placing of tie bars after consolidation of concrete will not be allowed. At contractor's option, drilling and grouting of the tie bars will be permitted after 72 hour curing period in accordance with Section 704.11.5.

- e. Protection Against Rain: In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the contractor will be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete. Protective material may consist of sheets of burlap, paper, or plastic film. Planks or other material with suitable stakes that can be used as temporary forms shall also be on hand. It will be the contractor's responsibility to protect the pavement from damage due to rain. Failure to properly protect unhardened concrete may constitute cause for the removal and replacement of defective pavement at the contractor's expense.

**704.17 Tolerance in Pavement Thickness.** It is the intent of these specifications that pavement shall be constructed strictly in accordance with the thickness shown on the approved plans and applicable SCDs. The thickness of the pavement will be measured, and where any pavement is found deficient in thickness, it shall be removed and replaced with satisfactory pavement.

- a. Metal plates will be placed on the subgrade at points selected by the City in areas where the planer has cut or leveled off the subgrade or at any points where conditions are conducive to deficient pavement thickness. When the surface of the pavement has been finished to final grade, the City will, for informational purposes, check the thickness of the completed pavement by measuring the distance from the surface of the pavement to the metal plates by use of a calibrated rod. The City reserves the option to place and stick plates if he deems necessary. The placing of plates does not obligate the City to stick any or all plates. The surface of the pavement shall be satisfactorily restored by the contractor after thickness measurements have been made.

The contractor shall, if necessary, furnish a bridge to facilitate the taking of the measurements. The City reserves the right to core drill the finished pavement to determine the thickness of the pavement. Cores may be drilled at the same locations as rod measurements or at any other locations. The contractor may require check cores to verify thicknesses determined by the City, and all costs of check core drilling shall be borne by the contractor. If the check cores requested by the contractor indicate that the City's measurement would have erroneously resulted in deductions for, or removal of, thin pavement, the cost of drilling the check cores will not be charged to the contractor.

- b. For the purpose of determining the constructed thickness of the pavement, four (4) cores per 1000 ft. will be taken at random intervals for each centerline mile, for each pavement pour. In addition, cores will be taken at all locations where thickness measurements taken during construction indicate a thickness deficiency sufficient to justify a deduction from the escrow or the contract unit bid price, or at any other locations as may be determined by the City. When the measurement of any core is deficient in excess of 0.3 in. from the plan thickness, additional cores will be taken at 20 ft. intervals parallel to centerline ahead and back of the affected location until the extent of the deficiency has been determined.
- c. It will be assumed that each core is representative of the pavement thickness for a distance extending one-half the distance to the next core, measured along centerline, or in the case of a beginning or ending core, the distance will extend to the end of the pavement section. Cores shall be 4 in. diameter units capable of being used to test the in place strength of the pavement. The drilling of cores in irregular areas, or on projects involving less than 2500 sq.yd. of concrete pavement, may be waived by the City. In this case the designed thickness will be considered as the measured thickness.

**704.18           Penalty for Insufficient Pavement Thickness.**

- a. If any core thickness measurement is deficient, from the design thickness, the City will have the option of having the contractor remove and replace the pavement at his expense or allow the contractor to leave the pavement in place and forfeit the following percent of escrow.

Deficiency in Thickness	Percent of Escrow Forfeited
0.00 in. to 0.3 in.	None
Over 0.30 in to 0.50 in.	20
Over 0.50 in. to 1.00 in.	40
More than 1.00 in.	100 or remove and replace

- b. Deficiencies in Compressive Strength: The compressive strength of concrete pavement will be determined through testing of cylinders and/or cores at frequencies determined by the City. The core or set of cylinders will represent the compressive strength for a distance extending one-half the distance to the next core (or set of cylinders), measured along centerline, or in the case of a beginning or ending core (or set of cylinders), the distance will extend to the end of the pavement section. If any compressive strength measurement is deficient from the design compressive strength, the City will have the option of having the contractor remove and replace the pavement at his expense or allow the contractor to leave the pavement in place and forfeit the following percent of escrow:

Compressive Strength	Percent of Escrow Forfeited
3800 psi	None
3367 psi to 3799 psi	20

3331 psi to 3666 psi	40
Less than 3331 psi	100 or remove and replace

Any pavement for which the sum of deductions for thickness and compressive strength exceeds 100 percent of the escrow amount shall be removed and replaced.

- c. In removing pavement, it shall be removed from the edge to a longitudinal joint, or between longitudinal joints, and on each side of the deficient pavement until no portion of the exposed cross sections is more than 0.3 in. deficient, except that there shall not be less than 10 ft. of pavement removed. If there remains less than 10 ft. of acceptable pavement between the section that has been removed and a transverse contraction, expansion, or construction joint, the contractor shall remove the pavement to the joint.
- d. For marred surface areas or slightly damaged concrete that remains in the completed pavement, a minimum forfeiture of 20 percent of the escrow will be made for the areas affected. The forfeiture amount will be applied to a section of pavement extending from edge of the pavement to a longitudinal joint or between longitudinal joints in that section of pavement affected. If the length of the section affected is less than 10 ft., the forfeiture amount will be computed for 10 ft. A marred surface is any surface that has not been properly finished as required by these specifications. Pavement that has been rained on; pavement that has not reached its initial set and has had water flow on its surface washing away cement; pavement that has had plastic placed on it wherein the plastic has actually caused indentations and random patterns; pavement that has been walked on by humans or animals or driven on by any type of vehicle; or pavement that has had curing compound sprayed on it before the initial set, resulting in pitting marks.

#### **END OF SECTION**

## SECTION 705

### Concrete Curb and Gutter

**705.1 Description.** This work shall consist of constructing concrete curb, gutter or combination of curb and gutter and shall consist of portland cement concrete, placed with or without reinforcement on a prepared subgrade. The type and dimensions shall be as shown on the construction plans or Standard Construction Details.

**705.2 Materials.** All materials shall conform to the specifications listed below.

- a. Portland Cement Concrete: Section 704.2.a
- b. Material for Joints: Section 704.2.c

**705.3 Construction Requirements.**

- a. These items shall be placed on a prepared subgrade of uniform density. Forms shall be metal or sound, dressed lumber, straight, free from warp, of sufficient strength to resist springing during construction, and of a height equal to the full depth of the item to be constructed. Wood forms shall have a minimum nominal thickness of 2 in. except where flexible forms are used. Flexible forms of metal or wood (with a nominal thickness of 1 in.) will be required for all curved form lines, except that straight steel form sections 10 ft. or less in length may be used for form lines having a radius greater than 200 ft. Straight steel form sections 5 ft. in length will be acceptable for form lines having a radius of not less than 100 ft. The forms shall be thoroughly cleaned, well oiled, securely staked, braced, and held to the required line and grade. Hangers used for face forms on curb must be entirely supported from the back form.

In lieu of the forming requirements specified in Section 705.3, slip form methods may be used for placement of concrete curb, concrete gutter, curb and gutter, and paved ditch providing proper lines, grades and typical sections are maintained. Paving requirements will be the same as Section 704.16.

- b. Required reinforcement and tie bars shall be held in the designated position during the placing of concrete by bar chairs or other approved devices. Joints shall be constructed at intervals and locations shown on the approved plans or as directed by the City. 1/2 in. expansion joints will be provided in curbs or curb and gutter sections at 20 ft. centers or as otherwise indicated.
- c. Concrete shall be placed on the prepared subgrade that has been sprinklered with water, compacted and struck off to the required thickness. Concrete shall be tamped or vibrated sufficiently to eliminate all voids and to bring mortar to the top, after which the surface shall be finished smooth and even. All edges shall be rounded with an edging tool having a 1/4 in. radius. Faces of curb shall be rounded at the top and bottom, by means of an approved tool, to the radius shown. The curb face forms will be stripped when the concrete is sufficiently set and the face of the curb will be rubbed using grout necessary to fill any voids and air bubbles. After the rubbing operation, a brush finish will be applied. After



finishing, concrete shall be cured in the same manner as required for concrete pavement except that transparent membrane shall be used on paved ditch.

The finished curb shall be true to line, grade, and cross section, with the top and face finished smooth and brushed. The top edges of the curb shall be rounded with an approved edging tool. Curing shall be accomplished in the same manner as required for concrete pavement. At 60 ft. intervals, joints of preformed material shall be placed through the curb to within 1/4 in. of the top and face of the curb. At all other joint locations, a matching saw joint will be allowed, provided that it is completely sawed through and sealed.

- d. During cold weather, the limitations and protection requirements of Section 704.4 shall apply to this work.
- e. Curb straightedged parallel to the centerline shall not show a variance greater than 1/2 in. from a 10 ft. straightedge. Failure to comply with this provision will require complete removal and replacement of the affected area. No area less than 10 ft. will remain in place.

#### **END OF SECTION**

## SECTION 706

### **Concrete Median, Median Strip, Sidewalk, Steps and Paved Approach**

**706.1 Description.** This work shall consist of constructing concrete medians, median strips, sidewalks, steps, and paved approaches in conformity with the lines, grades, dimensions, and typical sections indicated on the plans, or as directed by the engineer. Concrete median shall consist of a paved median constructed on a prepared subgrade. Concrete median strip shall consist of a paved median strip laid over and doweled to a previously constructed pavement.

**706.2 Materials.** All materials shall conform to the specifications and as specifically as follows:

- a. Portland Cement Concrete: Portland Cement concrete shall conform to the requirements of section 704.2.
- b. Reinforcing Steel for Concrete Structures: Unless otherwise specified, reinforcement shall be deformed bars meeting the requirements of one of the following:
  1. AASHTO M 31M/M 31 (ASTM A 615M/A 615), Deformed Billet-Sled Bars for Concrete Reinforcement, Grade 40 or Grade 60.
  2. AASHTO M 42M/M 42 (ASTM A 616M/A 616), Rail-Steel Deformed Bars for Concrete Reinforcement. Bars conforming to AASHTO M 42 (ASTM A 615) shall be in straight lengths only.
  3. AASHTO M 53M/M 53 (ASTM A 617M/A 617), Axle-Steel Deformed Bars for Concrete Reinforcement. Bars conforming to AASHTO M 53 (ASTM A 617) shall be in straight lengths only.
- c. Welded Steel Wire Fabric: Welded steel wire fabric shall conform to requirements of AASHTO M55 (ASTM A 185) or AASHTO M 221 (ASTM A 497).
- d. Materials for Joints: Materials for joints shall conform to the requirements of Section 704.2.3.

Concrete sidewalks and steps shall be constructed of 3,000 psi minimum strength concrete. Materials, proportioning, air-entrainment, mixing, slump, and transporting of portland cement concrete shall be in accordance with Section 704.2. Concrete shall be placed, finished, and cured in accordance with the applicable provisions of Section 704. Pipe handrails indicated at step locations shall be constructed of 2 in. galvanized schedule 40 pipe and anchored as indicated on the approved plans or approved by the City.

### **706.3 Construction Requirements.**

- a. All items shall be constructed on a subgrade compacted to the required density of the applicable subgrade material. The subgrade shall be checked by means of a template prior to placing concrete. Large rocks and boulders found in the subgrade shall be removed to a minimum of 6 in. below the proposed concrete, and the space shall be refilled with suitable materials. Forms shall be metal or

sound, dressed lumber, straight, free from warp, of sufficient strength to resist springing during construction, and of a height equal to the full depth of the item to be constructed. Wood forms shall have a minimum nominal thickness of 2 in. except where flexible forms are used. Flexible metal forms or wood forms having a nominal thickness of 1 in. will be required for all curved form lines, except that straight steel form sections 10 ft. or less in length may be used for form lines having a radius greater than 200 ft. Straight steel form sections 5 ft. in length will be acceptable for form lines having a radius of not less than 100 ft. The forms shall be thoroughly cleaned, well oiled securely staked, braced, and held to the required line and grade.

- b. Required reinforcement and tie bars shall be held in the designated position by bar chairs or other approved devices during the placing of concrete.
- c. Concrete median strip shall be doweled to the pavement with tie bars as shown on the plans. When the median strip is to be built on pavement constructed on a previous project or on pavement that has been used by traffic before the median strip is placed, the contractor shall drill 1 in. diameter holes, 6 in. deep on 24 in. centers using 10 in., No. 5 dowels grouted in place 24 hours in advance of placing concrete. Where the median strip is included with the paving contract and will be constructed before the pavement is opened to traffic, the contractor may insert the tie bars into the pavement immediately after it has been finished or may preform the holes and grout in the tie bars when the median strip is constructed. The holes shall be thoroughly cleaned just before the tie bars are grouted in place.
- d. Joints for all items shall be constructed at such intervals and locations as shown on the approved plans, as shown on the applicable SCD, or as directed by the City.
  - 1. Transverse joint for concrete median shall be sawed joints of the same dimensions as required for concrete pavement spaced approximately the same as transverse joints in non-reinforced concrete pavement. Load transfer devices will not be required. Longitudinal joints between the median and curb shall be constructed of 1/2 in. non-extruding preformed joint material. Sawed joints shall be sealed in accordance with Section 704.11.
  - 2. Transverse joints in concrete median strip shall be constructed of 1/2 in. non-extruding preformed joint material extending from top to bottom. Joints shall be constructed over each joint and major crack in the pavement, but at not less than 10 ft. intervals.
  - 3. Transverse joints for concrete sidewalks shall be 1/2 in. deep dummy joints made with a finishing tool. Preformed fiber joints shall be at 20 ft. intervals. Regardless of other details and notes shown on the plan, a mastic joint will be required in all new sidewalk construction at the right-of-way line. Other plans and specification requirements regarding joint placement may be varied as directed.
- e. Concrete shall be placed on the prepared subgrade that has been sprinklered with water, and shall be compacted and struck off to the required thickness.

Mechanical compacting and finishing equipment may be used provided satisfactory results are obtained. The concrete shall be tamped or vibrated sufficiently to eliminate all voids and to bring the mortar to the top after which the surface shall be uniformly finished. All edges shall be rounded with an edging tool having a 1/4 in. radius. After free water has left the surface, a hand broom finish will be applied. After finishing, the concrete shall be cured in the same manner as required for concrete pavement except that transparent membrane shall be used in lieu of pigmented membrane.

- f. After the concrete has sufficiently set, the forms shall be removed and here necessary, the area adjacent to the concrete shall be backfilled with suitable material, compacted and finished in a satisfactory manner.
- g. During cold weather, the limitations and protection requirements of Section 704.4 shall apply to this work.

#### **END OF SECTION**

## SECTION 707

### Traffic Signs

**707.1 Description.** This section describes the work consisting of the installation of both temporary and permanent in addition to standard and decorative traffic signs including, but not limited to street name, stop, yield, regulatory, warning, and guide signs.

**707.2 Retroreflectivity.** All signs shall use ASTM IV High Intensity Prismatic Material.

#### **707.3 Street Name Signs.**

- a. Standard Street Name Signs shall consists of a green background with white text using T-2000 HWY C font. Decorative street name signs shall use brown background with white text.
- b. All street name sign lettering shall be composed of a combination of lower-case letters with initial upper-case letters.
- c. Street name sign blade shall be extruded and connected to a galvanized steel post with a post to blade bracket and a blade to blade bracket.
- d. Street name signs shall be sized based on the intersecting street with the higher speed limit. Sign sizes shall be based as follows:

Posted Speed Limit	Height of Blade	Uppercase Name Height	Lowercase Name Height	Uppercase Type Height	Lowercase Type Height
≤ 30 MPH	6"	4"	3"	3"	2.25"
>30 MPH	9"	6"	4.5"	4.5"	3"

#### **707.4 Stop Signs.**

- a. A 30" x 30" stop sign shall be used for single lane approach intersections and a 36" x 36" stop sign shall be used for multi-lane approach intersections.

#### **707.5 Sign Posts.**

- a. All street name and stop sign posts shall be 2 3/8" O.D. galvanized steel posts. A breakaway flange is required for non-residential intersections.
- b. All other regulatory, warning, and guide signs shall be installed on a standard U-Channel post.
- c. Posts shall be embedded in a 3-foot deep and 1-foot diameter concrete cylinder placed 6 inches below grade.

**END OF SECTION**

**VEGATATION ESTABLISHMENT  
DIVISION 800**

**SECTION 800**

**General Requirements**

**800.1 Location.** Permanent vegetative cover shall be established on the development in accordance with the approved plans.

**800.2 Project Requirements.** Should the plans lack specific requirements, the contractor shall have 30 days once grading has ceased, in which sod or seed and straw shall be placed. Until such time that permanent vegetative cover is established at a density to prevent erosion, all sediment and erosion control Best Management Practices (BMPs) shall be maintained on the site.

**800.3 Inspections.** All work involving the establishment of vegetative cover shall be inspected by the City of Wentzville, in accordance with the requirements contained in Section 102.9. Any work performed without inspection may not be accepted by the City of Wentzville. The City of Wentzville shall be notified 48 hours in advance of any work for coordination and inspections.

**800.4 Field Changes.** Minor field changes may be accepted by the City Inspector. More substantial changes shall require a submittal to the City Engineer for approval.

**END OF SECTION**

## **SECTION 801**

### **Fertilizing**

**801.1 Description.** This work shall consist of the application of lime and commercial fertilizer, and soil preparation for seeding and sodding on areas indicated on the plans, or designated by the City Engineer.

#### **801.2 Materials.**

- a. Material used for soil neutralization, unless otherwise specified, shall be agricultural lime with not less than 90 percent passing the No. 8 sieve and containing not less than 65 percent calcium carbonate equivalent.
- b. The rate of application of limestone shall be that required to provide at least the quantity of effective neutralizing material per acre specified on the plans or when not specified will be one ton per acre of effective neutralizing material. When agricultural lime is to be furnished from a source that has not been tested and certified, an average rate of tons of limestone per acre will equal one ton of effective limestone per acre.
- c. Fertilizer shall be a standard commercial product which, when applied at the proper rate, will supply the quantity of total nitrogen (N), available phosphoric acid (P205) and soluble potash (K20), as specified on the plans. Material may be accepted on the basis of bag label analysis or supplier's certification. Commercial fertilizer shall have a minimum composition of 12% nitrogen, 12% available phosphoric acid and 12% soluble potash (12-12-12 Formula). The application of commercial fertilizer shall be at the rate of 300 lbs.-325 lbs. per acre or as otherwise directed by the City Engineer.

**801.3 Equipment.** Lime and commercial fertilizer shall be applied by mechanical equipment designed for this purpose. Small areas may be applied by hand methods with prior approval of the City Engineer.

#### **801.4 Construction Requirements.**

- a. The area to be limed and fertilized will be the area designated within the limits of construction; shall have a uniform surface free from rills, washes, and depressions; and shall conform to the finished grade and cross section as shown on the plans. The soil, while in a tillable condition, shall be thoroughly broken up, worked, tilled, and loosened to a minimum depth of 2 in. The seedbed or sodbed shall be prepared by loosening the existing soil on the slope, rather than by the addition of loose soil, except when indicated otherwise by the plans.
- b. Lime and fertilizer shall be applied evenly at the rates designated on the plans, and only when the soil is in a tillable condition. After application, the lime and fertilizer shall be mixed into the soil by disking, harrowing, or raking to a minimum depth of 2 in. unless applied hydraulically on slopes steeper than 2:1 in accordance with Sec 805.3.

- c. Lime and fertilizer shall be applied separately, but may be incorporated into the soil in one operation. Lime and fertilizer shall be applied not more than 48 hours before the seed is sown unless authorized by the City Engineer.

**END OF SECTION**



## SECTION 802

### Mulching

**802.1 Description.** This work shall consist of the application of a mulch covering of the type specified on the plans. All seeded areas except shoulders shall be mulched. Disturbed areas outside of authorized construction limits shall be mulched at the contractor's expense.

**802.2 Materials.** All materials used for mulching shall conform to the following:

- a. Type 1 Mulch (Vegetative): The vegetative mulch shall be the prairie hay or straw from oats, rye, wheat, or barley. Prairie hay shall consist of any combination of any of the following plants: big bluestem, little bluestem, indiangrass, sideoats grama and native wildflowers. The mulch shall be free of prohibited weed seed as stated in the Missouri Seed Law, and shall be relatively free of all other noxious and undesirable seeds. The mulch shall be clean and bright, relatively free of foreign material, and be dry enough to spread properly. If the above specifications cannot be met practicably, hay of the following plants may, with the City Engineer's approval, be substituted: smooth brome, timothy, orchard grass, tall fescue, red top, Kentucky blue grass, alfalfa, and birdsfoot trefoil.
- b. Type 2 Mulch (Vegetative with Asphalt Emulsion): The asphalt emulsion shall be SS-1, SS-1h, CSS-1 or CSS-1h conforming to the requirements of AASHTO M 140-70 or AASHTO M 208-72. The vegetative mulch shall be as specified in this section.
- c. Type 3 Mulch (Vegetative with an Overspray): The vegetative mulch shall be as specified in this section. The overspray material may be virgin wood cellulose fibers, bonded fiber matrix, or recycled paper as herein specified. It shall not contain any germination or growth inhibiting substances. The overspray shall be green in color after application and shall have the property to be evenly dispersed and suspended when agitated in water. When sprayed uniformly over vegetative mulch, the mulch fibers shall form an absorbent cover, allowing percolation of water to the underlying soil. The mulch shall be packaged in moisture resistant bags with the net weight of the packaged material plainly shown on each bag. The mulch fibers shall not be water soluble.
- c. Type 4 Mulch (Embedded): The vegetative mulch shall meet the requirements of this section. The mulch shall be embedded by a disc type roller having flat serrated discs spaced not more than 10 inches apart and cleaning scrapers shall be provided.

**802.3 Construction Requirements.**

- a. Type 1 Mulch (Vegetative): Type 1 Mulch shall be applied at the rate of 2.5 tons per acre. Straw shall be anchored by crimping, using a liquid tackifier, or netting.
- b. Type 2 Mulch (Vegetative with Asphalt Emulsion): Type 2 Mulch shall be applied by mechanical mulch spreaders equipped to eject, by means of a constant air

stream, controlled quantities of the vegetative mulch and emulsified asphalt in a uniform pattern over the specified area. The mulching machine shall be so designed that the asphalt will be injected at the proper rate directly into the air stream carrying the straw, resulting in a uniform spotty tacking of the vegetative mulch with asphalt. The vegetative mulch shall be applied at the rate of 2.5 tons per acre. The normal application rate for the asphalt emulsion shall be 100 gallons per ton of straw.

- c. Type 3 Mulch (Vegetative with an Overspray): Type 3 Mulch shall be hydraulically applied over the vegetative mulch as a separate operation. Recycled paper shall be applied at the rate of 750 pounds per acre. Virgin wood cellulose fibers with 90 percent or more organic matter shall be applied at the rate of 750 pounds per acre and that with 80 to 89 percent inclusive shall be applied at a rate calculated as follows:

$$\text{Rate (lb/acre)} = \frac{100}{\text{Actual Percent Organic Matter}} \times 750 \text{ (lb/acre)}$$

The overspray material shall be mixed with water in a manner to provide a homogeneous slurry. Equipment for mixing and applying the slurry shall be capable of applying it uniformly over the entire vegetative mulched area. The slurry mixture shall be agitated during application to keep the ingredients thoroughly mixed.

- d. Type 4 Mulch (Embedded): Type 4 Mulch shall be applied at the rate of 2.5 tons per acre. The mulch roller shall be operated approximately parallel to the roadway grade. The mulch shall be embedded in the soil a sufficient depth to prevent loss of mulch by wind or water erosion.

All mulch shall be distributed evenly over the area to be mulched within 24 hours following the seeding operation. Mulch shall not be tilled into the soil prior to planting due to competition between the decomposition process and plant nutrient needs. When container plants are to be installed, they shall be planted directly into the soil; surface mulch shall be less than 3" deep.

Following the mulching operation, precautions shall be taken to prohibit foot or vehicular traffic over the mulched area. Any mulch which is displaced shall be replaced at once, but only after the work preceding the mulching which may have been damaged as a result of the displacement has been acceptably repaired.

## END OF SECTION

## SECTION 803

### Sodding

**803.1 Description.** This work shall consist of preparing the areas for sodding and placing approved live sod. The entire area designated for sodding shall be covered with sod.

**803.2 Materials.** Unless otherwise specified on the plans, the sod shall be Kentucky Bluegrass, densely rooted and thrifty. The sod shall contain a growth of not more than 25 percent of other grasses and clovers, and be free of all weeds. The sod shall be cut in strips of uniform thickness with each strip containing at least 1/3 sq.yd. and not more than one square yard. Sod shall be cut into strips, not less than 12 in. in width nor more than 9 ft. in length. At the time of sod lifting, the top growth shall not exceed 3 in. in length. The thickness of the sod shall be determined by stacking ten pieces alternately with the soil of the first piece on the bottom. The height of the stack, without compression, shall exceed 11 in. and the thickness of the soil portion of each piece shall be not less than 3/4 in. All sod shall conform to the laws of Missouri and shall be obtained from sources meeting the approval of the Department of Agriculture, Plant Industries Division.

### **803.3 Construction Requirements.**

- a. Sod shall not be placed during a drought nor during the period from June 1 to September 1 unless authorized by the City Engineer, and shall not be placed on frozen ground. No dry or frozen sod shall be used.
- b. The sodbed shall be prepared, limed, and fertilized in accordance with Section 801. The bed shall be in a firm but uncompacted condition with a relatively fine texture at the time of sodding. Sod shall be moist and shall be placed on a moist earth bed. Sod strips shall be laid along contour lines, by hand, commencing at the base of the area to be sodded and working upward. The transverse joints of sod strips shall be broken, and the sod carefully laid to produce tight joints. The sod shall be firmed, watered, and refirmed immediately after it is placed. The firming shall be accomplished by use of a lawn roller or tamper. On slopes greater than 3:1, the sod shall be pegged with wood pegs approximately 1/2 in. square x 12 in. in length driven into the ground, leaving about 1/2 in. of the peg above sod, and spaced not more than 2 ft. apart. Pegging of sod shall be done immediately after the sod has been firmed. When sodding is completed, the sodded areas shall be cleared of loose sod, excess soil, or other foreign material, and a thin application of topsoil shall be scattered over the sod as a top dressing, and the areas thoroughly moistened.
- c. The contractor shall keep all sodded areas thoroughly moist for 21 days after laying. The sod shall be living at the time of acceptance.

**END OF SECTION**

## **SECTION 804**

### **Topsoil**

**804.1 Description.** This work shall consist of approved selected topsoil furnished and placed at the locations shown on the plans in the manner specified.

**804.2 Materials.** Topsoil shall be obtained from approved sources. It shall be a fertile; friable; and loamy soil of uniform quality; with relatively equal parts of sand, silt, and clay; without admixture of subsoil materials; and shall be free from materials such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than one inch in diameter, and any other similar impurities. Topsoil shall be relatively free from grass, roots, weeds, and other objectionable plant material or vegetable debris undesirable or harmful to plant life or which will prevent the formation of a suitable seedbed.

### **804.3 Construction Requirements.**

- a. The City Engineer shall be notified sufficiently in advance of the opening of any material source to permit the City Engineer to prepare for necessary checking and measurement. Topsoil shall be secured from areas from which the topsoil has not been previously removed, either by erosion or mechanical methods. The soil shall not be removed in excess of the depth approved by the City Engineer. Unless otherwise shown on the plans, the source of material shall be furnished by the contractor. During the period of removal of the topsoil material, the site shall be kept drained, and when all material has been removed, the site shall be left in a neat and presentable condition.
- b. The surface on which the topsoil is to be placed shall be free of all loose rock and foreign material greater in any dimension than one-half the depth of the topsoil to be added. It shall be raked or otherwise loosened just prior to being covered with topsoil. Topsoil shall be placed and spread over the designated areas to a depth sufficiently greater than shown on the plans so that after settling, the completed work will conform with the thickness shown on the plans. After spreading, all large clods and foreign material shall be removed by the contractor.

**END OF SECTION**

## SECTION 805

### Seeding

**805.1 Description.** This work shall consist of preparing, liming, and fertilizing a seedbed, and the furnishing and sowing of seeds as specified on the plans. All disturbed areas shall be seeded except: (1) sodded areas, (2) surfaced areas, (3) solid rock, and (4) slopes consisting primarily of broken rock. Disturbed areas outside of authorized construction limits shall be seeded at the contractor's expense.

### **805.2 Materials.**

- a. The seed shall be grown and processed in the United States or Canada; comply with the requirements of the Missouri Seed Law; and be free of all noxious and invasive species. Preferred sources are Missouri native seeds. The following percentages for purity and germination or pure live seed will be the minimum requirements in the acceptance of seed, unless otherwise permitted by the City Engineer.

	Purity	Germination Including Hard Seed	Pure Live Seed	Germination* Excluding Hard Seed	Maximum Percent Weed Seed
Bermuda Grass (W)	95	80			1.00
Big Bluestem (Debearded) (W)			42		0.30
Blue Grama (W)			64		0.10
Buffalograss (W)			72		0.30
Indiangrass (Debearded) (W)			54		0.30
Little Bluestem (Debearded) (W)			40		1.00
Sand Lovegrass (W)			69		0.30
Sideoats Grama (W)			67		0.20
Switchgrass (W)			62		0.20
Weeping Lovegrass (W)			83		0.20
Tall Fescue (C)	97	85			2.00
Red Fescue (C)	97	85			1.00
Smooth Brome Grass (C)	85	80			2.00
Kentucky Bluegrass (C)	85	80			1.00
Orchard Grass (C)	85	80			2.00
Perennial Rye Grass (C)	98	85			1.00
Sudan Grass (C)	98	85			1.00
Reed Canary Grass (C)	97	75			1.00
Timothy (C)	98	85			1.00
Redtop (C)	92	85			2.00
Oat Grain (CC)	98	85			1.00
Rye Grain (CC)	98	80			1.00
Alsike Clover (L)	98	85		55	1.00
Red Clover (L)	98	85		55	1.00
Sweet Clover (L)	98	85		55	1.00
White Clover (L)	98	85		55	1.00
Birdsfoot Trefoil (L)	98	80		50	1.00

\* Does not apply if unhulled or unscarified seed is specified.

W: warm season

C: cool season

CC: crop/companion planting

L: legume

If the specified quantity is in pounds of seed, no reduction will be permitted in the specified quantity of seed if the purity or germination, or both, are higher than the minimum required by the specification. If the specified quantity is in pounds of pure live seed, the pure live seed quantity shall be determined from the actual percentage shown by the supplier for native grasses or by multiplying the actual percentages of purity times the actual percentage of germination including hard seed for other seed.

- b. All leguminous seeds shall be inoculated or treated with the proper quantity of cultures approved for the particular legume to be sown. Leguminous seeds include Alsike Clover, Red Clover, Sweet Clover, and White Clover.
  - 1. The inoculant for treating leguminous seeds shall be a pure culture of nitrogen-fixing bacteria. The containers of the inoculant shall be plainly marked with the expiration date for use and the manufacturer's directions for inoculating seed.
  - 2. The process of inoculation shall be in accordance with the manufacturer's directions for the particular species of legume. The time lapse for sowing the seed following inoculation shall not exceed 24 hours. When hydraulic slurry seeding is used, an amount of inoculant equal to five times the normal rate required to inoculate only the legume seed shall be used. The inoculant shall be placed directly into the slurry and thoroughly mixed immediately before seeding. When other than the hydraulic slurry method is used, the legume seed may be inoculated at the normal rate if it is to be sown alone or if the legume seed is inoculated prior to mixing with other seed. A seed mixture which contains a legume that was not inoculated prior to mixing and is not to be seeded by the slurry method, shall be inoculated with sufficient inoculant to cover all seed.
  - 3. Prohibited Weed Seeds. No tolerance will be applied to mixtures for weed seeds prohibited in Missouri's Seed Law or the Missouri Department of Conservation's "Missouri Vegetation Management Manual" unless otherwise specified within this text, namely: Field Bindweed (*Convolvulus arvensis*), Johnson Grass (*Sorghum halepense*), and Canada Thistle (*Cirsium arvense*).

### **805.3 Construction Requirements.**

- a. The seedbed shall be prepared, limed, and fertilized in accordance with Section 801 and shall be a firm but uncompacted condition with a relatively fine texture at the time of seeding. Unless otherwise shown in the plans, the rate of application will be 210 lb./acre consisting of 100 lb. tall fescue, 100 lb. perennial rye grass, and 10 lb. Kentucky Bluegrass.
- b. During the months of December through May, August, and September, all lime, fertilizer, seed and mulch shall be applied to the finished slopes. During the months of June, July, October, and November, lime, fertilizer, seed, and mulch shall be applied at the following rates:

Lime--100 percent of the specified quantity.  
Fertilizer--75 percent of the specified quantity.  
Seed--50 percent of the specified quantity.  
Mulch--100 percent of the specified quantity.

Alternate methods of seeding will be considered when submitted for approval but will not relieve the contractor of compliance with this specification.

Seeding shall be done before the proposed seedbed becomes eroded, crusted over, or dried out and shall not be done when the ground is in a frozen condition or covered with snow. When the partial application has been made during June, July, October, or November, the remainder of the fertilizer plus 75 percent of the specified quantity of seed shall be applied by overseeding during August, September, December, January, or February. Seeds shall be uniformly applied at the rates prescribed. Provisions shall be made by markers or other means to insure that the successive seeded strips will overlap or be separated by a space no greater than the space left between the rows planted by the equipment being used. If inspection during the seeding operations indicates that strips wider than the space between rows planted have been left unplanted, additional seed shall be planted on these areas. Hand seeding will be permitted in isolated areas with prior approval of the City Engineer.

1. Hydraulic Seeding and Fertilizing: In lieu of mechanical application of seed and fertilizer, hydraulic application may be used. Seed and fertilizer may be applied hydraulically provided the seed and fertilizer are applied separately. The seed and fertilizer shall be incorporated into the soil as specified in Sections 801.4 and 805.3, in separate operations except that raking will not be required when seeding a previously seeded and mulched area. On slopes steeper than 2:1, or when seeding is applied to a previously seeded and mulched area, seed and fertilizer may be applied hydraulically in a single operation, and incorporation into the soil will not be required. Seed and fertilizer, separately or in combination, shall be mixed with water and constantly agitated so that a uniform mixture can be applied hydraulically to the designated areas. The ratio of seed and fertilizer to water shall be calculated by determining the surface area covered by a given quantity of water. Seed shall not be added to the water more than 4 hours before application.
2. Dry Seeding: Dry seeding shall be done mechanically with equipment designed for even distribution of dry seed. The equipment may either be hand operated, such as knapsack seeder, or be tractor-drawn, such as seed drill, except that tractor-drawn equipment will not be permitted on a previously seeded and mulched area. After completing the seeding operation, if in the judgment of the City Engineer the seedbed is either too loose or contains clods which would reduce the germination of the seed, the contractor shall firm the area by rolling. When rolling is required, a lawn-type roller shall be used and care shall be taken to avoid over-compacting the soil.

**END OF SECTION**

## SECTION 806

### Erosion Control Blankets and Netting

**806.1 Description.** This work shall consist of furnishing and placing erosion control blankets or netting as specified on the plans at locations shown on the plans, or as designated by the City Engineer.

#### **806.2 Materials**

- a. Plastic Netting: The netting shall consist of a green biodegradable polypropylene extruded oriented plastic net with bonded joints having openings not to exceed 4-1/2 sq.in. with either dimension not to exceed 3 in. Excelsior blanket may be used in lieu of plastic netting at the contractor's option in which case the excelsior blanket will serve as a substitute for both netting and mulch.
- b. Excelsior Blanket: Excelsior blanket shall consist of a machine produced mat of wood excelsior with approximately 80 percent of the fibers having a minimum length of 6 in. The wood from which excelsior is cut shall be properly cured to achieve adequately curled and barbed fibers. The blanket shall be of a consistent thickness, with the fibers evenly distributed over the entire area of the blanket. The blanket shall be covered on the top side with netting having a maximum mesh size of 1 1/2 in. X 3 in., composed of cotton cord, twisted Kraft paper yarn, or degradable extruded plastic. The netting shall be entwined with the excelsior mat for maximum strength and ease of handling. The blanket shall be made smolder resistant with a treatment that is non-leaching, non-toxic to vegetation, and neither toxic nor injurious to humans. The blanket shall meet the following requirements:

Weight--0.4 kg/m<sup>2</sup> (0.75 lb./sq.yd.), minimum.

Smolder Resistance--Blanket in air-dry condition shall not flame or smolder for a distance of more than 12 in. from where a lighted cigarette is placed on the surface.

- c. Staples: Staples for plastic netting or excelsior blanket shall be of No. 11 gage, or heavier, ungalvanized steel wire, "U" shaped, with approximately a 1 in. or larger crown, and have a length of not less than 6 in.
- d. The contractor shall furnish a manufacturer's certification in triplicate stating that the material furnished complies with the requirements of these specifications.

#### **806.3 Construction Requirements.**

- a. Plastic Netting: The area to be covered shall be seeded, fertilized, and mulched in accordance with the requirements of the plans before the plastic netting is installed. The netting shall be rolled loosely over the specified areas as soon as practicable following the mulching operations. The netting shall be installed 28 ft. wide in median ditches and 1 ft. above the flowline on other ditches. Lifting and stretching of the material will not be permitted. Any mulched areas disturbed by the installation of the netting shall be repaired at the contractor's expense.



Rolling will not be required. Materials shall overlap not less than 3 in. at all joints with the upper or upstream netting on top. All joints shall be stapled on 1 ft. centers. Staples at other locations shall be installed as shown on the plans. If excelsior blanket is used in lieu of plastic netting, it shall be installed as specified in this section.

- b. Excelsior Blanket: The area to be covered shall be seeded and fertilized in accordance with the requirements of the plans before the excelsior blanket is installed. The blanket shall be unrolled in the direction of water flow, with the netting on top and the fibers in contact with the soil. A longitudinal joint of adjoining blankets shall not be placed on the center line of the ditch. The blanket shall not be stretched or pulled tight. Successive rolls shall be snugly butted at ends and edges. The blanket shall be stapled along each edge and along the center of each blanket with staples at 6 ft. centers, and it shall be stapled across each end of each roll with four staples. The center row of staples shall be staggered 3 ft. from the edge staple spacing. A row of staples across the blanket, spaced at 6 in. centers and at right angles to the ditch line shall be placed within each 50 ft. on ditch grades of 4 percent or less and within each 25 ft. on ditch grades greater than 4 percent.

#### **END OF SECTION**

## SECTION 807

### Planting Trees, Shrubs, and Other Plants

**807.1 Description.** This work shall consist of furnishing and planting materials in the locations designated on the plans or established by the City Engineer. Shrubs designated to be removed and relocated shall be protected as required for new stock during the temporary removal interim, and then be replanted as hereinafter specified.

#### **807.2 Materials.**

##### **a. Plants:**

1. Unless otherwise specified or permitted by the City Engineer, trees, shrubs, and other plants shall be nursery stock and shall be true to type and name in accordance with the current edition of Standardized Plant Names published by the American Joint Committee on Horticultural Nomenclature. A nursery is defined as a place where trees and plants are grown in established rows for the purpose of replanting at a new location. The nursery stock shall have well developed branch systems and vigorous healthy root systems. All stock shall be well formed and the trunks of trees shall be uniform. All plants shall have a normal habit of growth and shall be sound, healthy, and vigorous. They shall be free from insects, disease, and defects such as knots, sun-scald, injuries, serious abrasions of the bark, or objectionable disfigurements. Thin weak plants will not be accepted. All nursery stock shall qualify under the AAN Horticultural Standards of the current American Standard for Nursery Stock, ANSI Z 60.1. Substitution of plant stock of other materials will not be permitted except by approval of the City Engineer.
2. All measurements for height, spread, branching, diameter, and root spread or ball size shall be as specified in the current AAN American Standard for Nursery Stock, ANSI Z 60.1, except as modified herein. For bare root trees, the minimum root spread in inches shall be equal to 12 in. for each inch diameter, plus 12 in., except that if the natural root spread does not meet this requirement, the plant may be accepted provided no roots have been cut. Pine and spruce trees shall be full to the base and have a ratio of approximately 5 height to 3 spread. All trees for which the number of branches are shown shall have not less than the number specified. A branch shall have a minimum length of 24 in. For trees and shrubs having a spread or base width specified, the spread or base width shall be measured not more than 10 in. from the ground line from tip to tip of branches in their natural position. The height of all plants shall be measured from the ground line to the tip of the uppermost branch.
3. Inspection of nursery stock may be made at the nursery by the City Engineer. Approval of material on such inspection shall not be construed as an acceptance. Inspection and acceptance of plant materials will be made only at the planting site following the completion of the planting work with the exception that acceptance for height, spread, and number of branches will be made before pruning the plant. Each shipment shall

be accompanied by an invoice showing sizes and varieties of materials included.

4. Invoices showing size and grade of materials shipped, plus all necessary state, federal, and other inspection certificates, showing the source of origin and the health of the plant materials shall be presented to the Director prior to final acceptance.
  5. All stock shall be dug and packed with special care to avoid unnecessary injury to or removal of roots. Each variety shall be packed in separate bundles, clearly and accurately labeled. Roots shall be carefully protected with wet straw, moss, or other material so that the plants arrive with roots in a moist and healthy condition. All stock shall have been grown within a 150 mile radius of St. Louis.
  6. Plants indicated by ball diameter shall be balled and burlapped and shall be lifted from the ground so as to retain as many roots as possible. Such plants shall be so dug and transported as to provide and retain a firm ball of the original soil. The ball shall be wrapped with burlap and securely tied to keep the ball firm and intact. Balls shall be adequately protected from rain or sudden changes in weather. Trees or other plants will not be accepted if the balls of earth are loosened or broken. Plants specified as container grown shall have grown in that container sufficiently long for new fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from the containers; however it shall not have grown in container long enough to have become pot bound. The container shall be sufficiently rigid to hold the ball shape protecting the root mass during shipping. The containers of all container grown plants shall be removed just prior to planting.
  7. All trees to be planted must be native to this area and non-invasive.
- b. Mulching Material: The mulching material shall be wood chips substantially free of foreign material.
  - c. Tree Wrapping Paper and Binder Twine: Wrapping paper for trees shall be a waterproofed tree wrapping paper of good commercial quality furnished in 4 in. width. Twine for tying paper shall be any approved commercially available binder twine.
  - d. Supporting Stakes for Trees: Supporting stakes for trees shall be an approved 2 in. x 2 in. x 6 ft. posts of sound wood and free from knots that would affect the serviceability of the posts.
  - e. Peat Moss: Peat moss shall be a natural domestic product consisting of partially decomposed stems and leaves of any variety of sphagnum mosses and shall be substantially free of woody substances and mineral matter such as sulphur and iron. Peat moss shall be granulated and used in an air-dry, loose condition.

### **807.3 Construction Requirements.**

- a. Planting Dates: Planting shall be performed during either the fall phase or the spring phase or both, as designated on the approved plans, and as approved by the City Engineer..
- b. On roadways open to traffic, the contractor shall avoid crossing the pavement with men, equipment, or materials.
- c. Care of Plants Before and During Planting: Immediately following delivery and inspection at the job site, all bare root plants shall be "heeled in" in a manner satisfactory to the City Engineer. All "heeled in", balled and burlapped, and container grown plants shall be protected and their roots kept moist until planted. While bare root plants are being transported to and from "heeling in" grounds, distributed in planting beds, or awaiting planting after distribution, their roots shall be protected from drying out by means of wet canvas, burlap, or straw, except as specified in this section. The trunks and branches of all trees shall be carefully protected from injury of any kind during all operations. Any injured tree may be rejected.
- d. Location and Spacing of Plants: The general location of each individual tree or shrub and the areas for ground cover plants will be shown on the plans. To facilitate the staking operations, the contractor shall notify the City Engineer in writing at least 2 weeks in advance of the date on which he intends to begin planting. Locations shall be as approved by the City Engineer.
- e. Pruning Roots: A maximum of root growth shall be preserved and no root pruning will be permitted except as noted herein. Any large or fleshy roots that have been broken, crushed, or badly bruised shall be cleanly cut back to sound wood. Interfering roots shall be pruned if directed by the City Engineer.
- f. Planting: The planting of all plants shall be subject to the inspection of the City Engineer. Any rock, rubble, or other underground obstructions shall be removed to the required depth. If underground obstructions, not feasible to move are encountered in the planting areas, then other locations may be selected by the City Engineer. The contractor shall notify the City Engineer at least 24 hours before proceeding with planting operations.
  - 1. *Preparation of Holes:* Holes for trees shall be not less than 18 in. larger in diameter than the ball diameter, container, or root spread. Holes for shrubs shall not be less than 12 in. larger than the ball diameter, container, or root spread. Holes for vines and seedlings shall be not less than 9 in. in diameter. The holes shall be of such depth to set the plants at the same height at which they grew in the nursery. If the holes are dug too deep, it shall be necessary to add enough backfill material to the bottom of the hole to allow for settling. Depth of holes for vines and seedlings shall be sufficient to allow for proper spreading of roots.
  - 2. *Backfill Material:* In general, backfill material for planting shall consist of the existing excavated soil broken into less than one inch clods and

thoroughly mixed with peat moss as required. Plants with a ball diameter, container, or root spread of 15 in. or less require one bushel of peat moss. Plants with a ball diameter, container, or root spread of over 15 in. require 2 bushels of peat moss. Peat moss will not be required for vines or seedlings.

3. *Bare Root Trees and Shrubs:* Plants with bare roots shall be held firmly in the proper position with the roots spread out during backfilling. Backfill material shall be worked and puddled around the roots and thoroughly firmed during backfilling. Sufficient water shall be used to insure thorough saturation of the backfill material around the plant roots.
4. *Balled and Burlapped and Container Grown Stock:* Plants which are balled and burlapped or container grown shall be set to proper position and grade. The backfill material shall be carefully worked and puddled around the ball. Sufficient water shall be used to insure thorough saturation of the backfill material.
5. *Vines and Seedlings:* Vines and seedlings shall be planted on 3 ft. centers and 3 ft. staggered rows within designated areas. When a bundle of plants is opened, all plants in that bundle shall immediately be placed in a container of water and each plant planted from the container. Plants placed in the holes shall be backfilled immediately. Backfill material shall be thoroughly firmed, and all plants shall be watered the same day of planting.
6. *Preparation of Plant Beds:* Prior to planting in areas designated on the plans as plant beds, the existing sod shall be removed by stripping with a sod cutter set for a 1 in. depth of cut. The sod so removed shall be disposed of by the contractor outside the limits of the right-of-way or as directed by the City Engineer.
7. *Mulching:* Individual plants except for vines and seedlings shall be mulched with a 4 in. layer of wood chips over the backfill or as shown on the plans. All areas shown on the plans as plant beds shall be mulched with a 4 in. thick layer of wood chips in a continuous bed over the entire area. Mulch will not be required for vines or seedlings.
8. *Fertilizing:* A 10-8-6 inorganic commercial fertilizer shall be applied to all plant materials at the time of planting. The fertilizer shall be delivered to the site in unopened containers bearing the manufacturer's statement of analysis. Apply fertilizer at the rate of 1/4 lb./in. to 1/2 lb./in. of caliber for trees, and 2 lb./100 sq.ft. of planting bed.

g. Pruning Branches or Stems:

1. Deciduous trees shall be pruned to balance the loss of roots. Pruning shall retain the natural form of the plant type. Only thinning cuts will be permitted on trees. A single trunk shall be preserved on all shade trees. All dead, broken, and interfering branches shall be removed. When

branches are removed, they shall be cut off flush with the parent branch. All cut surfaces over 1 in. in diameter shall be painted with tree paint or tar.

2. Deciduous shrubs shall be pruned by removing all dead wood and broken branches and by removing or heading approximately 1/3 to 1/2 of the branches.
  3. Evergreens shall be pruned only to the extent of removing dead or damaged portions of the branches, except as permitted by the City Engineer.
  4. Vines shall be pruned to the extent necessary to retain approximately 6 in. of runner above the ground surface.
- h. Wrapping Trees: The trunks of all deciduous trees, and the lower part of the largest branches of trees more than 5 in. caliber, shall be carefully wrapped with tree wrapping paper immediately after planting. The wrapping shall begin at the ground line and extend upward in a spiral to the lowest major branch. The spiral paper shall overlap not less than 1 in. Multiple stemmed trees shall have each stem separately wrapped to the lowest major branch. Suckers and small twigs shall be removed to permit proper wrapping. The wrapping paper shall be held in place with binder twine.
- i. Supporting Methods for Trees: Trees 2 in. or more in caliber, or as determined by the Director shall be properly supported using 3 guy wires securely anchored to approved stakes not less than 5 ft from the trunk and at a height as indicated on the plans. The trunk shall be adequately protected from the guy wires. The guy wires are to be No. 12 gage wire. The supports shall be installed within 2 days of planting.
- j. Finishing: Waste material, including sod, subsoil, rock, branches, twigs, packing material, and other debris shall be disposed of by the contractor outside the limits of the right-of-way or as directed by the City Engineer. All roadway shoulders and other areas damaged by the contractor's operations shall be restored to a satisfactory condition as directed by the City Engineer. Finishing in accordance with this section shall be performed following the completion of each planting phase when fall and spring planting phases are required.

#### **807.4 Care and Replacement.**

- a. Starting with the first day of planting for each phase and continuing through a period of 45 days following the last day of planting within the respective phase, the contractor shall keep all plants watered sufficiently to maintain moist soil in the root zone. The City Engineer may direct watering as necessary to maintain moist soil and may halt further planting within the respective phases until sufficient water is applied to those plants in place. In addition to watering, the contractor shall perform such weeding, adjusting tree supporting posts, pruning, chemical spraying for insect and disease control, and keep all bedded areas substantially clear of weeds and grass to insure healthy plants. The contractor,

will be permitted to apply commercial wilt-proofing compound or liquid fertilizer on plants during the planting or the watering period as indicated on the plans.

- b. The contractor shall be responsible for the proper care of all plants until final inspection and acceptance of the plants has been made by the City Engineer.
  1. Any plant, which in the judgment of the City Engineer, is not in a healthy growing condition at the time of final plant inspection shall be replaced by the contractor in accordance with the original specifications except that additional peat moss will not be required for the backfill material, and except that the specified 45-day watering period will not be required. No maintenance will be required for those plants replaced under this replacement specification.
  2. Final Plant Inspection: For those developments requiring fall phase planting only, the final inspection of plants will be made as soon as practicable after May 15. For those developments requiring spring phase planting only, or requiring both fall and spring phase planting, the final plant inspection will be made as soon as practicable following either the specified spring watering period or May 15 whichever comes last. Plants not accepted at the time of final plant inspection will be marked and shall be replaced in the fall in accordance with the dates established in the approved plans and/or specifications. The contractor will be relieved of all further responsibility for plants that are accepted at the time of final plant inspection.

#### **END OF SECTION**

**AS-BUILT DRAWINGS  
DIVISION 1100**

**SECTION 1100**

**As-Built Drawing Requirements**

**1100.1 Description.** This section covers the requirements for drawings containing information of infrastructure in the constructed or "as-built" state.

**1100.2 General.** All entities who construct public waterlines or facilities, storm drainage systems, impoundments, or sanitary sewers to be maintained by the City of Wentzville shall submit to the Engineering Division an as-built set of construction drawings as a part of the City's acceptance process. **All plan sheets shall be 24" x 36" reproducible mylar along with an AutoCad format digital file (contact the Engineering Division for acceptable formats).** All applicable information listed below shall be included on all as-built drawings.

**1100.3 General Information.** The following project summary information shall be included on the as-built drawings.

- a. Project Name
- b. City of Wentzville Engineering Project Number (to be included on the lower right corner of each sheet)
- c. Total linear footage and size of streets, water mains, sanitary sewer mains, storm sewer mains, number of valves, fire hydrants, manholes (sanitary and storm), and inlets (by type)
- d. Boundary of tract by courses and distance with references
- e. Tie to Missouri State Plane Coordinate System
- f. Vicinity map
- g. Scale of drawings and bar scale
- h. North arrow
- i. Location of benchmark
- j. Seal and signature of registered P.E. or P.L.S. licensed in the State of Missouri
- k. All easements identified and dimensioned
- l. Statement designating drawings are "as-built"

**1100.4 Water System Information.** The following information related to the water system shall be provided.

- a. Water Main location
- b. Pipe material
- c. Pipe size
- d. Location of all fire hydrants, valves, air release valves, bends, fittings, taps, pump stations
- e. Pipe lengths between fittings and other system facilities
- f. Location of casing pipe for future service lines.

**1100.5 Sanitary Sewer System Information.** The as-built drawings shall indicate the horizontal and vertical location of the sanitary sewer system in plan and shall include the following information.

- a. Pipe material
- b. Pipe size



- c. Structure top elevation and the elevations of all incoming and outgoing pipe flowlines
- d. Pipe slope and distance
- e. Pump station location including wet well, valve vault, retention chambers
- f. Pump station top and invert elevations
- g. Retention chamber size, pipe material, slope and flowline elevations
- h. Location of all sanitary sewer force main tracer wire access points and air release valves.

**1100.6 Storm Water Management System Information.** The as-built drawings shall indicate the horizontal and vertical location of the storm water management system in plan and shall include the following information.

- a. Outline of 100 year flood plain
- b. Pipe material
- c. Pipe size
- d. Structure top elevation and the elevations of all incoming and outgoing pipe flowlines
- e. Pipe slope and distance
- f. Show permanent stormwater impoundments.
- g. Include topography of the as-built condition of all stormwater detention/retention facilities (under ground detention shall be dimensioned in lieu of topography).
- h. Control and overflow structure location and size, and elevations. This shall include all information relevant to the proper operation of the structure (i.e. opening size, low flow and outlet pipe size, slope and flowline elevation, etc.) Additionally the channel protection volume elevation and flood protection elevations should be indicated on the plan. The volume of water contained for each design condition should be provided. Should significant volume differences from the design volume be determined, a recalculation of the actual design may need to be provided.
- i. Detention basin low flow swale location

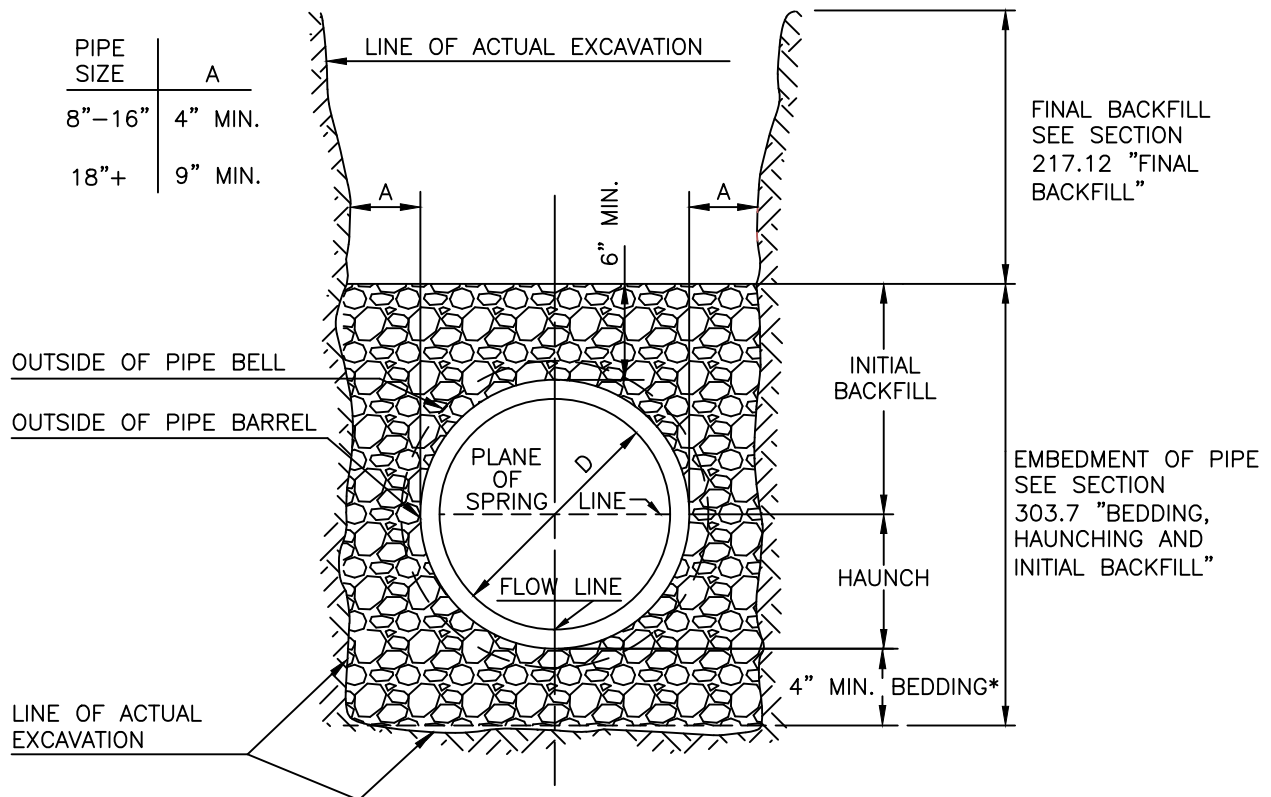
**END OF SECTION**

## List of Standard Construction Details

<u>Drawing Title</u>	<u>Date Approved</u>	<u>SCD #</u>
Standard Pipe Bedding For Sanitary Sewer	26-Jul-17	300.01
Concrete Encasement	10-Jun-09	300.02
Concrete Cradle	10-Jun-09	300.03
Concrete Collar	26-Jul-17	300.04
Standard Pipe Bedding For C906 Polyethylene Force Main Pipe	10-Jun-09	300.05
Standard Manhole	26-Jul-17	302.01
Inside Foul Water Drop Manhole (2' Drop or Greater)	10-Jun-09	302.02
Inside Foul Water Drop Manhole (Less Than 2' Drop)	26-Jul-17	302.03
Manhole Gasket	10-Jun-09	302.04
Precast Manhole Onto Existing Pipe with Continuous Flow	26-Jul-17	302.05A
New Sanitary Line Connection Onto Existing Manhole with Continuous Flow	26-Jul-17	302.05B
Adjust to Grade	26-Jul-17	302.06A
Shallow Manhole Top	26-Jul-17	302.06B
Cast Iron Manhole Frame and Cover	10-Jun-09	302.07
Standard Cast Iron Manhole Cover (Lock Type)	10-Jun-09	302.09
Standard Locking Device for Type "T" Lock Type Manhole Cover	10-Jun-09	302.10
Standard Locking Device for Type "N" Lock Type Manhole Cover	10-Jun-09	302.11
Standard Manhole Step	10-Jun-09	302.12
Standard New Service Connection	10-Jun-09	302.13a
Saddle Tee Connection to Plastic Main	10-Jun-09	302.13b
"Roll-In" For Existing Clay or Concrete Pipe	10-Jun-09	302.13c
Standard Deep Service Connection	10-Jun-09	302.14
Standard Force Main Air Release Valve	10-Jun-09	302.16
Standard Tracer Wire Test Station and Access Box	10-Jun-09	302.17
Standard Force Main Discharge at Receiving Manhole	10-Jun-09	304.01
Gravity Sanitary Creek Crossing (Below Flowline of Creek)	10-Jun-09	304.02
Aerial Pipe Crossing Typical Plan	10-Jun-09	304.03
Aerial Pipe Crossing Typical Profile	26-Jul-17	304.04
Aerial Pipe Crossing Typical Pipe Section and Elevation	10-Jun-09	304.05
Aerial Pipe Crossing Casing Pipe Details	10-Jun-09	304.06
Aerial Pipe Crossing Concrete Pier Detail	10-Jun-09	304.07
Typical Bore Detail	10-Jun-09	304.10

Sanitary Sewage Pump Station Layout	15-Oct-15	400.01
Wet Well and Valve Chamber	15-Oct-15	400.02
Wet Well and Valve Chamber Cross Section	15-Oct-15	400.03
Pump Station Control Panel	26-Jul-17	400.04
Standard Utility Locations	10-Jun-09	500.01
Standard Water Main Layout	10-Jun-09	500.02
Standard Tracer Wire Test Station and Access Box	10-Jun-09	500.03
Standard Water Main Installation	10-Jun-09	502.01
Standard Water and Sewer Separation	15-Oct-15	502.02
Standard C906 Joints and Fittings	15-Oct-15	502.03
Standard Fire Hydrant Assembly	10-Jun-09	502.04
Fire Hydrant Standard Location	10-Jun-09	502.05
Typical Gate Valve Detail	10-Jun-09	502.06
Standard Water Main Air Release Valve	10-Jun-09	502.07
Typical Water Main Wet Tap – PVC Pipe	10-Jun-09	502.08
Typical Water Main Wet Tap – C906 Poly Pipe	10-Jun-09	502.09
Typical Bore Detail	10-Jun-09	502.10
Typical Freezeless Yard Hydrant	10-Jun-09	502.11
Water Creek Crossing (Below Flowline of Creek)	15-Oct-15	502.12
Typical Water Service – ¾" Thru 2"	10-Jun-09	503.01
Standard Meter Box ¾" Thru 2" Service	10-Jun-09	503.02
Standard Meter Box 3" Thru 8" Service	10-Jun-09	503.03
3" Water Service Piping Layout	13-Oct-09	503.03A
4" Water Service Piping Layout	13-Oct-09	503.03B
6" Water Service Piping Layout	13-Oct-09	503.03C
8" Water Service Piping Layout	13-Oct-09	503.03D
Meter Electric Panel 4" Thru 8" Service	10-Jun-09	503.04
Standard Fire Line & Water Service	10-Jun-09	503.05
Typical Hydrant Meter Set-Up	10-Jun-09	505.01
Standard Pipe Bedding For Reinforce Concrete Pipe	10-Jun-09	600.01
Standard Pipe Bedding For HDPE Storm Sewer Pipe	10-Jun-09	600.02
Standard Manhole	26-Jul-17	602.01
Area Inlet Manhole (12" thru 24")	10-Jun-09	602.02
Cast-in-place Concrete Double Street Inlet w/ Precast Top Unit	10-Jun-09	602.03
Standard Inlet Top Stone	10-Jun-09	602.04

Precast Concrete Unit for Single Street Inlet	10-Jun-09	602.10
Precast Concrete Unit for 4 Way Area Inlet	10-Jun-09	602.11
Precast Concrete Unit "A" for Double Curb Inlet	10-Jun-09	602.12
Precast Concrete Unit "B" for Double Curb Inlet	10-Jun-09	602.13
Flared End Section	10-Jun-09	602.14
Standard Typical Section - Local Residential - 50' R/W, 26' PVMT	24-Feb-16	700.01a
Standard Typical Section - Rural Residential - 30' R/W, 24' PVMT	24-Feb-16	700.01b
Standard Typical Section - Minor Collector Residential - 60' R/W, 39' PVMT	24-Feb-16	700.02
Standard Typical Section - Commercial - 50' ROW, 32' PVMT	24-Feb-16	700.03
Standard Typical Section - Major Collector - 70' R/W, 39' PVMT	24-Feb-16	700.04
Standard Typical Section - Minor Arterial - 80' R/W, 51' PVMT	24-Feb-16	700.05
Standard Typical Section - Major Arterial - 100' R/W, 63' PVMT	24-Feb-16	700.06
Joint Details	10-Jun-09	700.07
Curb Details	10-Jun-09	700.08
Longitudinal Joint Location Details	16-Mar-10	700.09a
Joint Location Details	10-Jun-09	700.09b
Joint Location Notes	10-Jun-09	700.09c
Concrete Slab with Manhole	10-Jun-09	700.10
42' Radius Residential Cul-de-sac	10-Jun-09	700.11
55' Radius Residential and Non-residential Cul-de-sac	10-Jun-09	700.12
Residential Temporary Turn Around	24-Feb-16	700.13
Sidewalk and Curb Ramp	15-Oct-15	700.14
Sidewalk Curb Ramp Detectable Warnings	10-Jun-09	700.16
Right In - Right Out Channelized Street or Commercial Entrance	10-Jun-09	700.17
Street/Stop Sign	15-Oct-15	700.18
Street/Stop Sign & Street Light Locations at Intersections (Local Streets)	15-Oct-15	700.19
Street/Stop Sign & Street Light Locations at Intersections (Collector/Arterial Streets)	15-Oct-15	700.20
Dowel Supporting Units	10-Jun-09	700.21
Gutter Sump	10-Jun-09	700.22
Residential Entrance	21-Sep-09	700.23
Slab Replacement Details	10-Jun-09	700.24
End of Pavement Object Marker	24-Feb-16	700.25
Concrete Sidewalk	15-Oct-15	700.26
Pavement Markings	15-Oct-15	700.27
Underdrain Detail	10-Jun-09	700.28
Sight Distance Guidelines	10-Jun-09	700.37

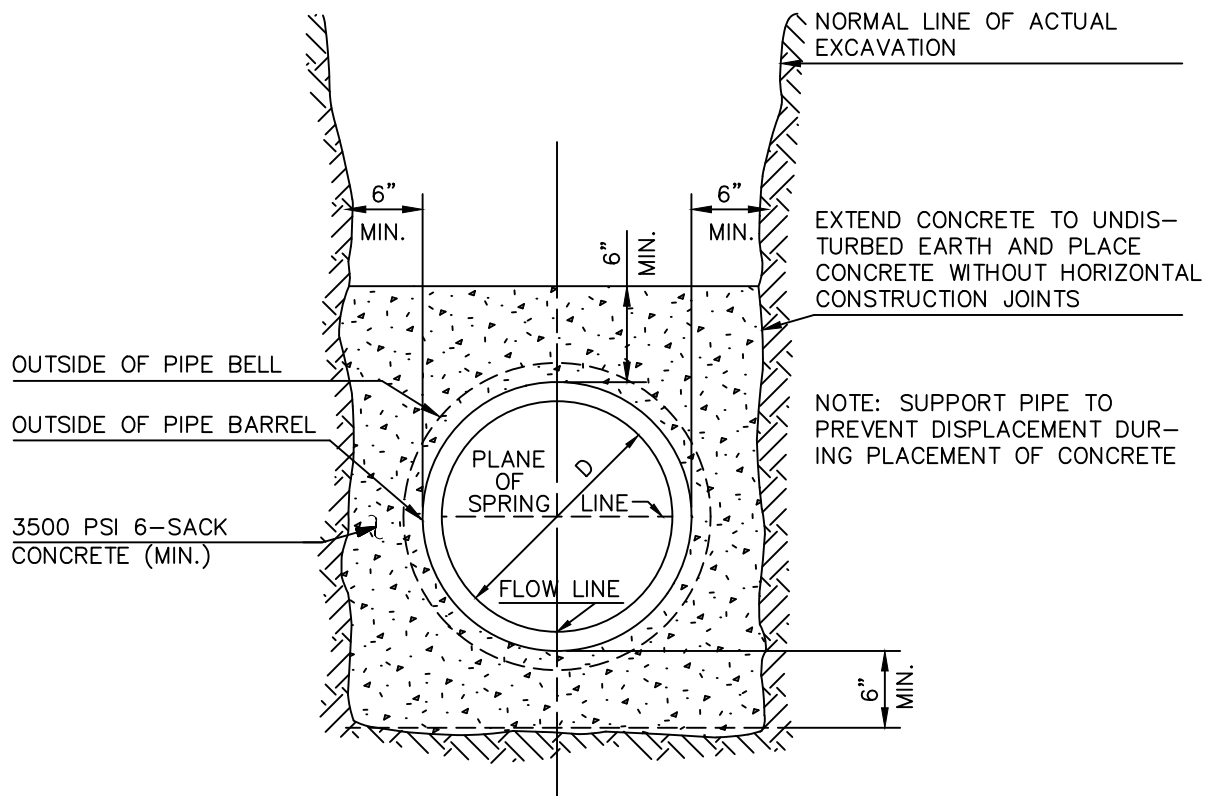


(\*) WHEN A TRENCH IS CUT THROUGH ROCK, IT SHALL BE EXCAVATED 6" BELOW THE PLANNED PIPE BOTTOM GRADE, AND BEDDED AND INITIALLY BACKFILLED WITH NON-ANGULAR GRANULAR BEDDING MATERIAL.

IN HIGHLY ORGANIC OR OPENLY FLOWING SOILS, THIS DEPTH SHALL BE INCREASED AS REQUIRED BY THE CITY.

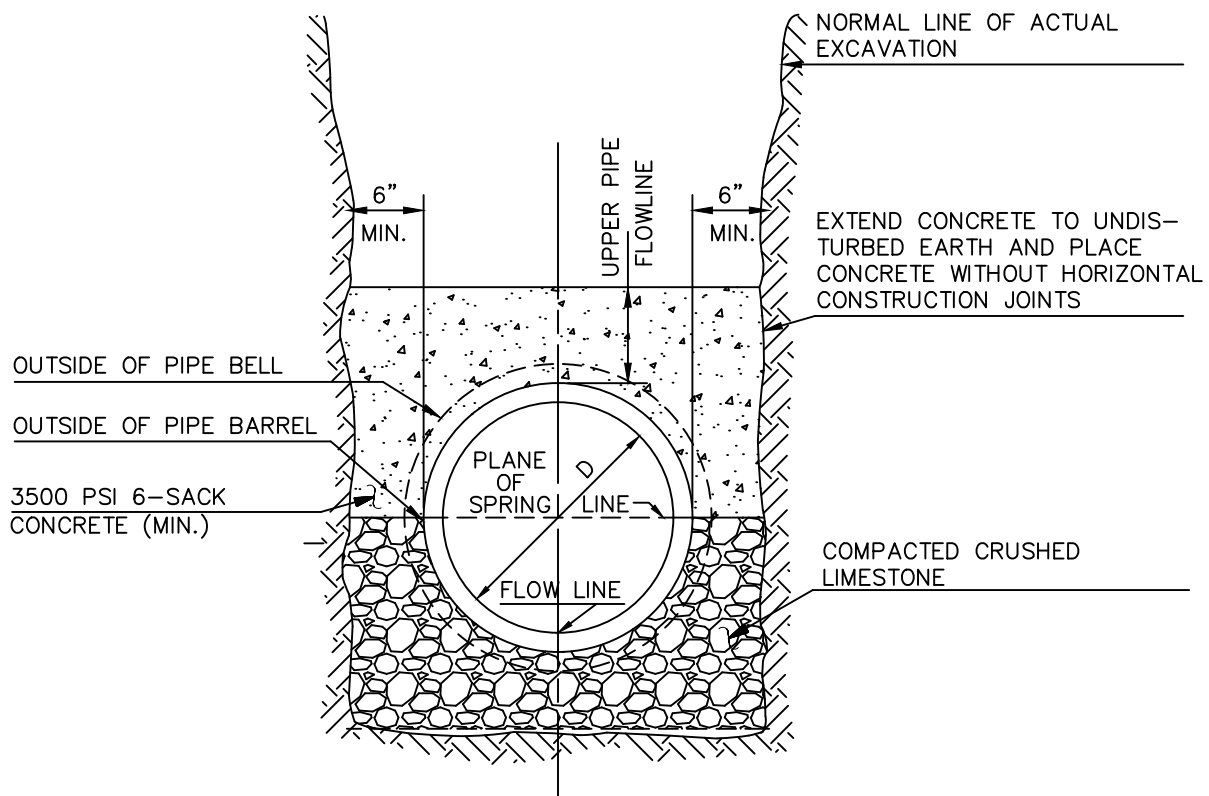
NOTES:

1. CHECK GRADE OF PIPE AFTER BACKFILL TO INSURE THE DESIRED FLOWLINE HAS NOT CHANGED
2. DURING JETTING PROCESS, NOZZLE SHALL NOT BE INSERTED CLOSER THAN TWO FEET FROM TOP OF PIPE.
3. ANY TRENCH BRACING USED BELOW THE TOP OF PIPE SHALL BE LEFT IN PLACE.
4. FOR INSTALLATIONS IN HIGHLY ORGANIC OR OPENLY FLOWING SOILS, THE ENTIRE PERIMETER OF THE PIPE BEDDING SHALL BE WRAPPED WITH AN APPROVED FILTER FABRIC OR THE "MINIMUM TRENCH WIDTH" SHALL BE EXPANDED BY INCREASING THE DISTANCE BETWEEN THE SIDE OF THE PIPE AND THE LINE OF ACTUAL EXCAVATION OR TRENCH BRACING TO A MINIMUM OF ONE PIPE DIAMETER. THIS IS TO PREVENT THE MIGRATION OF SOIL THROUGH THE ANNULAR VOID SPACE IN THE EMBEDMENT CLASS 1A MATERIAL.



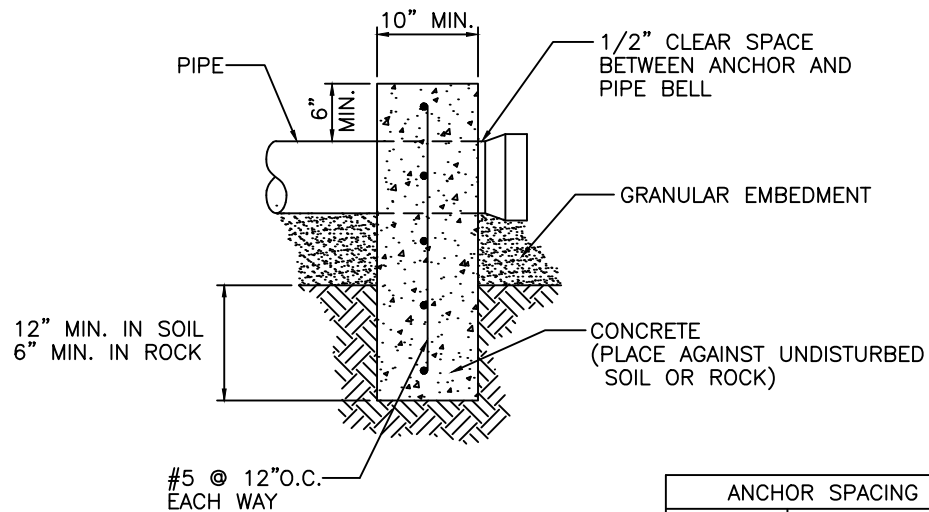
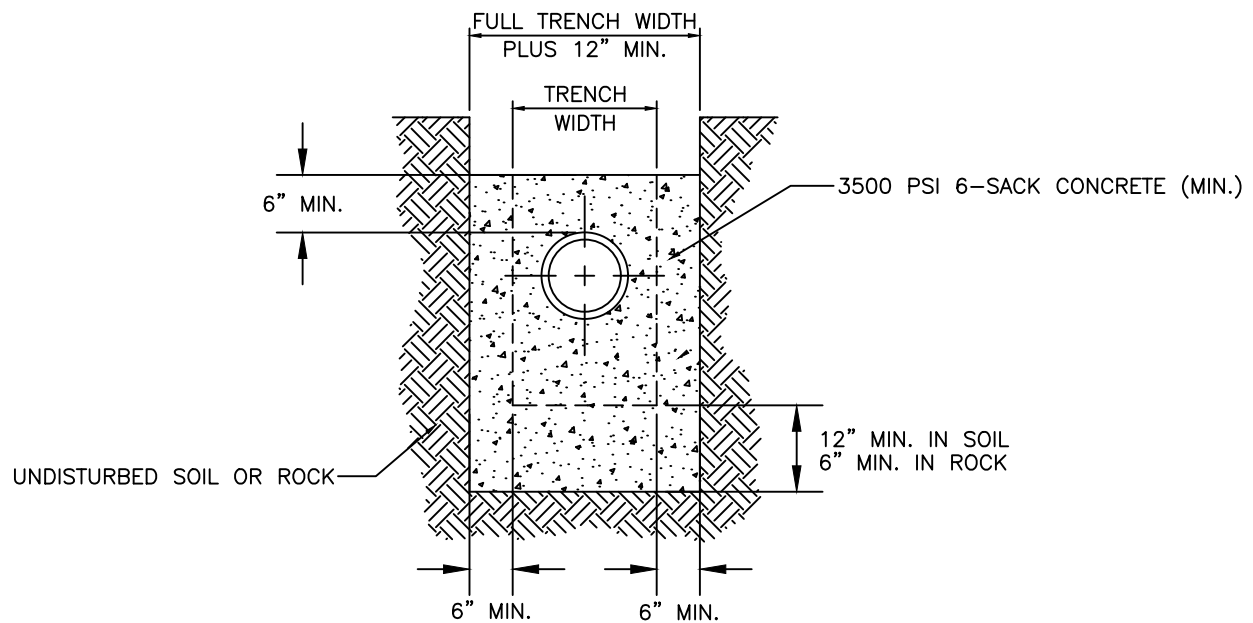
NOTES:

1. CONCRETE ENCASEMENT OF THE SANITARY SEWER IS REQUIRED WHEN:
  - A. THE SANITARY SEWER IS UNDER A STORM SEWER WITH LESS THAN 2 FEET OF VERTICAL SEPARATION. THE ENCASEMENT SHALL EXTEND 10 FEET ON EACH SIDE OF THE CROSSING.
  - B. THERE IS LESS THAN 3 FEET OF COVER OF THE TOP OF PIPE. THE ENCASEMENT SHALL EXTEND FOR THE LENGTH OF THE TRENCH WHERE COVER IS LESS THAN 3 FEET.
  - C. THERE IS INSUFFICIENT SEPARATION FROM THE WATER MAIN AS SHOWN ON SCD 502.02
2. WHERE CONCRETE ENCASEMENT IS REQUIRED THE PIPE SHALL BE SUPPORTED AT NO MORE THAN TWO PLACES WITH MASONRY SUPPORTS OR SELECTED HARDWOOD AS APPROVED BY THE CITY OF MINIMUM SIZE SUFFICIENT TO PROVIDE THE REQUIRED CLEARANCE AND TO PREVENT DISPLACEMENT DURING PLACING OF CONCRETE.
3. WHEN SANITARY SEWER IS ABOVE A STORM SEWER WITH LESS THAN 2 FEET OF VERTICAL SEPARATION A CONCRETE CRADLE SHALL BE POURED OVER THE STORM SEWER PIPE, FROM THE SPRINGLINE OF THE STORM SEWER UP TO THE FLOWLINE OF THE SANITARY SEWER, FOR THE WIDTH OF THE STORM SEWER TRENCH.



NOTES:

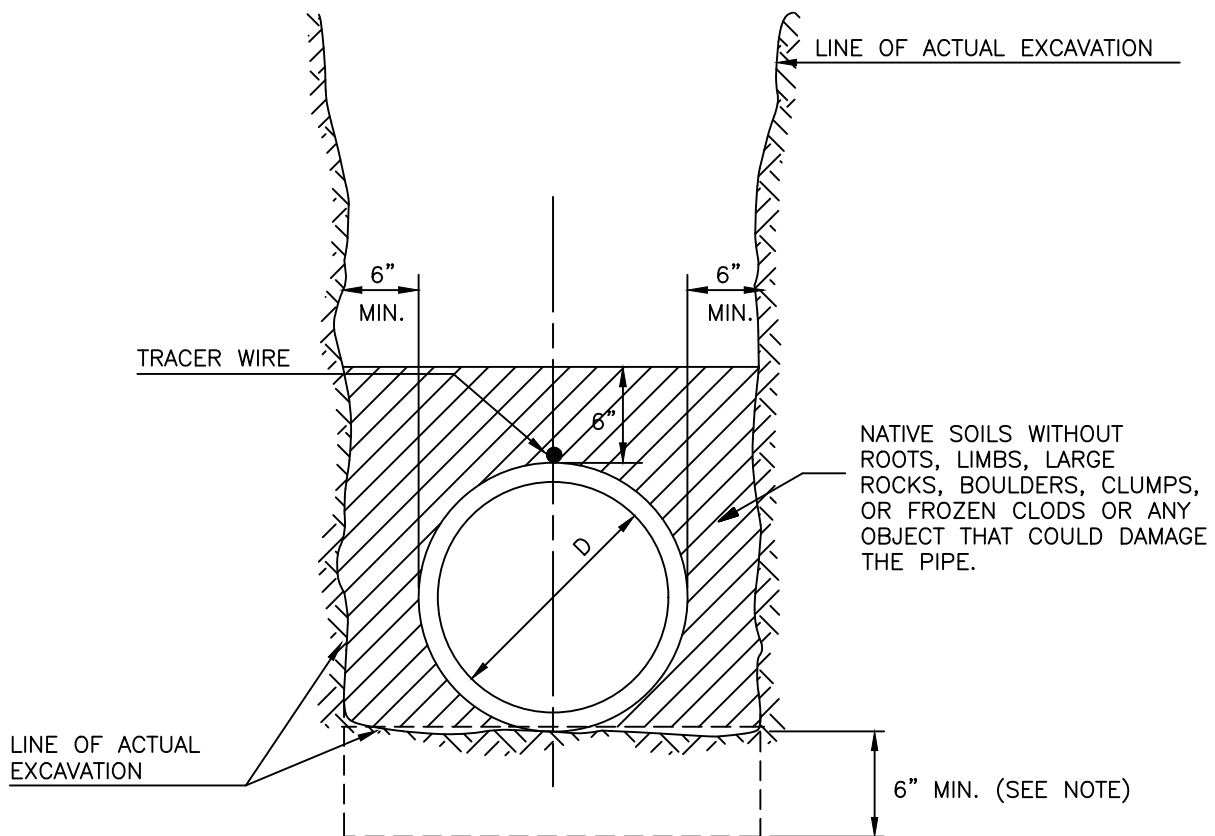
1. CONCRETE SHALL ACROSS THE FULL WIDTH OF THE TRENCH.
2. THE CRADLE SHALL BE FROM THE SPRINGLINE OF THE LOWER PIPE UP TO THE FLOWLINE OF THE UPPER PIPE.



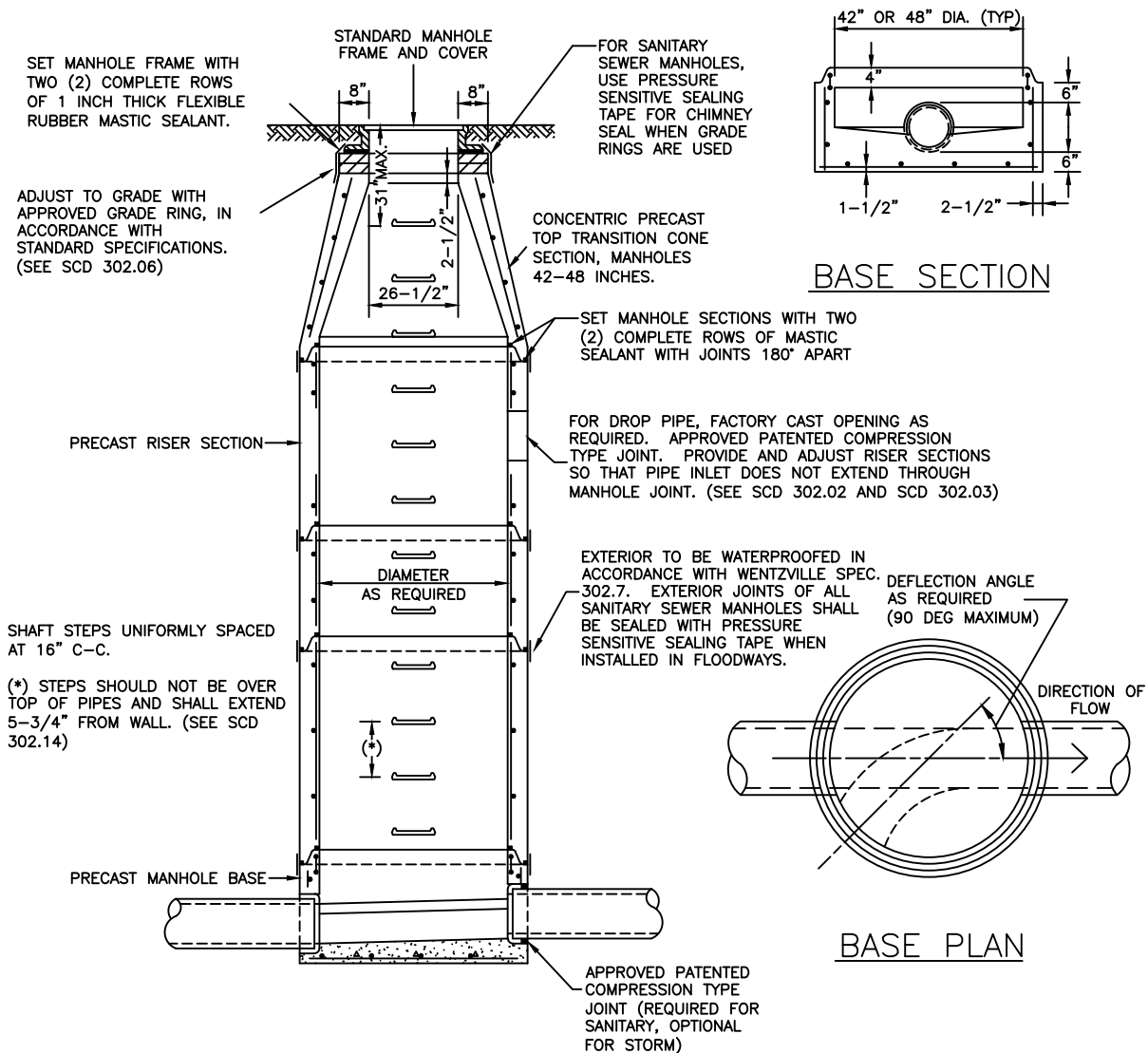
SIDE ELEVATION

ANCHOR SPACING	
SLOPE	MAX. DISTANCE
20%–35%	36'
35%–50%	24'
>50%	12' OR ONE PER JOINT OF PIPE
VELOCITY	MAX. DISTANCE
>15 FPS	15'





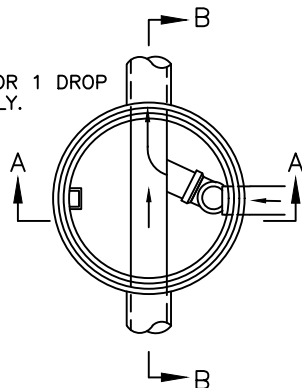
NOTE: WHEN A TRENCH IS CUT THROUGH ROCK, IT SHALL BE EXCAVATED 6" BELOW THE PLANNED PIPE BOTTOM GRADE, AND BEDDED AND INITIALLY BACKFILLED WITH NON-ANGULAR GRANULAR BEDDING MATERIAL.



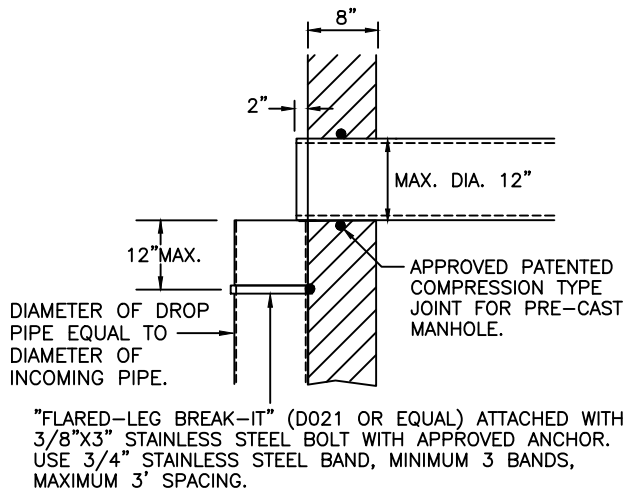
NOTES:

1. THE MINIMUM INSIDE DIAMETER FOR THE BASE AND RISER SECTIONS SHALL BE 42 INCHES FOR 8 INCH DIAMETER SEWERS. THE MINIMUM INSIDE DIAMETER FOR SEWERS LARGER THAN 8 INCH DIAMETER IS 48 INCHES. MANHOLE SHALL MEET ASTM C-478 REQUIREMENTS.
2. FLOWLINE ELEVATION OF INCOMING PIPES SHALL BE 0.2 FEET HIGHER THAN THAT OF OUTGOING PIPE (SANITARY SEWER ONLY).
3. PIPE SIZES 24 INCHES IN DIAMETER AND LARGER REQUIRE MANHOLE DIAMETERS OF 60 INCH MINIMUM AND MAY REQUIRE, 72 INCH, OR 96 INCH AS DETERMINED BY OUTSIDE DIAMETERS AND ORIENTATIONS OF CONNECTING PIPES.
4. ECCENTRIC CONES SHALL BE USED ON DIAMETERS 60 INCH AND LARGER. STEPS SHALL EXTEND DOWN VERTICAL WALL OF CONE.
5. PRIOR TO FABRICATION, SHOP DRAWINGS SHALL BE SUBMITTED TO THE CITY FOR APPROVAL OF MANHOLES ON PIPE DIAMETERS LARGER THAN 24 INCH AND ALSO FOR THOSE STRUCTURES WITH A DROP PIPE CONNECTION.
6. REINFORCEMENT IS REQUIRED IN ALL SECTIONS PER ASTM C 478M-06b
7. BRICK IS NOT ALLOWED IN SANITARY SEWER MANHOLES.

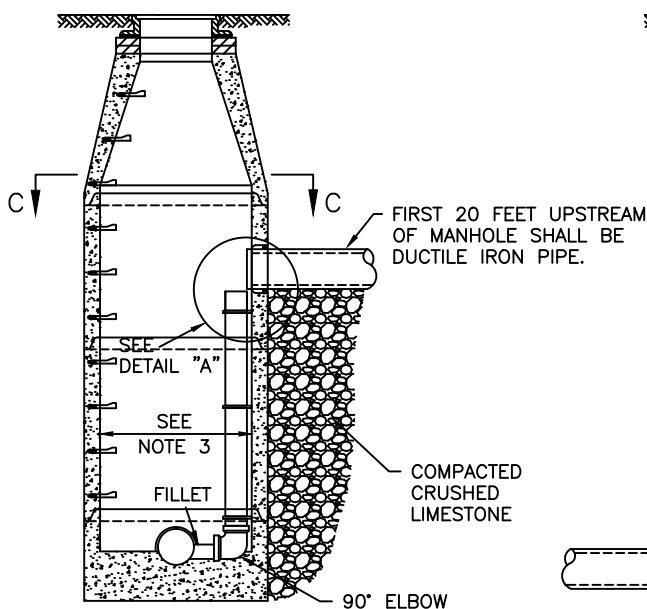
NOTE: FOR 1 DROP  
PIPE ONLY.



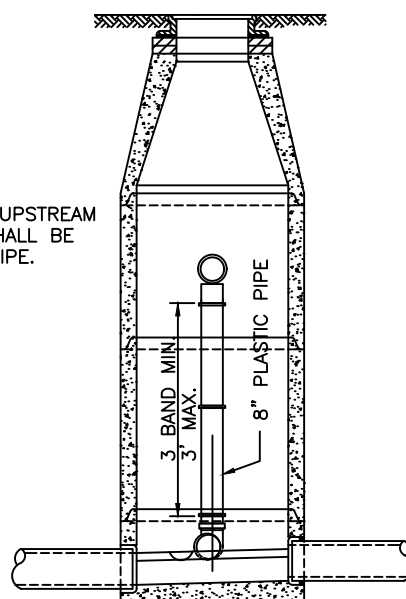
SECTION C-C



DETAIL "A"



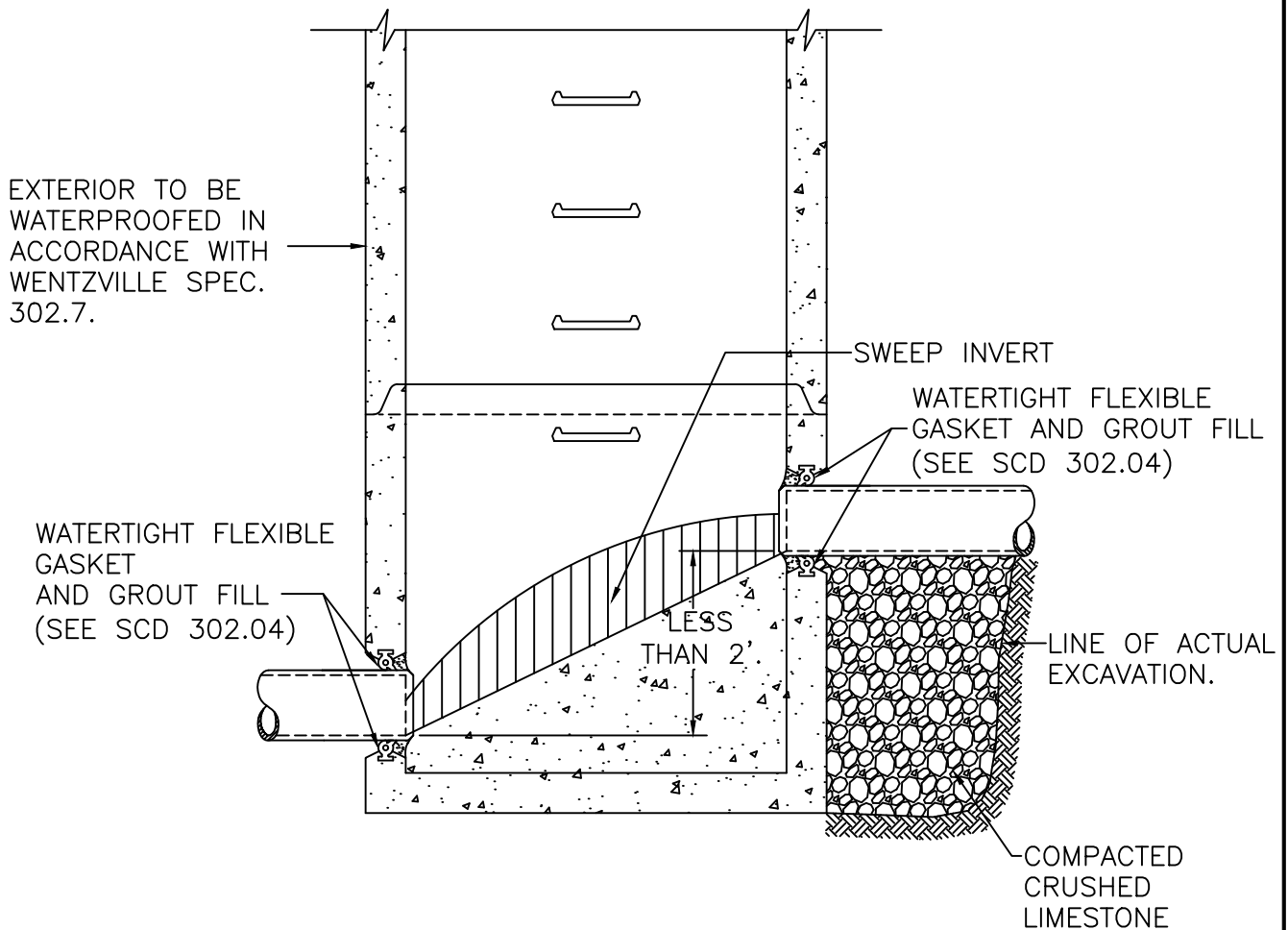
SECTION A-A



SECTION B-B

NOTES:

1. NEW INSIDE DROP ON EXISTING MANHOLE REQUIRES THAT THE FLOWLINE OF THE NEW DROP PIPE ELBOW BE CONSTRUCTED AT THE SAME ELEVATION AS THE SPRINGLINE OF THE EXISTING SEWER MAIN AT THE CENTER OF THE EXISTING MANHOLE. A CONCRETE FILLET AND INVERT SHALL BE CONSTRUCTED FOR DROP PIPE (3500 PSI 6 SACK MINIMUM).
2. PROVIDE DUCTILE IRON PIPE FOR 20 FEET UPSTREAM OF MANHOLE ON INCOMING PIPE.
3. INSIDE DROP MANHOLES SHALL BE 48" DIAMETER, MINIMUM, FOR SINGLE DROPS AND 60" DIAMETER FOR DOUBLE DROPS. THE MAXIMUM NUMBER OF ALLOWABLE DROPS IS TWO.
4. FACTORY CAST DROP OPENING AS REQUIRED. AN APPROVED, PATENTED COMPRESSION TYPE JOINT MUST BE INCLUDED. PROVIDE AND ADJUST RISER SECTIONS SO THAT PIPE INLET DOES NOT EXTEND THROUGH MANHOLE JOINT.
5. OUTSIDE DROP MANHOLES ARE NOT ACCEPTABLE.



NOTE:

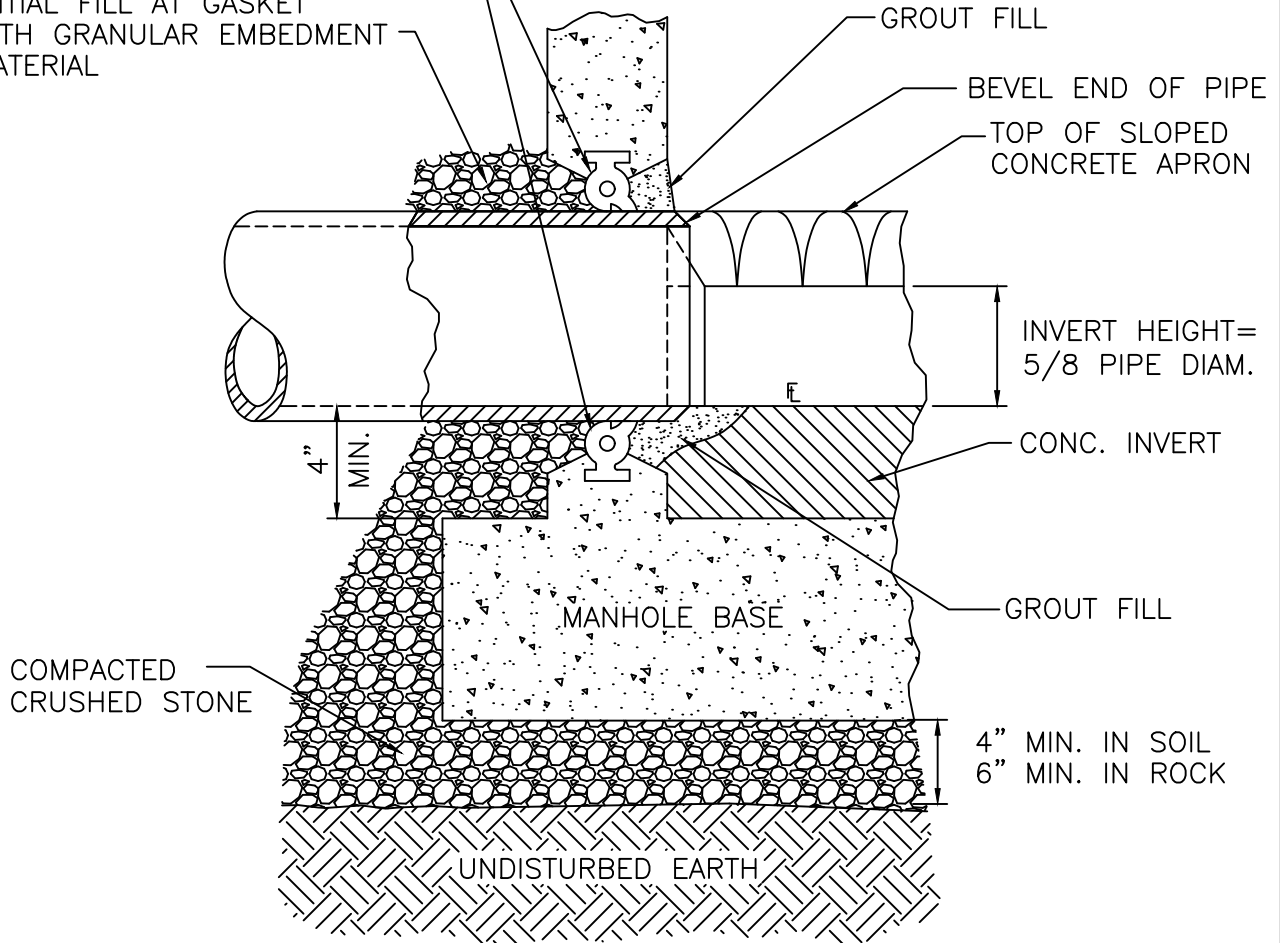
THE MINIMUM INSIDE DIAMETER FOR THE BASE AND RISER SECTIONS SHALL BE 42 INCHES FOR 8" DIAMETER SANITARY SEWERS. THE MINIMUM INSIDE DIAMETER FOR SANITARY SEWERS LARGER THAN 8" DIAMETER IS 48 INCHES.

WATERTIGHT FLEXIBLE GASKET

"A-LOK" OR EQUAL FOR  $\leq 7\%$

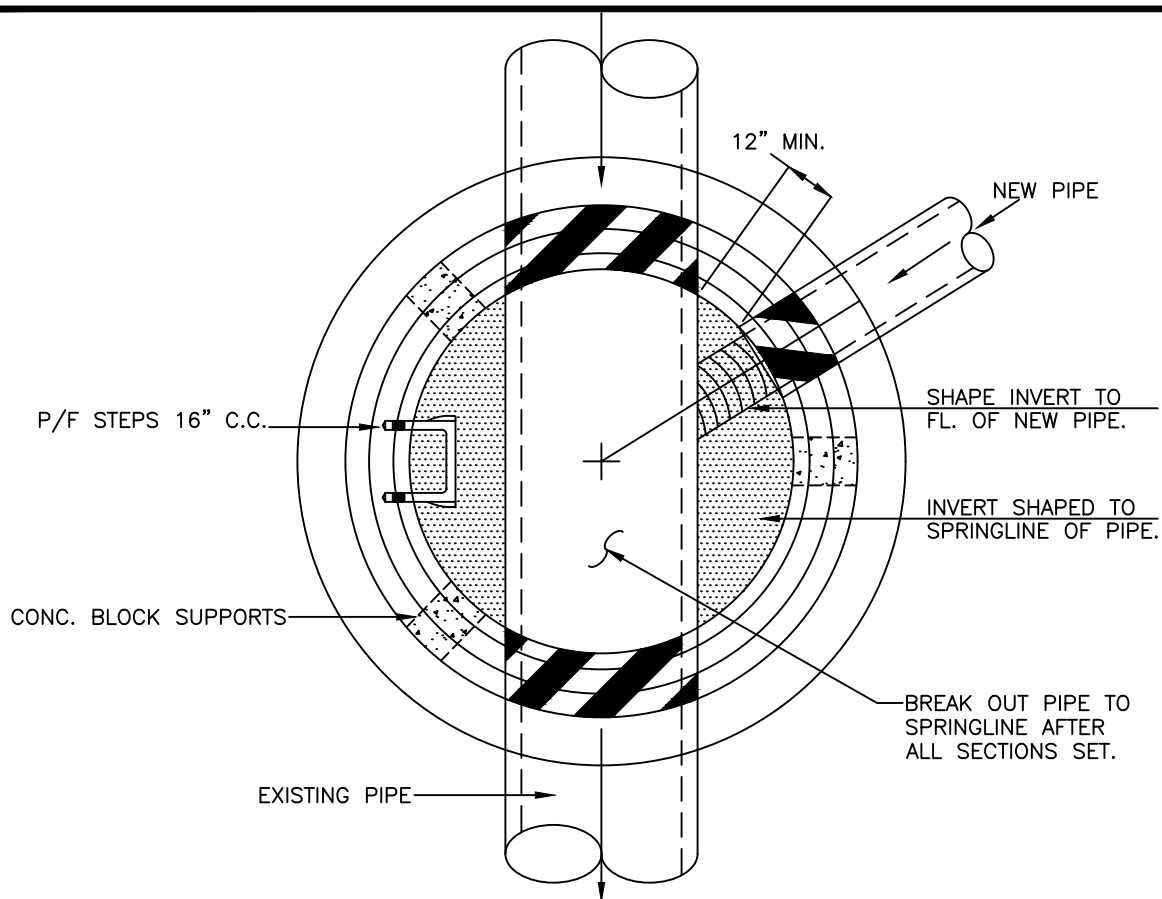
"Z-LOK" OR EQUAL FOR  $7\% < 25\%$

INITIAL FILL AT GASKET  
WITH GRANULAR EMBEDMENT  
MATERIAL

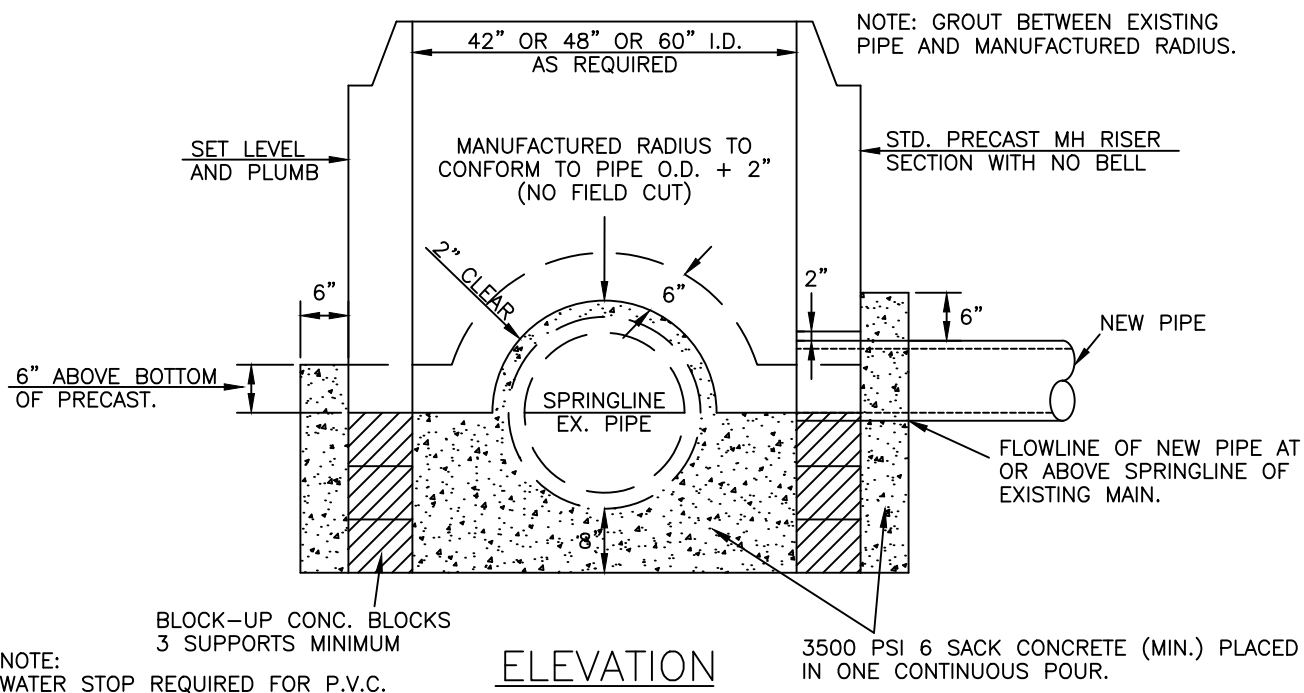


NOTE:

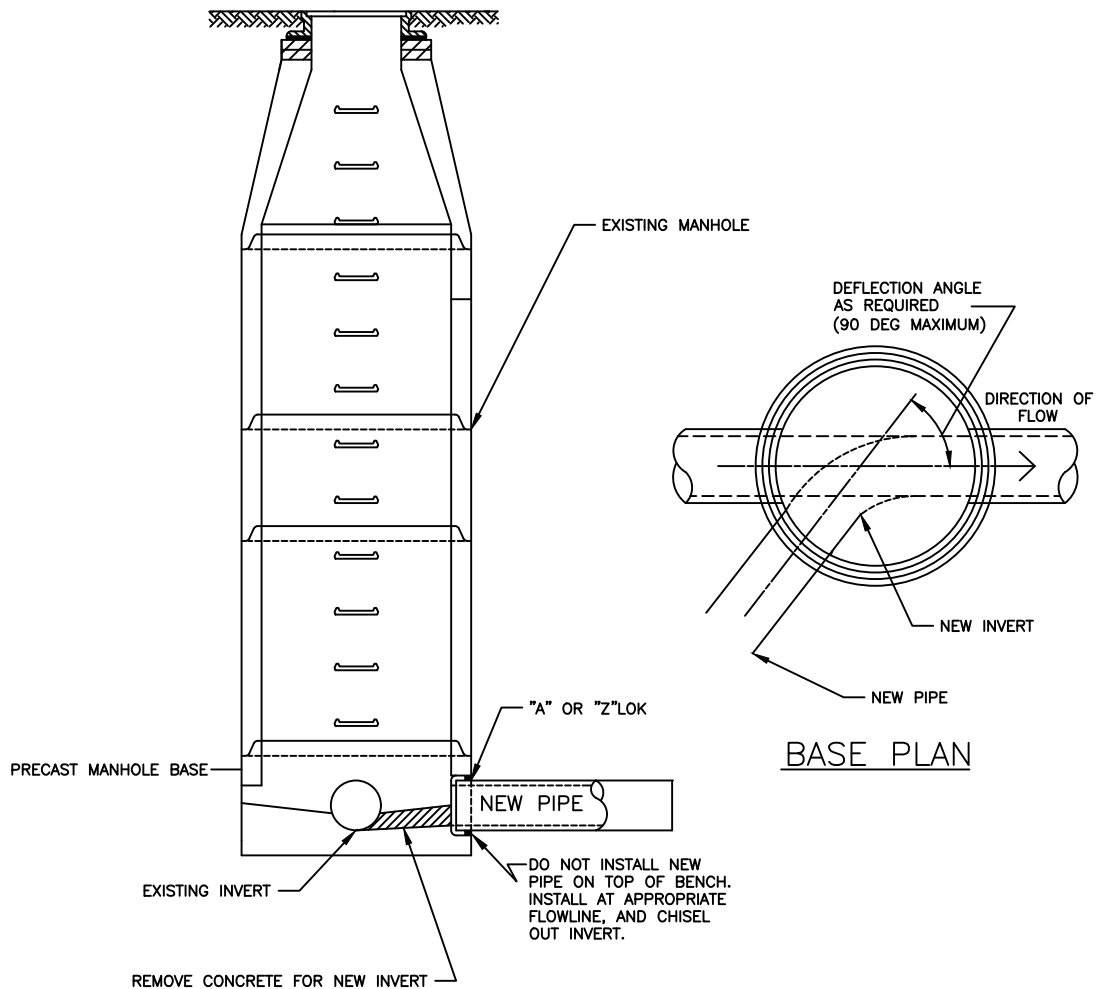
1. BITUMINOUS COATING ON EXTERIOR SURFACE OF MANHOLE SHALL NOT COME IN CONTACT WITH PIPE GASKET.
2. FOR CAST-IN-PLACE CONCRETE MANHOLES OR PRE-CAST WITH BOX-OUTS, THE PIPE GASKET SHALL BE A RUBBER LABYRINTH WATERSTOP WITH STAINLESS STEEL CLAMPING BANDS LOCATED AT CENTER OF WALL AND THE SPACE BETWEEN PIPE & WALL COMPLETELY GROUTED WITH NONSHRINKING MORTAR.
3. PIPE TO BE INSTALLED PAST GASKET SUCH THAT ANNULAR SPACE AROUND PIPE MAY BE GROUT FILLED.



PLAN



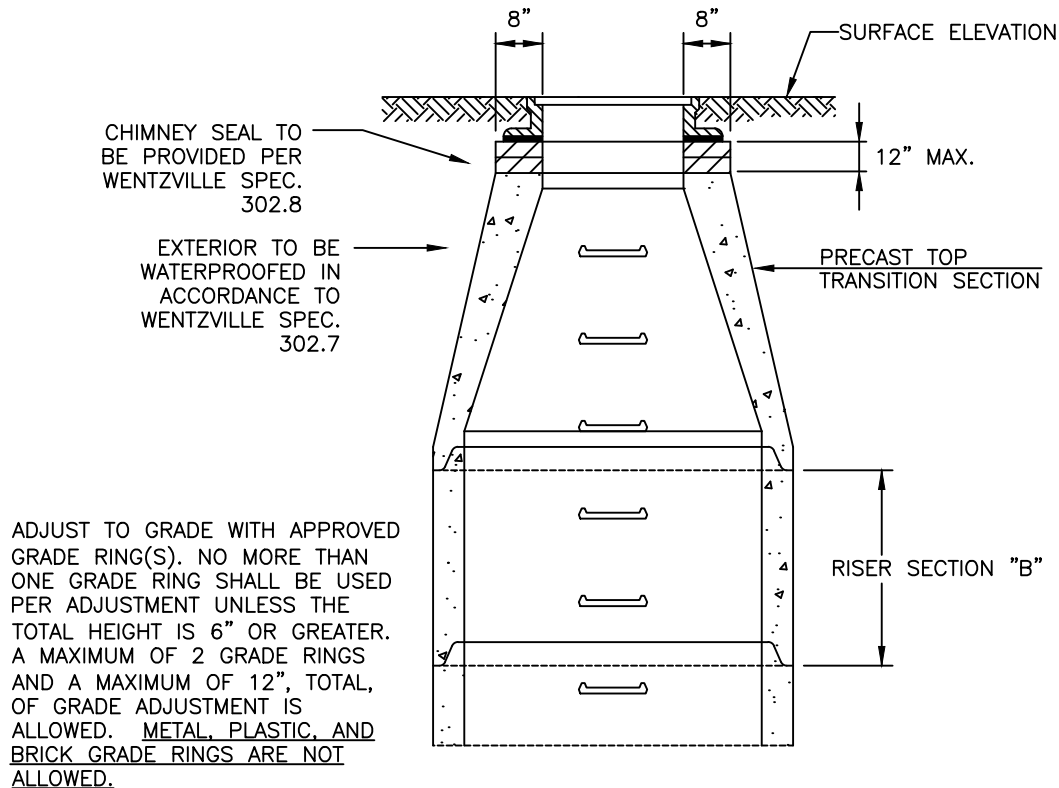
ELEVATION



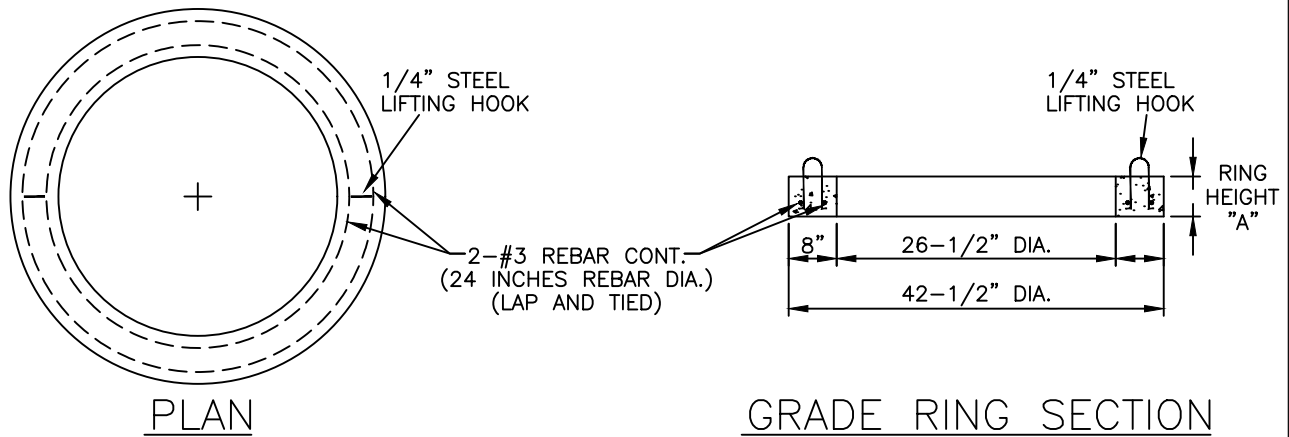
**NOTES:**

1. REMOVE PORTION OF WALL FOR NEW PIPE BY CORING WITH APPROPRIATE SIZED CORE DRILL OR A CONCRETE SAW THAT WILL NOT ALLOW OVER-CUTTING. NEW PIPE MUST BE INSTALLED WITH "A-LOK" FOR SLOPES OF LESS THAN 7% OR A "Z-LOK" FOR SLOPES OVER 7%. NON-SHRINK HYDRAULIC GROUT IS REQUIRED TO REPAIR HOLE.
2. FLOWLINE ELEVATION OF INCOMING PIPES SHALL BE 0.2 FEET HIGHER THAN THAT OF OUTGOING PIPE (SANITARY SEWER ONLY).
3. PIPE SHALL NOT BE INSTALLED TO DISCHARGE ONTO BENCH. PIPE MUST HAVE A DESIGNATED INVERT TO CARRY FLOW TO THE EXISTING INVERT.
4. BRICK IS NOT ALLOWED IN SANITARY SEWER MANHOLES.

STANDARD MANHOLE  
FRAME AND COVER.  
(SEE SCD 302.07)



ELEVATION



NOTES:

1. IF MANHOLE CANNOT BE ADJUSTED TO GRADE WITH GRADE RINGS AS DESCRIBED ABOVE A RISER SECTION WILL HAVE TO BE ADDED.
2. DIMENSION "A" STOCK GRADE RING MAY BE 3 INCHES MINIMUM TO 12 INCHES MAXIMUM.
3. DIMENSION "B" STOCK RISER SECTION SHALL BE 12 INCH MINIMUM.

**Wentzville Missouri**  
The Crossroads of the Nation

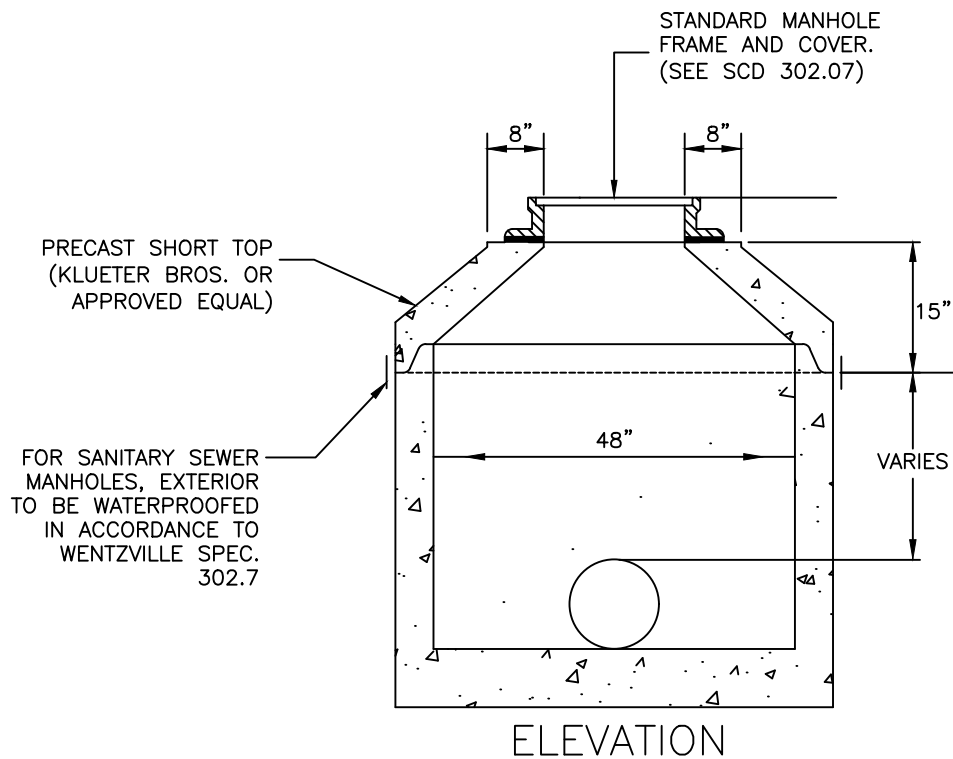
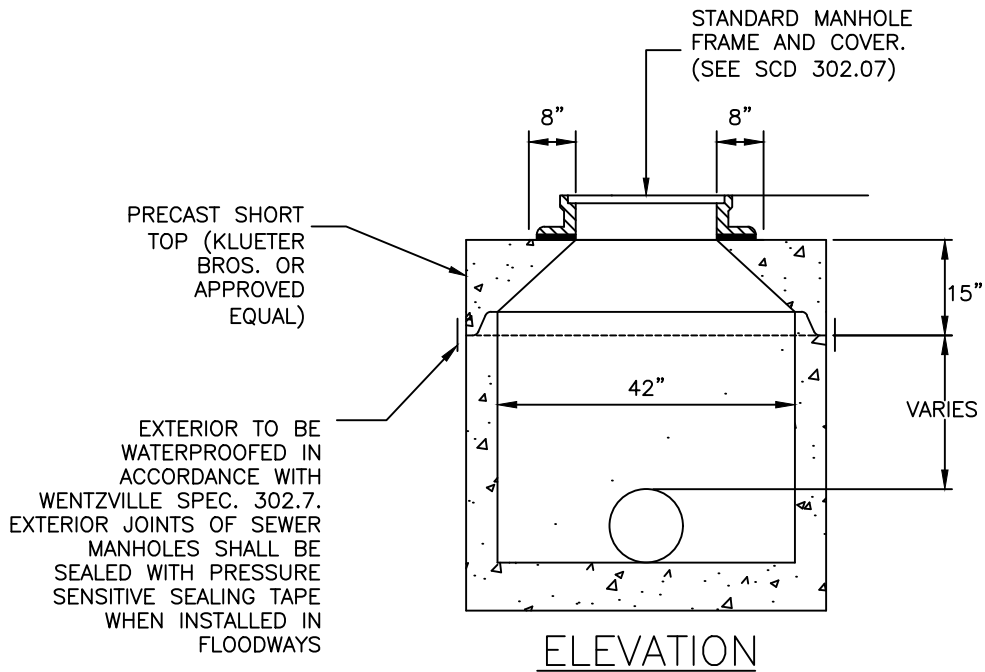
PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

ADJUST TO GRADE

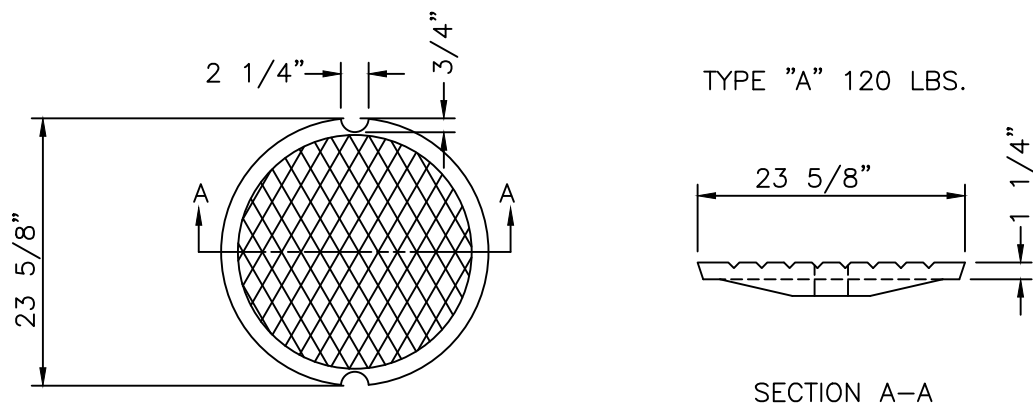
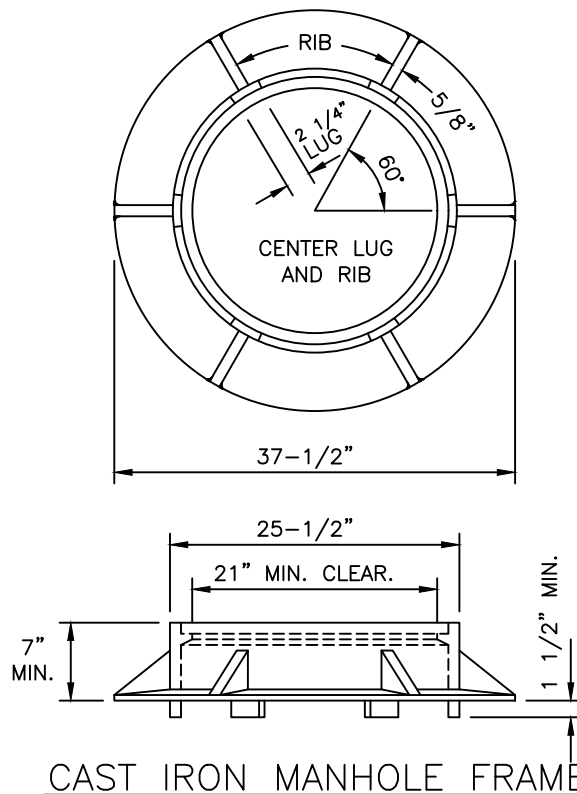
Approved: BOA  
Date: July 26, 2017

302.06A

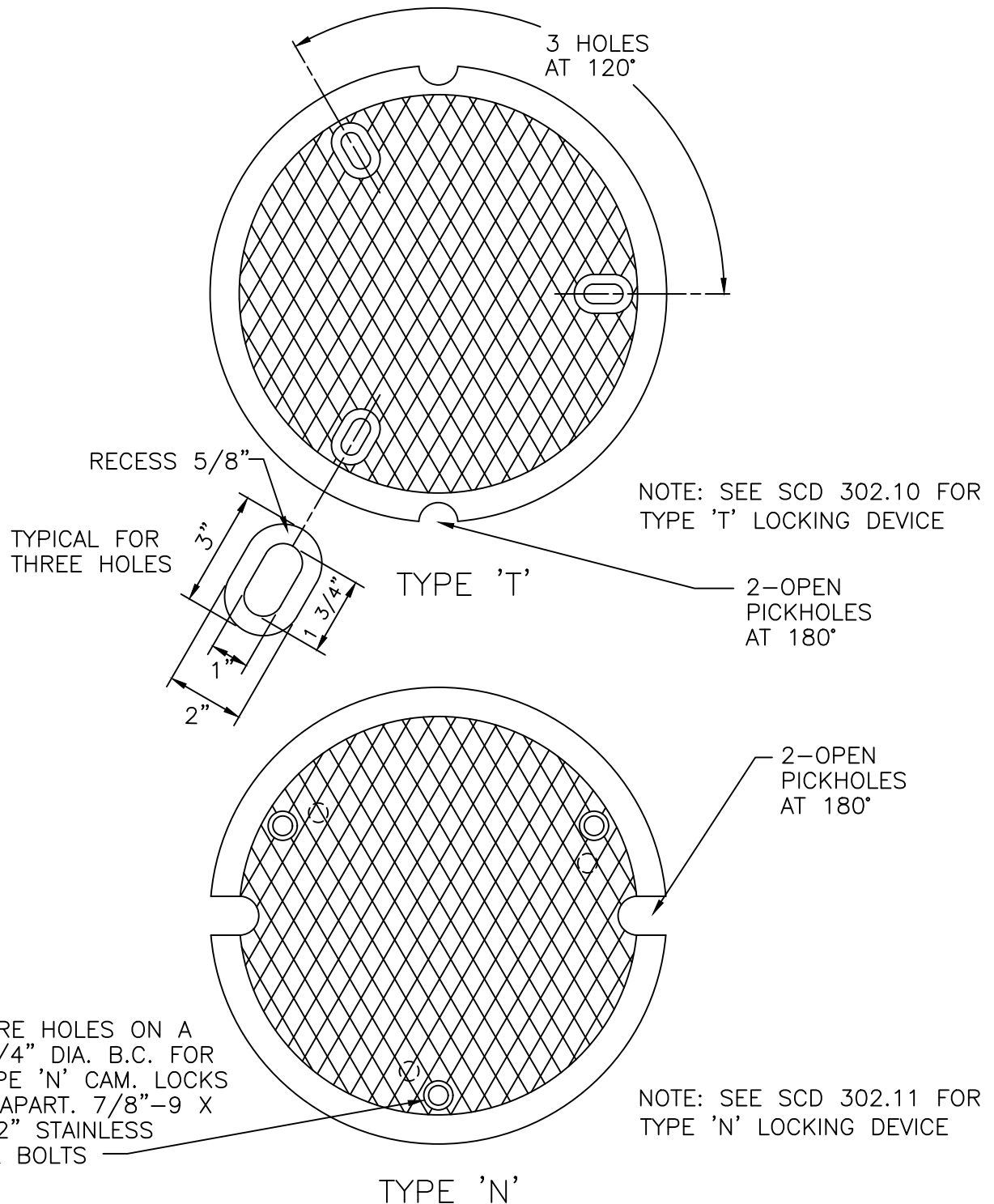


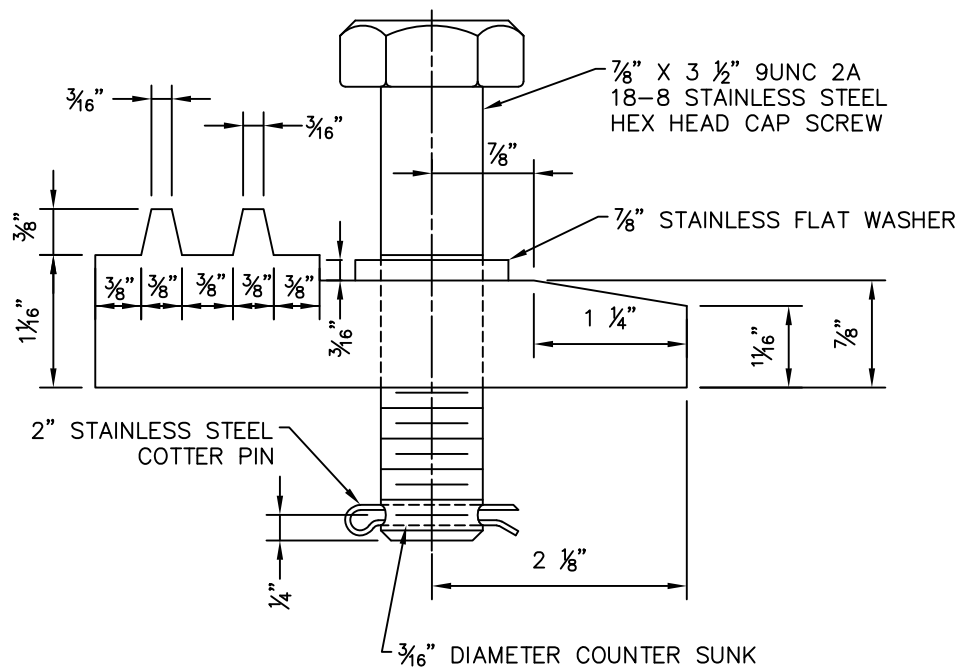
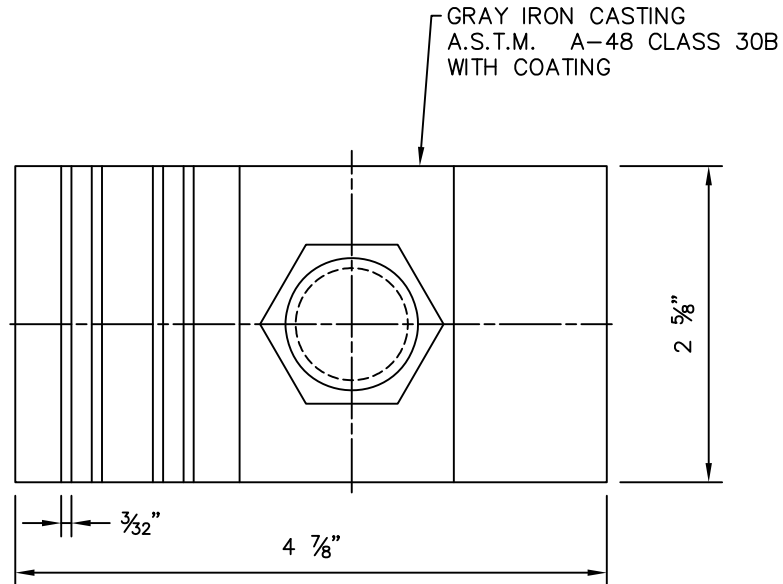


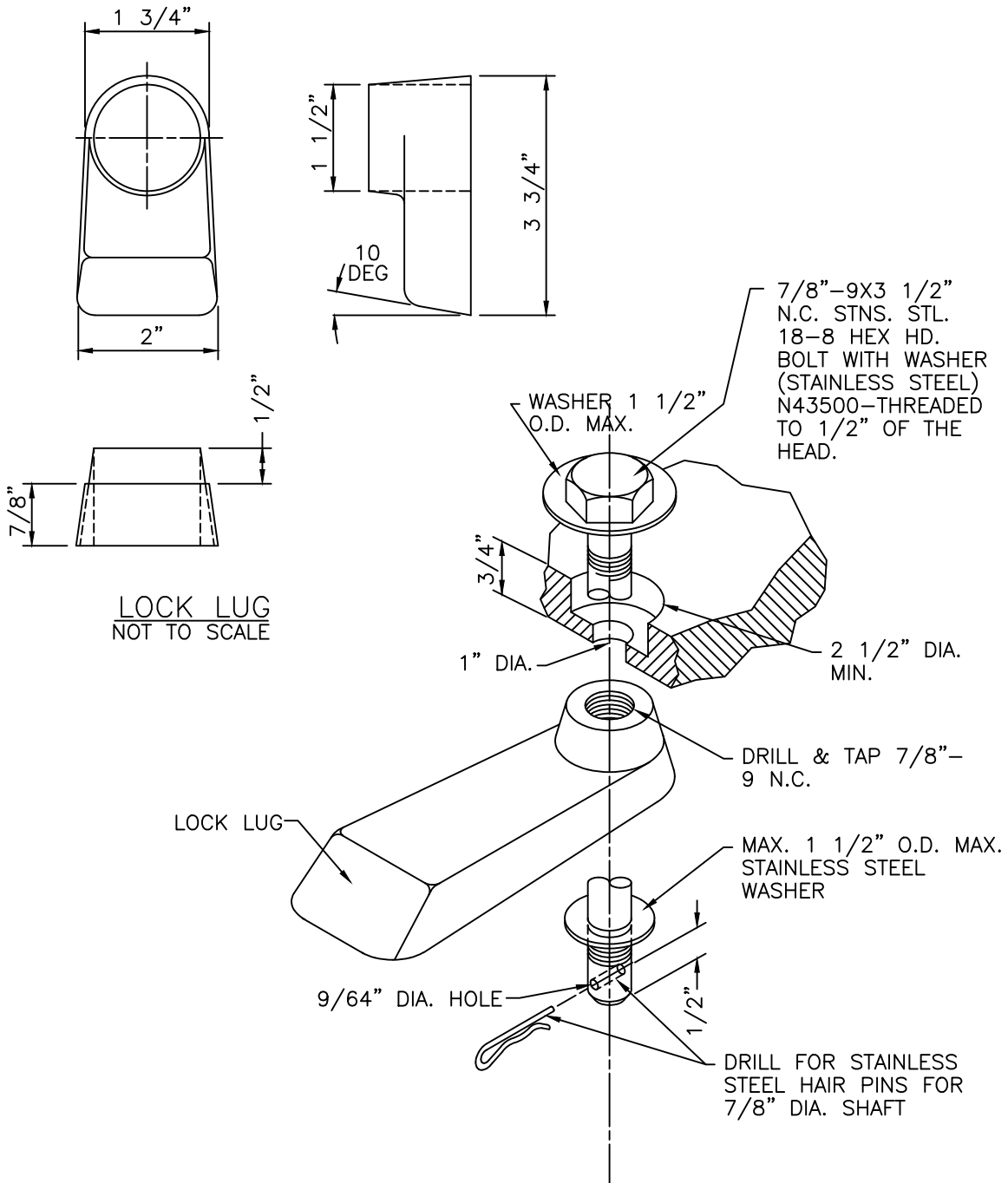
NOTE: SHALLOW MANHOLE  
TOPS MAY ONLY BE USED  
WITH PRIOR APPROVAL,  
WHERE FIELD CONDITIONS  
WILL NOT ALLOW A  
STANDARD 3 FT CONE.

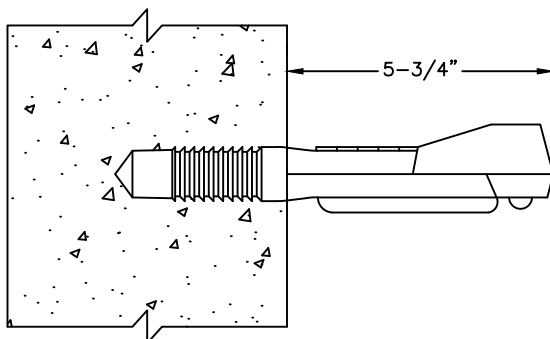
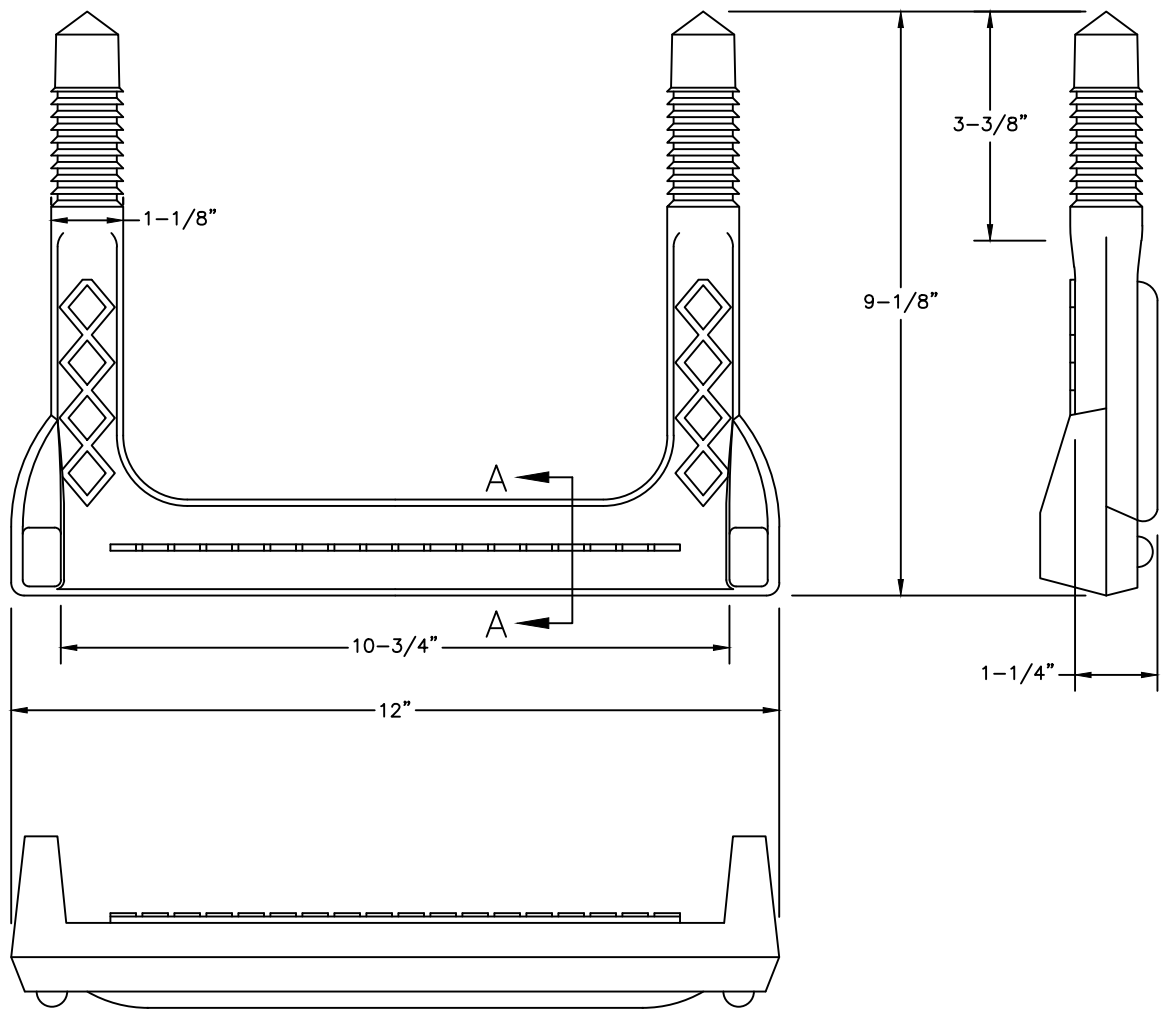


NOTE: MANHOLE FRAME AND COVER SHALL BE NEENAH FOUNDRY COMPANY R-1775 OR EQUIVALENT.

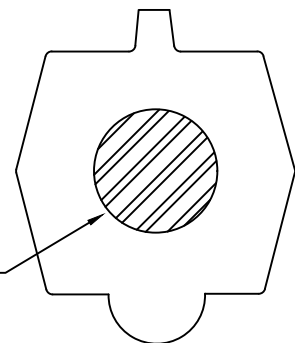








1/2" DIA. GRADE 60  
STEEL REINFORCEMENT



SECTION A-A

COPOLYMER POLYPROPYLENE PLASTIC

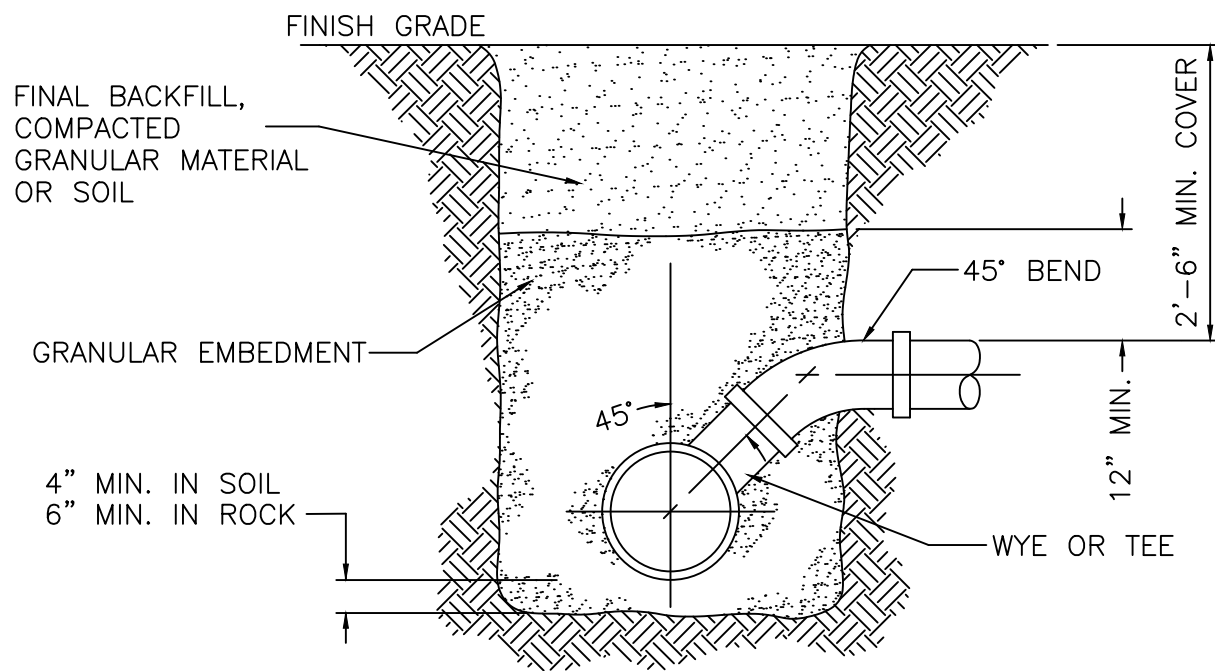
**Wentzville** Missouri  
The Crossroads of the Nation

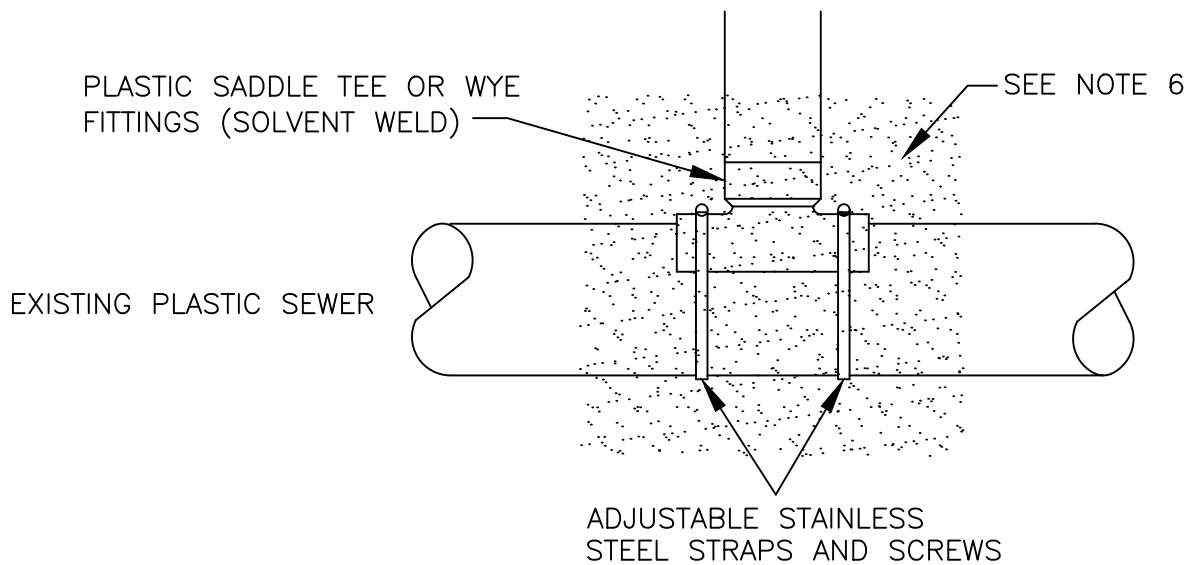
PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

STANDARD MANHOLE STEP

Approved: W.E.B.  
Date: June 10, 2009

302.12



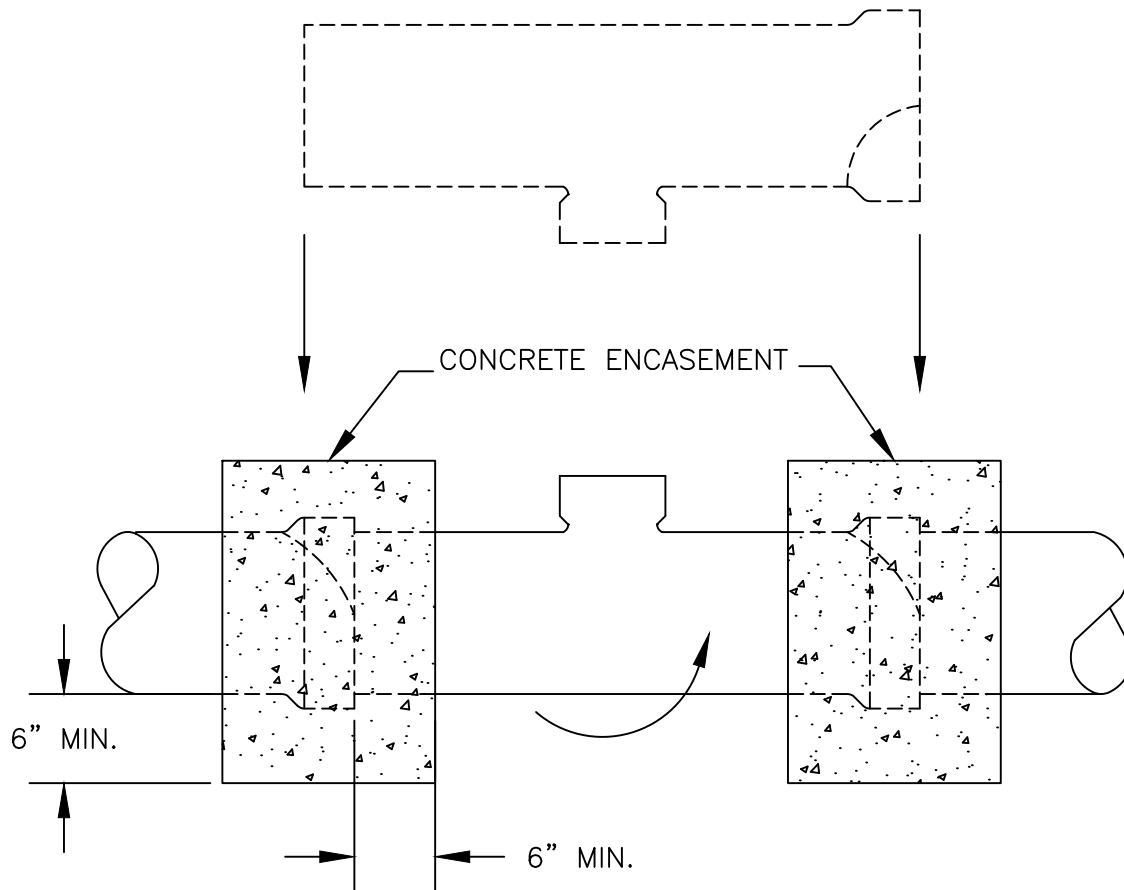


WHEN A CONNECTION TO AN EXISTING PLASTIC PIPE IS ALLOWED, A SOLVENT WELD SADDLE TEE OR WYE FITTING OF A SIMILAR MATERIAL MUST BE USED.

THIS IS ACCOMPLISHED BY CAREFULLY CUTTING A HOLE IN THE MAIN AT THE REQUIRED LOCATION. AFTER CUTTING AND SHAPING THE HOLE TO THE SIZE OF THE FITTING, THE FOLLOWING STEPS SHOULD BE TAKEN.

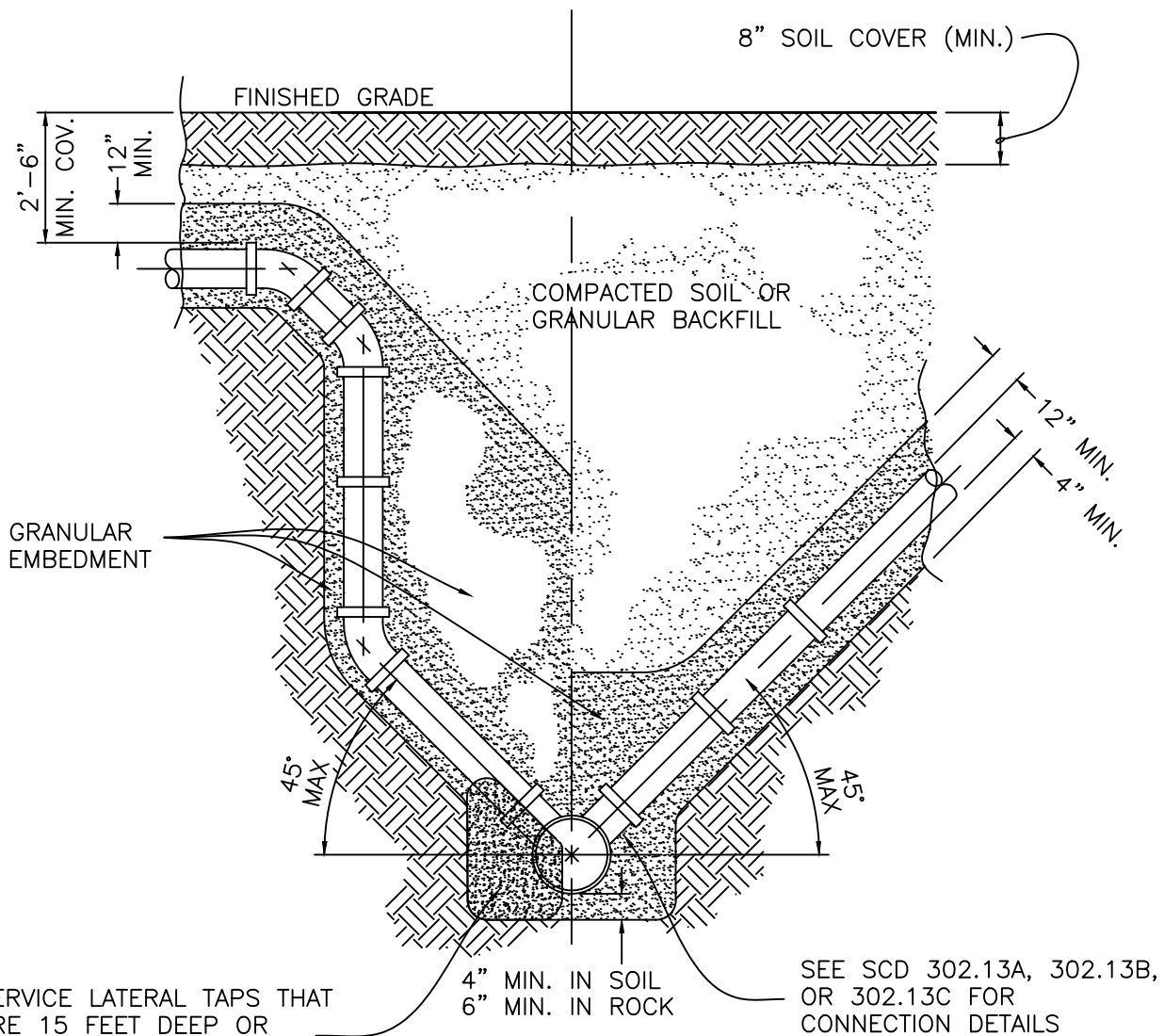
1. CLEAN AND DRY BOTH THE INSIDE SADDLE WYE AND PIPE SURFACE TO BE SOLVENT CEMENTED.
2. APPLY A LIBERAL COAT OF ONE-STEP SOLVENT CEMENT TO THE INSIDE SURFACE OF THE SADDLE WYE AND TO THE EXTERIOR SURFACE OF THE PIPE.
3. DO NOT USE OLD SOLVENT THAT HAS BECOME JELLED OR LUMPY.
3. WITHOUT DELAY, MATE THE SURFACES AND STRAP DOWN TIGHTLY. A BEAD OF SOLVENT SHOULD APPEAR AFTER THE SADDLE HAS BEEN STRAPPED DOWN TIGHTLY.
4. USING A RAG OR TOWEL, WIPE BEAD AND ANY EXCESS SOLVENT CEMENT OFF PIPE AND SADDLE.
5. ALLOW 30 – 60 MINUTES FOR SET-UP TIME BEFORE ENCASEMENT. CURE TIME DEPENDS ON SIZE AND FIT OF MATERIALS BEING INSTALLED AND WEATHER CONDITIONS.
6. THE COMPLETED CONNECTION SHALL BE COMPLETELY ENCASED WITH 1 TO 3 CEMENT TO SAND MORTAR MIX OR "PRE-MIX" CONCRETE PRIOR TO BACKFILLING.
7. THE CEMENT SAND MORTAR MIX OR "PRE-MIX" CONCRETE SHALL BE ALLOWED SUFFICIENT TIME TO CURE BEFORE BACKFILLING.



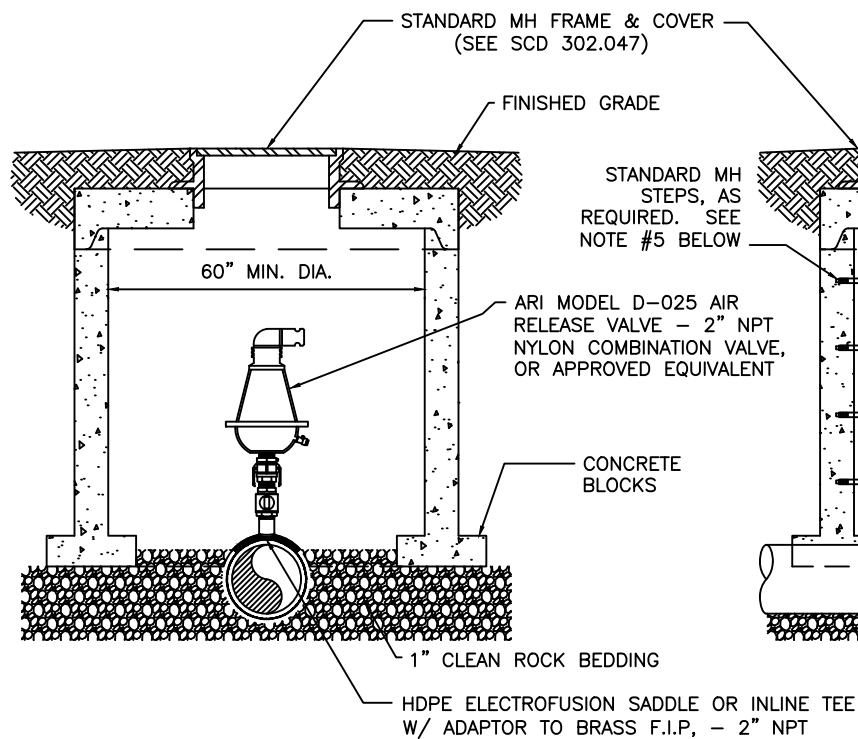


THE PIPE INSTALLATION IS ACCOMPLISHED BY BREAKING AWAY AND REMOVING ONE SECTION OF PIPE. THE TOP HALF OF THE BELL ON THE PIPE LYING ADJACENT TO THE GAP IS CAREFULLY BROKEN OFF. THE TOP HALF OF THE BELL ON THE MAIN REPLACEMENT SECTION (WITH A "TEE"/"WYE" FITTING) IS ALSO BROKEN OFF. THE REPLACEMENT PIPE IS THEN PLACED IN THE LINE GAP WITH THE STUB POINTED IN THE WRONG DIRECTION. THE BROKEN BELLS ON THE REPLACEMENT AND ADJOINING PIPE MAKE POSSIBLE FOR THE REPLACEMENT SECTION TO FIT INTO THE SEWER LINE WITHOUT DISTURBING THE ADJOINING PIPE SECTIONS. THE REPLACEMENT SECTION IS THEN ROTATED TO THE DESIRED POSITION AND THE BROKEN BELLS ARE ENCASED WITH A 6" 3500 PSI (MIN) CONCRETE ENCASEMENT.

PVC PIPE MAY BE USED AND WILL REQUIRE FULL CIRCUMFERENCE RUBBER FERNCO BOOTS WITH STAINLESS STEEL CLAMPS AND CONCRETE ENCASEMENT AS DESCRIBED ABOVE.

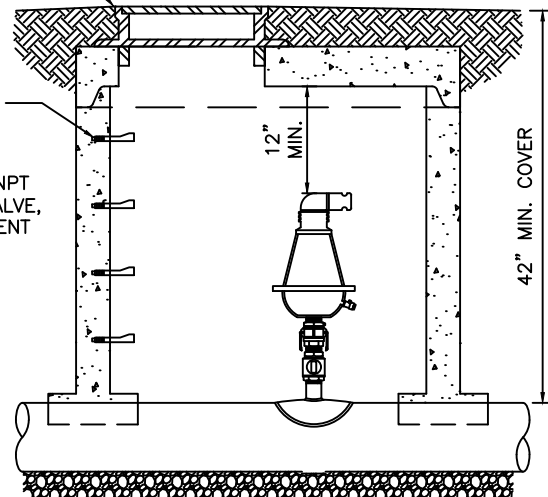


SERVICE LATERAL TAPS THAT ARE 15 FEET DEEP OR DEEPER MUST HAVE A CONCRETE CRADLE FROM THE SPRINGLINE OF THE PIPE TO UNDISTURBED EARTH. SEWERS DEEPER THAN 20 FEET SHALL NOT BE TAPPED.

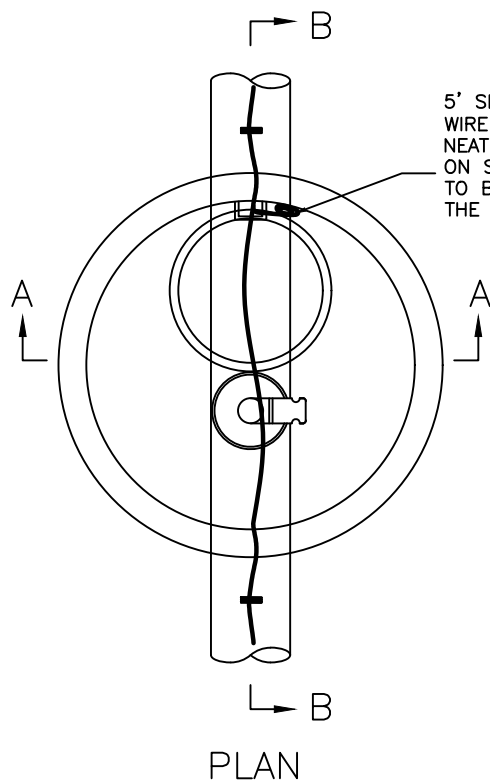


SECTION A-A

STANDARD MH  
STEPS, AS  
REQUIRED. SEE  
NOTE #5 BELOW



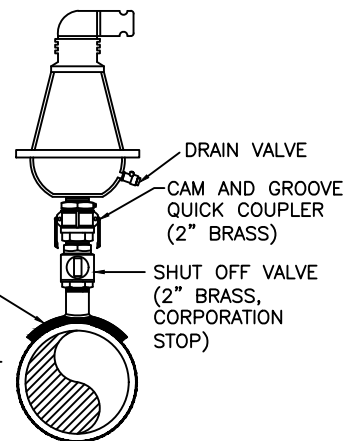
SECTION B-B



PLAN

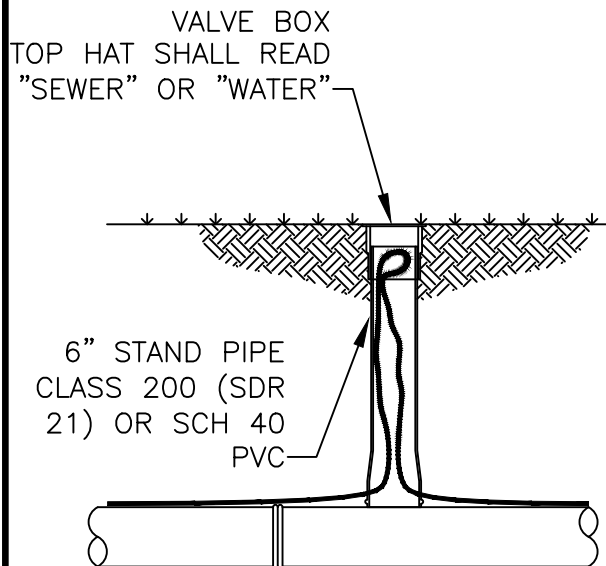
5' SLACK SECTION OF TRACER  
WIRE EXTENDED INTO VAULT,  
NEATLY ROLLED AND PLACED  
ON STAINLESS STEEL HOOK. WIRE  
TO BE CONTINUOUS THORUGH  
THE PIT

HDPE  
ELECTROFUSION  
SADDLE OR INLINE  
TEE W/ ADAPTOR  
TO BRASS F.I.P. -  
2\" NPT

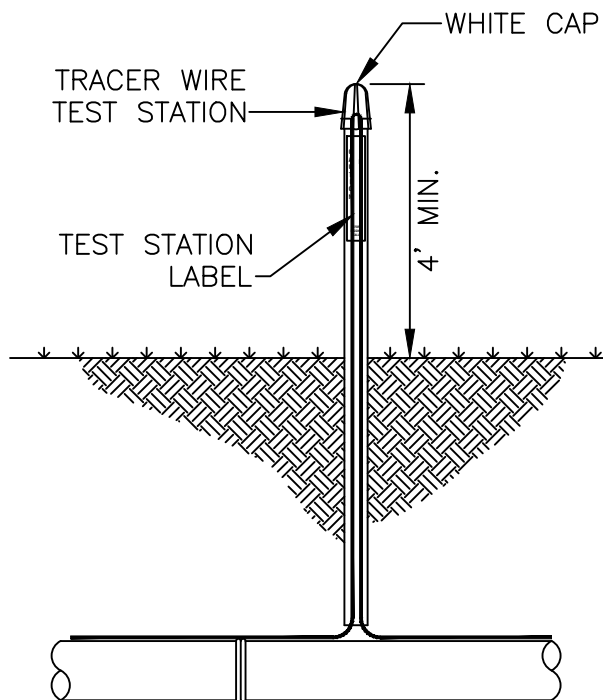


NOTES:

1. ALL FITTINGS AND PIPE VALVES SHALL BE BRASS
2. ALL AIR RELEASE VALVES FOR FORCE MAINS SHALL BE SUPPLIED WITH A BACKWASH ACCESSORY KIT.
3. ALL AIR RELEASE VALVES SHALL BE INSTALLED IN THE VERTICAL POSITION. FORCE MAINS 4\" AND SMALLER SHALL REQUIRE BRACING TO KEEP THE AIR RELEASE VALVE VERTICAL.
4. FINISHED GRADING SHALL PROVIDE DRAINAGE AWAY FROM THE ACCESS LID.
5. STEPS SHALL BE UNIFORMLY SPACED AT 16\" CENTER TO CENTER, AND SHALL EXTEND 5-3/4\" FROM WALL.



TRACER WIRE ACCESS BOX



TRACER WIRE TEST STATION

NOTES:

1. ALL SPLICING OF TRACER WIRE MUST BE MADE WITH APPROVED 3M WATERPROOF SPLICE KITS.
2. TEST STATIONS OR ACCESS BOXES SHALL BE PLACED AT THE PC AND PT OF ALL RADII, AT ALL BENDS AND EVERY 500' ON STRAIGHT RUNS OF PIPE. CURVE LENGTHS GREATER THAN 150 FEET REQUIRE INTERMEDIATE TEST STATIONS OR ACCESS BOXES IN ADDITION TO THE PC AND PT.
3. TRACER WIRE ACCESS BOXES SHALL BE USED IN IMPROVED AREAS, SUCH AS IN THE EASEMENT OR RIGHT-OF-WAY OF A RESIDENTIAL DEVELOPEMENT. TRACER WIRE TEST STATIONS SHALL BE USED IN UNIMPROVED AREAS, SUCH AS IN AREAS WITH HEAVY BRUSH OR TALL GRASSES.
4. TRACER WIRE SHALL BE CONNECTED TO THE TEST STATION AS DIRECTED BY THE MANUFACTURER'S INSTRUCTIONS.
5. A MINIMUM OF 3' OF EXCESS TRACER WIRE SHALL BE ROLLED UP AND BE AVAILABLE AT THE TOP OF THE TRACER WIRE ACCESS BOX.

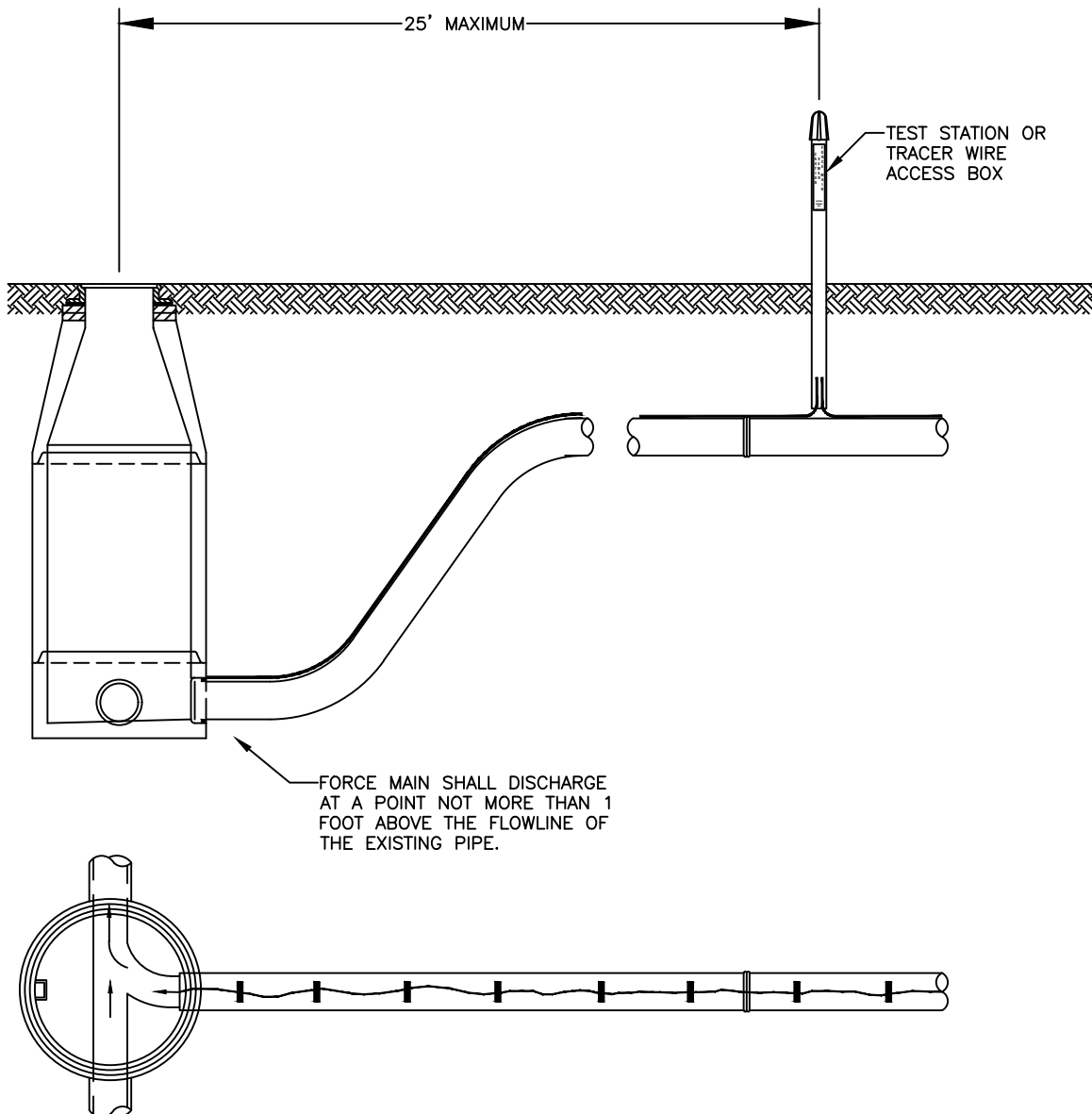
TEST STATIONS SHALL BE CARSONITE SCEPTER TEST STATIONS.

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SEWER TEST  
STATION LABEL  
(GREEN)

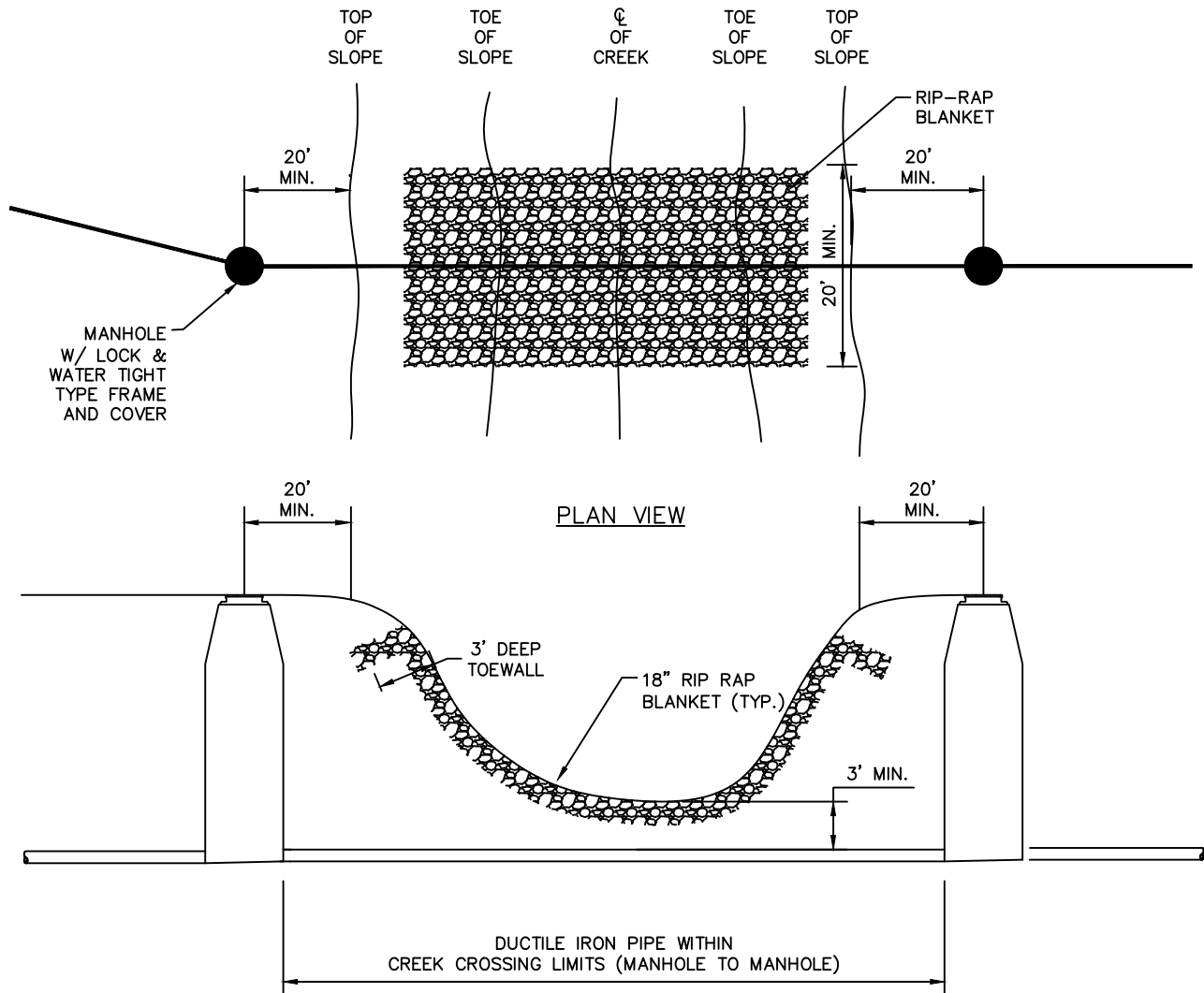
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WATER TEST  
STATION LABEL  
(BLUE)



NOTES:

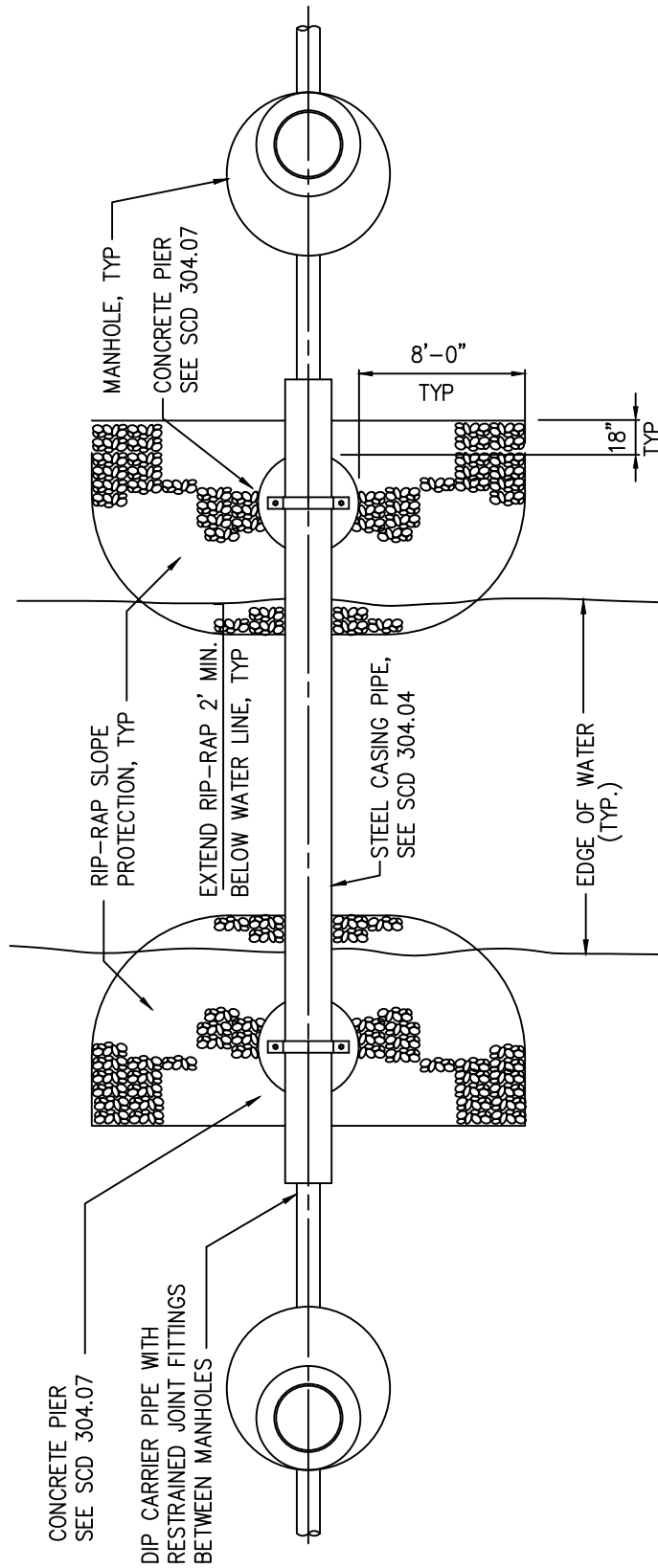
1. ALL SPLICING OF TRACER WIRE MUST BE MADE WITH APPROVED 3M WATERPROOF SPLICE KITS.
2. SEE SCD 302.17/500.03 FOR STANDARD TRACER WIRE TEST STATION.
3. TRACER WIRE SHALL BE DUCT TAPED TO THE TOP OF THE FORCE MAIN PIPE TO PREVENT MOVEMENT OF THE WIRE DURING BACKFILLING OPERATIONS.
4. THE RECEIVING MANHOLE AND THE NEXT TWO (2) DOWNSTREAM MANHOLES, AT A MINIMUM, SHALL BE PROTECTED BY AN EPOXY COATING ON THEIR INTERIOR SURFACES.

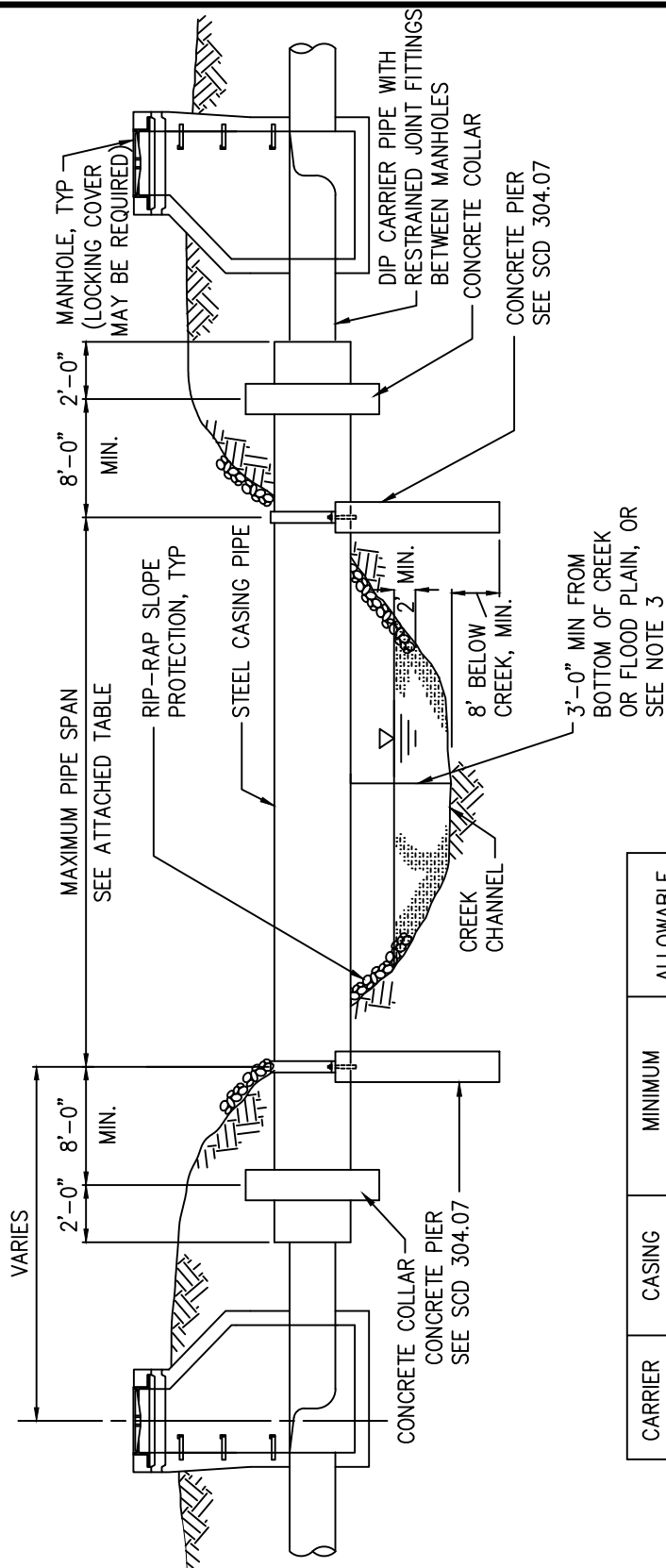


### PROFILE

### NOTES:

1. RIP RAP IS REQUIRED AT ALL CREEK CROSSINGS.
2. PLACE RIP RAP ON THE LOWER 3/4 OF SLOPE. THE UPPER 1/4 OF SLOPE SHOULD BE TREATED AS FOLLOWS BASED ON INCLINATION OF THE SLOPE:
  - A. 3H:1V OR LESS – SEED AND STRAW
  - B. STEEPER THAN 3H:1V – RIP RAP
3. INCORPORATE A 3 FEET DEEP TOE WALL ON EMBANKMENT'S UPPER EDGE OF RIP RAP.
4. TOP SURFACE OF RIP RAP SHOULD BE AT OR HIGHER THAN SURROUNDING GROUND SURFACE.
5. IF PIPE HAS LESS THAN 3 FEET OF COVER, THE PIPE MUST BE CONCRETE ENCASED.
6. DUCTILE IRON PIPE IS REQUIRED IN CREEK CROSSING, FROM MANHOLE TO MANHOLE.



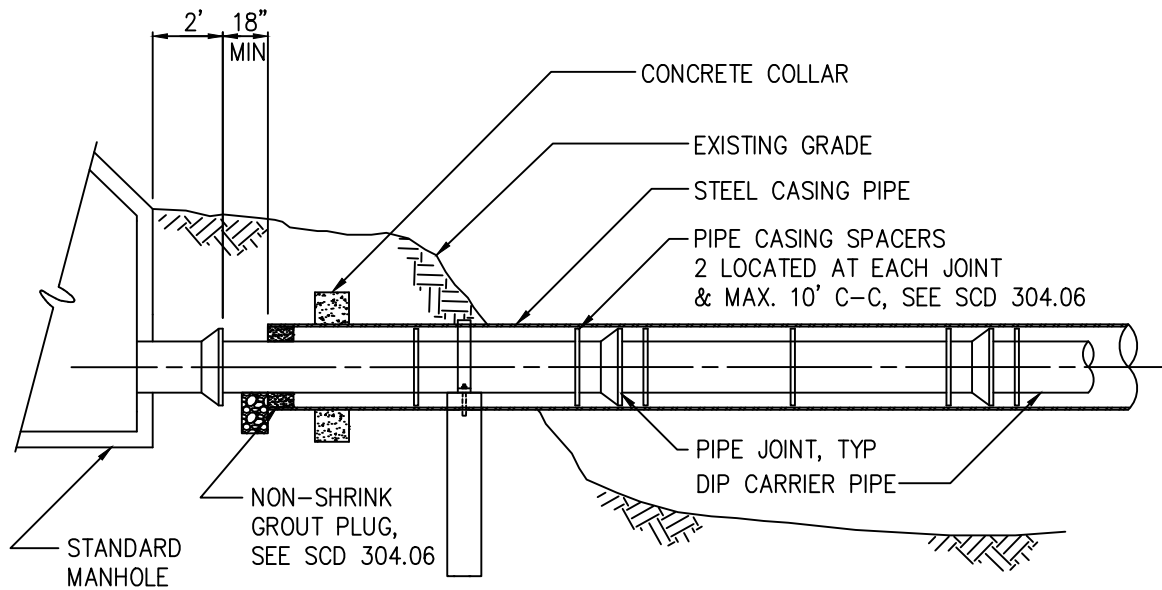


#### NOTES:

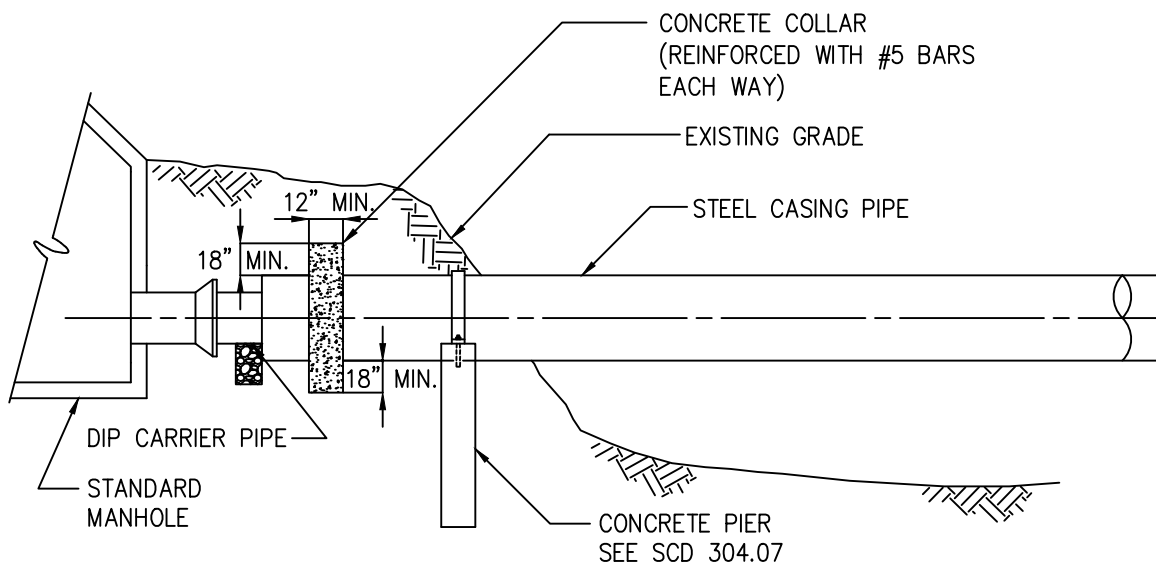
1. STEEL PIPE SHALL BE EITHER SPIRAL WELDED OR SMOOTH WALL SEAMLESS WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI.
2. DUCTILE IRON PIPE SHALL BE SUPPORTED WITH TWO CASING SPACERS AT EVERY JOINT WITHIN THE CASING PIPE USING APPROVED PIPE ALIGNMENT GUIDE. ALL JOINTS SHALL BE RESTRAINED.
3. BOTTOM OF CASING PIPE TO BE AT A MINIMUM OF 1' ABOVE THE 50 YEAR FLOOD ELEVATION.

CARRIER PIPE, DIP DIAMETER (IN.)	CASING PIPE, STEEL DIAMETER (IN.)	MINIMUM CASING PIPE WALL THICKNESS (IN.)	ALLOWABLE SPAN (FT.)
8	16	0.2500	45
10	18	0.3125	50
12	20	0.3125	50
14	24	0.3125	55
16	26	0.3750	55
18	30	0.3750	60
20	32	0.3750	60
24	36	0.4375	65
30	42	0.4375	65





SECTION



ELEVATION

NON-SHRINK GROUT  
BULKHEAD AT EACH  
END OF CASING PIPE

STYROFOAM PLUG TO  
ASSIST GROUT PLACEMENT,  
ALL AROUND

STEEL CASING PIPE

DIP CARRIER PIPE

FINISHED GRADE

8"

PROVIDE PLASTIC SHEET  
BOND-BREAKER BETWEEN  
CARRIER PIPE AND GROUT,  
ALL AROUND

PROVIDE 2" Ø GALV STEEL DRAIN  
IN BULKHEAD AT EACH END  
OF CASING PIPE AND 1/3  
CU YD OF CRUSHED STONE  
AT DRAIN, WRAP STONE  
WITH FILTER FABRIC

NOTE:  
NON-SHRINK GROUT SHALL BE  
"EUCCO-N-S" BY THE EUCLID  
CHEMICAL COMPANY; "MASTERFLOW  
713" BY MASTER BUILDERS,  
OR EQUAL.

### TYPICAL CASING PIPE PLUG

CARRIER PIPE

HIGH DENSITY POLYETHYLENE  
CASING SPACERS, RACI TYPE F60  
OR APPROVED EQUAL

CASING PIPE

POLYETHYLENE ENCASEMENT  
BETWEEN SPACER AND PIPE  
(DIP ONLY)

### PIPE ALIGNMENT GUIDE

**Wentzville Missouri**  
*The Crossroads of the Nation*

PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

## AERIAL PIPE CROSSING CASING PIPE DETAILS

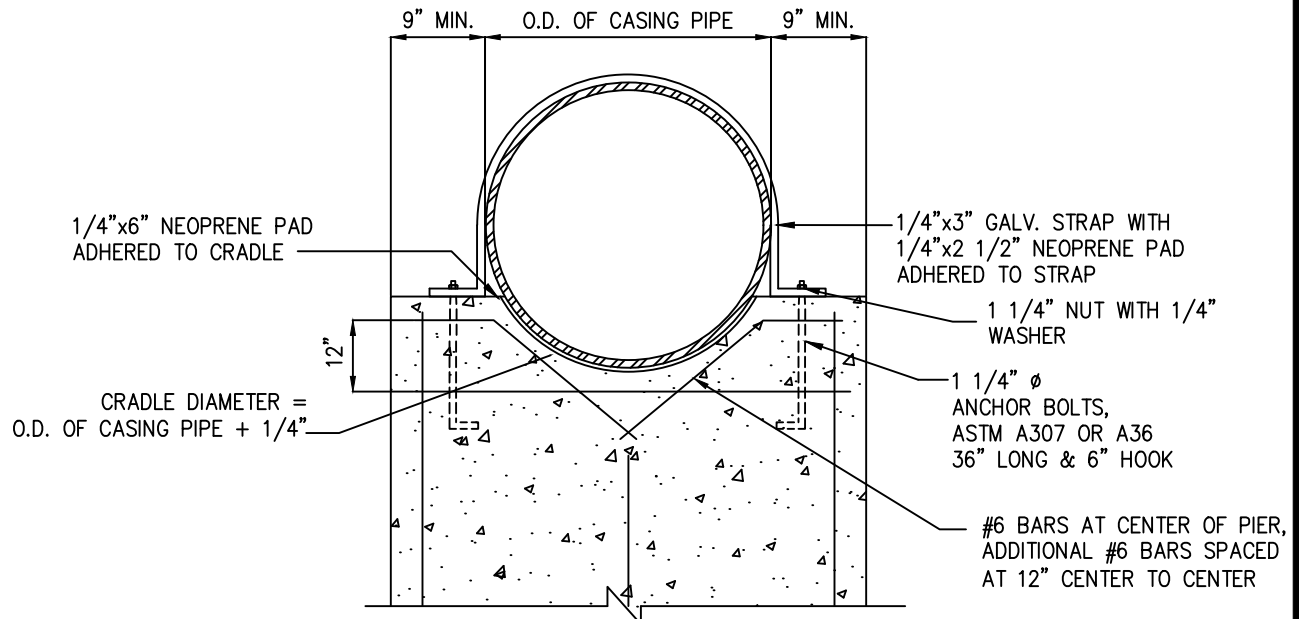
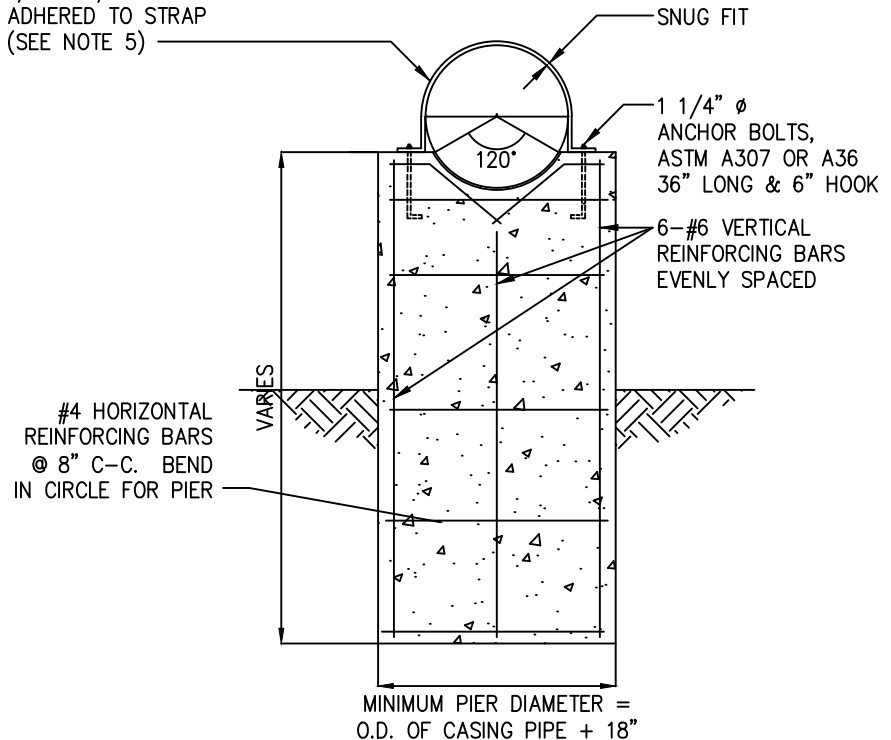
Approved: W.E.B.  
Date: June 10, 2009

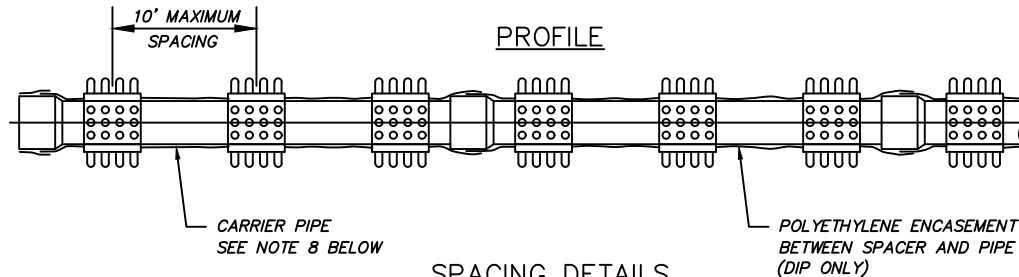
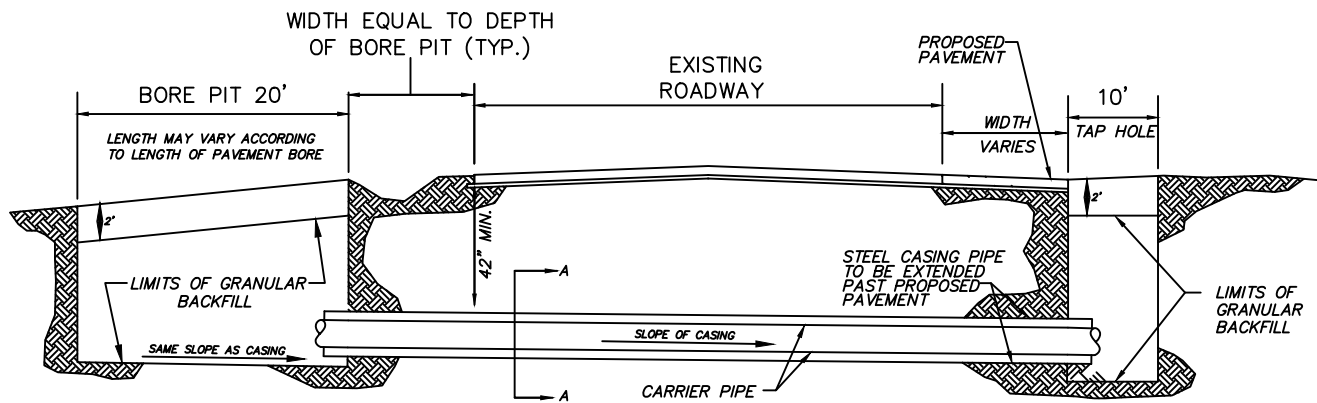
**304.06**

**NOTES:**

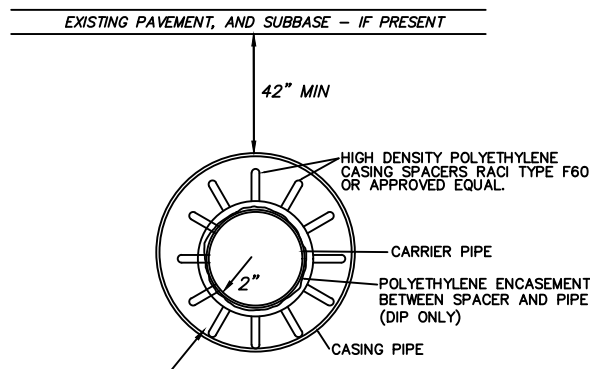
1. DEPTH OF PIER AND SUPPORT SHALL BE IN ACCORDANCE WITH THE APPROVED PLANS AND GEOTECHNICAL REPORT.
2. IF ROCK IS ENCOUNTERED, PIER SHALL BE SET AS SPECIFIED ON THE APPROVED PLANS AND GEOTECHNICAL REPORT.
3. ALL SPLICES IN REINFORCING STEEL SHALL BE 30 X BAR DIAMETER IN LENGTH MINIMUM.
4. MINIMUM COVER OVER PRIMARY REINFORCING SHALL BE 2".
5. CONCRETE ULTIMATE COMPRESSIVE STRENGTH OF 3,000 PSI MINIMUM.
6. REINFORCING STEEL SHALL BE GRADE 60.

1/4"x3" GALV. STRAP WITH  
1/4"x2 1/2" NEOPRENE PAD  
ADHERED TO STRAP  
(SEE NOTE 5)





SPACING DETAILS



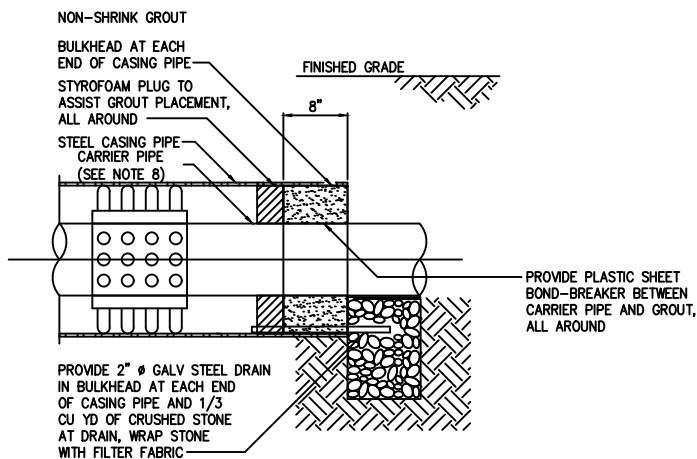
SECTION A-A

#### NOTES:

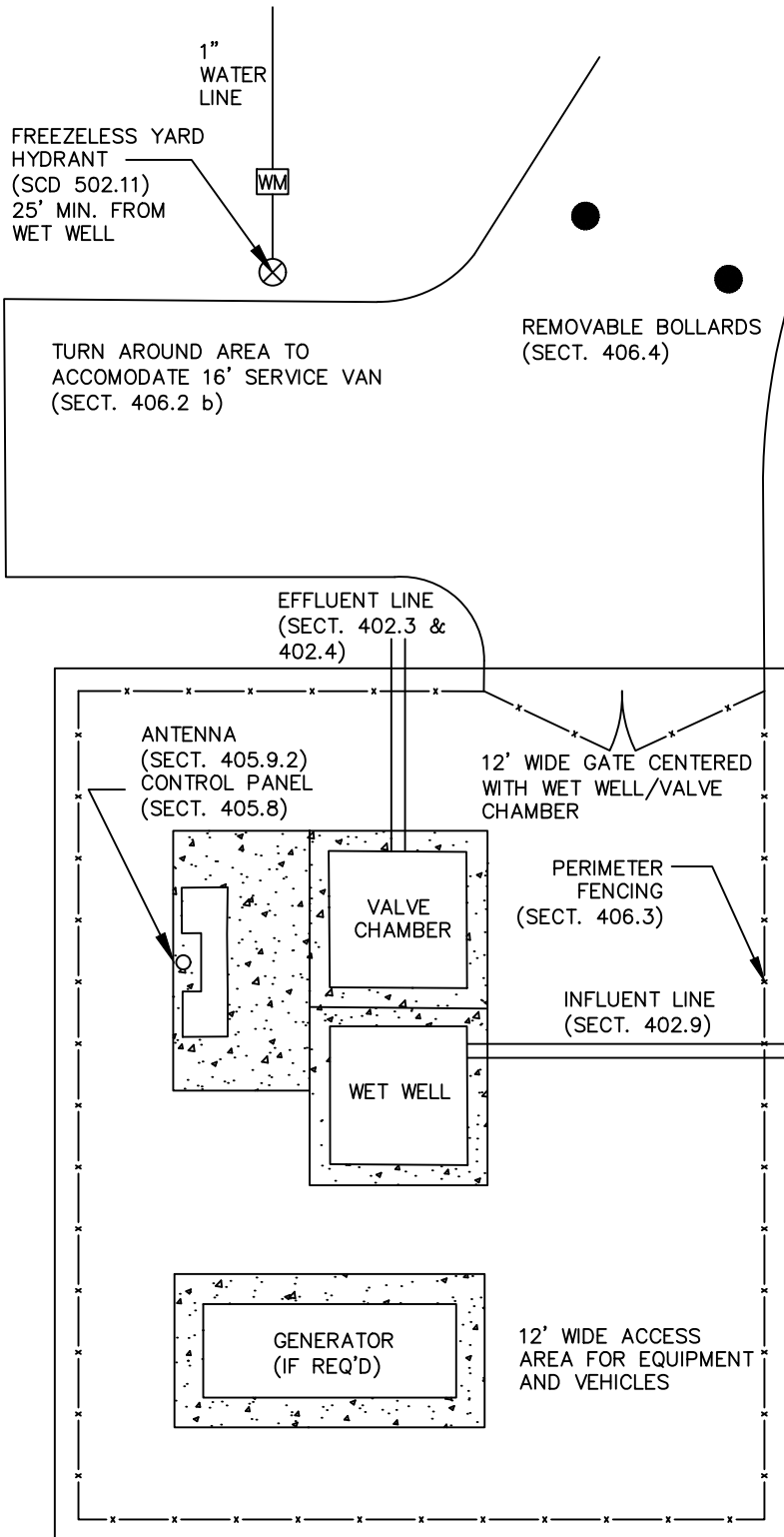
- DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
- ALL JOINTS IN THE CASING PIPE SHALL BE WELDED AND COLE TAR EPOXY COATED.
- STEEL CASING PIPE USED IN THE INSTALLATION OF WATER OR SEWER MAINS MUST HAVE A MINIMUM YIELD STRENGTH OF 35,000 P.S.I.
- HIGH DENSITY POLYETHYLENE CASING SPACERS SHALL BE RACI TYPE F60 OR APPROVED EQUAL.
- POLYETHYLENE SPACERS SHALL BE PLACED EVERY 10 FEET ALONG THE CARRIER PIPE AND 2 AT EVERY JOINT.
- BORE PIT AND TAP HOLE SHALL BE BACKFILLED WITH GRANULAR BACKFILL.
- STEEL CASING PIPE SHALL HAVE A MINIMUM WALL THICKNESS AS INDICATED ON THE TABLE BELOW.

CASING PIPE DIAMETER	CASING PIPE MINIMUM WALL THICKNESS
6" THRU 12"	0.188"
14" THRU 22"	0.250"
24" & 26"	0.281"
28" THRU 34"	0.312"
36" THRU 48"	0.344"

- CARRIER PIPE MATERIAL SHALL BE AS FOLLOWS. FOR WATER MAINS AND SANITARY SEWER FORCE MAINS, THE CARRIER PIPE SHALL BE C906 POLYETHYLENE. FOR SANITARY SEWER GRAVITY MAINS, THE CARRIER PIPE SHALL BE SDR 35 PVC OR DIP.
- SPACERS MAY BE OMITTED FOR C906 CARRIER PIPE, WHEN APPROVED BY ENGINEERING. IF SPACERS NOT USED, CASING PIPE SHALL BE A MIN. 4" DIA LARGER THAN CARRIER PIPE.



TYPICAL CASING PIPE PLUG



NOTES:

1. PAVING SHALL EXTEND A MINIMUM 1-FOOT BEYOND PERIMETER FENCE.

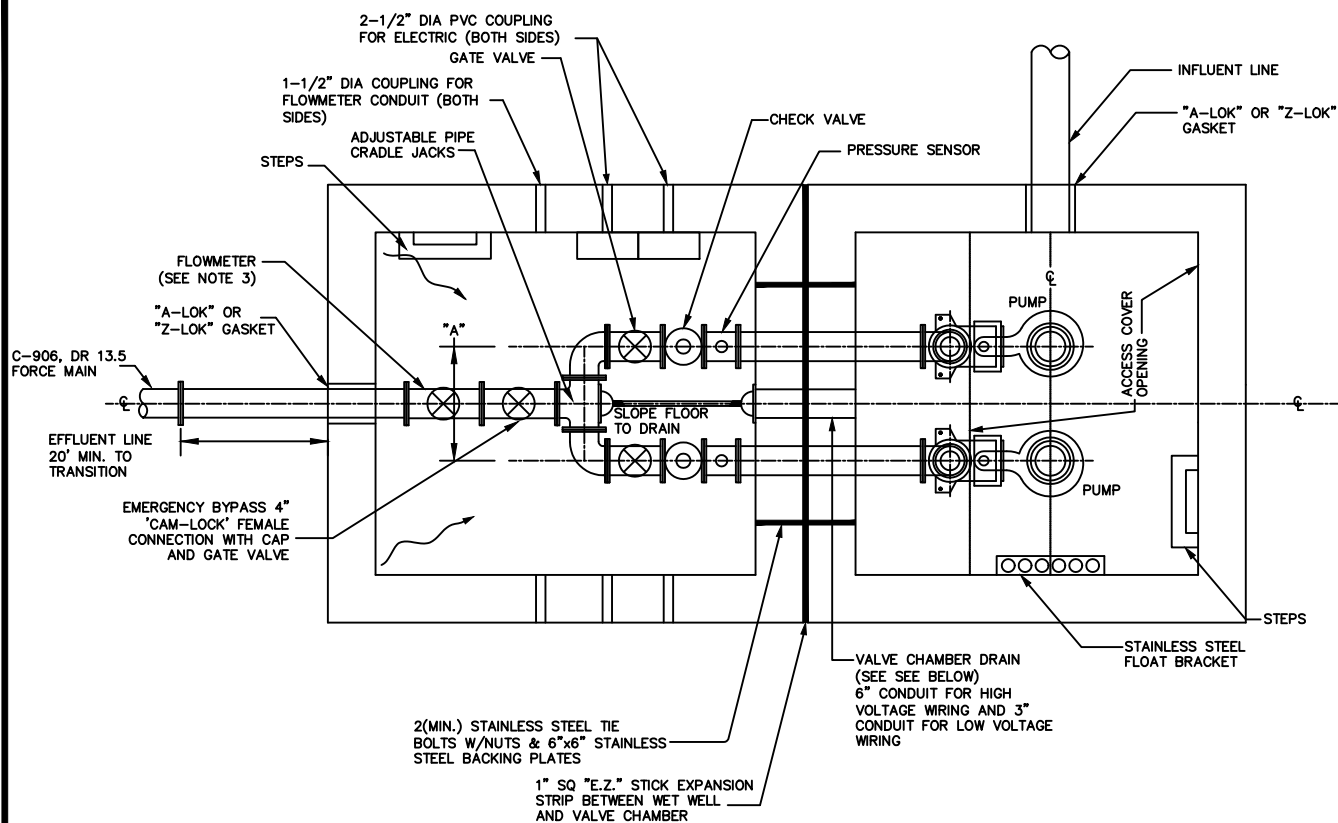
2. CONCRETE PAVING (MIN.)  
6" THICK 6-SACK MIX  
WITH 8 GAUGE 6X6  
WIRE MESH ON  
4" CRUSHED STONE

ASPHALT PAVING (MIN.)  
2" TYPE C ON  
6" TYPE X ON  
6" CRUSHED STONE

3. EQUIPMENT PADS SHALL BE MINIMUM 4" PCC WITH 8 GAUGE 6X6 WIRE MESH ON 4" CRUSHED ROCK.

4. SEE SCD 400.02, 400.03, 400.04, AND 400.05 FOR CONTROL PANEL, JUNCTION BOX, AND WET WELL AND VALVE CHAMBER DETAILS.

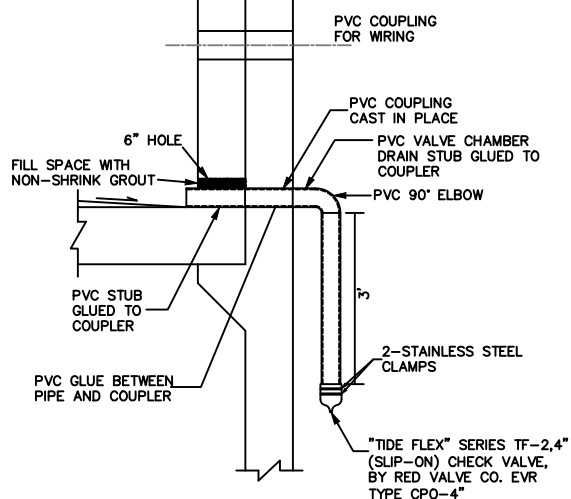
5. THIS LAYOUT DOES NOT CONSTITUTE A DESIGN AND IS FOR ILLUSTRATIVE PURPOSES ONLY.



MIN. "A" DIMENSION (INCHES)	PIPE DIAMETER (INCHES)
22	3
26	4
32	6
36	8
44	10
48	12

VALVE CHAMBER

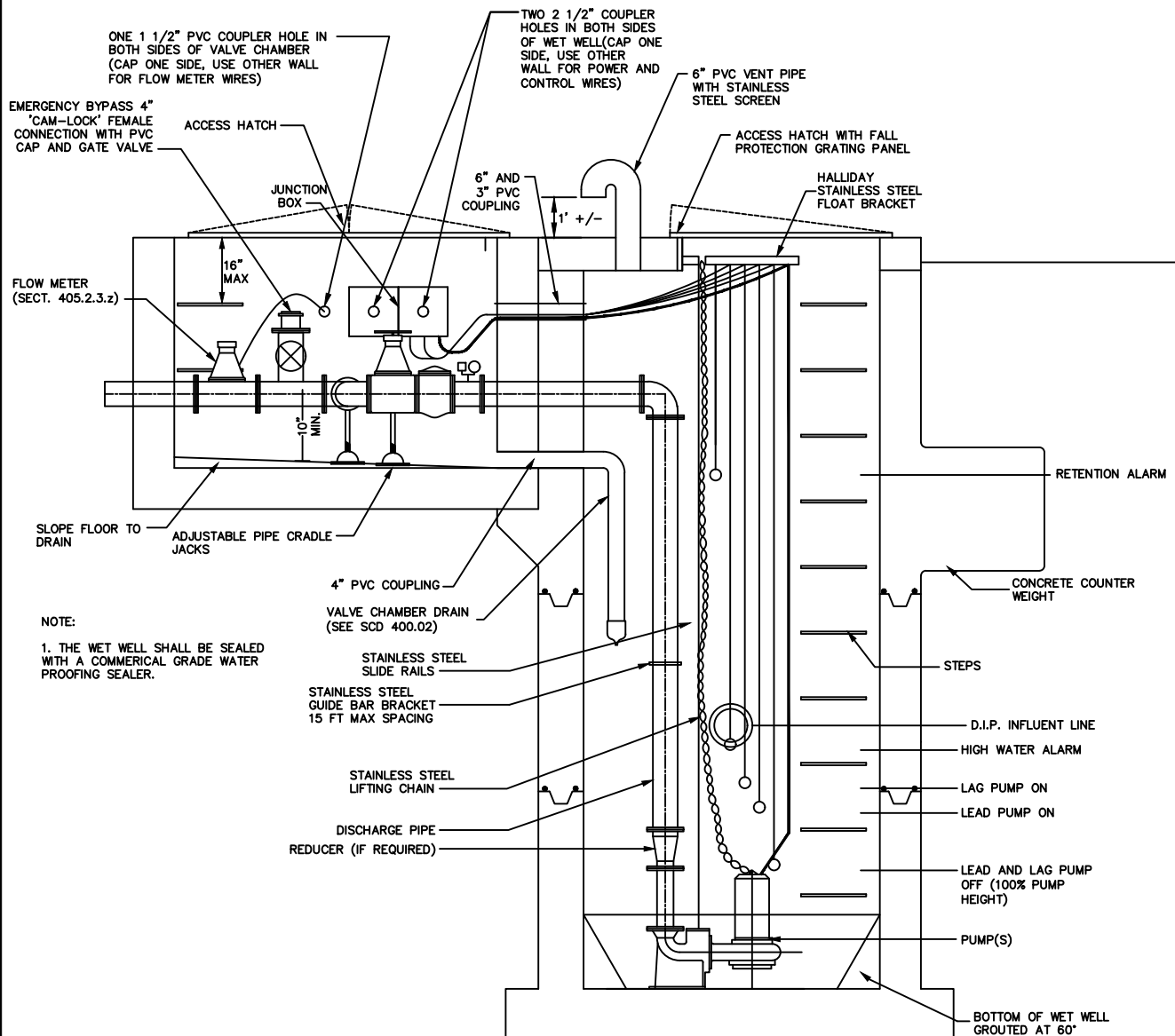
WET WELL



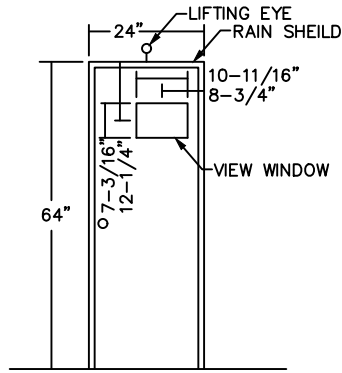
#### NOTES:

1. ACCESS HATCHES FOR WET WELL AND VALVE VAULT SHALL BE SIZED PER THE ENGINEERING DESIGN CRITERIA 4.04.01-2 AND AS SHOWN ON THE APPROVED PLANS.
2. LOW VOLTAGE CONDUIT SHALL RUN THROUGH A SEPARATE CONDUIT FROM HIGH VOLTAGE WIRES TO SEPARATE JUNCTION BOXES.
3. FOR PUMPS 25 HORSE POWER AND LARGER, A FLOWMETER IS REQUIRED. PROVIDE 5 PIPE DIAMETERS UPSTREAM AND 3 PIPE DIAMETERS DOWNSTREAM OF FLOWMETER OF STRAIGHT PIPE. (SECT. 405.2.3.2)

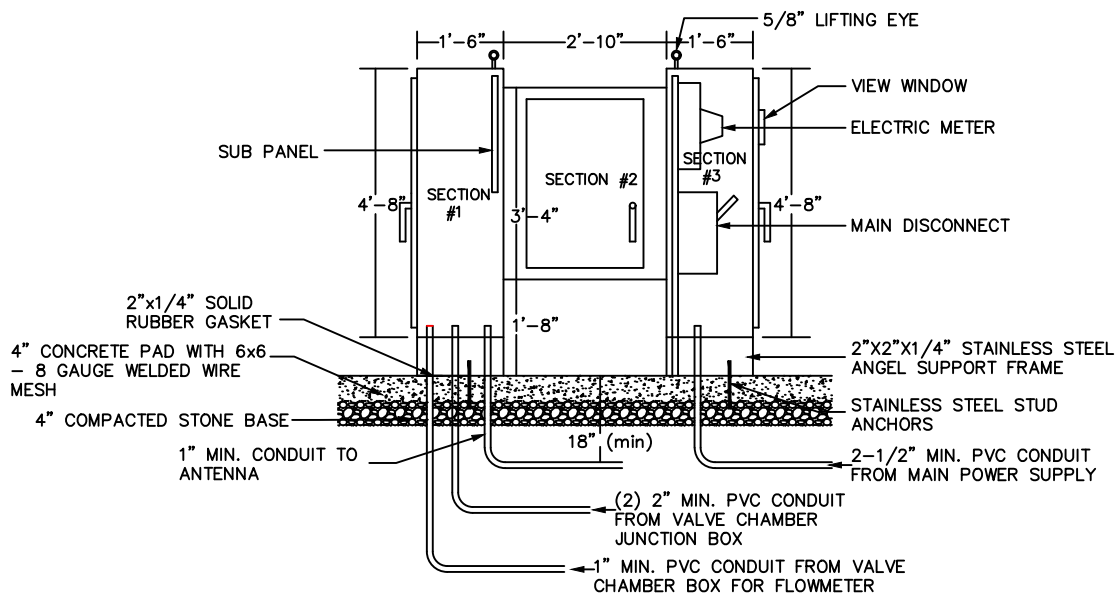
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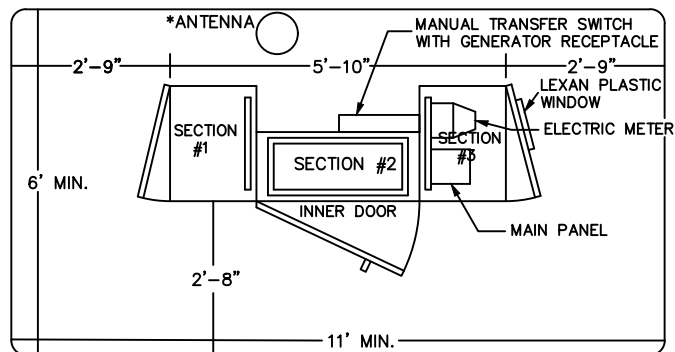
THIS LAYOUT DOES NOT CONSTITUTE A DESIGN AND IS FOR ILLUSTRATIVE PURPOSES ONLY.



FRONT OF SECTION #3



ELEVATION VIEW



PLAN VIEW

\*NOTE: ANTENNA MAY BE LOCATED DIRECTLY BEHIND THE CONTROL PANEL AND POURED MONOLITHICALLY WITH CONTROL PANEL PAD.

THIS LAYOUT DOES NOT CONSTITUTE A DESIGN AND IS FOR ILLUSTRATIVE PURPOSES ONLY.

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The Crossroads of the Nation

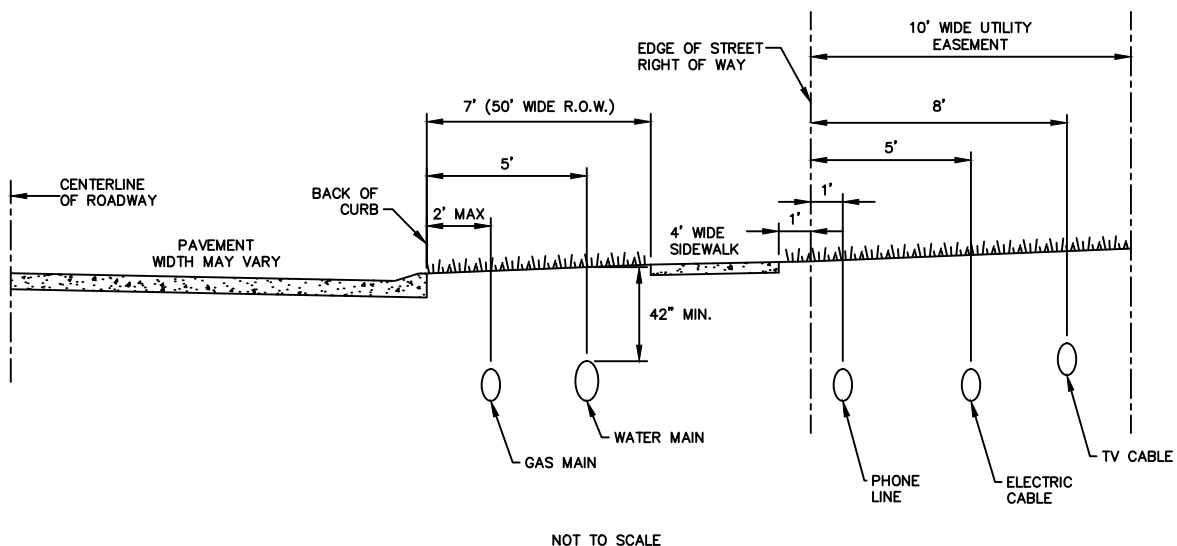
PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

**PUMP STATION  
CONTROL PANEL**

Approved: BOA  
Date: October 15, 2015

**400.04**

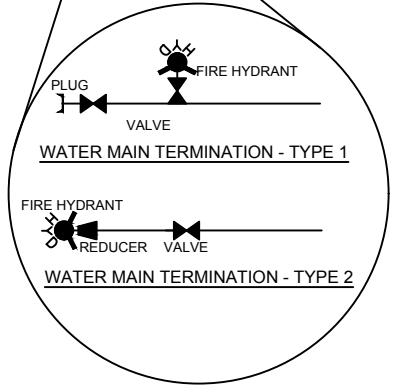
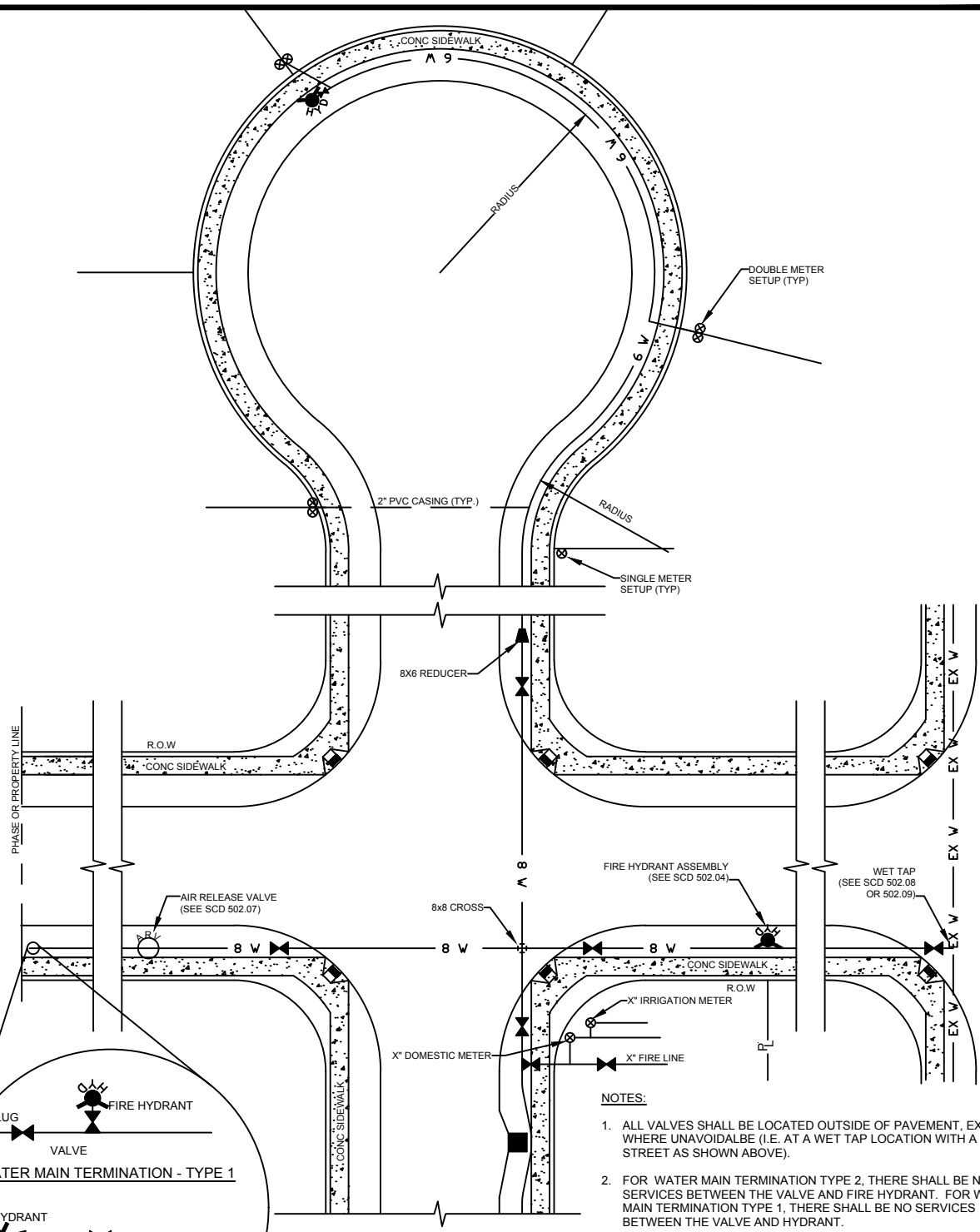




NOTE: 1. WATER MAINS ARE TO BE LOCATED 5' FROM THE BACK OF CURB ON THE SIDE OF THE STREET OPPOSITE THE SANITARY SEWER.

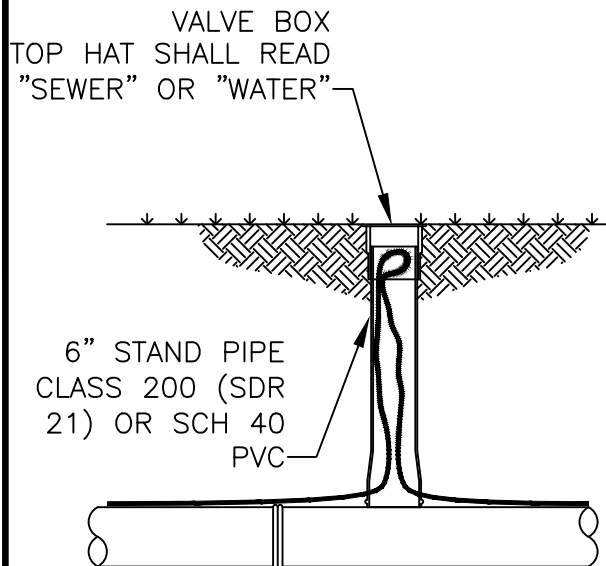
2. STORM SEWER LOCATIONS WILL BE AS APPROVED BY THE CITY. CURB INLETS SHOULD BE LOCATED TO PROVIDE PROPER PAVER CLEARANCE (TYPICALLY 31 FEET FACE TO FACE OF CURB INLETS).

3. UTILITY DEPTHS WILL VARY.

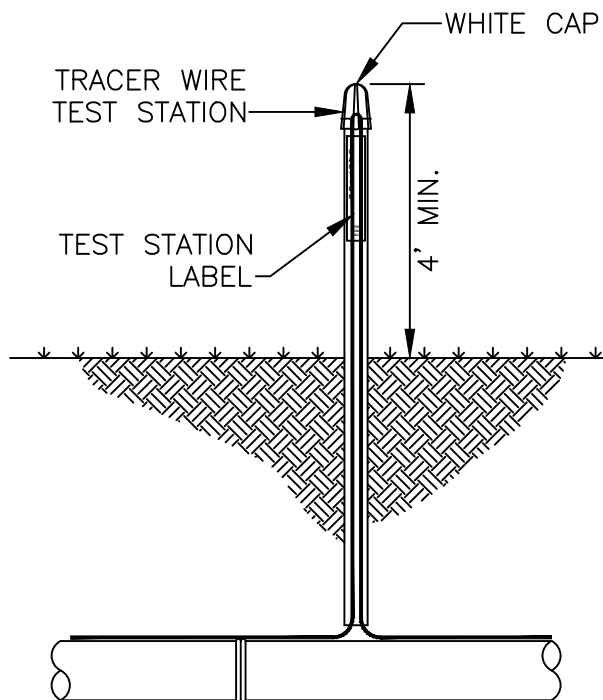


**NOTES:**

1. ALL VALVES SHALL BE LOCATED OUTSIDE OF PAVEMENT, EXCEPT WHERE UNAVOIDABLE (I.E. AT A WET TAP LOCATION WITH A NEW STREET AS SHOWN ABOVE).
2. FOR WATER MAIN TERMINATION TYPE 2, THERE SHALL BE NO SERVICES BETWEEN THE VALVE AND FIRE HYDRANT. FOR WATER MAIN TERMINATION TYPE 1, THERE SHALL BE NO SERVICES BETWEEN THE VALVE AND HYDRANT.
3. WATER MAIN TERMINATION TYPE 1 SHALL BE USED WHERE A MAIN IS STUBBED FOR FUTURE EXTENSION IN CLOSE PROXIMITY TO A FIRE HYDRANT REQUIRED FOR FIRE HYDRANT COVERAGE IN THE SYSTEM. WATER MAIN TERMINATION TYPE 2 SHALL BE USED AT FUTURE EXTENSION LOCATIONS THAT REQUIRE A FLUSHING DEVICE AND HAVE NO FIRE HYDRANT REQUIRED FOR FIRE HYDRANT COVERAGE IN THE SYSTEM IN CLOSE PROXIMITY TO THE WATER MAIN STUB.
4. THE LAST 300' OF MAIN ON CUL-DE-SACS MAY BE 6" DIAMETER.



TRACER WIRE ACCESS BOX



TRACER WIRE TEST STATION

NOTES:

1. ALL SPLICING OF TRACER WIRE MUST BE MADE WITH APPROVED 3M WATERPROOF SPLICE KITS.
2. TEST STATIONS OR ACCESS BOXES SHALL BE PLACED AT THE PC AND PT OF ALL RADII, AT ALL BENDS AND EVERY 500' ON STRAIGHT RUNS OF PIPE. CURVE LENGTHS GREATER THAN 150 FEET REQUIRE INTERMEDIATE TEST STATIONS OR ACCESS BOXES IN ADDITION TO THE PC AND PT.
3. TRACER WIRE ACCESS BOXES SHALL BE USED IN IMPROVED AREAS, SUCH AS IN THE EASEMENT OR RIGHT-OF-WAY OF A RESIDENTIAL DEVELOPEMENT. TRACER WIRE TEST STATIONS SHALL BE USED IN UNIMPROVED AREAS, SUCH AS IN AREAS WITH HEAVY BRUSH OR TALL GRASSES.
4. TRACER WIRE SHALL BE CONNECTED TO THE TEST STATION AS DIRECTED BY THE MANUFACTURER'S INSTRUCTIONS.
5. A MINIMUM OF 3' OF EXCESS TRACER WIRE SHALL BE ROLLED UP AND BE AVAILABLE AT THE TOP OF THE TRACER WIRE ACCESS BOX.

TEST STATIONS SHALL BE CARSONITE SCEPTER TEST STATIONS.

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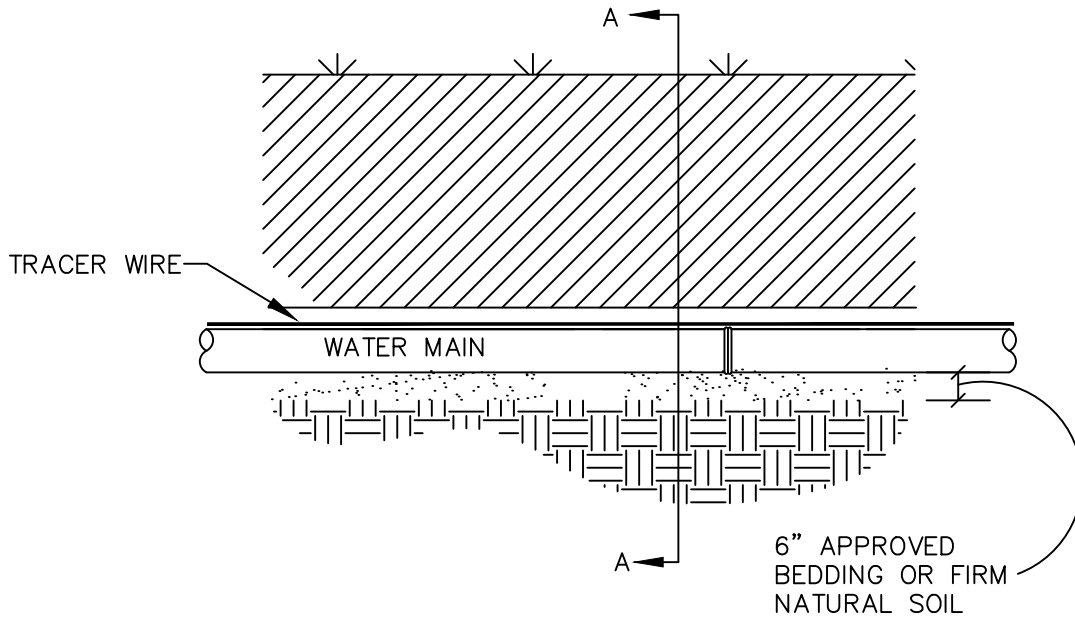
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1-800-DIG-RITE

SEWER TEST  
STATION LABEL  
(GREEN)

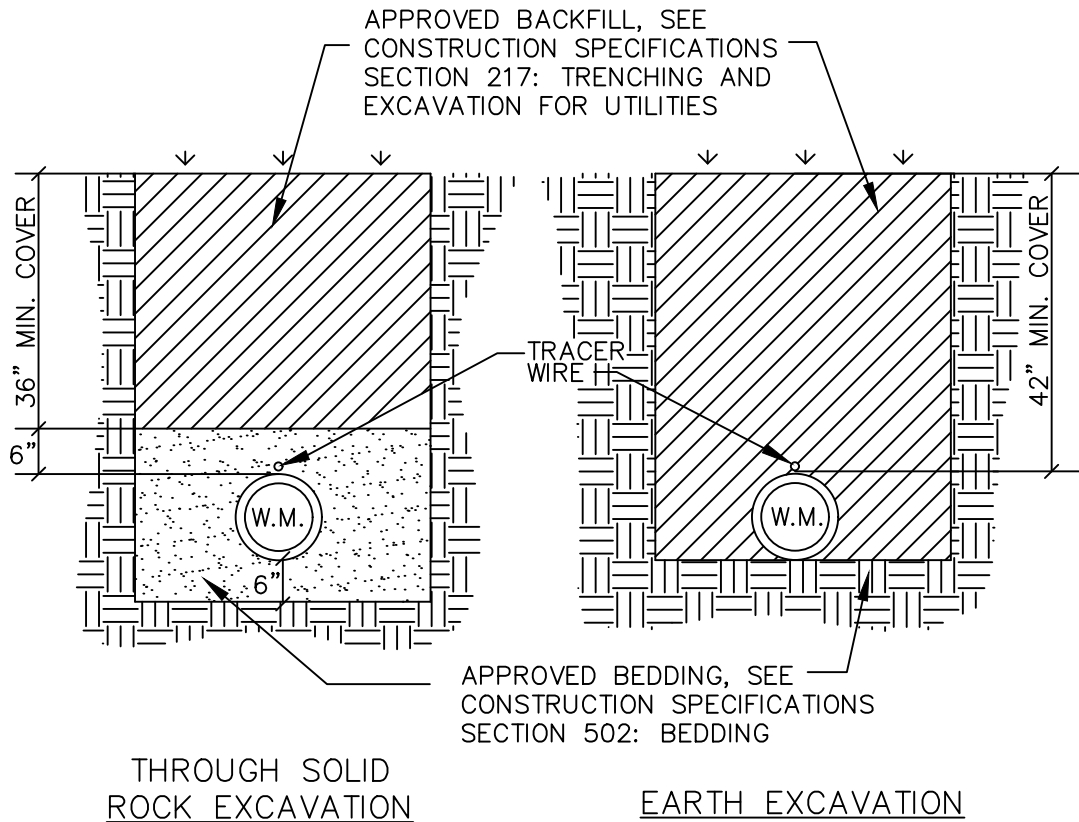
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WATER TEST  
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N.T.S.



SECTION A-A

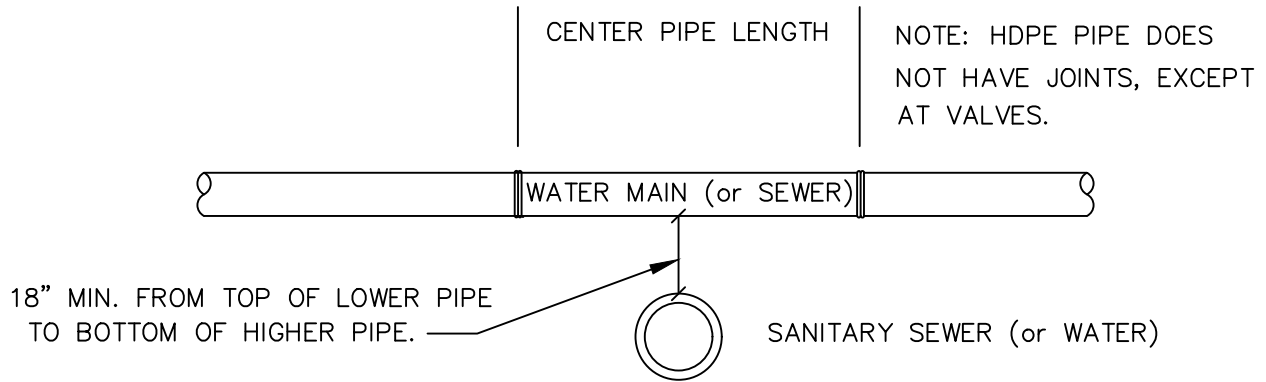
**Wentzville Missouri**  
The Crossroads of the Nation

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ENGINEERING DIVISION WENTZVILLE, MO. 63385

# STANDARD WATER MAIN INSTALLATION

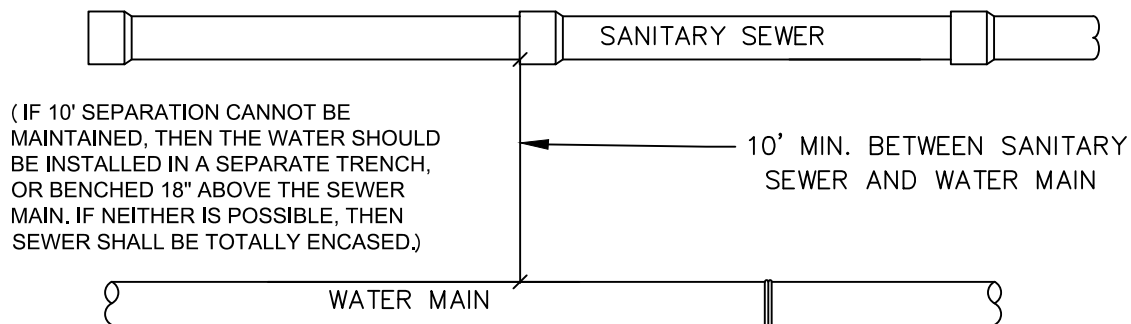
Approved: W.E.B.  
Date: June 10, 2009

**502.01**



STANDARD VERTICAL SEPARATION

N.T.S.

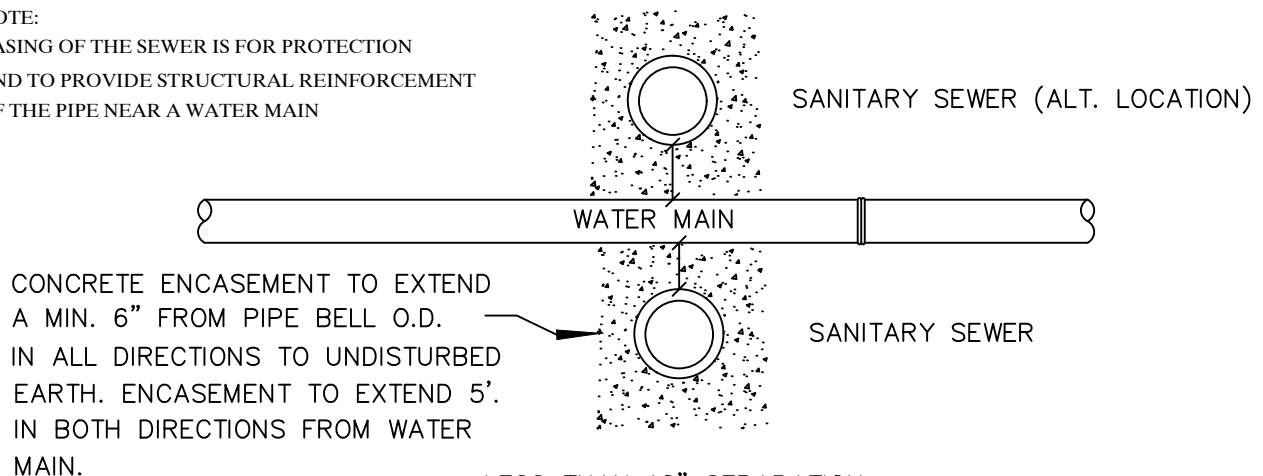


STANDARD HORIZONTAL SEPARATION

N.T.S.

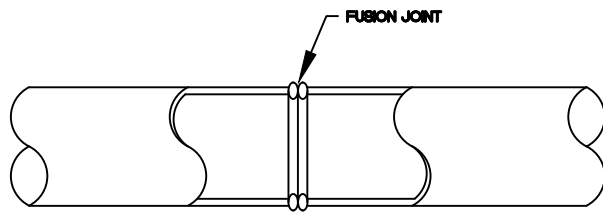
NOTE:

CASING OF THE SEWER IS FOR PROTECTION AND TO PROVIDE STRUCTURAL REINFORCEMENT OF THE PIPE NEAR A WATER MAIN

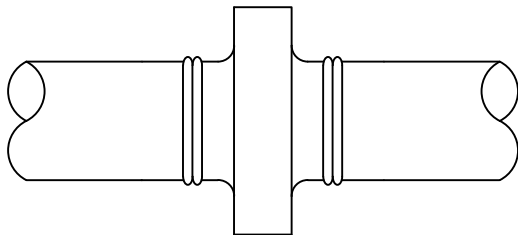


LESS THAN 18" SEPARATION

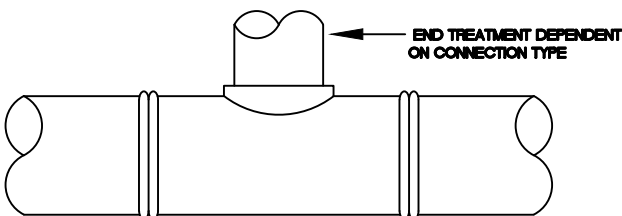
N.T.S.



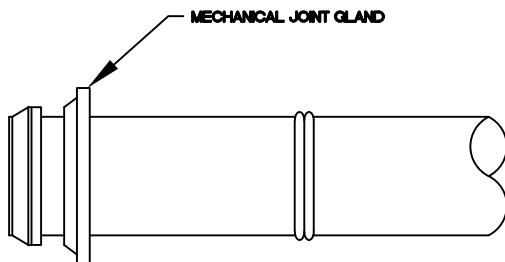
TYPICAL BUTT FUSION JOINT



THRUST-ISOLATOR / ANCHOR RING



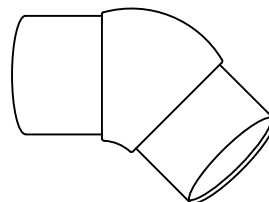
TYPICAL FUSION TEE



TYPICAL M.J. ADAPTER

NOTES:

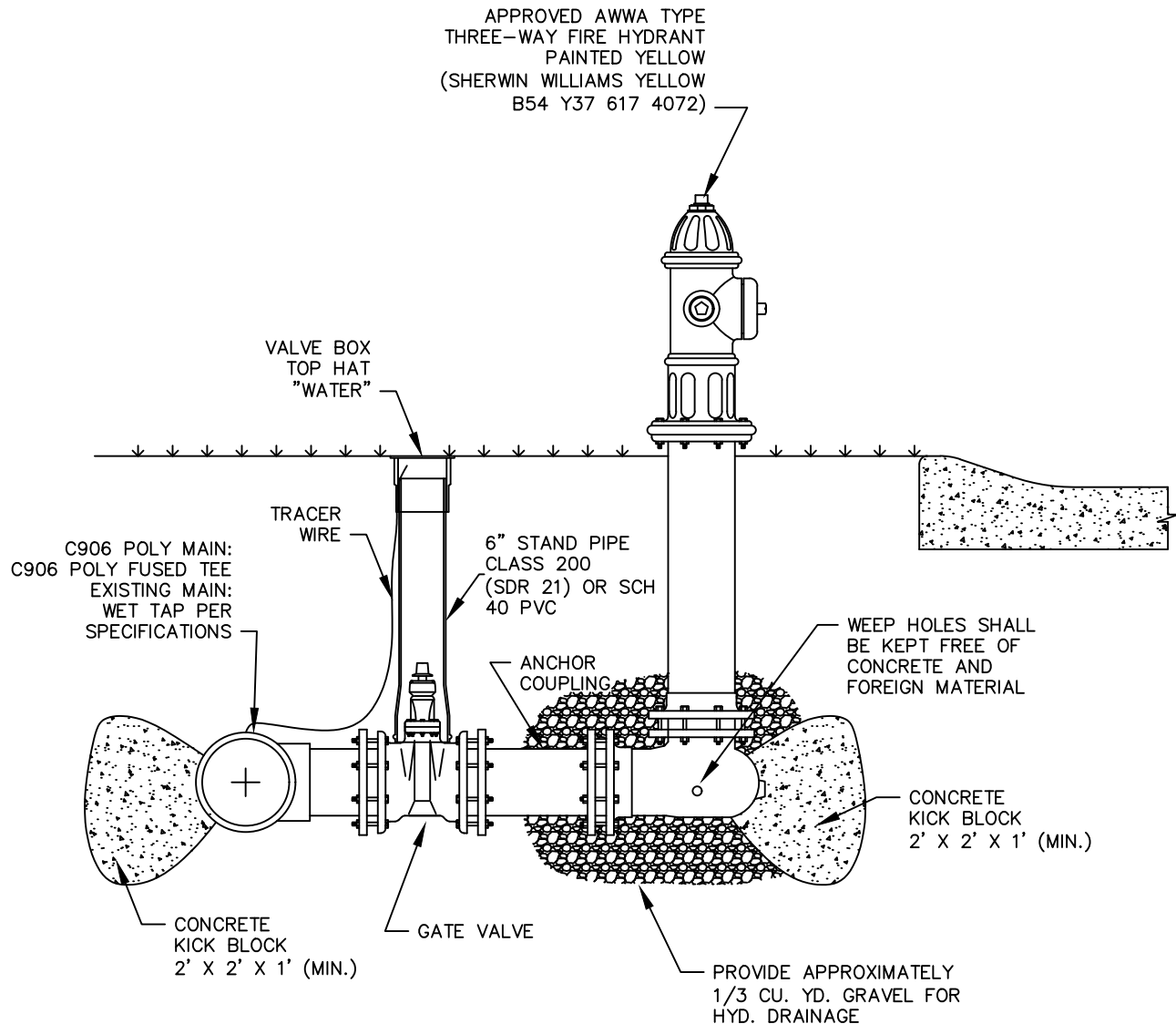
1. ALL JOINTS SHOULD BE BUTT FUSION JOINTS. THE USE OF ELECTROFUSION CONNECTIONS WILL ONLY BE APPROVED ON THE BASIS OF SITE CONDITIONS ON A CASE BY CASE BASIS BY THE ENGINEERING DEPARTMENT.
2. ALL CONNECTIONS TO VALVES SHALL BE MADE WITH MECHANICAL JOINTS. POLYETHYLENE WATER MAIN CONNECTION SHALL BE C906 MECHANICAL JOINT ADAPTER.
3. ALL TEES, REDUCERS AND BENDS SHALL BE MADE WITH POLYETHYLENE (C906) FITTINGS AS REQUIRED IN THE SPECIFICATIONS. CONNECTION TO THE C906 FITTINGS WILL BE MADE BY BUTT FUSION.
4. FABRICATED FITTINGS ARE NOT ALLOWED WITHOUT PRIOR APPROVAL FROM THE ENGINEERING DIVISION.
5. FITTINGS SHALL BE LOCATED A MINIMUM OF 3 FEET FROM THE NEXT CLOSEST FITTING.
6. ELECTROFUSION COUPLINGS MAY ONLY BE INSTALLED WITH THE APPROVAL OF THE ENGINEERING DIVISION AND WHEN APPROVED SHALL BE INSTALLED AT LEAST 3 FEET FROM THE NEAREST FITTING.



45° BEND



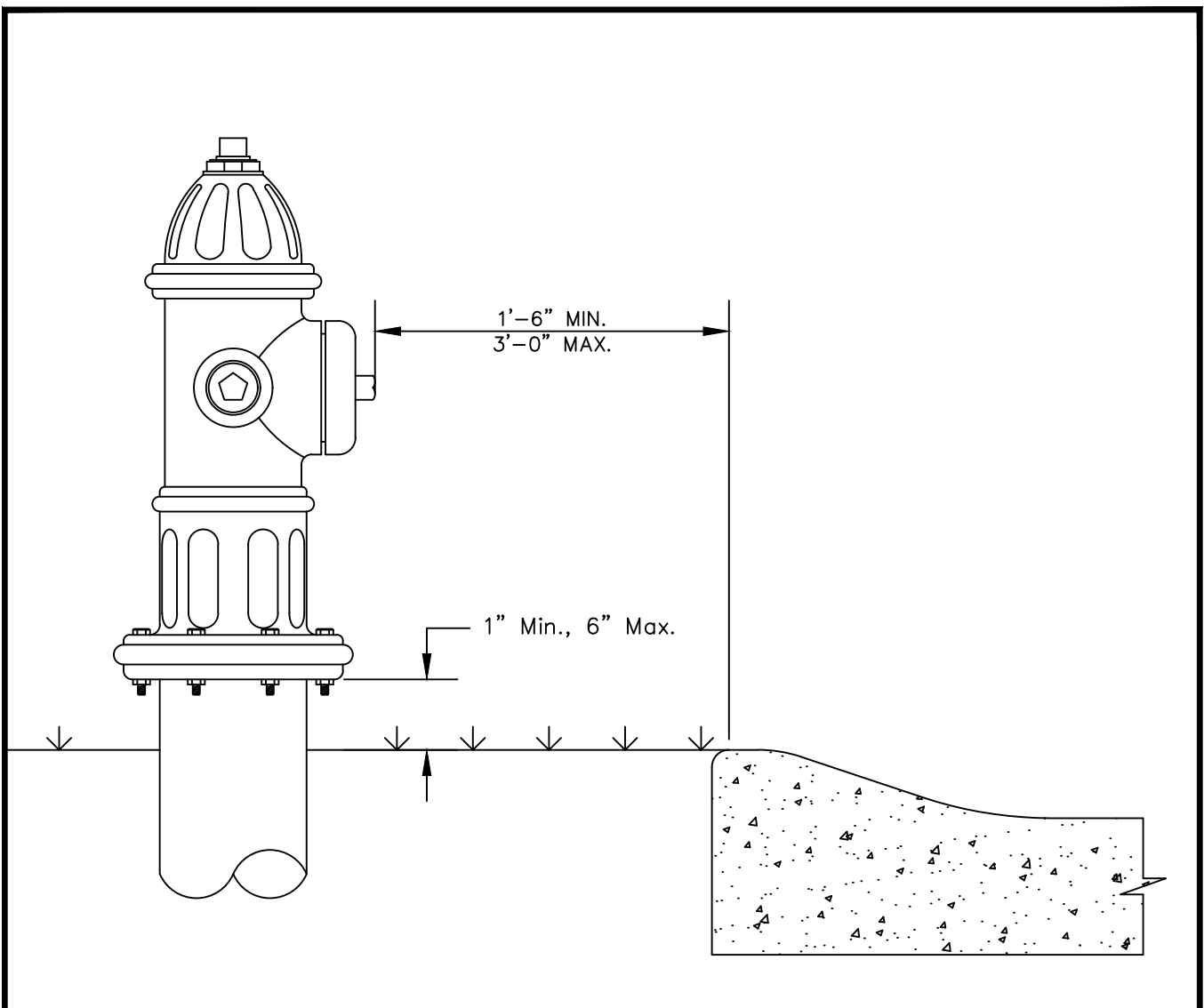
REDUCER



N.T.S.

NOTES:

1. GATE VALVE SHALL BE ANCHORED TO THE TEE AND THE HYDRANT SWIVEL ANCHOR SHALL BE ANCHORED TO THE VALVE.  
(HYDRANTS INSTALLED AS PART OF A NEW WATER MAIN EXTENSION MAY USE AN M.J. X M.J. VALVE.)
2. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO INSURE THAT THE HYDRANT DRAIN (WEEP HOLES) REMAIN OPEN.
3. SEE STANDARD CONSTRUCTION DETAIL 502.05 FOR FIRE HYDRANT ELEVATION AND SETBACK FROM THE STREET CURB.



N.T.S.

NOTES:

1. WHEN HYDRANT INSTALLATIONS HAVE A GREATER THAN NORMAL EXPOSURE TO DAMAGE DUE TO VEHICULAR TRAFFIC (PARKING LOT INSTALLATION, UNUSUAL DRIVING SITUATION, ETC.), THE CITY MAY REQUIRE HYDRANT PROTECTION USING 6" DIA. STEEL PIPE BOLLARDS FILLED WITH CONCRETE AND PAINTED TO MATCH HYDRANT – SHERWIN WILLIAMS YELLOW B54 Y37 617 4072.
2. ALL HYDRANTS SHALL STAND PLUMB WITH THE 5-1/4" PUMPER NOZZLE FACING THE CURB.

**Wentzville Missouri**  
The Crossroads of the Nation

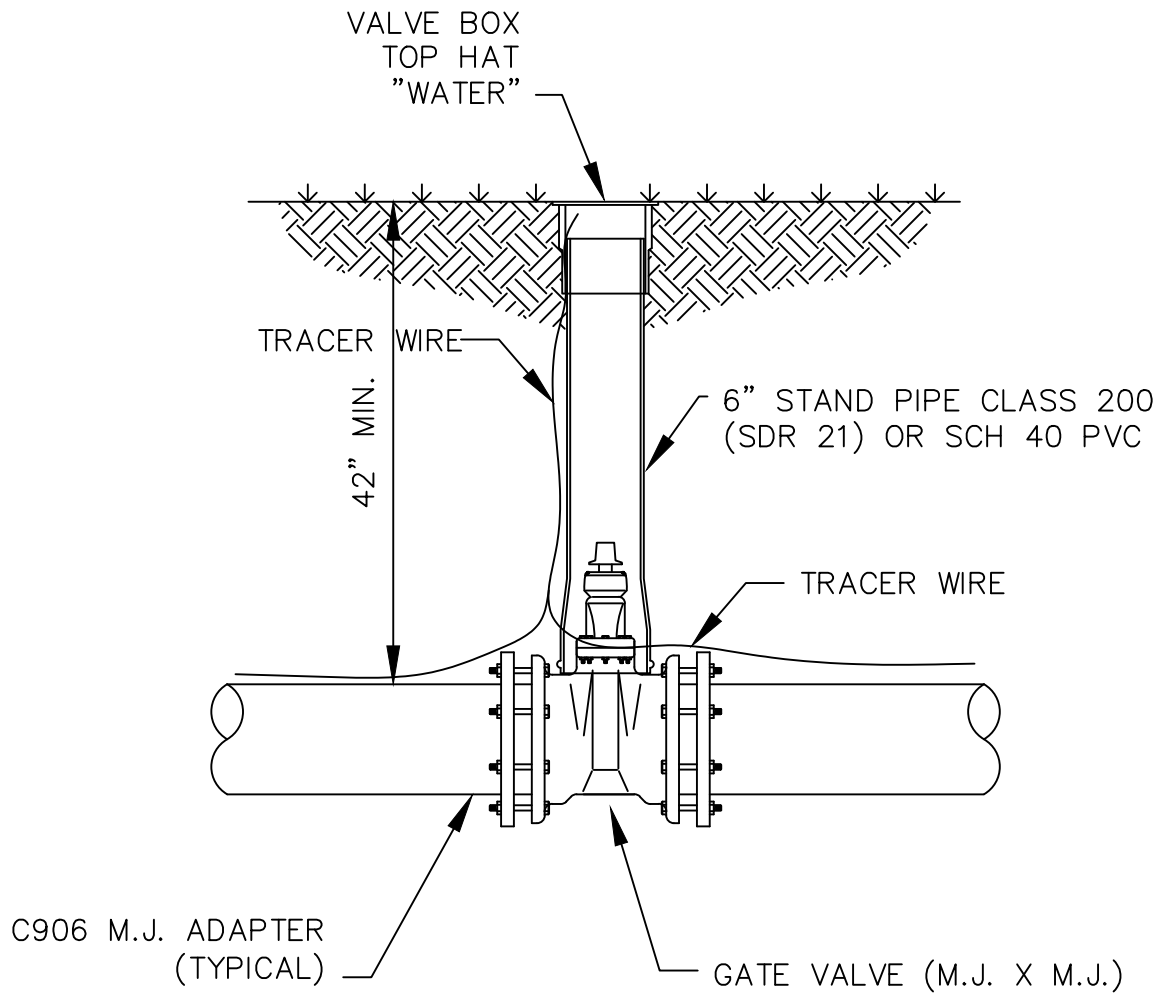
PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

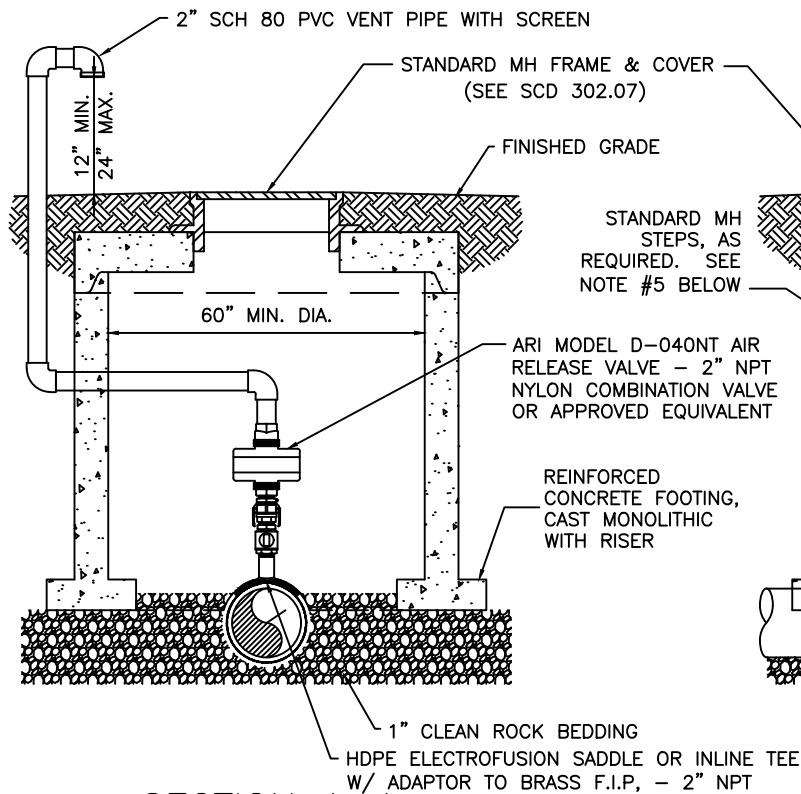
## FIRE HYDRANT STANDARD LOCATION

Approved: W.E.B.  
Date: June 10, 2009

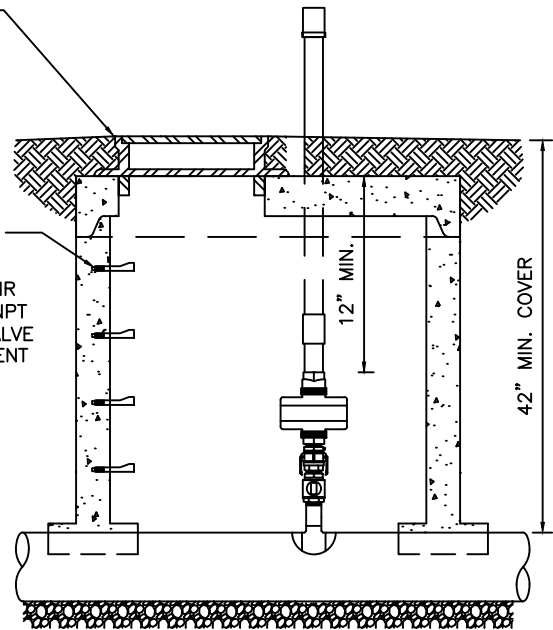
**502.05**



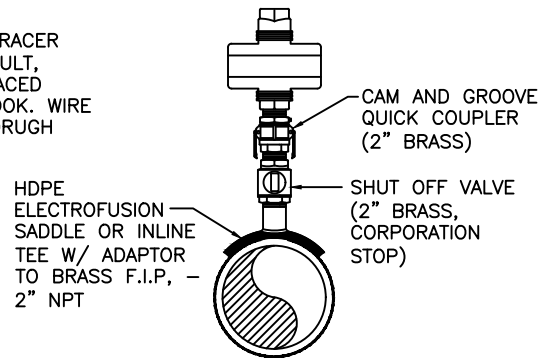
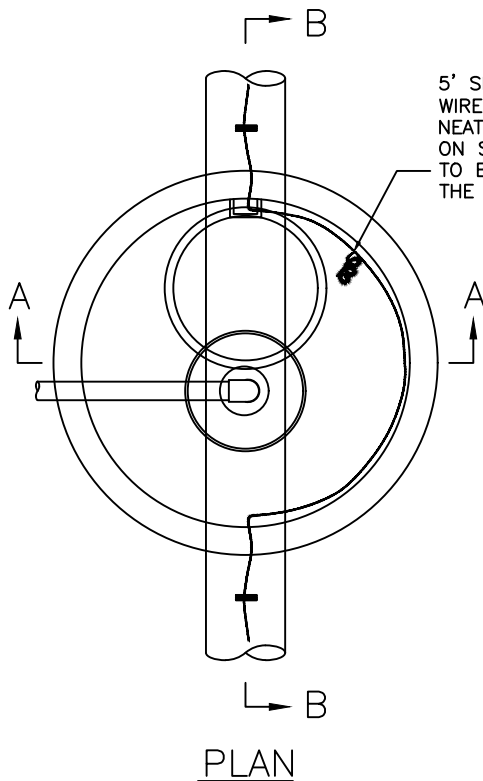




SECTION A-A

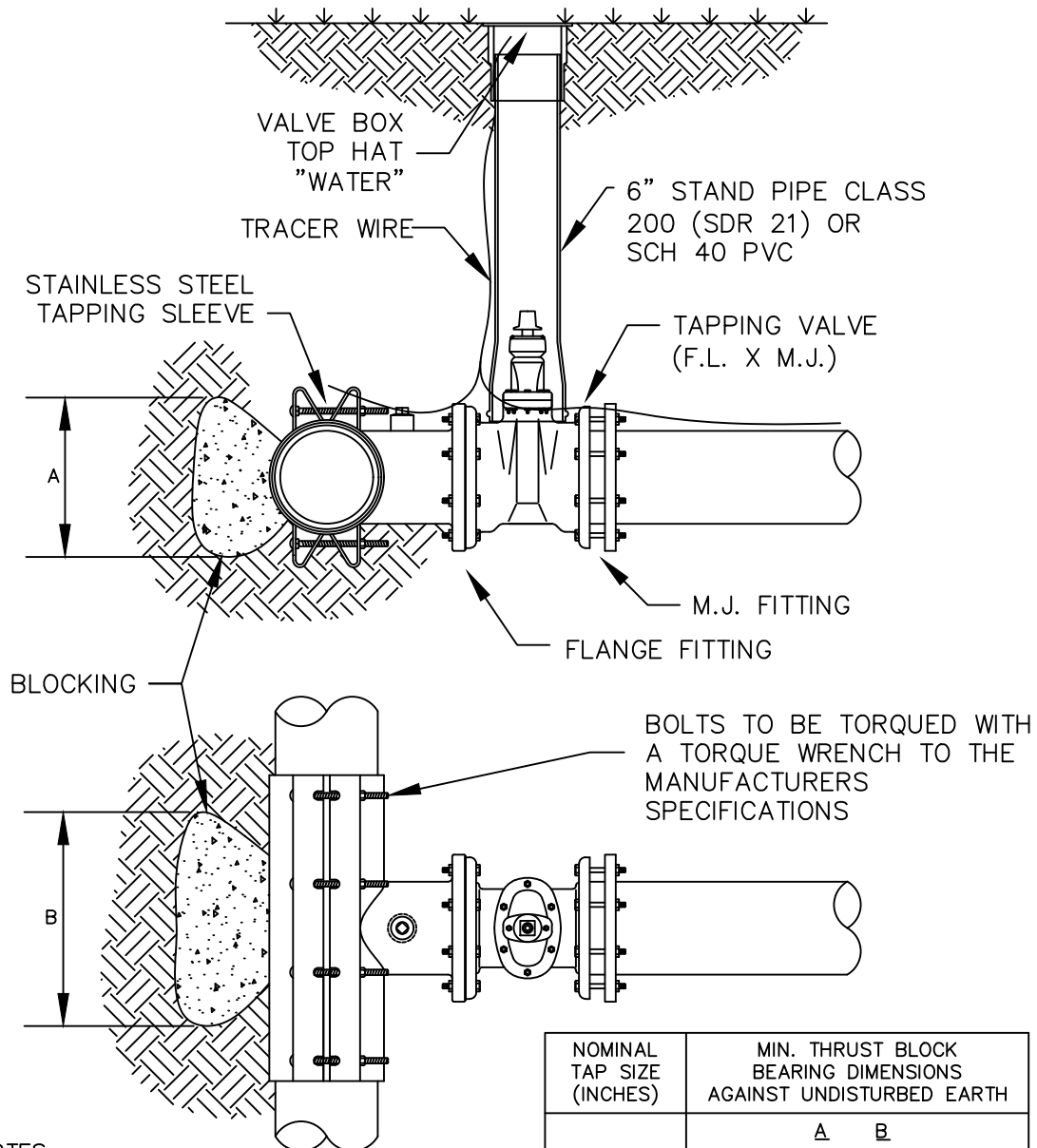


SECTION B-B



**NOTES:**

1. ALL FITTINGS AND PIPE FOR VALVES SHALL BE BRASS.
2. SCREENED VENT PIPE SHALL BE SCHEDULE 80 PVC.
3. ALL AIR RELEASE VALVES SHALL BE INSTALLED IN THE VERTICAL POSITION.
4. FINISHED GRADING SHALL PROVIDE DRAINAGE AWAY FROM THE ACCESS LID.
5. STEPS SHALL BE UNIFORMLY SPACED AT 16" CENTER TO CENTER AND SHALL EXTEND 5-3/4" FROM WALL.



**NOTES:**

1. CONCRETE SHALL NOT BE IN CONTACT WITH BOLTS OR ENDS OF MECHANICAL FITTINGS. PLASTIC SHEET BOND BREAKER SHALL BE PROVIDED BETWEEN THE CONCRETE AND THE PIPE AND TAPPING SLEEVE

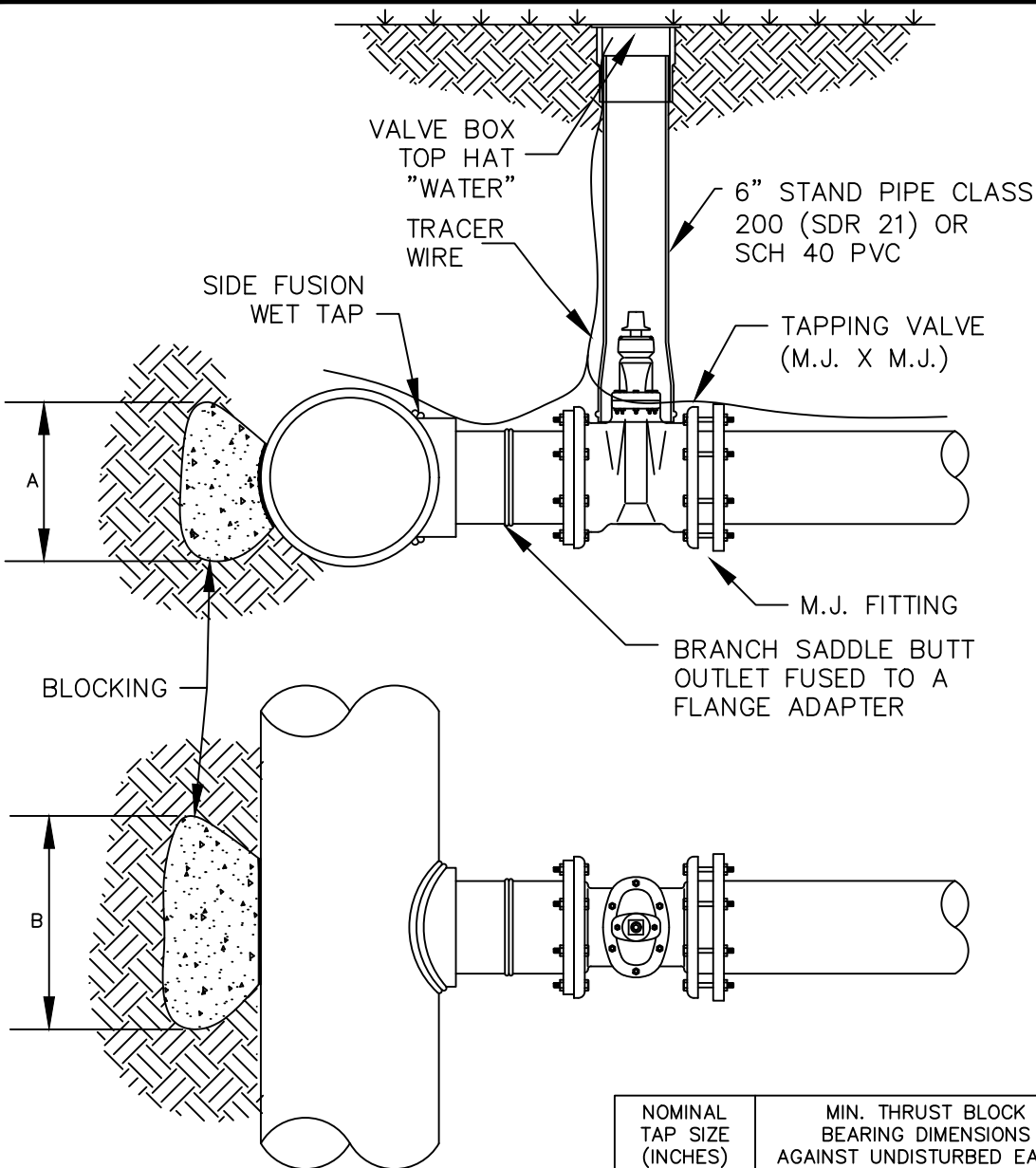
2. SEE TABLE FOR MINIMUM AREA OF CONCRETE BLOCKING.

3. REFER TO SCD 500.03, STANDARD TRACER WIRE TEST STATION AND ACCESS BOX FOR TRACER WIRE DETAILS

4. THE WET TAP SHALL BE PRESSURE TESTED AT 125 PSI AND HELD FOR 10 MINUTES IN THE PRESENCE OF A REPRESENTATIVE OF THE CITY BEFORE TAPPING.

5. THRUST BLOCK IS NOT REQUIRED FOR FULLY RESTRAINED PIPE.

NOMINAL TAP SIZE (INCHES)	MIN. THRUST BLOCK BEARING DIMENSIONS AGAINST UNDISTURBED EARTH	
	A	B
6	2' X 1.5'	
8	2' X 2.5'	
10	2' X 3.5'	
12	3' X 3.5'	
16	4' X 4.5'	
18	5' X 5.5'	



**NOTES:**

1. CONCRETE SHALL NOT BE IN CONTACT WITH BOLTS OR ENDS OF MECHANICAL FITTINGS. PLASTIC SHEET BOND BREAKER SHALL BE PROVIDED BETWEEN THE CONCRETE AND THE PIPE AND TAPPING SLEEVE

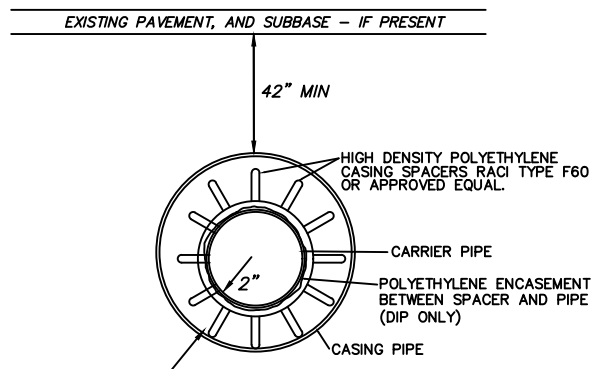
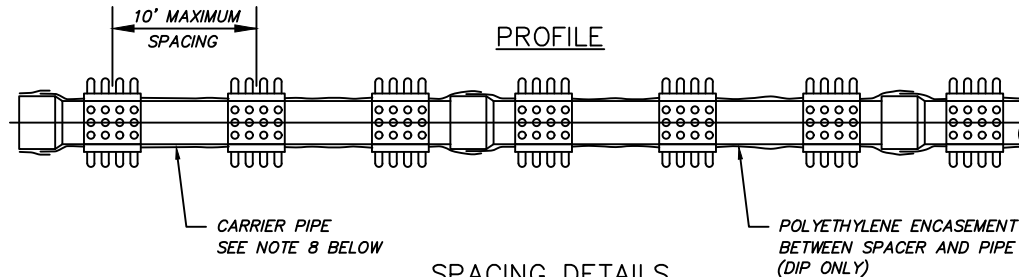
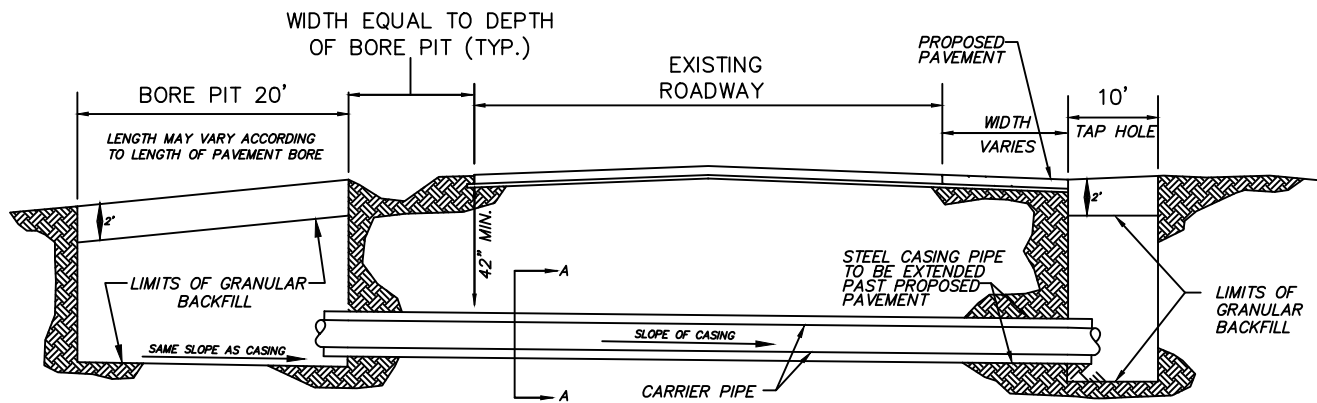
2. SEE TABLE FOR MINIMUM AREA OF CONCRETE BLOCKING.

3. REFER TO SCD 500.03, STANDARD TRACER WIRE TEST STATION AND ACCESS BOX FOR TRACER WIRE DETAILS

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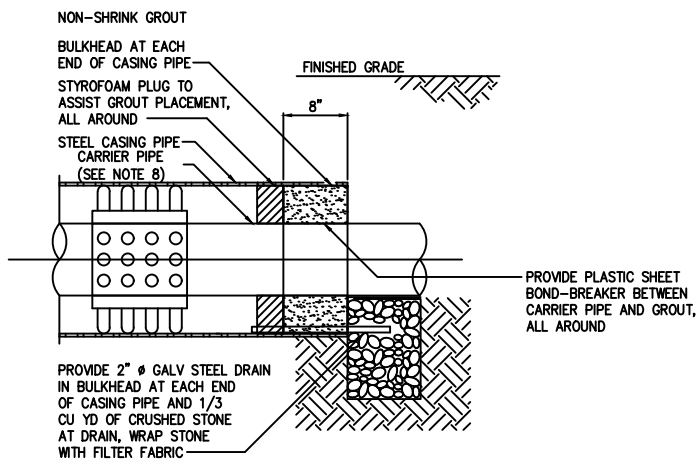
NOMINAL TAP SIZE (INCHES)	MIN. THRUST BLOCK BEARING DIMENSIONS AGAINST UNDISTURBED EARTH	
	A	B
6	2' X 1.5'	
8	2' X 2.5'	
10	2' X 3.5'	
12	3' X 3.5'	
16	4' X 4.5'	
18	5' X 5.5'	



#### NOTES:

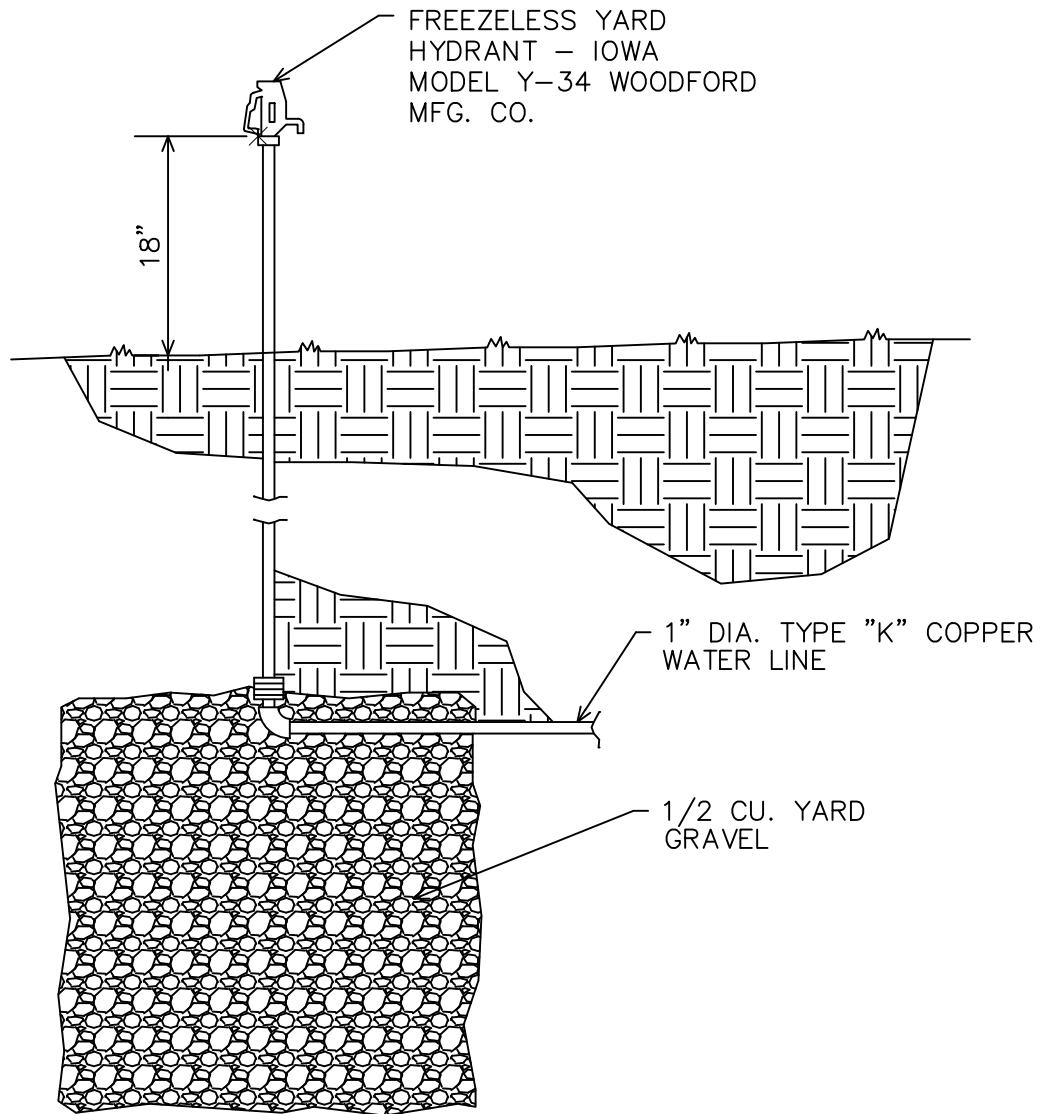
1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. ALL JOINTS IN THE CASING PIPE SHALL BE WELDED AND COLE TAR EPOXY COATED.
3. STEEL CASING PIPE USED IN THE INSTALLATION OF WATER OR SEWER MAINS MUST HAVE A MINIMUM YIELD STRENGTH OF 35,000 P.S.I.
4. HIGH DENSITY POLYETHYLENE CASING SPACERS SHALL BE RACI TYPE F60 OR APPROVED EQUAL.
5. POLYETHYLENE SPACERS SHALL BE PLACED EVERY 10 FEET ALONG THE CARRIER PIPE AND 2 AT EVERY JOINT.
6. BORE PIT AND TAP HOLE SHALL BE BACKFILLED WITH GRANULAR BACKFILL.
7. STEEL CASING PIPE SHALL HAVE A MINIMUM WALL THICKNESS AS INDICATED ON THE TABLE BELOW.

CASING PIPE DIAMETER	CASING PIPE MINIMUM WALL THICKNESS
6" THRU 12"	0.188"
14" THRU 22"	0.250"
24" & 26"	0.281"
28" THRU 34"	0.312"
36" THRU 48"	0.344"

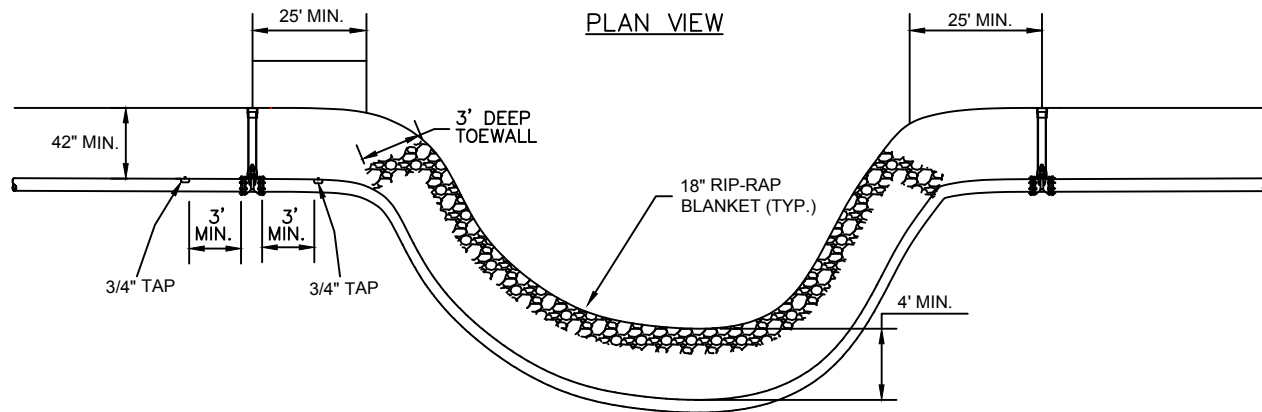
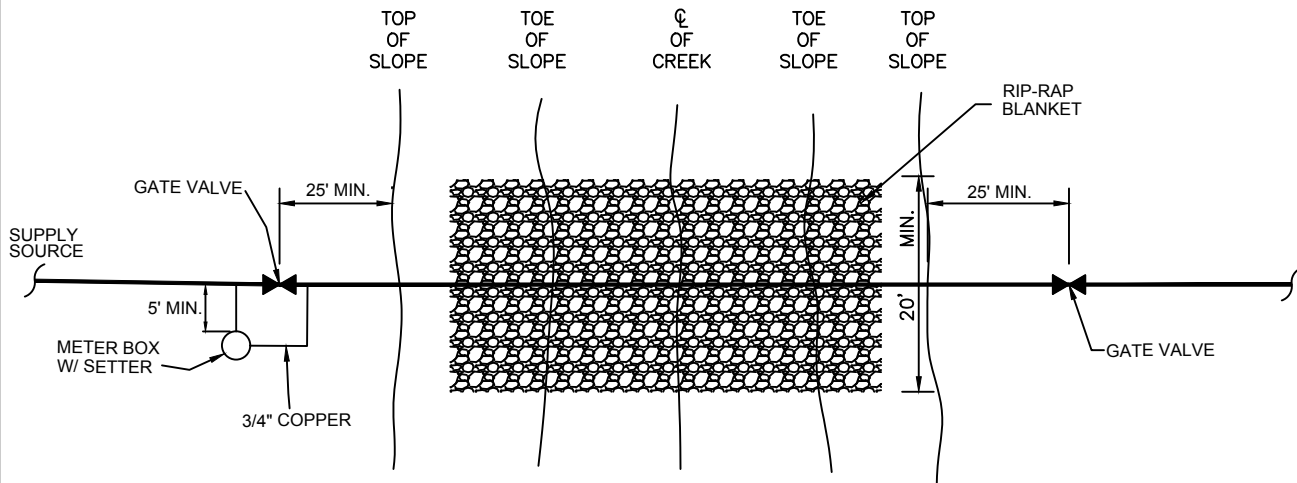


TYPICAL CASING PIPE PLUG

8. CARRIER PIPE MATERIAL SHALL BE AS FOLLOWS. FOR WATER MAINS AND SANITARY SEWER FORCE MAINS, THE CARRIER PIPE SHALL BE C906 POLYETHYLENE. FOR SANITARY SEWER GRAVITY MAINS, THE CARRIER PIPE SHALL BE SDR 35 PVC OR DIP.
9. SPACERS MAY BE OMITTED FOR C906 CARRIER PIPE, WHEN APPROVED BY ENGINEERING. IF SPACERS NOT USED, CASING PIPE SHALL BE A MIN. 4" DIA LARGER THAN CARRIER PIPE.



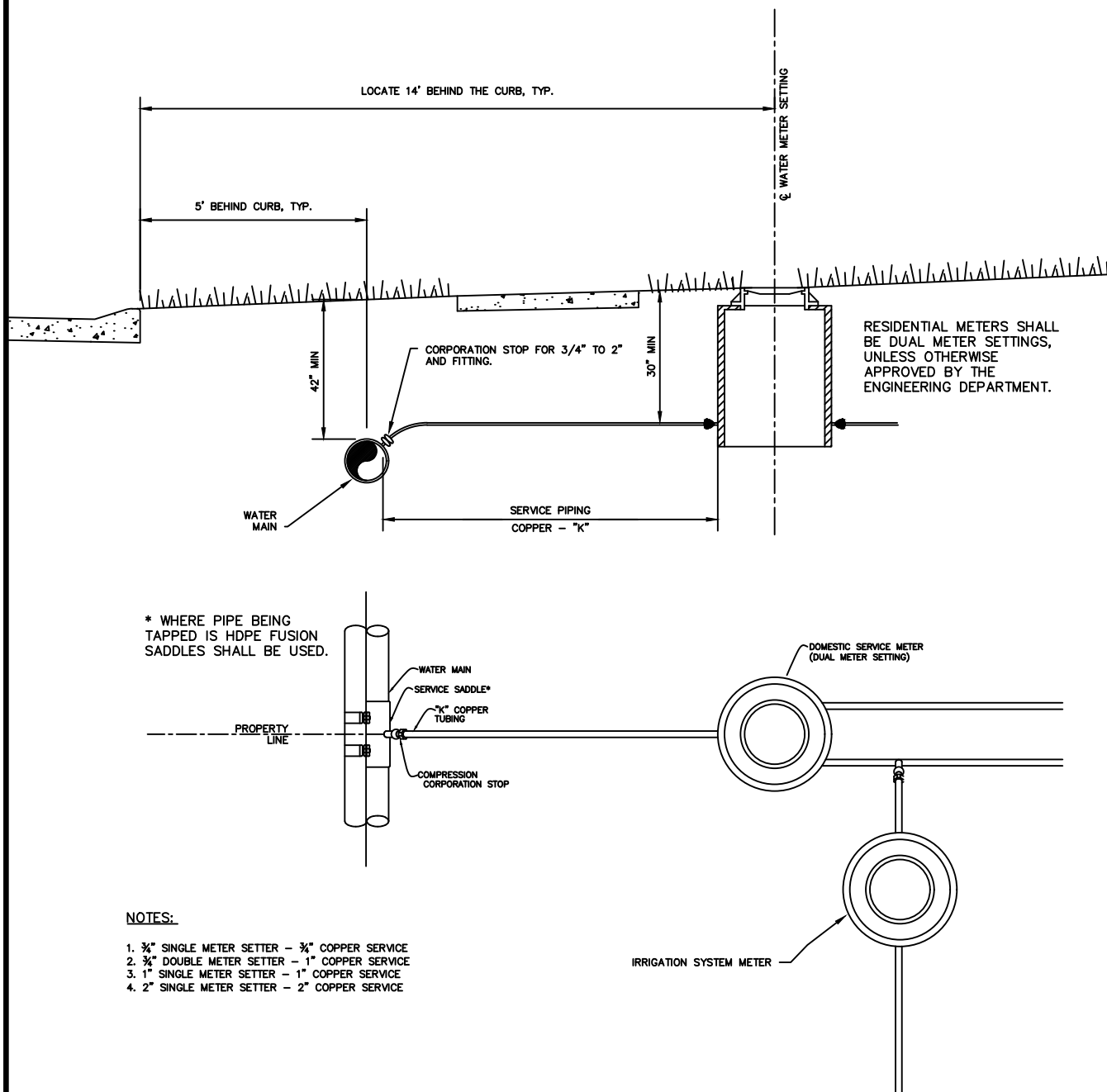
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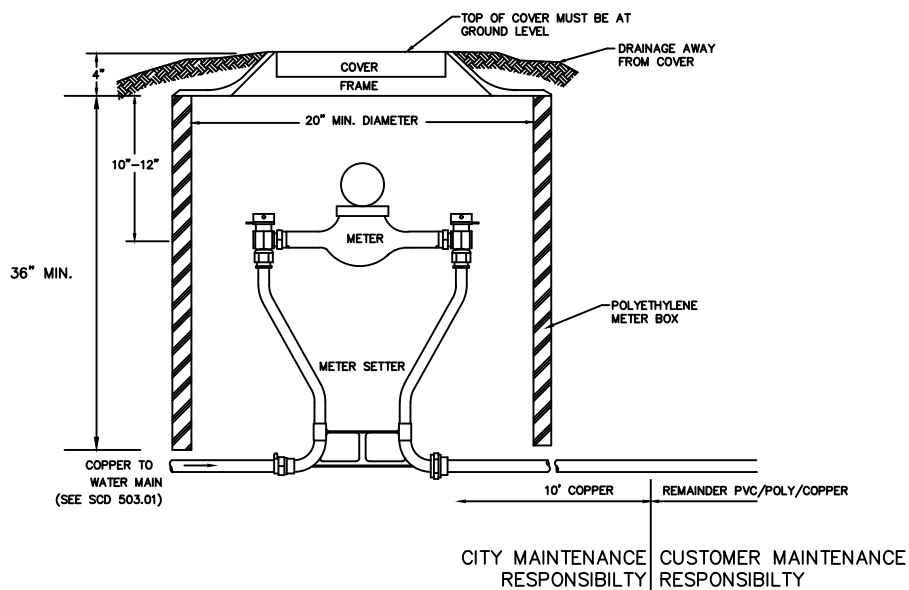
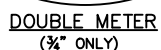
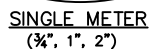
### PROFILE

### NOTES:

1. RIP RAP IS REQUIRED AT ALL CREEK CROSSINGS.
2. PLACE RIP RAP ON THE LOWER 3/4 OF SLOPE. THE UPPER 1/4 OF SLOPE SHOULD BE TREATED AS FOLLOWS BASED ON INCLINATION OF THE SLOPE:
  - A. 3H:1V OR LESS – SEED AND STRAW
  - B. STEEPER THAN 3H:1V – RIP RAP
3. INCORPORATE A 3 FEET DEEP TOE WALL ON EMBANKMENT'S UPPER EDGE OF RIP RAP.
4. TOP SURFACE OF RIP RAP SHOULD BE AT OR HIGHER THAN SURROUNDING GROUND SURFACE.
5. IF PIPE HAS LESS THAN 4 FEET OF COVER, THE PIPE MUST BE CONCRETE ENCASED.
6. PIPE MUST BE PROPERLY RESTRAINED DURING INSTALLATION TO PREVENT FLOATING.
7. 3/4" TAPS AND METER SETTING SHALL BE MADE AS SHOWN ON SCD 503.01 & SCD 503.02







NOT TO SCALE

1. ALL TAPS ARE TO BE MADE AT THE 10:00 OR 2:00 POSITION. NO BACKLOOPS WILL BE ALLOWED.

2. WATER METER BOX SHALL BE SET ON THE PROPERTY LINE (LOT LINE).

3. METER TILES SHALL BE SET 14' FROM THE BACK OF CURB AND SET TO THE PROPER FINISH GRADE.

4. WATER IS TO BE TURNED OFF AND ON BY CITY OF WENTZVILLE PERSONNEL ONLY. CALL 636-327-5102 FOR SERVICE.

5. METER BOX FRAME AND COVER GRADE  
ADJUSTMENT WITH APPROVED GRADE RING ONLY.

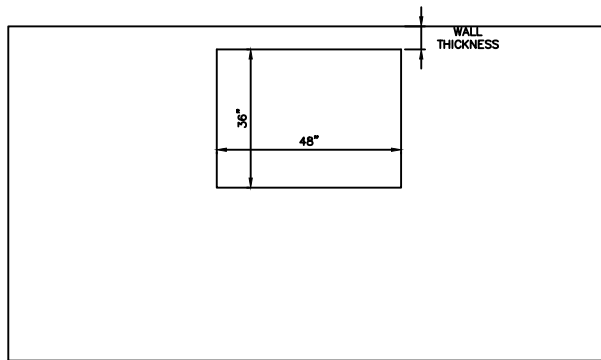
6. THE CITY OF WENTZVILLE WILL PROVIDE THE FOLLOWING SUPPLIES FOR ALL METER SETUPS:

SADDLE (COMPATIBLE WITH PIPE  
TO BE TAPPED.)  
CORPORATION STOP  
SETTER WITH COMPRESSION ENDS  
"Y" BRANCH (FOR DOUBLE METER SETTERS)

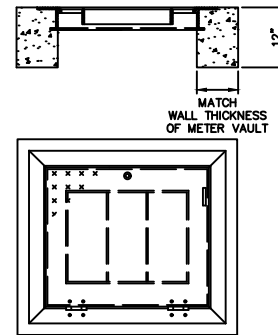
METER BOX  
METER  
FRAME & COVER

CALL 636-327-5102 FOR COORDINATION AND  
PICKUP OF SUPPLIES.

7. WHEN IN PAVEMENT, PYRAMID (PRECAST CONCRETE) METER BOX, FRAME, AND COVER SHALL BE FURNISHED BY THE CONTRACTOR.



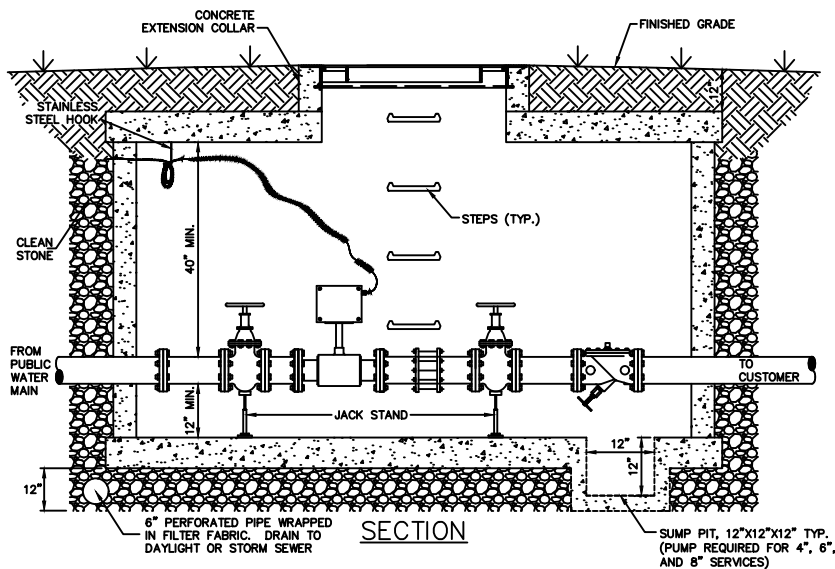
PLAN OF ROOF SLAB



ACCESS HATCH

NOTES:

1. DO NOT SCALE DRAWING. USE DIMENSIONS.
2. SHOP DRAWINGS OF THE VAULT, INTERNAL PIPING, AND EXTERNAL DRAINAGE SHALL BE PROVIDED TO THE CITY OF WENTZVILLE ENGINEERING DIVISION FOR APPROVAL.
3. STEPS TO BE UNIFORMLY SPACED AT 16" C-C. SEE SCD #302.12 FOR STEP DETAIL.
4. METER TO BE ORDERED FROM THE CITY OF WENTZVILLE WATER DEPARTMENT. CONTACT THE WATER DEPARTMENT FOR ORDERING LEAD TIME AT 636-327-5102.
5. PROVIDE STEEL PIPE SUPPORT JACK STAND AT EACH GATE VALVE.
6. ALL PIPING AND VALVES IN METER VAULT TO BE FLANGED CONNECTIONS (NO FLANGE ADAPTERS).
7. PIPING SHALL BE DUCTILE IRON PIPE CLASS 53 (MINIMUM).
8. BYPASS PIPING SIZE SHALL BE THE SAME AS METER SIZE.
9. METER VAULT SHALL BE PRECAST CONCRETE. SHOP DRAWING APPROVAL OF THE ENGINEERING DIVISION REQUIRED.
10. ACCESS HATCH SHALL BE 36" X 48" OPENING, SERIES S1S BY HALLIDAY PRODUCTS OR APPROVED EQUAL.
11. METER VAULT SHALL NOT BE LOCATED IN TRAFFIC AREAS UNLESS APPROVED BY THE CITY.
12. A SUMP PIT SHALL BE PROVIDED IN ALL VAULTS. THE BOTTOM OF THE VALVE VAULT SHALL DRAIN TO THE SUMP PIT.
13. SUMP PUMPS SHALL BE PROVIDED FOR 4" AND LARGER SERVICES. THE SUMP PIT SHALL BE OF SUFFICIENT SIZE TO ACCOMMODATE THE PUMP.
14. 4" THRU 8" METERS ARE MAG METERS & WILL REQUIRE ELECTRIC PANEL (SCD 503.04). 3" METER IS COMPOUND METER AND DOES NOT REQUIRE ELECTRIC PANEL.
15. FILTER FABRIC SHALL BE PROVIDED BETWEEN THE CLEAN ROCK BACKFILL AND THE SURROUNDING SOIL.
16. ALL OPENINGS IN THE VAULT SHALL BE PROPERLY SEALED.



SECTION

Meter Size	SCD	Meter Type	Minimum Inside Vault Dimensions		
			Length (in.)	Width (in.)	Height (in.)
3"	503.03A	Compound	120	67	60
4"	503.03B	Mag	120	71	60
6"	503.03C	Mag	138	77	60
8"	503.03D	Mag	158	82	60

See the applicable SCD for internal piping layout and typical dimensions

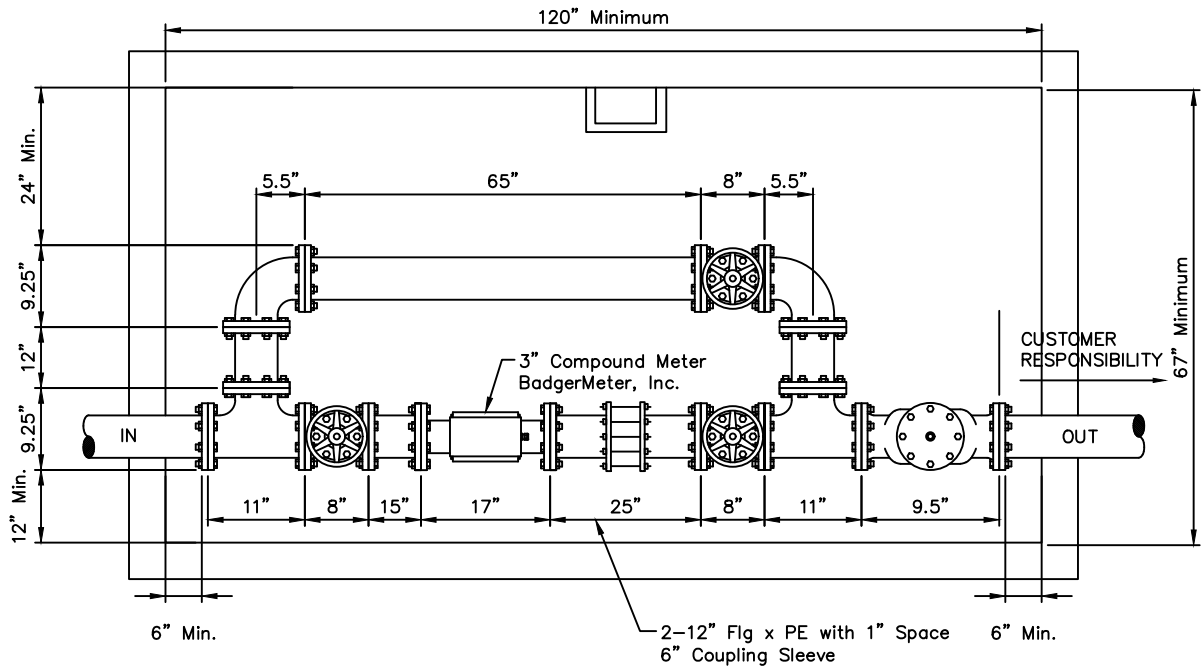
**Wentzville** Missouri  
The Crossroads of the Nation

PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

## STANDARD METER BOX 3" THRU 8" SERVICE

Approved: W.E.B.  
Date: Oct. 13, 2009

**503.03**

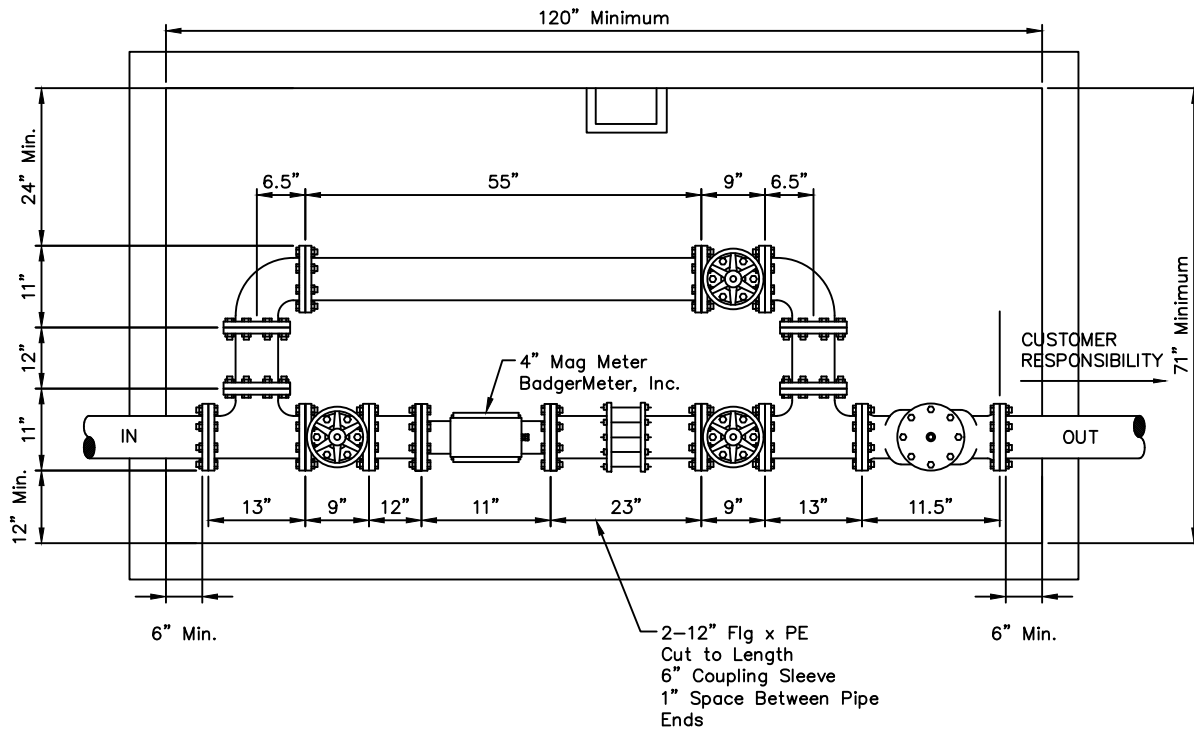


NOTES:

1. DO NOT SCALE DRAWING. USE DIMENSIONS.
2. SHOP DRAWINGS OF THE VAULT, INTERNAL PIPING, AND EXTERNAL DRAINAGE SHALL BE PROVIDED TO THE CITY OF WENTZVILLE ENGINEERING DIVISION FOR APPROVAL.
3. METER TO BE ORDERED FROM THE CITY OF WENTZVILLE WATER DEPARTMENT. CONTACT THE WATER DEPARTMENT FOR ORDERING LEAD TIME AT 636-327-5102.
4. ALL PIPING AND VALVES IN METER VAULT TO BE FLANGED CONNECTIONS (NO FLANGE ADAPTERS). ANY LENGTH ADJUSTMENTS NECESSARY SHALL BE MADE BY CUTTING THE FLG X PE PIECES FOR THE COUPLING SLEEVE TO THE REQUIRED LENGTH.
5. PIPING SHALL BE DUCTILE IRON PIPE CLASS 53 (MINIMUM).
6. THIS DRAWING REPRESENTS THE INTERNAL PIPING LAYOUT THAT IS ACCEPTABLE TO THE CITY OF WENTZVILLE. ALTERNATE PIPE LENGTHS MAY BE ACCEPTABLE.

**3" Service - Piping Parts List**

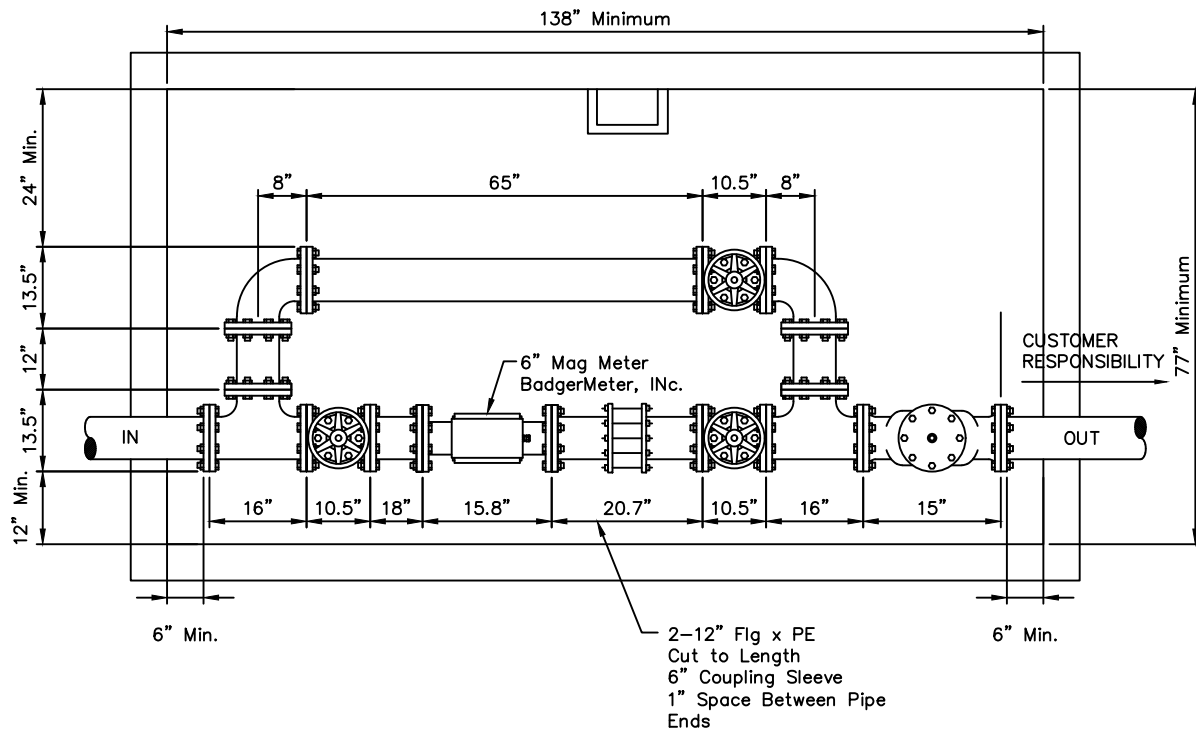
Item	Description	Count
4' FLG X PE	Transition Piping	2
12" FLG X PE	Coupling Sleeve Piping	2
12" FLG X FLG		2
15" FLG X FLG		1
65" FLG X FLG	Bypass Pipe	1
Tee		2
Bend, 90 deg		2
Gate Valve		3
Check Valve	Val-Matic Swing-Flex Series #500 or approved equal	1
6" Coupling Sleeve	JCM 210 Coupling or approved equal	1
Compound Meter	From Water Dept.	1



#### NOTES:

1. DO NOT SCALE DRAWING. USE DIMENSIONS.
2. SHOP DRAWINGS OF THE VAULT, INTERNAL PIPING, AND EXTERNAL DRAINAGE SHALL BE PROVIDED TO THE CITY OF WENTZVILLE ENGINEERING DIVISION FOR APPROVAL.
3. METER TO BE ORDERED FROM THE CITY OF WENTZVILLE WATER DEPARTMENT. CONTACT THE WATER DEPARTMENT FOR ORDERING LEAD TIME AT 636-327-5102.
4. ALL PIPING AND VALVES IN METER VAULT TO BE FLANGED CONNECTIONS (NO FLANGE ADAPTERS). ANY LENGTH ADJUSTMENTS NECESSARY SHALL BE MADE BY CUTTING THE FLGXPE PIECES FOR THE COUPLING SLEEVE TO THE REQUIRED LENGTH.
5. PIPING SHALL BE DUCTILE IRON PIPE CLASS 53 (MINIMUM).
6. ELECTRIC PANEL (SCD 503.04) IS REQUIRED.
7. SUMP PUMP IS REQUIRED.
8. THIS DRAWING REPRESENTS THE INTERNAL PIPING LAYOUT THAT IS ACCEPTABLE TO THE CITY OF WENTZVILLE. ALTERNATE PIPE LENGTHS MAY BE ACCEPTABLE.

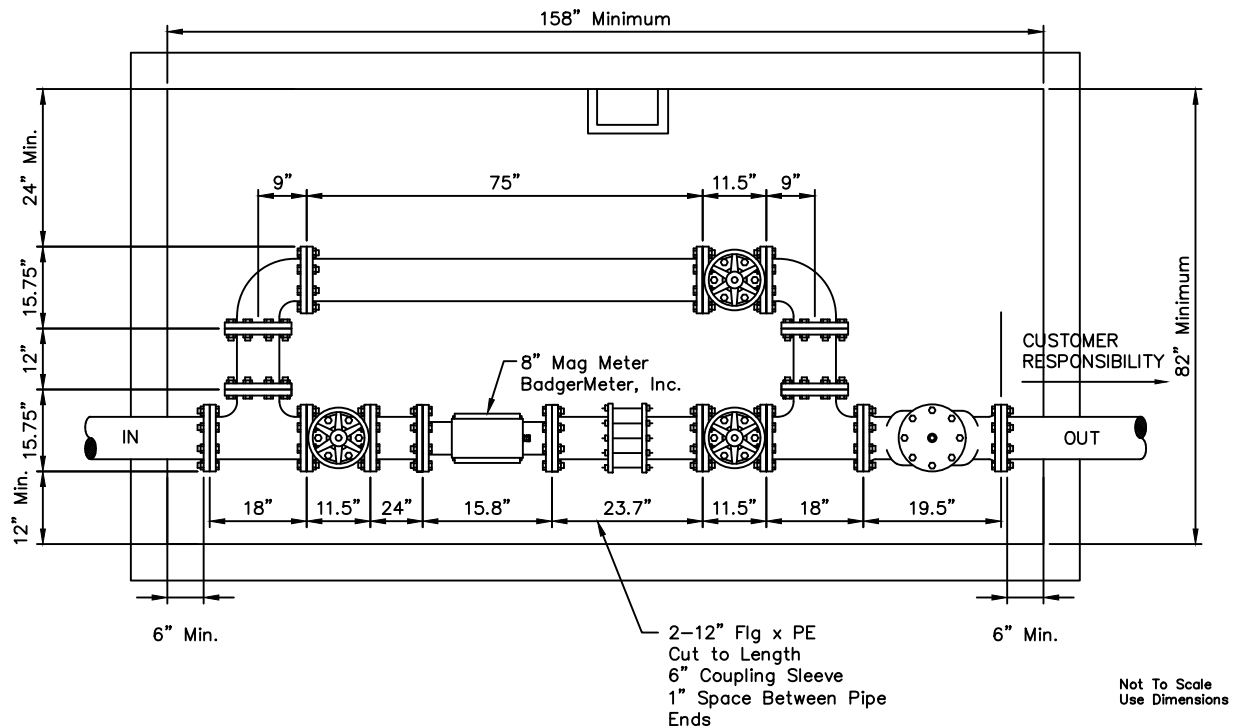
4" Service - Piping Parts List		
Item	Description	Count
4' FLG X PE	Transition Piping	2
12" FLG X PE	Coupling Sleeve Piping	2
12" FLG X FLG		3
55" FLG X FLG	Bypass Pipe	1
Tee		2
Bend, 90 deg		2
Gate Valve		3
Check Valve	Val-Matic Swing-Flex Series #500 or approved equal	1
6" Coupling Sleeve	JCM 210 Coupling or approved equal	1
Mag Meter	From Water Dept.	1



**NOTES:**

1. DO NOT SCALE DRAWING. USE DIMENSIONS.
2. SHOP DRAWINGS OF THE VAULT, INTERNAL PIPING, AND EXTERNAL DRAINAGE SHALL BE PROVIDED TO THE CITY OF WENTZVILLE ENGINEERING DIVISION FOR APPROVAL.
3. METER TO BE ORDERED FROM THE CITY OF WENTZVILLE WATER DEPARTMENT. CONTACT THE WATER DEPARTMENT FOR ORDERING LEAD TIME AT 636-327-5102.
4. ALL PIPING AND VALVES IN METER VAULT TO BE FLANGED CONNECTIONS (NO FLANGE ADAPTERS). ANY LENGTH ADJUSTMENTS NECESSARY SHALL BE MADE BY CUTTING THE FLGXPE PIECES FOR THE COUPLING SLEEVE TO THE REQUIRED LENGTH.
5. PIPING SHALL BE DUCTILE IRON PIPE CLASS 53 (MINIMUM).
6. ELECTRIC PANEL (SCD 503.04) IS REQUIRED.
7. SUMP PUMP IS REQUIRED.
8. THIS DRAWING REPRESENTS THE INTERNAL PIPING LAYOUT THAT IS ACCEPTABLE TO THE CITY OF WENTZVILLE. ALTERNATE PIPE LENGTHS MAY BE ACCEPTABLE.

6" Service - Piping Parts List		
Item	Description	Count
4' FLG X PE	Transition Piping	2
12" FLG X PE	Coupling Sleeve Piping	2
12" FLG X FLG		2
18" FLG X FLG		1
65" FLG X FLG	Bypass Pipe	1
Tee		2
Bend, 90 deg		2
Gate Valve		3
Check Valve	Val-Matic Swing-Flex Series #500 or approved equal	1
6" Coupling Sleeve	JCM 210 Coupling or approved equal	1
Mag Meter	From Water Dept.	1

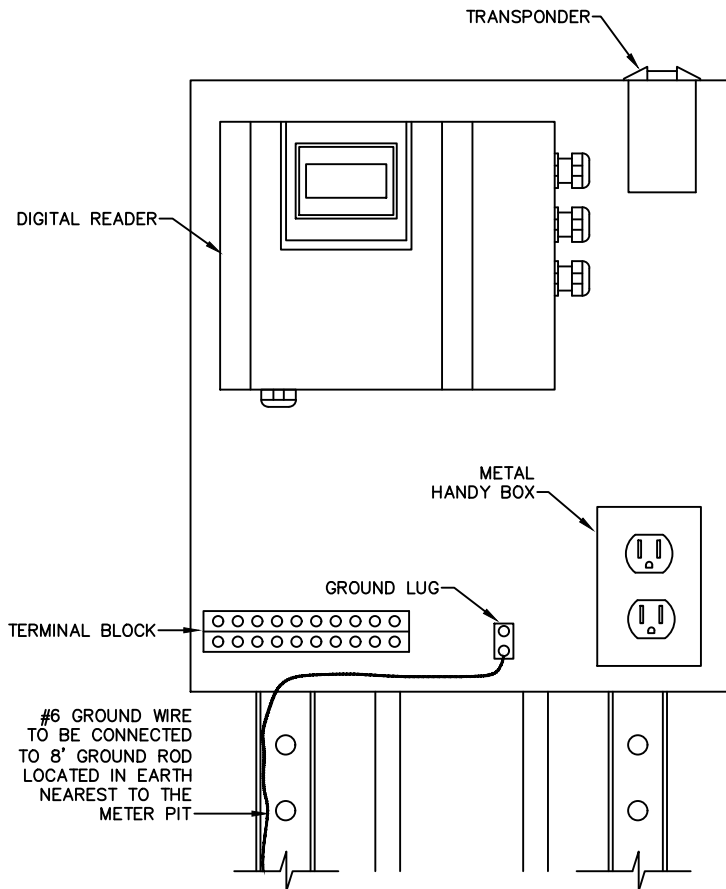


#### NOTES:

- DO NOT SCALE DRAWING. USE DIMENSIONS.
- SHOP DRAWINGS OF THE VAULT, INTERNAL PIPING, AND EXTERNAL DRAINAGE SHALL BE PROVIDED TO THE CITY OF WENTZVILLE ENGINEERING DIVISION FOR APPROVAL.
- METER TO BE ORDERED FROM THE CITY OF WENTZVILLE WATER DEPARTMENT. CONTACT THE WATER DEPARTMENT FOR ORDERING LEAD TIME AT 636-327-5102.
- ALL PIPING AND VALVES IN METER VAULT TO BE FLANGED CONNECTIONS (NO FLANGE ADAPTERS). ANY LENGTH ADJUSTMENTS NECESSARY SHALL BE MADE BY CUTTING THE FLGXPE PIECES FOR THE COUPLING SLEEVE TO THE REQUIRED LENGTH.
- PIPING SHALL BE DUCTILE IRON PIPE CLASS 53 (MINIMUM).
- ELECTRIC PANEL (SCD 503.04) IS REQUIRED.
- SUMP PUMP IS REQUIRED.
- THIS DRAWING REPRESENTS THE INTERNAL PIPING LAYOUT THAT IS ACCEPTABLE TO THE CITY OF WENTZVILLE. ALTERNATE PIPE LENGTHS MAY BE ACCEPTABLE.

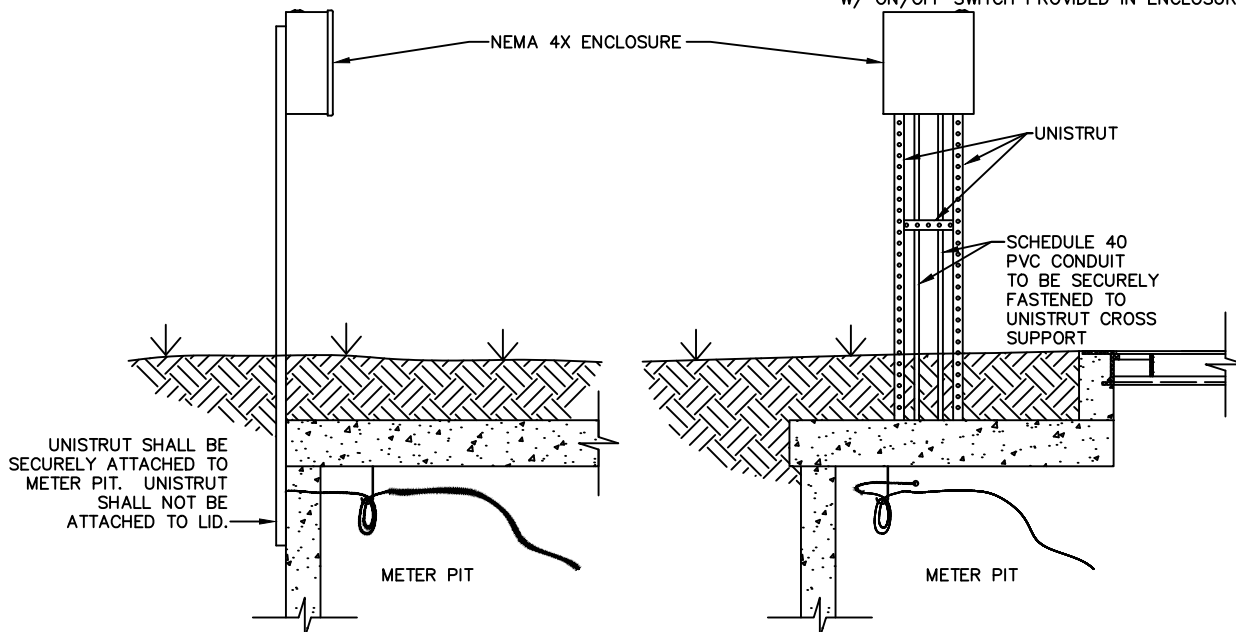
#### 8" Service - Piping Parts List

Item	Description	Count
4' FLG X PE	Transition Piping	2
12" FLG X PE	Coupling Sleeve Piping	2
12" FLG X FLG		2
24" FLG X FLG		1
75" FLG X FLG		1
Tee		2
Bend, 90 deg		2
Gate Valve		3
Check Valve	Val-Matic Swing-Flex Series #500 or approved equal	1
6" Coupling Sleeve	JCM 210 Coupling or approved equal	1
Mag. Meter	From Water Dept.	1

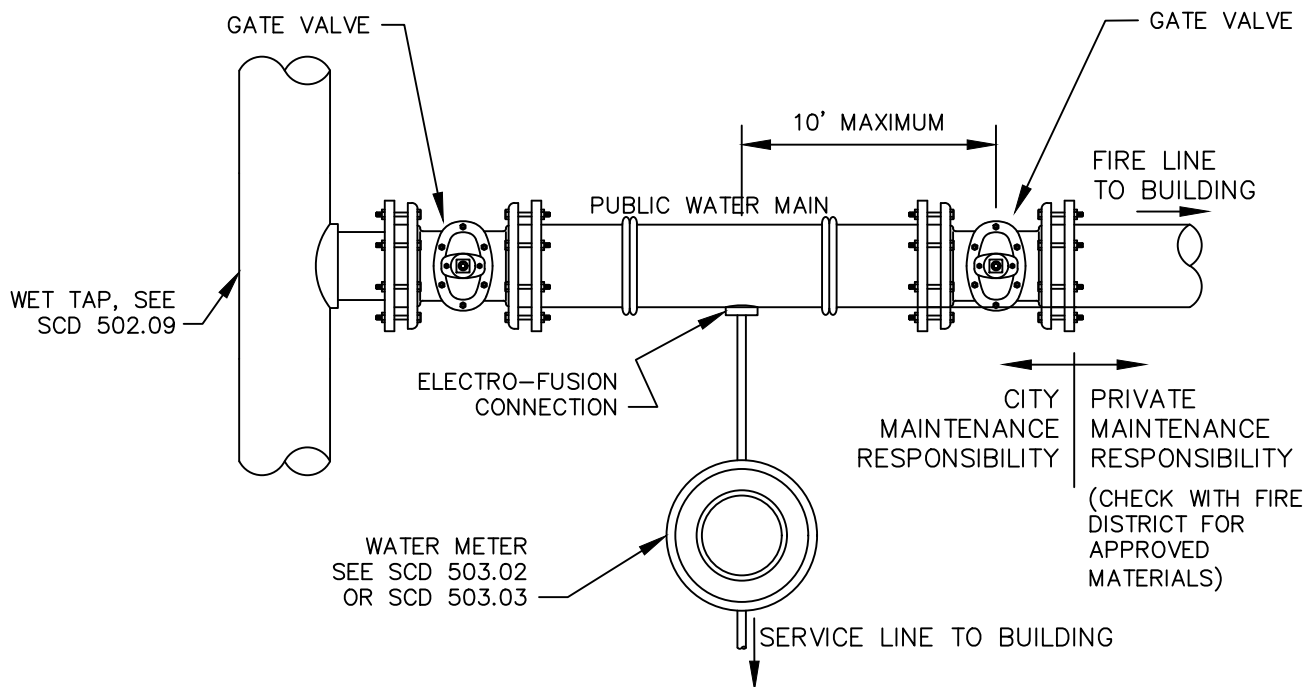


**NOTES:**

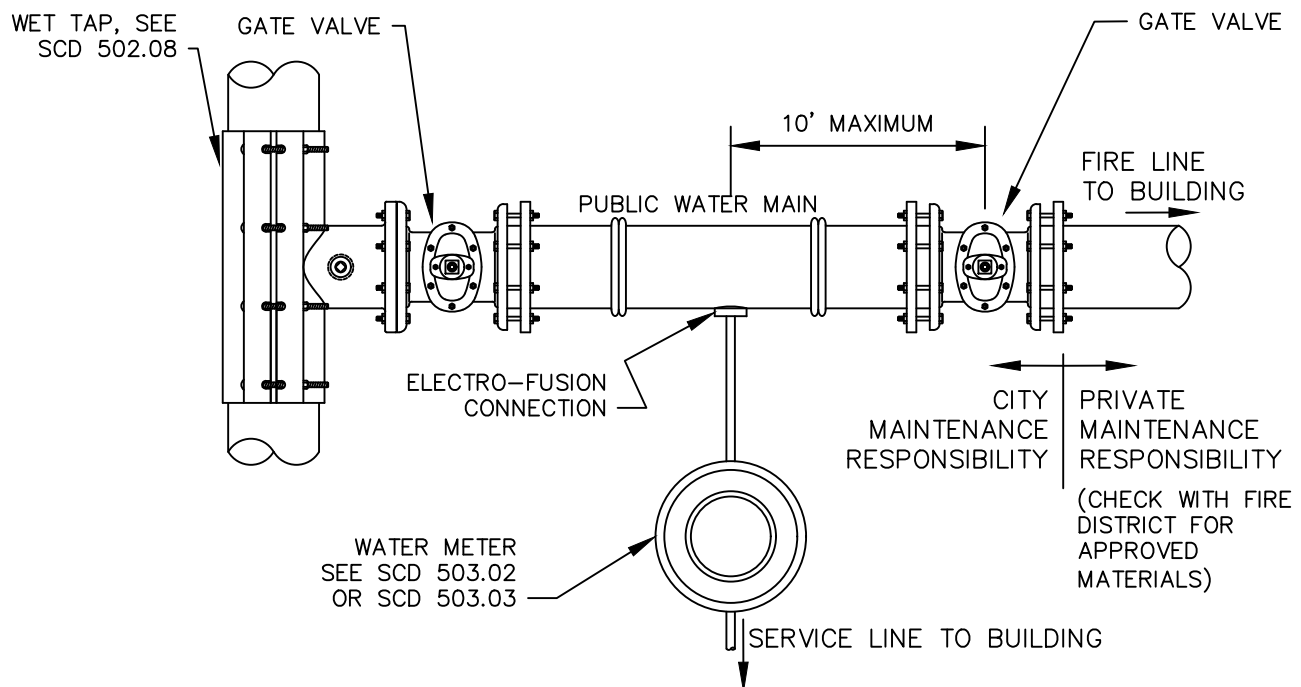
1. DO NOT SCALE DRAWING.
2. TRANSPONDER AND DIGITAL READER SUPPLIED WITH METER. CONTACT CITY OF WENTZVILLE WATER DEPARTMENT (636-327-5102).
3. ALL PANEL WIRING MUST BE SECURED WITH SELF STICK ZIPTIE TABS.
4. ALL CONDUIT FROM METER PIT TO PANEL SHALL BE SCHEDULE 40 PVC.
5. A #6 GROUND WIRE SHALL BE PROVIDED.
6. METAL HANDY BOX SHALL BE SINGLE GANG WITH 120 V DUPLEX RECEPTACLE (GFI).
7. PANEL MAY BE ATTACHED TO A STRUCTURE NEAR THE METER PIT WITH APPROVAL OF THE CITY OF WENTZVILLE ENGINEERING DEPARTMENT.
8. UNISTRUT SHALL BE GALVANIZED WITH ALL STAINLESS STEEL HARDWARE.
9. ENCLOSURE SHALL BE NEMA 4X STAINLESS STEEL LATCHING ENCLOSURE WITH INTERIOR PANEL.
10. METER DIGITAL READER AND TRANSPONDER SHALL BE INSTALLED ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
11. SHOULD SUMP PUMP BE REQUIRED SEPARATE 120 VOLT CIRCUIT SHALL BE PROVIDED W/ ON/OFF SWITCH PROVIDED IN ENCLOSURE.







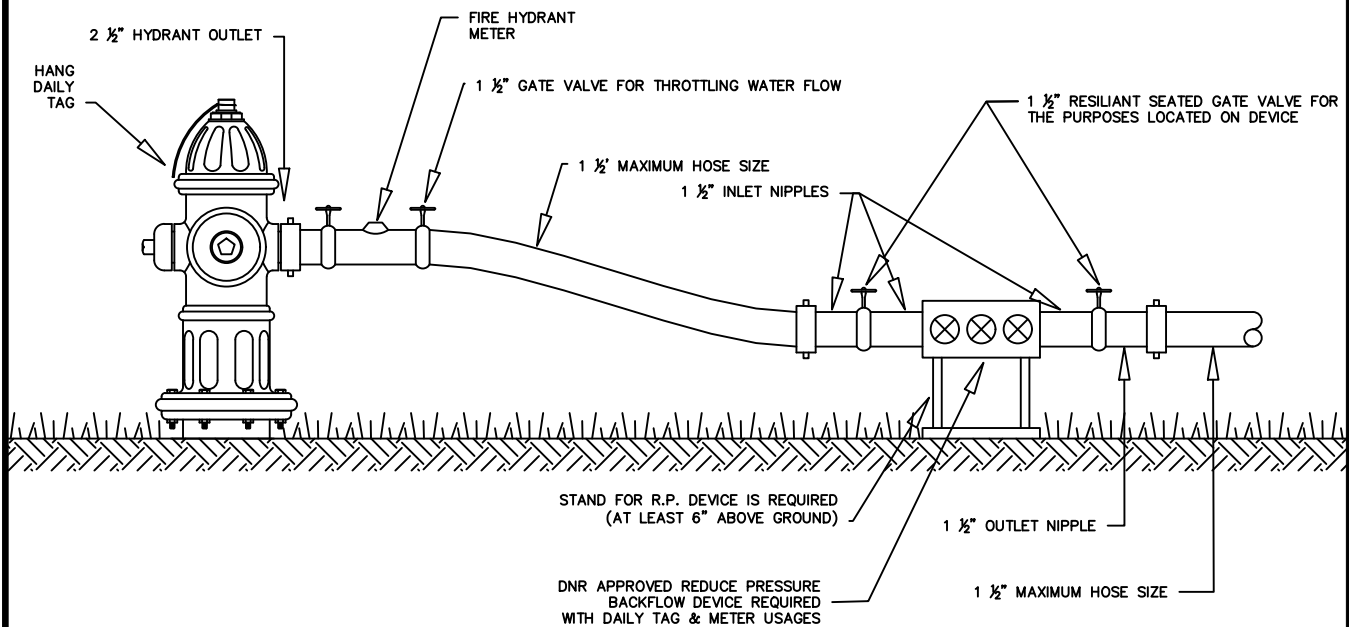
### FIRE LINE OFF OF POLYETHYLENE MAIN



### FIRE LINE OFF OF PVC MAIN

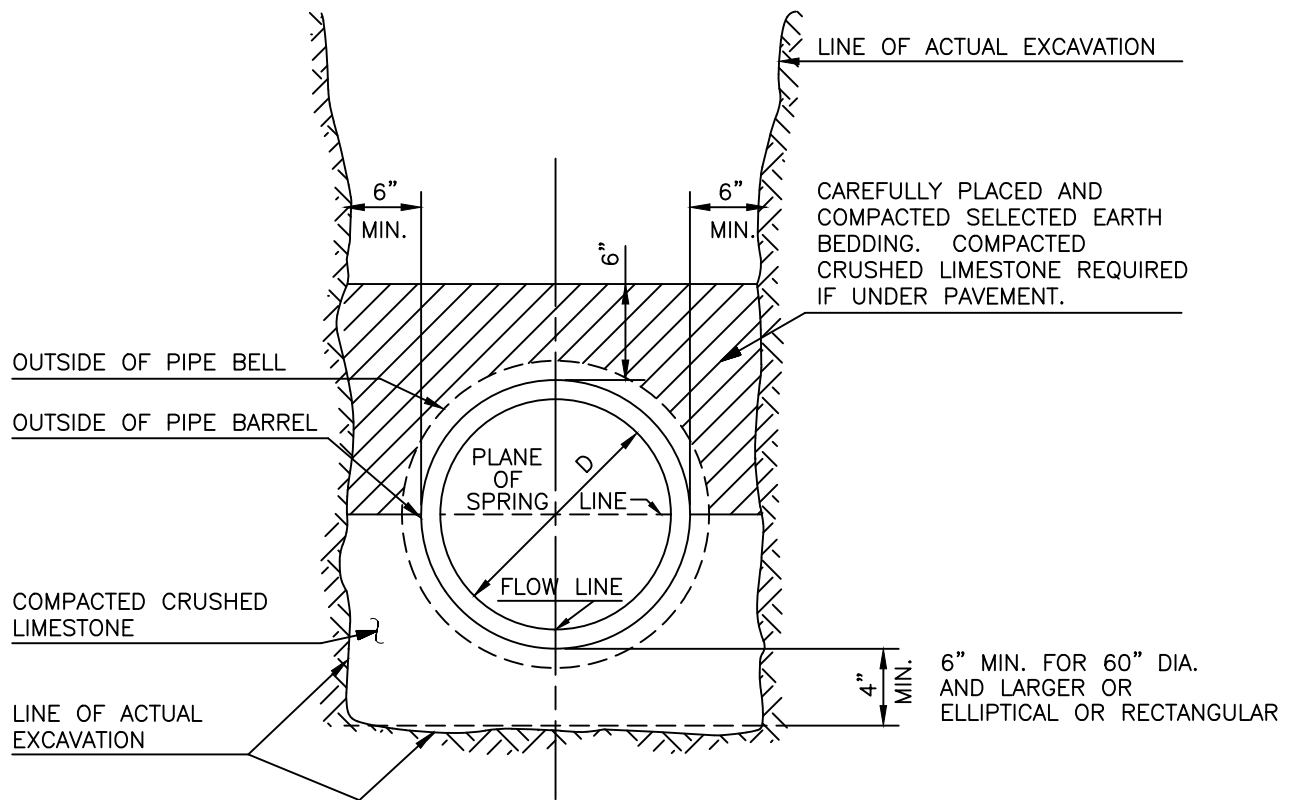
NOTE: MINIMUM PUBLIC WATER MAIN EXTENSION SHALL BE 6" HDPE. IF WATER SERVICE IS TO BE 2" OR LARGER OR IF THERE WILL BE A FIRE HYDRANT ON MAIN, MINIMUM MAIN EXTENSION SIZE SHALL BE 8".

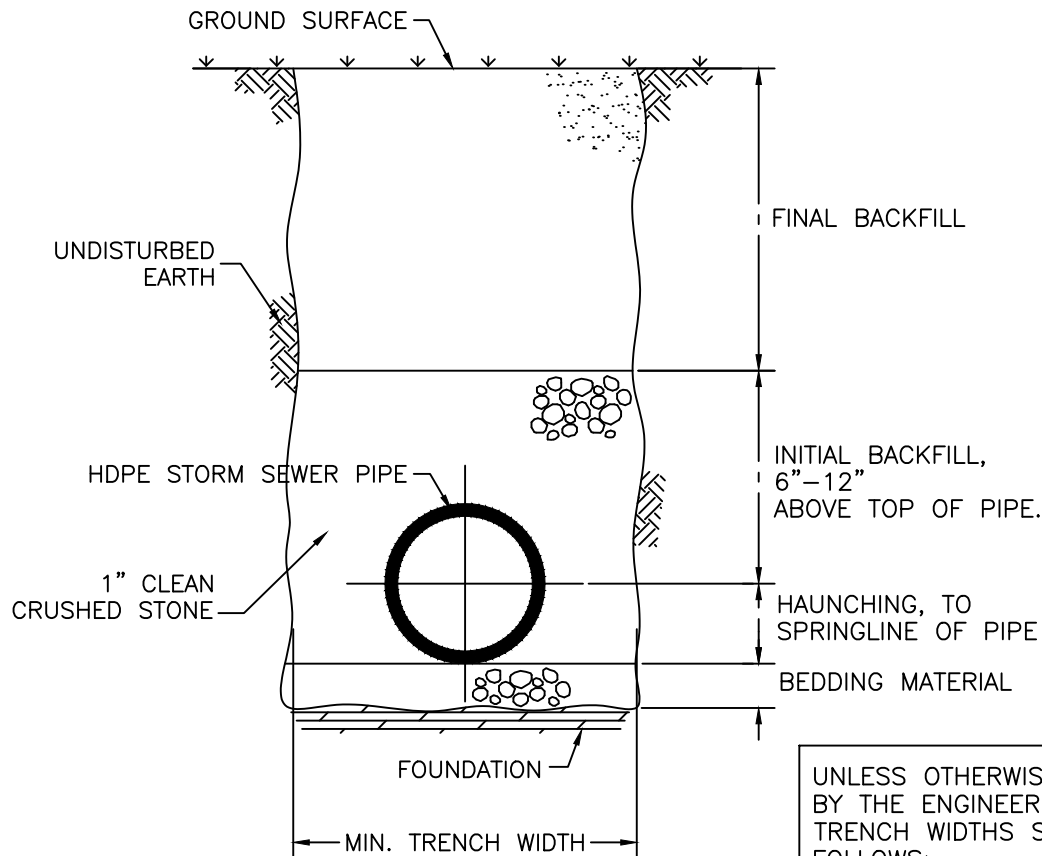




NOTES:

1. THE USE OF A HYDRANT IS CONTINGENT UPON THE FILING OF THE BACKFLOW PERMIT/REGISTRATION FORM AND THE SUBMITTAL OF EITHER A ONE-DAY HYDRANT TAP PERMIT OR HYDRANT METER PERMIT WITH THE CITY OF WENTZVILLE, PUBLIC WORKS. THE CERTIFICATION NUMBER OF THE BACKFLOW PREVENTER TO BE USED MUST BE INCLUDED ON THE BACKFLOW PERMIT/REGISTRATION.
2. ONLY ONE 2-1/2" OUTLET MAY BE USED FOR JETTING PER HYDRANT (SEE DRAWING ABOVE).
3. WHEN OPERATING THE HYDRANT MUST BE FULLY OPEN AND THE FLOW CONTROLLED BY USING THE 1 1/2" THROTTLING GATE VALVE. HYDRANT MUST BE OPENED AND CLOSED SLOWLY.
4. HYDRANT CAPS AND CONTROL NUT TO BE OPERATED ONLY BY A STANDARD HYDRANT WRENCH. ANY DAMAGE TO THE HYDRANT WILL RESULT IN THE USER BEING BILLED FOR DAMAGES AND REPAIR.
5. USE OF HYDRANT WITHOUT PROPER CONNECTIONS SHOWN ABOVE WILL RESULT IN REVOCATION OF THE HYDRANT USE PERMIT.





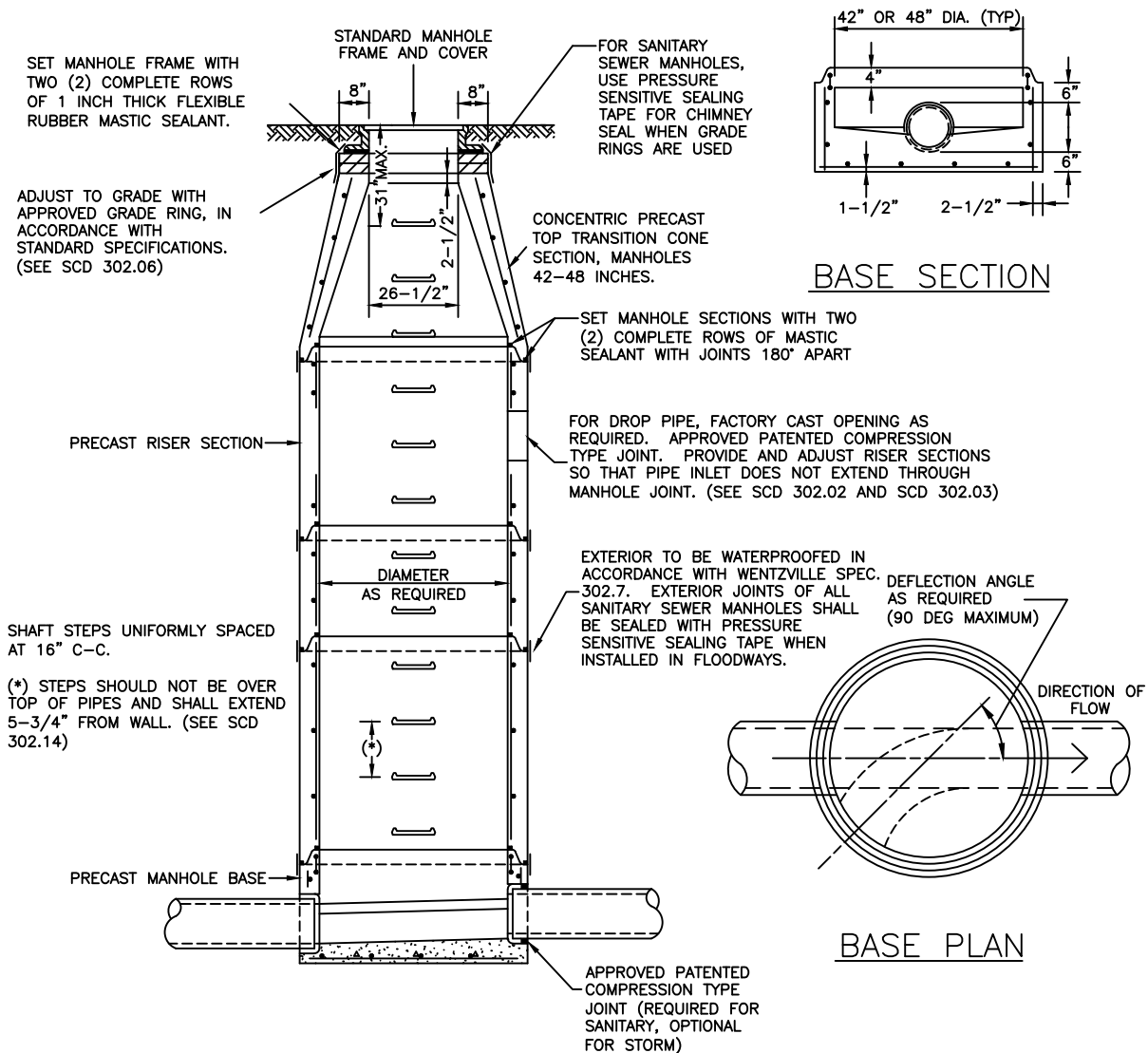
**TYPICAL TRENCH CROSS-SECTION**  
(N.T.S.)

UNLESS OTHERWISE SPECIFIED  
BY THE ENGINEER MINIMUM  
TRENCH WIDTHS SHALL BE AS  
FOLLOWS:

NOMINAL $\phi$ in	MIN. RECOMMENDED TRENCH WIDTH, in
12	31
15	34
18	39
24	48
30	66
36	78
42	83
48	89

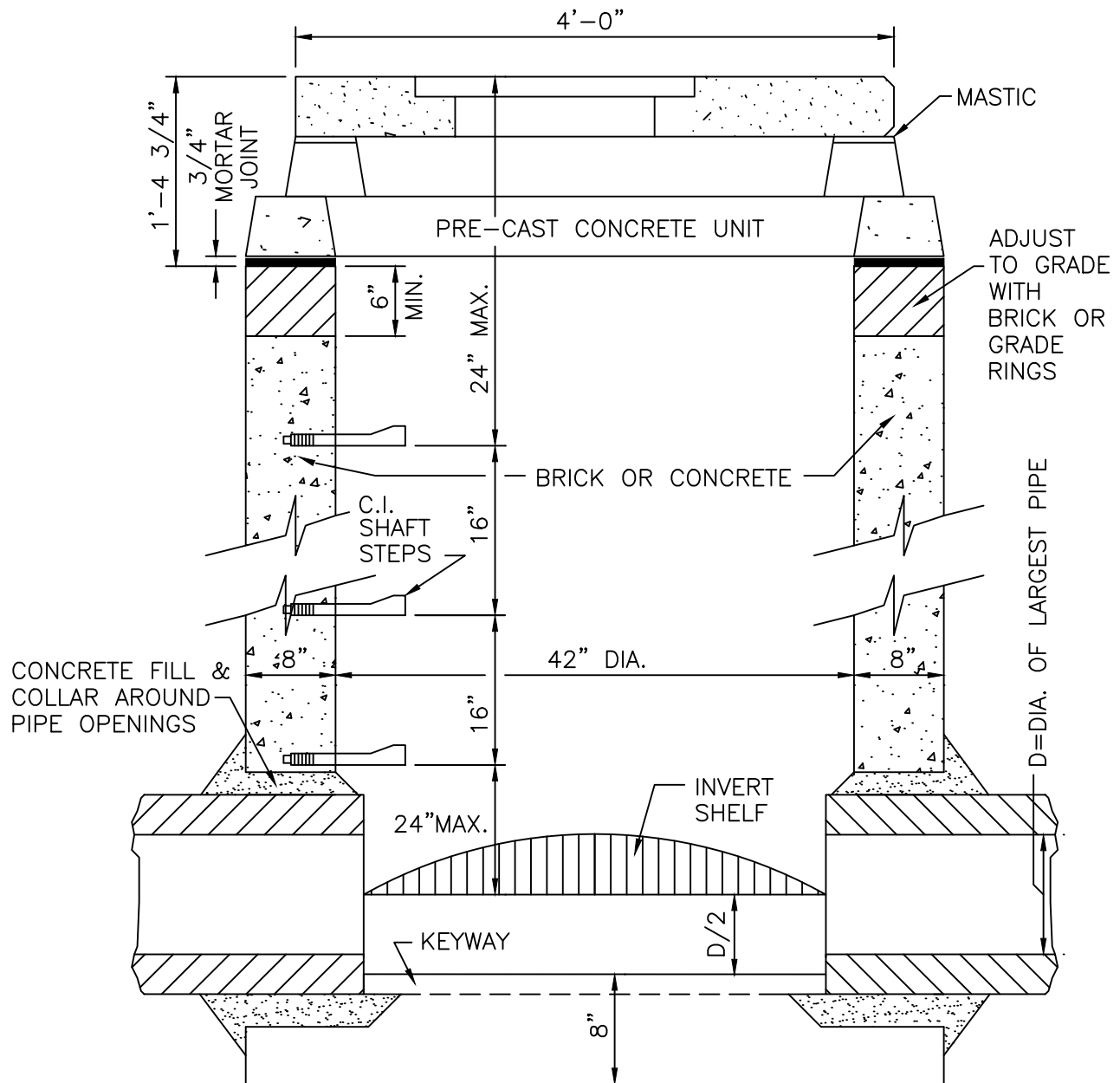
**NOTES:**

1. **FOUNDATION:** WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER OR INSPECTOR AND REPLACE WITH A FOUNDATION OF CLASS 1 OR CLASS 2 MATERIAL AS DEFINED IN ASTM D2321, "STANDARD PRACTICE FOR INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY-FLOW APPLICATIONS," LATEST EDITION; AS AN ALTERNATIVE AND AT THE DISCRETION OF THE ENGINEER OR INSPECTOR, THE TRENCH BOTTOM MAY BE STABILIZED USING A WOVEN GEOTEXTILE FABRIC.
2. **BEDDING, HAUNCHING, AND INITIAL BACKFILL:** SUITABLE MATERIAL SHALL BE 1" CLEAN, CLASS 1 CRUSHED LIMESTONE, INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION. MINIMUM BEDDING THICKNESS SHALL BE 4" FOR 4" TO 48" DIAMETER HDPE.

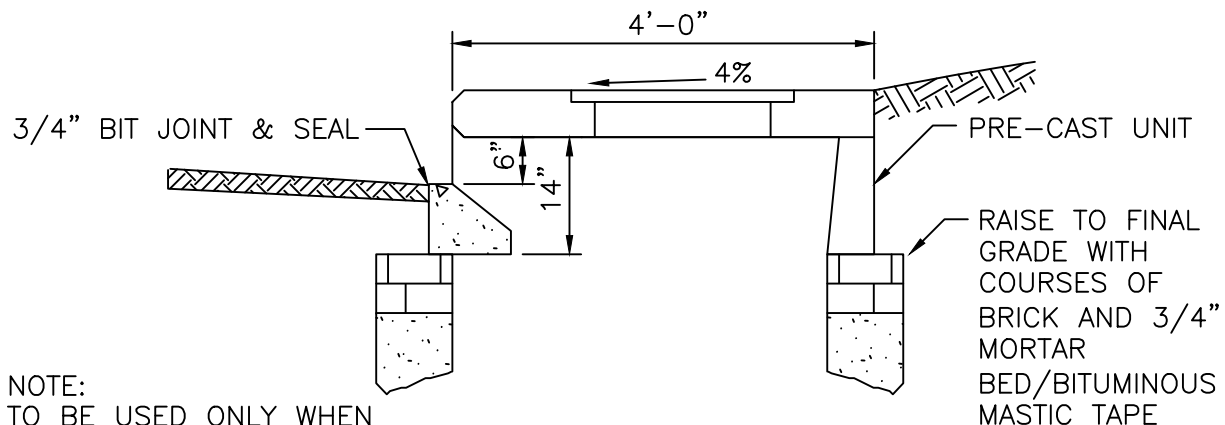
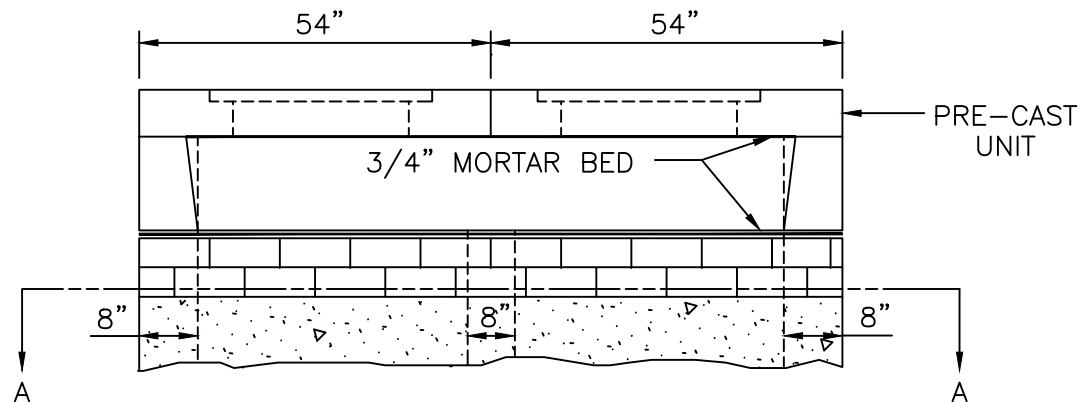
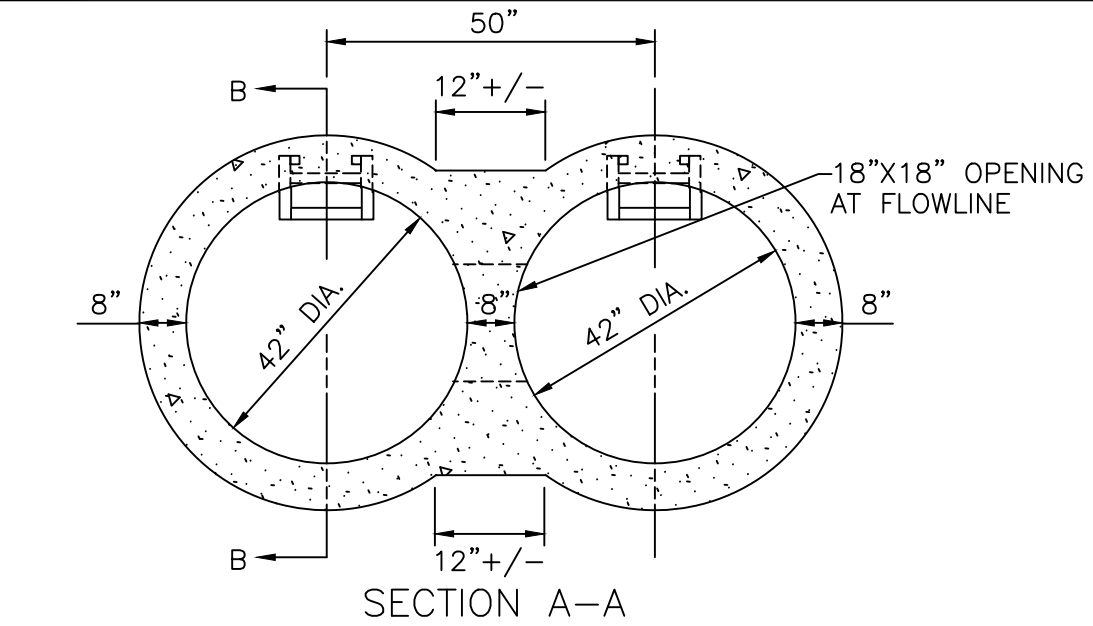


NOTES:

1. THE MINIMUM INSIDE DIAMETER FOR THE BASE AND RISER SECTIONS SHALL BE 42 INCHES FOR 8 INCH DIAMETER SEWERS. THE MINIMUM INSIDE DIAMETER FOR SEWERS LARGER THAN 8 INCH DIAMETER IS 48 INCHES. MANHOLE SHALL MEET ASTM C-478 REQUIREMENTS.
2. FLOWLINE ELEVATION OF INCOMING PIPES SHALL BE 0.2 FEET HIGHER THAN THAT OF OUTGOING PIPE (SANITARY SEWER ONLY).
3. PIPE SIZES 24 INCHES IN DIAMETER AND LARGER REQUIRE MANHOLE DIAMETERS OF 60 INCH MINIMUM AND MAY REQUIRE, 72 INCH, OR 96 INCH AS DETERMINED BY OUTSIDE DIAMETERS AND ORIENTATIONS OF CONNECTING PIPES.
4. ECCENTRIC CONES SHALL BE USED ON DIAMETERS 60 INCH AND LARGER. STEPS SHALL EXTEND DOWN VERTICAL WALL OF CONE.
5. PRIOR TO FABRICATION, SHOP DRAWINGS SHALL BE SUBMITTED TO THE CITY FOR APPROVAL OF MANHOLES ON PIPE DIAMETERS LARGER THAN 24 INCH AND ALSO FOR THOSE STRUCTURES WITH A DROP PIPE CONNECTION.
6. REINFORCEMENT IS REQUIRED IN ALL SECTIONS PER ASTM C 478M-06b
7. BRICK IS NOT ALLOWED IN SANITARY SEWER MANHOLES.



NOTE: SEE SCD 302.04 FOR MANHOLE GASKET DETAIL. WHEN OPENINGS FOR PIPE ARE BOXED OUT, SPACE BETWEEN PIPE AND WALL TO BE COMPLETELY GROUTED WITH NON SHRINK GROUT.



NOTE:  
TO BE USED ONLY WHEN  
PRE-CAST TOP SECTION  
IS AVAILABLE.

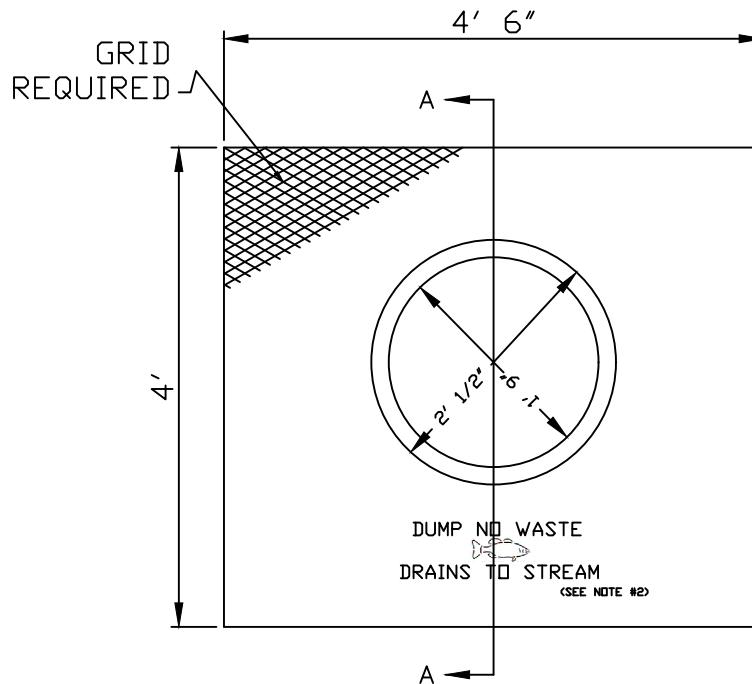
**Wentzville** Missouri  
The Crossroads of the Nation

PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

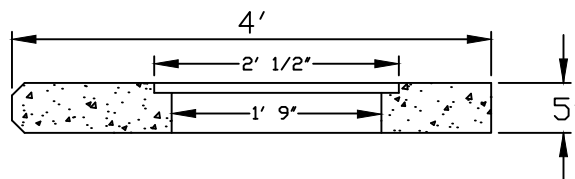
**CAST-IN-PLACE CONCRETE  
DOUBLE STREET INLET  
W/ PRECAST TOP UNIT**

Approved: W.E.B.  
Date: June 10, 2009

**602.03**



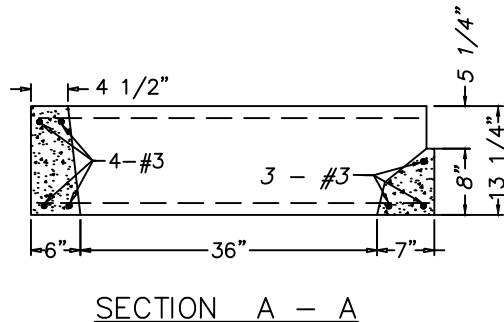
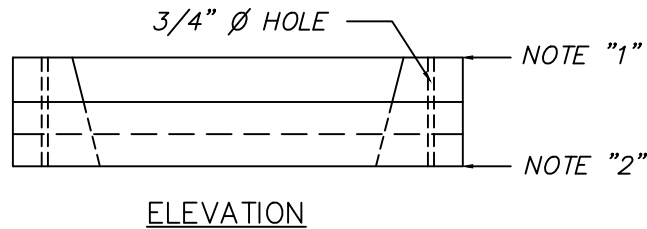
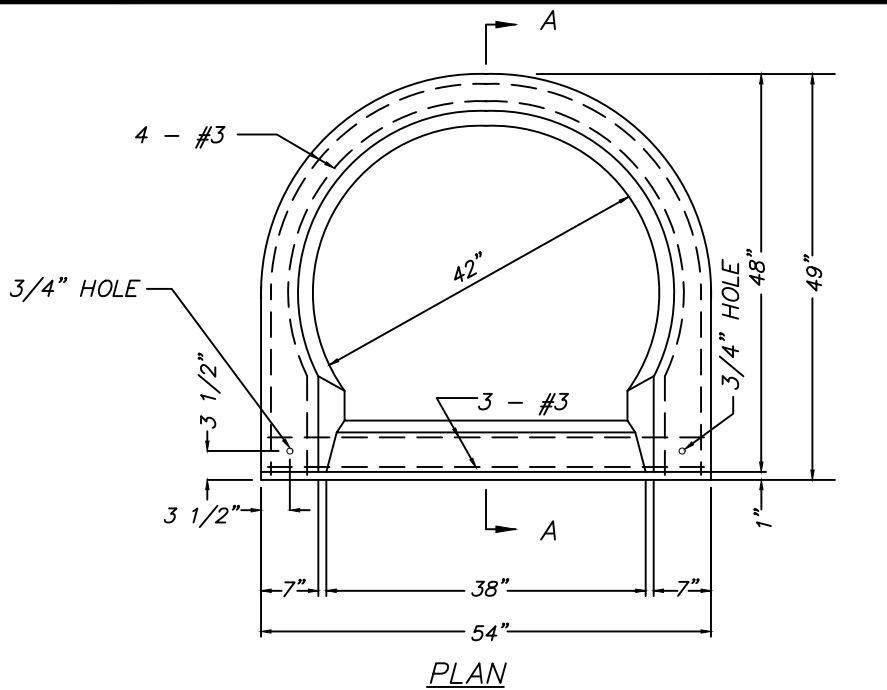
PLAN



SECTION A-A

NOTES:

1. REINFORCING BARS ARE REQUIRED IN ALL INLET STONES.
2. IT IS PREFERRED THAT ALL NEW STONES HAVE "DUMP NO WASTE...DRAINS TO STREAM" STAMPED ON THE INLET. AS AN ALTERNATIVE, 4" DIAMETER OR LARGER CIRCULAR METAL MARKERS THAT ARE 3-D EMBOSSED WITH THE SAME MESSAGE MAY BE INSTALLED WITH MASONRY ADHESIVE, RIVET FASTENERS, OR BOLTED ON THE INLET. METAL MARKERS SHALL BE ALMETEK ITEM SD-15 (MESSAGE AMENDED) OR EQUIVALENT AS APPROVED BY THE CITY OF WENTZVILLE STORMWATER COORDINATOR.



NOTES:

1. SET STANDARD INLET STONE IN 3/4" MORTAR BED AND DOWEL WITH 5/8" DIA. 1'-0" PINS AND GROUT
2. RAISE TO FINAL GRADE WITH COURSES OF BRICK AND 3/4" MORTAR BED/BITUMINOUS MASTIC TAPE.
3. THIS UNIT TO BE USED WITH 42" I.D. POURED IN PLACE CONCRETE OR BRICK BASE.
4. 4000 P.S.I. CONCRETE REQUIRED

**Wentzville** Missouri  
The Crossroads of the Nation

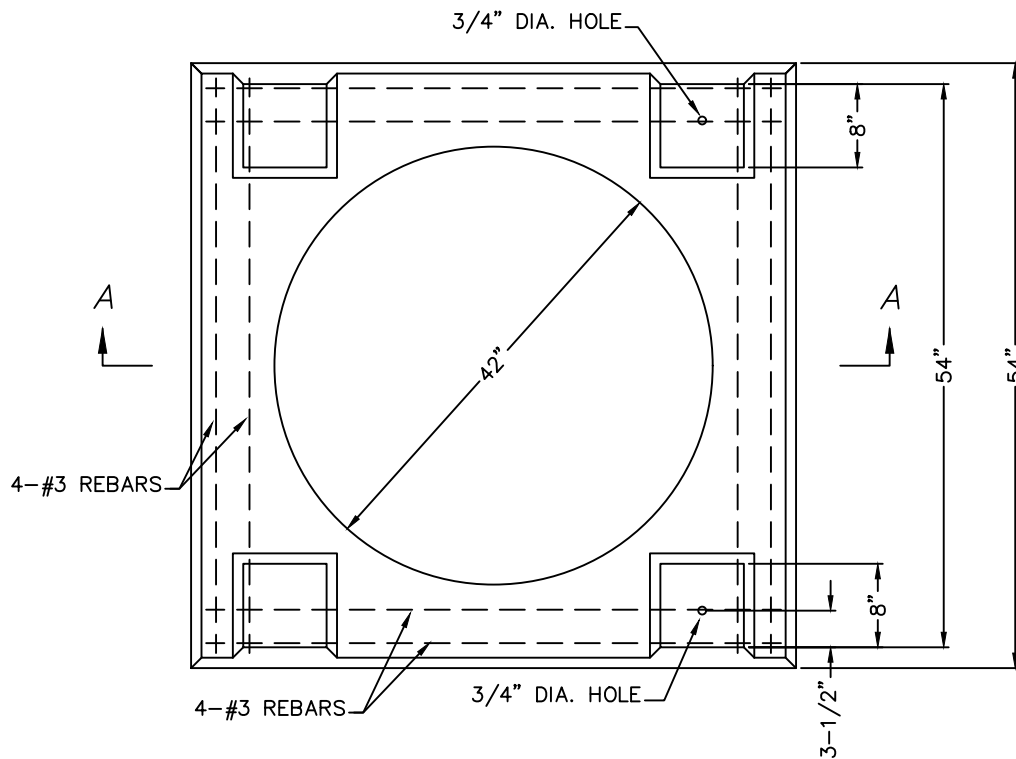
PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

**PRECAST CONCRETE UNIT  
FOR  
SINGLE STREET INLET**

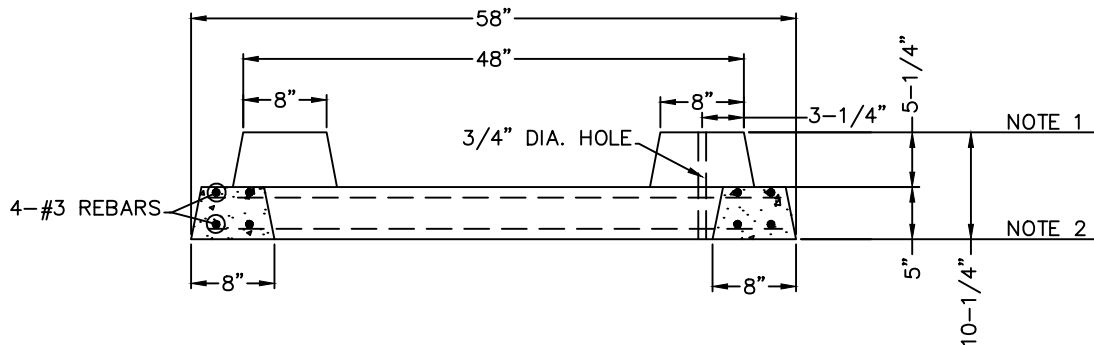
Approved: W.E.B.  
Date: June 10, 2009

**602.10**





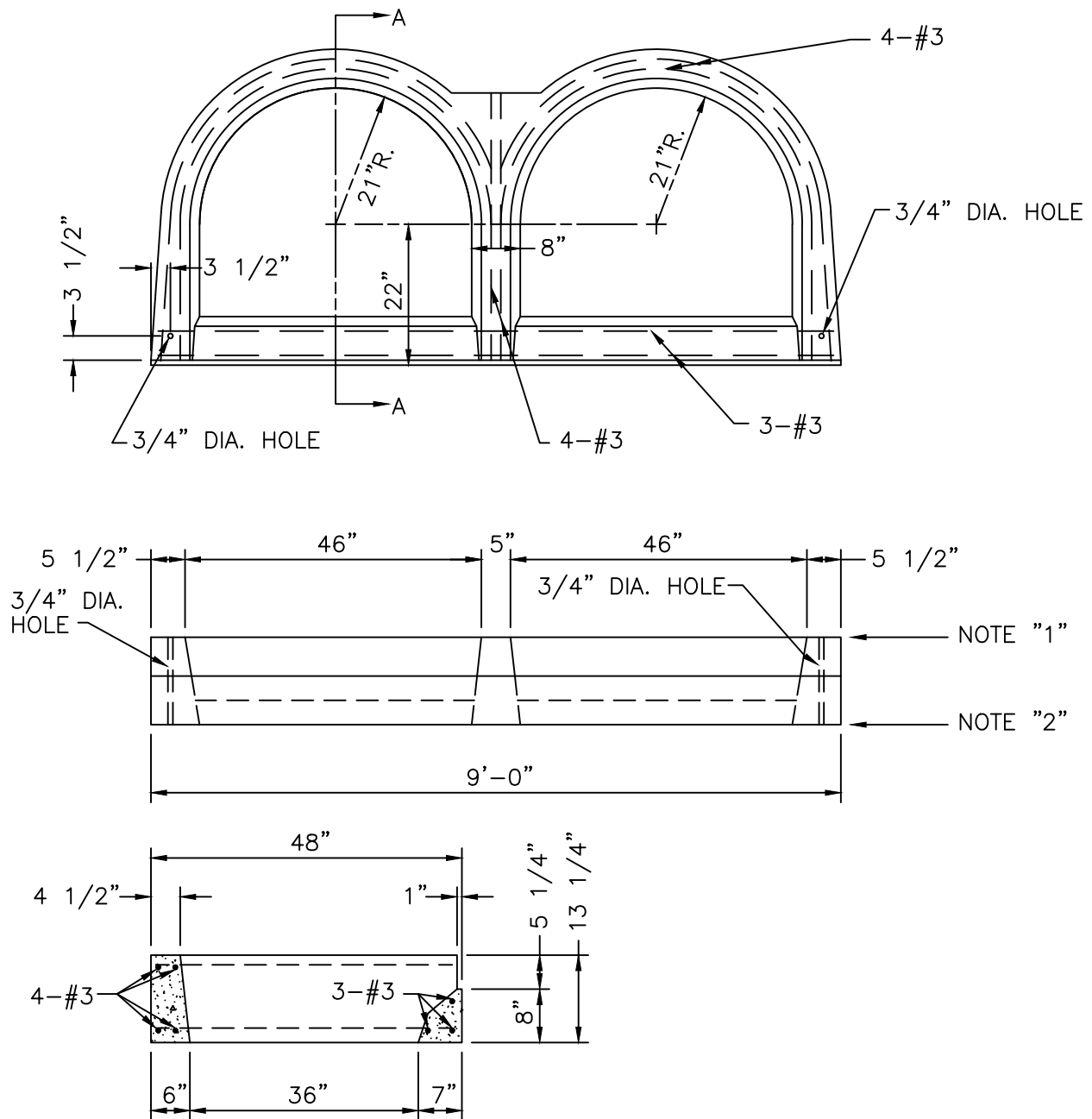
PLAN



SECTION A - A

NOTES:

1. SET STANDARD INLET STONE IN 3/4" MORTAR BED AND DOWEL WITH 5/8" DIA. 1'-0" PINS AND GROUT
2. RAISE TO FINAL GRADE WITH COURSES OF BRICK AND 3/4" MORTAR BED/BITUMINOUS MASTIC TAPE
3. THIS UNIT TO BE USED WITH 42" I.D. POURED IN PLACE CONCRETE OR BRICK BASE.
4. 4000 P.S.I. CONCRETE REQUIRED



SECTION A-A

NOTES:

1. SET 2 STANDARD INLET STONES IN 3/4" MORTAR BED AND DOWEL WITH 5/8" DIA. 1'-0" LONG PINS AND GROUT.
2. RAISE TO FINAL GRADE WITH COURSES OF BRICK OR PRECAST RISER & SET THE UNIT TO BASE WITH 3/4" MORTAR BED/BITUMINOUS MASTIC TAPE.
3. TO BE USED WITH POURED-IN-PLACE CONCRETE BASE.
4. 4000 P.S.I. CONCRETE REQUIRED.

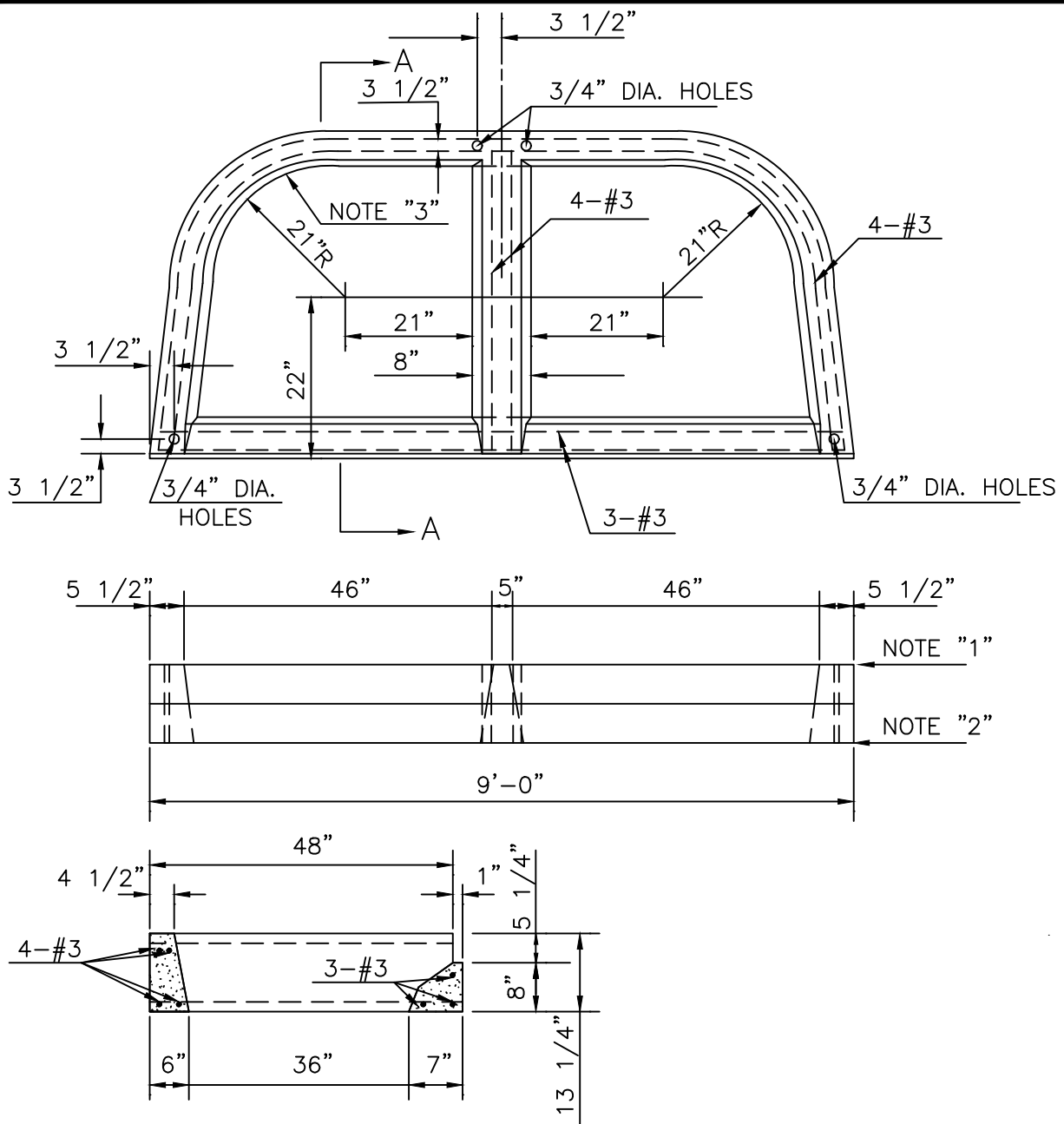
**Wentzville** Missouri  
The Crossroads of the Nation

PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

**PRECAST CONCRETE UNIT "A"**  
**FOR**  
**DOUBLE CURB INLET**

Approved: W.E.B.  
Date: June 10, 2009

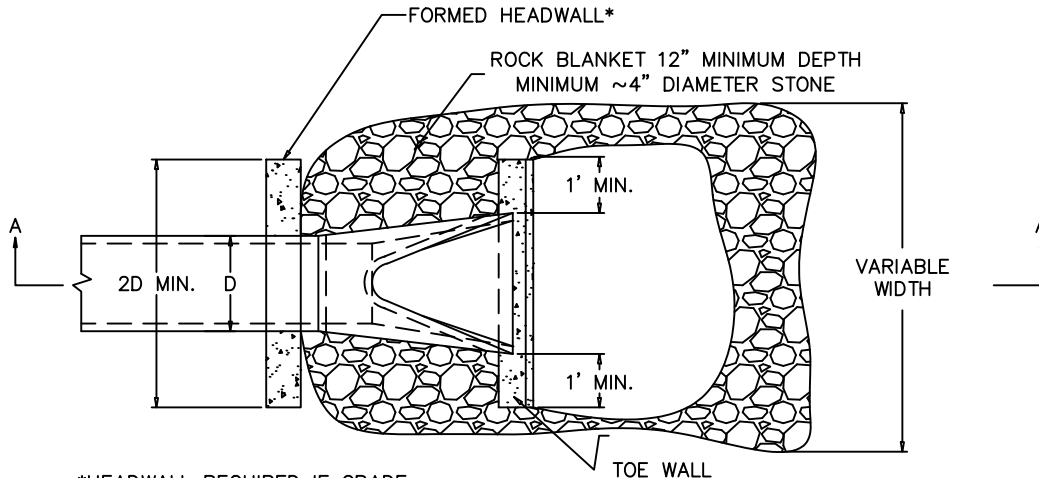
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SECTION A-A

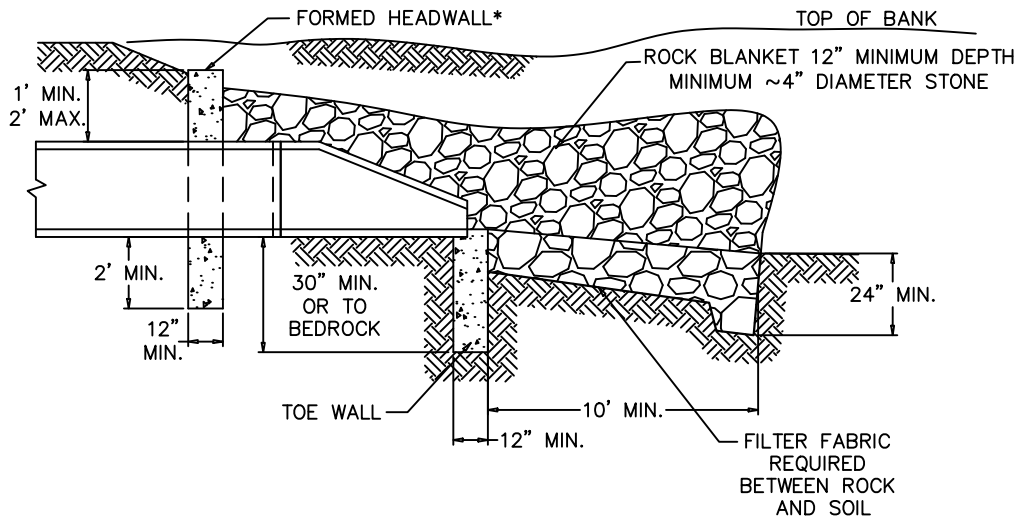
NOTES:

1. SET 2 STANDARD INLET STONES IN 3/4" MORTAR BED AND DOWEL WITH 5/8" DIA. 1'-0" LONG PINS AND GROUT.
2. SET UNIT TO BASE WITH 3/4" MORTAR BED/BITUMINOUS MASTIC TAPE.
3. THIS UNIT TO BE USED WITH A BRICK BASE HAVING 8" THICK WALLS AND INSIDE DIMENSIONS CONFORM TO THE INSIDE DIMENSIONS OF THE UNIT AS INDICATED.
4. 4000 P.S.I. CONCRETE REQUIRED.

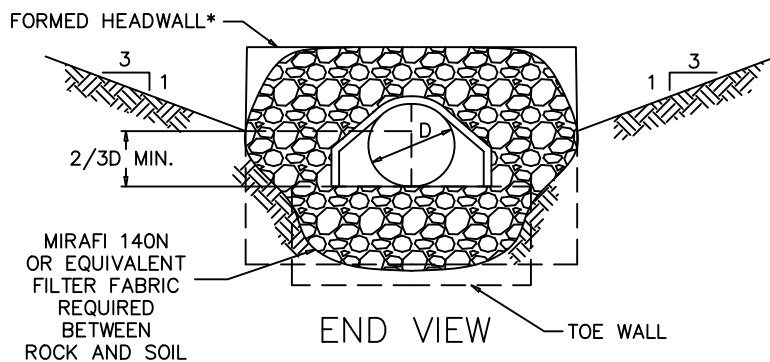


\*HEADWALL REQUIRED IF GRADE IS STEEPER THAN 3H:1V OR AS APPROVED BY INSPECTOR

PLAN VIEW

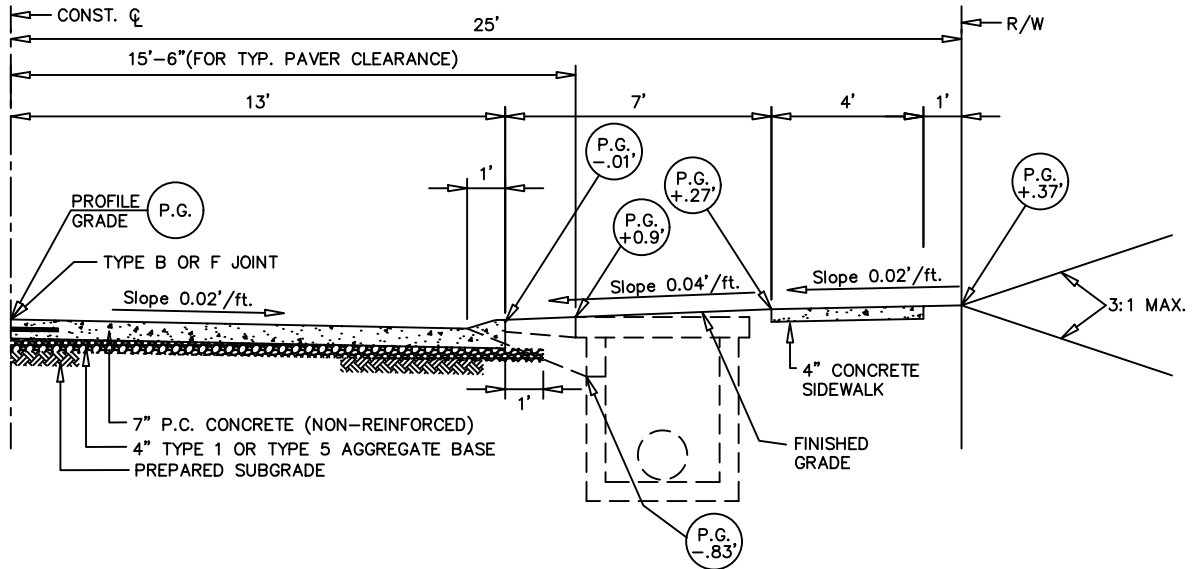


SECTION A-A



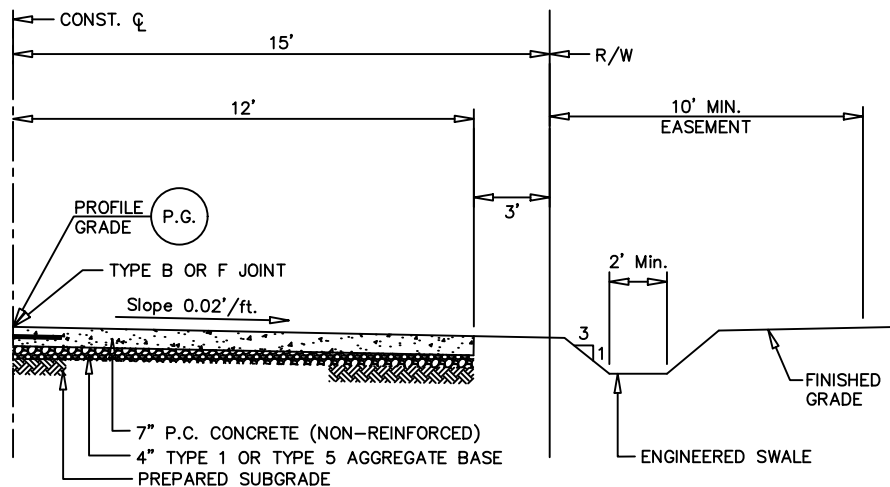
NOTES:

1. TO BE USED AT INTAKE AND DISCHARGE END OF PIPE.
2. GRADE OF ROCK BLANKET TO BE ADJUSTED ACCORDINGLY.
3. ACTUAL ROCK BLANKET DIMENSIONS SHALL BE TAKEN FROM APPROVED IMPROVEMENT PLANS OR ROCK BLANKET SIZING CALCUALTIONS MAY BE REQUIRED.
4. HEAD WALL AND TOE WALL SHALL BE 3500 PSI 6 SACK CONCRETE.
5. FLARED END SECTIONS SHALL BE CONCRETE.



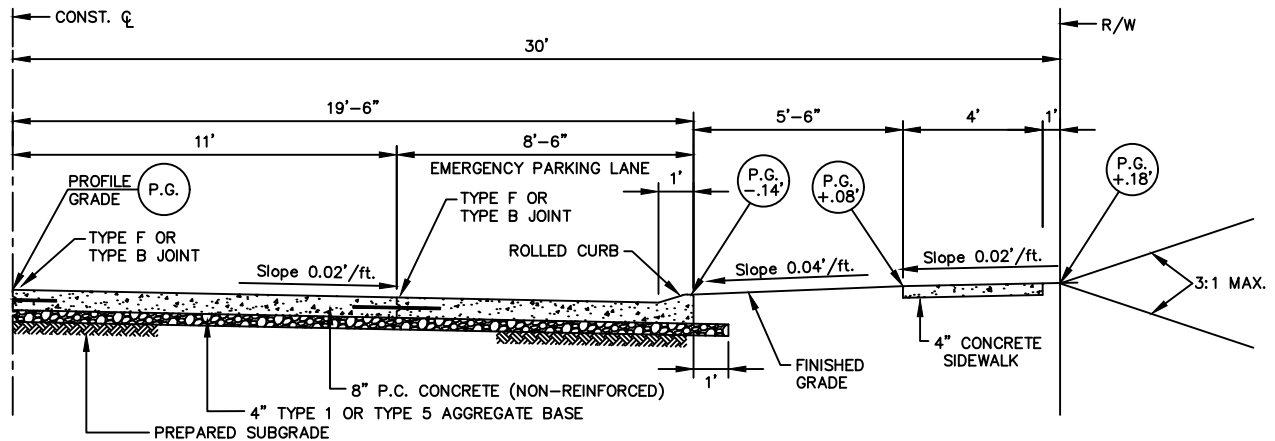
#### GENERAL NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS
2. SECTIONS SHOWN ARE SYMMETRICAL ABOUT CONSTRUCTION CENTERLINE.
3. FOR LONGITUDINAL AND TRANSVERSE JOINTS, DOWEL AND TIE BAR REQUIREMENTS AND CURB DIMENSIONS REFER TO SCD 700.07 AND SCD 700.08.
4. ALL PAVEMENT MARKINGS SHALL BE PER THE CONSTRUCTION SPECIFICATIONS AND STANDARD DETAILS, CURRENT EDITION, AND AS SHOWN ON SCD 700.27, PAVEMENT MARKINGS.
5. SECTIONS SHOWN MAY NOT APPLY AT INTERSECTIONS.
6. SIDEWALK THICKNESS TO BE 6" MIN. AT RESIDENTIAL DRIVEWAYS, SEE SCD 700.23
7. UNDERDRAINS (PERPENDICULAR TO THE STREET CENTERLINE) ARE REQUIRED AT ALL CURB INLETS. SEE SCD 700.28 FOR UNDERDRAIN DETAIL.
8. THE TRANSVERSE AND LONGITUDINAL JOINTS SHALL CONFORM TO THE CITY SPECIFICATIONS FOR THE CONSTRUCTION METHOD BEING USED BY THE CONTRACTOR. ANY DEVIATION IN THE JOINT TYPE OR JOINT LOCATION AS SHOWN ON THIS DETAIL SHALL BE APPROVED PRIOR TO CONSTRUCTION BY THE CITY ENGINEER.



#### GENERAL NOTES:

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5. SECTIONS SHOWN MAY NOT APPLY AT INTERSECTIONS.
6. SIDEWALKS, CURBS AND GUTTERS MAY BE PERMITTED IN PLANNED DEVELOPMENT-RESIDENTIAL PROJECTS HOWEVER WIDTHS OF PAVEMENT, RIGHT OF WAY, AND EASEMENT WILL NEED TO BE ADJUSTED TO ACCOMMODATE SAME.
7. UNDERDRAINS (PERPENDICULAR TO THE STREET CENTERLINE) ARE REQUIRED AT ALL CURB INLETS. SEE SCD 700.28 FOR UNDERDRAIN DETAIL.
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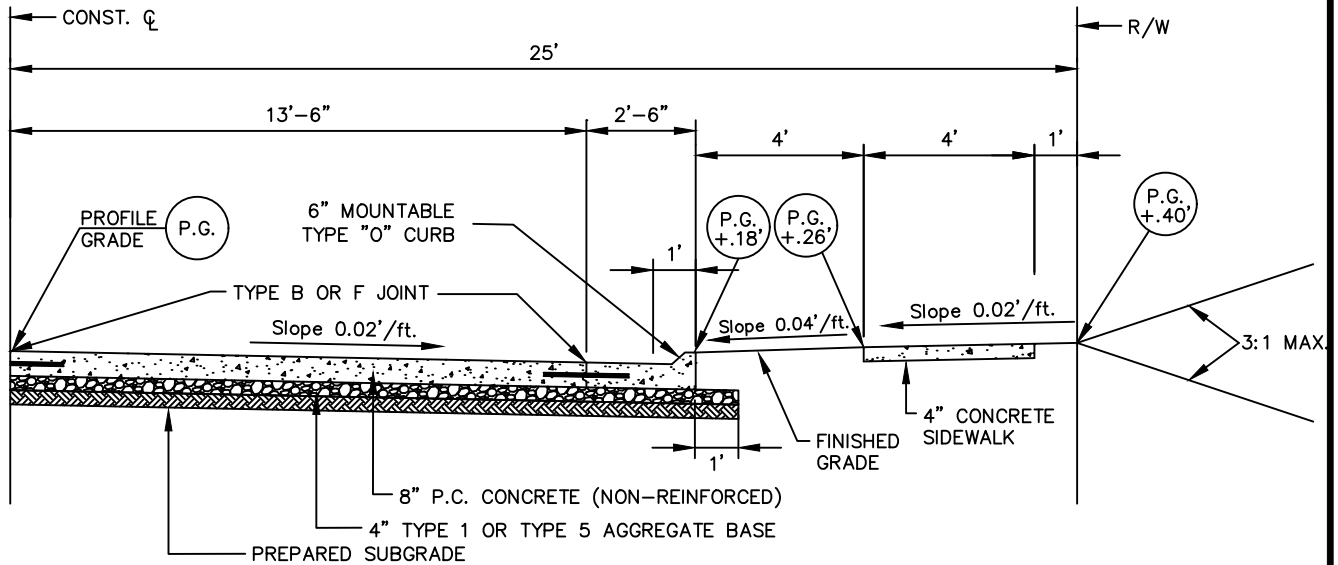
**Wentzville Missouri**  
The Crossroads of the Nation

PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

**STANDARD TYPICAL SECTION**  
**MINOR COLLECTOR**  
**RESIDENTIAL**  
**60' R/W 39' PVMT.**

Approved: BOA  
Date: 02/24/2016

**700.02**



#### GENERAL NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS
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**Wentzville Missouri**  
The Crossroads of the Nation

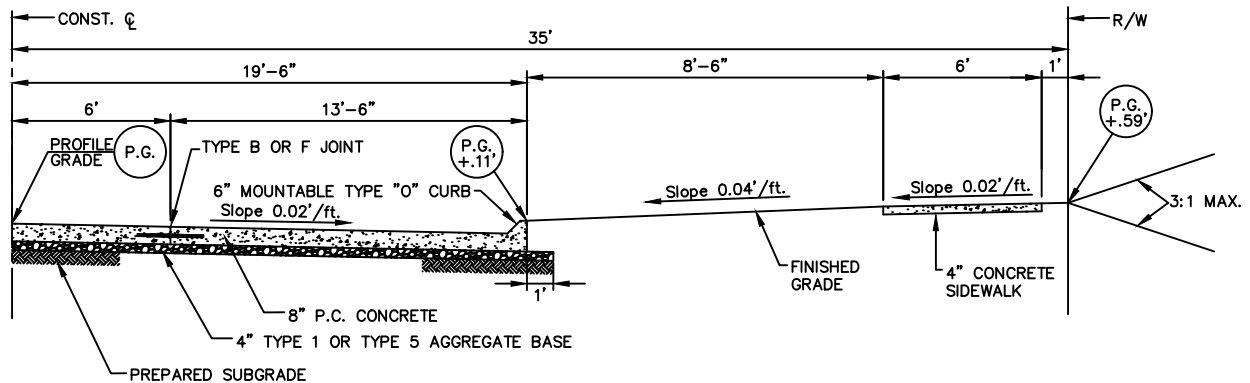
PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

**STANDARD TYPICAL SECTION**  
**COMMERCIAL**  
**50' R/W 32' PVMT.**

Approved: BOA  
Date: 02/24/2016

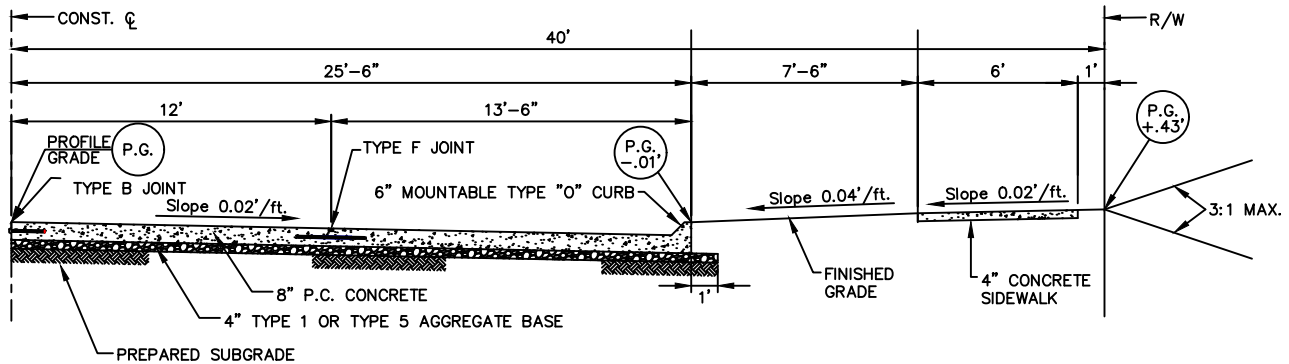
**700.03**





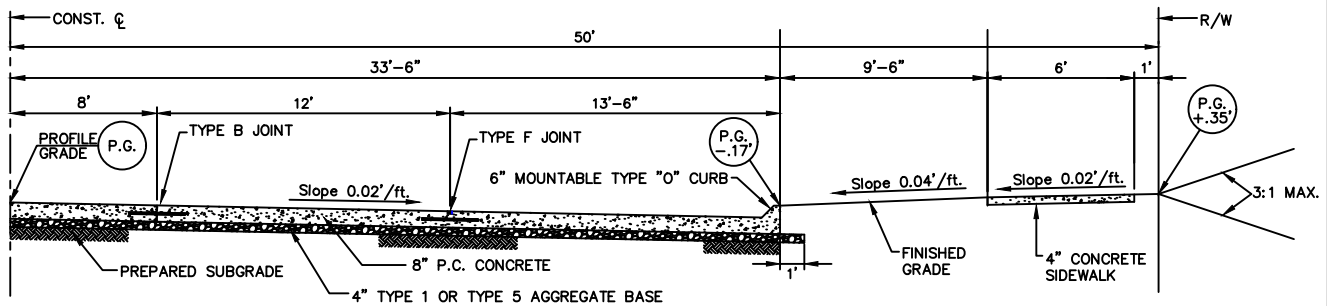
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7. ADDITIONAL PAVEMENT THICKNESS, REINFORCEMENT AND/OR BASE IS REQUIRED FOR HEAVY VEHICULAR USAGE OR HIGH TRAFFIC VOLUMES.
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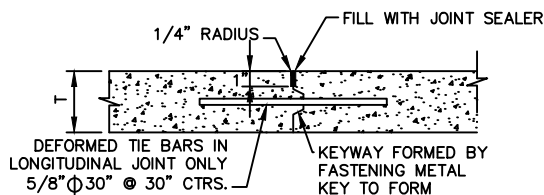
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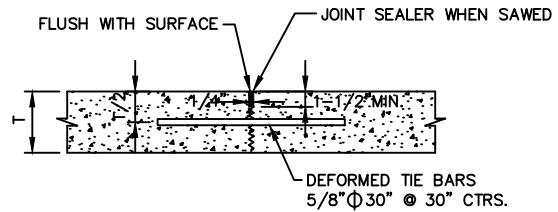


#### GENERAL NOTES:

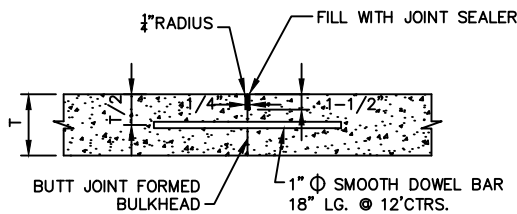
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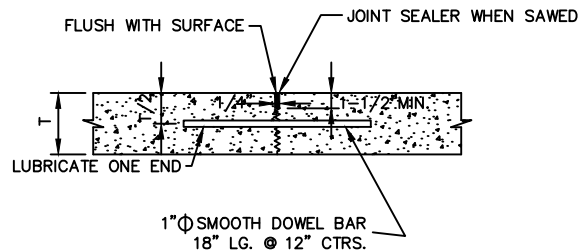
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CONSTRUCTION JOINT



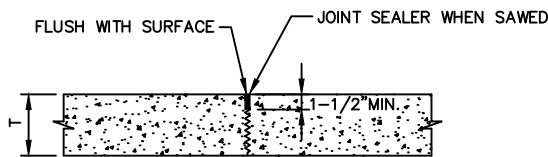
**TYPE F**  
SAWED LONGITUDINAL  
CONSTRUCTION JOINT



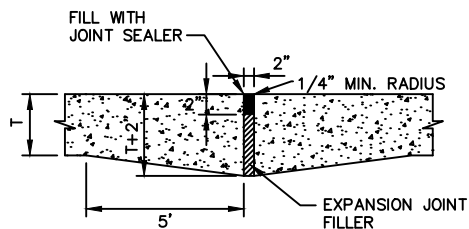
**TYPE D**  
TRANSVERSE CONSTRUCTION JOINT



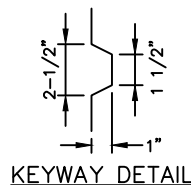
**TYPE G**  
SAWED TRANSVERSE  
CONSTRUCTION JOINT



**TYPE C**  
SAWED TRANSVERSE OR  
LONGITUDINAL CONSTRUCTION JOINT



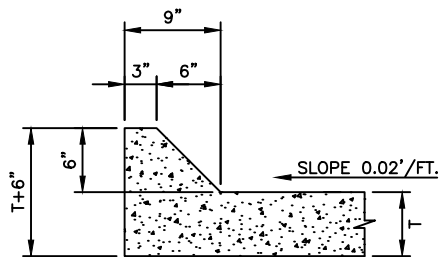
**TYPE A2**  
EXPANSION JOINT



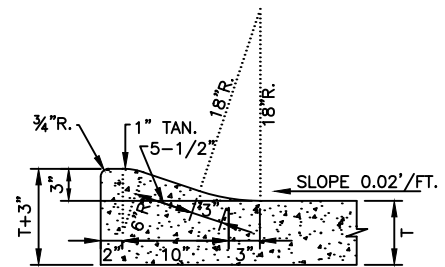
**KEYWAY DETAIL**

**GENERAL NOTES:**

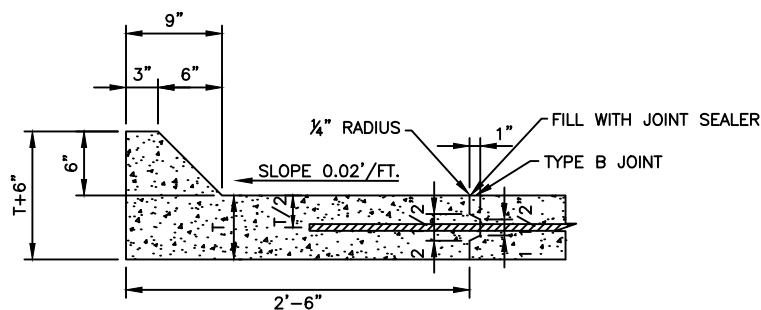
1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS
2. TYPE "G" TRANSVERSE JOINT IS REQUIRED FOR ALL NON-RESIDENTIAL STREETS. TYPE "C" TRANSVERSE JOINT IS REQUIRED FOR ALL RESIDENTIAL STREETS.
3. FOR STREETS HAVING 6" CONCRETE PAVEMENT 1/2" DEFORMED TIE BARS 30" LONG AT 30" CENTERS SHALL BE USED FOR TYPE "B" OR TYPE "F" LONGITUDINAL JOINTS.
4. REFER TO SCD 700.09A THROUGH 700.09D FOR JOINT AND REBAR CLASSIFICATIONS. NOTE THAT WIDTH AND LOCATION OF EACH POURED PORTION OF THE PAVEMENT MAY CHANGE THE TYPE AND LOCATION OF JOINT REQUIRED.
5. ALL DEFORMED BARS FOR JOINTS SHALL BE BILLET STEEL BARS CONFORMING TO A.S.T.M. 615-75, GRADE 40.
6. TRANSVERSE OR LONGITUDINAL CONSTRUCTION JOINTS IN SLIP FORMED PAVEMENTS MAY BE MADE WITH A GROOVER OR TOOL, IF SUCH DEVICE HAS BEEN APPROVED IN ADVANCE BY THE DIVISION.
7. THE FREE END OF THE DOWEL BAR FOR A LENGTH OF AT LEAST 11 INCHES SHALL BE COATED WITH AN APPROVED GRAPHITE GREASE (TYPE D AND TYPE G JOINTS).
8. ALL SMOOTH DOWEL BARS SHALL BE EPOXY COATED.
9. SEE SCD 700.21 FOR DETAILS OF DOWEL SUPPORTING UNITS FOR TYPE G JOINTS.



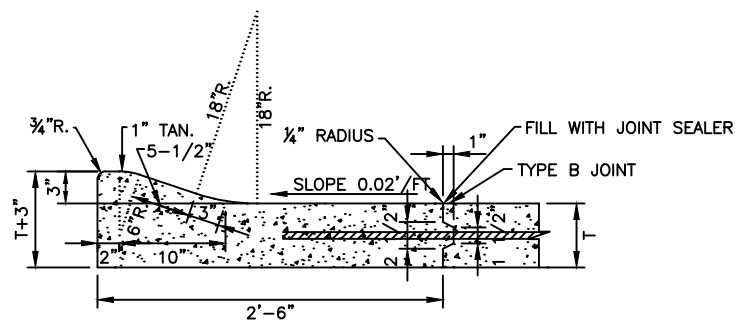
INTEGRAL MOUNTABLE CURB AND GUTTER  
TYPE "O"



INTEGRAL ROLLED CURB



MOUNTABLE CURB AND GUTTER  
TYPE "O"

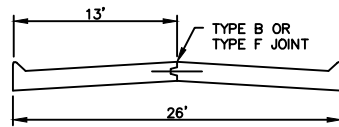


ROLLED CURB AND GUTTER

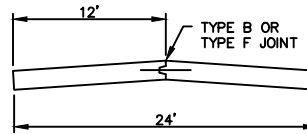
GENERAL NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS
2. PINNED ON CURB IS NOT PERMITTED.
3. DOWEL BARS WILL BE REQUIRED WHERE CURB AND GUTTER MEETS EXISTING PAVEMENT.
4. NORMALLY, THE CURB AND GUTTER WILL BE INSTALLED MONOLITHICALLY WITH SLAB PAVEMENT.
5. WHEN CURB AND GUTTER IS INSTALLED SEPERATELY FROM PAVEMENT THE MINIMUM WIDTH FROM BACK OF CURB TO JOINT SHALL BE 2'-6".

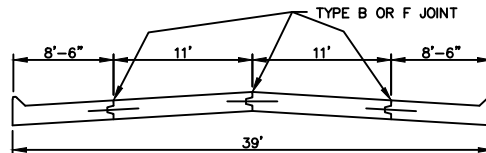
NOTE: ALL  
PAVEMENT  
SECTIONS SHALL  
HAVE A 0.02 FT/FT  
CROSS SLOPE



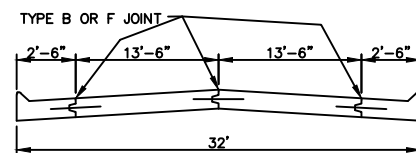
26' PAVEMENT WIDTH  
(SCD 700.01a)



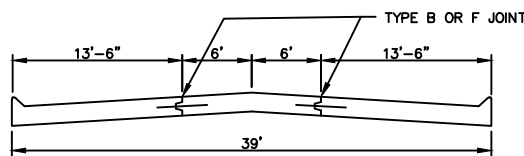
24' PAVEMENT WIDTH  
(SCD 700.01b)



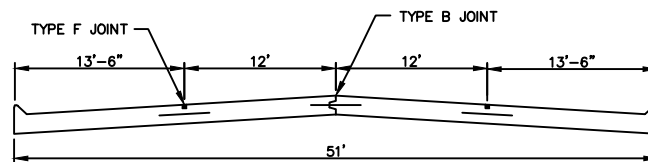
39' PAVEMENT WIDTH WITH PARKING BOTH SIDES  
(SCD 700.02)



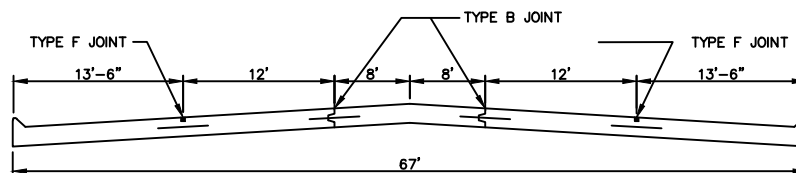
32' PAVEMENT WIDTH  
(SCD 700.03)



39' PAVEMENT WIDTH WITH TURNING LANE  
(SCD 700.04)



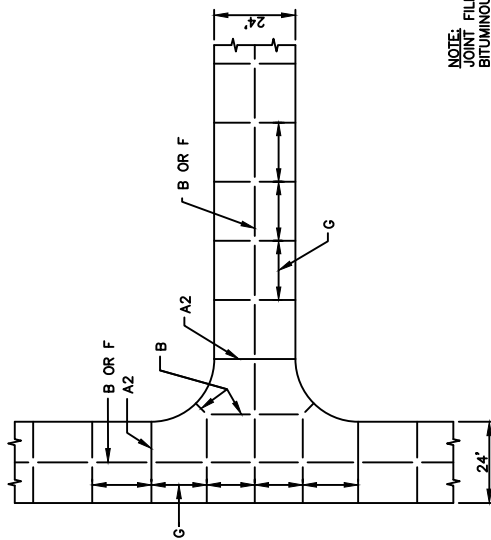
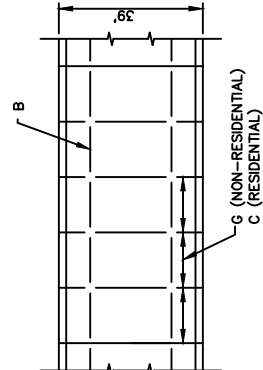
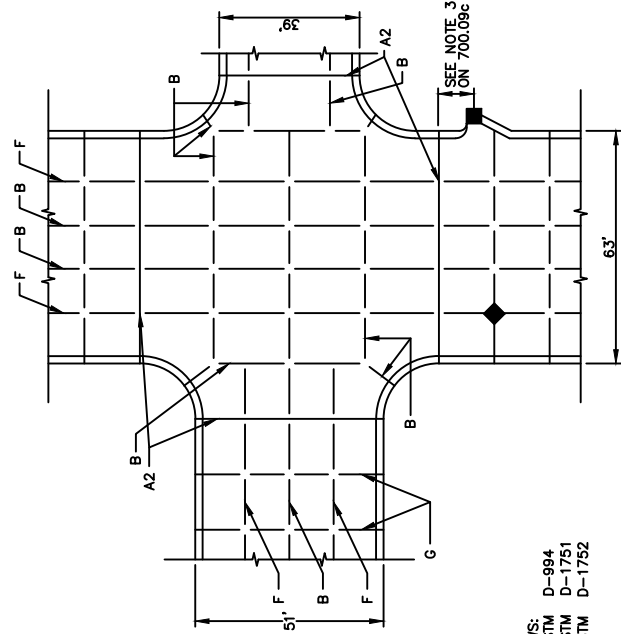
51' PAVEMENT WIDTH  
(SCD 700.05)



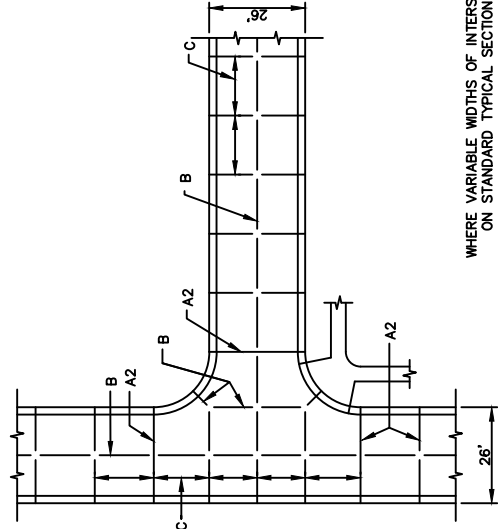
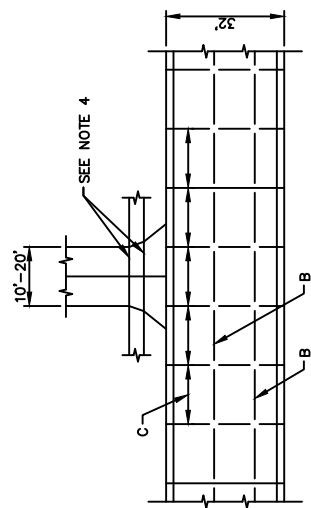
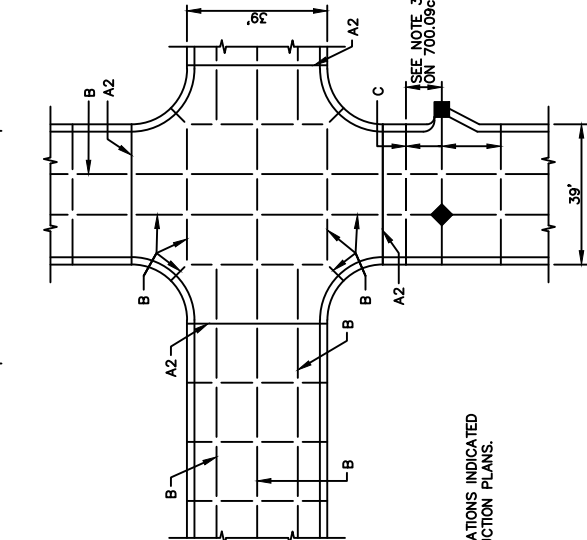
67' PAVEMENT WIDTH  
(SCD 700.06)

DO NOT SCALE DRAWINGS. FOLLOW DIMENSIONS.

TRANSVERSE JOINTS TYPICALLY SPACED AT 15'. JOINTS MAY BE EVENLY SPACED UPON APPROVAL OF THE CITY INSPECTOR. SEE SCD 700.09C FOR TRANSVERSE JOINT REQUIREMENTS.



NOTE: JOINT FILLER MATERIAL SHALL MEET ASTM DESIGNATIONS AS FOLLOWS:  
 BITUMINOUS TYPE.....ASTM D-994  
 NON EXTRUDING & RESILANT BITUMINOUS TYPE (FIBER).....ASTM D-1751  
 NON EXTRUDING & RESILANT NON BITUMINOUS TYPE (RUBBER).....ASTM D-1752



PLAN OF JOINT LOCATION  
 WHERE VARIABLE WIDTHS OF INTERSECTING PAVEMENTS ARE SHOWN JOINT SPACING MUST CONFORM TO LOCATIONS INDICATED ON STANDARD TYPICAL SECTIONS. INTERSECTION CHANNELIZATION DETAILS OR THE APPROVED CONSTRUCTION PLANS.

**GENERAL NOTES:**

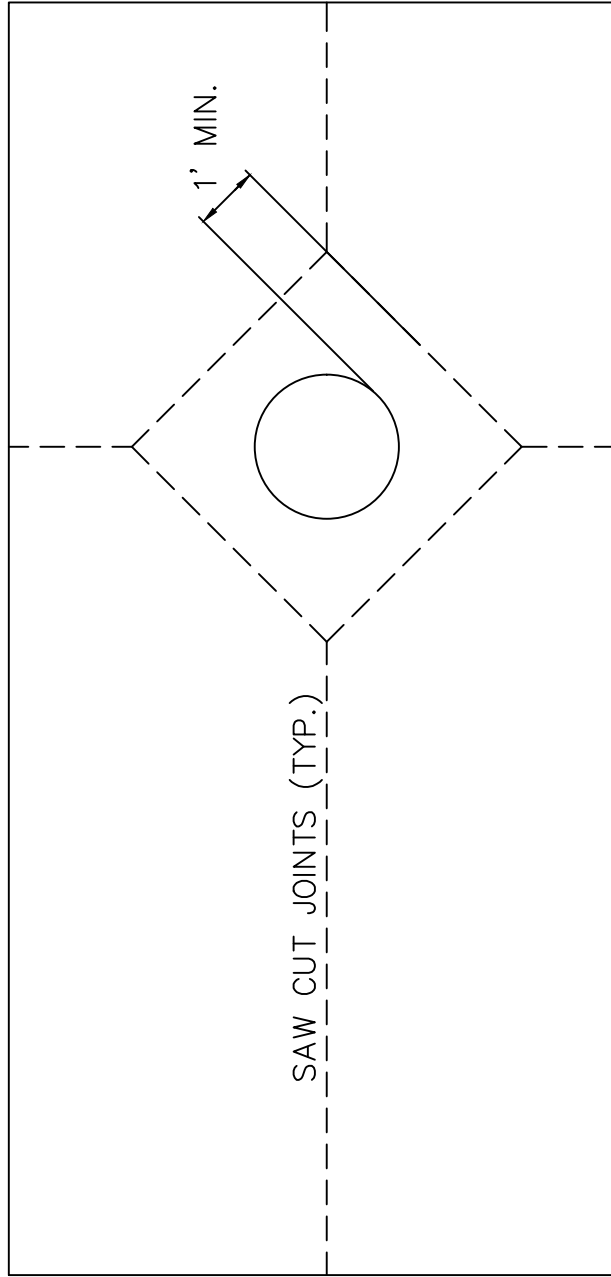
1. DO NOT SCALE DRAWINGS. FOLLOW DIMENSIONS.
2. ALL STREET INLETS SHALL BE SEPARATED FROM THE PAVEMENT AND CURB BY EXPANSION JOINT MATERIAL EXTENDING COMPLETELY THROUGH CURB AND SLAB. MANHOLE CASTING WITHIN PAVEMENT LIMITS SHALL BE BOXED.
3. WHEN A JOINT FALLS WITHIN 5 FT. OF OR CONTACTS INLETS, MANHOLES, OR OTHER STRUCTURES, SHORTEN ONE OR MORE PANELS EITHER SIDE OF OPENING TO PERMIT JOINT TO FALL ON ROUND STRUCTURES AND AT OR BETWEEN CORNERS OF RECTANGULAR STRUCTURES. SEE SCD 700.10
4. DRIVEWAY CONFIGURATIONS ARE SHOWN ON SCD 700.23 - RESIDENTIAL ENTRANCE.
5. CONSTRUCTION JOINTS AND TIE BARS MAY BE OMITTED WHEN CURB IS POURED MONOLITHIC WITH PAVEMENT.
6. FOR JOINT AND BAR REQUIREMENTS REFER TO SCD 700.07. NOTE THAT THE WIDTH AND LOCATION MAY CHANGE THE TYPE OF JOINT REQUIREMENTS.
7. TRANSVERSE OR LONGITUDINAL CONSTRUCTION JOINTS IN SLIP FORMED PAVEMENTS MAY BE MADE WITH A GROOVER OR TOOL, IF SUCH DEVICE HAS BEEN APPROVED BY THE ENGINEERING DEPARTMENT.
8. THE LOCATIONS OF THE TYPE B LONGITUDINAL CONSTRUCTION JOINTS IN THE SECTIONS MAY BE INTERCHANGED FOR THE DIFFERENT WIDTHS OF CONSTRUCTION IF APPROVED BY THE ENGINEERING DEPARTMENT.

JOINT REQUIREMENTS FOR CONCRETE PAVEMENT			
STREET	JOINT TYPE	JOINT AND BAR REQUIREMENTS	
RESIDENTIAL	TRANSVERSE	TYPE C NO STEEL BARS	
24', AND 26' WIDE PAVEMENT	LONGITUDINAL	WITHIN A POURED SECTION TYPE F 5/8" $\phi$ DEFORMED TIE BARS* 30" LONG @ 30" CENTERS	AT THE EDGE BETWEEN TWO POURED SECTIONS TYPE B 5/8" $\phi$ DEFORMED TIE BARS* 30" LONG @ 30" CENTERS
6" OR 7" THICK CONCRETE	EXPANSION	TYPE A2	
NON-RESIDENTIAL	TRANSVERSE	TYPE G 1" $\phi$ SMOOTH DOWEL BARS 18" LONG @ 12" CENTERS	
32, 39', 51, AND 63' WIDE PAVEMENT	LONGITUDINAL	WITHIN A POURED SECTION TYPE F 5/8" $\phi$ DEFORMED TIE BARS 30" LONG @ 30" CENTERS	AT THE EDGE BETWEEN TWO POURED SECTIONS TYPE B 5/8" $\phi$ DEFORMED TIE BARS 30" LONG @ 30" CENTERS
8" THICK CONCRETE	EXPANSION	TYPE A2	

\* 6" THICK RESIDENTIAL LONGITUDINAL JOINTS SHALL HAVE 1/2" DIAM. DEFORMED TIE BARS IN LEIU OF 5/8" DIAM DEFORMED TIE BARS.



LONGITUDINAL JOINT

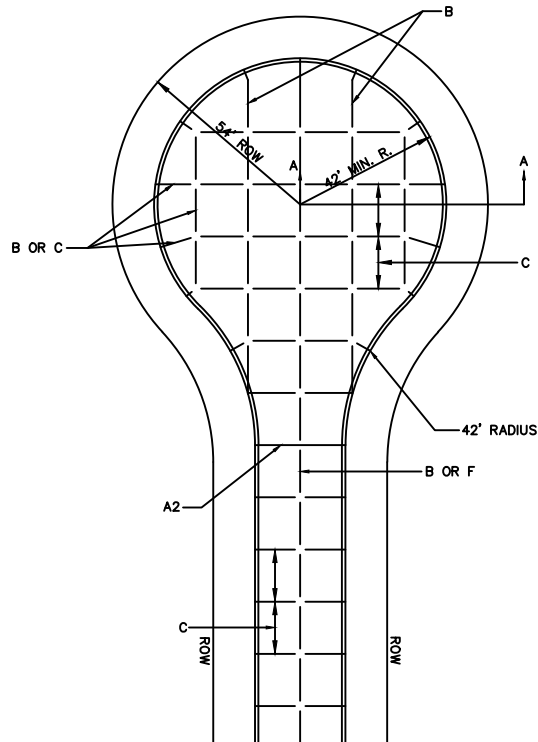


TRANSVERSE JOINT

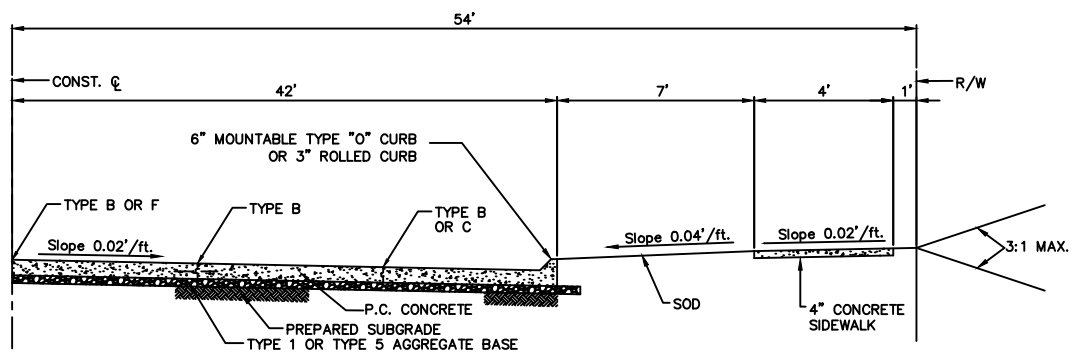
NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. WHEN A JOINT FALLS WITHIN 5 FT. OF OR CONTACTS INLETS, MANHOLES, OR OTHER STRUCTURES, SHORTEN ONE OR MORE PANELS EITHER SIDE OF OPENING TO PERMIT JOINT TO FALL ON ROUND STRUCTURES AND AT OR BETWEEN CORNERS OF RECTANGULAR AND SQUARE STRUCTURES, WHERE POSSIBLE.
3. REFER TO SCD'S 700.9A, B, AND C FOR LONGITUDINAL AND TRANSVERSE JOINT AND BAR REQUIREMENTS.

DO NOT SCALE DRAWINGS. FOLLOW DIMENSIONS.



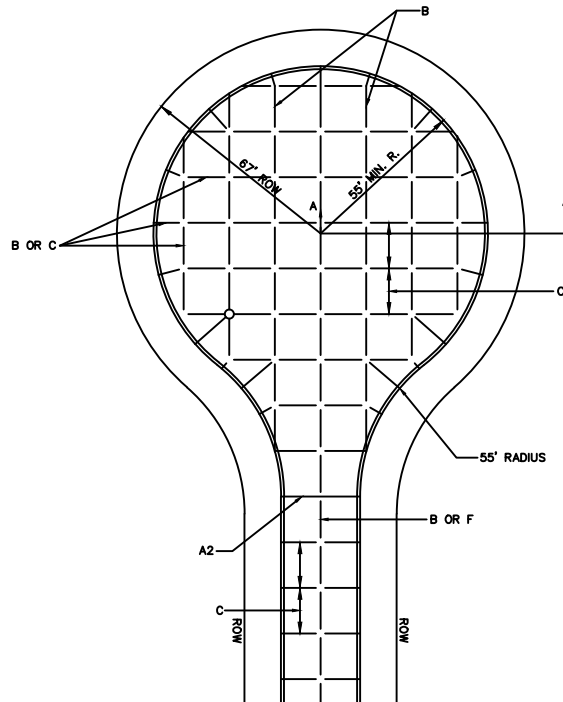
42' PAVEMENT RADIUS - 54' ROW



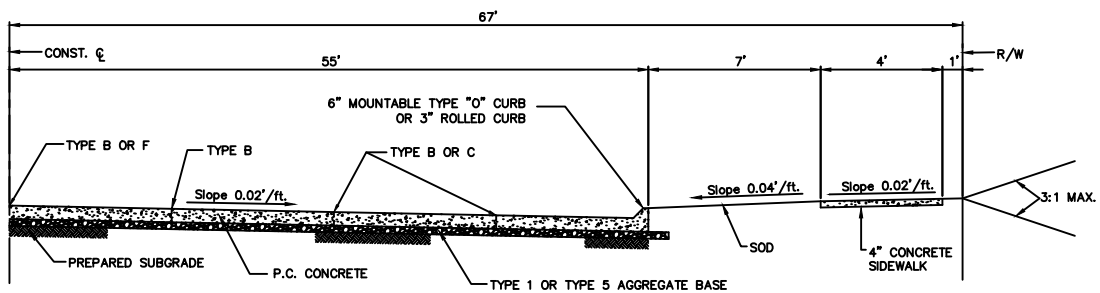
SECTION A-A

NOTE: CUL-DE-SAC WARPING DETAILS SHALL BE PROVIDED.

DO NOT SCALE DRAWINGS. FOLLOW DIMENSIONS.

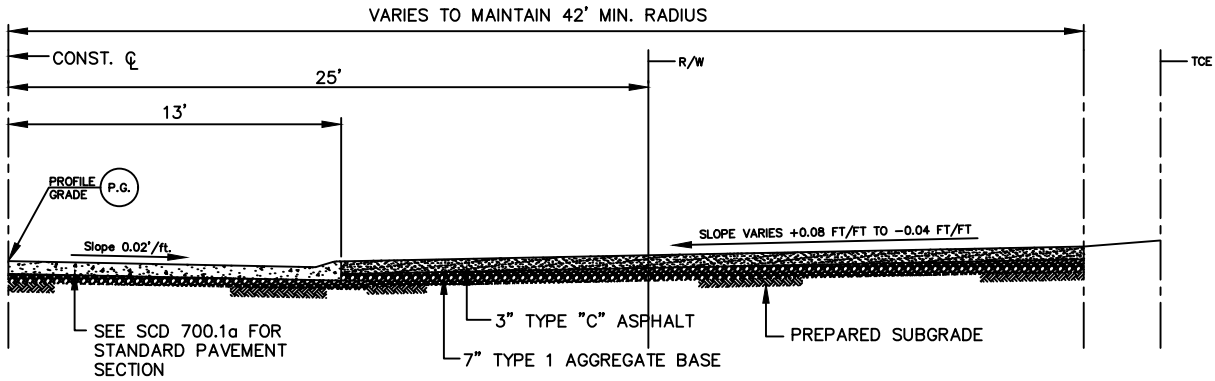


55' PAVEMENT RADIUS - 67' ROW

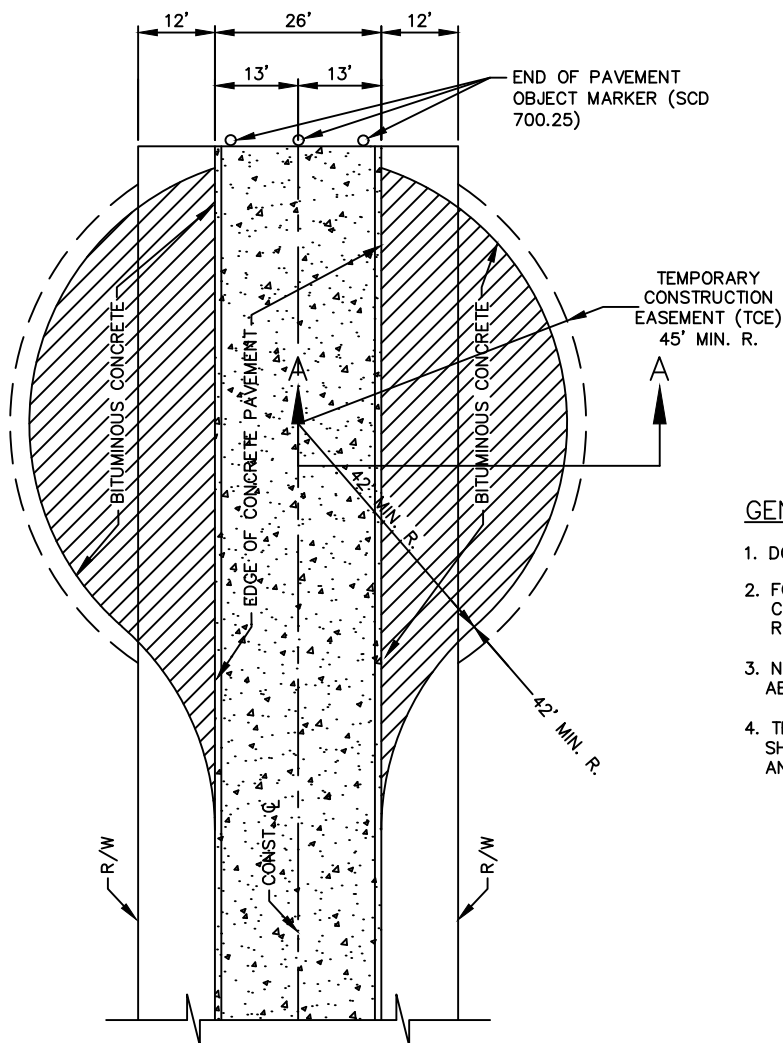


SECTION A-A

NOTE: CUL-DE-SAC WARPING DETAILS SHALL BE PROVIDED.

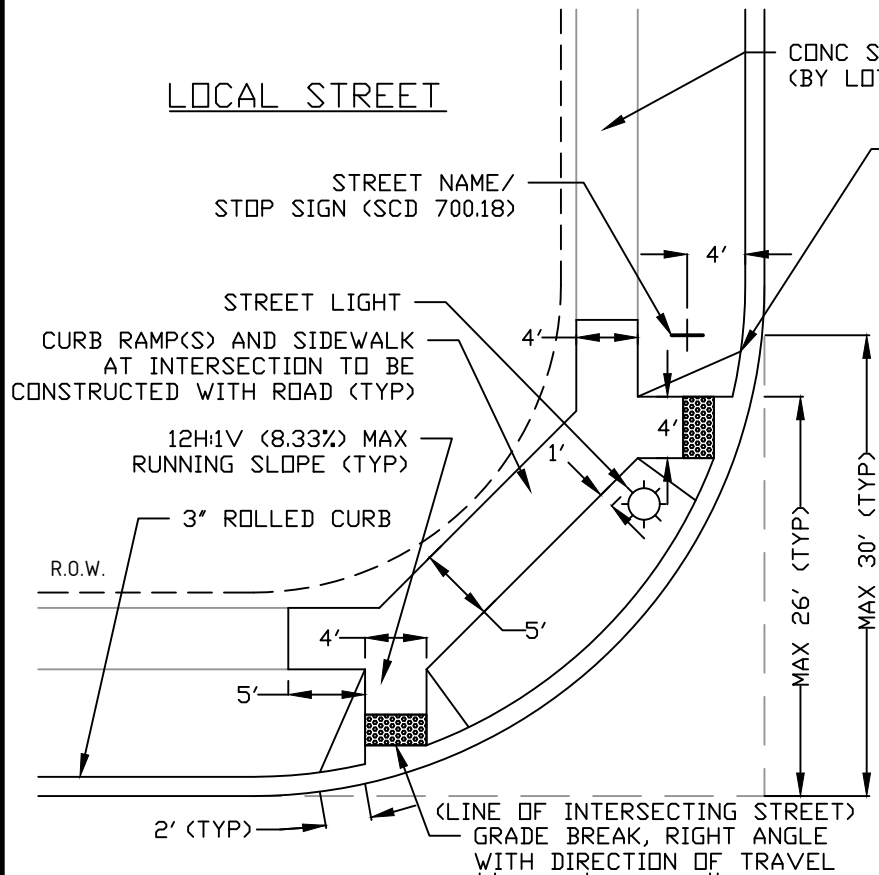


SECTION A-A



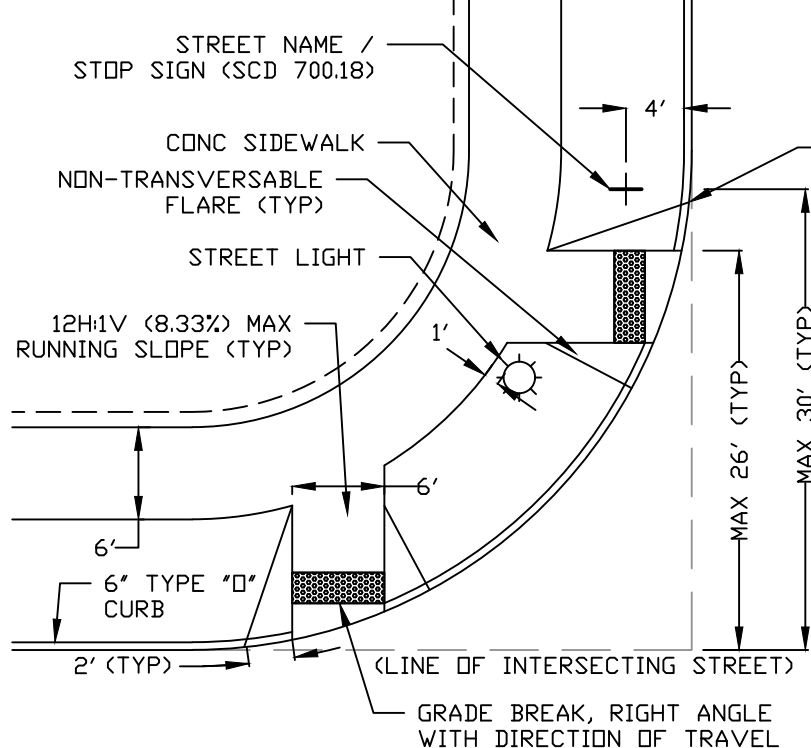
GENERAL NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS
2. FOR ROADWAY CROSS SLOPES, JOINTS, CURBS, PAVEMENT TYPES AND THICKNESS REFER TO THE STANDARD TYPICAL SECTIONS.
3. NO BUILDING PERMITS SHALL BE ISSUED FOR ANY LOTS ABUTTING A TEMPORARY TURNAROUND.
4. THE REMOVAL OF TEMPORARY TURNAROUND SURFACING SHALL BE PROVIDED FOR BY AN ESCROW AGREEMENT OR AN IRREVOCABLE LETTER OF CREDIT.

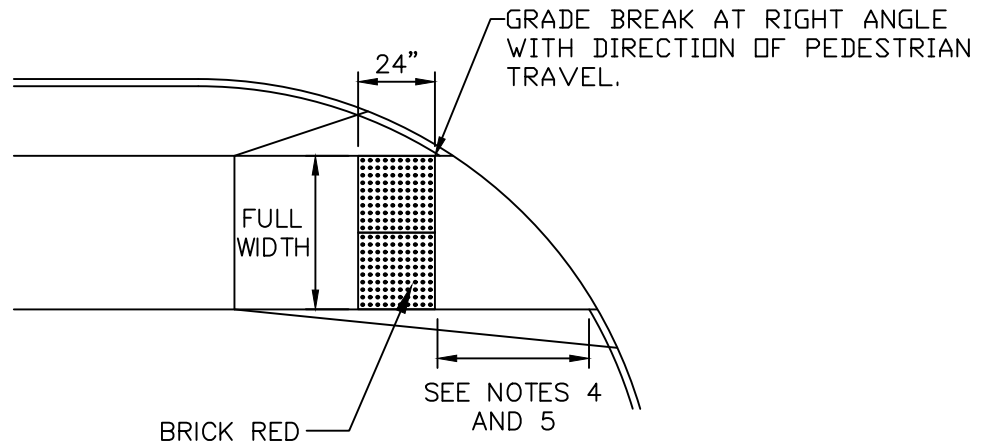


**NOTE:**

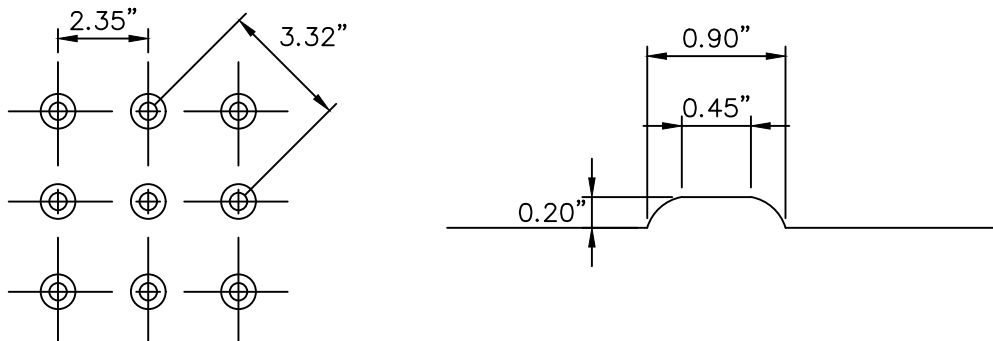
1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. SIDEWALKS AND CURB RAMPS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CURRENT PUBLIC RIGHT-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG) AND THESE DETAILS.
3. MINIMUM SIDEWALK WIDTH ALONG 3" CURB SHALL BE 4 FEET. MINIMUM SIDEWALK WIDTH ALONG 6" CURB SHALL BE 6 FEET.
4. MAXIMUM SIDEWALK CROSS SLOPE SHALL BE 0.02 FT/FT. MINIMUM SIDEWALK CROSS SLOPE SHALL BE 0.01 FT/FT.
5. SEE SCD 700.26 FOR CONCRETE SIDEWALK DETAILS.



COLLECTOR /  
ARTERIAL STREETS

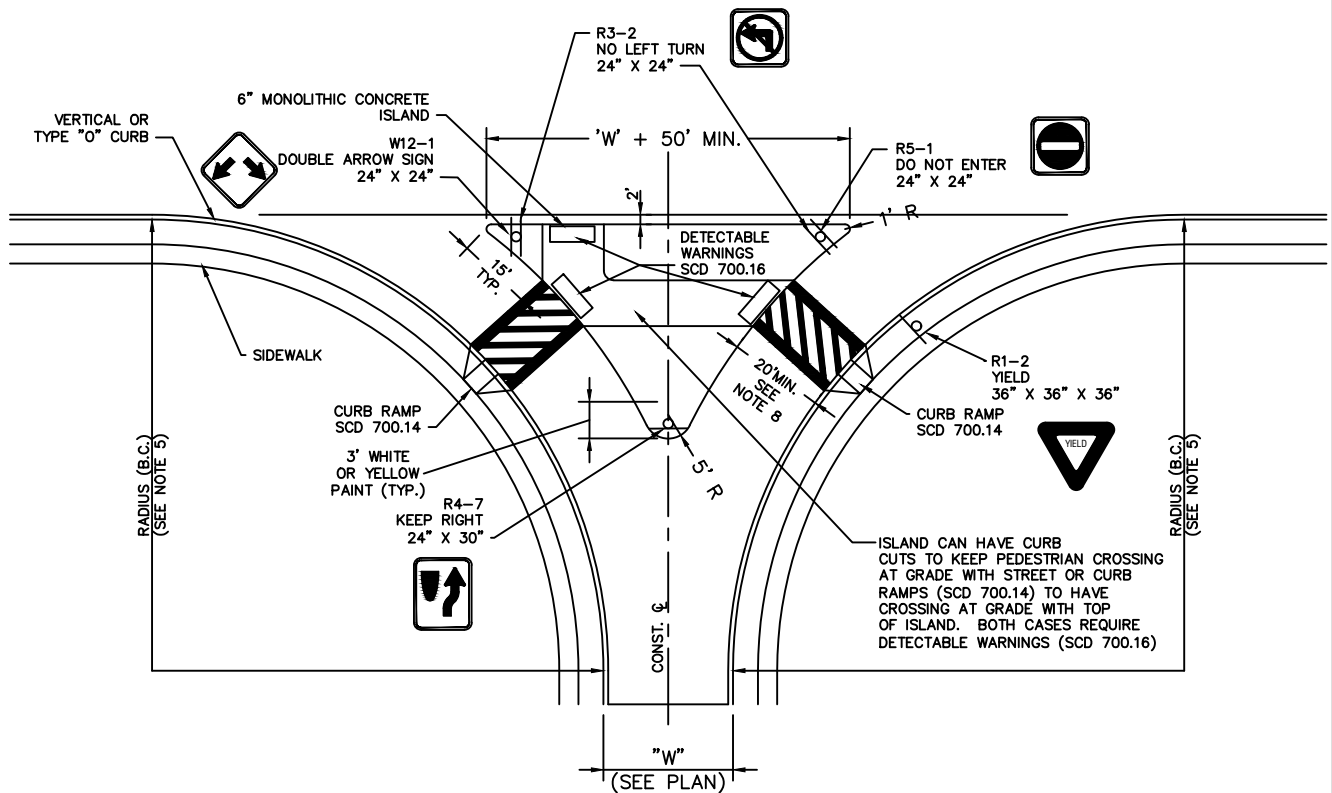


## CURB RAMP N.T.S.



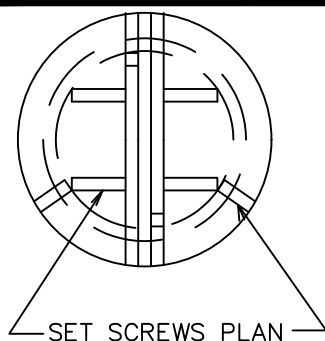
### GENERAL NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. SIDEWALKS AND CURB RAMP SHALL BE CONSTRUCTED IN ACCORDANCE WITH THESE DETAILS AND THE CURRENT PUBLIC RIGHT OF WAY ACCESSIBILITY GUIDELINES (PROWAG).
3. DETECTABLE WARNINGS PATTERN TO EXTEND THE ENTIRE WIDTH OF THE SIDEWALK AND SHALL BE BRICK RED, OTHER COLORS MAY BE CONSIDERED PER ADAAG 4.29.2.
4. DETECTABLE WARNINGS SHALL BE PLACED AT THE BOTTOM OF THE RAMP OR 6 TO 8 INCHES FROM THE FRONT OF THE CURB.
5. WHERE BOTH ENDS OF THE BOTTOM GRADE BREAK ARE FIVE (5) FEET OR LESS FROM THE BACK OF CURB, THE DETECTABLE WARNING SHALL BE LOCATED ON THE RAMP SURFACE AT THE BOTTOM GRADE BREAK. OTHERWISE THE DETECTABLE WARNING SHALL BE LOCATED ON THE LOWER LANDING.
6. DETECTABLE WARNING SHALL BE PRE-FORMED AND REPLACEABLE. DEVICES SHALL BE FROM MODOT'S APPROVED SUPPLIER LIST.

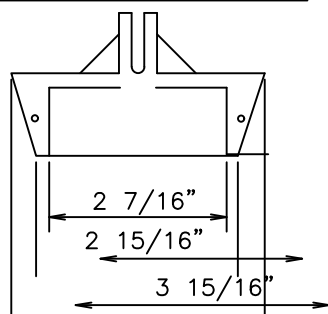


### GENERAL NOTES:

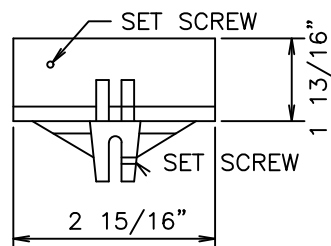
1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. SECTIONS ARE SYMETRICAL ABOUT CONSTRUCTION CENTERLINE.
3. FOR ROADWAY CROSS SLOPES, PAVEMENT TYPES AND THICKNESS REFER TO STANDARD TYPICAL SECTIONS.
4. ALL PAVEMENT MARKINGS SHALL BE PER THE CONSTRUCTION SPECIFICATIONS AND STANDARD DETAILS, CURRENT EDITION, AND AS SHOWN ON SCD 700.27, PAVEMENT MARKINGS.
5. EACH CORNER RADIUS SHALL BE AS REQUIRED BY THE GEOMETRIC LAYOUT SHOWN AND INCREASED TO THE NEAREST 5 FOOT DIMENSION. THE MINIMUM ACCEPTABLE CORNER RADIUS SHALL NOT BE LESS THAN 50 FEET.
6. THE INTERSECTION ANGLE SHALL BE DESIGNED AT 90° UNLESS OTHERWISE APPROVED BY THE ENGINEERING DIVISION.
7. GREATER CHANNELIZATION LANE WIDTHS MAY BE REQUIRED IF AN INTERSECTION ANGLE LESS THAN 90° IS APPROVED BY THE ENGINEERING DIVISION.
8. EACH NOSE OF THE ISLAND IS TO BE PAINTED YELLOW OR WHITE A MINIMUM OF 3 FEET DEEP.



POST TO BLADE BRACKET



BLADE TO BLADE BRACKET



STREET NAME FONT SIZE TABLE

	V	W	X	Y	Z
≤ 30 MPH	6"	4"	3"	3"	2.25"
> 30 MPH	9"	6"	4.5"	4.5"	3"

V - BLADE HEIGHT  
W - UPPERCASE NAME HEIGHT  
X - LOWERCASE NAME HEIGHT  
Y - UPPERCASE TYPE HEIGHT  
Z - LOWERCASE TYPE HEIGHT

STREET NAME SIGN POST MOUNTED

STREET SIGN → **Example St.**  
BLADE TO BLADE BRACKET →  
STREET SIGN →  
POST TO BLADE BRACKET →  
SEE NOTE #7

16-GAUGE STEEL POST  
2 3/8" O.D. GALV.

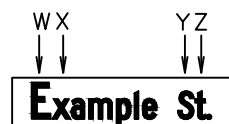
FIN. GRADE

3/8" STEEL ROD  
(MIN) 6" LONG

CONCRETE



12"  
(MIN)



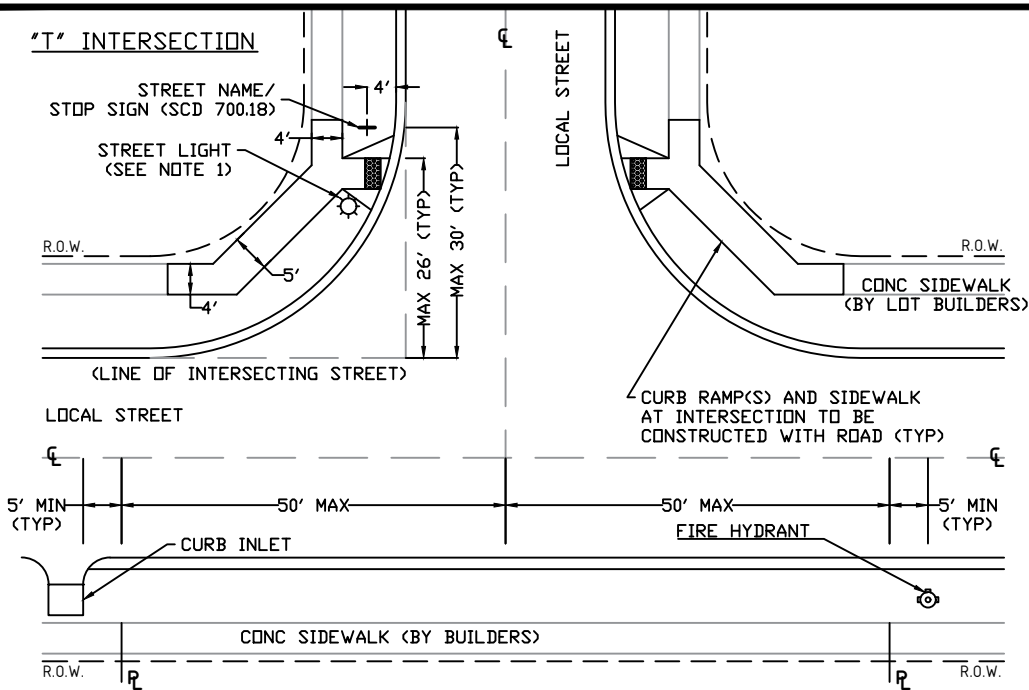
SECTION A-A

NOTES:

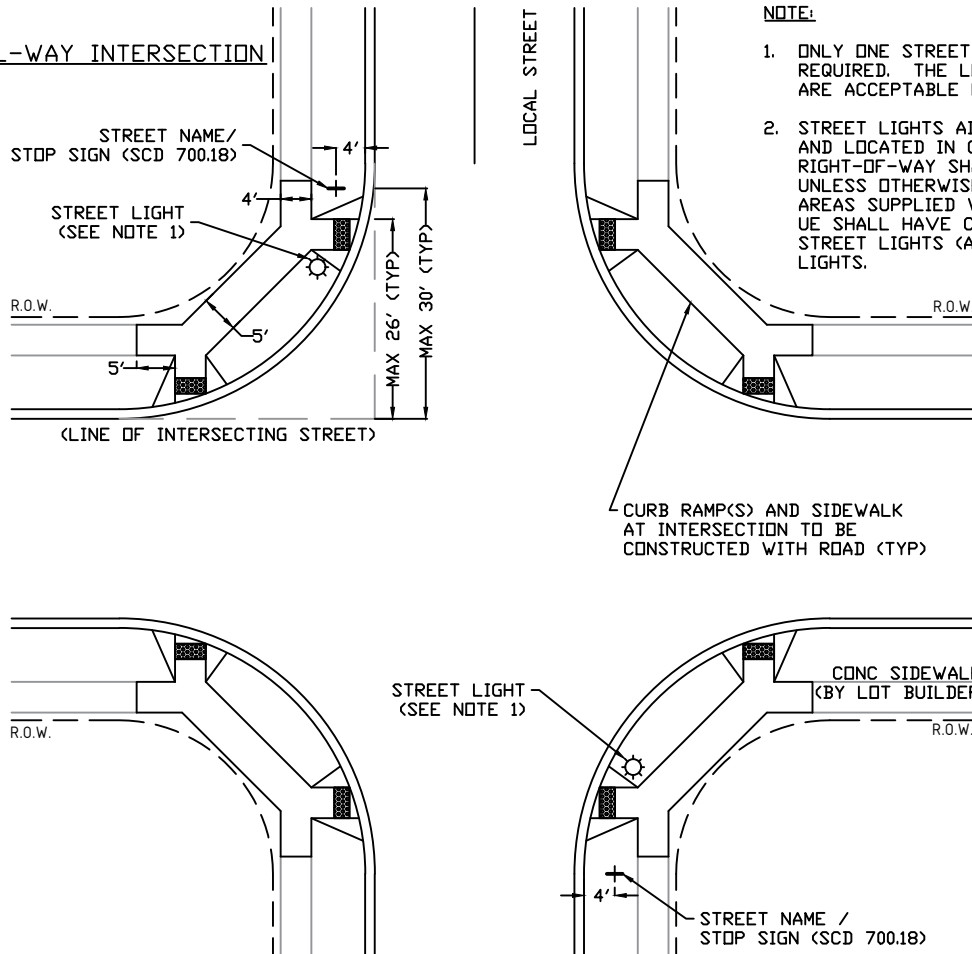
1. ALL STREET NAME AND/OR STOP SIGNS MUST BE INSTALLED PRIOR TO THE STREET BEING OPEN TO TRAFFIC AND PLACED IN SERVICE.
2. DO NO SCALE DRAWING. USE DIMENSIONS.
3. GALVANIZED STEEL POST WITH A BREAKAWAY FLANGE IS REQUIRED FOR NON-RESIDENTIAL INTERSECTIONS. RESIDENTIAL INTERSECTIONS SHALL USE A 2 3/8" O.D. 16-GAUGE GALVANIZED STEEL POST.
4. ALL SIGNS SHALL USE ASTM IV HIGH INTENSITY PRISMATIC MATERIAL.
5. STANDARD STREET NAME SIGNS SHALL BE GREEN BACKGROUND WITH WHITE TEXT USING T-2000HWYC FONT. DECORATIVE STREET NAME SIGNS SHALL USE A BROWN BACKGROUND.
6. ALL STREET NAME SIGN LETTERING SHALL BE COMPOSED OF A COMBINATION OF LOWER-CASE LETTERS WITH INITIAL UPPER-CASE LETTERS.
7. 30" X 30" STOP SIGN SHALL BE USED FOR SINGLE LANE APPROACH INTERSECTIONS AND A 36" X 36" STOP SIGN SHALL BE USED FOR MULTI-LANE APPROACH INTERSECTIONS.



## "T" INTERSECTION



## ALL-WAY INTERSECTION

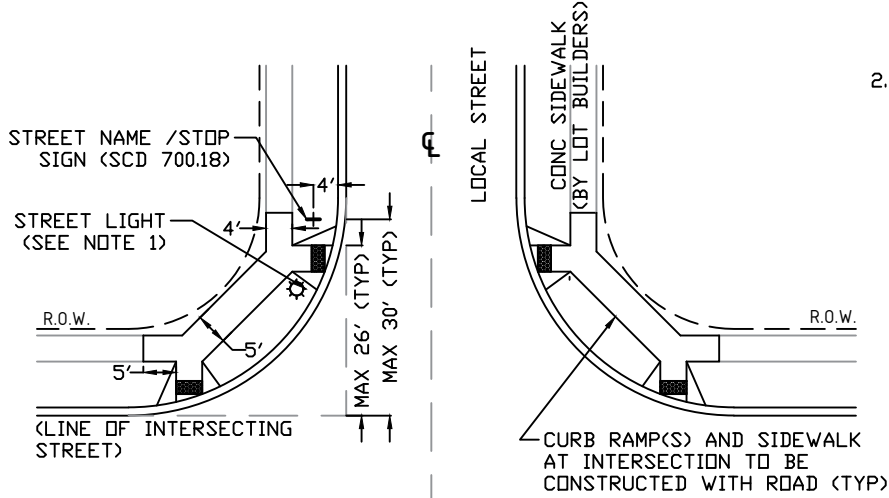


### NOTE:

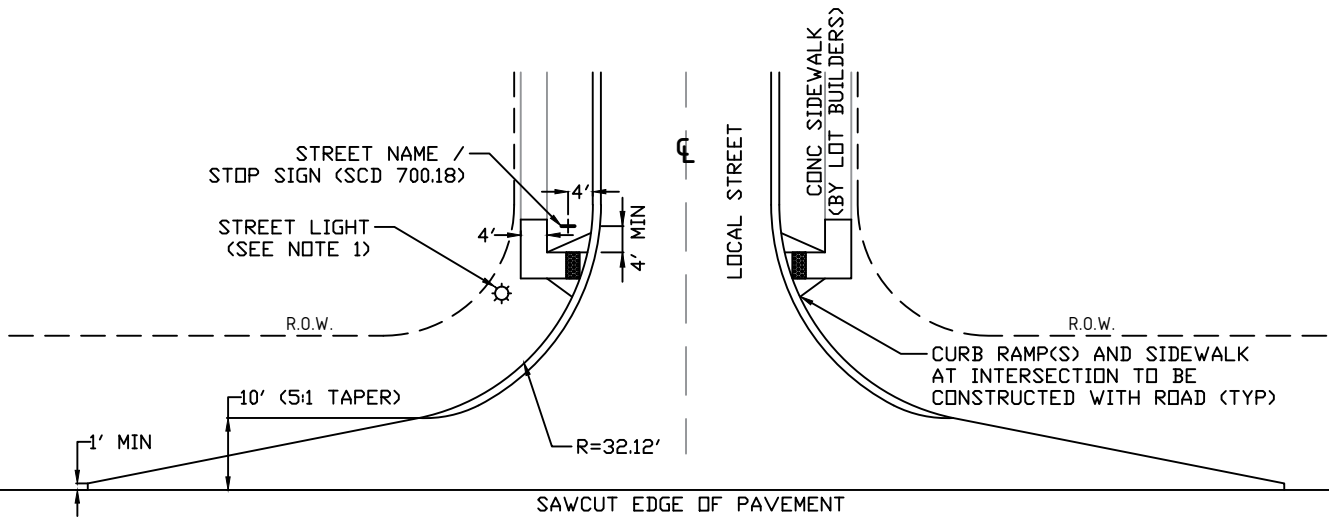
1. ONLY ONE STREET LIGHT PER INTERSECTION REQUIRED. THE LOCATIONS SHOWN ON THE PLAN ARE ACCEPTABLE LOCATIONS.
2. STREET LIGHTS ADJACENT TO PUBLIC STREETS AND LOCATED IN CITY OF WENTZVILLE RIGHT-OF-WAY SHALL BE PUBLIC MAINTENANCE UNLESS OTHERWISE PERMITTED BY THE CITY. AREAS SUPPLIED WITH ELECTRICITY BY AMEREN UE SHALL HAVE COLONIAL OR EARLY AMERICAN STREET LIGHTS (ASPEN OR CONTEMPORARY STREET LIGHTS).

**NOTE:**

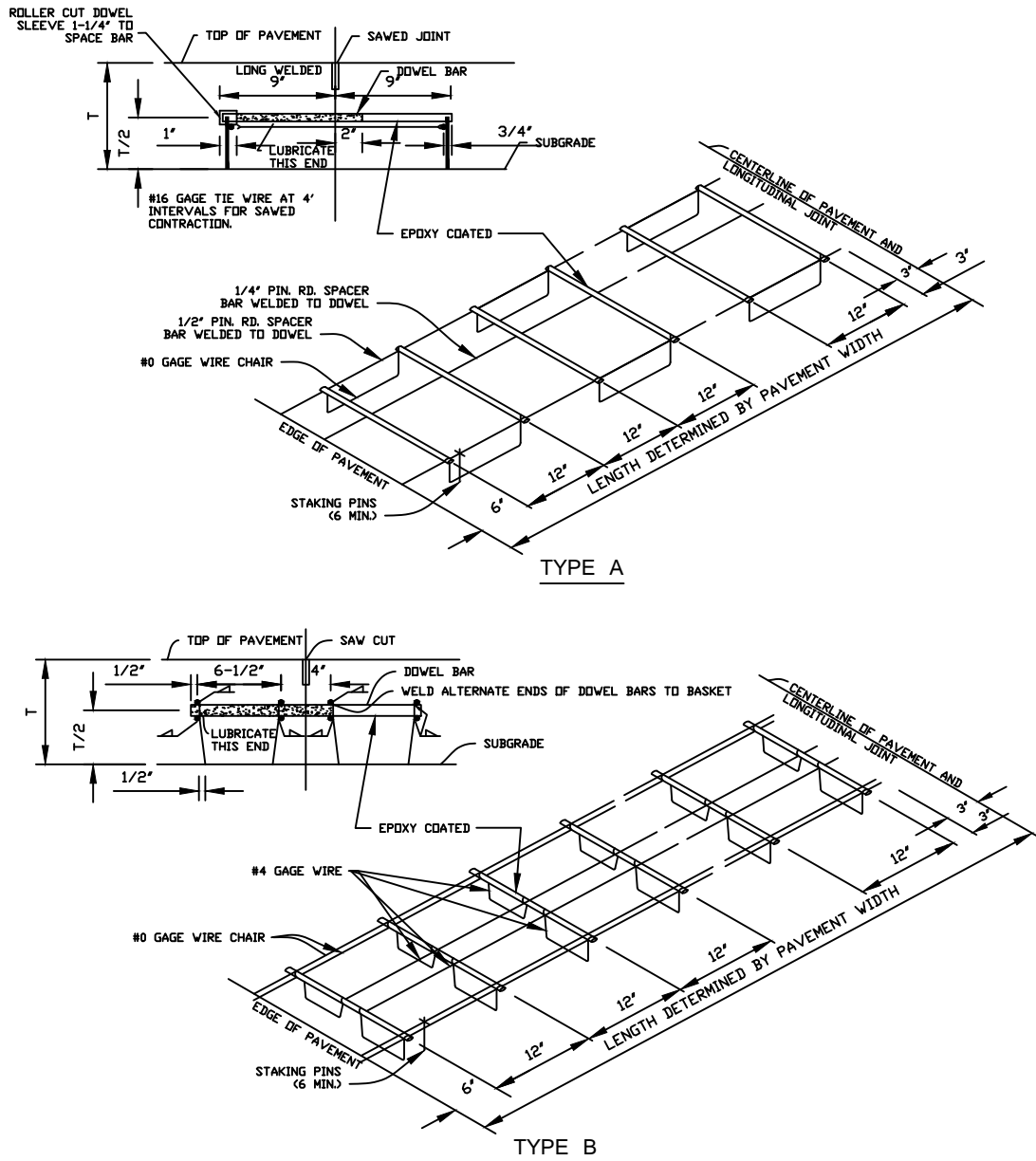
1. ONLY ONE STREET LIGHT PER INTERSECTION REQUIRED. THE LOCATIONS SHOWN ON THE PLAN ARE ACCEPTABLE LOCATIONS.
2. STREET LIGHTS ADJACENT TO PUBLIC STREETS AND LOCATED IN CITY OF WENTZVILLE RIGHT-OF-WAY SHALL BE PUBLIC MAINTENANCE UNLESS OTHERWISE PERMITTED BY THE CITY. AREAS SUPPLIED WITH ELECTRICITY BY AMEREN UE SHALL HAVE COLONIAL OR EARLY AMERICAN STREET LIGHTS (ASPEN OR CONTEMPORARY STREET LIGHTS).



**LOCAL STREET INTERSECTING IMPROVED COLLECTOR OR ARTERIAL**



**UNIMPROVED ARTERIAL OR COLLECTOR**

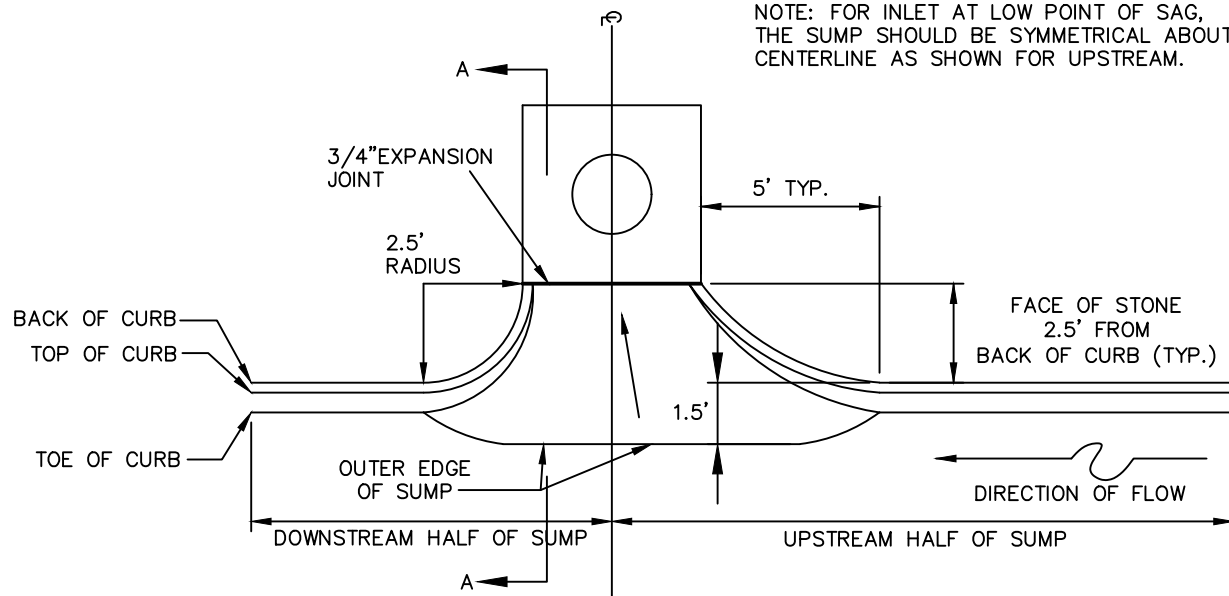


## GENERAL NOTES

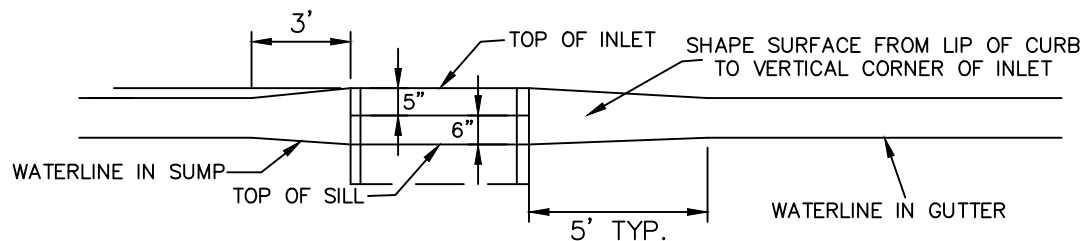
1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. THE DOWEL SUPPORTING UNIT SHALL BE FACTORY ASSEMBLED AND CAPABLE OF HOLDING THE DOWELS IN THEIR REQUIRED POSITIONS. IN THE COMPLETED JOINT INSTALLATION, NO DOWELS SHALL VARY FROM ITS REQUIRED POSITION MORE THAN 1 IN 36.
3. THE DOWEL BAR SPACING SHALL BE 12 INCHES ON CENTERS, BEGINNING 6 INCHES FROM OUTER EDGE OF THE PAVEMENT.
4. STAKING PINS SHALL BE FABRICATED FROM 0 GAGE (0.3065) WIRE MINIMUM WITH SUITABLE HOOK. STAKING PINS SHALL HAVE A LENGTH OF 18 INCHES TYPE A AND TYPE B ASSEMBLIES UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
5. WIRES, BARS, OR CLIPS SHALL BE USED AS NECESSARY TO STRENGTHEN THE ASSEMBLIES.
6. MINOR VARIATIONS IN THE CONFIGURATION OF THE SUPPORT UNITS WILL BE ALLOWED.
7. THE WIRE END OF EACH EPOXY COATED DOWEL SHALL BE MARKED WITH A SPOT OF PAINT AT LEAST ONE INCH IN DIAMETER AND CONTRASTING IN COLOR WITH THE EPOXY COATING.
8. THE FREE END OF THE DOWEL BAR FOR A LENGTH OF AT LEAST 11 INCHES SHALL BE COATED WITH AN APPROVED GRAPHITE GREASE.
9. THE DETAILS SHOWN ARE ADAPTED FROM THE MISSOURI DEPARTMENT OF TRANSPORTATION (MODOT) STANDARD DRAWINGS (DRAWING NO. 502.10J).

THIS DETAIL DEPICTS STANDARD 26' PAVEMENT RESIDENTIAL STREET WITH ROLLED CURB. DIFFERENT PAVEMENT WIDTH, R.O.W. WIDTH, AND CURB TYPE WILL REQUIRE ADJUSTMENTS.

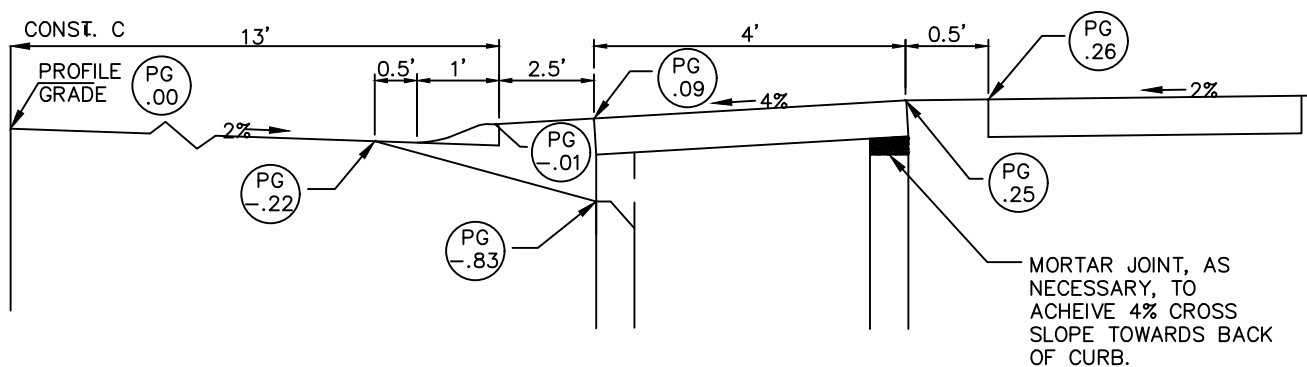
NOTE: FOR INLET AT LOW POINT OF SAG, THE SUMP SHOULD BE SYMMETRICAL ABOUT CENTERLINE AS SHOWN FOR UPSTREAM.



PLAN VIEW OF GUTTER SUMP



FRONT VIEW OF GUTTER SUMP



SECTION A-A: ROLLED CURB (TYP.)

NOTE: ALL INLETS CONSTRUCTED WITHIN OR ABUTTING A PAVED AREA SHALL HAVE GUTTER SUMPS.

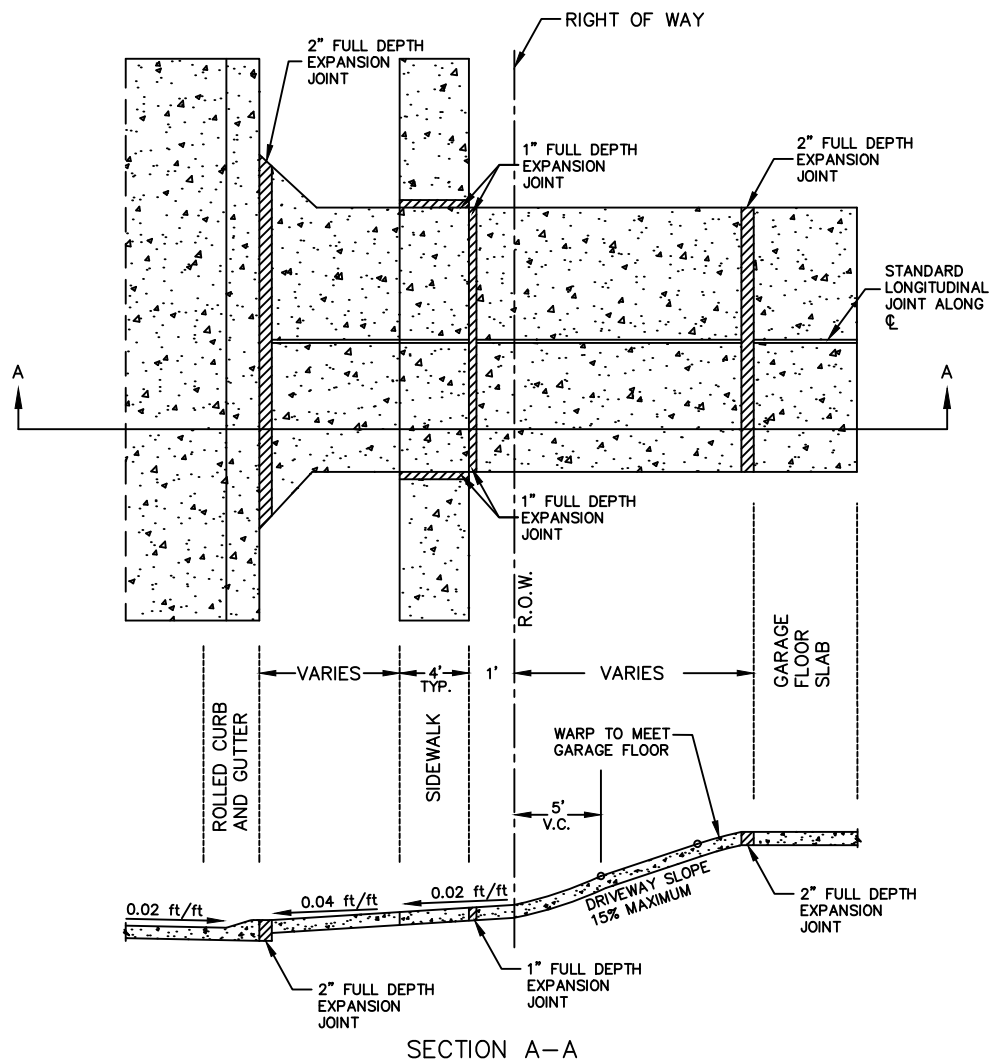
**Wentzville Missouri**  
The Crossroads of the Nation

PUBLIC WORKS DEPARTMENT 1001 SCHROEDER CREEK BLVD.  
ENGINEERING DIVISION WENTZVILLE, MO. 63385

**GUTTER SUMP**

Approved: W.E.B.  
Date: June 10, 2009

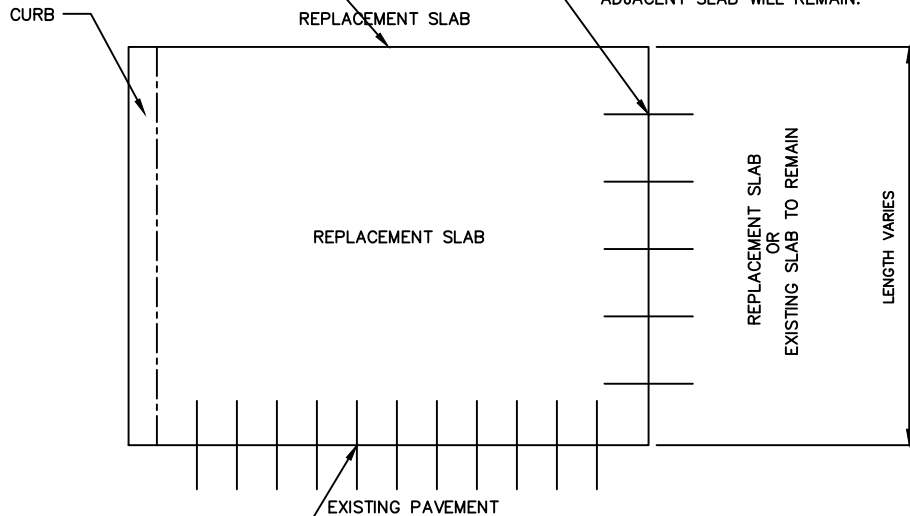
**700.22**



### GENERAL NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. FOR ROADWAY CROSS SLOPES, PAVEMENT TYPES AND THICKNESS REFER TO STANDARD TYPICAL SECTIONS.
3. THE THICKNESS OF THE SIDEWALK SECTION WITHIN THE DRIVEWAY SHALL BE INCREASED TO MATCH THE DRIVEWAY PAVEMENT THICKNESS (6" TYP.)
4. FULL DEPTH EXPANSION JOINTS ARE REQUIRED BETWEEN THE BACK OF CURB AND DRIVEWAY, DRIVEWAY AND BACK OF SIDEWALK, AND DRIVEWAY AND GARAGE.
5. ALL EXPANSION JOINTS SHALL BE FULL DEPTH.

TRANSVERSE JOINT BETWEEN REPLACEMENT SLABS FOR RESIDENTIAL PAVEMENT SHALL BE TYPE C (NO BARS) AND FOR NON-RESIDENTIAL PAVEMENT SHALL BE TYPE G (1" SMOOTH BARS @ 12" CENTERS)

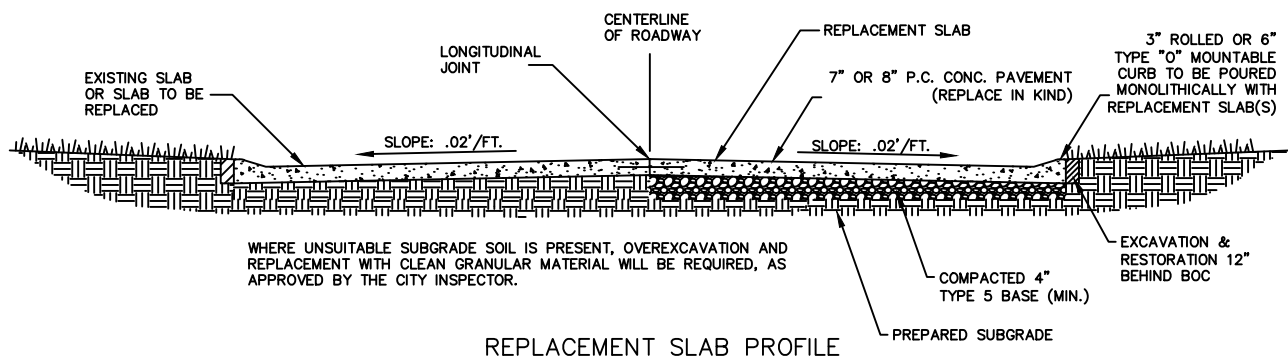


LONGITUDINAL JOINT FOR RESIDENTIAL AND NON-RESIDENTIAL STREETS SHALL BE TYPE B (5/8" DEFORMED BARS @ 30" CENTERS WITH KEYWAY) WHERE THE ADJACENT SLAB WILL BE REPLACED AND TYPE F (5/8" DEFORMED BARS @ 30" CENTERS, NO KEYWAY) WHERE THE ADJACENT SLAB WILL REMAIN.

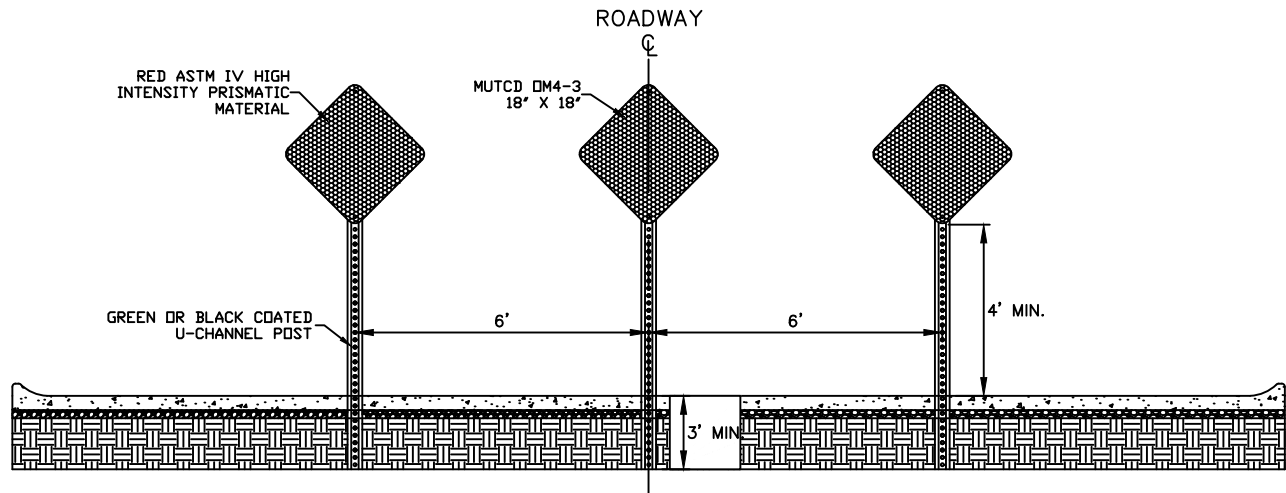
TRANSVERSE JOINT BETWEEN REPLACEMENT SLAB AND EXISTING SLABS TO REMAIN FOR RESIDENTIAL PAVEMENT SHALL BE TYPE F (5/8" DEFORMED BARS @ 30" CENTERS) AND FOR NON-RESIDENTIAL PAVEMENT SHALL BE TYPE G (1" SMOOTH BARS @ 12" CENTERS).

#### NOTES:

1. ALL JOINTS SHALL BE PER SCD 700.07 OR AS APPROVED BY THE CITY INSPECTOR.
2. JOINTS OF REPLACEMENT SLABS SHALL MEET THE JOINTS OF THE EXISTING SLABS WITH NO OFFSET.
3. BARS SHALL BE DRILLED AND SET IN EPOXY.



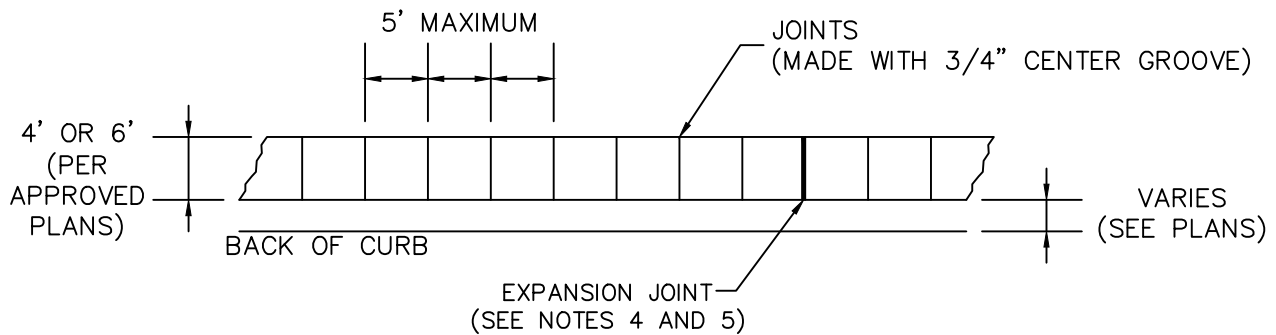
REPLACEMENT SLAB PROFILE



DRAWING N.T.S

GENERAL NOTES:

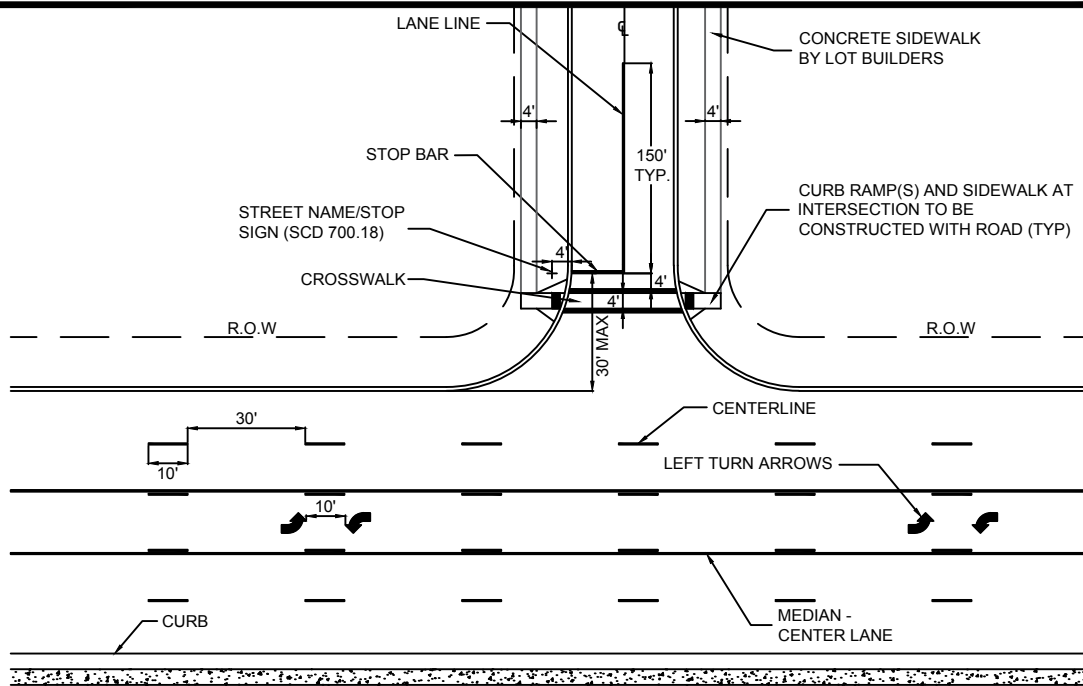
1. END OF PAVEMENT OBJECT MARKERS SHALL BE USED TO MARK THE END OF A ROADWAY WHERE THERE ARE NO ALTERNATE VEHICULAR PATHS.
2. ALL END OF PAVEMENT OBJECT MARKERS MUST BE INSTALLED PRIOR TO THE STREET BEING OPENED TO TRAFFIC AND PLACED INTO SERVICE.
3. END OF PAVEMENT OBJECT MARKERS SHALL BE LOCATED WITHIN 12 INCHES FROM THE END OF PAVEMENT.
4. END OF PAVEMENT OBJECT MARKERS SHALL BE EMBEDDED INTO THE GROUND A MIN. OF 3 FEET AND SHALL REMAIN VERTICAL.



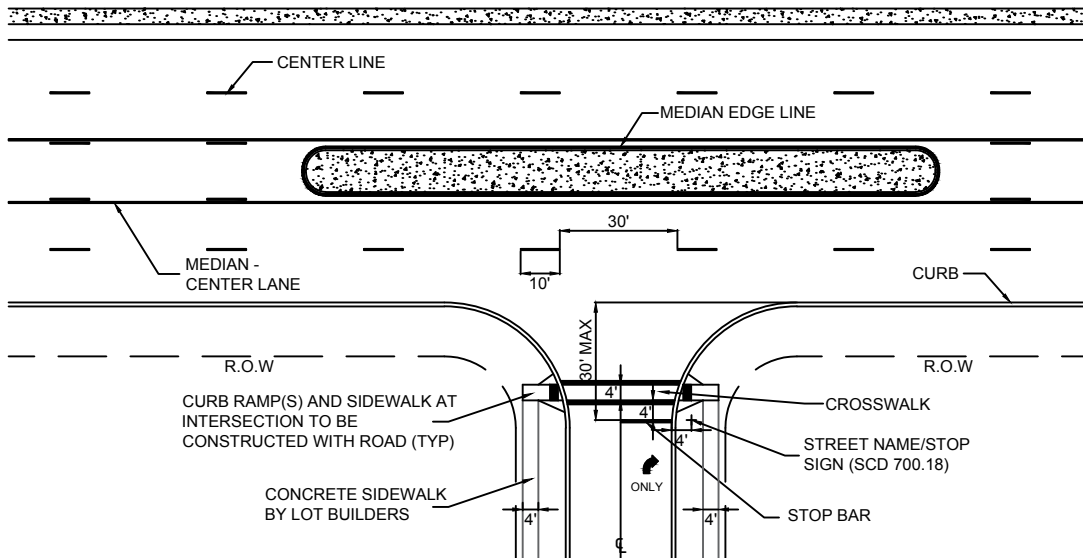
#### GENERAL NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. SIDEWALKS AND CURB RAMPS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CURRENT AMERICANS WITH DISABILITIES ACT ACCESSIBILITY GUIDELINES AND THESE DETAILS.
3. ALL SIDEWALKS SHALL BE A MINIMUM OF 4" THICK. THE THICKNESS OF THE SIDEWALK SECTIONS THROUGH ENTRANCES AND DRIVEWAYS SHALL BE INCREASED TO MATCH THE DRIVEWAY OR ENTRANCE PAVEMENT THICKNESS
4. EXPANSION JOINTS ARE REQUIRED BETWEEN SIDEWALK AND DRIVEWAYS, WHERE SIDEWALKS INTERSECT STREETS AND AT A MAXIMUM SPACING OF 20 FEET. FOR SLIP FORMED SIDEWALK THE MAXIMUM EXPANSION JOINT SPACING IS 50 FEET.
5. EXPANSION JOINTS SHALL BE FULL DEPTH.
6. MAXIMUM SIDEWALK CROSS SLOPES SHALL BE 2%.
7. FOR CURB RAMP DETAILS SEE SCD 700.14, 700.15, AND 700.16.
8. FOR RESIDENTIAL ENTRANCE DETAILS SEE SEE SCD 700.23.





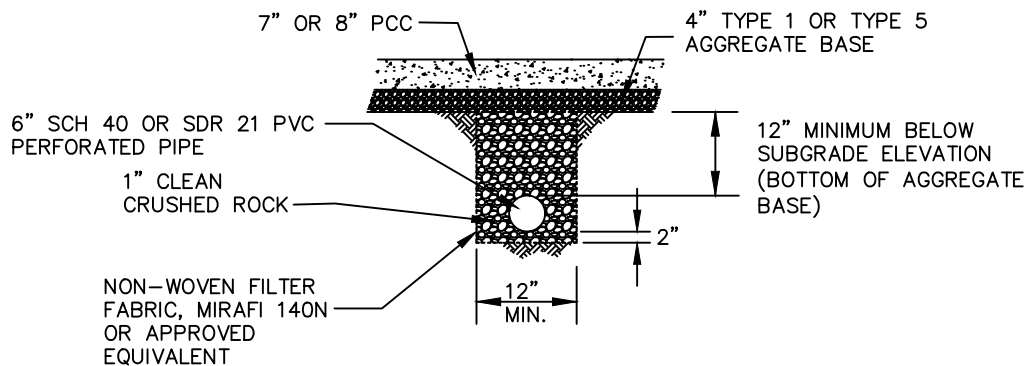
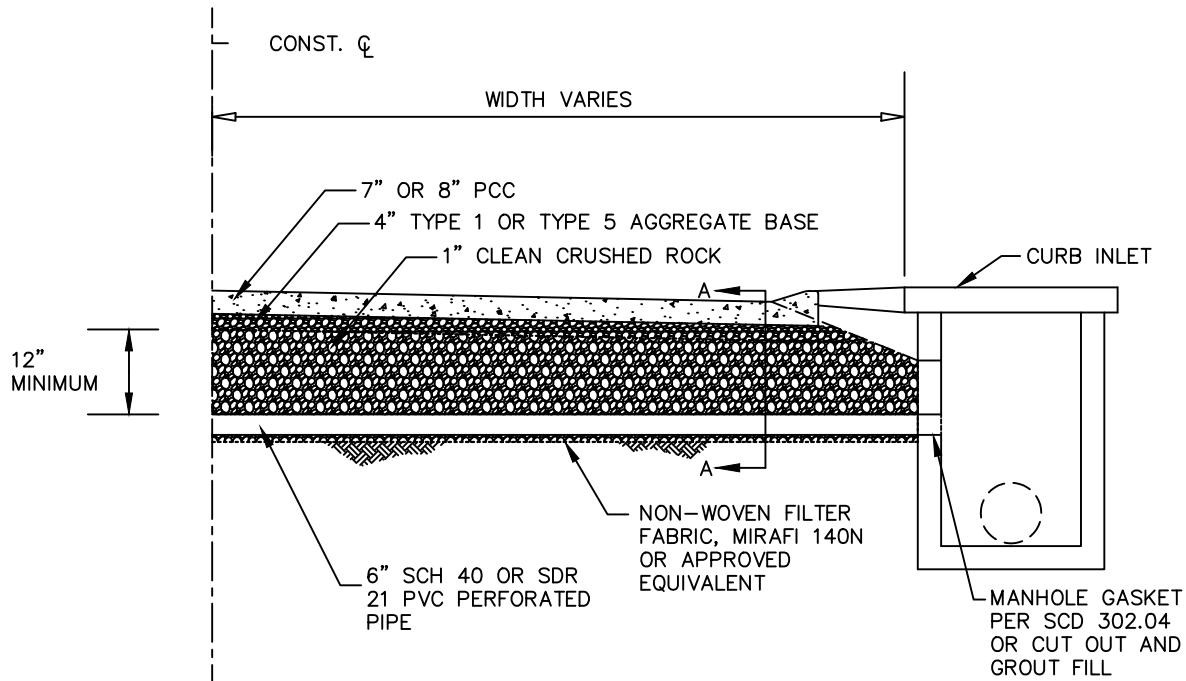
## RESIDENTIAL/COMMERCIAL ENTRANCE TO MAJOR ARTERIAL, MINOR ARTERIAL OR MAJOR COLLECTOR



## RIGHT IN/RIGHT OUT ENTRANCE TO MAJOR ARTERIAL, MINOR ARTERIAL OR MAJOR COLLECTOR

### NOTES:

1. PAVEMENT MARKINGS/STRIPING SHALL NOT BE INSTALLED UNTIL A LAYOUT PLAN HAS BEEN SUBMITTED AND APPROVED BY THE ENGINEERING DIVISION.
2. MINOR STRIPING REVISIONS MAY BE APPROVED IN THE FIELD BY THE CITY INSPECTOR. ADDITIONALLY, THE INSPECTOR MAY REQUIRE ADDITIONAL STRIPING/MARKING FROM THAT SHOWN ON THE PLANS, AS NECESSARY.
3. ANY ITEMS WHICH ARE NOT APPROVED WILL BE COMPLETELY REMOVED AND REPLACED AT THE EXPENSE OF THE CONTRACTOR.
4. THESE DRAWINGS ARE FOR ILLUSTRATIVE PURPOSES ONLY.

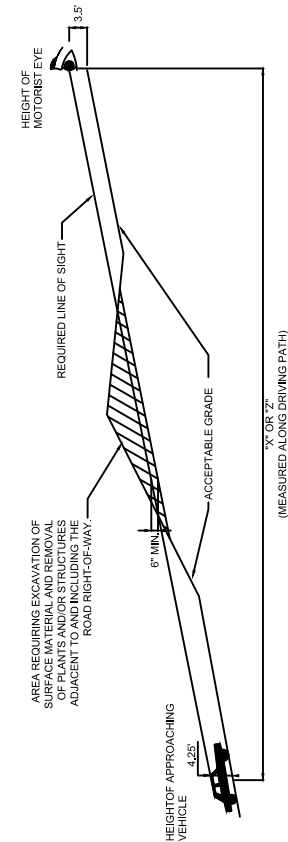


SECTION A-A

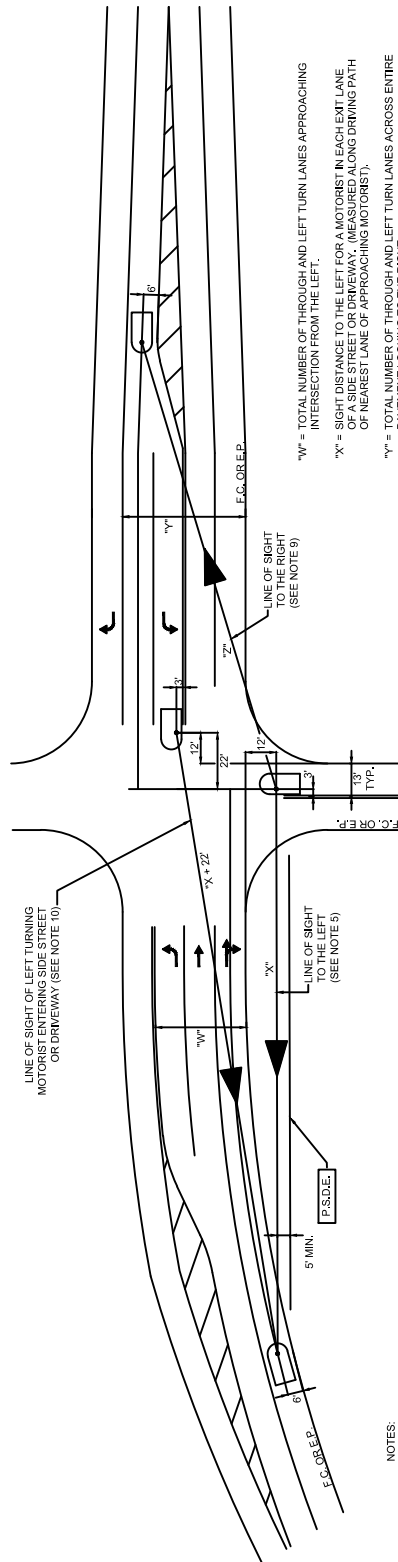
#### NOTES

1. SECTION IS SYMMETRICAL ABOUT CENTERLINE.
2. WHERE STORM STRUCTURES ARE PRESENT ON BOTH SIDES OF STREET (DIRECTLY ACROSS FROM EACH OTHER) THE UNDERDRAIN SHALL TIE INTO BOTH STRUCTURES. WHERE ONLY ONE STRUCTURE IS PRESENT THE UNDERDRAIN PIPE SHALL STILL EXTEND THE FULL WIDTH OF PAVEMENT.
3. ALL UNDERDRAIN PIPE SHALL BE LAID WITH PERFORATIONS DOWN.
4. NON-WOVEN FILTER FABRIC SHALL OVERLAP A MINIMUM OF 12" AT ALL JOINTS.
5. A MINIMUM OF TWO UNDERDRAIN PIPES SHALL BE PROVIDED UNDER CUL-DE-SACS. THE UNDERDRAINS SHALL EXTEND A MINIMUM LENGTH OF 10 FEET FROM THE CURB INLETS OR AS DIRECTED BY THE CITY INSPECTOR.

SIGHT DISTANCE FOR VEHICLE ENTERING ROADWAY FROM STOPPED POSITION OR ENTERING ROADWAY FROM LEFT TURN ASSOCIATED WITH NEW DEVELOPMENT					
DESIGN SPEED (M.P.H.)	W" = 1 LANE	W" = 2 LANES	W" = 3 LANES	Y" = 2 LANES	Y" = 3 LANES
15	150'	155'	165'	155'	165'
20	200'	210'	225'	210'	225'
25	250'	260'	280'	260'	280'
30	300'	310'	335'	310'	335'
35	350'	360'	390'	360'	390'
40	400'	415'	445'	415'	445'
45	450'	465'	500'	465'	500'
50	500'	515'	555'	515'	555'
55	550'	570'	610'	570'	610'
60	600'	620'	665'	620'	665'
65	650'	670'	720'	670'	720'
70	700'	720'	775'	720'	775'
					825'
					875'



TYPICAL PROFILE ALONG LINE OF SIGHT TO THE LEFT



- NOTES:
- DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
  - SHORT DISTANCES MAY BE BASED UPON THE NUMBER OF LANES OF THE ULTIMATE ROADWAY.
  - SHORT DISTANCES MAY BE BASED UPON THE DESIGN SPEED OF THE ROADWAY, OR 5 M.P.H. GREATER THAN THE POSTED SPEED LIMIT, WHICHEVER IS GREATER.
  - ON NEW ROADWAYS THE DESIGN SPEED SHALL BE 5 M.P.H. GREATER THAN THE ANTICIPATED POSTED SPEED LIMIT.
  - ON EXISTING ROADWAYS THE DESIGN SPEED SHALL BE THE ANTICIPATED POSTED SPEED LIMIT.
  - IF "W" IS GREATER THAN 3 LANES OR "Y" IS GREATER THAN 5 LANES, SIGHT DISTANCE DATA SHALL BE INCREASED BY 22 FEET.
  - EXTRAPOLATING FROM VALUES ON THE CHART.
  - INCLUDE A MEDIAN. SIGHT DISTANCE DATA SHALL BE INCREASED BY EXTRAPOLATING FROM VALUES ON THE CHART.
  - HEIGHT OF MOTORIST EYE IN VEHICLE = 3.5 FEET. HEIGHT OF APPROACHING VEHICLE = 4.25 FEET.
  - SIGHT DISTANCE REQUIREMENTS SHALL BE SATISFIED LOOKING LEFT AND RIGHT FOR A MOTORIST IN EACH EXIT LANE OF A SIDE STREET OR DRIVEWAY.
  - FOR LEFT TURNING MOTORIST ON THE THROUGH ROADWAY ATTEMPTING TO ENTER A SIDE STREET OR DRIVEWAY SHALL BE THE SAME AS THAT REQUIRED FOR "X" IN THE NEAREST EXIT LANE PLUS AN ADDITIONAL 22 FEET OF SIGHT DISTANCE.

- "W" = TOTAL NUMBER OF THROUGH AND LEFT TURN LANES APPROACHING INTERSECTION FROM THE LEFT.
- "X" = SIGHT DISTANCE TO THE LEFT FOR A MOTORIST IN EACH EXIT LANE OF A SIDE STREET OR DRIVEWAY. (MEASURED ALONG DRIVING PATH OF NEAREST LANE OF APPROACHING MOTORIST).
- "Y" = TOTAL NUMBER OF THROUGH AND LEFT TURN LANES ACROSS ENTIRE PAVEMENT LOOKING TO THE RIGHT.
- "Z" = SIGHT DISTANCES TO THE RIGHT FOR A MOTORIST IN EACH EXIT LANE OF A SIDE STREET OR DRIVEWAY. (MEASURED ALONG DRIVING PATH OF NEAREST LANE APPROACHING MOTORIST).
- [P.S.D.E.] = PERMANENT SIGHT DISTANCE EASEMENT. IF REQUIRED, MUST EXTEND A MINIMUM OF 5 FEET BEYOND THE LINE OF SIGHT.